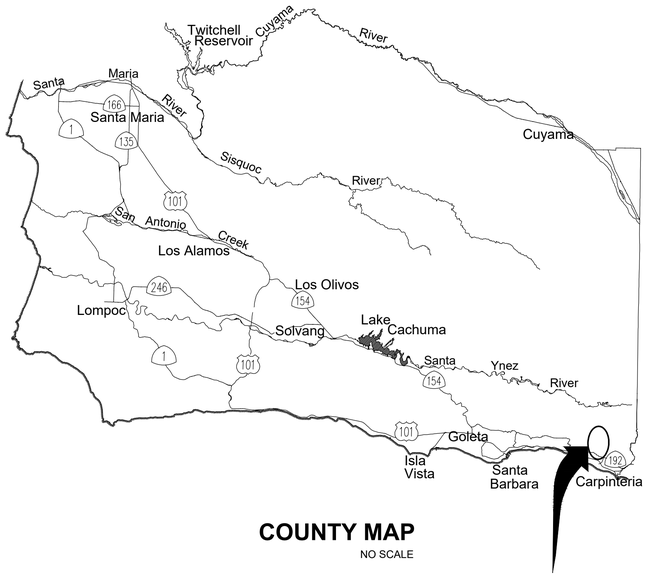


COUNTY MAP
NO SCALE

PROJECT VICINITY

DISTRICT BOARD OF DIRECTORS

FIRST DISTRICT	Das Williams
SECOND DISTRICT	Gregg Hart
THIRD DISTRICT	Joan Hartmann
FOURTH DISTRICT	Bob Nelson
FIFTH DISTRICT	Steve Lavagnino

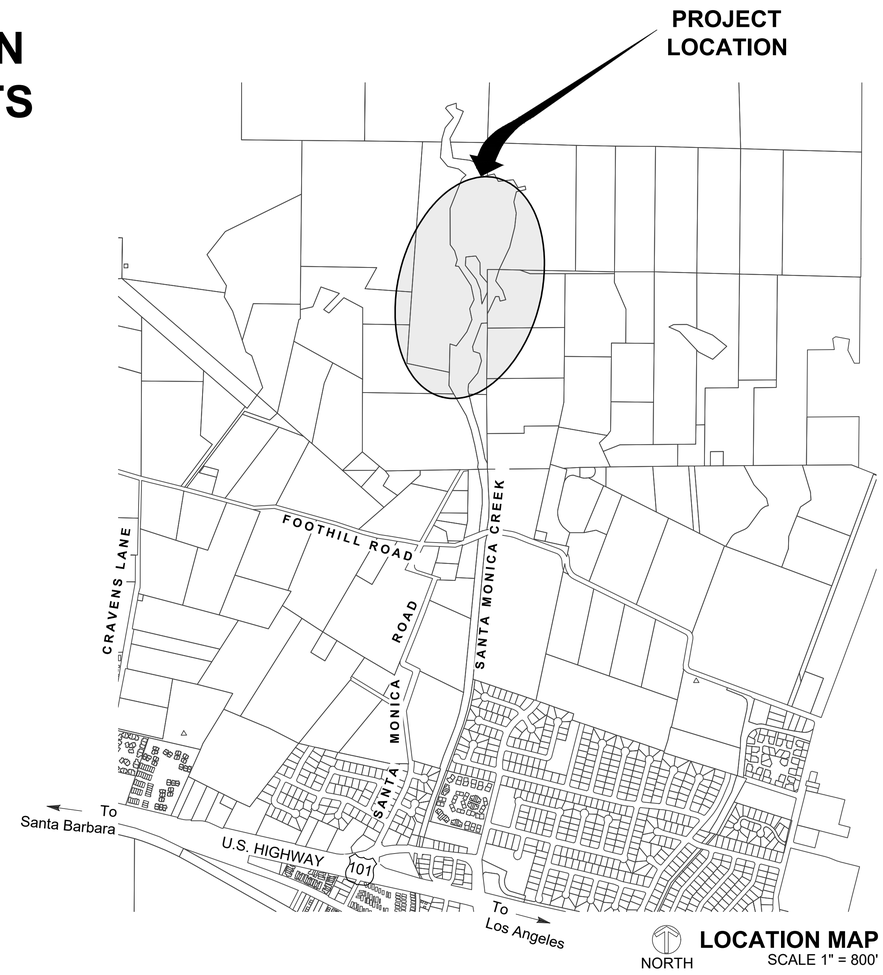
CHAIR, BOARD OF DIRECTORS _____
Joan Hartmann

SANTA BARBARA COUNTY FLOOD CONTROL AND
WATER CONSERVATION DISTRICT

SANTA MONICA DEBRIS BASIN OPERATIONAL IMPROVEMENTS

ABOVE HIGHWAY 192, FOOTHILL RD.
SANTA BARBARA COUNTY, CALIFORNIA

Sheet Index



LOCATION MAP
SCALE 1" = 800'

UNAUTHORIZED CHANGES OR USES: THE SANTA BARBARA COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT AND ITS EMPLOYEES WILL NOT BE RESPONSIBLE FOR, OR LIABLE FOR, UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS.

ALL PROPOSED CHANGES TO THE PLANS MUST BE PRESENTED IN WRITING TO THE DISTRICT AND APPROVED IN WRITING BY THE DISTRICT PRIOR TO IMPLEMENTATION OF ANY SUCH CHANGE OR USE. CONTRACTOR'S LICENSE

THE CONTRACTOR SHALL POSSESS THE CLASS (OR CLASSES) OF LICENSE AS SPECIFIED IN THE "NOTICE" ADVERTISING FOR BIDS.

NRCS Natural Resources Conservation Service

Gregory R. Norris, P.E.
State Conservation Engineer 03/24/2022
NAME:_____ DATE:_____

Know what's below. Call 811 before you dig.

REGISTERED PROFESSIONAL ENGINEER — Md Wahiduzzaman — No. C49838 — CIVIL — STATE OF CALIFORNIA
DATE: 2/8/22

REGISTERED PROFESSIONAL ENGINEER — T. Conti — No. C73108 — CIVIL — STATE OF CALIFORNIA
DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

REVIEWED BY: DocuSigned by: Jon Frye 3/25/2022 | 7:56 AM PDT — FLOOD CONTROL ENGINEERING MANAGER — DATE
REVIEWED BY: DocuSigned by: Rick Tomasini 3/25/2022 | 7:38 AM PDT — MAINTENANCE SUPERINTENDENT — DATE
REVIEWED BY: DocuSigned by: Walter Rubalcava 3/25/2022 | 8:37 AM PDT — FLOOD CONTROL DEPUTY DIRECTOR — DATE
REVIEWED BY: DocuSigned by: Maureen Spencer 3/24/2022 | 3:18 PM PDT — ENVIRONMENTAL SERVICES MANAGER — DATE

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

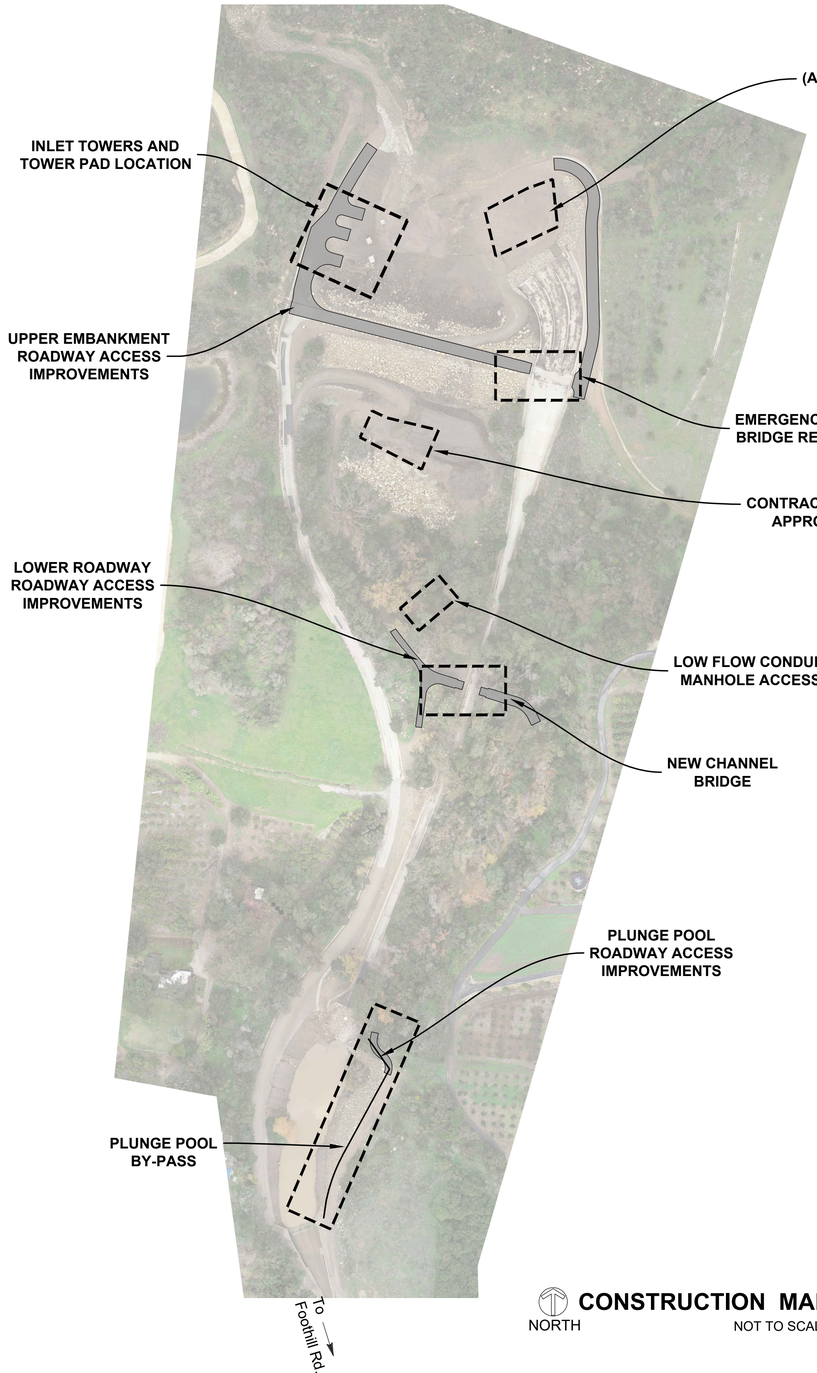
BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

TITLE SHEET
INDEX TO SHEETS AND
LOCATION MAPS

DESIGNED BY:	TC
DRAWN BY:	MC /HO /HS
CHECKED BY:	SO

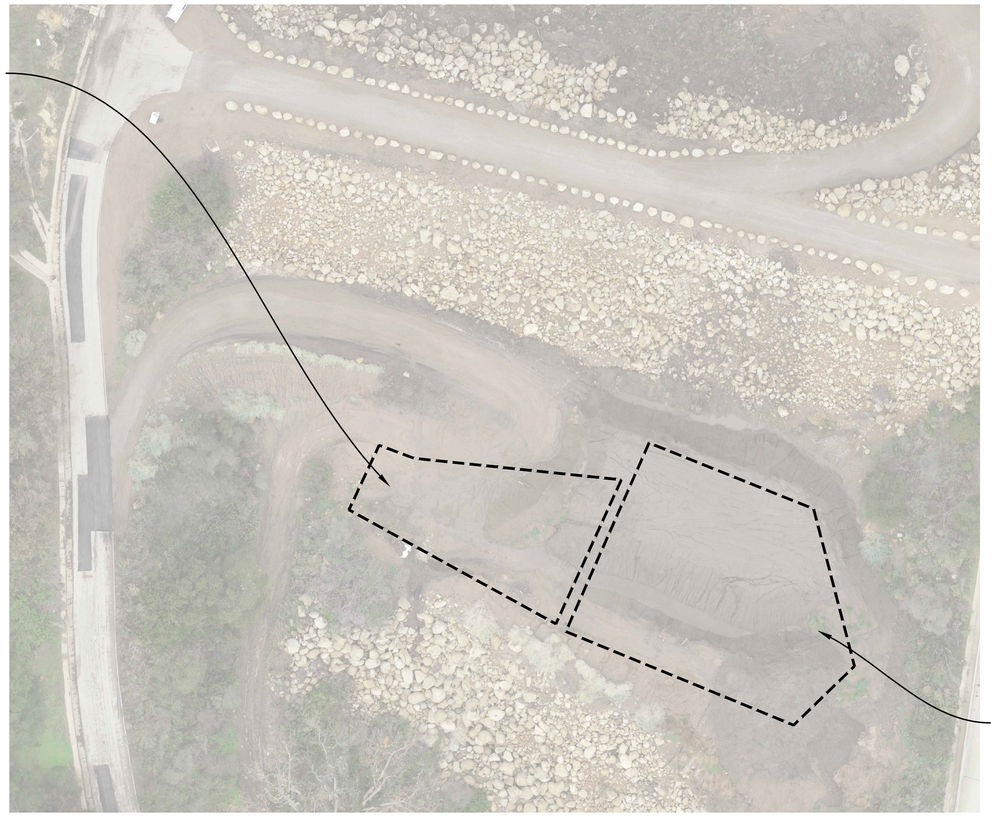
T-1

SHEET 1 OF 88



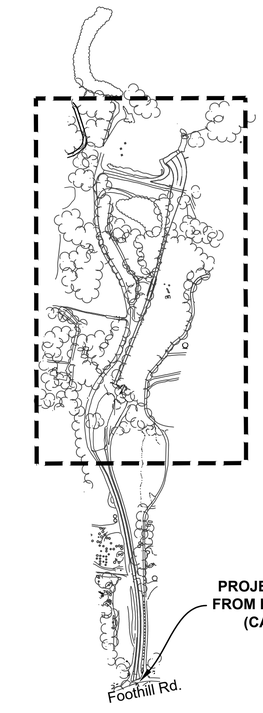
CONSTRUCTION MAP

NORTH NOT TO SCALE



CONTRACTOR STAGING

NORTH SCALE 1" = 40' 0 40' 80'



KEY MAP

NORTH SCALE 1" = 500' 0 500' 1000'

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 1 2

REGISTERED PROFESSIONAL ENGINEER Thomas Conti T. Conti No. C73108 CIVIL STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
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360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

SITE MAP PROJECT CONSTRUCTION LOCATIONS

DESIGNED BY:	TC
DRAWN BY:	HAO
CHECKED BY:	SO

G-1

SHEET 2 OF 88

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2/8/2022 9:44 AM PLOT DATE/TIME

NORTH

SURVEY CONTROL DIAGRAM

SCALE 1" = 250' (0, 250', 500')

SURVEYOR'S NOTES

1. BASIS OF BEARINGS AND COORDINATES

BEARINGS SHOWN ON THIS MAP ARE REFERENCED TO THE CALIFORNIA COORDINATE SYSTEM, NAD83(2011), ZONE 5, EPOCH 2010.0, DEFINED LOCALLY BY CONTINUOUSLY OPERATING REFERENCE STATIONS OPERATED BY THE CALIFORNIA SPATIAL REFERENCE CENTER. THIS SURVEY TIED TO STATIONS COPR, OZST, CSST AND CASN AS SHOWN HEREON.

ALL COORDINATES ARE REFERENCED TO SAID COORDINATE SYSTEM AND ARE EXPRESSED IN US SURVEY FEET UNITS.

SEE CONTROL DIAGRAM AND CONTROL POINT LISTING HEREON

2. VERTICAL DATUM

THE ELEVATIONS SHOWN HEREON ARE ORTHOMETRIC HEIGHTS (U.S. SURVEY FEET) REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) VIA APPLYING NGS'S "GEOID12B" GEOID MODEL TO COMPUTED ELLIPSOID HEIGHTS HOLDING THE PUBLISHED ORTHOMETRIC HEIGHT (AT GEODETIC REFERENCE POINT) OF 45.35 FEET (13.823 METERS) FIXED, SECOND ORDER CLASS II, APRIL 2006 ADJUSTMENT, AT SAID CORS STATION "COPR" (PID:DH6817).

SEE CONTROL POINT LISTING

3. AERIAL MAPPING

AERIAL IMAGERY WAS COLLECTED ON JANUARY 16, 2019. THE AVERAGE GROUND SAMPLING DISTANCE (GSD) IS 3.35 (CM). AERIAL TRIANGULATION WAS PERFORMED TO ORIENTATE IMAGES, PERFORM CAMERA CALIBRATION, CHECK FOR SYSTEMATIC ERRORS AND BLUNDERS. ONLY CONTROL POINTS AND CHECK POINTS USED IN THE AERIAL TRIANGULATION ADJUSTMENT ARE SHOWN, UNLESS NOTED OTHERWISE.

THE AERIAL TRIANGULATION ADJUSTMENT REPORTED AN ABSOLUTE HORIZONTAL ACCURACY OF 4.96 (CM) $RMSE_r$ AT THE 95% CONFIDENCE LEVEL AND AN ABSOLUTE VERTICAL ACCURACY OF 4.00 (CM) $RMSE_Z$ AT THE 95% CONFIDENCE LEVEL.

4. SUPPLEMENTAL FIELD MEASUREMENTS

SUPPLEMENTAL FIELD TOPO WAS PERFORMED ON 5/1/2019 IN THE CREEK, EAST OF THE EXISTING CHANNEL UPSTREAM FROM THE PLUNGE POOL AND AT THE NATURAL CREEK FLOWING INTO THE DEBRIS BASIN, UPSTREAM OF THE GROUTED ROCK. NOTE: SIGNIFICANT EROSION WAS OBSERVED IN THE CREEK COMPARED TO THE ORIGINAL SURFACE AT THE TIME AERIAL IMAGERY WAS TAKEN. SPOT ELEVATIONS AT THE FLOWLINE OF SAID CREEK ARE REPRESENTATIVE OF THE FIELD CONDITION ON 5/1/2019, CONTOURS REPRESENT THE FIELD CONDITIONS ON 1/16/2019.

5. PRESERVE EXISTING CONTROL POINTS

FIND AND PROTECT EXISTING CONTROLS POINTS IN THE FIELD.

CONTROL POINT LISTING

HORIZONTAL: NAD83(2011), ZONE 5 EPOCH 2010.00, US SURVEY FEET
VERTICAL: NAVD88, US SURVEY FEET

POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
1	1976513.38	6101270.71	108.73	SET MAG IN APNL ON AC
2	1976551.33	6101376.38	108.10	SET MAG IN APNL ON AC
3	1976844.41	6101280.15	129.15	SET 1/2IN IP W/PLUG STANTEC CTRL IN APNL
4	1979757.31	6101578.00	414.26	FD MAG IN APNL ON BRIDGE
5	1977217.18	6101188.66	150.47	FD MAG W/WSHR, PAINTED APNL
6	1977435.15	6101398.62	140.22	SET 60D NAIL IN NG, PAINTED APNL
7	1977202.57	6101293.33	149.08	FD MAG W/WSHR, PAINTED APNL
8	1977651.09	6101376.64	186.15	SET MAG IN AC W/APNL
9	1977629.02	6101099.87	178.07	SET 60D NAIL IN NG, PAINTED APNL
10	1978348.34	6101360.83	268.13	SET MAG IN AC W/APNL
11	1978327.70	6101006.74	226.56	FD 60D NAIL W/FEATHER, PAINTED APNL
12	1978865.68	6101643.56	352.92	SET MAG IN AC FL, PAINTED APNL
13	1978916.22	6101147.20	292.69	SET MAG W/WSHR IN AC, PAINTED APNL
14	1979168.32	6101412.40	289.45	SET SCRIBE X UPSTREAM END OF DITCH, PAINTED APNL
15	1979022.11	6100697.82	306.64	SET MAG W/WSHR IN AC, PAINTED APNL
16	1980064.84	6101352.60	350.25	OBLITERATED
17	1979952.39	6101079.79	405.34	SET MAG W/WSHR IN AC, PAINTED APNL
18	1980041.53	6101780.50	456.03	SET 60D NAIL IN NG, PAINTED APNL
19	1980333.30	6101178.02	398.77	SET 60D NAIL IN NG, PAINTED APNL
20	1979630.31	6101216.73	359.93	SET 60D NAIL IN NG, PAINTED APNL
21	1977881.07	6101141.59	195.30	SET 60D NAIL IN NG, PAINTED APNL

POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
22	1978025.72	6101035.70	213.46	SET 60D NAIL IN NG, PAINTED APNL
23	1978127.51	6101129.36	220.25	SET 60D NAIL IN NG, PAINTED APNL
24	1979850.78	6101295.64	409.99	FD 60D NAIL IN NG, PAINTED APNL
25	1979896.55	6101481.26	390.03	SET 60D NAIL NG, PAINTED APNL
26	1978986.18	6101248.39	293.89	SET MAG W/WSHR, PAINTED APNL
27	1979564.61	6101039.86	368.63	SET MAG W/WSHR, PAINTED APNL
28	1980194.05	6101576.68	385.62	PHOTO ID PT. PAINTED MARK ON DOWNSTREAM END DITCH
29	1980236.38	6101238.60	378.82	SET MAG IN GROUT, PAINTED APNL
30	1978212.64	6101184.79	229.83	SET 60D NAIL IN DIRT RD, PAINTED APNL
33	1977188.81	6101288.92	149.14	FD BRASS CAP STAMPED PLS 8961 MHPGN
200	1976502.00	6101271.20	108.94	FD SPIKE W/WSHR STAMPED PLS 8226
205	1976431.27	6101786.17	89.85	FD SPIKE W/WSHR SAMPLED PLS 8226
206	1976550.29	6101391.72	106.90	FD 1/2IN IP W/PLUG CALTRANS CONTROL
207	1977198.94	6101336.60	147.45	FD 1/2IN IP OPEN, BEND AND DOWN 0.9
209	1978989.75	6101225.30	297.47	FD 1/2IN IP ILLEGIBLE, DOWN 0.3
210	1979751.78	6101533.57	410.67	FD ALUM, CAP TOP W'LY WALL, NO MARKINGS
211	1979734.05	6101623.71	412.72	FD 1/2IN IP W/CAP, UP 0.05
212	1979673.78	6101909.76	448.54	FD 3IN BRASS CAP STAMPED SCS SBDM, FLUSH
213	1979907.27	6100983.02	440.84	FD 3IN BRASS CAP STAMPED SCS SBDM, FLUSH
214	1980239.36	6101132.75	407.85	FD 1/2IN IP OPEN

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

SURVEY CONTROL DIAGRAM

DESIGNED BY:	TC
DRAWN BY:	HAO
CHECKED BY:	SO

SC-1

SHEET 3 OF 88

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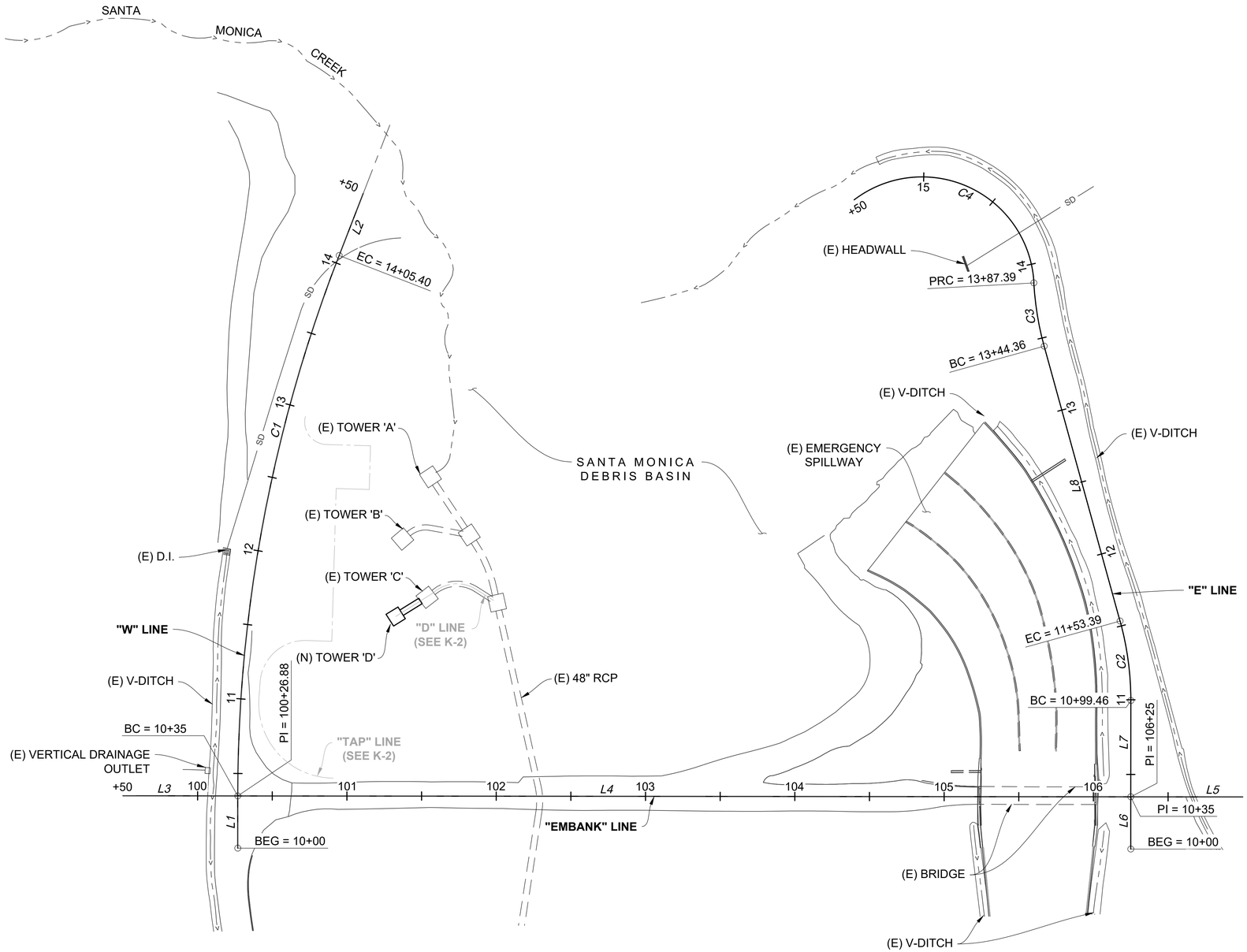

"W" LINE							
SEGMENT ID	START STATION	START NORTHING	START EASTING	LENGTH	END STATION	DIRECTION/ DELTA	RADIUS
L1	10+00.00	1979854.97	6101046.94	35.00	10+35.00	N14°10'00"E	
C1	10+35.00	1979888.91	6101055.51	370.40	14+05.40	21°13'21"	1000.00
L2	14+05.40	1980223.29	6101209.86	44.60	14+50.00	N35°23'21"E	

"EMBANK" LINE							
SEGMENT ID	START STATION	START NORTHING	START EASTING	LENGTH	END STATION	DIRECTION/ DELTA	RADIUS
L3	99+50.00	1979907.78	6100980.98	76.88	100+26.88	S75°47'23"E	
L4	100+26.88	1979888.91	6101055.51	598.12	106+25.00	S75°47'23"E	
L5	106+25.00	1979742.08	6101635.32	75.00	107+00.00	S75°47'23"E	

"E" LINE							
SEGMENT ID	START STATION	START NORTHING	START EASTING	LENGTH	END STATION	DIRECTION/ DELTA	RADIUS
L6	10+00.00	1979708.15	6101626.76	35.00	10+35.00	N14°10'00"E	
L7	10+35.00	1979742.08	6101635.32	64.46	10+99.46	N14°10'00"E	
C2	10+99.46	1979804.59	6101651.10	53.93	11+53.39	15°26'55"	200.00
L8	11+53.39	1979858.01	6101657.13	190.97	13+44.36	N1°16'55"W	
C3	13+44.36	1980048.93	6101652.86	43.03	13+87.39	12°19'38"	200.00
C4	13+87.39	1980091.72	6101656.52	162.61	15+50.00	124°13'38"	75.00

NORTH

UPPER EMBANKMENT

SCALE 1" = 40'

0 40' 80'

KEYLINE LEGEND:

"W" LINE	WEST ACCESS ROAD
"E" LINE	EAST ACCESS ROAD
"EMBANK" LINE	EMBANKMENT ROAD

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

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SANTA BARBARA COUNTY, CALIFORNIA

KEYLINE GEOMETRY

DESIGNED BY:	TC
DRAWN BY:	HS
CHECKED BY:	SO

K-1

SHEET 4 OF 88

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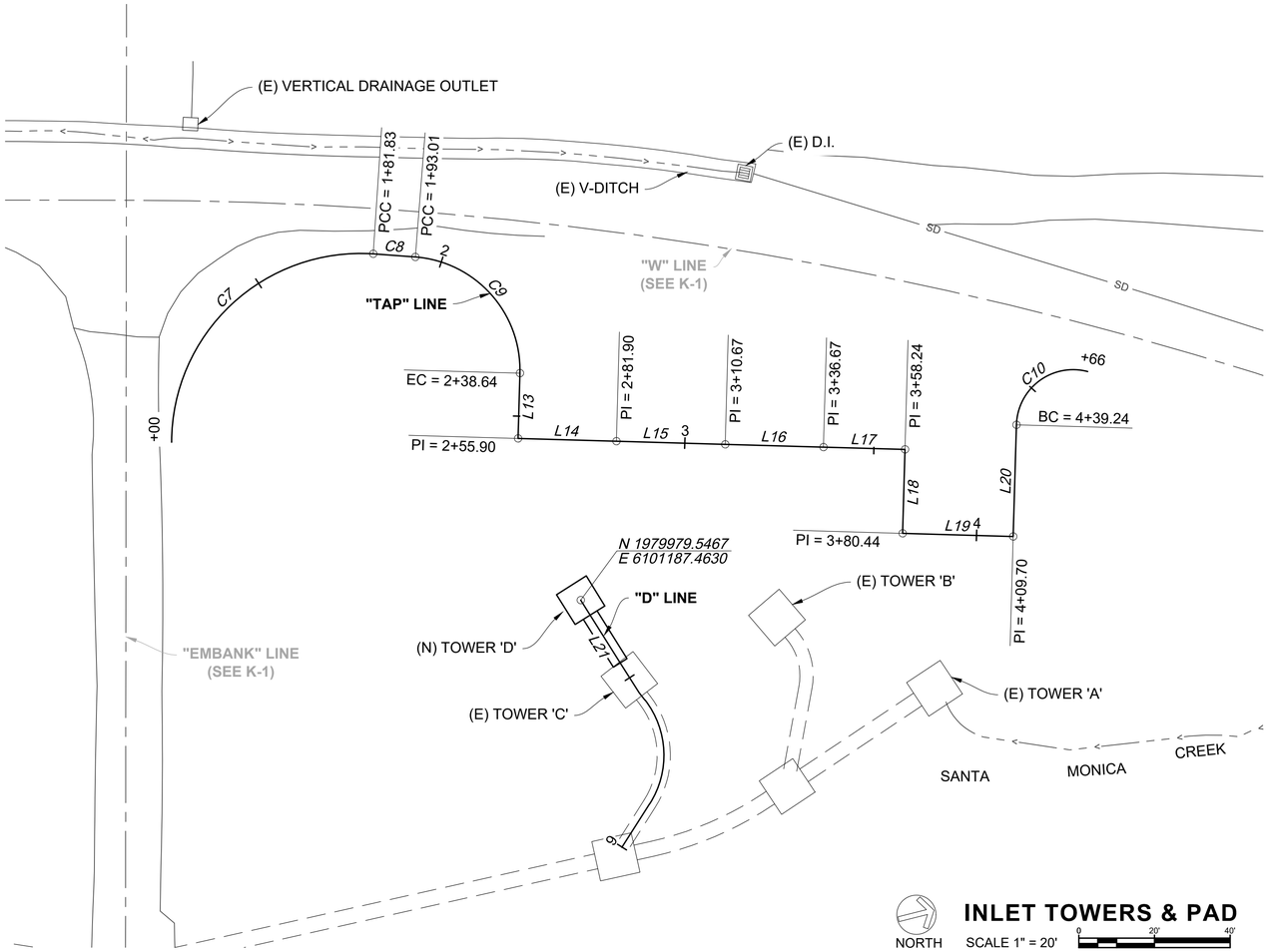

NORTH

INLET TOWERS & PAD

SCALE 1" = 20'

0 20' 40'

"TAP" LINE							
SEGMENT ID	START STATION	START NORTHING	START EASTING	LENGTH	END STATION	DIRECTION/ DELTA	RADIUS
C7	1+00.00	1979884.83	6101120.51	81.83	1+81.83	93°45'54"	50.00
C8	1+81.83	1979948.73	6101085.22	11.19	1+93.01	0°38'56"	988.00
C9	1+93.01	1979959.35	6101088.74	45.63	2+38.64	87°09'18"	30.00
L13	2+38.64	1979978.64	6101125.32	17.26	2+55.90	S74°13'25"E	
L14	2+55.90	1979973.94	6101141.93	26.00	2+81.90	N15°46'35"E	
L15	2+81.90	1979998.96	6101149.00	28.77	3+10.67	N15°46'35"E	
L16	3+10.67	1980026.65	6101156.82	26.00	3+36.67	N15°46'35"E	
L17	3+36.67	1980051.67	6101163.89	21.56	3+58.24	N15°46'35"E	
L18	3+58.24	1980072.42	6101169.75	22.20	3+80.44	S74°13'25"E	
L19	3+80.44	1980066.39	6101191.12	29.26	4+09.70	N15°46'35"E	
L20	4+09.70	1980094.55	6101199.07	29.54	4+39.24	N74°13'25"W	
C10	4+39.24	1980102.58	6101170.64	27.04	4+66.29	103°17'59"	15.00

"D" LINE							
SEGMENT ID	START STATION	START NORTHING	START EASTING	LENGTH	END STATION	DIRECTION/ DELTA	RADIUS
L21	9+54.66	1979985.61	6101206.10	19.59	9+74.25	S71°58'58"W	

KEYLINE LEGEND:

"TAP" LINE — TOWER ACCESS PAD

"D" LINE — TOWER D DRAIN

REGISTERED PROFESSIONAL ENGINEER — Thomas Conti — T. Conti — No. C73108 — CIVIL — STATE OF CALIFORNIA

DATE: 2/8/22

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KEYLINE GEOMETRY

DESIGNED BY: TC
DRAWN BY: HS
CHECKED BY: SO

K-2

SHEET 5 OF 88

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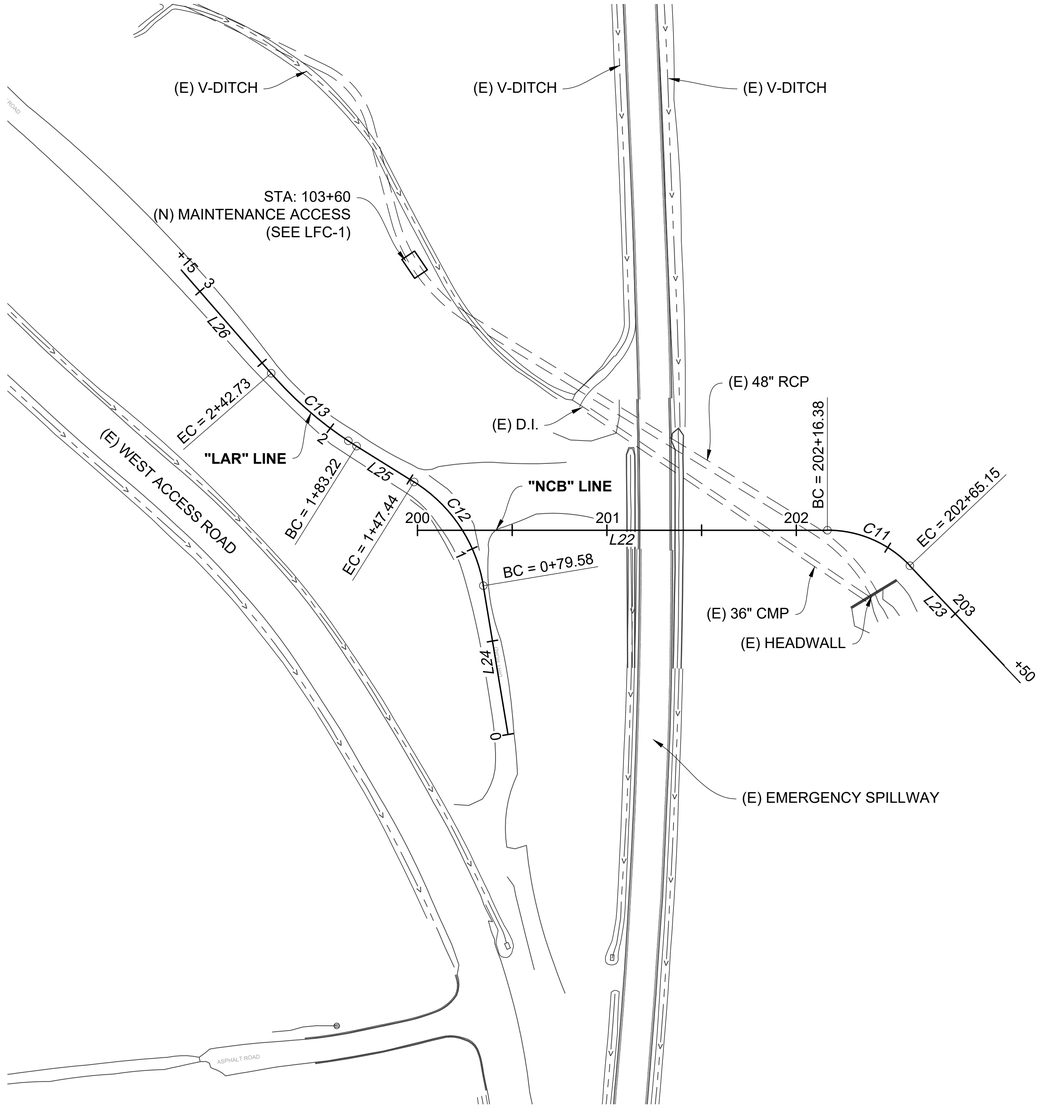

NORTH SCALE 1" = 40'

LOWER CHANNEL

"NCB" LINE							
SEGMENT ID	START STATION	START NORTHING	START EASTING	LENGTH	END STATION	DIRECTION/ DELTA	RADIUS
L22	200+00.00	1979159.72	6101290.81	216.38	202+16.38	S73°10'12"E	
C11	202+16.38	1979097.07	6101497.92	48.76	202+65.15	46°34'00"	60.00
L23	202+65.15	1979066.51	6101534.20	84.85	203+50.00	S26°36'12"E	

"LAR" LINE							
SEGMENT ID	START STATION	START NORTHING	START EASTING	LENGTH	END STATION	DIRECTION/ DELTA	RADIUS
L24	0+00.00	1979042.70	6101305.38	79.58	0+79.58	N7°23'08"E	
C12	0+79.58	1979121.62	6101315.61	67.86	1+47.44	48°36'06"	80.00
L25	1+47.44	1979184.61	6101296.45	35.78	1+83.22	N41°12'59"W	
C13	1+83.22	1979211.53	6101272.87	59.51	2+42.73	17°02'52"	200.00
L26	2+42.73	1979261.43	6101240.85	72.27	3+15.00	N24°10'07"W	

KEYLINE LEGEND:

"NCB" LINE NEW CHANNEL BRIDGE ROAD

"LAR" LINE LOWER ACCESS ROAD

REGISTERED PROFESSIONAL ENGINEER — T. Conti — No. C73108 CIVIL — STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
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OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

KEYLINE GEOMETRY

DESIGNED BY: TC
DRAWN BY: HS
CHECKED BY: SO

K-3

SHEET 6 OF 88

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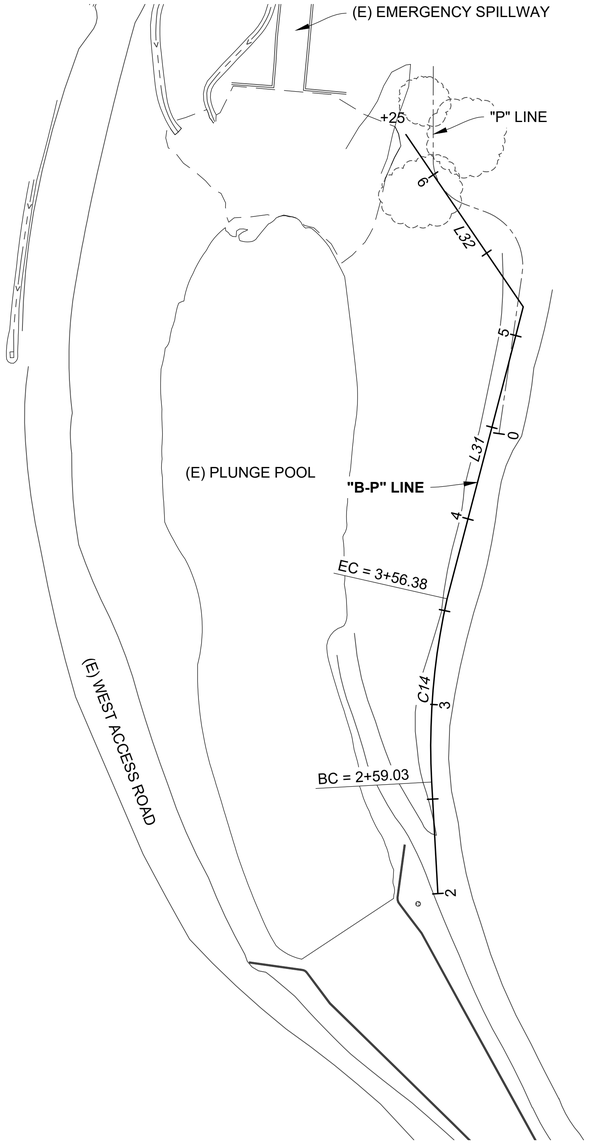
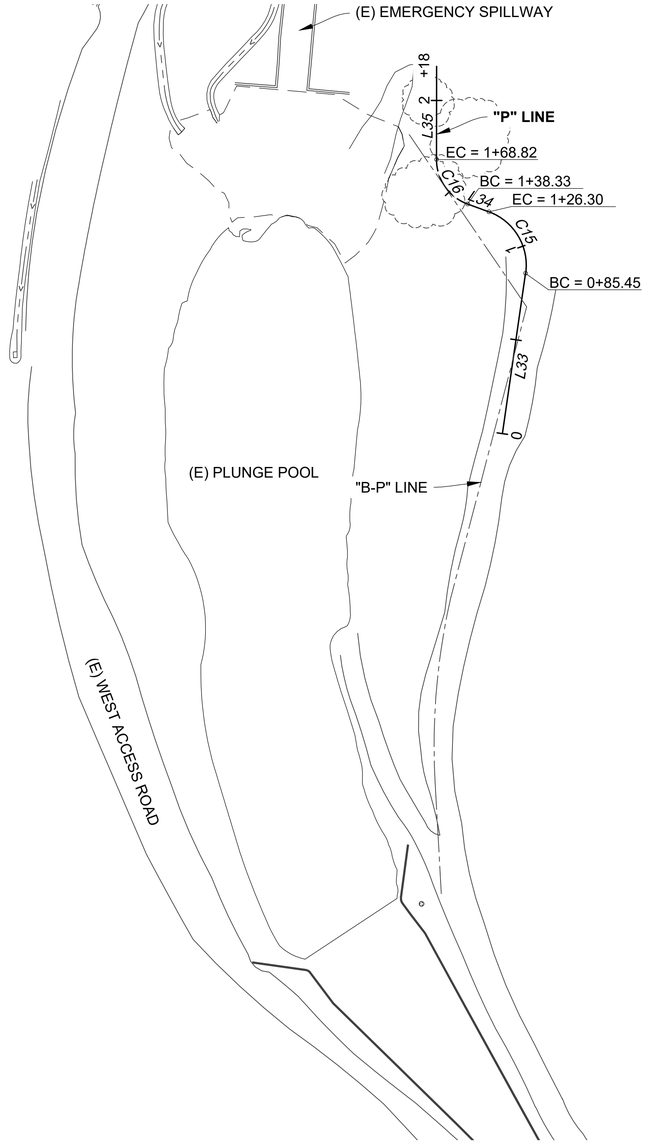


NORTH

PLUNGE POOL BY-PASS PIPE

SCALE 1" = 40'



NORTH

PLUNGE POOL BY-PASS ROAD

SCALE 1" = 40'

"B-P" LINE							
SEGMENT ID	START STATION	START NORTHING	START EASTING	LENGTH	END STATION	DIRECTION/ DELTA	RADIUS
C14	2+59.03	1978103.57	6101130.91	97.35	3+56.38	15°56'12"	350.00
L31	3+56.38	1978193.78	6101166.68	122.87	4+79.25	N31°27'04"E	
L32	5+15.68	1978329.67	6101249.79	110.07	6+25.75	N17°26'39"W	

"P" LINE							
SEGMENT ID	START STATION	START NORTHING	START EASTING	LENGTH	END STATION	DIRECTION/ DELTA	RADIUS
L33	0+00.00	1978269.34	6101218.15	85.45	0+85.45	N25°03'08"E	
C15	0+85.45	1978346.76	6101254.33	40.85	1+26.30	78°01'10"	30.00
L34	1+26.30	1978383.41	6101245.22	12.02	1+38.33	N52°58'02"W	
C16	1+38.33	1978390.65	6101235.62	30.50	1+68.82	69°53'27"	25.00
L35	1+68.82	1978417.89	6101226.76	49.18	2+18.00	N16°55'25"E	

KEYLINE LEGEND:

"B-P" LINE PLUNGE POOL BY-PASS LINE

"P" LINE PLUNGE POOL ACCESS ROAD

REGISTERED PROFESSIONAL ENGINEER — T. Conti — No. C73108 — CIVIL — STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

KEYLINE GEOMETRY

DESIGNED BY: TC
DRAWN BY: HS
CHECKED BY: SO

K-4

SHEET 7 OF 88

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

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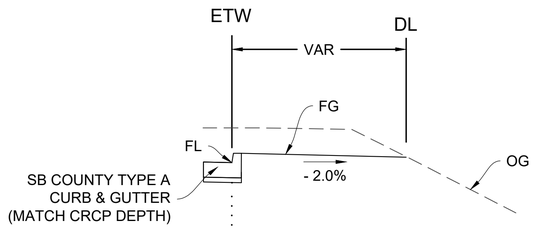
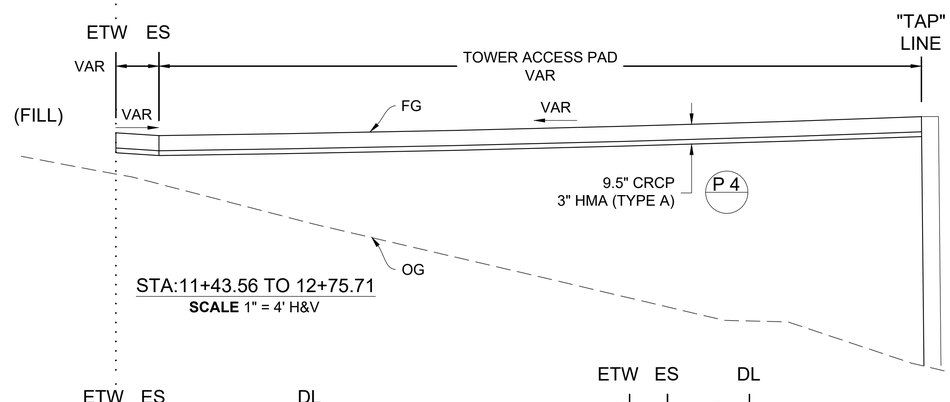
2/8/2022 9:44 AM PLOT DATE/TIME

TYPICAL SECTION NOTES:

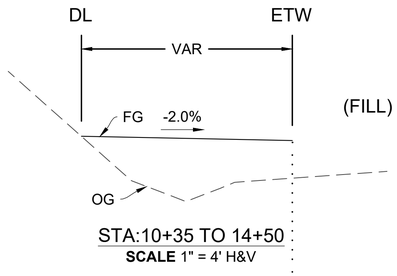
1. DIMENSIONS OF THE STRUCTURAL SECTION ARE SUBJECT TO TOLERANCES SPECIFIED IN THE STANDARD SPECIFICATIONS.
2. SEE CONSTRUCTION DETAILS FOR LIMITS OF CURBS AT TOWER ACCESS PADS.
3. SEE "CONSTRUCTION DETAILS" FOR FINISHED GRADES.
4. SEE CALTRANS STANDARD PLAN SHEET P-4 FOR DETAILS OF THE CONTINUOUSLY REINFORCED CONCRETE PAVEMENT.



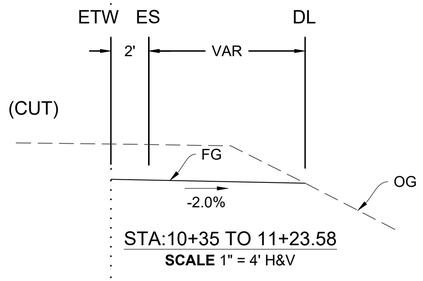
STA:12+80.16 (TAP BC) TO 14+50
SCALE 1" = 4' H&V



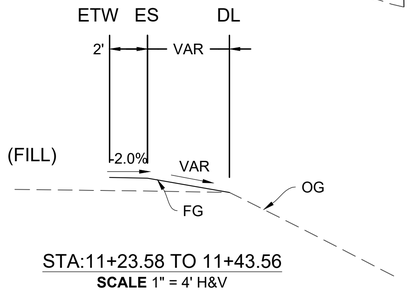
STA:11+43.56 TO 12+75.71
SCALE 1" = 4' H&V



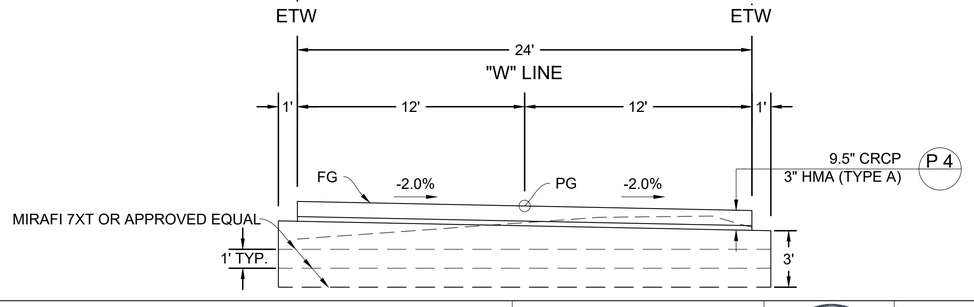
STA:10+35 TO 14+50
SCALE 1" = 4' H&V



STA:10+35 TO 11+23.58
SCALE 1" = 4' H&V



STA:11+23.58 TO 11+43.56
SCALE 1" = 4' H&V



"W" LINE
STA:10+35 TO 14+50
SCALE 1" = 4' H&V

TYPICAL CROSS SECTIONS LEGEND:

DL	DAYLIGHT LINE
EP	EDGE OF PAVEMENT
ES	EDGE OF SHOULDER
ETW	EDGE OF TRAVEL WAY
VAR	VARIES
CRCP	CONTINUOUSLY REINFORCED CONCRETE PAVEMENT

HMA (TYPE A) HOT MIXED ASPHALT TYPE A

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

SCALE 1" = 4' 0 4' 8'

DATE: 2/8/22

REVISIONS NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

WEST ACCESS ROAD
TYPICAL CROSS SECTIONS

DESIGNED BY: TC
DRAWN BY: HS
CHECKED BY: SO

X-1

SHEET 8 OF 88

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2

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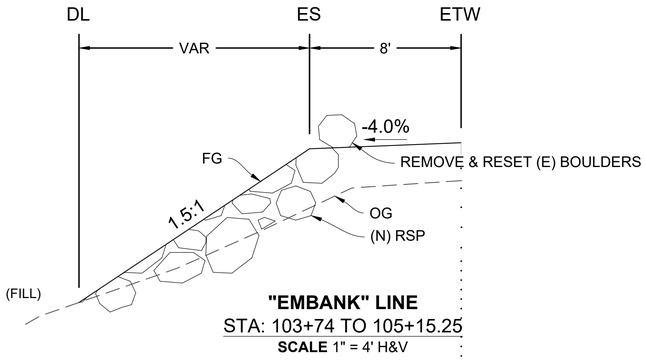
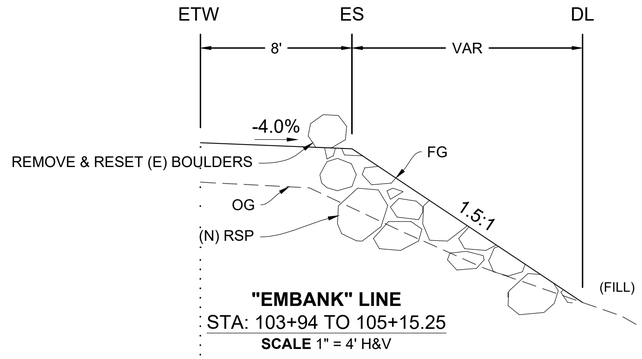
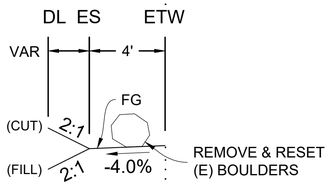


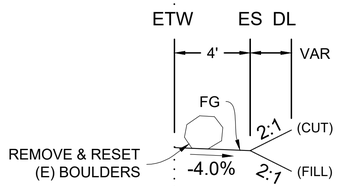
"EMBANK" LINE
STA: 103+74 TO 105+15.25
SCALE 1" = 4' H&V



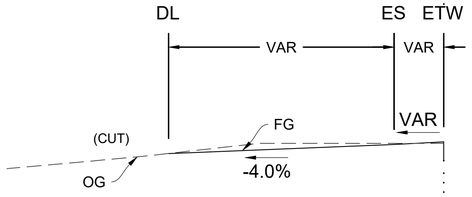
"EMBANK" LINE
STA: 103+94 TO 105+15.25
SCALE 1" = 4' H&V



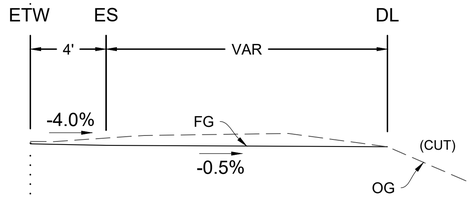
"EMBANK" LINE
STA: 100+90.89 TO 103+74
SCALE 1" = 4' H&V

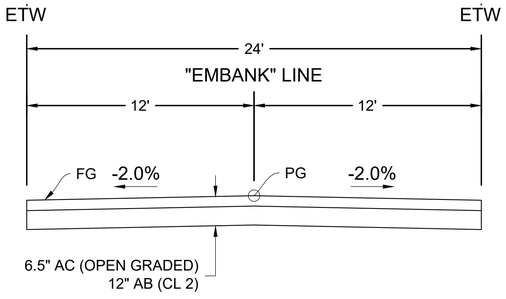


"EMBANK" LINE
STA: 100+90.89 TO 103+94
SCALE 1" = 4' H&V



"EMBANK" LINE
STA: 100+14.88 TO 100+90.89
SCALE 1" = 4' H&V





"EMBANK" LINE
STA: 100+14.88 TO 105+15.25
SCALE 1" = 4' H&V

(FILL)

(CUT)

NOTES:

1. SEE CONSTRUCTION DETAILS FOR ROADWAY TRANSITION AT SPILLWAY BRIDGE.
2. (N) RSP IS 3' THICK.

TYPICAL CROSS SECTIONS LEGEND:

DL	DAYLIGHT LINE
EP	EDGE OF PAVEMENT
ES	EDGE OF SHOULDER
ETW	EDGE OF TRAVEL WAY
VAR	VARIES
CRCP	CONTINUOUSLY REINFORCED CONCRETE PAVEMENT

HMA (TYPE A) HOT MIXED ASPHALT TYPE A

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

SCALE 1" = 4' 0 4' 8'

DATE: 2/8/22

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

EMBANKMENT ROAD
TYPICAL CROSS SECTIONS

DESIGNED BY: TC
DRAWN BY: HS
CHECKED BY: SO

X-2

SHEET 9 OF 88

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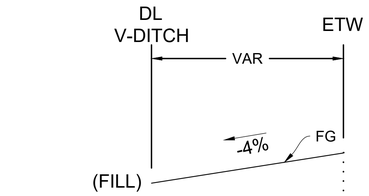
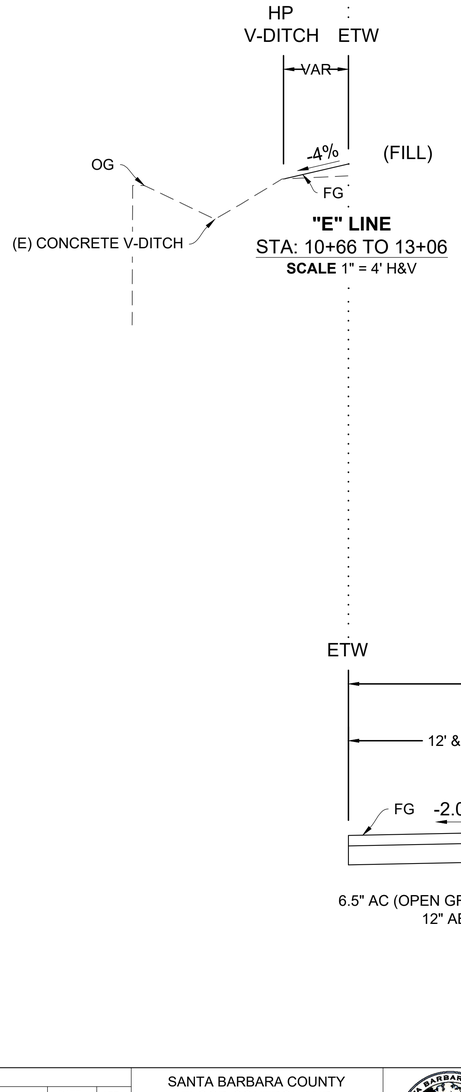
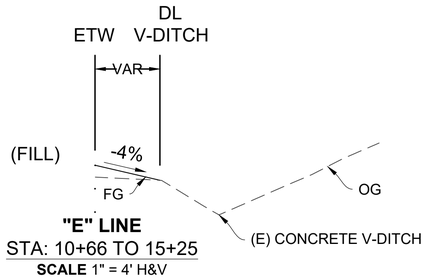
2/8/2022 9:45 AM PLOT DATE/TIME



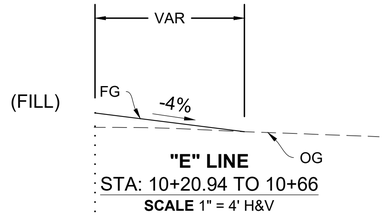
"E" LINE
STA:13+06 + 15+25
SCALE 1" = 4' H&V



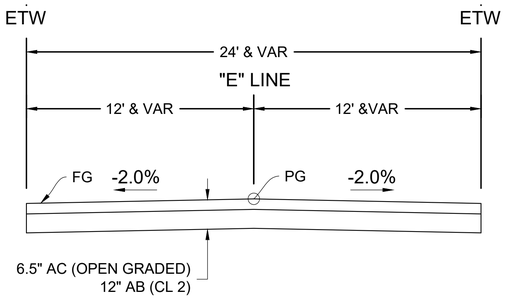
"E" LINE
STA: 10+66 TO 13+06
SCALE 1" = 4' H&V



"E" LINE
STA: 10+66 TO 15+25
SCALE 1" = 4' H&V



"E" LINE
STA: 10+20.94 TO 10+66
SCALE 1" = 4' H&V



"E" LINE
STA: 10+20.94 TO 15+25
SCALE 1" = 4' H&V

NOTES:

1. SEE CONSTRUCTION DETAILS FOR ROADWAY TRANSITION AT SPILLWAY BRIDGE

TYPICAL CROSS SECTIONS LEGEND:

DL	DAYLIGHT LINE
EP	EDGE OF PAVEMENT
ES	EDGE OF SHOULDER
ETW	EDGE OF TRAVEL WAY
VAR	VARIES
CRCP	CONTINUOUSLY REINFORCED CONCRETE PAVEMENT

HMA (TYPE A) HOT MIXED ASPHALT TYPE A

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

SCALE 1" = 4' 0 4' 8'

DATE: 2/8/22

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

EAST ACCESS ROAD
TYPICAL CROSS SECTIONS

DESIGNED BY:	TC
DRAWN BY:	HS
CHECKED BY:	SO

X-3

SHEET 10 OF 88

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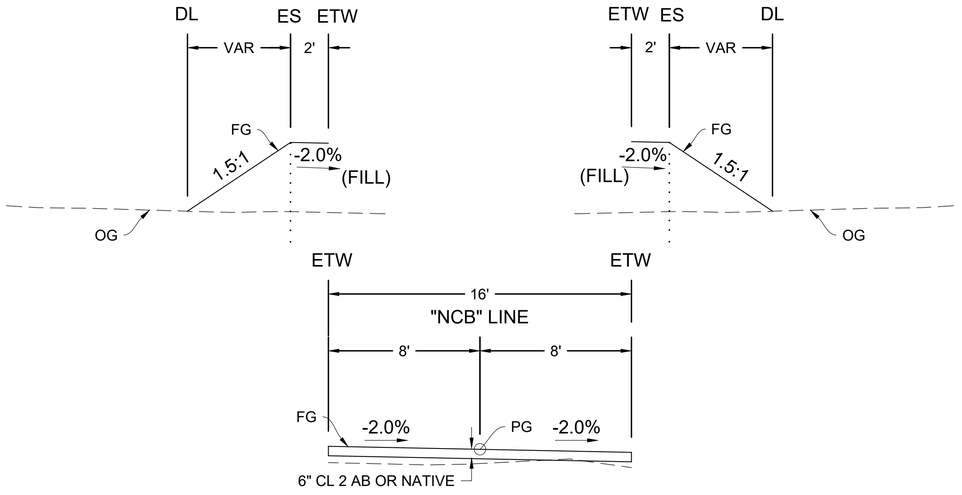
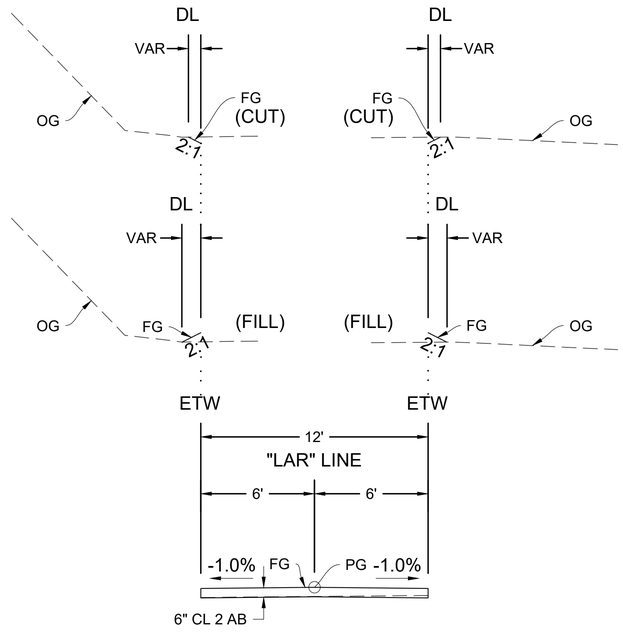


"NCB" LINE
STA: 200+22.28 TO 201+07.50 (CL 2)
& 201+43.50 TO 202+60 (NATIVE)
SCALE 1" = 4' H&V



"LAR" LINE
STA: 0+02 TO 2+19
SCALE 1" = 4' H&V

TYPICAL CROSS SECTIONS LEGEND:

DL	DAYLIGHT LINE
EP	EDGE OF PAVEMENT
ES	EDGE OF SHOULDER
ETW	EDGE OF TRAVEL WAY
VAR	VARIES
CRCP	CONTINUOUSLY REINFORCED CONCRETE PAVEMENT

HMA (TYPE A) HOT MIXED ASPHALT TYPE A

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

SCALE 1" = 4' 0 4' 8'

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

"NCB" & "LAR"
TYPICAL CROSS SECTIONS

DESIGNED BY:	TC
DRAWN BY:	HS
CHECKED BY:	SO

X-4

SHEET 11 OF 88

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ORIGINAL SCALE IS IN INCHES
0 1 2

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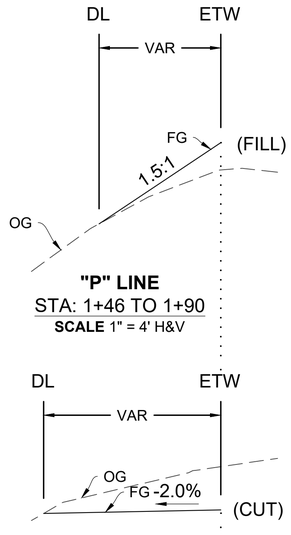
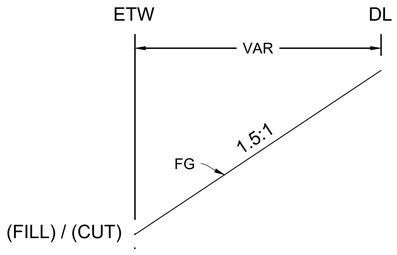
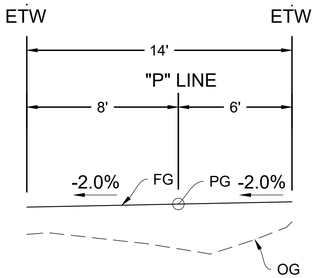


"P" LINE
STA: 1+46 TO 1+90
SCALE 1" = 4' H&V

"P" LINE
STA: 0+50 TO 1+46
SCALE 1" = 4' H&V



"P" LINE
STA: 0+50 TO 1+90
SCALE 1" = 4' H&V



"P" LINE
STA: 0+50 TO 1+90
SCALE 1" = 4' H&V

TYPICAL CROSS SECTIONS LEGEND:

DL	DAYLIGHT LINE
EP	EDGE OF PAVEMENT
ES	EDGE OF SHOULDER
ETW	EDGE OF TRAVEL WAY
VAR	VARIES
CRCP	CONTINUOUSLY REINFORCED CONCRETE PAVEMENT

HMA (TYPE A) HOT MIXED ASPHALT TYPE A

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

SCALE 1" = 4' 0 4' 8'

DATE: 2/8/22

REVISIONS NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

"P"
TYPICAL CROSS SECTIONS

DESIGNED BY: TC
DRAWN BY: HS
CHECKED BY: SO

X-5

SHEET 12 OF 88

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

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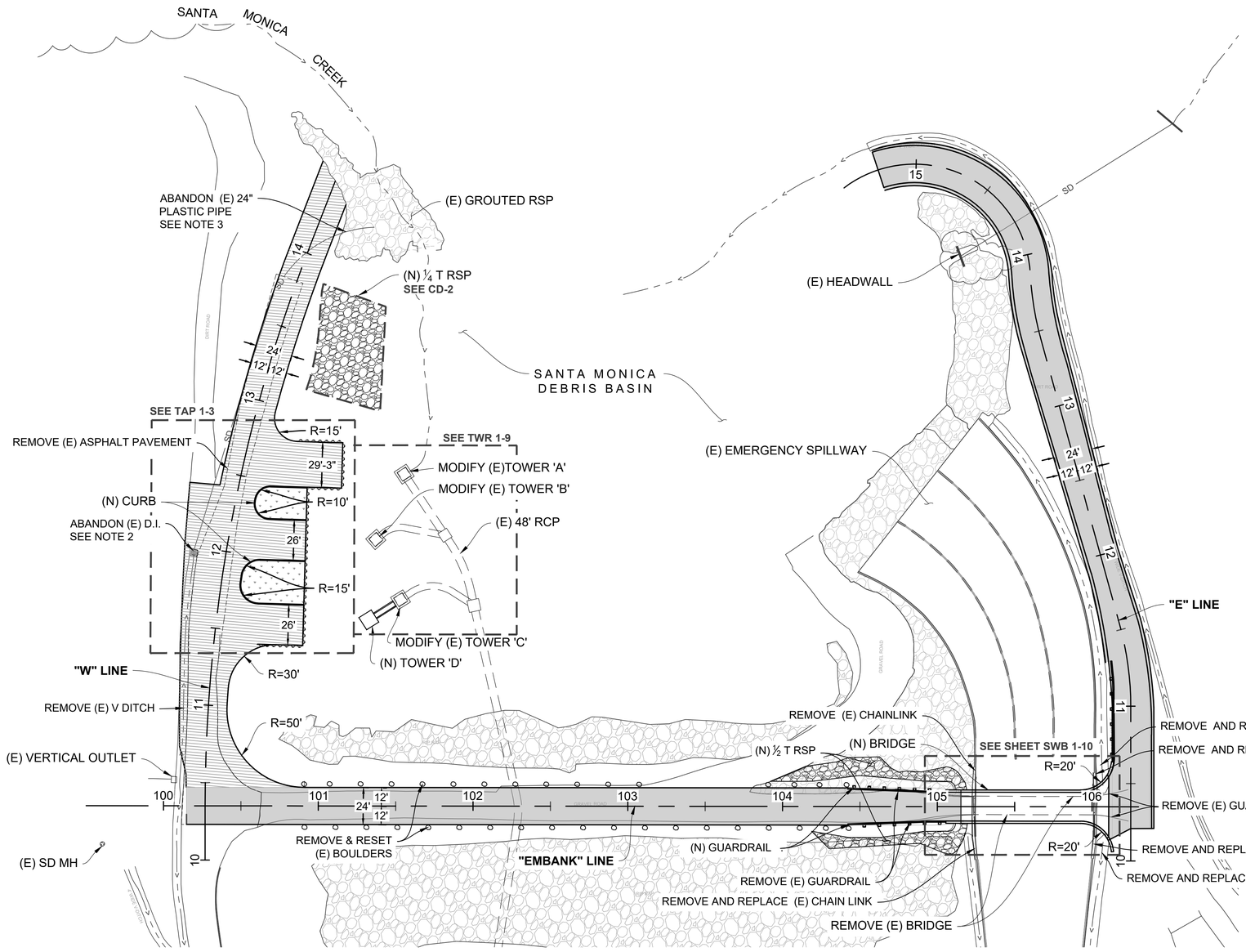


UPPER EMBANKMENT

NORTH SCALE 1" = 40'

0 40' 80'

LAYOUT NOTES:

1. SEE KEY LINE, CONSTRUCTION DETAILS & TYPICAL SECTIONS FOR MORE INFORMATION.
2. EXISTING DI ON "W" LINE: REMOVE GRATE AND PLUG DRAINAGE STRUCTURE TO TOP WITH CONCRETE.
3. 2-FT CONCRETE PLUG AT BOTH ENDS OF PIPE.

EMBANKMENT NOTES:

STRUCTURAL BACKFILL FOR THE SPILLWAY BRIDGE ABUTMENT SHALL HAVE THE FOLLOWING REQUIREMENTS:

a. COMPACTING BACKFILL AGAINST CONCRETE STRUCTURES OR IN TRENCHES SHALL BE PLACED IN 4-INCH LOOSE LIFTS AND COMPACTED WITH LIGHTWEIGHT TAMPING EQUIPMENT. (WALK BEHIND COMPACTORS, JUMPING JACK, WHACKERS). DENSITY TESTS PER ASTM D1556 SHALL BE PERFORMED AT INTERVALS NOT EXCEEDING 2 FEET IN VERTICAL RISE.)

b. IN-PLACE DENSITIES FOR DAM EMBANKMENT BACKFILL UNDER DSOD (DIVISION OF SAFETY OF DAMS) JURISDICTION WILL BE VERIFIED BY SAND CONE DENSITY TESTS (ASTM D1556). SAND CONES WILL BE THE ONLY TEST OF RECORD ACCEPTED BY DSOD.

c. DAM EMBANKMENT BACKFILL IS REQUIRED TO BE COMPACTED TO A MINIMUM OF 95%RELATIVE COMPACTION IN ACCORDANCE WITH ASTM D1557. ANY WORK FAILING COMPACTION TESTING WILL BE REWORKED AND RETESTED.

d. BENCHING INTO THE EMBANKMENT OR ABUTMENTS IS NOT ALLOWED, THE SLOPE SHOULD BE CUT BACK TO A UNIFORM SLOPE OF AT LEAST 1H:1V, PREFERABLY 3H:1V.

e. MATERIAL MUST BE PLACED AND COMPACTED IN A DIRECTION PARALLEL TO THE DAM CREST TO AVERT THE OCCASION OF STREAKS OR LENSES THROUGH THE EMBANKMENT.

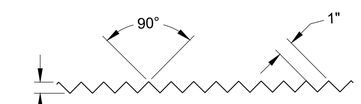
f. EMBANKMENT MATERIAL MUST BE COMPOSED OF SILTY SAND AND GRAVEL. EMBANKMENT MATERIAL MUST BE FREE OF SOD, ROOTS, BRUSH, DEBRIS, TRASH, ROCKS OVER 3 INCHES IN THE LARGEST DIAMETER, AND OTHER OBJECTIONABLE MATERIAL.

g. NO JETTING IS ALLOWED EXCEPT AROUND THE 36" PIPE CONNECTING TOWER "D" TO TOWER "C".

LEGEND

- 9.5" CRCP / 3" HMA (TYPE A)
- 6.5" AC (OPEN GRADED) / 12" AB (CL 2)
- 6" AB (CL 2)
- (E) ROCK SLOPE PROTECTION
- (N) ROCK SLOPE PROTECTION
- GRADED NATIVE SOIL
- BONDED FIBER MATRIX

GROOVES ANGLED 30 DEG. TOWARD BASIN



CRCP SURFACE FINISH SECTION DETAIL

NO SCALE

DATE: 2/8/22

REVISIONS NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

ROADWAY LAYOUT

DESIGNED BY: TC
DRAWN BY: HS
CHECKED BY: SO

LO-1

SHEET 13 OF 88

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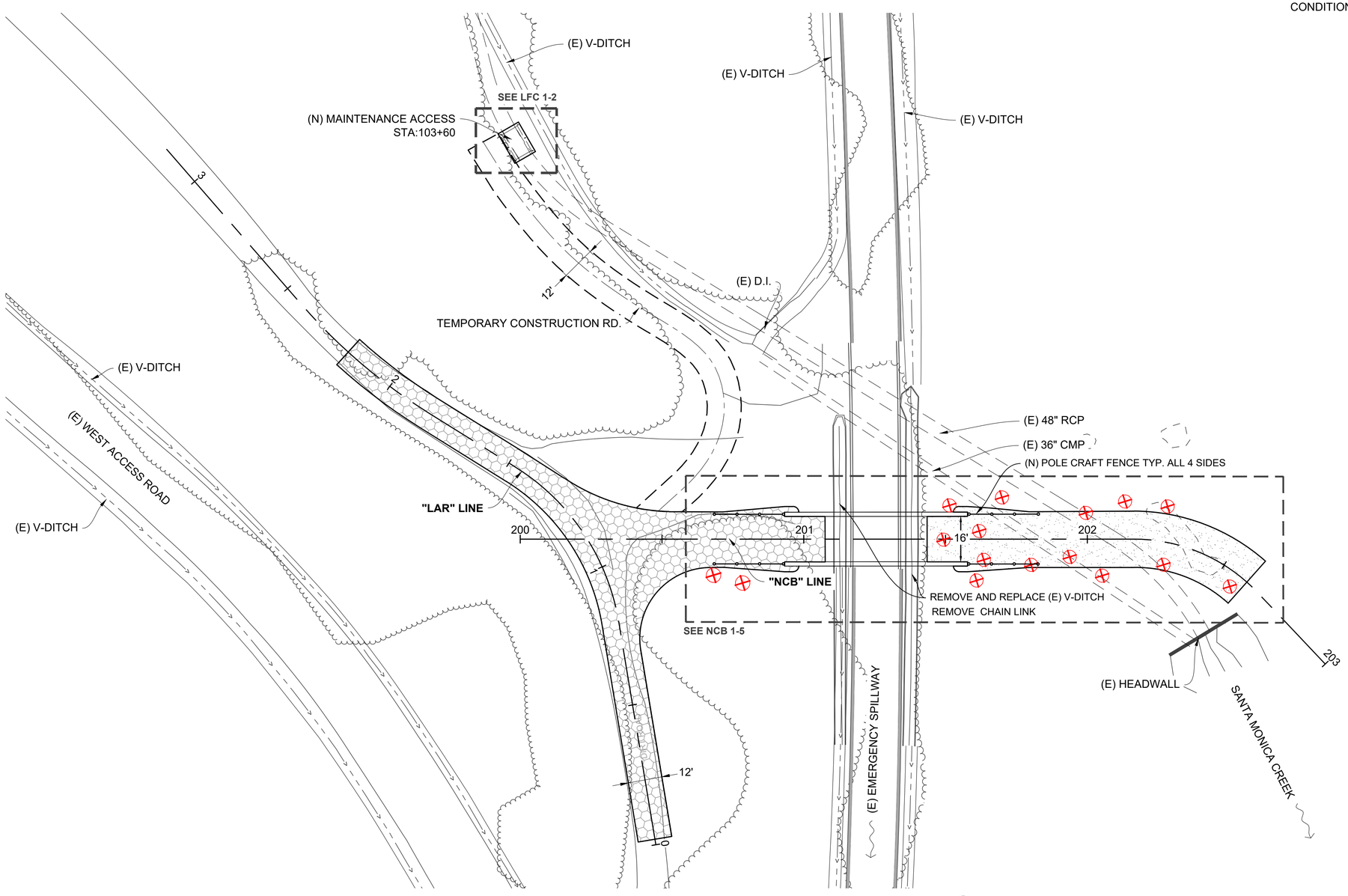
NOTES:

1. TEMPORARY CONSTRUCTION RD. TO BE RESTORED TO PRECONSTRUCTION CONDITIONS AFTER MAINTENANCE ACCESS CONSTRUCTION.



LOWER ACCESS

LEGEND

9.5" CRCP 3" HMA (TYPE A)	
6" AC (OPEN GRADED) 6" AB (CL 2)	
6" AB (CL 2)	
(E) ROCK SLOPE PROTECTION	
(N) ROCK SLOPE PROTECTION	
GRADED NATIVE SOIL	
BONDED FIBER MATRIX	
TREES TO BE REMOVED	⊗

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

ROADWAY LAYOUT

DESIGNED BY: TC
DRAWN BY: HS
CHECKED BY: SO

LO-2

SHEET 14 OF 88

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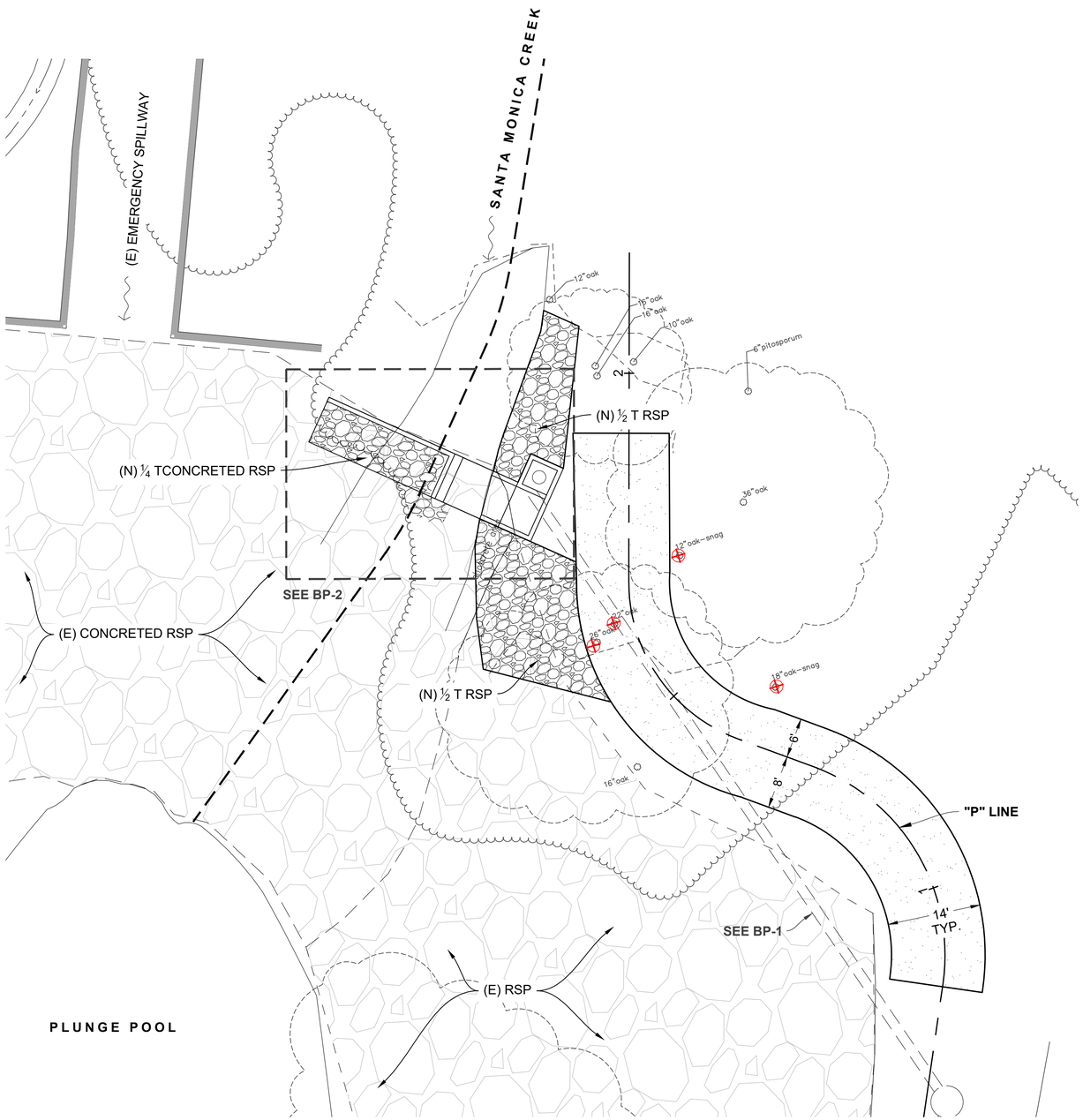
2/8/2022 9:46 AM PLOT DATE/TIME



LEGEND

- 9.5" CRCP / 3" HMA (TYPE A)
- 6" AC (OPEN GRADED) / 6" AB (CL 2)
- 6" AB (CL 2)
- (E) ROCK SLOPE PROTECTION
- (N) ROCK SLOPE PROTECTION
- GRADED NATIVE SOIL
- BONDED FIBER MATRIX
- TREES TO BE REMOVED

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

NORTH

PLUNGE POOL EAST ACCESS

SCALE 1" = 10'

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

ROADWAY LAYOUT

DESIGNED BY:	TC
DRAWN BY:	HS
CHECKED BY:	SO

LO-3

SHEET 15 OF 88

F:\Bengal\SB County - SMDB - Documents\Design\Production Drawings\Plunge Pool Bypass Access Rd.dwg
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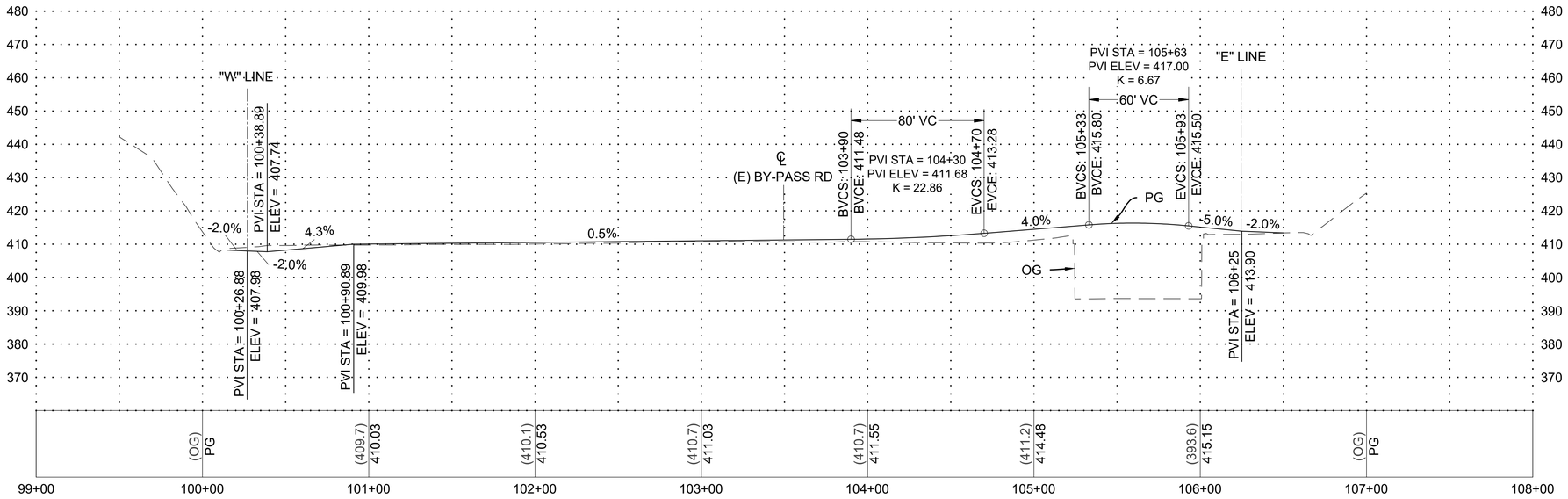
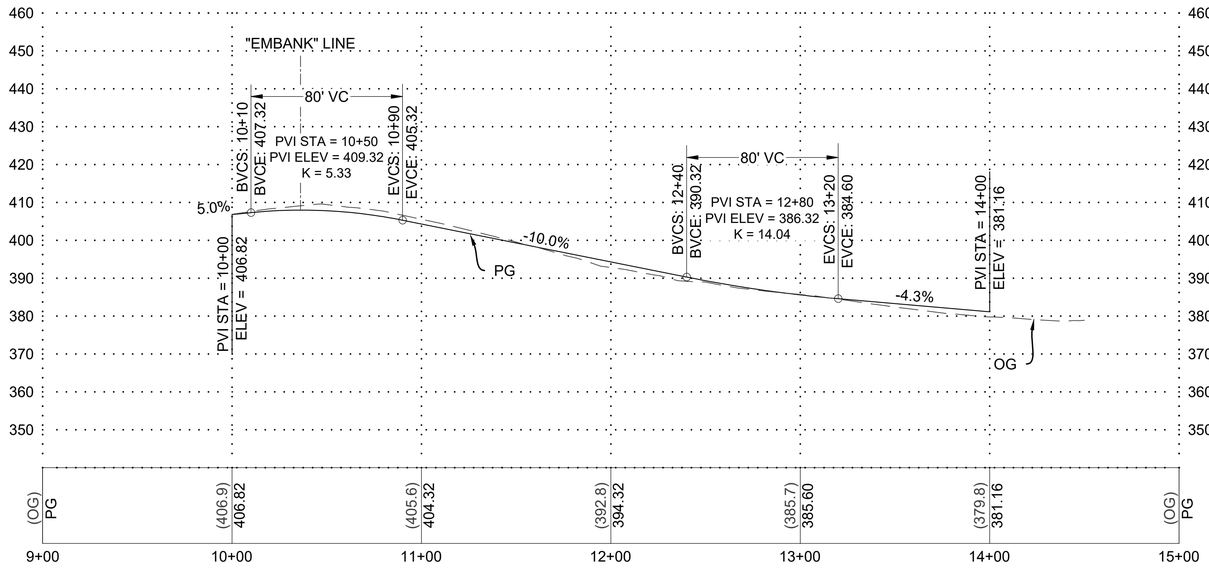


"EMBANK" LINE PROFILE

SCALE H 1" = 40' (0, 40', 80')
V 1" = 20' (0, 20', 40')



"W" LINE PROFILE

SCALE H 1" = 40' (0, 40', 80')
V 1" = 20' (0, 20', 40')

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

ROADWAY PROFILES
"EMBANK" LINE & "W" LINE

DESIGNED BY: TC
DRAWN BY: HAO
CHECKED BY: SO

P-1

SHEET 16 OF 88

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

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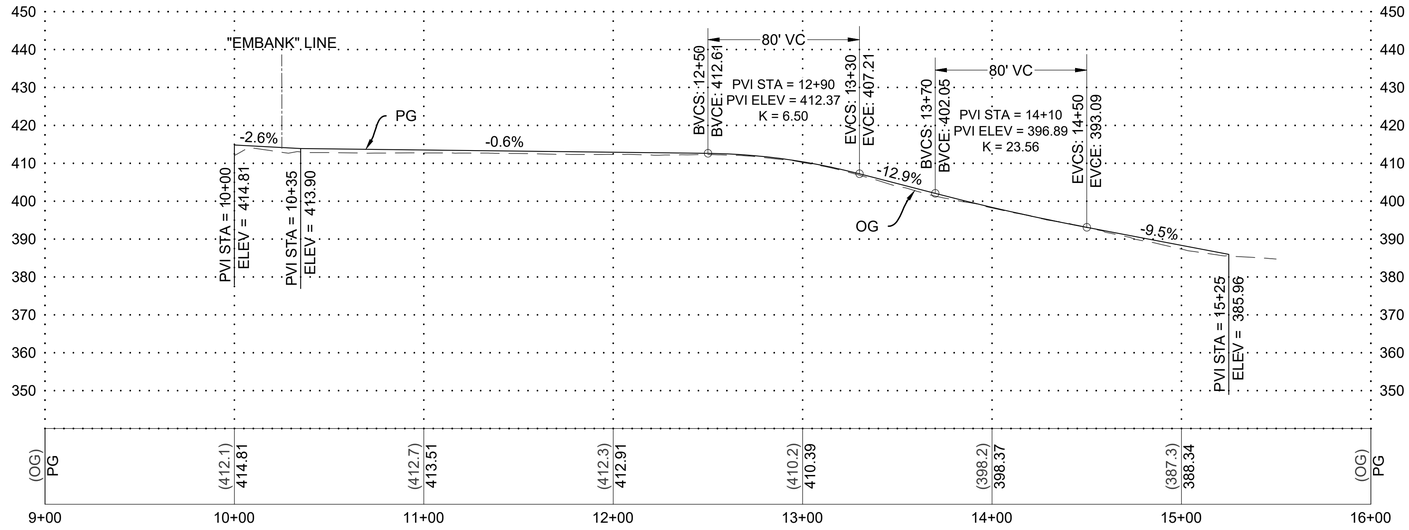
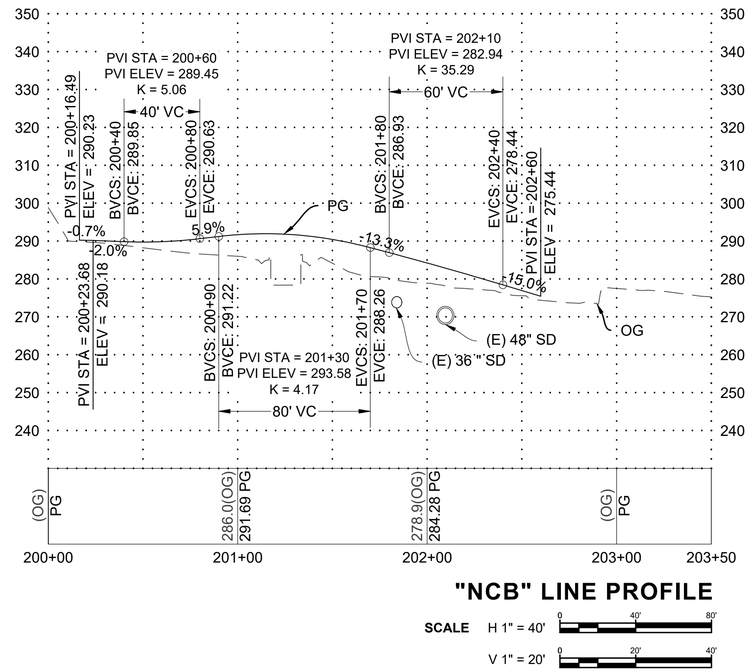


"E" LINE PROFILE

SCALE H 1" = 40' (0, 40', 80')
V 1" = 20' (0, 20', 40')



"NCB" LINE PROFILE

SCALE H 1" = 40' (0, 40', 80')
V 1" = 20' (0, 20', 40')

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

ROADWAY PROFILES
"E" LINE & "NCB" LINE

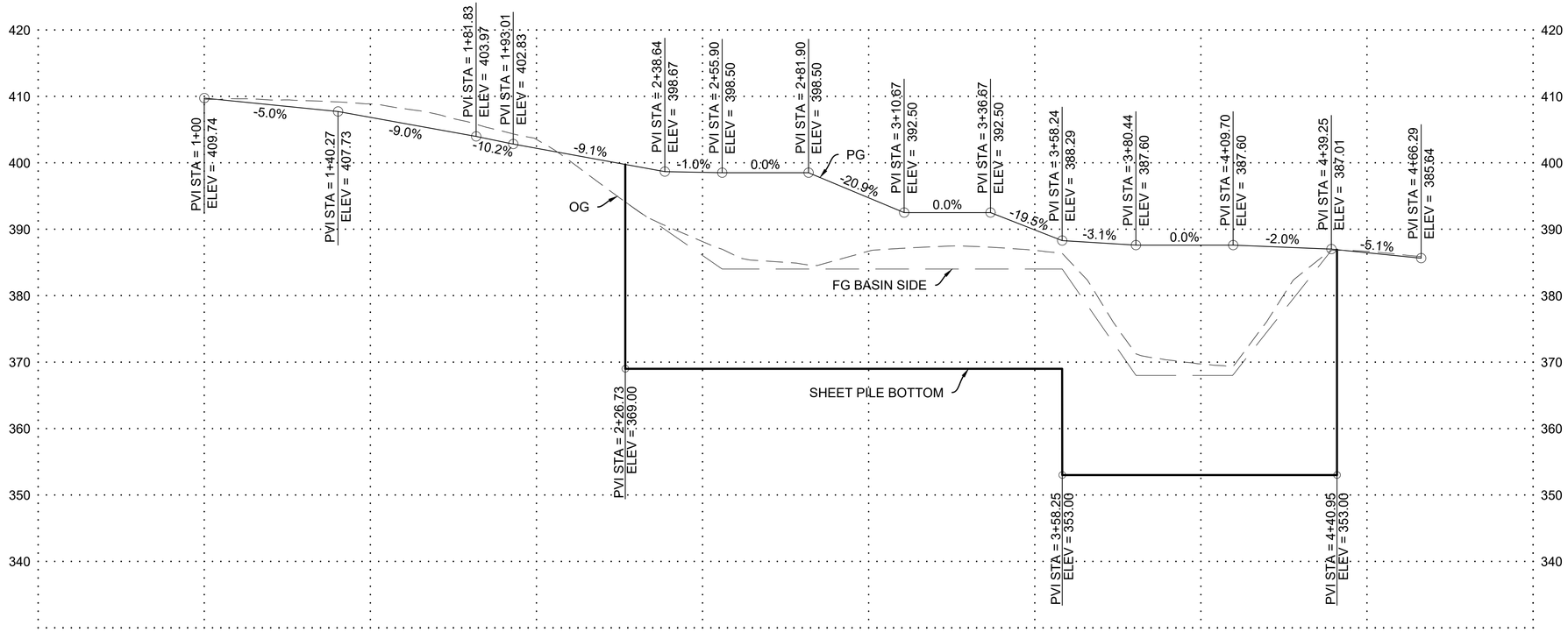
DESIGNED BY:	TC
DRAWN BY:	HAO
CHECKED BY:	SO

P-2

SHEET 17 OF 88

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2

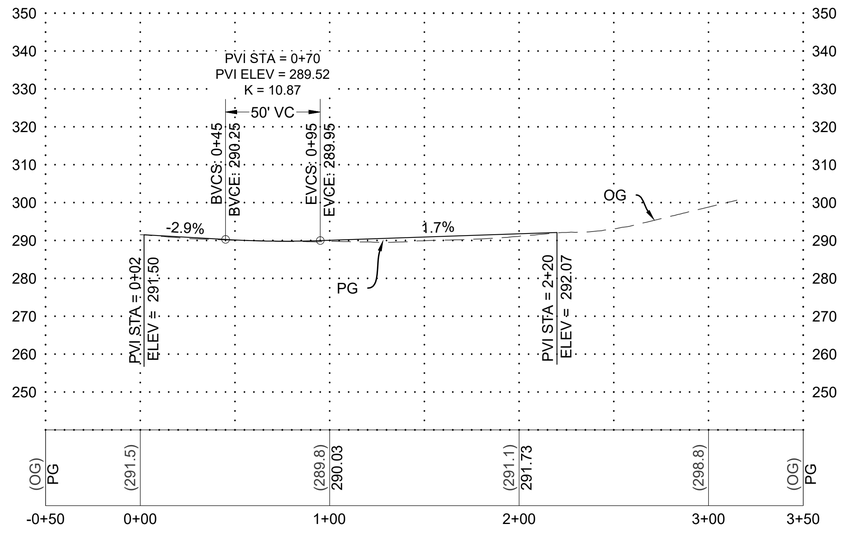
F:\Bengal\SB County - SMDB - Documents\Design\Production Drawings\06-Profiles.dwg
2/8/2022 9:47 AM PLOT DATE/TIME



"TAP" LINE WALL PROFILE

SCALE H 1" =20' (0, 20', 40')

V 1" = 10' (0, 10', 20')



"LAR" LINE PROFILE

SCALE H 1" = 40' (0, 40', 80')

V 1" = 20' (0, 20', 40')

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

ROADWAY PROFILES
"TAP" LINE & "LAR" LINE

DESIGNED BY: TC
DRAWN BY: HAO
CHECKED BY: SO

P-3

SHEET 18 OF 88

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

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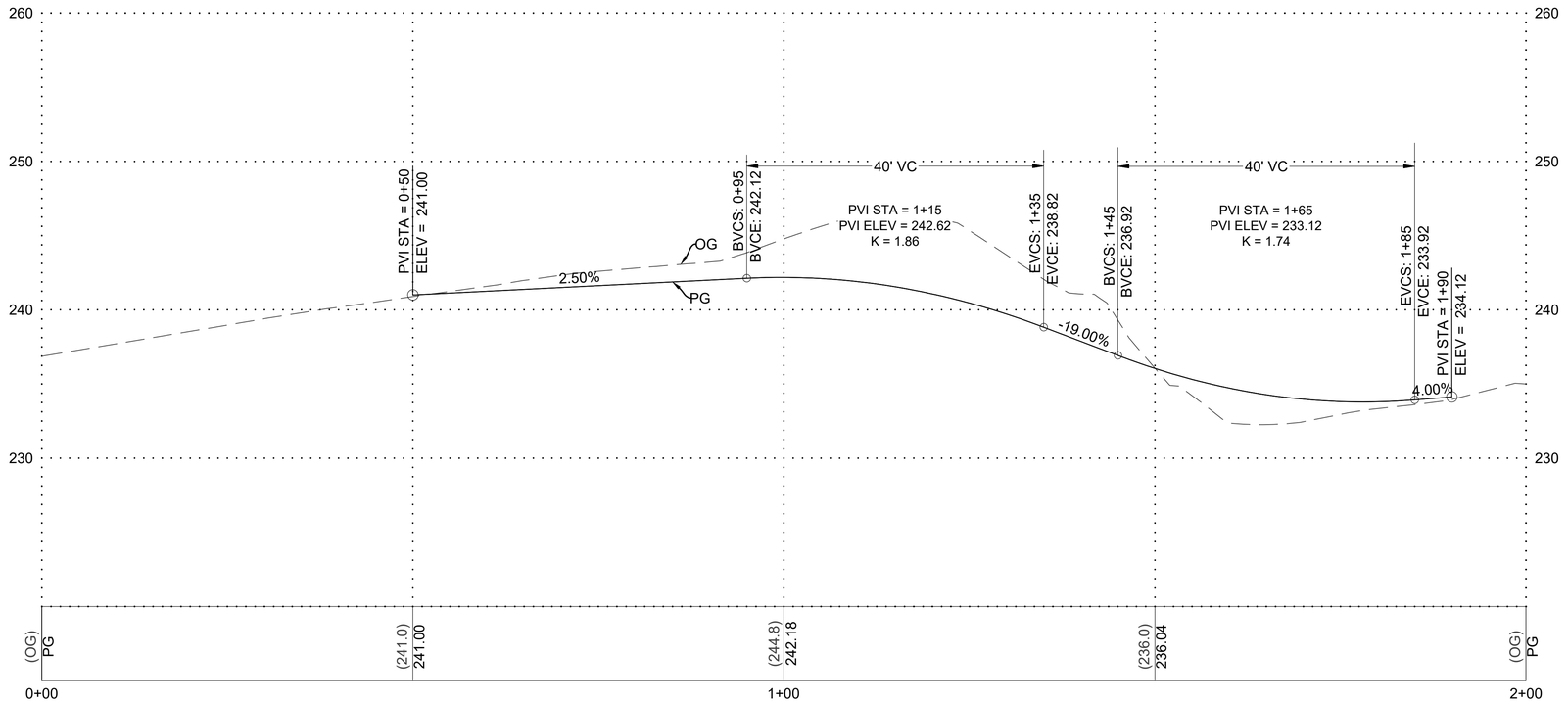

"P" LINE PROFILE

SCALE H 1" = 10'

V 1" = 5'

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

ROADWAY PROFILES
"P" LINE

DESIGNED BY:	TC
DRAWN BY:	HAO
CHECKED BY:	SO

P-4

SHEET 19 OF 88

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

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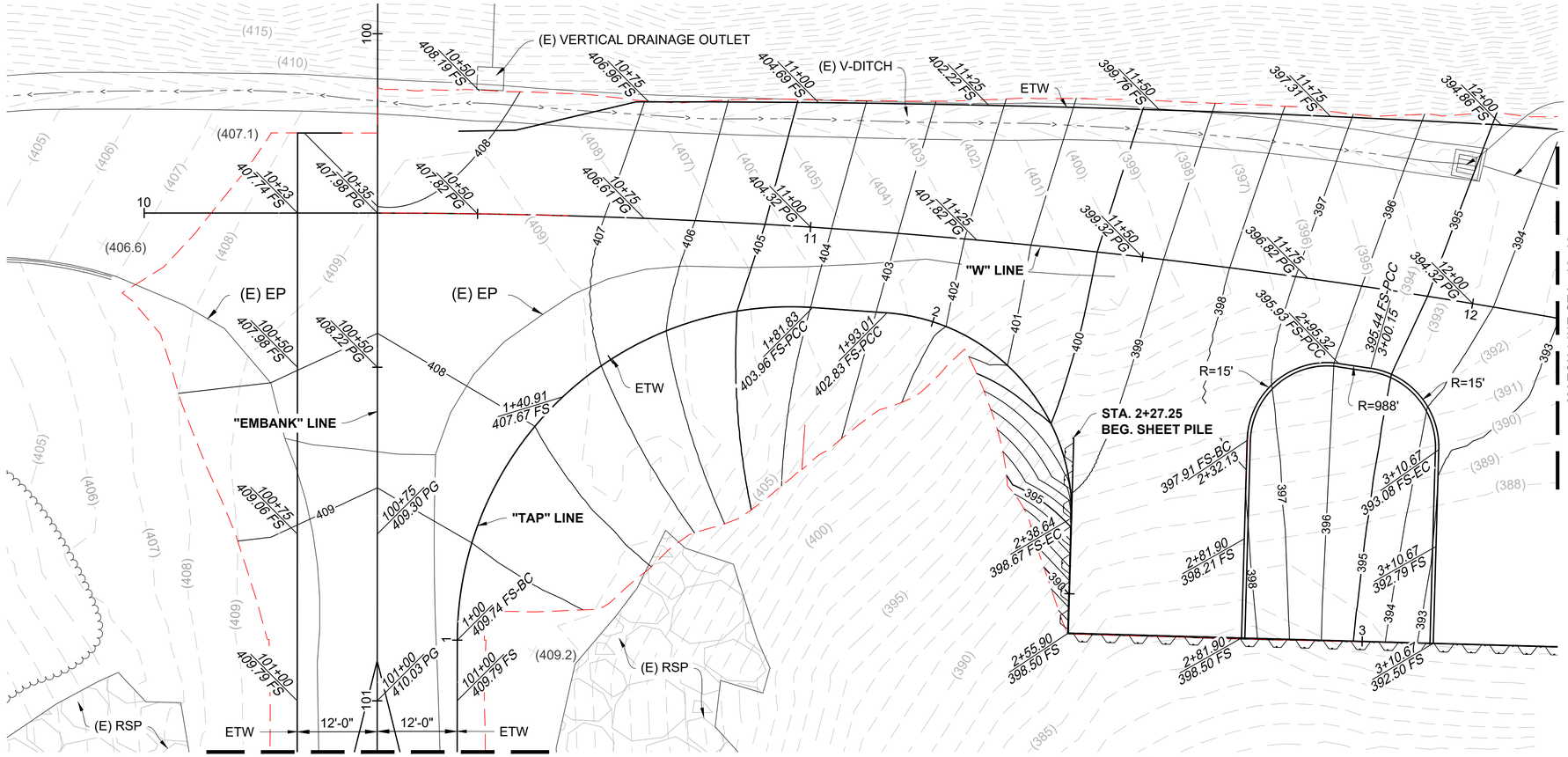
LEGEND:

DAYLIGHT



"W" LINE CONSTRUCTION DETAILS

NORTH

SCALE 1" = 10'

0 10' 20'

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

CONSTRUCTION DETAILS
"W" LINE

DESIGNED BY:	TC
DRAWN BY:	HAO
CHECKED BY:	SO

CD-1

SHEET 20 OF 88

FOR 22" PLANS
ORIGINAL 24" IN INCHES

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2/8/2022 9:47 AM PLOT DATE/TIME

MATCH LINE STA: 12+10

LEGEND:

DAYLIGHT

(E) DIRT ROAD

"W" LINE

"TAP" LINE

STA. 4+39.24
END SHEET PILE

ETW

ETW

(E) 24" PLASTIC PIPE

(E) RSP

(E) FAILING
EMBANKMENT

A

A

4

12+25
392.41 FS

12+50
389.59 FS

12+25
391.82 PG

12+50
389.35 PG

12+75
387.49 FS

12+75
387.25 PG

13+00
385.84 FS

13+00
385.60 PG

13+25
384.62 FS

13+25
384.38 PG

13+50
383.55 FS

13+50
383.31 PG

13+75
382.47 FS

13+75
382.23 PG

14+00
381.40 FS

14+00
381.16 PG

14+59
379.06 FS

14+50
378.92 PG

14+50

14+38.42
378.50 FS

3+49.39
390.50 FS-PCC

3+49.97
390.34 FS-PCC

3+36.67
392.02 FS-BC

3+58.24
389.02 FS-EC

3+36.67
392.26 FS

3+58.24
388.66 FS

392.50 FS
3+36.67

3+58.24
388.29 FS

4+39.24
381.01 FS-BC

4+06.29
385.64 FS-EC

13+15
384.71 FS

13+85
380.00 FS

14+00
380.92 FS

13+15
364.00 FS

13+85
357.95 FS

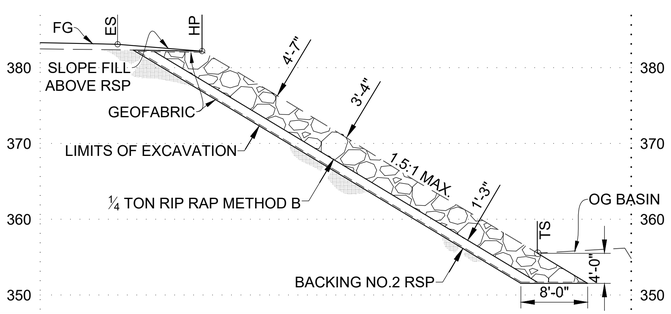
3+80.44
387.60 FS

4+09.70
387.60 FS

12'-0"

12'-0"

(379.7)



SLOPE REINFORCEMENT DETAIL
SECTION A-A

SCALE 1" = 10'

NORTH

"W" LINE CONSTRUCTION DETAILS

SCALE 1" = 10'

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

CONSTRUCTION DETAILS
"W" LINE

DESIGNED BY:	TC
DRAWN BY:	HAO
CHECKED BY:	SO

CD-2

SHEET 21 OF 88

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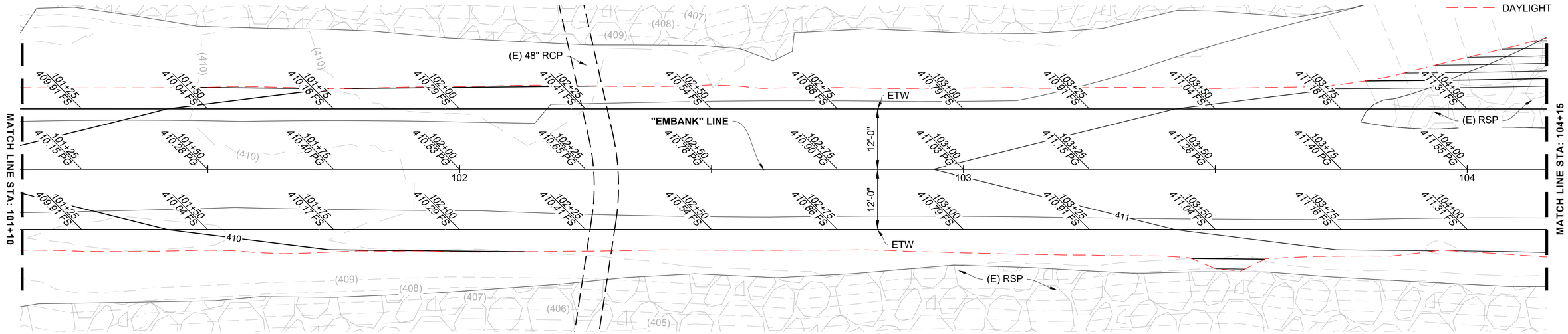

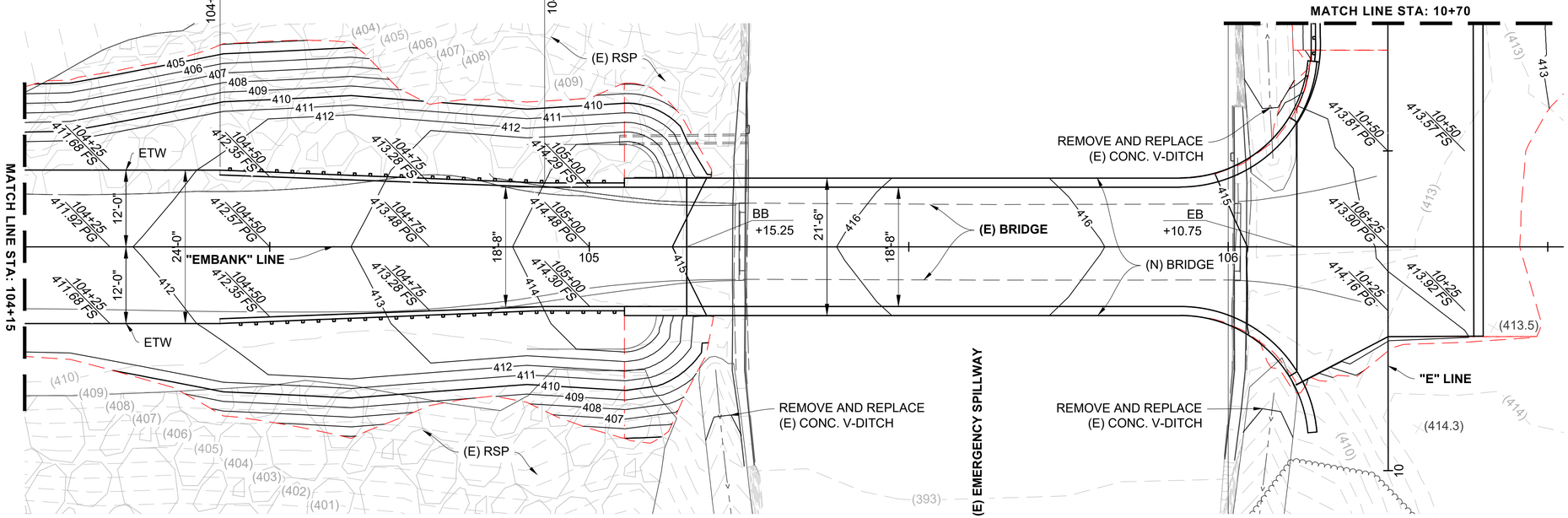

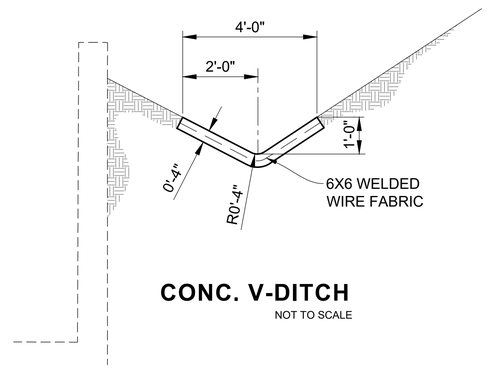

CONC. V-DITCH
NOT TO SCALE

NORTH

"EMBANK" LINE CONSTRUCTION DETAILS

SCALE 1" = 10'

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

CONSTRUCTION DETAILS
"EMBANK" LINE

DESIGNED BY:	TC
DRAWN BY:	HAO
CHECKED BY:	SO

CD-3

SHEET 22 OF 88

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2

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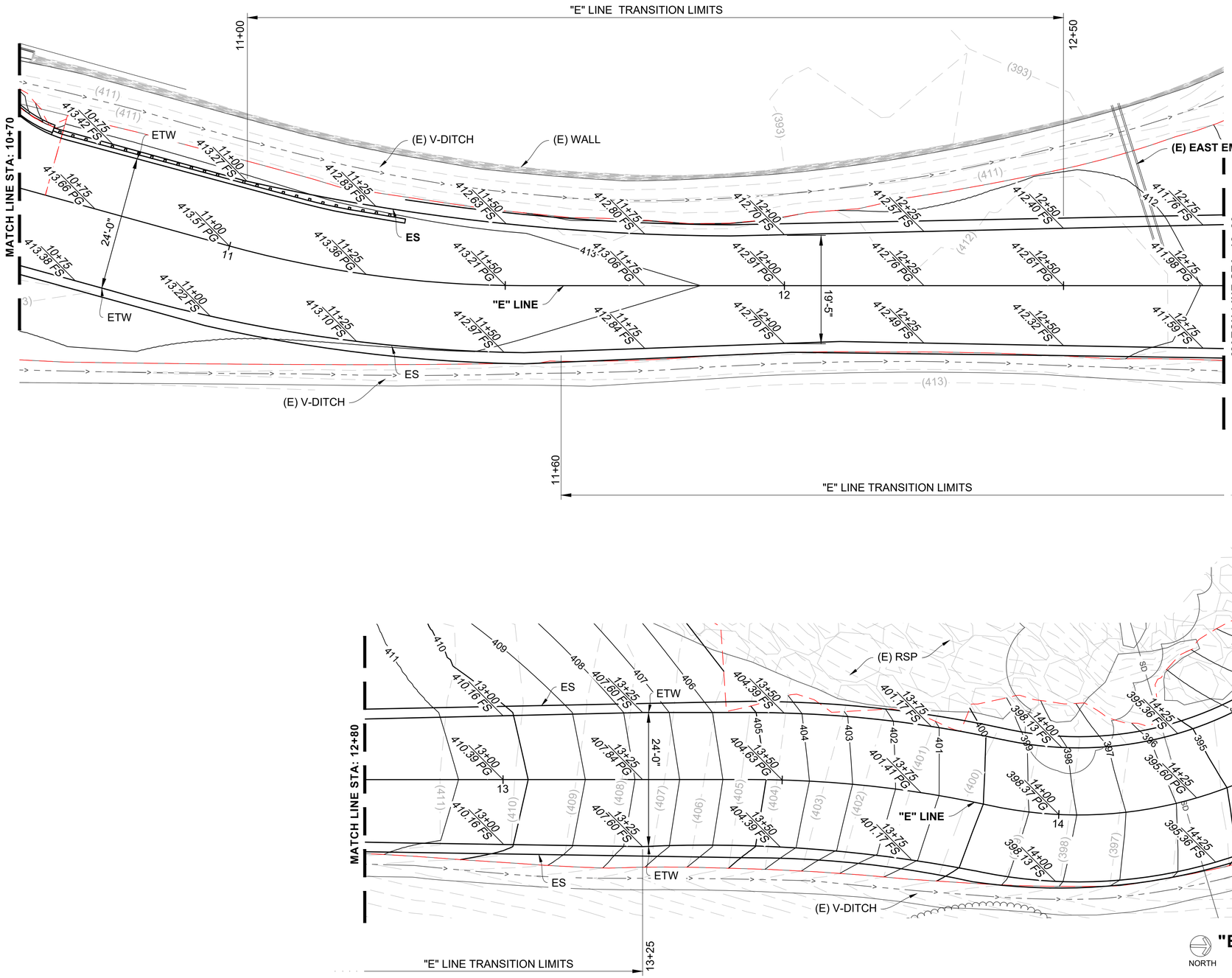
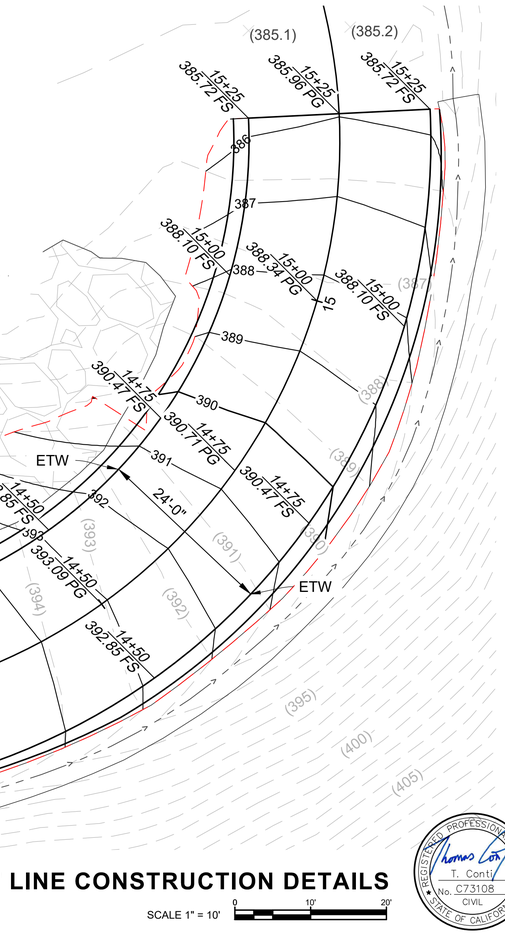




LEGEND:

DAYLIGHT

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

NORTH

SCALE 1" = 10'

"E" LINE CONSTRUCTION DETAILS

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

CONSTRUCTION DETAILS
"E" LINE

DESIGNED BY:	TC
DRAWN BY:	HAO
CHECKED BY:	SO

CD-4

SHEET 23 OF 88

F:\Bengal\SB County - SMDB - Documents\Design\Production Drawings\07-Details.dwg
2/8/2022 9:48 AM PLOT DATE/TIME

LEGEND:

DAYLIGHT

TREE REMOVAL

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

0 1 2

(E) EDGE OF CLEARING
TEMP. CONST. RD.
(E) V-DITCH
REMOVE AND REPLACE
(E) CONC. V-DITCH
SEE CD-3
(E) 48" RCP
(E) 36" CMP
"NCB" LINE
"LAR" LINE
BB
EB
ES
ETW
(E) EMERGENCY SPILLWAY
REMOVE AND REPLACE
(E) CONC. V-DITCH
SEE CD-3
(E) V-DITCH
8'-0"
19'-0"
200
201
202
203
1+25 290.25 FS
1+25 290.46 PG
1+25 290.40 FS
1+00 290.03 PG
1+00 289.97 FS
200+23.88 290.22 PG
200+50 290.02 FS
200+50 290.75 PG
200+50 289.52 FS
200+75 290.55 FS
200+75 290.36 PG
200+75 290.23 FS
201+00 291.93 FS
201+00 291.69 PG
201+00 291.53 FS
201+50 290.60 FS
201+50 290.44 PG
201+50 290.28 FS
201+75 287.74 FS
201+75 287.60 PG
201+75 287.40 FS
202+00 284.37 FS
202+00 284.21 PG
202+00 284.05 FS
202+25 280.82 FS
202+25 280.66 PG
202+25 280.50 FS
202+50 277.10 FS
202+50 276.94 PG
202+50 276.78 FS
202+60 275.60 FS
202+60 275.44 FS
202+60 275.28 FS
(273.8)
(273.4)

NORTH

"NCB" LINE CONSTRUCTION DETAILS

SCALE 1" = 10' 0 10' 20'

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

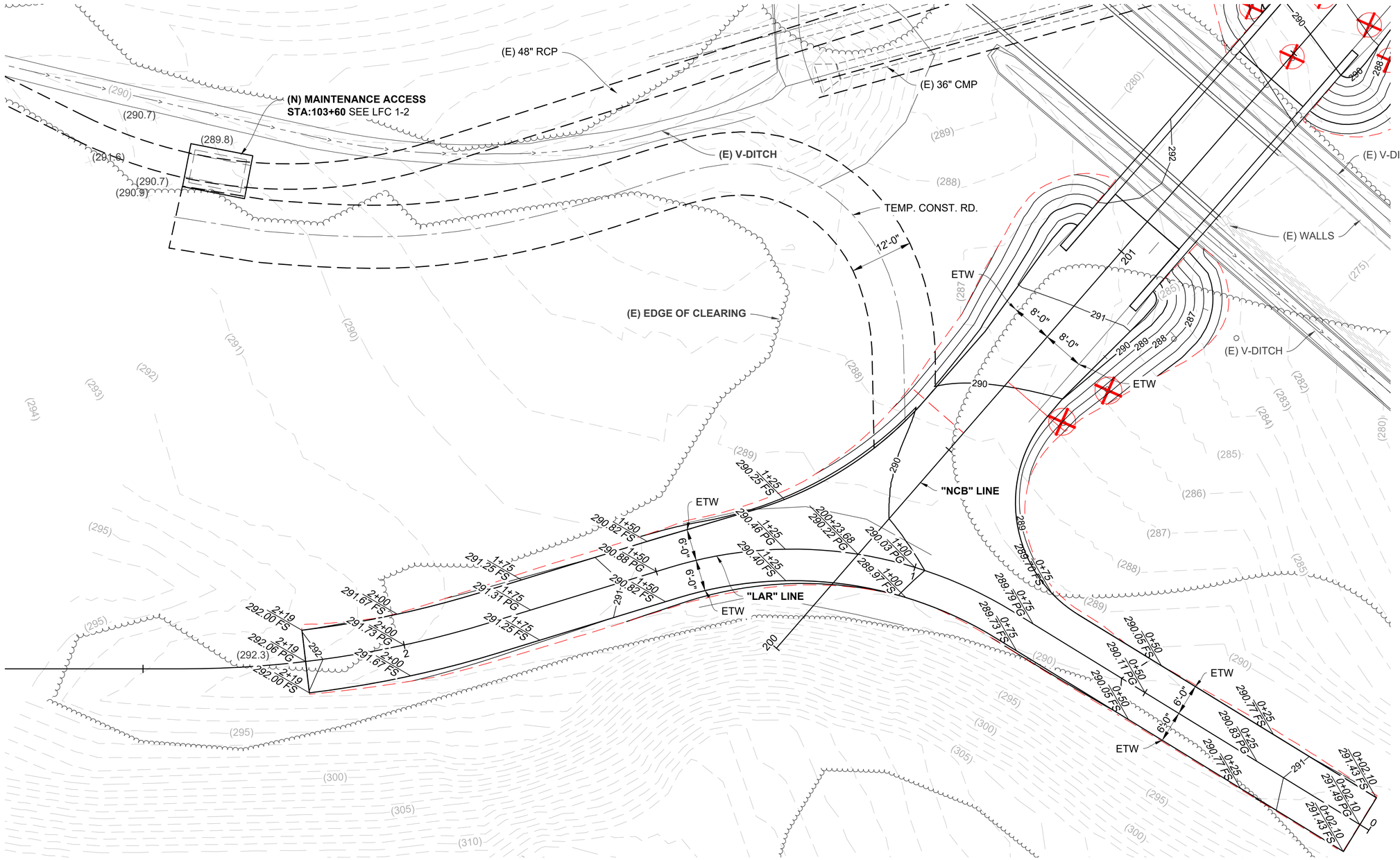
CONSTRUCTION DETAILS
"NCB" LINE

DESIGNED BY: TC
DRAWN BY: HAO
CHECKED BY: SO

CD-5

SHEET 24 OF 88

F:\Bengal\SB County - SMDB - Documents\Design\Production Drawings\07-Details.dwg
2/8/2022 9:48 AM PLOT DATE/TIME



"LAR" LINE CONSTRUCTION DETAILS

NORTH SCALE 1" = 10' (0, 10', 20')

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES (0, 1, 2)

REGISTERED PROFESSIONAL ENGINEER — T. Conti — No. C73108 — CIVIL — STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

CONSTRUCTION DETAILS
"LAR" LINE

DESIGNED BY: TC
DRAWN BY: HAO
CHECKED BY: SO

CD-6

SHEET 25 OF 88

F:\Bengal\SB County - SMDB - Documents\Design\Production Drawings\07-Details.dwg
2/8/2022 9:48 AM PLOT DATE/TIME

LEGEND:

DAYLIGHT

TREE REMOVAL

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES

NORTH

"P" LINE CONSTRUCTION DETAILS

SCALE 1" = 10'

REGISTERED PROFESSIONAL ENGINEER — Thomas Cox — T. Conti — No. C73108 — CIVIL — STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

CONSTRUCTION DETAILS
"P" LINE

DESIGNED BY: TC
DRAWN BY: HAO
CHECKED BY: SO

CD-7

SHEET 26 OF 88

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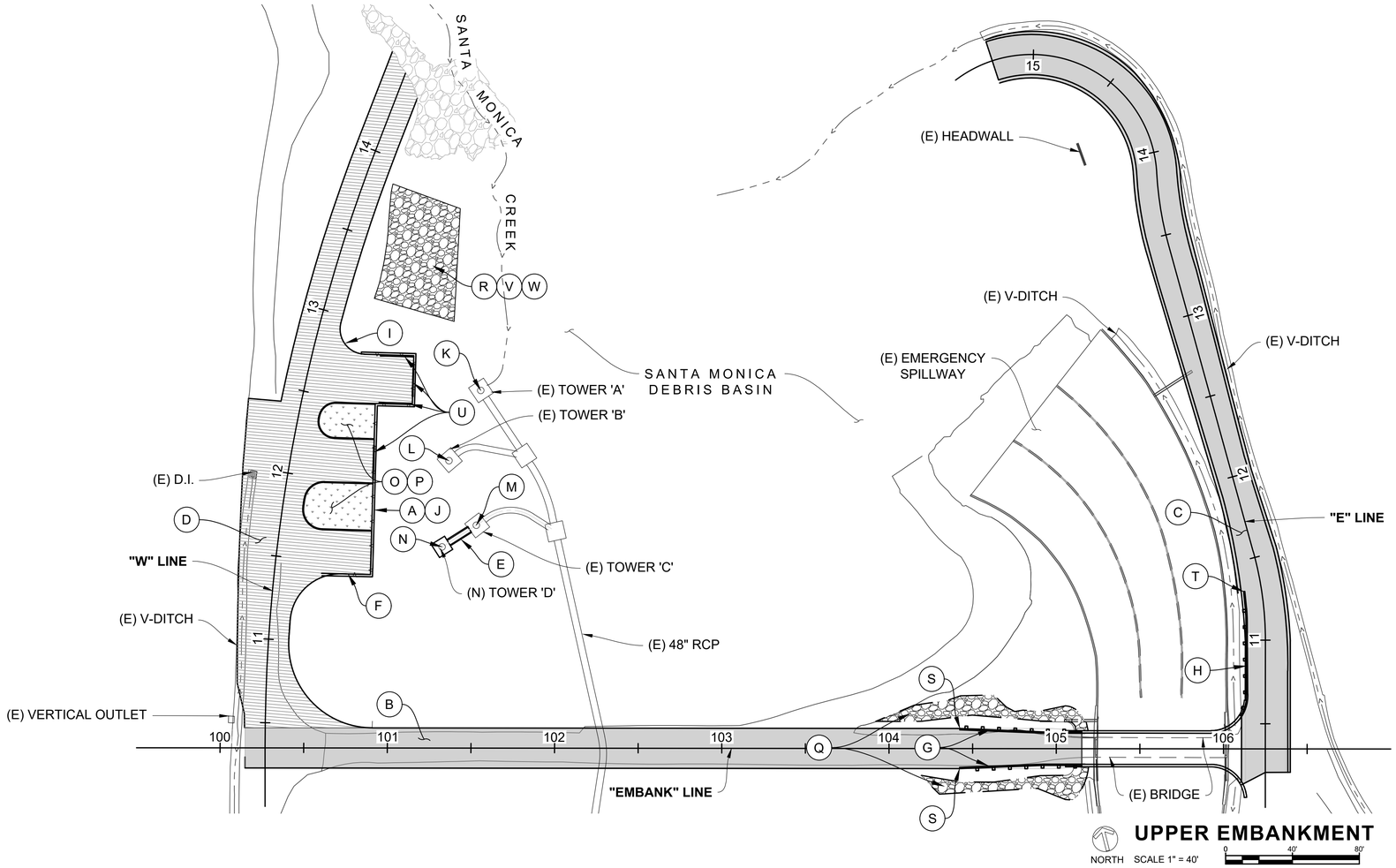
2/8/2022 9:46 AM PLOT DATE/TIME

NOTES: SEE SHEET Q-2 FOR QUANTITIES TABLE.



UPPER EMBANKMENT

NORTH SCALE 1" = 40'

0 40' 80'

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

SUMMARY OF QUANTITIES

DESIGNED BY:	TC
DRAWN BY:	HS
CHECKED BY:	SO

Q-1

SHEET 27 OF 88

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NOTES: SEE SHEET Q-1 FOR QUANTITY ITEMS

UPPER EMBANKMENT SUMMARY OF QUANTITIES

ITEM	DESCRIPTION	SHEET PILE	ASPHALT BASE & PAVING							REINFORCED CONCRETE BASE & PAVING							PIPE	CABLE RAILING	MW RAIL		CURB & GUTTER COSB STD 4-030		STEEL COPING	FRAME/ COVER	BONDED FIBER MATRIX	EROSION CONTROL BLANKET	ROCK SLOPE PROTECTION	ROCK SLOPE PROTECTION BACKING	K BARRIER	CL 8 RSP FABRIC
			BASE (CL -2)			HMA OPEN GRADED (OGFC)				HMA (TYPE A)				PCC					GUARD RAIL	TERMINAL SYSTEM	CL II	18" GUTTER								
		AREA	AREA (N)	DEPTH (N)	VOLUME	AREA (N)	DEPTH (N)	VOLUME (N)	VOLUME	AREA (N)	DEPTH (N)	VOLUME (N)	VOLUME	AREA (N)	DEPTH (N)	VOLUME	36" RCP CL V	LENGTH	LENGTH	ITEM	VOLUME	LENGTH	LENGTH	ITEM	AREA	AREA	VOLUME	VOLUME	LENGTH	AREA
		(SF)	(SF)	(FT)	(CY)	(SF)	(FT)	(CY)	(TON)	(SF)	(FT)	(CY)	(TON)	(SF)	(FT)	(CY)	(LF)	(LF)	(LF)	(EA)	(CY)	(LF)	(LF)	(EA)	(SF)	(SF)	(CY)	(CY)	(LF)	(SY)
A	Sheet Pile - Tower Access pad	12,400																												
B	Asphalt Road - ("Embank" Line)		11,975	0.50	222	11,975	0.50	222	488																					
C	Asphalt Road - ("E" Line)		12,510	0.50	232	12,510	0.50	232	510																					
D	Continuiously Reinfced Concrete pavement - ("W" Line)									16,262	0.25	151	331	16,262	0.79	477														
E	Tower D Pipe to Tower C																24													
F	Cable Railing w/ Removable Post (Tower Pad)																	125												
G	Guard Rail Sta: 104+42 - 105+17 ("EMBANK" Line)																		126											
H	Guard Rail STA: 10+52 - 11+31 ("E" Line)																		76											
I	Minor Concrete - Curb & Gutter																				19	349								
J	Steel Sheetpile Coping																						211							
K	Manhole - Tower A																							1						
L	Manhole - Tower B																							1						
M	Manhole - Tower C																							1						
N	Manhole - Tower D																							1						
O	Bonded Fiber Matrix																								1,720					
P	Rolled Erosion Control Blanket																									1,720				
Q	Rock Slope Protection- 1/2 T, Method A (3' Depth)																										210			
R	Rock Slope Protection- 1/4 T Method B (3.3' Depth)																										370			
S	Guard Rail Terminal System - Flared																			2										
T	Guard Rail Terminal System - Inline																			1										
U	Type K Barrier - CA STD T3A																												80	
V	Rock Slope Protection Backing No.2 (1.25' Depth)																											150		
W	Rock Slope Protection Fabric CL 8																													330
TOTALS	(Unrounded)	12,400	24,485		453	24,485		453	998	16,262		151	331	16,262		477	24	125	202	3	19	349	211	4	1,720	1,720	580	150	80	330
TOTALS	(Rounded for Bid)	12,400	24,500		460	24,500		460	1,000	16,300		160	340	16,300		480	24	130	210	3	20	350	220	4	1,720	1,720	580	150	80	330

(N)="Not a Pay Item": for information only.
*

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

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FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
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SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

SUMMARY OF QUANTITIES

DESIGNED BY: TC
DRAWN BY: HS
CHECKED BY: SO

Q-2

SHEET 28 OF 88

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

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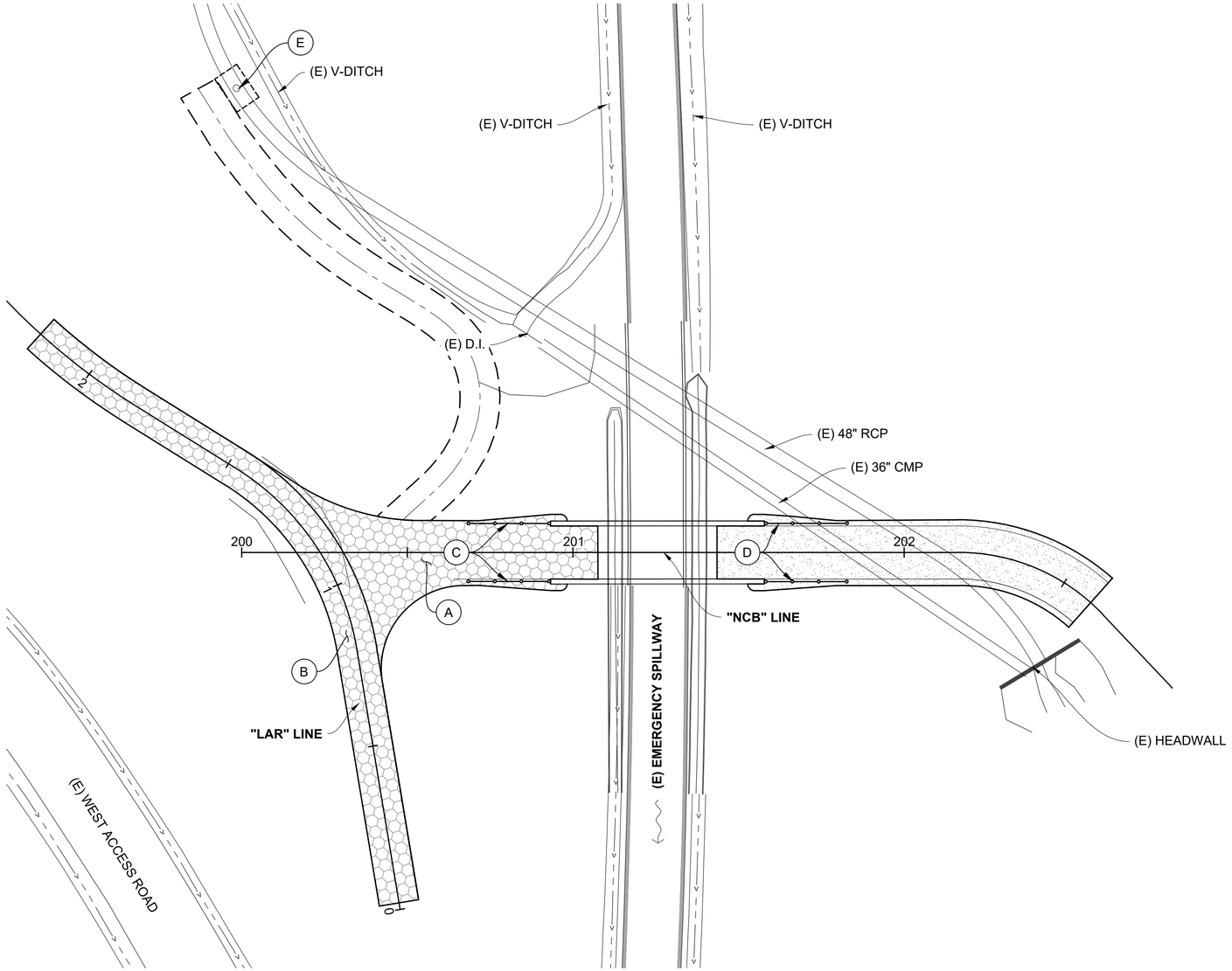

NORTH SCALE 1" = 20'

0 20' 40'

LOWER CHANNEL

LOWER CHANNEL SUMMARY OF QUANTITIES

AREA	DESCRIPTION	CL II BASE			FENCE	FRAME/ COVER
		AREA (N)	DEPTH (N)	VOLUME	LENGTH	
		(SF)	(FT)	(CY)	(LF)	(EA)
A	"NCB" Line - STA: 200+30 - 201+07.5	1,780	0.50	33		
B	"LAR" Line - STA: 00+02 - 02+19	2,612	0.50	48		
C	Pole Craft Fence - STA: 200+69 - 200+93 (LT/RT)				48	
D	Pole Craft Fence - STA: 201+58 - 202+82 (LT/RT)				48	
E	Maintianance Access Manhole SPPWC 210-3					1
TOTALS	(Unrounded)	4,392		81	96	1
TOTALS	(Rounded for Bid)	4,400		90	100	1
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SANTA BARBARA COUNTY, CALIFORNIA

SUMMARY OF QUANTITIES

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DRAWN BY: HS
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Q-3

SHEET 29 OF 88

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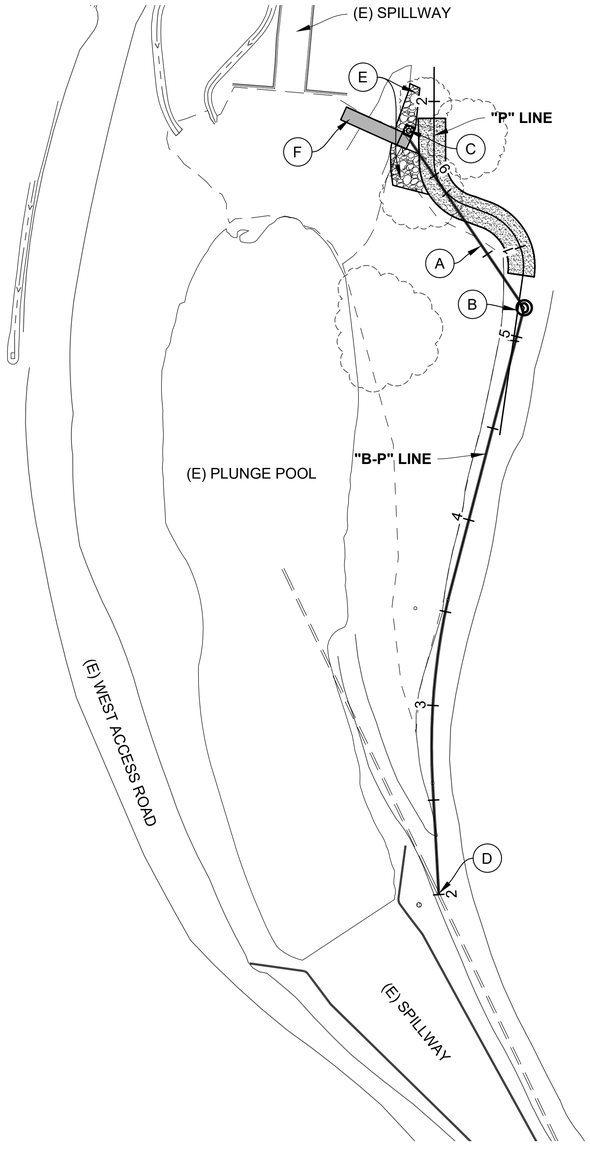

PLUNGE POOL BY-PASS

NORTH SCALE 1" = 40'

0 40' 80'

PLUNGE POOL BY-PASS SUMMARY OF QUANTITIES

AREA	DESCRIPTION	DRAINAGE				ROCK SLOPE PROTECTION	
		15" PLASTIC PIPE	MH	FRAME/ COVER	CONNECT TO EXISTING	ROCK SLOPE PROTECTION	GROUTED ROCK SLOPE PROTECTION
		(LF)	(EA)	(EA)	(EA)	CY	CY
A	"BP" Line Pipe - STA: 2+00 - 6+25	425					
B	Concrete Manhole (COSB Std. 3-080)		1	1			
C	Bypass Stucture			1			
D	Connect to Existing System (SSPWC 380-4)				1		
E	Rock Slope Protection (1/2 T, Method A)					56	
F	Concreted-Rock Slope Protection (1/4 T, Method A)						17
TOTALS	(Unrounded)	425	1	2	1	56	17
TOTALS	(Rounded for Bid)	430	1	2	1	60	20
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SUMMARY OF QUANTITIES

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Q-4

SHEET 30 OF 88

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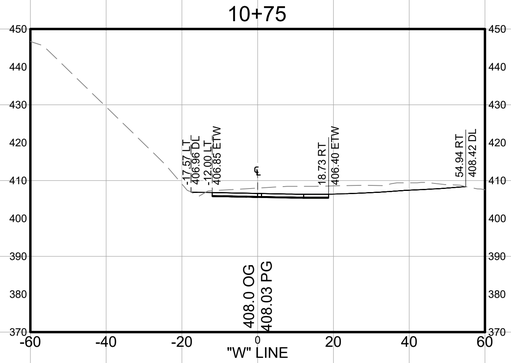

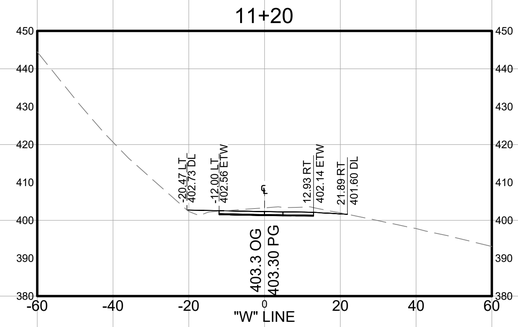

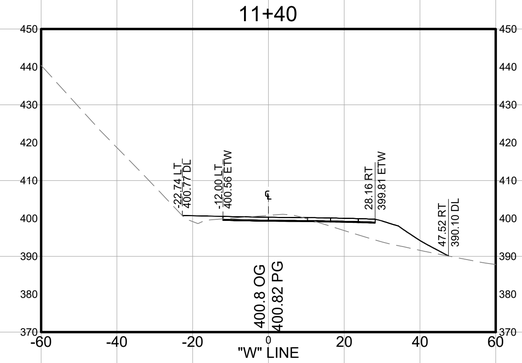

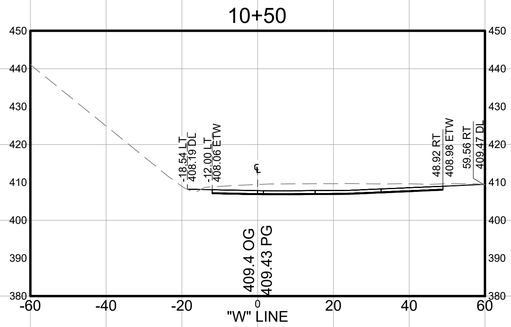

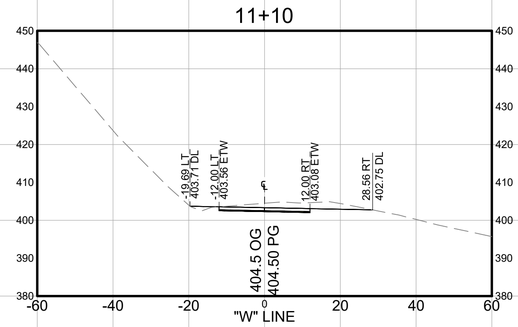

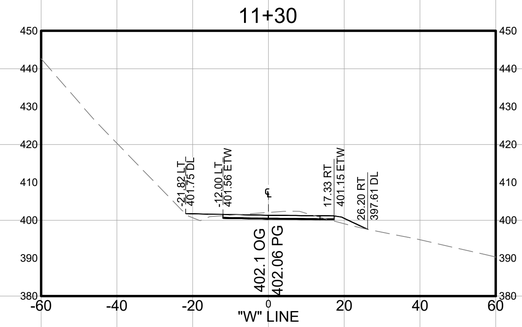

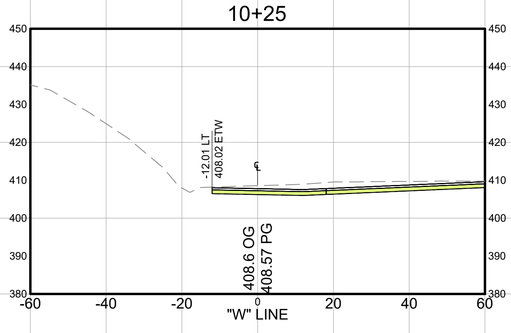

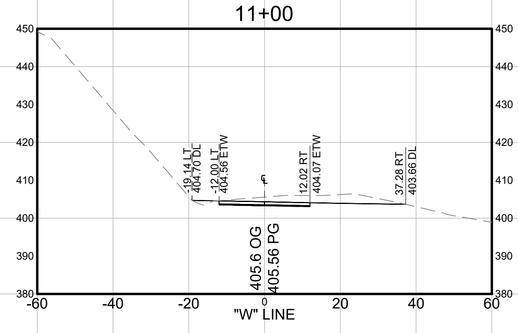

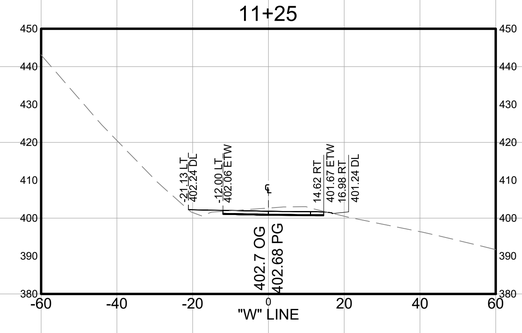

SCALE 1" = 20' H&V 0 20' 40'

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

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SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
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SANTA BARBARA COUNTY, CALIFORNIA

"W" SECTIONS

DESIGNED BY:	TC
DRAWN BY:	HS
CHECKED BY:	SO

XS-1

SHEET 31 OF 88

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0 1 2

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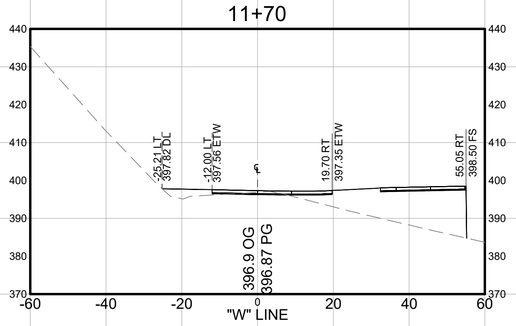

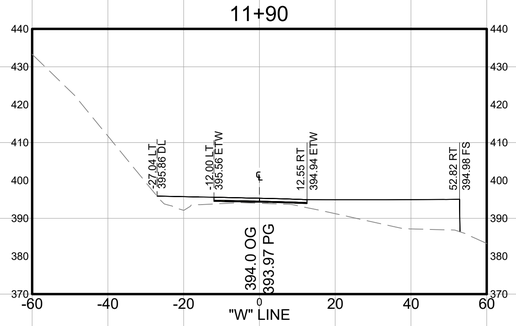

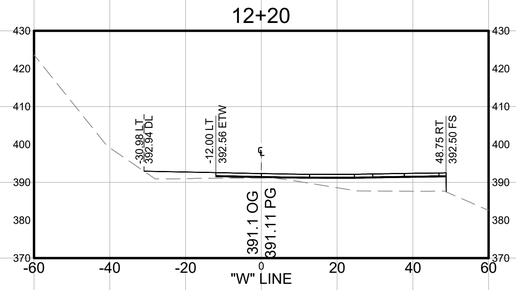

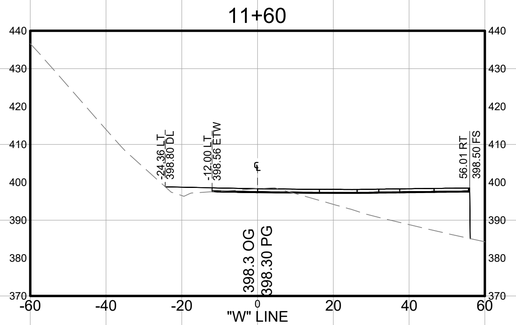

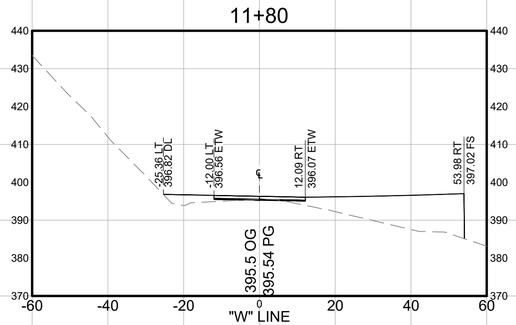

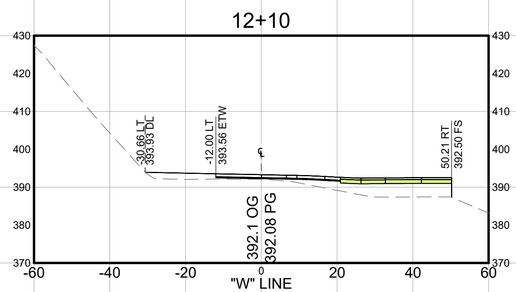

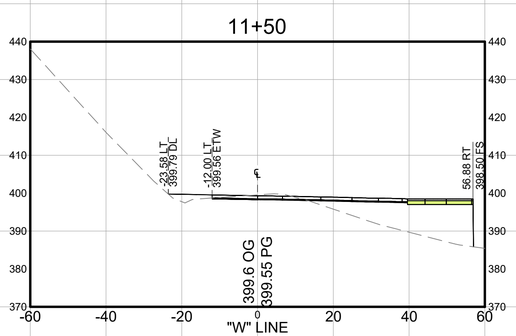

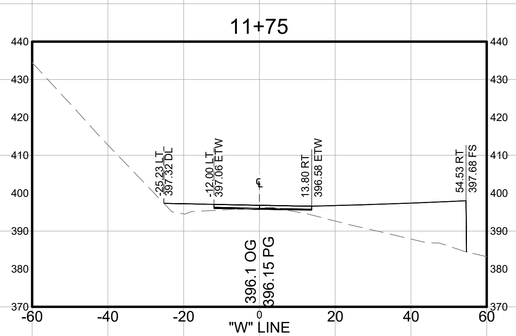

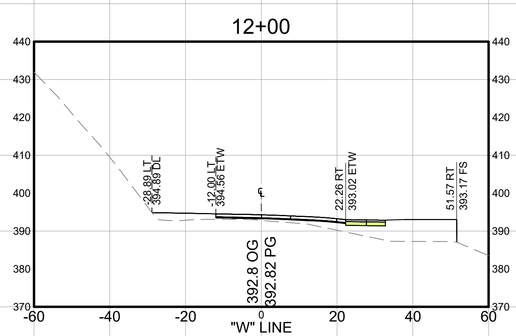

SCALE 1" = 20' H&V 0 20' 40'

FOR REDUCED PLANS
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0 1 2

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

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SANTA BARBARA COUNTY, CALIFORNIA

"W" SECTIONS

DESIGNED BY: TC
DRAWN BY: HS
CHECKED BY: SO

XS-2

SHEET 32 OF 88

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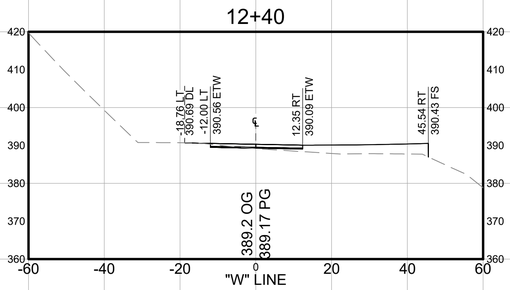

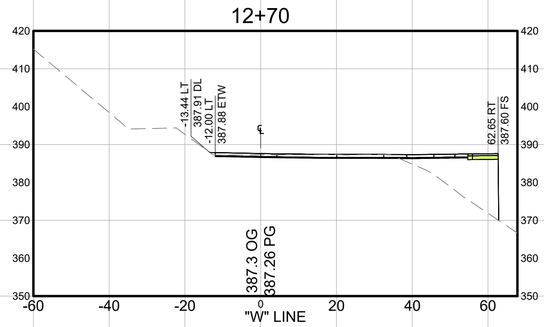

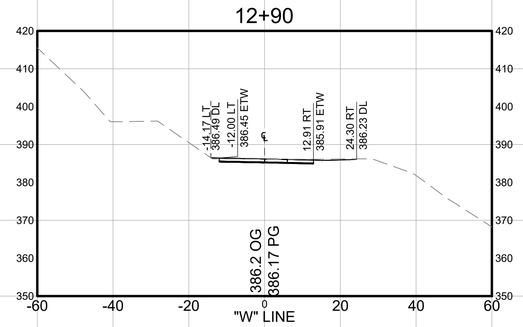

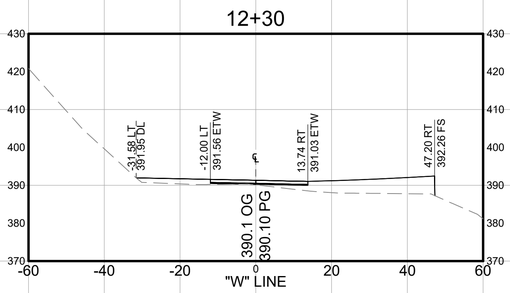

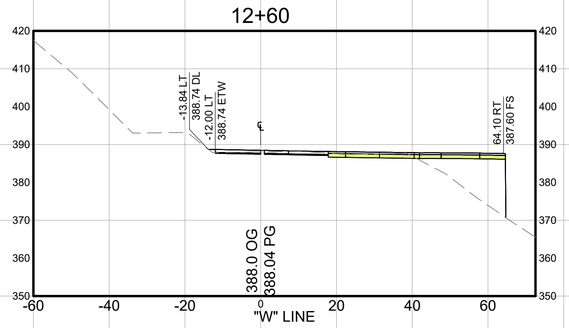

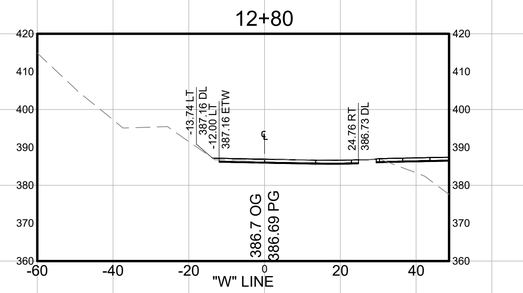

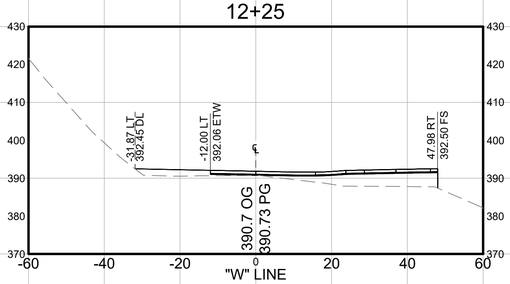

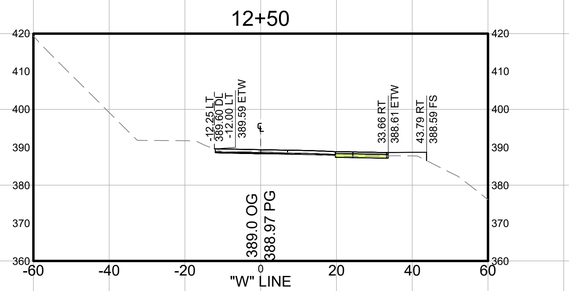

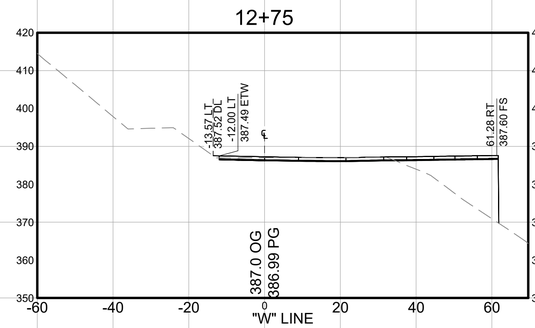

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SANTA BARBARA COUNTY, CALIFORNIA

"W" SECTIONS

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DRAWN BY:	HS
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XS-3

SHEET 33 OF 88

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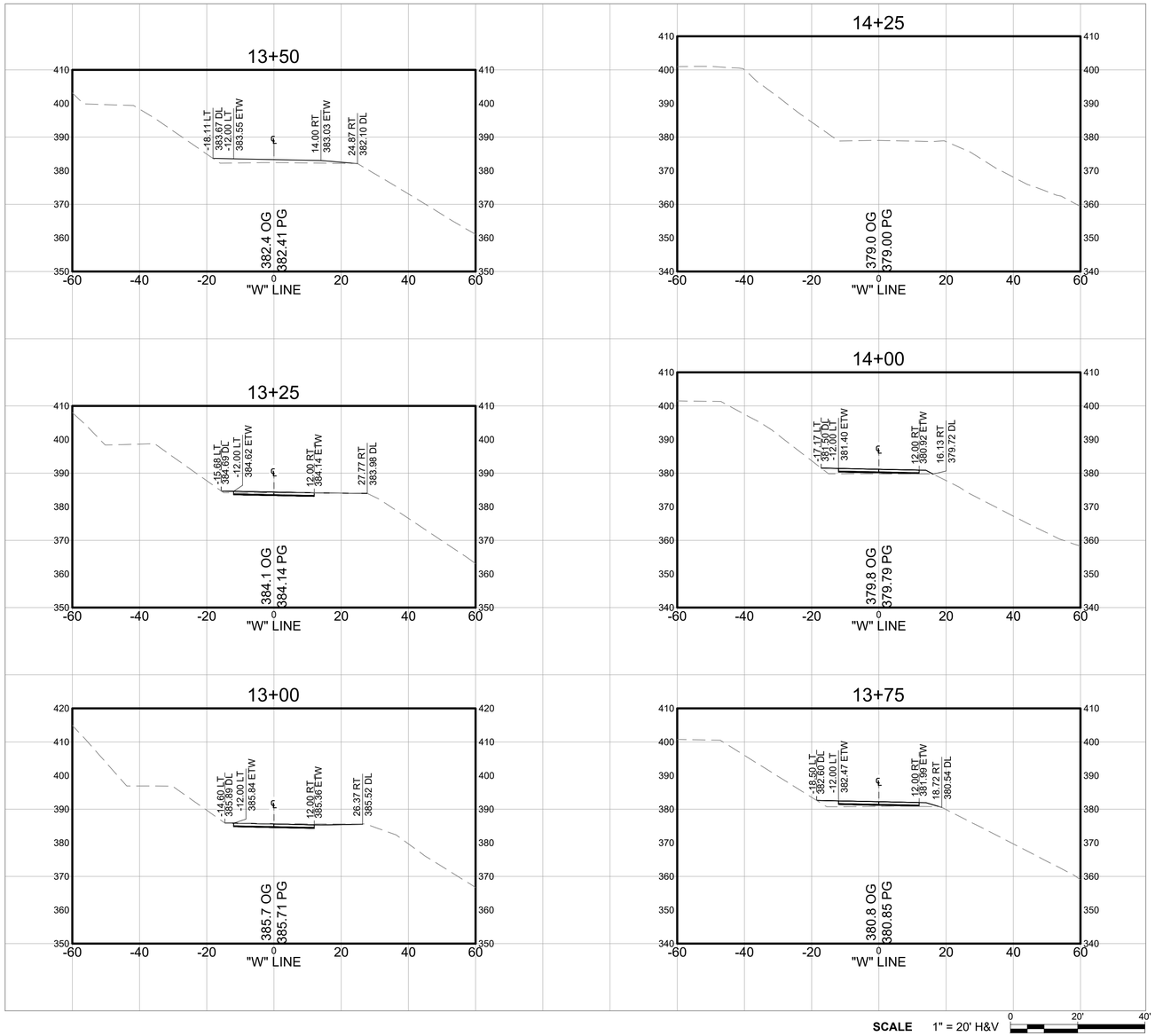

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No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

"W" SECTIONS

DESIGNED BY:	TC
DRAWN BY:	HS
CHECKED BY:	SO

XS-4

SHEET 34 OF 88

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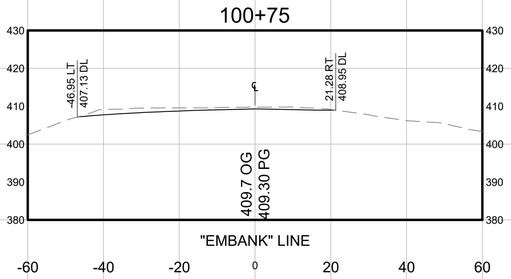

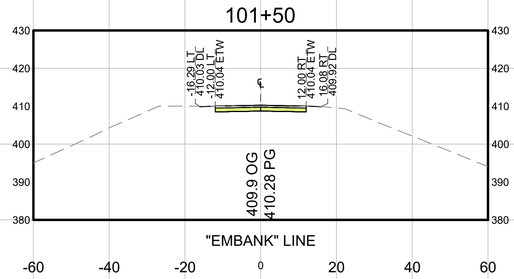

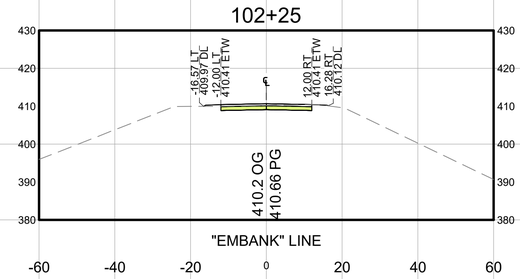

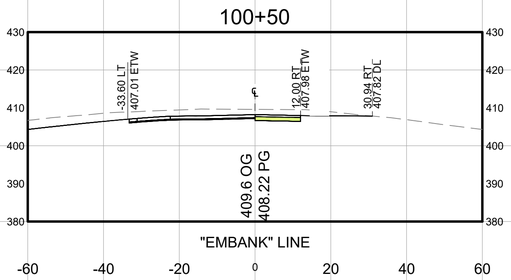

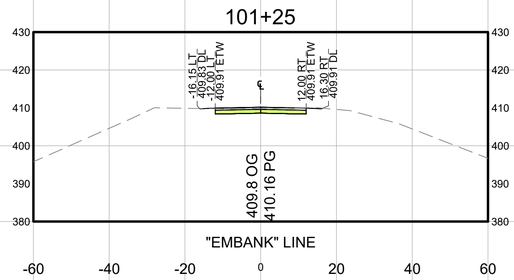

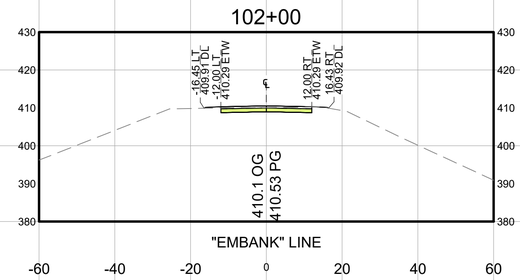

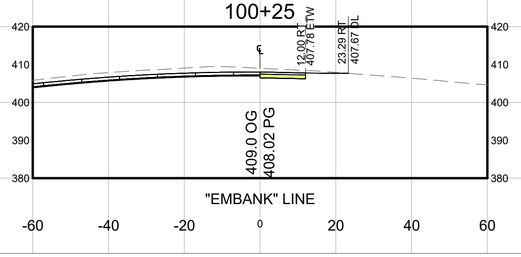

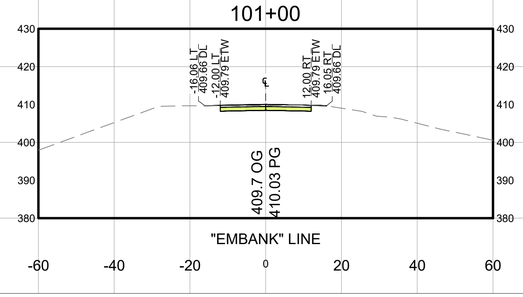

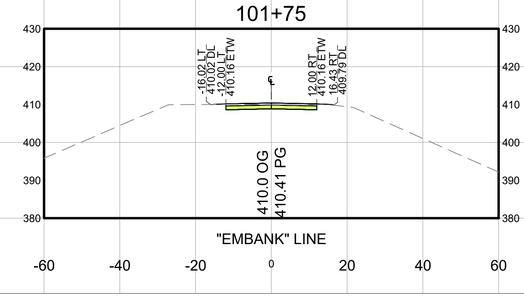

SCALE 1" = 20' H&V 0 20' 40'

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

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SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

"EMBANK" SECTIONS

DESIGNED BY: TC
DRAWN BY: HS
CHECKED BY: SO

XS-5

SHEET 35 OF 88

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2

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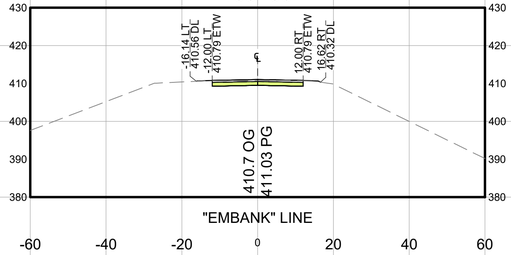

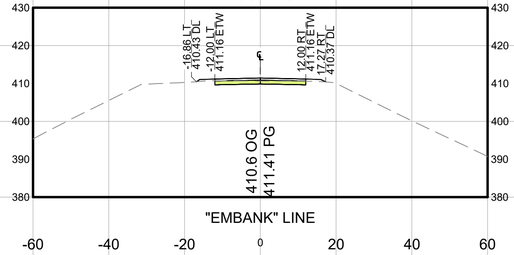

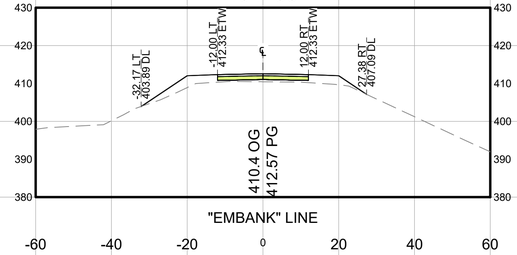

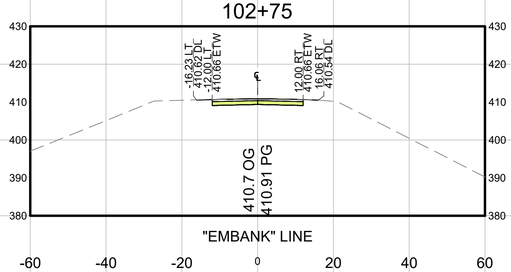

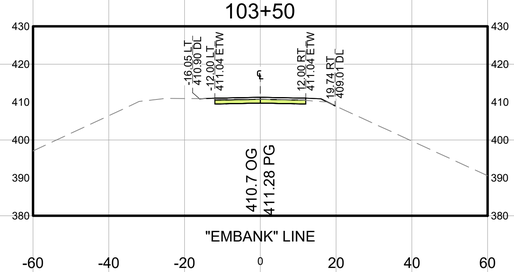

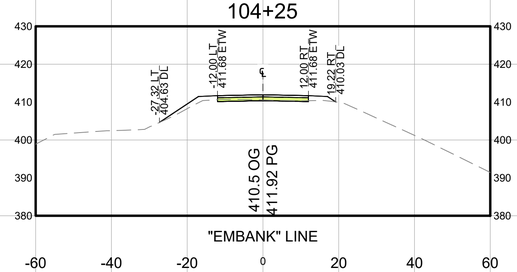

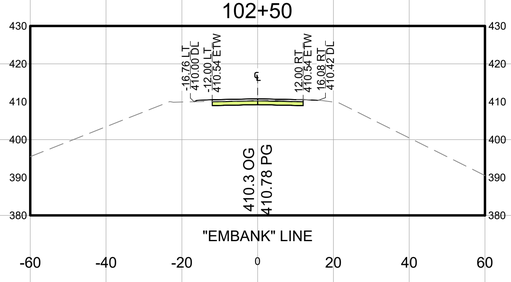

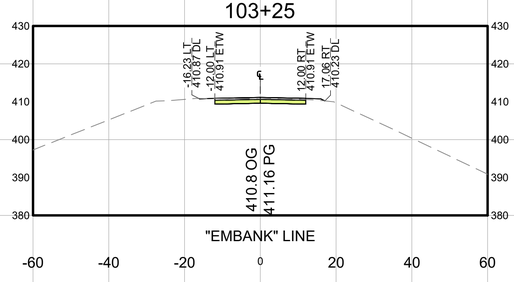

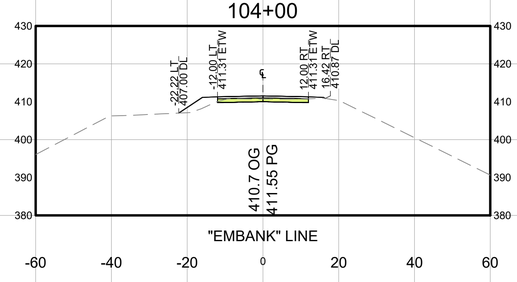

SCALE 1" = 20' H&V 0 20' 40'

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
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SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

"EMBANK" SECTIONS

DESIGNED BY:	TC
DRAWN BY:	HS
CHECKED BY:	SO

XS-6

SHEET 36 OF 88

FOR REDUCED PLANS
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0 1 2

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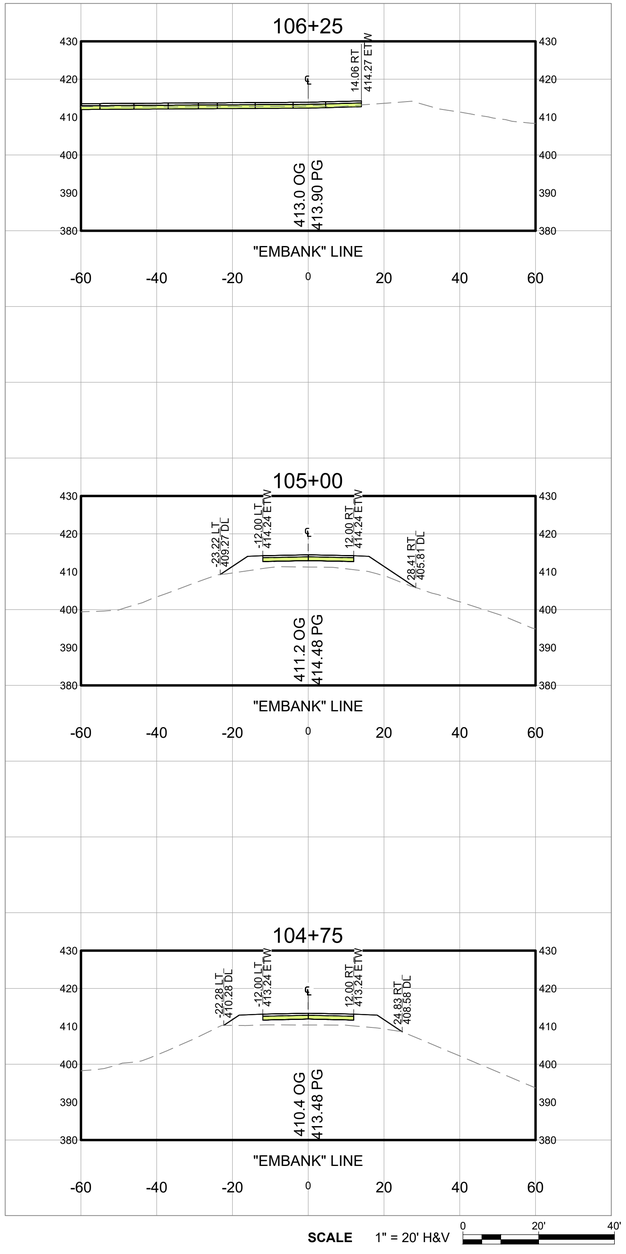

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SANTA BARBARA COUNTY, CALIFORNIA

"EMBANK" SECTIONS

DESIGNED BY:	TC
DRAWN BY:	HS
CHECKED BY:	SO

XS-7

SHEET 37 OF 88

FOR REDUCED PLANS
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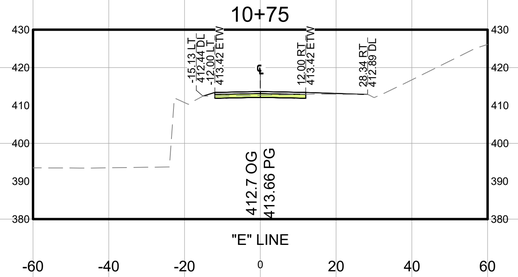

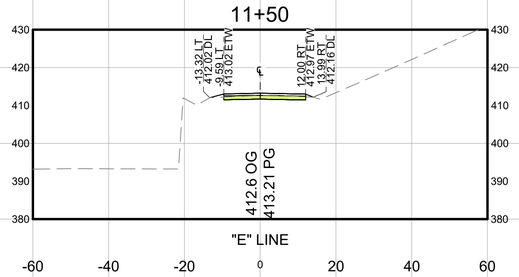

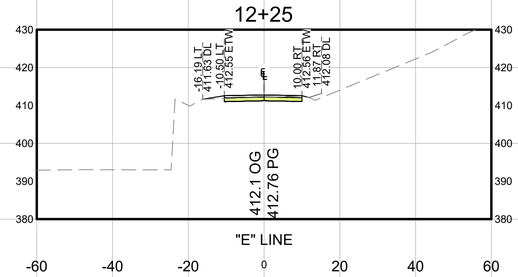

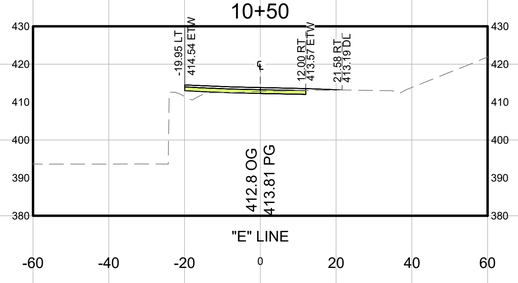

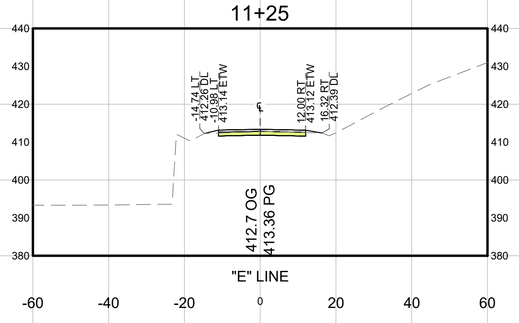

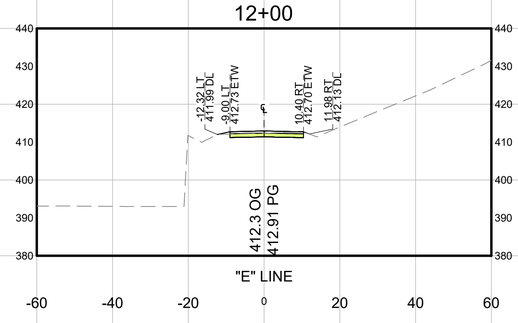

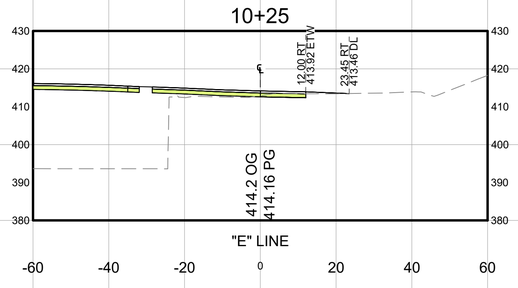

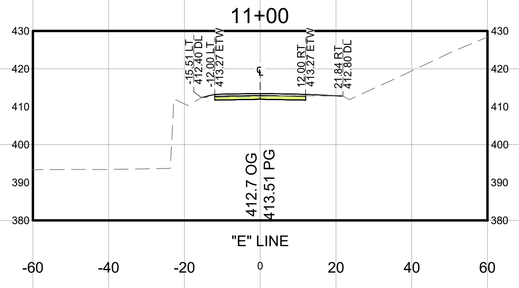

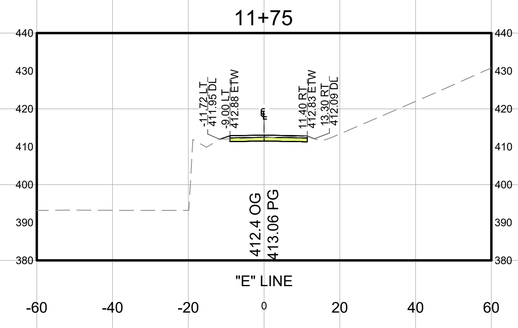

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REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
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SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

"E" SECTIONS

DESIGNED BY:	TC
DRAWN BY:	HS
CHECKED BY:	SO

XS-8

SHEET 38 OF 88

FOR REDUCED PLANS
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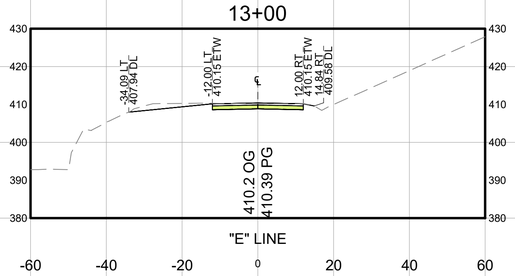

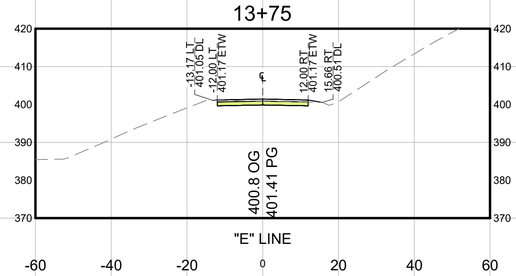

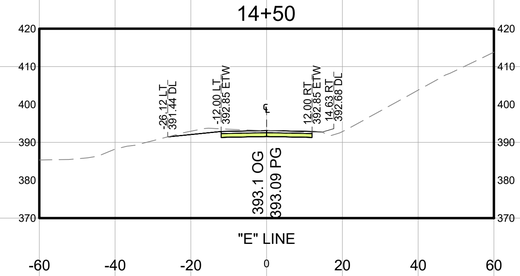

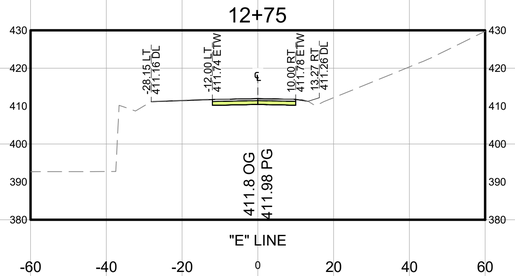

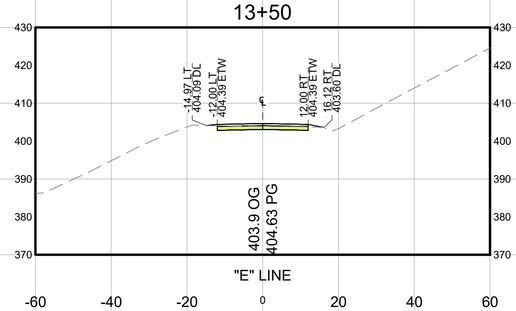

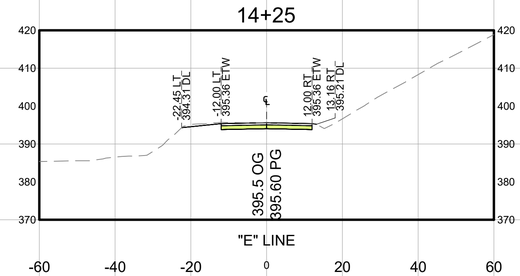

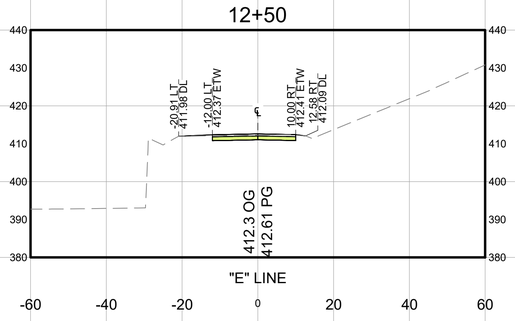

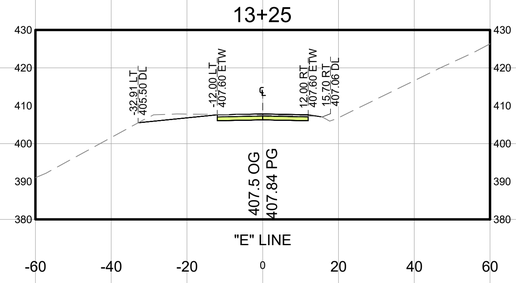

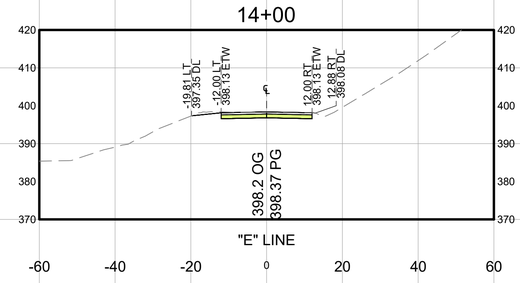

SCALE 1" = 20' H&V 0 20' 40'

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SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

"E" SECTIONS

DESIGNED BY: TC
DRAWN BY: HS
CHECKED BY: SO

XS-9

SHEET 39 OF 88

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2

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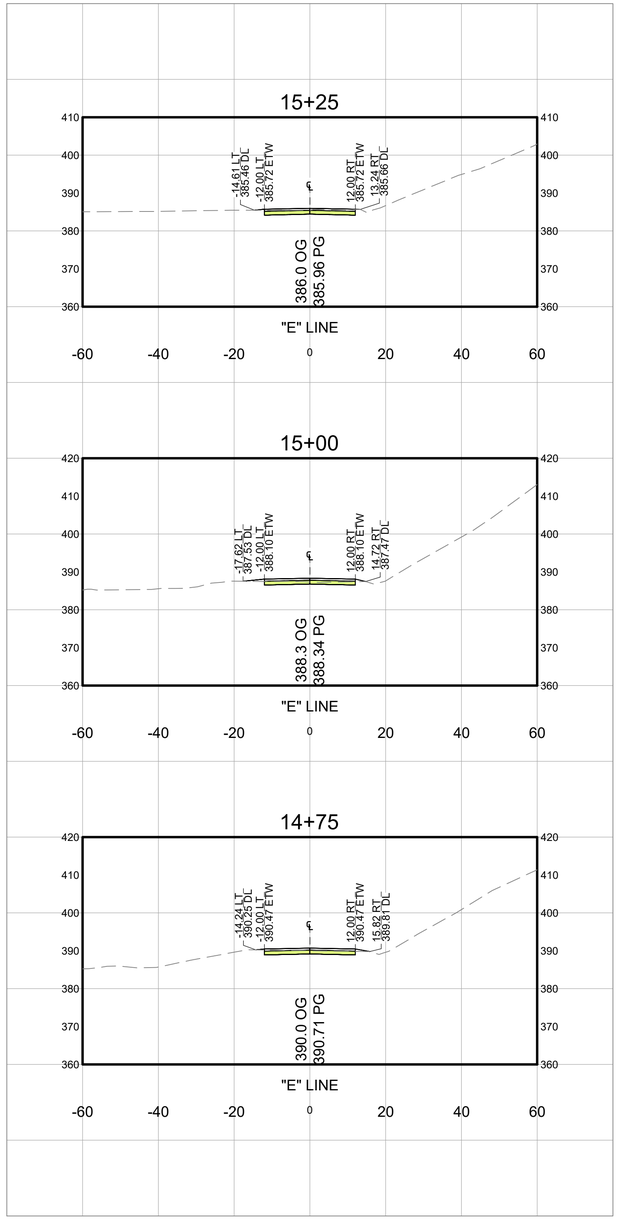

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SANTA BARBARA COUNTY, CALIFORNIA

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DRAWN BY: HS
CHECKED BY: SO

XS-10

SHEET 40 OF 88

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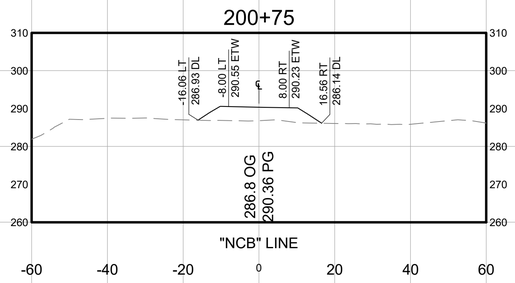

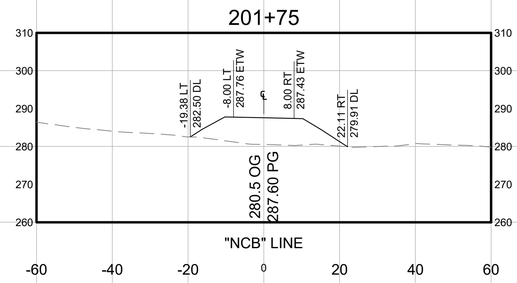

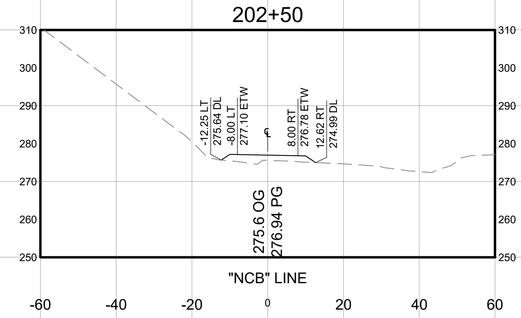

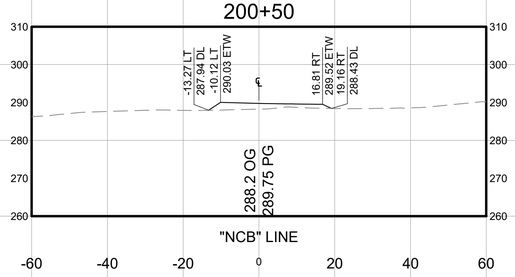

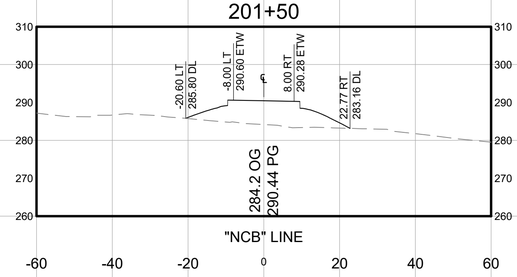

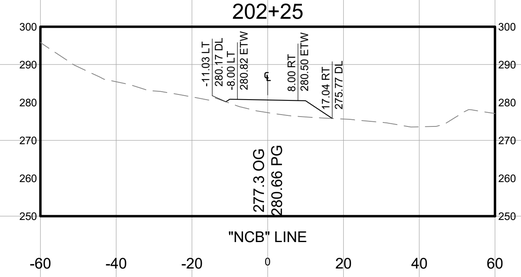

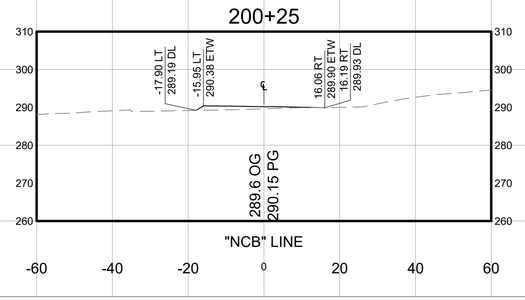

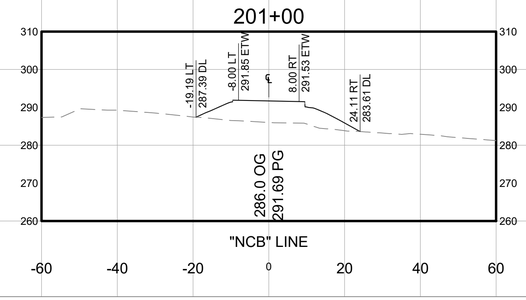

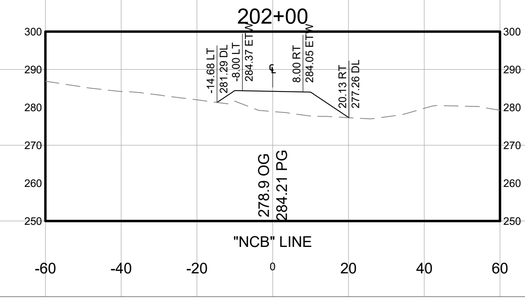

SCALE 1" = 20' H&V 0 20' 40'

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

"NCB" LINE SECTIONS

DESIGNED BY:	TC
DRAWN BY:	HS
CHECKED BY:	SO

XS-11

SHEET 41 OF 88

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2

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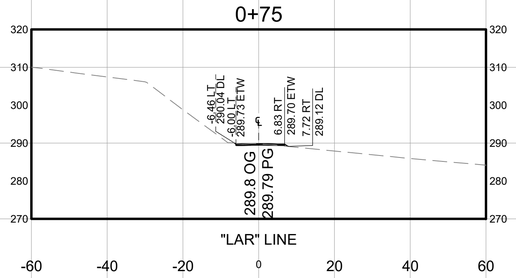

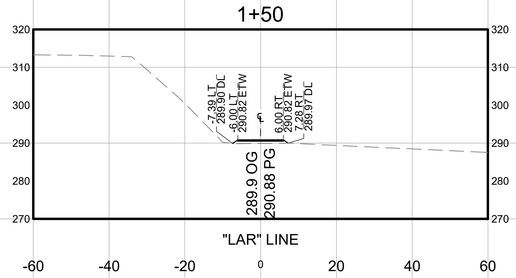

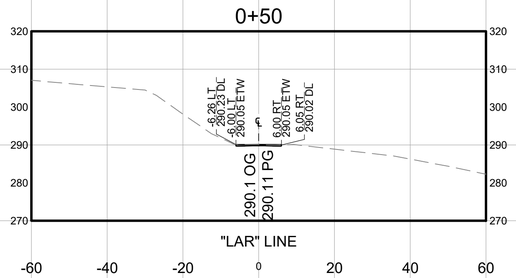

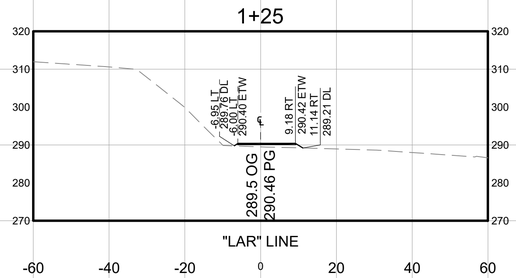

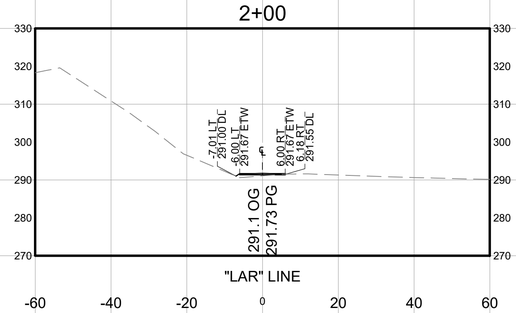

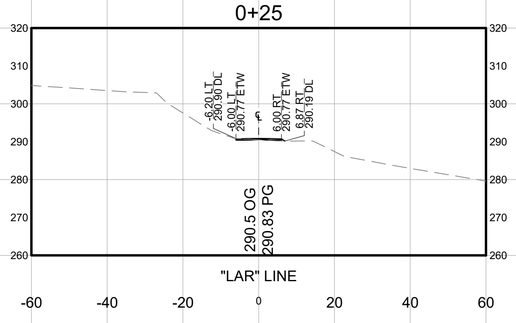

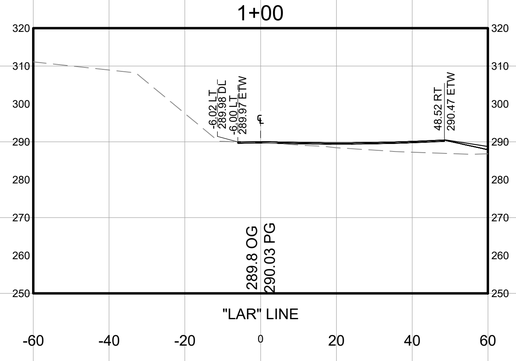

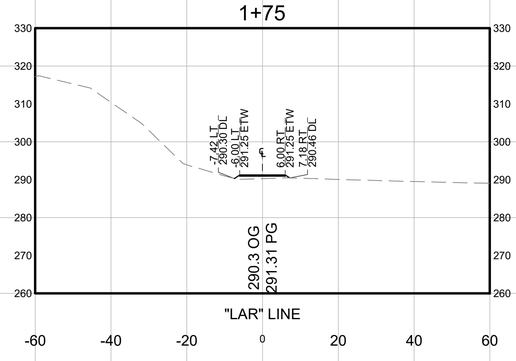

SCALE 1" = 20' H&V 0 20' 40'

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

"LAR" SECTIONS

DESIGNED BY:	TC
DRAWN BY:	HS
CHECKED BY:	SO

XS-12

SHEET 42 OF 88

FOR REDUCED PLANS
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0 1 2

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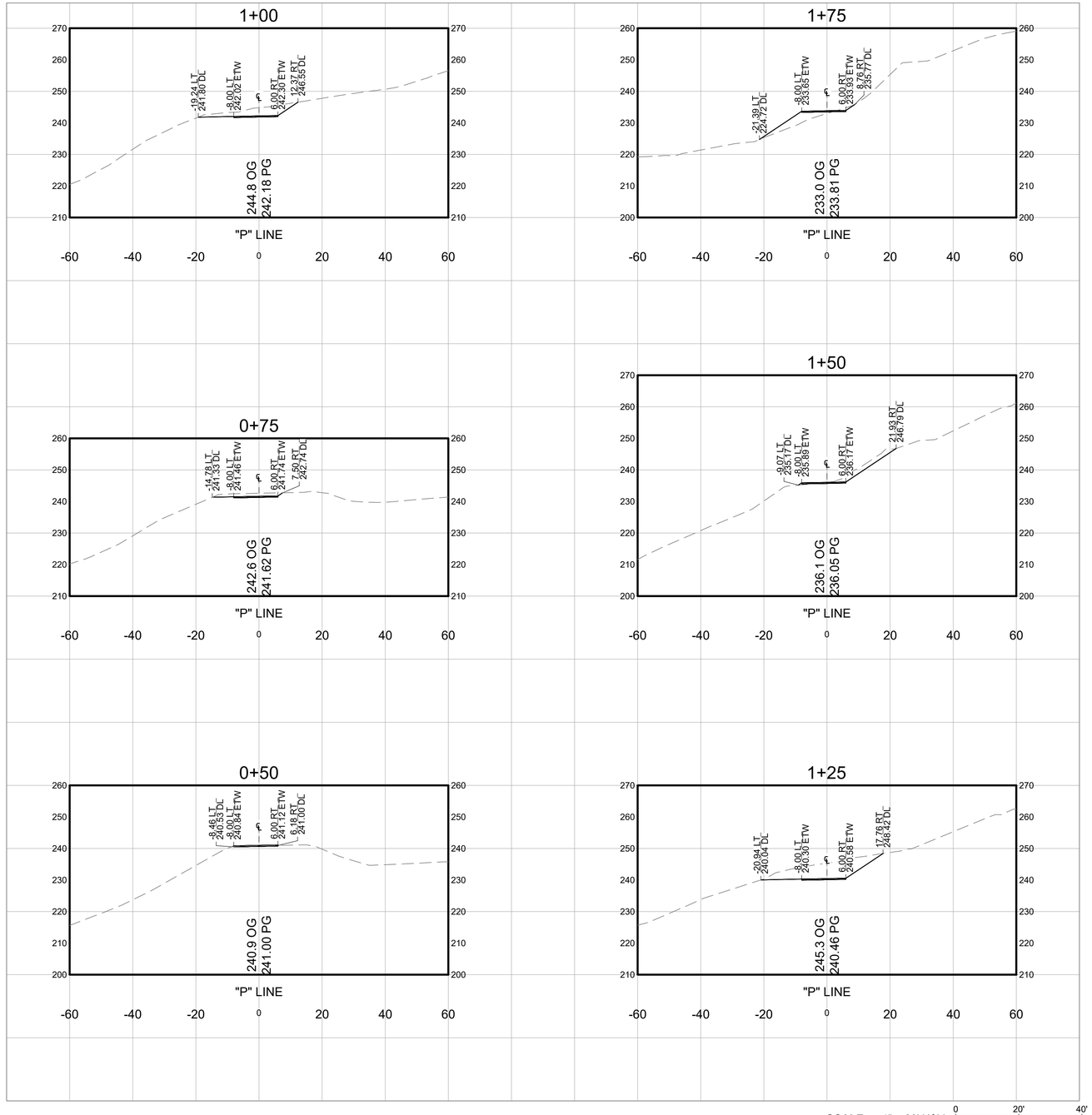

SCALE 1" = 20' H&V 0 20' 40'

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

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NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

"P" SECTIONS

DESIGNED BY:	TC
DRAWN BY:	HS
CHECKED BY:	SO

XS-13

SHEET 43 OF 88

FOR REDUCED PLANS
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TOTAL VOLUME - "W" - LINE
(10+50 TO 14+00)

Station	CUT AREA (SQ FT)	FILL AREA (SQ FT)	CUT VOL (CU YD)	FILL VOL (CU YD)	CUM CUT VOL (CU YD)	CUM FILL VOL (CU YD)	NET VOL (CU YD)
10+35	23	1	0	0	0	0	0
10+50	29	1	14	1	14	1	14
10+75	24	2	25	2	39	2	37
11+00	20	4	21	3	60	5	55
11+25	46	7	31	5	91	10	80
11+50	24	286	33	131	123	141	-18
11+75	3	354	13	286	136	427	-291
12+00	0	193	2	245	137	672	-535
12+25	0	149	0	155	137	827	-689
12+50	16	12	8	73	145	900	-755
12+75	41	208	26	97	171	997	-826
13+00	31	0	33	91	204	1088	-884
13+25	19	2	23	1	228	1089	-862
13+50	3	13	10	7	238	1096	-858
13+75	0	23	1	17	239	1113	-874
14+00	0	18	0	19	239	1131	-892

TOTAL VOLUME - "EMBANK" - LINE
(100+14.88 TO 106+25)

Station	CUT AREA (SQ FT)	FILL AREA (SQ FT)	CUT VOL (CU YD)	FILL VOL (CU YD)	CUM CUT VOL (CU YD)	CUM FILL VOL (CU YD)	NET VOL (CU YD)
100+14.88	22	0	0	0	0	0	0
100+25	32	0	10	0	10	0	10
100+50	204	0	109	0	119	0	119
100+75	85	0	134	0	253	0	253
101+00	34	0	55	0	308	0	308
101+25	34	0	31	0	339	0	339
101+50	33	0	31	0	370	0	370
101+75	29	1	29	0	399	1	398
102+00	29	1	27	1	426	2	424
102+25	30	2	27	1	453	3	450
102+50	29	2	27	2	481	4	476
102+75	35	0	30	1	511	5	505
103+00	33	1	31	0	542	6	536
103+25	31	2	30	1	572	7	565
103+50	27	4	27	2	598	9	589
103+75	22	4	22	4	621	13	608
104+00	20	20	19	11	640	25	616
104+25	7	23	12	20	652	44	608
104+50	0	75	3	45	655	89	566
104+75	0	89	0	76	655	165	490
105+00	0	108	0	91	655	256	399
105+15.25	0	35	0	40	655	297	359
105+25	0	0	0	0	655	297	359
105+50	0	0	0	0	655	297	359
105+75	0	0	0	0	655	297	359
106+00	0	0	0	0	655	297	359
106+10.75	0	23	0	0	655	297	359
106+25	5	0	1	6	657	303	354
106+25	3	0	0	0	657	303	354

TOTAL VOLUME - "E" - LINE
(10+00 TO 15+25)

Station	CUT AREA (SQ FT)	FILL AREA (SQ FT)	CUT VOL (CU YD)	FILL VOL (CU YD)	CUM CUT VOL (CU YD)	CUM FILL VOL (CU YD)	NET VOL (CU YD)
10+00	0	0	0	0	0	0	0
10+25	10	3	5	1	5	1	3
10+50	9	3	9	3	14	4	10
10+75	17	5	12	3	26	8	19
11+00	21	3	17	4	44	11	32
11+25	21	3	20	3	63	14	49
11+50	20	2	19	2	82	17	66
11+75	21	1	19	2	101	18	83
12+00	21	1	19	1	120	19	101
12+25	21	2	19	2	140	21	119
12+50	29	1	23	2	163	22	141
12+75	34	0	29	1	192	23	169
13+00	57	0	42	0	234	23	211
13+25	53	0	51	0	284	23	261
13+50	22	2	35	1	319	24	295
13+75	26	1	22	1	342	26	316
14+00	40	0	30	1	372	26	346
14+25	42	0	37	0	409	26	383
14+50	51	0	41	0	449	26	423
14+75	23	1	33	1	482	27	455
15+00	17	3	19	2	501	29	472
15+25	29	0	21	1	522	30	492

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

EARTHWORK VOLUMES

DESIGNED BY: TC
DRAWN BY: HS
CHECKED BY: SO

XS-14

SHEET 44 OF 88

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2/8/2022 9:48 AM PLOT DATE/TIME

TOTAL VOLUME - "LAR" - LINE
(0+02.05 TO 2+18.10)

Station	CUT AREA (SQ FT)	FILL AREA (SQ FT)	CUT VOL (CU YD)	FILL VOL (CU YD)	CUM CUT VOL (CU YD)	CUM FILL VOL (CU YD)	NET VOL (CU YD)
0+02.05	0	0	0	0	0	0	0
0+25	1	1	1	0	1	0	0
0+50	4	0	2	1	3	1	2
0+75	4	0	4	0	7	1	5
1+00	1	17	2	9	9	11	-2
1+25	0	11	1	15	9	26	-16
1+50	0	9	0	9	9	35	-25
1+75	0	9	0	8	9	43	-34
2+00	0	4	0	6	10	49	-40
2+18.10	4	1	1	2	11	51	-40
2+40	0	0	2	0	13	51	-39

TOTAL VOLUME - "P" - LINE
(0+85 TO 1+91.03)

Station	CUT AREA (SQ FT)	FILL AREA (SQ FT)	CUT VOL (CU YD)	FILL VOL (CU YD)	CUM CUT VOL (CU YD)	CUM FILL VOL (CU YD)	NET VOL (CU YD)
0+50	3	0	0	0	0	0	0
0+75	24	0	13	0	13	0	13
1+00	58	0	37	0	50	0	50
1+25	137	0	88	0	138	0	138
1+50	30	1	75	1	213	1	213
1+75	3	39	11	24	224	24	199
1+90	9	47	3	24	227	48	179

TOTAL VOLUME - "NCB" - WEST LINE
(200+52.64 TO 201+09.50)

Station	CUT AREA (SQ FT)	FILL AREA (SQ FT)	CUT VOL (CU YD)	FILL VOL (CU YD)	CUM CUT VOL (CU YD)	CUM FILL VOL (CU YD)	NET VOL (CU YD)
200+52.64	0	0	0	0	0	0	0
200+75	0	87	0	36	0	36	-36
201+00	0	0	0	40	0	76	-76
201+09.50	0	0	0	0	0	76	-76

TOTAL VOLUME - "NCB" - EAST LINE
(201+41.51 TO 202+80.44)

Station	CUT AREA (SQ FT)	FILL AREA (SQ FT)	CUT VOL (CU YD)	FILL VOL (CU YD)	CUM CUT VOL (CU YD)	CUM FILL VOL (CU YD)	NET VOL (CU YD)
201+41.51	0	170	0	0	0	0	0
201+50	0	165	0	53	0	53	-53
201+75	0	181	0	160	0	213	-213
202+00	0	121	0	140	0	353	-353
202+25	0	59	0	81	0	434	-434
202+50	0	18	0	34	0	468	-468
202+60	1	4	0	4	0	472	-472

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

EARTHWORK VOLUMES

DESIGNED BY: TC
DRAWN BY: HS
CHECKED BY: SO

XS-15

SHEET 45 OF 88

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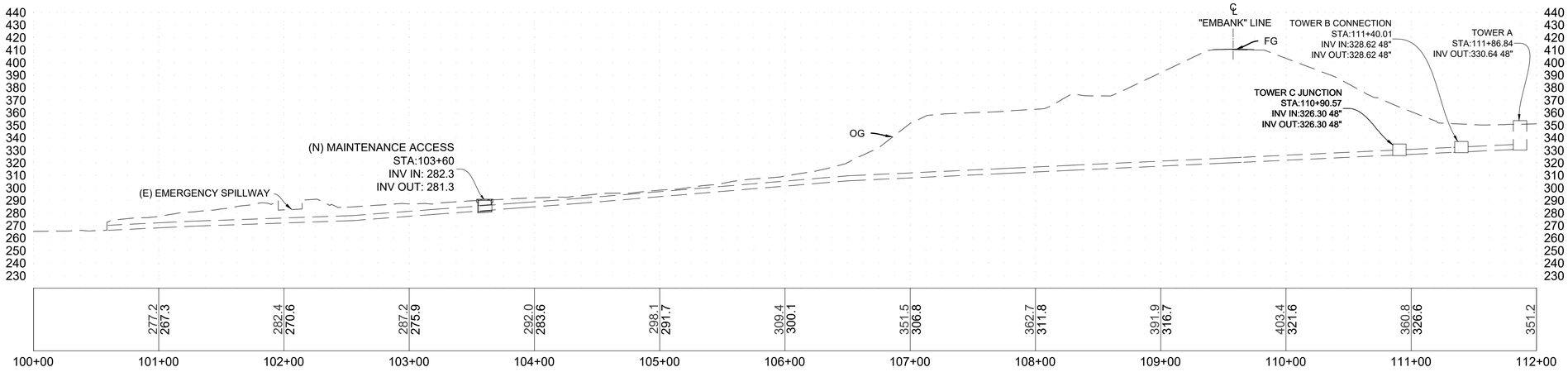


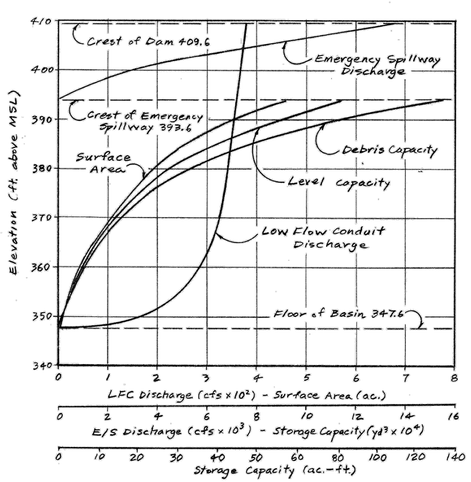
PROFILE "EX-LINE A" LINE

"LOW FLOW CONDUIT" PROFILE

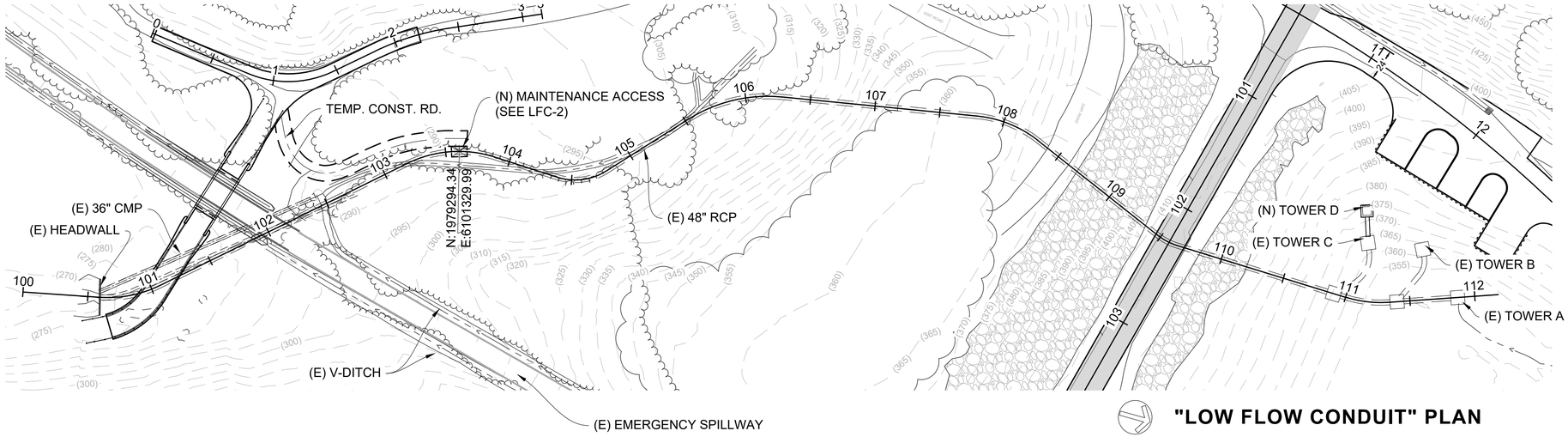
SCALE H 1" = 50' & V 1" = 50'

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

Attachment B



REVISED AREA-CAPACITY CURVES



NORTH

"LOW FLOW CONDUIT" PLAN

SCALE 1" = 50'

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

LOW FLOW CONDUIT
PLAN & PROFILE

DESIGNED BY:	TC
DRAWN BY:	HAO
CHECKED BY:	SO

LFC-1

SHEET 46 OF 88

B-1

F:\Bengal\SB County - SMDB - Documents\Design\Production Drawings\06-Profiles.dwg
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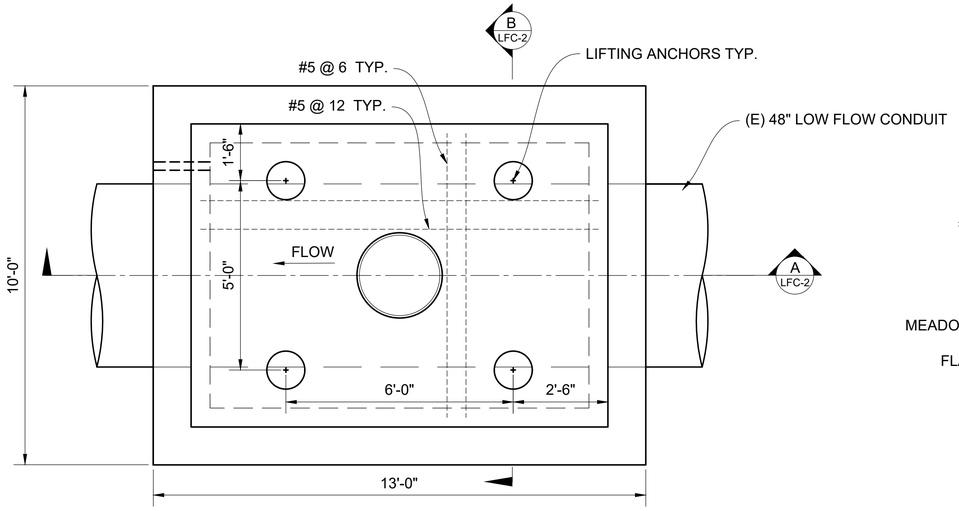
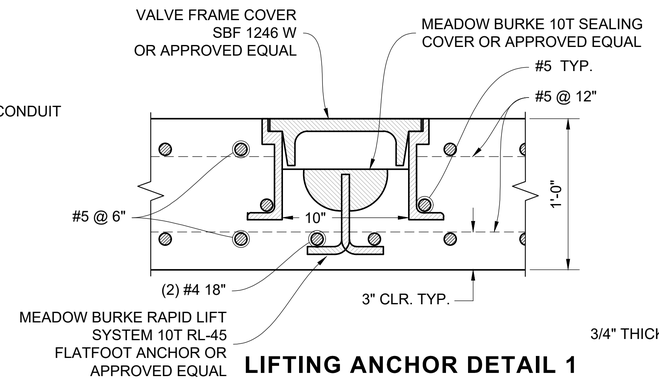


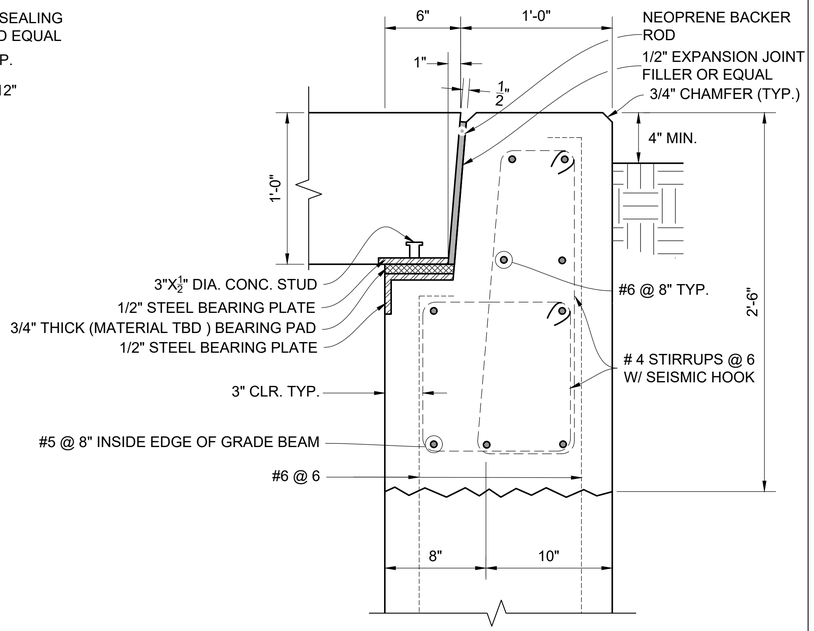
PLAN

SCALE 1/2" = 1'



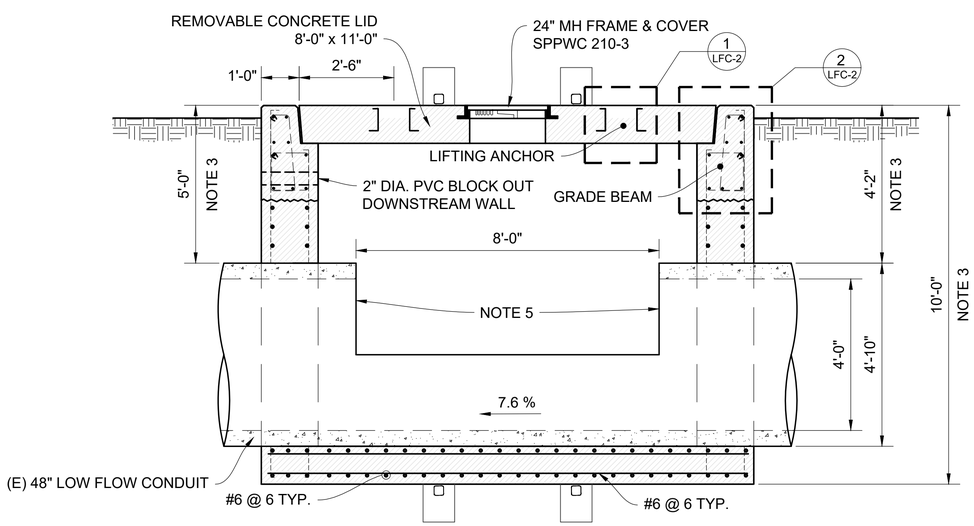
LIFTING ANCHOR DETAIL 1

NO SCALE



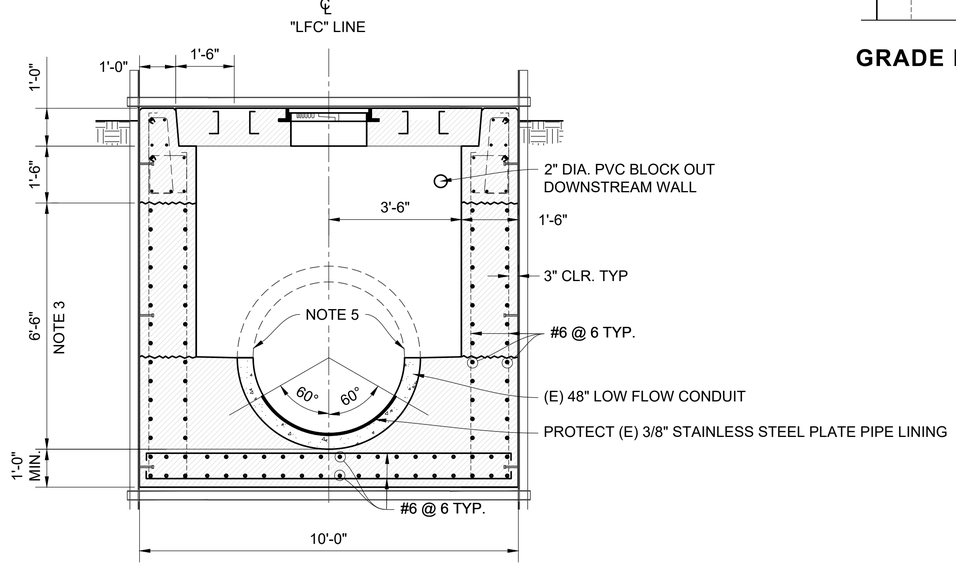
GRADE BEAM DETAIL 2

NO SCALE



SECTION A

SCALE 1/2" = 1'



SECTION B

SCALE 1/2" = 1'

NOTES:

1 SEE SHEET LFC-1 FOR MAINTENANCE LOCATION & ORIENTATION.

2 SEE RECORD DRAWINGS FOR (E) 48" LFC DETAILS.

3 PROFILE SLOPE NOT SHOWN. DEPTH TO BE SITE VERIFIED BY CONTRACTOR.

4 CONTRACTOR TO EXCAVATE LOCATION AND COORDINATE WITH THE ENGINEER.

5 REMOVE CENTER 8' OF (E) 48 RCP TO SPRING LINE.

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

MAINTENANCE ACCESS

DESIGNED BY:	TC
DRAWN BY:	HS
CHECKED BY:	SO

LFC-2

SHEET 47 OF 88

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

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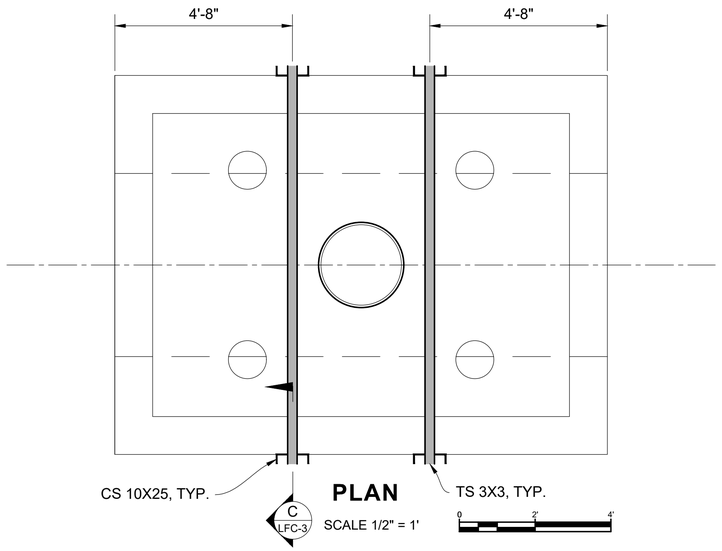
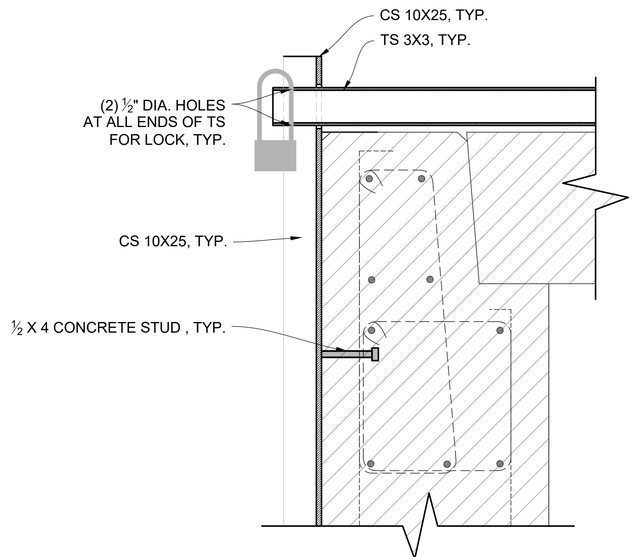


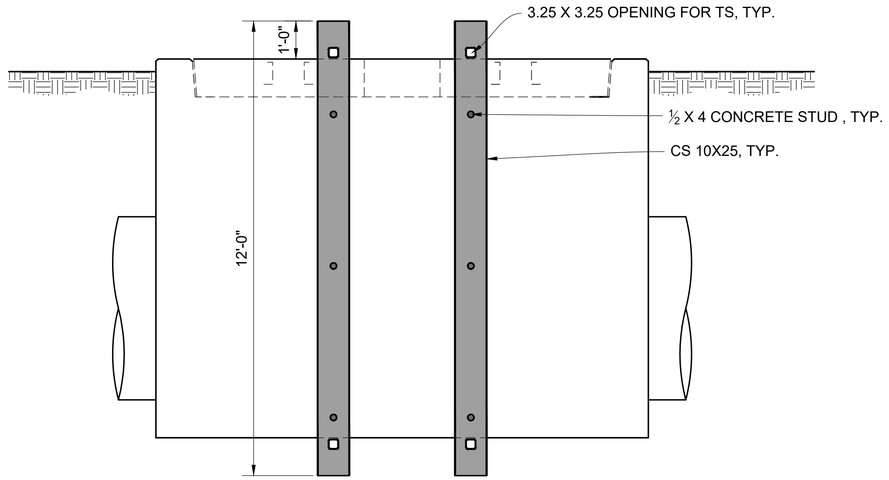
PLAN

SCALE 1/2" = 1'



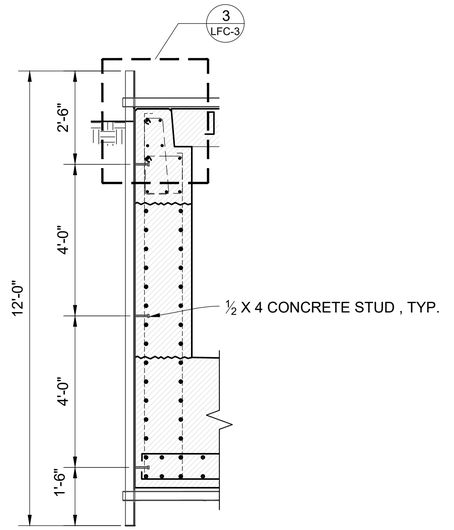
DETAIL 3

NO SCALE



ELEVATION

SCALE 1/2" = 1'



SECTION C

SCALE 1/2" = 1'

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

MAINTENANCE ACCESS

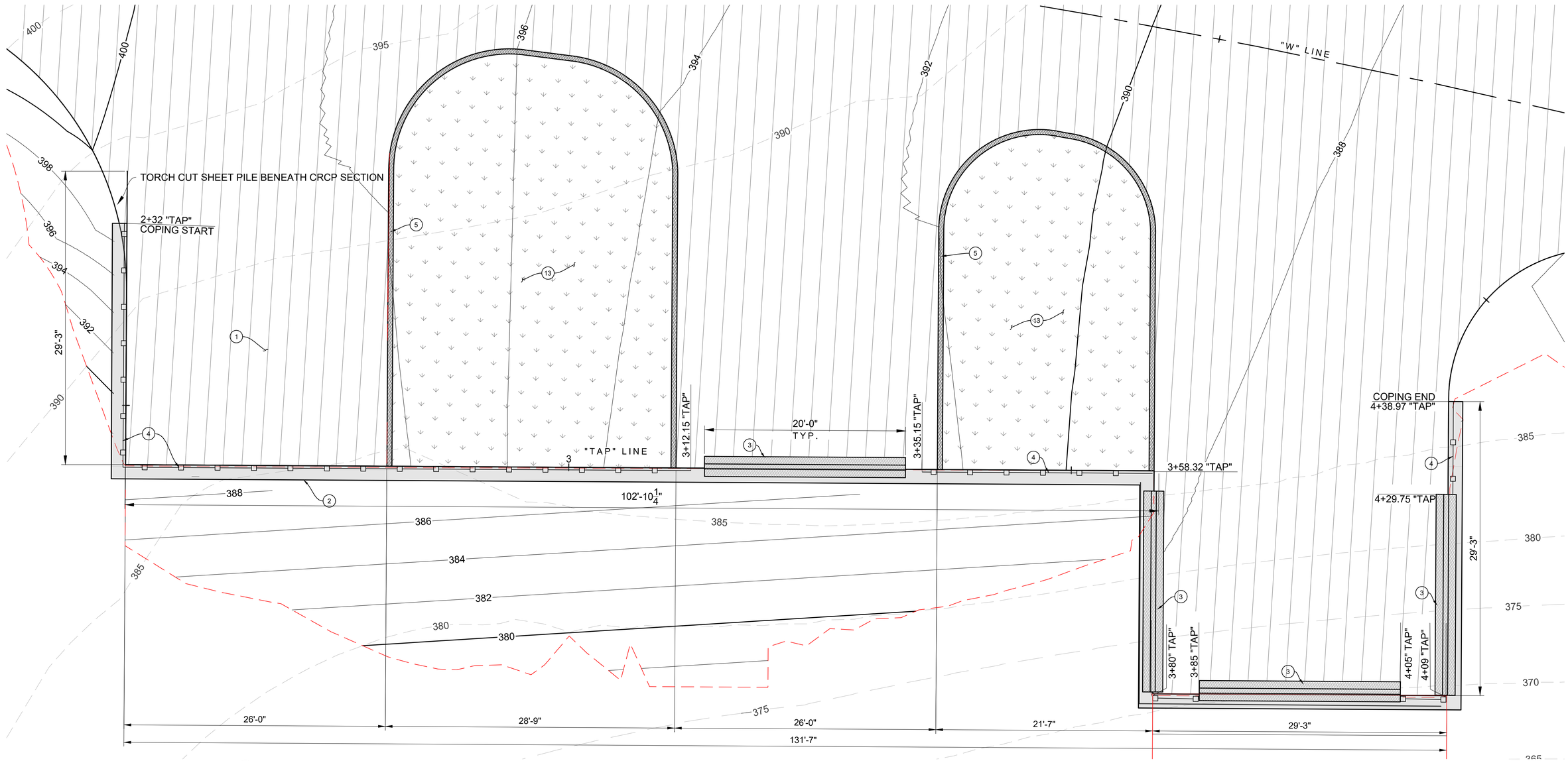
DESIGNED BY:	TC
DRAWN BY:	HS
CHECKED BY:	SO

LFC-3

SHEET 48 OF 88

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2

F:\Bengal\SB County - SMDB - Documents\Design\Production Drawings\10-Pipe Sections and Details.dwg
2/8/2022 9:52 AM PLOT DATE/TIME



NOTES:

1. CRCP
2. STEEL COPING ASSEMBLY
3. TYPE K BARRIER - CA STD T3A
4. CABLE RAILING - CA STD B11-47
5. CURB - SB COUTY STD. TYPE A
6. SHEET PILE - PZC 18
7. SHEET PILE - US 90
8. TIE BACK ASSEMBLY - TYPE A
9. TIE BACK ASSEMBLY - TYPE B
10. TIE BACK ASSEMBLY - TYPE C
11. DEADMAN- REINFORCED CONC. 4' X 3' X 1'
12. MIRAGRID 7XT OR APPROVED EQUAL
13. ROLLED EROSION CONTROL BLANKET W/ BONDED FIBER MATRIX

NORTH

0 5' 10'

PLAN
SCALE 1" = 5'

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

TOWER ACCESS PAD
SURFACE DETAILS

DESIGNED BY: TC
DRAWN BY: HS
CHECKED BY: SO

TAP-1

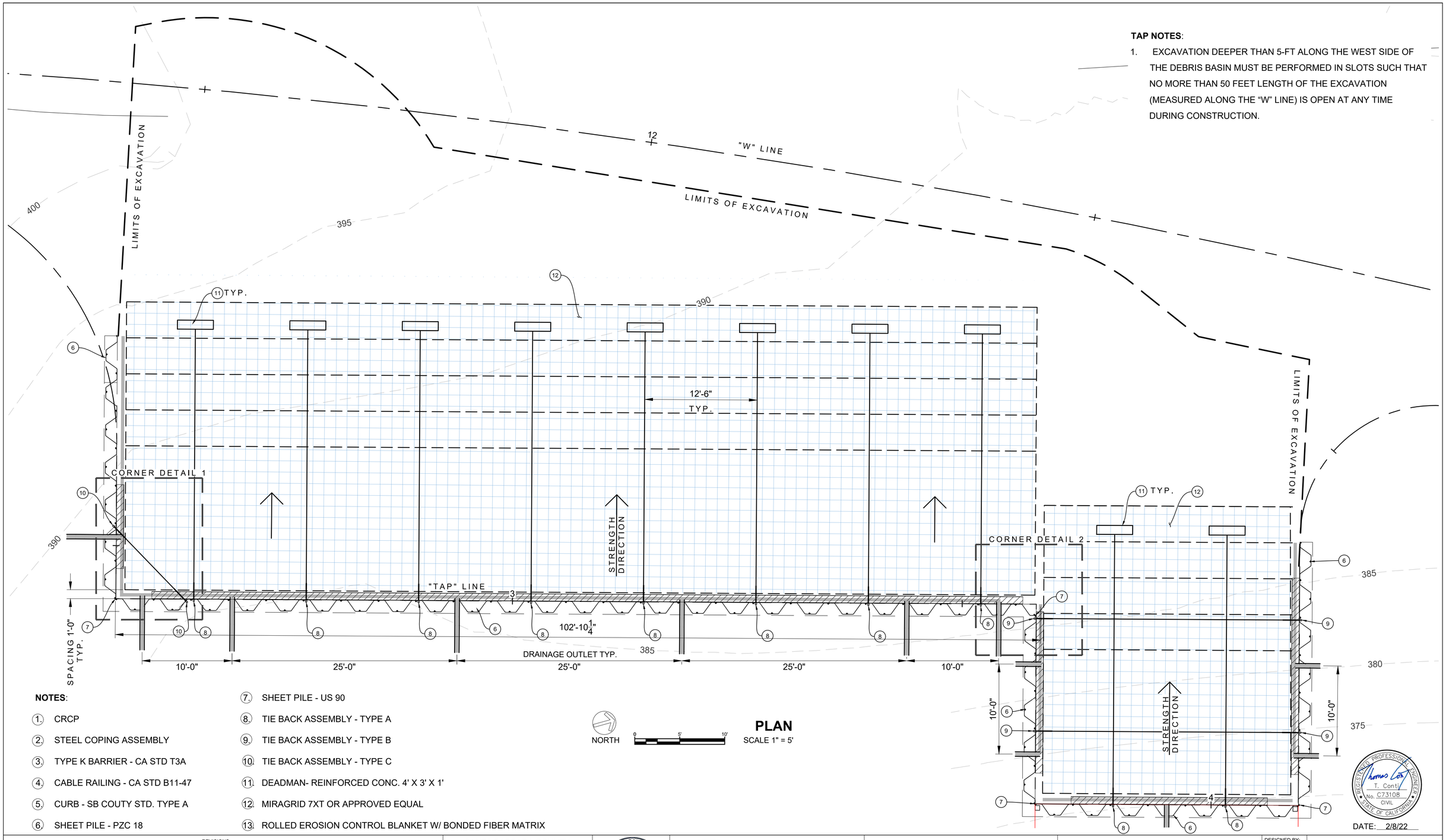
SHEET 49 OF 88

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2

F:\Bengal\SB County - SMDB - Documents\Design\Production Drawings\Crane Pad Structure Details.dwg
2/8/2022 9:53 AM PLOT DATE/TIME

TAP NOTES:

1. EXCAVATION DEEPER THAN 5-FT ALONG THE WEST SIDE OF THE DEBRIS BASIN MUST BE PERFORMED IN SLOTS SUCH THAT NO MORE THAN 50 FEET LENGTH OF THE EXCAVATION (MEASURED ALONG THE "W" LINE) IS OPEN AT ANY TIME DURING CONSTRUCTION.



NOTES:

1. CRCP
2. STEEL COPING ASSEMBLY
3. TYPE K BARRIER - CA STD T3A
4. CABLE RAILING - CA STD B11-47
5. CURB - SB COUTY STD. TYPE A
6. SHEET PILE - PZC 18
7. SHEET PILE - US 90
8. TIE BACK ASSEMBLY - TYPE A
9. TIE BACK ASSEMBLY - TYPE B
10. TIE BACK ASSEMBLY - TYPE C
11. DEADMAN- REINFORCED CONC. 4' X 3' X 1'
12. MIRAGRID 7XT OR APPROVED EQUAL
13. ROLLED EROSION CONTROL BLANKET W/ BONDED FIBER MATRIX

NORTH

0 5' 10'

PLAN
SCALE 1" = 5'

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

TOWER ACCESS PAD
SUB-SURFACE DETAILS

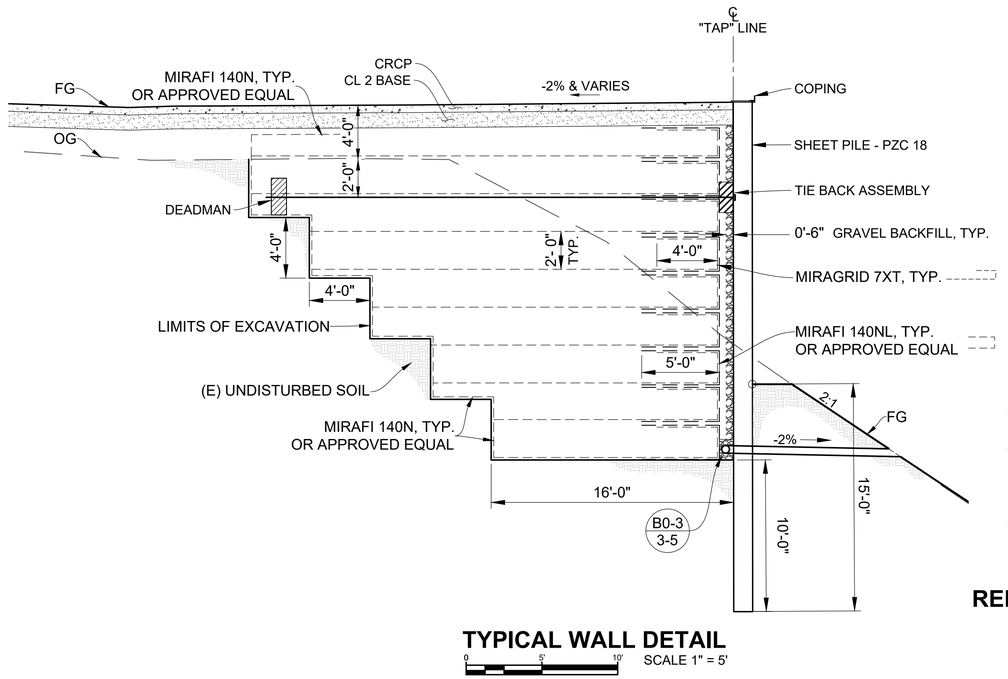
DESIGNED BY:	TC
DRAWN BY:	HS
CHECKED BY:	SO

TAP-2

SHEET 50 OF 88

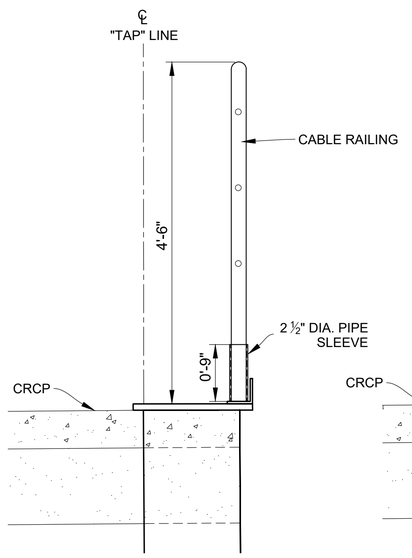
FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2

F:\Bengal\SB County - SMDB - Documents\Design\Production Drawings\Crane Pad Structure Details.dwg
2/8/2022 9:53 AM PLOT DATE/TIME



TYPICAL WALL DETAIL

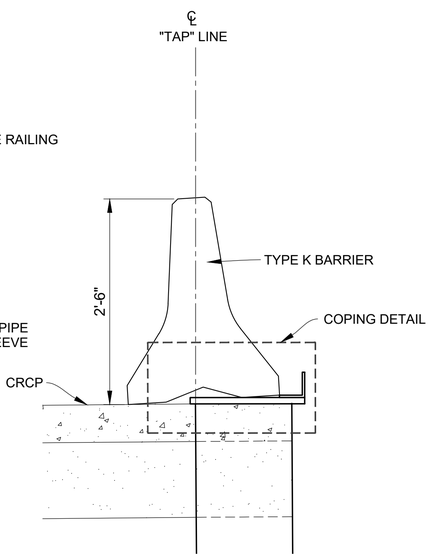
0 5' 10' SCALE 1" = 5'



COPING TYPE A
REMOVABLE CABLE RAILING

0 1' 2' SCALE 1" = 1'

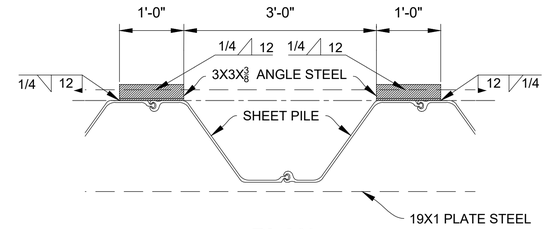
"TAP" LINE LIMITS:
2+27.27 - 3+12.15
3+35.15 - 3+58.32
3+80 - 3+85
4+05 - 4+09
4+27.75 - 4+38.97



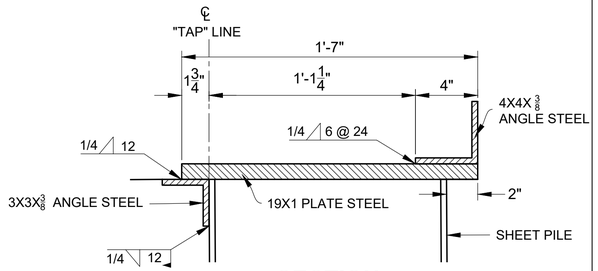
COPING TYPE B
REMOVABLE TYPE K RAILING

0 1' 2' SCALE 1" = 1'

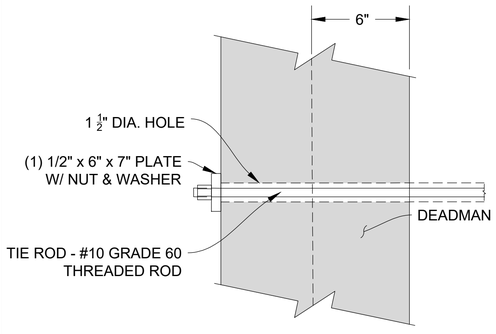
"TAP" LINE LIMITS:
3+12.15 - 3+35.15
3+58.32 - 4+27.75



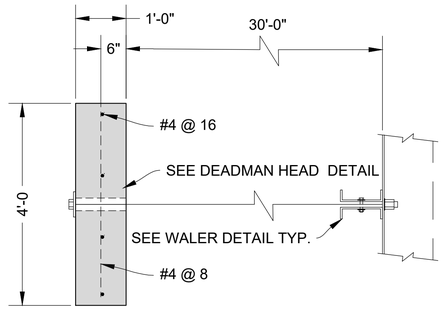
PLAN
NO SCALE



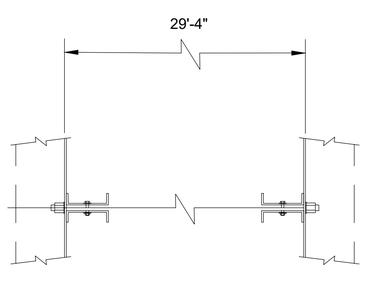
SECTION
COPING DETAIL
NO SCALE



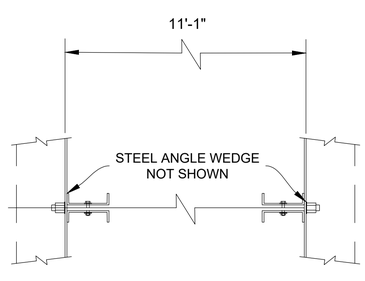
DEADMAN HEAD DETAIL
NO SCALE



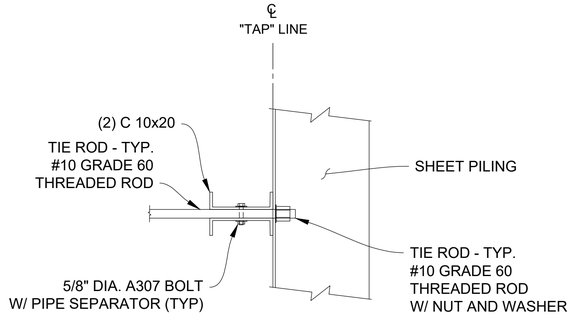
TIE BACK ASSEMBLY A
NO SCALE



TIE BACK ASSEMBLY B
NO SCALE



TIE BACK ASSEMBLY C
NO SCALE



WALER DETAIL
NO SCALE

REGISTERED PROFESSIONAL ENGINEER
Thomas Conti
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

TOWER ACCESS PAD
STRUCTURE PLANS

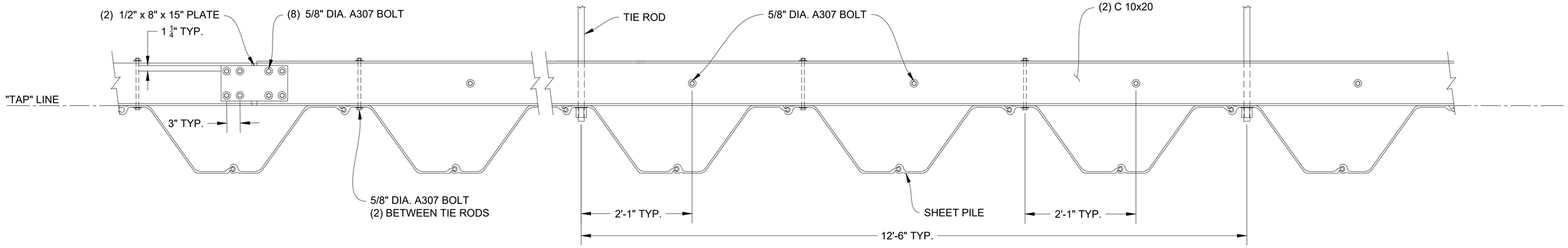
DESIGNED BY:	TC
DRAWN BY:	HS
CHECKED BY:	SO

TAP-3

SHEET 51 OF 88

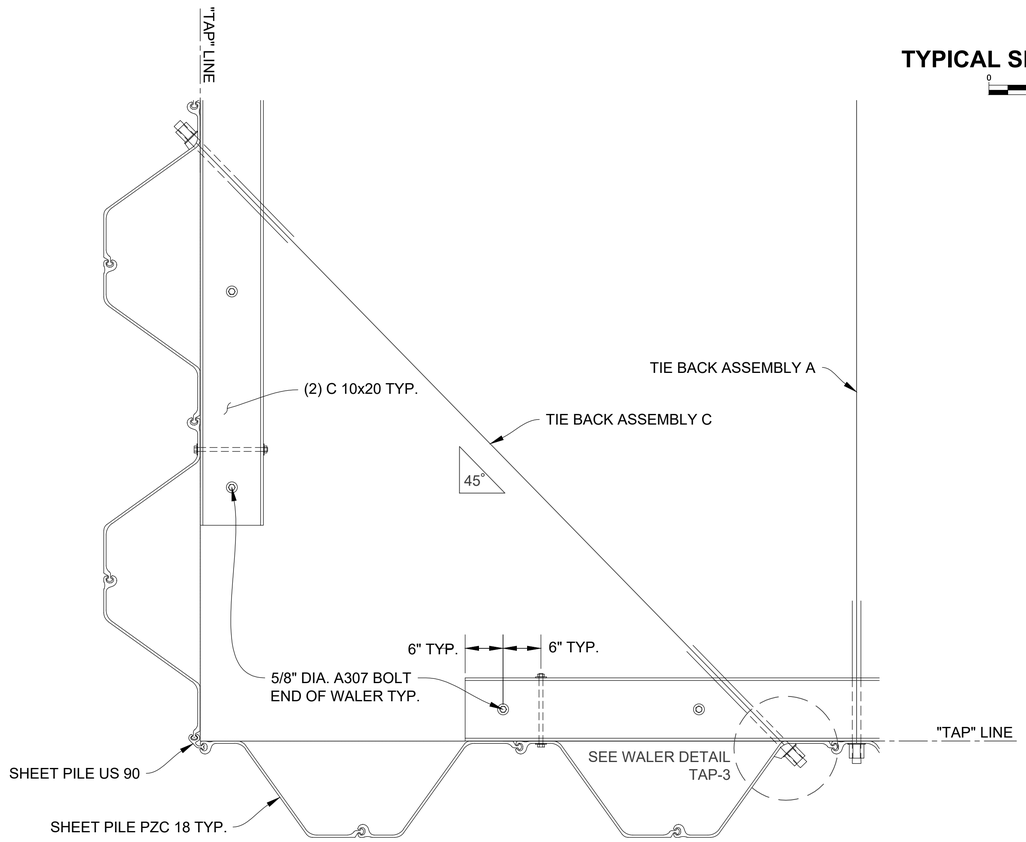
FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

F:\Bengal\SB County - SMDB - Documents\Design\Production Drawings\Crane Pad Structure Details.dwg
2/8/2022 9:53 AM PLOT DATE/TIME



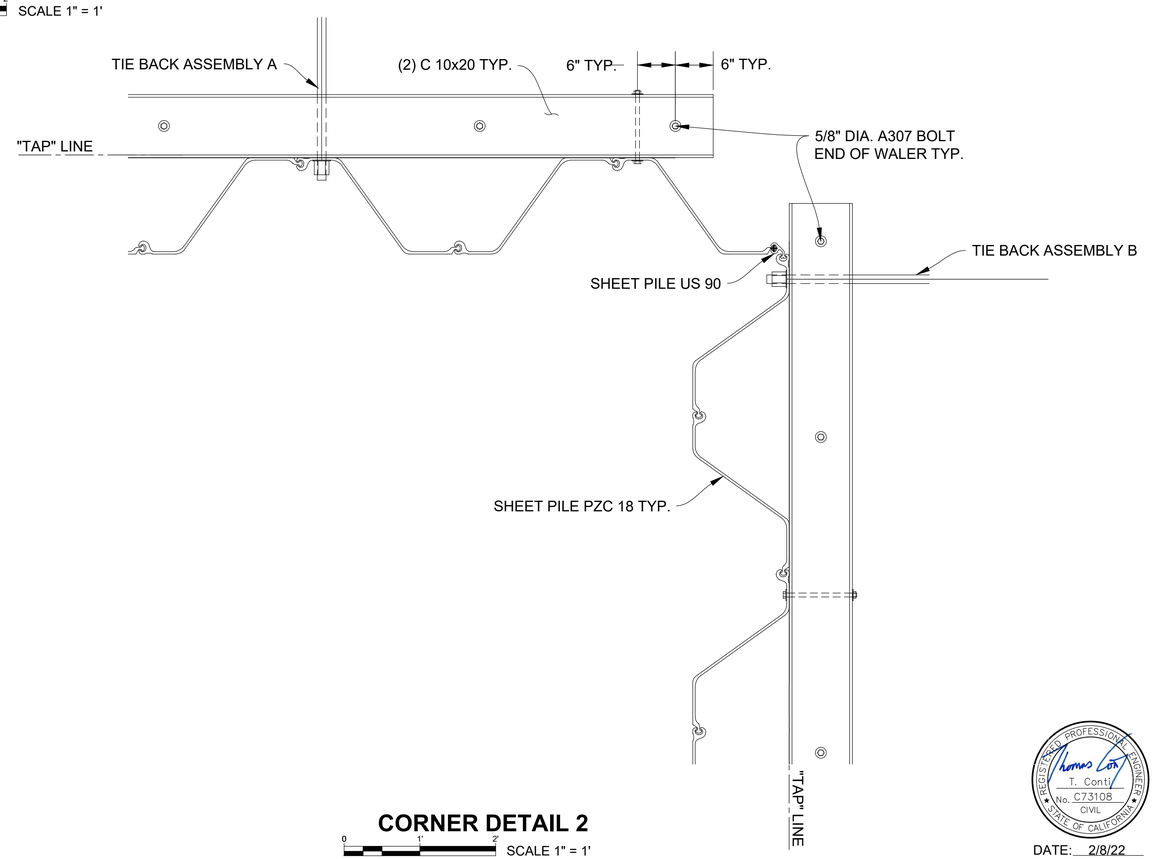
TYPICAL SHEET PILE DETAIL

SCALE 1" = 1'



CORNER DETAIL 1

SCALE 1" = 1'



CORNER DETAIL 2

SCALE 1" = 1'

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

TOWER ACCESS PAD
STRUCTURE PLANS

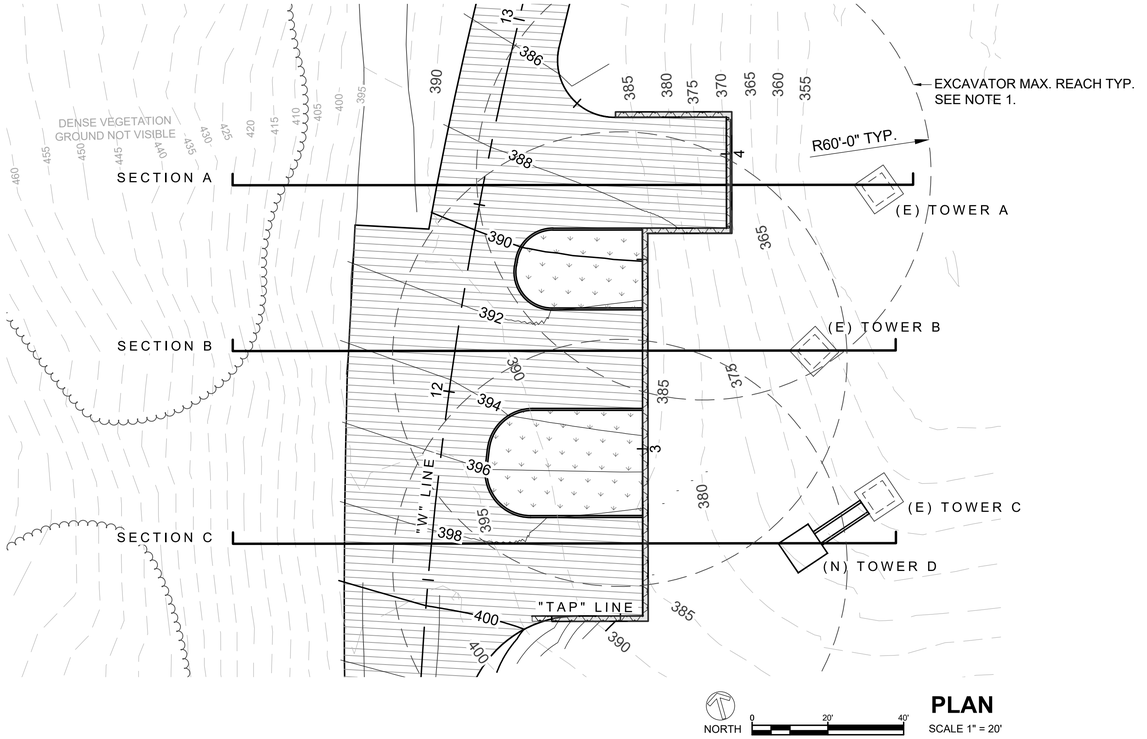
DESIGNED BY:	TC
DRAWN BY:	HS
CHECKED BY:	SO

TAP-4

SHEET 52 OF 88

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

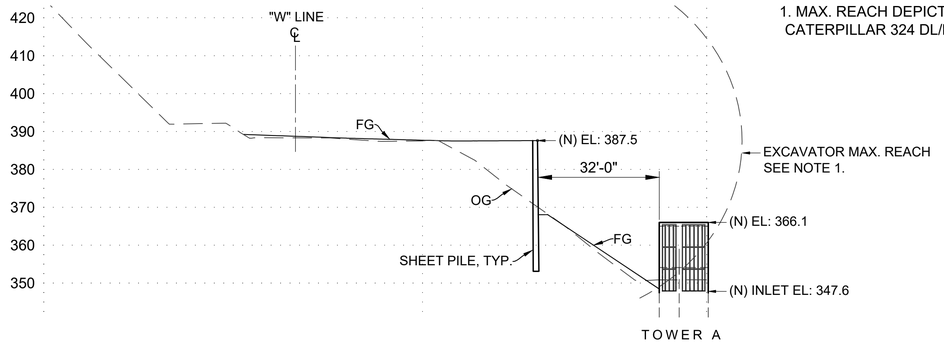
F:\Bengal\SB County - SMDB - Documents\Design\Production Drawings\Crane Pad Structure Details.dwg
2/8/2022 9:54 AM PLOT DATE/TIME



PLAN

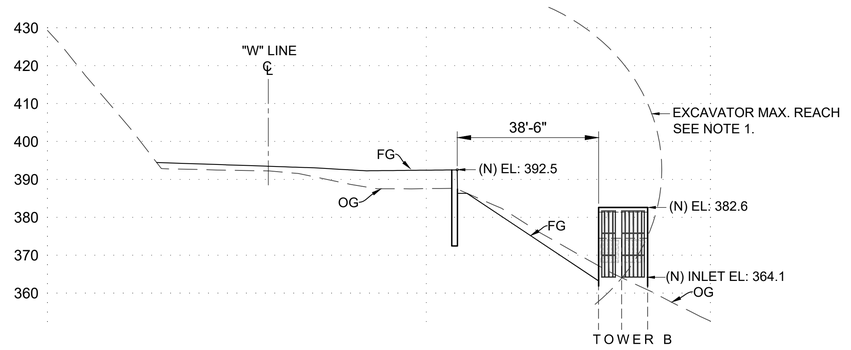
SCALE 1" = 20'

NOTES:
1. MAX. REACH DEPICTED IN PLANS, CATERPILLAR 324 DL/BOOM OPTION 5.



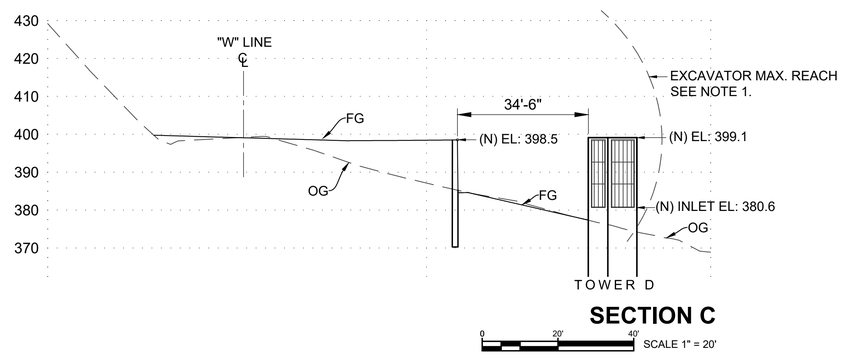
SECTION A

0 20' 40' SCALE 1" = 20'



SECTION B

0 20' 40' SCALE 1" = 20'



SECTION C

0 20' 40' SCALE 1" = 20'

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
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SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

TOWER ACCESS PAD
TOWER ACCESSIBILITY PLANS

DESIGNED BY:	TC
DRAWN BY:	HS
CHECKED BY:	SO

TAP-5

SHEET 53 OF 88

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2

F:\Bengal\SB County - SMDB - Documents\Design\Production Drawings\Crane Pad Structure Details.dwg
2/8/2022 9:54 AM PLOT DATE/TIME

NOTES:

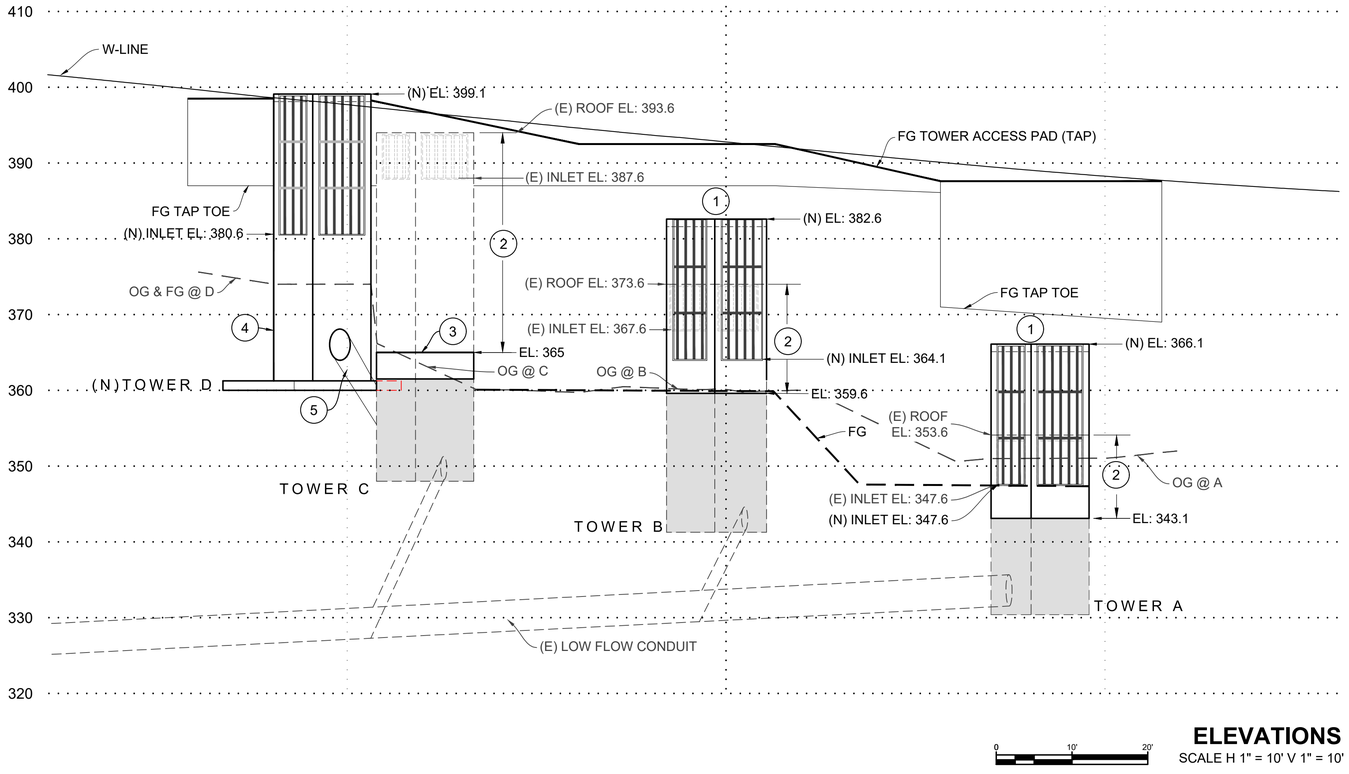
THIS SHEET IS FOR REFERENCE ONLY. CONTRACTOR IS TO REVIEW INDIVIDUAL INLET TOWER DETAIL SHEETS AND EXISTING SITE CONDITIONS.

LEGEND:

1. RAISE TOWER
2. REMOVE TO SPECIFIED EL
3. SEAL & CONSTRUCT MH ACCESS
4. CONSTRUCT TOWER D
5. 36" RCP PIPE TO INV. (E) TOWER C

(E) TOWER REMAINS

ELEVATION SCALE FROM FG SURFACE TO INLET ELEVATION FOR TOWER B,D & SPILLWAY WALL (SEE BELOW)



ELEVATIONS

SCALE H 1" = 10' V 1" = 10'

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

INLET TOWER ELEVATIONS

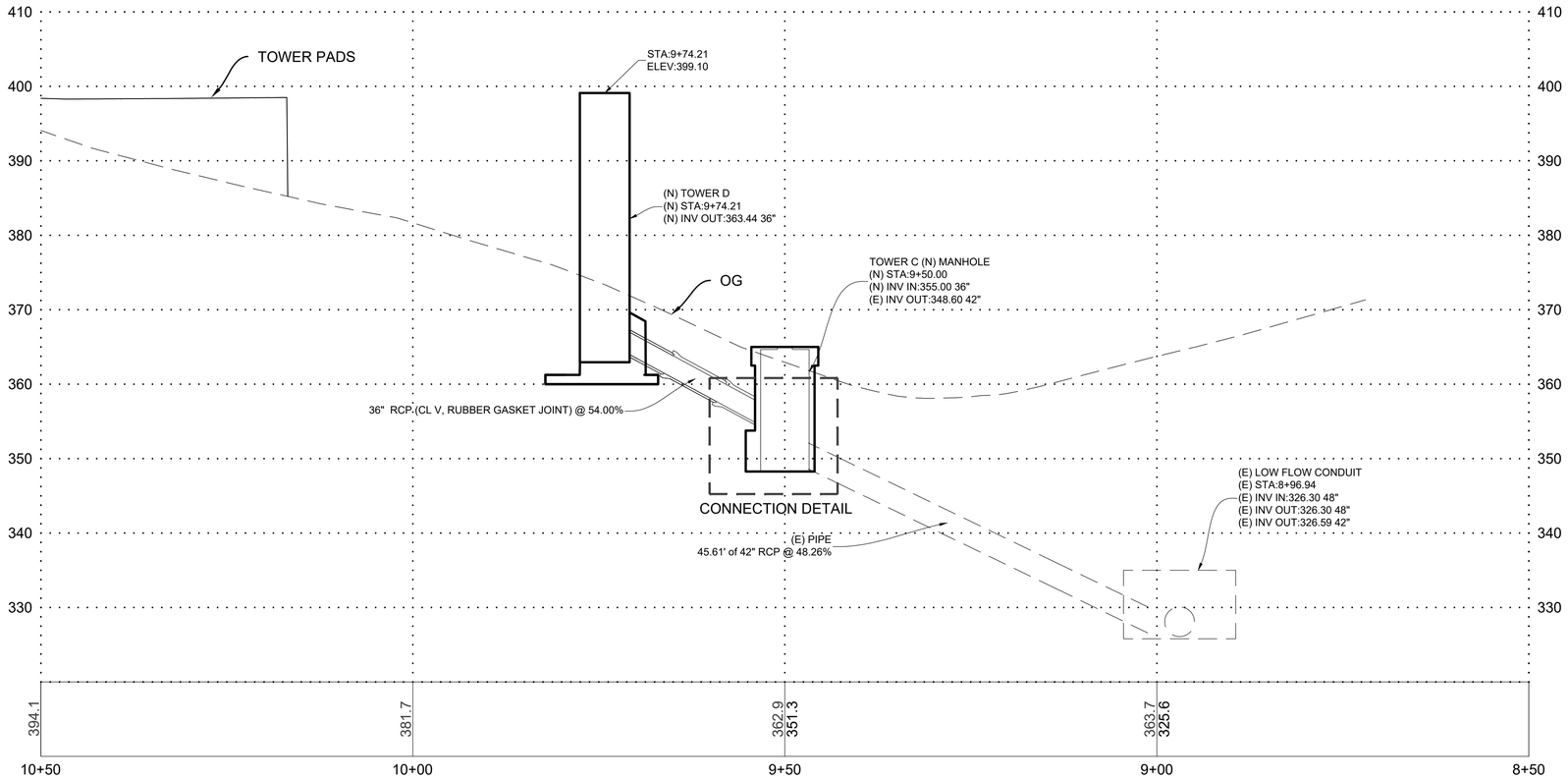
DESIGNED BY:	TC
DRAWN BY:	HMD
CHECKED BY:	SO

TWR-1

SHEET 54 OF 88

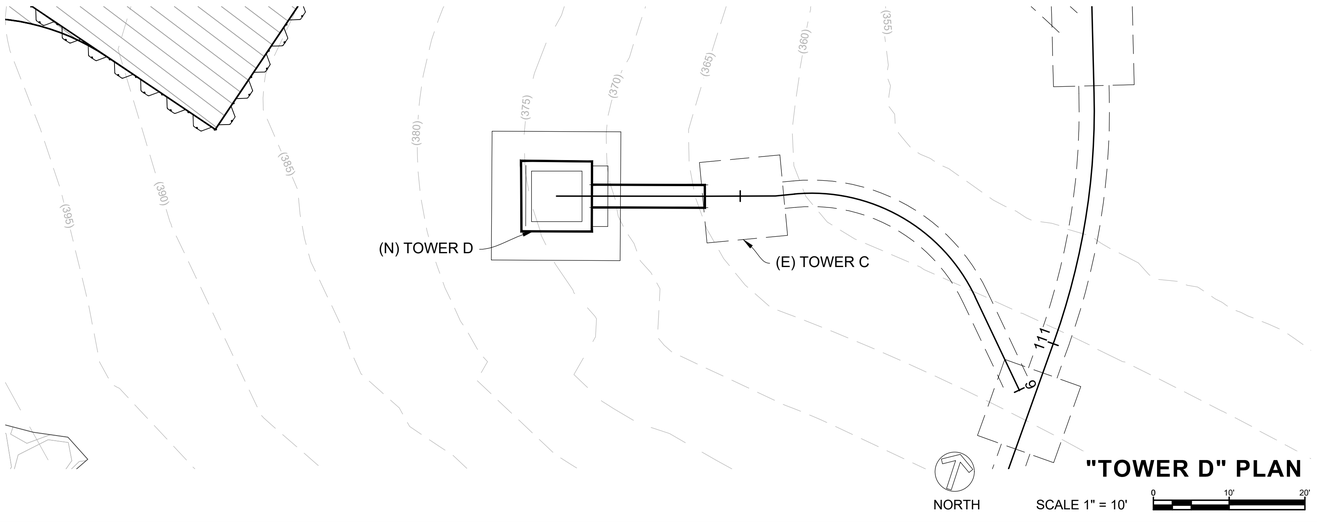
FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

F:\Bengal\SB County - SMDB - Documents\Design\Production Drawings\Tower Elevation Exhibit.dwg
2/8/2022 9:54 AM PLOT DATE/TIME



"TOWER D" PROFILE

SCALE H 1" = 10' & V 1" = 10'

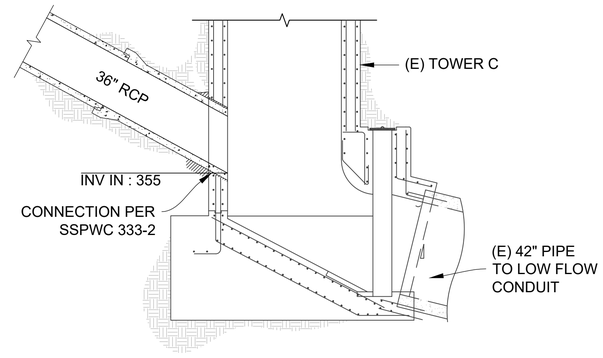


"TOWER D" PLAN

SCALE 1" = 10'

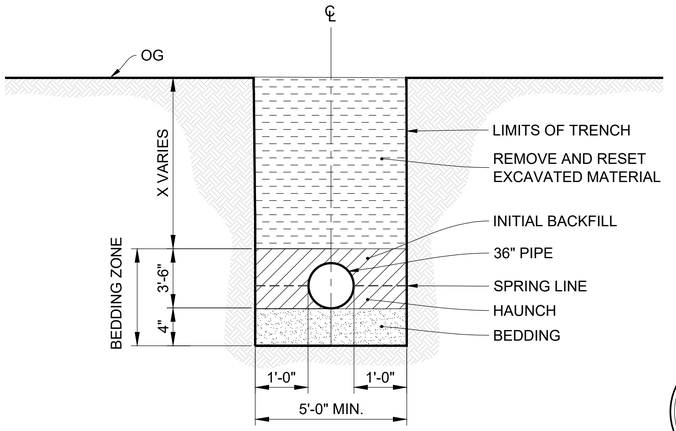
NOTES:

1. CONCRETE FOR PIPE ENCASEMENTS/CRADLES SHALL BE STRAPPED DOWN TO PREVENT FLOATING OF THE PIPE DURING THE PLACEMENT. CONCRETE SHALL BE PLACED ON ONE SIDE OF THE PIPE, VIBRATED, AND SEEN COMING OUT FROM UNDER THE OTHER SIDE OF THE PIPE TO ELIMINATE ANY POTENTIAL VOIDS IN THE CONCRETE.
2. CONNECTION BETWEEN TOWER C AND TOWER D HAS TWO GASKET JOINTS.



CONNECTION DETAIL

SCALE 1" = 4'



TRENCHING DETAIL

NOT TO SCALE

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

INLET TOWER 'D'
PLAN & PROFILE

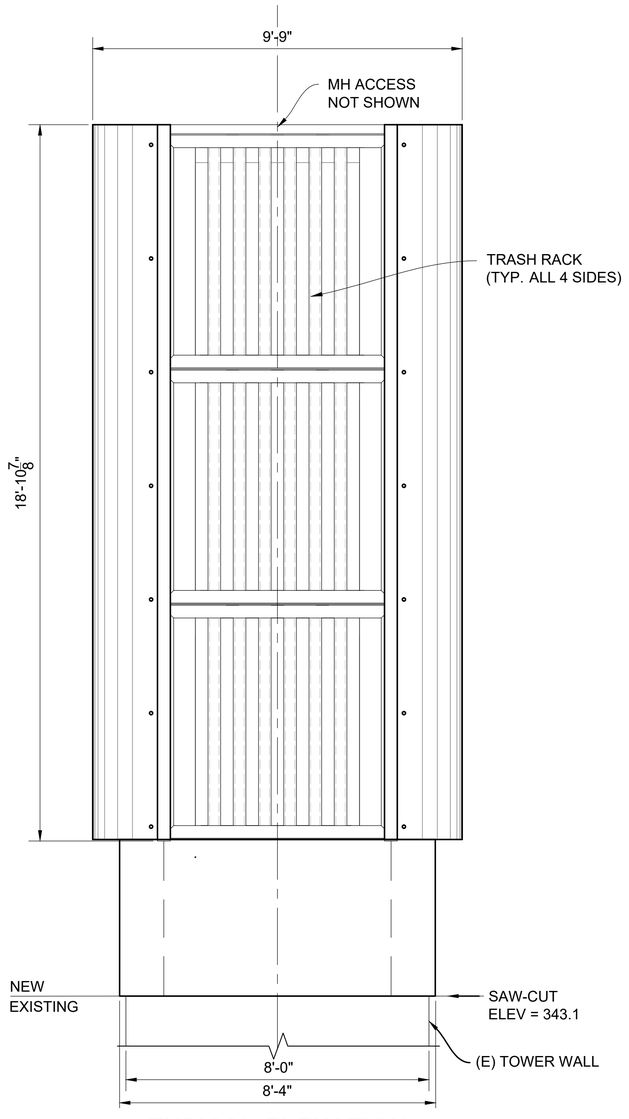
DESIGNED BY:	TC
DRAWN BY:	HAO
CHECKED BY:	SO

TWR-2

SHEET 55 OF 88

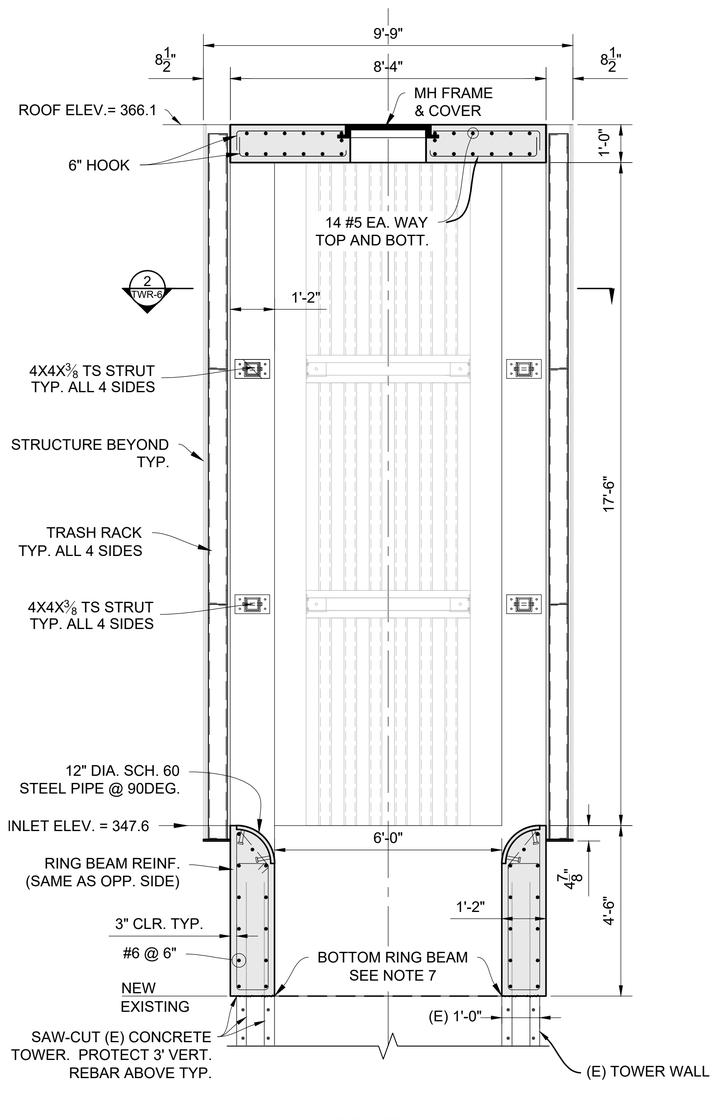
FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

F:\Bengal\SB County - SMDB - Documents\Design\Production Drawings\06-Profiles.dwg
2/8/2022 9:55 AM PLOT DATE/TIME



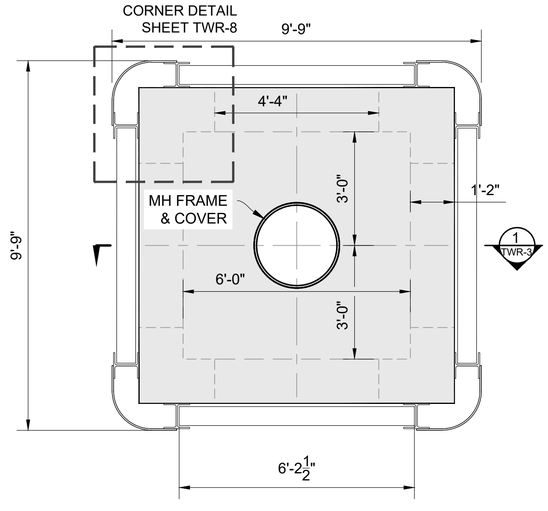
TYPICAL ELEVATION

SCALE: 1/2" = 1'-0"



SECTION 1

SCALE: 1/2" = 1'-0"



ROOF PLAN

SCALE: 1/2" = 1'-0"

NOTES:

1. SEE CIVIL PLANS FOR TOWER LOCATIONS & ORIENTATION OF OUTLETS.
2. SEE RECORD DRAWINGS FOR FOUNDATION DETAILS.
3. DIMENSIONS SHOWN ARE TYPICAL AT EA. CORNER CONDITION, U.N.O.
4. MANHOLE FRAME & COVER PER SPPWC 630.
5. SEE TWR-7 SECTION 2 FOR ADDITIONAL INFO.
6. COL. REINF. EXTENSION TO RING BEAM NOT SHOWN.
7. ALL EXISTING CONCRETE SURFACES SHALL BE ROUGHENED TO ¼" AMPLITUDE IN ROUGHNESS PRIOR TO NEW CONCRETE POUR TYP.
8. ALL STEEL BARS, PLATES AND SHAPES MUST BE A36 TYP.

REGISTERED PROFESSIONAL ENGINEER — Thomas Conti — T. Conti — No. C73108 — CIVIL — STATE OF CALIFORNIA

DATE: 2/8/22

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

INLET TOWER 'A'
DETAILS

DESIGNED BY: TC
DRAWN BY: HS
CHECKED BY: SO

TWR-3

SHEET 56 OF 88

F:\Bengal\SB County - SMDB - Documents\Design\Production Drawings\08-Towers.dwg
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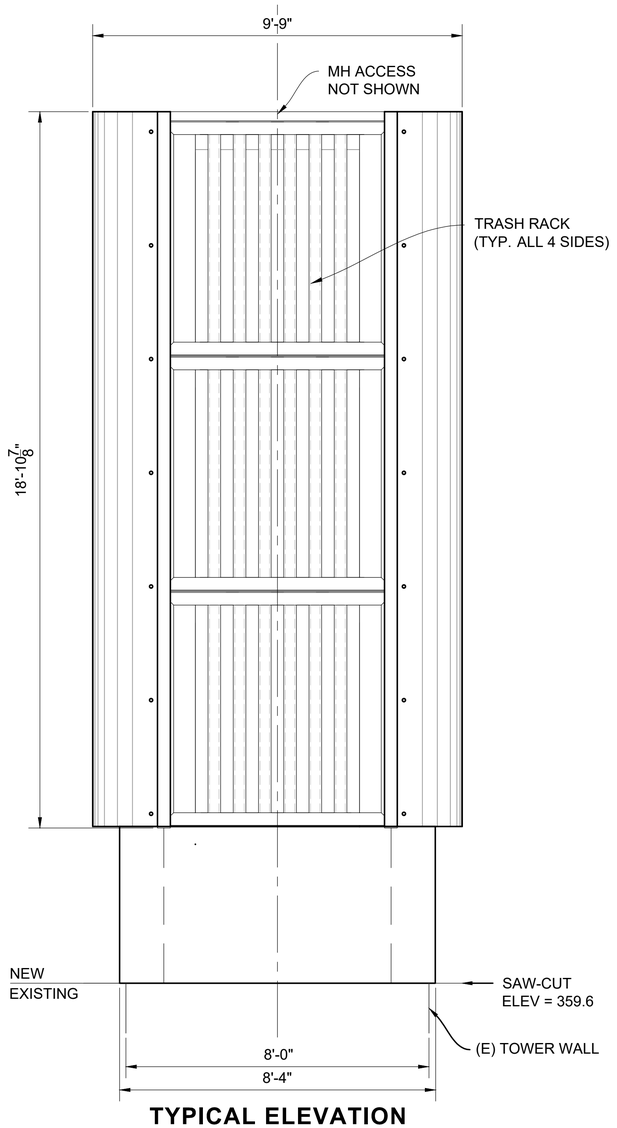
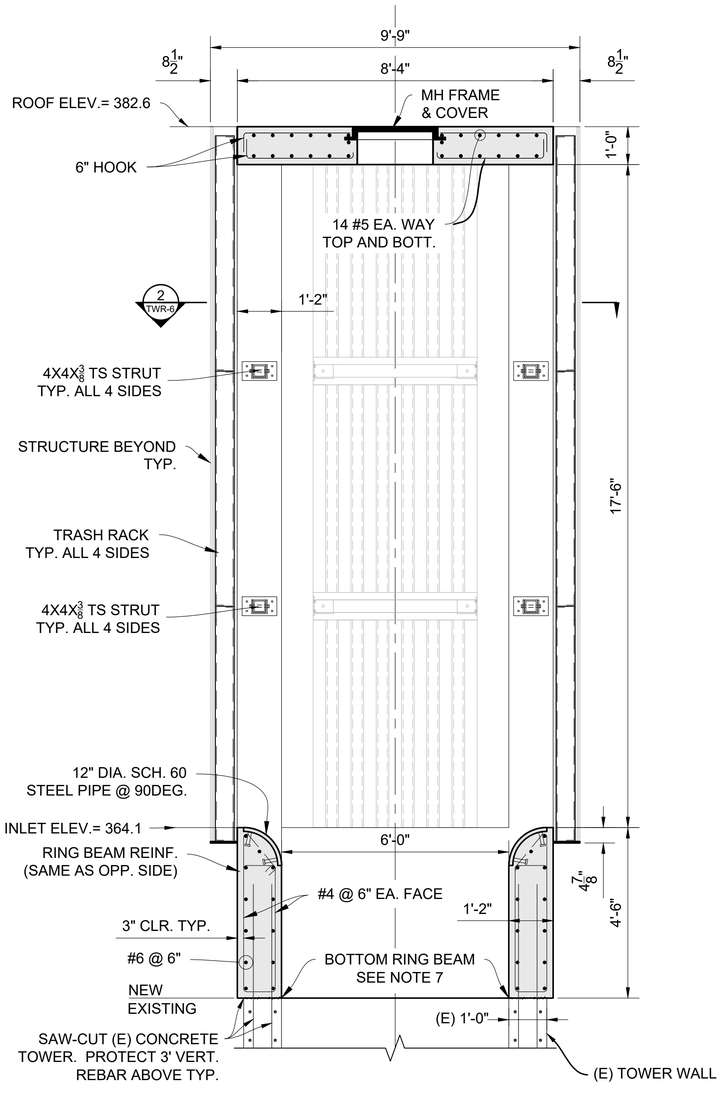


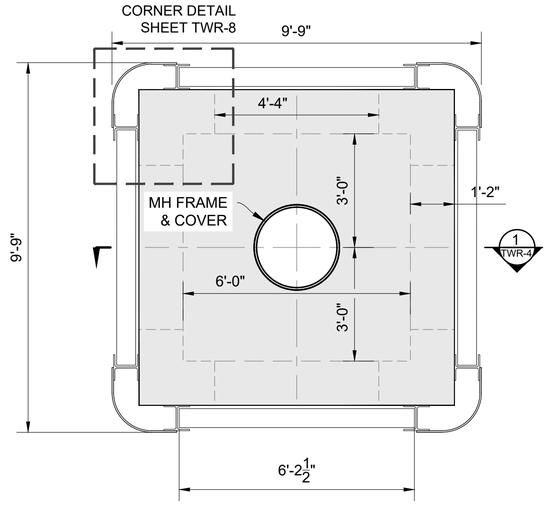
TYPICAL ELEVATION

SCALE: 1/2" = 1'-0"



SECTION 1

SCALE: 1/2" = 1'-0"



ROOF PLAN

SCALE: 1/2" = 1'-0"

NOTES:

1. SEE CIVIL PLANS FOR TOWER LOCATIONS & ORIENTATION OF OUTLETS.
2. SEE RECORD DRAWINGS FOR FOUNDATION DETAILS.
3. DIMENSIONS SHOWN ARE TYPICAL AT EA. CORNER CONDITION, U.N.O.
4. MANHOLE FRAME & COVER PER SPPWC 630.
5. SEE TWR-7 SECTION 2 FOR ADDITIONAL INFO.
6. COL. REINF. EXTENSION TO RING BEAM NOT SHOWN.
7. ALL EXISTING CONCRETE SURFACES SHALL BE ROUGHENED TO ¼" AMPLITUDE IN ROUGHNESS PRIOR TO NEW CONCRETE POUR.
8. ALL STEEL BARS, PLATES AND SHAPES MUST BE A36 TYP.

REGISTERED PROFESSIONAL ENGINEER — T. Conti — No. C73108 — CIVIL — STATE OF CALIFORNIA

DATE: 2/8/22

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

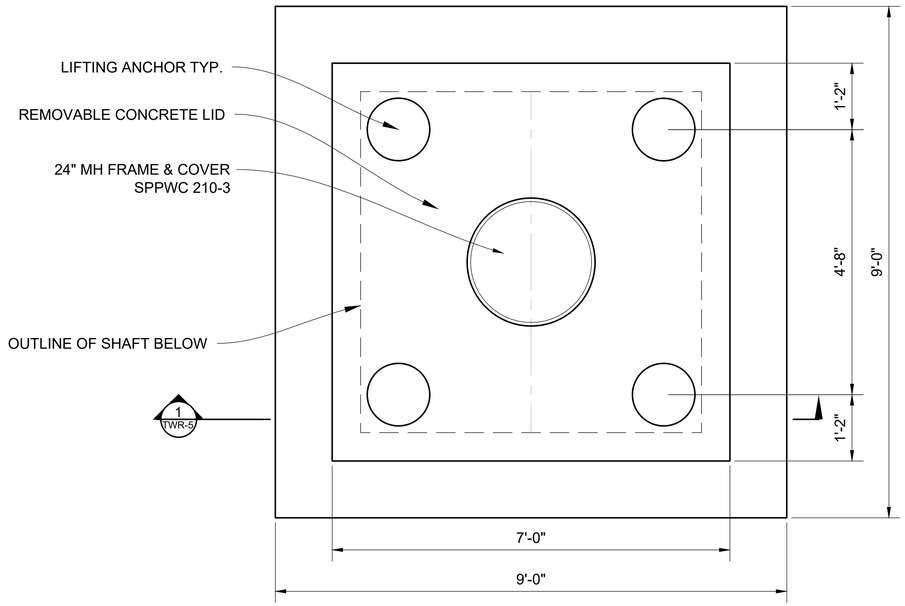
INLET TOWER 'B'
DETAILS

DESIGNED BY: TC
DRAWN BY: HS
CHECKED BY: SO

TWR-4

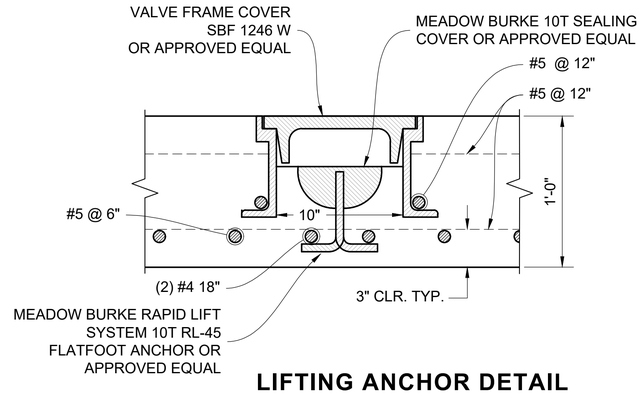
SHEET 57 OF 88

F:\Bengal\SB County - SMDB - Documents\Design\Production Drawings\08-Towers.dwg
2/8/2022 9:56 AM PLOT DATE/TIME



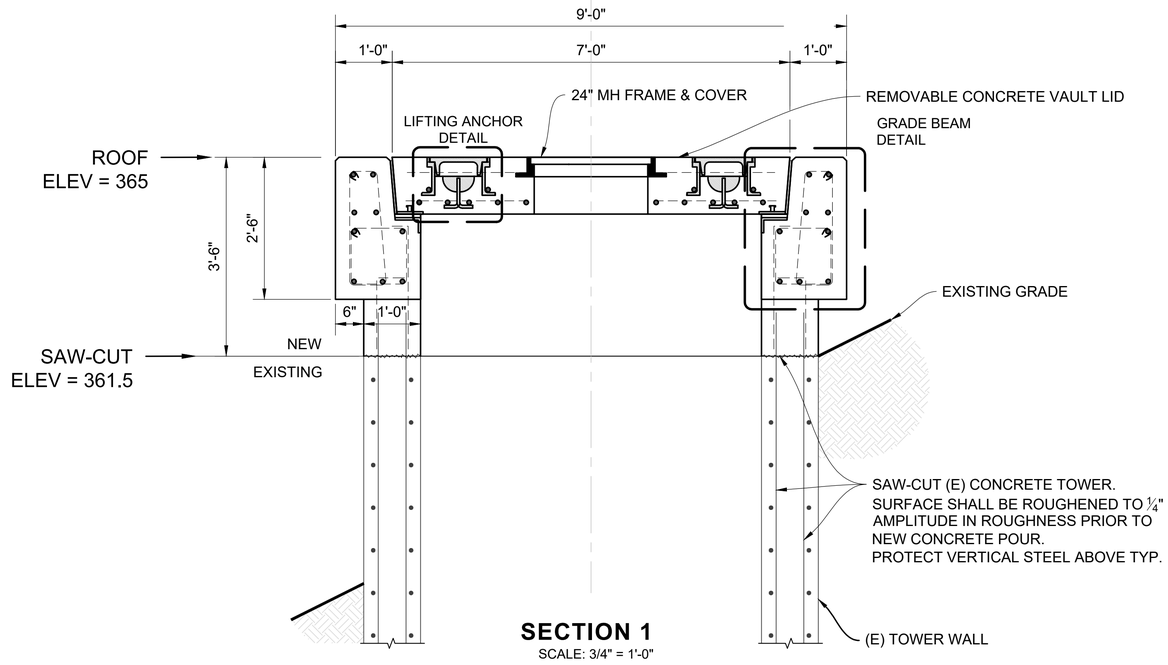
ROOF PLAN

SCALE: 3/4" = 1'-0"



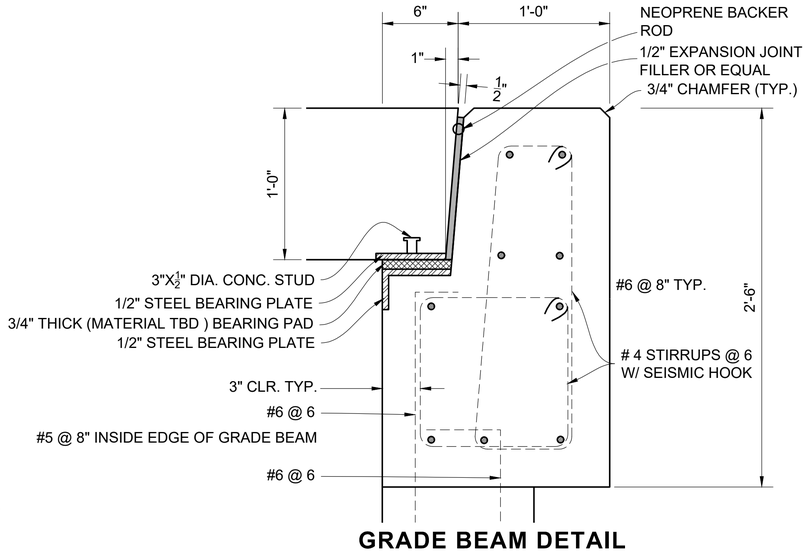
LIFTING ANCHOR DETAIL

NOT TO SCALE



SECTION 1

SCALE: 3/4" = 1'-0"



GRADE BEAM DETAIL

NOT TO SCALE

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

INLET TOWER 'C'
DETAILS

DESIGNED BY:	TC
DRAWN BY:	HS
CHECKED BY:	SO

TWR-5

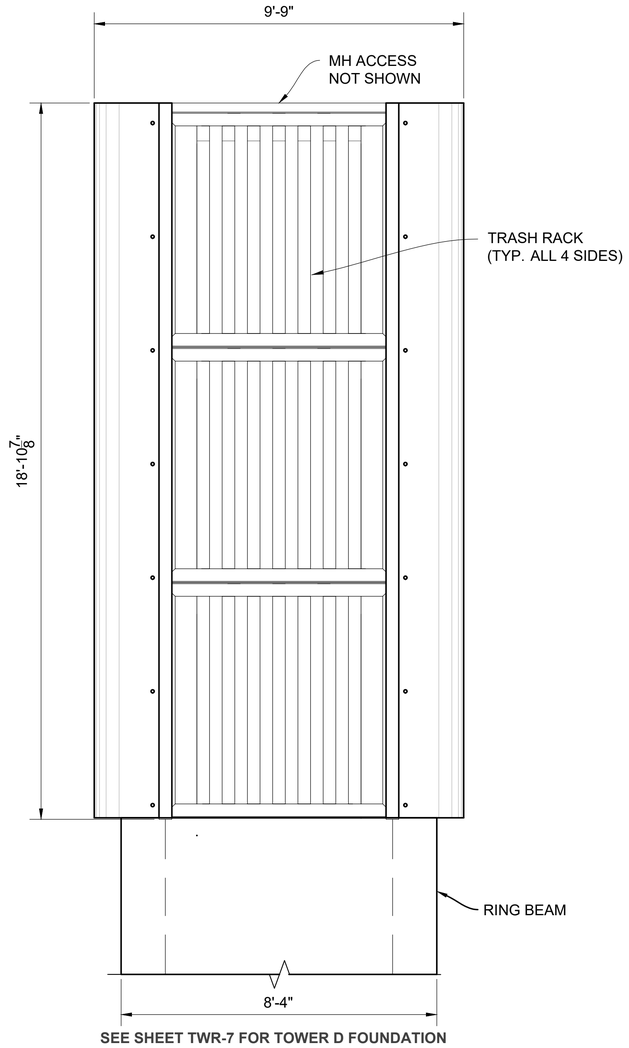
SHEET 58 OF 88

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

F:\Bengal\SB County - SMDB - Documents\Design\Production Drawings\08-Towers.dwg
2/8/2022 9:56 AM PLOT DATE/TIME

NOTES:

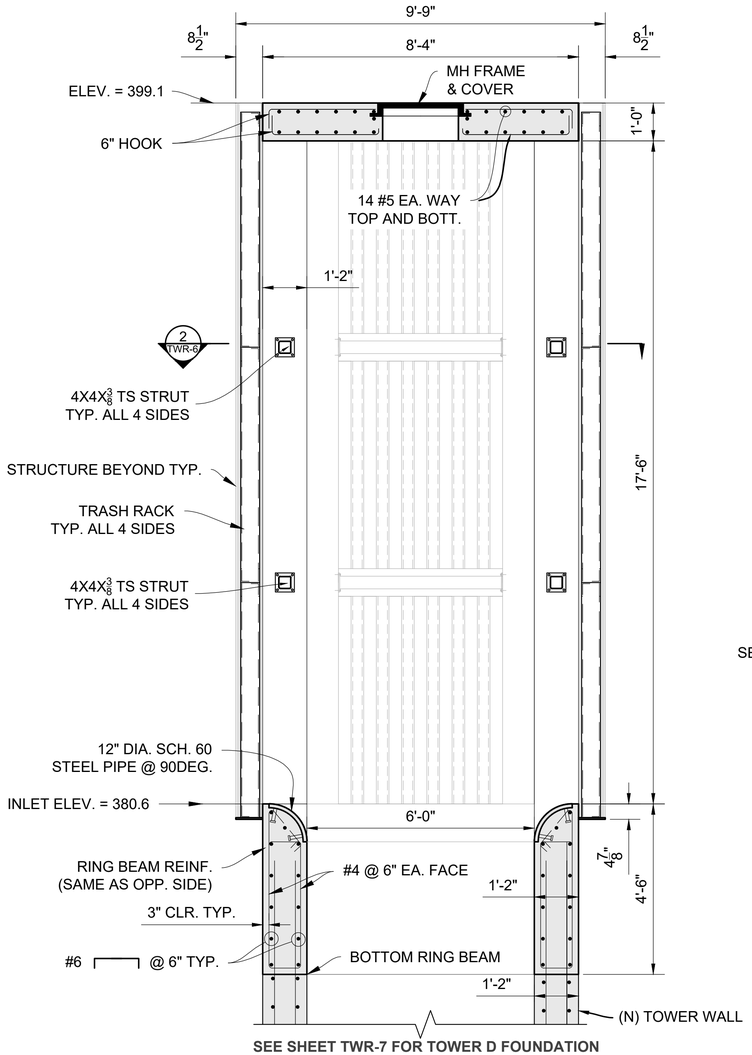
1. SEE CIVIL PLANS FOR TOWER LOCATIONS & ORIENTATION OF OUTLETS.
2. SEE RECORD DRAWINGS FOR FOUNDATION DETAILS.
3. DIMENSIONS SHOWN ARE TYPICAL AT EA. CORNER CONDITION, U.N.O.
4. MANHOLE FRAME & COVER PER SPPWC 630.
5. SEE TWR-7 SECTION 2 FOR ADDITIONAL INFO.
6. COL. REINF. EXTENSION TO RING BEAM NOT SHOWN.
7. ALL STEEL BARS, PLATES AND SHAPES MUST BE A36 TYP.



SEE SHEET TWR-7 FOR TOWER D FOUNDATION

TYPICAL ELEVATION

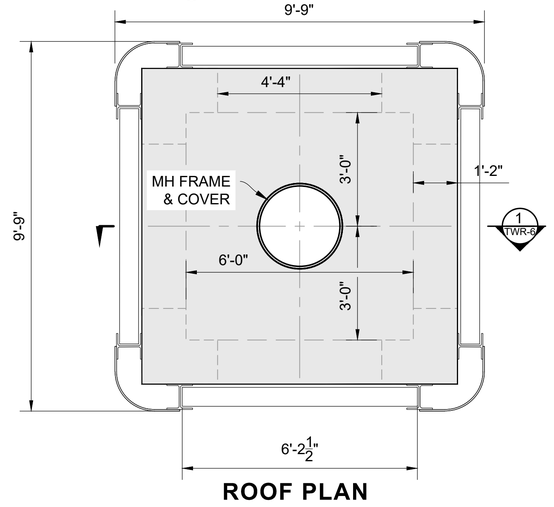
SCALE: 1/2" = 1'-0"



SEE SHEET TWR-7 FOR TOWER D FOUNDATION

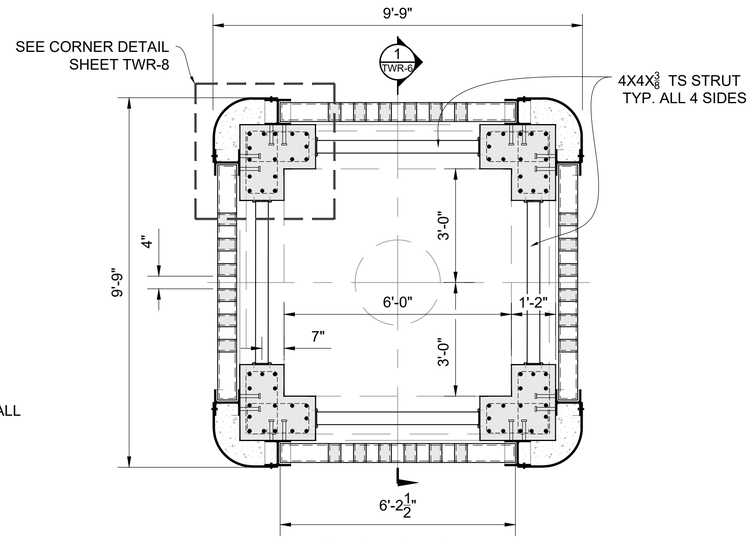
SECTION 1

SCALE: 1/2" = 1'-0"



ROOF PLAN

SCALE: 1/2" = 1'-0"



SECTION 2

SCALE: 1/2" = 1'-0"

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

INLET TOWER 'D'
REINFORCEMENT PLAN

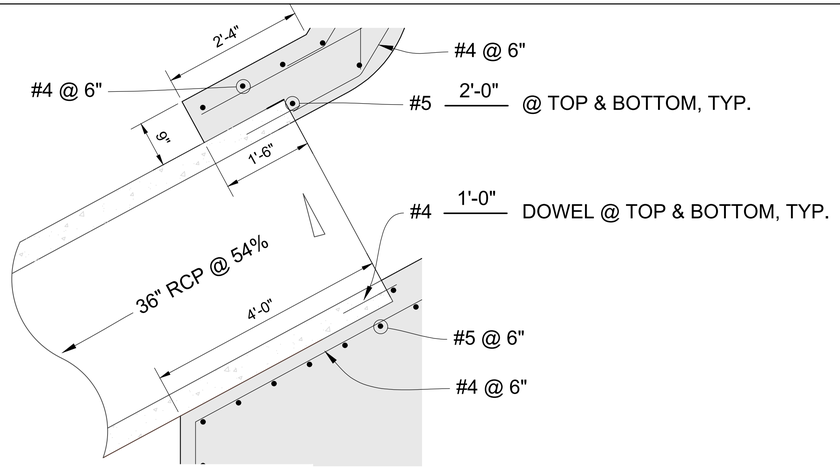
DESIGNED BY:	TC
DRAWN BY:	HS
CHECKED BY:	SO

TWR-6

SHEET 59 OF 88

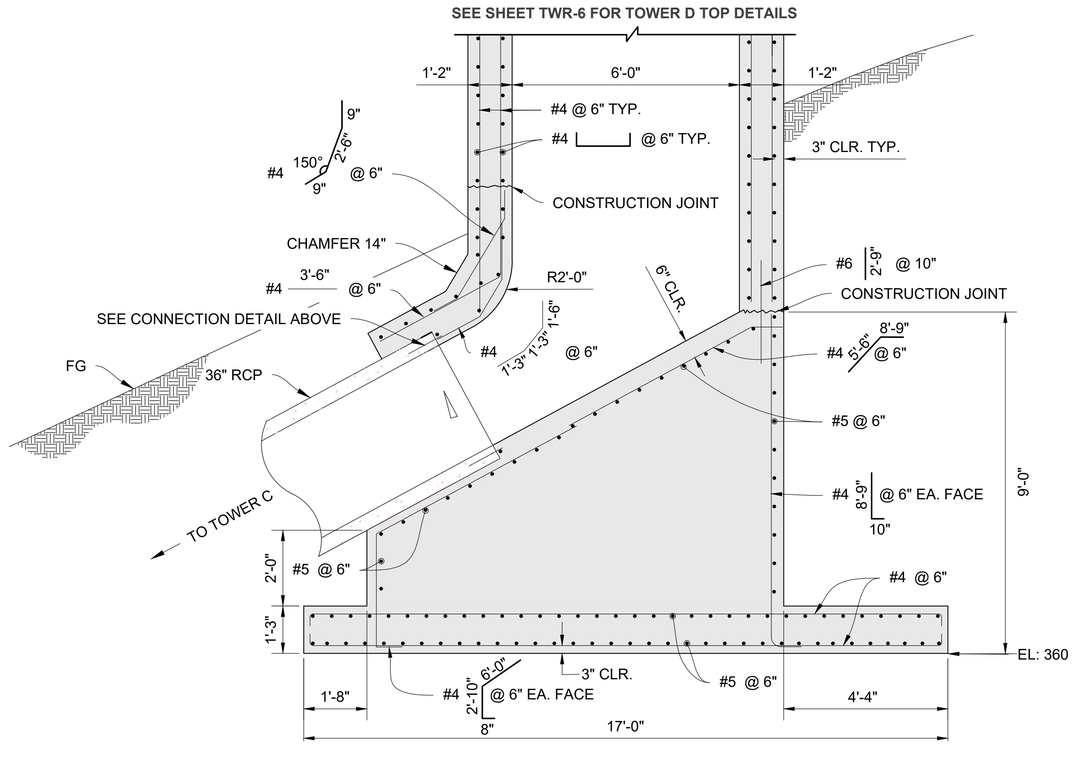
FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

F:\Bengal\SB County - SMDB - Documents\Design\Production Drawings\08-Towers.dwg
2/8/2022 9:57 AM PLOT DATE/TIME



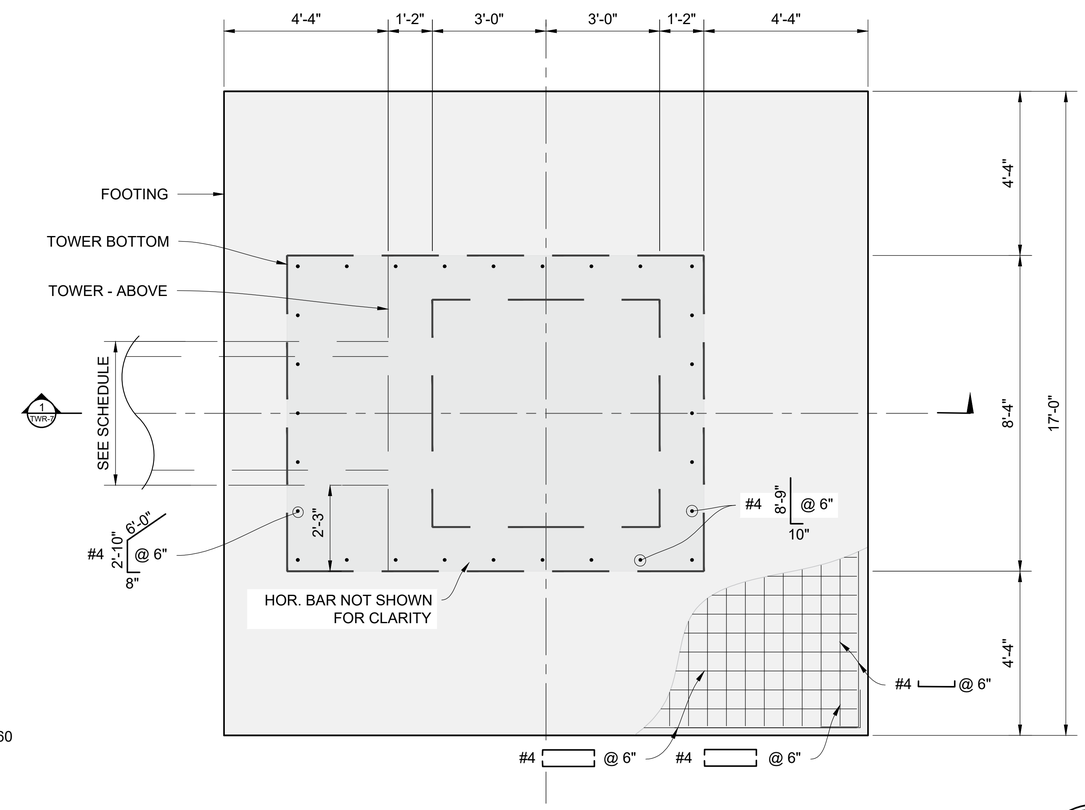
RCP CONNECTION

NO SCALE



SECTION 1 - FOUNDATION

SCALE: 1/2" = 1'-0"



FOUNDATION PLAN

SCALE: 1/2" = 1'-0"

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

INLET TOWER 'D'
FOUNDATION DIMENSION PLAN

DESIGNED BY:	TC
DRAWN BY:	HS
CHECKED BY:	SO

TWR-7

SHEET 60 OF 88

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2

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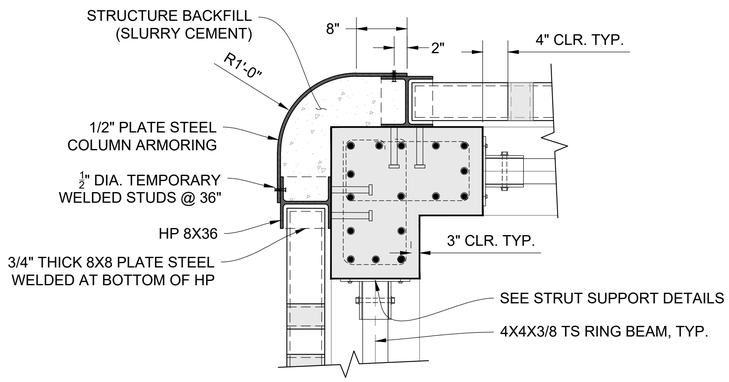
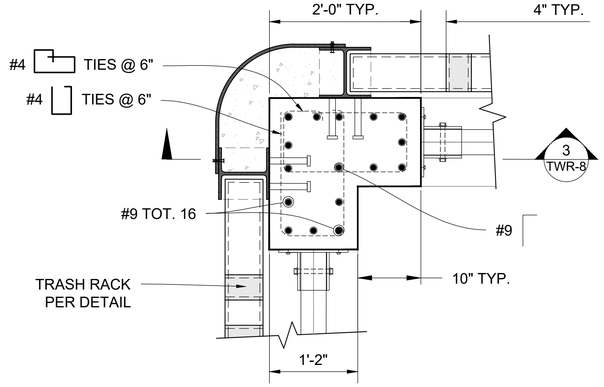


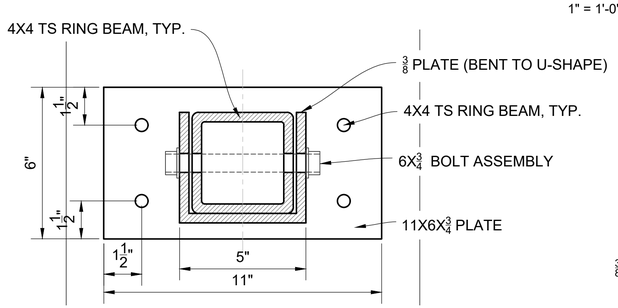
COLUMN CORNER DETAIL

1" = 1'-0"

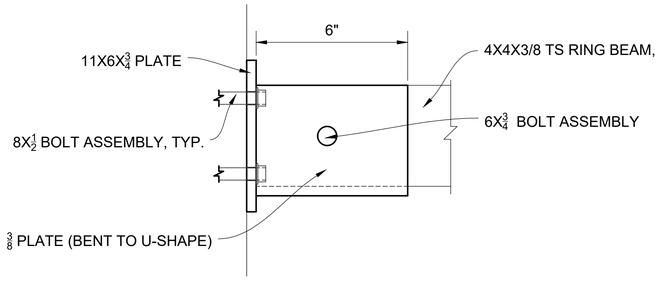


COLUMN REINFORCEMENT

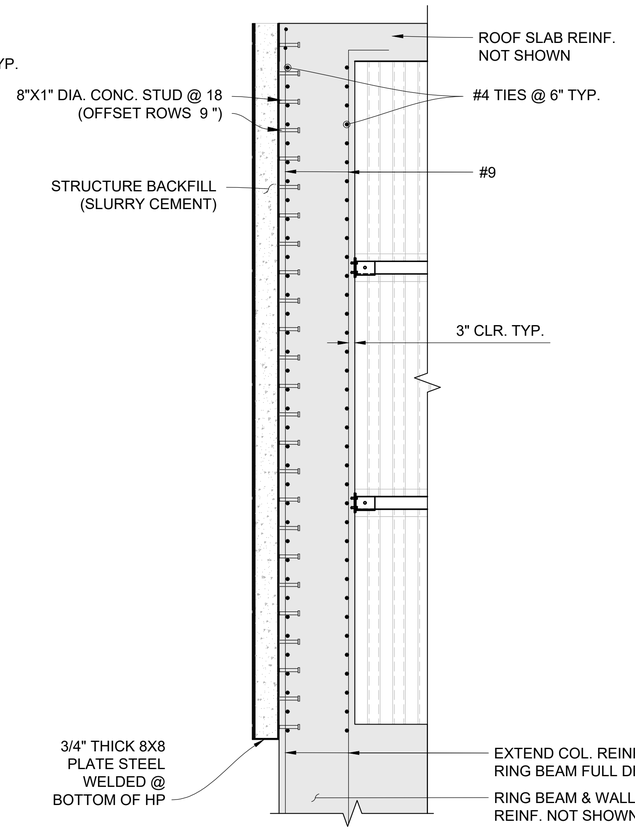
1/2" = 1'-0"



ELEVATION



SECTION

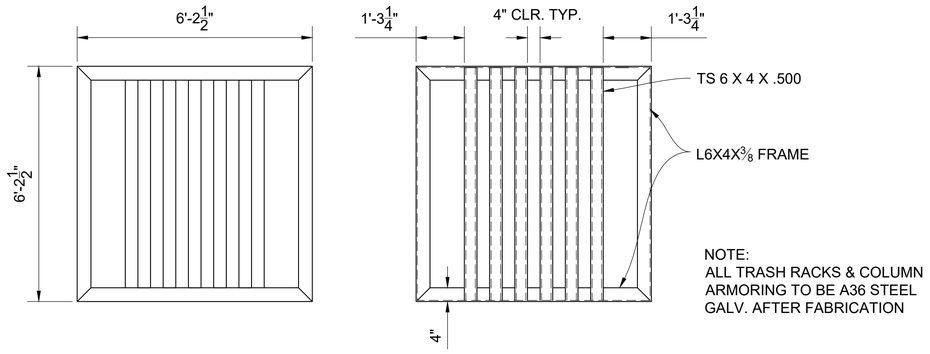


SECTION 3

1/2" = 1'-0"

STRUT SUPPORT DETAILS

NO SCALE



NOTE:
ALL TRASH RACKS & COLUMN ARMORING TO BE A36 STEEL GALV. AFTER FABRICATION

ELEVATION

SECTION

TRASH RACK DETAILS

1/2" = 1'-0"

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

INLET TOWER DETAILS

DESIGNED BY:	TC
DRAWN BY:	HS
CHECKED BY:	SO

TWR-8

SHEET 61 OF 88

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

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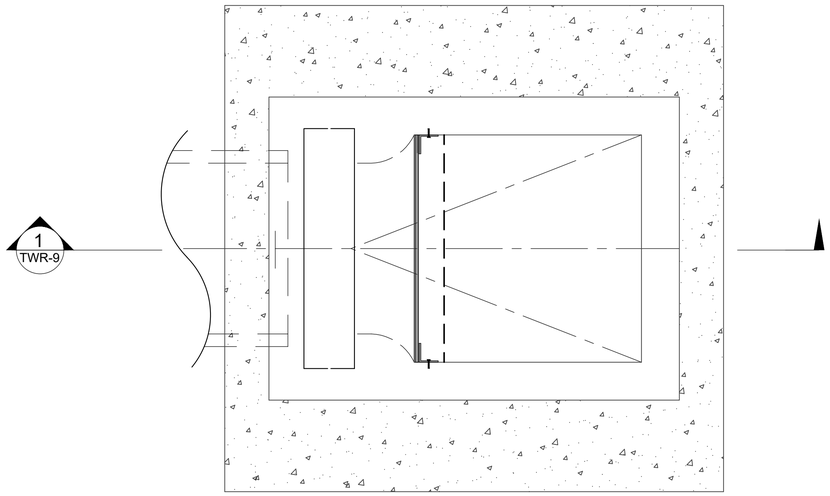
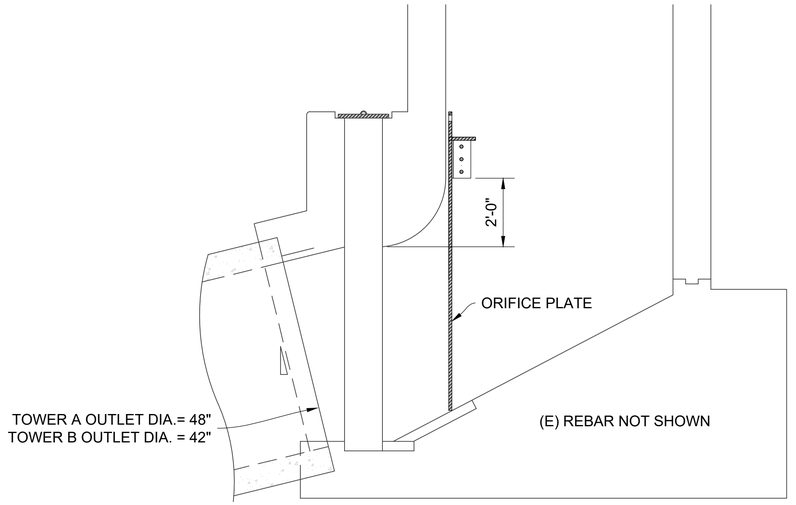


ORIFICE PLAN

1/2" = 1'-0"



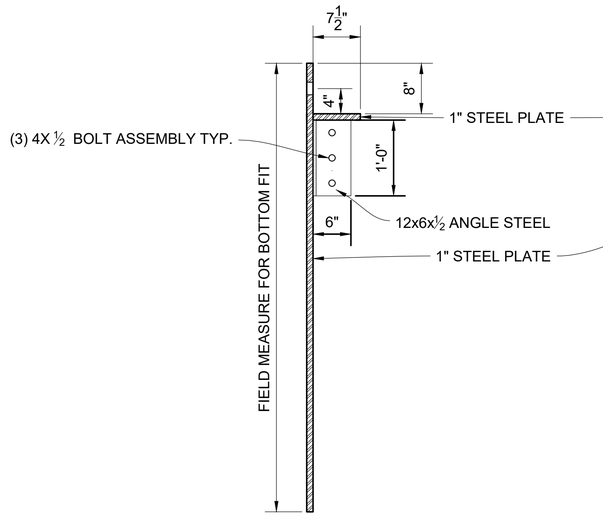
SECTION 1 - FOUNDATION

1/2" = 1'-0"

NOTES:

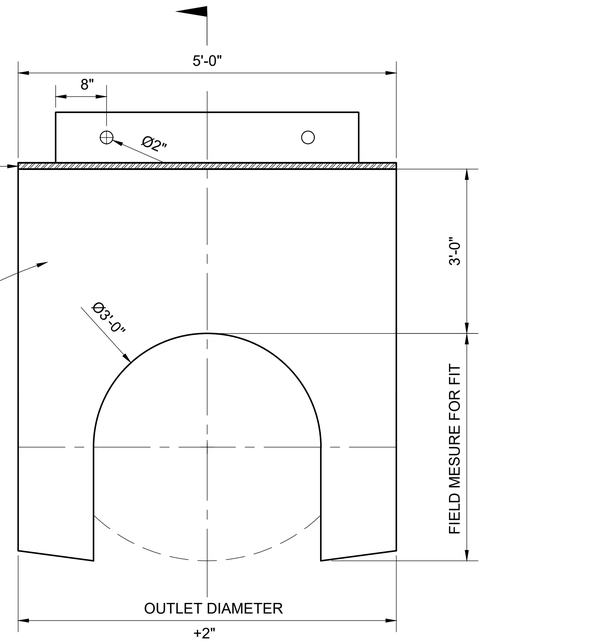
1. REMOVE EXISTING STOP LOG COVER PLATE AND PLACE 1" THICK GALVANIZED STEEL ORFICE PLATE.
2. SEE RECORD DRAWINGS FOR FOUNDATION DETAILS
3. CONTRACTOR TO VERIFY ORIFICE PLATE SIZE WITH EXISTING FOUNDATIONS.

SCALE H 1" = 40'
V 1" = 20'



SECTION 2- ORIFICE PLATE

1" = 1'-0"



2
TWR-9

ORIFICE PLATE ELEVATION

1" = 1'-0"

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

INLET TOWER 'A' & 'B'
ORIFICE PLATE DETAIL

DESIGNED BY:	TC
DRAWN BY:	HS
CHECKED BY:	SO

TWR-9

SHEET 62 OF 88

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

F:\Bengal\SB County - SMDB - Documents\Design\Production Drawings\08-Towers.dwg
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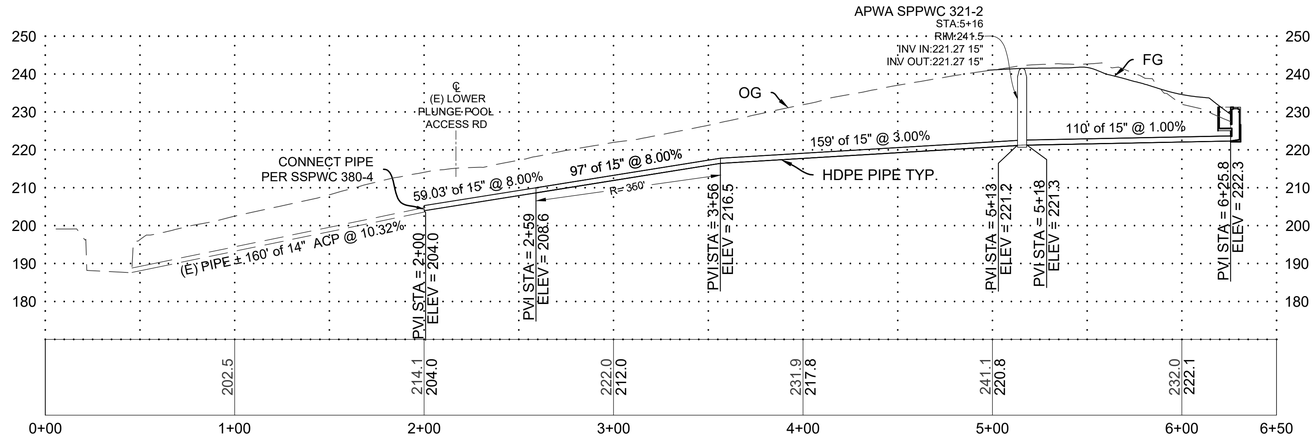


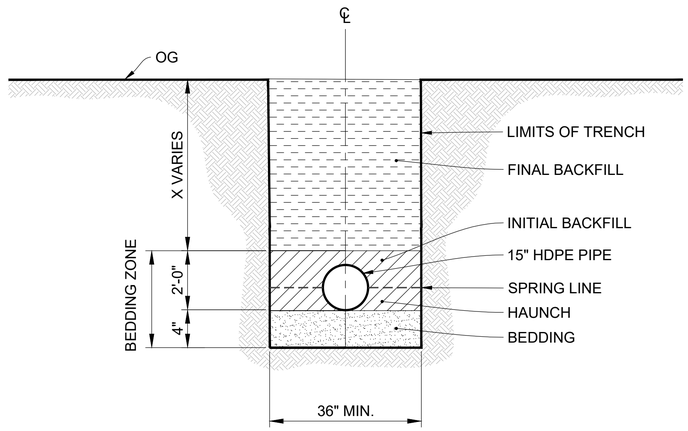
PLUNGE POOL BY-PASS PROFILE

SCALE H 1" = 40' (0, 40', 80')

V 1" = 20' (0, 20', 40')

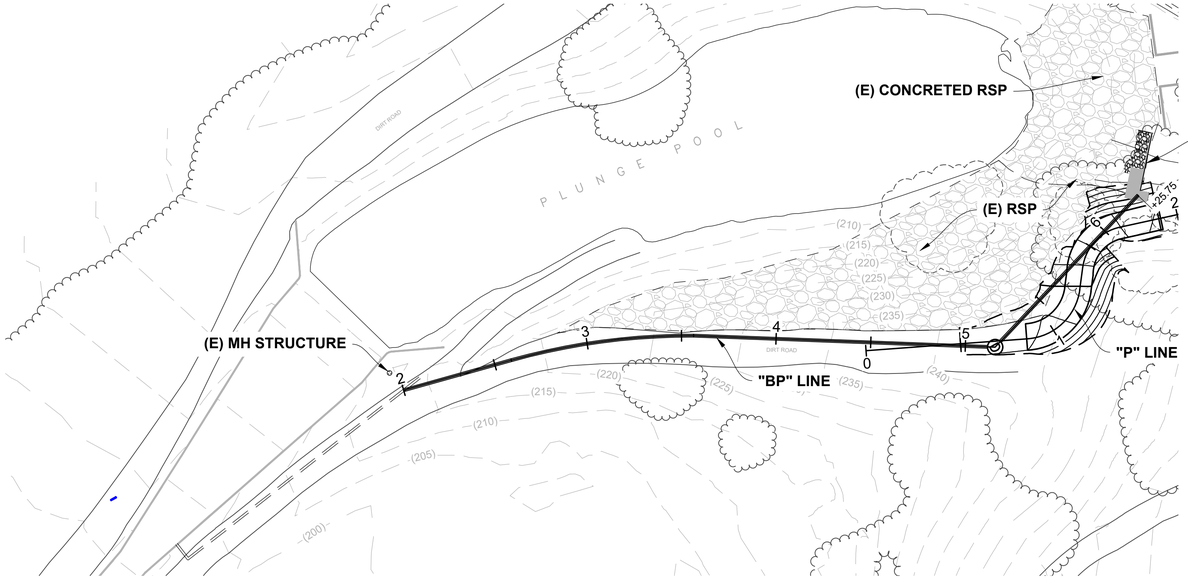
NOTES:

SEE COUNTY OF SANTA BARBARA STANDARD PLAN 2-010 AND 2-020 FOR ADDITIONAL REQUIREMENTS FOR THE BY-PASS PIPE CONSTRUCTION.



TYPICAL TRENCHING DETAIL

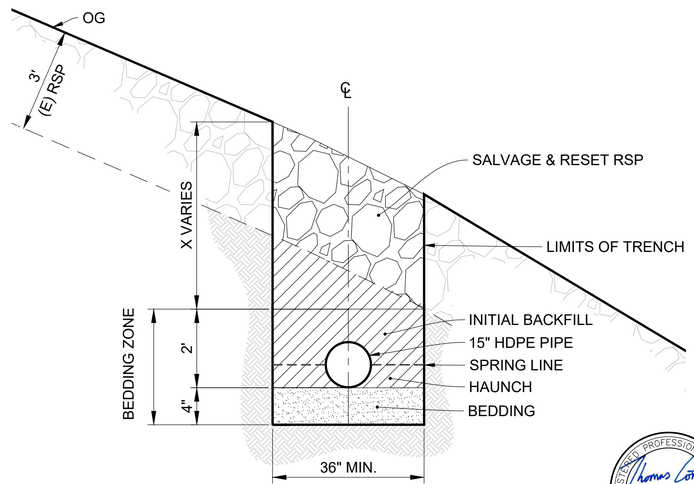
STA: 2+00 - 5+35 & 5+65 - 6+25.75 **NOT TO SCALE**



PLUNGE POOL BY-PASS PLAN

NORTH

SCALE 1" = 40' (0, 40', 80')



TRENCHING DETAIL

STA: 5+35 - 5+65 **NOT TO SCALE**

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

PLUNGE POOL BY-PASS
PLAN & PROFILE

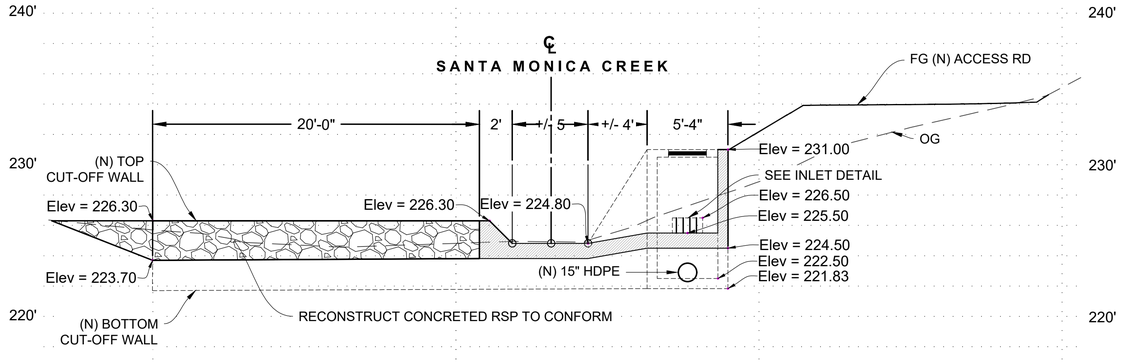
DESIGNED BY:	TC
DRAWN BY:	HAO
CHECKED BY:	SO

BP-1

SHEET 63 OF 88

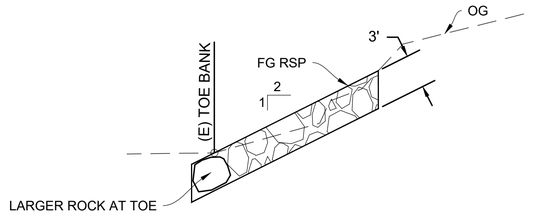
FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

F:\Bengal\SB County - SMDB - Documents\Design\Production Drawings\06-Profiles.dwg
2/8/2022 9:59 AM PLOT DATE/TIME



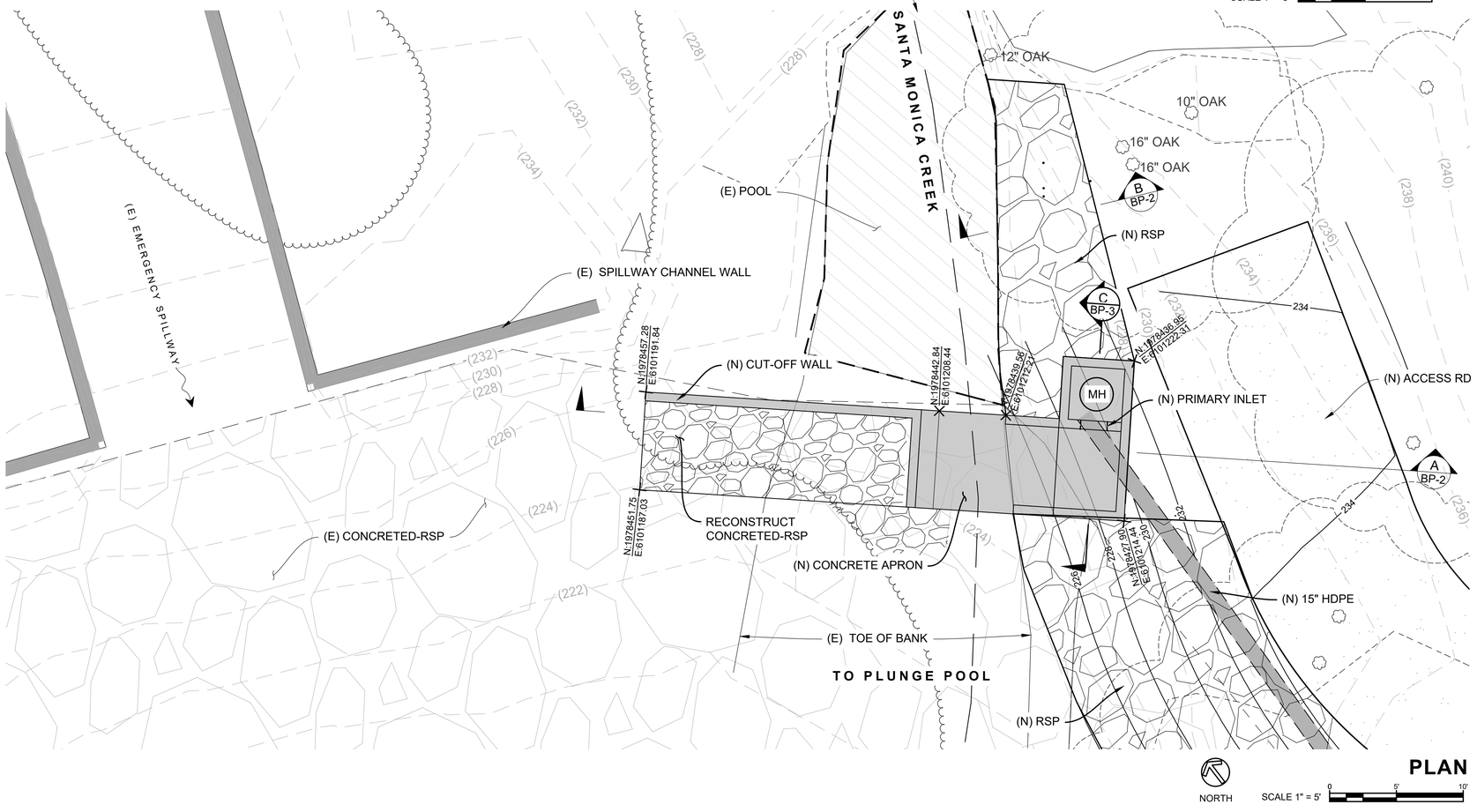
SECTION A-A

SCALE 1" = 5'



RSP TYPICAL DETAIL SECTION B-B

SCALE 1" = 5'



PLAN

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

PLUNGE POOL BYPASS STRUCTURE

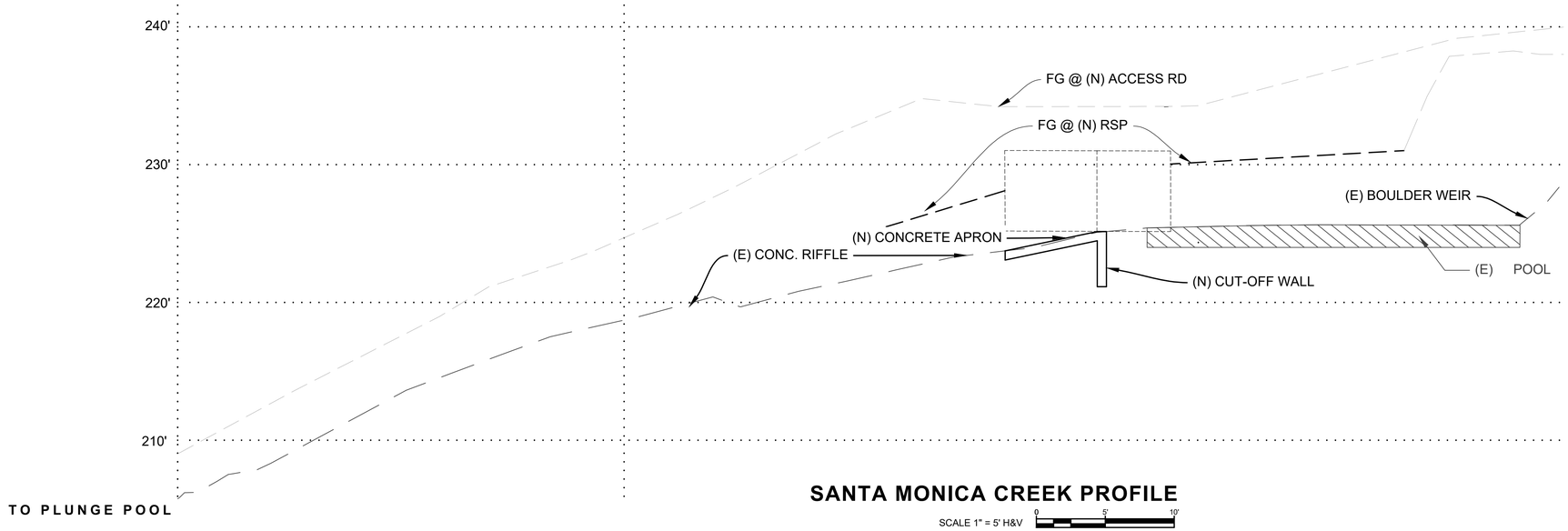
DESIGNED BY:	TC
DRAWN BY:	HS
CHECKED BY:	SO

BP-2

SHEET 64 OF 88

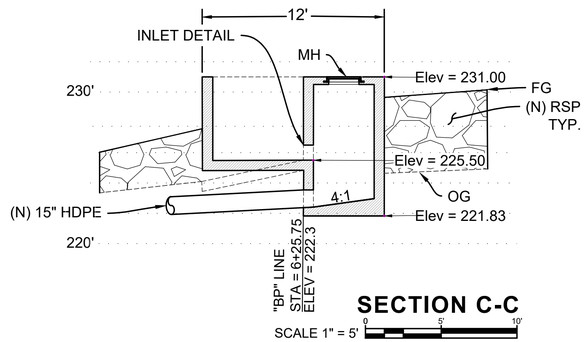
FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

F:\Bengal\SB County - SMDB - Documents\Design\Production Drawings\Plunge Pool Bypass Structure.dwg
2/8/2022 10:00 AM PLOT DATE/TIME



SANTA MONICA CREEK PROFILE

SCALE 1" = 5' H&V 0 5' 10'



SECTION C-C

SCALE 1" = 5' 0 5' 10'

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES 0 1 2

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

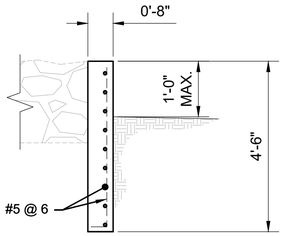
PLUNGE POOL BYPASS STRUCTURE

DESIGNED BY: TC
DRAWN BY: HS
CHECKED BY: SO

BP-3

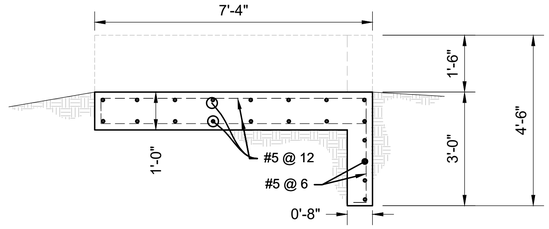
SHEET 65 OF 88

F:\Bengal\SB County - SMDB - Documents\Design\Production Drawings\Plunge Pool Bypass Structure.dwg
2/8/2022 10:00 AM PLOT DATE/TIME



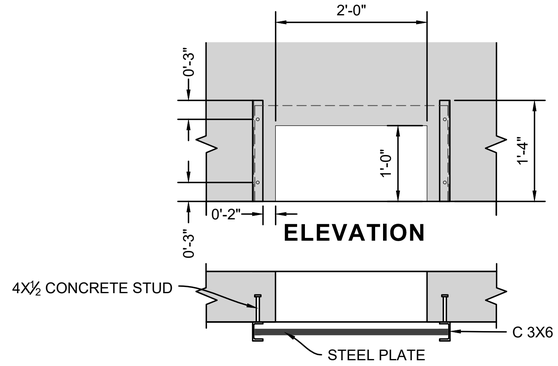
SECTION A

SCALE 1/2" = 1'



SECTION B

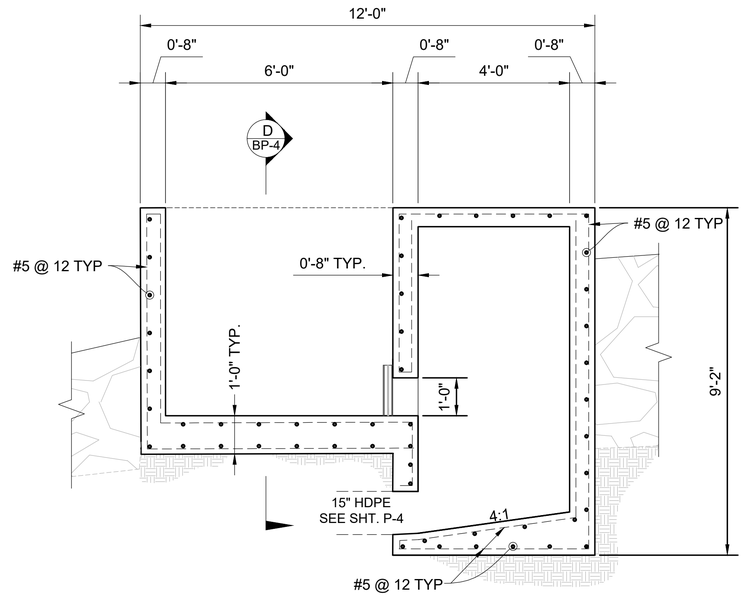
SCALE 1/2" = 1'



PLAN

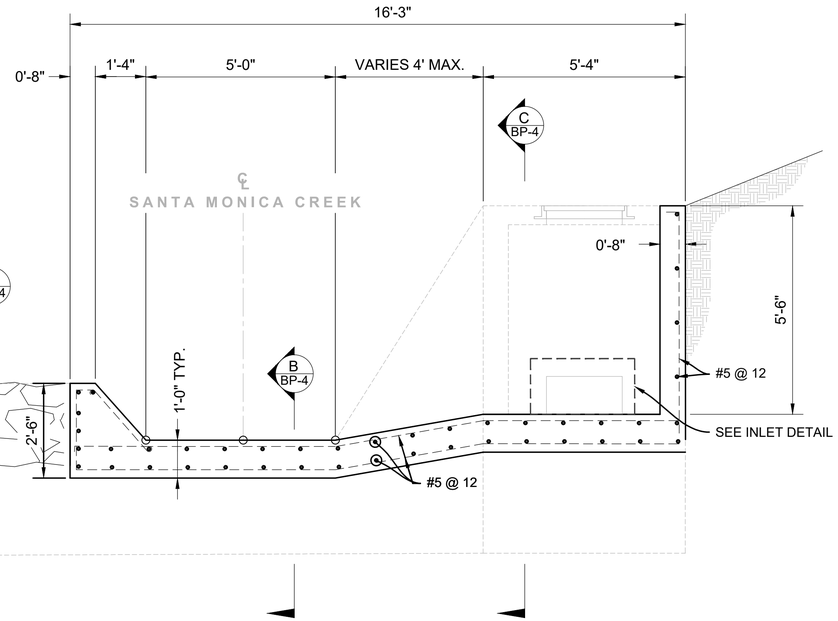
INLET DETAIL

SCALE 1" = 1'



SECTION C

SCALE 1/2" = 1'



SECTION D

SCALE 1/2" = 1'

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

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130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

PLUNGE POOL BYPASS STRUCTURE

DESIGNED BY:	TC
DRAWN BY:	HS
CHECKED BY:	SO

BP-4

SHEET 66 OF 88

FOR REDUCED PLANS
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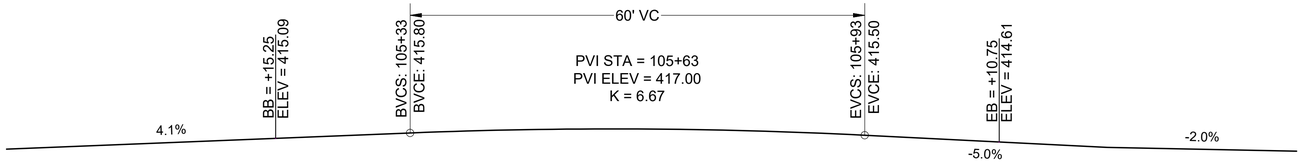
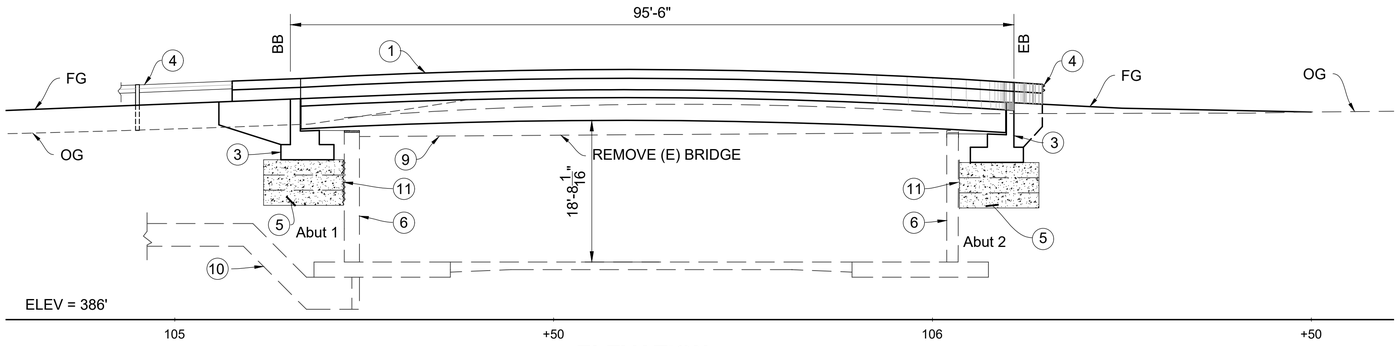


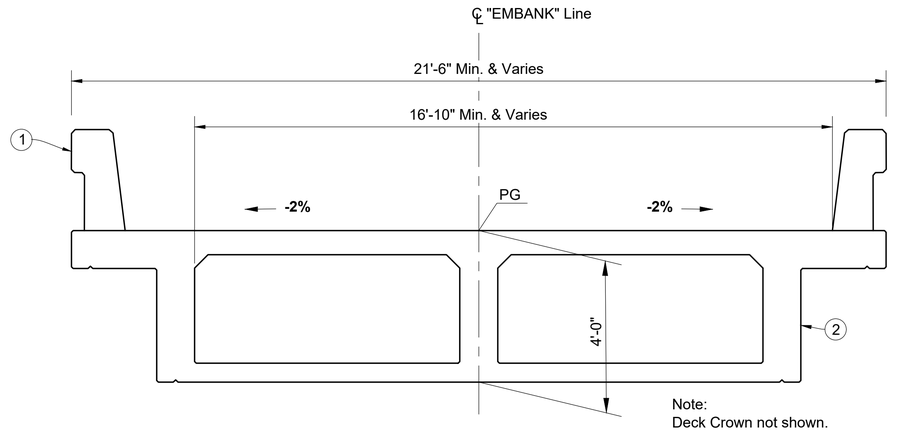
PROFILE

SCALE 1" = 10' H & V



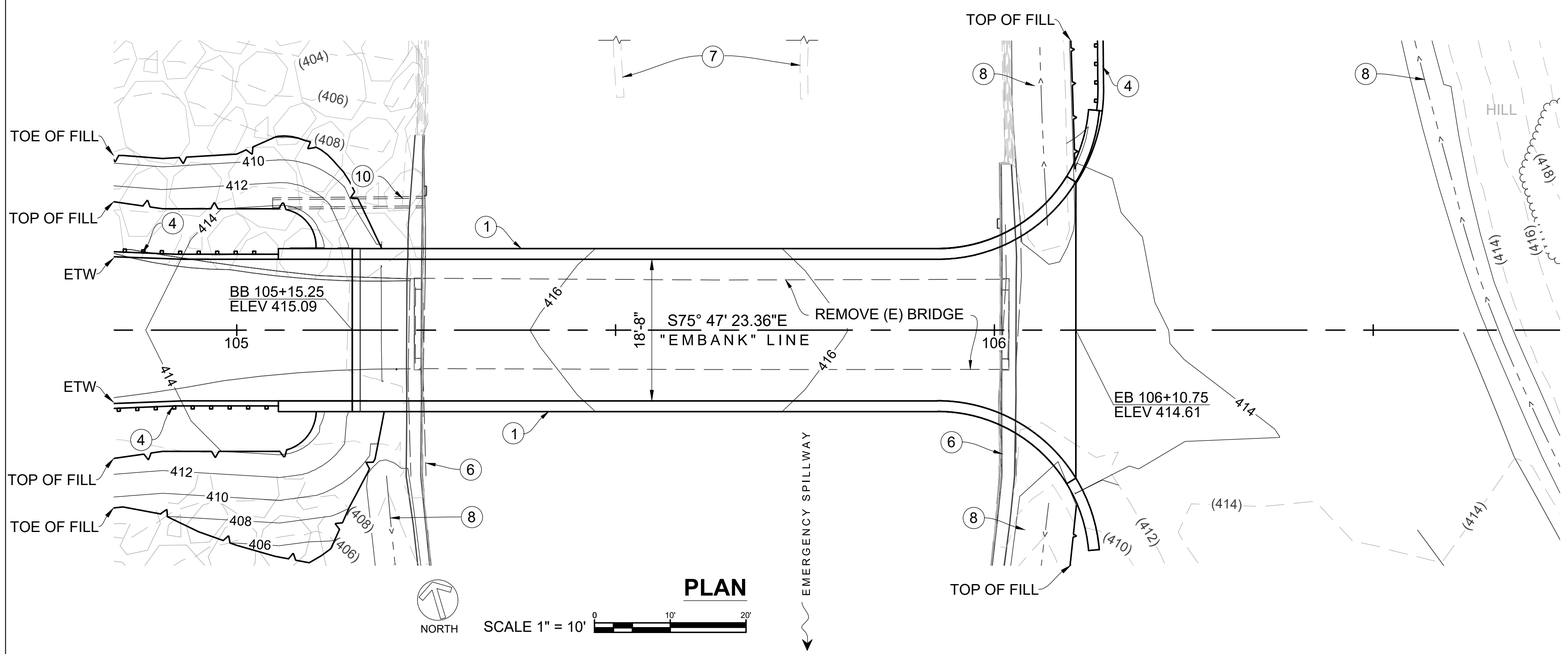
ELEVATION

SCALE 1" = 10' H & V



TYPICAL SECTION

SCALE 1/2" = 1'



PLAN

NOTES:

1. BARRIER RAIL: CALTRANS STD CONCRETE BARRIER TYPE 732
2. PRE-STRESSED CAST-IN-PLACE REINFORCED BOX GIRDER
3. CONCRETE ABUTMENT
4. GUARDRAIL
5. REINFORCED SLURRY-CEMENT FOUNDATION
6. (E) SPILLWAY WALL
7. (E) SPLITTER WALL
8. (E) CONC. V-DITCH
9. (E) BRIDGE SOFFIT (410.12 NAVD 88)
10. (E) CUT-OFF WALL - FIELD VERIFY
11. FLEXIBLE RETROFIT WATERSTOP - JP320L

INDEX TO BRIDGE PLANS

REGISTERED PROFESSIONAL ENGINEER
Md. Wahiduzzaman
No. C49838
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

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SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

SPILLWAY BRIDGE
GENERAL PLAN

DESIGNED BY:	MD
DRAWN BY:	MD
CHECKED BY:	SO

SWB-1

SHEET 67 OF 88

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

F:\Bengal\SB County - SMDB - Documents\Design\Production Drawings\Spillway Bridge 022620.dwg
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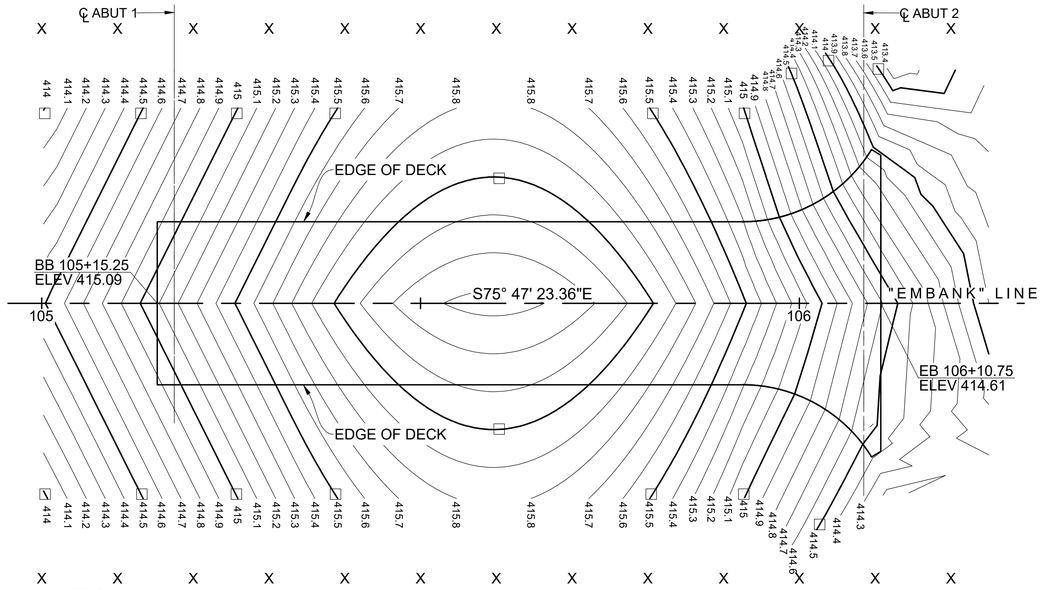


NOTES:

1. □ - Indicates 0.50' contours.
2. X - Denotes 10' interval along "EMBANK" line.
3. Contours do not include Camber.
4. Contour interval is 0.10'

NORTH

DECK CONTOURS

SCALE: 1" =10'

Structural Concrete, Bridge (4,000 psi @ 28 days)

Structural Concrete, Bridge (Polymer Fiber) (4,500 psi @ 28 days)

Structural Concrete, Bridge Footing (4,000 psi @ 28 days)

CONCRETE STRENGTH AND TYPE LIMITS

No Scale

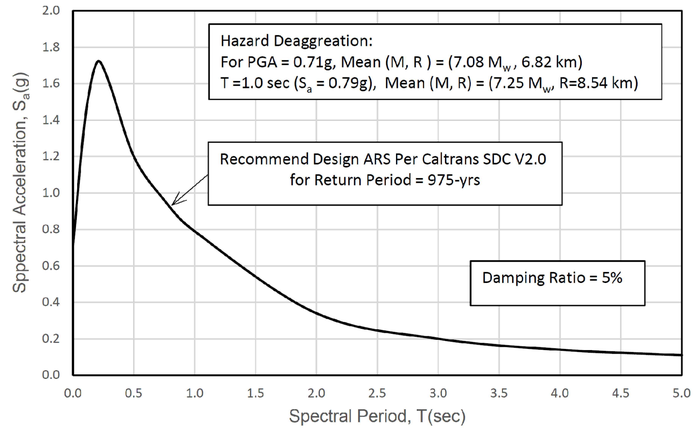
STANDARD PLANS, 2018

A3-A,B&C	ABBREVIATIONS
A62-A	EXCAVATION AND BACKFILL - MISCELLANEOUS DETAILS
A62-C	LIMITS OF PAYMENT FOR EXCAVATION AND BACKFILL-BRIDGE
B0-1	BRIDGE DETAILS
B0-3	BRIDGE DETAILS
B0-5	BRIDGE DETAILS
B0-13	BRIDGE DETAILS
B6-21	JOINT SEALS (MAXIMUM MOVEMENT RATING = 2")
B7-1	BOX GIRDER DETAILS
B7-10	UTILITY OPENING
B8-5	CAST-IN-PLACE POST TENSIONED GIRDER DETAILS

GENERAL NOTES
LOAD RESISTANCE FACTOR DESIGN

DESIGN:	AASHTO LRFD Bridge Design Specifications, Eigth Edition, 2017with Caltrans Amendments (AASHTO-CA BDS-8)
SEISMIC DESIGN:	Caltrans Seismic Design Criteria (SDC), V 2.0, April 2019
DEAD LOAD:	Includes 35 psf for future wearing surface Additional 0.1 k/ft assumed for future utilities
LIVE LOADING:	HL-93 and permit design loading
SEISMIC LOADING:	Site Specific Acceleration Response Spectra Curve
REINFORCED CONCRETE:	f_y = 60,000 psi f'_c = See "Concrete Strength and Type Limits" n = 8
PRESTRESSED CONCRETE:	See "Prestressing Notes" on "Girder Layout" Sheet
STRUCTURAL STEEL:	ASTM A709 Grade 50
STEEL PIPE PILES:	ASTM A252, Grade 3

ACCELERATION RESPONSE SPECTRA CURVE



REGISTERED PROFESSIONAL ENGINEER
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360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

SPILLWAY BRIDGE
DECK CONTOURS

DESIGNED BY:	MD
DRAWN BY:	MD
CHECKED BY:	SO

SWB-2

SHEET 68 OF 88

FOR REDUCED PLANS
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0 1 2

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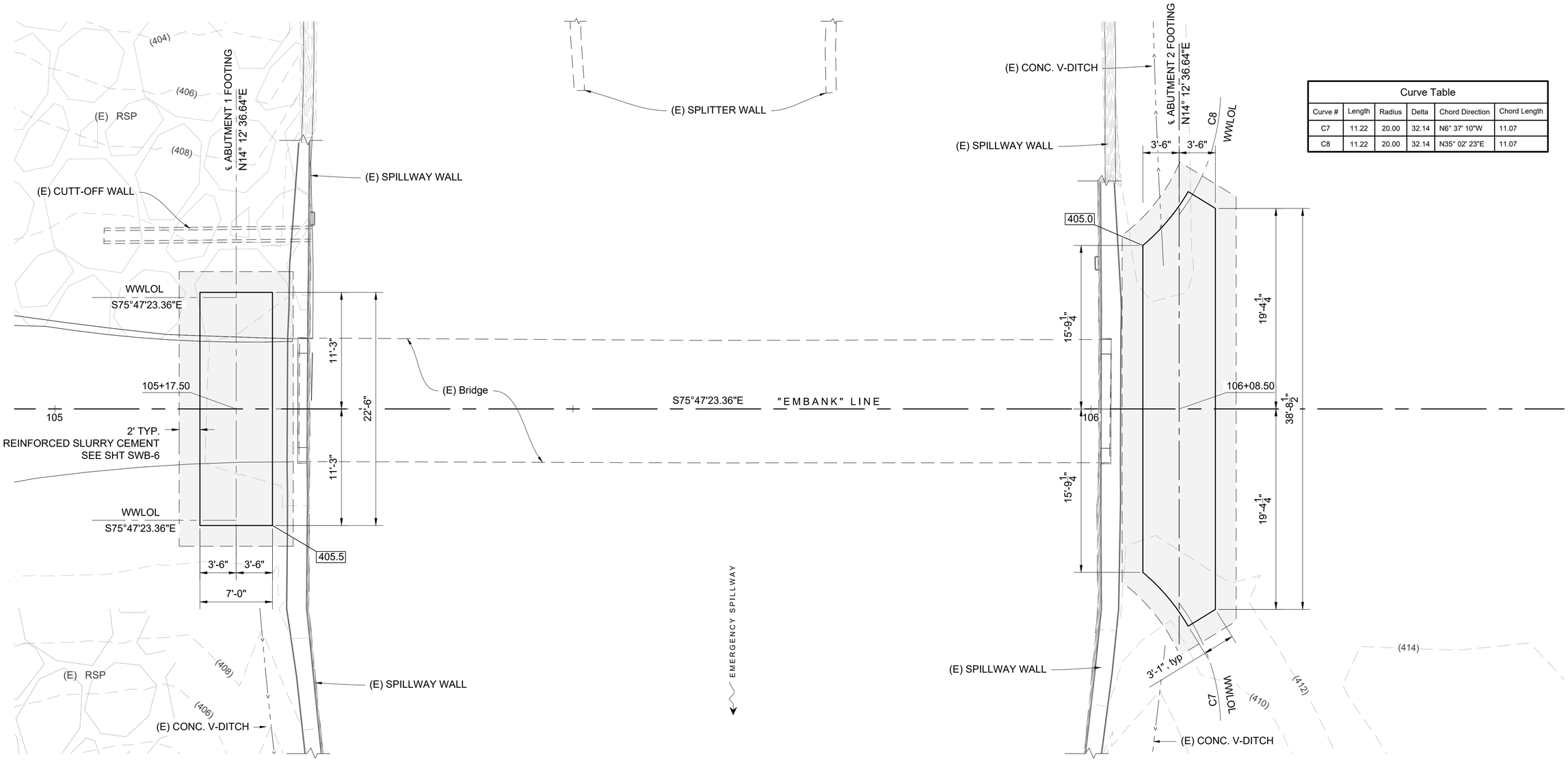

Curve Table					
Curve #	Length	Radius	Delta	Chord Direction	Chord Length
C7	11.22	20.00	32.14	N6° 37' 10"W	11.07
C8	11.22	20.00	32.14	N35° 02' 23"E	11.07

NORTH SCALE 1" = 5'

FOUNDATION PLAN

NOTE:

1. [XXX.X] Indicates bottom of abutment.

REGISTERED PROFESSIONAL ENGINEER
Md Wahiduzzaman
No. C49838
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

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SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

SPILLWAY BRIDGE
FOUNDATION PLAN

DESIGNED BY: MD	SWB-3
DRAWN BY: MD	SHEET 69 OF 88
CHECKED BY: SO	

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

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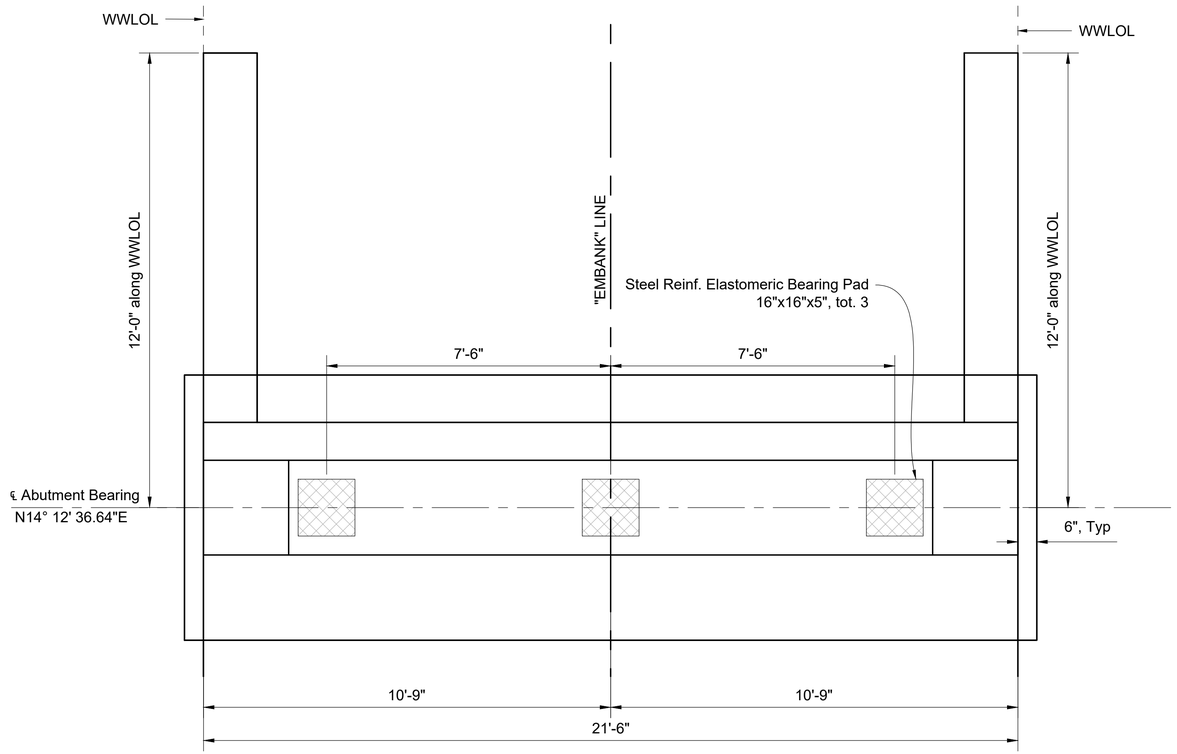
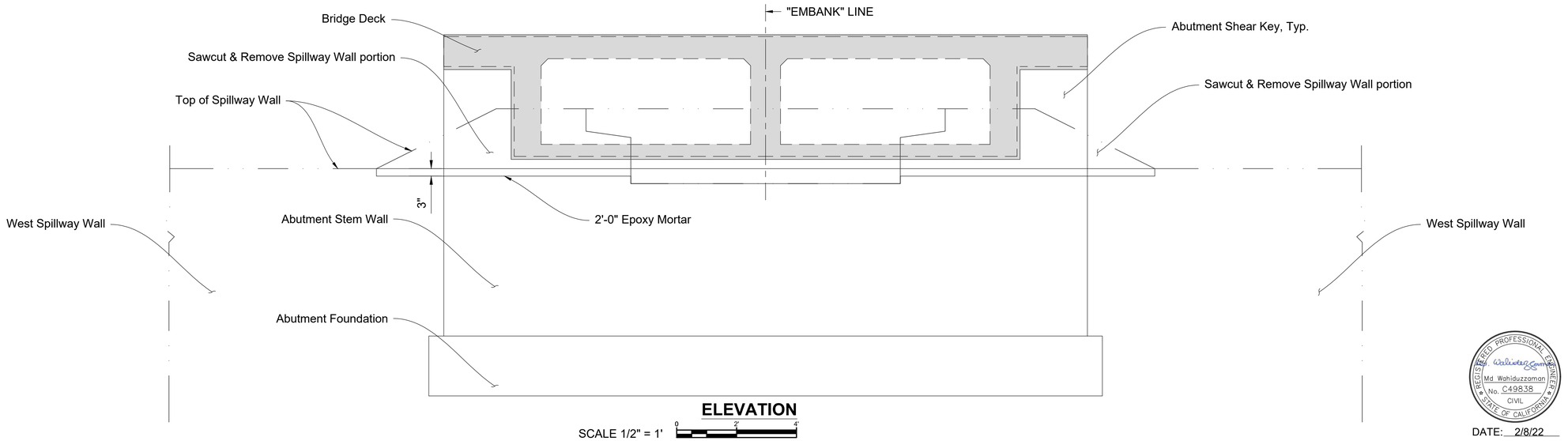
LEGEND:

Bearing Pad



PLAN

SCALE 1/2" = 1'



ELEVATION

SCALE 1/2" = 1'

REGISTERED PROFESSIONAL ENGINEER
Md Wahiduzzaman
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CIVIL
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SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

SPILLWAY BRIDGE
ABUTMENT 1 LAYOUT

DESIGNED BY:	MD
DRAWN BY:	MD
CHECKED BY:	SO

SWB-4

SHEET 70 OF 88

FOR REDUCED PLANS
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0 1 2

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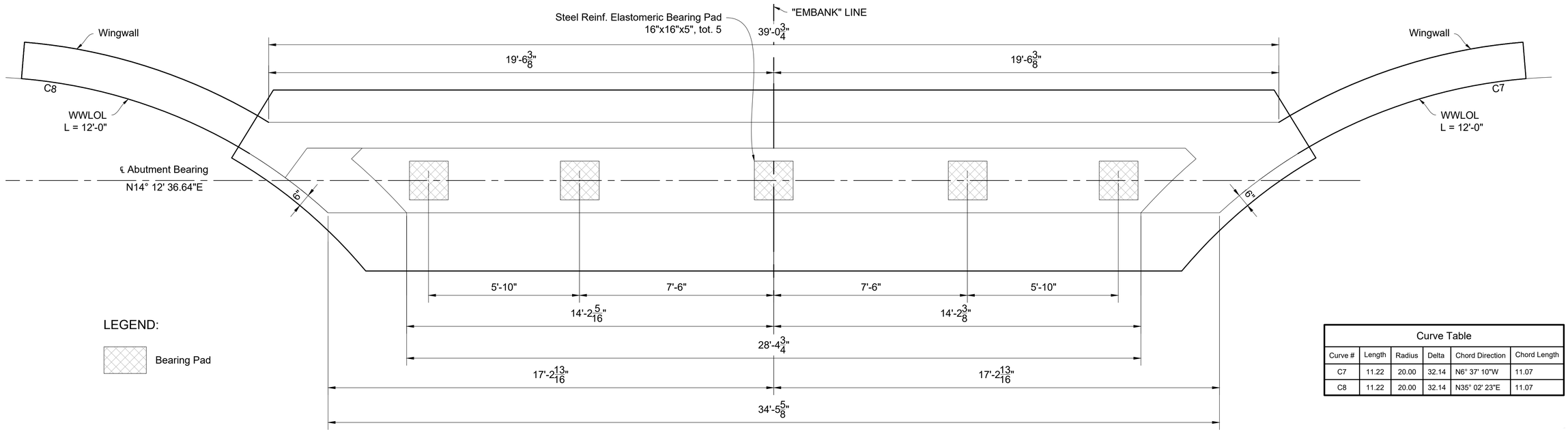
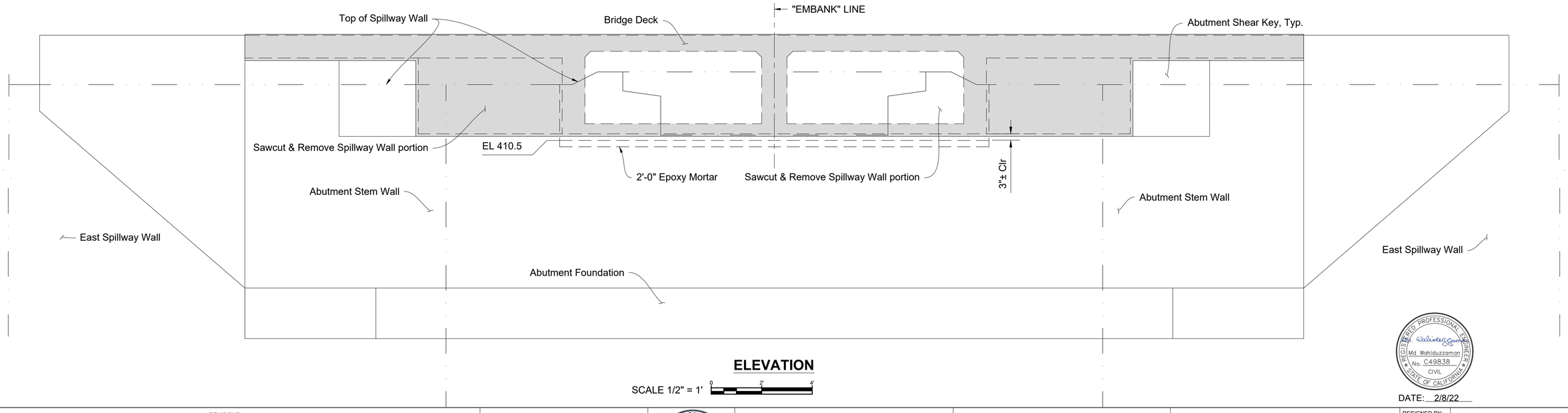


PLAN

SCALE 1/2" = 1'

Curve Table					
Curve #	Length	Radius	Delta	Chord Direction	Chord Length
C7	11.22	20.00	32.14	N6° 37' 10"W	11.07
C8	11.22	20.00	32.14	N35° 02' 23"E	11.07



ELEVATION

SCALE 1/2" = 1'

Md Wahiduzzaman
No. C49838
CIVIL
REGISTERED PROFESSIONAL ENGINEER
STATE OF CALIFORNIA

DATE: 2/8/22

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130 E. VICTORIA STREET
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BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

SPILLWAY BRIDGE
ABUTMENT 2 LAYOUT

DESIGNED BY:	MD
DRAWN BY:	MD
CHECKED BY:	SO

SWB-5

SHEET 71 OF 88

FOR REDUCED PLANS
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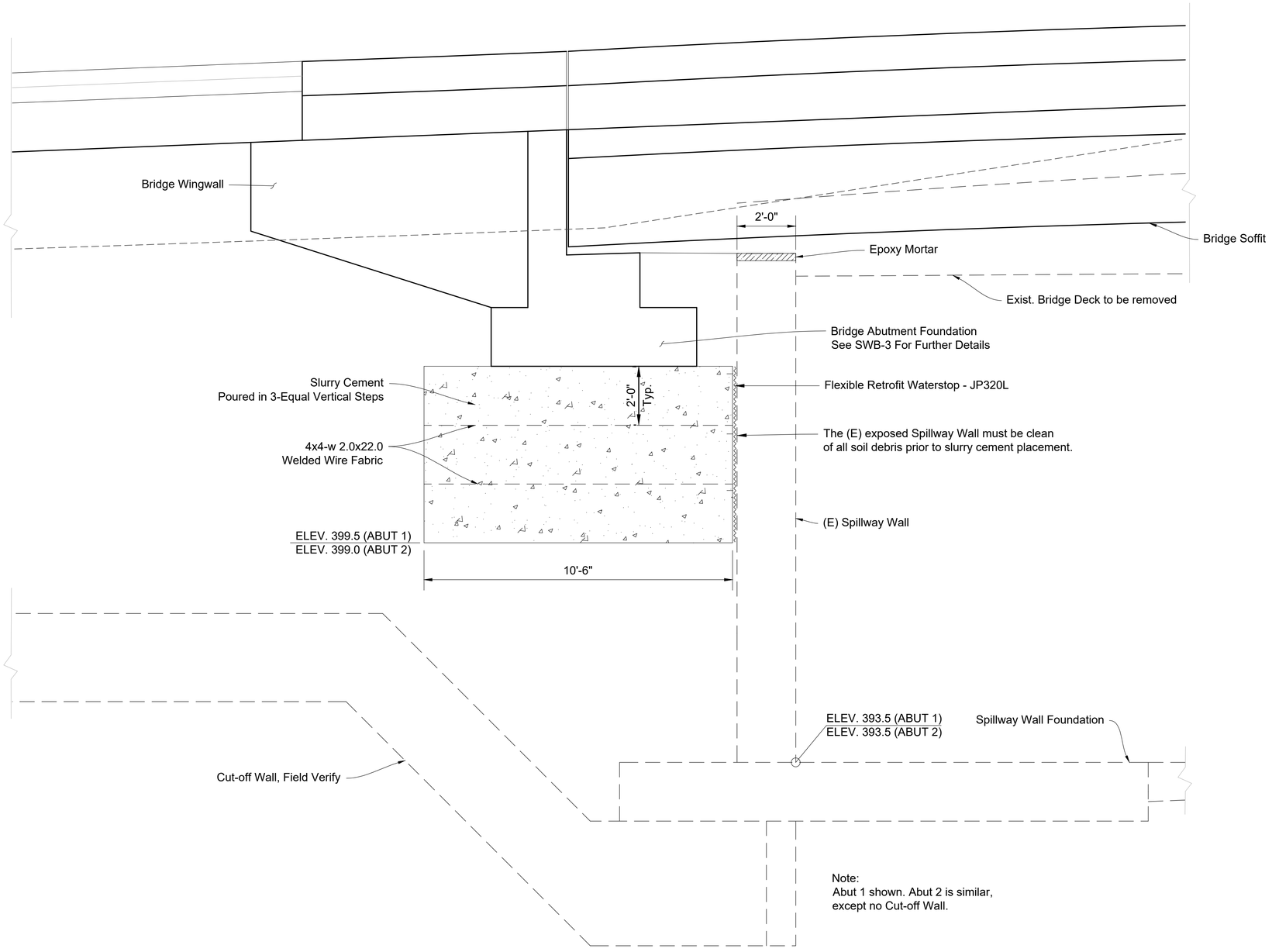

REINFORCED SLURRY CEMENT FOUNDATION

SCALE 1/2" = 1' 0 2' 4'

REGISTERED PROFESSIONAL ENGINEER
Md. Wahiduzzaman
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CIVIL
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SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

SPILLWAY BRIDGE
FOUNDATION DETAILS

DESIGNED BY:	MD
DRAWN BY:	MD
CHECKED BY:	SO

SWB-6

SHEET 72 OF 88

FOR REDUCED PLANS
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0 1 2

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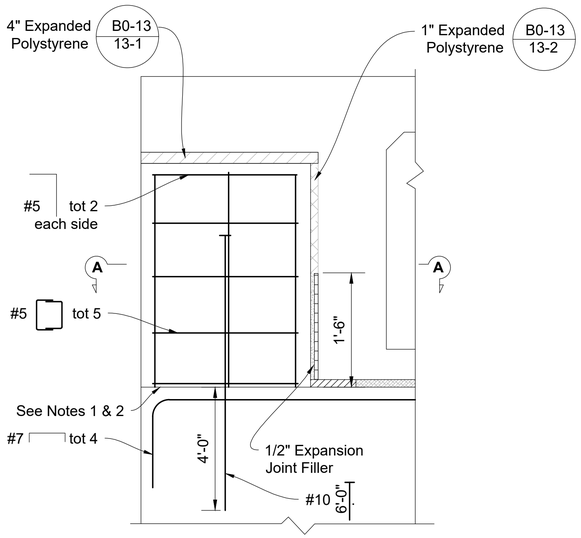
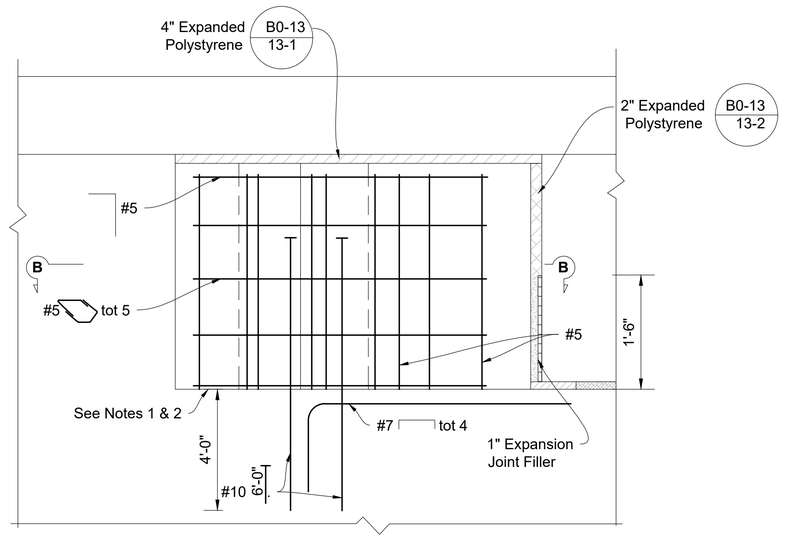
Notes:

1. Mandatory Joint Surface shall be smooth and Lined with 15 Pound Construction Paper.
2. Do not extend the Shear Key Rebars into Abutment Stem, except as shown.



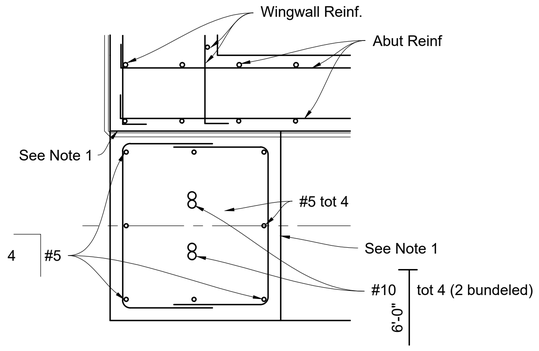
SHEAR KEY ABUT. 1- ELEVATION

SCALE: 1" = 1'-0"



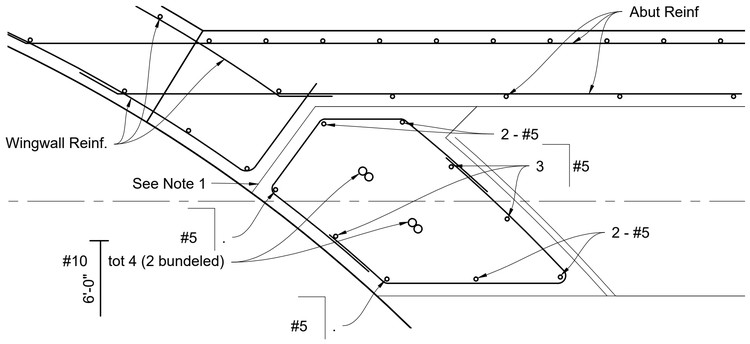
SHEAR KEY ABUT. 2- ELEVATION

SCALE: 1" = 1'-0"



SHEAR KEY - SECTION A-A

SCALE: 1" = 1'-0"



SHEAR KEY - SECTION B-B

SCALE: 1" = 1'-0"

REGISTERED PROFESSIONAL ENGINEER
Md Wahiduzzaman
No. C49838
CIVIL
STATE OF CALIFORNIA

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SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

SPILLWAY BRIDGE
SHEAR KEY DETAILS

DESIGNED BY: MD	SWB-7
DRAWN BY: MD	
CHECKED BY: SO	SHEET 73 OF 88

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ORIGINAL SCALE IS IN INCHES

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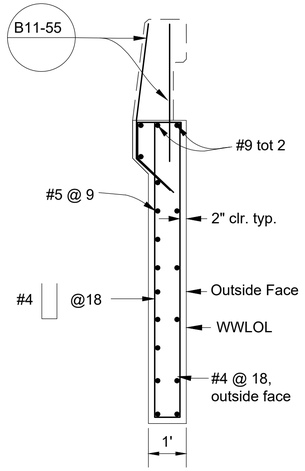
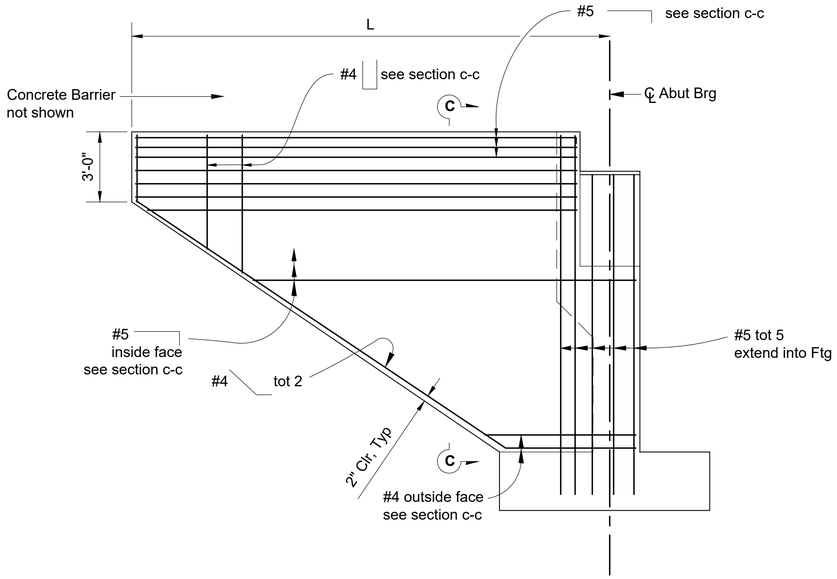


WING WALL SECTION C-C

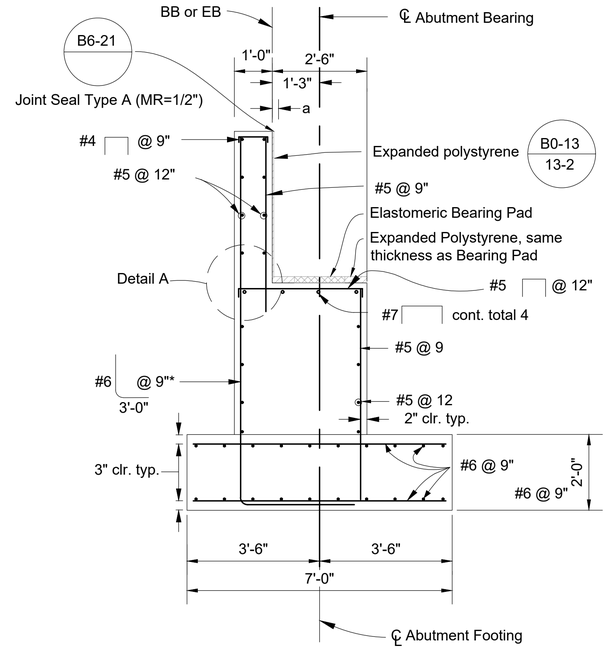
BO-1

NOT TO SCALE



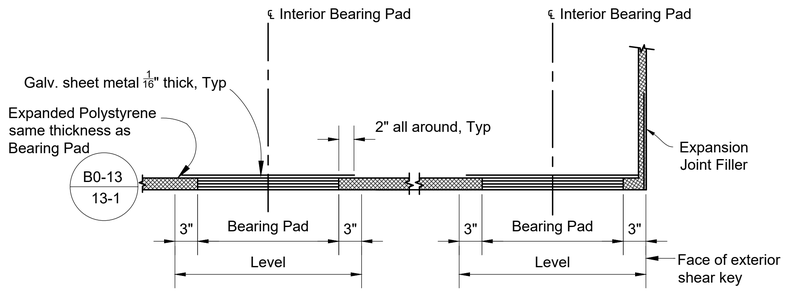
WINGWALL ELEVATION

NOT TO SCALE



TYPICAL SECTION

SCALE 1/2" = 1'

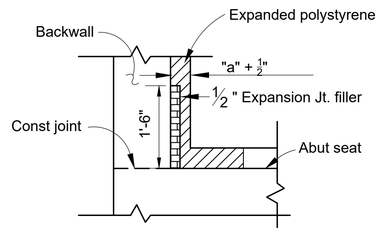


BEARING PAD DETAILS

NOT TO SCALE

Notes:

1. Coat top of Bearing Pad with grease prior to placing sheet metal.



DETAIL A

B0-13 | B6-21

NOT TO SCALE

DATE: 2/8/22

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360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

SPILLWAY BRIDGE
ABUTMENT DETAILS

DESIGNED BY:	MD
DRAWN BY:	MD
CHECKED BY:	SO

SWB-8

SHEET 74 OF 88

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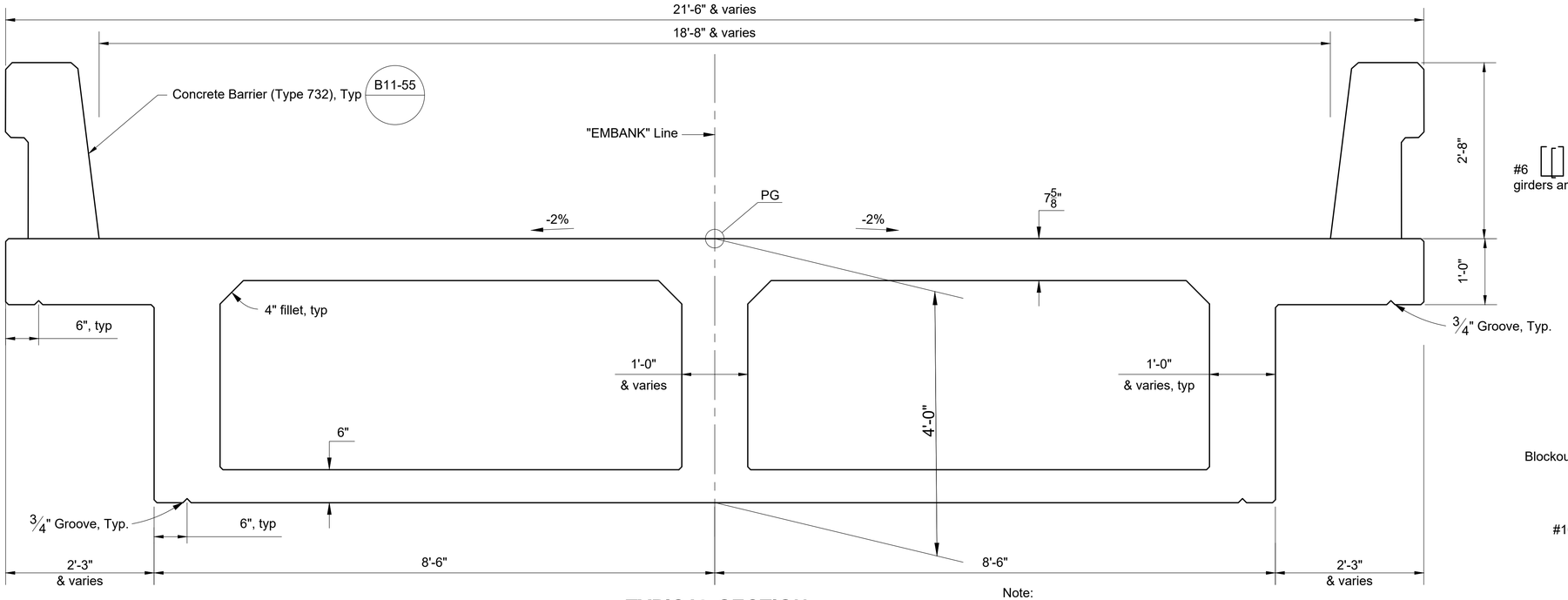
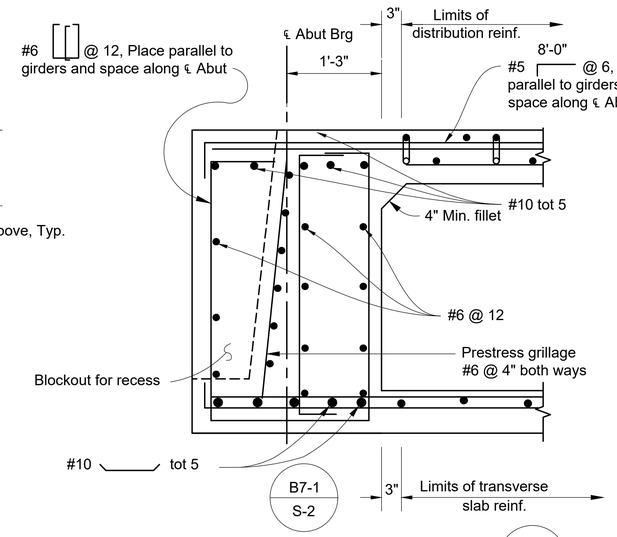


TYPICAL SECTION

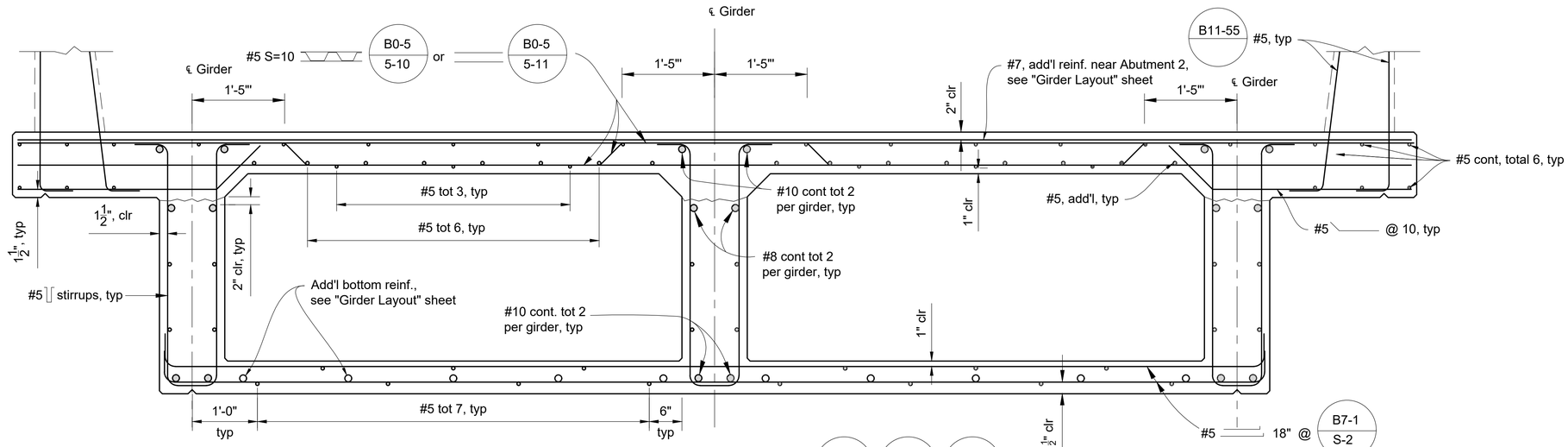
SCALE 1" = 1'-0"

Note:
Deck Crown not shown.



END DIAPHRAGM

NO SCALE



TYPICAL SECTION

B0-5 B7-1 B8-5

SCALE 1" = 1'-0"

REGISTERED PROFESSIONAL ENGINEER
Md Wahiduzzaman
No. C49838
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

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SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

SPILLWAY BRIDGE
TYPICAL SECTION

DESIGNED BY: MD	SWB-9
DRAWN BY: MD	SHEET 75 OF 88
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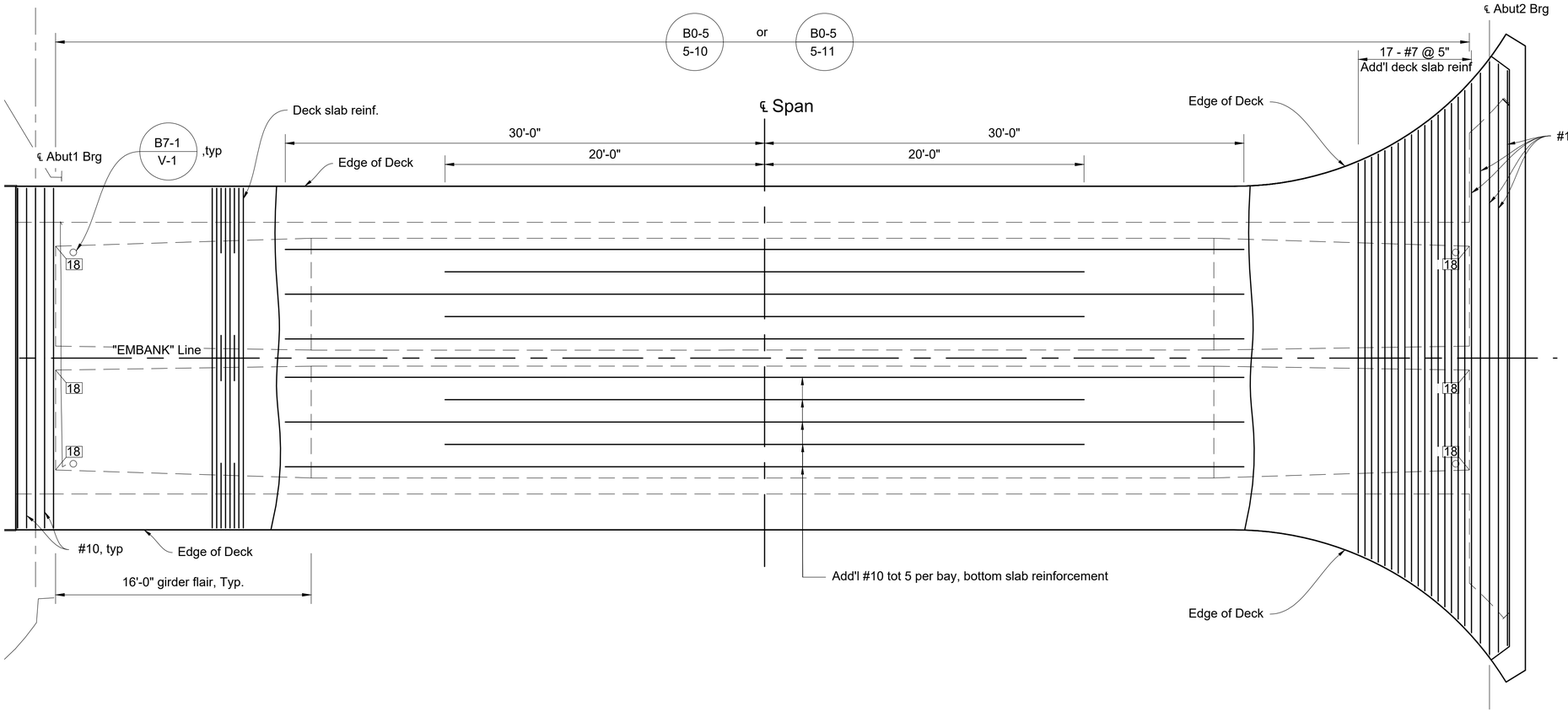
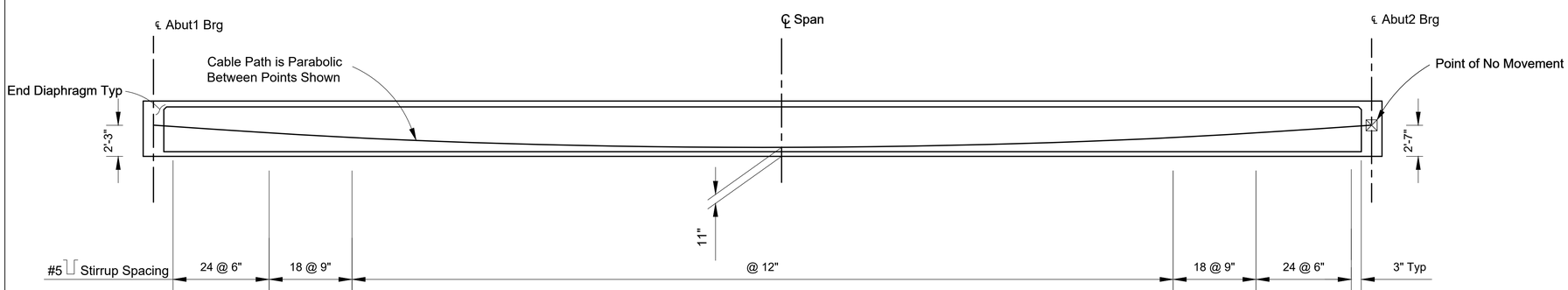


GIRDER LAYOUT

NORTH SCALE 1/4" = 1'



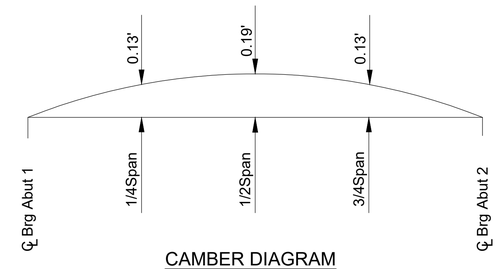
LONGITUDINAL SECTION

B7-1 B8-5

NO SCALE

Notes:

1. For additional top and bottom reinf. see "Typical Section" sheet.
2. Reinforcement to be spliced using service splice.



CAMBER DIAGRAM

(Does not include allowance for Falsework settlement)

PRESTRESSING NOTES

270 KSi Low Relaxation Strand:

P_{jack}	=	5,016 Kips
Anchor Set	=	$\frac{3}{8}$"
Total Number of Girders	=	3

Distribution of Prestress force (Pjack) between girders/ducts shall not exceed the ratio of 3:2. Maximum final force variation between girders shall not exceed 725 kips.

Concrete: f'_c = 4,500 psi @ 28 days
f'_{ci} = 3,600 psi @ time of stressing

Contractor shall submit elongation calculations based on initial stress at = 0.947 times jacking stress.

μ = 0.15; K = 0.0002

⊠ = Indicates theoritical point of no movement for one end stressing.

Denotes width of girder.

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Md Wahiduzzaman
No. C49838
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130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

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360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
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SANTA BARBARA COUNTY, CALIFORNIA

SPILLWAY BRIDGE
GIRDER LAYOUT

DESIGNED BY: MD	SWB-10
DRAWN BY: MD	
CHECKED BY: SO	SHEET 76 OF 88

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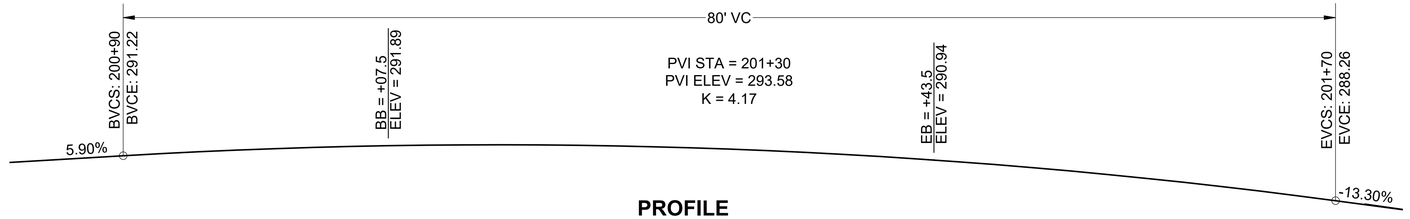
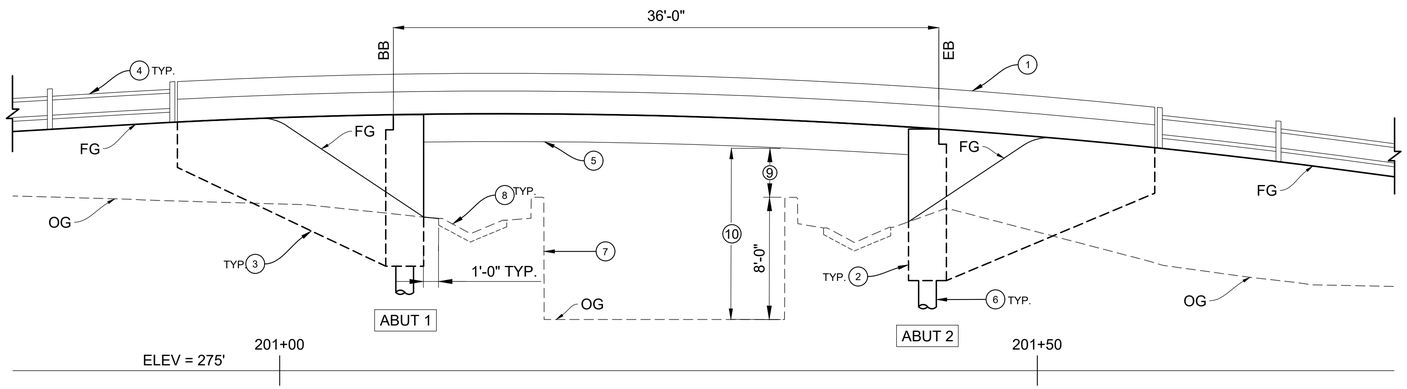


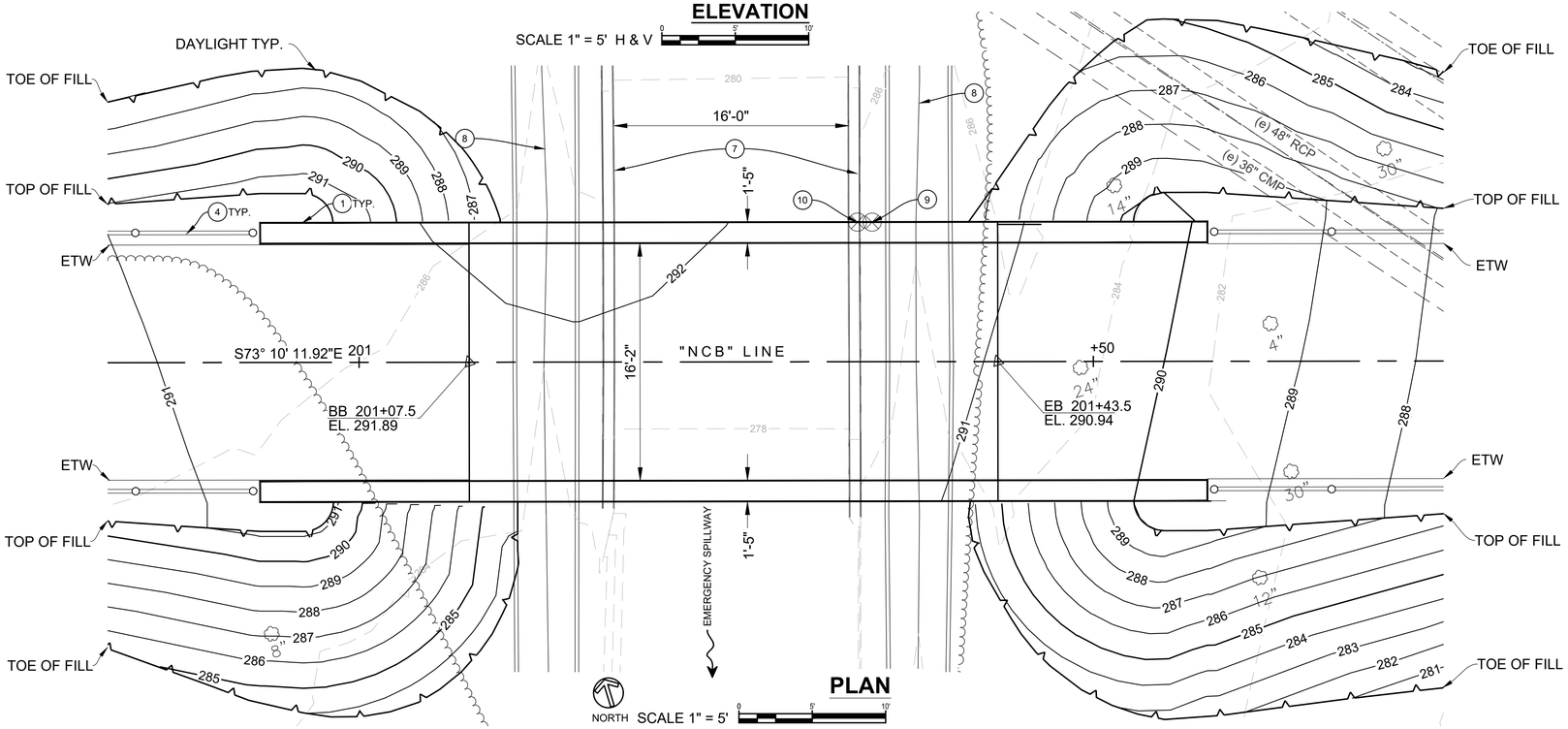
PROFILE

NO SCALE

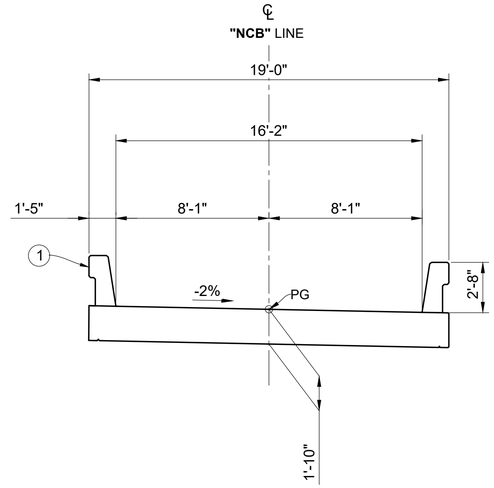


ELEVATION

SCALE 1" = 5' H & V



PLAN



TYPICAL SECTION

SCALE 1/4" = 1'

NOTES:

1. BARRIER RAIL: CALTRANS STD CONCRETE BARRIER TYPE 732
2. DIAPHRAGM ABUTMENT
3. WINGWALL
4. 2- POST POLE CRAFT FENCING
5. RC SLAB
6. 16" Ø CIDH PILE
7. (E) CHANNEL WALL
8. REMOVE AND REPLACE (E) CONC. V-DITCH (SEE CD-3) AS NEEDED TO CONSTRUCT PROPOSED IMPROVEMENTS.
9. CLR. TOP CHANNEL WALL = 2'-1" (2'-0" MIN OF CLEARANCE NEEDED FOR FALSEWORK BETWEEN TOP OF CHANNEL WALLS AND BOTTOM OF STRUCTURE).
10. CLR. BOTTOM CHANNEL = 10'-1"
11. REMOVE AND RECONSTRUCT CLF, AS NEEDED TO CONSTRUCT PROPOSED IMPROVEMENTS.

INDEX TO BRIDGE PLANS

REGISTERED PROFESSIONAL ENGINEER
Md Wahiduzzaman
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CIVIL
STATE OF CALIFORNIA

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(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

NEW CHANNEL BRIDGE
GENERAL PLAN

DESIGNED BY:	MD
DRAWN BY:	HS
CHECKED BY:	SO

NCB-1

SHEET 77 OF 88

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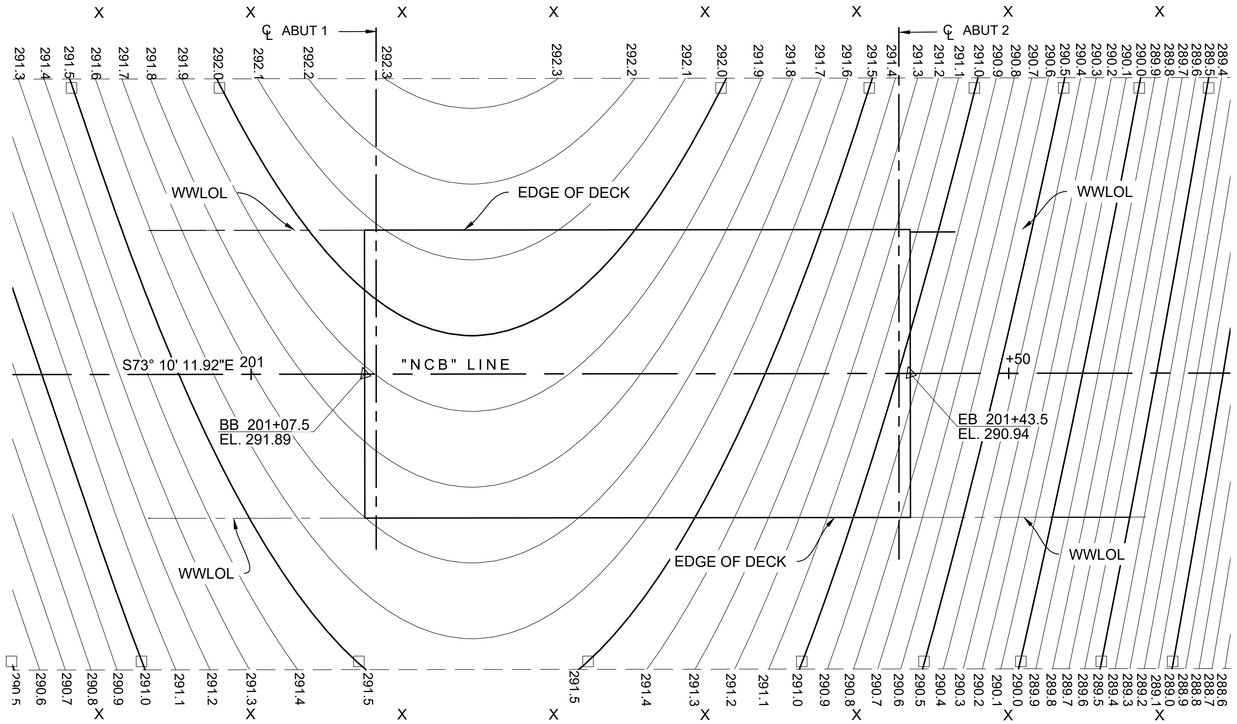
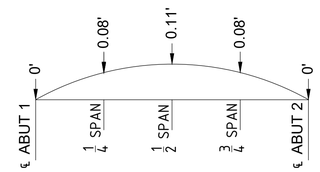


NORTH SCALE: 1" = 5'

DECK CONTOURS

NOTES:

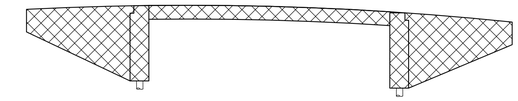
1. □ - Indicates 0.50' contours.
2. X - Denotes 10' interval along "EMBANK" line.
3. Contours do not include Camber.
4. Contour interval is 0.10'



CAMBER SHOWN DOES NOT INCLUDE ALLOWANCE FOR FALSWORK SETTELMENT

CAMBER DIAGRAM

NO SCALE



Structural Concrete, Bridge (4,000 psi @ 28 days)

CONCRETE STRENGTH AND TYPE LIMIT

NO SCALE

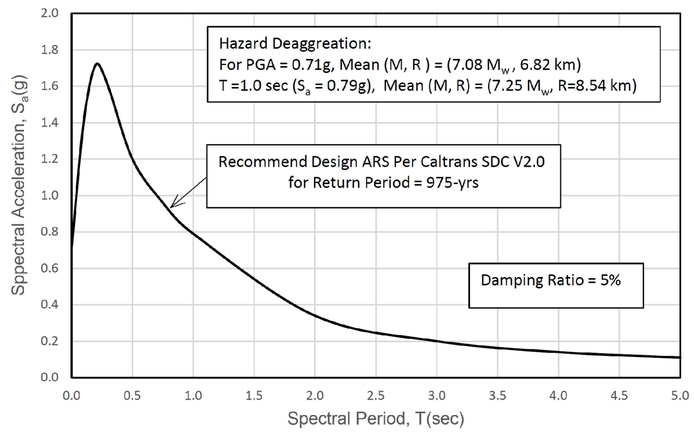
STANDARD PLANS (2018)

A10-A-C	ABBREVIATIONS
A62-A	EXCAVATION AND BACKFILL MISCELANEOUS DETAILS
A62-C	LIMITS OF PAY. FOR EXCAVATION & BACKFILL-BRIDGE
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
B11-55	CONCRETE BARRIER TYPE 732

GENERAL NOTES
LOAD RESISTANCE FACTOR DESIGN

Design:	AASHTO LRFD Specifications, Eigth Edition with California Amendments (AASHTO-CA BDS-8)
Seismic Design:	Caltrans Seismic Design Criteria (SDC) Version 2.0, April 2019
Live Loading:	HL93 and permit design load
Dead Load:	Includes 35 psf for future wearing surface
Seismic Loading:	Site Specific Acceleration Response Spectra Curve
Piles:	See "Pile Data" table on "Deck Contour" sheet
Reinforced Concrete:	f_y = 60,000 psi
	$f`_c$ = See "Concrete Strength and Type Limits"
Structural Steel:	ASTM A709 Grade 50
Steel Pipe Piles:	ASTM A252, Grade 3

ACCELERATION RESPONSE SPECTRA CURVE



PILE DATA TABLE

Location	Pile Type	Nominal Resistance (kips)		Design Tip Elevations (ft) [1,2]	Specified Tip Elevation (ft)
		Compression	Tension		
Bridge Abut 1	16" Ø CIDH	90	0	252.0(a) 252.0 (b) 252.0 (c)	252.0
Bridge Abut 2	16" Ø CIDH	90	0	251.0 (a) 251.0 (b) 251.0 (c)	251.0

Notes:

1. Design tip elevations are controlled by (a) Compression (static), (b) Settlement, (c) Lateral Load, respectively.
2. The Specified Tip Elevation shall not be raised above the design tip elevations for lateral, and tolerable settlement.

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Md Wahiduzzaman
No. C49838
CIVIL
STATE OF CALIFORNIA

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SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

NEW CHANNEL BRIDGE
DECK CONTOURS

DESIGNED BY: MD
DRAWN BY: HS
CHECKED BY: SO

NCB-2

SHEET 78 OF 88

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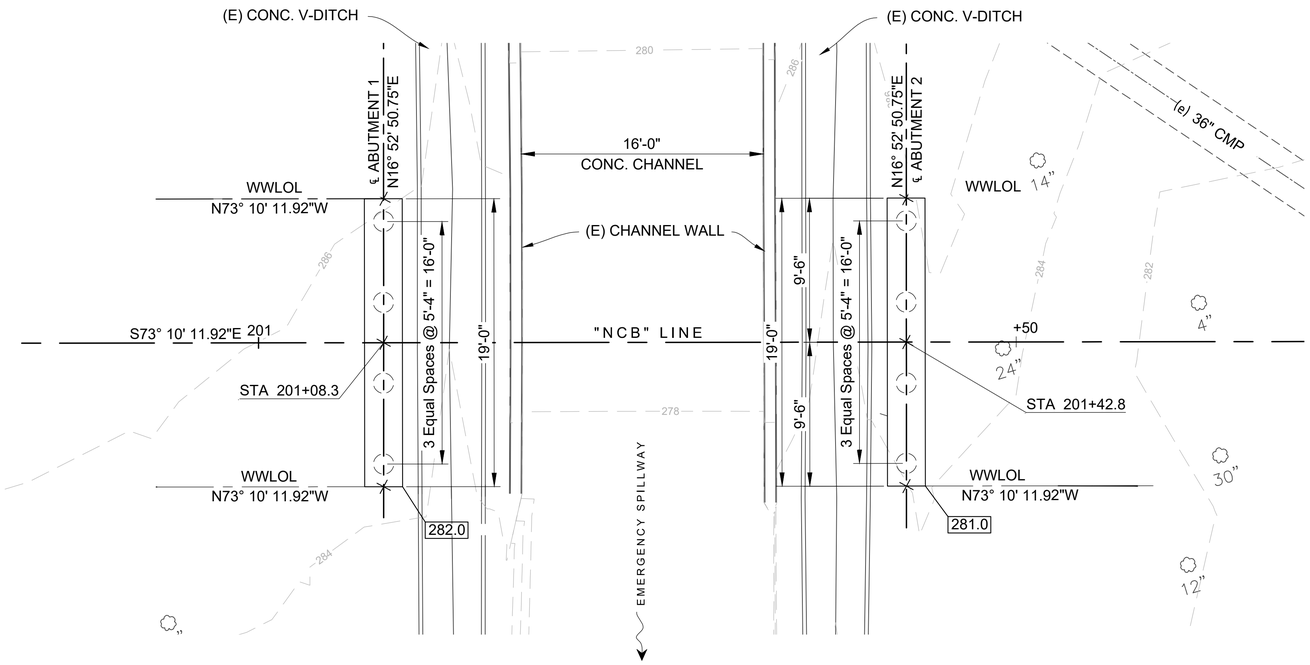

FOUNDATION PLAN

SCALE 1" = 5'-0"

NORTH

Hydrologic Summary

	Discharge (ft3/sec)	Water Surface (ft)	Velocity (ft/sec)	Freeboard (ft)
Channel Flow	3,100	282.8	52.7	6.4
Design Flow	5,100	284.3	61.3	4.9
Peak Freeboard Flow	13,600	Not contained		

Channel Flow Line Elevation = 279.1 ft

Channel Depth = 8 ft

BENCH MARKS:

Benchmark:	See "Survey Control Diagram" Sheet
Elevation:	See "Survey Control Diagram" Sheet
Datum:	NAD 83 CA State Planes, Zone V
Basis of Bearings:	See "Survey Control Diagram" Sheet

NOTES:

1. [xxx.x] Indicates bottom of abutment.
2. ◠ Indicates CIDH pile.

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Md Wahiduzzaman
No. C49838
CIVIL
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130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

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360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

NEW CHANNEL BRIDGE
FOUNDATION PLAN

DESIGNED BY: MD
DRAWN BY: HS
CHECKED BY: SO

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SHEET 79 OF 88

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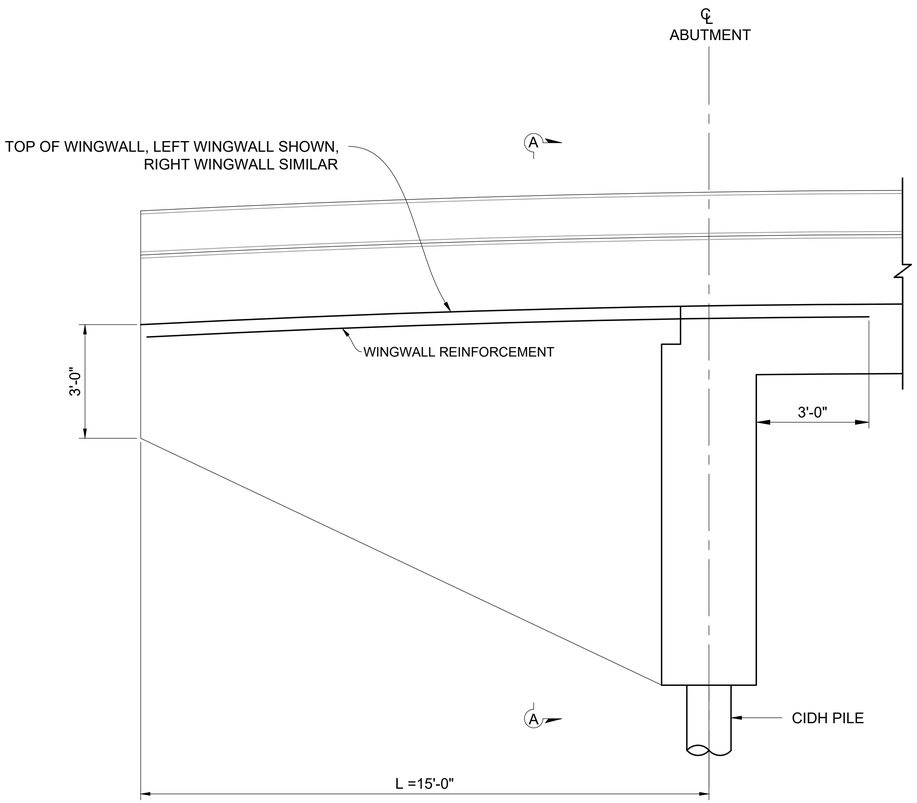
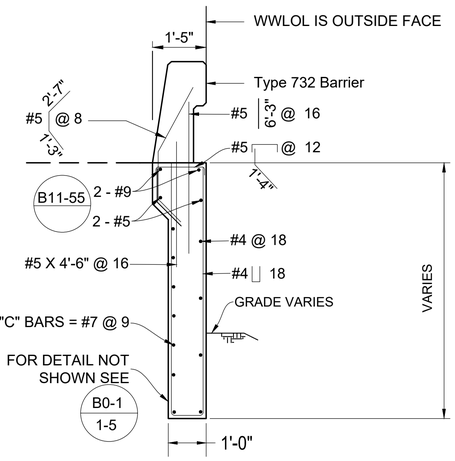


ABUTMENT ELEVATION

B0-1 / 1-5

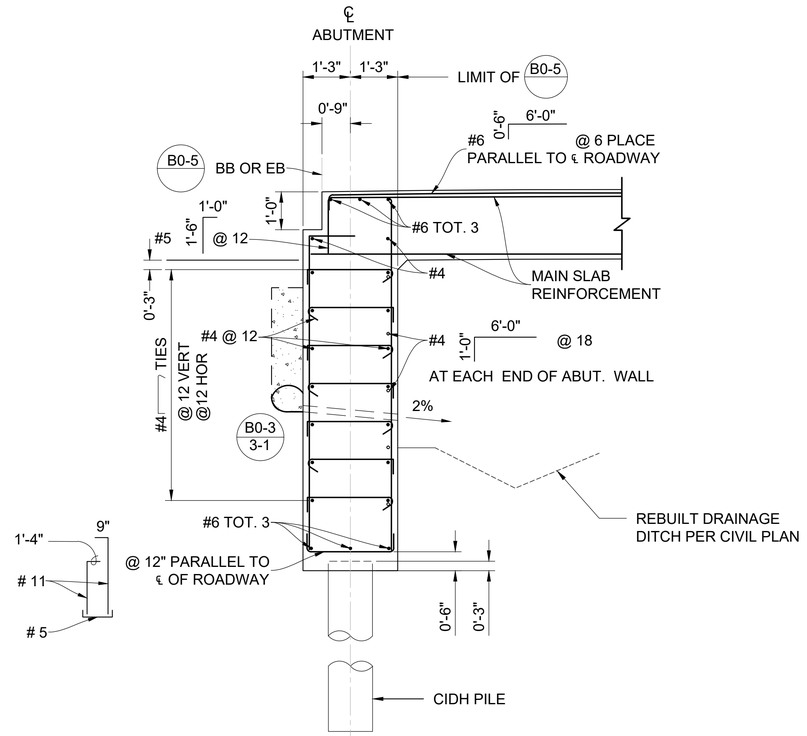
SCALE 1/4" = 1' 0 4' 8'



WING WALL SECTION A-A

B11-55

SCALE 1/4" = 1' 0 4' 8'



ABUTMENT DETAIL

B0-3 B2-3 B2-5

SCALE 1/4" = 1' 0 4' 8'

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CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

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(805) 568-3440

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360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

NEW CHANNEL BRIDGE
ABUTMENT LAYOUT

DESIGNED BY:	MD
DRAWN BY:	HS
CHECKED BY:	SO

NCB-4

SHEET 80 OF 88

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0 1 2

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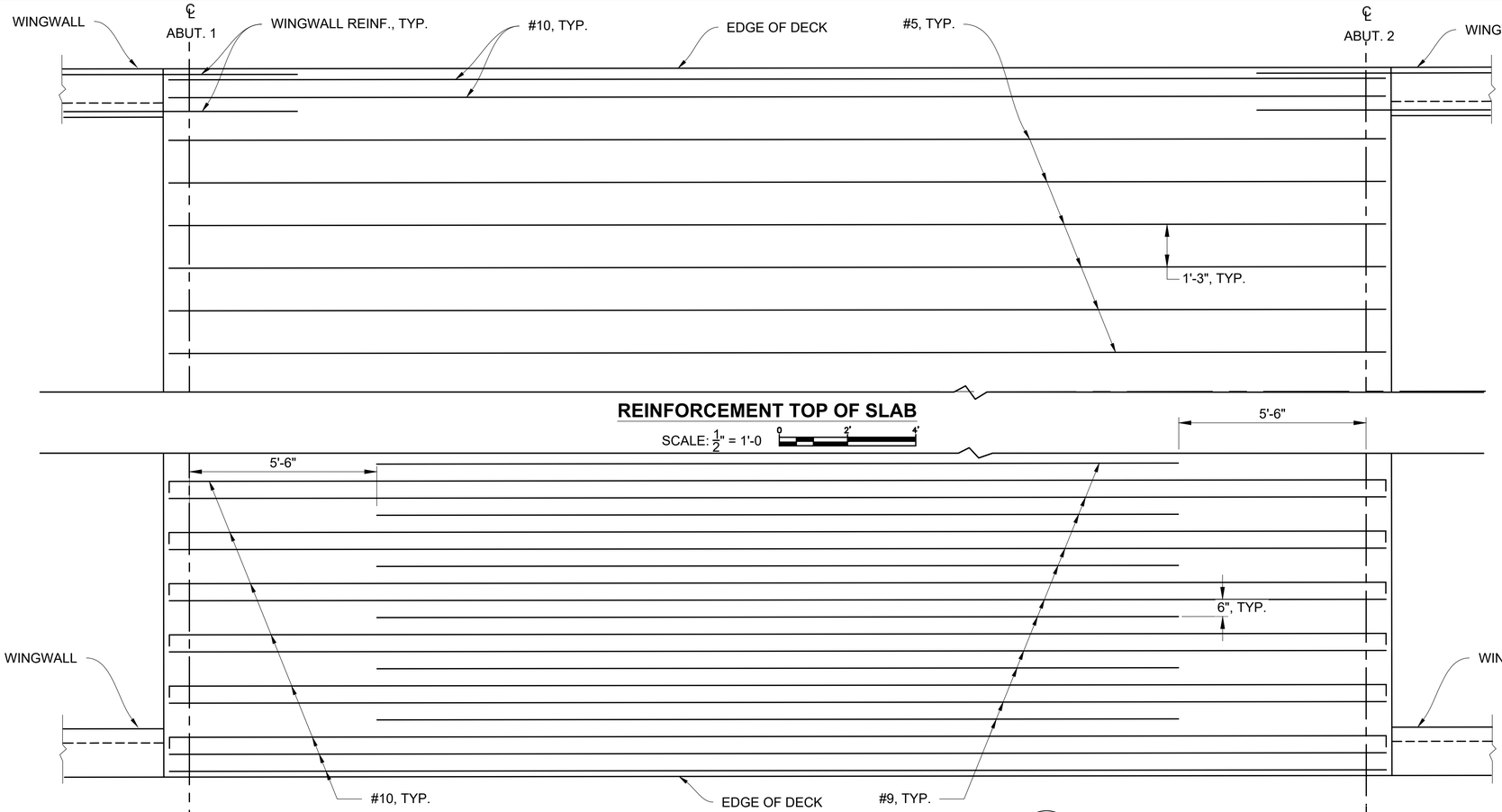


REINFORCEMENT TOP OF SLAB

SCALE: $\frac{1}{2}$" = 1'-0 (0, 2', 4')

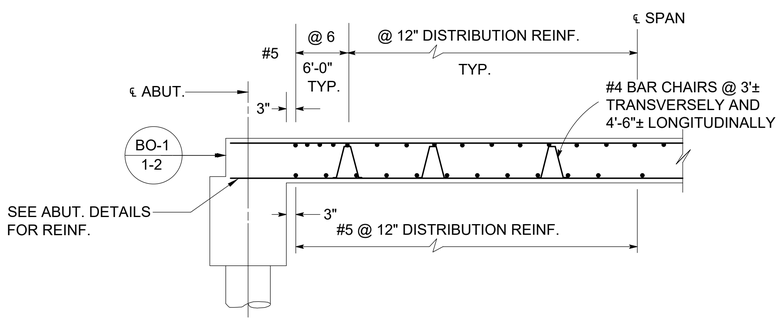
REINFORCEMENT BOTTOM OF SLAB

SCALE: $\frac{1}{2}$" = 1'-0 (0, 2', 4')

NORTH

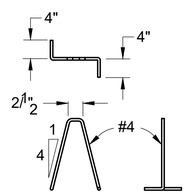
Reinforcement notes:

1. Only staggered "SERVICE SPLICES" in top main bars are allowed
2. Only staggered "SERVICE SPLICES" in bottom main bars allowed & are to be located away from the middle 2/3 portion of the span
3. Place all transverse bars parallel to Abutment 1.
4. Spacing of all transverse bars is measured along ℄ of bridge



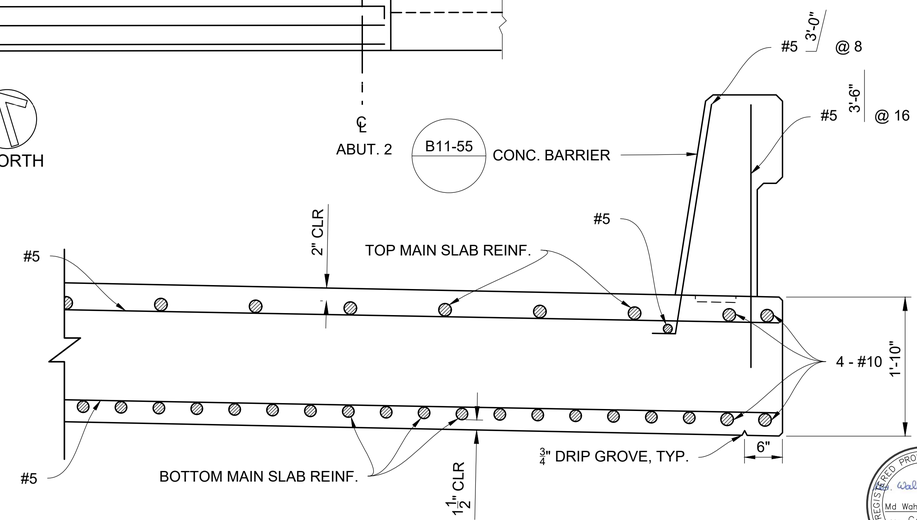
LONGITUDINAL SECTION

NO SCALE



BAR CHAIR DETAILS

NO SCALE



DECK SLAB REINFORCEMENT

SCALE 1" = 1'-0 (0, 1', 2')

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No. C49838
CIVIL
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SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
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SANTA BARBARA COUNTY, CALIFORNIA

NEW CHANNEL BRIDGE
DECK SLAB REINFORCEMENT

DESIGNED BY:	MD
DRAWN BY:	HS
CHECKED BY:	SO

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0 1 2

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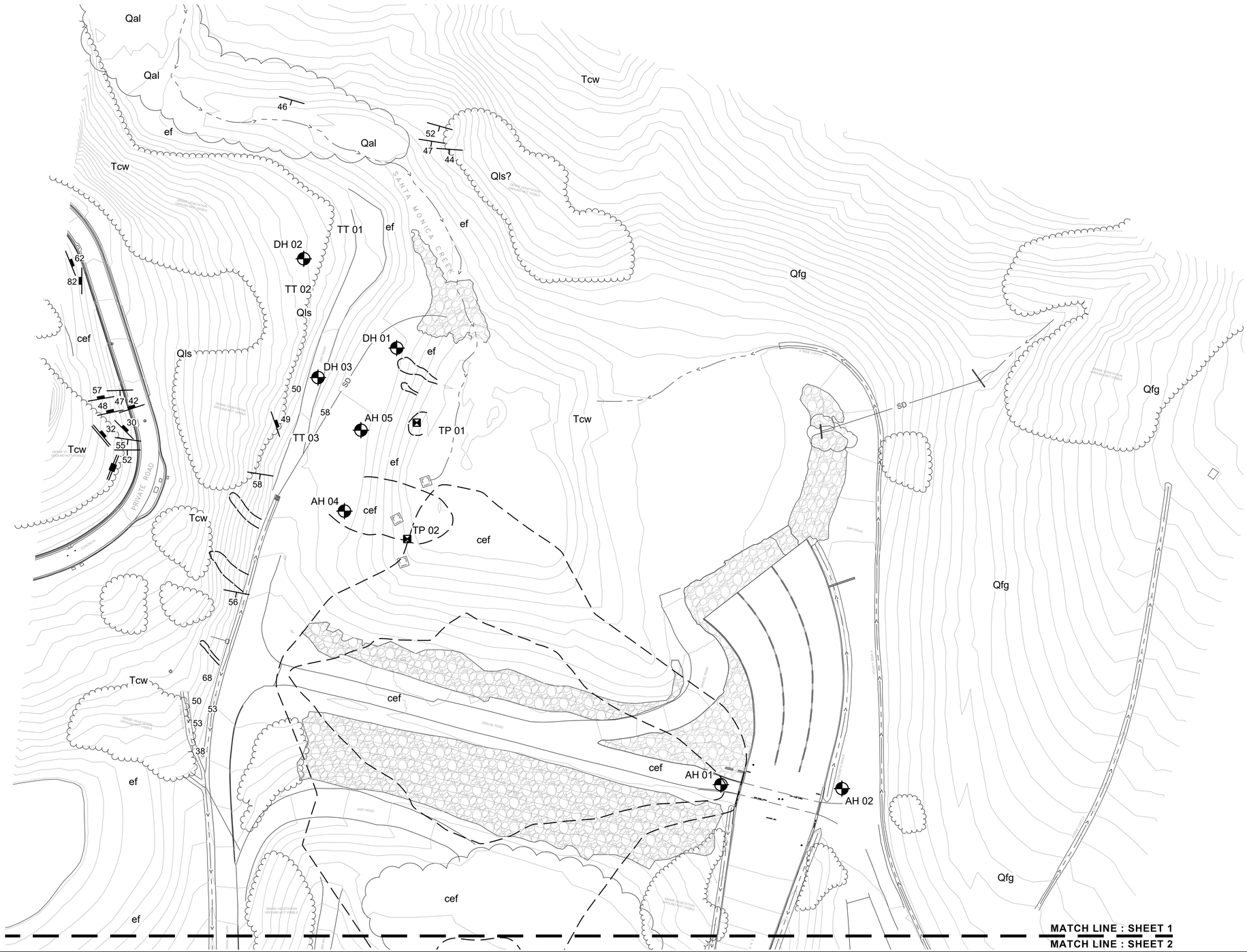

LEGEND

- ef = Earth fill
- cef = Compacted earth fill
- Qal = Alluvium
- Qls? = Questionable Landslide Deposits
- Qls = Probable Landslide Deposits
- Qfg = Fanglomerate (late Pleistocene geologic age)
- Tspl = Lower Sespe Formation (late Oligocene geologic age)
- Tcw = Coldwater Formation (Eocene geologic age)
- = Approximate location of large-diameter boring
- = Approximate location of hand-dug test pit
- = Approximate location of backhoe test trench
- 36 = Strike and dip of jointing
- 36 = Strike and dip of joint set
- 22 = Strike and dip of shear
- = Strike of vertical joint
- 22 = Strike and dip of bedding
- 22 = Strike and dip of contact
- = Approximate geologic contact
- = Approximate limits of surficial slide
- = Geologic cross-section
- 7 = Approximate depth to competent bedrock (in feet)

FOR REDUCED PLANS
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0 1 2

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

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FLOOD CONTROL AND
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130 E. VICTORIA STREET
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(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

GEOLOGIC MAP PLATE A

DESIGNED BY:	TC
DRAWN BY:	HAO
CHECKED BY:	SO

TB-1

SHEET 82 OF 88

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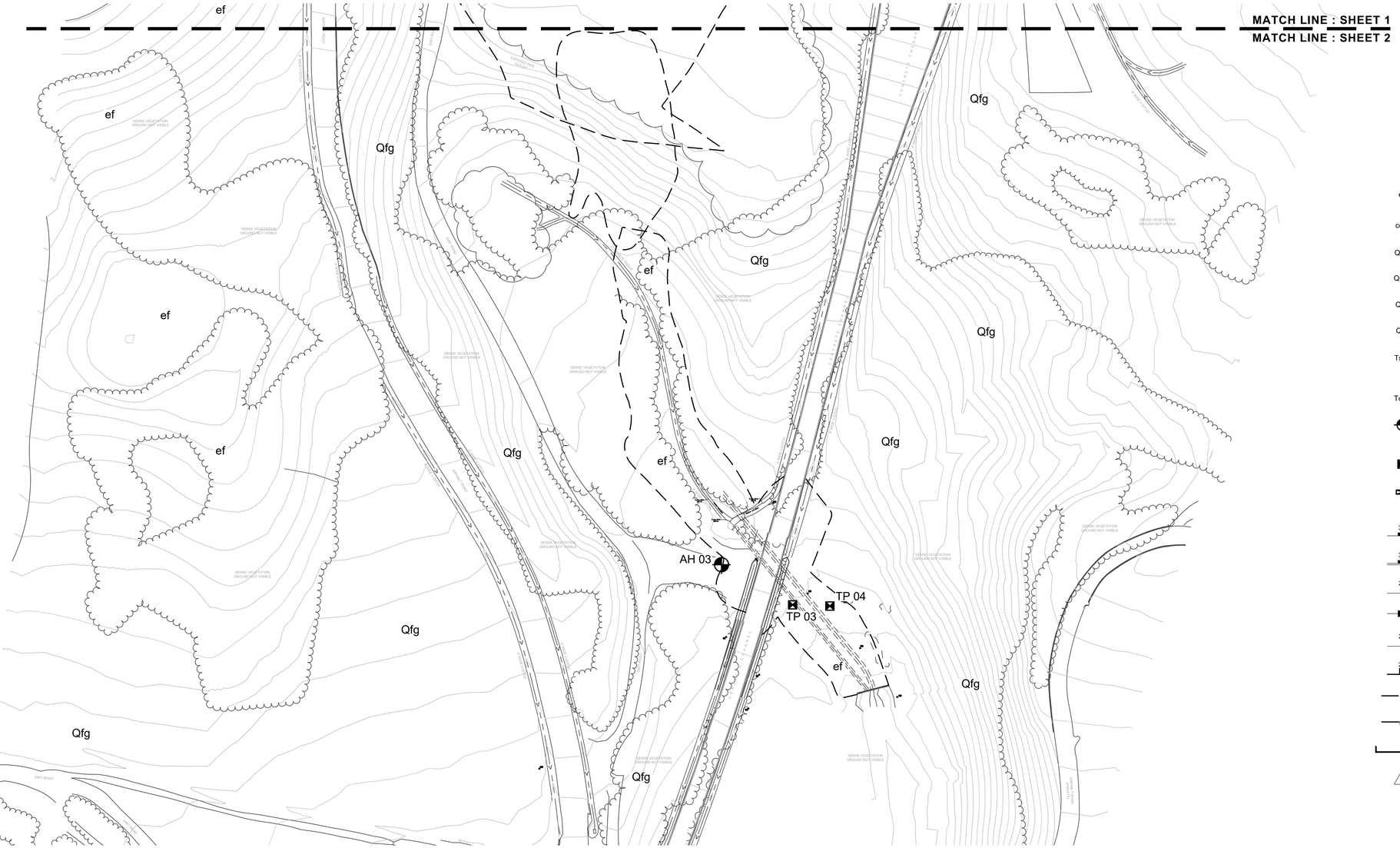

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- = Approximate location of large-diameter boring
- = Approximate location of hand-dug test pit
- = Approximate location of backhoe test trench
- 36 = Strike and dip of jointing
- 36 = Strike and dip of joint set
- 22 = Strike and dip of shear
- = Strike of vertical joint
- 22 = Strike and dip of bedding
- 22 = Strike and dip of contact
- = Approximate geologic contact
- = Approximate limits of surficial slide
- = Geologic cross-section
- 7 = Approximate depth to competent bedrock (in feet)

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2

REGISTERED PROFESSIONAL ENGINEER
Thomas Conti
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

GEOLOGIC MAP PLATE B

DESIGNED BY: TC
DRAWN BY: HAO
CHECKED BY: SO

TB-2

SHEET 83 OF 88

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BORING NUMBER AH 01

PAGE 1 OF 1

Bengal Engineering Inc.
360 S. Hope Avenue Suite C-110
Santa Barbara, CA 93105
Telephone: 805-563-0788

CLIENT SB County Flood Control
PROJECT NUMBER
DATE STARTED 12/3/18 **COMPLETED** 12/3/18
DRILLING CONTRACTOR Cascade Drilling
DRILLING METHOD Mud Rotary / HQ Coring
LOGGED BY E. Pongracz **CHECKED BY**
NOTES

PROJECT NAME SM Debris Basin Operational Improvements Project
PROJECT LOCATION Carpinteria, Santa Barbara County, California
GROUND ELEVATION 411.4 ft **HOLE SIZE** 5" inches
GROUND WATER LEVELS:
AT TIME OF DRILLING ---
AT END OF DRILLING ---
AFTER DRILLING ---

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	UNDRAINED SHR STRENGTH (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	OTHER TESTS
410	0				**Compacted Earth Fill (cef)**								
405		SPT	7-8-5 (13)		Fine- to medium-grained Silty Sand (SM) with scattered rock fragments - light reddish brown to light brownish yellow, moist, moderately compact		13						
	10												
400		MC	7-15-8 (23)		same as above (SM), with clay binder		11	114					
395		SPT	10-13-14 (27)		Clayey Sand to Sandy Clay (SC) with scattered gravel and small rock fragments - mottled light reddish brown to light grayish brown to light blue-gray, slightly moist to moist, compact		11						
	20												
390		MC	12-21-17 (38)		Silty Sand (SM) matrix with scattered to abundant sandstone fragments - tan to light brownish yellow, moist, compact		8	127					
385		SPT	25		23.0' - Harder, choppy drilling **Fanglomerate (Qfg)** Clayey, fine-grained Silty Sand (SM) with scattered sandstone clasts (gravel to small cobble) - light brown to light reddish brown, slightly moist, dense (fanglomerate)		15					2	SIEVE
	30												
380		SPT	12-20-26 (46)		Fine- to medium-grained Silty Sand - light reddish brown, slightly moist, very dense		15					7	SIEVE
375		MC	14/1"		35.0' - No Recovery (NR)								
	40												
370		SPT	50		Sand - olive brown to light reddish brown, slightly moist, very dense Very hard drilling (mud rotary refusal) at 41.5' below grade.		15						
365	50	RC			**Bedrock: Coldwater Formation (Tcw)** Medium- to coarse-grained Sandstone - light olive yellow, hard, well-cemented, thick-bedded to massive with occasional clay partings along bedding planes 42.0' - Switch to HQ wireline rock coring; easy coring to 45.0' Core Run #1: 42' - 45' Length Recovered (inches): 0/36; RQD (inches): 0 Core Run #2: 45' - 50' Length Recovered (inches): 26/60; RQD (inches): 26 Coring rate slows at ~47' below grade. 48.5' - very thin reddish brown sandy clay parting along bedding (?) - dips 30° Core Run #3: 50' - 55' Length Recovered (inches): 56/60; RQD (inches): 40 Boring backfilled with cement grout to surface.		1	153					
360		RC					2	149					UC
355					Bottom of borehole at 55.0 feet.								
	60												
350													

BORING NUMBER AH 02

PAGE 1 OF 1

Bengal Engineering Inc.
360 S. Hope Avenue Suite C-110
Santa Barbara, CA 93105
Telephone: 805-563-0788

CLIENT SB County Flood Control
PROJECT NUMBER
DATE STARTED 12/3/18 **COMPLETED** 12/3/18
DRILLING CONTRACTOR Cascade Drilling
DRILLING METHOD Hollow Stem Auger - CME 95
LOGGED BY E. Pongracz **CHECKED BY**
NOTES

PROJECT NAME SM Debris Basin Operational Improvements Project
PROJECT LOCATION Carpinteria, Santa Barbara County, California
GROUND ELEVATION 412.6 ft **HOLE SIZE** 8" inches
GROUND WATER LEVELS:
AT TIME OF DRILLING ---
AT END OF DRILLING ---
AFTER DRILLING ---

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	UNDRAINED SHR STRENGTH (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	OTHER TESTS
410	0	AU			**Earth Fill (ef)** Aggregate Base wear surface - light gray, compact; recently placed		8						
		MC	13-16-20 (36)		**Fanglomerate (Qfg)** Fine-grained Silty Sand to Sandy Silt (SM) matrix with scattered sub-angular to sub-rounded rock clasts (sandstone and granite) - light reddish brown, slightly moist, dense		9	124					
405		SPT	3-16-18 (34)		Fine-grained Silty Sand (SM) with scattered gravel to small cobbles - light golden brown, slightly moist, very dense		8						
	10	MC	3-8-9 (17)		Clayey Sand to Sandy Clay (SC) with scattered sub-rounded gravel - reddish brown, moist, stiff		14	116					DS
400		SPT	2-2-1 (3)		Silty, Clayey Sand (SC) with scattered small gravel - reddish brown, moist, medium stiff 14.0' - rougher drilling		12		25	17	8		ATT
395		MC	25-50/3"		Silty Sand (SM) with scattered to abundant gravel / small cobbles and occasional small boulder - light reddish brown, slightly moist, dense		9	116					DS
	20	AU			Difficult, choppy drilling from 15' - 19'.		4						CHEM
390		SPT	12/5"		Slow and choppy drilling from 21' to 25'.		11						
385		SPT	40/4"		Sandstone cobbles and gravel in light rust orange to orange brown Silty Sand matrix		12						
	30	AU			Choppy, slow drilling from 28' to 29.5'.		4						
380		SPT	50		Silty Sand (SM) matrix with sub-rounded gravel - light olive brown to light orange brown, slightly moist, dense Rough, choppy drilling from 31' to 35'.		4						
375		BULK			Very difficult drilling from 34.5' to 35.5'; eases to 40'.		7						
	40	SPT	17-35/4"		Clayey Sand (SC) matrix with abundant sub-angular gravel and cobble sandstone clasts - light olive brown to light reddish brown, slightly moist, stiff/dense		12						
370		SPT	13/4"		45.0' - No Recovery (NR) Rough, difficult drilling from 45' to 48'.								
365	50	SPT	25/3"										
360		SPT	10/1"		Groundwater and/or seepage not encountered. Boring backfilled with cement grout to 5' below grade; cuttings to surface.								
355					Bottom of borehole at 55.0 feet.								
	60												
350													

BORING NUMBER AH 03

PAGE 1 OF 1

Bengal Engineering Inc.
360 S. Hope Avenue Suite C-110
Santa Barbara, CA 93105
Telephone: 805-563-0788

CLIENT SB County Flood Control
PROJECT NUMBER
DATE STARTED 11/27/19 **COMPLETED** 11/27/19
DRILLING CONTRACTOR Choice Drilling
DRILLING METHOD Hollow Stem Auger - CME 95
LOGGED BY E. Pongracz **CHECKED BY**
NOTES

PROJECT NAME SM Debris Basin Operational Improvements Project
PROJECT LOCATION Carpinteria, Santa Barbara County, California
GROUND ELEVATION 288 ft **HOLE SIZE** 8" inches
GROUND WATER LEVELS:
AT TIME OF DRILLING ---
AT END OF DRILLING ---
AFTER DRILLING ---

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	UNDRAINED SHR STRENGTH (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	OTHER TESTS
285	0	AU 1			**Earth Fill (ef)** Fine- to medium-grained Silty Sand (SM) with scattered gravel - light brownish yellow to light tan, slightly moist								
		MC 2	32-50/4"		Sandstone rock fragments in silty sand matrix - light brown, slightly moist, compact, clast-supported								
280	5	MC 3	35-43		same as above (earth fill)								
		MC 4	28-46		Silty Sand (SM) to Clayey Sand with silt (SC) matrix with scattered light blue-gray to light blue-green sandstone clasts - medium maroon brown, slightly moist, medium compact to compact, well-graded								
275	10	SPT 5	15-16-27 (43)		Sandy Silt / Silty Sand (ML) with scattered gravel - light brown, slightly moist, compact								
					Alluvium (Qal) 12.5' - Begin to core through boulder; drilling eases at 14.5'								
270	15	SPT 6	32-50/5"		Cobbly, Sandy Gravel (GW) - light brown, slightly moist, medium dense; clast-supported								
		AU 7											
265	20	SPT 8	26-17-14 (31)		Very difficult drilling at 19.5' below grade. **Bedrock: Sespe Formation (Tspm)** Fine-grained Sandy Silt (ML) - light brownish red to maroon, slightly moist, stiff (weathered Sespe Formation)								
		AU 9											
260	25	SPT 10	18-19-25 (44)		Silty Sandstone and Siltstone - maroon to light gray, slightly moist, very dense; weakly indurated								
	30	MC 11	26-33		Fine- to medium-grained Silty Sandstone, Mudstone and occasional siltstone interbed - marron to light olive yellow (siltstone), moist, very dense; very weakly indurated								
255													
	35	MC 12	60/4"		Siltstone - brownish red to light reddish pink, slighly moist, slighly hard Groundwater and/or seepage not encountered. Boring backfilled with native materials.								
250					Bottom of borehole at 34.3 feet.								
	40												

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

BORING LOGS

DESIGNED BY:	TC
DRAWN BY:	HAO
CHECKED BY:	SO

TB-3

SHEET 84 OF 88

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360 S. Hope Avenue Suite C-110
Santa Barbara, CA 93105
Telephone: 805-563-0788

BORING NUMBER AH 04

CLIENT SB County Flood Control
PROJECT NAME SM Debris Basin Operational Improvements Project
PROJECT NUMBER
PROJECT LOCATION Carpinteria, Santa Barbara County, California
DATE STARTED 11/27/19 **COMPLETED** 11/27/19
GROUND ELEVATION 387.5 ft **HOLE SIZE** 8" inches
DRILLING CONTRACTOR Choice Drilling
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger - CME 95
AT TIME OF DRILLING ---
LOGGED BY E. Pongracz **CHECKED BY**
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	UNDRAINED SHR STRENGTH (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	OTHER TESTS
385	0	AU 1			**Earth Fill (ef)** Silty Sand (SM) with clay binder and scattered small rock fragments - mottled gray brown to gray, slightly moist, moderately compact								
	5	MC 2	29-39										
380		MC 3	18-30		same as above (ef)								
	10	MC 4	12-16		Clayey Sand to Sandy Clay (SC) matrix with small sandstone rock fragments - mottled brown to light reddish brown, slightly moist to moist, moderately compact								
375		MC 5	22-40		**Colluvium (Qc)** Sandstone clasts with pockets of Sandy Clay (SC) - brownish yellow (sandstone) to mottled red brown, moist, medium stiff								
	15	MC 6	38-50/5"		~13.0' - cuttings change to light brownish yellow fine- to medium-grained Sand with silt **Bedrock: Coldwater Formation (Tcw)** Fine- to medium-grained Sandstone - pale brownish yellow, slightly moist, moderately hard								
370		AU 7			18.0' - drilling becomes difficult Groundwater and/or seepage not encountered. Boring backfilled with native materials. Bottom of borehole at 19.0 feet.								
365	20												
360	25												
355	30												
350	35												
	40												

BORING NUMBER AH 05

CLIENT SB County Flood Control
PROJECT NAME SM Debris Basin Operational Improvements Project
PROJECT NUMBER
PROJECT LOCATION Carpinteria, Santa Barbara County, California
DATE STARTED 11/27/19 **COMPLETED** 11/27/19
GROUND ELEVATION 386 ft **HOLE SIZE** 8" inches
DRILLING CONTRACTOR Choice Drilling
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger - CME 95
AT TIME OF DRILLING ---
LOGGED BY E. Pongracz **CHECKED BY**
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	UNDRAINED SHR STRENGTH (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	OTHER TESTS
385	0				**Earth Fill (ef)** Silty Sand (SM) with rock fragments - mottled gray brown, slightly moist, compact								
	5	MC 1	16-29										
380					**Natural Soil (Qns) / Colluvium (Qc)** Sandy Clay (SC) - medium brown, slightl moist, very stiff/hard								
	10				Rough drilling at ~9.5' below grade.								
375		SPT 2	29-50/4"		**Colluvium (Qc) / Highly weathered Bedrock ?** Sandstone cobble in SPT sampler tip at 10.0'.								
	15				Drilling eases at ~14' below grade.								
370		SPT 3	35/3"		**Bedrock: Coldwater Formation (Tcw)** Medium- to coarse-grained Sandstone - pale yellow, hard, indurated								
	20				Drilling eases slightly to 20' below grade.								
365		MC 4	50/3"										
	25				Bottom of borehole at 25.0 feet.								
360													
	30												
355													
	35												
350													
	40												

BORING NUMBER DH 01

CLIENT SB County Flood Control
PROJECT NAME SM Debris Basin Operational Improvements Project
PROJECT NUMBER
PROJECT LOCATION Carpinteria, Santa Barbara County, California
DATE STARTED 11/26/19 **COMPLETED** 11/26/19
GROUND ELEVATION 381 ft **HOLE SIZE** 24" inches
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD Flight Auger
AT TIME OF DRILLING ---
LOGGED BY E. Pongracz **CHECKED BY**
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	UNDRAINED SHR STRENGTH (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	OTHER TESTS
380	0	AU 1			**Earth Fill (ef)** Silty Sand (SM) with scattered gravel and small cobbles - light brown, slightly moist, moderately compact								
					Colluvium (Qc) Silty Sand (SM) to Sandy Silt (ML) matrix with scattered sandstone cobbles and occasional boulder - medium brown, moist, medium dense to dense, massive								
					Auger refusal on boulder at 4.5' below grade.								
	5				Bottom of borehole at 4.5 feet.								
375													
	10												
370													
	15												
365													
	20												

REGISTERED PROFESSIONAL ENGINEER
Thomas Conti
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

BORING LOGS

DESIGNED BY: TC
DRAWN BY: HAO
CHECKED BY: SO

TB-4

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ORIGINAL SCALE IS IN INCHES
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Bengal Engineering Inc.
360 S. Hope Avenue Suite C-110
Santa Barbara, CA 93105
Telephone: 805-563-0788

BORING NUMBER DH 02

CLIENT SB County Flood Control
PROJECT NAME SM Debris Basin Operational Improvements Project
PROJECT NUMBER
PROJECT LOCATION Carpinteria, Santa Barbara County, California
DATE STARTED 11/26/19 **COMPLETED** 11/26/19
GROUND ELEVATION **HOLE SIZE** 24" inches
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD Flight Auger
AT TIME OF DRILLING ---
LOGGED BY E. Pongracz **CHECKED BY**
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	UNDRAINED SHR STRENGTH (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	OTHER TESTS
	0				**Natural Soil (Qns)** Clayey Sand - medium brown, slightly moist, very stiff to hard, occasional dessication crack; weakly developed soil profile								
	5				**Colluvium / Landslide Debris (Qc/Qls)** Fine-grained Silty Sand with localized clay binder to Clayey Sand/Sandy Clay (matrix) with sub-rounded to sub-angular sandstone rock fragments - medium brown, moist, dense								
	10												
	15				14.0' - difficult, choppy drilling 15.0' - switch to coring Cored from 1.5 hours; boring terminated at 16' below grade.								
	20				Bottom of borehole at 16.0 feet.								

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Bengal Engineering Inc.
360 S. Hope Avenue Suite C-110
Santa Barbara, CA 93105
Telephone: 805-563-0788

BORING NUMBER DH 03

CLIENT SB County Flood Control
PROJECT NAME SM Debris Basin Operational Improvements Project
PROJECT NUMBER
PROJECT LOCATION Carpinteria, Santa Barbara County, California
DATE STARTED 11/26/19 **COMPLETED** 11/26/19
GROUND ELEVATION 398 ft **HOLE SIZE** 24" inches
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD Flight Auger
AT TIME OF DRILLING ---
LOGGED BY E. Pongracz **CHECKED BY**
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	UNDRAINED SHR STRENGTH (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	OTHER TESTS
	0				**Earth Fill (ef)** 0-1.5' (north end of trench) Silty Sand with rock fragments - light brown, slightly moist, slightly to moderately compact 0-3.5' (south end of trench)								
395	5				**Colluvium / Landslide Debris (Qc/Qls)** Fine-grained Silty Sand with localized clay binder to Clayey Sand/Sandy Clay (matrix) with sub-rounded to sub-angular sandstone rock fragments - medium brown, moist, dense								
390	10				Difficult drilling at 9.0' below grade. 10.0' - apparent sub-horizontal and sharp contact with dark soil (?) 11.0' - switch to core barrel; boulders to 24" across; very slow advance								
385	15				~14.5' - coring eases, switch back to flight auger **Bedrock ?: Coldwater Formation (Tcw)** Fine-grained Sandstone - light gray brown to light olive brown, slightly moist, moderately hard; consistent drilling								
380	20				Bottom of borehole at 17.5 feet.								

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Bengal Engineering Inc.
360 S. Hope Avenue Suite C-110
Santa Barbara, CA 93105
Telephone: 805-563-0788

TEST PIT NUMBER TP 01

CLIENT SB County Flood Control
PROJECT NAME SM Debris Basin Operational Improvements Project
PROJECT NUMBER
PROJECT LOCATION Carpinteria, Santa Barbara County, California
DATE STARTED 11/25/19 **COMPLETED** 11/25/19
GROUND ELEVATION **TEST PIT SIZE** 24" x 36" inches
EXCAVATION CONTRACTOR Juan's Landscaping
GROUND WATER LEVELS:
EXCAVATION METHOD Hand-Dug Test Pit
AT TIME OF EXCAVATION ---
LOGGED BY E. Pongracz **CHECKED BY**
AT END OF EXCAVATION ---
NOTES
AFTER EXCAVATION ---

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	UNDRAINED SHR STRENGTH (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	OTHER TESTS
	0.0				**Earth Fill (ef)** Silty Sand (SM) with rock fragments - light gray brown, slightly moist, moderately compact *Test pit excavated below scarp of recent shallow slope failure. Fill, as described, is exposed in the scarp.								
	2.5	MC 1			**Alluvium (Qal)** Bedded fine- to medium-grained Sand (SP), laminated Sandy Silt (ML) and Gravelly Sand (SP) - light brown, dry grading to moist, medium dense								
	5.0				4.5' - Refusal on cobbles and small boulders Bottom of test pit at 4.5 feet.								
	7.5												
	10.0												

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ORIGINAL SCALE IS IN INCHES

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

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SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

BORING LOGS

DESIGNED BY:	TC
DRAWN BY:	HAO
CHECKED BY:	SO

TB-5

SHEET 86 OF 88

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Bengal Engineering Inc.
360 S. Hope Avenue Suite C-110
Santa Barbara, CA 93105
Telephone: 805-563-0788

TEST PIT NUMBER TP 02

CLIENT SB County Flood Control
PROJECT NAME SM Debris Basin Operational Improvements Project
PROJECT NUMBER
PROJECT LOCATION Carpinteria, Santa Barbara County, California
DATE STARTED 11/25/19 **COMPLETED** 11/25/19
GROUND ELEVATION **TEST PIT SIZE** 24" x 36" inches
EXCAVATION CONTRACTOR Juan's Landscaping
GROUND WATER LEVELS:
EXCAVATION METHOD Hand-Dug Test Pit
AT TIME OF EXCAVATION ---
LOGGED BY E. Pongracz **CHECKED BY**
AT END OF EXCAVATION ---
NOTES
AFTER EXCAVATION ---

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	UNDRAINED SHR STRENGTH (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	OTHER TESTS
	0.0				**Compacted Earth Fill (cef)** Silty Sand with scattered, small angular rock fragments - brownish gray to gray brown, slightly moist grading to moist, compact, occasional small wood fragment; difficult to excavate by hand								
	2.5	MC 1											
		GB 2											
	5.0	MC 3			Bottom of test pit at 5.5 feet.								
	7.5												
	10.0												

BENGAL BH V1 - BENGAL V1.GDT - 12/4/19 20:04 - F:\DOCUMENTS\BENTLEY\GINT\PROJECTS\SM DEBRIS BASIN SPILLWAY BRIDGE.GPJ

Bengal Engineering Inc.
360 S. Hope Avenue Suite C-110
Santa Barbara, CA 93105
Telephone: 805-563-0788

TEST PIT NUMBER TP 03

CLIENT SB County Flood Control
PROJECT NAME SM Debris Basin Operational Improvements Project
PROJECT NUMBER
PROJECT LOCATION Carpinteria, Santa Barbara County, California
DATE STARTED 11/25/19 **COMPLETED** 11/25/19
GROUND ELEVATION **TEST PIT SIZE** 24" x 36" inches
EXCAVATION CONTRACTOR Juan's Landscaping
GROUND WATER LEVELS:
EXCAVATION METHOD Hand-Dug Test Pit
AT TIME OF EXCAVATION ---
LOGGED BY E. Pongracz **CHECKED BY**
AT END OF EXCAVATION ---
NOTES
AFTER EXCAVATION ---

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	UNDRAINED SHR STRENGTH (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	OTHER TESTS
	0.0				**Earth Fill (ef)** 0-3' - Clayey Sand with scattered rock fragments - mottled brown, moist, compact								
		MC 1											
	2.5				3.0' - large boulders (clast-supported) with silty sand (SM) matrix; begin to advance 4" diameter hand-auger								
		MC 2											
	5.0				5.0' - Silty Sand with scattered small rock fragments - mottled light golden brown 5.5' - auger refusal								
		MC 3			Bottom of test pit at 5.5 feet.								
	7.5												
	10.0												

BENGAL BH V1 - BENGAL V1.GDT - 12/4/19 20:04 - F:\DOCUMENTS\BENTLEY\GINT\PROJECTS\SM DEBRIS BASIN SPILLWAY BRIDGE.GPJ

Bengal Engineering Inc.
360 S. Hope Avenue Suite C-110
Santa Barbara, CA 93105
Telephone: 805-563-0788

TEST PIT NUMBER TP 04

CLIENT SB County Flood Control
PROJECT NAME SM Debris Basin Operational Improvements Project
PROJECT NUMBER
PROJECT LOCATION Carpinteria, Santa Barbara County, California
DATE STARTED 11/25/19 **COMPLETED** 11/25/19
GROUND ELEVATION **TEST PIT SIZE** 24" x 36" inches
EXCAVATION CONTRACTOR Juan's Landscaping
GROUND WATER LEVELS:
EXCAVATION METHOD Hand-Dug Test Pit
AT TIME OF EXCAVATION ---
LOGGED BY E. Pongracz **CHECKED BY**
AT END OF EXCAVATION ---
NOTES
AFTER EXCAVATION ---

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	UNDRAINED SHR STRENGTH (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	OTHER TESTS
	0.0				**Earth Fill (ef)** Matrix of Silty Sand (SM) to Sandy Silt (ML) with abundant rock fragments - light brown, dry to slightly moist, compact, clast-supported; difficult to excavate by hand								
	2.5				2.0' - begin to advance 4" diameter hand-auger								
		GB 1			4.5' - auger refusal								
	5.0				Bottom of test pit at 4.5 feet.								
	7.5												
	10.0												

BENGAL BH V1 - BENGAL V1.GDT - 12/4/19 20:04 - F:\DOCUMENTS\BENTLEY\GINT\PROJECTS\SM DEBRIS BASIN SPILLWAY BRIDGE.GPJ

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS			
NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

BORING LOGS

DESIGNED BY: TC
DRAWN BY: HAO
CHECKED BY: SO

TB-6

SHEET 87 OF 88

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BORING NUMBER TT 01

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Bengal Engineering Inc.
360 S. Hope Avenue Suite C-110
Santa Barbara, CA 93105
Telephone: 805-563-0788

CLIENT SB County Flood Control
PROJECT NAME SM Debris Basin Operational Improvements Project
PROJECT NUMBER
PROJECT LOCATION Carpinteria, Santa Barbara County, California
DATE STARTED 11/25/19 **COMPLETED** 11/25/19
GROUND ELEVATION **HOLE SIZE** 2' x 15' inches
DRILLING CONTRACTOR
GROUND WATER LEVELS:
DRILLING METHOD Backhoe
AT TIME OF DRILLING ---
LOGGED BY E. Pongracz **CHECKED BY**
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	UNDRAINED SHR STRENGTH (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	OTHER TESTS
	0.0				**Colluvium / Landslide Debris (Qc/Qls)** Weakly developed topsoil grades to fine-grained Silty Sand/Sandy Silt (ML) with clay binder and occasional small rock fragments - mottled orange to olive brown, hard, slightly moist, occasional dessication crack, locally slightly porous									
	2.5				3.0' - grades to light orange brown to light brown clayey silty sand to Silty, Clayey Sand (matrix) with occasional well-cemented boulders, moist grading to very moist									
	5.0				5.5' - matrix of medium to dark brown fine-grained Clayey Sand to Sandy Clay (SC) with gravel to small cobbles of highly decomposed fine-grained Silty Sandstone - moist, stiff/dense, locally slightly porous with occasional rootlets 6.0' - backhoe refusal on boulders									
					Bottom of borehole at 6.0 feet.									
	7.5													
	10.0													
	12.5													
	15.0													

BENGAL BH V1 - BENGAL V1.GDT - 12/4/19 20:04 - F:\DOCUMENTS\BENTLEY\GINT\PROJECTS\SM DEBRIS BASIN SPILLWAY BRIDGE.GPJ

BORING NUMBER TT 02

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Bengal Engineering Inc.
360 S. Hope Avenue Suite C-110
Santa Barbara, CA 93105
Telephone: 805-563-0788

CLIENT SB County Flood Control
PROJECT NAME SM Debris Basin Operational Improvements Project
PROJECT NUMBER
PROJECT LOCATION Carpinteria, Santa Barbara County, California
DATE STARTED 11/25/19 **COMPLETED** 11/25/19
GROUND ELEVATION **HOLE SIZE** 2' x 15' inches
DRILLING CONTRACTOR
GROUND WATER LEVELS:
DRILLING METHOD Backhoe
AT TIME OF DRILLING ---
LOGGED BY E. Pongracz **CHECKED BY**
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	UNDRAINED SHR STRENGTH (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	OTHER TESTS
	0.0				**Natural Soil (Qns)** Clayey Sand - medium brown, slightly moist, very stiff to hard, occasional dessication crack; weakly developed soil profile								
	2.5	MC 1			**Colluvium / Landslide Debris (Qc/Qls)** Fine-grained Silty Sand with localized clay binder (matrix) with sub-rounded to sub-angular sandstone rock fragments - light brown, moist, dense								
	5.0												
	7.5	MC 2			8.5' - Fine-grained Silty Sand/Sandy Silt (ML) matrix with scattered highly weathered rock fragments - medium brown with light rust orange to light gray mottling, moist, medium dense to dense, slightly porous, occasional small charcoal fragments 9.5' - grades to dark brown Sandy Clay (SC) matrix with occasional rock fragments - dark brown, very moist; zones of highly weathered rock fabric								
	10.0				Bottom of borehole at 11.0 feet.								
	12.5												
	15.0												

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BORING NUMBER TT 03

PAGE 1 OF 1

Bengal Engineering Inc.
360 S. Hope Avenue Suite C-110
Santa Barbara, CA 93105
Telephone: 805-563-0788

CLIENT SB County Flood Control
PROJECT NAME SM Debris Basin Operational Improvements Project
PROJECT NUMBER
PROJECT LOCATION Carpinteria, Santa Barbara County, California
DATE STARTED 11/25/19 **COMPLETED** 11/25/19
GROUND ELEVATION **HOLE SIZE** 2' x 40' inches
DRILLING CONTRACTOR
GROUND WATER LEVELS:
DRILLING METHOD Backhoe
AT TIME OF DRILLING ---
LOGGED BY E. Pongracz **CHECKED BY**
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	UNDRAINED SHR STRENGTH (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	OTHER TESTS
	0.0				**Earth Fill (ef)** 0-1.5' (north and end of trench) Silty Sand with rock fragments - light brown, slightly moist, slightly to moderately compact 0-3.5' (south end of trench)								
	2.5	MC 1			**Natural Soil (Qns)** Sandy Silt with scattered small rock fragments and clay binder - dark brown/dark gray brown, moist, medium stiff, occasional roots (only found in south end of trench)								
	5.0	GB 2 MC 3			**Colluvium (Qc)** Fine-grained Silty Sand/Sandy Silt (ML) with clay binder and scattered to abundant rock fragments - medium brown, stiff/dense, slightly moist, massive (south end of trench) **Colluvium / Landslide Debris (Qc/Qls)**north end of trench) Grades vertically into landslide-affected bedrock - decomposed siltstone - brownish red to maroon brown, slightly moist, stiff, pervasively fractured, occasional sub-angular to sub-rounded weathered sandstone clast (sample at 6.5')								
	7.5	MC 4 GB 5			**Bedrock: Coldwater Formation (Tcw)** Medium-grained Sandstone - light brownish yellow, slightly moist, moderately hard, moderately well indurated 7.0' - shear: N40W, 58NE; 4"-4.5" thick shear zone bounded by root- and light maroon brown silt-lined joints (landslide shear zone)								
					Bottom of borehole at 9.0 feet.								
	10.0												
	12.5												
	15.0												

BENGAL BH V1 - BENGAL V1.GDT - 12/4/19 20:04 - F:\DOCUMENTS\BENTLEY\GINT\PROJECTS\SM DEBRIS BASIN SPILLWAY BRIDGE.GPJ

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

DATE: 2/8/22

REVISIONS NO.	DESCRIPTION	DATE	APR

SANTA BARBARA COUNTY
FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
130 E. VICTORIA STREET
SANTA BARBARA, CA 93101
(805) 568-3440

BENGAL ENGINEERING
360 S. HOPE AVE, STE C-110
SANTA BARBARA, CA 93105

SANTA MONICA DEBRIS BASIN
OPERATIONAL IMPROVEMENTS
SANTA BARBARA COUNTY, CALIFORNIA

BORING LOGS

DESIGNED BY: TC
DRAWN BY: HAO
CHECKED BY: SO

TB-7

SHEET 88 OF 88

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2

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2/8/2022 10:04 AM PLOT DATE/TIME

SANTA BARBARA COUNTY
FLOOD CONTROL AND WATER CONSERVATION DISTRICT

NOTICE TO BIDDERS
AND
SPECIAL PROVISIONS

FOR

Santa Monica Debris Basin Operational Improvements Project

UNDER:

Bid Book dated March 23, 2022	**Standard Specifications dated 2018**
Standard Plans dated 2018	

COUNTY PROJECT NO. SC8370

BID OPENING LOCATIONS:
PlanetBids
https://www.planetbids.com/portal/portal.cfm?CompanyID=43874

BID OPENING TIME AND DATE:
2:00 PM on April 21, 2022

Electronic Advertising Contract

SCOTT D. McGOLPIN
DIRECTOR OF PUBLIC WORKS

NOTICE TO BIDDERS AND SPECIAL PROVISIONS

Santa Monica Debris Basin Operational Improvements Project
COUNTY PROJECT NO. SC8370

The Special Provisions contained herein have been prepared under the direction of the following Registered Persons.

Md. Waliduzzaman — March 23, 2022

Md Wahiduzzaman
REGISTERED CIVIL ENGINEER — DATE

Thomas Conti — March 23, 2022

Thomas Conti
REGISTERED CIVIL ENGINEER — DATE

DocuSigned by: Matt Griffin — 3/24/2022 | 1:50 PM PDT
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Matthew G. Griffin — DATE
PROJECT MANAGER

DocuSigned by: Jon Frye — 3/25/2022 | 7:56 AM PDT
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Jonathan S. Frye — DATE
ENGINEERING MANAGER (*APPROVAL RECOMMENDED*)

DocuSigned by: Walter Rubalcava — 3/25/2022 | 8:37 AM PDT
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Walter Rubalcava — DATE
FLOOD CONTROL DEPUTY DIRECTOR (*APPROVED*)

Joan Hartmann — DATE
BOARD OF DIRECTORS, CHAIR (*APPROVED*)

TABLE OF CONTENTS

NOTICE TO BIDDERS

Bids open at **2:00 PM on Thursday, April 21, 2022** for:

Santa Monica Debris Basin Operational Improvements Project
COUNTY PROJECT NO. **SC8370**
General project work description: The Project generally consists of providing water pollution control; removal of existing bridge; modifications to existing drainage facilities; new bridges; new drainage facilities; reinforced earth and sheet pile retaining walls; and roadway improvements, including PCC and HMA surfacing.

Project location description: The WORK occurs in the unincorporated area of Santa Barbara County near Carpinteria, California, within Flood Control District owned property and easements.

Plans, Specifications, and Bid Book are available at no charge at
https://www.planetbids.com/portal/portal.cfm?CompanyID=43874

The County encourages the participation of DBEs as defined in 49 CFR 26. You are encouraged to employ craftsmen and other workers from the local labor market whenever possible to do so. Local labor market is defined as the labor market within the geographical confines of the County of Santa Barbara, State of California.

Submit bids to the web address below. Bids will be opened and available at the web address below immediately following the submittal deadline.

PlanetBids
https://www.planetbids.com/portal/portal.cfm?CompanyID=43874

Complete the project work within **260 Workings Days**.

The estimated cost of the project is **$4,950,000**

A non-mandatory pre-bid job walk is scheduled for **April 12, 2022 at 10:00 AM**. Bidders interested in attending are to meet at the project site located at 4300 Foothill Rd., entering from the north side of Foothill Rd., immediately west of the Santa Monica Channel.

This project is subject to compliance monitoring and enforcement by the Department of Industrial Relations.

A contractor or subcontractor shall not be qualified to bid on, be listed in a bid proposal, subject to the requirements of Section 4104 of the Public Contract Code, or engage in the performance of any contract for public work, as defined in this chapter, unless currently registered and qualified to perform public work pursuant to Section 1725.5. It is not a violation of this section for an unregistered contractor to submit a bid that is authorized by Section 7029.1 of the Business and Professions Code or by Section 10164 or 20103.5 of the Public Contract Code, provided the contractor is registered to perform public work pursuant to Section 1725.5 at the time the contract is awarded.

For each bid all forms must be filled out as indicated in the bid documents. The entire Bid Book must be submitted to PlanetBids when you 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 website, https://www.dir.ca.gov/.

The Bidder shall possess a Class A General Engineering Contractor license or a combination of Class C licenses which constitute the majority of the work in accordance with the provisions of Chapter 9, Division III of the Business and Professions Code at the time that the Bid is submitted. Failure to possess the required license(s) shall render the Bid as non-responsive and shall act as a bar to award of the Contract to any bidder not possessing said license.

Inquiries or questions based on alleged patent ambiguity of the plans, specifications, or estimate must be submitted as a bidder inquiry by **5:00 PM** on **the Friday of the week preceding the bid opening**. Submittals

after this date will not be addressed. Questions pertaining to this Project prior to Award of the Contract must be submitted via PlanetBids Q&A tab.

Bidders (Plan Holders of Record) will be notified by electronic mail if addendums are issued. The addendums, if issued, will only be available on PlanetBids, https://www.planetbids.com/portal/portal.cfm?CompanyID=43874

The OWNER reserves the right to reject any or all bids, to waive any informalities and/or inconsistencies in a bid, and to make awards to the lowest responsive, responsible bidder as it may best serve the interest of the OWNER.

By order of the Board of Directors of the Santa Barbara County Flood Control & Water Conservation District this project was authorized to be advertised on November 5, 2019.

Walter Rubalcava
Deputy Director, Public Works
Water Resources Division

COPY OF BID ITEM LIST

Item No.	F[1]	Item Code	Description	Quantity	Unit	Unit Price	Item Total
1		051260A	Construction Survey	1	LS	$	$
2		80050	Progress Schedule (Critical Path Method)	1	LS	$	$
3		130100	Job Site Management	1	LS	$	$
4		130300	Prepare Storm Water Pollution Prevention Plan	1	LS	$	$
5		130310	Rain Event Action Plan	8	EA	$500	$
6		130320	Storm Water Sampling and Analysis Day	10	EA	$1,000	$
7		130330	Storm Water Annual Report	1	EA	$2,000	$
8		131201	Temporary Creek Diversion	1	LS	$	$
9		153122	Remove Concrete (Miscellaneous)	1	LS	$	$
10		170103	Clearing and Grubbing	1	LS	$	$
11	F	190101	Roadway Excavation	3,800	CY	$	$
12	F	192001	Structure Excavation (Inlet Towers)	357	CY	$	$
13	F	192003	Structure Excavation (Spillway Bridge)	556	CY	$	$
14	F	192003	Structure Excavation (Channel Bridge)	35	CY	$	$
15	F	192032	Structure Excavation (Rock Slope Protection)	90	CY	$	$
16	F	193001	Structure Backfill (Inlet Towers)	303	CY	$	$
17	F	193001	Structure Backfill (ByPass)	32	CY	$	$
18	F	193003	Structure Backfill (Spillway Bridge)	214	CY	$	$
19	F	193003	Structure Backfill (Channel Bridge)	42	CY	$	$
20	F	193006	Structure Backfill (Slurry Cement)	150	CY	$	$
21		198010	Imported Borrow	600	CY	$	$
22		210252	Bonded Fiber Matrix	1,720	SF	$	$
23		210280	Rolled Erosion Control Product (Blanket)	1,720	SF	$	$
24		260203	Class II Aggregate Base	570	CY	$	$
25		398001	Remove Asphalt Concrete Pavement	8,000	SF	$	$
26		390132	Hot Mix Asphalt (Type A)	340	Ton	$	$
27		390137	Hot Mix Asphalt-Open Graded (Open Gap Friction Course)	1,000	Ton	$	$
28	F	400050	Continuously Reinforced Concrete Pavement	480	CY	$	$
29		460XXX	Tie Back Assembly A	10	EA	$	$
30		460XXX	Tie Back Assembly B	2	EA	$	$
31		460XXX	Tie Back Assembly C	1	EA	$	$
32	F	47702X	Geosynthetic Reinforced Soil, (Tower Access Pads)	7,200	SF	$	$

[1] "F" denotes Final Pay Item

Item No.	F[1]	Item Code	Description	Quantity	Unit	Unit Price	Item Total
33		480600	Temporary Shoring	1	LS	$	$
34		480XXX	Temporary Crossing (Lower Channel)	1	LS	$	$
35		490553	Furnish Steel Sheet Piling	12,400	SF	$	$
36	F	490553	Drive Steel Sheet Piling	12,400	SF	$	$
37		490601	16" Cast-in-Drilled Hole Concrete Piling	240	LF	$	$
38		500001	Prestressing Cast-In-Place Concrete	1	LS	$	$
39	F	510053	Structural Concrete, Bridge (Spillway Bridge)	54	CY	$	$
40	F	510053	Structural Concrete, Bridge (Channel Bridge)	90	CY	$	$
41	F	510051	Structural Concrete, Bridge Footing (Spillway Bridge)	29	CY	$	$
42	F	510053	Structural Concrete, Bridge (Polymer Fiber) (Spillway Bridge)	115	CY	$	$
43	F	51009X	Structural Concrete, Maintenance Access Structure	22	CY	$	$
44	F	51009X	Structural Concrete, By-Pass Structure	14	CY	$	$
45	F	51009X	Structural Concrete, Tower Inlet A	21	CY	$	$
46	F	51009X	Structural Concrete, Tower Inlet B	21	CY	$	$
47	F	51009X	Structural Concrete, Tower Inlet C	7	CY	$	$
48	F	51009X	Structural Concrete, Tower Inlet D	54	CY	$	$
49		51009X	Structural Concrete, Tower Pad Dead Man	10	EA	$	$
50		5190081	Joint Seal (MR 1/2")	60	LF	$	$
51	F	520101	Bar Reinforcing Steel (Spillway Bridge)	49,000	LB	$	$
52	F	520101	Bar Reinforcing Steel (Channel Bridge)	15,900	LB	$	$
53	F	550XXX	Tower Steel Armoring, Struts and Trash Rack System	47,000	LB	$	$
54		600097	Bridge Removal	1	LS	$	$
55		64110X	15" Plastic Pipe	430	LF	$	$
56		65232X	36" Reinforced Concrete Pipe (Class V, Rubber Gasket Joint)	20	LF	$	$
57		6500XX	Connect (N) pipe to existing structure (Tower C) (Std. SPPWC 333-2)	1	EA	$	$
58		6500XX	Connect (N) pipe to existing siphon pipe (Std. SPPWC (380-4)	1	EA	$	$
59		707223	Concrete Manhole (COSB Std. 3-080)	1	EA	$	$
60		71012X	Remove Drainage Facilities	1	LS	$	$
61		710100	Abandon 24" Culvert	1	EA	$	$
62		710110	Abandon Drainage Inlet	1	EA	$	$
63	F	72152X	Remove and Rest Rock Slope Protection (Various Locations)	1	LS	$	$
64	F	72152X	Rock Slope Protection Backing No. 2	150	CY	$	$
65	F	723030	Rock Slope Protection (1/2T, Method A)	270	CY	$	$
66	F	723050	Rock Slope Protection (1/4 T Method B)	370	CY	$	$
67	F	723215	Concreted-Rock Slope Protection (1/4 T, Method B)	20	CY	$	$

Item No.	F[1]	Item Code	Description	Quantity	Unit	Unit Price	Item Total
68		729011	Rock Slope Protection Fabric (Class 8)	330	SY	$	$
69		730010	Minor Concrete - Curb w/18" Gutter (COSB Std 4-030, Type A)	360	LF	$	$
70		730040	Minor Concrete (V-Ditch)	60	LF	$	$
71		7318XX	Remove Concrete (V-Ditch)	110	LF	$	$
72		75001X	Manhole Frame and Cover (Std. SPPWC 210-3)	3	EA	$	$
73		75001X	Manhole Frame and Cover (Std. SPPWC 630-4)	4	EA	$	$
74		730040	Steel Sheetpile Coping	220	LF	$	$
75		750500	Miscellaneous Metal (Bridge)	200	LB	$	$
76		7505XX	Tower Trash Racks	36	EA	$	$
77		7505XX	Steel Orifice Plates	2	EA	$	$
78		803050	Remove Chain-link Fence	200	LF	$	$
79		800320	Chain Link Fence (Type CL-4)	120	LF	$	$
80		800XXX	Wood Fence (Polecraft, 2-Rail)	96	LF	$	$
81		810190	Guard Railing Delineators	20	EA	$	$
82		831006	Midwest Guardrail System (Steel Post)	190	LF	$	$
83		833080	Concrete Barrier (Type K)	80	LF	$	$
84		839521	Cable Railing	130	LF	$	$
85		839584	Alternative In-Line Terminal System	1	EA	$	$
86		839585	Alternative Flared Terminal System	2	EA	$	$
87		839720	Concrete Barrier (Type 732) (Spillway Bridge)	191	LF	$	$
88		839720	Concrete Barrier (Type 732) (Channel Bridge)	130	LF	$	$
89		839752	Remove Guardrail	280	LF	$	$
90		999990	Mobilization	1	LS	$	$
91			Supplemental Work (Additional Water Pollution Control)	1	LS	$10,000	$10,000
92			Supplemental Work (Rock Excavation)	1	LS	$5,000	$5,000
93			Supplemental Work (Unsuitable Subgrade Stabilization)	1	LS	$10,000	$10,000
SUPPLEMENTAL WORK BID ITEMS SUBTOTAL							**$25,000**
TOTAL BID							

FLOOD CONTROL DISTRICT PROVISIONS

The work provided herein must be performed in accordance with the *Caltrans Standard Specifications*, 2018 edition (*Standard Specifications*). The *Standard Specifications* are incorporated herein by reference.

MODIFICATIONS TO STANDARD SPECIFICATIONS

DIVISION I GENERAL PROVISIONS

1 GENERAL

Add to section 1-1.01:

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

For local material from (1) a noncommercial source or (2) a source not regulated under California jurisdiction, you must submit a local material plan and analytical test results for pH, lead, and other constituents for each site. See section 6-1.03B(1) for the specifications.

Replace or add the following terms to section 1-1.07B:

Acceptance: The formal written approval by the Agency of a project which has been completed in all respects in accordance with the plans and specifications and any modifications thereof.

Agency: The Santa Barbara County (CA) Flood Control and Water Conservation District.

APWA Standard Plans: Standard Plans for Public Works Construction, promulgated by the American Public Works Association (Southern California Chapter)/Associated General Contractors of California (Southern California Districts) Joint Cooperative Committee, published by Building News Inc., 3055 Overland Avenue, Los Angeles, California 90034, 2009 edition.

Board: The Governing Board of Directors of the Santa Barbara County (CA) Flood Control and Water Conservation District.

Business day: Day on the calendar except Saturday, Sunday, and a holiday.

Caltrans: State of California, Business & Transportation Agency, Department of Transportation

County: The County of Santa Barbara, a political subdivision of the State of California.

County Clerk: The County Clerk of the County of Santa Barbara.

County Standard Details: Standard Details of the County of Santa Barbara Department of Public Works Roads Division, dated September, 2011

Department: The Santa Barbara County Flood Control District acting by and through its Department of Public Works; its authorized representatives.

Department of Transportation: The Santa Barbara County (CA) Flood Control and Water Conservation District

District: The Santa Barbara County (CA) Flood Control and Water Conservation District

District Office: The Santa Barbara County (CA) Flood Control and Water Conservation District Office

Director: Director of Public Works of the County of Santa Barbara, or the Director's duly authorized representative.

Engineer: The Flood Control District Engineer acting either directly or through properly authorized agents, such agents acting within the scope of the particular duties delegated to them.

Flood Control: The Santa Barbara County (CA) Flood Control and Water Conservation District

Green Book: Standard Specifications for Public Works Construction, 2015 edition, including supplements published by Building News, Inc., Los Angeles, CA.

Holiday: Holidays are shown in the following table:

Holidays

Holiday	Date observed
Every Sunday	Every Sunday
New Year's Day	January 1st
Birthday of Martin Luther King, Jr.	3rd Monday in January
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
Day after Thanksgiving Day	Day after Thanksgiving Day
Christmas Day	December 25th

If January 1st, July 4th, November 11th, or December 25th falls on a Sunday, the Monday following is a holiday. If January 1st, July 4th, November 11th, or December 25th falls on a Saturday, the preceding Friday is a holiday.

Owner: Same meaning as Agency

Prompt: The briefest interval of time required for a considered reply, including time required for approval by governing body

State: The State of California and its political subdivisions, including the Santa Barbara County (CA) Flood Control and Water Conservation District.

State Standard Plans: Standard plans prepared by State of California, Business & Transportation Agency, Department of Transportation (Caltrans)

Supplemental Work: Bid Item Work that is only performed if so directed by the Engineer in writing.

Replace line "2.1" under item "2. working day" in section 1-1.07B with:

2.1. Saturday, Sunday, and a holiday

Add to section 1-1.11:

Websites, Addresses, and Telephone Numbers

Reference or agency or department unit	Website	Address	Telephone number
Department of Industrial Relations Prevailing Wage Rates	https://www.dir.ca.gov/Public-Works/Prevailing-Wage.html		
Caltrans, Office of Construction Contract Standards	http://ppmoe.dot.ca.gov/des/oe/construction-contract-standards.html		
County PlanetBids Portal	https://www.planetbids.com/portal/portal.cfm?CompanyID=43874		(805) 568-3440
County Municipal Code	https://www.municode.com/library/CA/Santa_Barbara_County		
Flood Control Construction Manager		CONSTRUCTION MANAGER **TBD**	
Flood Control Project Manager		PROJECT MANAGER Matt Griffin	(805) 884-8074

Delete the row for Office Engineer in the table of section 1-1.11.

Replace section 1-1.12 with:

1-1.12 MISCELLANY

Make checks and bonds payable to the Santa Barbara County Flood Control & Water Conservation District.

2 BIDDING

Add to section 2-1.01:

More than one Bid from an individual, firm, partnership, corporation, or association under the same or different names will not be considered. If the OWNER has reasonable grounds for believing that any Bidder is interested in more than one Bid for the WORK contemplated, all Bids in which such Bidder is interested will be rejected. If the OWNER believes that collusion exists among the Bidders, all Bids will be rejected and collusion participants shall be restricted from submitting further proposals. A party who has quoted prices to a Bidder is not hereby disqualified from quoting prices to other Bidders, or from submitting a Bid directly for the WORK.

Each Bidder (including the Bidder's Superintendent assigned to the Project) shall be skilled, experienced, regularly engaged in and qualified to perform the type of work called for in the Bid documents.

If you are found to be not qualified to bid, your bid will be rejected.

Replace 2-1.04 with:

2-1.04 PREBID OUTREACH MEETING

Section 2-1.04 applies if a mandatory prebid meeting is shown on the *Notice to Bidders*.

Each bidder must attend the meeting. The bidder's representative must be a company officer, project superintendent, or project estimator. For a joint venture, one of the parties must attend the mandatory prebid meeting.

A sign-in sheet will be used to identify the attendees. Each bidder must include the name and title of the company representative attending the meeting. The sign-in sheet must be signed before the meeting start time.

The Department does not accept a bid from a bidder who did not sign the sign-in sheet before the meeting started.

The Department may hold a single prebid meeting for more than one contract. Sign the sign-in sheet for the contract you intend to bid on. If you are bidding on multiple contracts, sign each sign-in sheet for each contract you intend to bid on. The sign-in sheets, with the names of all companies in attendance at each prebid meeting, will be made available at the website shown on the *Notice to Bidders* for bidder inquiries.

Replace section 2-1.06A with:

2-1.06A General

The *Bid Book* includes bid forms and certifications.

The *Notice to Bidders and Special Provisions*, *Bid Book*, and project plans are available on the County's PlanetBids Portal.

Caltrans Standard Specifications, Revised Standard Specifications, Standard Plans and Revised Standard plans are available at State of California, Department of Transportation (Caltrans) Office of Construction Contract Standards website.

Replace section 2-1.06B with:

2-1.06B Supplemental Project Information

The Department makes supplemental information available as specified in the special provisions.

If an *Information Handout* or sections are available, you may view them at the County's PlanetBids Portal.

Add to section 2-1.07:

The failure or neglect of the Bidder to receive or examine any of the bid documents shall in no way relieve the Bidder from any obligations required by the bid documents. No claims for additional compensation will be allowed which is based upon lack of knowledge of any bid documents**.**

Add to section 2-1.09:

The Board of Directors reserves the right to waive technical errors and discrepancies if it determines it is in the public interest to do so.

Add to section 2-1.10:

On the Subcontractor List you may either submit the percentage of each bid item subcontracted with your bid or E-Mail the percentage to: mgriff@cosbpw.net within 2 business days after bid opening. You are solely responsible for correcting any inadvertent errors in the license numbers within 2 business days of bid opening. Failure to correct the license numbers in compliance with instructions and Public Contract Code § 4104 will cause the bid to be nonresponsive.

If you make a clerical error in listing subcontractors, submit a written notice to the Director within 2 business days after the time of the bid opening. Send copies of the notice to the subcontractors involved.

Delete sections 2-1.15 to 2-1.27.

Replace section 2-1.33A with:

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.

Submit *Bid Book* forms and your electronic bid as instructed in the *Notice to Bidders*. The original Bid Book must be submitted immediately upon request after the bid opening.

For Federal-Aid projects, submit *Bid Book* DBE forms in accordance to section 2-1.33B.

Failure to submit the forms and information as specified may result in a nonresponsive bid.

Include all applicable federal, state and local taxes in your bid amount.

Unauthorized conditions, limitations, or provisos attached to the Bid shall render it informal and may cause its rejection as being non-responsive. The Bid forms shall be completed without interlineations, alterations, or erasures in the printed text. Alternative Bids will not be considered unless called for.

The Board of Directors reserves the right to waive technical errors and discrepancies if it determines it is in the public interest to do so.

Replace section 2-1.33B(2)(b) of the RSS with:

2-1.33B(2)(b) Contracts with a DBE Goal

For a contract with a DBE goal, as 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	Time of bid except for the public works contractor registration number
Copy of the Bid to the Department 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
Opt Out of Payment Adjustments for Price Index Fluctuations [a]	Time of bid
DBE Commitment (**Exhibit 15-G**)	No later than 4 p.m. on the 5th day after bid opening [b]
DBE Confirmation (**Written confirmation of each listed DBE is required**)	No later than 4 p.m. on the 5th day after bid opening [b]
DBE Good Faith Efforts Documentation (**Exhibit 15-H**)	No later than 4 p.m. on the 5th day after bid opening [b]

[a] Submit only if you choose the option.

[b] If the last day for submitting the bid form falls on a Saturday or holiday, it may be submitted on the next business day with the same effect as if it had been submitted on the day specified.

Replace section 2-1.33B(2)(c) of the RSS with:

2-1.33B(2)(c) Contracts without a DBE Goal

For a contract without a DBE goal, as 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 without a DBE Goal

Form	Submittal deadline

Bid to the Department	Time of bid except for the public works contractor registration number
Copy of the Bid to the Department 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 numbers	10 days after bid opening
Opt Out of Payment Adjustments for Price Index Fluctuations [a]	Time of bid
DBE Commitment (**Exhibit 15-G**) [required only If DBEs are included in your bid]	No later than 4 p.m. on the 5th day after bid opening [b]
DBE Confirmation (**Written confirmation of each listed DBE is required**)	No later than 4 p.m. on the 5th day after bid opening [b]
DBE Good Faith Efforts Documentation (**Exhibit 15-H**) [required only If no DBEs are included in your bid]	No later than 4 p.m. on the 5th day after bid opening [b]

[a] Submit only if you choose the option.
[b] If the last day for submitting the bid form falls on a Saturday or holiday, it may be submitted on the next business day with the same effect as if it had been submitted on the day specified.

Replace section 2-1.33B(3) of the RSS with:

2-1.33B(3) Non-Federal-Aid Contracts

For a non-federal-aid contract, submit the bid forms according to the schedule shown in the following table:

Bid Form Submittal Schedule for a Non-Federal-Aid Contract

Form	Submittal deadline
Bid to the Department	Time of bid except for the public works contractor registration number
Copy of the Bid to the Department 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
Opt Out Payment Adjustment for Price Index Fluctuations [a]	Time of bid

[a] Submit only if you choose the option.

Replace section 2-1.34 with:

2-1.34 BIDDER'S SECURITY (PUB CONTRACT CODE § 20129(a))

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 made payable to the Santa Barbara County Flood Control & Water Conservation District
3. Certified check made payable to the Santa Barbara County Flood Control & Water Conservation District
4. Signed bidder's bond by an admitted surety insurer made payable to the Santa Barbara County Flood Control & Water Conservation District

Submit bidder's security with the *Bid Book* before the bid opening time.

If using a bidder's bond, you may use the form in the *Bid Book*.

If the bid schedule includes alternative or additive items or additive groups, the bid bond must equal at least 10%

of the bid plus all alternatives and additives.

Replace the 2nd paragraph of section 2-1.40 with:

A bidder may withdraw or revise a bid after it has been submitted to the office if this is done before the bid opening date and time.

Replace the first paragraph in section 2-1.50 with:

If reasonable cause exists to believe collusion exists among bidders, or that prices bid are unbalanced between bid items, any or all proposals may be rejected.

3 CONTRACT AWARD AND EXECUTION

Replace section 3-1.02B with:

The Department breaks a tied bid with a coin toss.

Replace section 3-1.04 with:

3-1.04 CONTRACT AWARD

Submit any bid protest before 5:00 p.m. of the 10th business day following bid opening to the Department. Include the name, address, and telephone number of your designated representative with a complete statement for grounds of the protest. The protest must refer to the specific portion of the document that forms the basis for the protest.

If the County awards the contract including additive items or additive groups, total bid shall include Total Base Bid plus those additive items or Total Base Bid plus those additive groups used in determining the lowest responsible bidder.

In its discretion, the Santa Barbara County Flood Control District may accept or reject any bids. The decision of the Board of Directors shall be final in accepting or rejecting the bid protest, awarding the bid to the next lowest responsive, responsible bidder, or rejecting any or all bids.

If the District awards the contract, the award is made to the lowest responsible bidder within 65 days. If the lowest responsible bidder refuses or fails to execute the contract, the Director may award the contract to the second lowest responsible bidder. Such award, if made, will be made within 80 days after the opening of bids. If the second lowest responsible bidder refuses or fails to execute the contract, the Director may award the contract to the third lowest responsible bidder. Such award, if made, will be made within 95 days after the opening of bids. The periods of time specified above within which the award of contract may be made shall be subject to a time extension as may be agreed upon in writing between the Department and the bidder concerned.

Replace section 3-1.05 with:

3-1.05 CONTRACT BONDS (PUB CONT CODE § 20129(b) AND CIV CODE § 9554)

The successful bidder must furnish 2 bonds:

1. Payment bond to secure the claim payments of laborers, workers, mechanics, or materialmen providing goods, labor, or services under the Contract. This bond must be equal to at least 100 percent of the total bid. The payment bond must also contain provisions which automatically increase amounts thereof and/or time of completion or both for all change orders, extensions and additions to the work provided pursuant to this Agreement.
2. Performance bond to guarantee the faithful performance of the Contract. This bond must be equal to at least 100 percent of the total bid.

You may provide alternative securities for monies withheld to ensure performance per the terms of Public Contract Code § 22300.

The District furnishes the successful bidder with bond forms.

Both the payment and performance bonds must be executed by one and only one surety. That Surety must be admitted and listed in the Insurance Organizations Authorized By The Insurance Commissioner To Transact Business Of Insurance In The State Of California for the current year, and must be further authorized by the commissioner to issue surety insurance.

Delete section 3-1.08.

Delete section 3-1.11.

Replace section 3-1.18 with:

3-1.18 CONTRACT EXECUTION
The successful bidder must sign the District Agreement (Contract) and deliver to the District the following documents:

1. Three (3) copies of the District Agreement (Contract) bearing your original signatures.
2. Two (2) copies of the Performance and Payment Bonds.
3. Insurance Certificates.
4. Executed Taxpayer Identification Number and Certification (IRS Form W-9) and Withholding Exemption Certificate (CA Form 590).
5. A copy of your Injury and Illness Prevention Program.
6. A copy of your policy on drugs and alcohol.

The District must receive these documents by 4:00 pm on the 8th business day after the bidder receives the unexecuted Contract.

The bidder's security may be forfeited, and a successful bidder may be prohibited from participating in future bidding on the project, for failure to execute the contract within the time specified.

Add to section 3-1.19 with:

3-1.19 BIDDERS SECURITIES
In accordance with Public Contract Code § 20129, upon an award to the lowest bidder(s), the security of an unsuccessful bidder must be returned in a reasonable period of time, but in no event will that security be held by the County beyond sixty (60) days from the time the award is made.

The person to whom the contract is awarded must execute a bond to be approved by the board for the faithful performance of the contract.

4 SCOPE OF WORK

Add to list in the 1st paragraph of section 4-1.06B:

3. Material differing from that represented in the Contract which you believe may be hazardous waste;
4. Subsurface or latent physical conditions at the site differing from those described by and shown in information available to bidders prior to submitting bids;

Add to end of section 4-1.06B:

The local public entity will promptly investigate the conditions, and if it finds that the conditions do materially so differ, or do involve hazardous waste, and cause a decrease or increase in your cost of, or the time required for performance of any part of the work will issue a change order under the procedures described in the Contract.

5 CONTROL OF WORK

Replace last paragraph of section 5-1.01 with:

Contract administration forms are available at the State's website for your use.

Before starting Work, you must contact all jurisdictional agencies and determine from each: 1) scope of work to be inspected and by whom, 2) scope of testing, and 3) advance notice required.

During the course of work, you must be responsible for calling for testing and inspection as required by the jurisdictional agencies. Work not properly tested and inspected will be subject to rejection.

If any work that is to be inspected, tested or approved is covered by you without written concurrence of the Engineer, it must, if requested by the Engineer, be uncovered for observation. Uncovering work will be at your expense unless you have given Engineer timely notice of your intention to cover the same and Engineer has not acted with reasonable promptness to such notice.

Any plan or method of work suggested by the Owner or the Engineer to you but not specified or required, if adopted or followed by you in whole or in part, must be used at the risk and responsibility of you. The Owner and the Engineer must assume no responsibility therefor and in no way be held liable for any defects in the work which may result from or be caused by use of such plan or method of work.

Replace the 2nd paragraph of section 5-1.02 with:

If a discrepancy exists:

1. The governing ranking of Contract parts in descending order is:
   - 1.1 Permits form other agencies as may be required by law
   - 1.2 Addendums
   - 1.3 Notice to Bidders and Special Provisions (Technical Provisions supersede Flood Control District Provisions)
   - 1.4 Project plans
   - 1.5 Revised standard specifications
   - 1.6 Standard specifications
   - 1.7 Revised standard plans
   - 1.8 Standard plans
   - 1.9 Supplemental project information
2. Written numbers and notes on a drawing govern over graphics
3. A detail drawing governs over a general drawing
4. A detail specification governs over a general specification
5. A specification in a section governs over a specification referenced by that section

Except, when there is a conflict of working hours the more stringent requirement will apply. Change Orders, Supplemental Agreements, and approved revisions to Plans and Specifications will take precedence over Items 2) through 5) above. Detailed plans will have precedence over general plans.

Add to section 5-1.03

If you and the District are unable to reach agreement on disputed work, the District may order you to proceed with the work, and you may submit a claim.

Although not to be construed as proceeding under extra work provisions, you must proceed as provided in Section 9-1.04, Force Account.

Add to section 5-1.09:

Section 5-1.09 applies if there is a bid item for *Partnering*.

Delete section 5-1.13C.

Delete section 5-1.13D.

Add to section 5-1.16:

You must notify the Owner, in writing, when you desire to change the Project Manager and Superintendent, and must provide in writing the name, qualifications, and experience statements of the personnel you propose to use

Add to section 5-1.17:

You must implement a policy on drugs and alcohol conforming to 49 CFR Part 40.

Add to section 5-1.23A:

Materials must not be furnished or fabricated, nor any work done for which shop drawings or submittals are required, before those shop drawings or submittals have been reviewed, as provided herein. Neither review nor approval of shop drawings or submittals by the Engineer will relieve you from responsibility for errors, omissions, or deviations from the Bid Documents, unless such deviations were specifically called to the attention of the Engineer in the letter of transmittal.

You will be responsible for the correctness of the submittals and shop drawings, including shop fits, field connections, and results obtained by use of such drawings.

You must pay Flood Control for review of any submission that varies from what the plans and specifications have called for, and/or for the review of any submission that is redundant (for example, submitting similar portland cement concrete mix designs from more than one supplier).

Add to list under the 4th paragraph of section 5-1.23A:

4. Federal Project Number, if any.

Add section 5-1.23B(2)(a):

5-1.23B(2)(a) Record Drawings

You must maintain a complete and accurate record of all changes of construction from that shown in these plans and specifications for the purpose of providing a basis for construction record drawings. No changes must be made without prior written approval of the Engineer.

Upon completion of the project, you must deliver a reproducible print record of all of the approved construction changes to the Engineer along with a separate letter certifying that other than the noted changes on this record, the project was constructed in conformance with the Bid Documents. Failure to submit the final record drawing may result in final payment request not being processed.

Add to section 5-1.23C:

Where the manufacturer of any material or equipment provides written recommendations or instructions for its use or method in installation (including labels, tags, manuals, or trade literature), such recommendations or instructions must be complied with except where the contract documents specifically require deviations. Copies of such manufacturer's recommendations must be provided by you to the Engineer.

Replace "3" in the second paragraph of section 5-1.27B with "4"

Replace section 5-1.27C with:

Make your records available for inspection, copying, and auditing by d representatives for the same time frame specified under section 5-1.27B. The records of subcontractors and suppliers must be made available for inspection, copying, and auditing by District representatives for the same period. Before Contract acceptance, the District representative notifies the Contractor, subcontractor(s), or supplier(s) five (5) business days before inspection, copying, or auditing.

If an audit is to start more than 30 days after Contract acceptance, the District representative notifies the Contractor, subcontractor(s), or supplier(s) of the date when the audit is to start.

Replace the 2nd through 4th paragraphs of section 5-1.27E with:

Submit change order bills to Engineer.

Add to section 5-1.30

The Agency will not be precluded or stopped by any measurement, estimate, or certificate made either before or after the completion and acceptance of the work and payment therefor from showing the true quantity and character of the work performed and materials furnished by you, nor from showing that any such measurement, estimate, or certificate is untrue or is incorrectly made, nor that the work or materials do not in fact conform to the contract.

The Agency will not be precluded or estopped, notwithstanding any such measurement, estimate, or certificate and payment in accordance therewith, from recovering from you, your surety, or both, such damages as it may sustain by reason of your failure to comply with the terms of the contract.

The failure of the Engineer to observe or to notify you of deviations from the approved plans and specifications, whether or not such deviations could have been corrected if such notification had been given, will in no way relieve you of any responsibility or liability for your failure to complete, and you will be required to repair and complete the work covered by this contract in exact accordance with the approved plans and specifications and all applicable laws and regulations; and the Agency will not be estopped or be deemed to have waived its right to insist on exact compliance by you with the plans and specifications and other terms of the contract because of such failure to observe or notify you of such defects or because of any progress or final payments made to you pursuant to the terms of this contract or the issuance of any inspection reports or any certificates of partial or final completion.

Neither the acceptance by the Engineer or by his representative nor any payment for or acceptance of the whole or any part of the work, nor any extension of time, nor any possession taken by the Engineer will operate as a waiver of any portion of the contract or of any right to damages.

A waiver of any breach of the contract will not be held to be a waiver of any other or subsequent breach.

Add to section 5-1.32:

Any agreement between you and a third party for use of private property for staging of equipment and storage of materials associated with this project must conform to any and all applicable land use ordinances and laws.

If you use private property for staging and storage of materials associated with this project, you must submit a written agreement from the property owner per Section 5-1.20B(4). Sample property-owner agreements are available on the Caltrans website.

Add to section 5-1.36A:

You must provide the regional notification center "Inquiry Identification" number to the District prior to the commencement of excavation or other work close to any underground facility. You are responsible for keeping the Inquiry Identification number valid throughout the duration of the construction contract.

Replace section 5-1.43 with:

You must follow Pub Cont Code § 9204 to pursue a potential claim.

Add to section 5-1.46

Neither the final certificate of payment nor any provision in the bid documents, nor partial or entire use of the improvements by the owner, will constitute an acceptance of work not done in accordance with the bid documents or relieve you of liability in respect to any express warranties or responsibility for faulty materials or workmanship.

You must attend the Final Job Walkthrough Meeting to be held prior to final payment at a time designated by the Engineer. Your representative must be present at all times during the final job walkthrough.

6 CONTROL OF MATERIALS

Delete the 2nd sentence of the 3rd paragraph of section 6-1.02.

Replace the 2nd paragraph of section 6-1.05 with:

Submit a substitution request no later than the 4th business day following bid opening.

Replace the 7th paragraph of section 6-2.01A with:

For a material specified to comply with a property shown in the following table, the County tests under the corresponding test shown:

Property	Test
Relative compaction	ANSI/ASTM D 1557 or California Tests 2016 or 231
Sand equivalent	California Test 217
Resistance (R-value)	California Test 301
Grading (sieve analysis)	California Test 202
Durability Index	California Test 229
Soil moisture content	ASTM D 3017
In place soil density	ASTM D 2922 or D 1556 or D 2922 or D 2937 or D 3017
Max/min soil index density	ASTM D 4253 and D 4254

Add to section 6-2.03B:

The Engineer will perform compaction tests to ascertain conformance with the specifications. The number of tests and their locations and depths will be determined by the Engineer. You must, as directed by the Engineer, make all excavations and subsequent backfill and compaction, required to perform the compaction tests. No additional compensation will be provided therefor.

You are responsible for any costs for materials testing services if you cancel the request less than 8 hours prior to the scheduled testing.

Replace the 1st paragraph of section 6-2.03C:

No materials must be incorporated into the project without first presenting evidence of testing, and complying with release procedures, or without first submitting a Certificate of Compliance with the delivered materials. The Project Number, Item Number, and Statement of Compliance with the Project Specification must appear on all Certificates of Compliance.

Any attempts to incorporate material without certified release tags, or acceptable Certificates of Compliance, must be just cause for immediate suspension of the construction operation involved. All materials that are untagged or do not have Certificates of Compliance, that are placed or installed in the Project by you or your subcontractor must be considered as placed or installed at your own expense and the District must not be charged therefor.

Materials incorporated into the Project without the required release tags or Certificates of Compliance must be removed, if directed by the Engineer, at no cost to the District.

7 LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

Replace section 7-1.02I(1) with:

7-1.02I(1) Santa Barbara County Code, Chapter 2, Article XIII
Sec. 2-94. - Exceptions.

The provisions of this article shall not apply to contracts or agreements for the acquisition, exchange or disposition of real property or interests therein, nor to contracts or agreements with the State of California, or its political subdivisions, or with the United States of America.

Sec. 2-95. - Prohibition of unlawful discrimination in employment practices.

The County of Santa Barbara reserves the right to terminate forthwith each and every written contract and agreement (except purchase orders) respecting real property, goods and/or services entered into by the County of Santa Barbara including but not limited to concessions, franchises, construction agreements, leases, whether now in effect or hereinafter made if the County finds that the Contractor is discriminating or has discriminated against any person in violation of any applicable state or federal laws, rules or regulations which may now or hereafter specifically prohibit such discrimination on such grounds as race, religion, sex, color, national origin, physical or mental disability, Vietnam era veteran/disabled, age, medical condition, marital status, ancestry, sexual orientation, or other legally protected status. This right of termination extends to contracts entered into by the County of Santa Barbara or by its joint powers, agencies or agents so long as the County obtains the consent of those parties.

Such finding may only be made after Contractor has had a full and fair hearing on notice of thirty days before an impartial hearing officer at which hearing Contractor may introduce evidence, produce witnesses and have the opportunity to cross-examine witnesses produced by the County. Further, any finding of discrimination must be fully supported by the facts developed at such hearing and set forth in a written opinion; and in addition, Contractor may move in the appropriate court of law for damages and/or to compel specific performance of a Contractor or agreement if any of the above procedures are not afforded to the Contractor. If Contractor is not found to have engaged in unlawful discriminatory practices, County shall pay all costs and expenses of such hearing, including reasonable attorneys' fees, to Contractor in accordance with current Santa Barbara County Superior Court schedule of attorneys' fees for civil trials. If Contractor is found to have engaged in such unlawful discriminatory employment practices, Contractor shall pay all such costs, expenses and attorneys' fees.

Whether or not a contract or agreement is still in existence at the time of final determination of such unlawful discrimination, the Contractor shall forthwith reimburse the County for all damages directly stemming from such discrimination; however, those damages shall not exceed and are not reimbursable in an amount which exceeds amounts paid to Contractor under the terms of the contract or agreement.

Nothing in this section 2-95 shall directly or by interpretation give a private cause of action to any third party (not a signatory to the contract or agreement) including employees past or present, or

applicants for employment to Contractor, it being the sole purpose of this clause to administratively assure compliance with the nondiscrimination clauses contained herein.

With respect to employment discrimination, employment practices shall include, but are not limited to, employment, promotion, demotion, transfer, recruitment and advertising for recruitment, layoff or other termination, rate of pay, employee benefits and all other forms of compensation or selection for training and apprenticeship and probationary periods.

Contractor shall permit access at all reasonable times and places to all of its records of employment, advertising, application forms, tests and all other pertinent employment data and records, to the County of Santa Barbara, its officers, employees and agents for the purpose of investigation to ascertain if any unlawful discrimination as described herein has occurred or is being practiced, provided that such records are relevant to a complaint of an unlawful discriminatory practice which has been forwarded to Contractor reasonably prior to the time Contractor is asked to make such records available. In addition, all such records shall be deemed "Confidential" by the officers, employees and agents of the County. No records or copies of such records may be removed from the premises of Contractor, and no disclosure, oral or written, of such record may be made to third parties except as provided within the agreement. Provided, however, that in the event of a hearing to determine whether or not Contractor is engaging in unlawful discrimination in employment practices as defined herein, the Board of Supervisors of Santa Barbara County may issue subpoenas to require that certified copies of such records be made available to the hearing.

Failure to fully comply with any of the foregoing provisions shall be deemed to be a material breach of any contract or agreement with the County of Santa Barbara. All persons contracting with or who have contracts for goods or services with the County shall be notified that this chapter applies to their contract or agreement with the County of Santa Barbara.

Sec. 2-95.5. - Exceptions.

Notwithstanding any other provisions in this article, any party contracting with the County of Santa Barbara having an affirmative action program which has been approved within twelve months from the date of the contract by an agency of the federal government shall be deemed to be in compliance with the provisions of this article upon furnishing documentary evidence of such approval satisfactory to the County Affirmative Action Officer. Loss of such approval shall be immediately reported by such party to the County Affirmative Action Officer.

Sec. 2-96. - Purchase orders.

Purchase orders shall contain the following clause as grounds for termination of such purchase order.

"If complaint is made that seller is engaging in discriminatory employment practices made unlawful by applicable state and federal laws, rules or regulations, and the State Fair Employment Practice Commission or the Federal Equal Employment Opportunities Commission determines that such unlawful discrimination exists, then the County of Santa Barbara may forthwith terminate this order."

Sec. 2-97. - Affirmative Action Officer.

At the discretion of the County Affirmative Action Officer, he or she shall promptly and thoroughly investigate, or cause to be investigated reports and complaints from whatever source, that any party contracting with the County of Santa Barbara is engaging, or during the term of a contract or agreement with the County of Santa Barbara has engaged, in any unlawful discriminatory employment practices as described in section 2-95 of this Code. If the investigation discloses reason to believe such unlawful discrimination does exist or has existed and the conditions giving rise thereto have not been changed so as to prevent further such unlawful discrimination, and the said party shall not forthwith terminate such unlawful discrimination, take all appropriate steps to prevent a recurrence of such or other unlawful practices, and compensate the person or persons unlawfully discriminated against for any and all loss incurred by reason of such unlawful discrimination, all to the satisfaction of the Affirmative Action Officer, then the Affirmative Action Officer shall cause the matter to be presented for action to the State Fair Employment Practices Commission or the Federal Equal Employment Opportunities Commission, or both, and to any other concerned state or federal agencies or officers.

If and when it has been finally determined by the Affirmative Action Officer, County Counsel,

or state or federal regulatory agencies that such unlawful discriminatory employment practice has in fact so occurred or are being carried on, then the Affirmative Action Officer shall forthwith present the entire matter to the Board of Supervisors of the County, together with all damages, costs and expenses related thereto and incurred by County, for appropriate action by the Board of Supervisors in accord with the intent and purposes of this article and of the affirmative action program of the County of Santa Barbara.

Sec. 2-98. - Youth group anti-discrimination.

(a) Neither the County of Santa Barbara, nor any of its agencies, departments, affiliates, or political subdivisions over which it exercises jurisdiction, shall:
    (1) Deny any youth group equal access to, or fair opportunity to conduct meetings or other events at, or otherwise utilize any public facility;
    (2) Deny any youth group use permits or licenses regarding, or otherwise withhold from any youth group permission to use, any public facility; or
    (3) Otherwise discriminate against any youth group; on the basis of the membership or leadership criteria of such youth group.
(b) For purposes of this section, a public facility shall include any public forum, limited public forum, public property, or public area including any public building, park, beach, campground, or any other area controlled or operated by the County of Santa Barbara.
(c) For purposes of this section, a youth group means any group or organization intended to serve young people under the age of twenty-one.

Add to section 7-1.02K(1):

7-1.02K(1)(a) Joint Labor Compliance Monitoring Program

The Joint Labor Compliance Monitoring Program monitors labor compliance by conducting interviews with construction workers at the job site. You, and all subcontractors, must cooperate in allowing approved Compliance Group Representatives along with a County employee access to the project employees and work site for the purpose of conducting worker interview to ensure compliance with the requirement to pay prevailing wages on County projects. This will be done in order to comply with the Board of Supervisors July 10, 2012 adoption of a Joint Labor Compliance Monitoring Program.

Each Compliance Group Representative will always be accompanied with a County employee for a joint contractor worker interview. The Compliance Group Representative will be issued an identification card by the County at the job site. Compliance Group Representatives must restrict their actions to interviewing workers employed on the project. A copy of the Joint Labor Compliance Monitoring Program and Board Letter adoption from July 10, 2012 is available on request.

7-1.02K(1)(b) Compliance Monitoring by the Department of Industrial Relations

This project is subject to compliance monitoring and enforcement by the Department of Industrial Relations (Labor Code § 1771.4).

Replace the 2nd paragraph of section 7-1.02K(2) with:

The general prevailing wage rates and any applicable changes to these wage rates are available on the California Department of Industrial Relations website.

Replace the 6th through 10th paragraphs of section 7-1.02K(3) with:

Submit certified payroll by mail to the Department.

Each submission must:

1. Include a signed Statement of Compliance form with each weekly record.
2. Be received by the Department by close of business on the 15th day of the month for the prior month's work.

Add to section 7-1.02K(5):

Working hours on working days will be between the hours of 7:00 a.m. and 5:00 p.m. No work will be done or noise generated outside these hours except such work as is necessary for the proper care and protection of the work already performed or in case of an emergency.

If the Contractor desires to work during periods other than above, the Contractor must make a request to the Engineer three (3) working days in advance. If District inspection forces are reasonably available, the Engineer

may authorize the Contractor to perform work during periods other than normal working hours/days. However, if District inspectors are required to perform in excess of their normal working hours/days solely for the benefit of the Contractor, the actual cost of inspection at overtime rates will be charged to the Contractor as actual costs deducted from your payment. If certain operations require extended or non-standard working hours, those operations and hours will be specified in the 'Technical Provisions' of the Contract.

Add to section 7-1.02K(6)(a):

Your Injury and Illness Prevention Program must include:

1. Safety manual
2. Jobsite checklist
3. Equipment safety checklist
4. Tailgate safety meetings
5. Permit application and job notification form (Construction, Demolition, Trenches, Excavation, Building, Structures, Falsework, Scaffolding) Form Cal/OSHA S-691, latest edition

Add to section 7-1.02K(6)(b):

You must obtain a State Division of Industrial Safety Permit for excavations and trenches prior to commencement of any excavation or trench of 5 feet or more in depth per California Code of Regulations, Title 8, Division 1, Chapter 3.2, Subchapter 2, Article 2, Section 341 and Title 8, Division 1, Chapter 4, Subchapter 4 of the California Occupational Safety and Health Regulations (Cal/OSHA). A copy of the permit must be submitted to the Engineer. All excavations must be completed and maintained in a safe and stable condition throughout the total construction phase in order to protect persons, property, trees and improvements. Structure and trench excavations must be completed to the specified elevations and to the length and width required to safely install, adjust, and remove any forms, bracing, or supports necessary for the installation of the work and/or protection of existing features. Excavations outside of the lines and limits shown on the drawings or specified herein required to meet safety requirements must be your responsibility in constructing and maintaining a safe and stable excavation.

Replace section 7-1.02M(4) Reserved with:

7-1.02M(4) American Medical Response, Santa Barbara County

For all temporary road closure activities, contact the nearest emergency medical response company for the area, American Medical Response, and provide the project location(s) and road closure schedule. Please see contact information below:

American Medical Response, Santa Barbara County Contact Information

	Name	Phone	Email
AMR Main Office	Santa Barbara County	(805) 688-6550	amr.santa.barbara@amr.net

Replace section 7-1.02M(5) Reserved with:

7-1.02M(5) Sheriff, Santa Barbara County

For all temporary road closure activities, contact the County of Santa Barbara Sheriff's office at dispatchstaff@sbsheriff.org and the City of Santa Barbara Police Department at dispatchers@sbpd.com and provide the project location(s) and road closure schedule.

Replace section 7-1.02P with:

7-1.02P County Ordinance

7-1.02P(1) General

Comply with County Ordinances.

County Ordinances are available at the County Municipal Code website and at County offices located at 123 East Anapamu Street, Santa Barbara, CA 93101.

Any references in State Standard Specifications to statutory provisions applicable only to state contracts or which are inconsistent with statutory provisions applicable to County or local agency contracts, will not prevail over, and will be superseded by, any statutory provisions applicable to County or local agency contracts.

7-1.02P(2) Grading

Comply with section 13, 17, and 19.

Santa Barbara County Ordinance No. 4766 and Ordinance No. 691 prohibits the dumping of debris or other materials in a watercourse so as to obstruct or impede normal flow of water therein.

7-1.02P(3) Preservation of Monuments

Comply with Ordinance 1491, Sec. 28-49.

Delete last sentence of Section 7-1.03 paragraph 15

Delete last sentence of Section 7-1.04 paragraph 7

Add to section 7-1.05:

7-1.05 INDEMNIFICATION

7-1.05A General

You must indemnify, defend (with counsel reasonably approved by County and District) and hold harmless County and District and its officers, officials, employees, agents and volunteers from and against any and all claims, actions, losses, damages, judgments and/or liabilities arising out of this Agreement from any cause whatsoever, including the acts, errors or omissions of any person or entity and for any costs or expenses (including but not limited to attorneys' fees) incurred by County and District on account of any claim except where such indemnification is caused by the active negligence, sole negligence, or willful misconduct of the County and District.

7-1.05B Notification of Accidents and Survival of Indemnification Provisions

You must notify County and District immediately in the event of any accident or injury arising out of or in connection with this Agreement. The indemnification provisions must survive any expiration or termination of this Agreement.

7-1.05C Responsibility to Other Entities

You are responsible for any liability imposed by law and for injuries to or death of any person, including workers and the public, or damage to property. Indemnify and save harmless any county, city or district and its officers and employees connected with the work, within the limits of which county, city, or district the work is being performed, all in the same manner and to the same extent specified for the protection of the County and District.

Replace section 7-1.06 with:

7-1.06 INSURANCE

7-1.06A General

You must procure and maintain for the duration of this Agreement insurance against claims for injuries to persons or damages to property which may arise from or in connection with the performance of the work hereunder and the results of your work, your agents, representatives, employees or subcontractors.

7-1.06B Minimum Scope and Limit of Insurance

Coverage shall be at least as broad as:

1. **Commercial General Liability (CGL):** Insurance Services Office (ISO) Form CG 00 01 covering CGL on an "occurrence" basis, including products-completed operations, personal & advertising injury, with limits no less than $2,000,000 per occurrence and $4,000,000 in the aggregate.
2. **Automobile Liability:** ISO Form Number CA 00 01 covering any auto (Code 1), with limit no less than $2,000,000 per accident for bodily injury and property damage.
3. **Workers' Compensation:** as required by the State of California, with Statutory Limits, and Employer's Liability Insurance with limit of no less than $1,000,000 per accident for bodily injury or disease.
5. **Builder's Risk (Course of Construction):** insurance utilizing an "all Risk" (aka "Special" policy form) coverage form, with limits equal to the completed value of the project and no coinsurance penalty provisions. The policy must include the perils of earthquake and flood and "certified acts of terrorism" with a minimum policy limit equal to the completed value of the project, with maximum deductible of $25,000. Coverage must also include soft costs, building ordinance or law, off site materials storage, property in transit, loss of materials and equipment at the job site and boiler and machinery if applicable.
6. **Umbrella Liability Insurance:** An umbrella (over primary) or excess policy may be used to comply with limits or other primary coverage requirements. When used, the umbrella policy shall follow form or be at least as

broad as the primary coverage. The coverage shall also apply to automobile liability.

If you maintain higher limits than the minimums shown above, the County and the District require and shall be entitled to coverage for the higher limits you maintain. Any available insurance proceeds in excess of the specified minimum limits of insurance and coverage shall be available to the County and the District.

7-1.06C Other Insurance Provisions
The insurance policies must contain, or be endorsed to contain, the following provisions:

1. **Additional Insured** – County, its officers, officials, employees, agents and volunteers are to be covered as additional insureds on the CGL policy with respect to liability arising out of work or operations performed by you or on your behalf including materials, parts, or equipment furnished in connection with such work or operations. General liability coverage can be provided in the form of an endorsement to your insurance at least as broad as ISO Form CG 20 10 11 85 or both CG 20 10, CG 20 26, CG 20 33, or CG 20 38; and CG 20 37 forms if later revisions used).
2. **Primary Coverage** – For any claims related to this Agreement, your insurance coverage shall be primary insurance at least as broad as ISO CG 20 01 04 13 as respects the County, its officers, officials, employees, agents and volunteers. Any insurance or self-insurance maintained by the County, its officers, officials, employees, agents or volunteers shall be excess of the CONTRACTOR's your insurance and shall not contribute with it.
3. **Notice of Cancellation** – Each insurance policy required above shall provide that coverage shall not be canceled, except with notice to the County.
4. **Waiver of Subrogation Rights** –**You agree to waive rights of subrogation which any of your insurer may acquire** from you by virtue of the payment of any loss. You agree to obtain any endorsement that may be necessary to effect this waiver of subrogation. **The Workers' Compensation policy shall be endorsed with a waiver of subrogation** in favor of the County for all work performed by you, your employees, agents and subcontractors. This provision applies regardless of whether or not the County has received a waiver of subrogation endorsement from the insurer.
5. **Deductibles and Self-Insured Retention** – Any deductibles or self-insured retentions must be declared to and approved by the County. At County's option, either: cause the insurer shall reduce or eliminate such deductibles or self-insured retentions as respects the County, its officers, officials, employees, agents and volunteers; or provide a financial guarantee satisfactory to the County guaranteeing payment of losses and related investigations, claim administration, and defense expenses.
6. **Acceptability of Insurers** – Unless otherwise approved by Risk Management, insurance shall be written by insurers authorized to do business in the State of California and with a minimum A.M. Best's Insurance Guide rating of "A- VII".
7. **Verification of Coverage** –You must furnish proof of insurance, original certificates and amendatory endorsements as required by this Agreement. The proof of insurance, certificates and endorsements must be received and approved by the County before work commences. However, failure to obtain the required documents prior to the work beginning shall not waive your obligation to provide them. You must furnish evidence of renewal of coverage throughout the term of the Agreement. The County reserves the right to require complete, certified copies of all required insurance policies, including endorsements required by these specifications, at any time.
8. **Failure to Procure Coverage** – In the event that any policy of insurance required under this Agreement does not comply with the requirements, is not procured, or is canceled and not replaced, County has the right but not the obligation or duty to terminate the Agreement. Maintenance of required insurance coverage is a material element of the Agreement and failure to maintain or renew such coverage or to provide evidence of renewal may be treated by County as a material breach of contract.
9. **Subcontractors** –You must require and verify that all subcontractors maintain insurance meeting all the requirements stated herein, and you must ensure that County is an additional insured on insurance required from subcontractors. For CGL coverage subcontractors shall provide coverage with a format least as broad as CG 20 38 04 13.
10. **Claims Made Policies** – If any of the required policies provide coverage on a claims-made basis:
    i. The Retroactive Date must be shown and must be before the date of the contract or the beginning of contract work.
    ii. Insurance must be maintained and evidence of insurance must be provided for at least five (5) years after completion of contract work.
    iii. If coverage is canceled or non-renewed, and not replaced with another claims-made policy form with a Retroactive Date prior to the contract effective date, you must purchase "extended reporting" coverage for a minimum of five (5) years after completion of contract work.
11. **Special Risks or Circumstances** – County reserves the right to modify these requirements, including limits, based on the nature of the risk, prior experience, insurer, coverage, or other circumstances.

Any change requiring additional types of insurance coverage or higher coverage limits must be made by amendment to this Agreement. You agree to execute any such amendment within thirty (30) days of receipt.

Any failure, actual or alleged, on the part of County to monitor or enforce compliance with any of the insurance and indemnification requirements will not be deemed as a waiver of any rights on the part of County.

7-1.06D Enforcement
The Department may assure your compliance with your insurance obligations. Ten days before an insurance policy lapses or is canceled during the Contract period you must submit to the Department evidence of renewal or replacement of the policy.

If you fail to maintain any required insurance coverage, the Department may maintain this coverage and withhold or charge the expense to you or terminate your control of the work.

You are not relieved of your duties and responsibilities to indemnify, defend, and hold harmless the County, its officers, agents, and employees by the Department's acceptance of insurance policies and certificates.

The minimum insurance coverage amounts do not relieve you for liability in excess of such coverage, nor do they preclude the County from taking other actions available to it, including the withholding of funds under this Contract.

7-1.06E Self-Insurance
Self-insurance programs and self-insured retentions in insurance policies are subject to separate annual review and approval by the County.

If you use a self-insurance program or self-insured retention, you must provide the County with the same protection from liability and defense of suits as would be afforded by first-dollar insurance. Execution of the Contract is your acknowledgment that you will be bound by all laws as if you were an insurer as defined under Ins Code § 23 and that the self-insurance program or self-insured retention shall operate as insurance as defined under Ins Code § 22.

Replace section 7-1.09 Reserved with:

7-1.09 Cargo Preference Act
Use of United States –flag vessels: The contractor agrees –

1. To utilize privately owned United State-flag commercial vessels to ship at least 50 percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners, and tankers) involved, whenever shipping any equipment, material, or commodities pursuant to this contract, to the extent such vessels are available at fair and reasonable rates for Unites States-flag commercial vessels.
2. To furnish within 20 days following the date of loading for shipments originating within the United States or within 30 working days following the date of loading for shipments originating outside the United States, a legible copy of a rated, 'on-board' commercial ocean bill-of-lading in English for each shipment of cargo described in paragraph (1) of this section to both the Contracting Officer (through the prime contractor in the case of subcontractor bills-of lading) and to the Division of National Cargo, Office of Market Development, Maritime Administration, Washington, DC 20590.
3. To insert the substance of the provisions of this clause in all subcontracts issued pursuant to this contract.

Replace section 7-1.11B with:

FHWA-1273 – Revised May 1, 2012

REQUIRED CONTRACT PROVISIONS
FEDERAL-AID CONSTRUCTION CONTRACTS

I. General
II. Nondiscrimination
III. Nonsegregated Facilities
IV. Davis-Bacon and Related Act Provisions
V. Contract Work Hours and Safety Standards Act Provisions
VI. Subletting or Assigning the Contract
VII. Safety: Accident Prevention
VIII. False Statements Concerning Highway Projects
IX. Implementation of Clean Air Act and Federal Water Pollution Control Act
X. Compliance with Governmentwide Suspension and Debarment Requirements
XI. Certification Regarding Use of Contract Funds for Lobbying

ATTACHMENTS

A. Employment and Materials Preference for Appalachian Development Highway System or Appalachian Local Access Road

Contracts (included in Appalachian contracts only)

I. GENERAL

1. Form FHWA-1273 must be physically incorporated in each construction contract funded under Title 23 (excluding emergency contracts solely intended for debris removal). The contractor (or subcontractor) must insert this form in each subcontract and further require its inclusion in all lower tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services).

The applicable requirements of Form FHWA-1273 are incorporated by reference for work done under any purchase order, rental agreement or agreement for other services. The prime contractor shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Form FHWA-1273 must be included in all Federal-aid design-build contracts, in all subcontracts and in lower tier subcontracts (excluding subcontracts for design services, purchase orders, rental agreements and other agreements for supplies or services). The design-builder shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Contracting agencies may reference Form FHWA-1273 in bid proposal or request for proposal documents, however, the Form FHWA-1273 must be physically incorporated (not referenced) in all contracts, subcontracts and lower-tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services related to a construction contract).

2. Subject to the applicability criteria noted in the following sections, these contract provisions shall apply to all work performed on the contract by the contractor's own organization and with the assistance of workers under the contractor's immediate superintendence and to all work performed on the contract by piecework, station work, or by subcontract.

3. A breach of any of the stipulations contained in these Required Contract Provisions may be sufficient grounds for withholding of progress payments, withholding of final payment, termination of the contract, suspension / debarment or any other action determined to be appropriate by the contracting agency and FHWA.

4. Selection of Labor: During the performance of this contract, the contractor shall not use convict labor for any purpose within the limits of a construction project on a Federal-aid highway unless it is labor performed by convicts who are on parole, supervised release, or probation. The term Federal-aid highway does not include roadways functionally classified as local roads or rural minor collectors.

II. NONDISCRIMINATION

The provisions of this section related to 23 CFR Part 230 are applicable to all Federal-aid construction contracts and to all related construction subcontracts of $10,000 or more. The provisions of 23 CFR Part 230 are not applicable to material supply, engineering, or architectural service contracts.

In addition, the contractor and all subcontractors must comply with the following policies: Executive Order 11246, 41 CFR 60, 29 CFR 1625-1627, Title 23 U.S.C. Section 140, the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), Title VI of the Civil Rights Act of 1964, as amended, and related regulations including 49 CFR Parts 21, 26 and 27; and 23 CFR Parts 200, 230, and 633.

The contractor and all subcontractors must comply with: the requirements of the Equal Opportunity Clause in 41 CFR 60-1.4(b) and, for all construction contracts exceeding $10,000, the Standard Federal Equal Employment Opportunity Construction Contract Specifications in 41 CFR 60-4.3.

Note: The U.S. Department of Labor has exclusive authority to determine compliance with Executive Order 11246 and the policies of the Secretary of Labor including 41 CFR 60, and 29 CFR 1625-1627. The contracting agency and the FHWA have the authority and the responsibility to ensure compliance with Title 23 U.S.C. Section 140, the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and Title VI of the Civil Rights Act of 1964, as amended, and related regulations including 49 CFR Parts 21, 26 and 27; and 23 CFR Parts 200, 230, and 633.

The following provision is adopted from 23 CFR 230, Appendix A, with appropriate revisions to conform to the U.S. Department of Labor (US DOL) and FHWA requirements.

1. Equal Employment Opportunity: Equal Employment Opportunity (EEO) requirements not to discriminate and to take affirmative action to assure equal opportunity as set forth under laws, executive orders, rules, regulations (28 CFR 35, 29 CFR 1630, 29 CFR 1625-1627, 41 CFR 60 and 49 CFR 27) and orders of the Secretary of Labor as modified by the provisions prescribed herein, and imposed pursuant to 23 U.S.C. 140 shall constitute the EEO and specific affirmative action standards for the contractor's project activities under this contract. The provisions of the Americans with Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) set forth under 28 CFR 35 and 29 CFR 1630 are incorporated by reference in this contract. In the execution of this contract, the contractor agrees to comply with the following minimum specific requirement activities of EEO:

a. The contractor will work with the contracting agency and the Federal Government to ensure that it has made every good faith effort to provide equal opportunity with respect to all of its terms and conditions of employment and in their review of activities under the contract.

b. The contractor will accept as its operating policy the following statement:

> 'It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, color, national origin, age or disability. Such action shall include: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship, pre-apprenticeship, and/or on-the-job training.'

2. EEO Officer: The contractor will designate and make known to the contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active EEO program and who must be assigned adequate authority and responsibility to do so.

3. Dissemination of Policy: All members of the contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action, or who are substantially involved in such action, will be made fully cognizant of, and will implement, the contractor's EEO policy and contractual responsibilities to provide EEO in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:

a. Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every six months, at which time the contractor's EEO policy and its implementation will be reviewed and explained. The meetings will be conducted by the EEO Officer.

b. All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, covering all major aspects of the contractor's EEO obligations within thirty days following their reporting for duty with the contractor.

c. All personnel who are engaged in direct recruitment for the project will be instructed by the EEO Officer in the contractor's procedures for locating and hiring minorities and women.

d. Notices and posters setting forth the contractor's EEO policy will be placed in areas readily accessible to employees, applicants for employment and potential employees.

e. The contractor's EEO policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

4. Recruitment: When advertising for employees, the contractor will include in all advertisements for employees the notation: 'An Equal Opportunity Employer.' All such advertisements will be placed in publications having a large circulation among minorities and women in the area from which the project work force would normally be derived.

a. The contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minorities and women. To meet this requirement, the contractor will identify sources of potential minority group employees, and establish with such identified sources procedures whereby minority and women applicants may be referred to the contractor for employment consideration.

b. In the event the contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, the contractor is expected to observe the provisions of that agreement to the extent that the system meets the contractor's compliance with EEO contract provisions. Where implementation of such an agreement has the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Federal nondiscrimination provisions.

c. The contractor will encourage its present employees to refer minorities and women as applicants for employment. Information and procedures with regard to referring such applicants will be discussed with employees.

5. Personnel Actions: Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to race, color, religion, sex, national origin, age or disability. The following procedures shall be followed:

a. The contractor will conduct periodic inspections of project sites to insure that working conditions and employee facilities do not indicate discriminatory treatment of project site personnel.

b. The contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.

c. The contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor will promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.

d. The contractor will promptly investigate all complaints of alleged discrimination made to the contractor in connection with its obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the contractor will inform every complainant of all of their avenues of appeal.

6. Training and Promotion:

a. The contractor will assist in locating, qualifying, and increasing the skills of minorities and women who are applicants for employment or current employees. Such efforts should be aimed at developing full journey level status employees in the type of trade or job classification involved.

b. Consistent with the contractor's work force requirements and as permissible under Federal and State regulations, the contractor shall make full use of training programs, i.e., apprenticeship, and on-the-job training programs for the geographical area of contract performance. In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision. The contracting agency may reserve training positions for persons who receive welfare assistance in accordance with 23 U.S.C. 140(a).

c. The contractor will advise employees and applicants for employment of available training programs and entrance requirements for each.

d. The contractor will periodically review the training and promotion potential of employees who are minorities and women and will encourage eligible employees to apply for such training and promotion.

7. Unions: If the contractor relies in whole or in part upon unions as a source of employees, the contractor will use good faith efforts to obtain the cooperation of such unions to increase opportunities for minorities and women. Actions by the contractor, either directly or through a contractor's association acting as agent, will include the procedures set forth below:

a. The contractor will use good faith efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minorities and women for membership in the unions and increasing the skills of minorities and women so that they may qualify for higher paying employment.

b. The contractor will use good faith efforts to incorporate an EEO clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their race, color, religion, sex, national origin, age or disability.

c. The contractor is to obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to furnish such information to the contractor, the contractor shall so certify to the contracting agency and shall set forth what efforts have been made to obtain such information.

d. In the event the union is unable to provide the contractor with a reasonable flow of referrals within the time limit set forth in the collective bargaining agreement, the contractor will, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, sex, national origin, age or disability; making full efforts to obtain qualified and/or qualifiable minorities and women. The failure of a union to provide sufficient referrals (even though it is obligated to provide exclusive referrals under the terms of a collective bargaining agreement) does not relieve the contractor from the requirements of this paragraph. In the event the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such contractor shall immediately notify the contracting agency.

8. Reasonable Accommodation for Applicants / Employees with Disabilities: The contractor must be familiar with the requirements for and comply with the Americans with Disabilities Act and all rules and regulations established there under. Employers must provide reasonable accommodation in all employment activities unless to do so would cause an undue hardship.

9. Selection of Subcontractors, Procurement of Materials and Leasing of Equipment: The contractor shall not discriminate on the grounds of race, color, religion, sex, national origin, age or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment. The contractor shall take all necessary and reasonable steps to ensure nondiscrimination in the administration of this contract.

a. The contractor shall notify all potential subcontractors and suppliers and lessors of their EEO obligations under this contract.

b. The contractor will use good faith efforts to ensure subcontractor compliance with their EEO obligations.

10. Assurance Required by 49 CFR 26.13(b):

a. The requirements of 49 CFR Part 26 and the State DOT's U.S. DOT-approved DBE program are incorporated by reference.

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

11. Records and Reports: The contractor shall keep such records as necessary to document compliance with the EEO requirements. Such records shall be retained for a period of three years following the date of the final payment to the contractor for all contract work and shall be available at reasonable times and places for inspection by authorized representatives of the contracting agency and the FHWA.

a. The records kept by the contractor shall document the following:

(1) The number and work hours of minority and non-minority group members and women employed in each work classification on the project;

(2) The progress and efforts being made in cooperation with unions, when applicable, to increase employment opportunities for minorities and women; and

(3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minorities and women;

b. The contractors and subcontractors will submit an annual report to the contracting agency each July for the duration of the project, indicating the number of minority, women, and non-minority group employees currently engaged in each work classification required by the contract work. This information is to be reported on Form FHWA-1391. The staffing data should represent the project work force on board in all or any part of the last payroll period preceding the end of July. If on-the-job training is being required by special provision, the contractor will be required to collect and report training data. The employment data should reflect the work force on board during all or any part of the last payroll period preceding the end of July.

III. NONSEGREGATED FACILITIES

This provision is applicable to all Federal-aid construction contracts and to all related construction subcontracts of $10,000 or more.

The contractor must ensure that facilities provided for employees are provided in such a manner that segregation on the basis of race, color, religion, sex, or national origin cannot result. The contractor may neither require such segregated use by written or oral policies nor tolerate such use by employee custom. The contractor's obligation extends further to ensure that its employees are not assigned to perform their services at any location, under the contractor's control, where the facilities are segregated. The term 'facilities' includes waiting rooms, work areas, restaurants and other eating areas, time clocks, restrooms, washrooms, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing provided for employees. The contractor shall provide separate or single-user restrooms and necessary dressing or sleeping areas to assure privacy between sexes.

IV. DAVIS-BACON AND RELATED ACT PROVISIONS

This section is applicable to all Federal-aid construction projects exceeding $2,000 and to all related subcontracts and lower-tier subcontracts (regardless of subcontract size). The requirements apply to all projects located within the right-of-way of a roadway that is functionally classified as Federal-aid highway. This excludes roadways functionally classified as local roads or rural minor collectors, which are exempt. Contracting agencies may elect to apply these requirements to other projects.

The following provisions are from the U.S. Department of Labor regulations in 29 CFR 5.5 'Contract provisions and related matters' with minor revisions to conform to the FHWA-1273 format and FHWA program requirements.

1. Minimum wages

a. All laborers and mechanics employed or working upon the site of the work, will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph 1.d. of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph 1.b. of this section) and the Davis-Bacon poster (WH–1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

b. (1) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(ii) The classification is utilized in the area by the construction industry; and

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every

additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(3) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Wage and Hour Administrator for determination. The Wage and Hour Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(4) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs 1.b.(2) or 1.b.(3) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

c. Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

d. If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

2. Withholding

The contracting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract, or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the contracting agency may, after written notice to the contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

3. Payrolls and basic records

a. Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

b. (1) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the contracting agency. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g. the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH–347 is available for this purpose from the Wage and Hour Division Web site at http://www.dol.gov/esa/whd/forms/wh347instr.htm or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the contracting agency for transmission to the State DOT, the FHWA or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the contracting agency..

(2) Each payroll submitted shall be accompanied by a 'Statement of Compliance,' signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(i) That the payroll for the payroll period contains the information required to be provided under §5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under §5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(ii) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(3) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH–347 shall satisfy the requirement for submission of the 'Statement of Compliance' required by paragraph 3.b.(2) of this section.

(4) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

c. The contractor or subcontractor shall make the records required under paragraph 3.a. of this section available for inspection, copying, or transcription by authorized representatives of the contracting agency, the State DOT, the FHWA, or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the FHWA may, after written notice to the

contractor, the contracting agency or the State DOT, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

4. Apprentices and trainees

a. Apprentices (programs of the USDOL).

Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice.

The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed.

Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination.

In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

b. Trainees (programs of the USDOL).

Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration.

The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration.

Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed.

In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

c. Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

d. Apprentices and Trainees (programs of the U.S. DOT).

Apprentices and trainees working under apprenticeship and skill training programs which have been certified by the Secretary of Transportation as promoting EEO in connection with Federal-aid highway construction programs are not subject to the requirements of paragraph 4 of this Section IV. The straight time hourly wage rates for apprentices and trainees under such programs will be established by the particular programs. The ratio of apprentices and trainees to journeymen shall not be greater than permitted by the terms of the particular program.

5. Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

6. Subcontracts. The contractor or subcontractor shall insert Form FHWA-1273 in any subcontracts and also require the subcontractors to include Form FHWA-1273 in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

7. Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

8. Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

9. Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

10. Certification of eligibility.

a. By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon

Act or 29 CFR 5.12(a)(1).

b. No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

c. The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

V. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

The following clauses apply to any Federal-aid construction contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by 29 CFR 5.5(a) or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

1. Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

2. Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (1.) of this section, the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1.) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (1.) of this section.

3. Withholding for unpaid wages and liquidated damages. The FHWA or the contacting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2.) of this section.

4. Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (1.) through (4.) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1.) through (4.) of this section.

VI. SUBLETTING OR ASSIGNING THE CONTRACT

This provision is applicable to all Federal-aid construction contracts on the National Highway System.

1. The contractor shall perform with its own organization contract work amounting to not less than 30 percent (or a greater percentage if specified elsewhere in the contract) of the total original contract price, excluding any specialty items designated by the contracting agency. Specialty items may be performed by subcontract and the amount of any such specialty items performed may be deducted from the total original contract price before computing the amount of work required to be performed by the contractor's own organization (23 CFR 635.116).

a. The term 'perform work with its own organization' refers to workers employed or leased by the prime contractor, and equipment owned or rented by the prime contractor, with or without operators. Such term does not include employees or equipment of a subcontractor or lower tier subcontractor, agents of the prime contractor, or any other assignees. The term may include payments for the costs of hiring leased employees from an employee leasing firm meeting all relevant Federal and State regulatory requirements. Leased employees may only be included in this term if the prime contractor meets all of the following conditions:

(1) the prime contractor maintains control over the supervision of the day-to-day activities of the leased employees;
(2) the prime contractor remains responsible for the quality of the work of the leased employees;
(3) the prime contractor retains all power to accept or exclude individual employees from work on the project; and
(4) the prime contractor remains ultimately responsible for the payment of predetermined minimum wages, the submission of payrolls, statements of compliance and all other Federal regulatory requirements.

b. 'Specialty Items' shall be construed to be limited to work that requires highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organizations qualified and expected to bid or propose on the contract as a whole and in general are to be limited to minor components of the overall contract.

2. The contract amount upon which the requirements set forth in paragraph (1) of Section VI is computed includes the cost of material and manufactured products which are to be purchased or produced by the contractor under the contract provisions.

3. The contractor shall furnish (a) a competent superintendent or supervisor who is employed by the firm, has full authority to direct performance of the work in accordance with the contract requirements, and is in charge of all construction operations (regardless of who performs the work) and (b) such other of its own organizational resources (supervision, management, and engineering services) as the contracting officer determines is necessary to assure the performance of the contract.

4. No portion of the contract shall be sublet, assigned or otherwise disposed of except with the written consent of the contracting officer, or authorized representative, and such consent when given shall not be construed to relieve the contractor of any responsibility for the fulfillment of the contract. Written consent will be given only after the contracting agency has assured that each subcontract is evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract.

5. The 30% self-performance requirement of paragraph (1) is not applicable to design-build contracts; however, contracting agencies may establish their own self-performance requirements.

VII. SAFETY: ACCIDENT PREVENTION

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

1. In the performance of this contract the contractor shall comply with all applicable Federal, State, and local laws governing safety, health, and sanitation (23 CFR 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the contracting officer may determine, to be reasonably necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of the work covered by the contract.

2. It is a condition of this contract, and shall be made a condition of each subcontract, which the contractor enters into pursuant to this

contract, that the contractor and any subcontractor shall not permit any employee, in performance of the contract, to work in surroundings or under conditions which are unsanitary, hazardous or dangerous to his/her health or safety, as determined under construction safety and health standards (29 CFR 1926) promulgated by the Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704).

3. Pursuant to 29 CFR 1926.3, it is a condition of this contract that the Secretary of Labor or authorized representative thereof, shall have right of entry to any site of contract performance to inspect or investigate the matter of compliance with the construction safety and health standards and to carry out the duties of the Secretary under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C.3704).

VIII. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, Form FHWA-1022 shall be posted on each Federal-aid highway project (23 CFR 635) in one or more places where it is readily available to all persons concerned with the project:

18 U.S.C. 1020 reads as follows:

'Whoever, being an officer, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 1, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined under this title or imprisoned not more than 5 years or both.'

IX. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

By submission of this bid/proposal or the execution of this contract, or subcontract, as appropriate, the bidder, proposer, Federal-aid construction contractor, or subcontractor, as appropriate, will be deemed to have stipulated as follows:

1. That any person who is or will be utilized in the performance of this contract is not prohibited from receiving an award due to a violation of Section 508 of the Clean Water Act or Section 306 of the Clean Air Act.
2. That the contractor agrees to include or cause to be included the requirements of paragraph (1) of this Section X in every subcontract, and further agrees to take such action as the contracting agency may direct as a means of enforcing such requirements.

X. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, consultant contracts or any other covered transaction requiring FHWA approval or that is estimated to cost $25,000 or more – as defined in 2 CFR Parts 180 and 1200.

1. Instructions for Certification – First Tier Participants:

a. By signing and submitting this proposal, the prospective first tier participant is providing the certification set out below.

b. The inability of a person to provide the certification set out below will not necessarily result in denial of participation in this covered transaction. The prospective first tier participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective first tier participant to furnish a certification or an explanation shall disqualify such a person from participation in this transaction.

c. The certification in this clause is a material representation of fact upon which reliance was placed when the contracting agency determined to enter into this transaction. If it is later determined that the prospective participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the contracting agency may terminate this transaction for cause of default.

d. The prospective first tier participant shall provide immediate written notice to the contracting agency to whom this proposal is submitted if any time the prospective first tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

e. The terms 'covered transaction,' 'debarred,' 'suspended,' 'ineligible,' 'participant,' 'person,' 'principal,' and 'voluntarily excluded,' as used in this clause, are defined in 2 CFR Parts 180 and 1200. 'First Tier Covered Transactions' refers to any covered transaction between a grantee or subgrantee of Federal funds and a participant (such as the prime or general contract). 'Lower Tier Covered Transactions' refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). 'First Tier Participant' refers to the participant who has entered into a covered transaction with a grantee or subgrantee of Federal funds (such as the prime or general contractor). 'Lower Tier Participant' refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

f. The prospective first tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction.

g. The prospective first tier participant further agrees by submitting this proposal that it will include the clause titled 'Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transactions,' provided by the department or contracting agency, entering into this covered

transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the $25,000 threshold.

h. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the Excluded Parties List System website (), which is compiled by the General Services Administration.

i. Nothing contained in the foregoing shall be construed to require the establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of the prospective participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

j. Except for transactions authorized under paragraph (f) of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default.

* * * * *

2. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – First Tier Participants:

a. The prospective first tier participant certifies to the best of its knowledge and belief, that it and its principals:

(1) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency;

(2) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(3) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (a)(2) of this certification; and

(4) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

b. Where the prospective participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

2. Instructions for Certification - Lower Tier Participants:

(Applicable to all subcontracts, purchase orders and other lower tier transactions requiring prior FHWA approval or estimated to cost $25,000 or more - 2 CFR Parts 180 and 1200)

a. By signing and submitting this proposal, the prospective lower tier is providing the certification set out below.

b. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department, or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

c. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous by reason of changed circumstances.

d. The terms ‘covered transaction,’ ‘debarred,’ ‘suspended,’ ‘ineligible,’ ‘participant,’ ‘person,’ ‘principal,’ and ‘voluntarily excluded,’ as used in this clause, are defined in 2 CFR Parts 180 and 1200. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations. ‘First Tier Covered Transactions’ refers to any covered transaction between a grantee or subgrantee of Federal funds and a participant (such as the prime or general contract). ‘Lower Tier Covered Transactions’ refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). ‘First Tier Participant’ refers to the participant who has entered into a covered transaction with a grantee or subgrantee of Federal funds (such as the prime or general contractor). ‘Lower Tier Participant’ refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

e. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.

f. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled ‘Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction,’ without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the $25,000 threshold.

g. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the Excluded Parties List System website (https://www.epls.gov/), which is compiled by the General Services Administration.

h. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

i. Except for transactions authorized under paragraph e of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

* * * * *

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Lower Tier Participants:

1. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency.

2. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

* * * * *

XI. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts which exceed $100,000 (49 CFR 20).

1. The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

a. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

b. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, 'Disclosure Form to Report Lobbying,' in accordance with its instructions.

2. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

3. The prospective participant also agrees by submitting its bid or proposal that the participant shall require that the language of this certification be included in all lower tier subcontracts, which exceed $100,000 and that all such recipients shall certify and disclose accordingly.

8 PROSECUTION AND PROGRESS

Replace the 1st and 2nd paragraphs of section 8-1.04B with:

The District will issue you a Notice to Proceed after the Contract has been awarded, and establish the first Contract Working Day with you. The Notice to Proceed will list the first Contract Working Day, which must not be more than 21 calendar days past the date on which the contract was awarded.

Start jobsite activities only after the WPCP or SWPPP is authorized.

Failure to start jobsite activities within 15 calendar days of the First Working Day listed on the Notice to Proceed may be considered as failure by you to supply an adequate workforce.

Replace the 1st paragraph of section 8-1.05 with:

Contract time starts on the day specified as the first Working Day in the Notice to Proceed. Working days will not be postponed if you do not start work on the first Working Day.

Add to section 8-1.06:

When existing conditions are encountered which, in the opinion of the Engineer, require temporary suspension of work for design modifications or for other determinations to be made, you must move to other areas of work until such determinations are made. No additional compensation will be allowed by reason of such temporary suspension of work when you can reasonably reschedule work at a different location.

You must notify the District 24 hours minimum in advance if you decide to suspend work for one day or more. You must notify the District a minimum of 24 hours in advance of recommencing work on the project.

The days during a suspension related to your performance are working days.

Add to section 8-1.10A:

Liquidated damages are listed on the table in this section of the Standard Specifications.

Add to end of section 8-1.13:

Any control exercised by the Surety towards the completion of the Project will be subject to the Bid documents, and review and approval of the District

9 PAYMENT

Add to section 9-1.06A:

Section 9-1.06 does NOT apply to supplemental work.

The District does not pay for eliminated supplemental work.

Add to section 9-1.16A:

Submit support data with application for progress payment. Support data must include:

1. Data required by Engineer
2. Copies of requisitions from Subcontractors and material suppliers

Include the County of Santa Barbara Auditor-Controller contract number as shown on executed Agreement.

Submit the following certification with each application for progress payment:

I, the undersigned, declare under penalty of perjury under the laws of the State of California that this Application for Payment is made in good faith, that the documents substantiating this application are accurate and complete and that the foregoing is true and correct.

BY: _____ Date: _____

(TYPE OR PRINT NAME AND TITLE OF PERSON SIGNING APPLICATION)

Any progress payment made after the scheduled completion date will not constitute a waiver of any liquidated damages heretofore agreed upon as part of this Contract.

Add to first paragraph of section 9-1.16B:

Submit a schedule of values for any lump sum bid item requested by the Engineer.

Replace section 9-1.16F with:

9-1.16F Prompt Payment of Funds Withheld to Subcontractors

The District shall hold five (5) percent retainage from the prime contractor and shall make prompt and regular incremental acceptances of portions, as determined by the District, of the contract work, and pay retainage to the prime contractor based on these acceptances. The prime contractor, or subcontractor, shall return all monies withheld in retention from a subcontractor within 30 days after receiving payment for work satisfactorily completed and accepted including incremental acceptances of portions of the contract work by the agency. Federal law (49 CFR 26.29) requires that any delay or postponement of payment over 30 days may take place only for good cause and with the agency's prior written approval. Any violation of this provision shall subject the violating prime contractor or subcontractor to the penalties, sanctions and other remedies specified in Section 7108.5 of the Business and Professions Code. These requirements shall not be construed to limit or impair any contractual, administrative, or judicial remedies otherwise available to the prime contractor or subcontractor in the event of a dispute involving late payment or nonpayment by the prime contractor, deficient subcontract performance, or noncompliance by a subcontractor.

Pursuant to Section 22300 of the Public Contract Code, and the project specifications, the Contractor may substitute securities for monies withheld to ensure contract performance.

Upon your request, the District will make payment of funds withheld to ensure performance of the Contract if you deposit in escrow with the Santa Barbara County Treasurer, or with a bank acceptable to the District , securities eligible for investment under Government Code Section 16430, or bank or savings and loan certificates of deposits, upon the following conditions;

1. You must bear the expense of the District and the escrow agent, either the County Treasurer or the bank, in connection with the escrow deposit made.
2. Securities or certificates of deposit to be placed in escrow will be of a value at least equivalent to the quantities of retention to be paid to you pursuant to this Section.
3. You must enter into an escrow agreement satisfactory to the District, which agreement must include provisions governing inter alia:
   1.1. The quantity of securities to be deposited.
   1.2. The providing of powers of attorney, or other documents necessary for the transfer of the securities to be deposited
   1.3. Conversion to cash to provide funds to meet defaults by you, including but not limited to the termination of your control over the work, stop notices filed pursuant to law, assessment of liquidated damages, or other quantities to be kept or retained under the provisions of the contract
   1.4. Decrease in value of securities on deposit.
   1.5. The termination of the escrow upon completion of the contract.
4. You must obtain the written consent of the surety to such agreement

Add to section 9-1.17C:

Submit all outstanding extra work billing no later than 15 days after acceptance by the Department.

Replace section 9-1.17D(3) with:

9-1.17D(3) Determination of Claims

The Department reviews and resolves claims pursuant to Public Contract Code § 9204, which is summarized within this section.

The Contractor shall furnish reasonable documentation to support the claim.

The Department's costs in reviewing or auditing a claim not supported by the Contractor's accounting or other records are damages incurred by the Department within the meaning of the California False Claims Act.

The Department will review the claim and provide a written statement of findings identifying what portions are disputed and undisputed within 45 days from receipt of claim when action by the Department Board of Directors is not required. This may be extended by mutual agreement.

For claims requiring action by the Department Board of Directors, a written statement will be provided within three days following the next duly publicly noticed meeting of the Board, or 45 days from receipt of claim, whichever is later.

The Contractor may request in writing by registered or certified mail, return receipt requested, a meet and confer conference if the Contractor disputes the Department's written response, or if the Department fails to respond to a claim within the time prescribed. The Department shall schedule a meet and confer conference within 30 days of receipt of the request for settlement of the dispute. Within 10 days following the meet and confer conference, the Department shall provide the Contractor a written statement identifying the portion of the claim that remains in dispute and the portion that is undisputed.

Any disputed portion of the claim shall be submitted to nonbinding mediation, with the Department and the Contractor sharing the associated costs equally. The Department and Contractor shall mutually agree to a mediator within 10 business days after the disputed portion of the claim has been identified in writing. If the parties cannot agree upon a mediator, each party shall select and pay the cost for a mediator and those mediators shall select a qualified neutral third party to mediate. If mediation is unsuccessful, the parts of the claim remaining in dispute shall be subject to applicable procedures outside this section.

The Department will make payment of undisputed portion of claim within 60 days of written statement of findings. After 60 days of written statement of findings, the Department pays 7 percent annual interest for unpaid and undisputed portions of claims.

If a subcontractor lacks legal standing to assert a claim due to lack of privity, the Contractor may present a claim on behalf of the subcontractor, and the subcontractor may request in writing that the Contractor present the claim on its behalf, provided that the subcontractor furnishes reasonable document supporting the claim to the Department. Within 45 days of the subcontractor's request, the Contractor shall notify the subcontractor in writing of whether the claim was submitted and state the reasons why it was not submitted if the claim was not submitted.

Delete section 9-1.22.

DIVISION II GENERAL CONSTRUCTION

10 GENERAL

Add to section 10-1.04:

A weekly construction meeting may be held at a time and place designated by the Engineer with your representatives and other affected parties.

12 TEMPORARY TRAFFIC CONTROL

Replace section 12-1.04 with:

You must pay for all costs associated with flagging.

13 WATER POLLUTION CONTROL

Add to section 13-1.01A:

Water Pollution Control work including implantation, maintenance, monitoring and repair tasks are included in the various items of work involved, unless the Bid Item List includes additional specific Water Pollution Control payment items, or unless work is specified as change order work8

Comply with the National Discharge Elimination System General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (Order No. 2012-0006-DWQ NPDES NO. CAS000002) referred to herein as Permit. The Permit governs stormwater and nonstormwater discharges from construction sites. The Permit may be viewed at the State Water Recourses Control Board website.

Add to list in the 1st paragraph of section 13-1.01A:

5. California Stormwater Quality Association (CASQA) Construction BMP Handbook/Portal at https://www.casqa.org/

Replace fourth paragraph in section 13-1.01A with the following:

A SWPPP must comply with the California Stormwater Quality Association (CASQA) Construction BMP Handbook/Portal at http://www.cabmphandbooks.com/. A WPCP must comply with the Department's Water Pollution Control Program (WPCP) Preparation Manual and must be prepared using the latest template posted on the Construction stormwater website.

Revise the following definitions in section 13-1.01B:

qualifying rain event: Storm that produces precipitation of 0.5 inch or more at the time of discharge.

Storm event: Storm that is forecasted to have a 50% or greater probability of producing precipitation.

Replace the 4th paragraph in section 13-1.03A with:

You may be directed to perform additional Water Pollution Control. This only applies in the event that change order work that requires additional Water Pollution Control is ordered by the Engineer. This work is Supplemental Work and will be paid in accordance with section 9-1.04. In no case will additional Water Pollution Control be paid for unless the project scope has changed.

Replace the 1st paragraph in section 13-1.01D(2) with:

Add to the end of section 13-3.01A:

The District will obtain a WDID for the Project under the Construction General Permit in California Water Boards Storm Water Multiple Application & Reporting Tracking System (SMARTS) and complete the 'Owner Info,' 'Developer Info,' and 'Billing Info tabs.' The District pays for the initial WDID application fee.

You are responsible for completing all other project tabs in SMARTS and uploading all required documentation and reports. Provide you SMARTS user identification information to the Engineer; the District will link this person to the Project in SMARTS as a 'Data Entry Person.'

14 ENVIRONMENTAL STEWARDSHIP

Add to Section 14-1.01:

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

15 EXISTING FACILITIES

Delete the last paragraph in Section 15-1.03B

DIVISION III EARTHWORK AND LANDSCAPE

19 EARTHWORK

Add to section 19-1.03B:

You may be directed to perform unsuitable subgrade stabilization. This only applies in the event that unsuitable subgrade, which is not otherwise addressed by the contract documents, is encountered and stabilization is ordered by the Engineer. This work is Supplemental Work and will be paid in accordance with section 9-1.04.

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*.

These Special Provisions incorporate some Standard Specifications into this one document at request of the jurisdictional agency. This does not admonish the precedence in documents set forth in section 5-1.02 “Contract Components” of the Standard Specifications as modified by Flood Control District Provisions. The Standard Specification incorporated herein are cited for reference only. The Contractor must follow the latest published Standard Specifications and any current revisions released. These documents are found on line at https://dot.ca.gov/programs/design/ccs-standard-plans-and-standard-specifications.

Special Provisions cited here within will not be italicized and are the governing Standard Special Provisions in the contract. Standard Specifications will be *italicized* and are still considered Standard Specifications. Standard Specifications amended by deletion or revision will be denoted by ~~strike through~~ text.

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

DIVISION I GENERAL PROVISIONS

Add prior to section 1:

Bid Items and Applicable Sections

Item code	Item description	Applicable section
0051260A	Construction Survey	5
080050	Progress Schedule (Critical Path Method)	8
999990	Mobilization	9

2 BIDDING

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

The Department makes the following supplemental project information available:

Supplemental Project Information

Means	Description
Included in the Information Handout	Environmental Permits, Licenses, Agreements, and Certificates (PLACs): 1.) Regional Water Quality Control Board Clean Water Act Section 401 Water Quality Certification No. 34217WQ07 (June 13, 2017) and its Second Amendment (February 1,2021). 2.) U.S. Army Corps of Engineers Clean Water Act Section 404 Permit SPL-2010-00361-CLH and 2021 DBMP NTP 3.) City of Santa Barbara Coastal Development Permit 21CDH-00006 and 21EXE-00019
Included in the Information Handout	Santa Monica Creek Debris Basin Record Drawings (SCS-1978)
Included in the Information Handout	CAL OSHA's 'COVID-19 INDUSTRY GUIDANCE: Construction' document
Included in the Information Handout	Neighbor notification list
Included in the Information Handout	Geotechnical Design Report Santa Monica Debris Basin Operational Improvements Project; District Project No. SC8370" (Bengal Engineering, March 2021)
Included in the *Information Handout*	As-Built Geological Report, Santa Monica Debris Basin August 1978
Included in the *Information Handout*	Standard Details and Plans
Included in the *Information Handout*	Caltrans Corrosion Guidelines, May 2021

Geotechnical reports, if applicable, are available in the Information Handout. Geotechnical reports are not part of the Contact Documents. The Bidder may rely upon the accuracy of the technical data contained in such information, however, the interpretation of such technical data, including any interpolation or extrapolation thereof, together with non-technical data, interpretations, and opinions contained in such information or the completeness thereof is the responsibility of the Bidder.

Replace section 2-1.04 with:

A non-mandatory pre-bid job walk is scheduled for **April 12, 2022,** at **10 AM**. Bidders interested in attending are to meet at the project site located at 4300 Foothill Rd., entering from the north side of Foothill Rd., immediately west of the Santa Monica Channel.

4 SCOPE OF WORK

Add section 4-1.03:

4-1.03 WORK DESCRIPTION

The Santa Monica Debris Basin (SMDB) was built as the key feature for the Santa Monica Creek portion of the Carpinteria Valley Watershed Project (CVWP) construction contract. Construction of the SMDB commenced in late winter of 1977 and was completed in the spring of 1978. A copy of the Santa Monica Creek Debris Basin Record Drawings (SCS-1978) is included in the Informational Handout The embankment of the basin is classified as a "High Hazard Dam" under the jurisdiction of the California Division of Safety of Dams (DSOD).

The SMDB components include:

- An earthfill dam embankment
- Three inlet towers that outlet to a low flow conduit (primary spillway)
- An emergency spillway
- Access roads
- Excavation borrow sites

- A reinforced concrete bridge that spans the emergency spillway

DSOD requires certain SMDB components under their jurisdictional purview to be compliant with the Unified Facilities Guide Specifications (UFGS) Section 03 30 00 Cast-in-Place Concrete. Elements which are required to follow these standards are the Inlet Towers (Inlet Towers A, B, C and D) and the emergency spillway bridge foundation. At the end of these special provisions is Section 03 30 00 Cast-in-Place Concrete for the two above listed components.

5 CONTROL OF WORK

Add section 5-1.01A:

5-1.01A WORKING HOURS

Working hours must only occur between 7:00 a.m. and 4:00 p.m., on Working Days.

If you desire to work outside of this time frame, you must receive consent from the District. If consent is given, you will be responsible for payment of construction manager and/or inspector's overtime costs.

You must comply with Section 7-102K(5) regarding Labor Code requirements.

Add to section 5-1.03:

5-1.03 Engineer's Authority

Field inspection by California Division of Safety of Dams (DSOD):

Representatives from DSOD will periodically inspect the work in progress during construction, including the materials being incorporated into the works, as well as the test results and documentation associated with the project. The contractor must allow DSOD representatives access to all the locations within the project boundaries. All communication with DSOD pertaining to the project shall be coordinated through the Owner's engineer or designated representative.

A 72-hour notice from the owner's representative is required to schedule a DSOD inspection. Therefore, the contractor must cooperate with the owner's representatives by giving at least 72-hour (business days excluding weekends and holidays) notice of inspection requiring components as described in section 4-1.03 to ensure the Owner has sufficient time to coordinate with DSOD.

You must coordinate and participate in a separate pre-construction conference with DSOD and the Engineer prior to the start of work. Items requiring DSOS submittal review, inspection and the required inspection notification period must be discussed and agreed upon by all parties.

Submittals and shop drawings involving work within the purview of the DSOD shall be granted an additional 5 days for review by the Engineer above and beyond what is generally allowed in the Standard Specifications and elsewhere in these special provisions.

Add to section 5-1.20B(1):

Copies of PLACs and Mitigation Measures and Conditions of Approval applicable to this project are located in the Information Handout.

Replace section 5-1.26 with:

5-1.26 CONSTRUCTION SURVEYS

5-1.26A General

Section 5-1.26 includes general specifications for construction surveys, furnishing and setting construction stakes and marks to establish the lines and grades required to control the work.

Construction surveys must comply with Chapter 12, 'Construction Surveys,' of the California Department of Transportation Surveys Manual as determined by the Engineer.

The location and elevation of benchmarks and horizontal control points are shown on the plans. The Engineer will not provide any additional survey services for the project.

5-1.26A(2) Submittals

Submit name, license number and contact information of the professional land surveyor prior to beginning staking.

Submit proposed procedures, methods, and equipment to be used.

Submit all computations, notes and other data used to accomplish the work.

5-1.26B Material

Not used

5-1.26C Construction

Perform construction staking under the direction of a Professional Land Surveyor registered in the State of California.

Within 2 working days of receiving notification to proceed with right-of-way (including permanent temporary easements) staking, stake County right-of-way. Maintain right-of-way corner stakes throughout construction.

Furnish and set stakes and marks with accuracy adequate to assure completed work conforms to lines, grades and sections shown.

All conflicts between the construction drawings and the actual field conditions must be brought to the attention of the Engineer for review prior to work continuing in the area of conflict.

Remove all stakes when no longer needed.

5-1.26D Payment

Not used

Revise section 5-1.32 to read:

Occupy Flood Control District owned property only for purposes necessary to perform the work.

Defend, indemnify and hold the County harmless to the same extent as under section 7-1.05

Add to section 5-1.36C(1):

You must provide the regional notification center “Inquiry Identification” number to the District prior to the commencement of excavation or other work close to any underground facility. You are responsible for keeping the Inquiry Identification number valid throughout the duration of the construction contract.

6 CONTORL OF MATERIALS

6-2 QUALITY ASSURANCE

6-2.01 GENERAL

6-2.01A General

Section 6-2 includes provisions related to quality.

Quality assurance includes all activities used to (1) provide an overall level of quality for the project and (2) determine compliance with the Contract documents.

Quality control includes sampling, testing, and inspections performed under your QC program to (1) control material quality and (2) ensure the specified quality characteristics for the project are met.
Department acceptance includes sampling, testing, and inspections performed by the Department to verify compliance with the Contract.

The Department's independent assurance program is described in the Department's Independent Assurance Manual: Procedures for Accreditation of Laboratories and Qualification of Testers. For the manual, go to the METS website.

For a material specified to comply with a State Specification number, the material may comply with a later version of the specification. Obtain State Specifications from METS.

For a material specified to comply with a requirement for a quality characteristic shown in the following table, the quality characteristic is tested under the corresponding California Test:

California Tests

Quality characteristic	California Test
Relative compaction	216 or 231
Sand equivalent	217
Resistance (R-value)	301
Gradation (sieve analysis)	202
Durability index	229

6-2.01B Authorized Facility Audit Lists

Section 6-2.01B applies where a facility is specified to be on an Authorized Facility Audit List.
An audit authorized by the Department not more than 3 years before completion of the fabrication process is acceptable if the Department determines the audit was for the same type of work to be performed.

For procedures to be included on an Authorized Facility Audit List, go to the Authorized Facility Audit List website.

6-2.01C Authorized Material Lists

Section 6-2.01C applies where a material is specified to be on an Authorized Material List.
The material must be on an Authorized Material List before it is incorporated into the work.
For procedures to be included on an Authorized Material List, go to the Authorized Material List website.

6-2.01D Authorized Material Source Lists

Section 6-2.01D applies where a material is specified to be on an Authorized Material Source List.
The material source must be on an Authorized Material Source List before the item from the source is incorporated into the work.

For procedures to be included on an Authorized Material Source List, go to the Authorized Material Source List website.

6-2.01E Material Source Inspection and Testing

Section 6-2.01E applies if a material is to be inspected or tested at the source.

Submit an inspection request form:

1. *At least 3 business days before the requested inspection date for a material source within California.*
2. *At least 5 business days before the requested inspection date for a material source outside California but within the United States.*
3. *50 days before the planned production start for a material source outside the United States. Notify the Engineer at least 20 days before the actual start.*

For the inspection request form and the procedure for its submittal, go to the METS website. Notify the Engineer of each submittal.

For each item shown in the following table, the Department deducts the corresponding amount shown:

Source Inspection Expense Deductions

Item	Distance[a]	Deduction
Steel pipe piling	> 300	$5,000
Prestressing system Tier 1 and tier 2 precast concrete members Epoxy-coated reinforcement Structural steel for sign structures Miscellaneous metal	> 3,000	$8,000
Extinguishable message signs Variable message signs Changeable message signs Service equipment enclosures Telephone demarcation cabinets Closed circuit television cabinets Weigh-in-motion cabinets Highway advisory radio cabinets	> 300	$2,000
Poles for electrical systems	> 300	$1,000 for ≤ 10 poles and $1,000 for every multiple of 10 poles thereafter
Structural steel	> 300	The greater of: 1. $5,000 2. $0.02/lb
	> 3,000	The greater of: 1. $8,000 2. $0.036/lb
Structural steel paint	> 300	The greater of: 1. $2,000 2. $0.01/sq ft
	> 3,000	The greater of: 1. $5,000 2. $0.015/sq ft
Check samples	> 300	$2,000
High mast poles	> 300	$2,500
	> 3,000	$5,000
PTFE bearings, ≤ 2 lots	> 300	$5,000
	> 3,000	$15,000
PTFE bearings, > 2 lots	> 300	$10,000
	> 3,000	$20,000

[a]Distance is air-line miles from both Sacramento and Los Angeles to the inspection source.

6-2.01F Test Samples

Section 6-2.01F applies where a test sample is specified or if a test sample is requested.

Notify the Engineer 10 days before taking a sample.

Submit material to be tested with a Sample Identification Card. For the card, go to the METS website.

Restore work immediately after sampling.

If requested, obtain the Department's authorization for the material before incorporating the material represented

by the test sample into the work.

6-2.01G–6-2.01K Reserved

6-2.02 QUALITY CONTROL

6-2.02A General

Material production and testing equipment must measure accurately and precisely.

6-2.02B Quality Control Program

Develop, implement, and maintain a QC program.

Prepare and maintain QC records, including:

1. *Names and qualifications of:*
   - *1.1. Samplers*
   - *1.2. Testers*
   - *1.3. Inspectors*
2. *Testing laboratories' identification and certifications*
3. *Testing equipment calibrations and certifications*
4. *Inspection reports*
5. *Sampling and testing records organized by date and type of material*
6. *Test results with comparison of quality characteristic requirements*
7. *Test results in relation to action and any suspension limits*
8. *Records of corrective actions and suspensions*

Within 24 hours, notify the Engineer of any noncompliance identified by your QC program.
Allow the Department access to all QC records.

Submit QC test data and QC test results within 2 business days of test completion.

6-2.02C Quality Control Manager

Section 6-2.02C applies to work requiring a QC manager.

The QC manager must be responsible directly to you for the quality of the work, including materials and workmanship performed by you and your subcontractors.

Assign the QC manager before the start of the affected work. The QC manager must be the sole individual responsible for:

1. *Receiving, reviewing, and approving all correspondence, submittals, and reports before they are submitted to the Department*
2. *Signing the QC plan*
3. *Implementing the QC plan*
4. *Maintaining the QC records*

The QC manager must be your employee or must be hired by a subcontractor providing only QC services. The QC manager must not be employed or compensated by a subcontractor or by other persons or entities hired by subcontractors who will provide other services or materials for the project.

Notify the Engineer of the name and contact information of the QC manager.

6-2.02D Quality Control Plans

Submit 7 copies of each authorized QC plan.

Make 1 copy available at each location where work is performed.

6-2.03 DEPARTMENT ACCEPTANCE

6-2.03A General

The Department may use multiple acceptance methods for a material.

Specifications in sections titled "Department Acceptance" do not include all requirements on which the Department makes its acceptance.

The Department may inspect, sample, and test materials for compliance with the Contract at any time.

Allow the Department to record, including photograph and video, to ensure a material is produced to comply with the Contract.

You may examine the records and reports of tests the Department performs.

Schedule work to allow time for the Department's inspection, sampling, and testing.

The Department deducts testing costs for work that does not comply with the Contract.

The Department may retest material previously tested and authorized for use. If the Department notifies you of a retest, furnish resources for retesting.

6-2.03B Job Site Inspection and Testing

Section 6-2.03B applies if a material is to be inspected or tested at the job site.

The material must be authorized for use before it is incorporated into the work.

6-2.03C Certificates of Compliance

Section 6-2.03C applies (1) where a certificate of compliance is specified and (2) if any material is produced outside the United States.

Submit a certificate of compliance:

1. *Before the material is incorporated into the work*
2. *For each lot of the material. Identify the lot on the certificate*
3. *Signed by the producer of the material and stating that the material complies with the Contract*

7 LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

Add section 7-1.02K(6)(f):

7-1.02K(6)(f) COVID-19 Preparedness

You must comply with CAL OSHA's 'COVID-19 INDUSTRY GUIDANCE: Construction' document. A copy of the COVID-19 INDUSTRY GUIDANCE: Construction document is included in the Information Handout.

You must develop and implement a COVID-19 Jobsite Safety Plan. A COVID-19 Jobsite Safety Plan template and COVID-19 Employee Memorandum are included with this addendum. Your COVID-19 Jobsite Safety Plan must be submitted to the Engineer for review and approval at least 7 days in advance of the start of work.

Replace section 7-1.02M(2) with:

7-1.02M(2) Fire Prevention

Inform nearest fire station of planned schedule of work including:
1. Project schedule
2. Description of work
3. Specific work components with fire risks such as welding, grinding and clearing with gasoline powered machinery.

Cooperate with local fire prevention authorities in eliminating hazardous fire conditions.

Immediately report to the nearest fire suppression agency fires occurring within the project limits.

Prevent project personnel from setting open fires that are not part of the work.
Prevent the escape of and extinguish fires caused directly or indirectly by job site activities

Except for motor trucks, truck tractors, buses, and passenger vehicles, equip all hydrocarbon-fueled engines, both stationary and mobile including motorcycles, with spark arresters that meet USFS standards as specified in the Forest Service Spark Arrester Guide. Maintain the spark arresters in good operating condition. Spark arresters are not required by Cal Fire, the BLM, or the USFS on equipment powered by properly maintained exhaust-driven turbo-charged engines or equipped with scrubbers with properly maintained water levels. The Forest Service Spark Arrester Guide is available at the district offices.

Each toilet must have a metal ashtray at least 6 inches in diameter by 8 inches deep half-filled with sand and within easy reach of anyone using the facility.

Locate flammable materials at least 50 feet away from equipment service, parking, and gas and oil storage areas. Each small mobile or stationary engine site must be cleared of flammable material for a radius of at least 15 feet from the engine.

Furnish the following fire tools:
1. 1 shovel and 1 fully charged fire extinguisher UL rated at 4 B:C or more on each truck, personnel vehicle, tractor, grader, or other heavy equipment.

2. 1 shovel and 1 backpack 5-gallon water-filled tank with pump for each welder.

3. 1 shovel or 1 chemical pressurized fire extinguisher, fully charged, for each gasoline-powered tool, including chain saws, soil augers, and rock drills. The fire tools must always be within 25 feet from the point of operation of the power tool. Each fire extinguisher must be of the type and size required by the Pub Res Code § 4431 and 14 CA Code of Regs § 1234. Each shovel must be size O or larger and at least 46 inches long.

Furnish a pickup truck and driver that will be available for fire control during working hours.

Add section 7-1.03A:

7-1.03A STANDARD NOTIFICATIONS

You must deliver notices to each residence adjacent to the Work two weeks minimum prior to commencement of project activities. The format and content of each notice must be approved by the Engineer (see example below).

Such notice must at minimum give the name of the Project, the duration of the Contract period, daily work hours for the proposed work, typical parking and access restrictions anticipated for the work the Contractor's representative and phone number, the County representative and phone number, along with any other information requested by the Engineer. All notices shall be approved by the Engineer for content and delivery schedule prior to actual delivery.

All notices must be in the format of door hangers (14 inches by 4 inches, 110 Springhill Index or approved equal) and be hung at the main door of each residence or business affected. The text of such notices must have one side printed in English with the reverse side printed in Spanish.

The following is an example of language required:

NOTICE
TO AREA RESIDENCES

The Santa Barbara County Flood Control District hereby informs you that (Contractor) will be constructing the Name of Project. The contract period is from (date) to (date).

Work on the Project will typically be performed between the hours of 7:00 AM and 4:00 PM.

We appreciate your patience and cooperation during this Project. If you have any questions, or require additional information please contact the following:

Contractor, Contact's Name and Telephone Number

Santa Barbara County Flood Control District, Contact's Name and Telephone Number

Maintain a log of all notifications. The log is to include the following information:

1. Property owner
2. Person of contact (If applicable)
3. Date of notification
4. Time of notification
5. Method of notification.

At a minimum, notifications must be made to properties named on the Neighbor Notification List, a copy of the Neighbor Notification List is contained in the Information handout.

8 PROSECUTION AND PROGRESS

Replace the 1st paragraph of section 8-1.02C(1) with:

Section 8-1.02C does not apply. Comply with section 8-1.02D except the 1st paragraph.

Add to the end of section 8-1.10B:

Liquidated damages for not completing _____ within _____ are $_____ per day.

9 PAYMENT

Add to section 9-1.16C:

The following items are eligible for progress payment (material costs only) even if they are not incorporated into the work:

1. Steel Sheet Piling
2. Bar Reinforcing
3. Tower Armoring, Struts and Trash Rack System
4. Tower Trash Racks

DIVISION II GENERAL CONSTRUCTION

Add prior to section 10:

Bid Items and Applicable Sections

Item code	Item description	Applicable section
130100	Job Site Management	13
130300	Prepare Storm Water Pollution Prevention Plan	13
130310	Rain Event Action Plan	13
130320	Storm Water Sampling And Analysis Day	13
130330	Storm Water Annual Report	13
131201	Temporary Creek Diversion	13
153122	Remove Concrete (Miscellaneous)	15

10 GENERAL

10-1 GENERAL

10-1.01 GENERAL

Section 10 includes general specifications for performing construction work.

Replace "Reserved" in section 10-1.01 of the RSS for section 10-1 with:

The Project Plans consist of **1** plans set, **Santa Monica Debris Basin Operational Improvements** (**88** Sheets).

The following is a general description of the type of work for each bid item listed in the Bid Schedule, and is not intended to be all-inclusive. Comply with the contract documents for the work.

Bid items quantified as lump sum items are required to submit a schedule of values according to section 9-1.16B. The schedule of values must be authorized by the Engineer prior to progress payments.

Bid items of work shown on the plans or indicated in the specifications which are not specifically identified in the bid item descriptions are included in lump sum items of work and must be identified in the Schedule of Values submittal by the Contractor and no additional payment will be made.

Summary Bid Item Descriptions:

1. **Construction Survey**
   Section 5-1.26 "Construction Surveys," of the Caltrans Standard Specifications does not apply. Comply with Section 5-1.26 of these special provisions. The Contractor is responsible for all project construction surveying and for establishing necessary lines and grades to complete the work. Surveying must be performed under the direction of a Licensed Land Surveyor or Civil Engineer authorized by the State of California to provide these services.
   Survey monuments must be preserved in accordance with Section 5-1.36 "Property and Facility Preservation".

2. **Progress Schedule (Critical Path Method)**
   Comply with the applicable provisions in section 8-1.02C of the Caltrans Standard Specifications. Payment terms are defined in section 8-1.02D(10) of the Caltrans Standard Specifications.

   Submit a schedule of values for this lump sum bid item according to section 9-1.16B of the Caltrans Standard Specifications.

3. **Job Site Management**
   Comply with section 13 of the Caltrans Standard Specifications and these special provisions. Job Site Management work includes spill prevention control, material management, waste management, non-storm water management, and dewatering activities. Implement effective handling, storage, usage, and disposal practices to control material pollution and manage waste and non-storm water at the job site before they enter the storm drain systems and receiving waters.

   Comply with mitigation measures and conditions of approval as stipulated in the Permits, Licenses, Agreements, and Certifications (PLAC's) appended to these Special Provisions. Payment for compliance and implementation of applicable mitigation measures and conditions of approval is included in Job Site Management and no separate payment will be made.

Submit a schedule of values for this lump sum bid item according to section 9-1.16B of the Caltrans Standard Specifications.

4. Prepare Storm Water Pollution Prevention Plan

Comply with Section 13 of the Caltrans Standard Specifications and these special provisions. Prepare a Stormwater Pollution Prevention Plan including implementing the SWPPP, providing a water pollution control manager, conducting water pollution control training, installing BMPs, and monitoring, inspecting and correcting water pollution control practices. This bid item includes furnishing materials, labor, placing, constructing, and maintaining temporary erosion control measures as outlined in the contractor authorized SWPPP. The temporary erosion control measures can include but not limited to temporary construction entrances, temporary silt fencing, temporary inlet protection, and any other measures as outlined in Section 13 included in the authorized SWPPP.

Submit a schedule of values for this lump sum bid item according to section 9-1.16B of the Caltrans Standard Specifications. All selected BMPs shall be included in the Schedule of Values, except for those items shown on the plans and paid for as a separate item of work.

5. Rain Event Action Plan

Comply with section 13-3.01C(3) of the Caltrans Standard Specifications.

Payment terms are defined in section 13-3.04 of the Caltrans Standard Specifications.

6. **Storm Water Sampling and Analysis Day**

Comply with Section 13 of the Caltrans Standard Specifications and these special provisions.

Payment terms are defined in section 13-3.04 of the Caltrans Standard Specifications.

7. Storm Water Annual Report

Comply with Section 13-3.01C (4) of the Caltrans Standard Specifications and these special provisions.

Payment terms are defined in section 13-3.04 of the Caltrans Standard Specifications.

8. **Temporary Creek Diversion**

Comply with section 13-6 of the Caltrans Standard Specifications.
The bid item Temporary Creek Diversion is intended to include diverting creek water away from the work at proposed construction locations that receive Santa Monica Creek water. Locations are inclusive of but not limited to Towers A, B, C, D, Low Flow Conduit, and the Plunge Pool By-Pass Structure.

Submit a schedule of values for this lump sum bid item according to section 9-1.16B of the Caltrans Standard Specifications.

9. Remove Concrete (Miscellaneous)

Comply with section 15 of the Caltrans Standard Specifications.

The bid item Remove Concrete (Miscellaneous) is bid as a lump sum and intended to include saw cutting, cutting reinforcing steel, and concrete/reinforcing steel removal at each construction location. Locations are inclusive of but not limited to locations identified on the plans for Towers A, B, C, D, portions of the emergency spillway wall (see bridge plans) and the Plunge Pool By-Pass Structure Concreted-Rock Slope Protection.

Submit a schedule of values for this lump sum bid item according to section 9-1.16B of the Caltrans Standard Specifications.

10. Clearing and Grubbing

Comply with section 17-2 of the Caltrans Standard Specifications and these special provisions. Work includes items described in the standard specification including removal and disposal of trees identified on the project plans including associated stumps.

Submit a schedule of values for this lump sum bid item according to section 9-1.16B of the Caltrans Standard Specifications.

11. Roadway Excavation

Comply with sections 19 of the Caltrans Standard Specifications.

This is a Final Pay Item as defined in section 9-1.02C of the Caltrans Standard Specifications.

12. Structure Excavation (Inlet Tower D)

Comply with section 19-3 of the Caltrans Standard Specifications. This item includes structure excavation for construction of Inlet Tower D.

Payment terms are defined in section 19-3.04 of the Caltrans Standard Specifications.

This is a Final Pay Item as defined in section 9-1.02C of the Caltrans Standard Specifications.

13. Structure Excavation (Spillway Bridge)

Comply with section 19-3 of the Caltrans Standard Specifications. This item includes excavation for the new spillway bridge abutments.

Payment terms are defined in section 19-3.04 of the Caltrans Standard Specifications.

This is a Final Pay Item as defined in section 9-1.02C of the Caltrans Standard Specifications.

14. Structure Excavation (Channel Bridge)

Comply with section 19-3 of the Caltrans Standard Specifications. This item includes excavation for the new channel bridge abutments

Payment terms are defined in section 19-3.04 of the Caltrans Standard Specifications.

This is a Final Pay Item as defined in section 9-1.02C of the Caltrans Standard Specifications.

15. Structure Excavation (Rock Slope Protection)

Comply with section 19-3 of the Caltrans Standard Specifications.

Payment terms are defined in section 19-3.04 of the Caltrans Standard Specifications.

The item Structure Excavation (Rock Slope Protection) is measured per cubic yard is intended to be utilized for remedial slope repairs on the westerly edge of the debris basin. Areas exhibiting slope failure will be excavated and Rock Slope Protection (1/2 T, Method A) will be placed to stabilize these areas north of the TAP line.

This is a Final Pay Item as defined in section 9-1.02C of the Caltrans Standard Specifications.

16. Structure Backfill (Inlet Towers)

Comply with section 19-3 of the Caltrans Standard Specifications. This item includes backfill for the new channel bridge abutments

Payment terms are defined in section 19-3.04 of the Caltrans Standard Specifications.

This is a Final Pay Item as defined in section 9-1.02C of the Caltrans Standard Specifications.

17. Structure Backfill (ByPass)

Comply with section 19-3 of the Caltrans Standard Specifications. This item includes backfill for the new ByPass structure.

Payment terms are defined in section 19-3.04 of the Caltrans Standard Specifications.

This is a Final Pay Item as defined in section 9-1.02C of the Caltrans Standard Specifications

18. Structure Backfill (Spillway Bridge)

Comply with section 19-3 of the Caltrans Standard Specifications. This item includes backfill for the new spillway bridge abutments

Payment terms are defined in section 19-3.04 of the Caltrans Standard Specifications.

This is a Final Pay Item as defined in section 9-1.02C of the Caltrans Standard Specifications.

19. Structure Backfill (Channel Bridge)

Comply with section 19-3 of the Caltrans Standard Specifications. This item includes backfill for the new channel bridge abutments

Payment terms are defined in section 19-3.04 of the Caltrans Standard Specifications.

This is a Final Pay Item as defined in section 9-1.02C of the Caltrans Standard Specifications.

20. Structure Backfill (Slurry Cement)

Comply with section 19-3 of the Caltrans Standard Specifications. This item Structure Backfill (Slurry Cement) includes steel reinforcing as shown on the project plans.

Payment terms are defined in section 19-3.04 of the Caltrans Standard Specifications.

This is a Final Pay Item as defined in section 9-1.02C of the Caltrans Standard Specifications.

21. Imported Borrow

Comply with section 19-7 of the Caltrans Standard Specifications.

22. Bonded Fiber Matrix

Comply with section 21 of the Caltrans Standard Specifications.

23. Rolled Erosion Control Product (Blanket)

Comply with section 21 of the Caltrans Standard Specifications.

24. Class II Aggregate Base

Comply with section 26 of the Caltrans Standard Specifications.

Payment terms are defined in section 26-1.04 of the Caltrans Standard Specifications.

25. Remove Asphalt Concrete Pavement

Comply with sections 15 and 39 of the Caltrans Standard Specifications.

26. Hot Mix Asphalt (Type A)

Comply with section 39 of the Caltrans Standard Specifications.

Payment terms are defined in section 39-2.01D of the Caltrans Standard Specifications.

27. Hot Mix Asphalt (Open Gap Friction Course)

Comply with section 39 of the Caltrans Standard Specifications.

Payment terms are defined in section 39-2.01D of the Caltrans Standard Specifications.

28. Continuously Reinforced Concrete Pavement

Comply with section 40 of the Caltrans Standard Specifications. The Continuous Reinforced Concrete Pavement (CRCP) is intended to follow Caltrans Standard Plan P 4, P 16 and associated referenced standards within. Included within the bid item CRCP is the texture shown on the plans to provide a traction surface.

This is a Final Pay Item as defined in section 9-1.02C of the Caltrans Standard Specifications.

29. Tie Back Assembly A

Comply with section 46 and 55 of the Caltrans Standard Specifications.

The unit price for Tie Back Assembly A is measured as each. The Contractor is to furnish all material, equipment, fabrication (either provided in the field or offsite), and labor. Materials such as tie rods, bolts, nuts C-channel, spacers, wedges, washers, and all other appurtenances are included in Tie Back Assembly A. The item Tie Back Assembly A includes the lengths from the Sheet Pile Wall to the Deadman as shown on the plans.

30. Tie Back Assembly B

Comply with section 46 and 55 of the Caltrans Standard Specifications.

The unit price for Tie Back Assembly B is measured as each. The Contractor is to furnish all material, equipment, fabrication (either provided in the field or offsite), and labor. Materials such as tie rods, bolts, nuts C-channel, spacers, wedges, washers and all other appurtenances are included in Tie Back Assembly B. The item Tie Back Assembly B includes the lengths from the Sheet Pile Wall to Sheet Pile Wall as shown on the plans.

31. Tie Back Assembly C

Comply with section 46 and 55 of the Caltrans Standard Specifications.

The unit price for Tie Back Assembly C is measured as each. The Contractor is to furnish all material, equipment, fabrication (either provided in the field or offsite), and labor. Materials such as tie rods, bolts, nuts C-channel, spacers, wedges, washers and all other appurtenances are included in Tie Back Assembly C. The item Tie Back Assembly C includes the lengths from the Sheet Pile Wall to Sheet Pile Wall as shown on the plans.

32. Geosynthetic Reinforced Soil, (Tower Access Pads)

Comply with the Caltrans Standard Specification, the special provisions supplemented herein and the project plans.

The unit price paid for Geosynthetic Reinforced Soil (Tower Access Pads) must be paid per square foot. The unit measurement of square foot for this item will be measured on the face or elevation of the TAP wall layout line. Price paid per square foot must include the in plane horizontally and vertically as shown in the project plans projecting back from the face or elevation of the TAP wall layout line. The unit price for Geosynthetic Reinforced Soil (Tower Access Pads) includes excavation, backfill, fabric (Mirafi, Miragrid, etc), compaction, equipment, and labor to complete the structure composition of the soil reinforcement complete in place.

This is a Final Pay Item as defined in section 9-1.02C of the Caltrans Standard Specifications.

33. Temporary Shoring

Comply with sections 7, 16 and 48 of the Caltrans Standard Specifications and these special provisions. A temporary shoring plan prepared by a professional engineer licensed in the State of California is required as an action submittal for all excavations that fall under the regulation of O.S.H.A..

Submit a schedule of values for this lump sum bid item according to section 9-1.16B of the Caltrans Standard Specifications.

34. Temporary Crossing (Lower Channel)

A temporary crossing will be needed for portions of the lower channel bridge. The contractor is to submittal a plan prepared by a professional engineer licensed in the State of California is required

Submit a schedule of values for this lump sum bid item according to section 9-1.16B of the Caltrans Standard Specifications.

35. Furnish Steel Sheet Piling

Comply with section 49-2 of the Caltrans Standard Specifications and these special provisions.

Payment scope complies with section 9-1.03 of the Caltrans Standard Specifications.

36. Drive Steel Sheet Piling

Comply with section 49-2 of the Caltrans Standard Specifications and these special provisions.

Payment scope complies with section 9-1.03 of the Caltrans Standard Specifications.

37. 16" Cast-in-Drilled Hole Concrete Piling

Comply with section 49-3 of the Caltrans Standard Specifications and these special provisions.

Payment scope complies with section 9-1.03 of the Caltrans Standard Specifications.

38. Prestressing Cast-In-Place Concrete

Comply with section 50 of the Caltrans Standard Specifications.

Submit a schedule of values for this lump sum bid item according to section 9-1.16B of the Caltrans Standard Specifications.

39. Structural Concrete, Bridge (Spillway Bridge)

Comply with section 51 of the Caltrans Standard Specifications.

This is a Final Pay Item as defined in section 9-1.02C of the Caltrans Standard Specifications.

40. Structural Concrete, Bridge (Channel Bridge)

Comply with section 51 of the Caltrans Standard Specifications.

This is a Final Pay Item as defined in section 9-1.02C of the Caltrans Standard Specifications.

41. Structural Concrete, Bridge Footing (Spillway Bridge)

Comply with section 51 of the Caltrans Standard Specifications.

This is a Final Pay Item as defined in section 9-1.02C of the Caltrans Standard Specifications.

42. Structural Concrete, Bridge (Polymer Fiber) (Spillway Bridge)

Comply with section 51 of the Caltrans Standard Specifications.

This is a Final Pay Item as defined in section 9-1.02C of the Caltrans Standard Specifications.

43. Structural Concrete, Maintenance Access Structure

Comply with section 51 of the Caltrans Standard Specifications. Included in the item Structure Concrete, Maintenance Access Structure is all labor, equipment and materials to complete the item in place. Materials included in this item such as earthwork, falsework, concrete, steel reinforcing, removable vault lid including lifting anchors, and all other materials required to complete the structure in place as shown on the plans.

This is a Final Pay Item as defined in section 9-1.02C of the Caltrans Standard Specifications.

44. Structural Concrete, By-Pass Structure

Comply with section 51 of the Caltrans Standard Specifications. Included in the item Structure Concrete, Maintenance Access Structure is all labor, equipment and materials to complete the item in place. Materials included in this item such as earthwork, falsework, concrete, steel reinforcing, vault lid, and all other materials required to complete the structure in place as shown on the plans.

This is a Final Pay Item as defined in section 9-1.02C of the Caltrans Standard Specifications.

45. Structural Concrete, Tower Inlet A

Comply with section 51 of the Caltrans Standard Specifications. Included in the item Structure Concrete, Tower Inlet A is all labor, equipment and materials to complete the item in place. Materials included in this item such as earthwork, falsework, concrete, steel reinforcing, and all other materials required to complete the structure in place as shown on the plans.

This is a Final Pay Item as defined in section 9-1.02C of the Caltrans Standard Specifications.

46. Structural Concrete, Tower Inlet B

Comply with section 51 of the Caltrans Standard Specifications. Included in the item Structure Concrete, Tower Inlet B is all labor, equipment and materials to complete the item in place. Materials included in this item such as earthwork, falsework, concrete, steel reinforcing, and all other materials required to complete the structure in place as shown on the plans.

This is a Final Pay Item as defined in section 9-1.02C of the Caltrans Standard Specifications.

47. Structural Concrete, Tower Inlet C

Comply with section 51 of the Caltrans Standard Specifications. Included in the item Structure Concrete, Tower Inlet C is all labor, equipment and materials to complete the item in place. Materials included in this item such as earthwork, falsework, concrete, steel reinforcing, removable vault lid including lifting anchors and all other materials required to complete the structure in place as shown on the plans.

This is a Final Pay Item as defined in section 9-1.02C of the Caltrans Standard Specifications.

48. Structural Concrete, Tower Inlet D

Comply with section 51 of the Caltrans Standard Specifications. Included in the item Structure Concrete, Tower Inlet D is all labor, equipment and materials to complete the item in place. Materials included in this item such as earthwork, falsework, concrete, steel reinforcing, and all other materials required to complete the structure in place as shown on the plans.

This is a Final Pay Item as defined in section 9-1.02C of the Caltrans Standard Specifications.

49. Structural Concrete, Tower Pad Dead Man

Comply with section 51 of the Caltrans Standard Specifications.

50. Joint Seal (MR 1/2")

Comply with section 51-2 of the Caltrans Standard Specification and these special provisions.

51. Bar Reinforcing Steel (Spillway Bridge)

Comply with section 52 of the Caltrans Standard Specifications.

This is a Final Pay Item as defined in section 9-1.02C of the Caltrans Standard Specifications.

52. Bar Reinforcing Steel (Channel Bridge)

Comply with section 52 of the Caltrans Standard Specifications.

This is a Final Pay Item as defined in section 9-1.02C of the Caltrans Standard Specifications.

53. Tower Steel Armoring and Trash Rack Systems

Comply with section 55 of the Caltrans Standard Specifications.

This is a Final Pay Item as defined in section 9-1.02C of the Caltrans Standard Specifications.

54. Bridge Removal

Comply with section 15, 60-2.02 of the Caltrans Standard Specifications and these special provisions.

This item will include cutting and removing section of the existing wall to be removed for the new bridge and sealing the top of wall with an epoxy mortar cap. Submit a schedule of values for this lump sum bid item according to section 9-1.16B of the Caltrans Standard Specifications.

55. 15" Plastic Pipe

Comply with sections 64 of the Caltrans Standard Specifications.

Contractor to note that the pipe alignment is constructed through existing sections of rock slope protection. Included within this unit price is removal, stockpile on site and resetting of rock slope protection effected by the pipe placement.

56. 36" Reinforced Concrete Pipe (Class V, Rubber Gasket Joint)

Comply with sections 61, 65 and 70 of the Caltrans Standard Specifications.

57. Connect (N) pipe to existing structure (Tower C) Std. SSWPC 333-2

Comply with section 61, 65 and 70 of the Caltrans Standard Specifications.

58. Connect (N) pipe to existing siphon pipe (Std. SSPWC 380-4)

Comply with section 61, 65 and 70 of the Caltrans Standard Specifications.

59. Concrete Manhole (COSB Std. 3-080)

Comply with County of Santa Barbara Standard Plans and Details.

60. Remove Drainage Facilities

Comply with section 15 and 71 of the Caltrans Standard Specifications.

61. Abandon 24" Culvert

Comply with section 15 and 71 of the Caltrans Standard Specifications.

62. Abandon Drainage Inlet

Comply with section 15 and 71 of the Caltrans Standard Specifications.

63. Remove and Reset Rock Slope Protection (Various Locations)

Comply with section 72-2 of the Caltrans Standard Specifications.

Submit a schedule of values for this lump sum bid item according to section 9-1.16B of the Caltrans Standard Specifications.

This is a Final Pay Item as defined in section 9-1.02C of the Caltrans Standard Specifications.

64. Rock Slope Protection Backing No. 2

Comply with section 72 of the Caltrans Standard Specifications. This items is intended for reconstruction of existing concrete rock slope protection scheduled for removal.

Payment scope complies with section 9-1.03 and 72-3.04 of the Caltrans Standard Specifications.

This is a Final Pay Item as defined in section 9-1.02C of the Caltrans Standard Specifications.

65. Rock Slope Protection (1/2T, Method A)

Comply with section 72-2 of the Caltrans Standard Specifications.

Payment scope complies with section 9-1.03 and 72-2.04 of the Caltrans Standard Specifications.

This is a Final Pay Item as defined in section 9-1.02C of the Caltrans Standard Specifications.

66. Rock Slope Protection (1/4T, Method B)

Comply with section 72-2 of the Caltrans Standard Specifications.

Payment scope complies with section 9-1.03 and 72-2.04 of the Caltrans Standard Specifications.

This is a Final Pay Item as defined in section 9-1.02C of the Caltrans Standard Specifications.

67. Concreted-Rock Slope Protection (1/4 T, Method B)

Comply with section 72-2 of the Caltrans Standard Specifications. This items is intended for reconstruction of existing concrete rock slope protection scheduled for removal.

Payment scope complies with section 9-1.03 and 72-3.04 of the Caltrans Standard Specifications.

This is a Final Pay Item as defined in section 9-1.02C of the Caltrans Standard Specifications.

68. Rock Slope Protection Fabric (Class 8)

Comply with section 72of the Caltrans Standard Specifications. This items is intended for reconstruction of existing rock slope protection scheduled for remediation of slope failure.

Payment scope complies with section 9-1.03 and 72-3.04 of the Caltrans Standard Specifications.

69. Minor Concrete Curb (COSB Std 4-030, Type A)

Comply with County of Santa Barbara Standard Plans and Details.

70. Minor Concrete (V-Ditch)

Comply with section 73 and section 90 of the Caltrans Standard Specifications

71. Remove Concrete (V-Ditch)

Comply with section 15 and section 73 of the Caltrans Standard Specifications

72. Manhole Frame and Cover (Std. SSPWC 210-3)

Comply Standard Plans and Details

73. Manhole Frame and Cover (Std. SSPWC 630-4)

Comply Standard Plans and Details

74. Steel Sheet Pile Wall Coping

Comply with section 55 and 75 of the Caltrans Standard Specifications

75. Miscellaneous Metal (Bridge)

Comply with section 75 of the Caltrans Standard Specifications.

76. Tower Trash Racks

Comply with section 75 of the Caltrans Standard Specifications.

77. Steel Orifice Plates

Comply with section 75 of the Caltrans Standard Specifications.

78. Remove Chain-link Fence

Comply with section 15 and section 80 of the Caltrans Standard Specification and these special provisions.

79. Chain Link Fence (Type CL-4)

Comply with section 80 of the Caltrans Standard Specification and these special provisions.
The Chain-Link Fence is intended to be replacement for the removals occurring adjacent and in the way of the new construction. Contractor is to confirm location prior to removal with the Engineer and replace in kind upon completion of the work in the prior location.

80. Wood Fence (Polecraft, 2-Rail)

Comply with manufacturer's installation procedures as amended herein. Posts must be 5-feet tall with embedment of 2-feet. Horizontal rails will be 18" O.C.

81. Guard Railing Delineators

Comply with section 83 of the Caltrans Standard Specifications.

82. Midwest Guardrail System (Steel Post)

Comply with section 83 of the Caltrans Standard Specification.

83. Concrete Barrier (Type K)

Comply with section 83 of the Caltrans Standard Specifications.

84. Cable Railing

Comply with section 83 of the Caltrans Standard Specification.

85. Alternative In-Line Terminal System

Comply with section 83 of the Caltrans Standard Specifications.

86. Alternative Flared Terminal System

Comply with section 83 of the Caltrans Standard Specifications.

87. Concrete Barrier (Type 732) (Spillway Bridge)

Comply with section 83 of the Caltrans Standard Specifications.

88. Concrete Barrier (Type 732) (Channel Bridge)

Comply with section 83 of the Caltrans Standard Specifications.

89. Remove Guardrail

Comply with section 83 of the Caltrans Standard Specifications.

90. Mobilization

As defined in section 9-1.16D of the Caltrans Standard Specifications.

Submit a schedule of values for this lump sum bid item according to section 9-1.16B of the Caltrans Standard Specifications.

Replace *Reserved* in section 10-1.03 with:

10-1.03 TIME CONSTRAINTS

Perform work in the following locations only within the dates lists.

1. Tower Inlet A: May 1st – December 1st
2. Tower Inlet B: April 1st – January 1st
3. Spillway Bridge: April 1st – January 1st
4. New Channel Bridge: April 1st – January 1st
5. Low Flow Conduit: May 1st – December 1st
6. By-pass Structure: May 1st – December 1st

It is anticipated that work at all of the above listed locations cannot be completed in one dry work season. Upon written request from you, work may be temporarily suspended if the time constraints prevent you from making progress on your approved critical path schedule, or as mutually agreeable.

Work at these locations must be finished and functional at the end of its time constraint period. Time constraints may be extended by written approval by the District, and as mutually agreeable. You are strongly encouraged to complete Tower Inlet A and Tower Inlet B within the first working season. Upon completion and acceptance by the District, you will be relieved of maintenance responsibilities for Tower Inlet A and Tower Inlet B.

Other work locations, including Inlet Tower Inlets C & D and Tower Access Pads are within the debris basin limits of inundation. It may be feasible to perform work at these locations without time constraints. You are responsible for protecting all partially completed proposed improvements in place and must comply with Section 13-1.03A(1). Upon written request from you, work may be temporarily suspended at these other work locations if it is anticipated that work cannot adequately progress outside of April 1st to January 1st, or as mutually agreeable.

10-1.04 TRAINING AND MEETINGS

Training and meetings are held at times and locations you and the Engineer agree to.

10-1.05–10-1.10 RESERVED

10-2–10-3 RESERVED

10-4 WATER USAGE

Section 10-4 includes general specifications for using water for construction activities.

The Department encourages you to conserve water in all construction activities.

The Engineer notifies you of any (1) water shortage or (2) mandate from a local water authority to ration water. Within 10 days of the notification, submit a water conservation plan. The plan must include:

1. *List of construction activities that require water*
2. *Measures you will implement for each activity to conserve water*
3. *Method for curing concrete other than the water method if included in the work*
4. *Dust palliative you will use for dust control*

10-5 DUST CONTROL

Section 10-5 includes general specifications for controlling dust resulting from the work.

Prevent and alleviate dust by:

1. *Applying a dust palliative under section 18*
2. *Applying temporary soil stabilization under section 13-5*
3. *Managing material stockpiles under section 13-4.03C(3)*

10-6 WATERING

Section 10-6 includes specifications for developing a water supply, furnishing water, and applying water.

Developing a water supply includes developing a supply of water and furnishing pipes or other equipment needed to convey the water to the water application equipment.

Water may be potable or nonpotable. Nonpotable water must be either recycled water or nonpotable water developed from other sources.

The sources and discharge of recycled water must comply with the water-recycling criteria of the CDPH and the requirements of the appropriate RWQCB. Obtain either a waste discharge permit or a waiver from the appropriate RWQCB for each water source. Submit a copy of the permit or waiver before using the water in the work.

If an available source of water is described in the Information Handout, verify the quality and quantity of water.

Nonpotable water must not be conveyed in tanks or drain pipes that will be used to convey potable water. Nonpotable water supplies and potable water supplies must not be connected. Nonpotable water supply, tanks, pipes, and other conveyances of nonpotable water must be labeled Nonpotable Water / Do Not Drink.

Each water storage tank and distribution system must be equipped with positive shut-off valves.

Keep at least 1 mobile unit with a capacity of at least 1,000 gal the job site at all times for applying water unless all water is applied through pipes or another authorized method.

For compacting embankment material, subbase, base, and surfacing material and for dust control, apply water with equipment that will apply it uniformly.

For compaction, you may use a chemical additive if authorized.

If a bid item for develop water supply is shown on the Bid Item List, the Department does not adjust the lump sum price for any increase or decrease in the quantity of water required or for change order work.

10-7–10-50 RESERVED

11 WELDING

11-1.01 GENERAL

Section 11 includes general specifications for welding where welding is specified to comply with an AWS welding code.

Do not perform welding using flux-cored welding electrodes that comply with AWS A5.20, E6XT-4 or E7XT-4.

Wherever reference is made to the following AWS welding codes in the Contract, the year of adoption for these codes is as shown in the following table:

AWS code	*Year of adoption*
D1.1	*2010*
D1.3	*2008*
D1.4	*2011*
D1.5	*2010*
D1.6	*2007*
D1.8	*2009*

11-1.02 DEFINITIONS

continuous inspection: *QC Inspector must be within close proximity of all welders or welding operators such that inspections by the QC Inspector of each welding activity at each welding location do not lapse for a period exceeding 30 minutes.*

gross nonconformance: *Rejectable indications are present in more than 20 percent of the tested weld length.*

11-1.03 QUALITY CONTROL INSPECTOR

Replace clause 6.1.3 of AWS D1.1, the 1st paragraph of clause 7.1.2 of AWS D1.4, and clause 6.1.2 of AWS D1.5 with:

> *The QC Inspector must be the duly assigned person who acts for and on your behalf for inspection, testing, and quality related matters for all welding.*
> *The QA Inspector is the authorized representative who acts for and on behalf of the Engineer.*
> *The QC Inspector must be responsible for QC acceptance or rejection of materials and workmanship.*
> *Where the term Inspector is used without further qualification, it refers to the QC Inspector.*

The QC Inspector must document inspection and approval of:

1. *All joint preparations, assembly practices, joint fit-ups, and welding techniques*
2. *Performance of each welder, welding operator, and tack welder on a daily basis for each day welding is performed*

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.

11-1.04 PERSONNEL QUALIFICATIONS AND CERTIFICATIONS

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:*

Certified NDT Level II technicians

1. *Level III technicians certified to perform the work of Level II technicians*

11-1.05 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.

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

Submit an inspection request form to METS at least 7 days before performing any procedure qualification tests. Notify the Engineer of your submittal. Witnessing of qualification tests by the Engineer does not constitute authorization of the intended joint locations, welding parameters, or essential variables.

11-1.06 NONDESTRUCTIVE TESTING

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.*

Clause 6.6.5 of AWS D1.1, clause 7.6.5 of AWS D1.4, and clause 6.6.5 of AWS D1.5 do not apply.

The Engineer may order you to perform NDT that is in addition to the visual inspection or NDT specified in the specifications or AWS welding code. The additional NDT and associated repair work is change order work. If the NDT discloses an attempt to defraud or reveals a gross nonconformance, the Department does not pay for the costs associated with the repair of the deficient area, the NDT of the weld and of the repair, or any delays caused by the repair.

If less than 100 percent of NDT is specified for any weld, the entire length of weld must comply with the specified acceptance criteria. If any welding deficiencies are discovered by additional NDT ordered or performed by the Engineer that uses the same NDT method as that originally specified, the Department does not pay for the costs associated with the repair of the deficient area, including NDT of the weld and of the weld repair, or any delays caused by the repair.

If any welding deficiencies are discovered by visual inspection ordered or performed by the Engineer, the Department does not pay for the costs associated with the repair of a deficient area or any delays caused by the repair.

11-2 WELDING QUALITY CONTROL

11-2.01 GENERAL

Section 11-2 applies to (1) work welded under sections 49, 52, 55, and 60-4.09, and (2) work in section 99 that must comply with an AWS welding code.

Section 11-2 does not apply to stud welding.

All welding requires inspection by the Engineer.

You must provide continuous inspection when any welding is being performed.

11-2.02 WELDING QUALITY CONTROL MANAGER

Assign a welding QC manager. The welding QC manager must be registered as a civil engineer in the State or currently certified as a CWI.

11-2.03 SUBMITTALS

11-2.03A General

If welding is performed at the job site, submit an inspection request form at least 3 business days before performing welding at the job site. Notify the Engineer of your submittal.

11-2.03B Welding Quality Control Plan

Before submitting a welding QC plan, hold a prewelding meeting to discuss the requirements for the welding QC plan. The meeting attendees must include the Engineer, your welding QC manager, and a representative from each entity performing welding or inspection for the Contract.

For the contents, format, and organization required for a welding QC plan, go to the METS Web site.

Submit 2 copies of a welding QC plan for each subcontractor or supplier for each item of work for which welding is performed.

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.

11-2.03C Welding Report

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*

The daily production log must include:

1. *Locations of all welding*
2. *For each location, the welders' names, quantity of welding performed, any problems or deficiencies discovered, and any testing or repair work performed*
3. *Daily report from each QC Inspector*

Clearly write the following information on the outside of radiographic film envelopes:

1. *Name of the QC manager*
2. *Name of the NDT firm*
3. *Name of the radiographer*
4. *Date*
5. *Contract number*
6. *Complete part description*
7. *All included weld numbers, report numbers, and station markers or views as detailed in the welding QC plan*

Clearly write on all interleaves the part description and all included weld numbers and station markers or views as detailed in the welding QC plan. Use a maximum of 2 pieces of film for each interleave.

The QC Inspector or certified technician must sign all visual inspection and NDT reports and submit them daily to the welding QC manager for review and signature before submittal to the Engineer. Corresponding names must be clearly printed or typewritten adjacent to all signatures.

The Engineer reviews the welding report to determine whether you are complying with the welding QC plan and the Contract. Except for field welded steel pipe piling and field welded bar reinforcement in CIP concrete piling:

1. *Allow the Engineer 15 days to review the report.*
2. *You may encase in concrete or cover welds for which the welding report has been submitted before receiving authorization of the welding report. If you choose this option, you will not be relieved of the responsibility for incorporating material in the work that complies with the Contract. Material not complying with the Contract is subject to rejection.*

For field welded steel pipe piling and field welded bar reinforcement in CIP concrete piling:

1. *Allow the Engineer 2 business days to review the welding report*
2. *Do not install the steel pipe piling or encase the reinforcement in concrete until the Engineer has authorized the welding report*

11-2.03D Certificates of Compliance

Submit a certificate of compliance for each item of work for which welding is performed. The certificate must be signed by the welding QC manager. The certificate must state that all of the materials and workmanship incorporated in the work, and all required tests and inspections of this work, have been performed in compliance with the Contract.

11-2.04 PERSONNEL QUALIFICATIONS AND CERTIFICATIONS

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:

> *The QC Inspector must be currently certified as an AWS Certified Welding Inspector under AWS QC1. The QC Inspector may be assisted by an Assistant QC Inspector provided that this individual is currently certified as an AWS Certified Associate Welding Inspector under AWS QC1. The Assistant QC Inspector may perform inspection under the direct supervision of the QC Inspector provided the assistant is always within visible and audible range of the QC Inspector. The QC Inspector must be responsible for signing all reports and for determining if welded materials comply with the workmanship and acceptance criteria. The ratio of QC Assistants to QC Inspectors must not exceed 5 to 1.*

Welding inspection personnel or NDT firms to be used in the work must not be employed or compensated by any subcontractor or by other persons or entities hired by subcontractors who will provide other services or materials for the Contract, unless one of the following conditions is met:

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.*

Except for the exempt facilities identified above, an authorized independent third party must witness the qualification tests for welders or welding operators. The independent third party must be currently certified as a CWI and must not be an employee of the Contractor performing the welding. Allow 15 days for the Engineer to review the qualifications and copy of the current certification of the independent third party.

11-2.05 WELDING INSPECTION

Replace clause 6.5.4 of AWS D1.5 with:

The QC Inspector must inspect and approve each joint preparation, assembly practice, welding technique, joint fit-up, and the performance of each welder, welding operator, and tack welder to make certain that the applicable requirements of this code and the qualified WPS are met. The QC Inspector must examine the work to make certain that it complies with clauses 3 and 6.26. The size and contour of all welds must be measured using suitable gauges. Visual inspection for cracks in welds and base metal, and for other discontinuities must be aided by strong light, magnifiers, or other devices as necessary. You may use acceptance criteria different from those specified in this code if authorized.

11-2.06 WELDING PROCEDURES QUALIFICATION

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.*

11-2.07 REPAIR WORK

Notify the Engineer immediately if you discover welding problems, deficiencies, base metal repairs, or any other type of repairs not included in the welding QC plan. Submit the proposed repair procedures to correct them.

Allow the Engineer 7 days to review the repair procedures.

You must receive authorization before performing:

1. *3rd-time excavations of welds or base metal to repair unacceptable discontinuities, regardless of NDT method*

2. *Repairs of cracks*
3. *Repairs not included in the welding QC plan*

Requests to perform 3rd-time excavations, repairs of cracks, or repairs not included in the welding QC plan must include an engineering evaluation. At a minimum, the engineering evaluation must address:

1. *Cause of each defect*
2. *Why the repair will not degrade the material properties*
3. *What steps are being taken to prevent similar defects from happening again*

11-3 WELDING FOR OVERHEAD SIGN STRUCTURES, STANDARDS, AND POLES

11-3.01 GENERAL

Section 11-3 applies to work welded under sections 56-2 and 56-3.02.

Fabricate overhead sign structures, standards, and poles at a plant on the Authorized Facility Audit List.

11-3.02 *WELDING INSPECTION*

Welding inspection personnel or NDT firms to be used in the work must not be employed or compensated by any subcontractor or by other persons or entities hired by subcontractors who provide other services or materials for the Contract except for welding performed at a permanent fabrication or manufacturing plant that is certified under the AISC Quality Certification Program.

The AISC Certification category for overhead sign structures is Bridge and Highway Metal Component (CPT) or Simple Steel Bridge Structures (SBR).

The AISC Certification category for pole structures is Bridge and Highway Metal Component (CPT) or Standard for Steel Building Structures (STD).

11-3.03 *SUBMITTALS*

Submit a welding report under section 11-2.03C except submit the welding report 2 business days before submitting the certificate of compliance.

11-4–11-9 RESERVED

13 WATER POLLUTION CONTROL

Add section 13-1.03A(1):

13-1.03A(1) Drainage Control

The proposed project is within and adjacent to the Santa Monica Debris Basin, the Debris Basin Emergency Spillway channel, and the natural Santa Monica Creek drainage course, which runs perennially and conveys and/or captures storm flow and natural debris. You are fully responsible for continually accepting and discharging water from any source in a manner that causes no damage to existing or partially completed proposed improvements, in a manner that causes no ponded water to accumulate at low points, and in a manner which poses no potential hazard to persons or property and is conformance with all permits required for this project. You will not be allowed to divert stormwater to surface streets. Damage to existing or partially completed proposed improvements caused by lack of drainage control shall be repaired, or removed and replaced, at your expense.

It must be understood and agreed that you must hold the Owner and the Engineer harmless from legal action taken by any third party with respect to construction and operation of temporary drainage control works.

You must submit your proposed methods for storm water and erosion control to the Engineer.

Add to the end of section 13-3.01A:

This project's risk level is 2.

Add to section 13-4.03G:

13-4.03G Dewatering

If dewatering activities are needed by you in order to perform excavation, dewatering discharged must conform to the Water Quality Control Plan for the Central Coast Basin – September 2017, Section 3.3.2 ‘OBJECTIVES FOR ALL INLAND SURFACE WATERS, ENCLOSED BAYS, AND ESTUARIES.’ Below is a link to the Basin Plan:

https://www.waterboards.ca.gov/centralcoast/publications_forms/publications/basin_plan/docs2017/2017_basin_plan_r3_complete.pdf

Comply with Section 5-1.20B(1).

Replace section 13-12 with:

13-12 TEMPORARY CREEK DIVERSION SYSTEMS

13-12.01 GENERAL

13-12.01A Summary

Section 13-12 includes specifications for constructing, maintaining, reconstructing, and removing temporary creek diversion system (TCDS), and restoring creek bed to original condition. The temporary diversion system is used to divert upstream water flows to allow construction in a dry or dewatered location.

13-12.01B Definitions

Not Used

13-12.01C Submittals

13-12.01C(1) Temporary Creek Diversion System Plan

Within 20 days of Contract approval, submit 3 copies of the Temporary Creek Diversion System Plan (TCDSP). The TCDSP must include:

1. Installation and removal process, including equipment, platforms for equipment, and access locations.
2. Anticipated flow rates.
3. Calculations supporting the sizing of piping, channels, pumps, or other conveyance by using FHWA HY-8 or other equivalent method. Calculate the discharge water flow rate and velocity anticipated where it discharges on any erodible surface, so its conveyance does not cause erosion within the project or at the discharge to the water body. Temporary culverts attached to banks, walls, or other locations must be designed to hold the full weight of the culvert at capacity and restrain the culvert for any expected hydraulic forces.
4. Plans showing locations of diversion, including layouts, cross sections, and elevations.
5. Materials proposed for use, including MSDS if applicable.
6. Operation and maintenance procedures for the TCDS.
7. Restoration plans showing before and after conditions, including photos of existing conditions for areas disturbed during the installation, operation, and removal of the TCDS.
8. Monitoring and reporting plan to ensure applicable water quality objectives are met. This includes schedule of work including Temporary BMP implementation as part of the Construction Site BMP strategy, and SWPPP or WPCP as applicable. Use with section 13-3.01A.
9. Details of the pumping system, if used, including power source, debris handling, fish screens, and monitoring requirements.
10. Fish passage plan, following the Caltrans Fish Passage Design for Road Crossings, CA Department of Fish and Wildlife (CDFW), CA Salmonid Stream Habitat Restoration Manual, and National Marine Fisheries Service (NMFS), Guidelines for Salmonid Passage at Stream Crossings, as required by the applicable PLACs.

11 The TCDS design must demonstrate how it will comply with section 13-12.03A, water tightness, and prevent seepage.

12. Contingency plan to remove workers, equipment, materials, fuels, and any other work items that will cause pollution or violation of PLACs during a rain event out of the flow area. Develop the contingency plan for when a 12-inch freeboard cannot be maintained and overtopping of the coffer dams may occur.

If revisions are required, the Engineer notifies you of the date when the review stopped and provides comments. Submit a revised TCDSP within 15 days of receiving the comments. The Department's review resumes when a complete TCDSP has been resubmitted.

Submit an electronic copy on a read-only CD, DVD, or other Engineer-authorized data storage device and 4 printed copies of the authorized TCDSP.

If the RWQCB or other regulatory agency requires review of the authorized TCDSP, the Engineer submits it to the RWQCB for review and comment. If the Engineer orders changes to the TCDSP based on the RWQCB's comments, submit a revised TCDSP within 10 days.

All submittals which include plans, specifications, and calculations must be sealed and signed by a civil engineer registered in the State.

13-12.01D Quality Assurance

Not Used

13-12.02 MATERIALS

13-12.02A Gravel

Gravel must:

1. Be river run gravel obtained from a river or creek bed with gradation of 100 percent passing a 3/4 inch sieve and 0% passing a 3/8 inch sieve
2. Be clean, hard, sound, durable, uniform in quality, and free of any detrimental quantity of soft, thin, elongated or laminated pieces, disintegrated material, organic matter, or other deleterious substances
3. Be composed entirely of particles that have no more than 1 fractured face
4. Have a cleanliness value of at least 85, as determined by California Test 227

13-12.02B Impermeable Plastic Membrane

Impermeable plastic membrane must be:

1. Single ply, commercial quality, polyethylene with a minimum thickness of 10 mils complying with ASTM D2103. You must use stronger plastic membrane if required as part of design to resist hydraulic forces.
2. Free of holes, punctures, tears or other defects that compromise the impermeability of the material.
3. Suitable for use as an impermeable membrane.
4. Resistant to UV light, retaining a minimum grab breaking load of 70 percent after 500 hours under ASTM D4355.

13-12.02C Gravel-Filled Bags

Gravel-filled bags must comply with section 13-5.02G.

13-12.02D Plastic Pipes

Plastic pipe must comply with section 61-3.01 and must:

1. Be clean, uncoated, in good condition free of rust, paint oil dirt or other residues that could potentially contribute to water pollution
2. Be adequately supported for planned loads
3. Use watertight joints under section 61-2.01.

4 Be made of a material or combination of materials that are suitable for clean water and which do not contain banned, hazardous or unlawful substances

5. For temporary pipes not reused on the project you may use the following materials:

5.1. PVC closed-profile wall pipe must comply with ASTM F1803

5.2. PVC solid wall pipe must comply with ASTM D3034, ASTM F679, AWWA C900, AWWA C905, or ASTM D2241 and cell class 12454 defined by ASTM D1784

5.3. HDPE solid wall pipe must comply with AASHTO M 326 and ASTM F714

5.4. Polyethylene large-diameter-profile wall sewer and drain pipe must comply with ASTM F894

13-12.02E Rock

Rock layer must comply with the table titled Rock Gradation for 7-inch-thick Layer in section 72-4.02.

13-12.02F Pumping System

Pumping system must:

1. Comply with section 74-2.02B
2. Be equipped with secondary containment
3. Be free of fuel and oil leaks
4. Meet intake screen regulatory requirements

13-12.02H Discharge Water Energy Dissipation and Erosion Control

Discharge water from pumps, pipes, ditches, or other conveyances must have BMPs to dissipate the flows and velocity of water discharged from the temporary diversion system if erosion would otherwise occur.

Energy dissipation measures:

1. May be plastic sheeting, flared end sections, rubber matting, or other materials appropriate for the design hydraulics
2. Must be anchored to prevent movement by expected flows
3. Must be removed when the TCDS is removed

13-12.03 CONSTRUCTION

13-12.03A General

Construction, use and removal of the TCDS is restricted to the time periods described in Section 10-1.03 of the technical provisions.

Do not use motorized equipment or vehicles in areas of flowing or standing water for the construction or removal of the TCDS in compliance with section 13-4.03.

Place rock at outlet of diversion pipe under section 72-4.03, except motorized vehicles and equipment must not be used in areas of flowing or standing water.

Seal openings or penetrations through the impermeable plastic membrane with commercial quality waterproof tape.

The TCDS must be water tight to keep the work area dry for construction and prevent the creation of pollutants. Maintain all portions of the TCDS and fix leaks as soon as they are discovered.

13-12.03B Maintenance

Maintain the TCDS to provide a minimum freeboard of 12 inches between the water surface and the impermeable top of the cofferdams.

Do not discharge runoff from existing or proposed drainage systems into the dry work area between the cofferdams. Runoff from these systems may be connected to the diversion pipe or conveyed by pipes downstream of the cofferdam.

Prevent leaks in the TCDS. Provide seepage pumps as necessary and keep the work area dry to prevent the creation of sediment-laden water.

Repair holes, rips and voids in the impermeable plastic membrane with commercial-quality waterproof tape. Replace impermeable plastic membrane when patches or repairs compromise the impermeability of the material.

Repair TCDS within 24 hours after the damage occurs.

Prevent debris from entering the TCDS and receiving water.

Remove and immediately replace gravel, gravel-filled bags, impermeable plastic membrane, or plastic pipes contaminated by construction activities.

Remove sediment deposits and debris from the TCDS as needed. If removed sediment is deposited within project limits, it must be stabilized and not subject to erosion by wind or water, under sections 19-1.01 and 19-2.03 B.

13-12.03C Removal

When no longer required, remove all components of TCDS. Return the debris basin, creek bed and banks to the original condition.

Do not excavate the native creek material. Backfill ground disturbance, including holes and depressions caused by the installation and removal of the TCDS with gravel. Maintain the original line and grade of the creek bed.

13-12.04 PAYMENT

Not Used

14 ENVIRONMENTAL STEWARDSHIP

Replace section 14-6.01C with:

14-6.01C CONSTRUCTION

The District will provide a biologist for this project as needed to comply with Section 5-1.20B(1). You must coordinate and accommodate the work of the biologist. The District biologist is Andrew Raaf, (805) 568-3445.

15 EXISTING FACILITIES

15-1.01 GENERAL

Section 15 includes general specifications for performing work on existing facilities.

Performing work on existing facilities includes abandoning, adjusting, modifying, obliterating, reconstructing, relaying, relocating, remodeling, removing, repairing, resetting, or salvaging a facility. Do not perform work on an existing facility until the facility is no longer needed.

Reconstructed facilities must comply with the design of and be equal to the best parts of the existing facilities.

Reconstruction work must comply with the specifications for new work of similar character.

15-1.02 MATERIALS

Materials for adjusting facilities to grade must be similar in character to the existing materials.

15-1.03 CONSTRUCTION

15-1.03A General

Backfill trenches, holes, depressions, and pits caused by performing work on an existing facility. In an unsurfaced area, backfill with embankment material under section 19. In a surfaced area, backfill with material equal to or better than the surrounding material. Grade backfilled areas to drain and blend in with the surrounding area.

Clean earth and other foreign material, including concrete, from material to be salvaged or incorporated into the work.

Dispose of removed facilities not to be salvaged or incorporated into the work.

If you damage a facility or a portion of a facility to remain in place, repair or replace it. The repair or replacement must be equal or better in quality than the original portion.

Repair or replace materials to be salvaged or incorporated into the work that are lost or damaged during work activities. The repair or replacement must be equal or better in quality than the original portion. Instead of this repair or replacement, the Department may deduct the repair or replacement cost.

Replace material from existing facilities described to be reused in the work if the Engineer determines the material is unsuitable. Furnishing the replacement material is change order work.

If you damage a part of a loop conductor specified to remain in place, including the part leading to the adjacent pull box, replace the entire loop detector and any adjacent loops damaged during the replacement.

Break the floors of structures within the roadway that are not required to be removed such that water will not be entrapped.

Where abrasive blasting is performed within 10 feet of a lane open to traffic, remove residue with a vacuum attachment operating concurrently with the blast cleaning equipment.

15-1.03B Removing Concrete

Where concrete is described to be removed, remove the concrete to a depth of at least 3 feet below finished grade.

Concrete removal includes removal of any steel embedded in the concrete.

Before removing a portion of a monolithic concrete element, make a 1-inch-deep saw cut to a true line along the limits of removal on faces of the element that will be visible in the completed work.

Protect existing reinforcement to be incorporated into the new work from damage.

Where new concrete is to join existing concrete, remove enough concrete to allow splicing of new reinforcement.

Thoroughly remove all material adhering to the existing reinforcement before embedding it in new concrete.

Instead of disposing of removed concrete, you may:

1. *Incorporate it in adjacent embankments if it is:*
    - *1.1. Broken into parts at most 10 inches in greatest dimension*
    - *1.2. Buried at least 3 feet below the finished grade and slope lines*
    - *1.3. Buried at least 10 feet from trees or highway facilities*
    - *1.4. Not buried where piling is to be constructed*
2. *Place it at authorized locations such that it will not present an unsightly appearance from the highway*

Delete the 7th paragraph of section 15-1.03B.

15-1.03C Salvaging Facilities

Tag the bundles, packages, and individually salvaged material. Show the following information on the tags:

1. *Name or description of the material*
2. *Type or model number*
3. *Dimensions*
4. *Quantity if more than 1*

Haul salvaged material directly to the location specified in the special provisions and stockpile it. If authorized, you may temporarily stockpile salvaged material at the job site. Replace any salvaged material that is lost before it is stockpiled at the location specified in the special provisions.

15-1.03D–15-1.03K Reserved

15-1.04 PAYMENT

Not Used

DIVISION III EARTHWORK AND LANDSCAPE

Add prior to section 17:

Bid Items and Applicable Sections

Item description	Applicable section
Clearing and Grubbing	19
Roadway Excavation	19
Structure Excavation (Inlet Towers)	19
Structure Excavation (Spillway Bridge)	19
Structure Excavation (Channel Bridge)	19
Structure Excavation (Rock Slope Protection)	19
Structure Backfill (Inlet Towers)	19
Structure Backfill (ByPass)	19
Structure Backfill (Spillway Bridge)	19
Structure Backfill (Channel Bridge)	19
Structure Backfill (Slurry Cement)	19
Imported Borrow	19
Bonded Fiber Matrix	21
Rolled Erosion Control Product (Blanket)	21

17 GENERAL

Add to section 17-2.01:

Clearing and Grubbing consists of removing all vegetation, trees, and tree stumps from within the limits of grading and excavation, as shown on the plans. All vegetation and tree removals require prior approval by the Engineer.

Some trees shown on the plans to be within the limits of grading and excavation may have been removed by others prior to the start of work. You are responsible for removing remaining stumps or downed vegetation from the jobsite that conflicts with the proposed work.

Vegetation and trees located beyond the limits of grading and excavation must be protected in place. You must coordinate your activities with the Engineer when working near trees specifically designated on the plans as 'Protect in Place.' You may be directed to modify grading slopes in these locations.

19 EARTHWORK

19-1 GENERAL

19-1.01 GENERAL

19-1.01A Summary

Section 19-1 includes general specifications for performing earthwork activities.

Performing earthwork activities includes removal of unsuitable material or a buried man-made object if the removal is described.

If paleontological resources mitigation is specified in the special provisions under section 14-7.04, performing earthwork activities includes:

1. *Paleontological resources training for your staff and subcontractors*
2. *Submittals of your schedule of subsurface-disturbing activities and updated schedules*
3. *Coordination and work with the Department's mitigation team*

Complete work specified in section 20-10.02C(2) before starting earthwork activities.

19-1.01B Definitions

Reserved

19-1.01C Submittals

Reserved

19-1.01D Quality Assurance

Reserved

19-1.02 MATERIALS

Add to section 19-1.02A General

Soil placed as backfill or fill must follow the Caltrans Corrosion Guidelines dated May 2021. See Informational Handout for complete Caltrans Corrosion Guidelines for contractor to reference for compliance.

19-1.03 CONSTRUCTION 19-1.03A General

Unless the material resulting from the excavation is hazardous, construct embankments and dikes or backfill structures with it. If the quantity of excavated material is not sufficient to construct embankments, obtain the material under section 19-7.

Add to section 19-1.03A:

Subgrade surfaces should be evaluated during grading and approved by the Owner's geotechnical representative(s) prior to the placement of any compacted backfill/fill or structures. All pavement base and subbase materials should be compacted to a relative dry density of at least 95% at a moisture content within Â±2.5% of the optimum water as per ASTM D1557

Add to section 19-1.03A(1): Existing Fills

It should be noted that existing fills along the alignments, where present, may not have been properly engineered and/or constructed. All surfaces to receive new compacted fills and/or structures should be firm and free of any loose/weak, wet or soft soils. Non-engineered existing fills or other soils present along the proposed roadway alignments should be over-excavated to a depth of at least two (2) feet prior to placement of any new fills or structures. Depending on the actual field conditions encountered during grading, deeper over-excavations may be required. All subgrade surfaces should be evaluated during grading and approved by the Owner's geotechnical representative(s) prior to the placement of any compacted backfill/fill or structures.

Add to section 19-1.03A(2): Spillway Bridge Foundation

Temporary lateral fluid pressure on the spillway sidewalls during construction should be limited by placing fluid slurry cement in lift of thickness ≤ 24 inches or less. Each in-place lift should be allowed to set at least for 4 hours prior to the placement of the overlying lift.

Foundation subgrade soils exposed at the bottom of the temporary excavation for the slurry cement pad construction should be scarified, moisture conditioned with ±2.0% of the optimum and compacted to at least 95% relation compaction per ASTM D1557 prior to the placement of the first lift of the slurry cement.

Add to section 19-1.03A(3): Continuously Reinforced Concrete Pavement

The upper two (2) feet of the subgrade soils beneath the asphalt concrete and on-grade CRCP slabs should be compacted to a minimum of 95% relative density as per ASTM D1557.

Add to section 19-1.03A(4): "W" Line

We recommend that any excavation deeper than five (5) feet along the west side of the debris basin (e.g., for the construction of the Tower Access Pads) be performed in slots such that no more than 50 feet length of the excavation (measured along the "W" Line) is open at any time during construction. We also recommend the use of light weight equipment for construction along or above the segment of the "W" Line located north of the TAP/GRS wall construction area.

19-1.03B Unsuitable Material

Excavate and dispose of unsuitable material encountered below the natural ground surface in embankment areas or below the grading plane in excavation areas as ordered.

Notify the Engineer before removing the unsuitable material if:

1. *Removal is not otherwise described*
2. *You request payment for removal as change order work*

Backfill the space resulting from excavating unsuitable material with material suitable for the planned use. Place and compact suitable material under section 19-5.

19-1.03C Grade Tolerance

Immediately before placing subsequent layers of material, prepare the grading plane such that the grading plane:

1. *Does not vary more than 0.05 foot above or below the grade established by the Engineer where HMA is to be placed.*

2. *Does not extend above the grade established by the Engineer where concrete base or pavement is to be placed.*

3. *Beneath structural approach slabs or the thickened portion of sleeper slabs do no extend above the grade established by the Engineer.*

4. *At any point is within 0.05 foot above the grade established by the Engineer if the material to be placed on the grading plane is paid by the cubic yard.*

5. *At any point is within 0.10 foot above the grade established by the Engineer if subbase or base material to be placed on the grading plane is paid by the ton.*

19-1.03D Buried Man-Made Objects

Remove and dispose of a buried man-made object encountered in an excavation as part of the excavation work.

Notify the Engineer before removing the buried man-made object if:

1. *Removal of the object is not otherwise described*
2. *Object could not have been determined by visual inspection*
3. *You request payment for removal of the object as change order work*

19-1.04 PAYMENT

Not Used

19-2 ROADWAY EXCAVATION

19-2.01 GENERAL

19-2.01A Summary

Section 19-2 includes specifications for performing roadway excavation.

Roadway excavation consists of all excavation involved in the grading and construction of the roadway except structure excavation and any excavation paid for as a separate bid item.

Roadway excavation includes:

1. *Excavating and stockpiling the selected material*
2. *Removing the stockpiled material and placing it in its final position*
3. *Removing surcharge material*
4. *Performing the removal of a slide or slipout which is paid for as the ty*pe of roadway excavation involved

19-2.01B Definitions selected material: *Specific material excavated from a described location on the job site. Selected material includes topsoil.*

19-2.01C Submittals

Reserved

19-2.01D Quality Assurance

Reserved

19-2.02 MATERIALS

Not Used

19-2.03 CONSTRUCTION

19-2.03A General

Excavate to the described or authorized grade. If you overexcavate, backfill with an authorized material and compact it.

Remove pavement within the limits of roadway excavation. Pavement removal must comply with section 39 and 41.

Compaction must comply with section 19-5.

Construct embankments under section 19-6.

19-2.03B Surplus Material

If a quantity of surplus material is shown, the quantity is approximate.

Ensure enough material is available to complete the embankments before placing the material at other locations on the job site or disposing of it.

Obtain authorization before disposing of surplus material or using it for any of the following:

1. *Widening embankments uniformly*
2. *Flattening slopes*
3. *Placing along the roadway or at other locations*

If you cannot use surplus material within the highway, dispose of it.

If you dispose of any surplus material prematurely and later find a material shortage, replace the surplus material with an authorized material.

If an ordered change increases the quantity of excavation or decreases the quantity of embankment such that surplus material must be disposed of, disposing of this material is change order work.

19-2.03C Deficiency Material

If the quantity of acceptable material from excavation is not enough to construct the embankments, the quantity of material needed to complete the embankments must consist of local or imported borrow.

Obtain local or imported borrow under section 19-7.

If a bid item for imported borrow is not shown on the Bid Item List, obtaining imported borrow is change order work.

19-2.03D Selected Material

19-2.03D(1) General

If selected material is not used for a specified layer, place the selected material in the roadway prism as embankment or structure backfill.

If selected material is used as a specified layer, spread and compact it under section 25.

If practicable and unless processing of material is required, haul selected material directly from the excavation to its final position in the roadway prism and compact it in place.

Selected material must remain in place until it can be placed in its final position unless stockpiling of selected material is ordered.

If stockpiling of selected material is ordered, excavate and stockpile the selected material until the stockpiled material is to be placed in its final position in the roadway prism. This work is change order work.

19-2.03D(2) Topsoil *Reserved*

19-2.03E Blasting

The Department does not allow excessive blasting.

Remove material outside the planned cross section that is shattered or loosened due to blasting.

Suspend blasting activities if any of the following conditions occurs:

1. *Any sign of overshooting*
2. *Endangerment to the public*
3. *Destruction of property or natural features*

19-2.03F Slides and Slipouts

Excavate and remove material:

1. *Outside the planned roadway or ditch slope that is unstable and constitutes a potential slide*
2. *From a slide that has come into the roadway or ditch*
3. *Slipped out of new or existing embankments*

Excavate to the designated lines or slopes either by benching or as ordered.

Use removed material to construct embankments unless otherwise ordered.

Before removal activities if removal of a slide or a slipout is not described, you may request the removal to be change order work.

If you complete a slope and are ordered to remove unstable or stable material and reslope the area, the removal and resloping is change order work.

Repair any damage to the completed work resulting from a slide or slipout as ordered.

Repairing damage to the completed work due to a slide or slipout is paid for as the type of work involved unless otherwise ordered as change order work.

If a slide or slipout is caused by your activities or negligence, remove the slide or slipout material and restore the slope.

19-2.03G Slopes

Construct slopes to the lines and grades established by the Engineer. Slope tolerances are measured perpendicular to the planned slope.

Any point on the completed excavation slope must be within 0.5 foot of the planned slope, unless the excavation is in rock, in which case, any point on the completed slope must be within 2 feet of the planned slope.

Slopes or portions of slopes must not encroach on the roadbed.

Round the tops of excavation slopes and ends of excavations.

Any point on the completed embankment slope must be within 0.5 foot of the planned slope for slopes within 4 feet of the shoulder grade. Slopes below 4 feet must be within 1 foot of the planned slope.

If an embankment is constructed of large rock and the size of rocks make it impracticable to construct slopes within 1 foot, the Engineer may authorize you to construct slopes more than 4 feet below shoulder grade to within 2 feet of the planned slope.

For median and side slopes with a 6:1 (horizontal:vertical) or flatter slope:

1. *Completed slopes must be within 0.2 foot from the grade established by the Engineer*

2. *Flowlines must be graded to drain and must be within 0.1 foot from the grade established by the Engineer*

If the slope is to be cultivated or straw is to be incorporated into the surface, remove loose rocks larger than 2-1/2 inches in maximum dimension, roots, and other debris on the surface of the slope before cultivation or incorporation of straw.

Maintain completed slopes. Repair any slope damage caused by erosion.

19-2.03H Ditch Excavation

Excavate ditches including channels for changing the course of streams.

Avoid excavating below the grade for the bottom of the ditch or water channel. If you excavate below grade, backfill with suitable material and compact it.

19-2.04 PAYMENT

The payment quantity for roadway excavation is the volume of roadway excavation material, including volume of material involved in:

1. *Embankment construction unless a separate bid item for constructing embankments is shown on the Bid Item List*

2. *Ditch or channel excavation if the bottom width of the ditch or channel is 12 feet or more 3. Local borrow excavation*

The volume of material for roadway excavation is determined from the average end areas and the distances between them.
If changed conditions or nature of a particular operation make determining the quantities of roadway excavation based on average end areas impractical, the payment quantity is the volume determined using a method best suited to obtain an accurate quantity.

If the quantities of roadway excavation are determined from average end areas and centerline distances, a correction for curvature is not applied to quantities within the roadway prism. In determining the quantity of material outside the original roadway prism, where the roadway centerline is used as a base, a correction is made for curvature if the centerline radius is 1,000 feet or less.

The volume of material removed from a stockpile is determined from measurements of the stockpile before removal.

If the bottom of a ditch or channel is less than 12 feet wide, the payment quantity for ditch excavation is the volume determined from average areas and the distances between them.

19-3 STRUCTURE EXCAVATION AND BACKFILL

19-3.01 GENERAL

19-3.01A Summary

Section 19-3 includes specifications for performing structure excavation and backfill.

Structure excavation includes:

1. *Excavating foundations for structures, including trenches for culverts, pipes, rods, deadmen, cutoff walls, and other facilities*

2. *Placing structure backfill where compaction of the structure backfill is not required.*
3. *Control and removal of water*
4. *Installation and removal of facilities required to complete the work unless specified or allowed to remain in place*

Structure excavation (Type A) includes excavation for footings where seal courses are shown.

Structure excavation (bridge) includes structure excavation not shown on the Bid Item List or plans as any other type of structure excavation.

Structure backfill (bridge) includes structure backfill not shown on the Bid Item List or plans as any other type of structure backfill.

Structure excavation (bridge) or structure backfill (bridge) includes structure excavation or structure backfill for bridges not described by type.

19-3.01B Definitions

Reserved

19-3.01C Submittals

19-3.01C(1) General

Reserved

19-3.01C(2) Cofferdams

Submit shop drawings for cofferdam construction. Include construction methods and calculations with the shop drawings. Shop drawings and calculations must be sealed and signed by an engineer who is registered as a civil engineer in the State.

For cofferdams on or affecting railroad property, allow 85 days for review.

19-3.01C(3) Soldier Pile Walls

Submit shop drawings for soldier pile wall construction. Shop drawings must include:

1. *Construction sequence*
2. *Traffic control*
3. *Method of soldier pile installation*
4. *Method of placing lagging*
5. *Excavation lift limits*
6. *Drilling and excavation equipment*
7. *Calculations showing soil stability at all stages of construction*

Shop drawings and calculations must be sealed and signed by an engineer who is registered as a civil engineer in the State.

Allow 10 days for review.

19-3.01C(4) Ground Anchor and Soil Nail Walls

Submit shop drawings for earthwork for each ground anchor wall and soil nail wall to OSD, Documents Unit. Notify the Engineer of the submittal. Include in the notification the date and a description of the contents of the submittal. The shop drawings must include:

1. *Wall construction schedule with construction sequence*
2. *Measures to ensure wall and slope stability during construction*
3. *Provisions for installing verification and proof test nails*
4. *Methods of excavation for the staged lifts and types of excavation equipment*
5. *Excavation lift height and maximum duration of exposure for each wall zone, including supporting calculations and provisions to stabilize the exposed excavated face*
6. *Details for measuring the movement of the excavated face and the wall during stability testing and construction*
7. *Space requirements for installation equipment*
8. *Dewatering plan to divert, control, and dispose of surface and groundwater during construction*
9. *Provisions for discontinuous rows of soil nails*

Shop drawings and calculations must be sealed and signed by an engineer who is registered as a civil engineer in the State.

Submit 5 copies of shop drawings for initial review. Allow 30 days for review.

Submit from 6 to 12 copies of final shop drawings as requested by the Engineer for final authorization.

19-3.01C(5) Test Results

Submit test results of any stability testing performed for ground anchor walls and soil nail walls as an action submittal.

19-3.01C(6) Controlled Low-Strength Material

If you propose using controlled low-strength material, submit a mix design. Include test data before excavating the trench where controlled low-strength material is to be used.

Add to section 19-3.01C(6)

Slurry Cement compressive strength must achieve 200 psi. The contractor is required to provide testing data meeting compressive strength.

19-3.01D Quality Assurance

19-3.01D(1) General

Reserved

19-3.01D(2) Stability Test for Ground Anchor and Soil Nail Walls *For soil nail walls, wall zones are specified in the special provisions.*

For ground anchor walls, a wall zone is the entire wall.

If you use an excavation lift height greater than 5 feet or an exposure duration longer than 1 work shift, perform stability testing. Perform the testing before roadway excavation.

Perform at least 1 stability test within the limits of each wall zone.

Excavate a neat face at most 3 feet in front of the final wall face alignment. The excavated face must:

1. *Have the height shown in the authorized shop drawings.*
2. *Be 20 feet long and parallel to the wall alignment with a constant height. You may excavate ramps outside the 20-foot section for construction access.*
3. *Be left open for the proposed exposure time shown in the authorized shop drawings.*
4. *Maintain its integrity without raveling, sloughing, or measurable displacement throughout the proposed exposure time.*

After authorization of the test results, you may use the proposed excavation height within the tested wall zone for the observed exposure time.

If the Engineer determines the exposed excavated face is not maintaining its integrity, you must immediately stabilize the excavated face and perform additional stability testing.

Stability testing does not apply to ground-anchored soldier pile walls.

19-3.02 MATERIALS

19-3.02A General

Reserved

19-3.02B Cofferdam

Interior dimensions of cofferdams must provide enough space inside the wales for (1) form construction, (2) pile driving, and (3) pumping of water from outside the foundation forms.

No shoring is allowed in cofferdams that would induce stress, shock, or vibration in the permanent structure.

19-3.02C Structure Backfill

Structure backfill must be free of organic or other unsatisfactory material.

The impervious backfill material must be an authorized earthy material. The sand equivalent requirement does not apply.

Structure backfill compacted to a relative compaction of at least 95 percent and material placed behind retaining walls must have a sand equivalent value of at least 20 and comply with the gradation requirements shown in the following table:

Sieve size	*Percentage passing*
3"	*100*
No. 4	*35–100*
No. 30	*20–100*

Except for material placed behind retaining walls, structure backfill compacted to a relative compaction of at least 90 percent must comply with the gradation requirements shown in the following table:

Sieve size	*Percentage passing*
3"	*100*

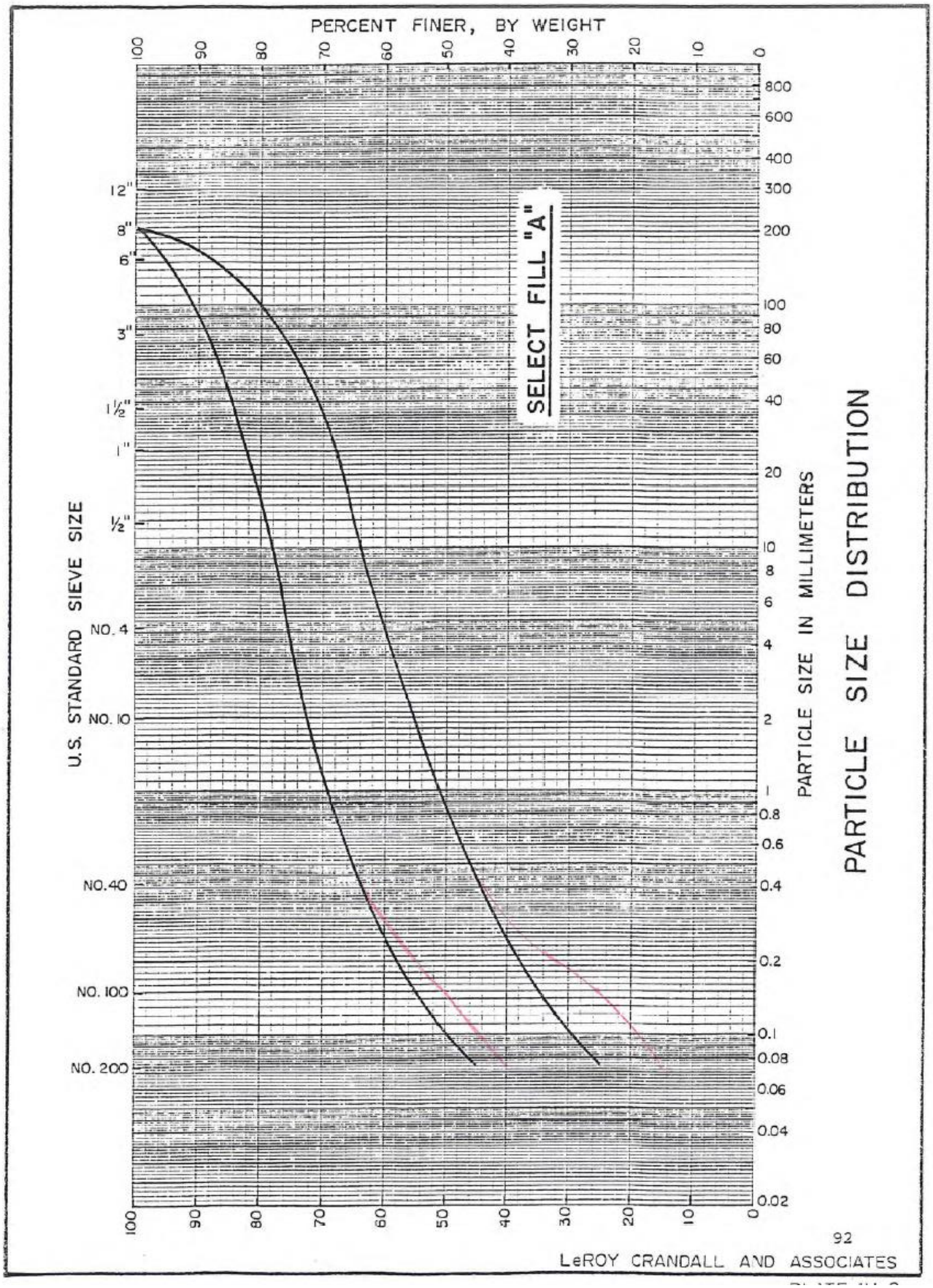
Material from structure excavation not suitable for use as structure backfill may be used to replace imported borrow or other excavated material.

Add to section 19-3.02C Structure Backfill:

Emergency Spillway Bridge – Abutment 1

The contractor must separate abutment 1 excavation material for reuse as backfill for abutment 1. Any material in excess required for backfill on the embankment at abutment 1 must consist of the same material composition as used in the embankments construction, classified as “Select Fill A”. Embankment material should be comprised of silty sand and gravel with P.I.<7. Backfill quality characteristics to meet the minimum corrosion requirements, as specified in Caltrans’ Corrosion Guidelines, see Informational Handout.

Engineer and/or other jurisdictional agencies approval of test results is required prior to use. The Select Fill A must achieve the properties below.



19-3.02D Pervious Backfill Material

Pervious backfill material must consist of one or any combination of the following materials:

1. *Gravel*
2. *Crushed gravel*
3. *Crushed rock*
4. *Natural sand*
5. *Manufactured sand*

Pervious backfill material must comply with the gradation requirements shown in the following table:

Sieve size	*Percentage passing*
2"	*100*
No. 50	*0–100*
No. 100	*0–8*
No. 200	*0–4*

The gradation for sacked pervious backfill material behind wall drain outlets must comply with the gradation specified for 1-1/2-by-3/4 inch primary aggregate in section 90-1.02C(4)(b).

A weep hole and geocomposite drain alternative must comply with section 68-7.

19-3.02E Slurry Cement Backfill

Slurry cement backfill must be a fluid workable mixture of aggregate, cement, and water.

The aggregate must be one of the following:

1. *Commercial-quality concrete sand*
2. *Excavated or imported material in any combination, free of organic material and other deleterious substances and complying with the gradation requirements shown in the following table:*

Sieve size	*Percentage passing*
1-1/2"	*100*
1"	*80–100*
3/4"	*60–100*
3/8"	*50–100*
No. 4	*40–80*
No. 100	*10–40*

The cement must comply with section 90-1.02B(2) except testing is not required.

The water must be free from oils, salts, and other impurities that adversely affect the backfill.

Proportion slurry cement backfill by weight or volume. The backfill must contain at least 188 pounds of cement per cubic yard and enough water to produce a fluid workable mix that flows and can be pumped without segregation during placement.

Mix materials thoroughly by machine. Use a pugmill, rotary drum, or other authorized mixer. Mix until cement and water are thoroughly dispersed.

Replace section 19-3.02E Slurry-Cement Backfill fifth to last paragraph

Slurry-Cement Backfill is intended for use with the spillway bridge subgrade foundation. The cement must comply with section 90-1.02B(2). There must be 3 tests for compressive strength on each slurry cement foundation. Compressive strength tests must achieve 200 psi at 3 days. Two cylinders collected for each test for a total of 12

samples for testing facility use. Test samples must be from separate concrete trucks (not all from the same truck). See the project plans for additional information.

Add to section 19-3.02E Slurry-Cement Backfill

Materials that comprise of the Slurry-Cement must consist of approved material proven to be innocuous. See section 6 for additional control of material requirements. The contractor is required to submit, furnish, install and utilize materials on the Caltrans Authorized Material List for "Innocuous Aggregates for Concrete" (https://dot.ca.gov/programs/engineering-services/authorized-materials-lists). Submit mix design for approval and authorization of its use prior to placement.

19-3.02F Culvert Beddings

19-3.02F(1) General

Culvert beddings must be shaped bedding, sand bedding, or soil cement bedding.

If more than 1 type of bedding is allowed, use the same bedding for the entire length of the culvert.

19-3.02F(2) Sand Beddings

Sand bedding must consist of sand:

1. *Free of clay or organic material*
2. *Suitable for the purpose intended*
3. *Complying with the gradation requirements shown in the following table:*

Sieve size	*Percentage passing*
No. 4	*90–100*
No. 200	*0–5*

19-3.02F(3) Soil Cement Beddings

Material and mixing requirements for soil cement bedding must comply with the specifications for slurry cement backfill in section 19-3.02E except:

1. *It must contain at least 282 pounds of cement per cubic yard*
2. *Aggregate must not be commercial-quality concrete sand*

19-3.02G Controlled Low-Strength Material

If authorized, controlled low-strength material may be used as structure backfill for pipe culverts unless the culvert has a diameter or span of more than 20 feet.

Controlled low-strength material must be a fluid workable mixture of aggregate, cement, and water.

Cement must be one of the following:

1. *Cement complying with ASTM C150*
2. *Blended hydraulic cement complying with either of the following:*
   2.1. *ASTM C595*
   2.2. *Physical requirements in ASTM C1157*

When tested under ASTM D4832, the controlled low-strength material must have a 28-day compressive strength:

1. *From 50 to 100 psi for pipe culverts with 20 feet or less in height of cover*
2. *Of at least 100 psi for pipe culverts with over 20 feet in height of cover*

Water must be free of oil, salts, and other impurities that adversely affect the backfill.

Aggregate must be one of the following:

1. *Commercial-quality concrete sand*

2. *Excavated or imported material in any combination, free of organic material and other deleterious substances and complying with the gradation requirements shown in the following table:*

Sieve size	*Percentage passing*
1-1/2"	*100*
1"	*80–100*
3/4"	*60–100*
3/8"	*50–100*
No. 4	*40–80*
No. 100	*10–40*

Mix materials thoroughly by machine. A pugmill rotary drum or other authorized mixer must be used. Mix until cement and water are thoroughly dispersed.

Wherever controlled low-strength material is placed within the travelled way or covered by paving or embankment materials, the controlled low-strength material must achieve a maximum indentation diameter of 3 inches when tested under ASTM D6024 before covering and opening to traffic.

19-3.02H Concrete Backfill

Concrete backfill encasing steel soldier piles below the lagging must comply with section 90-1 and contain at least 505 pounds of cementitious material per cubic yard.

19-3.02I Lean Concrete Backfill

Lean concrete backfill must comply with the specifications for slurry cement backfill in section 19-3.02E except the aggregate must be commercial-quality concrete sand.

19-3.02J Filter Fabric

Filter fabric must be Class A.

19-3.03 CONSTRUCTION

19-3.03A General

Reserved

19-3.03B Structure Excavation

19-3.03B(1) General

Remove any material that comes into an excavation from outside the described limits.

Obtain the Engineer's acceptance of the completed structure excavation before placing any concrete or masonry.

When embankments must be constructed before culverts are placed, construct embankments to the specified height and for a distance on each side of the culvert location 5 times the culvert diameter or height before excavating for and installing culverts. Where embankments are constructed on a steep slope or at a difficult location, the Engineer may modify embankment heights before culverts are installed.

Change order work includes:

1. *If structure excavation is more than 0.5 foot from the depth shown and you request an adjustment for the increased depth*

2. *The Engineer orders an adjustment for a decreased depth*

19-3.03B(2) Soldier Pile Walls

Excavate for and construct soldier pile walls in lifts from the top down.

Excavate in a way that minimizes voids requiring backfill behind the lagging.

Do not excavate more than 3 feet below any level of ground anchors that have not been stressed and grouted.

The Engineer determines whether boulders or portions of boulders that interfere with lagging must be removed. Perform any additional earthwork ordered. The additional earthwork is change order work.

Complete placing lagging to the full height of the exposed excavation face by the end of the work shift. ***19-3.03B(3) Pier Column Excavation***

Reserved

19-3.03B(4) Cofferdams

Cofferdams for foundation construction must be (1) carried below the bottom of footings, (2) braced, and (3) made as watertight as practicable.

You may construct the cofferdam large enough to provide clearance to perform the work.

Right or enlarge a cofferdam tilted or moved out of position during sinking to provide the required clearance and proper pier location.

In tidal waters or in streams that may flood, vent cofferdam walls at low water elevation to ensure equal hydrostatic head inside and outside the cofferdam when placing and setting seals.

Cross struts or bracing may extend through foundation concrete if authorized. Struts or bracing below low water may remain in place except in navigable streams or when specified to be removed. Remove struts or bracing above low water. Fill resulting spaces with the same type of concrete as the surrounding concrete.

Remove cofferdams to at least 2 feet below the streambed after completing substructure construction. Do not disturb or mar the finished concrete or masonry.

19-3.03B(5) Water Control and Foundation Treatment

Select the method to remove and control water at excavations where seal courses are not shown. Methods may include well point systems, pumping sumps, cofferdams, or concrete seal courses. If you construct a seal course comply with section 51-1.03D(3) except:

1. *Seal course thickness requirement does not apply for a spread footing*
2. *Curing requirements do not apply for a pile footing*

Where concrete seal courses are shown, use a cofferdam, concrete seal course, and dewatering pumps. Place seal course concrete under section 51-1.03D(3).

If no piles are used and footing concrete, culverts, or other structures are placed on an excavated surface other than rock:

1. *Perform excavation without disturbing foundation material. Dewater the excavation if groundwater is encountered and no seal course is used. Continue dewatering activities before and during subsequent excavation. Foundations must be free of water when footing concrete or pipes are placed. Continue dewatering activities as required to prevent damage to the work.*

2. *If foundation material is disturbed by excavation activities, damaged by water, or removed for your convenience in dewatering, restore the foundation to a condition at least equal to the undisturbed foundation. To replace damaged or removed foundation material for culverts, use Class 2 AB that complies with section 26. Compact the base as specified for structure backfill in section 19-3.03E.*

If the Engineer determines the undisturbed original material of the excavation is unsuitable, correct it as ordered. This work is change order work.

If footing concrete or masonry is placed on rock, fully uncover the rock and remove the surface to sound rock. Level or cut the rock to steps and then roughen it.

Pressure grout or treat seams in rock as ordered. This work is change order work.

If you encounter solid rock or other unyielding material when excavating for a culvert other than an arch culvert, remove 1 to 5 feet of the material below the bottom of the culvert not to exceed a depth of 1/24 of the height of the embankment above the top of the culvert.

Backfill the resulting space below the culvert using structure backfill under section 19-3.03E. Excavating and backfilling below the planned elevation of the bottom of the culvert is change order work.

For footings on piles, excavate to the bottom of footings before driving piles or drilling for piling. If swell or subsidence results from pile driving, excavate or backfill the footing area to the grade of the bottom of the footing. If the material under footings would mix with footing concrete or would not support the weight of wet concrete, replace the material with suitable material, install soffit forms, or provide a platform using authorized means on which to cast the footing.

19-3.03C–19-3.03D Reserved

19-3.03E Structure Backfill

19-3.03E(1) General

Place structure backfill in uniform layers. Bring backfill up uniformly on all sides of structures. Backfill layers must be at most 0.67 foot thick before compacting the thickness must be at most 4 feet when compaction is performed by ponding or jetting.

Do not use compaction equipment or methods that may cause excessive displacement or damage structures.

Do not place structure backfill until footings or other parts of the structure or facility are inspected by the Engineer and authorized for backfilling. Do not place backfill against the back of abutments, retaining walls, or outside walls of CIP concrete structures until the concrete has attained a compressive strength of at least 2,500 psi or the concrete has been in place for 28 days.

Place backfill inside bridge wingwalls and abutments before railings on wingwalls are constructed.

Compaction by ponding and jetting may be authorized under the following conditions:

1. *Backfill material is self-draining when compacted*
2. *Foundation materials will not soften or be damaged by water*
3. *Structures will not be damaged by hydrostatic pressure*

Ponding and jetting of the upper 4 feet below finished grade is not allowed. Perform work without damaging the structure or embankment and such that water is not collected and confined. Supplement ponding and jetting with vibratory or other compaction equipment.

Compact structure backfill to a relative compaction of at least 95 percent except you may compact structure backfill to a relative compaction of at least 90 percent at the following locations:

1. *Overside drains*
2. *Footings for slope protection, slope paving, and aprons*
3. *Headwalls, endwalls, and culvert wingwalls*
4. *Retaining walls, except for portions under any surfacing*
5. *Inlets in median areas or in traffic interchange loops*
6. *Footings and pumping plants not beneath surfacing*

At locations where ordered, place a compacted impervious backfill material for:

1. *Outer 2-foot portion of structure backfill adjacent to inlets and outlets for pipes and culverts*
2. *Structure backfill placed within 2 feet of finished grade at abutments, abutment wingwalls, retaining walls, and other portions of structures*

Structure backfill placed at bridge supports in waterways and water channels not beneath any embankment, pavement, or slope protection:

1. *Does not need to be compacted*
2. *Must be placed to the level of original ground or finished grade shown*

Any material you place outside the excavation pay limits material must comply with the material and compaction requirements of the adjacent structure backfill.

If imported borrow is shown on the Bid Item List, you may use imported borrow as structure backfill if it complies with the specifications for structure backfill.

Place material from structure excavation not used as structure backfill in roadway embankments under section 19-6 or disposed of it under section 19-2.03B.

19-3.03E(2) Crib Walls

Backfill (1) cells formed by crib members of a crib wall and (2) the space between a crib wall and structure excavation face.

Structure backfill for crib walls must not sift or flow through the openings in the walls.

Backfill crib walls simultaneously during wall erection. Place material in uniform layers before compacting. Compact material by hand tamping, mechanical compaction, or other authorized compaction methods.

19-3.03E(3) Soldier Pile Walls

Compact structure backfill behind lagging of soldier pile walls by hand tamping, mechanical compaction, or other authorized compaction method.

In fill areas behind the lagging, key the structure backfill into the existing or excavated back slope.

Place and compact the backfill behind the lagging at least 5 feet above the level of ground anchors before drilling for the anchors. Place and compact the remaining backfill behind the lagging after the anchors are grouted.

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 (1) contrasting color and (2) a size and composition complying with fabric manufacturer's instructions. Use from 5 to 7 stitches per inch of seam.*

4. *Repair any damaged filter fabric by (1) placing a piece of filter fabric large enough to cover the damaged area and (2) complying with the overlapping or stitching requirements.*

19-3.03F Slurry Cement Backfill

Place slurry cement backfill within 1 hour of mixing. Place it in a uniform manner that prevents (1) voids or segregation of the backfill and (2) floating or shifting of the culverts. Remove foreign material that falls into trenches.

Do not backfill over or place material over slurry cement backfill until at least 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.

If slurry cement backfill is used for structure backfill, you may reduce the excavation width such that the clear distance between the outside of the pipe and the side of the excavation on each side of the pipe is at least (1) 6 inches for pipes 42 inches or less in diameter or span and (2) 1 foot for pipes over 42 inches in diameter or span.

Place slurry cement backfill only for that portion of structure backfill (1) below the original ground or grading plane or (2) below the top of the embankment placed before excavating for the culvert pipe. Compact earth plugs at each end of the pipe before placing the backfill to completely contain slurry in the pipe trench.

19-3.03G Pervious Backfill Material

Place pervious backfill material in layers along with and by the same methods specified for structure backfill. Pervious backfill material at the same location must have approximately the same gradation. Cover pervious backfill material at locations exposed to erosion with a 1-foot layer of an authorized earthen material.

19-3.03H Culvert Bedding

Shape trench beds to fit the bottom of the culvert and to provide uniform support along the entire culvert length. You may excavate the trench below the bottom of the culvert and construct shaped bedding by backfilling and compacting the backfill material. Shape beds using a template conforming to the outside shape of the culvert and guided by headers set parallel to the culvert grade. Headers may be left in place.

Place soil cement bedding as specified for slurry cement backfill in section 19-3.03F except do not backfill over soil cement bedding until 8 hours after placement.

19-3.03I Controlled Low-Strength Material

If a controlled low-strength material l is used for structure backfill, you may reduce the excavation width such that the clear distance between the outside of the pipe culvert and the side of the excavation on each side of the pipe culvert is at least:

1. *6 inches for pipe culverts with either of the following conditions:*
   1.1. *20 feet or less in height of cover*
   1.2. *42 inches or less of diameter or span*
2. *1 foot for pipe culverts with either of the following conditions:*
   2.1. *Over 20 feet in height of cover*
   2.2. *Over 42 inches in diameter or span*

Place controlled low-strength material only for that portion of structure backfill (1) below the original ground or grading plane or (2) below the top of the embankment that is placed before excavating for the pipe. Compact earth plugs at each end of the pipe culvert before placing the backfill to completely contain slurry in the pipe culvert trench.

For trenches in existing pavement, place controlled low-strength material no higher than the bottom of the existing pavement's permeable drainage layer. Where a drainage layer does not exist, place the material no higher than 1 inch below the bottom of the existing asphalt concrete surfacing or no higher than the top of the base below the existing concrete pavement.

For rigid pipe culverts, the minimum height of controlled low-strength material relative to the pipe culvert invert must be 0.5 times the pipe culvert diameter or height.

For flexible pipe culverts, the minimum height of controlled low-strength material must be 0.7 times the pipe culvert diameter or height.

19-3.03J Soldier Pile Walls

Where necessary to install lagging, remove lean concrete backfill from drilled holes and in front of pile..

19-3.03K Ground Anchor and Soil Nail Walls

For ground anchor and soil nail walls excavate in lifts from the top down.

Clean the excavated face of loose materials, mud, rebound, and other materials that prevent or reduce the shotcrete from bonding to the excavated face and soil nails.

Remove cobbles, boulders, portions of boulders, and debris at the final wall alignment that protrude more than 2 inches from the excavated face.

If stability testing is not performed, apply the shotcrete facing during the same work shift that the excavation is performed. You may delay placing the shotcrete facing up to 24 hours if you demonstrate the integrity of the excavated face is maintained.

Notify the Engineer immediately if raveling or instability of the excavated face occurs or the wall face moves horizontally more than 0.4 percent of the excavated wall height.

Immediately stabilize unstable areas by buttressing the excavated face with an earth berm or other authorized methods. Stop construction in unstable areas. Take authorized remedial measures to stablilize the areas.

Replace any damaged soil nails and ground anchors.

If 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.

Do not excavate to the next underlying excavation lift until the following conditions have been met 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. *Soil nail facing anchorages are attached or ground anchors are locked off.*

Do not excavate beyond the horizontal limits of the overlying completed wall section. At the end of each excavation lift, maintain temporary slopes flatter than 2:1 (horizontal: vertical) to ensure slope stability.

19-3.04 PAYMENT

The Department does not adjust the payment quantity of imported borrow placed as structure backfill if replacement material for the imported borrow is provided.

For structures other than culverts, if the pay limits are not shown, the payment quantities for structure excavation and structure backfill are computed as follows:

1. *Horizontal limits are vertical planes 1 foot outside the neat lines of the footings or structures without footings.*

2. *Upper limit for structure excavation is the original ground surface. Where structure excavation is performed within a roadway excavation or a ditch excavation area, the upper limit is the plane of the bottom and side slopes of the excavated area. In new embankments, the upper limit is the plane of the new embankment at the specified elevation.*

3. *Upper limit for structure backfill is the finished grading plane or the finished slope lines.*
4. *Lower limit is a plane at the bottom of the completed footings or structures or the lower outside surface of rods or deadmen.*

Except for culverts, the Department does not adjust the unit price of structure excavation for an increase in depth of up to 2 feet or an increase in width of up to 3 times the outside width of the footing. For excavation to greater depths or widths, the Department does not adjust the unit price of structure excavation outside the limits unless before removal activities, (1) the Engineer authorizes the excavation outside the limits to be change order work or (2) you request the excavation outside the limits to be change order work. When the pay limits of structure excavation are so increased, the pay limits for structure backfill are similarly increased. The Department does not adjust the unit price of structure backfill.

If the depth of the structure excavation is reduced due to a reduction or elimination of the seal course, the Department does not decrease the payment quantity for structure excavation (Type A).

The payment quantity for structure backfill does not include:

1. *Volume of pervious backfill material within the limits of the structure backfill*
2. *Volume occupied by the new structure*

For culverts:

1. *Depth of structure excavation is the vertical distance between original ground and the bottom of the culvert trench.*

2. *Increased depth due to unsuitable material or rock or other unyielding material below the planned grade as specified in section 19-3.03H is not considered in determining the depth of structure excavation.*

3. *Structure excavation more than 0.5 foot from the depth shown is a work-character change if you request an adjustment for an increased depth or the Engineer orders an adjustment for a decreased depth.*

Add to section 19-3.04:

Pervious backfill material placed within the limits of payment for bridge is paid for as Structure Backfill (Channel Bridge). Pervious backfill material placed within the limits of payment for retaining walls is paid for as structure backfill (retaining wall).

19-4 ROCK EXCAVATION

19-4.01 GENERAL

19-4.01A General

19-4.01A(1) Summary

Section 19-4 include general specifications for performing rock excavation.

19-4.01A(2) Definitions flyrock: *Rock that becomes airborne due to blasting.* ***near-field blasting:*** *Blasting within 30 feet of a building, highway facility, or utilities.*

19-4.01A(3) Submittals

Reserved

19-4.01A(4) Quality Assurance

Reserved

19-4.01B Materials

Not Used

19-4.01C Construction

Excavate rock by blasting, controlled blasting, using chemical expanders or hydraulic splitters, or another authorized method.

Add to section 19-4.01C:

Construction Contractors are responsible for removing boulders that are 6-feet in average dimension or less from within the limits of excavation. Large boulders with an average dimension of 6 feet or greater that are visible or partially visible during the pre-bid job walk are the contractor's responsibility to relocate to remove and dispose of, including any necessary breaking necessary to facilitate the contractor's handling and management of these boulders. In the event that large boulders with an average dimension greater than 6-feet, which are not visible or partially visible at the time of the pre-bid job walk, are found to be too large to remove, the contractor may be directed to break these boulders into boulders between 4' – 6' average diameter, in order to facilitate moving of the boulders. Remove boulders found within the Finish Grade grading plane. At the discretion of the Engineer, boulders with an average dimension of 6 feet or greater found within the Finish Grade grading plane may be left in place. Backfill voids in the Finish Grade grading plane with excavated material. Backfilling of voids shall comply with section 19-6, Embankment Construction.

19-4.01D Payment

The payment quantity for any type of rock excavation is measured as specified for roadway excavation.

Add to section 19-4.01D:

Solely the breaking activity will be considered as Supplemental Work (Rock Excavation) and will be paid in accordance with section 9-1.04. Backfilling of voids is considered as included in the unit price paid for Basin Excavation and no additional compensation will be allowed therefore. Payment as supplemental work will only be utilized when different means and methods need to be employed in order to manage and dispose of large boulders with an average dimension of 6 feet or greater, and in no event will the contractor be paid to break these boulders to an average dimension of less than 4 feet, unless such limit is deemed infeasible be the Engineer.

19-4.02 PRESPLITTING

19-4.02A General

19-4.02A(1) Summary

Section 19-4.02 includes specifications for presplitting rock to form rock excavation slopes in conjunction with blasting or controlled blasting.

19-4.02A(2) Definitions presplitting: *Establishing a free surface or shear plane in rock along the specified excavation slope by the controlled use of explosives and blasting accessories in appropriately aligned and spaced drilled holes.*

19-4.02A(3) Submittals

Submit a copy of the explosive manufacturer's instructions as an informational submittal before using any column-type explosive for presplitting.

19-4.02A(4) Quality Assurance

Reserved

19-4.02B Materials

The maximum diameter of explosive used in a presplit hole must not be greater than 50 percent of the diameter of the presplit hole.

Standard cartridge explosives prepared and packaged by explosive manufacturing firms must be used in the presplit holes. The explosives must consist of one of the following:

1. *Fractional portions of standard cartridges to be affixed to a detonating cord in the field*
2. *Solid column explosives joined and affixed to a detonating cord in the field*

Stemming materials must be dry, free-running material complying with the gradation requirements shown in the following table when tested under California Test 202:

Sieve size	*Percentage passing*
3/8"	*100*
No. 8	*10*

19-4.02C Construction

Presplit the rock to form rock excavation slopes.

Before drilling the presplitting holes, remove overburden soil and weathered rock along the top of the excavation for a distance of at least 50 feet beyond the production hole drilling limits or to the end of the excavation. Expose fresh rock to an elevation equal to the bottom of the adjacent lift of the presplitting holes being drilled.

Drill slope holes for presplitting along the line of the planned slope. The drilled holes must be from 2-1/2 to 3 inches in diameter. Use the proper drilling equipment and techniques to ensure that no hole deviates (1) from the plane of the planned slope by more than 12 inches or (2) from parallel to an adjacent hole by more than 67 percent of the planned horizontal spacing between holes.

The Department does not pay for drilling more than 3 feet below finished grade unless additional drilling is ordered. The additional drilling is change order work.

The length of presplit holes for an individual lift must not exceed 20 feet, unless you can demonstrate to the Engineer that you can stay within the specified tolerances and produce a uniform slope. The length of holes may then be increased to a maximum of 60 feet if authorized.

Space the presplit holes a maximum of 3 feet on centers. Adjust the spacing to produce a uniform shear face between holes.

The Engineer may order you to drill auxiliary holes along the presplit line. These holes must not be loaded or stemmed. Except for spacing, the auxiliary drill holes must comply with the specifications for presplit holes. This work is change order work.

Place the adjacent line of production holes inside the presplit lines such that you avoid damage to the presplit face.

If necessary to reduce shatter and overbreak of the presplit surface, drill the 1st line of production holes parallel to the slope line at the top of the cut and at each bench level thereafter. Immediately stop blasting activities if the presplit surface is damaged.

Do not drill production holes within 8 feet of a presplit plane unless authorized. The bottom of the production holes must not be lower than the bottom of the presplit holes.

You may use a construction working bench offset by 24 inches from the bottom of each lift to drill the next lower presplitting pattern.

Adjust the drilling to compensate for any drift of previous levels and for the offset at the start of new levels to maintain the specified slope plane.

If the drilling and blasting methods do not produce a uniform slope and shear face without overbreak and within the specified tolerances, drill, blast, and excavate in short sections, up to 100 feet, until you achieve the desired results.

If you use a fractional portion of a standard explosive cartridge, firmly affix the cartridge to a length of detonating cord equal to the depth of the drill hole. Ensure the cartridge does not slip down the detonating cord or cock across the hole and bridge the flow of stemming material. Space the cartridges along the length of the detonating cord at a maximum of 30 inches on center. Adjust the spacing as needed to achieve the desired results.

If you use a solid column-type explosive, assemble and affix the column to the detonating cord under the explosive manufacturer's instructions.

The bottom charge of a presplit hole may be larger than the line charges but must not cause overbreak. Place the top charge of the presplitting hole far enough below the collar to avoid overbreaking the surface.

Before placing the charge, clear the hole of any obstructions for the hole's entire depth. Ensure that placing of the charge does not cause caving of material from the walls of the holes.

The Engineer may order the use of stemming materials as necessary to achieve a satisfactory presplit face. Stemmed presplit holes must be completely filled to the collar.

Simultaneously detonate charges in each presplitting pattern.

The tolerances specified in section 19-2.03G do not apply to presplit surfaces of excavation slopes where presplitting is required. The presplit face must not deviate more than 1 foot from the plane passing through adjacent drill holes, except where the character of the rock is such that irregularities are unavoidable. The average plane of the completed slopes must not deviate more than 1 foot from the plan slopes. These tolerances are measured perpendicular to the plane of the slope. No portion of the slope may encroach on the roadbed.

If equally satisfactory presplit slopes are obtained, you may either presplit the slope face before drilling for production blasting or presplit the slope face and production blast at the same time, provided that the presplitting drill holes are fired with zero delay. Detonation of the production holes must be delayed from the detonation of the presplit line and must start at the row of holes farthest from the new slope line and progressing in steps to the row of holes nearest the presplit line. Detonation of the production holes must result in a minimum 50 ms delay between detonation of the presplit holes and detonation of the row of production holes nearest the presplit line. The presplitting holes must extend either to the end of the excavation or for a distance of not less than 50 feet beyond the limits of the production holes to be detonated.

19-4.02D Payment

The payment quantity for drill hole (presplitting) is the theoretical slope length determined from the elevation taken before detonating each lift and a plane 3 feet below finished grade. For holes that comply with the specified slope and tolerances, except alignment within the plane of the slope, the payment quantity is 75 percent of the theoretical slope length.

The Department does not pay for holes that do not show a hole trace for approximately 50 percent of the drilled length.

19-5 *COMPACTION*

19-5.01 *GENERAL*

Section 19-5 includes specifications for compacting all earthwork except structure backfill.

19-5.02 *MATERIALS*

Add to section 19-5.02 MATERIALS

Soil placed as compacted backfill or fill should have a Plasticity Index PI<7. Therefore, on-site excavated site soils with PI <7 may be used as compacted fill/backfill. Excavated on-site soils consisting of sandy/silty clay (CL), and oversize (>3 inches) gravel, cobbles and boulders should not be used as fill or backfill.

Imported fills, if any, should consist of free-draining, well-graded granular soils with PI<7 and <10% passing #200 US Sieve, free of organic or other deleterious materials, gravels greater than 3 inches in maximum dimension, cobbles and boulders.

Compacted backfill/fill soils greater than 4 feet in height when placed on existing sloping ground should be keyed or benched into competent soil by removing surficial unsuitable (such as loose, soft, wet, cracked or disturbed/sliding) soils. Keys/benches should be cut along the slope in 4 feet or less in height.

19-5.03 *CONSTRUCTION*

19-5.03A General

Relative compaction specifications apply to material whether in an excavation or an embankment.

The moisture content of material to be compacted to at least 95 percent must be such that the specified relative compaction is attained and the embankment is in a firm and stable condition.

Do not compact material that contains excessive moisture until the material is dry enough.

19-5.03B Relative Compaction (95 Percent)

Compact earthwork to a relative compaction of at least 95 percent for at least a depth of:

1. *0.5 foot below the grading plane for the width between the outer edges of shoulders*
2. *2.5 feet below the finished grade for the width of the traveled way plus 3 feet on each side*

Except for the outer 5 feet measured horizontally from the embankment side slope, compact the full width and depth of the embankment within 150 feet of each bridge abutment to at least 95 percent relative compaction. The 150-foot limit is measured horizontally from the bridge abutment and either parallel or concentric with the roadway centerline.

Compact earthwork to a relative compaction of at least 95 percent for embankments under retaining wall footings without pile foundations:

1. *For the full depth of the embankment*
2. *Within the limits established by inclined planes sloping 1.5:1 (horizontal: vertical) out and down from lines 1 foot outside the bottom edges of the footing*

19-5.03C Relative Compaction (90 Percent)

Compact earthwork to a relative compaction of at least 90 percent in embankment areas not required to be compacted to 95 percent.

19-5.03D Foundation Preparation

You are responsible for preparing the foundation to receive material.

You may excavate and replace basement material to facilitate compaction. Before you replace the basement material, if ordered, compact a layer below the excavated material to a depth, width, and degree of compaction ordered. The ordered work is change order work.

19-5.04 PAYMENT

If basement material is (1) placed in the embankment or used in other planned or authorized work and (2) replaced with planned excavated material or imported borrow, the replaced material is paid for at the item bid price for the type of excavation or imported borrow involved.

19-6 *EMBANKMENT CONSTRUCTION*

19-6.01 GENERAL

19-6.01A Summary

Section 19-6 includes specifications for constructing embankments.

Constructing embankments includes:

1. *Preparing areas to receive embankment material*
2. *Placing and compacting embankment material including:*
    2.1. *Suitable material within roadway areas where unsuitable material has been removed*
    2.2. *Material in holes, pits, and other depressions within the roadway area*
3. *Constructing a temporary surcharge embankment above the grading plane*
4. *Constructing dikes*

19-6.01B Definitions *Reserved*

19-6.01C Submittals

For geosynthetic reinforced embankment, if you request the use of backfill with a gradation larger than the specified size submit test results for installation damage-reduction factors for each type of geosynthetic reinforcement under FHWA-NHI-00-044, section 5.1 with your LTDS calculations.

19-6.01D Quality Assurance

Reserved

19-6.02 MATERIALS

19-6.02A General

Embankment material must be excavated material from excavations or from local or imported borrow.

Material for embankment areas where piles are to be placed or driven, must not contain rocks, broken concrete, or other solid materials larger than 4 inches in greatest dimension.

Do not place borrow or excavation material having a sand equivalent value less than 10 within 2.5 feet of finished grade.

Add to section 19-6.02 General

Soil placed as compacted backfill or fill adjacent to abutment 1 of the Spillway Bridge must comply with section 19-3.02C Structure Backfill.

19-6.02B Geosynthetic Reinforced Embankment

Each geosynthetic reinforcement roll must be labeled with:

1. *Manufacturer's name*
2. *Production identification*
3. *Roll dimensions*
4. *Lot number*
5. *Date of manufacture*

The backfill for geosynthetic reinforced embankment must be free from:

1. *Organic material*
2. *Shale, soft, or poor-durability particles*
3. *Recycled materials such as glass, shredded tires, concrete rubble, or other unsuitable materials*
4. *Loose or extraneous material and sharp objects that may come in contact with the geosynthetic reinforcement*

The backfill must comply with the gradation requirements shown in the following table:

Sieve size	*Percent passing*

1-1/2"	*100*
3/4"	*75–100*
No. 4	*20–100*
No. 40	*0–60*
No. 200	*0–50*

The backfill must comply with the quality characteristics shown in the following table:

Quality characteristic	*Test method*	*Requirement*
Plasticity index (max)	*California Test 204*	*20*
pH	*California Test 643*	*5–9*

If authorized, you may backfill with a gradation larger than the specified size up to a 4 inch maximum.

19-6.03 CONSTRUCTION

19-6.03A General

Compact embankment under section 19-5.

Construct embankment slopes under section 19-2.03G.

Scarify, water, grade, and roll the existing roadbed before placing new material if you construct an embankment on an existing roadway.

If you construct an embankment against a slope, prepare original ground or embankment slopes by cutting into it at least 6 feet horizontally as you place the new embankment in layers. Compact the cut material along with the new embankment material.

For bridge footings constructed in an embankment, construct the embankment to the grading plane elevation and extend the finished slope to the grading plane before:

1. *Excavating for footings*
2. *Driving piles or drilling holes for CIP piles*

The grading plane of embankments beneath structure approach slabs and beneath the thickened portion of sleeper slabs must not project above the grade established by the Engineer.

Grade trenches, holes, depressions, and pits outside of areas where embankments are to be constructed to provide a presentable and well-drained area.

19-6.03B Subsidence

If there is a bid item for embankment or imported borrow, you may compact the ground surface on which an embankment is to be constructed before placing embankment material.

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

The Engineer determines the additional quantity of material for embankment work due to subsidence by the average end areas from the original measurement and the final measurements.

If a quantity is specified for either embankment or imported borrow for the anticipated effect of subsidence and you do not agree with this specified quantity, you may submit a plan for measuring the subsidence. The plan must include complete details of the measuring devices and their installation.

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

The Engineer takes readings as needed to determine the progress of subsidence. Help the Engineer as ordered.

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

Subsidence is considered zero at:

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

2. *Points on the cross sections 50 feet beyond the start and end of the area equipped with subsidencemeasuring devices unless the Engineer agrees otherwise*

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

The additional payment quantity of material for embankment work due to subsidence is the volume determined by the average end areas from the original measurement and the final measurements, including zero subsidence at specific areas.

19-6.03C Placing and Compacting

Do not construct embankments when material is frozen or a blanket of snow prevents proper compaction.

Construct embankment in layers. The loose thickness of each layer must not exceed 8 inches.

Break up clods or hard lumps of earth that are over 8 inches in greatest dimension before compacting material in the embankment, unless material such as hardpan or cemented gravel, cannot be broken readily in which case:

1. *Distribute the material throughout the embankment*
2. *Place enough earth or other fine material around the larger material as you deposit it to fill the interstices and produce a dense, compact embankment*

If embankment material contains rock, the loose thickness of each layer of embankment material before compaction below a plane 3 feet below finished grade must comply with the following requirements:

1. *If embankment material contains over 50 percent by volume of rock larger than 8 inches in greatest dimension, the loose thickness of each layer must not exceed the maximum size of rock in the material.*

2. *If embankment material contains from 25 to 50 percent by volume of rock larger than 8 inches in greatest dimension, the loose thickness of each layer must not exceed the maximum size of rock or 3 feet, whichever is less.*

3. *If embankment material contains less than 25 percent by volume of rock larger than 8 inches in greatest dimension, the loose thickness of each layer must not exceed 8 inches in the area between the rocks larger than 8 inches.*

Reinforcement or metal attached to reinforced concrete rubble placed in embankments must not protrude above the grading plane. Trim reinforcement or metal to less than 3/4 inch from the face of the reinforced concrete rubble material before placing the material within 2 feet below the grading plane.

In a sidehill embankment where the width, including bench cuts for bonding existing and new embankments, is too narrow to accommodate mobile power-compacting equipment, you may place the material by end dumping if authorized.

If end dumping is allowed for constructing an embankment against existing slopes or 1/2 the embankment width at a time, plow or cut the slopes of the original ground or embankment before starting end dumping.

Where embankments are constructed across low, swampy ground that cannot support the weight of hauling equipment, you may construct the lower part of the embankment by dumping successive loads in a uniformly distributed layer that can support the equipment for placing subsequent layers.

Construct embankments such that each layer has a cross fall of less than 5 percent.

At locations where it is impractical to use mobile power-compacting equipment, compact the embankment layers by any method that attains the specified compaction.

19-6.03D Settlement Periods and Surcharges

If an embankment settlement period is specified, construct the embankment to at least the grading plane and to the limits described for:

1. *Distance of at least 150 feet measured parallel to the centerline of the roadway from each bridge abutment*
2. *Entire length of a retaining wall and a width of at least 30 feet from the face of the wall*

If a surcharge is specified, place the surcharge in uniform layers. Compact the surcharge by routing the grading equipment across the full width.

Prevent the embankment and any surcharge from encroaching upon the traveled way or existing improvements.

The settlement period starts after the embankment and any specified surcharge construction is complete.

If ordered, install settlement platforms. The installation is change order work.

The surcharge must remain in place until the end of the specified settlement period or as ordered.

Before the end of the settlement period, do not:

1. *Excavate for abutments, bent footings, wingwalls, or retaining wall footings*
2. *Drive or drill holes for foundation piles*

Remove any surcharge material.

Remove surcharge material above the grading plane. Compact the embankment below the grading plane before placing the subsequent layers of subbase or base.

19-6.03E Geosynthetic Reinforced Embankment

Place geosynthetic reinforcement within 3 inches of the design elevations.

Place at least 3 inches of compacted backfill between the layers of reinforcement shown.

Geosynthetic reinforcement must be:

1. *Secured with staples, pins, or small piles of backfill*
2. *Placed without wrinkles*
3. *Aligned with the primary strength direction perpendicular to slope contours*
4. *Spliced under the manufacturer's instructions*
5. *Butted edge-to-edge for straight slope contours*
6. *Butted edge-to-edge at the slope face and fanned out or overlapped into the backfill for curved slope contours*

Cover the geosynthetic reinforcement with backfill within the same work shift.

Place at least 6 inches of backfill on the reinforcement before operating or driving equipment or vehicles over it, except, you may drive equipment or vehicles for spreading backfill directly on the reinforcement if you:

1. *Comply with the manufacturer's instructions*
2. *Use rubber-tire vehicles*
3. *Minimize traffic repetitions*
4. *Maintain a speed less than 5 mph*
5. *Avoid sudden braking and sharp turning*

Where guardrail posts will be placed at the top crest of a geosynthetic-reinforced embankment and the geosynthetic reinforcement interferes with the placement of posts, you may precut the affected layers of the

reinforcement into cross-shaped patterns. The precutting dimensions must not exceed the post dimensions by more than 12 inches.

Do not extend geosynthetic reinforcement into the pavement structure.

Repair any damaged reinforcement by placing additional reinforcement to cover the damaged area as follows:

1. *For reinforcement placed parallel to slope contours, overlap 5 aperture openings or 8 inches whichever is greater*
2. *For reinforcement placed perpendicular to slope contours, splice the edges under the manufacturer's instructions*

Grade and compact the backfill to ensure the reinforcement remains taut.

Compact the backfill to a relative compaction of at least 90 percent. If hand-operated equipment is used, do not place more than 6 inches of backfill before compaction.

Use hand-operated equipment to compact areas within 3 feet of:

1. *Slope contours*
2. *Underground structures*

Do not disk or plow in the reinforced area.

19-6.04 PAYMENT

If ordered to cut into a slope more than 6 feet, the excavated material in excess of 6 feet is paid for as roadway excavation.

If there is a bid item for embankment shown on the Bid Item List, the payment quantity for embankment is the volume determined from the planned or authorized cross sections and the measured ground surface.

The Department does not increase the embankment quantity if subsidence or consolidation occurs after you start placing the embankment material.

19-7 BORROW MATERIAL

19-7.01 GENERAL

19-7.01A Summary

Section 19-7 includes specifications for obtaining local and imported borrow material for embankment construction.

The payment quantity for imported borrow does not include aggregate base placed to fill low areas.

Add to the end of section 19-7.01A:

Prior to placement of imported borrow materials must be authorized for use. The Contractor must submit testing on imported borrow for the Engineers approval. Tests must indicate Atterberg limit, corrosivity, and gradation at a minimum. See Informational Handout for complete Caltrans Corrosion Guidelines for contractor to reference for compliance.

19-7.01B Definitions

Reserved

19-7.01C Submittals

Reserved

19-7.01D Quality Assurance

Notify the Engineer before opening any imported borrow material site so that the Department may test the material.

19-7.02 MATERIALS

19-7.02A General

Borrow material must be:

1. *Suitable for the purpose intended*
2. *Free of unsuitable material including organic matter*

Add to the end of section 19-7.02A:

3. Non-cohesive soils (PI<6)
4. Meet the minimum corrosion requirements, as specified in Caltrans' Corrosion Guidelines. See Informational Handout for complete Caltrans Corrosion Guidelines for contractor to reference for compliance.

19-7.02B Local Borrow '

Reserved

19-7.02C Imported Borrow

Imported borrow must be free of man-made refuse, such as:

1. *Concrete*
2. *Asphalt concrete*
3. *Residue from grooving and grinding operations*
4. *Metal*
5. *Rubber*
6. *Mixed debris*
7. *Rubble*

19-7.03 CONSTRUCTION

19-7.03A General

Clear, grub, and strip borrow sites if necessary.

Excavate, load, and if necessary haul borrow material.

Construct embankments under section 19-6.

19-7.03B Local Borrow

Obtain local borrow such that no scar or unsightly appearance is generated.

19-7.03C Imported Borrow

Before placing imported borrow in embankments, ensure enough space is available in embankment locations for placing planned or designated excavated material from the job site.

19-7.04 PAYMENT

The payment quantity for imported borrow paid by theoretical volume basis is the volume determined from the planned or authorized cross section for embankments and the measured ground surface adjusted by subtracting the theoretical quantities of material from excavations.

The theoretical quantity of materials from excavations used in embankments is determined by summing the quantities for roadway excavation, structure excavation, and ditch excavation and then by multiplying the quantities by the grading factor.

The grading factor used for excavated materials for determining payment quantity for imported borrow is 1.0.

If import borrow site is only being used for 1 project, you may request that import borrow be measured and paid based on borrow site cross sections and the following:

1. *Notify the engineer before opening any imported borrow material site so the Department may take cross-section elevations and measurements of the ground surface after clearing, grubbing and any stripping.*
2. *The payment quantity for imported borrow paid by the cubic yard is the volume determined from the average areas and the distances between them.*

3. *Areas and distances used to determine the volume are those from the material site before and after the imported borrow is excavated.*

DIVISION IV SUBBASES AND BASES

Add prior to section 23:

Bid Items and Applicable Sections

Item code	Item description	Applicable section
260203	Class II Aggregate Base	26

23 GENERAL

23-1 GENERAL

23-1.01 GENERAL

23-1.01A Summary

Section 23 includes general specifications for constructing subbases and bases.

23-1.01B Definitions

Reserved

23-1.01C Submittals

Submit a QC plan for the types of subbases or bases where described.

23-1.01D Quality Assurance

23-1.01D(1) General

23-1.01D(1)(a) General

Take samples under California Test 125.

23-1.01D(1)(b) Test Result Disputes

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 the test result if you dispute the test result.

If you or the Engineer dispute each 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 independent third party participates in a dispute resolution, it must be qualified under AASHTO re:source program and the Department's Independent Assurance Program. The independent third party must have no prior direct involvement with 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 material producer*

If split acceptance samples are not available, the independent third party uses any available material representing the disputed material for evaluation.

If the independent third party determines the Department's test results are valid, the Engineer deducts the independent third party testing costs from payments. If the independent third party determines your test results are valid, the Department pays the independent third party testing costs.

23-1.01D(2) Quality Control

23-1.01D(2)(a) General

Provide a QC manager when the quantity of subbase or base is as shown in the following table:

QC Manager Requirements

Subbase or base	*Requirement*
Stabilized soil (sq yd)	*≥ 20,000*
Aggregate subbases (cu yd)	*≥ 20,000*
Aggregate bases (cu yd)	*≥ 20,000*
CTB (cu yd)	*≥ 10,000*
Lean concrete base (cu yd)	*≥ 2,000*
Rapid strength concrete base (cu yd)	*≥ 1,000*
Lean concrete base rapid setting (cu yd)	*≥ 1,000*
Concrete base (cu yd)	*≥ 1,000*
Treated permeable bases (cu yd)	*≥ 2,000*
Reclaimed pavements (sq yd)	*≥ 10,000*

Provide a testing laboratory to perform quality control tests. Maintain sampling and testing equipment in proper working condition.

You are not entitled to compensation for the suspension of work resulting from noncompliance with quality control requirements, including those identified within the QC plan.

23-1.01D(2)(b) Quality Control Plan

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 outside of those limits. Suspension limits must not exceed specified acceptance criteria.
The QC plan must describe how test results will be submitted including times for sampling and testing for each quality characteristic.

23-1.01D(2)(c) Qualifications

Testing laboratories and testing equipment must comply with the Department's Independent Assurance Program.

Personnel performing sampling and testing must be qualified under the Department's Independent Assurance Program for the sampling and testing performed.

23-1.01D(3) Department Acceptance

Reserved

23-1.02 MATERIALS

Not Used

23-1.03 CONSTRUCTION *Not Used*

23-1.04 PAYMENT

Not Used

26 AGGREGATE BASES

26-1 GENERAL

26-1.01 GENERAL

26-1.01A Summary

Section 26 includes specifications for placing aggregate base.

26-1.01B Definitions *Reserved*

26-1.01C Submittals

Submit an aggregate base QC plan.

26-1.01D Quality Assurance 26-1.01D(1) General

Aggregate samples must not be treated with lime, cement, or chemicals before testing for durability index. Aggregate from untreated reclaimed processed AC, PCC, LCB, or CTB is not considered treated.

26-1.01D(2) Quality Control

26-1.01D(2)(a) General

Reserved

26-1.01D(2)(b) Quality Control Plan

Reserved

26-1.01D(2)(c) Qualifications

Reserved

26-1.01D(2)(d) Quality Control Testing

AB quality control must include testing the quality characteristics at the frequencies shown in the following table:

QC Testing Frequencies

Quality characteristic	Test method	Sampling location	Minimum frequency
R-value	California Test 301	Stockpiles, transportation units, windrows, or roadways	1 test before starting work and every 2,000 cu yd thereafter[a]
Aggregate gradation	California Test 202	Stockpiles, transportation units, windrows, or roadways	1 per 500 cu yd but at least one per day of placement
Sand equivalent	California Test 217	Stockpiles, transportation units, windrows, or roadways	
Durability index[b]	California Test 229	Stockpiles, transportation units, windrows, or roadways	1 per project
Relative compaction	California Test 231	Roadway	1 per 500 sq yd on each layer

[a]Additional R-value frequency testing will not be required when the average of 4 consecutive sand equivalent tests is 29 or greater for Class 2 AB or 25 or greater for Class 3 AB. [b]Applies if section 26-1.02 contains an applicable requirement for durability index

26-1.01D(3) Department Acceptance

The Department accepts AB based on aggregate gradation, R-value requirements, durability, and sand equivalent requirements specified in section 26-1.02.

The Department accepts AB based on percent relative compaction specified in section 26-1.03E tested under California Test 231.

The Engineer takes aggregate base samples for R-value, aggregate gradation, sand equivalent, and durability index from any of the following locations:

1. *Windrow*
2. *Roadway*

If the aggregate gradation test results, sand equivalent test results, or both comply with the Contract compliance requirements but not the operating range requirements, you may continue placing AB for the remainder of the work day. Do not place additional AB until you demonstrate to the Engineer the AB to be placed complies with the operating range requirements.

If the aggregate gradation test results, sand equivalent test results, or both do not comply with Contract compliance requirements, remove the AB or request a payment deduction. If your request is authorized, $2.00/cu yd is deducted. If AB is paid by weight, the Engineer converts tons to cubic yards for the purpose of reducing payment for noncompliant AB left in place.

Each aggregate gradation and a sand equivalent test represents no more than 500 cu yd of AB or 1 day's production, whichever is smaller.

26-1.02 MATERIALS

26-1.02A General

Aggregate must be clean and consist of any combination of the following:

1. *Broken stone*
2. *Crushed gravel*
3. *Natural rough-surfaced gravel*
4. *Sand*
5. *Processed reclaimed asphalt concrete, PCC, LCB, or CTB*

Use either 1-1/2-inch or 3/4-inch maximum aggregate gradation unless otherwise specified. Do not change your selected aggregate gradation without authorization.

26-1.02B Class 2 Aggregate Base

Aggregate gradation must be within the percentage passing limits for the sieve sizes shown in the following table:

Aggregate Gradation

Sieve size	*Percentage passing*			
	1-1/2 inch maximum		*3/4 inch maximum*	
	Operating range	*Contract compliance*	*Operating range*	*Contract compliance*
2"	*100*	*100*	*--*	*--*
1-1/2"	*90–100*	*87–100*	*--*	*--*
1"	*--*	*--*	*100*	*100*
3/4"	*50–85*	*45–90*	*90–100*	*87–100*
No. 4	*25–45*	*20–50*	*35–60*	*30–65*
No. 30	*10–25*	*6–29*	*10–30*	*5–35*
No. 200	*2–9*	*0–12*	*2–9*	*0–12*

The aggregate quality characteristics must comply with the requirements shown in the following table:

Aggregate Quality Characteristics

Quality characteristic	*Requirement*	
	Operating range	*Contract compliance*
Resistance (R-value, min)	*--*	*78*
Sand equivalent (min)	*25*	*22*
Durability index (min)	*--*	*35*

26-1.02C Class 3 Aggregate Base

Aggregate gradation must be within the percentage passing limits for the sieve sizes shown in the following table:

Aggregate Gradation

Sieve size	*Percentage passing*			
	1-1/2 inch maximum		*3/4 inch maximum*	
	Operating range	*Contract compliance*	*Operating range*	*Contract compliance*
2"	*100*	*100*	*--*	*--*
1-1/2"	*90–100*	*87–100*	*--*	*--*
1"	*--*	*--*	*100*	*100*
3/4"	*50–90*	*45–95*	*90–100*	*87–100*
No. 4	*25–60*	*20–65*	*40–70*	*35–75*
No. 30	*10–35*	*6–39*	*12–40*	*7–45*
No. 200	*3–15*	*0–19*	*3–15*	*0–19*

The aggregate quality characteristics must comply with the requirements shown in the following table:

Aggregate Quality Characteristic

Quality characteristic	*Requirement*	
	Operating range	*Contract compliance*
Resistance (R-value) (min)	*--*	*50*
Sand equivalent (min)	*21*	*18*

26-1.03 CONSTRUCTION

26-1.03A General

Apply water to the AB as needed for compaction.

26-1.03B Subgrade

Immediately before spreading AB, the subgrade must comply with the specified compaction and elevation tolerance for the material involved and be free from loose or extraneous material.

You may use AB to fill areas of the subgrade that are lower than the grade established by the Engineer.

26-1.03C Placing Geosynthetic Materials

Section 26-1.03C applies if geosynthetic materials are shown.

Geosynthetic materials include filter fabric and biaxial geogrid.

If filter fabric is shown, place it on the subgrade.

Before placing geosynthetic materials, remove sharp objects that may come in contact with the material.

Place the material:

1. *Under manufacturer's instructions*
2. *Longitudinally along the roadway alignment*
3. *Without wrinkles*

Overlap adjacent edges of geosynthetic material at least 2 feet. Overlap the ends of the rolls at least 2 feet in the direction AB is spread.

You may fold or cut geosynthetic material to conform to curves. If material is cut, overlap it at least 2 feet. You may hold material in place with mechanical ties, staples, pins, or small piles of AB.

Do not place stockpiles on geosynthetic material or place more material than can be covered in 72 hours.

Do not operate equipment or vehicles directly on filter fabric.

Do not operate equipment or vehicles directly on geogrid unless one of the following conditions is met:

1. *Vehicles and equipment are:*
    1.1. *Equipped with rubber tires*
    1.2. *Operated under 10 mph*
    1.3. *Operated to avoid sudden braking and sharp turns*
2. *At least 0.35 ft of AB has been placed, spread, and compacted on the material*

Repair or replace any damaged geosynthetic material by placing a new piece of material over the damaged area with at least 3 feet of overlap.

26-1.03D Spreading

Deliver uniform mixtures of AB to the roadbed. Deposit AB in layers or windrows. Spread and shape the AB to such thickness that after watering and compacting, the completed AB is within the tolerances specified in section 26-1.03E. When AB is spread and compacted the moisture content must be uniform and sufficient to obtain the required compaction. Avoid material segregation. AB must be free from pockets of coarse or fine material.

If the subgrade is cohesionless sand, you may dump AB in piles and spread it ahead in sufficient quantities to stabilize the subgrade, if authorized.

If the AB thickness shown is 0.50 foot or less, spread and compact the AB in at least1 layer. If the thickness shown is more than 0.50 foot, spread and compact the AB in at least 2 approximately equal layers in thickness. The compacted thickness of any one layer must not exceed 0.50 foot.

At locations inaccessible to spreading equipment, spread and compact AB by any means that will attain the specified requirements.

26-1.03E Compacting

Compact each AB layer to at least 95 percent relative compaction.

If biaxial geogrid is shown, compact AB with either (1) a smooth-wheeled roller or (2) a rubber-tired roller. Do not use vibratory devices during compaction.

The finished AB surface must not vary more than 0.05 foot from the grade established by the Engineer.

Correct areas of AB that do not comply with the described thickness or request a payment deduction if AB is paid for by volume. If your request is authorized, the Engineer calculates the deduction by multiplying:

1. *Deficient thickness less allowable tolerance*
2. *Planned width*
3. *Longitudinal distance of the deficient thickness*
4. *$17.00/cu yd or the item bid price adjusted for cubic yards, whichever is higher*

26-1.04 PAYMENT

If aggregate base is paid for by volume, the payment quantity is determined from the dimensions shown. The payment quantity does not include the volume of aggregate base used to fill low areas of the subgrade.

If the basement material is imported borrow, aggregate base placed to fill low areas is not measured or paid for as imported borrow.

If aggregate base is paid for by weight, the Engineer deducts the weight of the water at the time of weighing in excess of the optimum moisture content plus 1 percent from the weight of the aggregate base. The Engineer determines the optimum moisture content under California Test 216.

DIVISION V SURFACINGS AND PAVEMENTS

Add prior to section 36:

Bid Items and Applicable Sections

Item code	Item description	Applicable section
398001	Remove Asphalt Concrete Pavement	39
390132	Hot Mix Asphalt (Type A)	39
390137	Hot Mix Asphalt-Open Graded (Open Gap Friction Course)	39
400050	Continuously Reinforced Concrete Pavement	40

36 GENERAL

36-1 GENERAL

36-1.01 GENERAL

36-1.01A Summary

Section 36 includes general specifications for constructing surfacings and pavements.

36-1.01B Definitions *Reserved*

36-1.01C Submittals

Reserved

36-1.01D Quality Assurance

36-1.01D(1) General

Reserved

36-1.01D(2) Preconstruction Meetings

At least 3 business days before the start of surfacing and pavement operations, hold a preconstruction meeting with the Engineer and your:

1. *Project manager*
2. *QC manager*
3. *Project superintendent*
4. *Project foreman*
5. *Plant manager*
6. *Traffic control foreman*
7. *Subcontractors' foremen*

Meeting attendees must sign an attendance sheet provided by the Engineer. The Engineer retains the attendance sheet.

Discuss the project specifications and the processes for producing materials and constructing each item of work, including:

1. *Quality assurance:*
   1.1. *Quality control 1.2. Department acceptance*
2. *Placement of materials:*
   2.1. *Training*
   2.2. *Checklists*
   2.3. *Test sections or trial slabs*
3. *Contingency plan*
4. *Issues specific to the project, including:*
   4.1. *Weather*
   4.2. *Alignment and geometrics*
   4.3. *Traffic control issues*

4.4. *Haul distances*
4.5. *Presence and absence of shaded areas*
4.6. *Other local issues*

Do not place trial slabs, construct test strips, or start paving activities until the listed personnel have attended the meeting.

36-1.02 *MATERIALS*

Not Used

36-1.03 *CONSTRUCTION*

36-1.04 *Not Used*

36-1.05 *PAYMENT*

Not Used

36-2 BASE BOND BREAKER

36-2.01 GENERAL

36-2.01A Summary

Section 36-2 includes specifications for applying or placing a base bond breaker between a base and concrete pavement.

36-2.01B Definitions *Reserved*

36-2.01C Submittals

Submit a certificate of compliance for each shipment of base bond breaker material delivered.

36-2.01D Quality Assurance

Reserved

36-2.02 MATERIALS

The base bond breaker must be one of the following:

Base bond breaker no.	*Description*
1	*PG asphalt binder, Grade PG 64-10*
2	*Curing compound no. 3*
3	*White opaque polyethylene film under ASTM C171 except the minimum thickness must be 6 mils*
4	*White curing paper under ASTM C171*
5	*Geosynthetic bond breaker*

36-2.03 CONSTRUCTION

36-2.03A General

Before applying or placing a base bond breaker, remove foreign and loose materials from the base.

Do not place a base bond breaker until the base has cured.

Pave over the base bond breaker within 72 hours of placing it.

36-2.03B Applying and Placing Base Bond Breaker

Select a bond breaker to apply or place over the base material as shown in the following table:

Base material	*Bond breaker no.*
LCB	*1, 2, 5*
Concrete base	
LCB rapid setting	*3, 4, 5*

RSC base	
CTPB	
Existing base	

Apply base bond breaker no. 1 in a single application at a uniform rate from 0.09 to 0.15 gal/sq yd over the entire surface of the base. Cure for at least 4 hours before paving.

Mix base bond breaker no. 2 as specified for mixing curing compound for concrete. Apply the bond breaker in 1 or more applications to achieve a coverage rate of at least 0.12 gal/sq yd over the entire surface of the base. Cure for at least 4 hours before paving.

Place base bond breakers no. 3 and 4 without wrinkles. Overlap adjacent sheets a minimum of 6 inches in the same direction as the concrete pour. Tape or bond the sheets together as needed to prevent the sheets from folding or wrinkling. Secure the bond breaker such that it remains in place during concrete placement. Ensure that no concrete gets under the bond breaker.

Place base bond breaker no. 5 without wrinkles. Overlap adjacent sheets a minimum of 8 inches in the same direction as the concrete pour. Overlap no more than 3 layers at any location. Secure the base bond breaker to the base with pins or nails punched through galvanized washers or discs from 2 to 2.75 inches in diameter. Place fasteners less than 3 feet apart along the edges and 6 feet apart elsewhere. If the bond breaker moves or wrinkles during concrete pavement placement, use more fasteners at a smaller spacing. Ensure that no concrete gets under the bond breaker.

36-2.04 PAYMENT

The payment quantity for base bond breaker does not include the quantity used for overlaps.

36-3 PAVEMENT SMOOTHNESS

36-3.01 GENERAL

36-3.01A Summary

Section 36-3 includes specifications for measuring the smoothness of pavement surfaces.

36-3.01B Definitions area of localized roughness: *Moving average of the International Roughness Index values for each wheel path using a 25-foot continuous interval and a 250-mm filter.*

Mean Roughness Index: *Average of the International Roughness Index values for the left and right wheel paths for the same traffic lane using a fixed interval and a 250-mm filter.*

wheel paths: *Pair of lines 3 feet from and parallel to the edges of a traffic lane. Left and right wheel paths are based on the direction of travel.*

36-3.01C Submittals

36-3.01C(1) General

Reserved

36-3.01C(2) Inertial Profiler Certification

At least 5 business days before starting initial profiling or changing the 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. *Manufacturer's instructions and test procedures for calibration and verification of the inertial profiler*

Within 2 business days after cross-correlation testing, submit a ProVAL profiler certification analysis report for the test results to the Engineer and to the electronic mailbox address smoothness@dot.ca.gov.

36-3.01C(3) Inertial Profiler Data

36-3.01C(3)(a) General

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 smoothness@dot.ca.gov.

Within 2 business days after each day of profiling, submit the profile information to the Engineer and to the Department's secure file sharing system. After submitting the profile information to the Department's file sharing system, send a notification of your electronic submittal to the Engineer and to the above electronic mailbox address with the names of the files submitted.

For each surface with inertial profile smoothness requirements, the profiling information must include:

1. *Raw profile data for each lane*
2. *ProVAL ride quality analysis report for the Mean Roughness Index of each lane in a PDF file. Report the following:*
    - 2.1. *Listing of Mean Roughness Index values for 0.1-mile segments or portions thereof*
    - 2.2. *Inputs, including the specified Mean Roughness Index threshold and fixed segment length*
    - 2.3. *Raw profile data name selections*
    - 2.4. *Areas exempt from inertial profile smoothness*
3. *ProVAL ride quality analysis report for the International Roughness Index of the left and right wheel paths of each lane in a PDF file. Report the following:*
    - 3.1. *Listing of areas of localized roughness*
    - 3.2. *Inputs, including the specified area of the localized roughness threshold and continuous segment length*
    - 3.3. *Raw profile data name selections*
    - 3.4. *Areas exempt from inertial profile smoothness*
4. *GPS data file for each lane. Submit the data file in GPS eXchange file format.*
5. *Manufacturer's recommended calibration and verification test results for the inertial profiler.*
6. *Inertial profiler's calibration and verification test results, including results for bounce, block, and the distance measurement instrument.*
7. *Completed Pavement Smoothness Inertial Profiler Submittal Record.*

Submit Asphalt Concrete Pavement Smoothness Corrections Information or Concrete Pavement Smoothness Corrections Information with your final profiling information submittal.

Submit the raw profile data in an unfiltered electronic pavement profile file format. Use the following filenaming convention:

YYYYMMDD_TTCCCRRR_EA_D_L_W_B_E_X_PT.PPF

where:

YYYY = year

MM = month, leading zero

DD = day of month, leading zero

TT = district, leading zero

CCC = county, 2- or 3-letter abbreviation as shown in section 1-1.08

RRR = route number with no leading zeros

EA = Contract number, excluding the 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 with 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 with no leading zero

X = profile operation, EXIST for existing pavement, INTER for after prepaving smoothness correction, MILL for after milling, PAVE for after paving, and CORR for after final surface pavement correction, and FINAL for completed pavement documentation of compliance.

PT = type of pavement surface profiled, such as Type A HMA, RHMA-G, OGFC, JPCP, or CRCP

If you are submitting multiple inertial profiler data files, compress the files into a .ZIP file format and submit them using the file-naming convention TT_EA_X_YYYYMMDD.zip.

36-3.01C(3)(b) Smoothness Corrective Grinding Plan

At least 2 business days before performing corrective grinding for areas of localized roughness or areas exceeding the specified thresholds for the Mean Roughness Index, submit a corrective grinding plan as an informational submittal.

The corrective grinding plan must include:

1. *Grinder manufacturer make and model*
2. *Grinder wheelbase in feet, measured from the front centerline to the back centerline of the single wheel or tandem wheel spread*
3. *Grinder head position in feet, measured relative to the centerline of the front single wheel or the front tandem wheel spread*
4. *Tandem wheel spreads in feet, for rear and front wheels as applicable*
5. *Tabular listing of the planned corrective grinding, including:*
    - 5.1. *Start and stop locations in stationing to the nearest foot*
    - 5.2. *Width of grind, such as left half lane, right half lane, or full width lane*
    - 5.3. *Corresponding grinder head depths to the nearest 0.01 inch*
    - 5.4. *Direction of grind, up to 2 passes per grind location, such as forward, reverse, forward-forward, reverse-reverse, forward-reverse, reverse-forward*
    - 5.5. *Distance from start or stop locations to the nearest semipermanent reference point*
6. *Forecasted improvement in terms of the Mean Roughness Index and area of localized roughness values*

36-3.01C(4) Straightedge Measurements

Within 2 business days of measuring smoothness with a straightedge, submit a list of the areas requiring smoothness correction or a report stating there are no areas requiring smoothness correction. Identify the areas requiring 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 traffic lane:*
    - 4.1. *Lane direction, NB, SB, EB, or WB*
    - 4.2. *Lane number from left to right in the direction of travel*
    - 4.3. *Wheel path, L for left, R for right, or B for both*
5. *For correction areas not within a traffic lane:*
    - 5.1. *Identify the pavement area, such as shoulder, weigh station, or turnout*
    - 5.2. *Direction and distance from the centerline, L for left or R for right*
6. *Estimated size of correction area*

36-3.01D Quality Assurance

36-3.01D(1) General

Reserved

36-3.01D(2) Certifications

The inertial profiler must display a current certification decal showing the expiration date.

The operator must be certified for each model of inertial profiler operated.

The certifications issued by the Department for the inertial profiler and operator must not be more than 12 months old.

36-3.01D(3) Quality Control

36-3.01D(3)(a) General

Reserved

36-3.01D(3)(b) Smoothness

36-3.01D(3)(b)(i) General

Test pavement smoothness using an inertial profiler except use a 12-foot straightedge for the pavement at:

1. *Traffic lanes less than 1,000 feet in length, including ramps, turn lanes, and acceleration and deceleration lanes*
2. *Horizontal curves with a centerline radius less than the following and within the superelevation transition of such curves:*
    2.1. *150 feet for asphalt concrete pavements*
    2.2. *300 feet for Portland cement concrete pavements*
3. *Areas within 12.5 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*
2. *Determine the Mean Roughness Index and areas of localized roughness using FHWA's engineering software ProVAL*

Where OGFC is required, test the pavement smoothness of the final HMA or concrete pavement surface before placing OGFC and after placing OGFC.

36-3.01D(3)(b)(ii) Inertial Profiler Calibration and Verification Tests

Notify the Engineer at least 2 business days before performing calibration and verification testing of the inertial profiler.

Conduct the following calibration and verification tests in the Engineer's presence each day before profiling:

1. *Block test to verify the accuracy of the height sensor under California Test 387*
2. *Bounce test to verify the combined accuracy of the height sensor and accelerometer under California Test 387*
3. *Distance measurement instrument test to verify the accuracy of the distance measuring instrument under California Test 387*
4. *Manufacturer's recommended tests*

Conduct a cross-correlation verification test of the inertial profiler in the Engineer's presence before performing the initial profiling. A verification test must be performed at least annually. Conduct 5 repeat runs of the inertial profiler on an authorized test section. The test section must be a 0.1-mile segment of existing concrete pavement if you are measuring new concrete pavement or existing asphalt concrete pavement if you are measuring new asphalt concrete pavement. Where micro-milled asphalt concrete surfaces are to be measured, the cross-correlation verification test may be performed on the initial 0.1mile section of milled asphalt concrete surface. Calculate a cross-correlation to determine the repeatability of your device under California Test 387 using a ProVAL profiler certification analysis with a 3-foot maximum offset. The cross-correlation must be a minimum of 0.92.

36-3.01D(3)(b)(iii) Performing, Analyzing, and Collecting Data

Operate the inertial profiler under the manufacturer's instructions and AASHTO R 57 at 1-inch recording intervals using a minimum 4-inch line laser sensor.

Establish semipermanent reference points for aligning inertial profiler runs and locating potential corrective grinding. Place semipermanent reference points at a frequency of 0.5 mile or less along the edge of the traffic lane or roadway. Maintain semipermanent reference points until Department acceptance testing is completed.

Collect profiling data under AASHTO R 57 and analyze it using 250 mm and International Roughness Index filters.

While collecting the profile data to determine the International Roughness Index values, record semipermanent reference points and the beginning and end of the following locations in the raw profile data:

1. *Bridge approach slabs*
2. *Bridges*
3. *Culverts visible on the roadway surface*
4. *Railroad crossings*
5. *At-grade intersections*
6. *Project limits*
7. *Change in pavement type*

Profile the left and right wheel paths of each lane.

Determine the Mean Roughness Index for 0.1-mile fixed sections using the ProVAL ride quality analysis with a 250 mm filter. Calculate the Mean Roughness Index of each lane. A partial section equal or less than 0.05-mile length is to be included with the previous or the subsequent segment forming up to a 0.15mile length. A partial section greater than 0.05 mile, but less than 0.10 mile, is a separate segment. Sections must comply with the Mean Roughness Index specifications for a full section. A weighted average calculation will be used for those partial sections that have been combined with previous or subsequent segments.

Determine the areas of localized roughness using ProVAL with the average International Roughness Index values for each wheel path using a 25-foot continuous interval and a 250 mm filter.

36-3.01D(4) Department Acceptance

The Department accepts pavement surfaces for smoothness based on compliance with the smoothness specifications for the type of pavement surface specified.

For areas that require pavement smoothness determined using a 12-foot straightedge, 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*

Pavement located within 12.5 feet of the ends of bridges, approach slabs, culverts visible on the roadway surface, railroad crossings, at-grade intersections, and transverse surface joints with existing pavement must comply with Mean Roughness Index and 12-foot straightedge requirements. The requirements for areas of localized roughness do not apply to these areas.

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.

36-3.02 MATERIALS

Not Used

36-3.03 CONSTRUCTION

Notify the Engineer of the start location by station and start time at least 2 business days before each day of profiling.

Before profiling, remove foreign objects from the pavement surface and mark the beginning and ending station on the pavement shoulder. The stationing must be the same when profiling more than one surface.

36-3.04 PAYMENT

Not Used

39 ASPHALT CONCRETE

39-1 GENERAL

39-1.01 GENERAL

Section 39 includes specifications for performing asphalt concrete work.

39-1.02 MATERIALS

Not Used

39-1.03 CONSTRUCTION *Not Used*

39-1.04 PAYMENT

Not Used

39-2 HOT MIX ASPHALT

39-2.01 GENERAL

39-2.01A General

39-2.01A(1) Summary

Section 39-2.01 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*

WMA technologies must be on the Authorized Material List for WMA authorized technologies.

For HMA that uses asphalt binder containing crumb rubber modifier, submit a Crumb Rubber Usage Report form monthly and at the end of the project.

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 59	*2011 (2015)*
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 313	*2012 (2016)*
AASHTO T 315	*2012 (2016)*
AASHTO T 324	*2014*
AASHTO T 329	*2013*
AASHTO T 335	*2009*
ASTM D36/D36M	*2014$^{\varepsilon 1}$*
ASTM D92	*2012b*
ASTM D217	*2010*
ASTM D297	*2013*
ASTM D445	*2014*
ASTM D1856	*2009 (Reapproved 2015)*
ASTM D2007	*2011*
ASTM D2074	*2007 (Reapproved 2013)*
ASTM D2995	*1999 (Reapproved 2009)*
ASTM D4791	*2010*
ASTM D5329	*2009*
ASTM D7741/D7741M	*2011$^{\varepsilon 1}$*
Asphalt Institute MS-2	*7th edition (2015)*

39-2.01A(2) 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 a 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*

processed RAP: *RAP that has been fractionated.*

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.*

39-2.01A(3) Submittals

39-2.01A(3)(a) General

Reserved

39-2.01A(3)(b) Job Mix Formula

39-2.01A(3)(b)(i) 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 a Contractor Hot Mix Asphalt Design Data form dated within 12 months of the submittal for the JMF verification.*

2. *JMF verification on a Caltrans Hot Mix Asphalt Verification form and the Contractor Hot Mix Asphalt Design Data form that was submitted for the JMF verification, if applicable. 3. JMF renewal on a Caltrans Job Mix Formula Renewal form, if applicable*

4. *SDS 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 identify the AASHTO resource accredited lab responsible for the mix design and show documentation on aggregate quality.

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

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

1. *Target asphalt binder percentage greater than ±0.2 percent*
2. *Asphalt binder supplier*
3. *Combined aggregate gradation*
4. *Aggregate sources*
5. *Liquid antistrip producer or dosage*
6. *Average binder content in a new processed RAP stockpile by more than ±2.00 percent from the average RAP binder content reported on page 4 of your Contractor Hot Mix Asphalt Design Data form*

7. *Average maximum specific gravity in a new processed RAP stockpile by more than ±0.060 from the average maximum specific gravity value reported on page 4 of your Contractor Hot Mix Asphalt Design Data form*

8. *Any material in the JMF, except lime supplier and source*

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.

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.

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.

39-2.01A(3)(b)(ii) 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*

39-2.01A(3)(b)(iii) 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 at least 15 days before production. Each modified JMF submittal must include:

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.

39-2.01A(3)(c) Quality Control Plan

At least 5 business days prior to the pre-paving meeting, 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. *Using methods and materials for backfilling core locations*

The QC plan must address the elements affecting HMA quality, including:

1. *Aggregates*
2. *Asphalt binder*
3. *Additives*
4. *Production*
5. *Paving*

The QC plan must include aggregate QC sampling and testing during lime treatment.

Allow 5 business days for review of the QC plan.

If you change QC procedures, personnel, or sample testing locations, submit a QC plan supplement before implementing the proposed change. Allow 3 business days for review of the QC plan supplement.

39-2.01A(3)(d) 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.

If a tapered notched wedge is used, submit compaction test result values within 24 hours of testing.

39-2.01A(3)(e) Reserved

39-2.01A(3)(f) Liquid Antistrip Treatment

If liquid antistrip treatment is used, submit the following with your proposed JMF submittal:

1. *One 1 pt 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 the liquid antistrip*

For each delivery of liquid antistrip to the HMA production plant, submit a 1 pt 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 a tab delimited format. Use line feed carriage return with 1 separate record per line for each production data set. Allow enough 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 a percentage of the dry aggregate weight*
   - 2.6. *Flow rate of asphalt binder collected from the asphalt binder meter*
   - 2.7. *Flow rate of liquid antistrip collected from the liquid antistrip meter*
   - 2.8. *Asphalt binder content as a percentage of the total weight of mix calculated from:*
     - 2.8.1. *Aggregate weigh belt output*
     - 2.8.2. *Aggregate moisture input*
     - 2.8.3. *Asphalt binder meter output*
   - 2.9. *Liquid antistrip content as a percentage of the asphalt binder weight calculated from:*

2.9.1. *Asphalt binder meter output*
2.9.2. *Liquid antistrip meter output*

39-2.01A(3)(g) 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 aggregates*
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 percentage 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 aggregates*
   - 3.11. *Actual lime ratio calculated from the aggregate weigh belt output, aggregate moisture input, and dry lime meter output, expressed as a percentage 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 percentage 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 slurry meter output, expressed as a percentage of the dry aggregate weight*
   - 4.11. *Calculated difference between the authorized lime ratio and 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.

39-2.01A(3)(h) Warm Mix Asphalt Technology

If a WMA technology is used, submit the following with your proposed JMF submittal:

1. *SDS for the WMA technology*
2. *For 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*

3. *For 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. The snapshot of production data must include the following:

1. *Production date*
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 the production snapshot must have allowances for sufficient fields to satisfy the amount of data required by these specifications and include data titles at least once per report.

39-2.01A(3)(i) Reserved

39-2.01A(3)(j) Tack Coat

Prior to applying tack coat, submit calculations for the minimum spray rate required to achieve the minimum residual rate.

39-2.01A(3)(k) Reserved

39-2.01A(3)(l) Data Cores

Section 39-2.01A(3)(l) applies if a bid item for a 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

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. *1/2 inch for recovered material 7.2. 1.0 inch for unstabilized material*
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 adjacent 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*

39-2.01A(3)(m)–39-2.01A(3)(o) Reserved

39-2.01A(4) Quality Assurance

39-2.01A(4)(a) General

AASHTO T 324 (Modified) is AASHTO T 324 with the following parameters:

1. *Target air voids must equal 7.0 ± 1.0 percent*
2. *Specimen height must be 60 ± 1 mm*
3. *Number of test specimens must be 4 to run 2 tests*
4. *Do not average the 2 test results*
5. *Test specimen must be a 150 mm gyratory compacted specimen*
6. *Test temperature must be set at:*
   6.1. *113 ± 2 degrees F for PG 58*
   6.2. *122 ± 2 degrees F for PG 64*
   6.3. *131 ± 2 degrees F for PG 70 and above*
7. *Measurements for impression must be taken at every 100 passes along the total length of the sample*
8. *Inflection point is 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*

Take samples under California Test 125.

If a WMA technology is used, a technical representative for the WMA technology must attend the preconstruction meeting.

39-2.01A(4)(b) Job Mix Formula Verification

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 TV 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.

In the Engineer's presence and from the same production run, take samples of:

1. *Aggregates. Coarse, fine, and supplemental fine aggregates must be taken from the combined coldfeed belt or the 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 verify the TV submitted on a Contractor Job Mix Formula Proposal form.*

2. *Asphalt binder. Take at least two 1 qt samples. Each sample must be in a 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. Samples must be at least 50 lb from each fractionated stockpile used or 100 lb from the belt.*
4. *Plant-produced HMA. The HMA samples must be at least 250 lb.*

For aggregate, RAP, and HMA, split the samples into at least 4 parts and label their containers. 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. *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. Submit a JMF adjusted after verification failure based on your testing unless the Engineer authorizes reverification without adjustments. Engineer authorized reverification without adjustment is not JMF adjusted after verification failure. A JMF adjusted after verification failure may include a change in:

1. *Asphalt binder content TV up to ±0.20 percent from the OBC value submitted on the Contractor Hot Mix Asphalt Design Data form*

2. *Aggregate gradation TV within the TV 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. Do not resubmit any of the 2 proposed submittals including a JMF adjusted after verification failure that failed verification on any other Caltrans projects. 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.

39-2.01A(4)(c) Job Mix Formula Authorization *You may start HMA production if:*

1. *Engineer's review of the JMF shows compliance with the specifications*
2. *Department has verified the JMF within 12 months before HMA production*
3. *Engineer authorizes the verified JMF*

39-2.01A(4)(d) Job Mix Formula Renewal

For a JMF renewaland upon request, in the Engineer's presence and from the same production run, take samples of:

1. *Aggregates. Coarse, fine, and supplemental fine aggregates must be taken from the combined cold-feed belt or the 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-bin samples, the Department combines these aggregate samples to verify the TV submitted on a Contractor Job Mix Formula Proposal form.*

2. *Asphalt binder. Take at least two 1 qt samples. Each sample must be in a 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. 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 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 39-2.01A(4)(b) except:

1. *Engineer keeps the samples until you provide test results for your part on a Contractor Job Mix Formula Renewal form.*

2. *Department tests samples of materials obtained from the HMA production unit after you submit test results that comply with the 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.

39-2.01A(4)(e) Job Mix Formula Modification

The Engineer verifies the modified JMF after the modified JMF HMA is placed and verification samples are taken within the first 750 tons. The Engineer tests verification samples for compliance with:

1. *Hamburg wheel track mix design specifications*
2. *Air void content*
3. *Voids in mineral aggregate on plant-produced HMA mix design specifications*
4. *Dust proportion mix design specifications*

The Engineer may test for moisture susceptibility for compliance with the mix design specifications.

If the modified JMF is verified, the Engineer revises your Hot Mix Asphalt Verification form to include the new asphalt binder source, new liquid antistrip producer, or new liquid antistrip dosage. Your revised form will have the same expiration date as the original form.

If a modified JMF is not verified, stop production and any HMA placed using the modified JMF is rejected.

The Engineer deducts $2,000 from payments for each JMF modification.

39-2.01A(4)(f) Certifications

39-2.01A(4)(f)(i) General

Laboratories testing aggregate and HMA qualities used to prepare the mix design and JMF must be qualified under AASHTO re:source program and the Department's Independent Assurance Program.

39-2.01A(4)(f)(ii) Hot Mix Asphalt Plants

Before production, the HMA plant must have a current qualification under the Department's Material Plant Quality Program.

39-2.01A(4)(f)(iii)–39-2.01A(4)(f)(v) Reserved

39-2.01A(4)(g) Reserved

39-2.01A(4)(h) Quality Control

39-2.01A(4)(h)(i) General

QC test results must comply with the specifications for Department acceptance.

Condition each at-the-plant sample of HMA mixture for AASHTO 324 and AASHTO 283 in compliance with sections 7.1.2, 7.1.3, and 7.1.4 of AASHTO R 30. Condition each at-the-plant sample of HMA mixture when composite aggregate absorption factor is greater than 2.0 percent as indicated by the JMF in compliance with sections 7.1.2, 7.1.3, and 7.1.4 of AASHTO R 30.

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.

39-2.01A(4)(h)(ii) Reserved

39-2.01A(4)(h)(iii) Aggregates

39-2.01A(4)(h)(iii)(A) General *Reserved*

39-2.01A(4)(h)(iii)(B) Aggregate Lime Treatments

If lime treatment is required, sample coarse and fine aggregates from individual stockpiles before lime treatment. Combine aggregate in the JMF proportions. Test the aggregates under the test methods and frequencies shown in the following table:

Aggregate Quality Control During Lime Treatment

Quality characteristic	*Test method*	*Minimum sampling and testing frequency*
Sand equivalent[a, b]	*AASHTO T 176*	*1 per 750 tons of untreated aggregate*
Percent of crushed particles	*AASHTO T 335*	*1 per 10,000 tons or 2 per project whichever is greater*
Los Angeles Rattler	*AASHTO T 96*	
Fine aggregate angularity	*AASHTO T 304, Method A*	
Flat and elongated particles	*ASTM D4791*	

[a]Report test results as the average of 3 tests from a single sample. [b]Use of a sand reading indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, "Manual Shaker," 7.1.2, "Alternate Method No. 2," and 8.4.3, "Hand Method," do not apply. Prepare the stock solution as specified in section 4.8.1, "Stock solution with formaldehyde," except omit the addition of formaldehyde.

For lime slurry aggregate treatment, determine the aggregate moisture content at least once every 2 hours of treatment. Calculate moisture content under AASHTO T 255 and report it as a percent of dry aggregate weight. Use the moisture content calculations as a set point for the proportioning process controller.

The device controlling lime and aggregate proportioning must produce a treatment data log. The log must consist 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. Collected data must be stored by the controller for the duration of the Contract.

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 authorized 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 authorized 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 authorized 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.

39-2.01A(4)(h)(iv) 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.

39-2.01A(4)(h)(v) 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. *Aggregates*
2. *Asphalt binder*
3. *RAP*
4. *HMA*

Sample aggregates from the combined cold-feed belt or hot bin. Take RAP samples from the RAP system.

For aggregates, RAP, and HMA, split the samples into at least 4 parts and label their containers. Submit 3 parts 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.

39-2.01A(4)(h)(vi) 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.

39-2.01A(4)(h)(vii) Tapered Notched Wedge

Perform QC testing on the completed tapered notched wedge joint as follows:

1. *Perform density tests using a calibrated nuclear gauge 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 to comply with the specifications.

39-2.01A(4)(h)(viii) 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 location. 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.

39-2.01A(4)(h)(ix) Reserved

39-2.01A(4)(i) Department Acceptance

39-2.01A(4)(i)(i) 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 any of the following locations:

1. *Plant*
2. *Truck*
3. *Windrow*

The Engineer takes HMA samples for all other tests from any of the following locations:

1. *Plant*
2. *Truck*
3. *Windrow*
4. *Mat behind the paver*

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 for AASHTO 324 and AASHTO 283 in compliance with sections 7.1.2, 7.1.3, and 7.1.4 of AASHTO R 30. The Engineer conditions each at-theplant sample of HMA mixture when composite aggregate absorption factor is greater than 2.0 percent as indicated by the JMF in compliance with sections 7.1.2, 7.1.3, and 7.1.4 of AASHTO R 30.

No single aggregate or HMA test result may represent more than 750 tons or one day's production, whichever is less, except 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*

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.

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*

39-2.01A(4)(i)(ii) In-Place Density

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 must 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.

39-2.01A(4)(i)(iii) 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*
> 0.25 foot	*60 in/mi or less*
≤ 0.25 foot	*75 in/mi or less*

Note: These requirements do not apply to the OGFC surface. Smoothness requirements for OGFC are specified in section 39-2.04A(4)(c)(iii).

The final surface of HMA must comply with the Mean Roughness Index requirements before placing OGFC. Correct pavement to 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.

39-2.01A(4)(i)(iv) 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 re:source program, and the Department's Independent Assurance Program. The independent third party must have no prior direct involvement with 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*

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 39-2.01A(4)(b).

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.

39-2.01B Materials

39-2.01B(1) General

Reserved

39-2.01B(2) Mix Design

39-2.01B(2)(a) General

The HMA mix design must comply with the superpave HMA mix design as described in MS-2 Asphalt Mix Design Methods by the Asphalt Institute.

The Contractor Hot Mix Asphalt Design Data form must show documentation on aggregate quality.

39-2.01B(2)(b) Hot Mix Asphalt Treatments

If the proposed JMF indicates that the aggregate is being treated with dry lime or lime slurry with marination, or the HMA with liquid antistrip, then testing the untreated aggregate under AASHTO T 283 and AASHTO T 324 is not required.

If HMA treatment is required or being used by the Contractor, determine the plasticity index of the aggregate blend under California Test 204.

Do not use an aggregate blend with a plasticity index greater than 10.

If the plasticity index is from 4 to 10, treat the aggregate blend with dry lime with marination or lime slurry with marination.

If the plasticity index is less than 4, treat the aggregate blend with dry lime or lime slurry with marination, or treat the HMA with liquid antistrip.

39-2.01B(2)(c) Warm Mix Asphalt Technology

For HMA with WMA additive technology, produce HMA mix samples for your mix design using your methodology for inclusion of WMA admixture in laboratory-produced HMA. Cure the samples in a forcedair draft oven at 275 degrees F for 4 hours ± 10 minutes.

For WMA water injection foam technology, the use of foamed asphalt for mix design is not required.

39-2.01B(3) Asphalt Binder

Asphalt binder must comply with section 92.

For a leveling course, the grade of asphalt binder for the HMA must be PG 64-10 or PG 64-16.

39-2.01B(4) Aggregates

39-2.01B(4)(a) General

Aggregates must be clean and free from deleterious substances.

The aggregates for a leveling course must comply with the gradation specifications for Type A HMA in section 39-2.02B.

39-2.01B(4)(b) 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. Choose a TV within the TV limits shown in the tables titled "Aggregate Gradations."

Gradations are based on nominal maximum aggregate size.

39-2.01B(4)(c) Aggregate Lime Treatments

39-2.01B(4)(c)(i) General

If aggregate lime treatment is required as specified in section 39-2.01B(2)(b), the virgin aggregate must comply with the aggregate quality specifications.

Lime for treating aggregate must comply with section 24-2.02.

Water for lime treatment of aggregate with lime slurry must comply with section 24-1.02B.

Notify the Engineer at least 24 hours before the start of aggregate treatment.

Do not treat RAP.

The lime ratio is the pounds of dry lime per 100 lb of dry virgin aggregate expressed as a percentage. Water content of slurry or untreated aggregate must not affect the lime ratio.

Coarse and fine aggregate fractions must have the lime ratio ranges shown in the following table:

Aggregate fractions	*Lime ratio percent*
Coarse	*0.4–1.0*
Fine	*1.5–2.0*
Combined	*0.8–1.5*

The lime ratio for fine and coarse aggregate must be within ±0.2 percent of the lime ratio in the accepted JMF. The lime ratio must be within ±0.2 percent of the authorized lime ratio when you combine the individual aggregate sizes in the JMF proportions. The lime ratio must be determined before the addition of RAP.

If marination is required, marinate treated aggregate in stockpiles from 24 hours to 60 days before using in HMA. Do not use aggregate marinated longer than 60 days.

Treated aggregate must not have lime balls or clods.

39-2.01B(4)(c)(ii) 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 separately 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 a continuous mixing plant for HMA production without lime-marinated aggregates is used, 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.

When 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.

39-2.01B(4)(c)(iii) 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.

39-2.01B(5) 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.

39-2.01B(6)–39-2.01B(7) Reserved

39-2.01B(8) Hot Mix Asphalt Production

39-2.01B(8)(a) General

Do not start HMA production before verification and authorization of JMF.

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 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 minimum 15 minute or minimum 250 lb 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*

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 must be produced at the temperatures shown in the following table:

HMA Production Temperatures

HMA compaction	*Temperature (°F)*
HMA	
Density based Method	*≤ 325 305–325*

HMA with WMA technology	
Density based Method	*240–325* *260–325*

If you stop production for longer than 30 days, a production start-up evaluation is required.

39-2.01B(8)(b) Liquid Antistrip

If 3 consecutive sets of recorded production data show that the actual delivered liquid antistrip weight is more than ±1 percent of the authorized mix design liquid antistrip weight, stop production and take corrective action.

If a set of recorded production data shows that the actual delivered liquid antistrip weight is more than ±2 percent of the authorized mix design liquid antistrip weight, stop production. If the liquid antistrip weight exceeds 1.2 percent of the asphalt binder weight, do not use the HMA represented by that data.

The continuous mixing plant controller proportioning the HMA must produce a production data log. The log must consist 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, the 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 reasons:

1. *You fail to submit data*
2. *You submit incomplete, untimely, or incorrectly formatted data*
3. *You fail to take corrective actions*
4. *You take late or unsuccessful corrective actions*
5. *You fail to 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.

39-2.01B(8)(c) 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.*

4. *If dry HMA additives are used at continuous mixing HMA plants, bag-house dust systems must return all captured material to the mix. This requirement is waived for lime-treated aggregates.*

5. *HMA additive must be proportioned to within ±0.3 percent of the target additive rate.*

Batch mixing plants using HMA additives must comply with the following:

1. *Metered HMA additive must be placed in an intermediate holding vessel before being added to the stream of asphalt binder as it enters the pugmill.*

2. *If a container scale is used, weigh additive before combining with asphalt binder. Keep the container scale separate from other ingredient proportioning. The container scale capacity must be no more than twice the volume of the maximum additive batch size. The container scale's graduations must be smaller than the proportioning tolerance or 0.001 times the container scale capacity.*

3. *Dry HMA additive proportioning devices must be separate from metering devices for the aggregates and asphalt binder. Proportion dry HMA additive directly into the pugmill, or place in an intermediate holding vessel to be added to the pugmill at the appropriate time in the batch cycle. Dry ingredients for batch production must be proportioned with a hopper scale.*

4. *Zero tolerance for the HMA additive batch scale is ±0.5 percent of the target additive weight. The indicated HMA additive batch scale weight may vary from the preselected weight setting by up to ±1.0 percent of the target additive weight.*

39-2.01B(9) 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.

39-2.01B(10) Tack Coat

Tack coat must comply with the specifications for asphaltic emulsion or asphalt binder. Choose the type and grade of emulsion or binder.

39-2.01B(11) Miscellaneous Areas and Dikes *For miscellaneous areas and dikes:*

1. *Choose the aggregate gradation from:*
   1.1. *3/8-inch Type A HMA aggregate gradation*
   1.2. *1/2-inch Type A HMA aggregate gradation*
   1.3. *dike mix aggregate gradation*
2. *Choose asphalt binder Grade PG 64-10, PG 64-16 or PG 70-10.*
3. *Minimum asphalt binder content must be:*
   3.1. *6.40 percent for 3/8-inch Type A HMA aggregate gradation*
   3.2. *5.70 percent for 1/2-inch Type A HMA aggregate gradation*
   3.3. *6.00 percent for dike mix aggregate gradation*

If you request and the Engineer authorizes, you may reduce the minimum asphalt binder content.

Aggregate gradation for dike mix must be within the TV limits for the specified sieve size shown in the following table:

Dike Mix Aggregate Gradation (Percentage Passing)

Sieve size	*Target value limit*	*Allowable tolerance*
1/2"	*100*	*--*
3/8"	*---*	*95 - 100*
No. 4	*73–77*	*TV ± 10*
No. 8	*58–63*	*TV ± 10*
No. 30	*29–34*	*TV ± 10*
No. 200		*0 - 14*

For HMA used in miscellaneous areas and dikes, sections 39-2.01A(3), 39-2.01A(4), 39-2.01B(2), 392.01B(4)(c), and 39-2.01B(5)–(10) do not apply.

39-2.01C Construction

39-2.01C(1) 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 depositing, pickup, loading, and paving are continuous 4. For method compaction:*
   4.1. *The temperature of the HMA and the HMA produced with WMA water injection technology in the windrow does not fall below 260 degrees F*

   4.2. *The temperature of the HMA produced using WMA additive technology in the windrow does not fall below 250 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*
4. *Marks*
5. *Tearing*
6. *Irregular texture*

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*

39-2.01C(2) Spreading and Compacting Equipment

39-2.01C(2)(a) General

Paving equipment for spreading must be:

1. *Self-propelled*
2. *Mechanical*
3. *Equipped with a screed or strike-off assembly that can distribute HMA the full width of a traffic lane*
4. *Equipped with a full-width compacting device*
5. *Equipped with automatic screed controls and sensing devices that control the thickness, longitudinal grade, and transverse screed slope*

Install and maintain grade and slope references.

The screed must 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*

39-2.01C(2)(b) 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*

39-2.01C(2)(c) Method Compaction Equipment

For method compaction, each paver spreading HMA must be followed by at least one of each of the following 3 types of rollers:

1. *Breakdown roller must be a 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. *Intermediate roller must be an 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. *Finishing roller must be a 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.

39-2.01C(2)(d)–39-2.01C(2)(f) Reserved

39-2.01C(3) Surface Preparation

39-2.01C(3)(a) General

Before placing HMA, remove loose paving particles, dirt, and other extraneous material by any means including flushing and sweeping.

39-2.01C(3)(b) Subgrade

Prepare subgrade to receive HMA under the sections for the material involved. Subgrade must be free of loose and extraneous material.

Replace section 39-2.01C(3)(c) with:

39-2.01C(3)(c) Prime Coat

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

You may modify the prime coat application rates if authorized.

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

39-2.01C(3)(d) Prepaving Inertial Profiler

Section 39-2.01C(3)(d) applies to existing asphalt concrete surfaces receiving an HMA overlay if a bid item for prepaving inertial profiler is shown on the Bid Item List.

Before starting paving activities, perform prepaving inertial profiler measurements. Prepaving inertial profiler work includes taking profiles of the existing pavement and 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, take prepaving inertial profiler measurements before cold planning.

If the Contract includes replace asphalt concrete surfacing, take prepaving inertial profiler measurements after replacing the asphalt concrete surfacing.

39-2.01C(3)(e) Prepaving Grinding

Section 39-2.01C(3)(e) applies to existing asphalt concrete surfaces:

1. *That will not be cold planned or milled*
2. *That will receive an HMA overlay less than or equal to 0.25 foot exclusive of OGFC*
3. *If a bid item for prepaving grinding day is shown on the Bid Item List*

After performing prepaving inertial profiling, correct areas of localized roughness greater than 180 in/mi.

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.

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, taking profiles of the corrected areas, the 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 areas of localized roughness, take profiles of the corrected area and submit profile data as specified in section 36-3.01C(3).

Dispose of grinding residue.

Pave within 7 days of correcting areas.

The final pavement surface must comply with section 39-2.01A(4)(i)(iii).

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.

39-2.01C(3)(f) Tack Coat

Apply a 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*

Equipment for the application of tack coat must comply with section 37-1.03B.

Before placing HMA, apply a 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*
Concrete pavement and existing asphalt concrete 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 37-2.05 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 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 a tack coat to vertical surfaces with a residual rate that will thoroughly coat the vertical face without running off.

If authorized, 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 allow the tracking of tack coat onto pavement surfaces beyond the job site.

If you use an asphalt binder for tack coat, the asphalt binder temperature must be from 285 to 350 degrees F when applied.

39-2.01C(3)(g) Geosynthetic Pavement Interlayer

Where shown, place geosynthetic pavement interlayer over a coat of asphalt binder and in compliance with the manufacturer's instructions. Do not place the interlayer on a wet or frozen surface. If the interlayer, in compliance with the manufacturer's instructions, does not require asphalt binder, do not apply asphalt binder before placing the interlayer.

Before placing the interlayer or asphalt binder:

1. *Repair cracks 1/4 inch and wider, spalls, and holes in the pavement. This repair is change order work.*
2. *Clean the pavement of loose and extraneous material.*

If the interlayer requires asphalt binder, immediately before placing the interlayer, apply asphalt binder at a rate specified by the interlayer manufacturer; at 0.25±0.03 gal per square yard of interlayer; or at a rate that just saturates the interlayer; whichever is greater. Apply asphalt binder the width of the 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.

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.

If the interlayer placement does not require asphalt binder, apply tack coat prior to placing HMA at the application rates specified under section 39-2.01C(3)(f) based on the condition of the underlying surface on which the interlayer was placed.

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.

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.

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. The minimum HMA thickness over the interlayer must be 0.12 foot including at conform tapers.

39-2.01C(4) Longitudinal Joints

39-2.01C(4)(a) 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. Other longitudinal joint placement patterns are allowed if authorized.

A vertical longitudinal joint of more than 0.15 foot is not allowed at any time between adjacent lanes open to traffic.

For an 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 an HMA thickness greater than 0.15 foot, you must place HMA on adjacent traveled way lanes or shoulder such 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, saw cut or grind the pavement straight and vertical along the joint and remove extraneous material.

39-2.01C(4)(b) 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 keep 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.

39-2.01C(5) Pavement Edge Treatments

Construct edge treatment on the HMA pavement as shown.

Where a tapered edge is required, use the same type of HMA used for the adjacent lane or shoulder.

The edge of roadway where the tapered edge is to be placed must have a solid base, free of debris such as loose material, grass, weeds, or mud. Grade the areas to receive the tapered edge as required.

The tapered edge must be placed monolithic with the adjacent lane or shoulder and must be shaped and compacted with a device attached to the paver.

The device must be capable of shaping and compacting HMA to the required cross section as shown. Compaction must be accomplished by constraining the HMA to reduce the cross sectional area by 10 to 15 percent. The device must produce a uniform surface texture without tearing, shoving, or gouging and must not leave marks such as ridges and indentations. The device must be capable of transitioning to cross roads, driveways, and obstructions.

For the tapered edge, the angle of the slope must not deviate by more than ±5 degrees from the angle shown. Measure the angle from the plane of the adjacent finished pavement surface.

If paving is done in multiple lifts, the tapered edge must be placed with each lift.

Short sections of hand work are allowed to construct tapered edge transitions.

39-2.01C(6) 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.

39-2.01C(7) 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.

39-2.01C(8) Leveling

Section 39-2.01C(8) 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).

39-2.01C(9) Miscellaneous Areas and Dikes

Prepare the area to receive HMA for miscellaneous areas and dikes, including excavation and backfill as needed.

Spread the HMA in 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*

39-2.01C(10)–39-2.01C(14) Reserved

39-2.01C(15) Compaction 39-2.01C(15)(a)

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.

Do not open new HMA pavement to traffic until its mid depth temperature is below 160 degrees F.

If the surface to be paved is both in sunlight and shade, pavement surface temperatures are taken in the shade.

39-2.01C(15)(b) Method Compaction

Use method compaction for any of the following conditions:

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*

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.

The compacted lift thickness must not exceed 0.25 foot.

39-2.01C(15)(c)–39-2.01C(15)(e) Reserved

39-2.01C(16) Smoothness Corrections

If the pavement surface does not comply with section 39-2.01A(4)(i)(iii), 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 selected 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.

Corrected HMA pavement areas must be uniform rectangles, half the lane width, with edges:

1. *Parallel to and along the nearest HMA pavement edge or lane line*
2. *Perpendicular to the pavement centerline*

On ground areas not to be overlaid with OGFC, apply a fog seal under section 37-4.02.

Where corrections are made within areas requiring testing with inertial profiler, reprofile the entire lane length with the inertial profiler.

Where corrections are made within areas requiring testing with a 12-foot straightedge, retest the corrected area with the straightedge.

39-2.01C(17) Data Cores

Section 39-2.01C(17) 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 the outermost lane in each direction. On a roadway with more than 4 lanes, take data cores from the innermost 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 any of the following:

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 an authorized material.

After data core summary and photograph submittal, dispose of cores.

39-2.01D Payment

The payment quantity for geosynthetic pavement interlayer is the area measured from the actual pavement covered.

Except for tack coat used in minor HMA, payment for tack coat is not included in the payment for hot mix asphalt.

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 inplace compacted area. Payment for the HMA used for miscellaneous areas is not included in the payment for place hot mix asphalt (miscellaneous areas).

The Engineer does not adjust the unit price for an increase or decrease in the prepaving grinding day quantity.

39-2.02 TYPE A HOT MIX ASPHALT

39-2.02A General

39-2.02A(1) Summary

Section 39-2.02 includes specifications for producing and placing Type A hot mix asphalt.

You may produce Type A HMA using an authorized WMA technology.

39-2.02A(2) Definitions *Reserved*

39-2.02A(3) Submittals

39-2.02A(3)(a) General

Reserved

39-2.02A(3)(b) Job Mix Formula

The JMF must be based on the superpave HMA mix design as described in MS-2 Asphalt Mix Design Methods by the Asphalt Institute.

39-2.02A(3)(c) Reclaimed Asphalt Pavement

Submit QC test results for RAP gradation with the combined aggregate gradation within 2 business days of taking RAP samples during Type A HMA production.

39-2.02A(3)(d)–39-2.02A(3)(f) Reserved

39-2.02A(4) Quality Assurance

39-2.02A(4)(a) General

Reserved

39-2.02A(4)(b) Quality Control

39-2.02A(4)(b)(i) General

Reserved

39-2.02A(4)(b)(ii) Aggregates

Test the quality characteristics of aggregates under the test methods and frequencies shown in the following table:

Aggregate Testing Frequencies

Quality characteristic	*Test method*	*Minimum testing frequency*
Gradation[a]	*AASHTO T 27*	*1 per 750 tons and any remaining part*
Sand equivalent[b, c]	*AASHTO T 176*	
Moisture content[d]	*AASHTO T 255*	
Crushed particles	*AASHTO T 335*	*1 per 10,000 tons or 2 per project whichever is greater*
Los Angeles Rattler	*AASHTO T 96*	
Flat and elongated particles	*ASTM D4791*	
Fine aggregate angularity	*AASHTO T 304 Method A*	

[a]If RAP is used, test the combined aggregate gradation under California Test 384. [b]Reported value must be the average of 3 tests from a single sample.

[c]Use of a sand reading indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, "Manual Shaker," 7.1.2, "Alternate Method No. 2," and 8.4.3, "Hand Method," do not apply. Prepare the stock solution as specified in section 4.8.1, "Stock solution with formaldehyde," except omit the addition of formaldehyde.
[d]Test at continuous mixing plants only. If RAP is used, test the RAP moisture content at continuous mixing plant and batch mixing plant.

For lime treated aggregate, test aggregate before treatment and test for gradation and moisture content during HMA production.

39-2.02A(4)(b)(iii) Reclaimed Asphalt Pavement

Sample and test processed RAP at a minimum frequency of 1 sample per 1,000 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 can be part of this minimum sample requirement. If a processed RAP stockpile is augmented, sample and test processed RAP quality characteristics at a minimum frequency of 1 sample per 500 tons of augmented RAP.

The combined RAP sample when tested under AASHTO T 164 must be within ±2.00 percent of the average asphalt binder content reported on page 4 of your Contractor Hot Mix Asphalt Design Data form. If a new processed RAP stockpile is required, the average binder content of the new processed RAP stockpile must be within ±2.00 percent of the average binder reported on page 4 of your Contractor Hot Mix Asphalt Design Data form.

The combined RAP sample when tested under AASHTO T 209 must be within ±0.06 of the average maximum specific gravity reported on page 4 of your Contractor Hot Mix Asphalt Design Data form.

During Type A HMA production, sample RAP twice daily and perform QC testing for:

1. *Aggregate gradation at least once a day under California Test 384*
2. *Moisture content at least twice a day*

39-2.02A(4)(b)(iv)–39-2.02A(4)(b)(viii) Reserved

39-2.02A(4)(b)(ix) Type A Hot Mix Asphalt Production

Test the quality characteristics of Type A HMA under the test methods and frequencies shown in the following table:

Type A HMA Production Testing Frequencies

Quality characteristic	*Test method*	*Minimum testing frequency*
Asphalt binder content	*AASHTO T 308, Method A*	*1 per 750 tons and any remaining part*
HMA moisture content	*AASHTO T 329*	*1 per 2,500 tons but not less than 1 per paving day*
Air voids content	*AASHTO T 269*	*1 per 4,000 tons or 2 every 5 paving days, whichever is greater*
Voids in mineral aggregate	*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*	

39-2.02A(4)(c)–39-2.02A(4)(d) Reserved

39-2.02A(4)(e) 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[a]	*AASHTO T 27*	*JMF ± Tolerance*
Percent of crushed particles *Coarse aggregate (min, %)* *One-fractured face* *Two-fractured faces* *Fine aggregate (min, %) (Passing No. 4 sieve and retained on No. 8 sieve.)* *One-fractured face*	*AASHTO T 335*	 *95* *90* *70*
Los Angeles Rattler (max, %) *Loss at 100 Rev.* *Loss at 500 Rev.*	*AASHTO T 96*	 *12* *40*
Sand equivalent (min.)[b, c]	*AASHTO T 176*	*47*
Flat and elongated particles (max, % by weight at 5:1)	*ASTM D4791*	*10*
Fine aggregate angularity (min, %)[d]	*AASHTO T 304, Method A*	*45*

[a]*The Engineer determines combined aggregate gradations containing RAP under California Test 384.* [b]*Reported value must be the average of 3 tests from a single sample.*
[c]*Use of a sand reading indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, "Manual Shaker," 7.1.2, "Alternate Method No. 2," and 8.4.3, "Hand Method," do not apply. Prepare the stock solution as specified in section 4.8.1, "Stock solution with formaldehyde," except omit the addition of formaldehyde.*
[d]*The Engineer waives this specification if HMA contains 10 percent or less of nonmanufactured sand by weight of total aggregate. Manufactured sand is fine aggregate produced by crushing rock or gravel.*

2. *If RAP is used, RAP quality requirements shown in the following table:*

Reclaimed Asphalt Pavement Quality

Quality characteristic	*Test method*	*Requirement*
Binder content (% within the average value reported)	*AASHTO T 164*	*±2.00*
Specific gravity (within the average value reported)	*AASHTO T 209*	*±0.06*

3. *In place Type A HMA quality requirements shown in the following table:*

Type A HMA Acceptance In Place

Quality characteristic	*Test method*	*Requirement*
Asphalt binder content (%)	*AASHTO T 308 Method A*	*JMF -0.30, +0.50*
HMA moisture content (max, %)	*AASHTO T 329*	*1.00*
Air voids content at N_{design} (%)[a, b]	*AASHTO T 269*	*4.0 ± 1.5* *(5.0 ± 1.5 for 1-inch aggregate)*
Voids in mineral aggregate on laboratoryproduced HMA (min, %)[d]	*MS-2 Asphalt Mixture*	
Gradation:	*Volumetrics*	
No. 4		*16.5–19.5*
3/8-inch		*15.5–18.5*
1/2-inch		*14.5–17.5*

3/4-inch		*13.5–16.5*
1-inch *with NMAS = 1-inch*		*13.5–16.5*
with NMAS = 3/4-inch		*14.5–17.5*
Voids in mineral aggregate on plant-produced HMA (min, %)[a]	*MS-2 Asphalt Mixture*	
Gradation:	*Volumetrics[c]*	
No. 4		*15.5–18.5*
3/8-inch		*14.5–17.5*
1/2-inch		*13.5–16.5*
3/4-inch		*12.5–15.5*
1-inch *with NMAS = 1-inch*		*12.5–15.5*
with NMAS = 3/4-inch		*13.5–16.5*
Dust proportion	*MS-2 Asphalt Mixture Volumetrics*	*0.6–1.3[g]*
Density of core (% of max theoretical density)[e, f]	*California Test 375*	*91.0–97.0*
Hamburg wheel track (min number of passes at 0.5-inch rut depth)	*AASHTO T 324 (Modified)*	
Binder grade: PG 58		*10,000*
PG 64		*15,000*
PG 70		*20,000*
PG 76 or higher		*25,000*
Hamburg wheel track (min number of passes at inflection point)	*AASHTO T 324 (Modified)*	
Binder grade: PG 58		*10,000*
PG 64		*10,000*
PG 70		*12,500*
PG 76 or higher		*15,000*
Moisture susceptibility (min, psi, dry strength)	*AASHTO T 283*	*100*
Moisture susceptibility (min, psi, wet strength)	*AASHTO T 283*	*70*

[a]Prepare 3 briquettes. Report the average of 3 tests.
[b]The Engineer determines the bulk specific gravity of each lab-compacted briquette under AASHTO T 275, Method A, and theoretical maximum specific gravity under AASHTO T 209, Method A. [c]Determine bulk specific gravity under AASHTO T 275, Method A. [d]The Engineer determines the laboratory-prepared Type A HMA value for only mix design verification. [e]The Engineer determines percent of theoretical maximum density under California Test 375 except the Engineer uses:

1. *AASHTO T 275 to determine in-place density of each density core*
2. *AASHTO T 209, Method A to determine theoretical maximum density instead of calculating test maximum density*

[f]The Engineer determines theoretical maximum density under AASHTO T 209, Method A, at the frequency specified in California Test 375, part 5, section D. [g]For lime-treated aggregates, the dust proportion requirement is 0.6–1.5.

39-2.02B Materials

39-2.02B(1) General

Reserved

39-2.02B(2) Type A Hot Mix Asphalt Mix Design

The mix design for Type A HMA must comply with the requirements shown in the following table:

Type A HMA Mix Design Requirements

Quality characteristic	*Test method*	*Requirement*
Air voids content (%)	*AASHTO T 269[a]*	*$N_{initial}$ > 8.0* *N_{design} = 4.0* *(N_{design} = 5.0 for 1-inch aggregate)* *N_{max} > 2.0*
Gyration compaction (no. of gyrations)	*AASHTO T 312*	*$N_{initial}$ = 8* *N_{design} = 85.0 N_{max} = 130*
Voids in mineral aggregate (min, %)[b] *Gradation: No. 4* *3/8-inch* *1/2-inch* *3/4-inch* *1-inch* *with NMAS = 1-inch* *with NMAS = 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)[c]*	 *10,000* *15,000* *20,000* *25,000*
Hamburg wheel track (min number of passes at the inflection point) *Binder grade: PG 58* *PG 64* *PG 70* *PG 76 or higher*	*AASHTO T 324 (Modified)[c]*	 *10,000* *10,000* *12,500* *15,000*
Moisture susceptibility, dry strength (min, psi)	*AASHTO T 283[c]*	*100*
Moisture susceptibility, wet strength (min, psi)	*AASHTO T 283[c, d]*	*70*

[a]Calculate the air voids content of each specimen using AASHTO T 275, Method A, to determine bulk specific gravity. Use AASHTO T 209, Method A, to determine theoretical maximum specific gravity. Use a digital manometer and pycnometer when performing AASHTO T 209. [b]Measure bulk specific gravity using AASHTO T 275, Method A. [c]Test plant-produced Type A HMA. [d]Freeze thaw required.

For Type A HMA mixtures using RAP, the maximum allowed binder replacement is 25.0 percent in the upper 0.2 foot exclusive of OGFC and 40.0 percent below. The 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.

39-2.02B(3) Asphalt Binder

Reserved

39-2.02B(4) Aggregates

39-2.02B(4)(a) General

Before the addition of asphalt binder and lime treatment, the aggregates 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*	 *95* *90* *70*
Los Angeles Rattler (max, %) *Loss at 100 Rev.* *Loss at 500 Rev.*	*AASHTO T 96*	 *12* *40*
Sand equivalent (min)[a]	*AASHTO T 176*	*47*
Flat and elongated particles (max, % by weight at 5:1)	*ASTM D4791*	*10*
Fine aggregate angularity (min, %)[b]	*AASHTO T 304, Method A*	*45*

[a]The reported value must be the average of 3 tests from a single sample. Use of a sand reading indicator is required as shown in AASHTO T 176, Figure 1. Sections 4.7, "Manual Shaker," 7.1.2, "Alternate Method No. 2," and 8.4.3, "Hand Method," do not apply. Prepare the stock solution as specified in section 4.8.1, "Stock solution with formaldehyde," except omit the addition of formaldehyde.
[b]The Engineer waives this specification if the Type A 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.

39-2.02B(4)(b) 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 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 TV 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 size	*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 size	*Target value limit*	*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 size	*Target value limit*	*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*

39-2.02B(5) Reclaimed Asphalt Pavement

You may substitute RAP for part of the virgin aggregate in a quantity up to 25 percent of the aggregate blend.

Provide enough space at your plant for complying with all RAP handling requirements. 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

Size	*Test method*	*Requirement*
Coarse (% passing the 1-inch sieve)	*California Test 202[a]*	*100*
Fine (% passing the 3/8-inch sieve)	*California Test 202[a]*	*98–100*

[a]Maximum mechanical shaking time is 10 minutes.

ou 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.

39-2.02B(6)–39-2.02B(10) Reserved

39-2.02B(11) Type A Hot Mix Asphalt Production

If RAP is used, the asphalt plant must automatically adjust the virgin asphalt binder to account for RAP percentage and RAP binder.

During production, you may adjust hot- or cold-feed proportion controls for virgin aggregate and RAP. RAP must be within ±3 of RAP percentage described in your Contractor Job Mix Formula Proposal form without exceeding 25 percent.

39-2.02C Construction

Where the pavement thickness shown is 0.30 foot or greater, 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. *Table in Section 39-2.02B(4)(b) does not apply*
2. *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*

3. *Apply a tack coat before placing a subsequent lift*
4. *The Engineer evaluates each HMA lift individually for compliance*

If the ambient air temperature is below 60 degrees F, cover the loads in trucks with tarpaulins. If the time for HMA discharge to truck at the HMA plant until transfer to paver's hopper is 90 minutes or greater and if the ambient air temperature is below 70 degrees F, cover the loads in trucks with tarpaulins, unless the time from discharging to the truck until transfer to the paver's hopper or the pavement surface is less than 30 minutes. The tarpaulins must completely cover the exposed load until you transfer the mixture to the paver's hopper or the pavement surface.

Spread Type A HMA at the ambient air and surface temperatures shown in the following table:

Minimum Ambient Air and Surface Temperatures

Lift thickness (feet)	*Ambient air (°F)*		*Surface (°F)*	
	Unmodified asphalt binder	*Modified asphalt binder*	*Unmodified asphalt binder*	*Modified asphalt binder*
Type A HMA and Type A HMA produced with WMA water injection technology				
<0.15	*55*	*50*	*60*	*55*
≥0.15	*45*	*45*	*50*	*50*
Type A HMA produced with WMA additive technology				
<0.15	*45*	*45*	*50*	*45*
≥0.15	*40*	*40*	*40*	*40*

For Type A HMA and Type A HMA produced with WMA water injection technology 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*

For Type A HMA produced with WMA additive technology 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 240 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 140 degrees F*
   1.4 *You may continue static rolling below 140 degrees F to remove roller marks.*
2. *Modified, complete:*
   2.1 *1st coverage of breakdown compaction before the surface temperature drops below 230 degrees F*
   2.2 *Breakdown and intermediate compaction before the surface temperature drops below 170 degrees F*
   2.3 *Finish compaction before the surface temperature drops below 130 degrees F*
   2.4 *You may continue static rolling below 130 degrees F to remove roller marks.*

You may cool Type A HMA with water when rolling activities are complete if authorized.

39-2.02D Payment

Not Used

39-2.04 OPEN GRADED FRICTION COURSES

39-2.04A General

39-2.04A(1) Summary

Section 39-2.04 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 WMA technology.

39-2.04A(2) Definitions *Reserved*

39-2.04A(3) Submittals

Submit a complete JMF, except do not specify an asphalt binder content.

For RHMA-O and RHMA-O-HB, the JMF submittal must comply with section 39-2.03A(3)(c).

39-2.04A(4) Quality Assurance

39-2.04A(4)(a) General

Reserved

39-2.04A(4)(b) Quality Control

39-2.04A(4)(b)(i) General *Reserved*

39-2.04A(4)(b)(ii) Asphalt Rubber Binder

For RHMA-O and RHMA-O-HB, the asphalt rubber binder must comply with the specifications in 392.03A(4)(c)(ii).

39-2.04A(4)(b)(iii) Aggregates

Test the quality characteristics of aggregates 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*
Moisture content[a]	*AASHTO T 255*	*1 per 1500 tons and any remaining part*
Crushed particles	*AASHTO T 335*	*1 per 10,000 tons or 2 per project, whichever is greater*
Los Angeles Rattler	*AASHTO T 96*	
Flat and elongated particles	*ASTM D4791*	

[a]*Test at continuous mixing plants only.*

For lime treated aggregate, test aggregate before treatment and test for gradation and moisture content during OGFC production.

39-2.04A(4)(b)(iv) 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*

39-2.04A(4)(c) Department Acceptance

39-2.04A(4)(c)(i) General

The Department accepts OGFC based on compliance with:

1. *Aggregate quality requirements shown in the following table:*

Aggregate Quality

Quality characteristic	*Test method*	*Requirement*
Aggregate gradation	*AASHTO T 27*	*JMF ± Tolerance*
Percent of crushed particles: *Coarse aggregate (min, %) One-fractured face* *Two-fractured faces* *Fine aggregate (min, %)* *(Passing No. 4 sieve and retained on No. 8 sieve.) One-fractured face*	*AASHTO T 335*	 *90* *90* *90*
Los Angeles Rattler (max, %) *Loss at 100 Rev.* *Loss at 500 Rev.*	*AASHTO T 96*	 *12* *40*
Flat and elongated particles (max, % by weight @ 5:1)	*ASTM D4791*	*Report only*

2. *In-place OGFC quality requirements shown in the following table:*

OGFC Acceptance In Place

Quality characteristic	*Test method*	*Requirement*
Asphalt binder content (%)	*AASHTO T 308, Method A*	*JMF -0.40, +0.50*
HMA moisture content (max, %)	*AASHTO T 329*	*1.00*

39-2.04A(4)(c)(ii) Asphalt Rubber Binder

The Department accepts asphalt rubber binder in RHMA-O and RHMA-O-HB under 39-2.03A(4)(e)(ii).

39-2.04A(4)(c)(iii) Pavement Smoothness

Pavement smoothness of OGFC must comply with the 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*

39-2.04A(4)(c)(iv)–39-2.04A(4)(c)(v) Reserved

39-2.04B Materials

39-2.04B(1) 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.

39-2.04B(2) 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 39-2.01B(2)(a) does not apply.

39-2.04B(3) Asphalt Binder

Asphalt rubber binder in RHMA-O and RHMA-O-HB must comply with section 39-2.03B(3).

39-2.04B(4) Aggregates

39-2.04B(4)(a) General

Aggregates 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*

39-2.04B(4)(b) Aggregate Gradations

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*

For RHMA-O and RHMA-O-HB, the 1-inch aggregate gradation is not allowed.

For OGFC, the aggregate gradations must be within the TV 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 aggregates from 1.0 to 0.5 percent for OGFC.

39-2.04B(5) Sand

Sand for spreading over RHMA-O and RHMA-O-HB pavement must be free of clay or organic matter. Sand must comply with section 90-1.02C(3).

39-2.04C Construction

Use a material transfer vehicle when placing OGFC.

If the ambient air 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*
Concrete pavement and existing asphalt concrete 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 from 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 and HMA-O produced with WMA water injection technology:

1. *With unmodified asphalt binder:*
   1.1. *Spread and compact only if the atmospheric temperature is at least 55 degrees F and the surface temperature is at least 60 degrees F.*

1.2. *Complete the 1st coverage using 2 rollers before the surface temperature drops below 240 degrees F.*
1.3. *Complete all compaction before the surface temperature drops below 200 degrees F.*

2. *With modified asphalt binder, except asphalt rubber binder:*
2.1. *Spread and compact only if the atmospheric temperature is at least 50 degrees F and the surface temperature is at least 50 degrees F.*
2.2. *Complete the 1st coverage using 2 rollers before the surface temperature drops below 240 degrees F.*
2.3. *Complete all compaction before the surface temperature drops below 180 degrees F.*

For HMA-O produced with WMA additive technology:

1. *With unmodified asphalt binder:*
1.1. *Spread and compact only if the atmospheric temperature is at least 45 degrees F and the surface temperature is at least 50 degrees F.*
1.2. *Complete the 1st coverage using 2 rollers before the surface temperature drops below 230 degrees F.*
1.3. *Complete all compaction before the surface temperature drops below 190 degrees F.*
2. *With modified asphalt binder, except asphalt rubber binder:*
2.1. *Spread and compact only if the atmospheric temperature is at least 40 degrees F and the surface temperature is at least 40 degrees F.*
2.2. *Complete the 1st coverage using 2 rollers before the surface temperature drops below 230 degrees F.*
2.3. *Complete all compaction before the surface temperature drops below 170 degrees F.*

Spread sand at a rate between 1 and 2 lb/sq yd on new RHMA-O and RHMA-O produced with WMA water injection technology, and RHMA-O-HB and RHMA-O-HB produced with WMA water injection technology pavement after finish rolling activities are complete. Keep traffic off the pavement until spreading of the sand is complete.

For RHMA-O produced with WMA additive technology and RHMA-O-HB produced with WMA additives technology:

1. *Spread and compact if the ambient air temperature is at least 45 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 270 degrees F*
3. *Complete all compaction before the surface temperature drops below 240 degrees F*

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.

39-2.04D Payment

Not Used

39-3 *EXISTING ASPHALT CONCRETE*

39-3.01 GENERAL 39-3.01A

General

Section 39-3.01 includes general specifications for performing work on existing asphalt concrete facilities.

Work performed on existing asphalt concrete facilities must comply with section 15.

39-3.01B Materials

Not Used

39-3.01C Construction

Before removing a portion of an asphalt concrete facility, make a 2-inch deep saw cut to a true line along the limits of the removal area.

39-3.01D Payment

Not Used

39-3.05 REMOVE BASE AND SURFACING

39-3.05A General

Section 39-3.05 includes specifications for removing base and asphalt concrete surfacing.

39-3.05B Materials

Not Used

39-3.05C Construction

Where base and surfacing are described to be removed, remove base and surfacing to a depth of at least 6 inches below the grade of the existing surfacing. Backfill resulting holes and depressions with embankment material under section 19.

39-3.05D Payment

The payment quantity for remove base and surfacing is the volume determined from the dimensions shown.

40 CONCRETE PAVEMENT

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 action limit: *Test results at which corrective actions must be made while production continues.*

full-depth crack: *Crack other than a working crack that runs from one edge of a slab to the opposite or adjacent side of the slab.*

raveling: *Progressive disintegration of the concrete pavement surface resulting in dislodged aggregate.*

suspension limit: *Test results at which production must be suspended while corrections are made.*

working crack: *Crack that extends through the full depth of a slab and is parallel to and within 0.5 foot of a planned contraction joint.*

40-1.01C Submittals

40-1.01C(1) General

At least 15 days before delivery to the job site, submit the manufacturer's instructions for storage and installation of:

1. *Splice couplers for threaded tie bars*
2. *Joint filler*

Submit calibration documentation and operational guidelines for frequency measuring devices for concrete vibrators as an informational submittal.

Submit updated QC charts each paving day as an informational submittal.

If repair or replacement of noncompliant concrete is required, submit a repair or replacement plan.

40-1.01C(2) Certificates of Compliance *Submit a certificate of compliance for:*

1. *Tie bars*
2. *Splice couplers for threaded tie bars*
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 the laboratory determining the mix proportions as an informational submittal.

At least 15 days before starting field qualification, submit the proposed concrete mix proportions, the corresponding mix identifications, and laboratory test reports, including measurements of the modulus of rupture, for each trial mixture at 10, 21, 28, and 42 days.

40-1.01C(5) Just-In-Time Training

40-1.01C(6) Concrete Field Qualification

Submit field qualification data and test reports, including:

1. *Mixing date*
2. *Mixing equipment and procedures used*
3. *Batch volume in cubic yards*
4. *Type and source of ingredients used*
5. *Penetration of the concrete*
6. *Air content of the plastic concrete*
7. *Age and strength at the time of concrete beam testing*

The minimum batch size for field qualification is 5 cu yd.

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(7) Test Strips

You may request to eliminate a 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 the previous project's information with your request to eliminate a test strip.

40-1.01C(8) Cores

Submit the name of the laboratory that will test the cores for air content.

Submit each core in an individual plastic bag marked with a description of the location from which the core was taken.

40-1.01C(9) Coefficient of Thermal Expansion

Submit 4 test specimens fabricated from a single sample of concrete for testing the coefficient of thermal expansion under AASHTO T 336 for field qualification and during production.

Submit your coefficient of thermal expansion test data at:

http://169.237.179.13/cte/

40-1.01C(10)–40-1.01C(15) Reserved

40-1.01D Quality Assurance

40-1.01D(1) General

If the pavement quantity is at least 2,000 cu yd, provide a QC manager.

Core pavement as described for thickness, bar placement, and air content.

Provide material and labor to assist the Engineer in fabricating test beams for the Department's modulus of rupture testing.

Allow at least 25 days for the Department to schedule testing for the coefficient of friction. Notify the Engineer when a lane or lanes are scheduled to be opened to traffic and when the pavement is ready for testing, which is the latter of:

1. *7 days after paving*
2. *When the pavement has attained a modulus of rupture of at least 550 psi*

The Department tests for the coefficient of friction within 7 days of receiving notification that the pavement is ready for testing.

40-1.01D(2) Just-In-Time Training

Reserved

40-1.01D(3) Quality Control Plan

The QC plan must describe the organization and procedures used to:

1. *Control the production process*
2. *Determine whether a change to the production process is needed*
3. *Implement a change*

The QC plan must include action and suspension limits and the details of the corrective action to be taken if any process is outside of those limits. The suspension limits must not exceed the specified acceptance criteria.

The QC plan must address the elements affecting concrete pavement quality, including:

1. *Mix proportions* *9. Contraction and construction joints*
2. *Aggregate gradation* *10. Bar reinforcement placement and alignment*
3 *Materials quality* *11. Dowel bar placement, alignment, and anchorage*
4. *Stockpile management* *12. Tie bar placement*
5. *Line and grade control* *13. Modulus of rupture*
6. *Proportioning* *14. Finishing and curing*
7. *Mixing and transportation* *15. Protecting pavement*
8. *Placing and consolidation* *16. Surface smoothness*

40-1.01D(4) Qualifications

Testing laboratories and their test equipment must be qualified under the Department's Independent Assurance Program.

Use a laboratory that complies with ASTM C1077 to determine the mix proportions for concrete pavement. The laboratory must have a current AASHTO accreditation for:

1. *AASHTO T 97 or ASTM C78*
2. *ASTM C192/C192M*

Use an ACI-certified concrete laboratory technician, Grade I, to perform field qualification tests and calculations.

40-1.01D(5) Mix Designs

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 content of cementitious materials or the maximum ratio of water to cementitious materials, use modulus of rupture values of at least 570 psi for 28 days age and at least 650 psi for 42 days age.

If you change an aggregate supply source or the mix proportions, produce a trial batch and field qualify the new concrete. The Department does not adjust time for sampling, testing, and qualifying new mix proportions or changing an aggregate supply source.

40-1.01D(6) Test Strips

Construct a test strip for each type of pavement if the quantity is at least 2,000 cu yd. Obtain authorization of test strips before additional paving. Test strips must be:

1. *From 700 to 1,000 feet long*
2. *Same width as the planned paving*
3. *Constructed using the same equipment to be used for constructing pavement*

The Engineer selects from 6 to 12 core locations for dowel bars and up to 6 locations for tie bars for each 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 an inertial profile is not required*
2. *Dowel bar and tie bar placement*
3. *Pavement thickness*
4. *Final finishing except for the coefficient of friction*

Allow 3 business days for evaluation of a test strip. If a test strip is not authorized, submit a plan for changes to your materials, methods, or equipment. Allow 3 business days for authorization of the plan.
Construct another test strip under the authorized plan.

Remove test strips that are not authorized.

If a test strip is compliant except for smoothness and final finishing, you may grind the surface. After grinding, retest the smoothness under section 36-3. The Engineer retests the thickness after grinding.

Construct additional test strips if you change any of the following:

1. *Paving equipment, including:*
   1.1. *Paver*
   1.2. *Dowel bar inserter*
   1.3. *Tie bar inserter*
   1.4. *Tining machine*
   1.5. *Curing equipment*
2. *Concrete mix proportions*

40-1.01D(7) Quality Control

40-1.01D(7)(a) General

During paving, test the concrete pavement under the test methods and at the frequencies shown in the following table:

Concrete Pavement Test Methods and Testing Frequencies

Quality characteristic	*Test method*	*Minimum testing frequency*
Cleanness value	*California Test 227*	*2 per day*
Sand equivalent	*California Test 217*	
Aggregate gradation	*California Test 202*	
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*	
Penetration	*California Test 533*	
Aggregate moisture meter calibration[a]	*California Test 223 or 226*	*1 per day*

[a] *Check the 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.

Control charts for individual measurements of quality characteristics 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. *QC test results*

For control charts for fine and coarse aggregate gradation, record the running average of the previous 4 consecutive gradation tests for each sieve and superimpose the specification limits.

For control charts for air content, the action limit is ±1.0 percent of the specified value. If no value is specified, the action limit is ±1.0 percent of the value used for your authorized mix design.

As a minimum, a process requires corrective action if any of the following occurs:

1. *2 consecutive running averages of 4 tests for fine or coarse aggregate gradation are outside the specification limits*
2. *1 point falls outside the suspension limit line for individual penetration or air content measurements*
3. *2 points in a row fall outside the action limit line for individual penetration or air content measurements*

Stop production for processes requiring corrective action.

Before placing concrete pavement each day and at intervals not to exceed 4 hours during production, use a tachometer to test and record the vibration frequency of the concrete vibrators.

40-1.01D(7)(b) Concrete Field Qualification

Before paving, your mix design must be field qualified.

For field qualification, the modulus of rupture at an age of 28 days or earlier must be at least:

1. *550 psi for each single beam*
2. *570 psi for the average of 5 beams*

40-1.01D(7)(c)–40-1.01D(7)(h) Reserved

40-1.01D(8) Department Acceptance

40-1.01D(8)(a) General

The Department tests the concrete pavement under the test methods and at the frequencies shown in the following table:

Department Acceptance Testing Frequency

Quality characteristic	*Test method*		*Minimum testing frequency*[a]
	CRCP	*JPCP*	

Air content[b]	*California Test 504*		*1 day's paving*
Modulus of rupture at 28 days	*California Test 523*		*1,000 cu yd*
Dowel bar placement	*--*	*Measurement*	*700 sq yd*
Tie bar placement	*--*	*Measurement*	*4,000 sq yd*
Coefficient of friction	*California Test 342*		*1 day's paving*
Thickness	*California Test 531*		*1,200 sq yd*

[a]A single test represents no more than the frequency specified.
[b]Tested only if air entrainment is specified.

40-1.01D(8)(b) Verification Testing

40-1.01D(8)(b)(i) General *Reserved*

40-1.01D(8)(b)(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:

$$t = \frac{|\bar{X}_c - \bar{X}_v|}{S_p\sqrt{\frac{1}{n_c} + \frac{1}{n_v}}} \qquad \text{and} \qquad S_p^2 = \frac{S_c^2(n_c - 1) + S_v^2(n_v - 1)}{n_c + n_v - 2}$$

where:

- n_c = *number of your QC tests (minimum of 6 required)*
- n_v = *number of Department's tests (minimum of 2 required)*
- $\bar{X}_c$ = *mean of your QC tests*
- $\bar{X}_v$ = *mean of the Department's tests*
- S_p = *pooled standard deviation*
- S_c = *standard deviation of your QC tests*
- S_v = *standard deviation of the Department's tests*

Your QC test results are compared with the Department's test results at a level of significance of $\alpha = 0.01$. The t-value is compared to t_{crit} for the degrees of freedom shown in the following table:

Degrees of freedom (n_c+n_v-2)	*tcrit (for $\alpha = 0.01$)*
1	*63.657*
2	*9.925*
3	*5.841*
4	*4.604*
5	*4.032*
6	*3.707*
7	*3.499*
8	*3.355*
9	*3.250*
10	*3.169*

If the calculated t-value is less than or equal to t_{crit}, your QC test results are verified. If the calculated tvalue is greater than t_{crit}, your QC test results are not verified.

If your QC test results are not verified, core at least 3 specimens from the concrete pavement under section 40-1.03M. The Engineer selects the core locations. The authorized laboratory must test these specimens for air content under ASTM C457. The Engineer compares these test results with your QC test results using the t-test method. If your QC test results are verified based on this comparison, the Engineer uses the QC test results for acceptance of concrete pavement for air content. If your QC 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 C457 for acceptance.

40-1.01D(8)(c) Acceptance Testing

40-1.01D(8)(c)(i) General

The Department accepts concrete pavement based on compliance with the requirements shown in the following table:

Concrete Pavement Requirements for Acceptance

Quality characteristic	*Test method*		*Requirement*
	CRCP	*JPCP*	
Air content	*California Test 504*		*±1.5 % of the specified value*[a]
Modulus of rupture at 28 days (min, psi)	*California Test 523*		*570*[b]
Bar reinforcement depth tolerance at joints (min)	*Field measurement*		*1/2 inch below the saw cut depth*
Dowel bar placement tolerances[c]*:* *Horizontal offset (inch)* *Longitudinal translation (inch)* *Horizontal skew (max, inch)* *Vertical skew (max, inch)* *Vertical depth*	--	*Field measurement*	*±1* *±2* *5/8* *5/8* *The minimum distance measured from the concrete pavement surface to any point along the top of the dowel bar must be:* *DB + 1/2 inch where:* *DB = 1/3 of the pavement thickness or the saw cut depth in inches, whichever is greater* *The maximum distance below the depth shown must be 5/8 inch.*
Tie bar placement tolerances[c]*:* *Horizontal and vertical skew (max, inches)* *Longitudinal translation (inches)* *Horizontal offset (embedment, inches) Vertical depth*	--	*Field measurement*	*5 1/4* *±2* *±2* *At least 1/2 inch below the bottom of the saw cut* *At least 2 inches from any point along the bar to the pavement surface or bottom*
Coefficient of friction (min): *Concrete pavement* *Ramp termini*	*California Test 342*		*0.30* *0.35*

Pavement smoothness	*California Test 387, AASHTO R 57, and AASHTO R 56*	*1. No area of localized roughness with an International Roughness Index greater than 120 in/mi 2. Mean Roughness Index of 60 in/mi or less within a 0.1 mile section*
Thickness tolerance[d] (max, foot)	*California Test 531*	*0.01 foot deficient of the thickness shown*
[a]If no value is specified, the air content must be within ±1.5 % of the value used for your authorized mix design. [b]Average of the individual test results of 2 test beams. [c]Placement tolerance is measured relative to the completed joint. [d]See section 40-1.01D(8)(c)(iv) for additional thickness requirements.		

40-1.01D(8)(c)(ii) Dowel and Tie Bar Placement

Core each day's paving within 2 business days. The Engineer identifies the joint and dowel or tie bar to be tested. Each dowel or tie bar test consists of 2 cores, 1 on each end of the bar to expose both ends for measurement. If the initial cores show that dowel or tie bars are within alignment tolerances and the Engineer orders more coring, the additional cores are change order work.

If the coring indicates the dowel or tie bars are not placed within the specified tolerances or if unconsolidated concrete is around the dowel or tie bars, perform additional coring as ordered to determine the limits of unacceptable work. The Engineer determines the limits for removal and replacement.

40-1.01D(8)(c)(iii) Pavement Smoothness

The Department may accept pavement smoothness based on your inertial profiler testing in the absence of its own testing.

40-1.01D(8)(c)(iv) Thickness

Drill cores for the Department's acceptance testing for thickness under section 40-1.03M. Drill the cores in the primary area, which is the area placed in 1 day for each thickness. Core at the locations determined by the Engineer and in the Engineer's presence.

If grinding is required, do not core until 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.

You may request additional thickness measurements to determine the average thickness variation. The Engineer determines the locations with random sampling methods.

If each thickness measurement in a primary area is deficient by less than 0.05 foot, 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.

The thickness of the concrete pavement must not be deficient by more than 0.05 foot. 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 a 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. The thickness measurements for a secondary area in a slab determine that entire slab thickness.

The Engineer measures the remaining primary area thickness after removing the secondary areas from consideration for determining the average thickness deficiency.

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, thickness deficiencies, and 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 payment adjustment. If the deficiency is more than 0.05 foot, you must remove and replace the pavement.

The deduction for pavement thickness deficiency in each primary area is as shown in the following table:

Deduction for Thickness Deficiency

Average thickness deficiency[a]	*Deduction*
0.01 foot	*$0.90/sq yd*
0.02 foot	*$2.30/sq yd*
0.03 foot	*$4.10/sq yd*
0.04 foot	*$6.40/sq yd*
0.05 foot	*$9.11/sq yd*

[a]*Values greater than 0.01 foot are rounded to the nearest 0.01 foot.*

40-1.01D(8)(c)(v)–40-1.01D(8)(c)(viii) Reserved

40-1.02 MATERIALS

40-1.02A General

Tack coat must comply with section 39.

40-1.02B Concrete

40-1.02B(1) General

Concrete placed for tapered edges after the pavement has been placed may be minor concrete.

40-1.02B(2) Cementitious Material

Concrete must contain from 505 pounds to 675 pounds of 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

The specifications for a reduction in the operating range and contract compliance for cleanness value and sand equivalent specified in section 90-1.02C(2) and section 90-1.02C(3) for aggregate 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 the combined aggregate gradation, 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 specifications for air-entraining admixtures in the 2nd paragraph of section 90-1.02I(2)(a) do not apply.

The air content must be within ±1.5 percent of the specified value. If no value is specified, the air content must be within ±1.5 percent of the value used for your authorized mix design.

For a project in the low or south mountain climate region, add an 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 in a high desert or high mountain climate region, add an 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) General

Reserved

40-1.02C(2) Bar Reinforcement

Bar reinforcement must be deformed bars complying with section 52 unless the project is shown to be in a high desert or any mountain climate region, in which case, it must be one of the following:

1. *Epoxy-coated bar reinforcement under section 52-2.03B except bars must comply with either ASTM A706/A706M; ASTM A996/A996M; or ASTM A615/A615M, Grade 40 or 60. Bars must be handled under ASTM D3963/D3963M and section 52-2.02C.*

2. *Low-carbon chromium steel bar complying with ASTM A1035/A1035M.*

40-1.02C(3) Dowel Bars

For a project not shown to be in a high desert or any mountain climate region, dowel bars must be plain bars complying with section 52 and must be one of the following:

1. *Epoxy-coated bars. Bars must comply with ASTM A615/A615M, Grade 40 or 60. The 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 A955/A955M, UNS Designation S31603 or S31803.*

3. *Low carbon, chromium-steel bars under ASTM A1035/A1035M.*

For a project shown to be in a high desert or any mountain climate region, dowel bars must be plain bars complying with section 52 and be one of the following:

1. *Epoxy-coated bars. Bars must comply with ASTM A615/A615M, 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 A955/A955M, UNS Designation S31603 or S31803.*

Fabricate, sample, and handle epoxy-coated dowel bars under ASTM D3963/D3963M and section 522.03C except each sample must be 18 inches long.

40-1.02C(4) Tie Bars

Tie bars must be deformed bars.

For a project not shown to be in a 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 52-2.02B or 52-2.03B except bars must comply with ASTM A706/A706M; ASTM A996/A996M; or ASTM A615/A615M, Grade 40 or 60.*

2. *Stainless-steel bars. Bars must be descaled, solid stainless-steel bars under ASTM A955/A955M, UNS Designation S31603 or S31803.*

3. *Low carbon, chromium-steel bars under ASTM A1035/A1035M.*

For a project shown to be in a 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 A706/A706M; ASTM A996/A996M; or ASTM A615/A615M, Grade 40 or 60.*

2. *Stainless-steel bars. Bars must be descaled, solid stainless-steel bars under ASTM A955/A955M, UNS Designation S31603 or S31803.*

Fabricate, sample, and handle epoxy-coated tie bars under ASTM D3963/D3963M, section 52-2.02 or section 52-2.03.

Do not bend tie bars.

40-1.02C(5) Dowel and Tie Bar Baskets

For dowel and tie bar baskets, wire must comply with ASTM A1064/A1064M and be welded under ASTM A185/A185M, section 7.4. Assemblies must be either U-frame or A-frame shaped assemblies.

Wire intersections must be resistance welded.

For a project not shown to be in the high desert or any mountain climate region, baskets may be epoxycoated. The epoxy coating must comply with section 52-2.02B or 52-2.03B.

For a project shown to be in the high desert or any mountain climate region, the 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 A276/A276M, UNS Designation S31603 or S31803, and (2) the tension requirements in ASTM A1022/A1022M.*

Handle epoxy-coated tie bar and dowel bar baskets under ASTM D3963/D3963M and either section 522.02 or 52-2.03.

Fasteners must be driven fasteners as specified in ASTM F1667. Fasteners on LCB or asphalt concrete must have a minimum shank diameter of 3/16 inch and a minimum shank length of 2-1/2 inches. For ATPB or CTPB, 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 curing compound no. 3 or paraffin based. Paraffin-based lubricant must be Bradley Coatings Group BCG 6116 or Valvoline Tectyl 506 or an authorized equal and must be factoryapplied.

40-1.02E Joint Filler

Joint filler for an isolation joint must be a preformed, bituminous-type, expansion joint filler for concrete complying with ASTM D994.

40-1.02F Nonshrink Hydraulic-Cement Grout

Nonshrink hydraulic-cement grout must comply with ASTM C1107/C1107M. You may use clean, uniform, rounded aggregate filler to extend the grout. Aggregate filler must not exceed 60 percent of the grout mass or the maximum described in the manufacturer's instructions, whichever is less. The moisture content of the aggregate filler must not exceed 0.5 percent when tested under California Test 223 or California Test 226. When tested under California Test 202, aggregate filler must comply with the gradation requirements shown in the following table:

Aggregate Filler Gradation

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*

40-1.02G–40-1.02N Reserved

40-1.03 CONSTRUCTION

40-1.03A General

Proportion aggregate and bulk cementitious material by weight using an authorized automatic proportioning device.

For widenings and lane reconstruction, construct only the portion of the pavement where the work will be completed during the same closure. If you do not complete the construction during the same closure, construct temporary roadway pavement under section 41-1.02E.

40-1.03B Joints

40-1.03B(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 equipped with a diamond blade. After cutting, immediately wash slurry from the joint with water below 100 psi gauge 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. The filler material must not react adversely with the concrete or damage the pavement. After sawing and washing, install the material such that it 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 40-1.03I do not apply. If you use absorptive filler material, moisten the filler immediately before or after installation.

40-1.03B(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 and allow it to dry.

At joints between concrete pavement and asphalt concrete pavement, apply a tack coat between the two pavements.

Use a metal or wooden bulkhead to form transverse construction joints. If dowel bars are described, the bulkhead must allow dowel bar installation.

40-1.03B(3) Contraction Joints

Saw contraction joints before cracking occurs and after the concrete is hard enough to saw without spalling, raveling, or tearing.

Except for longitudinal joints parallel to a curving centerline, saw the contraction joints such that they are no 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 described.

Cut transverse contraction joints straight across the full width of the concrete pavement 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 where lanes converge or diverge.

40-1.03B(4) Isolation Joints

Before placing concrete at isolation joints, saw cut the existing concrete face to make a clean, flat, vertical surface and secure the joint filler. Make the saw cut the same depth as the depth of the new pavement.

40-1.03C Bar Reinforcement

Place bar reinforcement under section 52.

Bar reinforcement must be more than 1/2 inch below the saw cut depth at concrete pavement joints.

40-1.03D Dowel Bar Placement

Dowel bar placement must comply with the tolerances shown in the following table:

Dowel Bar Placement

Dimension	*Tolerance*
Horizontal offset (inch)	*±1*
Longitudinal translation (inch)	*±2*
Horizontal skew (max, inch)	*5/8*
Vertical skew (max, inch)	*5/8*
Vertical depth	*The minimum distance measured from the concrete pavement surface to any point along the top of the dowel bar must be:* *DB + 1/2 inch* *where:* *DB = 1/3 of the pavement thickness or the saw cut depth in inches, whichever is greater* *The maximum distance below the depth shown must be 5/8 inch.*

NOTE: Tolerances are measured relative to the completed joint.

If you are using curing compound as a lubricant, apply the curing compound to the dowels:

1. *In 2 separate applications. Apply the last application no more than 8 hours before placing the dowels.*
2. *Such that each dowel is completely lubricated before placement.*
3. *At a rate of 1 gallon per 150 square feet.*

Install dowel bars using one of the following methods:

1. *Drill and bond the bars under section 41-10.*
2. *Mechanically insert the bars. Eliminate evidence of the insertion by reworking the concrete over the dowels.*
3. *Use dowel bar baskets to hold the dowels at the specified depth and alignment before concrete placement. Anchor the baskets with at least 1 fastener per foot of basket section and at least 200 feet in advance of the pavement placement activity. You may request not to perform advance anchoring due to construction limitations or restricted access. After anchoring the baskets and before placing the concrete, cut and remove the temporary spacer wires and demonstrate the dowel bars do not move from their specified depth and alignment during concrete placement.*

If installation of dowel bars is noncompliant, stop paving, demonstrate your correction, and obtain verbal authorization.

40-1.03E Tie Bar Placement

Tie bar placement must comply with the tolerances shown in the following table:

Tie Bar Placement

Dimension	*Tolerance*
Horizontal and vertical skew (max, inch)	*5 1/4*
Longitudinal translation (inch)	*±2*
Horizontal offset (embedment, inch)	*±2*
Vertical depth	*1. At least 1/2 inch below the bottom of the saw cut 2. At least 2 inches from any point along the bar to the pavement surface or bottom*

NOTE: Tolerances are measured relative to the completed joint.

Install tie bars at longitudinal joints using one of the following methods:

1. *Drill and bond the bars under section 41-10.*
2. *Mechanically insert the bars into plastic slip formed concrete before finishing. Ensure there is full contact between the inserted bar and the concrete. Eliminate evidence of the insertion by reworking the concrete over the tie bars.*
3. *Use threaded couplers to splice the tie bars. The couplers must be fabricated from deformed bar reinforcement and free of external welding or machining.*
4. *Use tie bar baskets to hold the tie bars at the specified depth and alignment before concrete placement. Use fasteners to anchor tie bar baskets. Anchor the baskets at least 200 feet in advance of the pavement placement activity. You may request not to perform advanced anchoring due to construction limitations or restricted access. After anchoring the baskets and before placing the concrete, demonstrate the tie bars do not move from their specified depth and alignment during concrete placement.*

If installation of tie bars is noncompliant, stop paving, demonstrate your correction, and obtain verbal authorization.

40-1.03F Placing Concrete

40-1.03F(1) General

Immediately before placing concrete, the surface to receive the concrete must be:

1. *Within the 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 if the concrete placement is interrupted by more than 30 minutes. The transverse construction joint must be at the same longitudinal location as the contraction joint in the adjacent lane location, or you must remove the concrete pavement to the preceding transverse joint.

Place the concrete pavement in full-lane widths separated by construction joints or monolithically with contraction joints.

Do not retemper concrete.

If the surface width is constructed as shown, you may construct the pavement sides on a batter not flatter than 6:1 (vertical:horizontal).

40-1.03F(2) Paving Adjacent to Existing Concrete Pavement *Wherever pavement is placed adjacent to existing concrete pavement:*

1. *Grind the adjacent pavement before placing the new pavement.*
2. *Use paving equipment with padded crawler tracks or rubber-tired wheels with enough offset to prevent damage.*
3. *Match the pavement grade with the elevation of the existing concrete pavement after grinding.*

40-1.03F(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.

40-1.03F(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 they are attached to the top of metal forms, the attached section must be metal.

The side form base width must be at least 80 percent of the shown concrete pavement thickness.

Side forms, including interlocking connections with adjoining forms, must be rigid enough to prevent springing from (1) subgrading and paving equipment and (2) concrete pressure.

Construct the subgrade to the final grade before placing the side forms. The forms must bear fully on the foundation throughout their length and base width. Place the forms to the grade and alignment of the finished concrete pavement edge. Support the forms during concrete placement, compaction, and finishing.

After completing the subgrade and immediately before placing the concrete, true up the side forms and set to the line and grade for a distance that avoids delays due to form adjustment.

Clean and oil the forms before each use.

Side forms must remain in place for at least 1 day after placing the concrete and until the 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 to the shown cross section with minimal hand work.

Consolidate the concrete without segregation. If you use concrete vibrators:

1. *Vibration rate must be at least 3,500 cycles per minute for surface vibrators and 5,000 cycles per minute for internal vibrators. Use a calibrated device to measure the frequency of vibration.*
2. *Amplitude of vibration must cause perceptible concrete surface movement at least 1 foot from the vibrating element.*
3. *Vibrators must not rest on side forms or new concrete pavement.*
4. *Power to vibrators must automatically cease if forward or backward motion of the paving machine is stopped.*
5. *High-frequency internal vibrators must be used within 15 minutes of depositing concrete on the subgrade to uniformly consolidate the concrete across the paving width, including the area adjacent to the forms.*
6. *Mass of concrete must not be shifted with the vibrators.*

40-1.03F(5) Slip form Construction

If you use slip form construction, spread, screed, shape, and consolidate the concrete to the shown 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 pavement alignment by more than 0.1 foot.

Slip form paving machines must use high-frequency internal vibrators to consolidate concrete. You may mount the vibrators with their axes parallel or normal to the pavement alignment. If vibrators are mounted with their axes parallel to the pavement alignment, space the vibrators no more than 2.5 feet center-tocenter. If vibrators are mounted with their axes normal to the pavement alignment, space 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 the frequency of vibration.

40-1.03G Edge Treatment

If required, regrade the area for the preparation of tapered edge treatment.

Sections 40-1.03H(2) and 40-1.03H(3) do not apply to tapered edges.

For tapered edges placed after the concrete pavement is complete, install connecting bar reinforcement under section 52.

You may construct the tapered edges by saw cutting or grinding.

The angle of the tapered edge slope must not deviate by more than ±5 degrees from the angle shown measured from the plane of the adjacent finished pavement surface.

40-1.03H Finishing

40-1.03H(1) General

Reserved

40-1.03H(2) Preliminary Finishing

40-1.03H(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 approximately 1 by 2 feet. The stamp must be authorized before paving starts. The stamp must form a uniform mark from 1/8 to 1/4 inch deep. Locate the mark 20 ± 5 feet from the transverse construction joint formed at the start of paving each day and 1 ± 0.25 foot from the outside edge of the pavement. The mark must show the month, day, and year of placement and the station of the transverse construction joint. Orient the mark such that it can be read from the outside edge of the pavement.

Do not apply water to the pavement surface before float finishing.

40-1.03H(2)(b) Stationary Side Form Finishing

If you use stationary side-form construction, apply a preliminary finish to the pavement by machine-float or hand method.

For 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 placement. If the time from paving to machine-float finishing exceeds 30 minutes, stop pavement placement. When machine floats are in proper position, you may resume pavement placement.*
3. *Run machine floats on side forms or adjacent pavement lanes. If running on adjacent pavement, protect the adjacent pavement surface under section 40-1.03J. Floats must be hardwood, steel, or steel-shod wood and equipped with devices that adjust the underside to a true flat surface.*

For the hand method, finish the pavement smooth and true to grade with manually operated floats or powered finishing machines.

40-1.03H(2)(c) Slip form Finishing

For slip form construction, 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 the slump of the pavement edge in excess of 0.02 foot except for the edge rounding.

40-1.03H(3) Final Finishing

After completing preliminary finishing, round the edges of the initial paving widths to a 0.04-foot radius. Round the transverse and longitudinal construction joints to a 0.02-foot radius.

Texture the pavement before curing it. Perform the initial texturing with a burlap drag or broom device that produces striations parallel to the centerline. Perform the final texturing with a spring-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, spaced on 3/4-inch centers, and 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 a constant downward pressure on the surface of the pavement during texturing. The operation 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. The final texture must be uniform and smooth. Use a guide to

properly align the grooves. The grooves must be parallel and aligned to the pavement edge across its width. The 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 construct grooves using the hand method. Hand-constructed grooves must comply with the specifications for machine-constructed grooves.

Initial and final texturing must produce a coefficient of friction of at least 0.30. Do not open a lane or lanes to traffic unless the coefficient of friction is at least 0.30.

For ramp termini, use heavy brooming normal to the ramp centerline to produce a coefficient of friction of at least 0.35.

40-1.03I Curing

Cure the concrete pavement exposed area using the waterproof membrane method or curing compound method with curing compound no. 1 or 2. If you remove the side forms within 72 hours of the start of curing, also cure the pavement edges.

Apply curing compound with mechanical sprayers. Reapply curing compound to saw cuts and disturbed areas.

40-1.03J Protecting Concrete Pavement

Maintain the concrete pavement surface temperature at not less than 40 degrees F for the initial 72 hours.

Protect the surface from activities that cause damage and reduce the texture or coefficient of friction. Prevent soil, gravel, petroleum products, concrete, or asphalt mixes from being deposited on the pavement surface.

Construct crossings for traffic convenience. You may use RSC for crossings if authorized. Do not open crossings until the Department determines that the pavement modulus of rupture is at least 550 psi under California Test 523 or California Test 524.

Do not allow traffic on concrete pavement or use equipment on it (1) for 10 days after paving and (2) before the concrete has attained a modulus of rupture of 550 psi based on the Department's testing unless:

1. *Equipment is for sawing contraction joints*
2. *One side of the paving equipment tracks may be on the concrete pavement after a modulus of rupture of 350 psi has been attained if:*
    - 2.1. *Unit pressure exerted on the 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 to the concrete pavement edge*
    - 2.4. *Authorized*

If visible cracking or other damage occurs to the concrete pavement, stop operating the paving equipment on the pavement and repair the damage.

***40-1.03K Early Use of Concrete Pavement** To request early use of concrete pavement:*

1. *Furnish molds and machines for the modulus of rupture testing*
2. *Sample the concrete*
3. *Fabricate beam specimens*
4. *Test the beams for the modulus of rupture under California Test 523*

The pavement must have a modulus of rupture of at least 350 psi. Protect the pavement under section 40-1.03J.

40-1.03L Reserved

40-1.03M Drilling Cores

Drill concrete pavement cores under ASTM C42/C42M. Use diamond-impregnated drill bits.

Clean, dry, and fill core holes with nonshrink, hydraulic-cement grout or concrete. Coat hole walls with epoxy adhesive for bonding new concrete to old concrete. Finish the fill to match the adjacent surface elevation and texture.

40-1.03N Correcting Noncompliant Pavement Work

40-1.03N(1) General

Correct noncompliant pavement as follows:

1. *Replace the pavement*
2. *Repair spalls, ravels, and working cracks*
3. *Correct the 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 have either of the following:

1. *1 or more full-depth cracks*
2. *Combined raveled areas more than 5 percent of the total slab area or a single raveled area more than 4 sq ft*

Replace JPCP for 3 feet on both sides of a joint with a rejected dowel bar.

40-1.03N(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 0.30 foot*

Repair spalls or ravels under section 41-4 and complete the repairs before opening a lane or lanes to traffic.

40-1.03N(3) Crack Repair

Treat partial-depth cracks in JPCP under section 41-3.

If the joints are sealed, repair working cracks by routing and sealing. Use a 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. The equipment must not cause raveling or spalling.

Treat the contraction joint adjacent to the working crack by either of the following methods:

1. *Applying epoxy resin under ASTM C881/C881M, Type IV, Grade 2*
2. *Pressure injecting epoxy resin under ASTM C881/C881M, Type IV, Grade 1*

40-1.03O 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. *Corrective method is authorized*

Correct the entire lane width. Start 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 inertial profiler is required, retest the entire lane length with an inertial profiler.

If corrections are made within areas where testing with a 12-foot straightedge is required, retest the corrected area with a straightedge.

Allow 25 days for the Department's coefficient of friction retesting.

40- ***1.03P–40-1.03U Reserved***

40-1.04 PAYMENT

The payment quantity for any type of concrete pavement is the volume determined by the dimensions shown.

The Department does not pay for additional coring that you request to check dowel or tie bar alignment.

If the Engineer authorizes a test strip that remains in place as part of the pavement, the payment quantity for any type of concrete pavement includes the volume of the test strip.

The Department does not pay for additional tie bars required due to the curvature of the pavement slab.

Payment for grinding existing pavement is not included in the payment for concrete pavement.

CONTINUOUSLY REINFORCED CONCRETE PAVEMENT

40-2.01 GENERAL

40-2.01A Summary

Section 40-2 includes specifications for constructing continuously reinforced concrete pavement.

Constructing continuously reinforced concrete pavement includes terminal joints, expansion joints, wide flange beam terminals and pavement anchors.

40-2.01B Definitions *Reserved*

40-2.01C Submittals

For field qualification, submit the test data for the coefficient of thermal expansion of the concrete.

If you request to use plastic chairs to support the transverse bars, submit a sample of the plastic chair, including:

1. *Manufacturer's instructions for the applicable use and load capacity*
2. *Chair spacing*
3. *Your calculation for the load on a chair for the area of bar reinforcement it supports*

During production, submit the test data for the coefficient of thermal expansion as an informational submittal.

40-2.01D Quality Assurance

For field qualification, test the coefficient of thermal expansion of the concrete under AASHTO T 336. The coefficient of thermal expansion must not exceed 6.0 microstrain/degree F.

During the evaluation of the test strip, the Engineer visually checks the reinforcement and dowel and tie bar placement.

During production, test the coefficient of thermal expansion of the concrete at a frequency of 1 test for each 5,000 cu yd of paving but not less than 1 test for a project with less than 5,000 cu yd of concrete.

40-2.02 MATERIALS

40-2.02A General

Class 1 permeable material, filter fabric, and slotted plastic-pipe cross drain for pavement anchors must comply with section 68.

40-2.02B Transverse Bar Assembly

Transverse bar assemblies may be used to support longitudinal bars instead of transverse bars and other support devices.

40-2.02C Wide Flange Beam

Wide flange beams and studs must be either rolled structural steel shapes complying with ASTM A36/A36M or structural steel complying with ASTM A572/A572M.

Polyethylene foam board for wide flange beams must be commercial quality.

Inorganic zinc primer must comply with AASHTO M 300, Type I or II.

40-2.02D Joints

Joint seals for wide flange beam terminals and for transverse expansion joints must comply with section 51-2.02.

Expanded polystyrene for transverse expansion joints, Types WF and AN, must comply with section 512.01B(1).

Polyethylene bond breaker for wide flange beam terminal and expansion joint support slabs must comply with section 36-2

40-2.03 CONSTRUCTION

40-2.03A General

Reserved

40-2.03B Bar Reinforcement

Place bar reinforcement under section 52-1.03D except you may request to use plastic chairs. Plastic chairs will be considered only for support directly under the transverse bars. You must demonstrate the vertical and lateral stability of the bar reinforcement and plastic chairs during the construction of the test strip.

For a 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.

Lap splice bar reinforcement under section 52-6. For low carbon, chromium-steel bar reinforcement, the length of lap splice must be at least 30 inches.

40-2.03C Construction Joints

Transverse construction joints must be perpendicular to the lane line. Construct the joints to allow for lap splices of the longitudinal bar.

Clean joint surfaces before placing concrete against the surfaces. Remove laitance, curing compound, and other foreign materials.

40-2.03D Wide-Flange Beams

All welding must comply with AWS D1.1. 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.

Clean surface of wide flange beam to receive prime coat under section 59-2.01C(3)(b)(ii). The thickness of the prime coat must be 6 mils.

40-2.03E Correcting Noncompliant Pavement Work

40-2.03E(1) General

The specifications for repairing cracks in section 40-1.03N do not apply to CRCP. Do not apply highmolecular-weight methacrylate to cracks in CRCP.

CRCP that develops raveling areas of 6 by 6 inches or greater requires partial depth repair. CRCP that develops one or more full-depth transverse cracks with faulting greater than 0.25 inch or one or more fulldepth longitudinal cracks with faulting greater than 0.50 inch requires full-depth repair.

40-2.03E(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 depth of the saw cut must be between 2 inches from the surface to 1/2 inch above the longitudinal bars.*
2. *Provide additional reinforcement if each length of the repair boundaries is equal to or greater than 3 feet.*

40-2.03E(3) Full-Depth Repair

40-2.03E(3)(a) General

Remove the full-depth of CRCP except for the portion of reinforcement to remain in place. Provide continuity of the reinforcement. For low carbon, chromium-steel bar reinforcement, the length of lap splice must be at least 30 inches. Splicing must comply with section 52-6. Do not damage the base, concrete, and reinforcement to remain in place. Place concrete in the area where you removed CRCP.

40-2.03E(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.

40-2.03E(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 each end of the crack. You may propose alternate limits with your repair plan.

40-2.03F Reserved

40-2.04 PAYMENT

Not Used

DIVISION VI STRUCTURES

Add prior to section 45:

Bid Items and Applicable Sections

Item code	Item description	Applicable section
460XXX	Tie Back Assembly A	46
460XXX	Tie Back Assembly B	46
460XXX	Tie Back Assembly C	46
47702X	Geosynthetic Reinforced Soil, (Tower Access Pads)	47
480600	Temporary Shoring	48
489XXX	Temporary crossing (Lower Channel)	48
490553	Furnish Steel Sheet Piling	49
490553	Drive Steel Sheet Piling	49
490601	16" Cast-in-Drilled Hole Concrete Piling	49
500001	Prestressing Cast-In-Place Concrete	49
510053	Structural Concrete, Bridge (Spillway Bridge)	49
510053	Structural Concrete, Bridge (Channel Bridge)	50
510051	Structural Concrete, Bridge Footing (Spillway Bridge)	51
510053	Structural Concrete, Bridge (Polymer Fiber) (Spillway Bridge)	51
51009X	Structural Concrete, Maintenance Access Structure	51
51009X	Structural Concrete, By-Pass Structure	51
51009X	Structural Concrete, Tower Inlet A	51
51009X	Structural Concrete, Tower Inlet B	51
51009X	Structural Concrete, Tower Inlet C	51
51009X	Structural Concrete, Tower Inlet D	51
51009X	Structural Concrete, Tower Pad Dead Man	51
51909X	Joint Seal (MR 1/2")	51
520101	Bar Reinforcing Steel (Spillway Bridge)	51
520101	Bar Reinforcing Steel (Channel Bridge)	51
550XXX	Tower Steel Armoring, Struts and Trash Rack System	52
600097	Bridge Removal	60

47 EARTH RETAINING SYSTEMS

47-1 GENERAL

47-1.01 GENERAL

Section 47 includes specifications for constructing earth retaining systems.

47-1.02 MATERIALS

Not Used

47-1.03 CONSTRUCTION *Not Used*

47-1.04 PAYMENT

Not Used

47-2 MECHANICALLY STABILIZED EMBANKMENT

47-2.01 GENERAL

47-2.01A Summary

Section 47-2 includes specifications for constructing mechanically stabilized embankments.

Concrete panels must comply with section 51.

Reinforcement must comply with section 52.

Geosynthetic reinforcement must comply with section 96.

Earthwork must comply with section 19.

47-2.01B Definitions *Reserved*

47-2.01C Submittals

Submit results from the proposed button-head wire coupler test.

Submit results from each production button-head wire coupler test.

47-2.01D Quality Assurance

47-2.01D(1) General

Coupler test samples must comply with the minimum tensile specifications for plain wire in ASTM A1064A/1064M.

Total wire slip must be at most 3/16 inch when tested as specified for tension testing of round wire test samples under ASTM A370.

If any test samples fail, revise the connection and retest. Do not start face panel installation until tension and slip test results are accepted.

Perform tension and slip tests on the proposed button-head wire soil reinforcement and coupler connection. Test 6 connection test samples. Test samples must consist of two 24-inches long buttonhead wires connected by a swaged coupler. Testing must be performed by an authorized laboratory.

47-2.01D(2) Quality Control

Perform tension and slip testing on production button-head wire and coupler connections during wall construction. Test 4 connection test samples for each lot of 500 mat wire connections installed. If 2 or more test samples fail, the entire represented lot is rejected. If 1 test sample fails to comply with specified criteria, test an additional 4 test samples. If any of these additional samples fail, the entire represented lot is rejected.

47-2.02 MATERIAL

47-2.02A General

Concrete leveling pads must be constructed with minor concrete.

Soil reinforcement, connecting elements, and other steel components in contact with the earth must be galvanized under section 75-1.02B.

Threaded ends of inspection wires for metallic soil reinforcement may be formed before or after galvanizing. Coat the final 4 inches of the wire with 2 applications of organic zinc-rich primer. Encase the threaded end with a waterproof vinyl enclosure secured with a nylon tie. If the threaded end is galvanized after threading, clean the threads before painting.

Corrugated steel pipe must comply with section 66.

Perforated pipe underdrains and underdrain outlets and risers must comply with section 68-2. Perforated pipe must be steel unless perforated plastic pipe is shown.

Rock for rock slope protection at drain pipe outlets must be small-rock slope protection and must comply with the gradation specified for 7-inch-thick layer in section 72-4.02.

Filter fabric must be Class A.

Adhesive for bonding filter fabric to concrete panels must be commercial grade.

Resin bonded cork for horizontal joints must comply with ASTM D1752, Type II, with a compressive load of at least 100 psi.

Pipe pins must comply with ASTM A53/A53M except the zinc coating of actual surface must average at least 2.0 oz/sq ft and no individual specimen may be less than 1.8 oz/sq ft.

47-2.02B Face Panels

In freeze-thaw areas concrete panels must comply with section 90-1.02I and must contain at least 675 pounds of cementitious material per cubic yard.

If architectural treatment is not required, finish exposed surfaces of concrete members as specified for Class 1 surface finish under section 51-1.03F(3).

47-2.02C Structure Backfill

Structure backfill for mechanically stabilized embankment must:

1. *Be free of organic material and substantially free of shale and other soft material of poor durability*
2. *Not contain slag aggregate or recycled materials such as:*
   2.1. *Glass*
   2.2. *Shredded tires*
   2.3. *Portland cement concrete rubble including asphaltic dust, sand, rock, grindings, slabs, and boulders*
   2.4. *Asphaltic concrete rubble including asphaltic dust, sand, rock, grindings, slabs, and boulders*
   2.5. *Other unsuitable material as determined by the Engineer*

For an embankment with metallic soil reinforcement, structure backfill must comply with the requirements shown in the following tables:

Gradation Requirements

Sieve size	*Test method*	*Requirement (percent passing)*
6 inch	*California Test 202*	*100*
3 inch	*California Test 202*	*78–100*
No. 30	*California Test 202*	*0–60*
No. 200	*California Test 202*	*0–15*

Quality Characteristic Requirements

Quality characteristic	*Test method*	*Requirement*
Sand equivalent[a] (min)	*California Test 217*	*12*
Plasticity index[a] (max)	*California Test 204*	*6*
Minimum resistivity (ohm-cm)	*California Test 643*	*2000*

Chlorides (ppm)	*California Test 422*	*< 250*
Sulfates (ppm)	*California Test 417*	*< 500*
pH	*California Test 643*	*5.5–10.0*

[a]*Does not apply if 12 percent or less passes the no. 200 sieve and 50 percent or less passes the no. 4 sieve.*

For an embankment with geosynthetic soil reinforcement, structure backfill must comply with the requirements shown in the following tables:

Gradation Requirements

Sieve size	*Test method*	*Requirement (percent passing)*
2 inch	*California Test 202*	*100*
No. 4	*California Test 202*	*50–80*
No. 40	*California Test 202*	*0–30*
No. 200	*California Test 202*	*0–15*

Quality Characteristic Requirements

Quality characteristic	*Test method*	*Requirement*
Sand equivalent (min)	*California Test 217*	*12*
Plasticity index[a] (max)	*California Test 204*	*6*
Durability Index (min)	*California Test 229*	*35*
pH	*California Test 643*	*4.5–9.0*

47-2.02D Permeable Material

Permeable material must be Class 1, Type B, complying with section 68-2.02F.

Permeable material for an embankment with metallic soil reinforcement must comply with the requirements shown in the following table:

Quality Characteristic Requirements

Quality characteristic	*Test method*	*Requirement*
Minimum resistivity (ohm-cm)	*California Test 643*	*2,000*
Chlorides (max, ppm)	*California Test 422*	*250*
Sulfates (max, ppm)	*California Test 417*	*500*
pH	*California Test 643*	*5.5–10.0*

Permeable material for an embankment with geosynthetic soil reinforcement must comply with the requirements shown in the following table:

Quality Characteristic Requirements

Quality characteristic	*Test method*	*Requirement*
pH	*California Test 643*	*4.5–9.0*

47-2.02E Soil Reinforcement

Steel wire must comply with the specifications for plain wire reinforcement in ASTM A1064/A1064M. Welded wire reinforcement must comply with the specifications for plain wire welded wire reinforcement in ASTM A1064/1064M.

For button-headed wires:

1. *Buttons must be cold formed symmetrically about the axes of the wires*
2. *Buttons must develop the minimum guaranteed ultimate tensile strength of the wire*
3. *Do not use a cold-forming process that causes indentations in the wire*
4. *Button heads must not contain wide open splits, more than 2 splits per head, or splits nonparallel to the axis of the wire*

Steel wire reinforcement hooks and bends must comply with the Building Code Requirements for Structural Concrete published by ACI.

Couplers at wire reinforcement connections must be seamless steel sleeves applied over the button-head wires. Couplers must develop the wire minimum tensile strength with a total slip of at most 3/16 inch.

Splice welded wire reinforcement along its length with mechanical couplers that develop the minimum tensile strength of the wire.

Identification, storage, and handling of geosynthetic reinforcement must comply with ASTM D4873 and any alternative system details. Protect the geosynthetic reinforcement from chemicals, flames, welding sparks, and temperatures less than 20 degrees F or greater than 140 degrees F. Do not allow foreign materials to come into contact with or become affixed to the geosynthetic reinforcement.

47-2.03 CONSTRUCTION

47-2.03A General

Water for earthwork or for dust control within 500 feet of structures with metallic soil reinforcement must comply with the specifications for water in reinforced concrete in section 90-1.02D.

Protect the unthreaded portion of the galvanized inspection wire from damage.

47-2.03B Earthwork

47-2.03B(1) General

Grade the foundation level for a width equal to the length of soil reinforcement elements plus 1 foot or as shown. Compact foundation material to a relative compaction of at least 95 percent. Start wall construction activities after the Engineer accepts the compacted foundation area.

If ordered, remove unsuitable material. This work is change order work.

Place structure backfill simultaneously with erection of facing panels. Place and compact material without distorting soil reinforcement or displacing facing panels. Place structure backfill at the front of the wall before backfilling more than 15 feet above the bottom of the lowermost face element.

If a mechanically stabilized embankment with soil reinforcement is to be constructed on an embankment, compact embankment material to a relative compaction of at least 95 percent within the limits established by inclined planes sloping 1.5:1 (horizontal:vertical) from lines 1 foot outside the bottom limits of the mechanically stabilized embankment, including any permeable material.

Start placing and compacting structure backfill 1 foot from the back face of wall panels and progress toward the free end of the soil reinforcement. Operate compaction equipment parallel to the wall facing. Place and compact the remaining width of backfill behind wall panels after covering the soil reinforcement to a depth of 6 inches.

Do not use sheepsfoot or grid-type rollers within the limits of soil reinforcement. Use hand-held or handguided compacting equipment within 3 feet of facing panels.

Place structure backfill at each level of soil reinforcement to a plane 2 inches above the elevation of the soil reinforcement connection, starting 3 feet from the back of the face panel and extending for at least the remaining length of soil reinforcement. Complete this grading before placing the next layer of soil reinforcement.

Place permeable material and filter fabric when placing structure backfill. Place permeable material in layers less than 2 feet thick. Compaction of permeable material for the drainage system outside the limits of soil reinforcement is not required. Do not operate equipment directly on the permeable material or filter fabric. If a sloped layer of permeable material is placed to facilitate the work or to satisfy safety considerations, (1) the vertical limits of the permeable material must remain unchanged and (2) the thickness of the layer of permeable material is measured normal to the slope.

Grade backfill to drain away from the wall face at the end of each work shift. Use berms or ditches to direct runoff away from the wall site. Do not allow surface runoff from adjacent areas to enter the wall site.

47-2.03B(2) Soil Reinforcement

Tension soil reinforcement in the direction perpendicular to the wall face. Remove slack in the connection and the soil reinforcement. Secure soil reinforcement in place before and during compaction.

Swage wire reinforcement couplers with a hydraulic press.

Cover soil reinforcement with structure backfill during the same work shift that it is placed.

Do not operate construction equipment directly on soil reinforcement. Maintain a layer of structure backfill at least 6 inches thick between soil reinforcement and any construction equipment.

Place geosynthetic soil reinforcement in full-length sections.

Place structure backfill over geosynthetic soil reinforcement in lifts of at most 6 inches if using handoperated compaction equipment and 8 inches if using heavy compaction equipment.

47-2.03B(3) Face Panels

Vertical and horizontal panel alignment offset must not exceed 3/4 inch when measured along a 10-foot straightedge. The offset in any panel joint must not exceed 3/4 inch.

After placing backfill 2 feet above inspection elements, dry pack voids in face panels with mortar under section 51-1.03E(2). Mortar must comply with section 51-1.02F except the proportion of cementitious material to sand must be such that the mortar achieves a 28 day compressive strength of 1,000 to 1,500 psi.

47-2.03C Filter Fabric

Immediately before placing filter fabric, the subgrade to receive filter fabric must be free of loose or extraneous material and sharp objects that may damage the filter fabric.

Concrete panel surfaces to receive filter fabric must be dry and thoroughly cleaned.

Handle and place filter fabric under the manufacturer's instructions. Stretch, align, and place fabric without wrinkling.

Adjacent borders of filter fabric must be stitched or overlapped. Overlap rolls 12 to 18 inches. Place the preceding roll over the following roll in the direction the material is being spread. Stitch fabric using yarn of a contrasting color. Yarn size and composition must comply with the filter fabric manufacturer's instructions. Use 5 to 7 stitches per inch of seam.

Repair damaged filter fabric by placing a piece of filter fabric large enough to cover the damaged area and provide at least a 12-inch overlap.

Do not operate equipment, including vehicles, directly on filter fabric. Maintain at least 6 inches of permeable material between filter fabric and equipment during spreading of permeable material. Where structure backfill is to be placed on filter fabric, maintain at least 18 inches of structure backfill material between filter fabric and equipment during placement.

47-2.03D Leveling Pads

Place concrete for leveling pads at least 24 hours before erecting face panels.

47-2.04 PAYMENT

The vertical height of each section is the difference in elevation on the outer face from the bottom of the lowermost face element to the top of wall profile.

47-6 ALTERNATIVE EARTH RETAINING SYSTEMS

47-6.01 GENERAL

Add to section 47-6.01:

Construction of the Tower Access Pads (TAPs) will involve up to about 28 feet of excavation into the existing soil/slope, and placement of up to about 23 feet of compacted geosynthetic reinforced soils. An earth retaining system (ERS) is thus necessary to constructs the TAPs.

Based on the subsurface conditions, height of the retained soils, a Geosynthetic-Reinforced Soil (GRS) wall is proposed to comprise the TAPs subsurface structure.

The proposed GRS earth retaining system is designed and constructed to limit settlement (<1.0 inch) and to provide adequate external (global) and internal stabilities based on the principles and practices recommended in the Federal Highway Administration (FHWA, 2018) Report No. FHWA-HRT-17-080, Design and Construction Guidelines for Geosynthetic Reinforced Soil Abutments and Integrated Bridge Systems, and GEC 11, Design and Construction of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes – Volumes I and II (FHWA, 2009). The contractor must understand and comply with this report while constructing the TAPs.

47-6.01A Summary

Section 47-6 includes specifications for constructing alternative earth retaining systems.

You may use an alternative earth retaining system when specified in the special provisions.

Use only one type of system at any one location.

The alternative earth retaining system must comply with the specifications for the type of wall being constructed.

47-6.01B Definitions *Reserved*

47-6.01C Submittals 47-6.01C(1) General

For as-built drawings common to more than one structure, submit the as-built drawings for each structure.

47-6.01C(2) Shop Drawings

Submit shop drawings for the alternative system to OSD, Documents Unit. Submit 5 copies for initial review. Submit from 6 to 12 copies, as requested, of final shop drawings for final authorization. Include the following:

1. *All information required for construction of the system at each location*
2. *Existing ground line at the wall face*
3. *Design parameters, material notes, and wall construction procedures*

Verify existing ground elevations before submitting drawings.

Shop drawings and calculations must be sealed and signed by an engineer who is registered as a civil engineer in the State.

Allow 30 days for the Department's review.

47-6.01C(3) Certificates

Submit certificates of compliance for the alternative system stating the supplied materials comply with the authorization criteria for the system on the Authorized Material List for alternative earth retaining systems.

47-6.01D Quality Assurance

A qualified representative of the alternative system manufacturer must be present during erection and backfill of the first 10 vertical feet of the entire length of the wall. The representative must be available during the remaining installation. The representative must not be your employee.

47-6.02 MATERIALS

The alternative systems specified are taken from the Authorized Material List. Only systems having characteristics suitable for this project are specified. Some systems may be proprietary.

Alternative systems are selected based on data previously furnished by suppliers or manufacturers of each system.

Add to section 47-6.02:

47-6.02A TAP Backfill

Structure backfill recommended Reinforced Soil for GRS Abutment (AASHTO No. 89)

Gradation (AASHTO M-43)	U.S. Sieve	Percent Passing
	½ Inch	100
	3/8 Inch	90-100
	No. 4	20-55
	No. 8	5-30
	No 16	0-10
	No. 50	0-5
Plasticity Index (PI) (AASHTO T-90)	PI≤6	
Soundness (AASHTO T-104)	The reinforced zone soil shall be free of shale and other poor durability particles. The material shall have a magnesium sulfate loss of less than 30% after 4 cycles (or a sodium value less than 15% after 5 cycles).	

47-6.02B TAP Compaction

Compaction of the backfill must be to at least 95 percent of maximum dry density according to AASHTO T 99 for a well-graded aggregate and a method specification (e.g., three passes of the compactor) for an open-graded aggregate. Backfill material containing fines should be compacted at a moisture content close to optimum (±2 percent). Lifts of 8 inches should be compacted using vibratory roller compaction equipment. Other stiffness-based compaction control methods can be used if authorized for use by the engineer.

Hand-operated compaction equipment (e.g., a lightweight mechanical tamper, plate, or roller) is recommended within 3 ft of the front of the wall face.

Onsite compaction equipment must be selected to achieve the required density of the fill materials. Compaction equipment must be in good operating order for efficient use. In addition, backup equipment should be available to provide quality construction throughout the project and to avoid construction delays.

47-6.03 CONSTRUCTION

The structure must comply with the system details authorized on the Authorized Material List. Check vertical and horizontal alignment at each course during erection. Include a drainage system where shown.

Where shown, construct the alternative system to accommodate (1) wall-mounted lighting and drainpipes and (2) panels for future drainage inlets.

The top of wall profile must conform to the profile shown. The bottom of wall elevations must be at or below the elevations shown. Use a minimum height and length of wall adequate for the loading and site conditions described.

The length of soil reinforcement for any system must not be less than that shown.

The coping lip or barrier slab lip must cover the top of face panels at least 7 inches.

Place the top level of soil reinforcement:

1. *Parallel to the top of the concrete panel*
2. *At least 3 inches below the bottom of either the barrier slab lip or the concrete gutter behind the coping*
3. *At least 5 inches below the top edge of the concrete panel*

Add to section 47-6.03:

47-6.03A Compaction Procedure

Once fill is placed at the required thickness and graded, all areas should be compacted to the required density. Any depression behind should be filled level prior to compaction.

Compaction directly behind the wall face should be performed in a manner that maintains wall alignment while improving the density of fill behind the block. This can be achieved in the following ways:

- Placing a fill lift directly behind the while rodding or foot tamping along and while exerting downward pressure to prevent lateral movement. For multiple lifts, the top lift height is slightly higher to compensate for compression of the fill during compaction.
- Using a lightweight vibratory plate compactor directly behind while exerting downward pressure to prevent lateral movement.
- Using larger vibratory compactors for the remainder of the fill area 3 ft from the face of the GRS wall. Outward block movement should be checked for and adjusted accordingly

47-6.04 PAYMENT

Not Used

48 TEMPORARY STRUCTURES

48-1 GENERAL

48-1.01 GENERAL

Section 48-1 includes general specifications for constructing temporary structures.

48-1.02 MATERIALS

Not Used

48-1.03 CONSTRUCTION *Not Used*

48-1.04 PAYMENT

Full compensation for work specified in section 48 is included in the payment for the bid items involved unless:

1. *Bid item for the work is shown on the Bid Item List*
2. *Work is specified as change order work*

48-2 FALSEWORK

48-2.01 GENERAL

48-2.01A Summary

Section 48-2 includes specifications for constructing falsework.

You must design, construct, and maintain falsework that:

1. *Is safe and adequate*
2. *Provides the necessary rigidity*
3. *Supports the imposed loads*
4. *Produces a completed structure that conforms to the lines and grades shown*

48-2.01B Definitions previously welded splice: *Splice made in a falsework member in compliance with AWS D1.1 or other recognized welding standard before contract award.*

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.*

48-2.01C Submittals 48-2.01C(1)

General

Submit a certificate of compliance for each delivery of structural composite lumber used in falsework.

Submit a letter of certification that certifies all components of manufactured assemblies are used in compliance with the manufacturer's instructions.

If requested, (1) submit manufacturer's data for manufactured assemblies to verify manufacturer's instructions or (2) perform tests demonstrating adequacy of the proposed assemblies.

Submit field acceptance criteria for falsework piles with a calculated nominal resistance greater than 200 tons. Base acceptance criteria on a wave equation analysis performed on dynamic monitoring of falsework pile driving. Analyses must be signed by an engineer who is registered as a civil engineer in the State. Submit acceptance criteria before falsework erection is complete.

Submit a letter of certification for all falsework members with 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 placing any concrete on the falsework being certified.

Submit a welding certification for falsework members with previously welded splices. The certification must:

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

Submit a falsework lighting plan before starting construction on falsework containing openings for vehicular traffic, pedestrians, or railroad. You may propose a lighting plan that fulfills the light intensity specified using alternative methods. Supply data to allow evaluation of the alternative methods.

48-2.01C(2) Shop Drawings

Submit shop drawings with supporting calculations for falsework.

Shop drawings and calculations must be signed by an engineer who is registered as a civil engineer in the State if any of the following conditions apply:

1. *Height of any portion of the falsework measured from the ground line to the soffit of the superstructure is more than 14 feet*
2. *Any individual falsework clear span is more than 16 feet*
3. *Provisions for vehicular, pedestrian, or railroad traffic through the falsework are made*

Shop drawings and calculations for falsework piles with a calculated loading capacity greater than 100 tons must be designed by an engineer who is registered as a civil or geotechnical engineer in the State.

Submit 6 copies of falsework shop drawings and 2 copies of design calculations. Include with the submittal:

1. *Details of erection and removal activities.*
2. *Methods and sequences of erection and removal, including equipment.*
3. *Details for the stability of falsework during all stages of erection and removal activities.*
4. *Superstructure placing diagram showing concrete placing sequence and construction joint locations. If a schedule for placing concrete is shown, no deviation is allowed.*
5. *Assumed soil bearing values for falsework footings.*
6. *Maximum horizontal distance falsework piles may be pulled for placement under caps.*
7. *Maximum deviation of falsework piles from vertical.*
8. *Anticipated total falsework and form settlements, including footing settlement and joint take-up.*
9. *Grade (E-value), species, and type of any structural composite lumber. Include manufacturer's tabulated working stress values for the lumber.*
10. *Design calculations including stresses and deflections in load carrying members.*
11. *Provisions for complying with temporary bracing requirements.*
12. *Welding standard used for welded members.*

Submit separate drawings and calculations for each single bridge or portion of bridge.

For multi-frame bridges, submit a separate shop drawing for each frame.

You may revise authorized falsework shop drawings if you submit it before the start of the affected work to allow review and corrections without work delays. The additional time will not be more than that originally allowed.

For falsework over railways, comply with any additional requirements of the railway company involved.

The licensed engineer signing the falsework drawings must certify that the falsework is constructed as shown in the authorized shop drawings before concrete is placed. The certification must include any necessary testing to verify the ability of the falsework members to sustain the stresses required by the falsework design. The licensed engineer may assign a representative to perform this certification as follows:

1. *Where falsework contains openings for railroads, vehicular traffic, or pedestrians, the assigned representative must (1) have at least 3 years of combined experience in falsework design or supervising falsework construction and (2) be registered as a civil engineer in the State.*

2. *For other falsework, the assigned representative must have at least 3 years of combined experience in falsework design or supervising falsework construction.*

3. *The Engineer may request you certify the experience of the assigned representative and submit supporting documentation demonstrating the required experience.*

For 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, include the following information:

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*

48-2.01D Quality Assurance

48-2.01D(1) General

Reserved

48-2.01D(2) Welding and Nondestructive Testing

Welding must comply with AWS D1.1 or other recognized welding standard except for fillet welds if the load demands are 1,000 lb or less per inch for each 1/8 inch of fillet weld.

Perform NDT on welded splices using UT or RT. Each 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, perform and document all necessary testing and inspection required to certify the ability of the falsework members to sustain the design stresses.

48-2.02 MATERIALS

48-2.02A General

Reserved

48-2.02B Design Criteria 48-2.02B(1) General

Design falsework to resist the sum of the dead and live vertical loads and an assumed horizontal load.

Anticipated falsework settlement must not exceed 1 inch.

Design footings to carry the imposed loads without exceeding estimated soil bearing values or anticipated settlements.

Falsework spans for T-beam girders must not exceed 14 feet plus 8.5 times the T-beam girder depth.

Design falsework supporting deck slabs and overhangs on girder bridges such that there is no differential settlement between the girders and the deck forms during deck concrete placement.

For individual steel towers with maximum leg loads exceeding 30 kips, design foundations to provide uniform settlement under all legs of each tower.

Design support systems for form panels supporting concrete deck slabs and overhangs on girder bridges as falsework.

Temporary bracing must be designed to withstand all imposed loads during erection, construction, and removal of any falsework. Wind loads must be included in the design of the bracing.

Falsework removal systems 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 comply with 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.

48-2.02B(2) Loads

The design load for falsework must consist of dead and live vertical loads, and an assumed horizontal load. The minimum total design load for any falsework is 100 psf, including members that support walkways for the combined live and dead load.

Dead loads must include the weight of concrete, reinforcing steel, forms, and falsework. Loads due to concrete, reinforcing steel, and forms must be assumed to be at least:

1. *160 pcf for normal concrete*
2. *130 pcf for lightweight concrete*

Live loads must include:

1. *Actual weight of any equipment to be supported by the falsework applied as concentrated loads at the points of contact*

2. *Uniform load of at least 20 psf applied over the area supported by the falsework 3. Load of 75 lb/ft applied at the outside edge of deck overhangs*

The assumed horizontal load the falsework bracing system must resist must be the sum of the actual horizontal loads due to equipment, construction sequence or other causes, and a wind loading. The horizontal load in any direction must be at least 2 percent of the total dead load.

If the concrete is to be prestressed, design the falsework to support any increased or readjusted loads caused by the prestressing forces.

Design the falsework with sufficient rigidity to resist the assumed horizontal load without considering the concrete load.

For heavy-duty steel shoring or steel pipe column falsework with a vertical load capacity greater than 30 kips per leg or column, the minimum horizontal wind loading must be the sum of the products of the wind impact area, shape factor, and wind pressure value for each height zone. The wind impact area is the total projected area of all elements in the tower face or falsework bent normal to the direction of the applied wind. Use a shape factor of 2.2 for heavy-duty steel shoring and 1.0 for pipe column falsework. Use the wind pressure values shown in the following table:

Height zone (feet above ground)	*Wind pressure value*	
	Shores or columns adjacent to traffic (psf)	*At other locations (psf)*
0–30	*20*	*15*
30–50	*25*	*20*
50–100	*30*	*25*
Over 100	*35*	*30*

For all other falsework, the minimum horizontal wind loading must be the sum of the products of the wind impact area and the wind pressure value for each height zone. The wind impact area is the gross projected area of the falsework and any unrestrained portion of the permanent structure except for the areas between falsework bents or towers where diagonal bracing is not used. Use the wind pressure values shown in the following table:

Height zone (feet above ground)	*Wind pressure value*	
	For members over and bents adjacent to traffic opening (psf)	*At other locations (psf)*
0–30	*2.0 Q*	*1.5 Q*
30–50	*2.5 Q*	*2.0 Q*
50–100	*3.0 Q*	*2.5 Q*
Over 100	*3.5 Q*	*3.0 Q*

NOTE:

Q = 1 + 0.2W, but not more than 10

where:

W = width of the falsework system in feet, measured in the direction of the wind force

Design falsework to support placement of the entire superstructure cross-section, except railing, at one time. You may consider girder stems and connected bottom slabs self-supporting between falsework posts if:

1. *Girder stems and connected bottom slabs are placed more than 5 days before the top slab*
2. *Distance between falsework posts is at most 4 times the depth of the portion of the girder stem placed in the 1st pour*

Falsework for box girder structures with internal falsework bracing systems that use flexible members capable of withstanding only tensile forces must be designed to include (1) the vertical effects caused by elongation of the flexible member and (2) the design horizontal load combined with the dead and live loads imposed by concrete placement for girder stems and connected bottom slabs. This requirement does not apply to falsework composed of individual steel towers that use flexible members capable of withstanding only tensile forces to resist overturning.

48-2.02B(3) Stresses, Loadings, and Deflections

48-2.02B(3)(a) General

Maximum allowable stresses and loadings specified in section 48-2.02B(3) are based on the use of undamaged high-quality materials. Reduce stresses and loadings for materials of lesser quality.

48-2.02B(3)(b) Timber

Design timber connections under the Department's Falsework Manual.

The maximum allowable stresses, loadings, and deflections for timber are as shown in the following table:

Quality characteristic	*Requirement*
Compression perpendicular to the grain (psi)	*450*
Compression parallel to the grain (psi)	*480,000/(L/d)^2; 1,600 maximum*
Flexural stress	*1,800 psi; 1,500 psi maximum for members with a nominal depth of 8 inches or less.*
Horizontal shear (psi)	*140*
Axial tension (psi)	*1,200*
Deflection due to concrete loading only	*1/240 of span length[a]*
Modulus of elasticity (E) (psi)	*1.6 x 10^6*
Timber piles (tons)	*45*

NOTES:

L = unsupported length, inches d = least dimension of a square or rectangular column or the width of a square of equivalent crosssectional area for round columns, inches

[a]Irrespective of deflection compensated for in camber strips

48-2.02B(3)(c) Steel

Except for flexural compressive stresses, design stresses for identified grades of steel must not exceed stresses specified in the AISC Steel Manual.

Except for flexural compressive stresses, the design stresses for unidentified steel must not exceed those specified for steel complying with ASTM A36/A36M in the AISC Steel Manual or as shown in the following table:

Quality characteristic	*Requirement*
Tension, axial and flexural (psi)	*22,000*
Compression, axial (psi)	*16,000 - 0.38(L/r)^{2a}*
Shear on gross section of web of rolled shapes (psi)	*14,500*
Web yielding for rolled shapes (psi)	*27,000*
Modulus of elasticity (E) (psi)	*30 x 10^6*

NOTES:

L = unsupported length, inches r = radius of gyration of the member, inches

[a]L/r must not exceed 120

Design stresses and deflections for all grades of steel must not exceed the requirements shown in the following table:

Quality characteristic	*Requirement*
Compression, flexural (psi)	*12,000,000/[(L x d)/(b x t)][a]*

Deflection due to concrete loading only	*1/240 of the span[b]*
Modulus of elasticity (E) (psi)	*30 x 10^6*

NOTES:

L = unsupported length, inches d = least dimension of rectangular columns or the width of a square of equivalent cross-sectional area for round columns, or the depth of beams, inches b = width of the compression flange, inches t = thickness of the compression flange, inches

F_y = specified minimum yield stress in psi

[a]Not to exceed (1) 22,000 psi for unidentified steel, (2) 22,000 psi for steel complying with ASTM A36/A36M, or (3) 0.6F_y for other identified steel

[b]Irrespective of deflection compensated for in camber strips

48-2.02B(3)(d) Manufactured Assemblies

Do not exceed the manufacturer's instructions for loadings and deflections on jacks, brackets, columns, joists, and other manufactured devices except the dead load deflection of joists at locations other than under deck slabs between girders must not exceed 1/240 of their spans.

48-2.02B(4) Special Locations

Design and construct falsework over or adjacent to roadways or railroads that are open to traffic such that the falsework is stable if subjected to impact by vehicles.

Falsework posts at the following locations are considered adjacent to roadways or railroads:

1. *Posts supporting members that cross over a roadway or railroad*
2. *Posts located in the row of falsework posts nearest to the roadway or railroad and where the horizontal distance from the traffic side of the falsework to the edge of pavement or to a point 10 feet from the centerline of track is less than the total height of the falsework and forms*

The falsework design at the above locations must comply with section 48-2.02B and the following requirements:

1. *The vertical load used for the design of falsework posts and towers that support the portion of the falsework over openings must be the greater of:*

    1.1 *150 percent of the design load calculated under section 48-2.02B(2), not including any increased or readjusted loads caused by prestressing forces*

    1.2 *Increased or readjusted loads caused by prestressing forces*

2. *Falsework posts must be steel with a minimum section modulus about each axis of 9.5 cubic inches or sound timbers with a minimum section modulus about each axis of 250 cubic inches.*

3. *Each falsework post must be mechanically connected to the support footing at its base or laterally restrained to withstand a force of at least 2,000 lb applied at the base of the post in any direction except toward the roadway or railroad track. Posts must be mechanically connected to the falsework cap or stringer. The mechanical connection must resist a load in any horizontal direction of at least 1,000 lb.*

4. *Mechanically connect (1) exterior falsework stringers, (2) stringers adjacent to the ends of discontinuous caps, (3) stringers over points of minimum vertical clearance, and (4) every 5th remaining stringer to the falsework cap or framing. For falsework over railroads, mechanically connect all stringers to caps. Mechanical connections must resist at least a 500 lb load in any direction, including uplift on the stringer. Install connections before traffic passes under the span.*

5. *Connect timber bracing to falsework using at least 5/8-inch-diameter bolts or coil rod with a root diameter equal to that of the shank of a 5/8-inch-diameter bolt.*

6. *Falsework member clearances must be at least those shown in the following table:*

	Clearance

Falsework member	*To railing members, barriers, and anchored temporary railings*	*To unanchored temporary railings*
Footings	*0'-3"*	*2'-0"*
Piles	*1'-0"*	*2'-9"*
Other members	*2'-0"*	*2'-9"*

7. *Falsework bents within 20 feet of the centerline of a railroad track must be sheathed solid from 3 to 17 feet above the track on the side facing the track. Sheathing must be plywood at least 5/8 inch thick or lumber at least 3/4 inch thick. Brace these bents to resist the required assumed horizontal load or 5,000 lb, whichever is larger.*

8. *Provide clear openings through falsework as described.*

48-2.03 CONSTRUCTION

48-2.03A General

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

The materials used in the falsework construction must be of the quality necessary to sustain the stresses required by the falsework design.

Where falsework for multiple level bridges is supported on the deck of a structure:

1. *Falsework must bear either directly on girder stems or bent caps of the supporting structure or on falsework sills that transmit the load to the stems or cap without stress to the deck slab.*

2. *Additional falsework must be in place beneath the supporting structure when construction loads are imposed on the supporting structure. Design and construct additional falsework to support all construction loads imposed on the supporting structure from the upper structure.*

48-2.03B Foundations

Construct falsework on solid footings capable of supporting falsework loads. Protect footings from softening and undermining. The Engineer determines if you must verify that the design soil bearing values do not exceed the soil capacity using load testing.

You may place falsework foundation pads and piles before shop drawings are authorized.

Falsework piles must be driven and the actual nominal pile resistance assessed under section 49. ***48-2.03C Erection***

Construct falsework to support the loads imposed without settlement or take-up beyond that shown on the falsework drawings.

Install the final bracing system before placing falsework members above stringers.

If falsework is over or adjacent to roadways or railroads, all details of the falsework system that contribute to horizontal stability and resistance to impact, except for bolts in bracing, must (1) be installed when each element of the falsework is erected and (2) remain in place until the falsework is removed.

If ordered, use camber strips to compensate for falsework deflection, vertical alignment, and anticipated structure deflection. The Engineer furnishes the amount of camber to be used in constructing falsework.

Install tell-tales that (1) are attached to the soffit forms and (2) can be read from the ground. Provide sufficient tell-tales to allow the total settlement where concrete is being placed to be determined.

Construct deck slab forms between girders with no allowance for settlement relative to the girders.

Do not apply dead loads other than forms and reinforcing steel to falsework until authorized.

If (1) events occur that the Engineer determines will result in a structure that does not comply with the structure as described or (2) settlements occur that are more than ±3/8 inch greater than those shown on the falsework

drawings, stop concrete placement and apply corrective measures. If the measures are not provided before initial concrete set occurs, stop concrete placement at the location ordered.

48-2.03D Removal

Remove falsework such that portions of falsework not yet removed remain stable at all times.

Falsework removal includes lowering the falsework, blowing sand from sand jacks, turning screws on screw jacks, and removing wedges.

Except for concrete above the deck, do not release falsework supporting any span of a:

1. *Simple span bridge before 10 days after the last concrete has been placed*
2. *Continuous or rigid frame bridge before 10 days after the last concrete has been placed:*
   2.1. *In that span*
   2.2. *In adjacent portions of each adjoining span for a length equal to one-half of the span where falsework is to be released*
3. *Simple span, continuous, or rigid frame bridge until the supported concrete has attained a compressive strength of 2,600 psi or 80 percent of the specified strength, whichever is greater*

Do not release falsework for prestressed portions of structures until prestressing steel has been tensioned.

Do not remove falsework supporting any span of a continuous or rigid frame bridge until all required prestressing is complete (1) in that span and (2) in adjacent portions of each adjoining span for a length equal to at least one half of the span where falsework is to be released.

Release falsework supporting spans of CIP girders, slab bridges, or culverts before constructing or installing railings or barriers on the spans unless authorized.

Remove falsework for arch bridges uniformly and gradually. Start at the crown and work toward the springing. Remove falsework for adjacent arch spans concurrently.

Do not release falsework that supports overhangs, deck slabs between girders, or girder stems that slope 45 degrees or more from vertical before 7 days after deck concrete has been placed.

You may release falsework supporting the sides of girder stems that slope less than 45 degrees from vertical before placing deck concrete if you install lateral supports. Lateral supports must be:

1. *Designed to resist rotational forces on the girder stem, including forces due to concrete deck placement*
2. *Installed immediately after each form panel is removed*
3. *Installed before releasing supports for the adjacent form panel*

Do not release falsework for bent caps supporting steel or PC concrete girders before 7 days after placing bent cap concrete. Do not erect girders onto bent caps until bent cap concrete has attained a compressive strength of 2,600 psi or 80 percent of the specified strength, whichever is greater.

Remove falsework for structural members subject to bending as specified for simple span bridges.

Do not release falsework for box culverts and other structures with decks lower than the roadway pavement and span lengths of 14 feet or less until the last placed concrete has attained a compressive strength of 1,600 psi. Curing of the concrete must not be interrupted. Falsework removal for other box culverts must comply with the specifications for the release of bridge falsework.

Do not release falsework for arch culverts sooner than 40 hours after concrete has been placed.

Remove falsework piling to at least 2 feet below the original ground or streambed. Remove falsework piling driven within ditch or channel excavation limits to at least 2 feet below the bottom and side slopes of the excavated areas.

Dispose of falsework materials and work debris.

Falsework removal system 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 falsework removal system is not actively lowering the falsework at vehicular, pedestrian, or railroad traffic openings.

Bridge deck openings used to facilitate falsework removal activities must be formed and located away from the wheel path. The formed openings must be wedge shaped with a 5-inch maximum diameter at the top and a 3-inch maximum diameter at the bottom.

Anchor 10-inch-square aluminum or galvanized steel wire, 1/4-inch-mesh hardware cloth with a 0.025- inch minimum wire diameter firmly to the inside of the soffit openings. Construct a 1/2-inch drip groove to the outside of soffit openings.

Clean and roughen openings made in the bridge deck. Fill the deck openings with rapid setting concrete complying with section 60-3.02B(2).

48-2.03E Falsework Lighting

48-2.03E(1) General

Falsework lighting includes lighting to illuminate the pavement, portals, and pedestrian walkways at or under openings in the falsework required for traffic.

Falsework lighting components must comply with section 86.

Lighting for pedestrian walkway illumination must be installed at all pedestrian openings through or under the falsework.

Design falsework lighting so that required maintenance can be performed with a minimum of inconvenience to traffic. Closing of traffic lanes for routine maintenance is not allowed on roadways with posted speed limits greater than 25 mph.

Illuminate the following only during hours of darkness as provided in division 1, section 280, of the California Vehicle Code: (1) Falsework portals and (2) pavement under falsework with portals less than 150 feet apart. Photoelectric switches must be used to control falsework lighting systems. Pavement under falsework with portals 150 feet or more apart and all pedestrian openings through falsework must be illuminated 24 hours per day.

Lighting fixtures must be aimed to avoid glare to oncoming motorists.

Type NMC cable with no. 12 minimum conductors with ground wire must be used. Fasten cable to the supporting structure at sufficient intervals to adequately support the cable and within 12 inches from every box or fitting. Conductors within 8 feet of ground must be enclosed in a 1/2-inch or larger Type 1 conduit.

Each illumination system must be on a minimum of 1 separate branch circuit at each bridge location. Each branch circuit must be fused, not to exceed 20 A.

For falsework lighting, arrange with the service utility to complete service connections. You pay for energy, line extension, service, and service hookup costs.

48-2.03E(2) Pavement Illumination

Illumination of pavement at vehicular openings through falsework must comply with the following requirements:

1. *Fixture must include R/FL commercial-type flood lamp holder with protective covers.*
2. *Fixture must be fully adjustable with brackets and locking screws and allow mounting directly to a standard metal junction box.*
3. *Lamp must be medium-base 120 V(ac), 120 W, minimum, PAR-38 quartz-halogen flood lamp.*
4. *A continuous row of fixture types required must be installed at locations and spacing specified. Fixtures must be installed beneath falsework structure with the end fixtures not further than 10 feet inside portal faces. Fixtures must be installed and energized immediately after the members supporting them have been erected.*
5. *Fixtures along the sides of the opening must be placed not more than 4 feet behind or 2 feet in front of the roadway face of the temporary railing. Mounting heights of fixtures must be between 12 and 16 feet above the roadway surface and must present an unobstructed light pattern on the pavement.*

48-2.03E(3) Portal Illumination

Illumination of falsework portals must comply with the following requirements:

1. *On each side of each entrance portal, plywood sheet clearance guides must:*
   1.1. *Be 4 feet wide by 8 feet high.*
   1.2. *Be fastened vertically, facing traffic, with the bottom of the panel 3 to 4 feet above the roadway.*
   1.3. *Have the center of the panel located approximately 3 feet horizontally behind the roadway face of the railing.*
   1.4. *Have freshly painted panels for each installation with not less than 2 applications of flat white paint. Paint testing will not be required.*

2. *If ordered, repaint the designated areas to improve the general appearance of the painted surfaces. Repainting is change order work.*

3. *Falsework portals must be illuminated on the side facing traffic with 150 W, minimum, PAR floodlamps mounted on the structure directly over each vertical support adjacent to the traveled way, as needed to uniformly illuminate the exterior falsework beam, the clearance guides, and the overhead clearance sign. Each lamp must be supported approximately 16 feet above the pavement and approximately 6 feet in front of the portal face.*

4. *Portal lighting and clearance guides must be installed on the day the vertical members are erected.*

48-2.03E(4) Pedestrian Walkway Illumination

Illumination of pedestrian openings through or under the falsework must comply with the following requirements:

1. *Fixtures must be flush mounted in the overhead protection shield and equipped with a damageresistant, clear, polycarbonate diffuser lens. Lamps must be standard incandescent 100 W, 120 V(ac).*
2. *Fixtures must be centered over the passageway at intervals of not more than 15 feet with the end fixtures not more than 7 feet inside the end of the pedestrian openings.*

3. *Pedestrian passageway light systems must be installed immediately after the overhead protection shield is erected.*

48-2.04 PAYMENT

Not Used

48-3 TEMPORARY SUPPORTS

48-3.01 GENERAL

48-3.01A Summary

Section 48-3 includes specifications for providing temporary supports for existing structures during retrofit, reconstruction, and removal activities.

Temporary supports include jacking assemblies and accessories required to jack and support structures.

48-3.01B Definitions frame: *Portion of a bridge between*

expansion joints.

48-3.01C Submittals

48-3.01C(1) General

Submit 2 copies of the initial location survey of the existing structure signed by an engineer who is registered as a civil engineer in the State.

Submit a copy of the displacement monitoring record after completing reconstruction of each bent.

48-3.01C(2) Shop Drawings

Submit shop drawings with design calculations for the temporary support system. Submit 6 copies of shop drawings and 2 copies of design calculations. Include with the submittal:

1. *Descriptions and values of all loads, including construction equipment loads.*
2. *Descriptions of equipment to be used.*
3. *Details and calculations for jacking and supporting the existing structure.*

4. *Stress sheets, anchor bolt layouts, shop details, and erection and removal plans for the temporary supports.*
5. *Assumed soil bearing values and design stresses for temporary support footings, including anticipated foundation settlement.*
6. *Maximum distance temporary support piles may be pulled for placement under footing caps.*
7. *Maximum deviation of temporary support piles from a vertical line through the point of fixity.*
8. *Details for use of permanent piles. Include any additional loads imposed on the piles.*
9. *Details for additional bracing required during erection and removal of temporary supports.*
10. *Details of the displacement monitoring system, including equipment, location of control points, and methods and schedule for taking measurements.*
11. *Details for jacking the structure if settlement occurs in the temporary supports.*

Calculations must show a summary of computed stresses in (1) temporary supports, (2) connections between temporary supports and the existing structure, and (3) existing load-supporting members. The computed stresses must include the effect of the jacking sequence. Calculations must include a lateral stiffness assessment of the temporary support system.

Shop drawings and calculations must be signed by an engineer who is registered as a civil engineer in the State.

For temporary supports over railways, comply with any additional requirements of the railway company involved.

48-3.01D Quality Assurance

48-3.01D(1) General

Welding, welder qualification, and welding inspection for temporary supports must comply with AWS D1.1.

Calibrate each jack within 6 months of use and after each repair. Each jack and its gauge must (1) be calibrated as a unit with the cylinder extension in the approximate position that it will be at the final jacking force and (2) accompanied by a certified calibration chart. Each load cell must be calibrated. Calibration must be performed by an authorized laboratory.

Before starting bridge removal activities, an engineer who is registered as a civil engineer in the State must inspect and certify that (1) the temporary supports, jacking system, and displacement monitoring system comply with the authorized shop drawings and (2) the materials and workmanship are satisfactory for the work. A copy of this certification must be available at the job site at all times.

An engineer who is registered as a civil engineer in the State must:

1. *Be present during jacking activities or adjustments and during bridge removal activities.*
2. *Inspect jacking and removal activities and report daily on the progress of the operation and the status of the remaining structure. The daily report must be available at the job site at all times.*
3. *Immediately submit proposed procedures to correct or remedy unplanned occurrences.*

48-3.01D(2) Displacement Monitoring

Perform an initial survey to record the location of the existing structure before starting work.

Monitor and record vertical and horizontal displacements of the temporary supports and the existing structure. Use vandal-resistant displacement monitoring equipment. Perform monitoring continuously during jacking activities and at least weekly during removal and reconstruction activities. Make monitoring records available at the job site during normal work hours. Monitoring records must be signed by an engineer who is registered as a civil engineer in the State.

As a minimum, monitor the existing structure at the supported bent and at the midspan of both adjoining spans. Locate control points at each location near the center and at both edges of the superstructure. As a minimum, record elevations at the following times:

1. *Before starting jacking activities*
2. *Immediately after completing jacking*
3. *After completing bridge removal*

4. *Before connecting the reconstructed or retrofitted superstructure to the substructure*
5. *After removing temporary supports*

48-3.02 MATERIALS

48-3.02A General

Manufactured assemblies must comply with section 48-2.02B(3)(d).

48-3.02B Design Criteria

The Engineer does not authorize temporary support designs based on allowable stresses greater than those specified in section 48-2.02B(3).

If falsework loads are imposed on temporary supports, the temporary supports must also satisfy the deflection criteria in section 48-2.02B(3).

The temporary support system must support the initial jacking loads and the minimum temporary support design loads and forces shown. Adjust vertical design loads for the weight of the temporary supports and jacking system, construction equipment loads, and additional loads imposed by jacking activities. Construction equipment loads must be at least 20 psf of deck surface area of the frame involved.

Temporary supports must resist the described lateral design forces applied at the point where the column to be removed meets the superstructure. If the temporary support lateral stiffness exceeds the described minimum stiffness, increase the lateral design forces to be compatible with the temporary support stiffness.

Place temporary supports resisting transverse lateral loads within 1/2 of the span length from the existing bent. Place temporary supports resisting longitudinal lateral loads within the frame where columns are to be removed.

You may use the permanent piles as part of the temporary support foundation. Do not move or adjust permanent piles from the locations shown. If you install permanent piles longer than described to support the temporary supports above the top of the footing and later cut off the piles at their final elevation, you must use shear devices adequate to transfer all pile reactions into the footing.

Design temporary support footings to carry the loads imposed without exceeding the estimated soil bearing values or anticipated settlements. You must determine soil bearing values.

Where temporary supports are placed on the deck of an existing structure:

1. *Temporary supports must bear either:*
   1.1. *Directly on girder stems or bent caps of the supporting structure*
   1.2. *On falsework sills that transmit the load to the stems or cap without overstressing any member of the new or existing structure*
2. *Temporary supports must not induce permanent forces into the completed structure or produce cracking.*
3. *Place additional temporary supports beneath the existing structure where temporary support loads are imposed on the existing structure. Design and construct the additional temporary supports to support all loads from the upper structure and construction activities.*

Provide additional bracing as required to withstand all imposed loads during each phase of temporary support erection and removal. Include wind loads complying with section 48-2.02B(2) in the design of additional bracing.

Mechanically connect (1) the existing structure to the temporary supports and (2) the temporary supports to their foundations. Mechanical connections must be capable of resisting the lateral design forces. Friction forces developed between the existing structure and temporary supports (1) are not considered an effective mechanical connection and (2) must not be used to reduce lateral forces.

Design mechanical connections to accommodate adjustments to the temporary support frame during use.

If the concrete is to be prestressed, design temporary supports to support changes to the loads caused by prestressing forces.

Temporary supports must comply with the specifications for falsework in section 48-2.02B(4).

48-3.03 CONSTRUCTION

Where described, install temporary crash cushion modules under section 12-3.22 before starting temporary support activities. Remove crash cushion modules when authorized.

Construct temporary supports under the specifications for falsework in section 48-2.03C.

Equip each jack with a pressure gauge or load cell for determining the jacking force. Each pressure gauge must have an accurately reading dial at least 6 inches in diameter. Each load cell must be provided with an indicator to determine the jacking force.

Provide a redundant system of supports during jacking activities. The redundant system must include stacks of steel plates added as necessary to maintain the redundant supports at each jack location within 1/4 inch of the jacking sill or corbels.

Before starting bridge removal work at a location being supported, the temporary support system must (1) apply a force to the structure that is equal to the initial jacking load or the dead load shown and (2) hold that load until all initial compression and settlement of the system is completed.

Apply jacking loads simultaneously. Control and monitor jacking operations to prevent distortion and stresses that would damage the structure. Maintain total vertical displacements at control points to less than 1/4 inch from elevations recorded before jacking or as authorized.

Stop jacking activities if unanticipated displacements, cracking, or other damage occurs. Apply corrective measures before resuming jacking activities.

After reconstruction activities, the monitored control points must not deviate by more than 1/4 inch from the initial vertical survey elevations or other authorized elevations.

Remove temporary supports under the specifications for falsework in section 48-2.03D. If traffic is carried on the structure on temporary supports, do not release temporary supports until the supported concrete has attained 100 percent of the described strength.

Remove attachments from the existing structure. Restore concrete surfaces to original conditions except where permanent alterations are shown.

48-3.04 PAYMENT

Payment for crash cushion modules is not included in the payment for temporary support.

48-4 TEMPORARY DECKING

48-4.01 GENERAL

48-4.01A Summary

Section 48-4 includes specifications for temporary decking for joint or deck reconstruction.

If you are unable to complete bridge reconstruction activities before the bridge is to be opened to traffic, furnish and maintain temporary decking until that portion of the work is complete.

Temporary decking must comply with the specifications for existing structures in section 60 and the falsework specifications in section 48-2.

48-4.01B Definitions *Reserved*

48-4.01C Submittals

Submit shop drawings for temporary decking. Include the following:

1. *Description, location, and value of all loads*
2. *Details of the connection between the temporary decking and the existing structure*
3. *Storage location of equipment and materials that allows for 1 shift of work and placement of temporary decking within the time allowed*
4. *Construction sequence and schedule details*
5. *Cure time for concrete to be placed under a steel plate system*
6. *Details for removing temporary decking and restoring the existing structure*

Shop drawings must be signed by an engineer who is registered as a civil engineer in the State.

48-4.01D Quality Assurance

Temporary decking must comply with the falsework specifications in section 48-2.02B(2), section 482.02B(3), and the following:

1. *For the design loading shown, deflection must not exceed 1/300 of the temporary decking span.*
2. *Temporary decking must have a uniform surface with a coefficient of friction of at least 0.35 when measured under California Test 342.*
3. *Steel plate systems must be mechanically connected to the existing structure and adjacent approaches. If a steel plate spans a joint, the mechanical connection must accommodate at least 50 percent of the movement rating shown for that joint.*
4. *Temporary decking must not overstress, induce permanent forces into, or produce cracking in the existing structure.*

48-4.02 MATERIALS

Not Used

48-4.03 CONSTRUCTION

Temporary decking must consist of one of the following:

1. *Steel plate system that spans the incomplete work.*
2. *Falsework with an asphalt concrete surface that spans the incomplete work. Do not use falsework with an asphalt concrete surface to cover deck concrete that has not cured or to cover partially installed joint materials.*

Construct temporary decking under the specifications for falsework in section 48-2 except the first paragraph of section 48-2.03D does not apply.

If there is a horizontal gap of more than 1/2 inch or an elevation difference of more than 1/4 inch between the temporary decking and the adjacent deck, install tapers up to and away from the temporary decking. Use the ratio for tapers specified in the special provisions. If the temporary decking does not extend the entire width of the roadway, taper the sides of the temporary decking at a 12:1 (horizontal: vertical) ratio. Material for tapers must comply with section 60-3.02B(2). Cure tapers at least 3 hours before allowing traffic on the temporary decking.

For ramp locations, tapers may be installed at 12:1 (horizontal: vertical) up to and away from the temporary decking. If the temporary decking does not extend the entire width of the roadway, taper the sides of the temporary decking at 12:1 (horizontal: vertical). Material used at these locations must be sufficiently rigid to support traffic. If unanticipated displacements, cracking, or other damage occurs to the existing structure or to any new components installed in or adjacent to the deck, stop work on the deck and perform corrective measures.

Edges of steel plate systems must be in full contact with the existing deck and the adjacent approach slab. If used, shims must be securely attached to the plate.

For falsework with an asphalt concrete cover, asphalt concrete must be at least 3 inches thick and compacted in place.

Do not allow traffic on deck concrete until it has attained the design compressive strength shown. For RSC, do not allow traffic on deck concrete until it has cured at least 24 hours.

When temporary decking is no longer needed, remove temporary decking materials and connections from the existing structure as soon as possible. Restore modifications to the existing structure except where permanent alterations are shown.

48-4.04 PAYMENT

Not Used

49 PILING

49-1 GENERAL

49-1.01 GENERAL

49-1.01A Summary

Section 49-1 includes general specifications for constructing piles.

49-1.01B Definitions

control zone: *Zone that has the same subsurface profile and engineering properties as a corresponding support location.*

nominal driving resistance: *Sum of (1) nominal resistance required to resist the factored axial loads and (2) driving resistance from unsuitable or scourable penetrated soil layers that do not contribute to the design resistance.*

nominal resistance: *Design capacity required to resist the factored axial loads.*

49-1.01C Submittals

49-1.01C(1) General

Before handling or installing piles at a location closer than the length of the pile being handled or installed to the edge of a traveled way open to public use, submit a work plan of the measures to be used to provide for the safety of traffic and the public.

Submit a VECP for revisions to specified tip elevations shown or installation methods.

49-1.01C(2) Test Borings

If test borings are specified in the special provisions, submit the log of test borings and the test boring report upon completion of all test borings. Submit 4 copies of the test boring report and the log of test borings to OSD, Documents Unit. The submittal must comply with the specifications for shop drawings. Notify the Engineer of the submittal. Include in the notification the date and contents of the submittal.

If corrections to the submittal are required, submit 1 copy of the corrected test boring report and the log of test borings to OSD, Documents Unit.

The test boring report must include:

1. *Summary of drilling methods, drilling equipment, drill platforms, and drilling difficulties encountered*
2. *Location map of the surveyed position of the test borings relative to the new pile locations in the California Coordinate System and bridge stationing*
3. *Bore hole surveying notes*
4. *Photographs of rock cores*
5. *Copies of original daily drilling notes*

49-1.01D Quality Assurance

49-1.01D(1) General

Piling must have sufficient length to attain the specified tip elevation shown and extend into the pile cap or footing.

49-1.01D(2) Determination of Length

You may conduct additional foundation investigation, including installing and axial load testing of additional nonproduction indicator piling and performing test borings. Locations of additional foundation testing must be authorized. Notify the Engineer at least 5 business days before starting additional foundation testing.

Complete additional foundation investigation before requesting revised specified pile tip elevations or revisions to the described installation methods.

The following revisions are not authorized:

1. *Specified installation methods if settlement or lateral loads control the design tip elevation*

2. *Specified pile tip elevation above the design tip elevation shown for settlement or lateral loads*

3. *Specified pile tip elevation if the tip elevation is controlled by liquefaction or scour*

The pile structural capacity design is based on the nominal strength as defined in Article 8.1.3 of the Caltrans Bridge Design Specifications or the nominal resistance as defined in Article 1.3.2.1 of the AASHTO LRFD Bridge Design Specifications.

Indicator compression pile load testing must comply with ASTM D1143/D1143M. The pile must sustain the 1st compression test load applied that is equal to the nominal driving resistance, with no more than 1/2-inch total vertical movement at the top of the pile measured relative to the top of the pile before the start of compression load testing.

Indicator tension pile load testing must comply with ASTM D3689 except do not use the loading apparatus described as "Tensile Load Applied by Hydraulic Jack(s) Acting Upward at One End of Test Beam(s)." The pile must sustain the 1st tension test load applied that is equal to the nominal resistance in tension shown with no more than 1/2-inch total vertical movement at the top of the pile measured relative to the top of the pile before the start of tension load testing.

Remove indicator piling as specified for removing portions of bridges.

49-1.01D(3) Load Test Piles

If load test piles are shown, complete load testing of each load test pile before drilling holes, casting piling, cutting piling to length, driving piling, and fabricating reinforcing steel cages for any piles represented by the load test pile.

Notify the Engineer at least 10 days before drilling or driving piles to be load tested.

Except in cofferdams, the bottom of the footing excavation must be level and dewatered before pile load testing. The excavation must be kept dewatered during load testing.

Install load test piles with the same type of equipment to be used for installation of production piles.

Load test and anchor piles must comply with the specifications for piling as described and Class N steel pipe piling. Locate load test piles such that they may be cut off and become a part of the completed structure.

Remove load test and anchor piles not incorporated in the completed structure as specified for removing portions of bridges.

For load test anchorages in piles used as anchor piles:

1. *HS threaded steel rods must comply with ASTM A722/A722M for uncoated, deformed, Type II, HS steel bars, including the supplementary requirements, except the maximum weight requirement does not apply*
2. *Steel plates must comply with ASTM A709/A709M, Grade 36*
3. *Anchor nuts must hold the HS steel rods at a load producing a stress of not less than 95 percent of the specified ultimate tensile strength of the HS steel rod*
4. *Pipe, couplings, and fittings must be commercially available materials of the types and ratings shown*
5. *Welds that connect the anchor pile and the anchor pile head must be tested under section 49-2.02A(4)(b)(iii)(C)*

You may use additional cementitious material in load test and anchor piles.

You may use Type III cement in any load test and anchor pile not used as a part of the completed structure.

Furnish labor, materials, tools, equipment, and incidentals as required to assist the Department in the transportation, installation, operation, and removal of Department-furnished steel load test beams, jacks, bearing plates, drills, and other test equipment. This is change order work.

The Department performs testing of load test piles when the concrete in the load test and anchor piles has developed a compressive strength of at least 2,000 psi.

Allow the Department 15 days to perform pile load tests at each test location. Allow an additional 10 days for the Department to revise the specified tip elevations.

49-1.01D(4) Dynamic Monitoring

Section 49-1.01D(4) applies if dynamic monitoring of driven piling is specified in the special provisions.

The Department determines which piles from a control zone or support location receive dynamic monitoring.

The Department dynamically monitors driven piles using Department-furnished dynamic pile analyzer monitoring instruments.

Section 49-2.01A(4)(c) does not apply to driven piles if dynamic monitoring is required.

The Department conducts penetration and bearing analyses of dynamically monitored piles and develops bearing acceptance criteria curves for these piles. Penetration and bearing analyses are based on a wave equation analysis. Penetration and bearing analyses are specific to a driving submittal. Piles located within specified control zones are represented by the associated dynamically monitored pile for bearing acceptance criteria.

Except for load test piles and anchor piles, drive the 1st production pile in the control zone and perform dynamic monitoring as specified. Do not install any additional production piles until the Engineer provides you with the bearing acceptance criteria curves for any piles represented by the dynamically monitored piles.

Piles to be dynamically monitored must:

1. *Have an additional length of 2 times the largest cross-sectional dimension of the pile plus 2 feet.*
2. *Be available to the Department at least 2 business days before driving.*
3. *Be safely supported at least 6 inches off the ground in a horizontal position on at least 2 support blocks. If ordered, rotate the piles on the blocks.*
4. *Be positioned to provide safe access to the entire pile length and circumference for the installation of anchorages and control marks for monitoring.*

Prepare and drive piles to be dynamically monitored in the following sequence:

1. *Before driving, rotate and align the pile in the driving leads as ordered by the Department.*
2. *Temporarily suspend driving operations for approximately 15 minutes when the pile tip is 25 feet above the specified tip elevation shown.*
3. *During the 15 minute suspension, bolt the 1-pound instrument package securely to plugs or expansion anchors previously installed in the pile by the Department. Connect electrical cables to the instrument package as ordered by the Department.*
4. *Resume driving operations as ordered by the Department. Suspend driving operations approximately 1 foot above the specified tip elevation.*
5. *Remove the cables and instrument package from the pile and deliver them to the Engineer.*
6. *The following day, install the instrument package on the pile and attach the cables and resume driving the pile to the specified tip elevation.*
7. *Remove the cables and instruments from the monitored pile and deliver them to the Engineer. Replace in kind any cables or instruments that are damaged by your activities.*

After the pile has been dynamically monitored:

1. *Allow 15 days for the Department to revise the specified tip elevations and to provide bearing acceptance criteria curves*
2. *If pile load testing is performed in addition to dynamic monitoring, allow 25 days for the Department to revise the specified tip elevations and to provide bearing acceptance criteria curves*
3. *Cut pile to the specified cut-off elevation after bearing acceptance criteria is provided by the Department*

49-1.01D(5) Test Borings

Section 49-1.01D(5) applies if test borings are specified in the special provisions.

Notify the Engineer at least 15 days before drilling test borings.

Drill test borings under the job site supervision of, with the log of test borings stamped by, and with the test boring submittal signed by a geologist or civil engineer who is registered in the State and has at least 5 years of geotechnical engineering experience with deep foundations in both soil and rock.

Drill test borings at the center of each pile location shown.

Drill test borings by rotary drilling methods to a depth of at least 20 feet below the specified tip elevation shown. Test borings must be at least 3 inches in diameter.

Perform standard penetration tests in all soil types under ASTM D1586 for each test boring at 5-foot maximum intervals until (1) bedrock is encountered, (2) 10 blows with no discernible sampler advancement is observed, or (3) ordered.

Core the bedrock:

1. *Continuously with at least 90 percent core recovery. Rock must not be logged from drill cuttings. Rock quality designation must be made at 5-foot maximum intervals.*

2. *Using an outer and inner core barrel drilling system. The outer core barrel must be fitted with a diamond impregnated or polycrystalline drill bit and have an outside diameter of at least 3 inches. The split inner tube core barrel must have an inside diameter of at least 2 inches.*

Photograph the rock cores:

1. *Before removal from the split inner tube barrels and placement into core boxes*
2. *After core boxes are filled and before boxes are removed from the drilling platform*

Rock core photographs must be in color, 5 by 7 inches, and labeled with the borehole number, sample elevation, scale, and date and time of photograph.

Place the rock cores in rock core boxes labeled as specified in the Soil and Rock Logging, Classification, and Presentation Manual. Include the support or pile location. Store rock core boxes on or near the job site at an authorized location. Preserve and secure the rock core samples in a weather-protected facility until notified by the Engineer. Dispose of rock cores or transport them to Geotechnical Services, as ordered.

The log of test borings and the classification and description of soils and rock must comply with the Soil and Rock Logging, Classification, and Presentation Manual available at the Geotechnical Services website. Use the same version of the Soil and Rock Logging, Classification, and Presentation Manual shown. If no version is shown, use the most current version of the manual.

After the test boring report and the log of test borings have been authorized, allow 20 days for the Engineer to notify you of confirmation of or revisions to the specified pile tip elevations. Do not fabricate or manufacture to length steel pipe piling, permanent steel casing, micropiling, and filled and unfilled steel casing until you have been notified.

49-1.02 MATERIALS

Not Used

49-1.03 CONSTRUCTION

If the Contract allows the use of more than 1 pile type, use the same type of pile for all piles within each individual footing.

Dispose of drill cuttings under section 19-2.03B.

Add to section 49-1.03:

Expect difficult pile installation due to the conditions shown in the following table:

Pile location		Conditions
Bridge.	Support location	
New Channel		Hard and/or difficult drilling conditions should be anticipated during drilling holes for the CIDH piles. The alluvium at the site is underlain by soil-like stiff siltstone and mudstone, and very dense silty sandstone. Expect dense to very dense earth fill, potential boulders, rocks and other hard material to be encountered.

Alluvial soils present at the site are considering prone to caving into the holes drilled for CIDH pile installation if left unsupported. The contractor is response for constructing CIDH piles free from anomalies by maintaining the stability and dry conditions of the drilled hole at all times during CIDH pile installation, if necessary, by installing temporary casing.

The bottom of the CIDH holes should be free of any loose soils and firm/unyielding prior to placing reinforcements.

49-1.04 PAYMENT

Load test piles and adjacent anchor piles are paid for as the type or class of piling shown in the Bid Item List. The payment quantity is the length used in the load testing.

49-3 CAST-IN-PLACE CONCRETE PILING

49-3.01 GENERAL

49-3.01A General

Section 49-3.01 includes general specifications for constructing CIP concrete piles.

CIP concrete piles include:

1. *CIDH concrete piles*
2. *CIDH concrete pile rock sockets*
3. *CISS concrete piles*

Concrete must comply with section 51.

Bar reinforcing steel must comply with section 52.

49-3.01B Materials

49-3.01B(1) General

Unless otherwise shown, concrete must have a minimum 28-day compressive strength of 3,600 psi.

Prequalify the concrete under section 90-1.01D(5)(b).

The combined aggregate gradation must comply with the 1-inch, 1/2-inch, or 3/8-inch maximum gradation specified in section 90-1.02C(4).

49-3.01B(2) Mass Concrete

Section 49-3.01B(2) applies to CIP concrete piles with a diameter greater than 8 feet.

The quantity of cementitious material must comply with the values shown in the following table:

Pile diameter (D) (feet)	*Maximum quantity of cementitious material (lb/cu yd)*
8 < D ≤ 10	*750*
10 < D ≤ 14	*720*

Cementitious material must comply with section 90-1.02B(3), except at least 25 percent of the total cementitious material must be fly ash.

For piles with a diameter greater than 14 feet, concrete must comply with the specifications for mass concrete in section 51-6.

49-3.01C Construction

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, casing, or steel shell in a dry or dewatered hole.

Place and secure reinforcement. Securely block the reinforcement to provide the minimum clearance shown between the reinforcing steel cage and the sides of the drilled hole, casing, or steel shell.

Steel shells, casings, and drilled holes must be clean and free of debris before reinforcement and concrete are placed.

Provide a suitable light to the Engineer for inspecting the entire length of the steel shell or drilled hole before placing reinforcement and concrete.

The methods used to place the concrete must prevent segregation.

Concrete must not be allowed to fall from a height greater than 8 feet without the use of adjustable length pipes or tubes unless the flow of concrete is directed into the center of the hole and the concrete is not allowed to strike the reinforcement, reinforcement bracing, and other objects in the hole.

Vibrate concrete in the upper 15 feet of CIP concrete piles.

After placing concrete, cure the temporarily exposed surfaces of the CIP concrete piles under section 511.03H.

49-3.01D Payment

Bar reinforcing steel is not included in the payment for CIP concrete piling unless the CIP concrete piling is less than 24 inches in diameter or for overhead sign structures, standards, and poles.

49-3.02 CAST-IN-DRILLED-HOLE CONCRETE PILING

49-3.02A General

49-3.02A(1) Summary

Section 49-3.02 includes specifications for constructing CIDH concrete piles and CIDH concrete pile rock sockets.

Permanent steel casing and driven steel shell must comply with section 49-2.02.

49-3.02A(2) Definitions

dry hole: *A drilled hole that requires no work to keep it free of water.*

dewatered hole: *A drilled hole that:*

1. *Accumulates no more than 12 inches of water at the bottom during a 1 hour period without any pumping from the hole.*
2. *Has no more than 3 inches of water at the bottom immediately before placing concrete.*
3. *Does not require temporary casing to control the groundwater.*

49-3.02A(3) Submittals

49-3.02A(3)(a) General

Replace Reserved in section 49-3.02A(3)(a) with:

Submit as an informational submittal the proposed drilling equipment operational capacities or descriptions for:

1. Downward force in lb

2. Torque in ft-lb
3. Rotational speed in rpm
4. Rate of penetration in ft/hr
5. Number and type of drilling cutters or drilling teeth on drilling tool

49-3.02A(3)(b) Pile Installation Plan

Submit a pile installation plan. Include complete descriptions, details, and supporting calculations for:

1. *Concrete mix design, certified test data, and trial batch reports*
2. *Drilling or coring methods and equipment*
3. *Proposed method for casing installation and removal, if necessary 4. Methods for placing, positioning, and supporting bar reinforcement*
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*
6. *Methods and equipment for verifying the bottom of the drilled hole is clean before placing concrete*
7. *Methods and equipment for preventing upward movement of reinforcement, including the means of detecting and measuring upward movement during concrete placement operations*
8. *Drilling plan and sequence*
9. *Concrete sequence and placement plan*
10. *If inspection pipes are required, methods for ensuring the inspection pipes remain straight, undamaged, and properly aligned during concrete placement*

For concrete placed under slurry, include complete descriptions, details, and supporting calculations in the pile installation plan for:

1. *Concrete batching, delivery, and placing systems, including time schedules and capacities. Time schedules must include the time required for each concrete placing operation at each pile.*
2. *Concrete placing rate calculations. If requested, base calculations on the initial pump pressures or static head on the concrete and losses throughout the placing system, including anticipated head of slurry and concrete to be displaced.*
3. *Suppliers' test reports on the physical and chemical properties of the slurry and any proposed slurry chemical additives, including SDSs.*
4. *Slurry testing equipment and procedures.*
5. *Methods of removal and disposal of excavation, slurry, and contaminated concrete, including removal rates.*
6. *Methods and equipment for slurry agitating, recirculating, and cleaning.*

49-3.02A(3)(c) Inspection Pipe and Reinforcing Cage Coupler Log

If inspection pipes are required, submit a log of the locations of inspection pipe couplers and pile reinforcing cage couplers as an informational submittal within 2 business days of completion of concrete placement in the hole.

49-3.02A(3)(d) Concrete Placement Log

Submit the concrete placement log as an informational submittal within 2 business days of completion of concrete placement in the hole.

The log must:

1. *Show the pile location, tip elevation, cutoff elevation, dates of excavation and concrete placement, total quantity of concrete placed, length and tip elevation of any casing, and details of any hole stabilization method and materials used.*
2. *Include an 8-1/2 by 11 inch graph of concrete placed versus depth of hole filled as follows:*

a. *Plot the graph continuously throughout concrete placement. Plot the depth of drilled hole filled vertically with the pile tip at the bottom and the quantity of concrete placed horizontally. Take readings at each 5 feet of pile depth, and indicate the time of the reading on the graph.*

49-3.02A(3)(e) Coring Logs and Concrete Cores

If coring is performed under section 49-3.02C(5), submit coring logs and concrete cores. Allow 10 days for the review.

49-3.02A(3)(f) Testing Report

If you perform testing on a rejected pile, submit this additional information in a report. The report must be sealed and signed by an engineer who is registered as a civil engineer in the State. Allow 10 days for the review and analysis of this report.

49-3.02A(3)(g) Mitigation Plans

For each rejected pile to be mitigated, submit a mitigation plan for repair, supplementation, or replacement. The mitigation plan must:

1. *Comply with the specifications for shop drawings.*
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. *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. *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.*

Pile mitigation plans must include:

1. *Designation and location of the rejected pile.*
2. *Review of the structural, geotechnical, and corrosion design requirements of the rejected pile.*
3. *Step by step description of the mitigation work to be performed, including drawings if necessary. If the ADSC Standard Mitigation Plan is an acceptable mitigation method, include the most recent version.*

For the most recent version of the ADSC Standard Mitigation Plan, go to:
http://www.dot.ca.gov/hq/esc/geotech/ft/adscmitplan.htm

4. *Assessment of how the proposed mitigation work addresses the structural, geotechnical, and corrosion design requirements of the rejected pile.*
5. *Methods for preservation or restoration of existing earthen materials.*
6. *List of any affected facilities. Include methods and equipment to be used for the protection of these facilities during mitigation.*
7. *Your name and the names of any subcontractors on each sheet.*
8. *List of materials with quantity estimates for the mitigation work and a list of personnel with their qualifications who will be performing the mitigation work.*

For rejected piles to be repaired, include the following in the pile mitigation plan:

1. *Assessment of the nature and size of the anomalies in the rejected pile*
2. *Provisions for access for additional pile testing, if requested*

For rejected piles to be replaced or supplemented, include the following in the pile mitigation plan:

1. *Proposed location and size of additional piles*
2. *Structural details and calculations for any modification to the structure to accommodate the replacement or supplemental piles*

Replacement piles must comply with the Contract for CIDH concrete piles.

49-3.02A(3)(h) Mitigation Report

If repairs are performed, submit a mitigation report as an informational submittal within 10 days of completion of the repair. The report must state exactly what repair work was performed and quantify the success of the repairs

relative to the submitted mitigation plan. The mitigation report must be sealed and signed by an engineer who is registered as a civil engineer in the State. The mitigation report must include your name and the names of any subcontractors on each sheet.

49-3.02A(3)(i) Plastic Spacer Manufacturer's Data and Sample

If plastic spacers are proposed for use, submit the manufacturer's data and a sample of the plastic spacer. Allow 10 days for the review.

49-3.02A(3)(j) Certifications

If synthetic slurry is used, submit as an informational submittal the names and certifications of your employees who are trained and certified by the synthetic slurry manufacturer.

49-3.02A(3)(k) Slurry Test Record

If slurry is used, submit a slurry test record as an informational submittal within 2 business days of completion of concrete placement in the hole.

49-3.02A(4) Quality Assurance

49-3.02A(4)(a) General

Reserved

49-3.02A(4)(b) Preconstruction Meeting

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 meeting facility.

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 conducts the meeting. Be prepared to discuss:

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*

49-3.02A(4)(c) Quality Control

Section 49-3.02A(4)(c) applies if concrete is placed under slurry.

Before placing concrete under slurry, produce a concrete test batch and transport it to the job site under the same conditions and in the same time frame anticipated during the placement of concrete in the piles.

At the job site, place the test batch concrete in an excavated hole lined with plastic or suitable container to allow for testing. Placing concrete under slurry is not required. The test batch must demonstrate that the proposed mix design will achieve the minimum required slump after the specified set period.

Do not vibrate or agitate the concrete during the set period.

The Engineer tests the concrete for slump under California Test 556. In addition to meeting the specified nominal slump, the slump of the concrete must comply with the requirements shown in the following table:

Slump Requirements

Time required to place concrete[a], T (hours)	*Minimum set period before testing[b] (hours)*	*Slump, after set period (inches)*
T ≤ 2	*2T*	*≥ 7*
T > 2	*T + 2*	*≥ 7*

[a]As described in the pile installation plan [b]The set period starts at the start of concrete placement.

After testing, dispose of the concrete test batch.

49-3.02A(4)(d) Department Acceptance

49-3.02A(4)(d)(i) General

Section 49-3.02A(4)(d) applies to CIDH concrete piles except for piles (1) less than 24 inches in diameter or (2) constructed in dry or dewatered holes.

The Department performs acceptance testing using GGL to test the concrete density of the pile for homogeneity.

After notification by the Engineer of pile acceptance, fill the inspection pipes and cored holes with grout. Grout must comply with section 50-1.02C. Fill inspection pipes and holes using grout tubes that extend to the bottom of the pipe or hole or into the grout already placed.

49-3.02A(4)(d)(ii) Gamma-Gamma Logging

The Department performs GGL under California Test 233.

Separate reinforcing steel as necessary to allow the Department access to the inspection pipes.

After requesting testing and providing access to the piles, allow 15 days for the Department to perform the testing and to prepare and provide the pile acceptance test report.

During testing, do not perform construction activities within 25 feet of any GGL operation.

If the Department determines a pile is anomalous under California Test 233, part 5C, the pile is rejected.

49-3.02A(4)(d)(iii) Rejected Piles *If a pile is rejected:*

1. *Suspend concrete placement in the remaining piles*
2. *Submit a revised pile installation plan*
3. *Do not resume concrete placement until the revised pile installation plan is authorized*

Allow 30 days for the Department to determine whether the rejected pile requires mitigation and to provide this information to you. Day 1 of the 30 days is the 1st day after access has been provided to the Department to perform acceptance testing.
The Department may perform CSL to determine the extent of the anomalies identified by GGL and to further evaluate a rejected pile for the presence of anomalies not identified by GGL. The pile acceptance test report will indicate if the Department intends to perform CSL and when the testing will be performed. Allow the Department 20 additional days for a total of 50 days to perform CSL and to provide supplemental results.

If authorized, you may perform testing on the rejected pile.

The Department determines whether the rejected pile requires mitigation due to structural, geotechnical, or corrosion concerns. The Department considers the estimated size and location of the anomaly and potential effects on the design. The Department provides you with the conclusions of this analysis for developing the mitigation plan.

If a rejected pile does not require mitigation, you may repair the pile under an authorized mitigation plan or the amount shown in the table will be deducted for each anomaly up to the maximum total deduction:

	Anomaly deduction ($)		
Anomaly location	*D < 4 feet*	*4 ≤ D < 6*	*D ≥ 6*

Entirely or partially within the upper 2/3 of the pile length	*1,000*	*2,000*	*4,000*
Entirely within the lower 1/3 of the pile length	*500*	*1,000*	*2,000*
Maximum total deduction	*2,000*	*4,000*	*8,000*

Note:
D = Nominal pile diameter

If a rejected pile requires mitigation or you elect to repair a rejected pile that does not require mitigation, submit a mitigation plan for the repair, supplementation, or replacement of the rejected pile.

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.

If the Engineer determines it is not feasible to repair the rejected pile, submit a mitigation plan for replacement or supplementation of the rejected pile.

49-3.02A(4)(e) Certifications

If synthetic slurry is used, your employees who will be providing technical assistance in the slurry activities must be trained and certified by the synthetic slurry manufacturer to show their competency to perform inspection of slurry operations.

49-3.02B Materials

49-3.02B(1) General

Reserved

49-3.02B(2) Concrete

Concrete placed under slurry must:

1. *Have a nominal slump equal to or greater than 7 inches. The nominal and maximum slump and penetration specifications in section 90-1.02G(6) do not apply to concrete placed under slurry.*

2. *Contain at least 675 pounds of cementitious material per cubic yard and be proportioned to prevent excessive bleed water and segregation.*

In a freeze-thaw area, the formed portion of CIDH concrete piles must contain at least 675 pounds of cementitious material per cubic yard.

49-3.02B(3) Aggregate Gradation

For concrete placed under slurry, the combined aggregate gradation must comply with the 1/2-inch maximum gradation or the 3/8-inch maximum gradation specified in section 90-1.02C(4).

49-3.02B(4) Reserved

49-3.02B(5) Grout

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.

Grout used to backfill casings must comply with the following:

1. *Aggregate must be used to extend the grout.*

2. *Aggregate must consist of at least 70 percent fine aggregate and approximately 30 percent pea gravel, by weight.*
3. *Fine aggregate must comply with section 90-1.02C(3).*
4. *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.*
5. *Grout must contain at least 845 pounds of cementitious material per cubic yard.*

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.*

49-3.02B(6) Slurry

49-3.02B(6)(a) General *Reserved*

49-3.02B(6)(b) Mineral Slurry

Mineral slurry must be mixed and thoroughly hydrated in slurry tanks. Sample and test slurry from the slurry tanks before placement in the drilled hole.

Recirculate or continuously agitate slurry in the drilled hole.

For recirculated slurry:

1. *Remove drill cuttings from the slurry before discharging the slurry back into the drilled hole.*
2. *Sample and test slurry at least every 2 hours after starting its use until tests show that the samples taken from the slurry tank and from within 2 feet of the bottom of the hole have consistent specified properties. Once consistent properties have been achieved, sample slurry at least every 4 hours as long as the specified properties remain consistent.*

For nonrecirculated slurry:

1. *Sample and test slurry from the drilled hole at least every 2 hours after starting its use. Sample the slurry at mid-height and near the bottom of the hole.*
2. *Recirculate slurry if tests show samples taken from mid-height and within 2 feet of the bottom of the hole do not have consistent specified properties.*

Sample and test slurry before final cleaning of the bottom of the hole and again just before placing concrete. Sample the slurry at mid-height and within 2 feet of the bottom of the hole. Do not start cleaning the bottom of the hole or placing the concrete until tests show that the samples have consistent specified properties.
Mineral slurry must comply with the requirements shown in the following table:

Mineral Slurry Requirements[a]

Quality characteristic	*Test method*	*Requirement*
Density *Before placement in the drilled hole and during drilling (pcf)* *Before final cleaning and immediately before placing concrete (pcf)*	*Mud weight (density), API RP 13B-1 section 4*	*64.3–69.1*[b] *64.3–75.0*[b]
Viscosity *Bentonite (sec/qt)* *Attapulgite (sec/qt)*	*Marsh funnel and cup. API RP 13B-1, section 6.2*	*28–50* *28–40*
pH	*Glass electrode pH meter or pH paper*	*8–10.5*
Sand content *Before final cleaning and immediately before placing concrete (%)*	*Sand, API RP 13B-1, section 9*	*≤ 4.0*

[a]*Slurry temperature must be at least 40 °F when tested.*
[b]*If authorized, you may use slurry in salt water. The allowable density of slurry in salt water may be increased up to 2 pcf.*

49-3.02B(6)(c) Synthetic Slurry

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
BIG FOOT	MATRIX CONSTRUCTION PRODUCTS 50 S MAIN ST STE 200 NAPERVILLE IL 60540 (877) 591-3137
POLY-BORE	BAROID INDUSTRIAL DRILLING PRODUCTS 3000 N SAM HOUSTON PKWY EAST HOUSTON TX 77032 (877) 379-7412

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

Quality characteristic	Test method	Requirement
Density During drilling (pcf) Before final cleaning and immediately before placing concrete (pcf)	Mud weight (density), API RP 13B-1, section 4	 ≤ 67.0[a] ≤ 64.0[a]
Viscosity During drilling (sec/qt) Before final cleaning and immediately before placing concrete (sec/qt)	Marsh funnel and cup. API RP 13B-1, section 6.2	 50–120 ≤ 70
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 RP 13B-1, section 9	≤ 1.0

NOTE: Slurry temperature must be at least 40 °F when tested.

[a]If authorized, you may use slurry in a salt water environment. The allowable density of slurry in a salt water environment may be increased by 2 pcf.

Super Mud synthetic slurry must comply with the requirements shown in the following table:

Super Mud

Quality characteristic	Test method	Requirement
Density During drilling (pcf) Before final cleaning and immediately before placing concrete (pcf)	Mud weight (density), API RP 13B-1, section 4	 ≤ 64.0[a] ≤ 64.0[a]
Viscosity During drilling (sec/qt) Before final cleaning and immediately before placing concrete (sec/qt)	Marsh funnel and cup. API RP 13B-1, section 6.2	 32–60 ≤ 60
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 RP 13B-1, section 9	≤ 1.0

NOTE: Slurry temperature must be at least 40 °F when tested.

[a]If authorized, you may use slurry in a salt water environment. The allowable density of slurry in a salt water environment may be increased by 2 pcf.

Shore Pac GCV synthetic slurry must comply with the requirements shown in the following table:

Shore Pac GCV

Quality characteristic	Test method	Requirement
Density During drilling (pcf) Before final cleaning and immediately before placing concrete (pcf)	Mud weight (density), API RP 13B-1, section 4	 ≤ 64.0[a] ≤ 64.0[a]
Viscosity During drilling (sec/qt) Before final cleaning and immediately before placing concrete (sec/qt)	Marsh funnel and cup. API RP 13B-1, section 6.2	 33–74 ≤ 57
pH	Glass electrode pH meter or pH paper	8.0–11.0
Sand content, percent by volume Before final cleaning and immediately before placing concrete (%)	Sand, API RP 13B-1, section 9	 ≤ 1.0

NOTE: Slurry temperature must be at least 40 °F when tested.

[a]If authorized, you may use slurry in a salt water environment. The allowable density of slurry in a salt water environment may be increased by 2 pcf.

Terragel or Novagel Polymer synthetic slurry must comply with the requirements shown in the following table:

Terragel or Novagel Polymer

Quality characteristic	Test method	Requirement
Density During drilling (pcf) Before final cleaning and immediately before placing concrete (pcf)	Mud weight (density), API RP 13B-1, section 4	 ≤ 67.0[a] ≤ 64.0[a]
Viscosity During drilling (sec/qt) Before final cleaning and immediately before placing concrete (sec/qt)	Marsh funnel and cup. API RP 13B-1, section 6.2	 45–104 ≤ 104
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 RP 13B-1, section 9	 ≤ 1.0

NOTE: Slurry temperature must be at least 40 °F when tested.

[a]If authorized, you may use slurry in a salt water environment. The allowable density of slurry in a salt water environment may be increased by 2 pcf.

Synthetic slurry material and quality characteristic requirements are specified in the special provisions.

Do not use synthetic slurries in holes drilled in primarily soft or very soft cohesive soils as determined by the Engineer.

Sample and test synthetic slurries:

1. *When the slurry temperature is at least 40 degrees F.*
2. *At mid-height and within 2 feet of the bottom of the hole.*
3. *During drilling to verify the slurry properties.*

4. *When drilling is complete but before final cleaning of the bottom of the hole. When samples comply with the requirements shown in the tables for the slurry material selected, clean the bottom of the hole of any loose or settled material.*

5. *After final cleaning and immediately before placing concrete.*

49-3.02B(6)(d) Water Slurry *Reserved*

49-3.02B(7) Reserved

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*

49-3.02B(9) Inspection Pipes

Inspection pipes must be schedule 40 PVC pipe complying with ASTM D1785 with a nominal pipe size of 2 inches.

Watertight PVC couplers complying with ASTM D2466 are allowed to facilitate pipe lengths in excess of those commercially available.

49-3.02B(10) Reserved

49-3.02C Construction

49-3.02C(1) General

Unless otherwise authorized, drilling the hole and placing reinforcement and concrete in the hole must be performed in a continuous operation.

Except for CIDH concrete piles for sound walls and retaining walls, you may propose to increase the diameter and revise the pile tip elevation of CIDH concrete piles with a diameter less than 2 feet.

For CIDH concrete piles for sound walls and retaining walls, you may propose to increase the diameter of CIDH concrete piles with a diameter less than 2 feet, except pile tip elevations must not be revised.

49-3.02C(2) Drilled Holes

The axis of the drilled hole must not deviate from plumb more than 1-1/2 inches per 10 feet of length.

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.

During excavation, do not disturb the foundation material surrounding the pile. Equipment or methods used for excavating holes must not cause quick soil conditions or cause scouring or caving of the hole.

For rock sockets, equipment and drill methods must not result in softened materials on the borehole walls.

If slurry is used during excavation, maintain the slurry level at a height required to maintain a stable hole, but not less than 10 feet above the piezometric head.

After excavation has started, construct the pile expeditiously to prevent deterioration of the surrounding foundation material from air slaking or from the presence of water. Remove and dispose of deteriorated foundation material, including material that has softened, swollen, or degraded, from the sides and the bottom of the hole.

Just before placing reinforcement or concrete, clean the bottom of the hole to remove any loose sand, gravel, dirt, and drill cuttings.

If caving occurs or deteriorated foundation material accumulates on the bottom of the hole, clean the bottom of the hole after placing reinforcement and before placing concrete in the hole. You must verify that the bottom of the hole is clean.

Remove water that has infiltrated the dewatered hole before placing concrete, as required for dewatered hole. Do not allow fluvial or drainage water to enter the hole.

If authorized, to control caving or water seepage, you may enlarge portions of the hole, backfill the hole with slurry cement backfill, concrete, or other material, and redrill the hole to the diameter shown. Backfill material at enlarged piles must be chemically compatible with concrete and steel, be drillable, and have the necessary strength required for the conditions.

Dispose of material resulting from placing concrete.

49-3.02C(3) Temporary Steel Casings

Furnish temporary steel casings where shown and where necessary to control water or to prevent quick soil conditions or caving of the hole. Place temporary casings tight in the hole.

Section 11 does not apply to temporary steel casings.

Temporary casings must be:

1. *Watertight and of sufficient strength to withstand the loads from installation, removal, lateral concrete pressures, and earth pressures*
2. *Noncorrugated with smooth surfaces*
3. *Clean and free of hardened concrete*

Remove the temporary casing during concrete placement. Maintain the concrete in the casing at a level required to maintain a stable hole, but not less than 5 feet above the bottom of the casing, to prevent displacement of the concrete by material from outside the casing.

If slurry is not used, do not withdraw the temporary casing until the concrete head in the casing is greater than the groundwater head outside of the casing. Maintain this positive concrete head during withdrawal of the casing.

You may vibrate or hammer the temporary casing to (1) assist in removal of the casing from the hole, (2) prevent lifting of the reinforcement, and (3) prevent concrete contamination.

The withdrawal of casings must not leave voids or cause contamination of the concrete with soil or other materials.

49-3.02C(4) Reinforcement

Reinforcement for CIDH concrete piles with increased diameters and revised tip elevations must comply with the following:

1. *Size and number of the reinforcing bars and hoops, the percentage of bars required to extend to the pile tip, and the size and pitch of spiral reinforcement must be the same as shown for the original piles.*
2. *Required length of the spiral reinforcement and of any reinforcing bars that do not extend to the pile tip must be at least the length that would have been required for the original specified or ordered tip elevation.*
3. *Diameter of the spiral or hoop reinforcement must remain the same as required for the original pile or may be increased to provide not less than the concrete cover required for the original pile. Provide positive means to ensure that the reinforcement is centered in the pile.*

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 under the manufacturer's instructions.

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 in diameter than the column cage:*
    2.1. *Maintain a clear horizontal distance of at least 3.5 inches between the two cages, if the concrete is placed under dry conditions*
    2.2. *Maintain a clear horizontal distance of at least 5 inches between the two cages if the concrete is placed under slurry*
    2.3. *The offset between the centerlines of the two cages must not exceed 6 inches*

49-3.02C(5) Vertical Inspection Pipes

For acceptance testing, install and test vertical inspection pipes as follows:

1. *Log the location of the inspection pipe couplers and pile reinforcing cage couplers with respect to the plane of pile cutoff.*

2. *Cap each inspection pipe at the bottom. Extend the pipe from 3 feet above the pile cutoff to the bottom of the reinforcing cage. Provide a temporary top cap or similar means to keep the pipes clean before testing. If pile cutoff is below the ground surface or working platform, extend inspection pipes to 3 feet above the ground surface or working platform.*

3. *If any changes are made to the pile tip, extend the inspection pipes to the bottom of the reinforcing cage.*

4. *Install inspection pipes in a straight alignment and parallel to the main reinforcement. Securely fasten inspection pipes in place and provide protective measures to prevent misalignment or damage to the inspection pipes during installation of the reinforcement and placement of concrete in the hole.*

Construct CIDH concrete piles such that the relative distance of inspection pipes to vertical steel reinforcement remains constant.

5. *After concrete placement is complete, fill inspection pipes with water to prevent debonding of the pipe.*

6. *Provide safe access to the tops of the inspection pipes.*
7. *After placing concrete and before requesting acceptance testing, test each inspection pipe in the Engineer's presence by passing a rigid cylinder through the length of pipe. The rigid cylinder must:*
    7.1. *Be 1-1/4-inch diameter by 4.5-foot long.*
    7.2. *Weigh 12 pounds or less.*
    7.3. *Be able to freely pass down through the entire length of the pipe under its own weight and without the application of force.*

8. *When performing acceptance testing, inspection pipes must provide a 2-inch-diameter clear opening and be completely clean, unobstructed, and either dry or filled with water as authorized.*

9. *After acceptance testing is complete, completely fill the inspection pipes with water.*

If the rigid cylinder fails to pass through the inspection pipe:

1. *Completely fill the inspection pipes in the pile with water immediately.*
2. *Core a nominal 2-inch-diameter hole through the concrete for the entire length of the pile for each inspection pipe that does not pass the rigid cylinder. Coring must not damage the pile reinforcement.*

3. *Locate cored holes as close as possible to the inspection pipes they are replacing and no more than 5 inches clear from the reinforcement.*

Core holes using a double wall core barrel system with a split tube type inner barrel. Coring with a solid type inner barrel is not allowed.

Coring methods and equipment must provide intact cores for the entire length of the pile.

Photograph and store concrete cores as specified for rock cores in section 49-1.01D(5).

The coring operation must be logged by an engineering geologist or civil engineer licensed in the State and experienced in core logging. Coring logs must comply with the Department's Soil and Rock Logging, Classification, and Presentation Manual for rock cores. Coring logs must include core recovery, rock quality designation of the concrete, locations of breaks, and complete descriptions of inclusions and voids encountered during coring.

The Department evaluates the portion of the pile represented by the cored hole based on the submitted coring logs and concrete cores. If the Department determines a pile is anomalous based on the coring logs and concrete cores, the pile is rejected.

49-3.02C(6) Permanent Steel Casing Installation

Section 49-2.01A(4)(c) and the 6th through 8th paragraphs of section 49-2.01C(5) do not apply to permanent steel casings.

For permanent steel casings placed in a drilled hole:

1. *Casings must be watertight and of sufficient strength to prevent damage and to withstand the loads from installation, drilling and tooling equipment, lateral concrete pressures, and earth pressures.*

2. *Use spacers to center the casing inside the drilled hole. You may weld spacers to the outside of the casing.*

3. *Fill voids in the annular space between the casing and the soil with grout.*
4. *Place grout from the bottom of the casing using grout tubes. Place grout continuously until all voids have been filled and the grout reaches the top of the casing. Free fall of the grout from the top to the bottom of the casing is not allowed.*

5. *Pump grout into the annular space such that the grout head is maintained uniformly around the casing and no visible evidence of water or air is ejected at the top of the grout.*

6. *Place grout tubes along the circumference of the casing with a minimum of 4 grout tubes per casing. The spacing of the grout tubes must not exceed 4 feet.*
7. *Extend grout tubes to within 1 foot of the bottom of the casing.*

If the Engineer lowers the permanent steel casing tip elevation:

1. *CIDH concrete pile, including bar reinforcing steel and inspection pipes, must extend to that same elevation*

2. *Tip elevation of the rock socket must extend to maintain the length of the rock socket into rock as shown*

The additional work involved in lowering the permanent steel casing tip elevation is change order work.

49-3.02C(7) Construction Joint

Section 49-3.02C(7) applies to CIDH concrete piles if 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 or a dry hole, 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(6).*

Section 49-2.01A(4)(c) and the 6th through 8th paragraphs of section 49-2.01C(5) do not apply to permanent casings specified in section 49-3.02C(7).

49-3.02C(8) Placing Concrete

Section 51-1.03D(3) does not apply to CIDH concrete piles.

You may construct CIDH concrete piles 24 inches in diameter or larger by excavating and depositing concrete under slurry.

Form, finish, and cure portions of CIDH concrete piles shown to be formed under section 51.

49-3.02C(9) Placing Concrete Under Slurry

49-3.02C(9)(a) General

Section 49-3.02C(9) applies if placing concrete under slurry.

If drill cuttings settle out of the slurry, clean the bottom of the drilled hole after placing reinforcement and before placing concrete in the drilled hole. Verify that the bottom of the drilled hole is clean.

Carefully place concrete in a compact, monolithic mass, using a method that prevents washing of the concrete. Do not vibrate the concrete.

Placing concrete must be a continuous operation lasting no longer than the time specified for each concrete placing operation at each pile in your pile installation plan.

The delivery tube system must consist of one of the following:

1. *Tremie tube or tubes, each of which is at least 10 inches in diameter, fed by 1 or more concrete pumps*
2. *1 or more concrete pump discharge tubes, each fed by a single concrete pump*

The delivery tube system must consist of watertight tubes with sufficient rigidity to keep the tube ends always in the mass of concrete placed. If only 1 delivery tube is used to place the concrete, place the tube near the center of the hole. Multiple tubes must be uniformly spaced in the hole.

Internal bracing for the steel reinforcing cage must accommodate the delivery tube system. Do not use tremies for piles without space for a 10-inch-diameter tube.

During concrete placement, provide a fully operational standby concrete pump and slurry pump at the job site that is adequate to complete the work in the time specified in the pile installation plan.

Do not allow concrete to fall into the slurry during concrete placing operations. Cap the delivery tube with a watertight cap, or plug the tube above the slurry level with a good-quality, tight-fitting, moving plug that expels the slurry from the tube as the tube is charged with concrete. The cap or plug must be designed to release as the tube is charged.

Extend the pump discharge or tremie tube to the bottom of the hole before charging the tube with concrete. After charging the tube with concrete, induce the flow of concrete through the tube by slightly raising the discharge end.

During concrete placement:

1. *Embed the tip of the delivery tube within 6 inches of the bottom of the hole until 10 feet of concrete has been placed. Maintain the embedment of the tip at least 10 feet below the top surface of the concrete.*
2. *Do not rapidly raise or lower the delivery tube.*
3. *Maintain the slurry level at a height required to maintain a stable hole, but not less than 10 feet above the piezometric head.*

If the seal is lost or the delivery tube becomes plugged and must be removed:

1. *Withdraw and clean the tube*
2. *Cap the tip of the tube to prevent slurry from entering*
3. *Restart the operation by pushing the capped tube 10 feet into the concrete and then reinitiating the flow of concrete*

Maintain a log of concrete placement for each drilled hole.

If a temporary casing is used, maintain concrete placed under slurry at a level required to maintain a stable hole, but not less than 5 feet above the bottom of the casing. The withdrawal of the casing must not cause contamination of the concrete with slurry.

The equivalent hydrostatic pressure inside the casing must be greater than the hydrostatic pressure on the outside of the casing to prevent intrusion of water, slurry, or soil into the column of freshly placed concrete.

Remove scum, laitance, and slurry-contaminated concrete from the top of the pile.

Dispose of material resulting from using slurry.

49-3.02C(9)(b) Mineral Slurry

Remove any caked slurry on the sides or bottom of hole before placing reinforcement.

If concrete is not placed immediately after placing reinforcement, the reinforcement must be removed and cleaned of slurry, the sides of the drilled hole must be cleaned of caked slurry, and the reinforcement again placed in the hole for concrete placement.

49-3.02C(9)(c) Synthetic Slurry

A manufacturer's representative must:

1. *Provide technical assistance for the use of their material*
2. *Be at the job site before introduction of the synthetic slurry into the drilled hole*
3. *Remain at the job site until released by the Engineer*

After the manufacturer's representative has been released by the Engineer, your employee certified by the manufacturer must be present during the construction of the pile under slurry.

49-3.02D Payment

Not Used

BIG-FOOT synthetic slurry must comply with the requirements shown in the following table:

BIG-FOOT

Quality characteristic	*Test method*	*Requirement*
Density *During drilling (pcf)* *Before final cleaning and immediately before placing concrete (pcf)*	*Mud weight (density), API RP 13B-1, section 4*	*≤ 64.0[a]* *≤ 64.0[a]*
Viscosity *During drilling (sec/qt)* *Before final cleaning and immediately before placing concrete (sec/qt)*	*Marsh funnel and cup. API RP 13B-1, section 6.2*	*30–125* *55-114*
pH	*Glass electrode pH meter or pH paper*	*8.5–10.5*
Sand content, percent by volume *Before final cleaning and immediately before placing concrete (%)*	*Sand, API RP 13B-1, section 9*	*≤ 1.0*

NOTE: Slurry temperature must be at least 40 °F when tested.

[a]If authorized, you may use slurry in a salt water environment. The allowable density of slurry in a salt water environment may be increased by 2 pcf.

POLY-BORE synthetic slurry must comply with the requirements shown in the following table:

POLY-BORE

Quality characteristic	*Test method*	*Requirement*
Density *During drilling (pcf)* *Before final cleaning and immediately before placing concrete (pcf)*	*Mud weight (density), API RP 13B-1, section 4*	*62.8-65.8[a]* *62.8-64.0[a]*
Viscosity *During drilling (sec/qt)* *Before final cleaning and immediately before placing concrete (sec/qt)*	*Marsh funnel and cup. API RP 13B-1, section 6.2*	*50–80* *50-80*
pH	*Glass electrode pH meter or pH paper*	*7.0–10.0*
Sand content, percent by volume *Before final cleaning and immediately before placing concrete (%)*	*Sand, API RP 13B-1, section 9*	*≤ 1.0*

NOTE: Slurry temperature must be at least 40 °F when tested.

[a]If authorized, you may use slurry in a salt water environment. The allowable density of slurry in a salt water environment may be increased by 2 pcf.

50 PRESTRESSING CONCRETE

50-1 GENERAL

50-1.01 GENERAL

50-1.01A Summary

Section 50 includes specifications for prestressing concrete.

50-1.01B Definitions *Reserved*

50-1.01C Submittals

50-1.01C(1) General

Submit test samples to METS. Notify the Engineer of each submittal. Include in the notification the date and contents of the submittal.

50-1.01C(2) Certifications

Submit the certifications specified in the following to METS:

1. *ASTM A416/A416M for uncoated seven-wire steel strand*
2. *ASTM A722/A722M for uncoated HS-steel bars*
3. *ASTM A882/A882M for filled epoxy-coated seven-wire prestressing steel strand*

Include with each certification:

1. *Representative load-elongation curve for each size and grade of strand and for each size of bar*
2. *Copy of the QC tests performed by the manufacturer*

50-1.01C(3) Shop Drawings

Submit shop drawings for the proposed prestressing system to OSD, Documents Unit. Notify the Engineer of the submittal. Include in the notification the date and list of contents of the submittal.

For initial review, submit:

1. *6 copies for railroad bridges unless the project includes a BNSF Railway underpass*
2. *8 copies for railroad bridges if the project includes a BNSF Railway underpass*
3. *4 copies for structures other than railroad bridges*

After initial review, submit from 6 to 12 copies to OSD, Documents Unit, if requested.

The shop drawings must show complete details and substantiating calculations of the method and materials proposed for use in the prestressing activities, including the addition or rearrangement of reinforcing steel.

The details must outline the method and sequence of stressing and include:

1. *Complete specifications and details of the prestressing steel and anchorage system.*
2. *Jacking stresses.*
3. *Type of ducts.*
4. *Proposed arrangement of the prestressing steel in the members.*
5. *Exact location of anchorage system components, ducts, and other related elements. Show duct location data, including elevations, at least every 1/8th point of the span for each span.*
6. *Elongation calculations.*
7. *All other data pertaining to the prestressing.*

Each shop drawing submittal must consist of drawings for a single bridge or portion of a bridge. For multiframe bridges, each frame must have a separate shop drawing submittal

Allow the following time for review of the shop drawings:

1. *60 days for railroad bridges*
2. *45 days for structures other than railroad bridges*

For railroad bridges, comply with the requirements of the railroad company involved.

Include a grouting plan with your shop drawing submittal. If you propose an alternative prestressing system for a CIP PS box girder bridge, submit shop drawings, including all details and checked calculations.

50-1.01C(4) Alternative Prestressing Systems for Cast-In-Place Prestressed Box Girder Bridges

Replace the introductory clause of the 1st paragraph of section 50-1.01C(4) with:

The details shown for CIP PS box girder bridges are based on a combination of bonded partial-length tendon and bonded full-length draped tendon prestressing systems. You may submit a VECP for an alternative prestressing system that varies the percentage of bonded partial-length tendons and bonded full-length draped tendons if the proposed system and associated details comply with the following requirements:

~~*The details shown for CIP PS box girder bridges are based on a bonded full-length draped tendon prestressing system.You may submit a VECP for an alternative prestressing system using bonded partiallength tendons. The proposed system and associated details must comply with the following requirements:*~~

1. *Moment and shear resistances must be at least equal to those used for the design of the structure shown.*
2. *Concrete strength must be at least that shown.*
3. *Not less than 35 percent of the total prestressing force at any section must be provided by full-length draped tendons.*
4. *Anchorage blocks for partial-length tendons must be located such that the blocks will not interfere with the placement of the utility facilities shown or any future utilities to be placed through openings shown.*
5. *Any temporary prestressing tendons must be de-tensioned, and the temporary ducts must be filled with grout before completion of the work. Temporary tendons must be either removed or fully encased in grout before completion of the work.*

At your request, the Department furnishes you with the demand moments and shears used in the design shown.

50-1.01C(5) Test Samples

Submit test samples for the materials to be used in the work as shown in the following table:

Material	*Number of test samples*	*Test sample description*
Uncoated strand[a]	*1*	*4-foot-long sample from each reel or pack*
Epoxy-coated strand:		
Uncoated strand[a]	*1*	*4-foot-long sample of uncoated strand removed from each reel or pack before coating*
Coated strand[a]	*4*	*5-foot-long sample from each reel or pack of coated strand*
Epoxy powder	*1*	*8-ounce sample from each batch[b]*
Epoxy patching material	*1*	*8-ounce sample from each batch[b]*
Bar[a]	*1*	*7-foot-long sample of each size for each heat*
Bar coupler[a]	*1*	*Coupler from each lot of couplers with two 4-foot-long bars[c]*
Anchorage assemblies[a]	*1*	*Anchorage assembly from each lot of anchorage assemblies*

[a]Randomly selected by the Engineer. [b]Packaged in an airtight container and identified with the manufacturer's name and batch number.
[c]Submit coupler and bar samples assembled. The bars must be from the same bar heats to be used in the work.

Sampling must comply with the requirements of the ASTM to be used for testing the sample.

With each bar or strand test sample, include a certificate from the manufacturer stating the minimum guaranteed ultimate tensile strength of each sample.

Identify each test sample by location and Contract number with weatherproof markings.

Allow 45 days for the Department's testing.

Obtain the Department's authorization of the material before incorporating it into the work.

50-1.01C(6) Grouting Plan

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 and 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 for 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. *Forms for recording grouting information*
14. *Procedure for secondary grouting*
15. *Names of people who will perform grouting activities and their relevant experience and certifications*

50-1.01C(7) Daily Grouting Report

Submit a daily grouting report for each day grouting is performed. Submit the report within 3 business 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 the grouting occurred*
3. *Time the grouting started and ended*
4. *Date of placing the prestressing steel in each duct*
5. *Date of stressing*
6. *Type of grout used*
7. *Injection end and applied grouting pressure*
8. *Actual and theoretical quantities of grout used to fill each 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 the results*
12. *Names of personnel performing the grouting activity*
13. *Summary of problems encountered and corrective actions taken*
14. *Summary of void investigation and repairs made*

50-1.01C(8) Post-tensioning Jack Calibration Chart *Submit the post-tensioning jack calibration plot.*

50-1.01C(9) Pretensioning Jack Calibration Chart

For any pretensioning jack calibrated by an authorized laboratory, submit a certified calibration plot.

50-1.01D Quality Assurance

50-1.01D(1) General

For accurate identification, assign an individual lot number and tag each lot of the following items to be shipped to the job site or casting site:

1. *Bars of each size from each heat*
2. *Strand from each reel or pack*
3. *Anchorage assemblies*
4. *Bar couplers*

The Department rejects any unidentified prestressing steel, anchorage assemblies, or bar couplers received at the job site or casting site.

50-1.01D(2) Quality Control

50-1.01D(2)(a) General

Reserved

50-1.01D(2)(b) Equipment and Calibration

50-1.01D(2)(b)(i) General

Each jack body must be permanently marked with the ram area.

Each pressure gauge 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.

Each load cell must be calibrated and have an indicator that can be used to determine the force in the prestressing steel.

The range of each load cell must be such that the lower 10 percent of the manufacturer's rated capacity is not used in determining the jacking force.

Each jack must be calibrated equipped with its gauges.

Mechanically calibrate the gauges with a dead weight tester or other authorized means before calibration of the jacking equipment.

50-1.01D(2)(b)(ii) Post-tensioning

Equip each hydraulic jack used to tension prestressing steel with 2 pressure gauges or 1 pressure gauge and a load cell. Only 1 pressure gauge must be connected to the jack during stressing.

Each jack used to tension prestressing steel permanently anchored at 25 percent or more of its specified minimum ultimate tensile strength must be calibrated by METS within 1 year of use and after each repair. You must:

1. *Schedule the calibration of the jacking equipment with METS.*
2. *Verify that the jack and supporting systems are complete, with proper components, and are in good operating condition.*
3. *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.*
4. *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 180 days of use and after each repair.

50-1.01D(2)(b)(iii) Pretensioning

Each jack used to pretension prestressing steel must be calibrated, equipped with its gauges, by a laboratory on the Authorized Laboratories List to perform pretensioning calibrations within 1 year of use and after each repair.

Calibrate pretensioning jacks:

1. *Under ASTM E4 using an authorized laboratory. Certification that the calibration is performed to ASTM accuracy is not required.*
2. *In the presence of the Engineer. Notify the Engineer at least 2 business days before calibrating the jack.*
3. *Using 3 test cycles. Average the forces from each test cycle at each increment.*
4. *To cover the load range used in the work.*

Gauges for pretensioning jacks may:

1. *Be electronic pressure indicators that display either:*
   1.1. *Pressure in 100 psi increments or less*
   1.2. *Load to 1 percent of the maximum sensor/indicator capacity or 2 percent of the maximum load applied, whichever is smaller*
2. *Have a dial less than 6 inches in diameter*

Gauges displaying pressure must have been calibrated within 1 year of the jack calibration.

Each hydraulic jack used for pretensioning must be equipped with either 2 gauges or 1 gauge and a load cell or you must have a calibrated standby jack with its gauge present on site during stressing.

50-1.01D(2)(c) 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 gauge 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. *Repair the leaks with authorized methods and retest if a pressure loss exceeds 25 psi.*

Compressed air used to clear and test the ducts must be clean, dry, and free from oil or contaminants.

50-1.01D(2)(d) Duct Demonstrations for 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.

Demonstrations must be performed in the presence of the Engineer.

50-1.01D(2)(e) Void Investigation

In the presence of the Engineer, investigate the ducts for voids between 24 and 72 hours after grouting. As a minimum, inspect the inlet and outlet ports at the anchorages and at high points in the tendons for voids after removal of the inlet and outlet pipes. Completely fill any voids found with secondary grout.

50-1.01D(2)(f) 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.

Perform 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.

50-1.01D(3) Department Acceptance

The Department tests the prestressing steel test samples for compliance with section 50-1.02B.

The Department tests the efflux time of grout under California Test 541.

The Department may verify the prestressing force using the Department's load cells.

The Department determines the reduction of area of each test sample bar with the deformations removed. The deformations are removed by machining the bar no more than necessary to remove the deformations over a length of 12 inches.

If couplers are used to extend bars, the Department rejects the heat of bars and lot of couplers represented by the assembled unit test sample if the sample does not have a tensile strength of at least the manufacturer's minimum guaranteed ultimate tensile strength of the bars.

Prestressing steel that sustained physical damage is rejected.

Prestressing steel is rejected if surface rust either (1) cannot be removed by hand-cleaning with a fine steel wool pad or (2) leaves pits visible to the unaided eye after hand-cleaning.

If non-epoxy-coated prestressing steel is installed in the ducts of post-tensioned members after completion of concrete curing and if tensioning and grouting are completed within 10 days after the installation, then (1) rust that may form during this period is not cause for rejection of the steel and (2) the use of a corrosion inhibitor in the duct is not required after installation.

50-1.02 MATERIALS

50-1.02A General

Post-tensioning prestressing systems must be on the Authorized Material List for post-tensioning systems.

Organic zinc-rich primer must be on the Authorized Material List for organic zinc rich primer.

50-1.02B Prestressing Steel

Uncoated strand must comply with ASTM A416/A416M.

Epoxy-coated strand must comply with ASTM A882/A882M, grit impregnated coating, including annex A1.

Bars must comply with ASTM A722/A722M, Type II, including all supplementary requirements, except the maximum weight requirements do not apply. The reduction of area of bars with deformations removed must be at least 20 percent.

If couplers are used to extend bars:

1. *Assembled units must have a tensile strength of at least the manufacturer's minimum guaranteed ultimate tensile strength of the bars*
2. *Location of couplers in the member must be authorized*

Protect the prestressing steel against physical damage and rust or other results of corrosion at all times, from manufacture to grouting or encasing in concrete.

Package the prestressing steel in containers or shipping forms that protect the steel against physical damage and corrosion during shipping and storage. Except for epoxy-coated strand, a corrosion inhibitor that prevents rust or other results of corrosion must be (1) placed in the container or shipping form, (2) incorporated in a corrosion-inhibitor-carrier-type packaging material, or (3) applied directly to the steel if authorized.

Corrosion inhibitors must not have a deleterious effect on the steel, concrete, or bond strength of the steel to concrete.

Clearly mark each shipping container or form with:

1. *Statement that the package contains prestressing steel*
2. *Type of corrosion inhibitor used*
3. *Date packaged*

Immediately replace or restore any damaged container or shipping form to its original condition.

Do not store epoxy-coated strand within 1,000 feet of ocean or tidal water for more than 60 days.

Patching material for epoxy-coated strand must be:

1. *Furnished by the manufacturer of the epoxy powder*
2. *Applied under the manufacturer's instructions*
3. *Compatible with the original epoxy powder material*
4. *Inert in concrete*

50-1.02C 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 90-1.02E except admixtures must not contain chloride ions in excess of 0.25 percent by weight.

The efflux time of grout immediately after mixing must be at least 11 seconds. Determine the efflux time under California Test 541.

Secondary grout must:

1. *Comply with ASTM C1107*
2. *Not have a deleterious effect on the steel, concrete, or bond strength of the steel to the concrete*

50-1.02D Ducts

Ducts for prestressing steel must:

1. *Be galvanized rigid ferrous metal.*
2. *Be fabricated with either welded or interlocked seams except galvanizing of the welded seams is not required.*
3. *Be mortar tight.*
4. *Have sufficient strength to maintain their correct alignment during placing of concrete.*

5. *Have positive metallic connections at joints between sections that do not result in angle changes at the joints.*

6. *Have waterproof tape at the connections.*
7. *Have bends that are not crimped or flattened.*
8. *Have ferrous metal or polyolefin transition couplings connecting the ducts to anchorage system components. Ferrous metal transition couplings need not be galvanized.*

9. *Have an inside cross-sectional area of at least 2.5 times the net area of the prestressing steel for multistrand tendons.*

10. *Have an inside diameter of at least 1/2 inch larger than the diameter of the bar.*
11. *Have an outside diameter not exceeding 50 percent of the girder web width.*

Furnish all ducts or anchorage assemblies with pipes or other suitable connections for the injection of grout after prestressing.

50-1.02E Vents

Vent all ducts having a vertical duct profile change of 6 inches or more. Vents must:

1. *Be at least 1/2-inch-diameter standard pipe or suitable plastic pipe.*
2. *Be connected to ducts using metallic or plastic structural fasteners. Plastic components must not react with the concrete or enhance corrosion of the prestressing steel and be free from water soluble chlorides.*
3. *Be mortar tight and taped as necessary.*
4. *Provide a means for injection of grout through the vents and for sealing the vents.*

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 D1693, 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 fasteners complying with ASTM F593. All fastener components must be alloy 316.*

5. *Be pressure rated at or above 150 psi.*

50-1.02G Debonding 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.

50-1.02H Anchorage System

The anchorage system for post-tensioning must:

1. *Be capable of holding 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 secure the ends of the prestressing steel*

3. *Be equipped with permanent grout caps*

50-1.03 CONSTRUCTION

50-1.03A General

50-1.03A(1) General

If authorized, you may:

1. *Apply a portion of the total prestressing force to a PC member before the member has obtained the concrete strength shown*
2. *Move the member after applying the portion of prestressing force*

Except for epoxy-coated strand, prestressing steel installed in members before placing and curing of the concrete must be continuously protected against rust or other results of corrosion until grouted. Protect the steel by using a corrosion inhibitor placed in the ducts or applied to the steel in the duct.

After final fabrication of the strand, do not perform any electric welding on the prestressing steel. If electric welding is performed on or near members containing prestressing steel, attach the welding ground directly to the steel being welded.

50-1.03A(2) Epoxy-Coated Strand

Cover epoxy-coated strand with an opaque polyethylene sheeting or other suitable protective material to protect the strand from exposure to sunlight, salt spray, and weather. For stacked coils, drape the protective covering around the perimeter of the stack. The covering must be adequately secured and allow for air circulation around the strand to prevent condensation under the covering.

Cut epoxy-coated strand using an abrasive saw.

Patch all visible damage to the epoxy coating caused by shipping, job site or casting site handling, installation, or cutting of ends under ASTM A882/A882M.

50-1.03A(3) Ducts

Accurately place prestressing ducts. Securely fasten the ducts in place to prevent movement of the ducts during concrete placement.

After installation, cover the duct ends and vents to prevent water or debris from entering.

Support ducts vertically and horizontally during concrete placement at a maximum spacing of 4 feet.

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.

50-1.03A(4) 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*

50-1.03B Prestressing

50-1.03B(1) General

Tension the prestressing steel using hydraulic jacks. The force in the prestressing steel must be the value shown in the shop drawings.

After seating, the maximum tensile stress in the prestressing steel must not exceed 75 percent of the minimum ultimate tensile strength shown.

50-1.03B(2) Post-Tensioned Members

50-1.03B(2)(a) General

If requested, for verification of the force in the prestressing steel, furnish the resources necessary to install and support the Department's testing equipment at the prestressing steel location and to remove the equipment after the testing is complete.

Conduct the tensioning process such that the force being applied and the elongation of the prestressing steel can be measured at all times.

The maximum temporary tensile stress in the prestressing steel of post-tensioned members must not exceed 75 percent of the specified minimum ultimate tensile strength of the prestressing steel.

If steam curing is used for PC members, do not install prestressing steel for post-tensioning until the steam curing is completed.

Do not tension the prestressing steel of post-tensioned members until (1) at least 10 days after the last concrete has been placed in the member and (2) the concrete has attained the compressive strength described.

Distribute the prestressing force of post-tensioned bridge girders with an approximately equal quantity in each girder and place the force symmetrically about the centerline of the structure. In slabs, distribute the prestressing force uniformly across the slab.

Sequence the stressing of post-tensioned bridge girders such that no more than 1/2 of the prestressing force in any girder is applied before an equal force is applied in the adjacent girders. The maximum temporary force variation between girders must not exceed the prestressing force of the largest tendon used in all girders. Do not apply an eccentric force about the centerline of the structure that exceeds 1/6 of the total prestressing force at any time during the prestressing.

50-1.03B(2)(b) Losses

Reserved

50-1.03B(2)(c) Anchorages and Distribution

The ends of post-tensioned prestressing steel must be secured with a permanent type anchoring system.

You may omit steel distribution plates or assemblies if you use an anchorage device of a type that is sufficiently large and that is used in conjunction with a steel grillage embedded in the concrete that effectively distributes the compressive stresses to the concrete.

If loop tendon anchorages are used, enclose the anchorages in ducts for their entire length.

Where the end of a post-tensioned assembly is not to be covered by concrete, recess the anchorage system such that the ends of the prestressing steel and all parts of the anchorage system are at least 2 inches inside of the end surface of the members. After post-tensioning, fill the recesses with concrete and finish flush.

The concrete used to fill the recess must be the same as that used for the structure.

The load from the anchorage system must be effectively distributed to the concrete such that:

1. Concrete bearing stress directly underneath the plate or assembly does not exceed 3,300 psi 2. When the prestressing steel is tensioned to 95 percent of its specified ultimate tensile strength:
2.1. Bending stress in the plate material or assembly material does not exceed the yield point of the material
2.2. No visible distortion is evident in the anchorage plate

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 from oil or contaminants.

Prevent the leakage of grout through the anchorage assembly by positive mechanical means.

Before starting daily grouting activities, drain the pump system to remove any water from the piping system.

Break down and thoroughly clean the pump and piping system after each grouting session.

After completing duct grouting activities:

1. *Abrasive blast clean and expose the aggregate of concrete surfaces where concrete is to be placed to cover and encase the anchorage assemblies*

2. *Remove the ends of vents 1 inch below the roadway surface*

50-1.03B(2)(d)(ii) Grouting Equipment *Grouting equipment must be:*

1. *Capable of grouting at a pressure of at least 100 psi*
2. *Equipped with a pressure gauge 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. 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)(iii) 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)(iv) 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 one continuous activity 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.

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, 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. 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.

After closing all vents, 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)(v) 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 after the placement of grout, provide adequate means to protect the grout in the ducts from damage by freezing.

50-1.03B(2)(d)(vi) Curing

During grouting and for a period of 24 hours after grouting, eliminate vibration from Contractor-controlled sources within 100 feet of the frame 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 the 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 set and cured for at least 24 hours.

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 adjacent 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.

50-1.03B(2)(d)(ix) Secondary Grouting

Perform secondary grouting by vacuum grouting.

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 a 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(3) Pretensioned Members

50-1.03B(3)(a) General

Anchor the prestressing steel at stresses that will result in the ultimate retention of jacking forces at least equal to those shown.

If prestressing steel for pretensioning is placed in the stressing bed and is to be exposed to the elements for more than 36 hours before encasing in concrete, protect the steel from contamination and corrosion using authorized measures.

Do not cut or release prestressing steel in pretensioned members until the concrete in the member has attained a compressive strength of at least the value shown or 4,000 psi, whichever is greater. If epoxycoated strand is used, do not cut or release the steel until the temperature of the concrete surrounding the strand is less than 150 degrees F and falling.

If requested, check individually-tensioned strands using authorized methods and equipment for loss of prestress not more than 48 hours before placing concrete for the members. Strands showing a loss of prestress of more than 3 percent must be retensioned to the original computed jacking force.

If prestressing steel in pretensioned members is tensioned at a temperature appreciably lower than the estimated temperature of the concrete and the prestressing steel at the time of initial set of the concrete, the calculated elongation of the prestressing steel must be increased to compensate for the loss in stress.

The maximum temporary tensile stress in the prestressing steel of pretensioned members must not exceed 80 percent of the specified minimum ultimate tensile strength of the prestressing steel.

Cut and release the prestressing steel in pretensioned members in such an order that lateral eccentricity of the prestress force is a minimum.

Cut off pretensioned prestressing steel flush with the end of the member. After cutting the steel, clean and paint the exposed ends of the steel and a 1-inch strip of adjoining concrete as follows:

1. *Wire brush or abrasive blast clean to remove all dirt and residue on the metal and concrete surfaces.*
2. *Immediately after cleaning, apply 1 coat of organic zinc-rich primer to the surfaces except apply 2 coats to surfaces that will not be covered by concrete or mortar. Do not use aerosol cans. Mix the paint thoroughly when applying and work into any voids in the prestressing steel.*

50-1.03B(3)(b) Debonding Prestressing Strands

Where debond prestressing strands are shown, debond the strands by encasing the strands in plastic sheathing along the entire length shown and sealing the ends of the sheathing with waterproof tape.

Distribute the debonded strands symmetrically about the vertical centerline of the girder. The debonded lengths of pairs of strands must be equal.

Do not end debonding at any one cross section of the member for more than 40 percent of the debonded strands or 4 strands, whichever is greater.

Thoroughly seal the ends with waterproof tape to prevent the intrusion of water or cement paste before placing the concrete.

50-1.04 PAYMENT

Not Used

51 CONCRETE STRUCTURES

51-1 GENERAL

51-1.01 GENERAL

51-1.01A Summary

Section 51-1 includes general specifications for constructing concrete structures.

Earthwork for the following concrete structures must comply with section 19-3:

1. *Sound wall footings*
2. *Sound wall pile caps*
3. *Culverts*
4. *Barrier slabs*
5. *Junction structures*
6. *Minor structures*
7. *Pipe culvert headwalls, endwalls, and wingwalls*
8. *Pile extensions*
9. *Drainage inlets*

Falsework must comply with section 48-2.

Joints must comply with section 51-2.

Elastomeric bearing pads must comply with section 51-3.02.

Reinforcement for the following concrete structures must comply with section 52:

1. *Sound wall footings*
2. *Sound wall pile caps*
3. *Barrier slabs*
4. *Junction structures*
5. *Minor structures*
6. *PC concrete members*
7. *Drainage inlets*
8. *Pipe culvert headwalls and endwalls for a pipe with a diameter of less than 5 feet*

You may use RSC for a concrete structure only where the specifications allow the use of RSC.

51-1.01B Definitions form panel: *Continuous section of form facing material, unbroken by joint marks, against which concrete is placed.*

opening age: *Minimum age at which an element constructed with RSC may be opened to traffic.*

age of break: *Age in hours, determined by your testing, at which RSC attains its minimum specified compressive strength.* ***pier column:*** *Extension of a column or pier into bedrock material.*

51-1.01C Submittals

51-1.01C(1) General

Submit a deck placement work plan for concrete bridge decks.

If requested, submit shop drawings for PC members proposed by you. Include construction joint details, foundation bedding, and other requested information.

51-1.01C(2) Permanent Steel Deck Forms

Submit 3 copies of shop drawings for permanent steel deck forms. Include in the submittal:

1. *Layout plan*
2. *Grade of steel*

3 Physical and section properties of members

4. *Method of support and grade adjustment*
5. *Method for accommodating skew*
6. *Methods of sealing against grout leaks*

51-1.01C(3) Bonding Materials

Except for a bonding material previously authorized by the Department, submit at least a 45-pound test sample to METS. Allow 45 days for testing. Obtain the Department's authorization of the bonding material before incorporating it into the work.

For a bonding material previously authorized by the Department, submit a certificate of compliance for each shipment of the material.

51-1.01C(4) Rapid Strength Concrete

For RSC, submit the mix design at least 10 days before use. Include in the submittal:

1. *Compressive strength test results for prequalification of RSC at age of break, at 3 days, and at 28 days*
2. *Opening age in hours*
3. *Proposed aggregate gradation*
4. *Mix proportions of cementitious material, aggregate, and water*

5. *Types and quantities of chemical admixtures, if used*
6. *Range of ambient temperatures over which the mix design will achieve the required minimum compressive strength*
7. *Source of materials*

51-1.01C(5) Chemical Adhesives

Submit chemical adhesive manufacturer's installation procedures and warnings or precautions as an informational submittal at least 2 business days before starting work.

Submit 1 test sample of each chemical adhesive system to be used from each lot to METS for testing at least 25 days before use. The test sample must consist of 1 unit of chemical adhesive, 1 mixing nozzle, and 1 retaining nut. A lot for chemical adhesives is 100 units, or fraction thereof, of the same brand and product name.

Each test sample must be clearly marked with the following:

1. *Manufacturer's name and system model number*
2. *Date of manufacture*
3. *Lot number*
4. *Shelf life or expiration date*

51-1.01C(6) Colored Concrete

Submit technical data, manufacturer's specifications, and a work plan for mixing, delivery, placement, finishing, and curing of colored concrete.

51-1.01C(7) Hinge Tiedowns

Reserved

51-1.01D Quality Assurance

51-1.01D(1) General

Reserved

51-1.01D(2) Quality Control

51-1.01D(2)(a) General

Reserved

51-1.01D(2)(b) Rapid Strength Concrete

51-1.01D(2)(b)(i) General

Reserved

51-1.01D(2)(b)(ii) Prequalification of Mix Design

Prequalify RSC under section 90-1.01D(5)(b) before use. Prequalification of an RSC mix design includes determining the opening age and attaining the specified minimum 28-day compressive strength.

Determine the opening age of the RSC mix design as follows:

1. *Fabricate at least 5 test cylinders to be used to determine the age of break.*
2. *Immediately after fabrication of the 5 test cylinders, store the cylinders in a temperature medium of 70 ± 3 degrees F until the cylinders are tested.*
3. *Determine the age of break to attain an average strength of the 5 test cylinders.*
4. *Opening age is the age of break plus 1 hour.*

The average strength of the 5 test cylinders must be at least the minimum specified compressive strength. Not more than 2 test cylinders may have a strength of less than 95 percent of the minimum specified compressive strength.

If compressive strength tests performed in the field show that the RSC has attained the minimum specified compressive strength, you may open the lane to traffic at the age of break. Perform the compressive strength

tests under the specifications for sampling and testing cylinders in section 901.01D(5)(a). If you choose to use this option, notify the Engineer before starting construction.

51-1.01D(2)(b)(iii) Mock-ups

Reserved

51-1.01D(2)(c) Test Panels

Test panels must be:

1. *Constructed at an authorized location*
2. *At least 4 by 4 feet by 5 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 panels be constructed until the specified finish, texture, and color are attained.

The Engineer uses the authorized test panel to determine acceptability of the work.

51-1.01D(3) Department Acceptance

51-1.01D(3)(a) General

Reserved

51-1.01D(3)(b) Testing Concrete Surfaces

51-1.01D(3)(b)(i) General

The Engineer tests roadway concrete surfaces for smoothness, coefficient of friction, and crack intensity.

The Engineer tests POC concrete deck surfaces for smoothness and crack intensity.

51-1.01D(3)(b)(ii) Surface Smoothness

The Engineer tests the surface smoothness of the following:

1. *Completed roadway concrete surfaces of structures and approach slabs and the adjacent 50 feet of approach pavement*
2. *Surfaces of concrete decks to be covered with another material*
3. *Completed concrete deck surfaces, including ramps and landings of POCs*

You must schedule smoothness testing. Allow 10 days for the Engineer to perform smoothness testing.

Before the testing, clean the test area and remove obstructions.

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*

Deck surfaces must comply with the following smoothness requirements:

1. *Profile trace having no high points over 0.02 foot*
2. *Profile count of 5 or less in any 100-foot section for portions within the traveled way*
3. *Surface not varying more than 0.02 foot from the lower edge of a 12-foot-long straightedge placed transversely to traffic*

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-footlong 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*

Grind surfaces not complying with the smoothness requirements under section 42-3 until the required smoothness is attained. Grinding must not reduce the concrete cover on the reinforcing steel to less than 1-1/2 inches.

Replace portions of decks that cannot be corrected by grinding.

51-1.01D(3)(b)(iii) Coefficient of Friction

After deck surfaces and approach slabs have been textured, the Engineer tests the coefficient of friction of the concrete surfaces under California Test 342.

Deck surfaces and approach slabs must have a uniform surface texture with a coefficient of friction of not less than 0.35 when opened to traffic or before seal coats are placed, whichever occurs first.

If portions of completed deck surfaces or approach slabs have a coefficient of friction of less than 0.35, those portions must be ground or grooved parallel to the center line to produce a coefficient of friction of not less than 0.35. Grinding and grooving must comply with section 42.

The coefficient of friction requirements do not apply for bridge decks to be covered with membrane seals.

51-1.01D(3)(b)(iv) Crack Intensity

The Engineer measures crack intensity of deck surfaces after curing, before prestressing, and before falsework release. Clean the surface for the Engineer to measure surface crack intensity.

In any 500 sq ft portion of a new bridge deck surface, if there are more than 50 feet of cracks having a width at any point of over 0.02 inch, treat the deck with methacrylate resin under section 60-3.03B. Treat the entire deck width between barriers to 5 feet beyond where the furthest continuous crack emanating from the 500 sq ft section is 0.02 inch wide. Treat the deck surface before grinding.

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 60-3.03B. 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.

51-1.02 MATERIALS

51-1.02A General

Reserved

51-1.02B Concrete

Except for minor structures, the cementitious material content per cubic yard of concrete in structures or portions of structures must comply with the content shown in the following table:

Use	*Cementitious material content (lb/cu yd)*
Deck slabs and slab spans of bridges	*675–800*
Roof sections of exposed top box culverts	*675–800*
Pier columns	*675–800*
Seal courses	*675 min*
Other portions of structures	*590–800*

Concrete for PC members	*590–925*

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.

51-1.02C Bonding Materials

Bonding materials must be magnesium phosphate concrete, modified high-alumina-based concrete, or portland-cement-based concrete.

Magnesium phosphate concrete must be either single component that is water activated or dual component with prepackaged liquid activator.

Modified high-alumina-based concrete and portland-cement-based concrete must be water activated.

Bonding materials must comply with the requirements shown in the following table:

Quality characteristic	*Test method*	*Requirement*
Compressive strength (psi, min): *at 3 hours at 24* *hours*	*California Test 551*	 *3000* *5000*
Flexural strength at 24 hours (psi, min)	*California Test 551*	*500*
Bond strength at 24 hours (psi, min): *Saturated surface dry concrete* *Dry concrete*	*California Test 551*	 *300* *400*
Water absorption (percent, max)	*California Test 551*	*10*
Abrasion resistance at 24 hours (g, max)	*California Test 550*	*25*
Drying shrinkage at 4 days (percent, max)	*ASTM C596*	*0.13*
Soluble chlorides by weight (percent, max)	*California Test 422*	*0.05*
Water soluble sulfates by weight (percent, max)	*California Test 417*	*0.25*

Magnesium phosphate concrete must be formulated for a minimum initial set time of 15 minutes and minimum final set time of 25 minutes at 70 degrees F. Store the materials in a cool, dry environment before use.

The mix water used with water-activated material must comply with section 90-1.02D.

The quantity of water for single-component type or liquid activator for dual-component type to be blended with the dry component, must be within the limits recommended by the manufacturer and must be the least quantity required to produce a pourable batter.

If authorized, you may add retarders to magnesium phosphate concrete. The addition of retarders must comply with the manufacturer's instructions.

Magnesium phosphate concrete must not be mixed in containers or worked with tools containing zinc, cadmium, aluminum, or copper metals. Modified high alumina based concrete must not be mixed in containers or worked with tools containing aluminum.

51-1.02D Rapid Strength Concrete

RSC placed in bridge decks must contain at least 675 pounds of cementitious material per cubic yard.

RSC must have a minimum 28-day compressive strength of 4,000 psi except RSC placed in bridge decks must have a minimum 28-day compressive strength of 4,500 psi.

51-1.02E Colored Concrete

Color pigments for colored concrete must be iron oxides complying with ASTM C979/C979M. The dosage must not exceed 10 percent by weight of cementitious material in the concrete mix design.

When test panels are specified, cementitious materials and aggregates from the same sources used in the authorized test panel must be used for the colored concrete in the completed work.

51-1.02F Mortar

Mortar must be composed of cement, sand, and water. Materials for mortar must comply with section 90. The proportion of sand to cement measured by volume must be 2 to 1. Mortar must contain only enough water to allow placing and packing. Sand particles must be no larger than 1/2 the size of the recess or space in which the mortar is to be placed.

51-1.02G Grout

Grout must consist of portland cement and water, with a water content of at most 4 gallons per 94 pounds of cement.

51-1.02H Chemical Adhesives

Chemical adhesives for bonding dowels must be on the Authorized Material List for chemical adhesive/cartridge epoxies. The chemical adhesive must be appropriate for the installation conditions.

51-1.02I Miscellaneous Metal

Materials for access opening covers for new structures must comply with section 75-3.

Metal frames, covers, grates, and other miscellaneous iron and steel used with drainage inlets must comply with section 75-2.

51-1.02J Miscellaneous Materials

Plastic pipe for deck bleeder drains must be schedule 40 PVC complying with ASTM D1785.

Galvanized wire cloth for deck bleeder drains must be 1/4-inch mesh with 0.047-inch-diameter wire.

51-1.03 CONSTRUCTION

51-1.03A General

Reserved

51-1.03B Methods and Equipment

Vehicles weighing over 1,000 lb are not allowed on any bridge span until the concrete attains a compressive strength of at least 2,400 psi. Vehicles weighing over 4,000 lb are not allowed on any span until the concrete attains a compressive strength of at least 3,250 psi or attains an age of 28 days.

Vehicles exceeding the weight limitations in Veh Code Div 15 that cross bridges as allowed in section 51.37B must not make repetitive crossings of any span until the concrete attains an age of 28 days.

Vehicles with a gross weight over 10,000 lb are not allowed on any span of PS concrete structures until the prestressing steel for that span is tensioned.

If authorized, you may precast structural elements not designated as PC members.

You may use the slip form method for constructing pier shafts if (1) the results are equal to those obtained by compliance with these specifications and (2) adequate arrangements are made and carried out for curing, finishing, and protecting the concrete.

When slip forms are used for pier construction, the line and grade furnished by the Engineer is limited to establishing control points and checks of slip form position. You must provide targets, markers, or other devices for the Engineer to determine the pier shaft position.

Shotcrete is not allowed as an alternative construction method for reinforced concrete members.

You may construct warped portions of wingwalls at the ends of culverts using shotcrete complying with section 53-1.

You may use PC drainage inlets as an alternative to CIP drainage inlets.

51-1.03C Preparation

51-1.03C(1) General

Bottom of footing elevations shown are approximate.

The Engineer may order changes in footing dimensions or elevations.

Where a roughened concrete surface is described, roughen the existing concrete surface to a full amplitude of approximately 1/4 inch by abrasive blasting, water blasting, or using mechanical equipment.

Pump water from the interior of foundation enclosures without removing concrete materials. Do not pump water during concrete placement or for 24 hours after placing concrete, unless the pumping is done from a sump separated from the concrete work.

51-1.03C(2) Forms

51-1.03C(2)(a) General *Forms must be:*

1. *Mortar tight*
2. *True to the dimensions, lines, and grades of the structure*
3. *Strong enough to prevent deflection during concrete placement*

Face exposed surfaces of concrete structures with form panels.

Form panels for exposed surfaces must be plywood complying with or exceeding the requirements of U.S. Product Standard PS 1 for Exterior B-B (Concrete Form) Class I Plywood or any material that produces a similarly smooth, uniform surface. For exposed surfaces, use only form panels in good condition and free of defects such as scars, dents, or delaminations.

Design and construct forms for exposed surfaces such that surfaces do not undulate more than 3/32 inch or 1/270 of the center-to-center distance between studs, joists, form stiffeners, form fasteners, or wales in any direction. Stop using forms or forming systems that produce excessive undulations until modifications satisfactory to the Engineer are made. The Engineer may reject portions of structures with excessive undulations.

Form exposed surfaces of each element of a concrete structure with the same forming material or with materials that produce similar surface textures, color, and appearance.

Use form panels in uniform widths of at least 3 feet and uniform lengths of at least 6 feet except at the ends of continuously formed surfaces where the final panel length is less than 6 feet. For members less than 3 feet wide, form panels must be the width of the entire member.

Arrange form panels in symmetrical patterns conforming to the general lines of the structure. Place panels for vertical surfaces with the long dimension horizontal and horizontal joints level and continuous.

Form panels for curved column surfaces must be continuous for at least 1/4 of the circumference or 6 feet. For walls with sloping footings that do not abut other walls, you may place panels with the long dimension parallel to the footing.

Align form panels on each side of panel joints with supports or fasteners common to both panels so that a continuous, unbroken concrete plane results. Form filler panels that join prefabricated panels must (1) have a uniform width of at least 1 foot and (2) produce a smooth, uniform surface with consistent longitudinal joint lines between panels.

Construct forms for exposed surfaces with triangular fillets at least 3/4 by 3/4 inch. Attach fillets so as to prevent mortar runs and to produce smooth, straight chamfers at all sharp edges of the concrete.

For drainage inlets, extend the outside forms at least 12 inches below the top of the inlet. You may place concrete against excavated earth below this depth except:

1. *You must use full-depth outside forms or other protection when work activities or unstable earth may cause hazardous conditions or contamination of the concrete.*

2. *You must increase the wall thickness 2 inches if placing concrete against the excavated surface. The interior dimensions must be as shown.*

Clean inside form surfaces of dirt, mortar, and foreign material. Thoroughly coat forms to be removed with form oil before placing concrete. Form oil must:

1. *Be commercial quality or an equivalent coating*
2. *Allow the ready release of forms*

3. *Not discolor the concrete*

Do not place concrete in forms until:

1. *All form construction work has been completed, including removing foreign material*
2. *All materials to be embedded in the concrete have been placed*
3. *Engineer has inspected the forms*

Forms for concrete surfaces that will not be completely enclosed or hidden below the permanent ground surface must comply with the specifications for forms for exposed surfaces. Interior surfaces of underground drainage structures are considered completely enclosed surfaces.

Use form fasteners to prevent form spreading during concrete placement. Do not use twisted wire ties to hold forms in position.

Form fasteners and anchors must be of those types that can be removed as specified for form bolts in section 51-1.03F(2) without chipping, spalling, heating or otherwise damaging the concrete surface.

You may cast anchor devices into the concrete for supporting forms or lifting PC members. Do not use driven types of anchorages for fastening forms or form supports to concrete except for interior surfaces of girders in PS box girder bridges where:

1. *Girders have more than 2 inches of cover over the reinforcement*
2. *Anchorages do not penetrate the girder more than 2 inches and have a minimum spacing of 6 inches*
3. *Anchorages are placed at least 3 inches clear from the edge of concrete*

51-1.03C(2)(b) Removing Forms

Remove all forms, except soffit forms for deck slabs of CIP box girders, forms for the interior voids of PC members, and the forms in hollow abutments or piers may remain in place for any of the following conditions:

1. *Permanent access into the cells or voids is not shown*
2. *Utility facilities are not to be installed in the completed cells or voids*
3. *Utility facilities to be installed in completed cells or voids are to be inserted into casings that are placed before the completion of the cell or void*

4. *Permanent access is shown or utility facilities other than those in preplaced casings are to be installed in cells or voids, and you:*
    - 4.1 *Remove the portions of the forms that obstruct access openings or conflict with utility facilities.*
    - 4.2 *Provide a longitudinal crawl space at least 3 feet high and 2 feet wide throughout the length of these cells or voids*
    - 4.3 *Use a forming system that leaves no sharp projections into the cells or voids*
    - 4.4 *Remove forms between the hinge and 5 feet past the access openings in cells of CIP box girder bridges with access openings near the hinges*

Clear the inside of the cells or voids of all loose material before completing the forming for the deck of CIP box girders or for the cells or voids of other members when the forms are to remain in place, or after the removal of the forms or portions of forms.

You may remove forms that do not support the dead load of concrete if 24 hours have elapsed after concrete placement and the concrete has sufficient strength to prevent damage to the surface.

You may remove forms for railings or barriers after the concrete has hardened. Protect exposed surfaces from damage.

For drainage inlets, remove exterior forms to at least 12 inches below the final ground surface. Exterior forms below this depth may remain if their total thickness is not more than 1 inch.

51-1.03C(2)(c) Permanent Steel Deck Forms

51-1.03C(2)(c)(i) General

Permanent steel deck forms and supports must comply with ASTM A653/A653M, Designation SS, Grades 33 through 80, coating designation G165.

Permanent steel deck forms are only allowed where shown or if specified as an option in the special provisions.

51-1.03C(2)(c)(ii) Design Requirements

Design permanent steel deck forms based on the combined dead load of forms, reinforcement, and plastic concrete with an allowance for construction loads of at least 50 psf. The combined dead load must be assumed to be at least 160 pcf for normal concrete and 130 pcf for lightweight concrete.

Configure forms such that the weight of deck slab and forms is at most 110 percent of the weight of the deck slab as shown.

Compute the physical design properties under AISI's North American Specification for the Design of ColdFormed Steel Structural Members.

The design span for form sheets is the clear span of the form plus 2 inches, measured parallel to the form flutes.

Maximum allowable stresses and deflections are as follows:

1. *Tensile stress must not exceed the lesser of 0.725 times the specified yield strength or 36,000 psi.*
2. *Dead load deflection must not exceed the lesser of 0.0056 times the form span or 1/2 inch. The dead load for deflection calculations must be at least 120 psf total.*
3. *You may use form camber based on the actual dead load condition. Do not use camber to compensate for deflection exceeding the allowable limits.*

51-1.03C(2)(c)(iii) Installation

Do not weld steel deck forms to flanges of steel girders.

Permanent steel deck forms must not interfere with movement at deck expansion joints.

Clearance between deck forms and bar reinforcement must be at least 1 inch.

Do not use permanent steel deck forms for sections of deck slabs with longitudinal expansion joints unless additional supports are placed under the joint.

Do not rest form sheets directly on top of girder flanges. Fasten sheets securely to form supports. Provide at least 1 inch of bearing at each end. Place form supports in direct contact with girder flanges. Attach supports using bolts, clips, or other authorized means.

Locate transverse deck construction joints at the bottom of flutes. Field drill 1/4-inch weep holes at not less than 12 inches on center along the joint line.

Repair galvanized form surfaces damaged before installation by wire brushing to remove loose and cracked coating and applying 2 coats of zinc-rich primer. Do not use aerosol cans. You do not need to repair minor heat discoloration in welded areas.

51-1.03D Placing Concrete

51-1.03D(1) General

Thoroughly moisten forms and subgrade with water immediately before placing concrete.

Place and consolidate concrete using methods that (1) do not cause segregation of the aggregate and (2) produce dense, homogeneous concrete without voids or rock pockets.

Place concrete while fresh and before initial set. Do not retemper partially hardened concrete with additional water.

Place concrete continuously in each integral part of the structure. Do not start work unless placement can be completed uninterrupted.

Place concrete for girder spans in at least 2 operations. The last operation must consist of placing the deck slab. Allow at least 5 days between operations.

Place concrete as close to its final position as possible. Do not use vibrators for extensive shifting of concrete.

Except for CIP piles, do not allow fresh concrete to fall more than 8 feet without using pipes, tubes, or double belting to prevent segregation. Do not use double belting unless the member thickness is less than 16 inches.

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.

For structure footings over 2.5 feet in depth that have a top layer of reinforcement, reconsolidate the concrete to a depth of 1 foot after placing, consolidating, and initial screeding of the concrete. Reconsolidate the concrete as late as the concrete will respond again to vibration but not less than 15 minutes after the initial screeding.

Vibrators used for concrete with epoxy-coated reinforcement or prestressing steel must have a resilient covering to prevent damage to the epoxy coating.

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.

Do not place concrete for horizontal members until the concrete in supporting vertical members has been consolidated and settlement due to bleeding is complete.

Where shown, apply a bond breaker to joint surfaces.

Do not construct drainage structures to final grade until adjacent paving or surfacing is complete.

If using a mobile volumetric mixer, before each work shift and after each time the mixer is washed out, discharge at least 2 cubic feet of RSC into a concrete waste container before placing RSC into the work.

51-1.03D(2) Concrete Bridge Decks

For concrete decks placed on continuous steel girders or PC concrete girders, place the portion of deck over the supports last.

For decks on PC concrete girders, place intermediate and end diaphragms at least 5 days before placing the deck concrete.

For decks on structural steel, install cross frames the entire width of the bridge before placing the deck concrete.

Deck closure pours must comply with the following:

1. *During primary deck placement and for at least 24 hours after completing the deck placement, reinforcing steel protruding into the closure space must be free from any connection to reinforcing steel, concrete, forms, or other attachments of the adjacent structure.*
2. *Closure pour forms must be supported from the superstructure on both sides of the closure space.*

51-1.03D(3) Concrete Placed Under Water

Only seal course concrete may be placed under water.

If the Engineer determines that it is impossible or inadvisable to dewater excavations before placing concrete, place a seal course under the water using a tremie or a concrete pump. The seal course must be at least 2 feet thick and thick enough to seal the cofferdam.

The tremie must be a watertight tube at least 10 inches in diameter with a hopper at the top. When concrete is deposited into the hopper, flow is induced by raising the discharge end. Equip discharge and tremie tubes with a device to prevent water from entering the tube when charging the tube with concrete. Support the tubes so as to allow for free movement of the discharge end over the entire work surface and rapid lowering of the tube.

Fill the tubes using a method that prevents washing of the concrete. Keep the discharge end submerged in the concrete at all times. The tube must contain enough concrete to prevent water entry.

Place the concrete carefully in a compact mass. Concrete flow must be continuous until completion of the seal course. The seal course must be monolithic and homogeneous. Do not disturb concrete after placement. Maintain still water at the point of placement.

Cure the seal course concrete for at least 5 days before dewatering the cofferdam. Increase the curing time for seal course concrete placed in water that is below 45 degrees F. Periods of time when the water temperature is continuously below 38 degrees F is not considered as curing time.

Dewater the cofferdam after the seal course has adequate strength to resist the hydrostatic load. After dewatering, clean the top of the concrete of all scum, laitance, and sediment. Remove local high spots to provide the specified clearance for reinforcing steel before placing fresh concrete.

51-1.03D(4) Construction Joints

Place construction joints only where described unless authorized.

At horizontal construction joints:

1. *Thoroughly consolidate fresh concrete surfaces without completely removing surface irregularities*
2. *At joints between girder stems and decks, roughen the surfaces of fresh concrete to at least a 1/4inch amplitude*

Abrasive blast clean construction joint surfaces before placing fresh concrete against the joint surfaces. Remove surface laitance, curing compound, and other foreign materials.

Flush construction joint surfaces with water and allow the surfaces to dry to a surface-dry condition immediately before placing concrete.

If authorized in an emergency, you may place a construction joint at a location not described. The Engineer determines the location of the construction joint and the quantity of additional reinforcing steel to be placed across the joint.

Locate longitudinal construction joints in bridge decks along lane lines if a joint location is not shown.

51-1.03D(5) Colored Concrete

When placing colored concrete:

1. *Monitor the water content, weight of cementitious materials, and size, weight, and color of aggregate to maintain consistency and accuracy of the mixed colored concrete.*
2. *Schedule delivery of concrete to provide consistent mix times from batching until discharge. Do not add water after a portion of the batch has been discharged.*
3. *Use consistent finishing practices to ensure uniformity of texture and color.*
4. *Protect surrounding exposed surfaces during placement, finishing, and curing activities of colored concrete.*

If more than 1 concrete pump is used to place concrete, designate the pumps to receive colored concrete. The designated pumps must receive only colored concrete throughout the concrete placement operation.

Cure colored concrete by the forms-in-place method or the curing compound method.

If the curing compound method is used, the curing compound must be clear or match the color of the colored concrete and must be manufactured specifically for colored concrete. Do not use curing compounds containing calcium chloride. The time between completing surface finishing and applying the curing compound must be the same for each colored concrete component.

51-1.03D(6) Bearing Surfaces

For elastomeric bearing pads, wood float finish the concrete bearing surface to a level plane that varies at most 1/16 inch from a straightedge placed in any direction and is within 1/8 inch of the specified elevation. The bearing area must extend at least 1 inch beyond the limits of the bearing pads.

For bearing assemblies or masonry plates not embedded in concrete, construct the concrete bearing area above grade and grind to a true level plane that (1) does not vary perceptibly from a straightedge placed in any direction and (2) is within 1/8 inch of the elevation shown.

51-1.03D(7) Pier Columns

Place concrete for pier columns against firm, undisturbed foundation material on the bottom and sides of the pier column excavations except place concrete against forms where shown. Immediately before placing concrete, all excavated surfaces against which the concrete is to be placed must be free from standing water, ice, mud, debris, and loose material.

51-1.03E Miscellaneous Construction

51-1.03E(1) General

Where shown, paint the bridge name, bridge number, and bent number in neat, 2-1/2-inch-high black letters and figures.

Where shown and before backfilling to within 3 feet of finished grade, install temporary bumpers at the ends of bridges and grade top culverts.

Where pipes outside the structure join the structure, cast bell recesses in the concrete to receive the pipe or cast sections of the pipe in the concrete. If bell recesses are used, mortar the pipe end into the bell.

51-1.03E(2) Placing Mortar

Place mortar in recesses and holes, on surfaces, under structural members, and at other locations where described.

Clean concrete areas to be in contact with mortar of loose or foreign material that would prevent bonding between the mortar and the concrete surfaces. Flush the concrete areas with water and allow them to dry to a surface-dry condition immediately before placing the mortar.

Tightly pack mortar to completely fill spaces. Locations where mortar can escape must be mortar-tight before placing mortar. Cure mortar for 3 days using the water method under section 90-1.03B.

Do not load mortar until 72 hours after placement unless authorized.

51-1.03E(3) Drill and Bond Dowels

For drill and bond dowels, drill the holes without damaging the adjacent concrete. Holes for bonded dowels must be 1/2 inch larger than the nominal dowel diameter.

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.

Coat the surface of any dowel coated with zinc or cadmium with a colored lacquer. Allow the lacquer to dry thoroughly before installing the dowel.

Each drilled hole must be clean and dry when placing the bonding material and dowel. The bonding material and dowel must completely fill the drilled hole. The surface temperature must be at least 40 degrees F when magnesium phosphate concrete is placed.

Thoroughly dry finishing tools cleaned with water before working magnesium phosphate concrete.

Leave dowels undisturbed for 3 hours or until the dowels can be supported by the concrete.

Cure modified high-alumina-based concrete and portland-cement-based concrete using the curing compound method. Do not cure magnesium phosphate concrete.

Replace dowels that fail to bond or are damaged.

51-1.03E(4) Drill and Grout Dowels

Drill the holes under section 51-1.03E(3).

For drill and grout dowels, drill the holes 1/4 inch larger than the nominal dowel diameter. Immediately before placing dowels, holes must be cleaned, be thoroughly saturated with water, have all free water removed, and be dried to a saturated surface dry condition.

Place grout into the holes and insert the dowels. Retempering of grout is not allowed. Cure grout at least 3 days or until the dowels are encased in concrete. Immobilize the dowels during the curing period. Cure using curing compound method or by keeping the surface continuously damp.

Replace dowels that fail to bond or are damaged.

51-1.03E(5) Drill and Bond Dowels (Chemical Adhesive)

For drill and bond dowel (chemical adhesive), install dowels under the chemical adhesive manufacturer's instructions.

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.

Immediately after inserting the dowels into the chemical adhesive, support the dowels as necessary to prevent movement until the epoxy has cured the minimum time specified in the Authorized Material List for chemical adhesive/cartridge epoxies.

Replace dowels that fail to bond or are damaged. Drill new holes adjacent to rejected dowels and install replacement dowels.

51-1.03E(6) Nonskid Abrasive Finish

Where shown, place a nonskid abrasive finish on pedestrian walkways, stair treads, and landings. The nonskid finish must consist of commercial-quality aluminum oxide, silicon carbide, or almandite garnet grit particles, sieve size no. 12 to 30 or no. 14 to 35. Uniformly apply grit particles at a rate of at least 0.3 lb/sq ft onto the floated concrete surface while the concrete is plastic. Bury the particles into the concrete to a depth of approximately 0.7 times the diameter of each particle.

51-1.03E(7) Drains in Walls

Where shown, construct drain holes and weep holes in abutment walls, wingwalls, and retaining walls. Cover retaining wall and abutment wall drains at the back face of the wall with 1/4-inch mesh, 0.025-inchdiameter aluminum or galvanized steel wire hardware cloth. Mount hardware cloth in forms before pouring concrete or fasten the cloth to the exterior concrete surface with masonry nails.

In addition to wall drains, install hydrostatic pressure relief holes 3 inches in diameter at the bottom of walls immediately above footings at approximately 15-foot centers.

51-1.03E(8) Deck Bleeder Drains

The Engineer provides the exact location for each deck bleeder drain.

Drill the holes for drains in existing bridges using a diamond core drill bit. Do not spall hole edges. Holes must be 2 inches in diameter.

Install drains such that the top of the pipe is approximately 1/4 inch below the concrete deck surface. Replace drains out of position as determined by the Engineer.

Secure plastic pipe installed in existing bridges with an epoxy adhesive. Score the outside surfaces of the pipe before installing the pipe. Spread epoxy on both the pipe and hole surfaces. Epoxy must completely fill the space between the pipe and the hole.

Install drains before placing the deck seal. Center the wire cloth above the drains. Place the cloth after placing the deck seal and before placing the HMA. Secure the cloth using an authorized method to prevent movement during HMA placement. Do not damage the deck seal.

51-1.03E(9) Utility Facilities

Where shown, utility facilities will be carried in or on structures.

Install hangers, anchor bolt inserts, manhole frames and covers, sleeves, and other accessories required for the utility facility that must be cast in the concrete. The utility owner will furnish these items.

The utility owner will furnish and install conductors and casings when the structure is ready for the installation and before any work that interferes with installation is started.

Notify the Engineer at least 30 days before the date structures are ready for utility installation. The Engineer will notify the utility owner.

51-1.03E(10) Concrete Headers and Steel Plates

Concrete for concrete headers must comply with the specifications for minor concrete.

Steel plates and attachment hardware must comply with section 75-1 except that galvanizing is not required.

51-1.03E(11) Diaphragm Bolsters

Reserved

51-1.03E(12) Hinge Tiedowns

Reserved

51-1.03F Finishing Concrete

51-1.03F(1) General

Strike off exposed surfaces of consolidated concrete to the lines and grades shown. Provide a uniform surface texture having the specified finish without undulations or irregularities.

The Engineer determines the acceptability of the surface finishes.

Finish sidewalks, curbs, and stairways on structures under section 73-3 except surfaces are not marked.

51-1.03F(2) Ordinary Surface Finish

Apply ordinary surface finish to all concrete surfaces as a final finish or before applying a higher class finish.

Ordinary surface finish must be the final finish for the following surfaces:

1. *Undersurfaces of slab spans, box girders, spandrel arch spans, and floor slabs between girders of superstructures*
2. *Inside vertical surfaces of T girders of superstructures*
3. *Surfaces to be buried underground or covered with embankment and surfaces of culverts above finished ground that are not visible from the traveled way*
4. *Interior and top surfaces of drainage inlets*

Ordinary surface finish includes:

1. *Filling holes or depressions*
2. *Repairing rock pockets and unsound concrete*
3. *Removing fins and projections flush to the surface*
4. *Removing stains and discolorations visible from traveled ways*

You do not need to remove fins from surfaces that are buried underground or enclosed.

Remove form bolts and metal placed for your convenience to at least 1 inch below the concrete surface. Clean and fill the resulting holes with mortar. You do not need to remove form bolts in box girder cells except you must remove bolts flush if deck forms are removed from the cells.

Fill bolt holes with mortar under section 51-1.03E(2). Fill depressions and pockets with packed mortar or shotcrete as determined by the Engineer. Cure filler under section 51-1.03H.

For exposed surfaces, add enough white cement to the patching material to match the surrounding concrete after drying.

If the Engineer determines that rock pockets are extensive, remove and replace the affected portions of the structure.

51-1.03F(3) Class 1 Surface Finish

Class 1 surface finish includes finishing concrete surfaces to produce smooth, even surfaces of uniform texture and appearance without bulges, depressions, or other imperfections.

Class 1 surface finish must be the final surface finish for the following surfaces:

1. *Except for those surfaces listed in ordinary surface finish, the surfaces of bridge superstructures, including the undersurfaces of deck overhangs*
2. *Surfaces of bridge piers, piles, columns, and abutments, and retaining walls above finished ground and to at least 1 foot below finished ground*

3. *Surfaces of open spandrel arch rings, spandrel columns, and abutment towers*
4. *Surfaces of pedestrian undercrossings, except floors and surfaces to be covered with earth*
5. *Surfaces of culvert headwalls above finished ground and endwalls visible from a traveled way*
6. *Interior surfaces of culvert barrels having a height of 4 feet or more for a distance equal to the culvert height where visible from a traveled way*
7. *Interior surfaces of pump house motor and control rooms and engine-generator rooms*
8. *Surfaces of railings*

Do not apply Class 1 surface finish until a uniform appearance can be attained.

Use power carborundum stones or disks to remove bulges and other imperfections.

Sand areas not complying with the Class 1 surface finish requirements using power sanders or other authorized abrasive means until the specified surface finish is attained.

51-1.03F(4) Class 2 Surface Finish

Where a Class 2 surface finish is described:

1. *Apply an ordinary surface finish to the concrete surface.*
2. *Abrasive blast the surface to a rough texture and then thoroughly wash the surface with water.*
3. *Pneumatically apply a mortar coat approximately 1/4 inch thick in at least 2 passes to the damp surface. The coating must firmly bond to the concrete surface.*

The mortar coat must consist of either (1) sand, portland cement, and water, mechanically mixed before entering the nozzle or (2) premixed sand and portland cement, with water added before leaving the nozzle. The proportion of cement to sand must be at least 1 to 4. Use sand with a grading suitable for the work.

You may substitute cementitious material complying with section 90 for portland cement. You may use admixtures specified in section 90 if authorized.

Do not mortar coat areas where bridge name or other designations are to be painted.

The coating surface must be (1) uniform without unsightly bulges, depressions, or other imperfections and (2) as left by the nozzle. Protect the coating from damage and keep it damp for 3 days after placing. Remove and replace loose areas of coating.

Where a Class 2 surface finish is described for a pedestrian undercrossing, use silica sand and white portland cement.

51-1.03F(5) Finishing Roadway Surfaces

51-1.03F(5)(a) General

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. 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. Elevation control points will not be closer together than approximately 8 feet longitudinally and 24 feet transversely to the bridge centerline.

Before starting concrete placement for any deck section:

1. *Set to grade all rails and headers used to support or control the finishing equipment*
2. *Check rails and headers to ensure the completed deck complies with smoothness requirements*
3. *Move the finishing equipment over the length of the section to check steel and bulkhead clearances*

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).

Finish bridge decks to be covered with membrane seals to a smooth surface free of mortar ridges and other projections.

Where a future widening is shown, strike off deck surfaces under curbs, railings, barriers, and sidewalks to the same plane as the roadway and leave undisturbed.

Deck surfaces must comply with the following smoothness requirements:

1. *Profile trace having no high points over 0.02 foot*
2. *Profile count of 5 or less in any 100-foot section for portions within the traveled way*
3. *Surface not varying more than 0.02 foot from the lower edge of a 12-foot-long straightedge placed transversely to traffic*

Complete the smoothness testing and any required grinding before applying seal coats.

51-1.03F(5)(b) Bridge Deck Surface Texture

51-1.03F(5)(b)(i) General

Except for bridge widenings and bridge decks to be covered with an overlay, 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.

For bridge decks that are to be covered with an overlay, texture the deck using a burlap drag or broom device that produces striations either parallel or transverse to the centerline. If these structures are opened to traffic before the overlay is placed, the deck surface must meet the coefficient of friction requirement in section 51-1.01D(3)(b)(iii).

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 to within 18 inches of the toe of the barrier as follows:

1. *Grind the surface 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 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.

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.

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-footlong 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*

51-1.03G Concrete Surface Textures

51-1.03G(1) General

Provide the concrete surface textures shown. The Engineer determines the acceptability of the surface textures.

Construct a test panel for each type of concrete surface texture shown.

Fractured rib texture must consist of straight ribs of concrete with a fractured texture on the raised surface between ribs. Grooves between ribs must be (1) continuous with no apparent curves or discontinuities and (2) straight to within 1/4 inch in 10 feet. The texture must have random shadow patterns. Broken concrete at adjoining ribs and groups of ribs must have a random pattern. The texture must not have repetitive fractured surfaces or secondary shadow patterns.

Heavy blast texture must consist of an abrasive-blasted concrete surface of uniform color and sandy texture with air and water bubbles in the concrete partially exposed.

Formed relief texture must consist of a formed relief constructed to the dimensions and shapes shown with a Class 1 surface finish. Intersecting corners of plane surfaces must be sharp and crisp without easing or rounding.

Cure concrete surface textures by the forms-in-place or water methods.

51-1.03G(2) Form Liners

Use form liners for concrete surface textures except for heavy blast and formed relief textures. Other forming methods must be authorized.

Form liners must (1) be manufactured from an elastomeric material by a manufacturer of commercially available concrete form liners and (2) leave a crisp, sharp definition of the concrete surface texture.

Form liners must comply with the requirements shown in the following table:

Quality characteristic	*Test method*	*Requirement*
Shore A hardness	*ASTM D2240*	*50–90*
Tensile strength (psi, min)	*ASTM D412*	*1,000*

Comply with the form liner manufacturer's instructions for use.

Seal and repair cuts and tears in form liners under the form liner manufacturer's instructions. Do not use form liners that are delaminated or deformed.

Extend form liners the full length of texturing, with transverse joints at 8-foot minimum spacing. Do not use small pieces of form liners. Align grooves straight and true. Grooves must match at joints between form liners. For grooved patterns, joints in the direction of grooves must be located in depressions. Butt adjoining liners together without distortion, open cracks, or offsets. Clean joints between liners and remove mortar before use.

Adhesives must be compatible with the form liner material and the concrete. Adhesives must be recommended by the liner manufacturer and not cause swelling of the liner material.

Cast form liner patterns to prevent recurring textural configurations exhibited by repeating, recognizable shadow patterns. Remove surfaces with recurring textural configurations by reworking using authorized methods or by replacement.

Use a form release agent recommended by the form liner manufacturer. The release agent must not:

1. *Cause swelling of the liner material*
2. *Cause delamination from the forms*
3. *Stain the concrete*
4. *React with the liner material*

Coat form liners with a thin film of release agent. For textures with longitudinal patterns, apply the release agent using a natural bristle brush in the direction of the pattern. Clean excess release agent from liners using compressed air. Remove release agent buildup due to liner reuse at least every 5 uses.

Form liners must release without leaving pieces of liner on the concrete or removing concrete from the surface.

Except for formed relief textures, abrasive blast concrete surface textures with fine abrasive after removing forms to remove sheen without exposing coarse aggregate.

51-1.03H Curing Concrete Structures

Except for bridge decks, cure newly placed concrete for CIP structures using the water method or the forms-in-place method under section 90-1.03B.

Cure the top surface of bridge decks using both the curing compound method and the water method. The curing compound must be curing compound no. 1.

Cure the top surface of bridge decks to be sealed with butyl rubber membrane using only the water method.

For bridge decks and flat slabs using the water method without a curing medium, keep the entire surface damp by applying water with an atomizing nozzle that forms a mist and not a spray until the concrete has set. After the concrete has set, continuously sprinkle the entire concrete surface with water for at least 7 days.

You may use a pigmented curing compound complying with section 90-1.03B(3) for:

1. *Concrete surfaces of construction joints*
2. *Concrete surfaces that are to be buried underground*
3. *Concrete surfaces not visible from a public traveled way, where only a ordinary surface finish is to be applied and a uniform color is not required*

If you use the curing compound method on the bottom slab of box girder spans, the curing compound must be curing compound no. 1.

If ordered during periods of hot weather, apply water to concrete surfaces being cured by the curing compound method or by the forms-in-place method until the Engineer determines that a cooling effect is no longer required. This work is change order work.

Section 90-3.03 does not apply to curing RSC for bridge decks. Cure bridge decks constructed with RSC as follows:

1. *Immediately after strike-off, continually mist the deck with water using atomizing nozzles. Continue misting until the concrete reaches a compressive strength of at least 2000 psi.*

2. *After misting, apply curing compound no. 1 to the deck under section 90-1.03B(3).*

Repair any damage to the film of the curing compound with additional curing compound. Repairing damaged curing compound after the deck is opened to traffic is not required.

51-1.03I Protecting Concrete Structures

Maintain concrete at a temperature of not less than 45 degrees F for 72 hours after placing and at not less than 40 degrees F for an additional 4 days.

51-1.04 PAYMENT

The payment quantity for seal course concrete is the actual volume of seal course concrete placed except the maximum payment quantity is 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.

The payment quantity for structural concrete, drainage inlet is the volume determined from the dimensions shown for CIP drainage inlets.

51-2 *JOINTS*

51-2.01 GENERAL

51-2.01A General

51-2.01A(1) Summary

Section 51-2.01 includes general specifications for constructing, sealing, and protecting joints in concrete structures.

51-2.01A(2) Definitions

Reserved

51-2.01A(3) Submittals

Submit a certificate of compliance for polyethylene material for snowplow deflectors.

51-2.01A(4) Quality Assurance

Reserved

51-2.01B Materials

51-2.01B(1) General

Premolded expansion joint filler must comply with ASTM D1751.

Expanded polystyrene must be commercially available polystyrene board with (1) a flexural strength of at least 35 psi when tested under ASTM C203 and (2) a compressive yield strength from 16 to 40 psi at 5 percent compression. Face the surfaces of expanded polystyrene that concrete is placed against with 1/8-inch-thick hardboard complying with ANSI A135.4. You may use other facing materials that provide equivalent protection. Secure the hardboard using nails, waterproof adhesive, or other authorized means.

51-2.01B(2) Snowplow Deflectors

Snowplow deflectors must consist of ultra-high-molecular-weight polyethylene plates with anchorage devices.

Anchorage devices must comply with ASTM A276, UNS designation S32205 or S31803.

Ultra-high-molecular-weight polyethylene plates must be UV stabilized and comply with ASTM D4020 and the requirements shown the following table:

Quality characteristic	*Test method*	*Requirement*
Density (pcf, min)	*ASTM D792*	*58*
Tensile strength, ultimate (psi, min)	*ASTM D638*	*5,800*
Tensile strength, yield (psi, min)	*ASTM D638*	*2,750*

Elongation at break (percent)	*ASTM D638*	*290*
Hardness (Shore D, min)	*ASTM D2240*	*60*

51-2.01C Construction

51-2.01C(1) General

Construct open joints using a suitable material that you subsequently remove. Do not chip or break concrete corners when removing the material. Reinforcement must not extend across an open joint.

For filled joints, place premolded or expanded polystyrene joint filler in position before placing concrete. Fill holes and joints with mastic to prevent the passage of mortar or concrete.

Finish concrete edges at joints using an edger.

51-2.01C(2) Snowplow Deflectors

Drilling and bonding anchorage devices must comply with the specifications for drilling and bonding dowels in section 51-1.03E(3).

Where shown, apply a thread locking system to the anchorage devices under section 75-3.02B.

51-2.01D Payment

Not Used

51-2.02 SEALED JOINTS

51-2.02A General

51-2.02A(1) General

51-2.02A(1)(a) Summary

Section 51-2.02 includes general specifications for fabricating and installing sealed joints.

Sealed joints must:

1. *Be in planned position*
2. *Resist the intrusion of foreign material and water*
3. *Provide bump-free passage of traffic*

MR is measured normal to the longitudinal joint axis.

Use the seal type shown in the following table for the MR shown:

Movement rating	*Seal type*
MR ≤1 inch	*Type A or B*
1 inch < MR ≤ 2 inches	*Type B*
2 inches < MR ≤ 4 inches	*Strip seal joint seal assembly*
MR > 4 inches	*Modular unit joint seal assembly or seismic joint*

51-2.02A(1)(b) Definitions

Reserved.

51-2.02A(1)(c) Submittals

Submit a work plan for cleaning expansion joints. Include details for preventing material, equipment, or debris from falling onto traffic or railroad property.

51-2.02A(1)(d) Quality Assurance

Reserved

51-2.02A(2) Materials

You may clean and paint metal surfaces of joint seal assemblies instead of galvanizing. Cleaning and painting must comply with the specifications for new structural steel in section 59-2 except SSPC-QP 1, SSPC-QP 2, and

AISC-420-10/SSPC-QP 3 certifications are not required. Finish coats are not required. Do not paint stainless steel or anchorages embedded in concrete.

51-2.02A(3) Construction

The Engineer may order you to install a joint seal larger than required by the MR. This work is change order work.

The joint opening at the time of placement must be that shown adjusted for temperature. Do not impair the joint clearance.

Cover or otherwise protect joints at all times before joint seals are installed. Do not allow debris or foreign material to enter joints.

Clean expansion joints at existing bridges before installing joint seals. Remove all existing seal material, dirt, debris, damaged waterstops, and joint filler. Use methods that do not damage existing sound concrete.

Verify the joint size after cleaning.

Clean existing joints with undamaged waterstops to the top of the waterstop unless the waterstop is to be removed.

Clean existing joints without waterstops and joints with damaged waterstops down to the hinge or bearing seat.

Repair joint damage as ordered.

Cleaning joints below existing waterstops that are damaged and repairing existing joint damage is change order work.

51-2.02A(4) Payment

Joint seals and joint seal assemblies are measured from end to end along the centerline of the completed seal, including return sections and curb faces.

51-2.02B Type A and AL Joint Seals

51-2.02B(1) General

51-2.02B(1)(a) Summary

Section 51-2.02B includes specifications for installing Type A and AL joints seals.

Type A and AL joint seals consist of field-mixed silicone sealant placed in grooves in the concrete.

51-2.02B(1)(b) Definitions

Reserved

51-2.02B(1)(c) Submittals

Submit a certificate of compliance and certified test report for each batch of sealant.

At least 30 days before use, submit 1-quart test samples of the following to METS:

1. *Both components from each batch of sealant*
2. *Manufacturer-required primers*

51-2.02B(1)(d) Quality Assurance

51-2.02B(1)(d)(i) General

Reserved

51-2.02B(1)(d)(ii) Department Acceptance

The Department tests sealants under California Test 435.

51-2.02B(2) Materials

The sealant must be a 2-component silicone type that withstands a ±50 percent movement.

The sealant must comply with the requirements shown in the following table:

Quality characteristic	Test method	Requirement
Modulus at 150 percent elongation (psi)	California Test 435	8–75
Recovery (inches, max)	California Test 435	21/32
Notch test	California Test 435	Notched or loss of bond, 1/4 inch max
Water resistance	California Test 435	Notched or loss of bond, 1/4 inch max
Ultraviolet exposure	California Test 435	No more than slight cracking or checking
Cone penetration (mm)	California Test 435	4.5–12.0

The sealant must be self-leveling and cure rapidly enough to not flow on grades up to 15 percent.

Label sealant containers or provide identification tickets for tanks of 2-component material. Include the following:

1. *Material designation*
2. *Lot number*
3. *Manufacturer's name and instructions for use*
4. *Dates of manufacture, packing, and expiration*

Do not use material that has expired unless it is retested and authorized.

Polyethylene foam or rod stock for retaining sealant must be commercial quality with a continuous, impervious glazed surface.

51-2.02B(3) Construction

51-2.02B(3)(a) General

Do not use sealant or adhesive that has skinned over or cannot be redispersed by hand stirring.

Abrasive blast clean joints and remove foreign material with high-pressure air immediately before installing seals. Protect waterstops during cleaning.

Joint surfaces must be surface dry when seals are placed.

Place the sealant using equipment that mixes and extrudes the sealant into the joint. The equipment and the sealant placement must be as recommended by the sealant manufacturer.

Do not use liquid components that have been exposed to air for more than 24 hours.

51-2.02B(3)(b) Type A Seal Preparation

For Type A joint seals, do not start cutting grooves until joint material is delivered to the job site.

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.

Saw cutting grooves is not required at the following locations:

1. *Joints armored with metal*
2. *Joints in curbs, sidewalks, barriers, and railings, if grooves are formed to the required dimensions*
3. *Existing joints where Type A seals are to be installed*

Remove all material from the deck joint to the bottom of the saw cut. Remove foreign material from joints in curbs, sidewalks, barriers, railings, and deck slab overhangs.

The Engineer may order you to saw cut grooves at existing joints to be sealed with a Type A joint seal. This work is change order work.

Repair spalls, fractures, or voids in the grooved surface at least 64 hours before installing the joint seal. Bevel the lips of saw cuts by grinding.

51-2.02B(3)(c) Type AL Seal Preparation

For Type AL joint seals, remove expanded polystyrene and foreign material to the depth of the joint seal. Grind or edge the lip of the joint.

51-2.02B(4) Payment

Not Used

51-2.02C Type B Joint Seals

51-2.02C(1) General

51-2.02C(1)(a) Summary

Section 51-2.02C includes specifications for installing Type B joint seals.

Type B joint seals consist of preformed elastomeric joint seals placed in grooves in the concrete.

51-2.02C(1)(b) Definitions *Reserved*

51-2.02C(1)(c) Submittals

Submit a certificate of compliance with certified test report for each lot of elastomeric joint seal and lubricant-adhesive. Test reports must include the seal MR, the manufacturer's minimum uncompressed width, and test results.

Submit each joint seal test sample selected by the Engineer for testing with its certificate of compliance at least 30 days before use.

51-2.02C(1)(d) Quality Assurance

51-2.02C(1)(d)(i) General

Reserved

51-2.02C(1)(d)(ii) Quality Control

The Engineer selects test samples of joint seal material and lubricant-adhesive at random from each lot of material. Test samples are selected from stock at the job site or at a location acceptable to the Engineer and the manufacturer. Joint seal test samples must be at least 3 feet long.

Demonstrate the adequacy of installation procedures for Type B seals before starting installation activities.

51-2.02C(1)(d)(iii) Department Acceptance

Reserved

51-2.02C(2) Materials

Preformed elastomeric joint seals must:

1. *Comply with ASTM D2628*
2. *Consist of a multi-channel, nonporous, homogeneous material furnished in a finished, extruded form*
3. *Have a minimum seal depth at the contact surface of at least 95 percent of the minimum uncompressed seal width designated by the manufacturer*
4. *Provide an MR of at least that shown when tested under California Test 673*
5. *Have the top and bottom edges in continuous contact with the sides of the groove throughout the entire range of joint movement*
6. *Be furnished full length for each joint with at most 1 shop splice in any 60-foot length*

For seals that would admit water or debris, fill each cell to a depth of 3 inches at the open ends with opencell polyurethane foam or close the cells by other authorized means.

You may make 1 field splice per joint if authorized. Splice location and method must be authorized. Seals must be manufactured full length and then cut at the splice location and rematched before splicing.

Shop and field splices must have no visible offset of exterior surfaces and no evidence of bond failure.

Combination lubricant-adhesive must comply with ASTM D4070.

51-2.02C(3) Construction

Prepare joints under section 51-2.02B(3)(b) except remove all material from the deck joint to the top of the waterstop or to the depth of the seal to be installed plus 3 inches.

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. Liberally apply the lubricant-adhesive to vertical groove surfaces and the sides of the joint seal under the manufacturer's instructions.

Install joint seals full length for each joint using equipment that does not distort or damage the seal or the concrete. The top edges of the installed seal must be in a plane normal to the sides of the groove.

51-2.02C(4) Payment

Not Used

51-2.02D Joint Seal Assemblies with a Movement Rating of 4 inches or Less

51-2.02D(1) General

51-2.02D(1)(a) Summary

Section 51-2.02D includes specifications for fabricating and installing joint seal assemblies with an MR of 4 inches or less.

Joint seal assemblies with an MR of 4 inches or less must consist of metal or metal and elastomeric assemblies placed in recesses over joints. Strip seal joint seal assemblies consist of a 1 joint cell.

If authorized, you may use an alternative joint seal assembly if:

1. *Quality of the alternative assembly and its suitability for the intended application are at least equal to that of the joint seal assembly shown. The factors to be considered include the ability of the assembly*

to resist the intrusion of foreign material and water throughout the full range of movement for the application and the ability to function without distress to any component.

2. *Alternative joint seal assembly has had at least 1 year of proven satisfactory service under conditions similar to those described.*

51-2.02D(1)(b) Definitions *Reserved*

51-2.02D(1)(c) Submittals

51-2.02D(1)(c)(i) General

For alternative joint seal assemblies, submit a certificate of compliance for each shipment of joint seal materials. The certificate must state that the materials and fabrication involved comply with the specifications and the data submitted in obtaining the authorization for the alternative joint seal assembly.

51-2.02D(1)(c)(ii) Shop Drawings

For alternative joint seal assemblies, submit 5 copies of shop drawings for each joint seal assembly to OSD, Documents Unit. Notify the Engineer of your submittal. Include in the notification the date and contents of the submittal.

After review, submit 6 to 12 copies, as requested, for final authorization and use during construction. Include details of the joint seal assembly and anchorage components, method of installation, blockout details, and additions or rearrangements of reinforcing steel.

If requested, submit supplemental calculations for each proposed alternative joint seal assembly.

Include in the shop drawings the thermal equation for setting the minimum joint opening at installation.

Shop drawings and calculations must be sealed and signed by an engineer who is registered as a civil engineer.

Allow 25 days for the Department's review.

Submit 1 corrected copy to OSD, Documents Unit, for each joint seal assembly within 20 days of final authorization.

51-2.02D(1)(d) Quality Assurance

Reserved

51-2.02D(2) Materials

51-2.02D(2)(a) General

Metal parts must comply with section 75-3.

Bolts, nuts, and washers must comply with ASTM F3125, Grade A325.

Sheet neoprene must comply with the specifications for neoprene in section 51-2.04B. Fabricate sheet neoprene to fit the joint seal assembly accurately.

51-2.02D(2)(b) Alternative Joint Seal Assemblies

Alternative joint seal assemblies must have CIP anchorage components for casting into the deck.

The anchorage components must include anchor studs spaced at a maximum of 4-1/2 inches. The studs must be at least 5/8 inch in diameter and 8 inches long, except the studs may be 6 inches long in the overhang.

Instead of complying with section 75-3, metal parts may comply with ASTM A572/A572M.

Elastomer must be neoprene complying with the requirements shown in Table 1 of ASTM D2628, except recovery and compression-deflection tests are not required, and the requirements shown in the following table:

Quality characteristic	Test method	Requirement
Hardness (points, Type A durometer)	ASTM D2240 (modified)	55–70
Compression set (percent, max, 70 hours at 100 °C)	ASTM D395 (modified)	40

The design loading must be 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.

The MR of the assembly must be measured normal to the longitudinal axis of the assembly. Dimensions for positioning the assembly within the MR during installation must be measured normal to the longitudinal axis. Do not consider skew of the deck expansion joint.

The maximum depth and width of the recess must be such that the primary reinforcement providing the necessary strength of the structural members is outside the recess. The maximum depth at abutments and hinges is 10 inches. The maximum width on each side of the expansion joint is 12 inches.

Horizontal angle points and vertical corners at curbs must be premolded sections or standard sections of the assembly that have been miter cut or bent to fit.

51-2.02D(3) Construction

Deck surfaces must comply with section 51-1.03F(5) before placing and anchoring joint seal assemblies. POC deck surfaces must comply with section 51-1.03F(6) before placing and anchoring joint seal assemblies.

Preassemble metal parts of assemblies before installation to verify geometry.

Except for primary reinforcement, continue reinforcement through the recess construction joint into the recess and engage anchorage components of the assembly.

Thoroughly clean joints immediately before installing sheet neoprene. Install sheet neoprene at such time that it will not be damaged by construction activities.

Place the assembly in the blocked-out recess in the concrete deck surface. The depth and width of the recess must allow the installation of the assembly anchorage components or anchorage bearing surface to the lines and grades shown.

For alternative joint seal assemblies, install elastomer under the manufacturer's instructions. Thoroughly clean the joint and blockout immediately before elastomer installation.

51-2.02D(4) Payment

Not Used

51-2.02E Joint Seal Assemblies with a Movement Rating Over 4 inches

51-2.02E(1) General

51-2.02E(1)(a) Summary

Section 51-2.02E includes specifications for fabricating and installing joint seal assemblies with an MR over 4 inches.

Joint seal assemblies and seismic joints consist of metal or metal and elastomeric assemblies anchored or cast into a recess in the concrete over the joint.

51-2.02E(1)(b) Definitions *Reserved*

51-2.02E(1)(c) Submittals

51-2.02E(1)(c)(i) General

Reserved

51-2.02E(1)(c)(ii) Shop Drawings

Submit shop drawings for each joint seal assembly to OSD, Documents Unit. Notify the Engineer of your submittal. Include in the notification the date and contents of the submittal.

If requested, submit supplemental calculations for each proposed alternative joint seal assembly.

Shop drawings and calculations must be sealed and signed by an engineer who is registered as a civil engineer.

Allow 30 days for the Department's review.

After review, submit 6 to 12 copies, as requested, for final authorization and use during construction. Include details of the joint seal assembly and anchorage components, method of installation, blockout details, and additions or rearrangements of reinforcing steel.

Submit 1 corrected copy to OSD, Documents Unit, for each joint seal assembly within 20 days of authorization.

51-2.02E(1)(c)(iii) Certificate of Compliance

Submit a certificate of compliance for each shipment of joint seal assembly materials.

51-2.02E(1)(d) Quality Assurance

51-2.02E(1)(d)(i) General

Vertical expansion joints in barriers must be accessible for inspection after recess concrete is placed.

Joint seal assemblies will not be authorized without evidence of 1 year of satisfactory service under similar conditions.

51-2.02E(1)(d)(ii) Quality Control

A qualified representative of the assembly manufacturer must be present during the installation of the 1st assembly and available during remaining installations.

51-2.02E(1)(d)(iii) Department Acceptance

Reserved

51-2.02E(2) Materials

51-2.02E(2)(a) General

Joint seal assemblies must consist of a metal frame system, supporting rails, and support bars with intervening neoprene glands.

Neoprene glands must comply with the requirements shown in Table 1 of ASTM D2628, except recovery and compression-deflection tests are not required, and the requirements shown in the following table:

Quality characteristic	*Test method*	*Requirement*
Hardness (points, Type A durometer)	*ASTM D2240 (modified)*	*55–70*
Compression set (percent, max, 70 hours at 100 °C)	*ASTM D395 (modified)*	*40*

Metal parts of the joint seal assembly must comply with section 75-3 or ASTM A572/A572M. Bolts, nuts, and washers must comply with the specifications for HS steel fastener assemblies in section 75-1.

Anchorage components must include anchor studs spaced at a maximum of 4-1/2 inches. Studs must be at least 5/8 inch in diameter and 8 inches long, except the studs may be 6 inches long in the overhang.

Assemblies must be assembled completely at the fabrication site.

51-2.02E(2)(b) Design Requirements

If the assembly consists of more than 1 component, design the assembly such that the external components can be removed and reinstalled at any position within the larger half of the MR to allow for inspection of the internal components.

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.

The maximum width of unsupported or yielding components or grooves in the roadway surface of the assembly must be 3 inches measured in the direction of vehicular traffic.

Assemblies must be capable of adjustment to the "a" dimension shown.

The assembly must have CIP anchorage components that form a mechanical connection between the joint components and the concrete deck.

51-2.02E(3) Construction

Measure dimensions for positioning the assembly during installation normal to the longitudinal axis of the assembly, disregarding the skew of the deck expansion joint.

Deck surfaces must comply with section 51-1.03F(5) before placing joint seal assemblies and anchorages.

Place each assembly into a blocked-out recess in the concrete deck surface. The depth and width of the recess must allow the installation of the assembly anchorage components or anchorage bearing surface to the lines and grades shown.

Except for primary reinforcement, continue reinforcement through the recess construction joint into the recess and engage anchorage components of the assembly.

Install each assembly with a watertight, continuous return 6 inches up into barriers at the low side of the deck. Neoprene glands must be continuous without field splices or joints.

51-2.02E(4) Payment

Not Used

51-2.02F Asphaltic Plug Joint Seals

51-2.02F(1) General

51-2.02F(1)(a) Summary

Section 51-2.02F includes specifications for constructing asphaltic plug joint seals.

Asphaltic plug joint seals consist of an asphaltic binder and aggregate joint seal system.

51-2.02F(1)(b) Definitions

Reserved

51-2.02F(1)(c) Submittals

51-2.02F(1)(c)(i) General

Reserved

51-2.02F(1)(c)(ii) Shop Drawings

Submit 5 copies of shop drawings for the proposed asphaltic plug joint seal system to OSD, Documents Unit. Notify the Engineer of your submittal. Include in the notification the date and contents of the submittal.

Allow 30 days for the Department's review. After review, submit 6 to 12 copies, as requested, for final authorization and use during construction.

51-2.02F(1)(c)(iii) Product Data

Submit evidence from the manufacturer that 5,000 linear feet of the joint seal has had at least 2 years of satisfactory service under similar conditions.

51-2.02F(1)(c)(iv) Certificate of Compliance

Submit certificates of compliance for materials used in the joint seals.

Submit a copy of the certified test report for binder material.

51-2.02F(1)(c)(v) Samples

Submit a 10-pound test sample of binder material to METS. The test sample must be removed from the same material to be shipped to the job site. Submit the test sample at least 15 days before shipment to the job site.

51-2.02F(1)(d) Quality Assurance

51-2.02F(1)(d)(i) General *Reserved*

51-2.02F(1)(d)(ii) Quality Control

Binder material must be tested and certified by an authorized laboratory.

A technical representative of the joint seal manufacturer must be present during installation.

51-2.02F(2) Materials

All joint components must be from a single manufacturer.

The binder must be a thermoplastic, polymeric-modified asphalt; thermoplastic, polymer-modified bitumen; polymer-modified asphalt sealant; or modified elastomeric binder complying with the requirements shown in the following table:

Quality characteristic	*Test method*	*Requirement*
Asphalt compatibility	*ASTM D5329*	*Pass*
Bond, nonimmersed *at -20 °F, 50% at 0* *°F, 100%*	*ASTM D5329*	*Pass 3 cycles* *Pass 3 cycles*
Cone penetration, nonimmersed (mm) *200 g total weight,* *60 seconds at 0 ± 2 °F* *150 g total weight,* *5 seconds at 77 ± 2 °F*	*ASTM D5329 (modified)*	*1, min* *9, max*
Ductility (cm, min, at 77 ± 2 °F)	*ASTM D113*	*40*
Flexibility (at 10 ± 2 °F)	*ASTM D5329[a]*	*Pass*
Flow (mm, max, 5 hours at 140 ± 2 °F)	*ASTM D5329*	*3*
Resilience (percent, min, at 77 ± 2 °F)	*ASTM D5329*	*40*
Softening point (°F, min)	*ASTM D36*	*180*
Tensile adhesion (percent, min)	*ASTM D5329*	*550*

Safe heating temperature (°F)		*390–410*
Recommended pouring temperature (°F)		*360–390*

[a]Do not oven age specimens. After 24 hours at standard conditions, allow specimens to condition at -10 ± 2 °F for 2 hours before testing.

Binder material delivered to the job site must be labeled with:

1. *Manufacturer's name*
2. *Lot or batch number*
3. *Dates of manufacturing, packaging, and expiration*
4. *Manufacturer's instructions for use*

Binder material must be retested and recertified for use if the expiration date passes.

Aggregates must comply with:

1. *Section 90-1.02C except the results of cleanness value and sand equivalent tests must comply with the requirements for both operating range and contract compliance*

2. *Asphaltic plug manufacturer's instructions*

The polyethylene backer rod must be commercial quality with a continuous, impervious, glazed surface that can withstand the hot liquid binder material and is suitable for retaining the hot liquid binder while it hardens.

The bridging plate must be 8 inches wide and at least 1/4 inch thick and comply with ASTM A36/A36M.

Cut the bridging plate into 48-inch-minimum-length sections. Place holes for locating pins along the longitudinal plate centerline 12 inches on center. The locating pins must be at least 16d common steel nails or equal.

51-2.02F(3) Construction

Uniformly double wash and dry natural aggregates before use.

Remove existing expansion dams and asphaltic concrete to the limits shown. Do not damage the deck or remaining asphaltic concrete.

Steel dowels exposed when removing concrete must be cut off flush with the existing concrete or at the bottom of concrete removal, whichever is lower. Patching around or over dowels in sound concrete is not required. Chip voids back to sound concrete and fill voids with magnesium phosphate concrete.

Clean expansion joints under section 51-2.02C(3). Repair spalls if ordered. Repairing spalls is change order work.

Abrasive blast blockout surfaces to receive the asphaltic plug joint seal.

Clean and dry blockout surfaces and the adjacent 6 inches of roadway immediately before placing the joint seal. Use a hot air lance producing a minimum temperature of 2,500 degrees F and a directional velocity of at least 2,500 ft/sec. There must be no moisture present during installation.

Place the top of the backer rod to a depth of at least 1 inch and at most equal to the width of the existing gap below the bottom of the blockout.

Center bridging plate sections over the existing gap. Place the sections flat on the bottom of the blockout. The sections must be butt jointed. Do not overlap the sections or allow gaps between the plate and blockout.

Install the joint seal under the manufacturer's instructions.

51-2.02F(4) Payment

Not Used

51-2.04 WATERSTOPS

51-2.04A General

51-2.04A(1) Summary

Section 51-2.04 includes specifications for installing waterstops.

51-2.04A(2) Definitions *Reserved*

51-2.04A(3) Submittals

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.

51-2.04A(4) Quality Assurance

Reserved

51-2.04B Materials

Waterstops must be manufactured from neoprene or PVC.

Neoprene must (1) be manufactured from a vulcanized elastomeric compound containing neoprene as the only elastomer and (2) comply with the requirements shown in the following table:

Quality characteristic	*Test method*	*Requirement*
Tensile strength (min, psi)	*ASTM D412*	*2,000*
Ultimate elongation (min, percent)	*ASTM D412*	*300*
Compression set (max, percent, 22 hours at 70 °C)	*ASTM D395, Method B*	*30*
Tear strength (min, kN/m)	*ASTM D624, Die C*	*26*
Hardness, Type A (points)	*ASTM D2240*	*55 ± 5*
Ozone resistance (20% strain, 100 hours at 100 ± 2.2 °F)	*ASTM D1149 except 100 ± 20 parts per 100,000,000*	*No cracks*

Brittleness temperature at -40 °C	*ASTM D746, Section 9.1.2*	*Pass*
Flame propagation	*ASTM C542*	*Must not propagate flame*
Change in volume (max, percent, IRM 903, immersed 70 hours at 100 °C)	*ASTM D471*	*80*
Change in mass (max, percent, immersed 7 days at 70 °C)	*ASTM D471*	*15*

After accelerated aging under ASTM D573 for 70 hours at 100 degrees C, the elastomer must not show quality characteristic changes greater than those shown in the following table:

Quality characteristic	*Requirement*
Tensile strength (percent)	*-15*
Elongation at break (percent)	*-40*
Hardness (points)	*+10*

PVC waterstops must (1) be manufactured from PVC complying with CRD-C 572 and (2) comply with the ozone resistance requirement for neoprene.

Furnish waterstops full length for straight portions of joints. Manufacturer's shop splices must be fully vulcanized.

51-2.04C Construction

Use spacers, wire, or other authorized methods to secure reinforcing bars supporting waterstops.

If waterstops are out of shape or position after placing concrete, remove the concrete and reset waterstops.

Field splices for neoprene waterstops must be one of the following:

1. *Vulcanized*
2. *Mechanical using stainless steel parts*
3. *Made with a splicing union of the same stock as the waterstop*

Completed field splices must have a full-size tensile strength of 100 pounds per inch of width.

Field splice PVC waterstops by heat sealing under the manufacturer's instructions. Do not burn the plastic when melting.

Cut and splice waterstops at changes in direction as necessary to avoid buckling or distortion of the waterstop.

51-2.04D Payment

Not Used

51-2.05 STRIP WATERSTOPS

51-2.05A General

Section 51-2.05 includes specifications for installing strip waterstops.

51-2.05B Materials

The neoprene sheet must comply with the specifications for neoprene in section 51-2.04B.

The neoprene adhesive must comply with Federal Specification MMM-A-121.

The protective board must be at least 1/2-inch-thick wood or fiberboard that is at least 4 ft long and the width shown.

The neoprene sheet must be smooth and free from pin holes or surface blemishes and show no sign of delamination.

51-2.05C Construction

Join neoprene sheets as follows:

1. *Lap the sheets at least 12 inches.*
2. *Apply the adhesive to both faces at the manufacturer's recommended rate.*
3. *Let the adhesive dry to an aggressive tack.*
4. *Bring the sheets together and roll in both directions to obtain a tight bond.*

Abrasive blast clean the concrete surfaces to receive a strip waterstop. Allow the cleaned surfaces to air dry 24 hours before applying the adhesive.

Surfaces where adhesive is to be applied must have a cloth finish or a buffed finish. Surfaces must be clean and dry when the adhesive is applied.

Apply the adhesive to the concrete and neoprene sheet at the manufacturer's recommended rate. Let the adhesive dry to an aggressive tack. Apply the sheet to the concrete surface and roll in both directions to obtain a tight bond.

Completely cover the installed strip waterstops with 1 layer of protective board attached with adhesive. The protective board must remain in place until backfilling is complete.

51-*2.05D Payment*

Not Used

51-7 MINOR STRUCTURES

51-7.01 GENERAL

51-7.01A General

Section 51-7 includes specifications for constructing minor structures.

Minor structures include structures described as minor structures.

51-7.01B Materials

Concrete must comply with the specifications for minor concrete.

Nonshrink grout must be a dry, packaged type complying with ASTM C1107/C1107M.

Metal frames, covers, grates, and other miscellaneous iron and steel used with minor structures must comply with section 75-2.

51-7.01C Construction

You may construct minor structures using PC units or a combination of PC and CIP structures as an alternative to CIP construction, provided that the structure in place substantially complies with the specified CIP construction.

Remove exterior forms to at least 5 inches below the final ground surface. Exterior forms below this depth may remain if their total thickness is not more than 1 inch.

Cure concrete surfaces of minor structures using the water method, the forms-in-place method, or the curing compound method.

51-7.01D Payment

The Department does not adjust the payment quantity for minor structures designated as final pay on the Bid Item List if the constructed height of the minor structure is within 6 inches of the vertical dimensions shown.

Metal frames and covers or frames and grates are not included in the payment for minor structures.

Replace section 51-8 Reserved with:

51-8 INLET TOWERS

51-8.01 GENERAL

51-8.01A(1) General

Inlet Tower D

Foundation design objectives for the new Inlet Tower D are to limit settlement/rotation and provide adequate factor of safety against bearing, lateral and overturning failures.

Tower D's foundation transfers the load of a structure to the earth and resists loads imposed. The objectives of the new Tower D foundation are:

- Distribute the weight of the structure over an area to avoid overloading the soil beneath.
- Load the sub-stratum evenly and to prevent unequal settlement.
- Provide a level surface for building operations.
- Embed the structure into the ground and increasing its stability.

51-8.01A(2) Quality Assurance

Foundation design objectives are requirements to achieve.

The new Inlet Tower D assumes certain parameters will be found in the underling soil beneath Tower D's foundation. Parameter assumptions were derived from research of the original construction documentation. We assume the subgrade material exposed at the bottom of the excavation for the Tower D foundation is to consist of bedrock or predominantly granular soils (i.e., <50% passing #200 US Sieve and PI<7) with a friction angle of at least 30 degrees.

During excavation to ensure success of the assumptions and objectives, soil encountered at the bottom of the Tower D foundation will be collected by the District. To verify the assumed friction angle of 30 degrees, sampling of subgrade will occur at a minimum of two (2) locations within the seventeen by seventeen foot (17'x17') Tower D foundation footprint. When the design foundation elevation of 360' is reached, a four-inch (4") diameter hand-auger borings will be advanced to a depth of one foot (1') and a sample will be obtained through the use of a thin-walled, steel, hand-held sampler driven into the subgrade materials. The soil will be retained in 1" high brass rings with a 2.50" outside diameter and a 2.37" inside diameter. The samples should then be sent to an approved laboratory for examination, testing, and classification, using the Unified Classification system conducting the following laboratory tests, one each:

- Sieve Analysis (ASTM D422)
- Atterberg Limits (Liquid Limit and Plastic Limit) Tests (ASTM D4318)
- Direct Shear Test (ASTM D3080)

Testing will be expedited by the district but the Contractor will allow 10 working days for testing and analysis to confirm design objectives and assumptions.

If the above material requirements are not meet, remove and replace the upper three (3) feet subgrade soils with compacted structure backfill materials as defined in Caltrans Standard Specifications.

The following soil parameters are recommended for the lateral stability analysis of the Inlet Tower D.

1. Embedment Soils
    i. Total unit weight of soil = 120 pcf
    ii. Cohesion, c=0.0 psf
    iii. Friction angle, Φ= 35 degrees
2. Foundation Soils
    i. Total unit weight of soil = 125 pcf
    ii. Cohesion, c=0.0 psf
    iii. Friction angle, Φ= 40 degrees
3. Friction factor between the footing and the foundation soils = 0.6.

51-8.01B Materials

DSOD requires certain SMDB components under their jurisdictional purview to be compliant with the Unified Facilities Guide Specifications (UFGS) Section 03 30 00 Cast-in-Place Concrete. Elements which are required to follow these standards are the Inlet Towers (Inlet Towers A, B, C and D and the emergency spillway bridge foundation. At the end of these special provisions is Section 03 30 00 Cast-in-Place Concrete for the two above listed components.

51-8.01C Construction

Construction of the Tower D footing foundation may encounter difficult excavation conditions due to the location on a slope and the presence of caving prone cohesionless soils and hard to excavate bedrock at shallow depths. The contractor is responsible for maintaining the stability of all temporary excavation and for selecting the appropriate means and methods for construction.

The Contractor is to follow the standard specification provisions outlined in section 51-1.

51-8.01D Payment

Inlet Tower confirmation of foundation soils is to be included as subsidiary to the construction of tower D foundation and costs must be distributed to ancillary items associated with Tower D construction.

52 REINFORCEMENT

52-1 GENERAL

52-1.01 GENERAL

52-1.01A Summary

Section 52-1 includes general specifications for fabricating and placing reinforcement.

52-1.01B Definitions

affected zone: *Portion of the reinforcing bar where any properties of the bar, including the physical, metallurgical, or material characteristics, have been changed by either:*

1. *Fabrication or installation of a splice. The weld and 1 inch adjacent to the weld is part of the affected zone.*
2. *Manufacturing process for headed bar reinforcement.*

lot:

1. *150 count, or fraction thereof, of the same type of mechanical splice coupler model for each:*
   - 1.1. *Bar size*
   - 1.2. *Bar deformation pattern*
   - 1.3. *Hoop diameter*
2. *150 count, or fraction thereof, of CJP butt-welded splices or resistance-butt-welded splices for each:*
   - 2.1. *Bar size*
   - 2.2. *Hoop diameter*

52-1.01C Submittals

52-1.01C(1) General

Reserved

52-1.01C(2) Shop Drawings

If a portion of an assemblage of bar reinforcing steel exceeds 20 feet in height and is not encased in concrete, submit shop drawings and design calculations for a temporary support system.

Temporary support system shop drawings and calculations must be sealed and signed by an engineer who is registered as a civil engineer in the State.

The temporary support system must be designed to:

1. *Resist all expected loads*
2. *Prevent collapse or overturning of the cage*

If form installation or other work requires changes to or the temporary release of any part of the temporary support system, the shop drawings must show the support system to be used during these changes or the temporary release.

The minimum horizontal wind load to be applied to the reinforcing steel assemblage or to a combined assemblage of reinforcing steel and forms must be the sum of the products of the wind impact area and the applicable wind pressure value for each height zone.

The wind impact area is the total projected area of the assemblage normal to the direction of the applied wind. Determine wind pressure values using the following table:

Wind Pressure

Height zone, H (feet above ground)	*Wind pressure value (psf)*
0 ≤ 30	20
30 < H ≤ 50	25
50 < H ≤ 100	30
H > 100	*35*

52-1.01C(3) Certificates

Submit a certificate of compliance for each shipment of reinforcement.

If requested, submit the following:

1. *Copy of the certified mill test report for each heat and size of reinforcing steel showing physical and chemical analysis*
2. *2 copies of a list of all reinforcement before starting reinforcement placement*

52-1.01D Quality Assurance

Reserved

52-1.02 MATERIALS

52-1.02A General

Reserved

52-1.02B Bar Reinforcement

Reinforcing bars must be deformed bars complying with ASTM A706/A706M, Grade 60, except you may use:

1. *Deformed bars complying with ASTM A615/A615M, 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 A615/A615M, 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*

You may substitute welded wire reinforcement for reinforcing bars in the following:

1. *Slope paving and lined ditches*
2. *Retaining walls*
3. *Concrete barriers*
4. *Sidewalks, curbs, and gutters on structures*
5. *Nonstructural aesthetic additions*
6. *Culvert headwalls, end walls, and wing walls*
7. *Shotcrete*
8. *Deck overlays*
9. *Shear reinforcement stirrups in PC girders*

Substituted welded wire reinforcement must be on an equivalent area basis. The Engineer determines the exact location. If the welded wire reinforcement does not provide the required area of steel, supplement it with reinforcing bars.

52-1.02C Welded Wire Reinforcement

Welded wire reinforcement must comply with ASTM A1064/A1064M.

52-1.02D Reinforcing Wire

Reinforcing wire must comply with the specifications for plain wire in ASTM A1064/A1064M.

52-1.02E Dowels

Reinforcing steel dowels must be deformed bars complying with section 52-1.02B.

Threaded rods used as dowels must comply with section 75-1.02A.

52-1.03 CONSTRUCTION

52-1.03A General

Reserved

52-1.03B Cleaning

Before concrete is placed, the reinforcement to be embedded must be free of mortar, oil, dirt, excessive mill scale and scabby rust, and other coatings that would destroy or reduce the bond.

52-1.03C Bending

Do not bend or straighten bars in a way that damages the material. Do not use bars with kinks or improper bends.

Hooks and bends must comply with the Building Code Requirements for Structural Concrete published by ACI.

52-1.03D Placing

Firmly and securely hold reinforcement in position by:

1. *Wiring at intersections and splices.*
2. *Using precast mortar blocks or ferrous metal chairs, spacers, metal hangers, supporting wires, or other authorized devices of sufficient strength to resist crushing under applied loads. Do not use aluminum, plastic, or wood supports.*

Do not place bars on layers of fresh concrete as the work progresses.

Metal supports must have a clear cover of at least 1 inch. Do not consider protective coatings on metal supports when determining clear cover. Where the clear cover to reinforcement shown or determined by the Engineer exceeds the minimum specified clear cover, increase the clear cover for metal supports accordingly.

The center-to-center spacing of parallel bars must be at least 2.5 times the bar diameter.

The clear distance between bundles of bars and adjacent bundles or single bars must be at least:

1. *1.5 times the maximum size of the coarse aggregate*
2. *2 times the larger bar diameter for 2-bar bundles*

3. *2.5 times the larger bar diameter for 3-bar bundles*

Tie bundle bars together at not more than 6-foot centers.

Unless otherwise shown, reinforcement must have a 2-inch clear cover measured from the surface of the concrete to the outside of the reinforcement.

Adjust or relocate reinforcement in post-tensioned concrete during the installation of prestressing ducts or tendons as required to provide described clearances to the prestressing tendons, anchorages, jacks, and equipment. Obtain authorization for any adjustments or relocations.

End 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.

Roll welded wire reinforcement flat before placing concrete. Secure welded wire reinforcement in place with devices that prevent the reinforcement's vertical and transverse movement.

Do not tack weld on reinforcing bars unless shown.

For column and pile bar reinforcing cages measuring 4 feet in diameter and larger:

1. *Tie all reinforcement intersections with double wire ties on at least 4 vertical bars of each cage equally spaced around the circumference.*

2. *Tie at least 25 percent of remaining reinforcement intersections in each cage with single wire ties. Stagger tied intersections from adjacent ties.*

3. *Provide bracing to avoid collapse of the cage during assembly, transportation, and installation.*

52-1.04 PAYMENT

The payment quantity of bar reinforcing steel is the calculated weight of the reinforcing bars and wire.

The payment quantity of bar reinforcing steel includes the lap of bars for lap splicing, including locations where you use a continuous bar instead of the splice shown.

The payment quantities are based on the following:

Bar Reinforcing Steel Quantities

Deformed bar designation no.	*Weight (pounds per foot)*	*Nominal diameter (inches)*
3	*0.376*	*0.375*
4	*0.668*	*0.500*
5	*1.043*	*0.625*
6	*1.502*	*0.750*
7	*2.044*	*0.875*
8	*2.670*	*1.000*
9	*3.400*	*1.128*
10	*4.303*	*1.270*
11	*5.313*	*1.410*
14	*7.650*	*1.693*
18	*13.600*	*2.257*

NOTE: Bar numbers approximate the number of eighths of an inch included in the nominal diameter of the bars. The nominal diameter of a

deformed bar is equal to the diameter of a plain round bar having the same weight per linear foot as the deformed bar.

The cross sectional area of reinforcing wire, in hundredths of square inches, is equal to its W-size number. The density of reinforcing wire is 0.2833 lb/cu in.

The payment quantity of welded wire reinforcement is determined based on the measured area covered by the reinforcement and does not include laps.

The payment quantity for bar reinforcing steel (bridge) includes diaphragm dowels and bolts in PC concrete members.

If alternative transverse deck reinforcement placement details are shown, the payment quantities are based on the detail that shows truss bars.

Bar reinforcing steel involved in bridge work is paid for as bar reinforcing steel (bridge) or bar reinforcing steel (epoxy coated)(bridge) unless it is included in a separate bid item.

52-6 SPLICING

52-6.01 GENERAL

52-6.01A Summary

Section 52-6 includes specifications for splicing bar reinforcement.

Reinforcing bar splices consist of lap splices, service splices, or ultimate butt splices.

52-6.01B Definitions

group: *Set of 5 or fewer consecutive lots after the 1st lot.*

52-6.01C Submittals

52-6.01C(1) General

Section 52-6.01C applies to service and ultimate butt splices.

52-6.01C(2) Product Data

52-6.01C(2)(a) General *Reserved*

52-6.01C(2)(b) Radiographic Film Developing Process Records

If requested, submit records of radiographic film developing processes and any chemical changes to the developing processes.

52-6.01C(3) Samples

52-6.01C(3)(a) General *Reserved*

52-6.01C(3)(b) Test Samples

Submit service splice and ultimate butt splice test samples to METS.

Include copies of the certificates of compliance with the test samples for mechanical splices and resistance-butt-welded splices.

52-6.01C(4) Test Reports

52-6.01C(4)(a) General *Reserved*

52-6.01C(4)(b) Splicing Quality Control Test Report

Submit a QC test report for each lot of service splices and ultimate butt splices.

Each QC test report must include:

1. *Group number, lot number, and location*
2. *Bar size*
3. *Splice type*
4. *Mechanical splice length*
5. *Location of fracture*

6. *Physical condition of splice test sample*
7. *Notable defects*
8. *Total measured slip*
9. *Ultimate tensile strength of each splice*
10. *The following for ultimate butt splices:*
    10.1. *Location of visible necking area*
    10.2. *Largest measured strain*

Allow 3 business days for the Engineer's review.

52-6.01C(4)(c) Splice Rejection Mitigation Report

For a rejected lot of service splices or ultimate butt splices, submit a splice rejection mitigation report.

Allow 3 business days for the Engineer's review.

52-6.01C(5) Certificates

Submit a certificate of compliance for each shipment of service splice or ultimate butt splice material. Include with the submittal:

1. *Type or series identification of the splice material, including tracking information for traceability*
2. *Grade and size number of reinforcement to be spliced*
3. *Statement that the splice material complies with the type of mechanical splice on the Authorized Material List for steel reinforcing couplers*
4. *For resistance-butt-welded material:*
    4.1. *Heat number*
    4.2. *Lot number*
    4.3. *Mill certificates*

52-6.01C(6) Qualification Statements

52-6.01C(6)(a) General *Reserved*

52-6.01C(6)(b) Welder and Welding Procedures Qualifications

Submit welder and welding procedure qualifications as an informational submittal.

52-6.01C(6)(c) Splice Prequalification Report

For each bar size of each coupler model type of service splice or ultimate butt splice to be used in the work, submit a splice prequalification report that includes:

1. *Copy of the manufacturer's product literature giving complete data on the splice material and installation procedures*
2. *Names of the operators who will be performing the splicing*
3. *Descriptions of the positions, locations, equipment, and procedures that will be used in the work*

4 Certified test results from the authorized laboratory for the prequalification splice test samples

5. *Certifications from the fabricator for operator and procedure prequalification*
6. *Manufacturer's QC Process Manual*

52-6.01C(6)(d) Weld Flash Removal Process

If specified, submit a proposed weld flash removal process. The submittal must show that the process produces a smooth profile that can be successfully epoxy coated under section 52-2.

52-6.01D Quality Assurance

52-6.01D(1) General

Section 52-6.01D applies to service and ultimate butt splices.

Assign a splicing QC manager.

Before starting service or ultimate butt splicing activities, select the lots that constitute each group for QA testing.

Before testing resistance-butt-welded splice test samples of reinforcement to be epoxy coated, remove the weld flash using the authorized process for flash removal.

Section 11-2 does not apply to resistance-butt-welded splices.

52-6.01D(2) Qualifications

52-6.01D(2)(a) General

Reserved

52-6.01D(2)(b) Operator and Procedure Prequalification

Before performing any service or ultimate butt splicing, obtain certifications from the fabricator for prequalification of the operators and the procedures to be used in the work.

For each bar size of each splice coupler model type to be used, each operator must prepare 4 prequalification splice test samples.

Splice test samples must have been prepared and tested no more than 2 years before the submittal of the splice prequalification report.

Splice test samples and testing must comply with the QC testing requirements specified in section 526.01D(4)(b) for the type of splice to be used in the work.

52-6.01D(2)(c) Welder and Welding Procedure Qualifications

Before performing any CJP butt welds, qualify welders and welding procedures under AWS D1.4.

Qualify welders and welding procedures on splice test samples of the type to be used in the work.

52-6.01D(3) Test Samples

52-6.01D(3)(a) General

Prepare splice test samples under California Test 670.

For splicing new reinforcement to existing reinforcement, make splice test samples using only reinforcement having the deformation pattern of the new reinforcement.

Before transporting splice test samples to an authorized laboratory and METS:

1. *Securely bundle and package the 4 test samples for each test in a way that preserves their condition during transportation*
2. *Identify each splice test sample by location, lot number, and Contract number using weatherproof markings*
3. *Attach a completed Sample Identification Card to each bundle*

When preparing or removing splice test samples for QC testing, concurrently prepare or remove 4 Department acceptance splice test samples from the same lot during:

1. *1st QC test*
2. *1 QC test from each group, randomly selected by the Engineer*

If splices from a lot will be encased in concrete prior to receiving passing Department acceptance test results, you must prepare additional samples selected by the Engineer from the same lot for additional Department acceptance testing. You may prepare the samples as specified for service splice test samples in section 52-6.01D(4)(b)(iii). The Department will test service splice test samples as specified for service splices and ultimate butt splice test samples as specified for ultimate butt splices.

52-6.01D(3)(b) Ultimate Butt Splice

After completing the ultimate butt splices in a lot, including any required epoxy coating, notify the Engineer that the splices are ready for testing. Except for hoops, the Engineer selects splice test samples at the job site or PC plant. The Engineer selects splice test samples for hoops at the job site, PC plant, or fabrication plant.

After being notified, the Engineer randomly selects the 4 splice test samples to be removed and places tamper-proof markings or seals on the test samples.

A test sample is rejected if the tamper-proof marking or seal is disturbed before testing.

52-6.01D(4) Quality Control

52-6.01D(4)(a) General *Reserved*

52-6.01D(4)(b) Quality Control Testing

52-6.01D(4)(b)(i) General

QC testing includes total slip testing, service splice testing, and ultimate butt splice testing.

Test QC splice test samples:

1. *In the condition received*
2. *Under California Test 670*
3. *At a laboratory on the Authorized Laboratories List for testing reinforcing steel splices*

Before performing service splice or ultimate butt splice testing, perform total slip testing on the service splice or ultimate butt splice test samples as specified in section 52-6.01D(4)(b)(ii).

Do not perform tests on splice test samples from bundles containing fewer than 4 test samples.

At least 5 business days before performing any testing at the authorized laboratory, notify the Engineer of:

1. *Date of the testing*
2. *Location of the authorized laboratory where the tests will be conducted*
3. *Number of lots to be tested*
4. *Group number of each lot*

If a QC test for a lot is rejected, repair or replace reinforcing bars from which test samples were removed before the Engineer selects additional splices from this lot for more testing.

If a lot of splices is rejected, do not use the rejected lot or any subsequent lots until:

1. *QC manager has performed a complete review of your QC process for these splices*
2. *You have prepared a splice rejection mitigation report describing:*
    - 2.1. *Cause of the failure*
    - 2.2. *Method used to identify the cause of failure*
    - 2.3. *Identification of affected lots*
    - 2.4. *Provisions for preventing similar failures in future lots*
    - 2.5. *Procedure for repairing or replacing the splices in the rejected lot*
3. *Engineer has notified you that the splice rejection mitigation report is authorized*

52-6.01D(4)(b)(ii) Total Slip Testing

Except for mechanical lap, welded, or hoop splices, test 1 of the 4 splice test samples for total slip.

If the splice test sample exceeds the total slip value specified in section 52-6.02B(1), test the 3 remaining test samples for total slip. If any of the 3 remaining test samples exceed the specified total slip value, the Department rejects all splices in the lot.

52-6.01D(4)(b)(iii) Service Splice Testing

A service splice test consists of preparing and testing 4 splice test samples for each lot of completed splices.

Prepare the test samples using the same splice material, position, operators, location, equipment, and procedures to be used in the work.

Splice test samples must comply with the requirements specified in section 52-6.02B(2) as follows:

1. If only 1 splice test sample complies with the requirements, the Department rejects all splices in the lot.

2. If only 2 splice test samples comply with the requirements, perform 1 additional test on the same lot of splices. This additional test must consist of tensile testing 4 splice test samples, randomly selected by the Engineer and removed by you from the lot of completed splices. If any of the 4 splice test samples from this additional test do not attain the specified minimum tensile strength, the Department rejects all splices in the lot.

3. If 3 or more splice test samples comply with the requirements, the Department accepts all splices in the lot.

52-6.01D(4)(b)(iv) Ultimate Butt Splice Testing

An ultimate butt splice test consists of removing and testing 4 splice test samples from each lot of completed splices.

At fracture, splice test samples must comply with the requirements specified in section 52-6.02B(3) as follows:

1. If only 1 splice test sample complies with the requirements, the Department rejects all splices in the lot.

2. If only 2 splice test samples comply with the requirements, perform 1 additional ultimate butt splice test on the same lot of splices. If any of these 4 splice test samples do not comply with the specified requirements, the Department rejects all splices in the lot.

3. If 3 or more splice test samples comply with the requirements, the Department accepts all splices in the lot.

The Department does not require ultimate butt splice testing on repaired splices from a lot unless an additional ultimate butt splice test is required on the same lot of splices. If this additional test is required, the Engineer may select any repaired splice for the additional test.

If splices are made vertically at the job site in or above their final positions for bar reinforcement of columns or CIP concrete piles, instead of removing the splice test samples from the completed lot, you may prepare the samples as specified for service splice test samples in section 52-6.01D(4)(b)(iii). Test the splice test samples as specified for ultimate butt splice test samples.

If test samples for CJP butt-welded splices are not removed from a lot of completed splices, perform RT as follows:

1. Perform RT of CJP butt-welded splices under AWS D1.4:
    2.1. Before tensile testing the splice test samples
    2.2. On 25 percent of CJP butt-welded splices from a production lot
2. Radiographic procedures must comply with AWS D1.1 and D1.4.
3. For field-produced CJP butt welds, do not radiograph more than 1 weld during 1 exposure.
4. Make radiographs by either X-ray or gamma ray. Each radiograph must have a density of from 2.3 to 3.5 in the area of interest. The Department allows a density tolerance of 0.05 for densitometer variations. Gamma rays must be from the iridium 192 isotope, and the emitting specimen must not exceed 0.18 inch in the greatest diagonal dimension.

5. You may add an allowable weld buildup of 0.16 inch to the total material thickness when determining the proper penetrameter selection. The Department does not accept image quality indicator equivalency.

6. Sufficiently shim penetrameters using a radiographically identical material. Penetrameter image densities must be from 2.0 to 3.6.

7. Regardless of the reinforcing bar size, radiographic film must be Class 1.
8. Record the results of radiographic interpretations on a signed certification and keep a copy with the film packet.

For RT:

1. The Department does not allow sight development of film.
2. Technique sheets prepared under ASME Boiler and Pressure Vessel Code, section V, article 2, section T-291, must include the developer temperature, developing time, fixing duration, and all rinse times.

Notify the Engineer 48 hours before performing any RT. The Engineer selects the splices that compose the production lot and the splices within each lot to receive RT.

If more than 12 percent of the splices radiographically tested in a production lot are defective, perform RT on an additional 25 percent of the splices selected by the Engineer from the same production lot. If more than 12 percent of the cumulative total of splices tested from the same production lot are defective, perform RT on all remaining splices in the lot. The Department does not pay for additional RT performed due to the identification of defective splices.

Repair defects under AWS D1.4.

52-6.01D(4)(c) Weld Flash Removal Process

Removal of the weld flash must produce a smooth profile free of any sharp edges that would prevent proper coating of the reinforcement such that:

1. Ultimate tensile strength and elongation properties of the bar are not reduced 2. Outside radius of the flash at any point along the circumference of the bar is not:
    2.1. Less than the nominal radius of the bar
    2.2. Greater than 3/16 inch beyond the nominal radius of the bar

52-6.01D(4)(d) Splicing Quality Control Test Report

The splicing quality control test report must be (1) prepared by the laboratory performing the testing and (2) signed by an engineer representing the laboratory. The Engineer must be registered as a civil engineer in the State.

52-6.01D(5) Department Acceptance

The Department tests service splices and ultimate butt splices as specified for QC testing in section 526.01D(4).

If a Department acceptance test result does not comply with the material and QA requirements, the Department rejects all splices in the lot and the group.

For the other lots in the rejected group that pass QC testing, you may request the Engineer to perform additional Department acceptance testing for additional splice samples. If a Department acceptance splice test result complies with the material and QA requirements, the Department accepts all splices in that lot.

If a lot of splices is rejected, prepare a splice rejection mitigation report for that rejected lot as specified in section 52-6.01D(4)(b)(i).

If the QC and the Department acceptance test results have different compliance determinations, the Department will sample and test all subsequent lots until QC and the Department acceptance test compliance determinations are consistent for 2 consecutive lots before resuming sampling and testing of 1 lot from every group.

The Department will notify you of the Department acceptance test results for each bundle of 4 test samples of splices within 3 business days after METS receives the bundle unless more than 1 bundle is received on the same day, in which case allow 2 additional business days for each additional bundle received.

52-6.02 MATERIALS

52-6.02A General

Reserved

52-6.02B Service Splices and Ultimate Butt Splices

52-6.02B(1) General

Section 52-1.02B applies if service splices or ultimate butt splices are used in the work.

The total slip must not exceed the values shown in the following table when tested under California Test 670:

Total Slip

Reinforcing bar no.	*Total slip (inch)*
4	*0.020*

5	*0.020*
6	*0.020*
7	*0.028*
8	*0.028*
9	*0.028*
10	*0.036*
11	*0.036*
14	*0.048*
18	*0.060*

The following must be on the Authorized Material List for steel reinforcing couplers:

1. *Mechanical couplers*
2. *Fabricators of resistance-butt-welded splices*

52-6.02B(2) Service Splices

Service splices must develop a minimum tensile strength of 80,000 psi.

52-6.02B(3) Ultimate Butt Splices

Ultimate butt splice test samples must demonstrate necking as either of the following:

1. *Except for 30-inch and smaller diameter hoops, for Necking Option I as specified in California Test 670, the test sample must fracture in the reinforcing bar outside of the affected zone and show visible necking. For 30-inch and smaller diameter hoops, the test sample must show visible necking at fracture at any location.*

2. *For Necking Option II as specified in California Test 670, the largest measured strain must be at least:*
   2.1. *6 percent for no. 11 and larger bars*
   2.2. *9 percent for no. 10 and smaller bars*

52-6.03 CONSTRUCTION

52-6.03A General

Butt-welded or mechanical splices not shown as requiring a service splice or an ultimate butt splice must comply with the specifications for service splices.

Do not place splices at a location shown as a no-splice zone.

Reinforcing bars may be continuous where splices are shown. If splice locations are not shown, determine splice locations using commercial lengths where practicable.

Unless another option is shown, stagger splices in adjacent reinforcing steel. The minimum distance between staggered lap splices or staggered mechanical lap splices must be the same as the length specified for a lap splice in the largest bar. The minimum distance between staggered butt splices must be 2 feet measured between the splice midpoints along a line centered between the axis of the adjacent bars.

For reinforcing bars where splice test samples were removed, replace either of the following:

1. Removed portion of the bar or hoop using mechanical ultimate butt splices 2. Bar or hoop in kind

52-6.03B Lap Splicing

Splices made by lapping must consist of placing reinforcing bars in contact and wiring them together while maintaining the alignment of the bars and the minimum clearances.

Do not splice the following by lapping:

1. *No. 14 bars*
2. *No. 18 bars*
3. *Hoops*

4. *Reinforcing bars where you cannot provide a minimum clear distance of 2 inches between the splice and the nearest adjacent bar*

For uncoated and galvanized reinforcing bars complying with ASTM A615/A615M, Grade 60, ASTM A706/A706M, or ASTM A767/A767M, Class 1, the length of lap splices must be at least:

1. *45 diameters of the smaller bar spliced for reinforcing bars no. 8 or smaller*
2. *60 diameters of the smaller bar spliced for reinforcing bars nos. 9, 10, and 11*

For epoxy-coated reinforcing bars and alternatives to epoxy-coated reinforcing bars complying with ASTM A775/A775M, ASTM A934/A934M, ASTM A1035/A1035M, or ASTM A1055/A1055M, the length of lap splices must be at least:

1. *65 diameters of the smaller bar spliced for reinforcing bars no. 8 or smaller*
2. *85 diameters of the smaller bar spliced for reinforcing bars nos. 9, 10, and 11*

For reinforcing bars complying with ASTM A615/A615M, Grade 40, the length of lap splices must be at least:

1. *30 diameters of the smaller bar spliced for reinforcing bars no. 8 or smaller*
2. *45 diameters of the smaller bar spliced for reinforcing bars nos. 9, 10, and 11*

For splices in bundled bars, the length of the lap splices must be:

1. *Equal to the length of a single bar lap splice for bundles of 2 bars*
2. *1.2 times the length of a single bar lap splice for bundles of 3 bars*

Lap welded wire reinforcement such that the overlap between the outermost cross wires is at least the larger of the following:

1. *6 inches*
2. *Spacing of the cross wires plus 2 inches*
3. *Numerical value of the longitudinal wire size (W-size number) times 4.3 divided by the spacing of the longitudinal wires in inches*

52-6.03C Service Splices and Ultimate Butt Splices

52-6.03C(1) General

Service splices and ultimate butt splices must be one of the following:

1. *Mechanical splices*
2. *Resistance-butt-welded splices*
3. *CJP butt-welded splices*

52-6.03C(2) Mechanical Splices

Perform service splicing and ultimate butt splicing of mechanical splices:

1. *Under the manufacturer's instructions, unless otherwise specified*
2. *Using the manufacturer's standard equipment, jigs, clamps, and other required accessories*

Splice devices must have a clear cover of at least 1-3/4 inches measured from the surface of the concrete to the outside of the splice device. To provide the specified clear cover to reinforcement:

1. *Adjust or relocate stirrups, ties, and other reinforcement*
2. *Place additional reinforcement, if needed*

52-6.03C(3) Resistance-Butt-Welded Splices

If resistance-butt-welded bar reinforcement is to be epoxy coated, remove the weld flash using the authorized process for flash removal.

52-6.03C(4) Complete-Joint-Penetration Butt-Welded Splices *CJP butt-welded splices must comply with AWS D1.4.*

Use only the joint details and dimensions shown in Figure 3.2 of AWS D1.4 except do not use the SingleV-Groove Weld with Split Pipe Backing detail.

Make butt welds with multiple weld passes without an appreciable weaving motion using a stringer bead having a width at most 2.5 times the diameter of the electrode. Perform slagging between each weld pass. Weld reinforcement must not exceed 0.16 inch in convexity.

Electrodes for welding must have a minimum CVN impact value of 27 J at -4 degrees F.

For welding of bars complying with ASTM A 615/A 615M, Grade 40 or 60, the requirements of Table 5.2 of AWS D1.4 are superseded by the following: The minimum preheat and interpass temperatures must be 400 degrees F for Grade 40 bars and 600 degrees F for Grade 60 bars. Immediately after completing the welding, cover at least 6 inches of the bar on each side of the splice with insulated wrapping to control the rate of cooling. The insulated wrapping must remain in place until the bar has cooled below 200 degrees F.

If welding different grades of reinforcing bars:

1. *Electrode must comply with the specifications for Grade 40 bar*
2. *Preheat must comply with the specifications for Grade 60 bar*

If any of the specified preheat, interpass, and post-weld cooling temperatures are not met, remove the weld and heat-affected-zone metal and reweld the splice.
Protect welding from air currents, drafts, and precipitation to prevent loss of heat or loss of arc shielding.

Do not direct butt splice reinforcing bars by thermite welding.

52-6.04 PAYMENT

Not Used

60 EXISTING STRUCTURES

60-1 GENERAL

60-1.01 GENERAL

Section 60 includes specifications for performing work on existing structures.

Work performed on existing structures must comply with section 15.

60-1.02 MATERIALS

Not Used

60-1.03 CONSTRUCTION *Not Used*

60-1.04 PAYMENT

Not Used

60-2 STRUCTURE REMOVAL

60-2.01 GENERAL

60-2.01A General

Add to section 60-2.01A:

Remove the following structures or portions of structures:

Bridge no./Structure name	Description of work
Spillway Bridge	Removal of Spillway Bridge and portions of spillway walls as shown in the project plans.

The Santa Monica Debris Basin Emergency spillway is a life safety facility for areas of western Carpintaria. As such it is imperative the contractor takes every precaution to not damage the facility. The Contractor must protect the emergency spillway from damage during bridge removal. Submit bridge demolition plan for review, approval and authorization to commence demolition.

Section 60-2 includes specifications for removing structures or portions of structures.

Design and construct temporary support shoring, temporary bracing, and protective covers under section 48.

60-2.01B Materials

Not Used

60-2.01C Construction

Before removing portions of monolithic concrete elements, make a 1-inch-deep saw cut to a true line along the limits of removal on faces of the element that will be visible in the completed work.

Remove piling, piers, abutments, footings, and pedestals to 1 foot below the ground line or 3 feet below finished grade, whichever is lower.

Protect existing reinforcement to be incorporated into the new work from damage. Thoroughly remove all material adhering to the existing reinforcement before embedding the existing reinforcement in new concrete.

Do not use explosives.

Do not use the following for breaking or removing concrete attached to or supported by bridges:

1. *Tools with a manufacturer's-rated striking energy of more than 1,200 ft-lb per blow*
2. *Freely falling mass*
3. *Falling mass attached to a cable, rope, or chain*

Do not use a freely falling mass or a falling mass attached to a cable, rope, or chain above any public space. Do not use falling masses within 30 feet horizontally of any public space without protective covers.

Design and construct protective covers, shoring, and falsework with sufficient strength and rigidity to support all imposed loads. Covers must be at least equal to 2-inch Douglas-fir planking on posts spaced at 5-foot centers

The Engineer may require you to remove existing footing concrete that is below ground and outside of the footing limits. This work is change order work.

60-2.01D Payment

Not Used

60-2.02 BRIDGE REMOVAL

60-2.02A General

60-2.02A(1) Summary

Section 60-2.02 includes specifications for removing bridges or portions of bridges.

60-2.02A(2) Definitions

Reserved

60-2.02A(3) Submittals

If a daily inspection report is required, submit the daily inspection report as an informational submittal.

Submit a bridge removal work plan for each bridge. Include details for the following:

1. *Removal sequence, including staging of removal activities and equipment locations*
2. *Temporary support shoring or bracing*
3. *Locations where work is performed over traffic, utilities, or railroad property*
4. *Locations and types of protective covers*
5. *Protection of people, property, utilities, and improvements*
6. *Methods for preventing material, equipment, and debris from falling onto traffic or railroad property*

If protective covers are required or superstructure removal work is performed, bridge removal work plans must be (1) accompanied by substantiating calculations and (2) signed by an engineer who is registered as a civil engineer in the State.

Calculations for bridge removal work plans must demonstrate the stability of the structure during each stage of removal and must include dead and live loads used in the design of the protective covers. A stage is removal of (1) the deck, soffit, or girders in any span; or (2) walls, bent caps, or columns at support locations.

If an unplanned event occurs or the removal activities deviate from the authorized work plan, immediately submit procedures proposed to correct or remedy this occurrence. The procedures must be signed by an engineer who is registered as a civil engineer in the State.

Allow 20 days for review of the bridge removal work plan.

60-2.02A(4) Quality Assurance

60-2.02A(4)(a) General

Reserved

60-2.02A(4)(b) Quality Control

For bridge removal work plans signed by a registered engineer, the engineer signing the work plan must:

1. *Be present at all times during bridge removal activities.*
2. *Prepare a daily inspection report for removal activities. The daily inspection report must describe work activities for each day and the condition of the remaining structure. A copy of the report must be available at the job site at all times.*

60-2.02B Materials

60-2.02B(1) General

Reserved

60-2.02B(2) Design Criteria for Temporary Support Shoring and Temporary Bracing

The horizontal load to be resisted in any direction for temporary support shoring and temporary bracing must be (1) the sum of actual horizontal loads due to equipment, construction sequence, or other causes plus an allowance for wind and (2) not less than 5 percent of the total dead load of the structure being removed.

60-2.02C Construction

60-2.02C(1) General

The Engineer may require you to perform additional exploratory work of bridge members for unforeseen damage. This work is change order work.

You may use flame and saw cutting for removing, widening, or modifying bridges.

If complete bridges are removed, do not start removal activities until traffic is no longer carried on the bridge.

For bridge removal activities over or adjacent to roadways that are only closed to traffic when removal work is being performed:

1. *Have all necessary personnel, materials, and equipment to complete the work onsite before closing the roadway. Perform activities without interruption until the roadway is reopened.*

2. *Perform bridge removal activities only when the roadway is closed to traffic except as specified for preliminary work.*

3. *During roadway closures, debris from bridge removal activities may fall directly onto the roadway if protection is furnished for highway facilities. Minimum protection for paved areas is a 2-foot-thick earthen pad or a 1-inch-thick steel plate placed over the impact area. Before reopening the roadway, all debris, protective pads, and devices must be removed and the roadway swept clean with wet power sweepers or equivalent methods.*

4. *For girder bridges, completely remove each girder within a span before starting removal of the adjacent girder.*

5. *For slab bridges, perform removal activities within a span along a front parallel with the primary reinforcing steel.*

Temporary support shoring, temporary bracing, and protective covers must not encroach within 8 feet horizontally or 15 feet vertically of traffic lanes or shoulders open to traffic.

Temporary support shoring, temporary bracing, and protective covers over railroad property must (1) conform to guidelines of the railroad company involved and (2) provide the minimum clearances specified for railroad traffic.

60-2.02C(2) Protective Covers

Provide protective covers for removal work over traffic or railroad property. Protective covers must:

1. *Be constructed before starting removal activities.*
2. *Prevent any materials, equipment, or debris from falling onto traffic or railroad property.*
3. *Be supported using shoring, falsework, or the existing structure.*
4. *Provide the openings specified in section 12-4. If no openings are specified for removal work, provide a vertical opening of 15 feet and a horizontal opening of 32 feet for traffic.*
5. *Be cleaned of debris and fines before being removed.*

At locations where only bridge railing is removed, protective covers must extend from the face of the exterior girder or at least 2 feet inside of the railing to be removed to at least 4 feet beyond the outside face of the railing.

At locations where entire girders are removed, protective covers must extend at least 10 feet beyond the outside face of the bridge railing.

A separate protective cover is not required during removal of bridge segments if portions of the bridge satisfy the requirements for protective covers.

60-2.02C(3) Preliminary Work

Preliminary work is limited to activities that (1) will not reduce the structural strength or stability of the bridge or bridge elements to a hazardous level as determined by the Engineer or (2) do not cause debris or any other material to fall onto the roadway.

You may perform preliminary work if you use protective covers. Protective covers must:

1. *Support all loads*
2. *Prevent dust and fine material from falling onto the traveled way 3. Extend at least 4 feet beyond the limit of the work being performed.*

Bottom slabs of box girders may be considered as protective covers for preliminary work performed on top slabs inside the limits of the exterior girders.

Use temporary support shoring and bracing during preliminary work if needed to ensure the stability of the bridge.

60-2.02D Payment

Not Used

60-4 *MODIFYING STRUCTURES*

60-4.01 GENERAL

60-4.01A General

Section 60-4 includes specifications for modifying structures.

60-4.01B Materials

Not Used

60-4.01C Construction

Not Used

60-4.01D Payment

Not Used

60-4.05 CORING AND PRESSURE GROUTING DOWELS

60-4.05A General

Section 60-4.05 includes specifications for coring holes through concrete and grouting dowels into the cored holes.

Coring must comply with section 60-4.04.

60-4.05B Materials

Grout must comply with ASTM C1107 or ASTM C845, Type K, with a compressive strength of 5,000 psi at 28 days when tested under California Test 551.

Dowels must comply with the specifications for bar reinforcing steel in section 52.

Water for grout must comply with the specifications for water in section 90-1.02D.

Admixtures must not contain more than 500 ppm of chlorides as Cl when tested under California Test 422 and not more than 2,500 ppm of sulfates as SO_4 when tested under California Test 417.

60-4.05C Construction

Clean loose and foreign material from concrete and steel surfaces that will be in contact with the grout. Flush holes with water and let them dry to a surface-dry condition immediately before grouting.

Seal the ends of holes after placing the dowels. Place a vent tube at one end of the hole and an injection feed tube at the other end of the hole. For holes with only a single end, place vent and injection feed tubes in the same end. Place tubes such that the air will vent and the hole will be completely filled with grout.

Mix grout under the manufacturer's instructions.

Pump grout into holes. Use sufficient pressure so that the hole is free of voids. Continually waste grout until air and water eject from the vent tubes and there are no visible slugs.

60-4.05D Payment

Payment for furnishing dowels is not included in the payment for core and pressure grout dowel.

DIVISION VII DRAINAGE FACILITIES

Add prior to section 61:

Bid Items and Applicable Sections

Item code	Item description	Applicable section
64110X	15" Plastic Pipe	64
65232X	36" Reinforced Concrete Pipe (Class V, Rubber Gasket Joint)	65
6500XX	Connect (N) pipe to existing structure (Tower C) (Std. SPPWC 333-2)	65
6500XX	Connect (N) pipe to existing siphon pipe (Std. SPPWC 380-4)	65
707XXX	Concrete Manhole (COSB Std. 3-080)	70
71012X	Remove Drainage Facilities	71
710100	Abandon 24" Culvert	71
710110	Abandon Drainage Inlet	71

61 GENERAL

61-1 GENERAL

61-1.01 GENERAL

Section 61 includes general specifications for constructing drainage facilities.

61-1.02 MATERIALS

Not Used

61-1.03 CONSTRUCTION *Not Used*

61-1.04 PAYMENT

Not Used

61-2 CULVERT AND DRAINAGE PIPE JOINTS

61-2.01 GENERAL

61-2.01A Summary

Section 61-2 includes specifications for constructing joint systems and couplers for culverts and drainage pipes.

Joint systems and couplers for culverts and drainage pipes are classified as standard, positive, or downdrain.

61-2.01B Definitions

shear strength: *Required joint shear strength expressed as a percentage of the calculated pipe shear strength at a transverse section remote from the joint.*

moment strength: *Moment strength required of the joint expressed as a percentage of the calculated moment capacity of the pipe on a transverse section remote from the joint.*

tensile strength: *Resistance to the longitudinal force that tends to separate adjacent pipe sections.* ***integral joint overlap:*** *Projection of 1 pipe barrel into another pipe barrel.*

sleeve joint overlap: *Minimum sleeve width required to engage abutted pipe barrels.* ***watertightness:*** *Ability of a joint to hold water under pressure without leaking.*

joint: *Connection point for 2 or more pipe sections.*

61-2.01C Submittals

For watertight joints, submit your analysis or test results performed on representative joints proposed for installation.

Submit a certificate of compliance for each classification of joint systems and couplers.

Where field leakage testing is shown for pipe systems, submit:

1. *Proposed field leakage test procedure for each portion of each pipe system at least 15 days before you start testing. The submittal for each proposed field leakage test procedure must include: 1.1. Type of test: exfiltration, low-pressure air, negative air pressure, or other authorized method*
    1.2. *Specific joints or pipe sections to be tested*
    1.3. *Maximum and minimum pressures or hydrostatic head to be applied*
    1.4. *Duration of tests from location to location*
    1.5. *Date and time of each test*
    1.6. *List of test equipment to be used*
    1.7. *Date of last calibration if applicable*
2. *Leakage calculations for the exfiltration and infiltration tests*
3. *Repair procedure for joints or pipe sections that fail the field leakage test*

61-2.01D Quality Assurance

61-2.01D(1) General

Reserved

61-2.01D(2) Quality Control

61-2.01D(2)(a) Watertightness Test

Perform watertightness tests of the assembled joints. The assembled joints must pass the tests without joint leakage.

The watertightness test must consist of testing the hydrostatic pressure on a joint by connecting 2 pipe sections under the manufacturer's instructions. Provide suitable bulkheads within the pipe adjacent to and on either side of the joint or at the outer ends of the joined pipe sections. Do not place mortar or concrete coating, filling, or packing in addition to that normally required for the joint before conducting the watertightness test. After the pipe sections are fitted together with the gasket or gaskets in place, subject the assembly to a 10-foot water pressure head above the pipe crown for 10 minutes. Moisture or beads of water appearing on the surface of the joint are not considered leakage. Perform the test on individual joints at the manufacturer's plant.

Test joint watertightness on pipe sections in straight alignment and on pipe sections deflected from straight alignment. When you test joints on pipe sections not in straight alignment, position the pipe sections to create a gap on one side of the outside pipe perimeter that is 1/2 inch wider than the gap for the pipe sections in straight alignment. If you use coupling bands to test the pipe sections not in straight alignment and the maximum gap on one side of the outside pipe perimeter is less than 1/2 inch wider than that for the pipe sections in straight alignment, position the coupling band and the pipe sections to provide the maximum gap.

61-2.01D(2)(b) Performance Specifications

For joint systems and couplers under section 61-2.01D(2)(b), determine the values for joint properties by mathematical analysis or an authorized test. Joint components subject to bending forces must not be stressed beyond the minimum specified yield strength of the material as determined by using the plastic section modulus.

Joint systems or couplers must:

1. *Perform their intended function*
2. *Possess durability equivalent to that of the pipe*
3. *Comply with the quality characteristics shown in the following table:*

Joint Classification Requirements

Quality characteristic	*Requirement*		
	Standard	*Positive[a]*	*Downdrain[b]*
Shear strength (min, %)	*2*	*5*	*5*

Moment strength (min, %)	*0*	*15*	*15*
Tensile strength			
6"–42" dia[c,] (min, lb)	*0*	*0*	*5,000*
45"–84" dia[c] (min, lb)	*0*	*0*	*10,000*
Joint overlap[d]			
Integral			
12" and smaller dia[e] (min, in)	*1/4*	*1/2*	*--*
15"–33" dia[e] (min, in)	*1/2*	*3/4*	*--*
36" and larger dia[e] (min, in)	*3/4*	*1*	*--*
Sleeve width (min, in)	*10-1/2*	*10-1/2*	*10-1/2*
Watertightness	*Where described*	*Where described*	*Required*

[a]Positive joints must comply with either (1) shear strength, moment strength, and joint overlap-sleeve properties, or (2) shear strength and joint overlap-integral characteristics.
[b]Joints for downdrains have at least the specified values when tested with joints sealed to comply with the watertightness requirement. [c]Limits for corrugated metal pipe arch depend upon the equivalent diameter of circular pipe under AASHTO M 36 for corrugated steel pipe and AASHTO M 196 for corrugated aluminum pipe.
[d]Joints designed to comply with required values by means other than joint overlap as shown in the table may be used if authorized.
[e]Inside diameter of circular pipes or inside horizontal dimension of oval or arch pipes.

61-2.01D(3) Field Leakage Testing

61-2.01D(3)(a) General

Perform field leakage testing on culverts and drainage structures wherever field leakage testing is shown.

Field leakage testing includes:

1. *Cleaning and presoaking pipes*
2. *Installing and removing bulkheads or plugs necessary to perform tests*
3. *Removing and disposing of waste materials*
4. *Retesting*
5. *Repairing*
6. *Changing the drainage system to comply with specifications for field leakage testing*

For pipe systems less than 1,500 feet in length, test all joints for leakage.

For pipe systems 1,500 feet or greater in length, test each pipe system for leakage at locations selected by the Engineer at a rate of:

1. *50 joints per 100 pipe joints for pipe systems less than 1 mile in length*
2. *30 joints per 100 pipe joints for pipe systems from 1 mile to 3 miles in length*
3. *20 joints per 100 pipe joints for pipe systems more than 3 miles in length*

For every selected joint or section that fails leakage requirements, the Engineer may select up to 4 more joint locations or sections between joints for testing.

Clean the pipe and remove debris and sediment before you start testing.

Clean and test each pipe system and appurtenances by using the exfiltration, infiltration, low-pressure air, or negative air pressure method, except the Engineer must approve the use of the infiltration test if the groundwater table is low. You may test installed pipe joints using air or water under low pressure. Field leakage testing is conducted after backfilling.

Do not use your test equipment until it is authorized. The Engineer may require a calibration test of gauges or other instrumentation.

Use only 1 leak test method on a contiguous pipe system unless the pipe type or diameter changes in the same run.

Complete the cleaning and testing of each pipe system between inlets or ends within 20 days after backfilling for storm drain lines and structures.

Perform each test in the presence of the Engineer.

Prevent joints from separating during a test. Repair any damage resulting from the field leakage test.

Take corrective action and retest the line if the leakage exceeds the allowable quantity. Determine the leak source and repair or replace the defective pipe whenever an installed pipe system fails to comply with the requirements under the test method used.

The Engineer does not accept a pipe installation if it fails to pass the field leakage test.

Stop all obvious leaks even if the leakage is below the allowable quantity.

61-2.01D(3)(b) Exfiltration and Infiltration Testing

Exfiltration and infiltration tests must comply with ASTM C969 except:

1. *You may fill the pipe with clear water to allow normal absorption into the pipe wall before performing the exfiltration leakage test. Start the leakage test within 72 hours after filling the pipe and complete the field leakage test within 24 hours thereafter. The test period must be at least 1 hour in duration. For plastic and metal pipe, the absorption period is not required.*

2. *Leakage must not be more than 1,000 gallons per inch of nominal pipe diameter per mile of pipe per day with a minimum test pressure of 6 feet of water column above the pipe crown at the upper end of the pipe or above the active groundwater table, whichever is higher. Limit the length of pipe you test such that the pressure on the invert of the lower end of the section does not exceed 20 feet of water column. Increase the allowable leakage by 8 percent for each increase in pressure of 1.5 feet above the basic 6-foot water column measured above the crown or at the lower end of the section.*

3. *Whenever a suitable head of groundwater exists above the pipe crown and if the pipe is large enough to work inside, the Engineer may accept the installed pipe on the basis of visible leakage repair during the infiltration leakage test.*

4. *Take into account all lateral or side storm drains included in the test section in computing the allowable leakage. Make an allowance of 0.2 gallons per hour per foot of head above the invert for each junction structure or drainage inlet included in the test section.*

Storm drains, side storm drains, and fittings must be open, clean, and free draining upon final completion of the work.

61-2.01D(3)(c) Low-Pressure Air Test

You may use the low-pressure air test instead of the exfiltration test or the infiltration test for pipes 30 inches in nominal diameter or less. You may prewet the pipes. Test pipes from inlet to inlet or shorter lengths. Do not use the low-pressure air test for drainage pipes over 30 inches in nominal diameter regardless of the material type. If you use a low-pressure air test, perform the test immediately following pipe cleaning.

Brace plugs and bulkheads to prevent release during the low-pressure air test. Locate gauges, air piping manifolds, and valves above the ground. Do not allow anyone to enter a manhole or inlet of a plugged pipe when it is under pressure. Equip the air testing apparatus with a pressure release device, such as a rupture disk or a pressure relief valve, designed to relieve pressure in the pipe at 6 psi when under test.

Start the test after the pressure is stabilized at or above an internal pressure of 3.5 psi greater than the average back pressure of the groundwater that could submerge the pipe. Start recording the time when the internal pressure drops to 3.5 psi. The tested portion of the pipe passes the field leakage test when the pressure drop is less than 1 psi for the time period calculated for the size and length of the pipe to be tested as shown in the following table:

Minimum Test Time for Pressure Drop

Nominal pipe diameter (inches)	*Time for pressure drop (minutes/100 feet)*
6	*0.7*
8	*1.2*
10	*1.5*
12	*1.8*
15	*2.1*
18	*2.4*
21	*3.0*
24	*3.6*
27	*4.2*
30	*4.8*

61-2.01D(3)(d) Other Allowable Tests *If authorized, you may test:*

1. *Pipes over 27 inches in nominal diameter 1 joint at a time under ASTM C1103 instead of the exfiltration test specified in section 61-2.01D(3)(b).*

2. *Plastic pipe 30 inches or less in nominal diameter with the low-pressure air test specified in ASTM F1417.*

3. *Pipes 36 inches or less in nominal diameter with the negative 3.5 psi vacuum air pressure test specified in ASTM C1214 instead of the exfiltration test or low-pressure air test specified in section 61-2.01D(3)(b) and 61-2.01D(3)(c). The minimum test times for pressure drop for pipes:*
    - 3.1. *30 inches in nominal diameter and smaller must be the same as the low-pressure air test specified in section 61-2.01D(3)(c)*
    - 3.2. *33 inches in nominal diameter must be 5.4 minutes per 100 feet*
    - 3.3. *36 inches in nominal diameter must be 6.0 minutes per 100 feet*

61-2.01D(3)(e) Joints or Pipe Section Not Passing Leakage Testing

Identify joints or pipe sections that exceed the maximum allowable leakage after you complete field leakage testing. Repair and retest the failed joints or pipe sections until they comply with the test requirements.

Repair and retest the failed joints or pipe sections as specified in the repair procedures submitted under section 61-2.01C. If the same joint fails the leakage test a second time, remove and replace the pipe sections on either side of the joint with new pipes. Replace any pipe section that fails. Retest the replaced pipe section for leaks.

61-2.01D(3)(f) Reserved

61-2.02 MATERIALS

Resilient joint material must be a neoprene expanded rubber or sheet rubber gasket, "O" ring rubber gasket, butyl rubber base joint sealant, or other authorized resilient material.

All joints, including any connection, must be capable of transferring the required shear across the joint.

Watertightness must be attained by use of an authorized durable, high-quality, resilient joint material designed to perform the intended function.

61-2.03 CONSTRUCTION

Not Used

61-2.04 PAYMENT

The payment quantity for field leakage testing:

1. Is the length of the pipe that has passed field leakage tests 2. Is measured:
2.1. Along the invert of the pipe
2.2. To the inside face of drainage inlets or similar structures that are within the length of the tested pipe
3. Includes the length through elbows, tees, and other fittings that have passed field leakage tests

61-3 ALTERNATIVE CULVERTS

61-3.01 GENERAL

Section 61-3 includes specifications for constructing alternative culverts.

Choose from the types of alternative culverts shown.

Reinforced concrete pipe must comply with section 65.

Corrugated steel pipe and pipe arches must comply with section 66.

Corrugated aluminum pipe and pipe arches must comply with section 66.

HDPE pipe must comply with section 64.

PVC pipe must comply with section 64.

Structural steel plate pipe, arches, and pipe arches must comply with section 67.

Structural aluminum plate pipe, arches, and pipe arches must comply with section 67.

Reinforced concrete box culverts must comply with section 51.

Alternative culverts include concrete collars and concrete tees and reinforcement for connecting new pipe to existing or new facilities.

61-3.02 MATERIALS

Concrete for the collars and tees must be minor concrete.

Reinforcement for the concrete collars or tee connections must comply with section 52.

61-3.03 CONSTRUCTION *Not Used*

61-3.04 PAYMENT

Not Used

61-5 CONCRETE BACKFILL FOR PIPE TRENCHES

61-5.01 GENERAL

61-5.01A Summary

Section 61-5 includes specifications for placing concrete backfill in pipe trenches.

61-5.01B Definitions

Reserved

61-5.01C Submittals

If RSC is used for concrete backfill, submit the concrete mix design and test data from an authorized laboratory at least 10 days before excavating the pipe trench. The laboratory must specify the cure time required for the concrete mix to attain a 500 psi compressive strength when tested under California Test 521.

61-5.01D Quality Assurance

Reserved

61-5.02 MATERIALS

Concrete backfill must comply with the specifications for minor concrete, except the concrete must contain at least 380 pounds of cementitious material per cubic yard.

You may use RSC for concrete backfill except:

1. *Section 90-1 does not apply*
2. *RSC must comply with minor concrete sections 90-2.01C, 90-2.01D, 90-2.02B, 90-2.02C 90-2.02D and 90-2.02E*

61-5.03 CONSTRUCTION

For installation of plastic pipe where saturated clay, peat, or other unsuitable material is encountered immediately adjacent to the pipe trench, the material must be removed to a distance at least equal to 1/4 of the pipe diameter, but not less than 6 inches, on each side of the pipe.

Place concrete backfill in the trench against undisturbed material at the sides and bottom of the trench in a way that prevents (1) floating or shifting of the pipe and (2) voids or segregation of the concrete. Immediately remove foreign material that falls into the trench before or during placement of the concrete. Construct and compact earth plugs at the ends of the planned concrete backfill to contain the concrete within the trench where necessary.

Wherever minor concrete is used, do not place materials on top of the concrete backfill within 8 hours of placing the concrete backfill.

Wherever RSC is used, do not place materials on top of the concrete backfill before the required cure time to attain 500 psi has elapsed.

Consolidate concrete backfill using high-frequency internal vibrators.

If HMA is to be placed directly on the concrete backfill, broom the surface with a heavy broom to produce a uniform rough surface.

61-5.04 PAYMENT

The payment quantity for concrete backfill (pipe trench) is the volume determined from the dimensions shown and the length of pipe if the limits of concrete backfill are shown.

If the limits of concrete backfill are not shown, the payment quantity for concrete backfill (pipe trench) is the volume determined as follows:

1. *Horizontal limits are determined from vertical planes 6 inches outside of each side of the pipe for a diameter or span of less than 42 inches and 12 inches outside of each side of the pipe for a diameter or span of 42 inches or greater.*
2. *Upper limit is determined from a horizontal plane 12 inches above the top of the pipe.*
3. *Lower limit is determined from a horizontal plane at the bottom of the pipe.*
4. *If alternative pipe is shown, the payment quantity for concrete backfill (pipe trench) is determined from the required trench width for the alternative pipe with the smallest outside diameter and the length of the pipe.*
5. *Volume occupied by the pipe is not included in the payment quantity. Concrete backfill placed outside of these limits is not included in the payment.*

61-6 TEMPORARY CULVERTS

61-6.01 *GENERAL*

Section 61-6 includes specifications for constructing temporary culverts.

Temporary culverts include pipe bends, wyes, tees, and other branches.

Excavation, backfill, and shaped bedding must comply with section 19-3.

61-6.02 *MATERIALS*

You may install a removed, undamaged, temporary culvert in the permanent work if it complies with the specifications for the permanent culvert and it is new when installed as a temporary culvert on the project.

61-6.03 *CONSTRUCTION*

Install a size and type of temporary culvert capable of sustaining the intended load and discharging a quantity of water equivalent to the type and size of culvert shown. Obtain authorization for the strength and capacity of the culvert before its installation.

Excavate and backfill the trench for a temporary culvert in a way that provides a firm, nonsettling foundation for the roadbed to be constructed over the culvert.

61-6.04 *PAYMENT*

The payment quantity for temporary culvert:

1. *Is the length measured along the centerline of the pipe and parallel with the slope line.*
2. *Includes the length of pipe reducers, bends, wyes, tees, and other branches to the point of intersection. The length of pipe reducer is included in the length of the larger diameter pipe connected to the reducer.*
3. *Is the length of pipe necessary to be placed before cutting, measured in 2-foot increments, if the pipe is cut to fit a structure of slope.*

64 PLASTIC PIPE

64-1 GENERAL

64-1.01 GENERAL

64-1.01A Summary

Section 64-1 includes general specifications for fabricating and installing plastic pipe.

64-1.01B Definitions

Reserved

64-1.01C Submittals

Submit a certificate of compliance for plastic pipe, including the average pipe stiffness, resin material cell classification and date of manufacture.

64-1.01D Quality Assurance

Reserved

64-1.02 MATERIALS

Not Used

64-1.03 CONSTRUCTION *Not Used*

64-1.04 PAYMENT

Not Used

64-2 *PLASTIC PIPE*

64-2.01 GENERAL

64-2.01A Summary

Section 64-2 includes specifications for fabricating and installing plastic pipe.

Installing plastic pipe includes excavation, backfill, connection of new pipe to new or existing facilities, reinforcement, concrete collars or tees, and other connecting devices.

64-2.01B Definitions

Reserved

64-2.01C Submittals

For corrugated polyethylene pipe, submit the manufacturer's copy of plant audits and test results from the National Transportation Product Evaluation Program for the current cycle of testing for each pipe diameter furnished.

64-2.01D Quality Assurance

Reserved

64-2.02 MATERIALS

64-2.02A General

Plastic pipe must be Type C or Type S corrugated polyethylene pipe or corrugated PVC pipe with smooth interior.

The residue from the ignition of HDPE and PVC compounds must not exceed 30 percent as determined under ASTM D2584 except the muffle furnace temperature must be 840 ± 45 degrees F.

Pipes and fittings must be homogenous throughout and uniform in color, opacity, density, and other properties. The inside and outside surfaces must be semimatte or glossy in appearance and free of chalky, sticky, or tacky material. The pipe walls must be free of cracks, holes, blisters, voids, foreign inclusions, or other defects affecting the pipe wall integrity or visible to the naked eye. Do not use pipes or fittings with abrasions or scratches deeper than 10 percent of the wall thickness. The joint surfaces where the gaskets bear must be smooth and free of imperfections, ridges, fractures, or cracks that could adversely affect the joint seal.

Store pipes in unit packages and protect the bell end of the pipes from damage. Support unit packages with racks or dunnage to prevent damage and bending. If unit packages are stacked, do not allow the weight of the upper units to cause deformation to the pipes in the lower units. Do not store pipes adjacent to heat sources. Do not allow pipes to overhang vehicles or storage areas unsupported by more than 3 feet.

Cover pipes to provide temporary sun block protection. Provide adequate air circulation around the covered pipes to reduce excessive heat accumulation. Protect gaskets from exposure to weather, heat, ozone, oil, grease, and sunlight for any time period exceeding 48 hours. Do not store gaskets near electrical or exhaust heat sources.

The Department rejects pipes with cracked or split gaskets.

Protect pipes and fittings from damage when handling and installing.

64-2.02B Backfill

Structure backfill material for plastic pipe must comply with section 19-3 except the gradation of structure backfill must comply with the following table:

Gradation of Structure Backfill for Plastic Pipe

Sieve size	*Percentage passing*
1-1/2"	*100*
No. 4	*25–70*
No. 50	*5–20*
No. 200	*0–5*

Controlled low-strength material and slurry cement backfill must comply with section 19-3.

64-2.02C Corrugated Polyethylene Pipe

Corrugated polyethylene pipe must be 60 inches or less in nominal diameter.

Type C and Type S corrugated polyethylene pipe must be manufactured from HDPE virgin compounds and comply with AASHTO M 294.

HDPE compounds used in the manufacture of corrugated polyethylene pipe and fittings must comply with AASHTO M 294 except the mix must contain from 2 to 4 percent well-dispersed carbon black.

The corrugated polyethylene pipe manufacturer must:

1. *Participate in the National Transportation Product Evaluation Program for each plant supplying corrugated polyethylene pipe and fittings for the project*
2. *Conduct and maintain a quality control program under National Transportation Product Evaluation Program*

64-2.02D Corrugated PVC Pipe with Smooth Interior

Corrugated PVC pipe must have smooth interior and be manufactured as a single extrusion. The corrugated exterior profile must be annular and seamless. The pipe dimensions, wall thickness, socket sizes, and fitting tolerances must comply with ASTM F949.

The minimum stiffness of corrugated PVC pipe must be 46 psi when tested under ASTM D2412.

Corrugated PVC pipe and fittings must be manufactured from PVC virgin compounds, except clean, reworked, recycled PVC materials generated from the manufacturer's pipe or fitting fabrication may be reused.

Corrugated PVC pipe must comply with ASTM F949 for cell classification 12454 under ASTM D1784. Fillers that lower the tensile strength of the compound or change the minimum cell classification are not allowed. PVC compounds must contain at least 0.5 percent by weight rutile titanium dioxide or the quantity recommended by the pipe manufacturer.

The chemical resistance of corrugated PVC pipe and fittings must comply with ASTM D5260 for cell classification S47552.

The manufacturer's code must include the day, month, year, shift, and plant of manufacture.

Do not expose pipes to direct sunlight for more than 30 days.

64-2.02E Joints

Plastic pipe joints must comply with section 61-2.01D(2)(b) for standard or positive joints. Where sleeve joint connections are used, the sleeve width must be at least 7-3/4 inches and engage at least 2 corrugations of each pipe being joined.

Joints for pipes shown as watertight must be watertight under pressure and all conditions of expansion, contraction, and settlement, and must comply with section 61-2.01D(2)(a) for watertightness.

For corrugated polyethylene pipe:

1. *If watertight joints are shown, use Type S corrugated polyethylene pipe with gaskets. If watertight joints are not shown, use gasketed joints when specified. Gaskets for Type C corrugated polyethylene pipe must be installed on each side of the joint. Gaskets must comply with ASTM F477 and be factory-installed.*

2. *Corrugated polyethylene pipe joints manufactured to comply with section 61-2.01D(2)(b) for integral joints must be laid to line and grade with sections closely jointed. Corrugated polyethylene pipe to be joined by sleeve joints must be laid to line and grade with the separate sections not more than 1-1/2 inches apart and then firmly joined together with at least 2 corrugations from each pipe section engaged in the coupler.*

For corrugated PVC pipe with smooth interior:

1. *Elastomeric gaskets must comply with ASTM F477 for low-head applications. Use extruded or molded gaskets cured in a way so that any cross section will be dense, homogeneous, and free of pores, blisters, pitting or other imperfections. Double gaskets must be single-piece gaskets that fit into the first 2 full corrugation valleys on the spigot end. Ship gaskets in containers that will prevent damage from UV exposure and handling.*

2. *Wyes, tees, reducers, elbows, couplings, laterals, and other fittings must be molded or fabricated under ASTM F949 for cell classification 12454 or 13343 as specified in ASTM D1784.*

3. *Lubricant must comply with the pipe manufacturer's instructions. The lubricant must not have a detrimental effect on gaskets or pipes.*

4. *Joints must comply with section 61-2.01D(2)(b) for integral joints except the joint overlap requirements are as shown. Pipe joints must be bell and spigot type with gaskets ready for field assembly. Install joints so that the elastomeric gasket will be compressed radially between the pipe bell and spigot to form a tight seal when assembled.*

64-2.02F–64-2.02H Reserved

64-2.03 CONSTRUCTION

64-2.03A General

Install Type C corrugated polyethylene pipe wherever corrugated interior wall type is shown.

Install Type S corrugated polyethylene pipe or corrugated PVC pipe wherever smooth interior wall type is shown.

You may install corrugated or smooth interior wall pipe if the type of plastic pipe is not shown.

For PVC pipe, whenever the atmospheric temperature is forecast to be 40 degrees F or less, demonstrate to the Engineer that the bar and block method or any other mechanical assistance method for assembling the pipes will not damage the pipes before proceeding with pipe assembly.

64-2.03B Earthwork

Excavation, backfill, and shaped bedding must comply with section 19-3 except:

1. *Where saturated clay, peat, or other unsuitable material is encountered immediately adjacent to the pipe trench, remove the material to a distance at least equal to the pipe diameter on each side of the pipe if compacted backfill is to be placed or a distance at least equal to 1/4 the pipe diameter, but not less than 6 inches, on each side of the pipe if slurry cement or controlled low-strength material is to be placed.*

2. *Backfill corrugated polyethylene pipe greater than 48 inches in nominal diameter with either controlled low-strength material under section 19-3.02G or with slurry cement backfill under section 19-3.02E.*

3. *Place controlled low-strength material or slurry cement backfill used for structure backfill to a level at least 12 inches above the pipe crown.*

Lay plastic pipe in a trench excavated to the established lines and grades. Grade and prepare the bottom of the trench as shown throughout the entire length of the pipe.

Removing unsuitable material and replacing it with suitable material is change order work.

64-2.03C Pipe Placement

Provide the necessary facilities for lowering and properly placing pipe sections in the trench.

Lay plastic pipe to line and grade with sections closely jointed.

Do not let the pipe trench flood before backfilling.

Construct concrete collars or tee connections with minor concrete whenever concrete collars or tee connections are required to connect new plastic pipe to existing or new pipe. Reinforcement for concrete collars and tees must comply with section 52.

For corrugated PVC pipe with smooth interior:

1. *Install gaskets on pipe spigots after the pipe is placed into the trench and ready for joint connection. Place the gasket on the spigot end under the pipe manufacturer's installation instructions. The leading edge of the gasket must point toward the spigot end whenever a double gasket is used. Both the spigot and bell ends must be free of debris before connection. Apply the pipe manufacturer's recommended lubricant to the inside of the bell and over the gasket. Insert the spigot end of the pipe into the bell end until the factory provided insertion line on the spigot end lines up with the bell edge.*

2. *Whenever the spigot end of a pipe is shortened, cut the end square and bevel it to the same angle as provided on the factory-finished spigot end so that burrs are not visible. Re-mark the shortened pipe with a new insertion line on the spigot using a factory-marked spigot insertion line as a guide.*

3. *Cover the ends of installed corrugated PVC pipe that were not backfilled after installation at the end of each day.*

4. *Pipes must not exhibit deflection in excess of 5 percent of the original inside diameter at any location after being backfilled to at least 5 feet above the top of the pipe or to the completed grade, whichever is less.*

64-2.04 PAYMENT

The payment quantity for plastic pipe:

1. *Is the length designated by the Engineer*
2. *Is measured along the centerline of the pipe and parallel with the slope line*
2. *Includes the length of pipe elbows, wyes, tees, and other branches to the point of intersection*

3. *Is the length of pipe necessary to be placed before cutting, measured in 2-foot increments, if the pipe is cut to fit a structure or slope*

65 CONCRETE PIPE

65-1 GENERAL

65-1.01 GENERAL

Section 65-1 includes general specifications for constructing concrete pipe.

Excavation, backfill, and culvert beddings must comply with section 19-3.

65-1.02 MATERIALS

Not Used

65-1.03 CONSTRUCTION

Where pipes are connected to inlet and outlet structures, place the ends of the pipes flush or cut them off flush with the structure face.

Lay and joint reinforced concrete pipe used for drainage purposes and dry conduits under generally accepted practices suitable for the purpose intended.

Connect new reinforced concrete pipe to new or existing drainage facilities as shown.

Furnish the necessary facilities for lowering and properly placing pipe sections in the trench.

Clean and then seal each joint with the type of sealing material necessary to make a tight joint to prevent leakage and infiltration.

Lay pipes to lines and grades with the sections closely jointed. Lay pipes upgrade.

Fill any voids occurring in the outer and inner annular sealing material with the same type of sealing material and finish the inside of the joint smooth.

Take every precaution to prevent flooding of the pipe trench before backfilling activities start.

65-1.04 PAYMENT

The payment quantity for concrete pipe is the length measured along the centerline of the pipe and parallel with the slope line. The payment quantity includes the length of bends, wyes, tees, and other branches to the point of intersection.

If pipes are cut to fit a structure or a slope, the payment quantity is the length of pipe necessary to be placed before cutting measured in 2-foot increments. If you construct CIP connection instead of cutting off the pipe to fit the structure, the payment quantity is the length measured along the centerline of the pipe to the inside face of the structure.

65-2 REINFORCED CONCRETE PIPE

65-2.01 GENERAL

65-2.01A Summary

Section 65-2 includes specifications for constructing reinforced concrete pipe.

65-2.01B Definitions modified designs: *Designs that differ from direct designs shown with respect to reinforcement only.*

oval shaped pipe: *Pipes having major and minor internal axial dimensions described. The minor axis length must be 60 to 65 percent of the major axis length. The 1st dimension designated represents the rise and the 2nd dimension represents the span.*

special designs: *Designs that differ from direct designs in any respect from those shown.*

65-2.01C Submittals

If you choose to use resilient joint materials, submit them for testing and authorization.

For circular reinforced concrete pipe, direct design method, submit:

1. *Shop drawings. Modified designs and special designs must comply with the Department's bridge design specifications. For modified designs, do not change the clear coverage between the surface of the concrete and the outside of the reinforcement or the thickness of the pipe barrel wall shown. Submit 3 sets of shop drawings for initial review by the Office of Design and Technical Services. Submit 6 sets of shop drawings after the initial review for use during construction and by the Office of Design and Technical Services. Shop drawings must include:*
    - 1.1. *Wall thickness*
    - 1.2. *Type, size, location, and configuration of the reinforcement*
    - 1.3. *List of station locations for the pipes, including the size, wall type, and maximum cover height*
    - 1.4. *Method of excavation, bedding, and backfill for each location*
2. *Proof of adequacy for modified design and special design proposals. The Engineer will determine the adequacy of modified and special designs based upon compliance with crack requirements and structural design parameters. The Department will not be liable to you for failure to accept any modified design or special design you submit.*
3. *A copy of the concrete mix design before using the concrete or revising the mix proportions*
4. *A certificate of compliance for each pipe shipment. The certificate must:*
    - 4.1. *Be signed by the manufacturer's quality control representative*
    - 4.2. *State that all materials and workmanship comply with the specifications and authorized shop drawings*

For nonreinforced concrete pipe substituted for circular reinforced concrete pipe described or chosen by class, submit proof of adequacy for proposed modifications or special designs. Proof must consist of 3edge bearing tests either (1) certified by an authorized laboratory or (2) the pipe manufacturer's tests witnessed by the Department. The tests must demonstrate the adequacy of the proposed design. A minimum of 3 proof tests will be required for each size and class you supply.

65-2.01D Quality Assurance

65-2.01D(1) General

Before hydrostatic testing, reinforced concrete pipe must be tested under the 3-edge bearing method to a maximum D-load that is 10 percent greater than the 0.01-inch cracking D-load under AASHTO M 170 or to the actual D-load required to produce a 0.01-inch-wide crack, whichever is less.

65-2.01D(2) Field Testing of Siphon and Pressure Pipe

Perform field leakage tests on siphons and low-head conduits with internal hydrostatic heads not exceeding 50 feet.

Fill the pipe with water to a hydrostatic head of 10 feet above the highest point in the line after the pipe has been laid and backfill has been placed and compacted to a minimum of 2 feet above the pipe.

Conduct a hydrostatic test for a period of not less than 24 hours. Make accurate measurements of the water required to maintain the test pressure during that period. Any leakage developed by the test must not exceed the allowable leakage as computed by the following formula:

$E = 0.00002H^{1/2}LD$

where:
E = allowable leakage in gpm
H = difference in elevation in feet between the water surface at 10 feet above the highest point in the line and the invert elevation of the pipe at its lowest point
L = length of the culvert or drainage pipe in feet D =
internal diameter of the pipe in inches

Furnish all water, materials, and labor for the hydrostatic test. Conduct all hydrostatic tests in the presence of the Engineer. The Department does not pay for hydrostatic testing.

Stop any leakage in excess of the allowable leakage as authorized. Repeat the hydrostatic test until the total leakage does not exceed the allowable leakage. Stop all obvious leaks whether or not the leakage from the line exceeds the allowable leakage. You may maintain the pipe line full of water for not more than 8 hours before you start hydrostatic testing.

65-2.01D(3) Circular Reinforced Concrete Pipe, Described or Chosen by Class

The basis for acceptance of reinforced concrete pipe over 24 inches in nominal diameter is determined from results of the 3-edge bearing test for the load to produce a 0.01-inch-wide crack. Testing to the ultimate load is not required except as necessary to obtain samples for the absorption test.

Pipes 24 inches in nominal diameter and smaller do not need to be tested to the load to produce a 0.01inch-wide crack if the pipe is subjected to a load equivalent to the ultimate test load and complies with section 65-2.02. Instead of broken pipe pieces obtained as specified above, you may furnish 4-inchdiameter cores from pipe sections selected by the Engineer for performing the absorption test. Pipe sections that have been tested to the actual 0.01-inch-wide crack will not be load-tested further, and those sections that comply with or exceed the required strength and workmanship standards may be used in the work if authorized.

65-2.01D(4) Circular Reinforced Concrete Pipe, Direct Design Method

Sample and test the concrete compressive strength under AASHTO M 170 at least once every production shift, but not less than once daily.

The 3-edge bearing test does not apply to direct design method pipes.

65-2.01D(5) Oval Shaped Reinforced Concrete Pipe

The basis for acceptance of oval shaped reinforced concrete pipe larger than an equivalent 24-inchnominal-diameter circular pipe must be determined by the results of the 3-edge bearing test for the load to produce a 0.01-inch-wide crack. Testing to the ultimate load will not be required except as necessary to obtain samples for the absorption test.

Oval shaped reinforced concrete pipe 24 inches in nominal diameter and smaller does not need to be tested to the load to produce a 0.01-inch-wide crack if the pipe is subjected to a load equivalent to the ultimate test load and complies with section 65-2.02. Instead of broken pipe pieces obtained as specified above, you may furnish 4-inch-diameter cores from pipe sections selected by the Engineer for performing the absorption test. Pipe sections that have been tested to the actual 0.01-inch-wide crack will not be load-tested further, and those sections that comply with or exceed the required strength and workmanship standards may be used in the work if authorized.

65-2.02 MATERIALS

65-2.02A General

The cementitious material and aggregate for concrete pipe must comply with section 90-1.02, except (1) gradation requirements do not apply to the aggregate and (2) the use of SCM must comply with AASHTO M 170.

The concrete for reinforced concrete pipe must contain at least 470 pounds of cementitious material per cubic yard and have a water to cementitious material ratio that does not exceed 0.40 by weight. You may use SCM. Reinforcement must have a minimum cover of 1 inch, except pipes with a nominal diameter of 18 inches or less must have a minimum cover of 3/4 inch.

Special reinforced concrete pipe having concrete cover over the steel reinforcement greater than the cover under AASHTO M 170 must comply with section 65-2.02, except the crack width produced by the D-load test under AASHTO M 170 must be determined by the following formula:

$$b = \frac{t - 3/8d}{t - 3/8d - C} \times 0.01 \text{ inch}$$

where:

b = Width of crack to be produced instead of 0.01-inch crack under AASHTO M 170
t = Wall thickness of pipe, inches d = Effective depth of section to be tested, feet
C = Concrete cover over steel reinforcement in excess of cover under AASHTO M 170

If concrete collars or tee connections are required to connect new concrete pipe to new or existing pipes, the concrete collars or tee connections must be constructed of minor concrete. Reinforcement for the concrete collars or tee connections must comply with section 52.

65-2.02B Delivery, Storage and Handling

Rubber gaskets must be stored at 70 degrees F or less. Do not expose rubber gaskets to direct sun rays for more than 72 hours.

Sufficiently protect jointing materials from the air and sun to prevent drying or deterioration.

Keep liquid types of sealing materials in molds or runners.

65-2.02C Circular Reinforced Concrete Pipe

65-2.02C(1) General

Circular reinforced concrete pipe described by class must comply with section 65-2.02C(2) for the class of pipe described.

If the class of pipe is not described and the nominal diameter is less than 24 inches, choose the class of pipe. The pipe chosen must comply with section 65-2.02C(2).

Pipes must be marked as specified in AASHTO M 170, except circular pipe sections with elliptical reinforcing must have the location of the minor axis of the reinforcing indicated by 3-inch-wide, waterproof, painted stripes on the inside and outside of each pipe at the top and bottom, at least 12 inches long at each pipe section end, or you may provide a lift hole or lift holes at the top of each pipe along the minor axis of the reinforcement.

If the class of pipe is not described and the nominal diameter is 24 inches or greater, choose either:

1. *The class of pipe. The pipe chosen must comply with section 65-2.02C(2).*
2. *The wall thickness and reinforcement details under section 65-2.02C(3).*

If 1 lift hole is provided, the lift hole must be located at the balance point; if 2 lift holes are provided, the lift holes must be spaced equidistant on each side of the balance point. The lift holes must not interfere with the reinforcement. After placing the pipe, fill the open lift holes with cement mortar or concrete plugs before backfilling.

65-2.02C(2) Circular Reinforced Concrete Pipe, Described or Chosen by Class

Circular reinforced concrete pipe described or chosen by class must comply with AASHTO M 170.

If the class of circular reinforced concrete pipe is not described, choose the class of pipe and corresponding method of backfill for the type of installation shown.

If the class of circular reinforced concrete pipe is described, choose the method of backfill for the type of installation shown.

The D-load to produce a 0.01-inch-wide crack must be not less than the specified D-load.

For pipe classes not specified under AASHTO M 170, but within the minimum and maximum size limits under AASHTO M 170, determine the wall thickness and steel area by interpolation from data given in the tables for pipes of the next smaller size and pipes of the next larger size.

For pipe classes, except Class I, that are less than the minimum size for a particular class under AASHTO M 170, the minimum wall thickness must be not less than 1-3/4 inches and the steel area must be not less than 0.06 sq in/lf of pipe barrel.

The Department will grant the authorization required under AASHTO M 170 to extrapolate minimum wall thicknesses and steel areas beyond the limits for wall A or B in table 4 and for wall B in table 5 under AASHTO M 170 if you submit your pipe designs in advance and the pipes comply with all of the specified tests and performance requirements.

For reinforced concrete pipe sizes 36 inches in nominal diameter and smaller, you may substitute nonreinforced concrete pipe if the nonreinforced concrete pipe complies with the following requirements:

1. *Minimum 3-edge bearing strength must be the D-load to produce the ultimate load for the class of equivalent reinforced concrete pipe under AASHTO M 170.*

2. *Pipes must comply with AASHTO M 86M/M 86, Class 1, 2 or 3 as required to comply with the specified D-load requirements. You may request authorization for modified or special designs under AASHTO M 86M/M 86.*

3. *Cementitious material and aggregate for nonreinforced concrete pipe must comply with specifications for cementitious material and aggregate under section 65-2.02.*

65-2.02C(3) Circular Reinforced Concrete Pipe, Direct Design Method

Circular reinforced concrete pipe, direct design method must comply with AASHTO M 170.

The wall thickness and reinforcement you choose must comply with the details shown. Use the backfill method shown for the particular pipe design chosen.

The wall thickness of Wall X circular reinforced concrete pipe must not vary by more than 1/4 inch from the wall thickness shown.

Determine the mix proportions for the concrete to be used in direct design method pipes.

Concrete must comply with the specifications for concrete designated by compressive strength.

The circumferential reinforcement for circular reinforced concrete pipe must be smooth or deformed with a minimum yield strength of 65,000 psi. Longitudinal reinforcement must be welded to circumferential reinforcement at not more than 8-inch spacing if the reinforcement is smooth or at not more than 16-inch spacing if the reinforcement is deformed.

Splices of circumferential reinforcement must develop a strength at least equal to $A_{wr} \times F_y$.

Where:
A_{wr} = required area of reinforcement shown, sq in
F_y = specified yield strength of reinforcement, psi

Spacers or stirrups may be welded to the longitudinal reinforcement. The welding of spacers or stirrups will be allowed on not more than 10 percent of the circumferential reinforcement at not less than 24-inch spacing along the pipe length. The strength of the circumferential reinforcement across the completed welds must be at least equal to 1.1 x A_{wr} x F_y where spacers or stirrups are welded to the circumferential reinforcement in excess of the above requirements or where longitudinals are welded to the circumferential reinforcement.

If you determine that handling and installation stresses require additional reinforcement, furnish and place additional reinforcement. The Department does not pay for additional reinforcement required for handling and installation stresses.

Markings for circular reinforced concrete pipe, direct design method must comply with AASHTO M 170, except the pipe class marking is not required. The markings under AASHTO M 170 must be supplemented with the Contract number, maximum cover height, and method of backfill.

65-2.02D Oval Shaped Reinforced Concrete Pipe

Oval shaped reinforced concrete pipe must comply with AASHTO M 207M/M 207.

The Department will grant the authorization required under AASHTO M 207/M 207 to extrapolate the minimum wall thicknesses and steel areas beyond the limits in table 1 and table 2 under AASHTO M 207M/M 207 if you submit your pipe designs in advance and the pipes comply with the specified tests and performance requirements.

Special oval shaped reinforced concrete pipe having concrete cover over the steel reinforcement greater than the cover specified under AASHTO M 207M/M 207 must comply with section 65-2.02C, except the crack width produced by the D-load test under AASHTO M 207M/M 207 must be determined by the following formula:

$$b = \frac{t - 3/8d}{t - 3/8d - C} \times 0.01 \text{ inch}$$

where:

b =	*Width of crack to be produced instead of 0.01-inch crack under AASHTO M 207*
t =	*Wall thickness of pipe, inches*
d =	*Effective depth of section to be tested, feet*
C =	*Concrete cover over steel reinforcement in excess of cover under AASHTO M 207M/M 207*

65-2.02E Reserved

65-2.02F Joints

Joints for culvert and drainage pipes must be standard joints unless the classification is described.

At your choosing, concrete pipe joints must comply with the details shown or section 61-2.01D(2)(b).

Unless described otherwise, sealing materials must be one or more of the following:

1. *Cement mortar composed of 1 part portland cement and 2 parts sand by volume and the following:*
   1.1. *Well graded sand passing a no. 8 sieve.*
   1.2. *Mix materials to a consistency suitable for the purpose intended. Use the mortar within 30 minutes after you add the mixing water.*
   1.3. *You may use admixtures of hydrated lime, fire clay, diatomaceous earth, or other authorized inert material in the mortar to facilitate workability. Obtain authorization for the quantity of admixture.*

2. *Rubber gasketed joints complying with ASTM C443. Rubber gasketed joints must be:*
   2.1. *Flexible and able to withstand expansion, contraction, and settlement.*
   2.2. *The type of rubber gaskets requiring lubrication. Lubricate the rubber gaskets with lubricant recommended and supplied by the pipe manufacturer.*

3. *Resilient joint materials consisting of polyvinyl chloride, fiberglass impregnated with epoxy resin, or other suitable resilient materials.*

You may use other joint sealant materials that prevent leakage and infiltration if authorized.

Joints for siphons and pressure pipes and joints for pipes shown as watertight must be watertight under pressure and all conditions of expansion, contraction, and settlement, and must comply with section 612.01D(2)(a) for watertightness.

65-2.03 CONSTRUCTION

65-2.03A General

Reserved

65-2.03B Earthwork

Add to section 65-2.03B:

If you encounter solid rock or other unyielding material at the planned elevation of the bottom of the bedding shown, remove the material below the bottom of the bedding to a depth of 1/50 of the height of the embankment over the top of the culvert but not less than 6 inches or more than 12 inches. Backfill the resulting trench below the bottom of the bedding with structure backfill material under section 19-3.03E. Do not compact the outer bedding before pipe placement.

Lay the pipe in a trench 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 pipe length.

You may partially or completely backfill culvert pipe trenches while the joint mortar is still plastic. If the joint mortar sets before you place the backfill, do not backfill the pipe trench within 16 hours after jointing the pipe sections.

65-2.03C Laying Pipe

Reinforced concrete pipe used for siphons and low-head conduits with internal hydrostatic heads not exceeding 50 feet must have watertight joints under pressure and all conditions of expansion, contraction, and settlement.

Place circular pipe with elliptical reinforcement with the minor axis of the reinforcement in the vertical position.

Pour or pump liquid materials into the joint space in a continuous operation and agitate until the joint is completely filled.

Do not allow free water to come in contact with the pipeline until portland cement sealing materials have set at least 24 hours.

65-2.04 PAYMENT

Not Used

70 MISCELLANEOUS DRAINAGE FACILITIES

70-1 GENERAL

70-1.01 GENERAL

Section 70-1 includes general specifications for (1) installing miscellaneous drainage facilities for water drainage and transmission and (2) constructing casings for bridges.

Miscellaneous drainage facilities include pipe components made of pipe or other materials.

Pipe risers include pipe riser connections and bar reinforcement steel riser safety cage.

Miscellaneous drainage facilities do not include steel covers, frames and grates, frames and covers, manhole frames and grates, manhole frames and covers, or other miscellaneous metal parts.

Iron and steel items used for miscellaneous drainage facilities must comply with section 75.

For a miscellaneous drainage component with alternative in the bid item description, choose from the types of the component shown. Do not mix different types of the same component in the same location.

70-1.02 MATERIALS

Steps and ladders must be (1) steel if they are installed in steel or concrete drainage facilities or (2) aluminum if they are installed in aluminum drainage facilities.

Hardware installed in aluminum drainage facilities must be aluminum.

Epoxy-resin adhesive for bonding a pipe slip joint to a cross drain must comply with the materials specifications for applying epoxy-resin adhesive to concrete.

Boards for redwood covers must be no. 1 heart structural grade, S4S redwood.

Minor concrete drainage appurtenances including concrete foundations, bases, and basin floors must comply with section 51-7.

70-1.03 CONSTRUCTION

Excavation and backfill for miscellaneous drainage facilities must comply with section 19.

Attach steps and ladders to miscellaneous drainage facilities where described.

If new drain inlets or manholes are placed in paved or surfaced areas, do not construct the drain to final grade until the paving or surfacing adjacent to the drain is completed.

Install drainage pipe stubs, pipe riser connections and bar reinforcement steel riser safety cages.

70-1.04 PAYMENT

The Department does not pay for pipe or casing in excess of the length shown.

The payment quantity for any type of pipe is the length measured along the centerline of the pipe to the nearest 0.1 foot of pipe.

70-4 *PRECAST CONCRETE PIPE DRAINAGE FACILITIES*

70-4.01 *GENERAL*

Section 70-4 includes specifications for fabricating and installing drainage facilities with precast concrete pipes.

70-4.02 *MATERIALS*

PC concrete pipe for drainage facilities must comply with AASHTO M 199M/M 199.

Concrete must comply with section 90-1 except for the aggregate gradation requirements.

Reinforcement must comply with section 52.

70-4.03 *CONSTRUCTION*

Construct mortar joints under section 65.

You may form inlets in place as an alternative to using PC concrete pipe and cutting the side openings.

70-4.04 PAYMENT

Not Used

70-5 *DRAINAGE APPURTENANCES*

70-5.01 *GENERAL*

70-5.01A General

Section 70-5.01 includes general specifications for fabricating and installing appurtenances to drainage facilities. Drainage appurtenances include:

1. *Miscellaneous metal appurtenances*
2. *Drainage inlet markers*
3. *Drainage gates*

Miscellaneous metal appurtenances are not included in the payment for miscellaneous drainage facilities.

70-5.01B Materials

Not Used

70-5.01C Construction

Construct concrete appurtenances under section 51.

70-5.01D Payment

Not Used

70-5.02 FLARED END SECTIONS

70-5.02A General

70-5.02A(1) Summary

Section 70-5.02 includes specifications for fabricating and installing flared end sections..

70-5.02A(2) Definitions

Reserved

70-5.02A(3) Submittals

Reserved

70-5.02A(4) Quality Assurance

The Department accepts a PC concrete flared end section based on section 5.1.2 of AASHTO M 170.

70-5.02B Materials

70-5.02B(1) General

Minor fabrication variations in flared end sections may be authorized.

70-5.02B(2) Concrete Flared End Sections

PC flared end sections must comply with the specifications for Class III reinforced concrete pipe in AASHTO M 170 and the following requirements:

1. *Portland cement and aggregate must comply with section 90-1 except for the aggregate gradation requirements*

2. *Area of steel reinforcement per linear foot of a flared end section must be at least equal to the minimum steel requirements for circular reinforcement in a circular pipe with the same diameter as the internal diameter of the circular portion of the flared end section*

Reinforcement must comply with section 52.

Cutoff walls for PC concrete flared end sections must be minor concrete except the concrete must contain at least 470 pounds of cementitious material per cubic yard.

70-5.02B(3) Metal Flared End Sections

Metal flared end sections must be prefabricated steel or aluminum sections.

Prefabricated steel flared end sections must comply with AASHTO M 36 and AASHTO M 218.

Prefabricated aluminum flared end sections must comply with AASHTO M 196 and AASHTO M 197.

Metal flared end sections may be used as an alternative to PC concrete flared end sections or plastic flared end sections. Metal flared end sections used on concrete pipe 36 inches in diameter or smaller must have toe plates.

Mortar used to connect metal flared end sections to PC concrete pipe must comply with section 51-1.

Welded wire fabric must be commercial quality.

70-5.02B(4) Plastic Flared End Sections

Plastic flared end sections must comply with ASTM D3350.

70-5.02B(5) Alternative Flared End Sections

An alternative flared end section must be the same material type as the drainage facility that it is attached. Comply with the material specifications in section 61-3.

70-5.02C Construction

Construct cutoff walls under section 51.

70-5.02D Payment

Not Used

70.5.03 DRAINAGE GATES

70-5.03A General

Section 70-5.03 includes specifications for installing drainage gates.

70-5.03B Materials

70-5.03B(1) General

Reserved

70-5.03B(2) Automatic Drainage Gates

70-5.03B(2)(a) General

An automatic drainage gate must:

1. *Provide free outflow*
2. *Prevent backflow*
3. *Be attached to the pipe or anchored to a concrete wall*

The gate must be assembled in the shop and its cast iron parts must be shop coated with commercial quality asphaltic paint.

70-5.03C Construction

Not Used

70-5.03D Payment

Not Used

70-5.05 DRAINAGE INLET MARKERS

70-5.05A General

Section 70-5.05 includes specifications for installing drainage inlet markers.

70-5.05B Materials

If a specific type of drainage marker is not shown, choose one of the following:

1. *Thermoplastic*
2. *Medal medallion*
3. *Plastic medallion*
4. *Stamped concrete*

The thermoplastic drainage inlet marker must be free of lead and chromium and must comply with the requirements shown in the following table:

Thermoplastic Inlet Marker Requirements

Quality characteristic	*Test method*	*Requirement*

Thickness (in)	*--*	*0.080–0.160*
Legend color, nonreflective	*--*	*Blue or green*
Background color, nonreflective	*AASHTO M 249*	*White*
Skid resistance (min, BPN[a])	*ASTM E303*	*60*

[a]BPN means British Pendulum Number

The metal medallion drainage inlet marker must be fabricated from commercial-grade stainless steel, aluminum, brass, or bronze sheet metal or cast and must comply with the requirements shown in the following table:

Metal Medallion Inlet Marker Requirements

Quality characteristic	*Test method*	*Requirement*
Thickness of metal (in)	*--*	*0.055–0.138*
Height of marker (in)	*--*	*0.055–0.138*
Legend color, nonreflective[b]	*--*	*Blue or green*
Background color, nonreflective[b]	*--*	*White or bare metal*
Skid resistance (min, BPN[a])	*ASTM E303*	*60*

[a]BPN means British Pendulum Number [b]Requirement if metal marker is colored

The plastic medallion drainage inlet marker must be fabricated from plastic that contains UV inhibitors and must comply with the requirements shown in the following table:

Plastic Medallion Inlet Marker Requirements

Quality characteristic	*Test method*	*Requirement*
Thickness(in)	*--*	*0.025–0.060*
Thickness with dome (in)	*--*	*0.055–0.120*
Legend color, nonreflective	*--*	*Blue or green*
Background color, nonreflective	*--*	*White*
Weathering resistance	*ASTM D1435*	*1 year without yellowing, fogging, or pitting*

70-5.05C Construction

Install prefabricated drainage inlet markers by:

1. *Mechanically cleaning and preparing the surface*
2. *Attaching the prefabricated drainage inlet markers to the surface with adhesives, fasteners, or heat as recommended by the manufacturer*

Install stamped concrete drainage inlet markers by:

1. *Imprinting uncured concrete with an authorized concrete stamp for drainage inlet markers*
2. *Producing stamped concrete surfaces that are free from blemishes*

70-5.05D Payment

Not Used

71 EXISTING DRAINAGE FACILITIES

71-1 GENERAL

71-1.01 GENERAL

Section 71-1 includes general specifications for performing work on existing drainage facilities.

Drainage facilities include culverts, inlets, headwalls, endwalls, aprons, drains, pipes, gutters, gutter depressions, junction structures, spillways, and check dams.

71-1.02 MATERIALS

Temporary 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*
3. *Commercially-manufactured plug if its use is required for less than 6 months*

71-1.03 CONSTRUCTION

Trenches, holes, depressions, and pits caused by removing, salvaging, reconstructing, abandoning, destroying, modifying, resetting, relocating, adjusting, relaying, remodeling, and rehabilitating highway facilities must be backfilled with embankment material under section 19. If the trenches, holes, depressions, and pits are in surfaced areas that remain undisturbed, backfill with material that is equal or better in quality and to the thickness of the surrounding materials.

Where partial removal of reinforced concrete is required, remove a sufficient volume of concrete to expose the reinforcement for splicing. Splicing must comply with section 52. Clean off material adhering to the reinforcement before placing new concrete.

71-1.04 PAYMENT

Not Used

71-2 REMOVE DRAINAGE FACILITIES

71-2.01 GENERAL

Section 71-2 includes work for removing drainage facilities.

71-2.02 MATERIALS

Not Used

71-2.03 CONSTRUCTION

Box culverts, 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.

Except for concrete pipe, removing PCC components of drainage facilities must comply with section 151.03B.

Reuse frames, grates, and covers at the locations shown.

71-2.04 PAYMENT

Payment for removing and reusing frames, grates, and covers is included in the payment for the various items of work that include the reused frames, grates, and covers.

71-4 *MODIFY DRAINAGE STRUCTURES*

71-4.01 GENERAL

71-4.01A General

Section 71-4 includes specifications for partially removing, adjusting, and adding to drainage facilities.

71-4.01B Materials

Not Used

71-4.01C Construction

Not Used

71-4.01D Payment

Not Used

71-4.02 PIPES

71-4.02A General

Modifying pipes includes extending pipes. Extending pipes must comply with the specifications for new pipe installation.

71-4.02B Materials

Not Used

71-4.02C Construction

Existing headwalls or end walls must be removed or moved to a new location.

If headwalls or end walls are to be moved, cut the pipe so that it has smooth edges at a point approximately 1 foot behind the headwall or end walls and perpendicular to the centerline of the pipe. Move the headwall or end wall to the reconstructed location and connect the pipes.

71-4.02D Payment

Not Used

71-4.03 INLETS, MANHOLES, AND RISERS

71-4.03A General

Not Used

71-4.03B Materials

Not Used

71-4.03C Construction

Modify inlet, manhole, and riser structures by capping.

Excavate and remove structures to a depth of at least 1 foot below the grading plane.

Cap inlet structures with minor concrete. Where shown, round the bottom of structures with minor concrete. Minor concrete must contain at least 590 pounds of cementitious material per cubic yard. Backfill to match the grading plane

71-4.03D Payment

Not Used

71-4.04 SLOTTED PIPE GRATE

Reserved

71-5 *ADJUST DRAINAGE STRUCTURES*

71-5.01 *GENERAL*

Section 71-5 includes specifications for partially removing and either lowering or raising facilities.

Adjust to grade with new materials that are similar in character to the existing materials.

71-5.02 *MATERIALS*

Not Used

71-5.03 *CONSTRUCTION*

71-5.03A General

Not Used

71-5.03B Frames, Covers, Grates, and Manholes

Adjust frames, covers, grates and manholes by lowering before cold planing and raising after paving or surfacing. Before opening the lane to traffic, either (1) complete permanent paving or surfacing or (2) temporarily fill any depressions with HMA.

Where paving or surfacing work is shown, do not adjust to final grade until the adjacent pavement or surfacing is complete.

For a structure that is to be raised, remove the cover or frame and trim the top of the structure to provide a suitable foundation for the new material.

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*

Where manholes are to be lowered, remove the facility to 3.5 feet below finished grade or to an authorized depth. Adjust the manhole using the taper needed to match the finished grade.
If a manhole cover is unstable or noisy under traffic, place a coil of asphalt-saturated rope, a plastic washer, or asphaltic compound on the cover seat. Before placement, obtain authorization for use of the material.

71-5.03C Inlet

Adjust inlets as shown.

Use minor concrete with at least 590 pounds of cementitous material per cubic yard.

Where inlets are adjusted before placing the uppermost layer of pavement or surfacing, limit the work area so that adjusting the inlet and final paving or surfacing is completed within the same work day. The top of the inlet grate or cover must be protected during paving operations by heavy plywood covers, steel plate covers, or other authorized methods. Excess paving material must be removed before rolling.

Where inlets are adjusted after placing the uppermost layer of pavement or surfacing, do not adjust the inlet to final grade until the paving or surfacing has been completed immediately adjacent to the inlet.

71-5.04 PAYMENT

If adjust inlet is paid by the linear foot, adjusting the inlet is measured as the difference in the length between the top of the existing inlet and the top of the adjusted inlet.

If no item is shown for adjust inlet, payment for adjusting the inlet is included in the payment for the type of pavement or surfacing shown in the Bid Item List.

If (1) no item is shown for adjust inlet and (2) pavement or surfacing is not involved, payment for adjusting the inlet is included in the payment for the type of excavation shown in the Bid Item List.

If no item is described for adjust (1) frames, (2) covers, (3) grates, or (4) manholes, payment for adjusting these materials is included in the payment for the type of pavement or type of surfacing in the Bid Item List.

If no item is shown for adjust (1) frames, (2) covers, (3) grates, or (4) manholes, and if pavement or surfacing is not involved, payment for adjusting these materials is included in the payment for the type of excavation shown in the Bid Item List.

71-6 ABANDON DRAINAGE STRUCTURES

71-6.01 GENERAL

71-6.01A General

Section 71-6 includes specifications for partially removing and rendering facilities unserviceable in place.

Wherever manholes or drainage facilities are abandoned, pipes entering the manhole or drainage facility must be securely closed by a tight-fitting plug that is either 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*

The bases of manholes or drainage facilities must be broken so that water is prevented from being entrapped. Demolish the manhole or drainage facility to an elevation that is 3.5 feet below finished grade. Backfill must comply with section 19-3.03E.

71-6.01B Materials

Not Used

71-6.01C Construction

Not Used

71-6.01D Payment

Not Used

71-6.02 MANHOLES

Reserved

71-6.03 CULVERTS AND PIPELINES

Reserved

71-6.04 INLETS

Reserved

71-7 SALVAGE DRAINAGE FACILITIES

71-7.01A GENERAL

Section 71-7 includes specifications for salvaging drainage facilities.

Replace the 2nd paragraph in section 71-7.01A with:

Salvage the following:

1. Existing Trash Racks

71-7.01B MATERIALS

Not Used

71-7.01C CONSTRUCTION *Not Used*

71-7.01D PAYMENT

Not Used

DIVISION VIII MISCELLANEOUS CONSTRUCTION

Add prior to section 72:

Bid Items and Applicable Sections

Item code	Item description	Applicable section
72152X	Remove and Rest Rock Slope Protection (Various Locations)	72
72152X	Rock Slope Protection Backing No.2	72
723030	Rock Slope Protection (1/2T, Method A)	72
723050	Rock Slope Protection (1/4 T, Method B)	72
723215	Concreted-Rock Slope Protection (1/4 T, Method B)	72
729011	Rock Slope Protection Fabric (Class 8)	72
730010	Minor Concrete - Curb w/18" Gutter (COSB Std 4-030, Type A)	73
730040	Minor Concrete (V-Ditch)	73
7318XX	Remove Concrete (V-Ditch)	73
75001X	Manhole Frame and Cover (Std. SPPWC 210-3)	75
75001X	Manhole Frame and Cover (Std. SPPWC 630-4)	75
730040	Steel Sheet pile 72Coping	75
750500	Miscellaneous Metal (Bridge)	75
7505XX	Tower Trash Racks	75
7505XX	Steel Orifice Plates	75
803050	Remove Chain-link Fence	80
800320	Chain Link Fence (Type CL-4)	80
800XXX	Wood Fence (Polecraft, 2-Rail)	80

72 SLOPE PROTECITON

72-1 GENERAL

72-1.01 GENERAL

Section 72-1 includes general specifications for constructing slope protection.

72-1.02 MATERIALS

Construct slope protection or slope paving using minor concrete.

Unless otherwise specified, fabric must be Class 8 RSP fabric.

72-1.03 CONSTRUCTION

Earthwork must comply with section 19.

If placement of fabric is required, place the fabric before placing slope protection, slope paving, and gabions.

Before placing the fabric, the surface of the slope must be free of loose or extraneous material and sharp objects that may damage the fabric.

Handle and place the fabric under manufacturer's instructions. Place the fabric loosely on the slope such that it conforms to the surface without damage to the fabric when the cover material is placed.

Join the edges of the fabric with either overlapped joints or stitched seams.

If the fabric is joined with overlapped joints, the adjacent borders of the fabric must be overlapped by at least 24 inches. Overlap in the same direction that the cover material is placed.

If the fabric is joined by stitched seams, stitch with contrasting colored yarn. Use the size and composition of yarn that is recommended by the fabric manufacturer. Use 5 to 7 stitches per inch of seam. The strength of a stitched seam must be the same as that specified for the fabric, except if the stitched seams are oriented up and down a slope, the strength may be reduced to a value that it is at least 80 percent of that specified for the fabric.

Do not operate equipment or drive vehicles directly on the fabric.

If the fabric is damaged and the Engineer determines that it cannot be repaired, replace the fabric.

If the Engineer determines that the fabric can be repaired, then repair it by covering the damaged area with new fabric. If the repair is made using overlapped joints, the overlap must be at least 3 feet.

72-1.04 PAYMENT

The Department does not pay for additional fabric used for overlaps.

Payment for rock slope protection fabric is not included in the payment for rock slope protection.

72-2 ROCK SLOPE PROTECTION

72-2.01 GENERAL

Section 72-2 includes specifications for constructing RSP.

Use the class of rock and the method for placement described.

72-2.02 MATERIALS

72-2.02A General

Reserved

72-2.02B Rock

For method A and B placement and the class of RSP described, comply with the rock gradation shown in the following table:

Rock Gradation

Nominal RSP class by median particle diameter[b]		*Nominal median particle weight $W_{50c,d}$*	*d_{15}[c] (inches)*		*d_{50}[c] (inches)*		*d_{100}[c] (inches)*	*Placement*
Class[a]	*Diameter (inches)*		*Min*	*Max*	*Min*	*Max*	*Max*	*Method*
I	*6*	*20 lb*	*3.7*	*5.2*	*5.7*	*6.9*	*12.0*	*B*
II	*9*	*60 lb*	*5.5*	*7.8*	*8.5*	*10.5*	*18.0*	*B*
III	*12*	*150 lb*	*7.3*	*10.5*	*11.5*	*14.0*	*24.0*	*B*
IV	*15*	*300 lb*	*9.2*	*13.0*	*14.5*	*17.5*	*30.0*	*B*
V	*18*	*1/4 ton*	*11.0*	*15.5*	*17.0*	*20.5*	*36.0*	*B*
VI	*21*	*3/8 ton*	*13.0*	*18.5*	*20.0*	*24.0*	*42.0*	*A or B*
VII	*24*	*1/2 ton*	*14.5*	*21.0*	*23.0*	*27.5*	*48.0*	*A or B*
VIII	*30*	*1 ton*	*18.5*	*26.0*	*28.5*	*34.5*	*48.0*	*A or B*
IX	*36*	*2 ton*	*22.0*	*31.5*	*34.0*	*41.5*	*52.8*	*A*
X	*42*	*3 ton*	*25.5*	*36.5*	*40.0*	*48.5*	*60.5*	*A*
XI	*46*	*4 ton*	*28.0*	*39.4*	*43.7*	*53.1*	*66.6*	*A*

[a]For RSP Classes I–VIII, use Class 8 RSP fabric. For RSP Classes IX–XI, use Class 10 RSP fabric.
[b]Intermediate or B dimension (i.e., width) where A dimension is length and C dimension is thickness. [c]d%, where % denotes the percentage of the total weight of the graded material.
[d]Values shown are based on the minimum and maximum particle diameters shown and an average specific gravity of 2.65. Weight will vary based on specific gravity of rock available for the project.

Rock material must comply with the requirements shown in the following table:

Rock Material Requirements

Quality characteristic	*Test method*	*Requirement*
Apparent specific gravity (min)	*California Test 206*	*2.5*
Absorption (max, %)	*California Test 206*	*4.2*

Durability index (min)	*California Test 229*	*52*

Notes:
Durability absorption ratio (DAR) = course durability index/(percent absorption + 1)
If the DAR is greater than 10, the absorption may exceed 4.2 percent.
If the DAR is greater than 24, the durability index may be less than 52.

Select rock such that the shapes provide a stable structure for the required section. If the slope is steeper than 2:1, do not use rounded boulders and cobbles. Angular shaped rock may be used on any planned slope. Flat or needle-shaped rock must not be used unless the individual rock thickness is greater than 0.33 times the length.

72-2.02C Fabric

Fabric must be RSP fabric that complies with the class shown in the following table: ***Fabric Class***

Class	*Largest rock gradation class used in slope protection*
8	*Classes I–VIII*
10	*Classes IX–XI*

72-2.03 CONSTRUCTION

72-2.03A General

Excavate the footing trench along the toe of the slope.

Local surface irregularities of the RSP must not vary from the planned slope by more than 1 foot as measured at right angles to the slope.

At the completion of slope protection work, fill voids in the footing trench with excavated material. Compaction is not required.

72-2.03B Placement Method A *Do not*
place rocks by dumping.

Place larger rocks in the footing trench.

Place rocks on the slope such that their longitudinal axis is normal to the face of the embankment.

Place foundation course rocks such that they are in contact with the ground surface.

For rocks above the foundation course, place them such that each rock has a 3-point bearing on underlying rocks; do not bear them on smaller rocks which may be used for chinking voids.

72-2.03C Placement Method B

Rocks may be placed by dumping and may be spread in layers by bulldozers or other suitable equipment.

Place rocks such that:

1. *There is a minimum of voids*
2. *Larger rocks are in the toe course and on the outside surface of the slope protection*

72-2.04 PAYMENT

If RSP is paid by the ton, the payment quantity is the weight determined from scale weighings.

If RSP is paid by the cubic yard, the payment quantity is the volume determined from the dimensions shown or ordered.

72-3 CONCRETED-ROCK SLOPE PROTECTION

72-3.01 *GENERAL*

Section 72-3 includes specifications for constructing concreted-rock slope protection.

Use the class of rock and the method for placement described.

72-3.02 *MATERIALS*

72-3.02A General

Reserved

72-3.02B Concrete

If colored slope protection is described, color the concrete by mixing a fine, ground, synthetic mineral oxide into the concrete. The synthetic mineral oxide must be specifically manufactured for coloring concrete.

The color of the completed concrete after curing and when air dry must match color no. 30450 of FEDSTD-595.

Use the 1-inch-maximum combined aggregate gradation in the concrete.

The water content of the concrete must allow gravity flow into the interstices with limited spading and brooming.

72-3.02C Rock

Rocks for concreted-rock slope protection must comply with the gradation shown in the following table:

Concreted-Rock Gradation

Nominal RSP class by median particle diameter[b]		Nominal median particle weight $W_{50c,d}$ Weight[a]	d_{15c}		d_{50c}		d_{100}[c]
Class[a]	Size (inches)		Min	Max	Min	Max	Max
I	6	20 lb	3.7	5.2	5.7	6.9	12.0
II	9	60 lb	5.5	7.8	8.5	10.5	18.0
III	12	150 lb	7.3	10.5	11.5	14.0	24.0
V	18	1/4 ton	11.0	15.5	17.0	20.5	36.0
VII	24	1/2 ton	14.5	21.0	23.0	27.5	48.0

[a]Use Class 8 RSP fabric. [b]Intermediate or B dimension (i.e., width) where A dimension is length and C dimension is thickness. [c]d%, where % denotes the percentage of the total weight of the graded material.
[d]Values shown are based on the minimum and maximum particle diameters shown and an assumed specific gravity of 2.65. Weight will vary based on specific gravity of rock available for the project.

Rock for concreted-rock slope protection must comply with the requirements shown in the following table:

Rock Material Requirements

Quality characteristic	Test method	Requirement
Apparent specific gravity (min)	California Test 206	2.5
Absorption (max, %)	California Test 206	4.2
Durability index (min)	California Test 229	52

Notes:
Durability absorption ratio (DAR) = course durability index/(percent absorption + 1)
If the DAR is greater than 10, the absorption may exceed 4.2 percent
If the DAR is greater than 24, the durability index may be less than 52

Select rock such that the shapes provide a stable structure for the required section. If the slope is steeper than 2:1, do not use rounded boulders and cobbles. Angular shaped rock may be used on any planned slope. Flat or needle-shaped rock must not be used unless the individual rock thickness is greater than 0.33 times the length.

72-3.02D Weep Tubes *Weep tubes must:*

1. *Be schedule 80, perforated PVC pipe complying with section 68-2.02D*
2. *Have a 2-inch nominal diameter*

72-3.03 CONSTRUCTION

72-3.03A General

Excavate a footing trench along the toe of the slope.

Mix the coloring agent uniformly and homogeneously with the concrete.

Local surface irregularities of the concreted-rock slope protection must not vary from the planned slope by more than 1 foot as measured at right angles to the slope.

At the completion of slope protection work, fill voids in the footing trench with excavated material. Compaction is not required.

72-3.03B Placement Method A

Placement Method A must comply with section 72-2.03B.

72-3.03C Placement Method B

Placement Method B must comply with section 72-2.03C.

72-3.03D Placing Weep Tubes

Wrap each weep tube in filter fabric.

Place weep tubes and secure them such that they contact the face of the fabric on the slope and extend at least 2 inches beyond the outer surface of the rock. If placement of fabric on the slope is not required, the end of the tube near the slope must be covered with a cap made of the same material as the weep tube. Ensure that concrete will not plug the tube and perforations.

72-3.03E Placing Concrete

The surface of the rock to be concreted must be cleaned of adhering soil and then moistened. At any one location, place the concrete in a continuous operation during a work day. Deposit concrete by use of chutes, tubes, buckets, pneumatic equipment, or other mechanical methods. Do not allow the concrete to flow more than 10 feet across the slope protection.

Immediately after depositing, spade and rod the concrete into place with suitable spades, trowels, or other suitable means. The minimum concrete penetration must comply with the requirements shown in the following table:

Minimum Concrete Penetration

	Rock class				
	VII	V	III	II	I
Penetration (inches)	18	14	10	8	6

After placing the concrete, thoroughly brush the rocks to expose the top surfaces. Outer rocks must project above the concrete by a height of 0.25–0.32 times the rock diameter. After completion of any 10foot strip, do not allow workmen or loads on the surface for at least 24 hours.

Cure the concreted-rock slope protection by one of the methods specified for curing concrete. As an alternative, you may cure the concreted-rock slope protection by sprinkling a fine spray of water every 2 hours during the daytime for a period of 3 days. If colored concrete is described and you use the curing compound method, apply curing compound no. 6.

72-3.04 PAYMENT

If concreted-rock slope protection is paid by the ton, the payment quantity is the weight determined from scale weightings.

If concreted-rock slope protection is paid by the cubic yard, the payment quantity is the volume determined from the dimensions shown or ordered.

73 CONCRETE CURBS AND SIDEWALKS

73-1 GENERAL

73-1.01 GENERAL

Section 73-1 includes general specifications for constructing concrete curbs, sidewalks, and their appurtenances, such as gutter depressions and island paving; and curb ramps and driveways.

Steel dowels, reinforcing steel, and welded wire reinforcement must comply with section 52.

73-1.02 MATERIALS

73-1.02A General

Add to section 73-1.02A:

Concrete must be minor concrete complying with section 90-2 and may contain returned plastic concrete complying with section 90-9.

Concrete for curbs, sidewalks and their appurtenances must be minor concrete containing at least 463 pounds of cementitious material per cubic yard.

For extruded or slip form curb construction, the maximum aggregate size must be from 3/8 to 1 inch. The cementitious material content must be at least 505 pounds per cubic yard if a maximum of 3/8-inch aggregate is used.

Preformed expansion joint filler must comply with ASTM D1751.

Mortar must comply with section 51-1.02F.

Form oil must:

1. *Be commercial quality or an equivalent coating*
2. *Allow the ready release of forms*
3. *Not discolor the concrete*

73-1.03 CONSTRUCTION

73-1.03A General

Construct contraction joints by (1) scoring concrete with a grooving tool and rounding corners with an edger tool or (2) saw cutting hardened concrete to a depth of at least 1 inch. Immediately apply curing compound to the exposed surfaces of saw cut joints.

Construct expansion joints at each side of structures and at the ends of curb returns. Fill expansion joints with 1/4-inch-thick preformed joint filler. Finish the concrete adjacent to expansion joints with an edger tool. Do not construct expansion joints within 20 feet of an island nose. Shape the preformed joint filler to match the surface contour of the concrete.

73-1.03B Subgrade Preparation

Remove soft or spongy basement material to a depth of 6 inches below the subgrade elevation for curbs, gutter depressions, island paving, and driveways and 3 inches below the subgrade elevation for sidewalks and curb ramps. Backfill the subgrade with earth, sand, or gravel to produce a stable foundation.

Apply water to the subgrade and thoroughly compact it before placing concrete.

Prepare subgrade to required grade and cross section. Verify that the finished surface of the subgrade does not project into the concrete cross section at any point by:

1. *Using a template supported on the side forms for the fixed form method*
2. *Measuring from the offset guide line or survey marks for the extruded or slip form method*

73-1.03C Fixed Form Method

Set forms to the required alignment, grade, and dimensions.

Forms must:

1. *Be smooth on the side placed against concrete.*
2. *Have a straight upper edge.*
3. *Be rigid enough to withstand the pressure of fresh concrete without distortion. Use enough stakes, clamps, spreaders, and braces to ensure rigidity.*
4. *Be clean of debris and old concrete.*
5. *Coated with form oil before placing concrete.*

You may use either benders or thin plank forms on curves, grade changes, or curb returns.

Wet the subgrade and forms immediately before placing the concrete.

Place the preformed joint filler at expansion joints in the correct position before placing concrete against the filler.

Place and compact the concrete without segregation.

73-1.03D Extruded and Slip Form Methods

Wet the subgrade immediately before placing the concrete.

Feed concrete into the extrusion machine at a uniform rate. Restrain forward travel of the extrusion machine to produce a well-compacted mass of concrete requiring no further finishing other than a light brushing. The brush may be filled with water. Do not finish the concrete surface with a brush application of grout.

If you use a slip form machine, automatically control the alignment, grade, and cross slope by one of the following methods:

1. *Sensing from preset string lines*
2. *String line control of the alignment and grade and automatic control of the cross slope*

The slip form machine must have traveling forms rigid enough to produce the required cross section. The machine must produce a dense, homogeneous concrete, true to grade and cross section and require minimum handwork. Consolidate the concrete with internal vibrators or other authorized method.

Use a smaller, maximum size of aggregate with an extruded or slip form machine if it is required to produce concrete (1) free from surface pits larger than 3/16 inch in diameter and (2) with well-defined web marks of water on the surface.

You may construct expansion joints by sawing through the concrete cross section to its full depth. The width of the cut must provide a tight fit for the joint filler. Insert preformed joint filler into sawed joints and mortar it in place.

If a joint is cut before the concrete has hardened:

1. *Protect the adjacent surfaces with close fitting, firmly supported shields*
2. *Complete the saw cut and insertion of the preformed joint filler before curing the concrete*

If a joint is cut after the concrete has hardened:

1. *Mortar preformed joint filler in place using heavy trowel pressure*
2. *Cover the exposed portions of the concrete in the vicinity of the saw cut with an additional application of curing compound*

After the concrete has cured, check the joint filler for a tight fit. If any loose joints are found, mortar the joint in place and recheck after the mortar has cured. Repeat as necessary to achieve a tight fit.

73-1.03E Curing

Cure concrete using the curing compound method with pigmented curing compound.

Completely coat the exposed faces of the concrete with curing compound.

73-1.04 PAYMENT

Not Used

SECTION 73 CONCRETE CURBS AND SIDEWALK

73-2 CURBS

73-2.01 *GENERAL*

Section 73-2 includes specifications for constructing curbs.

73-2.02 *MATERIALS*

Not Used

73-2.03 *CONSTRUCTION*

73-2.03A General

If curbs are constructed over existing pavement, use steel dowels and reinforcing steel or adhesive to anchor the curb to the existing pavement.

Anchor steel dowels in drilled holes with mortar made from equal parts by volume of portland cement, sand, and water. You may use anchor bolts instead of anchored steel dowels if authorized.

If adhesive is used, remove all dust, loose material, or oil from the surface of the existing pavement by either wire brushing or blast cleaning.

Construct contraction and expansion joints at right angles to the line of the curb. Space contraction joints at 20-foot intervals. For curbs adjacent to existing concrete, align the curb joints with the existing concrete's pavement joints.

The top and face of the finished curb must be true and straight. The top surface of the curb must be uniform in width and free from humps, sags, or other irregularities. Clean any discolored concrete by abrasive blast cleaning or other authorized method.

Except for curbs on structures, you may place curbs with an extrusion machine or a slip form paver if:

1. *Finished curb is true to line and grade*
2. *Concrete contains the maximum quantity of water that maintains the curb's shape without support*
3. *Required surface texture is attained*

Check the flatness of the top and face of the curb and the surface of the gutter with a 10-foot straightedge. The surfaces must be flat to within 0.01 foot except at grade changes or curves.

73-2.03B Fixed Form Method

Set fixed forms the full depth of the back and face of the curb.

The back forms may be constructed with 1/2-inch-thick bender boards.

Cleat the back forms together as required to attain the full depth of the curb.

Use form clamps to prevent interference with finishing activities.

Before removing the forms, finish the surface true to grade with a straightedge float at least 10 feet in length. Operate the straightedge float longitudinally over the concrete surface.

Remove the forms from the face of the curb from 1 to 6 hours after placing the concrete. Do not remove the forms if the concrete is plastic enough to slump.

After removing the forms, immediately use a steel trowel to attain a smooth finish. The smooth finish must extend (1) to within 0.17 foot of the flow line or (2) to the flow line of a curb with an integral gutter. After smoothing the curb's face, apply a fine-brush finish parallel to the line of the curb.

73-2.03C Extruded or Slip Form Methods

For an extrusion machine, use the Department's survey marks to determine the offset guide line for setting the grade for the top of the curb. The extrusion machine must have a grade-line gauge or pointer that allows continual comparison between the curb placement and the offset guide line.

The machine must be capable of vertical adjustment during forward travel to construct curbs of varying height as determined by the offset guide line.

You may operate the extrusion machine on rails or forms set at a uniform depth below the established grade of the top of curb.

73-2.04 PAYMENT

Not Used

75 MISCELLANEOUS METAL

75-1 GENERAL

75-1.01 GENERAL

75-1.01A Summary

Section 75 includes specifications for fabricating and installing miscellaneous metals.

Welding must comply with AWS D1.1.

75-1.01B Definitions *Reserved*

75-1.01C Submittals

Reserved

75-1.01D Quality Assurance

75-1.01D(1) General

Reserved

75-1.01D(2) Qualifications

Welders and welding operators must be qualified under AWS D1.1.

75-1.01D(3) Department Acceptance

The following miscellaneous metal materials are inspected at the fabrication site:

1. *Miscellaneous iron and steel*
2. *Miscellaneous metal (bridge)*

Notify the Engineer:

1. *When materials listed above have been delivered to the fabrication site*
2. *At least 10 days before starting fabrication*

75-1.02 MATERIALS

75-1.02A General

Materials must comply with the requirements shown in the following table:

Miscellaneous Metal Materials

Material	*Requirement*
Steel bars, plates, and shapes	*ASTM A36/A36M, A575, or A576 (AISI or M Grades 1016–1030)*
Steel fastener components for general applications:	
Bolts and studs	*ASTM A307*

Anchor bolts	*ASTM F1554 [a]*
HS bolts and studs	*ASTM A449, Type 1 [a]*
HS threaded rods	*ASTM A449, Type 1 [a]*
HS nonheaded anchor bolts	*ASTM F1554, Grade 105, Class 2A [a]*
Nuts	*ASTM A563, including appendix X1[b]*
Washers	*ASTM F844*
Hardened washers	*ASTM F436, Type 1, including S1 supplementary requirements*
Components of HS steel fastener assemblies for use in HS joints:	
Bolts	*ASTM F3125, Grade A325, Type 1*
Tension control bolts	*ASTM F3125, Grade F1852, Type 1*
Nuts	*ASTM A563, including appendix X1[b]*
Hardened washers	*ASTM F436, Type 1, Circular, including S1 supplementary requirements*
Direct tension indicators	*ASTM F959, Type 325, zinc-coated*
Stainless steel fasteners, alloys 304 & 316, for general applications:	
Bolts, screws, studs, threaded rods, and nonheaded anchor bolts	*ASTM F593*
Nuts	*ASTM F594 or F836M*
Washers	*ASTM A240/A240M and ASME B18.22M*
Gray iron castings:	
Inside a roadbed	*AASHTO M 306*
Outside a roadbed	*AASHTO M 306 except only AASHTO M 105, Class 35B is allowed*
Ductile iron castings	*ASTM A536, Grade 80-55-06*
Carbon-steel castings	*ASTM A27/A27M, Grade 65-35, Class 1*
Malleable iron castings	*ASTM A47/A47M, Grade 32510*
Cast iron pipe	*Commercial quality*
Steel pipe	*Commercial quality, welded or extruded*
Other parts for general applications	*Commercial quality*

[a]Use hardened washers.

[b]Zinc-coated nuts tightened beyond snug or wrench tight must be furnished with a dry lubricant complying with supplementary requirement S2 in ASTM A563.

Remove burrs, rough and sharp edges, and other flaws.

Straighten warped pieces after fabricating and galvanizing.

75-1.02B Galvanizing

Galvanize miscellaneous metal materials under the schedules and specifications shown in the following table:

Galvanizing Schedules and Specifications

Material	*Schedule[a]*	*Specification*
Rolled, pressed, and forged steel shapes,	*Except for pregalvanized standard pipe, galvanize*	*ASTM A123/A123M*

plates, bars, and strip ≥ 1/8 inch thick	*material after fabrication into the largest practical sections*	
Steel <1/8 inch thick	*Galvanize before or after fabrication*	*Galvanized before fabrication:* *ASTM A653/A653M,* *Coating Designation G210* *Galvanized after fabrication:* *ASTM A123/A123M except the weight of zinc coating must average at least 1.2 oz/sq ft of surface area with no individual specimen having a coating weight of less than 1.0 oz/sq ft*
Standard pipe	*--*	*ASTM A53/A53M except the zinc coating for fence pipes and structural shapes except for metal line posts for barbed and woven wire fences must average at least 1.2 oz/sq ft of surface area with no individual specimen having a coating weight of less than 1.0 oz/sq ft*
Iron and steel hardware except threaded studs, bolts, nuts, and washers specified to comply with ASTM A307; F3125, Grade A325; A449; A563; F436; or F1554[b]	*Galvanize after fabrication*	*ASTM A153/A153M*
Rail elements, backup plates, terminal sections, and end and return caps of guardrail	*--*	*AASHTO M 180*

[a]*Fabrication includes shearing, cutting, punching, forming, drilling, milling, bending, welding, and riveting.*
[b]*For threaded studs, bolts, nuts, and washers specified to comply with ASTM A307; F3125, Grade A325; A449; A563; F436; or F1554, galvanize under their ASTMs.*

Galvanizing is not required for stainless steel, monel metal, and similar corrosion-resistant parts.

Galvanizing is not required for the following miscellaneous bridge metal:

1. *Portions of plates, shapes, or other items embedded more than 2 inches in concrete.*
2. *Embedded steel pipe ending at or below the surface of encasing concrete.*
3. *Items described to receive other finishes.*

Clean welded areas before galvanizing to remove slag or other material that would interfere with the adherence of the zinc.

Galvanize parts of fastener assemblies separately before assembly.

Tapping of nuts or other internally threaded parts to be used with zinc-coated bolts, anchor bars, or studs must (1) be performed after galvanizing and (2) comply with thread dimensions and overtapping allowances in ASTM A563.

Repair damaged galvanized surfaces as follows:

1. *Clean by thoroughly wire brushing damaged areas and removing loose and cracked coating.*

2. *Paint cleaned areas with 2 applications of organic zinc-rich primer from the Authorized Material List for organic zinc-rich primers. Do not use aerosol cans.*

75-1.02C–75-1.02H Reserved

75-1.03 CONSTRUCTION

Not Used

75-1.04 PAYMENT

Except for final-pay-item miscellaneous metal materials, the payment quantity for miscellaneous metal material is the weight determined from scale weighings.

75-2 *MISCELLANEOUS IRON AND STEEL*

75-2.01 *GENERAL*

Section 75-2 includes specifications for fabricating miscellaneous iron and steel.

Add to section 75-2.01:

Submit a detailed Work Plan for fabrication of tower trash racks and tower armoring, including descriptions of facilities, equipment, personnel, and related information prior to the start of fabrication with detailed procedures for safe conduct of the work, careful removal and disposition of materials, protection of property that is to remain undisturbed if work is completed on site, and coordination with other work in progress. Include in the procedures a detailed description of the methods and equipment to be used for each operation, and the sequence of operations for all work that occurs. Include the recommended measuring system for ensuring dimensional tolerances in the Work Plan.

a. Material with welds will not be accepted unless the welding is specified or indicated on the submitted shop drawings or otherwise approved. Do not begin welding until welding procedures, inspectors, nondestructive testing personnel, welders, welding operators, and tackers have been qualified and approved.

75-2.01A Shop Drawings

Prepare all shop drawings in accordance with AISC 303, AISC 326, AISC 360, and AISC 325. Return elements of fabricated items inadvertently omitted on contract drawings to the Engineer of Record for detailing unless they are to be detailed by the fabricator and so indicated on the shop drawings. Cloud any and all details developed by the fabricator on the shop drawings for separate approval by the Engineer of Record. Any items designed by the Contractor must be prepared and sealed by a Registered Professional Engineer. All splices must be approved by the Engineer of Record. Make all splices with complete joint penetration groove welds. Identify all field welds on the shop drawings. Prior to performing any fabrication of the structures listed above, submit complete, detailed shop drawings for approval. Show complete details of materials.

75-2.01B Quality Assurance

a. Form miscellaneous metalwork to shape and size, with sharp lines and angles and true curves. Drill and punch producing clean true lines and surfaces. Provide exposed surfaces of work in place with a smooth finish, and unless otherwise approved. Where tight fits are required, mill joints. Cope or miter corner joints, well formed, and in true alignment. Accurately set work to established lines and elevations and securely fastened in place. Install in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

b. Perform welding continuously along the entire area of contact except where tack welding is permitted. Do not tack weld exposed connections of work in place. Grind exposed welds smooth.

c. Qualify welders, perform welding, welding inspection, and corrective welding, in accordance with AWS D1.1/D1.1M. Use procedures, materials, and equipment of the type required for the work. Submit welder certifications for each welder stating the type of welding and position qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests. (If the qualification date of the welding operator is more than 6 months old, the welding operator's qualification certificate must be

accompanied by a current certificate by the welder attesting to the fact that he has been engaged in welding since the date of certification, with no break in welding service greater than 6 months.)

75-2.02 Fabrication

75-2.02A Structural Fabrication

Material must be straight before being laid off or worked. Perform straightening by methods that will not impair the metal. Material will be rejected for sharp kinks or bends. Material with welds will not be accepted except where welding is definitely specified, indicated or otherwise approved. Take precautions to avoid overheating the metal where heating is required and allow it to cool in a manner that will not impair the original properties of the metal. Obtain approval prior to flame cutting material, other than structural steel, indicated on detail drawings.

Accurately shear material and neatly finish all portions of the work. Provide square and true corners unless otherwise shown. Fillet re-entrant cuts to a minimum radius of 25 mm 1 inch in accordance with AWS D1.5M/D1.5 Workmanship Clause unless otherwise indicated or approved. Provide finished members free of twists, bends and open joints

75-2.02B Welded Connections

75-2.02B(1) Welding Procedure

a. Perform welding in accordance with the applicable provisions of AWS D1.5M/D1.5. Prior to the start of production welding, submit a complete schedule of welding procedures for a typical structure that conforms to the requirements specified in the provisions of AWS D1.5M/D1.5. Provide detailed procedure specifications and tables or diagrams showing the procedures to be used for each required joint in the schedule.

75-2.02B(2) Welding Process

a. Perform welding of structural steel in accordance with applicable provisions of AWS D1.5M/D1.5 by an electric arc welding process using a method which excludes the atmosphere from the molten metal for all welds. Minimize residual stresses, distortion and shrinkage during welding.

75-2.02B(3) Filler Metal

The electrode, electrode-flux combination and grade of weld metal must conform to the appropriate AWS specification for the base metal and welding process being used or must be as shown where a specific choice of AWS specification allowable is required. Follow the requirements of AWS D1.5M/D1.5 for matching filler metal. Include the AWS designation of the electrodes to be used in the schedule of welding procedures. Do not combine filler metals and processes in the same joint or weld.

75-2.02B(4) Workmanship

Perform welding in accordance with AWS D1.5M/D1.5, Workmanship Clause for all welds and other applicable requirements of these specifications.

75-2.02C Bolted Connections

Install all high strength connections to a tension not less than that given for ASTM F3125/F3125M Grade A325M A325 Bolts. Use turn-of-nut method, direct tension indicator, calibrated wrench, or alternative design bolt methods for tightening. The installation and verification of all bolted assemblies must follow the requirements of RCSC A348.

Tighten all other connections to the snug-tight condition. The snug-tight condition is defined as the tightness attained by either a few impacts of an impact wrench or the full effort of a worker with an ordinary spud wrench that brings the plies into firm contact. Perform snugging in a systematic manner starting at the most rigid part of the joint and working to the outside of the connection or the free edges. Install all bolts in a connection to a snug tight condition prior to pre-tensioning. Perform pre-tensioning in the same order as snug-tightening.

75-2.02C(1) Bolts, Nuts, and Washers

Use ASTM A563 nuts with high strength bolts. Equip all nuts with washers. Where the use of high strength bolts is specified or indicated the materials, workmanship and installation must conform to the applicable provisions of

ASTM F3125/F3125M and RCSC Specifications for Structural Joints using Grade A325M A325 or Grade A490M A490 Bolts. Use ASTM F436/F436M washers with high strength bolts.

75-2.02 *MATERIALS*

75-2.02A General

Raised pattern plates must be commercial quality.

75-2.02B Frames, Grates, and Covers

Grates must be produced from one of the following:

1. *Structural steel complying with either of the following*
   1.1. *ASTM A36/A36M*
   1.2. *ASTM A576, Grades 1021, 1022, 1026, 1029, or 1030*
2. *Ductile iron castings*
3. *Carbon-steel castings*

Manhole frames and covers must comply with AASHTO M 306.

Galvanize cast iron manhole frames and covers for sidewalks after fabrication and before assembling component parts. Coat other cast iron items with commercial-quality asphalt except machined surfaces of manhole frames and covers for decks.

Drainage inlet frames and grates except those on bridges need not be galvanized or coated with asphalt.

Match-mark frames and grates and frames and covers in pairs before delivery to the job site. Grates and covers must fit into their frames without rocking.

75-2.03 *CONSTRUCTION*

Add to section 75-2.03:

Concrete must be minor concrete complying with section 90-2 and may

75-2.04 *PAYMENT*

A frame and cover pair is 1 measurement unit. A frame and grate pair is 1 measurement unit.

75-3 MISCELLANEOUS BRIDGE METAL

75-3.01 GENERAL

75-3.01A Summary

Section 75-3 includes specifications for fabricating and installing miscellaneous bridge metal.

Miscellaneous bridge metal consists of:

1. *Structural steel and cast steel portions of bearing plates, bars, rockers, assemblies, and other expansion or fixed bearing devices in concrete structures*
2. *Equalizing bolts and expansion joint armor in concrete structures*
3. *Expansion joint armor in steel structures*
4. *Manhole frames and covers, frames and grates, ladder rungs, guard posts, and access door assemblies*
5. *Deck drains, area drains, retaining wall drains, and drainage piping not included in bridge deck drainage system*

75-3.01B Definitions *Reserved*

75-3.01C Submittals

75-3.01C(1) General

Submit a certificate of compliance for anchorage devices.

Submit a work plan for placing the nonskid surface showing:

1. *Application method*
2. *Spread rate of epoxy and grit*
3. *Number of coats*

75-3.01C(2) Bridge Deck Drainage System

Submit a certificate of compliance for fiberglass pipe and fittings; include laboratory test results.

75-3.01D Quality Assurance

75-3.01D(1) General

Reserved

75-3.01D(2) Quality Control

75-3.01D(2)(a) General

Test spring latches and other mechanical devices before delivery to the job site; they must operate smoothly and properly.

75-3.01D(2)(b) Bridge Deck Drainage System

After installing the drainage system and final cleanup of the deck and drainage areas, test each drain pipe and facility except short free fall pipes in the Engineer's presence by discharging 100 gallons of water into the drain. The test must demonstrate the proper operation of the drain pipe and facility. If the test indicates obstructions in the pipe, clear the pipe and repeat the test until the drain pipe and facility are unobstructed.

75-3.01D(2)(c) Nonskid Surface

Before applying any nonskid material, demonstrate the method of application to the Engineer by preparing a 1 sq ft test sample applied on hardboard at least 1/4 inch thick. The nonskid surface must have a total thickness of 1/8–3/16 inch.

75-3.01D(3) Department Acceptance

Reserved

75-3.02 MATERIALS

75-3.02A General

Fabricate the parts shown in the table below from the corresponding materials shown:

Miscellaneous Metal Parts

Part	*Material*
Bearing assemblies	*ASTM A36/A36M*
Access opening covers	*Commercial-quality sheet steel*
Access doors	*Galvanized sheet steel complying with ASTM A653/A653M, Coating Designation G210 [Z600]*
Springs for deck drain grating latches	*Commercial-quality, stainless steel spring wire containing a nominal composition of 18% chromium and 8% nickel*
Pipe bends	*Commercial-quality tube bends or fabricated bends of equal smoothness. Do not use miter-joint bends.*
Metal parts of anchorage devices except iron castings for CIP inserts	*Steel or stainless steel*
Iron castings for CIP inserts	*Malleable iron or ductile iron*

Fabricate expansion joint armor from steel plates, angles, or other structural shapes. Shape the armor to the section of the concrete deck and match-mark it in the shop.

Cast steel and cast iron must comply with section 55.

Transition fittings between pipes of different diameters must be:

1. *Smooth and uniform, without sags, projections, or offsets*
2. *At least 4 inches in length for each 1-inch reduction in pipe diameter.*

Sealing compound for caulking and adhesive sealing must be polysulfide or polyurethane complying with ASTM C920, Type S, Grade NS, Class 25, Use O.

75-3.02B Bolted and Threaded Bar Connections

HS bolted connections must comply with the specifications for HS steel fasteners and bolted connections in section 55.

Equalizing bolts must be bolts or threaded bars. Threaded bars shown as prestressing steel must comply with the specifications for plain bars in ASTM A722/A722M, including supplementary requirements. Nuts must comply with section 50-1.02H and the 1st paragraph of section 50-1.03B(2)(c).

Abrasives used for blast cleaning must comply with section 59-1.02B.

Thread locking systems must be on the Authorized Material List for anaerobic thread locking systems and must comply with the requirements thereon.

75-3.02C Anchorage Devices

75-3.02C(1) General

Concrete anchorage devices must be on the Authorized Material List for stud mechanical expansion anchors, shell-type mechanical expansion anchors, resin caspsule anchors, or cast-in-place inserts.

Concrete anchorage devices must be (1) mechanical expansion anchors or resin capsule anchors installed in drilled holes or (2) CIP concrete inserts.

An anchorage device must be a complete system, including threaded studs, hex nuts, and cut washers. Thread dimensions for externally threaded anchorage devices before zinc coating must comply with ASME B1.1 having Class 2A tolerances or ASME B1.13M having Grade 6g tolerances. Thread dimensions for internally threaded concrete anchorage devices must comply with ASTM A563.

Except for mechanical expansion anchors and iron castings for CIP inserts, metal parts of anchorage devices must be hot-dip or mechanically galvanized.

75-3.02C(2) Mechanical Expansion Anchors

Mechanical expansion anchors must be (1) hot-dip or mechanically galvanized, (2) made from stainless steel, or (3) coated with electrodeposited zinc complying with ASTM B633.

Mechanical expansion anchors must be the integral stud type or the shell type with internal threads and an independent stud. Do not use self-drilling mechanical expansion anchors.

When tested under California Test 681, mechanical expansion anchors must withstand the application of a sustained tension test load of at least the values shown in the following table for at least 48 hours with a movement of at most 0.035 inch:

Mechanical Expansion Anchor Sustained Tension Test Load

Stud diameter (inches)	*Sustained tension test load (pounds)*
3/4[a]	*5,000*
5/8	*4,100*
1/2	*3,200*
3/8	*2,100*
1/4	*1,000*

[a]Maximum stud diameter allowed for mechanical expansion anchors

75-3.02C(3) Resin Capsule Anchors

When tested under California Test 681, resin capsule anchors must withstand the application of a sustained tension test load of at least the values shown in the following table for at least 48 hours with a movement of at most 0.010 inch:

Resin Capsule Anchor Sustained Tension Test Load

Stud diameter (inches)	*Sustained tension test load (pounds)*
1-1/4	*31,000*
1	*17,900*
7/8	*14,400*
3/4	*5,000*
5/8	*4,100*
1/2	*3,200*
3/8	*2,100*
1/4	*1,000*

75-3.02C(4) Cast-in-Place Concrete Inserts

CIP concrete inserts must be ferrule loop or cast iron.

Iron castings for CIP inserts must be mechanically galvanized.

When tested under California Test 682, CIP inserts must withstand the minimum ultimate test loads shown in the following table:

CIP Insert Ultimate Tension Test Load

Stud diameter (inches)	*Ultimate tensile load (pounds)*
1-1/4	*25,000*
1-1/8	*19,800*
1	*16,000*
7/8	*11,600*
3/4	*7,200*
5/8	*6,600*
1/2	*4,200*

75-3.02D Bridge Deck Drainage System

75-3.02D(1) General

Reserved

75-3.02D(2) Pipe Connections and Joints

Self-tapping screws for sleeve connections must:

1. *Be stainless steel with hex-heads*
2. *Be installed in holes drilled to fit the screws*
3. *Comply with ASTM A276, Type 304, for a project in a non-freeze-thaw area 4. Comply with ASTM A276, Type 316, for a project in a freeze-thaw area*

Drain pipe joints must be watertight, smooth, and free from projections or offsets over 1/16 inch on the inside. Mechanical couplings in piping must be gasketed short-sleeve type consisting of:

1. *Mild steel middle ring with pipe stop*
2. *2 rubber compound wedge section ring gaskets*
3. *2 mild steel follower rings*
4. *Mild steel bolts to compress the gaskets*

75-3.02D(3) Fiberglass Pipes and Fittings

You may use fiberglass pipes and fittings with the same diameters and minimum bend radii as shown instead of welded pipe.

Fiberglass pipe and fittings must:

1. *Comply with ASTM D2996*
2. *Have a minimum short-term rupture strength of 30,000 psi*

For joining pipe and fittings, use the adhesive type recommended by the manufacturer.

Fiberglass pipe not enclosed in a box girder cell or encased in concrete must be made from UV-resistant resin pigmented with concrete-gray color or be coated with a concrete-gray resin-rich exterior coating. Do not use paint.

Fiberglass pipe with UV protection must withstand at least 2,500 hours of accelerated weathering when tested under ASTM G154 with UVB-313 lamps. The resting cycle must be 4 hours of UV exposure at 140 degrees F and then 4 hours of condensate exposure at 120 degrees F. After testing, the pipe surface must show no fiber exposure, crazing, or checking and only slight chalking or color change.

75-3.02D(4) PVC Pipes and Fittings

For drainage pipe NPS 8 or smaller encased in concrete or enclosed in a box girder cell and exposed for at most 20 feet within the cell, you may use PVC pipe and fittings with the same diameters and minimum bend radii shown instead of welded pipe.

PVC pipe and fittings must be schedule 40, complying with ASTM D1785.

75-3.02E Bearing Devices

Reserved

75-3.02F Nonskid Surface

Epoxy must comply with section 95-1.02C, 95-1.02D, or 95-1.02G.

Grit must be:

1. *Commercial-quality aluminum oxide, silicon carbide, or almandite garnet grit particles*
2. *Screen size no. 12–30 or no. 14–35*
3. *Applied uniformly at a rate of at least 0.3 pounds per square foot of surface area.*

75-3.03 CONSTRUCTION

75-3.03A General

Straighten warped sections of expansion joint armor before placing. Secure the expansion joint armor in the correct position during concrete placement.

75-3.03B Bolted and Threaded Bar Connections

Where cleaning is described, clean nuts, bolts, threaded bars, and plate washers under SSPC-SP 6 or SSPC-SP 2 before painting.

Surfaces blast cleaned under SSPC-SP 6 must have a dense, uniform, angular anchor pattern of at least 1.5 mils when measured under ASTM D4417. Paint blast-cleaned surfaces the same day blast cleaning is performed unless otherwise authorized.

Reclean surfaces that rust or become contaminated before paint is applied.

Paint surfaces with 2 applications of organic zinc-rich primer from the Authorized Material List for organic zinc-rich primers. Do not use aerosol cans. For threads engaged by nuts, apply the 2nd application to the nuts and threads after installation.

75-3.03C Anchorage Devices

Install mechanical expansion anchors, resin capsule anchors, and CIP inserts under the manufacturer's instructions.

If the manufacturer's instructions do not include torque requirements, tighten nuts used to attach equipment or fixtures to anchorage devices to the installation torque requirements shown in the following table:

Torque Requirements

Stud diameter (inches)	*Installation torque requirements (ft-lb)*		
	Shell-type mechanical expansion anchors	*Integral-stud-type mechanical expansion anchors*	*Resin capsule anchors and CIP inserts*
1-1/4	*--*	*--*	*400*
1	*--*	*--*	*230*
7/8	*--*	*--*	*175*
3/4	*80*	*175*	*150*
5/8	*35*	*90*	*75*
1/2	*22*	*50*	*30*
3/8	*11*	*25*	*18*
1/4	*4*	*7*	*--*

Install concrete anchorage devices such that the attached equipment or fixtures bear firmly against the concrete.

Install shell-type mechanical expansion anchors such that the top surface of the anchor body remains 1/2 to 1 inch below the concrete surface after expansion. After installation of shell-type mechanical expansion anchors and before mounting equipment or fixtures, demonstrate to the Engineer that the expansion anchors are firmly seated within these tolerances.

75-3.03D Bridge Deck Drainage System

Securely cover deck drain grates and other grating openings to prevent intrusion of debris until after final cleanup of the deck and drainage areas.

Provide a transition section where a pipe under a walkway or other improved area must be of a smaller diameter than the downdrain pipe.

Couplings used to connect PVC or fiberglass pipe to steel must be threaded or flanged. For PVC or fiberglass pipe, do not use the sleeve connections shown.

If fiberglass pipe is used, support spacing for fiberglass pipe must be the same as shown for welded steel pipe. Each pipe support must have a width of at least 1-1/2 inches.

If PVC pipe is used, pipe support spacing for PVC pipe must be at most 6 feet.

75-3.03E Bearing Devices

Bearing assemblies or masonry plates placed on mortar pads must comply with section 55-1.03C(3).

Set bearing plates level. Set rockers and expansion devices to comply with the temperature at the time of erection or to the specified setting.

75-3.03F Nonskid Surface

Where a nonskid surface is shown on steel plates, apply an epoxy mixed with grit.

The finish color of the nonskid surface must be light gray.

Before applying epoxy and grit to a galvanized surface, prepare the surface under section 59-3.03.

If authorized, you may use a commercial-quality nonskid surface made of a 2-component UV-resistant epoxy and grit if the quality is equal to the epoxy-grit mixture specified.

75-3.04 PAYMENT

The payment quantity for miscellaneous metal does not include the weight of epoxy and grit for a nonskid surface.

75-8 TIE ROD ASSEMBLIES

Replace Reserved in section 75-8 with:

75-8.01 GENERAL

75-8.01A Summary

Section 75-8 includes specifications for installing tie rod assemblies.

Tie rod assemblies consist of grouted HS rods, bearing plates, couplers, and anchorage devices.

Earthwork for tie rod assemblies must comply with section 19-3.

75-8.01B Definitions

Not Used

75-8.01C Submittals

For the corrosion-inhibiting grease, submit a sample from the lot to be used and test results at least 40 days before use.

75-8.01D Quality Assurance

Tie rod assemblies must comply with the sampling requirements for prestressing steel in section 50.

75-8.02 MATERIALS

You are responsible for selecting the type of anchorage devices and couplers and for determining the required lengths of the rod assemblies.

HS rods must comply with ASTM A722/A722M, including supplementary requirements.

Tie rod assemblies must comply with the material specifications for prestressing steel in section 50.

The anchorage device and coupler must develop at least 90 percent of the ultimate tensile strength of the HS rod.

HS rods must be sheathed full-length with PVC or HDPE corrugated plastic and pregrouted.

Galvanize exposed steel parts except HS rods.

Anchorage devices and couplers must include locking devices to prevent turning or loosening.

Ship each rod assembly as a complete unit, including anchorage device and coupler.

Corrosion-inhibiting grease must:

1. Provide corrosion protection to the tie rod anchorage
2. Be chemically stable and nonreactive with the tie rod
3. Be organic
4. Have appropriate polar, moisture displacing, and corrosion inhibiting additives
5. Have the physical properties shown in Table 1 of Specification for Unbonded Single Strand Tendons published by the Post-Tensioning Institute

Bearing plates must comply with ASTM A36/A36M.

Elastomeric bearing pads must:

1. Comply with section 51-3.02 except the pads may consist of only elastomer regardless of thickness and laminated reinforcement is not required
2. Be bonded to bearing plates with adhesive complying with Federal Specification MMM-A-121

75-8.03 CONSTRUCTION

Remove pavement and base under section 15.

Structural concrete backfill for pavement outside the limits of approach slabs must comply with the specifications for approach slab concrete in section 51-5.

Fill the tube at the end anchorage with corrosion-inhibiting grease.

Pack the space at the abutment around the sheathed tie rod with commercial quality burlap.

After installation, clean exposed parts of threads of HS rods as specified for repairing damaged galvanized surfaces.

surfaces.

75-8.04 PAYMENT

Not Used

80 FENCES

80-1 GENERAL

80-1.01 GENERAL

Section 80-1 includes general specifications for constructing fences.

80-1.02 MATERIALS

A temporary fence must comply with the plan details and specifications for a permanent fence of the same type except:

1. *Used materials may be incorporated in the fence if the materials are good, sound, and suitable for the intended purpose*

2. *Materials may be commercial quality if the dimensions and sizes of the materials are equal to or greater than the dimensions and sizes shown or specified in section 80 3. Post must be either metal or wood*

4. *The Department does not require:*
    - 4.1. *Galvanizing or painting of steel elements*
    - 4.2. *Treating wood with a wood preservative*
    - 4.3. *Concrete footings for metal posts*

For concrete for a metal post or brace footing or for a deadman, use:

1. *Commercial-quality aggregates and cementitious material*
2. *At least 470 pounds of cementitious material per cubic yard*

A reinforcing bar must comply with ASTM A706/A706M.

80-1.03 CONSTRUCTION

Remove earth, trees, brush, and other obstructions that interfere with fence construction.

Connect new fences to existing fences.

Measure post spacing parallel to the ground slope. Place each post in a vertical position except where the Engineer orders you to set the post perpendicular to the ground surface.

Place a corner post with a brace for each direction of strain at each junction with an existing fence.

Fasten the wire in the new and existing fences to each post.

If ordered at a structure, connect the new fence to the structure such that stock can pass freely through or under the structure; otherwise, install an end post and connect the fence to it.

Crown each concrete footing to shed water.

After constructing a fence, uniformly spread the surplus excavated material along the adjacent roadway where designated by the Engineer.

80-1.04 PAYMENT

The payment quantity for fence is the length measured:

1. *Parallel to the ground slope*
2. *Along the fence*

The payment quantity does not include the width of openings.

80-3 CHAIN LINK FENCES

80-3.01 GENERAL

80-3.01A Summary

Section 80-3 includes specifications for constructing chain link fences.

80-3.01B Definitions

corner: *Change in a line where the angle of deflection exceeds 30 degrees.*

diamond count: *Number of mesh openings in each height of chain link fence.*

fence, Type CL: *Chain link fence. Type CL is followed by a number representing the width in feet of the fence fabric. The number is shown in the bid item description.*

fence, Type CL, slatted: *Chain link fence with wood or plastic slats inserted vertically in the chain link fabric.*

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.*

80-3.01C Submittals

If you use the protective coating system specified in section 80-3.02B, submit a certificate of compliance for the system.

Submit a certificate of compliance for posts and braces that includes the information specified in ASTM F1043, section 9, "Quality Control Provisions."

80-3.01D Quality Assurance

Reserved

80-3.02 MATERIALS

80-3.02A General

Galvanize or coat ferrous materials.

Do not use materials imperfectly galvanized or coated or with serious abrasions.

For barbed wire on a chain link fence, comply with section 80-2.02D.

80-3.02B Posts and Braces

The base metal for posts and braces must be commercial-quality, weldable steel complying with AASHTO M 181, Type 1, except for the protective coating requirements.

Posts and braces must comply with the strength requirements in ASTM F1043:

1. *Group IA, regular grade, for round posts*
2. *Group II-L for roll-formed posts and braces*
3. *Group IC, 50,000 psi yield, for round steel pipes*

Group IC, 50,000 psi yield, for round steel pipes may be used instead of group IA, regular grade steel round pipes of the same diameter.

Galvanize posts and braces under section 75-1.02B except, instead of galvanizing, tubular posts and braces may have a protective coating system complying with the following:

1. *Exterior surfaces of tubular posts and braces must have a combination coating consisting of hot-dip galvanized primer followed by a chromate conversion coating and then a finish coat of clear, crosslinked organic coating. For this combination coating:*
    1.1. *Thickness of the zinc coating must be at least 0.9 mil as determined from the average results of at least 2 samples and at least 0.8 mil on an individual sample.*
    1.2. *Chromate conversion coating must be at least 15 µg/sq in.*
    1.3. *Total thickness of the combination coating must be at least 1.7 mils.*
    1.4. *Exterior clear-coated surface of the pipe must have demonstrated the ability to resist 1,000 hours of exposure to salt fog with a maximum of 5 percent red rust when tested under ASTM B117.*
    1.5. *Clear finish coat must not have any film cracking after 500 hours of exposure in an artificial weathering device under one of the following:*
        1.5.1. *ASTM G152, cycles 1, or 3 Carbon Arc artificial weathering device.*
        1.5.2. *ASTM G155, cycles 1, or 2 Xenon Arc artificial weathering device.*
    1.6. *Clear finish coat must not have blistering or cracking after 500 hours of exposure to 100 percent relative humidity under ASTM D2247.*

2. *Interior surfaces must have a zinc coating or a cross-linked organic coating containing a corrosion inhibitor. For these coatings:*
    2.1. *Coating thickness must be at least 0.3 mil.*
    2.2. *Interior coated surface must have demonstrated the ability to resist 300 hours of exposure to salt fog with a maximum of 5 percent red rust when tested under ASTM B117.*

Obtain authorization of the protective coating system before you use it. Any change to the protective coating system is a new system that requires authorization.

Each post length must be at least the depth of the concrete footing plus the height of the fabric less 4 inches. The length does not include any top fixture or other top tension wire support integral with the post.

Each post must have provisions to securely hold the top tension wire in position and allow for post removal and replacement without damaging the wire. Fit each tubular post with a rainproof top.

Post tops, extension arms, stretcher bars, and other fittings and hardware must be:

1. *Steel or malleable or wrought iron*
2. *Galvanized after fabrication under section 75-1.02B*

80-3.02C Fabric

Chain link fabric must comply with AASHTO M181 for Type I fabric with a Class C coating or ASTM F1345, Class 2, unless vinyl-clad fabric is described in the fence bid item; in which case, the fabric must comply with AASHTO M181 for Type IV fabric with a medium or dark green Class A coating.

The wire for the fabric must be:

1. *11 gauge for a fence 84 inches or less in height*
2. *9 gauge for a fence over 84 inches in height and for a slatted chain link fence*

Chain link fabric for nonslatted fence must have the diamond count corresponding to the fabric height shown in the following table:

Diamond Counts

Fabric height (inches)	*36*	*42*	*48*	*60*	*72*	*84*	*96*
Diamond count	*10-1/2*	*12-1/2*	*13-1/2*	*17-1/2*	*20-1/2*	*24-1/2*	*27-1/2*

Chain link fabric for slatted fence must have 3-1/2-inch-vertical and 5-inch-horizontal mesh.

Knuckle finish fabric on the top and bottom edges.

80-3.02D Tension Wires, Hog Rings, Turnbuckles, Truss Tighteners, Truss Rods, and Stretcher Bars and Bar Bands

Tension wire must be commercial-quality 7-gauge coil spring steel.

Tie wires and hog rings must be at least 9-gauge steel.

Post clips must be at least 6-gauge steel.

Galvanize tension and tie wires, hog rings, and post clips under ASTM A116, coating Class 3.

Turnbuckles and truss tighteners must be:

1. *Commercial-quality steel, malleable iron, or wrought iron*
2. *Galvanized under section 75-1.02B*
3. *Equal in tensile strength to the truss rod*

Truss tighteners must have a strap thickness of at least 1/4 inch.

Each truss rod must be steel and have a diameter of at least 3/8 inch.

Each stretcher bar must be at least 1/4 by 3/4 inch.

Each stretcher bar band must be at least 1/8 by 3/4 inch.

80-3.02E Slats

Slats must be wood or plastic.

Wood slats must be one of the following:

1. *Clear redwood*
2. *Medium-weight wood produced from the species Shorea (Meranti)*

Each wood slat must have:

1. *Thickness of at least 1/4 inch*
2. *Width about 2-5/8 inch*
3. *Length enough to fill the vertical openings of the fabric*

Each plastic slat must:

1. *Be a HDPE with UV inhibitors*
2. *Have a flat tubular cross section with:*
    2.1. *Wall thickness of about 0.03 inch*
    2.2. *Depth of about 0.325 inch*
    2.3. *Width of about 2.38 inches*
    2.4. *Length equal to the fence height*

The plastic slat material must comply with the requirements shown in the following table: ***Plastic Slat Material Requirements***

Quality characteristic	*Test method*	*Requirement*
Melt index	*ASTM D1238*	*0.24*
Density	*ASTM D1505*	*0.951*
Low temperature brittleness (°F)	*ASTM D746*	*-76*
Tensile strength (psi)	*ASTM D638*	*3,700*

80-3.03 CONSTRUCTION

Brace each end, latch, and corner post to the nearest line post with either of the following:

1. *Diagonal brace used as a compression member*
2. *Horizontal brace used as a compression member and truss rods used as tension members*

Brace each gate post to the nearest line post with a horizontal brace used as a compression member and truss rods used as tension members.

Equip each steel truss rod with a turnbuckle or truss tightener.

Brace line posts horizontally and truss in both directions at intervals of at most 1,000 feet unless the fabric is installed by stretching with equipment.

Fasten chain link fabric on the side of the posts designated by the Engineer.

Stretch and securely fasten the fabric to the posts.

Fasten the top and bottom edges of the fabric to the tension wires. Stretch the tension wires tight.

Install the bottom tension wire on a straight grade between posts by excavating high points of the ground. Do not fill in low points.

Fasten the fabric to end, latch, corner, and gate posts with stretcher bars and stretcher bar bands at 1foot intervals except the fabric may be fastened to end and corner posts by threading through loops formed on the posts.

Fasten the fabric to line posts with tie wires or post clips and to tension wires with tie wires or hog rings. Space the fasteners at about 14 inches on line posts and about 18 inches on tension wires. Give wire ties at least 1 complete turn. Close each hog ring with the ends overlapping. Wrap tension wires around terminal posts. The top of the fabric to the top tension wire must be at most 2 inches.

If supporting arms for barbed wire are shown, extend each arm upward from the top of the fence at an angle of about 45 degrees. Fit it with clips or other means for attaching 3 lines of barbed wire. Attach the top outside wire to the supporting arm at a point about 12 inches above the top of the chain link fabric and 12 inches out from the fence line. Attach the other wires to the arm spaced evenly between the top of the fence and the top outside wire.

For a chain link fence with slats, install slats vertically in the mesh openings such that the slats fit snugly. Fasten them in a way that prevents easy removal or displacement.

80-3.04 PAYMENT

Not Used

80-10 GATES

80-10.01 GENERAL

80-10.01A Summary

Section 80-10 includes specifications for constructing gates in fences.

Constructing a gate in an existing fence includes removal of the fence.

80-10.01B Definitions

gate unit for a barbed wire or wire mesh fence: *1 gate with fittings, hardware, and gate posts with braces.*

gate unit for a chain link fence: *1 gate with fittings, hardware, and gate and latch posts with braces.*

80-10.01C Submittals

Reserved

80-10.01D Quality Assurance

Reserved

80-10.02 MATERIALS

Each drive gate for a chain link fence must be the width shown in the bid item description.

Each drive gate for a barbed wire or wire mesh fence must be at least 48 inches and at most 58 inches high.

Each walk gate must be 4 feet wide.

A gate greater than 8 feet in width must have vertical stays such that no panel exceeds 8 feet in width.

A gate frame must be made with pipe at least 1-1/2 inch in diameter. Interior vertical stays must be made with pipe at least 1 inch in diameter. Pipe must comply with the specifications for posts and braces in section 80-3.02B.

Each gate frame panel must be cross trussed with adjustable truss rods at least 3/8 inch in diameter.

Fasten and reinforce each corner of a gate frame with a malleable iron or pressed steel fitting or by welding.

Each pressed steel fitting must:

1. *Have a nominal thickness before galvanizing of at least 0.135 inch*
2. *Be fastened to develop the strength of connected members*

Welds must be smooth and develop the strength of the connected member.

Galvanize fittings, latches, rods, and other gate hardware under section 75-1.02B.

Fabric for gates in a barbed wire or wire mesh fence must comply with the specifications for nonslatted chain link fence in section 80-3.

Fabric for gates in chain link fences must comply with the specifications for the fabric for the fence in which the gate is installed.

Attach chain link fence fabric to the gate frame using stretcher bars and tie wires as specified for fence construction. Space tension connectors at 1-foot intervals.

For a chain link walk gate installed in an existing fence, the gate mounting hardware must not contain open-end slots for the fastening bolts.

Each gate must have a combination steel or malleable iron catch and locking attachment that does not rotate around the latch post.

80-10.03 CONSTRUCTION

Hang each gate with at least 2 steel or malleable iron hinges at least 3 inches in width such that the gate is securely clamped to the gate post and permits the gate to be swung back against the fence. The bottom hinge must have a socket to take the ball end of the gate frame.

Construct a center rest with a catch and stops to hold gates open.

For a walk gate constructed in an existing fence, remove a line post and install the gate such that the gate is centered on the hole of the removed post. When not working on the walk gate, close the opening made in the existing fence with existing fence fabric or 6-foot chain link fabric.

80-10.04 PAYMENT

The gate payment quantity is the quantity of gate units.

80-15 EXISTING FENCES

80-15.01 GENERAL

80-15.01A General

Section 80-15 includes specifications for performing work on existing fences.

Work performed on existing fences must comply with section 15.

80-15.01B Materials

Not Used

80-15.01C Construction

Not Used

80-15.01D Payment

The bid items for work performed on existing fences and gates are measured as specified for the construction of new fences and gates.

80-15.02 RECONSTRUCT FENCES

80-15.02A General

Section 80-15.02 includes specifications for reconstructing fences.

80-15.02B Materials

Not Used

80-15.02C Construction

Prevent livestock from escaping during fence reconstruction.

At the junction of the reconstructed fence and cross fence, place corner posts with braces and join the fences.

Install gates to be reused at the locations designated by the Engineer.

If the amount of fence to be disassembled exceeds the amount needed for reconstruction, dispose of the excess fencing.

80-15.02D Payment

Not Used

80-15.03 SALVAGE FENCES

80-15.03A General

Section 80-15.03 includes specifications for salvaging fences.

80-15.03B Materials

Not Used

80-15.03C Construction

Package salvaged chain link fabric in 50-feet segments per pallet. Group salvaged end and corner posts in 1 assembly per bundle.

80-15.03D Payment

Not Used

DIVISION IX TRAFFIC CONTROL DEVICES

Add prior to section 81:

Bid Items and Applicable Sections

Item code	Item description	Applicable section
810190	Guard Railing Delineators	81
831006	Midwest Guardrail System (Steel Post)	83
833080	Concrete Barrier (Type K)	83
839521	Cable Railing	83
839584	Alternative In-Line Terminal System	83
839585	Alternative Flared Terminal System	83
839720	Concrete Barrier (Type 732) (Spillway Bridge)	83
839720	Concrete Barrier (Type 732) (Channel Bridge)	83
839752	Remove Guardrail	83

83 RAINLINGS AND BARRIERS

83-1 GENERAL

83-1.01 GENERAL

Section 83-1 includes general specifications for constructing railings and barriers.

Excavation and backfill must comply with section 19.

83-1.02 MATERIALS

83-1.02A General

Reserved

83-1.02B Steel Parts and Hardware

Welding must comply with AWS D1.1. Grind welds on exposed surfaces flush with the adjacent surfaces.

Galvanize completed steel parts and hardware for railings and thrie beam barrier under section 75-1.02B.

After galvanizing, the railing and barrier elements must be free of fins, abrasions, rough or sharp edges, and other surface defects and must not be kinked, twisted, or bent. If straightening is necessary, use an authorized method. Elements with kinks, twists, or bends may be rejected.

Clean and regalvanize (1) abraded or damaged galvanized surfaces of steel rail elements and posts and (2) ends of steel rail elements cut after galvanizing. If authorized, you may repair the surfaces under section 75-1.02B instead of regalvanizing.

83-1.02C Mortar

Mortar must comply with the specifications for mortar in section 51-1, except the mortar must consist of 1 part by volume of cement and 3 parts by volume of clean sand.

83-1.02D Markers

Markers must comply with section 82.

83-1.03 CONSTRUCTION

83-1.03A General

At locations exposed to traffic, schedule construction activities such that at the end of each day no post holes are open and no posts are installed without the blocks and rail elements assembled and mounted.

After constructing railings, barriers, terminal systems, crash cushions, and vegetation control, uniformly spread the surplus excavated material along the adjacent roadway where designated by the Engineer unless the material is hazardous.

83-1.03B Mortar

Cure mortar by either the water method or the curing compound method using curing compound no. 6.

83-1.03C Median Barriers

Trim existing median plantings to clear the work area for median barrier construction. Dispose of the trimmings.

Do not remove an existing median barrier more than 500 feet in advance of the barrier being constructed.

At the end of each day's activities, reset the existing median barrier without mesh or glare screen and anchor the barrier in an authorized way such that no gap is left between the reset barrier and the barrier being constructed. You may place Type K temporary railing instead of resetting the existing barrier.

83-1.04 PAYMENT

Except for midwest guardrail system and double midwest guardrail system, the payment quantity for railings is the length measured along the face of the railing, including end and intermediate posts, with no deductions for gaps in the railing for lighting and sign supports.

83-2 METAL RAILINGS AND BARRIERS

83-2.01 GENERAL

83-2.01A General

83-2.01A(1) General

Section 83-2 includes specifications for constructing metal railings and barriers.

83-2.01A(2) Materials

Plastic blocks for midwest guardrail systems and thrie beam barrier must be on the Authorized Material List for highway safety features.

Grease used to coat the inside surfaces of foundation tubes to receive wood posts must not melt or run at a temperature of 149 degrees F.

83-2.01A(3) Construction

For midwest guardrail systems and thrie beam barrier, install posts, foundation tubes, and soil plates in soil.

83-2.01A(4) Payment

Not Used

83-2.01B Minor Concrete Vegetation Control

Reserved

83-2.02 MIDWEST GUARDRAIL SYSTEMS

83-2.02A General

83-2.02A(1) Summary

Section 83-2.02 includes specifications for constructing midwest guardrail systems.

The reinforcing steel in the concrete anchors for Type CA end anchor assemblies must comply with section 52.

83-2.02A(2) Definitions *Reserved*

83-2.02A(3) Submittals

Submit 2 certified copies of mill test reports as an informational submittal for each heat of steel from which the rail elements and steel posts are formed or fabricated.

For end anchor assemblies and rail tensioning assemblies, submit:

1. *2 certified copies of the mill test reports for each manufactured length of cable used.*
2. *1 sample of the cable for testing. The cable must be 39 inches in total length and must be properly fitted with a swaged fitting and right-hand thread stud at both ends as specified in section 832.02B(2), including a clevis if shown.*

83-2.02A(4) Quality Assurance

Reserved

83-2.02B Materials

83-2.02B(1) General

83-2.02B(1)(a) General

Railing parts must be interchangeable with similar parts, regardless of the source.

83-2.02B(1)(b) Steel Components and Hardware

Workmanship for steel components and hardware must be equivalent to good commercial practice. Edges, bolt holes, and surfaces must be free of torn metal, burrs, sharp edges, and protrusions.

Fabricate the metal work in the shop. Do not punch, cut, or weld in the field.

Rail elements, end caps, and return caps must comply with AASHTO M 180 for Class A, Type I, W-beam guardrail, except within 0.5 miles of the coast the components must comply with AASHTO M 180 for Class A, Type II, W-beam guardrail.

Bolts, nuts, and other fittings must comply with AASHTO M 180.

Instead of the rolled steel section shown, you may substitute a welded section built up from structural steel plates if:

1. *Depth, width, and average thicknesses of the welded section are at least equal to those of the rolled section*
2. *Steel plates of the welded section comply with ASTM A36/A36M*
3. *Flanges of the welded section are welded to the web with continuous fillet welds on each side of the web*

The rail element metal must withstand a cold bend, without cracking, of 180 degrees around a mandrel of a diameter equal to 2.5 times the plate thickness.

If the radius of curvature of a rail element is 150 feet or less, shape the rail element in the shop. Stencil the radius of curvature on the back of each rail element in 2-1/2-inch-high numerals.

Fabricate steel posts from steel complying with ASTM A36/A36M.

Bolts must have shoulders of a shape that will prevent the bolts from turning. The holes in the rail elements must be of a shape similar to the bolt shoulder.

The bolted connection of the rail element to the post must withstand a 5,000 lb pull at 90 degrees to the line of the railing.

83-2.02B(1)(c) Wood Posts and Blocks

The grade and species of wood posts and blocks must be no. 1 timbers, also known as no. 1 structural, Douglas fir or no. 1 timbers Southern yellow pine. Wood posts and blocks must be graded under section 57-2.01B(2), except allowances for shrinkage after mill cutting must not exceed 5 percent of the American Softwood Lumber Standard, PS 20, minimum sizes when installed.

Wood posts and blocks must be rough or S4S. The size tolerance of rough sawn blocks in the direction of the bolt holes must not exceed ±1/4 inch.

After fabrication, the wood posts and blocks must be pressure treated under section 57-2.01 and AWPA U1, Use Category UC4A, Commodity Specification A.

83-2.02B(1)(d) Bolt Hole Grease

Grease used to fill bolt holes in wood posts and blocks must be recommended for corrosion protection by the manufacturer. The grease must not melt or run at a temperature of 149 degrees F.

83-2.02B(1)(e) Components for Connection to a Concrete Surface

Components for connecting midwest guardrail systems to vertical concrete surfaces, such as bridge railings, barriers, retaining walls, and abutments, must comply with the following requirements:

1. *Metal box spacers and plate washers must be fabricated from steel complying with ASTM A36/A36M.*
2. *Metal box spacers must be fabricated from separate plates and welded or press-formed and welded.*
3. *HS bolts must comply with ASTM F3125, Grade A325/A325M, or ASTM A449, or be fabricated from steel rods complying with ASTM A449. The bolts or rods must comply with the mechanical requirements in ASTM F3125, Grade A325/A325M after galvanizing. The nuts and washers must comply with ASTM F3125, Grade A325/A325M.*

4. *For connecting guardrail to existing bridge railings or barriers, the epoxy adhesive used in the sand and the epoxy adhesive mixture for repairing spalled or damaged areas around the anchor bolt holes must be a 2-component, commercial-quality epoxy adhesive manufactured especially for making epoxy-sand mortar.*

83-2.02B(2) End Anchor Assemblies and Rail Tensioning Assemblies

Section 83-2.02B(2) applies to end anchor assemblies and rail tensioning assemblies.

Concrete used to construct the anchors for end anchor assemblies must comply with the specifications for minor concrete.

Fabricate the metal components of anchor assemblies in compliance with good shop practice.

Fabricate the anchor plates, metal plates, foundation tubes, and soil plates from steel complying with ASTM A36/A36M.

Fabricate the anchor rods from steel complying with ASTM A36/A36M, ASTM A572, or ASTM A576, Grade 1018, 1019, 1021, or 1026. Hot forge the eyes or form the eyes with CJP welds. After fabricating and before galvanizing, thermally stress relieve anchor rods with eyes that were formed with any part of the eye below 1,600 degrees F during forming or with eyes that were closed by welding. The completed anchor rod after galvanizing must develop a strength of 50,000 lb.

Instead of using built-up fabrication, you may press-form the anchor plates from steel plate with or without welded seams.

Bolts and nuts must comply with ASTM A307.

Anchor cables must be 3/4-inch, preformed 6 x 19 wire strand core or independent wire rope core, galvanized under Federal Specification RR-W-410, right regular lay, manufactured from improved plow steel with a minimum breaking strength of 23 tons. The overall length of each cable anchor assembly must be at least 6.5 feet.

Use cable clips and a cable thimble to attach the cable to the anchor rod where shown. Thimbles must be commercial-quality, galvanized steel. Cable clips must be commercial-quality, drop-forged, galvanized steel.

Swaged fittings must be machined from hot-rolled steel bars complying with AISI C 1035 and annealed suitable for cold swaging. Galvanize the swaged fitting before swaging. To keep the stud in the proper position, drill a lock pin hole through the head of the swaged fitting and install a 1/4-inch plated steel spring pin. Stamp the manufacturer's identifying mark on the body of the swaged fitting.

Before galvanizing, mill a 3/8-inch slot in the stud end for the locking pin. Studs must comply with ASTM A449 after galvanizing.

The swaged fittings, stud, and nut assembly must develop the specified breaking strength of the cable. Ship

cable assemblies as a complete unit, including studs and nuts.

Clevises must be drop-forged galvanized steel and must develop the specified breaking strength of the cable.

For anchor rods to be buried in earth, coat the portions to be buried with a 20-mil minimum thickness of one of the following:

1. *Coal tar enamel complying with AWWA C 203*
2. *Coal tar epoxy complying with either of the following:*
    2.1. *SSPC-Paint 16, Coal Tar Epoxy-Polyamide Black Paint*
    2.2. *U.S. Army Corps of Engineers Specifications, Formula C-200a, Coal Tar-Epoxy (Black) Paint*

83-2.02B(3) Type WB-31 Transition Railings

Section 83-2.02B(3) applies to Type WB-31 transition railings.

Ten-gauge rail elements must comply with AASHTO M 180 for Class B, Type I, thrie beam element, except within 0.5 miles of the coast the 10-gauge rail elements must comply with AASHTO M 180 for Class B, Type II, thrie beam element.

Other rail elements and end caps must comply with AASHTO M 180 for Class A, Type I, thrie beam element, except within 0.5 miles of the coast the rail elements and end caps must comply with AASHTO M 180 for Class A, Type II, thrie beam element.

83-2.02C Construction

83-2.02C(1) General

83-2.02C(1)(a) General

At locations where traffic is adjacent to midwest guardrail system work, all materials required to complete the guardrail work at a location must be available before you start work at the location.

Construct midwest guardrail systems using:

Replace item 1 in the list in the 2nd paragraph of section 83-2.02C(1)(a) with:

1. Steel line posts.

Replace item 2 in the list in the 2nd paragraph of section 83-2.02C(1)(a) with:

2. Wood blocks for line posts.

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.

Add to section 83-2.02C(1)(a):

The exposed bolt threads on guardrail beyond the nut that are more than 0.5 inch must be cut off.

83-2.02C(1)(b) Posts

Place the posts at equal intervals, except you may space the end posts closer to the adjacent posts if authorized.

Drive wood posts with or without pilot holes, or place the posts in drilled holes. Backfill any space around the wood posts with selected earth that is free of rock. Place the earth in 4-inch-thick layers. Moisten and thoroughly compact each layer.

Drive steel posts with or without pilot holes. If pilot holes are used, backfill any space around the steel posts with dry sand or pea gravel after driving.

Drive steel foundation tubes with soil plates attached with or without pilot holes, or place them in drilled holes. Backfill any space around the foundation tubes with selected earth that is free of rock. Place the earth in 4-inch-thick layers. Moisten and thoroughly compact each layer. Coat the inside surfaces of the foundation tubes to receive wood terminal posts with grease. Insert the posts into the tubes by hand. Do not drive the posts. You may slightly round the post edges to facilitate insertion.

83-2.02C(1)(c) Bolt Holes and Cuts in Wood Posts and Blocks

If copper naphthenate, ammoniacal copper arsenate, ammoniacal copper zinc arsenate, ammoniacal copper quat, or copper azole is used to treat wood posts and blocks, before inserting the bolts, fill the bolt holes with grease.

You may field bore the 2-3/8-inch-diameter holes shown for breakaway wood guardrail terminal posts.

If you perform field cutting or boring after treatment, thoroughly swab, spray, or brush the cuts and holes with 2 applications of the same type of preservative as initially used or treat the cuts and holes with copper naphthenate under AWPA Standard M4. Preservative application in the field must comply with the 1st and 2nd paragraphs of section 57-2.01C(3)(b).

83-2.02C(1)(d) Rail Elements

The edges and center of the rail elements must contact each post block.

Splice the rail elements at 12.5-foot maximum intervals. Locate the splices at midspan between posts.

Rail element splices must be lapped at least 12-1/2 inches and bolted.

Lap the rail elements such that the exposed ends do not face approaching traffic.

The rail elements must have full bearing at joints.

Install end caps and return caps under the manufacturer's instructions.

83-2.02C(1)(e) Connection to a Concrete Bridge Railing or Barrier

If connecting a midwest guardrail system to a new concrete bridge railing or barrier, drill anchor bolt holes in the concrete or form holes using metal or PVC sleeves.

If connecting a midwest guardrail system to an existing concrete bridge railing or barrier, drill anchor bolt holes in the concrete.

Repair any areas around the holes that were spalled or otherwise damaged during drilling using an epoxy adhesive and sand mixture in proportions of 1:4 to 1:6. The epoxy adhesive must comply with section 832.02B(1)(e). Mix the 2 components and the epoxy-sand mixture under the manufacturer's instructions.

83-2.02C(1)(f) Anchor Bolts Set With Epoxy

For anchor bolts set with epoxy, place the anchor bolts in holes filled with a 2-component epoxy mixture complying with the specifications for load bearing applications.

83-2.02C(2) End Anchor Assemblies

Place the concrete for end anchors for Type CA end anchor assemblies against the undisturbed material of the excavated holes. If ordered, form the top 12 inches of the holes.

Tighten the anchor cables for Type CA end anchor assemblies after the concrete anchor has cured for at least 5 days.

Backfill the holes excavated in the slope to construct buried post end anchors with selected earth. Place the earth in layers approximately 1 foot thick. Moisten and thoroughly compact each layer.

83-2.02C(3) Type WB-31 Transition Railings

Reserved

83-2.02D Payment

Except for midwest guardrail systems located within the pay limits of (1) a terminal system, (2) a transition railing, (3) an end anchor assembly, or (4) a railing tensioning assembly, the payment quantity for midwest guardrail system is the length measured along the face of the rail element from end post to end post of the completed railing and includes buried post anchors. The point of measurement at the end post is the center of the bolt attaching the rail element to the end post. If midwest guardrail system is connected to a structure, barrier, wall, or abutment, the point of measurement is the midpoint between the 2 bolts attaching the rail element to the structure, barrier, wall, or abutment.

The payment quantity for double midwest guardrail system is the length measured from end post to end post along the center line of the guardrail.

83-2.03 THRIE BEAM BARRIERS

83-2.03A General

Section 83-2.03 includes specifications for constructing thrie beam barrier.

Thrie beam barrier must comply with the specifications for midwest guardrail systems in section 83-2.02.

Single thrie beam barrier work includes transition sections between W beam and thrie beam elements.

83-2.03B Materials

Rail elements, terminal connectors, end caps, and return caps must comply with AASHTO M 180 for Class A, Type I, thrie beam guardrail, except within 0.5 miles of the coast the components must comply with AASHTO M 180 for Class A, Type II, thrie beam guardrail.

Ten-gauge rail elements for transition railings must comply with AASHTO M 180 for Class B, Type I, thrie beam element, except within 0.5 miles of the coast the 10-gauge rail elements must comply with AASHTO M 180 for Class B, Type II, thrie beam element.

Other rail elements and end caps for transition railings must comply with AASHTO M 180 for Class A, Type I, thrie beam element, except within 0.5 miles of the coast the rail elements and end caps must comply with AASHTO M 180 for Class A, Type II, thrie beam element.

Use steel posts for thrie beam barrier on bridges. Use wood posts for approach barrier transitions to connect to concrete structures and for posts set in steel foundation tubes at trailing end anchors. At all other locations, use either wood or steel posts. Use only 1 type of post in any 1 continuous length of barrier.

Use wood blocks with wood and steel posts. You may use plastic blocks with steel posts where shown.

For thrie beam barrier on bridges:

1. *Threaded rods must comply with ASTM A307*
2. *Anchor bolts must comply with ASTM F1554, Grade 55*
3. *Plates must comply with section 55*

83-2.03C Construction

Toenailing wood blocks to wood posts is not required.

If the spacing between the posts must be varied from the standard spacing, you may modify the rail elements at the job site if authorized. Repair damaged galvanizing under section 75-1.02B.

For thrie beam barrier on bridges:

1. *If cored or drilled holes for anchor bolts must be offset to avoid existing main reinforcing steel, the corresponding base plate anchor bolt holes may be slotted to adjust to the new anchor bolt locations. Slotting must not reduce the edge distance of the hole to less than 7/8 inch.*

2. *Drilling of anchor bolt holes and bonding of bolts must comply with the specifications for drilling and bonding dowels in section 51-1.03E(3).*

If median barrier delineation is shown, match the barrier marker spacing to the raised pavement marker spacing on the adjacent median edgeline pavement delineation.

83-2.03D Payment

The payment quantity for single thrie beam barrier is the length measured from end post to end post along the face of the rail element of the installed barrier. The quantity does not include any portion of single thrie beam barrier within the pay limits of transition railing (Type STB).

The payment quantity for single thrie beam barrier constructed on each side of a bent underneath a structure or on each side of other obstructions is the length measured along each face of the installed barriers.

The payment quantity for double thrie beam barrier is the length measured from end post to end post along the center line of the installed barrier. The quantity does not include any portion of double thrie beam barrier within the pay limits of transition railing (Type DTB).

The point of measurement at the end posts of single and double thrie beam barriers is the center of the bolt or rod attaching the rail element to the end post.

If a single thrie beam barrier is constructed on each side of a median obstruction and the single barriers merge into a double barrier, the post with 2 blocks attached is the end post for measuring the length of the single and double thrie beam barriers.

The division point for determining the payment quantities of double thrie beam barrier (bridge) and double thrie beam barrier is the face of the paving notch of the bridge.

83-2.04 TERMINAL SYSTEMS

83-2.04A General

83-2.04A(1) General

Section 83-2.04 includes specifications for constructing terminal systems.

83-2.04A(2) Materials

Not Used

83-2.04A(3) Construction

Not Used

83-2.04A(4) Payment

Not Used

83-2.04B Alternative In-Line Terminal Systems

Reserved

83-2.04C Alternative Flared Terminal Systems

Reserved

83-2.04D–83-2.04H

Reserved

83-2.05 CALIFORNIA BRIDGE RAILS

83-2.05A General

83-2.05A(1) Summary

Section 83-2.05 includes specifications for constructing California bridge rail.
Concrete must comply with section 51.
Reinforcement must comply with section 52.

California ST-20S bridge rail work includes the handrailing.

83-2.05A(2) Definitions

Reserved

83-2.05A(3) Submittals

Submit shop drawings for the California bridge rail. The shop drawings must include:

1. *Details for venting and pickup holes in rails and sleeves*
2. *Railing layout*
3. *Complete details for the construction of the work, including construction methods, sequence of shop and field assembly, and installation procedures*

Submit 7 copies of the shop drawings. Allow 25 days for review. Upon authorization, the Engineer returns 2 copies to you for use during construction.

83-2.05A(4) Quality Assurance

Reserved

83-2.05B Materials

83-2.05B(1) General

Reserved

83-2.05B(2) Reinforced Concrete *In freeze-thaw areas:*

1. *Concrete must contain at least 675 pounds of cementitious material per cubic yard*
2. *Bar reinforcing steel must comply with section 52-2.02*

83-2.05B(3) Metal Components

Structural shapes, structural tubing, plates, bars, bolts, nuts, and washers must comply with section 551.02. Other fittings must be commercial quality.

Formed steel sections must be uniform in appearance.

Stud bolts must comply with the specifications for studs in clause 7 of AWS D1.1.

Ferrous metal parts must be galvanized under section 75-1.02B.

Railings must conform to the curvature by means of a series of short chords, from center-to-center of rail posts, except (1) tubing for railings described as conforming to the curvature must be shop bent to fit the curvature and (2) tubing with a horizontal curve radius less than 900 feet must be shop bent or fabricated to fit the curvature. Joints must be matchmarked.

83-2.05B(4) Coatings

Organic zinc-rich primer used to paint the exposed bolt threads must be on the Authorized Material List for organic zinc-rich primers.

83-2.05C Construction

Railings must present a smooth, uniform appearance in their final position, conforming closely to the horizontal and vertical lines shown or ordered.

Erect railings carefully and true to line and grade. Posts 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. Adjacent rail elements must align with each other within 1/16 inch.

In freeze-thaw areas, cure concrete by the water method.

After installing the rail, paint the exposed bolt threads with 2 applications of organic zinc-rich primer.

83-2.05D Payment

The payment quantity for California bridge rail is the length measured from end to end along the face of the railing, including reinforced concrete end blocks and intermediate posts.

83-2.06 CHAIN LINK RAILINGS

83-2.06A General

Section 83-2.06 includes specifications for constructing chain link railings.

83-2.06B Materials

Structural shapes, plates, bars, and bolts must comply with section 55-1.02.

Structural tubing steel must comply with ASTM A500/A500M or A501.

Frame members carrying electrical conductors must be rigid metal conduit manufactured of mild steel complying with UL 6, Electrical Rigid Metal Conduit - Steel. Hot dip galvanize the interior and exterior surfaces of the rigid metal conduit.

Truss rods, post tops, and other required fittings and hardware must be steel, malleable iron, or wrought iron. Post tops and other closures must be watertight. Fittings and hardware must fasten properly to the posts and other members.

Cable used in the frame must:

1. *Be wire rope*
2. *Be 5/16 inch in diameter*
3. *Have a minimum breaking strength of 5,000 lb*
4. *Be galvanized under Federal Specification RR-W-410*

Crimped sleeve clamps and stud socket assemblies must:

1. *Be metal*
2. *Develop the strength of the cable*
3. *Be the same color as the cable*

Tension wires must be at least 7-gauge coil spring steel.

Post clips must be at least 9-gauge steel.

Wire ties or hog rings must be 9-gauge, commercial-quality steel wire.

Galvanize the tension wires, post clips, wire ties, and hog rings under ASTM A116, Coating Type Z, Class 3.

You may substitute one of the following for the steel wire ties or hog rings:

1. *6-gauge (0.192-inch minimum diameter) aluminum wire ties complying with ASTM B211 or B211M, Alloy 1100-H18*

2. *6-gauge (0.192-inch minimum diameter) aluminum hog rings complying with ASTM B211 or B211M, Alloy 6061-T94 or Alloy 5052-H38*

Chain link fabric must be 11 gauge and must comply with one of the following:

1. *AASHTO M 181, Type I, Class C*
2. *AASHTO M 181, Type IV, Class A*
3. *ASTM F1345, Class 2*

Chain link fabric must be woven into approximately 1-inch mesh.

All of the railings for a single structure must be the same color.

83-2.06C Construction

Give wire ties at least 1 complete turn. Bend the wire tie ends away from pedestrian traffic.

Tighten truss rods and cables with turnbuckles or other fittings.

Install a thimble at each cable loop.

Stretch and fasten the chain link fabric securely to the posts, other members, and tension wires. Stretch the tension wires tightly.

Wherever necessary to conform to horizontal or vertical curvature, rework and fit the fabric to present a smooth, neat, and workmanlike appearance.

Provide openings in the fabric as required by other facilities. Reinforce the openings with at least 1 turn of 6-gauge wire.

Attach pipe handrailing to chain link railing where shown. Pipe handrailing must comply with section 832.09.

83-2.06D Payment

Not Used

83-2.07 CABLE RAILINGS

83-2.07A General

Section 83-2.07 includes specifications for constructing cable railings.

83-2.07B Materials

Concrete for the post footings must comply with the specifications for minor concrete.

Pipe for posts and braces must be standard steel pipe or pipe complying with section 80-3.02B.

Truss rods, post tops, cable clamps, eye bolts, thimbles, and other required fittings must be commercialquality steel, malleable iron, or wrought iron. Post tops must be watertight. The eye of the eye bolts must be either drop forged or formed with a complete penetration weld. The eye must develop 100 percent of the bolt strength.

Turnbuckles must:

1. *Be commercial quality*
2. *Have jaw or eye ends*
3. *Have a minimum breaking strength of 2,700 lb*
4. *Be steel pipe type or drop-forged steel*

Crimped sleeve clamps and stop sleeve clamps must:

1. *Be nonferrous metal*
2. *Develop the strength of the cable*
3. *Be the same color as the cable*

Cables must:

1. *Be wire strand or rope*
2. *Have a minimum diameter of 1/4 inch*
3. *Have a minimum breaking strength of 1,800 lb*
4. *Be galvanized under Federal Specification RR-W-410*

83-2.07C Construction

Tension the cables to provide taut railings between posts.

Install a thimble at each cable loop.

83-2.07D Payment

Not Used

83-3 *CONCRETE BARRIERS*

83-3.01 GENERAL

83-3.01A Summary

Section 83-3 includes specifications for constructing concrete barriers and wildlife passage ways in concrete barriers.

Concrete must comply with section 51.
Reinforcement must comply with section 52.
Drill and bond dowels under section 51.
Concrete barrier work includes:

1. *Bar reinforcing steel, including the length that extends from the barrier into decks, walls, and footings*
2. *Constructing Type L wildlife passage ways*
3. *Constructing steel plate barriers at overhead sign foundations, electroliers, drainage structures, and other locations shown*

For Type 80SW concrete barriers:

1. *Tubular handrailing and tubular lower rail must comply with the specifications for tubular handrailings in section 83-2.08*

2. *Threaded rods for the tubular handrailing and resin capsule anchors for the tubular lower rail must comply with section 75-3*

Type K concrete barrier must comply with the specifications for Type K temporary railing in section 123.20 and the plans for Type K temporary railing, except removable panels must not be used and the barriers must remain in place at the completion of the work.

Thrie beam barrier elements, end caps, and hardware required to construct Type M wildlife passage ways must comply with section 83-2.03.

83-3.01B Definitions

Reserved

83-3.01C Submittals

If the extrusion or slip form method is to be used and the reinforcement is not fixed in place before placing the concrete, submit a QC plan for the extrusion or slip form construction method. The QC plan must include:

1. *Contingency plan for correcting problems in production, transportation, or placement*
2. *Procedure for splicing concrete barrier reinforcement*
3. *Procedure for positioning reinforcement during extrusion or slip form operations*
4. *Test procedure for verifying the final positions of the longitudinal reinforcement*
5. *Test report form to be used that shows the station of the test, the position of the reinforcement relative to the top of the barrier, and the clearance cover from the faces of the barrier to the reinforcement*

Submit the test report forms within 48 hours after constructing the concrete barrier.

Submit a certificate of compliance for a new or used Type 60K portable concrete barrier that is not cast on the job site.

For the tubular handrailing on a Type 80SW concrete barrier, submit 2 copies of the threaded rod layouts before placing the barrier reinforcement.

83-3.01D Quality Assurance

83-3.01D(1) General

Reserved

83-3.01D(2) Quality Control

83-3.01D(2)(a) General

Reserved

83-3.01D(2)(b) Barrier Smoothness

Test the smoothness of the top and exposed faces of barriers using a 10-foot straightedge laid on the surfaces.

83-3.01D(2)(c) Barrier Reinforcement Positions

For the extrusion or slip form construction method, if the reinforcement is not fixed in place before placing the concrete, verify the final positions of the horizontal reinforcement at 100-foot intervals, evaluated a minimum of 20 feet behind the trailing extrusion or slip form edge, by testing the position of the reinforcement relative to the top of the barrier and the clearance cover from the faces of the barrier to the reinforcement.

83-3.01D(3) Department Acceptance

The Department rejects concrete barriers with any reinforcement that does not comply with section 833.03A(6)(c)(iii).

83-3.02 MATERIALS

83-3.02A General

Reserved

83-3.02B Concrete

83-3.02B(1) General

Concrete for Type 60 series concrete barriers must comply with the specifications for minor concrete, except the concrete must contain at least 550 pounds of cementitious material per cubic yard.

In non-freeze-thaw areas, concrete for concrete barriers other than Type 60 series must contain at least 590 pounds of cementitious material per cubic yard.

In freeze-thaw areas, concrete for concrete barriers must contain at least 675 pounds of cementitious material per cubic yard.

For Type 60F, 60GE, and 60SF concrete barriers, the concrete paving between the tops of the 2 walls of the barrier and the optional concrete slab at the base between the 2 walls of the barrier must comply with the specifications for minor concrete.

83-3.02B(2) Concrete for Extrusion or Slip form Methods

Minor concrete for extruded or slip formed concrete barriers must comply with the following:

1. *Maximum aggregate size must be no larger than 1-1/2 inches and no smaller than 3/8 inch.*
2. *If the 3/8-inch maximum size aggregate is used, the concrete must contain at least 675 pounds of cementitious material per cubic yard.*
3. *Combined aggregate gradation must produce concrete of the shape and surface texture specified.*
4. *Consistency must be such that after extrusion or slip forming, the concrete maintains the shape of the barrier without support.*

You may make the concrete by continuously batching the materials by volume and mixing in a continuous mixer under the batching and mixing requirements in ASTM C685/C685M.

83-3.02C Bar Reinforcing Steel

In freeze-thaw areas, bar reinforcing steel for concrete barriers must be epoxy coated under section 522.02.

83-3.02D Steel Plates and Hardware

Structural steel plates and hardware required to join the concrete barrier at gaps caused by overhead sign foundations, electroliers, drainage structures, and at other locations shown must comply with section 75-3.02A.

83-3.02E Granular Backfill

For Type 60F, 60GE, and 60SF concrete barriers, the granular material for backfill between the 2 walls of concrete barrier must:

1. *Be earthy material suitable for the purpose intended*

2. *Have no rocks, lumps, or clods exceeding 1-1/2 inches in greatest dimension*

83-3.02F Type K Concrete Barrier Reflectors

Type K concrete barrier reflectors must be Type K temporary railing reflectors on the Authorized Material List for signing and delineation materials.

The adhesive used to mount reflectors on a Type K concrete barrier must comply with the manufacturer's instructions.

83-3.02G Connection of a Concrete Barrier to a Structure

Sheet metal, neoprene strip, and grease at the connection of a concrete barrier to a structure must comply with the following:

1. *Sheet metal must be commercial-quality galvanized sheet steel that is smooth and free of kinks, bends, or burrs. Joints in the sheet metal must be butt joints sealed with plastic duct-sealing tape.*
2. *Neoprene strip must comply with the specifications for neoprene in section 51-2.04.*
3. *Grease must comply with SAE AS8660.*

Expanded polystyrene at the connection of a concrete barrier to a structure and at a concrete barrier transition at a bridge column must comply with section 51-2.01B(1).

83-3.02H Type 60K Portable Concrete Barriers

Type 60K portable concrete barrier must consist of interconnected new or undamaged used PC portable concrete barrier units.

For Type 60K portable concrete barrier:

1. *Concrete must comply with the specifications for minor concrete, except weighmaster certificates and certificates of compliance are not required.*
2. *Steel plates must comply with ASTM A36/A36M. After fabrication, galvanize the steel plates under section 75-1.02B.*
3. *Connection pins must be round bars complying with ASTM A36/A36M.*

83-3.03 CONSTRUCTION

83-3.03A General

83-3.03A(1) General

Reserved

83-3.03A(2) Closing Gaps in Concrete Barriers

During construction on highways open to traffic, if a gap is left in the concrete barrier, such as for equipment or special drainage features, close the gap by temporary or permanent means when work is not actively in progress at the location of the gap.

83-3.03A(3) Adjusting Barrier Height

If the concrete barrier height is adjusted, the Engineer determines the adjustment amount before the concrete is placed.

If a concrete barrier is constructed on AB, adjust the barrier height to compensate for irregularities in the surface of the finished AB.

For a concrete barrier constructed on a recently completed bridge, adjust the barrier height to compensate for the camber and dead load deflection of the superstructure. Construct the barrier after the falsework has been released and as long after the superstructure construction as the progress of the work will allow.

For a concrete barrier constructed on existing pavement or on an existing structure, adjust the barrier height to compensate for irregularities in the existing grade.

83-3.03A(4) Locating Expansion Joints

Locate concrete barrier expansion joints at deck, pavement, and principal wall joints. The expansion joint filler material must be the same size as the joint or a minimum of 1/2 inch.

83-3.03A(5) Placing Barriers

The concrete barrier must present a smooth, uniform appearance in its final position, conforming closely to the horizontal and vertical lines shown or ordered. The barrier must be free of lumps, sags, or other irregularities.

You may place the portion of the barrier that is below finished grade to the neat lines of the excavation.

83-3.03A(6) Barrier Construction Methods

83-3.03A(6)(a) General

Construct Type 60 series concrete barriers by one of the following methods:

1. *Cast-in-place-with-fixed-forms method*
2. *Extrusion or slip form method*
3. *Combination of both methods*

Construct concrete barriers other than Type 60 series by the cast-in-place-with-fixed-forms method.

83-3.03A(6)(b) Cast-In-Place-with-Fixed-Forms Method

Concrete barriers constructed by the cast-in-place-with-fixed-forms method must comply with section 51.

Do not use PC mortar blocks to support the reinforcing steel on the traffic side of barriers.

83-3.03A(6)(c) Extrusion or Slip form Method

83-3.03A(6)(c)(i) General

Reserved

83-3.03A(6)(c)(ii) Placing Concrete

For concrete barriers constructed using an extrusion or slip form machine or other similar type of equipment, the concrete must be well compacted and dense and the exposed surfaces must comply with section 51. You may be required to submit evidence of successful operation of the extrusion or slip form machine or other equipment.

Feed the concrete to the extrusion or slip form machine at a uniform rate. Operate the machine under enough uniform restraint to the forward motion to produce a well-compacted concrete mass free from surface pits larger than 1 inch in diameter and requiring no further finishing other than that specified in section 83-3.03A(7).

83-3.03A(6)(c)(iii) Placing Reinforcing Bars

For concrete barriers constructed using extrusion or slip form methods, place the horizontal reinforcing bars continuously.

If the reinforcement is not fixed in place before placing the concrete, the reinforcement must not deviate more than 1 inch from the positions shown when tested under section 83-3.01D(2)(c).

83-3.03A(6)(c)(iv) Maintaining Barrier Grades

The grade for the top of concrete barriers constructed using extrusion or slip form methods must be indicated by an offset guide line set from survey marks established by the Engineer. The forming portion of the extrusion or slip form machine must be readily adjustable vertically during the forward motion of the machine to conform to the predetermined grade line. A grade line gauge or pointer must be attached to the machine such that a continual comparison can be made between the barrier being placed and the established grade line as indicated by the offset guide line.

Instead of the above method for maintaining the barrier grade, the extrusion or slip form machine may be operated on rails or forms set at a uniform depth below the predetermined finished top of the barrier grade or on existing pavement or bridge decks.

83-3.03A(6)(c)(v) Constructing Expansion Joints

For concrete barriers constructed using extrusion or slip forming methods, construct expansion joints using one of the following methods:

1. *Comply with section 51.*

2. *Saw through the barrier section to its full depth. Insertion of joint filler is not required.*

If you saw or form the joints before the concrete has hardened, firmly support the adjacent portions of the barrier with close fitting shields.

If you saw or form the joints after applying curing compound, treat the exposed barrier faces in the vicinity of the joint with curing compound after sawing or forming the joints.

83-3.03A(7) Finishing

Before applying the curing compound, the surface finish of Type 60 series concrete barriers must be free from surface pits larger than 1 inch in diameter and you must give the surface a final soft brush finish with strokes parallel to the line of the barriers. Do not finish the surface with a brush application of grout.

To facilitate finishing, remove fixed forms for CIP Type 60 series concrete barriers as soon as possible after the concrete has set enough to maintain the barrier shape without support.

At least 7 days after placing Type 60 series concrete barriers, give the exposed surfaces a light abrasive blast finish to achieve a uniform appearance.

The final surface finish of concrete barriers other than Type 60 series must be a Class 1 surface finish complying with section 51-1.03F(3). Any alternative method of final surface finishing must be authorized.

83-3.03A(8) Curing

Cure the exposed surfaces of concrete barriers under section 90-1.03B by the curing compound method using curing compound no. 6. For concrete barriers on bridges and walls that do not support soundwalls, you may instead cure the formed surfaces of the barriers by the forms-in-place method if you keep the forms in place for at least 12 hours after placing the concrete.

For Type 60 series concrete barriers, apply the curing compound using a mechanical sprayer capable of applying the curing compound to at least 1 entire side and the top of the concrete barrier in 1 application at a uniform rate of coverage. Protect the spray against wind.

In freeze-thaw areas, cure concrete barriers on bridges and walls under section 90-1.03B by the water method.

For Type 80 series concrete barriers, keep the forms in place for at least 36 hours after placing the concrete.

83-3.03A(9) Smoothness

The top and exposed faces of barriers must comply with the following smoothness requirements when tested under section 83-3.01D(2)(b):

1. *For Type 60 series concrete barriers, the top must not vary more than 0.02 foot from the edge of the straightedge and the faces must not vary more than 0.04 foot from the edge of the straightedge.*

2. *For concrete barriers other than Type 60 series, both the top and faces must not vary more than 0.02 foot from the edge of the straightedge.*

83-3.03A(10) Installing Tubular Handrailings

For a tubular handrailing mounted on a Type 80SW concrete barrier, drill and bond the threaded rods under the specifications for drilling and bonding dowels in section 51-1.

83-3.03A(11) Installing Barrier Markers

Where concrete barrier markers are shown, cement the markers to the barrier under the manufacturer's instructions. Match the barrier marker spacing to the raised pavement marker spacing on the adjacent median edgeline pavement delineation.

83-3.03A(12) Installing Reflectors

Where shown, install reflectors on Type K concrete barriers. Mount the reflectors using an adhesive complying with section 83-3.02F.

83-3.03A(13) Placing Granular Backfill

For Type 60F, 60GE, and 60SF concrete barriers, place the granular material for backfill between the 2 walls of the concrete barrier must be placed without compaction.

83-3.03B Concrete Barriers at Existing Structures

For a concrete barrier constructed on an existing structure, bond the dowels in drilled holes in the existing concrete.

For a concrete barrier constructed to the face of an existing concrete structure, match the existing weep holes.

83-3.03C Connection of a Concrete Barrier to a Structure

At the connection of a concrete barrier to a structure, apply a uniform film of grease to the upper surface of the neoprene strip before placing the sheet metal.

83-3.03D Concrete Barrier Transitions *For a concrete barrier transition:*

1. *Remove portions of the existing concrete barrier where shown*
2. *Roughen the contact surfaces of the existing concrete barrier*
3. *Drill and bond dowels into the existing concrete barrier*

83-3.03E Type 60K Portable Concrete Barriers

Set Type 60K portable concrete barriers on a firm, stable foundation. Grade the foundation to provide uniform bearing throughout the entire barrier length.

Place and maintain the abutting ends of the PC concrete units in alignment without substantial offset to each other. Position the PC concrete units straight on tangent alignments and on a true arc on curved alignments. The minimum curve radius for horizontal alignments is 164 feet.

The final surface finish of Type 60K portable concrete barriers must comply with section 51-1.03F(2).

Place the fabrication date and your name or logo on each panel. The fabrication date and name or logo must be 4 inches or less in height and must be located 12 inches or less above the bottom of the rail panel.

Cure the exposed surfaces of concrete elements by the water method, the forms-in-place method, or the curing compound method. Curing compound must be curing compound no. 1.

83-3.03F Wildlife Passage Ways

Construct wildlife passage ways in concrete barriers where shown.

Construct the passage way opening by forming the opening in the concrete barrier or, after the concrete barrier is constructed, by saw cutting the outline of the opening and removing the concrete and bar reinforcing steel within the limits of the opening.

The completed opening for the wildlife passage way must be clear and unobstructed for the dimensions shown.

For a Type M wildlife passage way, you may be required to remove concrete barrier. Before removing the concrete barrier, make a saw cut of approximately 1 inch in depth on the face of the barrier along the removal limits.

83-3.04 PAYMENT

The payment quantity for concrete barriers other than Types 60F, 60GE, and 60SF is the length measured along the top of the barrier.

The payment quantity for Type 60F, 60GE, and 60SF concrete barriers is the length measured once along the centerline between the 2 walls of the barrier.

The payment quantity for concrete barriers includes the length of gaps in the concrete barrier where steel plate barrier is attached to the concrete barrier.

DIVISION XI MATERIALS

90 CONCRETE

90-1 GENERAL

90-1.01 GENERAL

90-1.01A Summary

Section 90-1 includes general specifications for furnishing, curing, and protecting concrete.

Concrete must be composed of cementitious material, fine aggregate, coarse aggregate, admixtures if used, and water.

PCC must comply with the specifications for concrete.

90-1.01B Definitions

***free water:** Total water in the concrete mixture minus the water absorbed by the aggregates in reaching a saturated surface-dry condition.*

***reclaimed aggregate:** Aggregate that has been recovered from plastic concrete by washing away the cementitious material.*

90-1.01C Submittals

90-1.01C(1) General

Reserved

90-1.01C(2) Aggregate Gradation

Before starting concrete work, submit the gradation of the primary aggregate nominal sizes. If the aggregate source changes, submit the new gradation before using the aggregate.

If a primary coarse aggregate or the fine aggregate is separated into 2 or more sizes, submit the gradation and proposed proportions of each size combined mathematically to show 1 proposed gradation. Show the percentage passing for each applicable sieve size.

90-1.01C(3) Cementitious Materials

Submit a certificate of compliance for cementitious materials. Include the source name and location.

If the cementitious material is delivered directly to the job site, the certificate of compliance must be signed by the cementitious material supplier.

If the cementitious material is used in ready-mixed concrete, the certificate of compliance must be signed by the concrete manufacturer.

If blended cement is used, the certificate of compliance must include a statement signed by the blended cement supplier that shows the actual percentage of SCM, by weight, in the blend. Determine the weight of SCM by using a weighing device or by chemical analysis.

90-1.01C(4) Admixtures

If you propose to use an admixture from the Authorized Material List for chemical admixture for use in concrete, submit a certificate of compliance from the manufacturer certifying that the admixture furnished is the same as that previously authorized.

90-1.01C(5) Curing Compound

For each batch of curing compound delivered to the job site or casting site, submit:

1. *Split curing compound test samples to METS. The test samples must be from the shipping containers at the manufacturer's source of supply.*
2. *Certificate of compliance to the Engineer and to METS. The certificate of compliance must include:*
   - 2.1. *Test results for the tests specified in section 90-1.01D(6).*
   - 2.2. *Certification that the material was tested within 1 year before use.*

If the curing compound is shipped in tanks or tank trucks, submit a shipping invoice with each load. The invoice must show the same information specified for container labels in section 90-1.03B(3)(b).

90-1.01C(6) Mix Design

Submit the concrete mix design before using the concrete in the work and before changing the mix proportions or an aggregate source.

90-1.01C(7) Concrete Delivery

Submit a weighmaster certificate as an informational submittal with each load of concrete delivered to the job site.

The weighmaster certificate must show:

1. *Mix identification number.*
2. *Nonrepeating load number.*
3. *Date and time the materials were batched.*
4. *Total quantity of water added to the load.*
5. *For transit-mixed concrete, the revolution counter reading at the time the truck mixer is charged with cement.*
6. *Actual scale weights in pounds for the ingredients batched. Do not substitute theoretical or target batch weights for actual scale weights.*

Submit weighmaster certificates in printed form or, if authorized, in electronic media. Present electronic media in a tab-delimited format on a CD or DVD. Captured data for the ingredients represented by each batch must be a line-feed, carriage-return, and one line separated record with sufficient fields for the specified data.

You may submit a weighmaster certificate with a separate certificate that lists the actual batch weights or measurements for a load of concrete if both certificates are delivered to the job site and are imprinted with the same nonrepeating load number that is unique to the Contract.

90-1.01C(8) Testing

If the concrete is tested for shrinkage, submit the test data with the mix design.

If prequalification is specified, submit certified test data or trial batch test reports under section 901.01D(5)(b).

If 56 days are allowed for the concrete to attain the strength described, submit test results under section 90-1.01D(5)(a).

90-1.01C(9) Stationary Mixer Certification

If you weigh the SCM cumulatively with the cement for concrete completely mixed in a stationary mixer, submit certification of the stationary mixer under section 90-1.02F(4)(c).

90-1.01C(10) Protecting Concrete

If requested, submit a plan for protecting the concrete.

90-1.01D Quality Assurance

90-1.01D(1) General

If requested, furnish test samples of the freshly mixed concrete and provide satisfactory facilities for obtaining the test samples.

90-1.01D(2) Cementitious Material Content

Adjust the batch proportions as necessary to produce concrete having the specified cementitious material content.

The Engineer verifies compliance with the specified cementitious material content by testing under California Test 518 for cement content. For testing purposes, SCM is considered to be cement.

For all concrete except minor concrete, if the cementitious material, portland cement, or SCM content is less than the minimum required and is not within the batching tolerances allowed under section 901.02F(3), you must remove the concrete. If the Engineer determines that the concrete is structurally adequate, the concrete may

remain in place and $0.25 is deducted for each pound of cementitious material, portland cement, or SCM less than the minimum required. No deductions are made based on the results of California Test 518.

90-1.01D(3) Shrinkage

If shrinkage limitations are specified, test the concrete under AASHTO T 160, modified as follows:

1. *Prepare specimens that have a 4 by 4-inch cross section.*
2. *Remove each specimen from the mold 23 ± 1 hours after mixing the concrete and place the specimen in lime water at 73 ± 3 degrees F until 7 days age.*
3. *Take a comparator reading at 7 days age and record it as the initial reading.*
4. *Store the specimens in a humidity-controlled room maintained at 73 ± 3 degrees F and 50 ± 4 percent relative humidity for the remainder of the test.*
5. *Take subsequent readings at 7, 14, 21, and 28 days drying.*

Perform AASHTO T 160 testing at a laboratory that is accredited to perform AASHTO T 160 or that maintains a current rating of 3 or better for the Cement and Concrete Reference Laboratory concrete proficiency sample program.

Shrinkage test data authorized by the Department no more than 3 years before the 1st day of the Contract is authorized for the entire Contract. The test data must be for concrete with similar proportions and using the same materials and material sources to be used on the Contract. Concrete is considered to have similar proportions if no more than 2 mix design elements are varied and the variation is within the tolerances shown in the following table:

Mix design element	*Tolerance (±)*
Water to cementitious material ratio	*0.03*
Total water content (%)	*5*
Coarse aggregate content (%)	*10*
Fine aggregate content (%)	*10*
SCM content (%)	*5*
Admixture as originally dosed[a] (%)	*25*

[a]Admixtures must be the same brand.

90-1.01D(4) Concrete Uniformity

The Engineer determines the uniformity of concrete mixtures based on differences in test results between 2 test samples of mixed concrete from the same batch for the following tests:

1. *California Test 533 if the mix design specifies a penetration value*
2. *ASTM C143 if the mix design specifies a slump value*
3. *California Test 529*

90-1.01D(5) Compressive Strength

90-1.01D(5)(a) General

Section 90-1.01D(5) applies for either of the following cases:

1. *Concrete is designated by compressive strength.*
2. *Attaining a minimum concrete compressive strength is specified as a prerequisite to applying loads or stresses to a concrete structure or member.*

If the 28-day compressive strength described is 3,600 psi or greater, the concrete is designated by compressive strength.

If the concrete is designated by compressive strength, the strength of concrete that is not steam cured is determined from cylinders cured under Method 2 of California Test 540.

If attaining a minimum concrete compressive strength is specified as a prerequisite to applying loads or stresses to a concrete structure or member, cylinders for concrete that is not steam cured are cured under Method 2 of California Test 540 and the concrete compressive strength is evaluated based on individual tests.

For concrete with a described 28-day compressive strength greater than 3,600 psi, 42 days are allowed to attain the strength described.

Except for concrete specified to be in a freeze-thaw area, 56 days are allowed to attain the strength described if the cementitious material satisfies the following equation:

$$[(41 \times UF) + (19 \times F) + (11 \times SL)]/TC \geq 7.0$$

where:
F = natural pozzolan or fly ash complying with AASHTO M 295, Class F or N, including the quantity in blended cement, lb/cu yd. F is equivalent to the sum of FA and FB as defined in section 901.02B(3).
SL = GGBFS, including the quantity in blended cement, lb/cu yd
UF = silica fume, metakaolin, or UFFA, including the quantity in blended cement, lb/cu yd TC = total quantity of cementitious material used, lb/cu yd

For concrete satisfying the equation above, test for the compressive strength at least once every 500 cu yd at 28, 42, and 56 days. Submit the test results to the Engineer and to METS, Attention: Office of Structural Materials, Concrete Materials Testing Branch.

The Engineer determines the concrete compressive strength from test cylinders:

1. *Made from concrete sampled under California Test 539*
2. *Molded and initially field cured under California Test 540*
3. *Cured and tested under California Test 521*

A compressive strength test represents no more than 300 cu yd of concrete and consists of the average compressive strength of 2 cylinders made from material taken from a single load of concrete. If a cylinder shows evidence of improper sampling, molding, or testing, the cylinder is discarded and the test consists of the compressive strength of the remaining cylinder.
If a single compressive strength test result is below the strength described at the maximum age specified or allowed, or if the compressive strength of concrete tested at 7 days indicates to the Engineer that the concrete will not attain the strength described at the maximum age specified or allowed, correct the mix design or concrete fabrication procedures and obtain authorization before you place additional concrete.

If a single compressive strength test result is below the strength described at the maximum age specified or allowed, the concrete represented by the test is subject to one of the following actions:

1. *If the compressive strength is at least 95 percent of the strength described, $10 per cubic yard of concrete is deducted.*

2. *If the compressive strength is below 95 percent of the strength described but is at least 85 percent of the strength described, $15 per cubic yard of concrete is deducted.*

3. *If the compressive strength is below 85 percent of the strength described, you must remove the concrete.*

If a strength test result at the maximum age specified or allowed is below the strength described but is at least 85 percent of the strength described, the deductions specified above apply unless you obtain and submit evidence that the strength of the concrete placed in the work is greater than or equal to the strength described and this evidence is accepted by the Engineer.

If a strength test result at the maximum age specified or allowed is below 85 percent of the strength described, you must remove the concrete represented by the test unless you obtain and submit evidence that the strength of the concrete placed in the work is at least 85 percent of the strength described and this evidence is accepted by the Engineer.

If the evidence consists of tests made on cores taken from the work, obtain and test the cores under ASTM C42.

90-1.01D(5)(b) Prequalification

If the concrete has a described 28-day compressive strength greater than 3,600 psi, or if prequalification is specified, prequalify the materials, mix proportions, mixing equipment, and procedures proposed for use in the work before placing the concrete.

Submit certified test data or trial batch test reports based on the same materials, mix proportions, mixing equipment, procedures, and batch size proposed for use in the work.

Certified test data must show that:

1. *Results of 90 percent or more of at least 20 consecutive tests exceed the compressive strength described at the maximum number of days specified or allowed and none of the test results are less than 95 percent of the strength described*

2. *All tests are the most recent tests made on concrete of the proposed mix design and were made within 1 year of the proposed use of the concrete*

Trial batch test reports must show that:

1. *Average compressive strength for 5 consecutive concrete cylinders taken from a single batch and tested at not more than the maximum age specified or allowed is at least 600 psi greater than the 28day compressive strength described*

2. *No individual cylinder has a strength less than the strength described at the maximum age specified or allowed*

3. *Data contained in the report is from trial batches produced within 1 year of the proposed use of the concrete*

If air entrainment is specified, the air content of the trial batches must be greater than or equal to the air content specified for the concrete without reduction due to tolerances.
Perform tests under the appropriate California Test methods or comparable ASTM test methods. Use testing equipment that is in good condition and properly calibrated. If tests are performed during the Contract, notify the Engineer in advance so that the Engineer can witness the test procedures.

Certified test data and trial batch reports must include:

1. *Date of mixing*
2. *Mixing equipment and procedures*
3. *Batch size in cubic yards*
4. *Weight, type, and source for each ingredient*
5. *Penetration or slump as specified in section 90-1.02G(6)*
6 *Air content if an air-entraining admixture is used*
7. *Concrete age at the time of testing*
8. *Compressive strength for each cylinder tested*
9. *Signature of an official of the testing firm*

If authorized, you may use the concrete from trial batches in the work at locations where lower quality concrete is required.

Any change to the prequalified materials, mix proportions, mixing equipment, or procedures that could result in a concrete strength below that described requires additional prequalification by trial batch testing.

90-1.01D(6) Curing Compound

Test each batch of curing compound delivered to the job site or casting site for:

1. *Water loss at 24 hours under California Test 534*
2. *Reflectance under ASTM E1347*
3. *Viscosity under ASTM D2196*
4. *Nonvolatile content under ASTM D2369*
5. *Pigment content under ASTM D3723*

A batch must be no larger than 10,000 gal.

The Engineer samples the curing compound at any of the following:

1. *Manufacturer's supply source*
2. *Job site or casting site*

The curing compound sampled from shipping containers from the manufacturer's supply source or from the job site must match the test results for viscosity, nonvolatile content, and pigment content within the tolerances specified in the precision and bias statements for the test methods.

Additional testing of the curing compound may be required before its use if the compound has not been used within 1 year or if the Engineer believes that the compound may no longer be acceptable.

90-1.02 MATERIALS

90-1.02A General

Concrete for pavement, approach slabs, and bridge decks must comply with the shrinkage limitations shown in the following table when tested under section 90-1.01D(3):

Type of work	*Maximum length change of laboratory cast specimens at 28 days drying (average of 3) (percent)*
Paving and approach slab concrete	*0.050*
Bridge deck concrete	*0.045*

When tested for uniformity under section 90-1.01D(4), the differences in test results between the 2 concrete test samples must comply with the following:

1. *When tested under California Test 533, the difference in penetration values must not exceed 1/2 inch.*
2. *When tested under ASTM C143, the difference in slump values must not exceed the values shown in the following table:*

Average slump, S (in)	*Maximum permissible difference (in)*
S < 4	*1*
4 ≤ S ≤ 6	*1-1/2*
6 < S ≤ 9	*2*

3. *When tested under California Test 529, the difference in the proportion of coarse aggregate must not exceed 170 pounds of aggregate per cubic yard of concrete.*

Unless a modulus of rupture is specified, the minimum required compressive strength for concrete must be the greater of either the strength described or 2,500 psi. Proportion the concrete to attain the minimum required compressive strength.
For concrete not designated by compressive strength, the concrete must attain at least 85 percent of the minimum required compressive strength when tested at 28 days.

90-1.02B Cementitious Materials

90-1.02B(1) General

The cementitious materials type and brand must be on the Authorized Material List for cementitious material for use in concrete when the mix design is submitted.

Unless otherwise specified, the cementitious material must be one of the following:

1. *Combination of Type II or V portland cement and SCM*
2. *Blended cement*

The cementitious materials used in CIP concrete for exposed surfaces of similar elements of a structure must be from the same sources and of the same proportions.

Protect cementitious materials from moisture until used.

Place sacked cementitious materials in a pile to allow access for tallying, inspecting, and identifying each shipment.

Provide facilities that ensure the cementitious materials to be used in the work are kept separate from each other and from other cementitious materials.

A storage silo containing a cementitious material must be emptied before using the silo for a different cementitious material. Blended cements with a percentage of SCM differing by more than 2 percent are considered different cementitious materials.

Sample cementitious materials under California Test 125.

90-1.02B(2) Cement

Portland cement must comply with ASTM C150, except the C_3S content of Type II cement must not exceed 65 percent.

Blended cement must comply with portland blast-furnace slag cement, Type IS (MS), or portlandpozzolan cement, Type IP (MS), specified in AASHTO M 240, except:

1. *Maximum limits on pozzolan content do not apply*
2. *Blended cement must be composed of Type II or V cement and SCM produced by one of the following methods:*
    - 2.1. *Intergrinding of portland cement clinker and granulated blast furnace slag, GGBFS, or pozzolan*
    - 2.2. *Blending of portland cement and either GGBFS or finely divided pozzolan 2.3. Combination of intergrinding and blending*

Types II, III, and V portland cement must comply with the following:

1. *Alkali content must not exceed 0.60 percent by mass of alkalies as $Na_2O + 0.658\ K_2O$ when determined under AASHTO T 105.*
2. *Autoclave expansion must not exceed 0.50 percent.*

Type III portland cement may be used only if specified or authorized.

90-1.02B(3) Supplementary Cementitious Materials *Each SCM must be one of the following:*

1. *Fly ash complying with AASHTO M 295, Class F, and either of the following:*
    - 1.1. *Available alkali as $Na_2O + 0.658\ K_2O$ must not exceed 1.5 percent when tested under ASTM C311.*
    - 1.2. *Total alkali as $Na_2O + 0.658\ K_2O$ must not exceed 5.0 percent when tested under AASHTO T 105.*
2. *UFFA complying with AASHTO M 295, Class F, and the chemical and physical requirements shown in the following 2 tables:*

Chemical quality characteristic	*Requirement (percent)*
Sulfur trioxide (SO_3) (max)	*1.5*
Loss on ignition (max)	*1.2*
Available alkalies as $Na_2O + 0.658\ K_2O$ (max)	*1.5*

Physical quality characteristic	*Requirement (percent)*
Particle size distribution *Less than 3.5 microns (min)* *Less than 9.0 microns (min)*	 *50* *90*
Strength activity index with portland cement *7 days (% of control, min)* *28 days (%t of control, min)*	 *95* *110*
Expansion at 16 days when testing project materials under ASTM C1567[a] (max)	*0.10*

[a]In the test mix, at least 12 percent, by weight, of the Type II or V portland cement must be replaced with UFFA.

3. *Raw or calcined natural pozzolans complying with AASHTO M 295, Class N, and either of the following:*
   3.1. *Available alkali as Na_2O + 0.658 K_2O must not exceed 1.5 percent when tested under ASTM C311.*
   3.2. *Total alkali as Na_2O + 0.658 K_2O must not exceed 5.0 percent when tested under AASHTO T 105.*
4. *Metakaolin complying with AASHTO M 295, Class N, and the chemical and physical requirements for the quality characteristics shown in the following 2 tables:*

Chemical quality characteristic	*Requirement (percent)*
Silicon dioxide (SiO_2) + aluminum oxide (Al_2O_3) (min)	*92.0*
Calcium oxide (CaO) (max)	*1.0*
Sulfur trioxide (SO_3) (max)	*1.0*
Loss on ignition (max)	*1.2*
Available alkalies as Na_2O + 0.658 K_2O (max)	*1.0*

Physical quality characteristic	*Requirement (percent)*
Particle size distribution less than 45 microns (min)	*95*
Strength activity index with portland cement *7 days (% of control, min)* *28 days (% of control, min)*	 *100* *100*

5. *GGBFS complying with AASHTO M 302, Grade 100 or 120.*
6. *Silica fume complying with AASHTO M 307, with a minimum reduction in mortar expansion of 80 percent when using the cement from the proposed mix design.*

Fly ash from different sources may be commingled at uncontrolled ratios if:

1. *Each source produces fly ash complying with AASHTO M 295, Class F*
2. *At the time of commingling, each fly ash has:*
   2.1. *Running average of relative density that does not differ from any other fly ash by more than 0.25*
   2.2. *Running average of loss on ignition that does not differ from any other fly ash by more than 1 percent*
3. *Final commingled fly ash complies with AASHTO M 295, Class F*
4. *Fly ash supplier is responsible for testing the commingled fly ash*

The quantity of portland cement and SCM in concrete must comply with the minimum cementitious material content specified.

The SCM content in concrete must comply with one of the following:

1. *Any combination of portland cement and at least 1 SCM, satisfying equations 1 and 2:*
   Equation 1:

   [(25 x UF) + (12 x FA) + (10 x FB) + (6 x SL)]/MC ≥ X

   where:
   UF = silica fume, metakaolin, or UFFA, including the quantity in blended cement, lb/cu yd
   FA = natural pozzolan or fly ash complying with AASHTO M 295, Class F or N, with a CaO content of up to 10 percent, including the quantity in blended cement, lb/cu yd
   FB = natural pozzolan or fly ash complying with AASHTO M 295, Class F or N, with a CaO content of greater than 10 percent and up to 15 percent, including the quantity in blended cement, lb/cu yd
   SL = GGBFS, including the quantity in blended cement, lb/cu yd
   MC = minimum quantity of cementitious material specified, lb/cu yd
   X = 1.8 for innocuous aggregate, 3.0 for all other aggregate

   Equation 2:
   MC - MSCM - PC ≥ 0

   where:
   MC = minimum quantity of cementitious material specified, lb/cu yd MSCM = minimum sum of SCMs that satisfies equation 1, lb/cu yd
   PC = quantity of portland cement, including the quantity in blended cement, lb/cu yd

2. *15 percent Class F fly ash with at least 48 oz of $LiNO_3$ solution added per 100 lb of portland cement. The CaO content of the fly ash must not exceed 15 percent.*

90-1.02C Aggregates

90-1.02C(1) General

Both the coarse and fine aggregate must be on the Authorized Material List for the aggregate used in concrete to be considered innocuous.

Aggregates must be free from deleterious coatings, clay balls, roots, bark, sticks, rags, and other extraneous material.

Provide safe and suitable facilities, including splitting devices, for obtaining aggregate test samples under California Test 125.

Aggregates must have:

1. *Characteristics that enable the production of workable concrete within the limits of water content specified in section 90-1.02G(6).*

2. *No more than 10 percent loss when tested for soundness under California Test 214. The soundness requirement does not apply to fine aggregate if the durability index of the fine aggregate is 60 or greater when tested under California Test 229.*

Each cleanness value, sand equivalent, or aggregate gradation test represents no more than 300 cu yd of concrete or 1 day's pour, whichever is smaller.

If the results of any 1 or more of the cleanness value, sand equivalent, or aggregate gradation tests do not comply with the requirements for operating range, but all comply with the requirements for contract compliance:

1. *Suspend the concrete placement at the completion of the current pour*
2. *Do not restart the concrete placement until test results or other information show that the next material to be used in the work complies with the requirements for operating range*

If the results of either or both of the cleanness value and coarse aggregate gradation tests do not comply with the requirements for contract compliance, you must remove the concrete represented by the tests. If the Engineer determines that the concrete is structurally adequate, the concrete may remain in place and $3.50 per cubic yard for paving concrete and $5.50 per cubic yard for other concrete is deducted for the concrete represented by these tests and left in place.

If the results of either or both of the sand equivalent and fine aggregate gradation tests do not comply with the requirements for contract compliance, you must remove the concrete represented by the tests. If the Engineer determines that the concrete is structurally adequate, the concrete may remain in place and $3.50 per cubic yard for paving concrete and $5.50 per cubic yard for other concrete is deducted for the concrete represented by these tests and left in place.

The 2 preceding paragraphs apply individually to the contract compliance requirements for coarse and fine aggregate. If both coarse and fine aggregate do not comply with the contract compliance requirements, both paragraphs apply. The deductions specified in those paragraphs are in addition to any deductions made under section 90-1.01D(2).

90-1.02C(2) Coarse Aggregate

Coarse aggregate must consist of gravel, crushed gravel, crushed rock, reclaimed aggregate, crushed air-cooled iron blast furnace slag, or a combination of these.

Do not use crushed air-cooled iron blast furnace slag in reinforced or PS concrete.

Reclaimed aggregate must comply with the specifications for aggregate.

Coarse aggregate must have the requirements for the quality characteristics shown in the following table:

Quality characteristic	*Test method*	*Requirement*
Loss in Los Angeles rattler after 500 revolutions (%, max)	*California Test 211*	*45*
Cleanness value		
Operating range (min)	*California Test 227*	*75*
Contract compliance (min)	*California Test 227*	*71*

For cleanness value, an operating range limit of 71 minimum and a contract compliance limit of 68 minimum apply if you submit a certificate of compliance certifying that:

1. *Coarse aggregate sampled at the completion of processing at the aggregate production plant had a cleanness value of at least 82 when tested under California Test 227*

2. *Prequalification tests performed under California Test 549 showed that the aggregate would develop a relative strength of at least 95 percent and have a relative shrinkage of no more than 105 percent based on concrete*

90-1.02C(3) Fine Aggregate

Fine aggregate must consist of natural sand, manufactured sand produced from larger aggregate, or a combination of these. Manufactured sand must be well graded.

Fine aggregate must have the requirements for the quality characteristics shown in the following table:

Quality characteristic	*Test method*	*Requirement*
Organic impurities	*California Test 213*	*Satisfactory*[a]
Sand equivalent:		
Operating range (min)	*California Test 217*	*75*
Contract compliance (min)	*California Test 217*	*71*

[a]*Fine aggregate that develops a color darker than the reference standard color may be authorized if 95 percent relative mortar strength is achieved when tested under ASTM C87.*

For sand equivalent, an operating range limit of 71 minimum and a contract compliance limit of 68 minimum apply if you submit a certificate of compliance certifying that:

1 Fine aggregate sampled at the completion of processing at the aggregate production plant had a sand equivalent value of at least 82 when tested under California Test 217

2. Prequalification tests performed under California Test 549 showed that the aggregate would develop a relative strength of at least 95 percent and have a relative shrinkage of no more than 105 percent based on concrete

90-1.02C(4) Aggregate Gradation

90-1.02C(4)(a) General

Proposed aggregate gradations must be within the percentage passing limits shown in the following table:

Primary aggregate nominal size	*Sieve size*	*Limits of gradation (% passing)*
1-1/2 x 3/4 inch	*1 in*	*19–41*
1 inch x No. 4	*3/4 in*	*52–85*
1 inch x No. 4	*3/8 in*	*15–38*
1/2 inch x No. 4	*3/8 in*	*40–78*
3/8 inch x No. 8	*3/8 in*	*50–85*
Fine aggregate	*No. 16*	*55–75*
Fine aggregate	*No. 30*	*34–46*
Fine aggregate	*No. 50*	*16–29*

The Engineer may waive, in writing, the specifications for gradation if in the Engineer's opinion furnishing the gradation is not necessary for the work.

90-1.02C(4)(b) Coarse Aggregate Gradation

Coarse aggregate must be graded within the limits shown in the following table for each size of coarse aggregate:

	Primary aggregate nominal sizes							
	1-1/2 x 3/4 inch		*1 inch x No. 4*		*1/2 inch x No. 4*		*3/8 inch x No. 8*	
Sieve size	*Operating Range (% passing)*	*Contract Compliance (% passing)*	*Operating Range (% passing)*	*Contract Compliance (% passing)*	*Operating Range (% passing)*	*Contract Compliance (% passing)*	*Operating Range (% passing)*	*Contract Compliance (% passing)*
2 inch	*100*	*100*	*--*	*--*	*--*	*--*	*--*	*--*
1-1/2 inch	*88–100*	*85–100*	*100*	*100*	*--*	*--*	*--*	*--*
1 inch	*X ± 18*	*X ± 25*	*88–100*	*86–100*	*--*	*--*	*--*	*--*
3/4 inch	*0–17*	*0–20*	*X ± 15*	*X ±22*	*100*	*100*	*--*	*--*
1/2 inch	*--*	*--*	*--*	*--*	*82–100*	*80–100*	*100*	*100*
3/8 inch	*0–7*	*0–9*	*X ± 15*	*X ± 22*	*X ± 15*	*X ± 22*	*X ± 15*	*X ± 20*
No. 4	*--*	*--*	*0–16*	*0–18*	*0–15*	*0–18*	*0–25*	*0–28*
No. 8	*--*	*--*	*0–6*	*0–7*	*0–6*	*0–7*	*0–6*	*0–7*

NOTE: "X" is the percent passing of the gradation that you propose to furnish for the specific sieve size under section 90-1.02C(4)(a).

Furnish coarse aggregate for the 1-1/2-inch maximum combined aggregate gradation under section 901.02C(4)(d) in 2 or more primary aggregate nominal sizes. You may separate each primary aggregate nominal size into 2 sizes and store them separately, provided that the combined material complies with the gradation specifications for the primary aggregate nominal size.

You may separate the coarse aggregate for the 1-inch maximum combined aggregate gradation under section 90-1.02C(4)(d) into 2 sizes and store them separately, provided that the combined material complies with the gradation specifications for the 1 inch x No. 4 primary aggregate nominal size.

90-1.02C(4)(c) Fine Aggregate Gradation

Fine aggregate must be graded within the limits shown in the following table:

Sieve size	Operating range (% passing)	Contract compliance (% passing)
3/8 inch	100	100
No. 4	95–100	93–100
No. 8	65–95	61–99
No. 16	X ± 10	X ± 13
No. 30	X ± 9	X ± 12
No. 50	X ± 6	X ± 9
No. 100	2–12	1–15
No. 200	0–8	0–10

NOTE: "X" is the percent passing of the gradation that you propose to furnish for the specific sieve size under section 90-1.02C(4)(a).

Fine aggregate sizes must be distributed such that the difference between the total percentage passing the No. 16 and No. 30 sieves is from 10 to 40, and the difference between the percentage passing the No. 30 and No. 50 sieves is from 10 to 40.

You may separate fine aggregate into 2 or more sizes and store them separately, provided that the combined material complies with the gradation specifications.

90-1.02C(4)(d) Combined Aggregate Gradation

Use combined aggregate gradation limits only for the design of concrete mixes. Design concrete mixes such that aggregates are combined in proportions that produce a mixture within the gradation limits for combined aggregate.

Use either the 1-1/2-inch maximum gradation or the 1-inch maximum gradation, unless otherwise specified.

Combined aggregate must be graded within the limits shown in the following table:

Sieve size	1-1/2 inch max (% passing)	1 inch max (% passing)	1/2 inch max (% passing)	3/8 inch max (% passing)
2 inch	100	--	--	--
1-1/2 inch	90–100	100	--	--
1 inch	50–86	90–100	--	--
3/4 inch	45–75	55–100	100	--
1/2 inch	--	--	90–100	100
3/8 inch	38–55	45–75	55–86	50–100
No. 4	30–45	35–60	45–63	45–63
No. 8	23–38	27–45	35–49	35–49
No. 16	17–33	20–35	25–37	25–37
No. 30	10–22	12–25	15–25	15–25
No. 50	4–10	5–15	5–15	5–15
No. 100	1–6	1–8	1–8	1–8
No. 200	0–3	0–4	0–4	0–4

Do not change from one aggregate gradation to another during the progress of the work.

90-1.02D Water

Water for washing aggregates, mixing concrete, and curing must not contain:

1. *Oil*
2. *Impurities at concentrations that cause either of the following results when compared to the same test using distilled or deionized water:*
   - 2.1. *Change of more than 25 percent in the setting time of cement when tested under ASTM C191 or ASTM C266*
   - 2.2. *Reduction by more than 5 percent in the mortar compressive strength at 14 days when tested under ASTM C109*
3. *Chlorides as Cl or sulfates as SO_4 in excess of the values shown in the following table:*

	Type of concrete work		
Quality characteristic	*Nonreinforced*	*Reinforced*	*PS*
Chloride as Cl[a] (ppm, max)	*2,000*	*1,000*	*650*
Sulfate as SO_4[b] (ppm, max)	*1,500*	*1,300*	*1,300*

[a]When tested under California Test 422 [b]When tested under California Test 417

Water for curing concrete must not contain impurities at concentrations that cause discoloration or surface etching.

Water reclaimed from washing out the mixer may be used in mixing concrete. The water must not contain coloring agents or more than 300 ppm of alkalis as $Na_2O + 0.658\ K_2O$ as determined on the filtrate. The specific gravity of the water must not exceed 1.03 and must not vary more than ±0.010 during a day's activities.

90-1.02E Admixtures

90-1.02E(1) General

The admixture type and brand must be on the Authorized Material List at the time of mix design submittal.

Admixtures must comply with the following:

1. *Chemical admixtures must comply with ASTM C494*
2. *Air-entraining admixtures must comply with ASTM C260*
3. *Lithium nitrate must be in an aqueous solution that complies with the following:*
   - 3.1. *Lithium nitrate as $LiNO_3$ must be 30 ± 0.5 percent by weight*
   - 3.2. *Sulfate as SO_4 must be less than 1,000 ppm*
   - 3.3. *Chloride as Cl must be less than 1,000 ppm*
   - 3.4. *Alkalis as $Na_2O + 0.658\ K_2O$ must be less than 1,000 ppm*

Chemical or air-entraining admixtures must not contain more than 1 percent chlorides as Cl by weight of admixture when tested under California Test 415.

Store and dispense the admixtures in liquid form.

Admixture properties must be uniform throughout their use in the work.

If more than 1 admixture is used, the admixtures must be compatible with each other such that the desirable effects of all the admixtures used are realized.

Use chemical admixtures in compliance with the manufacturer's written instructions. The instructions must include a statement that the admixture is compatible with the types and quantities of SCM used.

If you are ordered to use admixtures in the concrete that are not specified, furnishing the admixtures and adding them to the concrete is change order work.

90-1.02E(2) Chemical Admixtures

If the use of chemical admixtures is specified, use the dosage specified. If the dosage is not specified, use the dosage recommended by the admixture manufacturer.

You may use any of the following admixture types to conserve cementitious material or to facilitate construction:

1. *Type A or F, water-reducing*
2. *Type B, retarding*
3. *Type D or G, water-reducing and retarding*

If you use a water-reducing admixture or a water-reducing and retarding admixture, you may reduce the specified cementitious material content by up to 5 percent by weight. The resulting concrete must contain at least 505 pounds of cementitious material per cubic yard. If you reduce the cementitious material content, use at least the admixture dosage used in authorizing the admixture as shown on the Authorized Material List for chemical admixture for use in concrete.

You may use a Type S admixture.

You may use a Type C accelerating admixture. Inclusion of the Type C admixture in the mix design is not required if it is added to counteract changing conditions that contribute to delayed setting of the concrete and if the use or change in dosage of the admixture is authorized.

90-1.02E(3) Air-Entraining Admixtures

If air entrainment is specified or ordered, use the quantity of air-entraining admixture that produces concrete having the specified air content when tested under California Test 504.

If air entrainment is not specified or ordered, you may use an air-entraining admixture to facilitate the use of a construction procedure or equipment. The average air content of 3 successive tests must not exceed 4 percent and each test value must be no more than 5.5 percent when tested under California Test 504.

90-1.02F Proportioning Concrete

90-1.02F(1) General

Reserved

90-1.02F(2) Storage of Aggregates

Store or stockpile aggregates such that the coarse and fine particles of each size do not separate and various sizes do not intermix before proportioning.

Prevent contamination by foreign materials while storing, stockpiling, and handling aggregates.

If you store the aggregates at a batching or mixing plant that is erected after the Contract is awarded and is used for furnishing concrete for the work:

1. *Prevent intermingling of different aggregate sizes by using measures such as the physical separation of stockpiles or the construction of bulkheads of adequate length and height*

2. *Prevent contamination of the aggregates by contact with the ground through measures such as placing the aggregates on wooden platforms or on hardened surfaces made of concrete, asphalt concrete, or cement-treated material*

When placing the aggregates in storage or moving the aggregates from storage to the weigh hopper of the batching plant, do not use methods that cause either of the following:

1. *Segregation, degradation, or the combining of materials of different gradations and result in an aggregate size failing to comply with the gradation specifications at the weigh hopper*

2. *Excessive particle breakage*

You may be required to use devices that reduce the impact of falling aggregates.

90-1.02F(3) Proportioning Devices

Automatic weighing systems must comply with section 90-1.02F(4)(c). For an automatic device, the single operation of a switch or starter must be the only manual operation required to proportion the aggregates, cement, and SCM for 1 batch of concrete.

Insulate the weighing equipment against the vibration or movement of other plant equipment.

The weight of each batch of material must not vary from the weight designated by the Engineer by more than the specified tolerances.

The weighing and measuring equipment must have the following zero tolerances:

1. *For cumulative weighing of aggregates, ±0.5 percent of the designated total aggregate batch weight*
2. *For weighing each aggregate size separately, ±0.5 percent of the designated batch weight for each aggregate size*
3. *For cumulative weighing of cement and SCM, ±0.5 percent of the designated total batch weight of the cement and SCM*
4. *For weighing cement and SCM separately, ±0.5 percent of their designated individual batch weights 5. For measuring water, ±0.5 percent of its designated weight or volume*

The weight indicated for a batch of material must not vary from the preselected scale setting by more than the following:

1. *Aggregates weighed cumulatively must be within ±1.0 percent of the designated total aggregate batch weight.*
2. *Aggregates weighed separately must be within ±1.5 percent of the designated batch weight of each aggregate.*
3. *Cement weighed separately must be within +2 to -1 percent of the designated cement batch weight.*
4. *SCM weighed separately must be within +2 to -1 percent of the designated SCM batch weight.*
5. *For cement and SCM weighed cumulatively, the cement must be within +2 to -1 percent of the designated cement batch weight and the total for cement and SCM must be within +2 to -1 percent of the sum of the designated cement and SCM batch weights.*
6. *Water must be within ±1.5 percent of the designated weight or volume of water.*

Each scale graduation must be no more than 0.001 of the total scale capacity. For each material being weighed, use a scale with single graduations that indicate a weight not exceeding the maximum permissible weight variation above, except that graduations less than 1 lb are not required.

90-1.02F(4) Proportioning

90-1.02F(4)(a) General

Proportioning consists of dividing the aggregates into the specified sizes, each stored in a separate bin, and combining the aggregates with cementitious material, admixtures if used, and water.

Proportion the aggregates by weight.

At the time of batching:

1. *Aggregates must be dried and drained to a stable moisture content such that no visible separation of water from the aggregate occurs during transportation from the proportioning plant to the point of mixing*
2. *Free moisture content of the fine aggregate must not exceed 8 percent of its saturated surface-dry weight*

If the proportioning plant has separate supplies of the same size group of aggregate with different moisture content, specific gravity, or surface characteristics affecting workability, exhaust one supply before using another supply.
Weigh bulk Type IP (MS) or Type IS (MS) cement in an individual hopper and keep it separate from the aggregates until the ingredients are released for discharge into the mixer.

Bulk cement and SCM may be weighed in separate weigh hoppers or in the same weigh hopper. Keep the cement and SCM separate from the aggregates until the ingredients are released for discharge into the mixer.

If the cement and SCM are weighed in the same weigh hopper, weigh the cement first. If the cement and SCM are weighed in separate weigh hoppers, the weigh systems for the proportioning of the aggregate, the cement, and the SCM must be individual and distinct from all other weigh systems. To constitute an individual and distinct material-weighing device, each weigh system must have a hopper, a lever system, and an indicator.

Discharge the cement and the SCM into the mixer simultaneously with the aggregate.

The scales and weigh hoppers for bulk weighing cement, SCM, or cement plus SCM must be separate and distinct from the aggregate weighing equipment.

For batches of 1 cu yd or more, the batching equipment must comply with one of the following combinations:

1. *Separate boxes and separate scale and indicator for weighing each aggregate size*
2. *Single box and scale indicator for all aggregates*
3. *Single box or separate boxes and automatic weighing mechanism for all aggregates*

If you are requested to check the accuracy of batch weights, determine the gross weight and tare weight of batch trucks, truck mixers, truck agitators, and nonagitating hauling equipment. Weigh the equipment using scales designated by the Engineer.

For proportioning pavement concrete, install and maintain in good operating condition an electronically actuated moisture meter that indicates, on a readily visible scale, changes in the moisture content of the fine aggregate as it is batched within a sensitivity of 0.5 percent by weight of the fine aggregate.

90-1.02F(4)(b) Proportioning and Dispensing Liquid Admixtures

Liquid admixture dispensers must:

1. *Have enough capacity to measure at 1 time the total quantity of admixture required for each batch of concrete*

2. *Include a graduated measuring unit that is accurate to within ±5 percent of the required quantity for each batch of concrete*

3. *Be located and maintained such that the graduations can be read accurately from the point at which proportioning is controlled to allow a visual check of batching accuracy before discharge*

4. *Have measuring units that are clearly marked for the type and quantity of admixture*

Each liquid admixture dispensing system must be equipped with a sampling device that consists of a valve located in a safe and readily accessible position such that the Engineer can slowly withdraw a test sample.

If more than 1 liquid admixture is used in the concrete mix, each admixture must have a separate measuring unit and must be dispensed by injecting equipment located such that the admixtures are not mixed at high concentrations and do not interfere with the effectiveness of each other.

If an air-entraining admixture is used with other liquid admixtures, incorporate the air-entraining admixture into the mix first, unless you demonstrate that a different sequence improves performance.

If automatic proportioning devices are used, the liquid admixture dispensers must operate automatically with the batching control equipment. The dispensers must have an automatic warning system in good operating condition that provides a visible or audible signal at the point at which proportioning is controlled. The signal must activate if the quantity of admixture measured varies from the preselected dosage by more than 5 percent or if the entire contents of the measuring unit are not emptied from the dispenser.

Add liquid admixtures to the premeasured batch water or discharge the admixtures into the stream of water such that they are well-dispersed throughout the batch.

You may dispense air-entraining admixtures directly into moist sand in the batching bins if you maintain adequate control of the concrete air content.

90-1.02F(4)(c) Automatic Proportioning

Automatic proportioning devices must be authorized by the Department.

The batching of the aggregate and the cement, SCM, or cement plus SCM must be interlocked such that a new batch cannot start until all weigh hoppers are empty, the proportioning devices are within zero tolerance, and the discharge gates are closed.

The interlock must not allow any part of the batch to be discharged until all aggregate hoppers and the cement and SCM hoppers or the cement plus SCM hopper are charged with weights that are within the tolerances specified in section 90-1.02F(3).

If interlocks are required for the cement and SCM charging mechanisms and the cement and SCM are weighed cumulatively, their charging mechanisms must be interlocked to prevent the introduction of SCM until the weight of cement in the cement weigh hopper is within the tolerances specified in section 901.02F(3).

If the concrete is mixed completely in a stationary mixer, weigh the SCM in a separate weigh hopper and introduce the SCM and cement simultaneously into the mixer proportionately with the aggregate. If you submit certification that the stationary mixer is capable of mixing the cement, SCM, aggregates, and water uniformly before discharge, you may weigh the SCM cumulatively with the cement. Certification must include:

1. *Test results for 2 compressive strength test cylinders taken within the first 1/3, and 2 compressive strength test cylinders taken within the last 1/3, of a single batch of concrete discharged from the stationary mixer. Strength tests and cylinder preparation must comply with section 90-1.01D(5).*

2. *Calculations demonstrating that the average of the 2 compressive strengths taken within the first 1/3 of the batch do not differ by more than 7.5 percent from the average of the 2 compressive strengths taken within the last 1/3 of the batch.*

3. *Mixer rotation speed and time of mixing before discharge that are required to produce a mix that complies with the above requirements.*

The discharge gate on the cement and SCM hoppers or the cement plus SCM hopper must be designed to allow the regulation of the flow of cement, SCM, or cement plus SCM into the aggregate.

If separate weigh boxes are used for each aggregate size, the discharge gates must allow the regulation of the flow of each aggregate size.

Material discharged from each bin must be controlled by gates or by mechanical conveyors.

The means of withdrawal from the bins and of discharge from the weigh box must be interlocked such that not more than 1 bin can discharge at a time and the weigh box cannot be tripped until the required quantity from each bin has been deposited into it.

If a separate weigh box is used for each aggregate size, all the weigh boxes may be operated and discharged simultaneously.

If the discharge from the bins is controlled by gates, each gate must be actuated automatically such that the required weight is discharged into the weigh box, after which the gate must automatically close and lock.

The automatic weighing system must be designed to allow all required proportions to be set on the weighing controller at the same time.

90-1.02G Mixing and Transporting Concrete

90-1.02G(1) General

Mix the concrete in a mechanically operated mixer, except, if authorized, you may mix batches not exceeding 1/3 cu yd by hand methods under section 90-1.02G(5).

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

Concrete must be thoroughly mixed, homogeneous, and free of lumps or evidence of undispersed cementitious material.

90-1.02G(2) Machine Mixing

Concrete mixers must be the revolving drum or revolving blade type. Operate the mixing drum or blades uniformly at the mixing speed recommended by the manufacturer. Do not use a mixer or agitator that has an accumulation of hard concrete or mortar.

Immediately before placing the concrete, the temperature of the mixed concrete must be from 50 to 90 degrees F. Cool or heat the aggregates and mixing water as necessary to produce concrete within these temperature limits. Do not heat the aggregates or water above 150 degrees F. Any ice used to cool the concrete must be melted before the concrete is discharged from the mixer.

Charge the batch into the mixer such that some water enters before the cementitious materials and aggregates. Add all the water to the drum by the end of the first 1/4 of the specified mixing time. If the concrete is delivered in a truck mixer, you may withhold a portion of the mixing water and, if authorized, add it at the delivery point as specified in section 90-1.02G(3).

Batch and charge the cementitious materials into the mixer by means that will not cause:

1. *Loss of cementitious materials due to the effect of wind*
2. *Accumulation of cementitious materials on the surfaces of conveyors or hoppers*
3. *Other conditions that reduce or vary the required quantity of cementitious material in the concrete mixture*

Operate stationary mixers with an automatic timing device. The timing device and discharge mechanism must be interlocked such that during normal operation no part of the batch is discharged before the specified mixing time has elapsed.
The total time from the intermingling of damp aggregates and all cementitious materials to the start of mixing must not exceed 30 minutes.

The batch size must not exceed the manufacturer's guaranteed capacity.

For pavement or base concrete, install and maintain suitable batch counters in good operating condition at job site batching plants and stationary mixers. The batch counters must indicate the exact number of batches proportioned and mixed.

Mix and deliver the concrete to the job site by one of the following methods:

1. *Central-mixed concrete, in which the concrete is mixed completely in a stationary mixer and transported to the delivery point in a truck agitator or nonagitating hauling equipment.*

2. *Shrink-mixed concrete, in which the concrete is mixed partially in a stationary mixer and the mixing is completed in a truck mixer.*

3. *Transit-mixed concrete, in which the concrete is mixed completely in a truck mixer.*

Agitators must be truck mixers operating at agitation speed or truck agitators. Each mixer and agitator must have a metal plate attached in a prominent place that clearly shows:

1. *Various uses for which the equipment is designed*
2. *Manufacturer's guaranteed drum or container capacity in terms of the volume of mixed concrete*
3. *Rotation speed of the mixing drum or blades*

Truck mixers must have an electrically or mechanically actuated revolution counter that readily allows verification of the number of revolutions of the drum or blades.

For shrink-mixed concrete, transfer concrete that has been partially mixed at a central plant into a truck mixer and comply with the specifications for transit-mixed concrete. Partial mixing in a central plant does not count toward the number of revolutions at mixing speed.

90-1.02G(3) Transporting Mixed Concrete

You must transport mixed concrete to the delivery point in one of the following:

1. *Truck agitator operating at the manufacturer's designated agitating speed if it:*
    1.1. *Does not carry more than the manufacturer's guaranteed capacity*
    1.2. *Maintains the mixed concrete in a thoroughly mixed and uniform mass during hauling*
2. *Truck mixer operating at the manufacturer's designated agitating speed*

3. *Nonagitating hauling equipment with a body that does not allow leakage of any part of the concrete mix at any time*

When discharged at the delivery point, the consistency and workability of the mixed concrete must be suitable for adequate placement and consolidation in place and the mixed concrete must comply with the specifications for uniformity in section 90-1.02A.
Protect concrete hauled in open-top vehicles from rain or from exposure to the sun for more than 20 minutes if the ambient temperature exceeds 75 degrees F.

Do not add water to the concrete in excess of that in the authorized mix design. At the delivery point, you may add water withheld during batching if authorized. Add the water in 1 operation before the discharge of more than 1/4 cu yd. The equipment for supplying the water must comply with section 90-1.02G(6). After adding the water, revolve the drum at least 30 revolutions at mixing speed before discharging the concrete.

Control the rate of discharge of mixed concrete from a truck mixer or agitator by the speed of rotation of the drum in the discharge direction with the discharge gate fully open.

If you use a truck mixer or agitator to transport the concrete to the delivery point, comply with the following limits:

1. *Complete the discharge within 1.5 hours or before 250 revolutions of the drum or blades, whichever occurs first, after introducing the cementitious materials to the aggregates.*

2. *Under conditions contributing to quick stiffening of the concrete, or if the concrete temperature is 85 degrees F or above, the time allowed may be less than 1.5 hours.*

3. *If you use an admixture to retard the set time:*
    3.1. *Concrete temperature must not exceed 85 degrees F*
    3.2. *Time limit is 2 hours*
    3.3. *Revolution limit is 300*

If you use nonagitating hauling equipment to transport the concrete to the delivery point:

1. *Complete the discharge within 1 hour after introducing the cementitious materials to the aggregates*
2. *Under conditions contributing to quick stiffening of the concrete, or if the concrete temperature is 85 degrees F or above, complete the discharge within 45 minutes after introducing the cementitious materials to the aggregates*

If you add a high-range water-reducing admixture to the concrete at the job site, the total number of revolutions must not exceed 300.

90-1.02G(4) Time or Quantity of Mixing

Mixing of the concrete in a stationary mixer must continue for the required mixing time after all ingredients, except water and admixture that is added with the water, are in the mixing compartment of the mixer before any part of the batch is released. The transfer time in multiple drum mixers must not be counted as part of the required mixing time.

For concrete used in concrete structures other than minor structures, the mixing time in a stationary mixer must be at least 90 seconds and no more than 5 minutes, except that if authorized the minimum mixing time may be reduced to 50 seconds. For all other concrete, the mixing time must be at least 50 seconds and no more than 5 minutes.

The minimum required revolutions at the mixing speed for transit-mixed concrete must be at least that recommended by the mixer manufacturer and must be enough to produce uniform concrete under section 90-1.02A.

90-1.02G(5) Hand Mixing

Hand-mixed concrete must be made in batches of 1/3 cu yd or less.

Use the following procedure to make hand-mixed concrete:

1. *Measure the quantity of coarse aggregate in measuring boxes.*
2. *Spread the coarse aggregate on a watertight, level platform.*
3. *Spread the fine aggregate on the layer of coarse aggregate. The total depth of the 2 layers must be 1 foot or less.*

4. *Spread the dry cementitious materials on the aggregates.*
5. *Turn the whole dry mass at least 2 times.*
6. *Add and evenly distribute the water.*
7. *Turn the whole mass at least 3 more times, not including placement in the carriers or forms.*

90-1.02G(6) Quantity of Water and Penetration or Slump

Regulate the quantity of water used in the concrete mix such that the penetration as tested under California Test 533, or the slump as tested under ASTM C143, complies with the nominal range shown in the following table:

	Nominal		Maximum	
	Penetration	Slump	Penetration	Slump
Type of work	(in)	(in)	(in)	(in)
Concrete pavement	0–1	--	1.5	--
Nonreinforced concrete members	0–1.5	--	2	--
Reinforced concrete structures with:				
Sections over 12 inches thick	0–1.5	--	2.5	--
Sections 12 inches thick or less	0–2	--	3	--
Concrete placed under water	--	6–8	--	9
CIP concrete piles	2.5–3.5	5–7	4	8

If the penetration or slump exceeds the nominal range, adjust the mixture for subsequent batches to reduce the penetration or slump to a value within the nominal range.

Do not use a batch of concrete with a penetration or a slump that exceeds the maximum value shown in the table above.

If Type F or G chemical admixtures are used, the penetration requirements do not apply and the slump must not exceed 9 inches after adding the chemical admixtures.

The quantity of free water must not exceed 310 pounds per cubic yard of concrete plus 20 pounds of free water for each required 100 pounds of cementitious material in excess of 550 pounds of cementitious material per cubic yard of concrete.

When determining the total quantity of free water, consider liquid admixtures to be water if the dosage is more than 1/2 gallon of admixture per cubic yard of concrete.

If there are adverse or difficult conditions that affect concrete placement, you may exceed the specified penetration and free water content limitations if you:

1. *Receive authorization to increase the cementitious material content per cubic yard of concrete*
2. *Increase the water and cementitious material at a ratio that does not exceed 30 pounds of water per added 100 pounds of cementitious material per cubic yard of concrete*

The equipment for supplying water to the mixer must accurately measure to within 1.5 percent of the quantity of water required to be added to the mix for any position of the mixer.

The tanks used to measure the water must be designed such that water cannot enter while water is being discharged into the mixer. The water must be discharged into the mixer rapidly in 1 operation without dribbling.

Arrange the equipment to allow checking of the quantity of water delivered by discharging into measured containers.

90-1.02H Concrete in Corrosive Environments

Section 90-1.02H applies to concrete specified in the special provisions to be in a corrosive environment.

The cementitious material to be used in the concrete must be a combination of Type II or V portland cement and SCM.

The concrete must contain at least 675 pounds of cementitious material per cubic yard.

The reduction of cementitious material content as specified in section 90-1.02E(2) is not allowed.

The specifications for SCM content in section 90-1.02B(3) do not apply.

The cementitious material must be composed of one of the following, by weight:

1. *25 percent natural pozzolan or fly ash with a CaO content of up to 10 percent and 75 percent portland cement*
2. *20 percent natural pozzolan or fly ash with a CaO content of up to 10 percent, 5 percent silica fume, and 75 percent portland cement*
3. *12 percent silica fume, metakaolin, or UFFA, and 88 percent portland cement*
4. *50 percent GGBFS and 50 percent portland cement*

90-1.02I Concrete in Freeze-Thaw Areas

90-1.02I(1) General

Section 90-1.02I applies to concrete for projects specified in the special provisions to be in a freeze-thaw area.

90-1.02I(2) Materials

90-1.02I(2)(a) General

The concrete must contain at least 590 pounds of cementitious material per cubic yard unless a higher cementitious material content is specified.

Add an air-entraining admixture to the concrete at the rate required to produce an air content of 6.0 ± 1.5 percent in the freshly mixed concrete.

For concrete placed at least 2 feet below the adjacent undisturbed grade or at least 3 feet below compacted finished grade, an air-entraining admixture is not required unless the concrete will experience freezing conditions during construction.

The cementitious material must satisfy the following equation:

$$[(41 \times UF) + (19 \times F) + (11 \times SL)]/TC \leq 7.0$$

where:
UF = silica fume, metakaolin, or UFFA, including the quantity in blended cement, lb/cu yd
F = natural pozzolan or fly ash complying with AASHTO M 295, Class F or N, including the quantity in blended cement, lb/cu yd. F is equivalent to the sum of FA and FB as defined in section 901.02I(2)(b).
SL = GGBFS, including the quantity in blended cement, lb/cu yd TC = total quantity of cementitious material used, lb/cu yd

90-1.02I(2)(b) Concrete Exposed to Deicing Chemicals

Section 90-1.02I(2)(b) applies to concrete specified in the special provisions to be exposed to deicing chemicals.

The specifications for SCM content in section 90-1.02B(3) and the equation in section 90-1.02I(2)(a) do not apply.

The cementitious material must be composed of any combination of portland cement and at least 1 SCM satisfying the following equation:

Equation 1:

$$[(25 \times UF) + (12 \times FA) + (10 \times FB) + (6 \times SL)]/TC \geq X$$

The SCM must satisfy the following equations:

Equation 2:

$$4 \times (FA + FB)/TC \leq 1.0$$

Equation 3:
$(10 \times UF)/TC \leq 1.0$

Equation 4:
$2 \times (UF + FA + FB + SL)/TC \leq 1.0$

The concrete mix design must satisfy the following equation:

Equation 5:
$27 \times (TC - MC)/MC \leq 5.0$

where:
UF = silica fume, metakaolin, or UFFA, including the quantity in blended cement, lb/cu yd. If UF is used, the quantity of UF must be at least 5 percent.
FA = natural pozzolan or fly ash complying with AASHTO M 295, Class F or N, with a CaO content of up to 10 percent, including the quantity in blended cement, lb/cu yd. If FA is used, the quantity of FA must be at least 15 percent.
FB = natural pozzolan or fly ash complying with AASHTO M 295, Class F or N, with a CaO content of greater than 10 percent and up to 15 percent, including the quantity in blended cement, lb/cu yd. If FB is used, the quantity of FB must be at least 15 percent.
SL = GGBFS, including the quantity in blended cement, lb/cu yd
TC = total quantity of cementitious material, lb/cu yd
X = 1.8 for innocuous aggregate, 3.0 for all other aggregate
MC = minimum quantity of cementitious material specified, lb/cu yd

90-1.02J Curing Compound

Curing compound water loss must not exceed 0.15 kg/m^2 in 24 hours when tested under California Test 534.

90-1.03 CONSTRUCTION

90-1.03A General

Reserved

90-1.03B Curing Concrete

90-1.03B(1) General

Unless otherwise specified, cure newly placed concrete by one of the method specified in this section.

Cure mortar and grout by keeping the surface damp for 3 days.

90-1.03B(2) Water Method

The water method must consist of keeping the concrete continuously wet by applying water for a curing period of at least 7 days after the concrete is placed.

You may use cotton mats, rugs, carpets, or earth or sand blankets as a curing medium to retain the moisture during the curing period.

For curing structures, you may use a curing medium consisting of white opaque polyethylene sheeting extruded onto burlap. The polyethylene sheeting must have a minimum thickness of 4 mils and must be extruded onto 10-ounce burlap.

For curing columns, you may use a curing medium consisting of polyethylene sheeting with a minimum thickness of 10 mils achieved in a single layer of material.

Keep the concrete surface damp by applying water with an atomizing nozzle that forms a mist and not a spray until the surface is covered with the curing medium. Do not apply the water under pressure directly on the concrete or allow the water to flow over or wash the concrete surface. At the end of the curing period, remove the curing medium.

If you use polyethylene sheeting or polyethylene sheeting on burlap as a curing medium:

1. *Secure the sheeting and the sheeting joints as necessary to retain moisture*

2. *Keep the sheeting within 3 inches of the concrete at all points along the surface being cured*
3. *Monitor the concrete temperature during curing*
4. *Discontinue the use of these curing media if the concrete temperature cannot be maintained below 140 degrees F*

90-1.03B(3) Curing Compound Method

90-1.03B(3)(a) General

The curing compound method must consist of uniformly spraying the concrete surfaces exposed to the air with a curing compound.

90-1.03B(3)(b) Materials

The curing compound must comply with the requirements shown in the following table for the curing compound number specified:

Curing compound no.	*ASTM C309 classification*
1	*Pigmented, Type 2, Class B[a]*
2	*Pigmented, Type 2, Class B*
3	*Pigmented, Type 2, Class A*
4	*Nonpigmented, Type 1, Class B*
5	*Nonpigmented, Type 1, Class A*
6	*Nonpigmented with fugitive dye, Type 1-D, Class A*

[a]The resin type must be poly-alpha-methylstyrene. The infrared scan for the dried vehicle must match the scan on file at METS.

If no curing compound number is specified, use any of the curing compounds shown in the table above.

The curing compound must be manufactured to:

1. *Remain sprayable at temperatures above 40 degrees F*
2. *Control sagging, pigment settling, leveling, and de-emulsification*
3. *Maintain the specified properties for at least 1 year*

Pigmented curing compounds must be manufactured such that the pigment does not settle badly, cake or thicken in the container, or become granular or curdled.

Settlement of pigment must be a thoroughly wetted, soft, mushy mass allowing the complete and easy vertical penetration of a paddle. Settled pigment must be easily predisposed, with minimum resistance to the sideways manual motion of the paddle across the bottom of the container, to form a smooth, uniform product of the proper consistency.

Do not dilute or alter the curing compound after manufacture.

The curing compound must be packaged in clean 274-gallon totes, 55-gallon barrels, or 5-gallon pails, or must be supplied from a suitable storage tank located at the job site or casting site. The containers must comply with 49 CFR 171–180. The 274-gallon totes and 55-gallon barrels must have removable lids and airtight fasteners. The 5-gallon pails must be round and have standard full open head and bail. Do not use lids with bungholes.

Containers must be filled in a way that prevents skinning.

Steel containers and lids must be lined with a coating that prevents destructive action by the compound or chemical agents in the air space above the compound. The coating must not come off the container or lid as skins.

Plastic containers and lids must not react with the curing compound.

Label each curing compound container with:

1. *Manufacturer's name*

2. *ASTM C309 classification*
3. *Batch number*
4. *Volume*
5. *Date of manufacture*
6. *Volatile organic compound content*
7. *Warning that curing compound containing pigment must be well stirred before using*
8. *Precautions concerning the handling and application of curing compound in compliance with 8 CA Code of Regs §§ 1500–1938 and 3200–6184*
9. *Statement that the contents fully comply with State air pollution control rules and regulations*

90-1.03B(3)(c) Mixing

Before using a curing compound, completely redisperse settled or separated solids in containers, except tanks, by mixing at low speed in compliance with these specifications and the manufacturer's instructions. Mix manually using a paddle or mix using a mixing blade driven by a drill motor at low speed. Mixing blades must be the type used for mixing paint.

Keep on-site storage tanks clean and free of contaminants. Each tank must have a permanent system that completely redisperses settled material without introducing air or other foreign substances.

At the time of use, compounds containing pigments must be thoroughly mixed. Use a paddle to loosen all settled pigment from the container bottom and use a power-driven agitator to disperse the pigment uniformly throughout the vehicle.

Agitation must not introduce air or other foreign substances into the curing compound.

90-1.03B(3)(d) Application

Apply the curing compound at a nominal rate of 150 sq ft/gal.

At any point, the application rate must be within ±50 sq ft/gal of the nominal rate. The average application rate must be within ±25 sq ft/gal of the nominal rate when tested under California Test 535. Apply the curing compound such that there are no runs, sags, thin areas, skips, or holidays.

Apply the curing compound using power-operated spraying equipment with an operational pressure gauge and a means of controlling the pressure. The Engineer may allow hand spraying for small and irregular areas that, in the Engineer's opinion, are not reasonably accessible to power-operated spraying equipment.

Apply the curing compound to the concrete after finishing the surface, immediately before the moisture sheen disappears from the concrete surface but before drying shrinkage or craze cracks start to appear.

If the concrete surface cracks or dries, immediately and continually apply water with an atomizing nozzle as specified in section 90-1.03B(2) until application of the curing compound is resumed or started. Do not apply the curing compound over freestanding water.

If the film of curing compound is damaged before the expiration of 7 days after the concrete is placed for structures and 72 hours for pavement, immediately repair it with additional compound.

90-1.03B(4) Waterproof Membrane Method

The waterproof membrane method must consist of:

1. *Spraying the exposed finished concrete surfaces with water, using an atomizing nozzle that forms a mist and not a spray, until the concrete has set*
2. *Placing the waterproof curing membrane immediately after spraying*
3. *Keeping the membrane in place for at least 72 hours*

The membrane must be sheeting material that complies with ASTM C171 for white reflective materials.

Use sheeting material of such a width as to completely cover the entire concrete surface. Cement the sheeting joints together securely such that the joints are waterproof. The joint seams must have at least a 4-inch lap.

Securely weigh down the sheets by placing an earth bank on the sheet edges or by other authorized means.

If any portion of the sheets are damaged within 72 hours after being placed, immediately repair the damaged portion by cementing new sheets into place.

Do not use a membrane that is no longer waterproof or has been damaged such that it is unfit for curing concrete.

90-1.03B(5) Forms-In-Place Method

The forms-in-place method must consist of curing formed concrete surfaces by keeping the forms in place.

Keep the forms in place for at least 7 days after the concrete is placed, except keep the forms in place for at least 5 days for concrete members over 20 inches in least dimension.

The joints in the forms and the joints between the end of the forms and the concrete must be kept moisture tight during the curing period. Reseal cracks in the forms and cracks between the forms and the concrete using authorized methods.

90-1.03C Protecting Concrete

Protect the concrete from damage due to any cause, including rain, heat, cold, wind, your actions, and the actions of others.

Do not place the concrete on frozen or ice-coated ground or subgrade or on ice-coated forms, reinforcing steel, structural steel, conduits, PC members, or construction joints.

If it is raining, you must provide adequate protection against damage or you must stop placing the concrete before the quantity of surface water is sufficient to damage the surface mortar or cause a flow or wash of the concrete surface.

90-1.04 PAYMENT

Not Used

90-2 *MINOR CONCRETE*

90-2.01 GENERAL

90-2.01A Summary

Section 90-2 includes specifications for furnishing and protecting minor concrete.

90-2.01B Definitions *Reserved*

90-2.01C Submittals

If required by the following table, submit compressive strength test results with the mix design that verify the minimum required compressive strength:

SCM	*Test submittal required*
Fly ash used alone	*If portland cement content < 350 lb/cu yd*
GGBFS used alone	*If portland cement content < 250 lb/cu yd*
Natural pozzolan used alone	*If portland cement content < 350 lb/cu yd*
More than 1 SCM	*Always*

NOTE: Compressive strength tests must be performed by an ACI-certified technician.

Submit the concrete mix design before using the concrete in the work and before changing the mix proportions.

Submit a proposed combined aggregate gradation. After authorization of the gradation, the aggregate furnished for minor concrete must comply with that gradation.

If requested, submit periodic test reports of the aggregate gradation furnished.

The Engineer may waive the specifications for gradation if the Engineer determines that furnishing a gradation is not necessary for the type or quantity of concrete work to be constructed.

Before placing minor concrete from a source not previously used on the Contract, submit a certificate of compliance stating that the minor concrete to be furnished complies with the Contract requirements, including the specified minimum cementitious material content.

Submit a weighmaster certificate as an informational submittal with each load of ready-mixed concrete at the concrete discharge location. The weighmaster certificate must show the date and time the load left the batching plant and, if hauled in a truck mixer or agitator, the time the mixing cycle started.

90-2.01D Quality Assurance

Section 90-1.01D(5) and the specifications for uniformity in section 90-1.02A do not apply to minor concrete.

The Engineer may perform tests and inspect the facilities, materials, and methods for producing the minor concrete to ensure that it is of suitable quality for use in the work.

The Engineer verifies compliance with the specified cementitious material content by testing under California Test 518 for cement content. For testing purposes, SCM is considered to be cement. Adjust the batch proportions as necessary to produce concrete having the specified cementitious material content.

90-2.02 MATERIALS

90-2.02A General

Reserved

90-2.02B Cementitious Material

Minor concrete must contain at least 505 pounds of cementitious material per cubic yard.

You may use rice hull ash as an SCM. Rice hull ash must comply with AASHTO M 321 and the requirements for the quality characteristics shown in the following tables:

Chemical quality characteristic	*Requirement (percent)*
Silicon dioxide (SiO_2)[a] (min)	*90*
Loss on ignition (max)	*5.0*
Total alkalies as Na_2O equivalent (max)	*3.0*

[a]SiO_2 in crystalline form must not exceed 1.0 percent.

Physical quality characteristic	*Requirement*
Particle size distribution	
Less than 45 microns (min, %)	*95*
Less than 10 microns (min, %)	*50*
Strength activity index with portland cement[a]	
7 days (min, % of control)	*95*
28 days (min, % of control)	*110*
Expansion at 16 days when testing project materials under ASTM C1567[b] (max, %)	*0.10*
Surface area when testing by nitrogen adsorption under ASTM D5604 (min, m^2/g)	*40.0*

[a]When tested under AASHTO M 307 for strength activity testing of silica fume.
[b]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.

90-2.02C Aggregate

Sections 90-1.01C(2) and 90-1.02C do not apply to minor concrete.

The aggregate must be clean and free from deleterious coatings, clay balls, roots, and other extraneous material.

The maximum aggregate size must not be larger than 1-1/2 inches or smaller than 3/4 inch.

You may use crushed concrete and reclaimed aggregate if they comply with the specifications for aggregate.

90-2.02D Water

Section 90-1.02D does not apply to minor concrete.

Water used for washing, mixing, and curing must be free from oil, salts, and other impurities that would discolor or etch the surface or have an adverse affect on the concrete quality.

90-2.02E Production

Sections 90-1.02F, 90-1.02G(1), 90-1.02G(2), 90-1.02G(3), and 90-1.02G(4) do not apply to minor concrete.

Store, proportion, mix, transport, and discharge the cementitious material, water, aggregate, and admixtures in compliance with recognized standards of good practice that result in thoroughly and uniformly mixed concrete suitable for the intended use. Recognized standards of good practice are outlined in various industry publications, such as those issued by ACI, AASHTO, or the Department.

Use a quantity of water that produces concrete with a consistency that complies with section 90-1.02G(6). Do not add water during hauling or after arrival at the delivery point unless allowed by the Engineer.

Discharge ready-mixed concrete from the transport vehicle while the concrete is still plastic and before stiffening occurs. Take whatever action is necessary to eliminate quick stiffening, except do not add water.

Conditions contributing to quick stiffening are:

1. *Elapsed time of 1.5 hours in agitating hauling equipment or 1 hour in nonagitating hauling equipment*
2. *More than 250 revolutions of the drum or blades after introduction of the cementitious material to the aggregates*
3. *Concrete temperature over 90 degrees F*

The mixing time in a stationary mixer must be at least 50 seconds and no more than 5 minutes.

The minimum required revolutions at mixing speed for transit-mixed concrete must be at least that recommended by the mixer manufacturer and must be increased as needed to produce thoroughly and uniformly mixed concrete.

If you add a high-range water-reducing admixture to the concrete at the job site, the total revolutions must not exceed 300.

90-2.03 CONSTRUCTION

Maintain a concrete temperature of at least 40 degrees F for 72 hours after placing.

90-2.04 PAYMENT

Not Used

96 GEOSYNTHETICS

96-1.01 GENERAL

96-1.01A Summary

Section 96 includes specifications for furnishing geosynthetics.

96-1.01B Definitions *Reserved*

96-1.01C Submittals

96-1.01C(1) General

For each type of geosynthetic submit:

1. *Certificate of compliance*

2. *Test sample representing each lot*
3. *Minimum average roll value*

Label submittals with the manufacturer's name and product information.

96-1.01C(2) Geotechnical Subsurface Reinforcement

Submit the LTDS and its supporting calculations at least 15 days before placing geotechnical subsurface reinforcement. The calculations must be signed by an engineer registered as a civil engineer in the State.

96-1.01D Quality Assurance

Geosynthetics must be on the DataMine list for geotextiles and geosynthetics at the National Transportation Product Evaluation Program website. The manufacturing source code must be printed every 5 meters along the edge of the material except for:

1. *Paving mat*
2. *Paving grid, Class 2 and 3*
3. *Biaxial geogrid*

96-1.02 MATERIALS

96-1.02A General

Treat geosynthetics to resist degradation from exposure to sunlight. Furnish geosynthetics in covers to protect against damage from moisture, sunlight, and shipping and storage.

96-1.02B Filter Fabric

Geosynthetics used for filter fabric must be permeable and nonwoven. Filter fabric must be manufactured from one of the following:

1. *Polyester*
2. *Polypropylene*

Filter fabric must comply with the requirements shown in the following table: ***Filter Fabric***

Quality characteristic	*Test method*	*Requirement*		
		Class A	*Class B*	*Class C*
Permittivity, (min, sec^{-1})	*ASTM D4491*	*0.5*	*0.2*	*0.1*
Apparent opening size, average roll value, (max, US standard sieve size)	*ASTM D4751*	*40*	*60*	*70*
Grab breaking load, 1-inch grip, in each direction, (min, lb)	*ASTM D4632*	*157*		
Apparent elongation, in each direction, (min, percent)	*ASTM D4632*	*50*		
Puncture strength, (min, lb)	*ASTM D6241*	*310*		
Trapezoid tearing strength, (min, lb)	*ASTM D4533*	*56*		
UV resistance, retained grab breaking load, 500 hours, (min, percent)	*ASTM D4355*	*70*		

96-1.02C Geocomposite Wall Drain

Geocomposite wall drain must consist of a polymeric core with filter fabric integrally bonded to one or both sides of the core creating a stable drainage void.

Filter fabric must comply with section 96-1.02B.

Geocomposite wall drain must be from 0.25 to 2 inches thick.

Geocomposite wall drain must comply with the requirements shown in the following table: ***Geocomposite Wall Drain***

Quality characteristic	*Test method*	*Requirement*

Transmissivity, (gal/min/ft) gradient = 1.0, Normal stress = 5,000 psf	*ASTM D4716*	*4*

96-1.02D Geotechnical Subsurface Reinforcement

96-1.02D(1) General

Geosynthetic reinforcement used for geotechnical subsurface reinforcement must be either geotextile or geogrid.

When tested under ASTM D4491, geotextile permittivity must be at least 0.05 sec^{-1}.

Geogrid must have a regular and defined open area. The open area must be from 50 to 90 percent of the total grid area.

96-1.02D(2) Long Term Design Strength

Determine the LTDS of geosynthetic reinforcement from the ultimate tensile strength in the primary strength direction divided by reduction factors. Calculate LTDS from the guidelines in Geosynthetic Research Institute Standard Practice GG4a, GRI GG4b, or GRI GT7.

The product of the reduction factors must be at least 1.30. Determine the reduction factor for creep using a 75 year design life for permanent applications. For temporary applications, use a 5 year design life to determine the reduction factor. Determine the installation damage reduction factor from the characteristics of backfill materials used.

If test data is not available, use default values of reduction factors in the Geosynthetic Research Institute Standard Practice to determine LTDS.

96-1.02E Silt Fence Fabric

Silt fence fabric must comply with the requirements shown in the following table:

Silt Fence Fabric

Quality characteristic	*Test method*	*Requirement*	
		Woven	*Nonwoven*
Grab breaking load, 1-inch grip in each direction, (min, lb)	*ASTM D4632*	*120*	*120*
Apparent elongation, in each direction (min, percent)	*ASTM D4632*	*15*	*50*
Water flow rate, average roll value, (min and max, gal per minute/sq ft)	*ASTM D4491*	*10–100*	*100–150*
Permittivity, (min, sec^{-1})	*ASTM D4491*	*0.05*	*1.1*
Apparent opening size, average roll value, (max, inches)	*ASTM D4751*	*0.023*	*0.012*
UV resistance, retained grab breaking load, 500 hours, (min, percent)	*ASTM D4355*	*70*	*70*

96-1.02F Gravel-Filled Bag

Gravel-filled bag must comply with the requirements shown in the following table:

Gravel-Filled Bag

Quality characteristic	*Test method*	*Requirement*
Grab breaking load, 1-inch grip in each direction, (min, lb)	*ASTM D4632*	*205*
Water flow rate, average roll value, (min and max, gal per minute/sq ft	*ASTM D4491*	*80–150*
Permittivity, (min, sec^{-1})	*ASTM D4491*	*0.2*
Apparent opening size, average roll value, (max, inches)	*ASTM D4751*	*0.016*
UV resistance, retained grab breaking load, 500 hours, (min, percent)	*ASTM D4355*	*70*

96-1.02G Sediment Filter Bag

The sediment filter bag must comply with the requirements shown in the following table:

Sediment Filter Bag

Quality characteristic	*Test method*	*Requirement*	
		Woven	*Nonwoven*
Grab breaking load, 1-inch grip in each direction,(min, lb)	*ASTM D4632*	*200*	*250*
Apparent elongation, in each direction, (min, percent)	*ASTM D4632*	*10*	*50*
Water flow rate, average roll value, (min and max, gal per minute/sq ft)	*ASTM D4491*	*100-200*	*75-200*
Permittivity, (min, sec^{-1})	*ASTM D4491*	*1.0*	*1.0*
Apparent opening size, average roll value, (max, inches)	*ASTM D4751*	*0.023*	*0.012*
UV resistance, retained grab breaking load, 500 hours, (min, percent)	*ASTM D4355*	*70*	*70*

96-1.02H Temporary Cover

Temporary cover must comply with the requirements shown in the following table:

Temporary Cover

Quality characteristic	*Test method*	*Requirement*	
		Woven	*Nonwoven*
Grab breaking load, 1-inch grip in each direction, (min, lb)	*ASTM D4632*	*200*	*200*
Apparent elongation in each direction, (min, percent)	*ASTM D4632*	*15*	*50*
Water flow rate, average roll value, (min and max, gal per minute/sq ft)	*ASTM D4491*	*4-10*	*80-120*
Permittivity, (min, sec^{-1})	*ASTM D4491*	*0.05*	*1.0*
Apparent opening size, average roll value,(max, inches)	*ASTM D4751*	*0.023*	*0.012*
UV resistance, retained grab breaking load, 500 hours, (min, percent)	*ASTM D4355*	*70*	*70*

96-1.02I Rock Slope Protection Fabric

RSP fabric must be a permeable, nonwoven, needle-punched geotextile. The fabric must be manufactured from one of the following:

1. *Polyester*
2. *Polypropylene*
3. *Combined polyester and polypropylene*

Polymers must be either virgin compounds or clean reworked material. Do not subject virgin compounds to use or processing other than required for initial manufacture. Clean reworked material must be previously processed material from the processor's own production that has been reground, pelletized, or solvated. The fabric must not contain more than 20 percent of clean reworked material by weight. Do not use recycled materials from either post-consumer or post-industrial sources.

RSP fabric must comply with the requirements shown in the following table:

RSP Fabric

Quality characteristic	*Test method*	*Requirement*	
		Class 8	*Class 10*
Mass,(min, oz/sq yd)	*ASTM D5261*	*7.5*	*9.5*
Grab breaking load, 1 inch grip in each direction, (min, lb)	*ASTM D4632*	*200*	*250*
Apparent elongation in each direction, (min, percent)	*ASTM D4632*	*50*	*50*
Permittivity, (min, sec^{-1})	*ASTM D4491*	*1.0*	*0.70*
Apparent opening size, (min and max, US Standard sieve size)	*ASTM D4751*	*70–100*	*70–100*
UV resistance, retained grab breaking load, 500 hours, (min, percent)	*ASTM D4355*	*70*	*70*

96-1.02J Paving Fabric

Geosynthetics used for paving fabric must be nonwoven.

Paving fabric must comply with the requirements shown in the following table: ***Paving Fabric***

Quality characteristic	*Test method*	*Requirement*
Mass per unit area, (min, oz/sq yd)	*ASTM D5261*	*4.1*
Grab breaking load, 1-inch grip in each direction, (min, lb)	*ASTM D4632*	*100*
Apparent elongation in each direction, (min, percent)	*ASTM D4632*	*50*
Hydraulic bursting strength, (min, psi)	*ASTM D3786*	*200*
Melting point, (min, ℉)	*ASTM D276*	*325*
Asphalt retention, (min, gal/sq yd)	*ASTM D6140*	*0.2*

96-1.02K Paving Mat

Geosynthetics used for paving mat must be a nonwoven fiberglass and polyester hybrid material.

Paving mat must comply with the requirements shown in the following table:

Paving Mat

Quality characteristic	*Test method*	*Requirement*
Breaking force, (min, lb/2 inch cut strip)	*ASTM D5035*	*45*
Ultimate elongation, (max, percent)	*ASTM D5035*	*5*
Mass per unit area, (min, oz/sq yd)	*ASTM D5261*	*3.7*
Melting point, (min, ℉)	*ASTM D276*	*400*
Asphalt retention, (min, gal/sq yd)	*ASTM D6140*	*0.10*

96-1.02L Paving Grid

Geosynthetics used for paving grid must be a geopolymer material formed into a grid of integrally connected elements with openings.

Paving grid must comply with the requirements shown in the following table:

Paving Grid

Quality characteristic	*Test method*	*Requirement*		
		Class I	*Class II*	*Class III*

Tensile strength at ultimate, (min, lb/in[a])	*ASTM D6637*	*560 x 1,120*	*560*	*280*
Aperture size, (min, inch)	*Calipered*	*0.5*	*0.5*	*0.5*
Elongation, (max, percent)	*ASTM D6637*	*12*	*12*	*12*
Mass per area, (min, oz/sq yd)	*ASTM D5261*	*16*	*10*	*5.5*
Melting point, (min, °F)	*ASTM D276*	*325*	*325*	*325*

[a] For Class I, machine direction x cross direction. For Class II and Class III, both directions.

96-1.02M Paving Geocomposite Grid

Paving geocomposite grid must consist of a paving grid specified in section 96-1.02L bonded or integrated with a paving fabric as specified in section 96-1.02J.

Paving geocomposite grid must have a peel strength of at least 10 lb/ft when tested under ASTM D413.

96-1.02N Geocomposite Strip Membrane

Geocomposite strip membrane must be various widths of strips manufactured from asphaltic rubber and geosynthetics.

Geocomposite strip membrane must comply with the requirements shown in the following table: ***Geocomposite Strip Membrane***

Quality characteristic	*Test method*	*Requirement*
Strip tensile strength, (min, lb/inch)	*ASTM D882*	*50*
Elongation at break, (min, percent)	*ASTM D882*	*50*
Resistance to puncture, (min, lb)	*ASTM E154*	*200*
Permeance, (max, perms)	*ASTM E96/E96M*	*0.10*
Pliability, 1/4 inch mandrel with sample conditioned at 25 °F	*ASTM D146*	*No cracks in fabric or bitumen*
Melting point, (°F)	*ASTM D276*	*325*

96-1.02O Subgrade Enhancement Geotextile

Subgrade enhancement geotextile must be either polyester or polypropylene.

Subgrade enhancement geotextile must comply with the requirements shown in the following table:

Subgrade Enhancement Geotextile

Quality characteristic	*Test method*	*Requirement[a]*				
		Class A1	*Class A2*	*Class B1*	*Class B2*	*Class B3*
Elongation at break, (percent)	*ASTM D4632*	*<50*	*≥50*	*<50*	*<50*	*≥50*
Grab breaking load, 1-inch grip in each direction, (min, lb)	*ASTM D4632*	*250*	*160*	*--*	*320*	*200*
Wide width tensile strength at 5 percent strain, (min, lb/ft)	*ASTM D4595*	*--*	*--*	*2,000*	*--*	*--*
Wide width tensile strength at ultimate strength, (min, lb/ft)	*ASTM D4595*	*--*	*--*	*4,800*	*--*	*--*
Tear strength, (min, lb)	*ASTM D4533*	*90*	*60*	*--*	*120*	*80*
Puncture strength, (min, lb)	*ASTM D6241*	*500*	*310*	*620*	*620*	*430*
Permittivity, (min, sec^{-1})	*ASTM D4491*	*0.05*	*0.05*	*0.20*	*0.20*	*0.20*

Apparent opening size, (max, inches)	*ASTM D4751*	*0.012*	*0.012*	*0.024*	*0.012*	*0.012*
UV resistance, retained grab breaking load, 500 hours, (min, percent)	*ASTM D4355*	*70*	*70*	*70*	*70*	*70*

[a]*Values are based on minimum average roll value in the weaker principal direction except apparent opening size is based on maximum average roll value.*

96-1.02P Biaxial Geogrid

Geosynthetics used for biaxial geogrid must be a punched and drawn polypropylene material formed into an integrally formed biaxial grid.

Biaxial geogrid must comply with the requirements shown in the following table:

Biaxial Geogrid

Quality characteristic	*Test method*	*Requirement*
Aperture size, (min and max, inch)[a]	*Calipered*	*0.8-1.3 x 1.0-1.6*
Rib thickness, (min, inch)	*Calipered*	*0.04*
Junction thickness, (min, inch)	*Calipered*	*0.150*
Tensile strength, 2% strain, (min, lb/ft)[a]	*ASTM D6637*	*410 x 620*
Tensile strength at ultimate, (min, lb/ft)[a]	*ASTM D6637*	*1,310 x 1,970*
UV resistance, retained tensile strength, 500 hours, (min, percent)	*ASTM D4355*	*100*
Junction strength, (min, lb/ft)[a]	*ASTM D7737*	*1,220 x 1,830*
Overall flexural rigidity, (min, mg-cm)	*ASTM D7748*	*750,000*
Torsional rigidity at 20 cm-kg, (min, mm-kg/deg)[b]	*GRI GG9*	*0.65*

[a]*Machine direction x cross direction* [b]*Geosynthetic Research Institute, Test Method GG9, Torsional Behavior of Bidirectional Geogrids When Subjected to In-Plane Rotation*

96-1.02Q Geosynthetic Bond Breaker

Geosynthetic bond breaker must be nonwoven; needle punched; not heat treated; polypropylene, polyethylene material.

Geosynthetic bond breaker material must comply with the requirements shown in the following table:

Geosynthetic Bond Breaker

Quality characteristic	*Test method*	*Requirement*
Mass per unit area, (min, oz/sq yd)	*ASTM D5261*	*14.7*
Thickness at 29 psi, (min, mm)	*ASTM D5199*	*1.0*
Tensile strength at ultimate, (min, lb/ft)	*ASTM D4595*	*685*
Elongation, (max, percent)	*ASTM D4595*	*130*
Permittivity at 2.9 psi, (min, m/s)	*ASTM D5493*	*0.0001*
Hydraulic transmissivity at 29 psi, (min, m/s)	*ASTM D6574*	*0.0002*
UV resistance, retained grab breaking load, 500 hours, (min, percent)	*ASTM D4355*	*60*

96-1.02R Geomembrane

Geomembrane must be:

1. *Polyethylene or polypropylene*
2. *Water resistant*

3. *Unreinforced or scrim reinforced*

Cushion fabric must be nonwoven.
Geomembrane and cushion fabric must comply with the requirements shown in the following tables:

Unreinforced Geomembrane

Quality characteristic	*Test method*	*Requirement*		
		Class A	*Class B*	*Class C*
Thickness, smooth (min, mil)	*ASTM D5199*	*20*	*20*	*20*
Thickness, textured (min, mil)	*ASTM D5994*			
Tensile break strength (min, lb/in)	*ASTM D6693 Type IV*	*75*	*65*	*55*
Puncture resistance (min, lb)	*ASTM D4833*	*45*	*40*	*35*
Tear resistance (min, lb)	*ASTM D1004*	*20*	*15*	*10*
Carbon black content (%)	*ASTM D4218*	*2–3*		

Scrim Reinforced Geomembrane

Quality characteristic	*Test method*	*Requirement*		
		Class A	*Class B*	*Class C*
Thickness, smooth (min, mil)	*ASTM D5199*	*20*	*20*	*20*
Thickness, textured (min, mil)	*ASTM D5994*			
Tensile break strength (min, lb)	*ASTM D7004*	*250*	*200*	*150*
Puncture resistance (min, lb)	*ASTM D4833*	*45*	*40*	*35*
Tear resistance (min, lb)	*ASTM D5884*	*55*	*55*	*55*
Ply adhesion (min, lb)	*ASTM D6636*	*20*	*20*	*20*
Carbon black content (%)	*ASTM D4218*	*2–3*		

Cushion Fabric

Quality characteristic	*Test method*	*Requirement*					
Mass per unit area (oz/sq yd)	*ASTM D5261*	*10*	*12*	*16*	*24*	*32*	*60*
Grab tensile break strength (min, lb)	*ASTM D4632*	*230*	*300*	*370*	*450*	*500*	*630*
Grab tensile break elongation (min, %)	*ASTM D4632*	*50*					
Puncture strength (min, lb)	*ASTM D6241*	*700*	*800*	*900*	*1100*	*1700*	*2400*
Trapezoidal tear strength (min, lb)	*ASTM D4533*	*95*	*115*	*145*	*200*	*215*	*290*
UV resistance (min, %)	*ASTM D7238*	*70*					

96-1.02S–96-1.02Y Reserved

96-1.03 CONSTRUCTION *Not Used*

96-1.04 PAYMENT *Not Used*

DETAILED SPECIFICATIONS – CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. *For an understanding of the complete contract, reference is made to the Agreement.*

1.02 SUMMARY

A. *Section includes all cast-in-place concrete work.*

1.03 RELATED SECTIONS

A. *Section 5 – Control of Work*

B. *Section 51 and 90 – Concrete Structures and Concrete Joints*

1.04 REFERENCES

A. *General: The publications listed below form a part of this specification to the extent referenced. Where a date is given for reference standards, the edition of that date shall be used. Where no date is given for reference standards, the latest edition available on the date of solicitation of bids shall be used.*

1. *Standard Specifications for Public Works Construction (SSPWC).*

2. *American Concrete Institute (ACI) references.*

3. *American Society for Testing and Materials (ASTM) references.*

4. *NSF/ANSI 61 – Drinking Water System Components – Health Effects by NSF International.*

5. *American Water Works Association (AWWA) references.*

1.05 DEFINITIONS

A. *Structural Concrete: Concrete to be used in all cases except where indicated otherwise in these specifications or on the drawings.*

B. *Pea Gravel Concrete: Concrete containing 1/2" nominal maximum size aggregate intended for application in thin sections and areas with congested reinforcing can be used at the option of the Contractor and with the Engineer's written approval for the specific location. Nominal maximum size aggregate is the smallest sieve opening through which the entire amount of the aggregate is permitted, but not required, to pass.*

C. *Sitework Concrete: Concrete for curbs, gutters, catch basins, sidewalks, pavements, fence and guard post embedment, underground pipe encasement, underground duct bank encasement, and all other concrete appurtenant to electrical facilities unless otherwise indicated on the drawings.*

D. *Lean Concrete: Concrete for thrust blocks, pipe trench cut-off blocks, and cradles that are indicated on the drawings as unreinforced. Lean concrete shall be used as protective cover for dowels intended for future connection.*

E. *Hydraulic Structure: Concrete structure for the storage, flow control, measurement, treatment, or transmission of water.*

F. *Mass Concrete: All hydraulic structure concrete sections with a minimum specified section that is equal to or greater than 2 feet 0 inches in least dimension.*

G. *Architectural Grade Concrete: Special concrete finishes identified and defined by the contract documents.*

H. *Maximum In-place Concrete Temperature (mass concrete): Maximum internal concrete temperature after placement and during the thermal control period measured at the center or mid-depth of the concrete placement, unless otherwise specified or defined by the Thermal Control Plan.*

I. *Maximum In-place Concrete Temperature Difference (mass concrete): Maximum temperature difference between the center of the concrete placement and the nearest surface with the greatest heat loss (shortest heat loss path) during the thermal control period, unless otherwise specified or defined by the Thermal Control Plan.*

1.06 SUBMITTALS

A. *Submit the following in accordance with Section 5-1.23:*

1. *Concrete Supplier: Only one concrete supplier will be approved for the contractor, including all subcontractors. All concrete supplied to the project shall originate from the approved single facility and one alternate preapproved facility. The concrete supplier shall not be changed without written approval of the Engineer.*

2. *Source of cement, supplementary cementitious materials, fine and coarse aggregate: Once approved, the source of cement, supplementary cementitious materials, fine or coarse aggregate shall not be changed without written approval of the Engineer.*

3. *Concrete mixture designs showing the proportions and gradations of materials proposed for each class of concrete. For concrete mixtures as specified in Article 2.07 of this Section, documentation showing compliance with all specified concrete requirements. Mixture designs shall be verified for compliance with the specifications by a testing laboratory approved by the City of Los Angeles Building and Safety Department. Mixture designs shall be stamped and signed by a licensed civil or structural engineer registered in the State of California.*

4. *Documentation of average strength for each proposed mixture design in accordance with ACI 301. For concretes with 56-day or 90-day specified minimum compressive strengths, develop and submit strength versus time curves as required in 2.07.B of this Section.*

5. *Letter of certification that concrete supplier has verified compatibility of constituent materials in design mixture based on historical performance and/or laboratory testing.*

6. *Test data relating to the cement, aggregates, admixtures, and curing compounds. For cement and aggregates, data shall be less than 180 days old. Submit the following:*

a. *Chemical and physical analysis reports for cement and supplementary cementitious materials.*

b. *Letter of Certification verifying the cement was <u>not</u> obtained from kilns that burn metal-rich hazardous waste fuels.*

c. *Shrinkage test results in accordance with ASTM C157/C157M as modified by Structural Engineers Association of California (SEAOC) "Supplementary Recommendations for Control of Shrinkage in Concrete." ASTM C157/C157M modifications are specified herein.*

d. *Admixture certifications. Include chloride ion content.*

e. *Aggregate gradation test results and material properties showing compliance with requirements of ASTM C33/C33M. Include a Letter of Certification verifying the each aggregate complies with the requirements as set forth in ASTM C33/C33M.*

f. *Manufacturer's material information sheets for evaporation retarders and curing compounds.*

7. *Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and support for concrete reinforcement.*

8. *Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer, detailing fabrication, assembly, and support of formwork.*

a. *Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.*

9. *NSF/ANSI 61 Certifications for all materials and products to be used in structures and facilities in contact with potable water.*

10. *For hot weather concreting see Section 51. Submit a hot weather concreting plan. Hot weather placement plan shall include description of proposed precautions for hot-weather concrete placement including procedures for protecting the concrete and concrete ingredients from detrimental effects of hot weather.*

11. *Documentation supporting the Thermal Control Plan with design calculations and a validated finite element analysis (FEA) capable of estimating the cracking potential during the thermal control period for the steel reinforced hydraulic structure concrete designated as mass concrete as defined in 1.05 of this Section.*

12. *Letter of Certification that Thermal Control Plan complies with the mass concrete requirements as specified in the Contract Documents. Thermal Control Plan must be stamped and signed by a licensed civil or structural engineer registered in the State of California. Resubmit an updated Thermal Control Plan if the approved concrete mixture design or Concrete Placement Plan is changed.*

13. *Crack Mitigation Plan for avoiding cracks in concrete. The plan shall include a description of proposed precautions and procedures for avoiding cracks in concrete including plastic settlement cracks, plastic shrinkage and crazing cracks, formwork movement cracks, construction overload cracks, and other cracks related to Contractor's construction techniques.*

14. *Contingency Equipment Plan for backup equipment such as ready mix plant, concrete pumps, vibrators and other construction equipment used during concrete placement.*

15. *Concrete Placement Plan in compliance with the requirements of the Thermal Control Plan, Contract Documents and 3.07 of this Section.*

16. *Concrete Repair Plan in compliance with the requirements of 3.12, 3.13 and 3.14 including detailed repair procedures and materials.*

1.07 QUALITY ASSURANCE

A. *General:*

1. *Notify the Engineer in writing not less than 96 hours in advance of placement of any concrete. Such notification shall not be made until all forms, steel, anchors, ties, inserts, and other embedded items are in place and ready for inspection by the Engineer.*

2. *Engage a testing laboratory, approved by the City of Los Angeles Building and Safety Department, to sample and test the concrete for compliance with these specifications in accordance with ASTM C172/C172M (Sampling), ASTM C1064/C1064M (Temperature), C143/C143M (Slump), C138/C138M (Unit Weight), ASTM C231/C231M if applicable (Air Content), ASTM C31/C31M (Making & Curing Test Specimens), and ASTM CC39/C39M (Compressive Strength of Cylindrical Concrete Specimens).*

3. *The cost of laboratory tests for mixture designs on cement, aggregates, and concrete, will be at no additional expense to the Department.*

4. *Furnish concrete for testing and assist the Engineer in obtaining samples and in disposal and cleanup of excess material.*

5. *Concrete construction shall conform to requirements of ACI 117, ACI 301, ACI 318 and ACI 350 except as modified herein. High strength concrete construction shall conform to ACI ITG-4.1-07 except as modified herein.*

B. *Preinstallation Meetings:*

1. *Preinstallation or preconstruction meetings: Conduct meeting at project site. Examine procedures for ensuring quality of concrete materials and finished concrete product. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including at a minimum the following: contractor's superintendent(s), independent testing agency responsible for concrete design mixtures, testing agency responsible for performing field concrete tests and field quality control, ready-mix concrete producer and concrete subcontractor.*

2. *Review: At a minimum and if applicable, review the special inspection and testing and inspecting-agency procedures for field quality control; concrete finishes and finishing; hot-weather concreting procedures; mass concreting procedures, thermal control plan and placing sequence; curing procedures; construction, contraction and isolation joints; forms and form removal limitations; shoring and reshoring procedures and limitations; anchor rod and anchorage device installation tolerances; steel reinforcement installation; vapor-retarder/barrier installation; methods for achieving specified floor and slab flatness and levelness; floor and slab flatness and levelness measurements; concrete defects and repair procedures; concrete protection; and other as needed for ensuring the quality of the finished concrete product.*

C. *Tolerances:*

1. *Crack width for hydraulic structure shall be 0.008 in. or less. Cracks exceeding this width limit found no later than 14 days prior to time of hydrostatic test shall be repaired in accordance with 3.12 of this Section.*

2. *Set and maintain concrete forms and perform finishing operations to ensure that the completed work is within tolerances. Tolerance is the permissible variation from lines, grades, or dimensions indicated on the drawings.*

3. *Unless otherwise specified, construction tolerances shall conform to ACI 117.*

a. *Formed surfaces resulting in concrete members with dimensions smaller than permitted by tolerances of ACI 117 may be considered deficient in strength and subject to rejection.*

b. *Formed surfaces resulting in concrete members with dimensions larger than permitted by ACI 117 are subject to rejection. Remove excess materials when required by the Engineer.*

c. *Inaccurately formed concrete surfaces that exceed ACI 117 tolerances are subject to rejection.*

d. *Finished slabs exceeding the tolerances in ACI 117 are subject to rejection.*

e. *Concrete members placed against formwork surfaces exceeding the limitations of ACI 117 are subject to rejection.*

f. *Concrete surfaces not meeting the requirements of ACI 117 are subject to rejection.*

D. *Thermal Control Plan: Where required herein below, a thermal control plan shall at a minimum include the following for Mass Structural Concrete (Classes F & G) and Mass High Strength Structural Concrete (Classes H & J):*

1. *Mixture design (Class per contract documents and mixture number). See 2.05 of this Section.*

2. *Calculate and field verify the adiabatic temperature rise for a specific volume of concrete using the proposed mass concrete mixtures. Calculate the transient adiabatic (fully insulated, no heat loss) thermal performance based on the proposed mixtures and concrete placement or starting temperatures. Verify by field testing one or more 3 ft cubic blocks of concrete (1 cubic yard of concrete) insulated to a minimum R20 and monitored with recording temperature sensors.*

3. *Maximum concrete temperature at time and point of placement (temperature of concrete as placed). Maximum temperature shall not exceed the lowermost temperature as submitted and approved in the Thermal Control Plan or as shown below:*

Class F & G	*75 ^{o}F*
Class H & J	*75 ^{o}F*

a. *The maximum temperature of 75^{o}F as shown above may be increased to 80^{o}F when the following conditions are satisfied: 1) measured internal concrete temperatures and temperature differentials after concrete placement show the maximum temperature can be increased without exceeding the maximum allowable internal and differential temperatures, and 2) written approved by the Engineer. For consideration, submit all supporting information including measured concrete temperatures and ambient conditions.*

b. *The maximum temperature of 75^{o}F as shown above may be increase beyond 80^{o}F when a new or revised Thermal Control Plan with supporting information has been approved by the Engineer.*

4. *Description of specific measures and equipment that will be used to ensure maximum concrete temperature at time and point of placement shall not exceed the specified temperature limit.*

5. *Calculated maximum concrete temperature in placement based on expected conditions at the time of placement and use of proposed measures to control temperatures. The maximum internal temperature in concrete after placement and during the thermal control period shall not exceed 160^{o}F as allowed by ACI 301-16 or as approved by the Engineer.*

6. *Maximum temperature differential that prevents cracking from exceeding the limit stated in 1.07 B 1 of this Section during the thermal control period. Unless otherwise approved by the Engineer, the maximum temperature difference shall be computed from a temperature gradient along the shortest heat loss path, designated as (d), not to exceed 1.4^{o}F per inch. The heat loss path (d) shall be the distance from the center or mid-depth of the concrete placement to the nearest surface with the greatest heat loss during the curing period.*

Table 1.07.2 Maximum Temperature Difference Delta-T

Pour Depth (inch)	*Heat Loss Path (inch)*	*Max Delta-T (^{0}F)*
48	*24*	*34*
36	*18*	*25*
30	*15*	*21*
20	*10*	*14*

In no case shall the maximum difference between the center or mid-depth and surface of any concrete placement exceed 35^{o}F unless approved by the Engineer.

7. *Description of specific measures and equipment that will be used to ensure the temperature difference shall not exceed specified temperature difference.*

8. *Calculated maximum temperature difference in placement based on expected conditions at the time of placement and use of proposed measures to control temperature differences.*

9. *Description of equipment and procedures that will be used to monitor and log temperatures and temperature difference. Monitor concrete temperatures in accordance with provisions of the Thermal Control Plan, Contract Documents and 2.12 of this Section.*

10. *Drawings showing locations for temperature sensors in placement.*

11. *Format and frequency of providing temperature data to Engineer.*

12. *Thermal control period and description of measures to address and reduce temperatures and temperature differences.*

13. *Curing procedures including materials and methods that will be used.*

14. *Formwork removal procedures to ensure temperature difference at temporarily exposed surface will not exceed temperature difference limit and how curing will be maintained.*

15. Concrete Placement Plan that shall include the sequence of concrete placement with minimum cure periods and required thermal conditions of previously placed concrete before casting new concrete against or adjacent to previously placed concrete in accordance with provisions of the Thermal Control Plan, Contract Documents and 3.07 of this Section.

E. Hydrostatic testing shall comply with requirements in 3.16 of this Section.

1.08 CONCRETE MIXTURE DESIGNS

A. Proportions by weight of all materials entering into the concrete delivered to the jobsite shall conform to the approved mixture design unless otherwise approved by the Engineer.

B. The proportions of such mixture design shall be based on a full cubic yard of concrete.

1.09 GEOTECHNICAL REPORT

A. Refer to the Geotechnical Report(s), as defined in the Information Handout .

PART 2 - PRODUCTS

2.01 CONCRETE MATERIALS

A. General:

1. Cementitious materials shall be kept dry and free from contaminants. Store and handle aggregates to avoid segregation and contamination by other materials or other sizes of aggregates. Store aggregates in a manner so aggregates will drain freely. Protect water and ice from contamination during storage and handling. Protect stored admixtures against contamination, evaporation or damage. Provide agitating equipment for admixtures to ensure uniform distribution of the constituents. Protect admixtures from temperatures changes that would adversely affect their characteristics.

2. All materials in contact with potable water shall comply with the requirements of NSF/ANSI 61.

a. Concrete in contact with potable water shall be NSF/ANSI 61 compliant by one of two methods:

1) All cementitious materials and admixtures of the concrete shall be NSF/ANSI 61 compliant.

2) Concrete consisting of non-certified ingredients shall be certified as NSF/ANSI 61 compliant through NSF International's "Concrete Site Mix Evaluation and Certification Program."

b. Classes F, G, H and J Concretes shall be considered in contact with potable water and shall comply with requirements of NSF/ANSI 61.

3. Cement obtained from kilns that burn metal-rich hazardous waste fuel shall not be used for concrete in contact with potable water.

B. Portland cement: Comply with ASTM C 150 for Type II or Type II/V cement. Use only one brand of cement from one manufacturing plant.

C. Aggregates shall be innocuous, not causing deleterious expansion of concrete, and shall conform to the requirements of ASTM C33/C33M. Maximum size of coarse aggregate shall be as indicated herein. Lightweight sand for fine aggregate shall not be used.

1. Test individual concrete aggregates in accordance with ASTM C1260/C1260M Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method). Maximum expansion after 14 days of exposure to the solution of NaOH shall not exceed 0.10%.

If any of individual concrete aggregates do not meet the limit specified above in 2.01, C, 1, the aggregate can be tested with the production cementitious materials (Portland cement and Class F fly ash proportioned according to the mixture design) per ASTM C1567/C1567M. The Contractor is allowed to test either individual aggregates or their blend proportioned according to the mixture design. In either case, the expansion in 14 days of exposure to the solution of NaOH shall not exceed 0.10%.

2. Fine aggregate shall be clean, natural sand consisting of hard, strong, durable, and uncoated particles. Sand Equivalent Value of fine aggregate shall be in accordance with SSPWC 200-1.5.3. Gradation of fine aggregate shall conform to SSPWC 200-1.5.5.

3. Mortar specimens made with fine aggregate shall comply with SSPWC 200-1.5.3.

4. Coarse aggregate shall comply with SSPWC 200-1.4, except as modified by these specifications.

5. Aggregates that has disintegrated or weathered badly under exposure conditions similar to those that will be encountered in the work shall not be used.

D. Admixtures used in a concrete mixture shall be manufactured and supplied by the same admixture company to ensure compatibility, unless otherwise approved by the Engineer.

1. Certify that admixtures do not contain calcium chlorides or other corrosive materials.

2. Concrete shall not be air-entrained.

3. Approved shrinkage-reducing admixtures (SRA) shall be:

a. Type S shrinkage-reducing chemical admixture conforming to ASTM C494/C494M.

b. *PREVent-C, manufactured by Premier Magnesia, LLC, Construction Products Group. Adding PREVent-C to an approved concrete mixture constitutes a new concrete mixture requiring a mixture design submittal and written approval by the Engineer. Dosage rate shall be 3.0% by weight of cement.*

c. *As approved by the Engineer.*

4. *Approved water-reducing admixtures shall be:*

a. *Type I or II plasticizing admixture conforming to ASTM C1017/C1017M.*

b. *Type A, F or G water-reducing admixture conforming to ASTM C494/C494M.*

5. *Approved retarders and accelerators admixtures shall be:*

a. *Type B and C admixtures conforming to ASTM C494/C494M.*

2.02 CURING MATERIALS

A. *Materials for curing concrete as indicated herein shall conform to the following requirements and ASTM C309 -Standard Specification for Liquid Membrane- Forming Compounds for Curing Concrete:*

1. *Hydraulic Structures shall be water cured or as approved by the Engineer.*

2. *Curing compounds shall be white pigmented and resin-based. Sodium silicate compounds shall not be used. Concrete curing compound shall be Kurez by Euclid Chemical Company; Masterkure N-Seal-HS as manufactured by ChemRex; or L&M Cure R or as approved by Engineer. Water based curing compounds shall be used where local air quality regulations prohibit the use of a solvent-based compound and when curing compound must be removed for finishes or grouting. Water based curing compounds shall be Aqua-Cure by Euclid Chemical Company;*

Masterkure--100W by ChemRex; or L&M Cure R-2 or as approved by Engineer. For concrete in contact with or containing potable water, curing compounds shall be NSF/ANSI 61 compliant. For submittal requirements, see Subarticle 1.06A8 of this Section.

3. *Polyethylene sheet used for covering the surfaces of concrete to inhibit moisture loss during the cure period shall conform to the requirements of ASTM C171, shall be white and shall have a nominal thickness of at least*

6 mils. The sheet material shall exhibit a water vapor transmission rate (WVTR) of no more than 10 g/m^2 in 24 hours when tested according to Test Methods E96/E96M using the Water Method in the environment (test cabinet) specified in Test Method C156.

4. *Polyethylene-coated waterproof paper sheeting used for covering the surfaces of concrete to inhibit moisture loss during curing shall consist of white polyethylene sheeting free of visible defects, with a nominal thickness of at least 2 mils, and permanently bonded to waterproof paper conforming to the requirements of Federal Specification UU-B-790A. The sheet material shall exhibit a water vapor transmission rate (WVTR) of no more than 10 g/m^2 in 24 hours when tested according to Test Methods E96/E96M using the Water Method in the environment (test cabinet) specified in Test Method C156.*

5. *Polyethylene-coated burlap used for covering the surfaces of concrete to inhibit moisture loss during curing shall conform to the requirements of ASTM C171, shall be at least 4-mil thick, white opaque polyethylene film impregnated or extruded into one side of the burlap. Burlap shall weigh not less than 9 ounces per square yard. The sheet material shall exhibit a water vapor transmission rate (WVTR) of no more than 10 g/m^2 in 24 hours when tested according to Test Methods E96/E96M using the Water Method in the environment (test cabinet) specified in Test Method C156.*

6. *Curing mats for use in Curing Method 6, as indicated in Article 3.10 of this Section, shall be non-staining heavy shag rugs or carpets or cotton mats quilted at 4 inches on center. Curing mats shall weigh a minimum of12 ounces per square yard when dry.*

2.03 JOINT MATERIALS

A. *Materials for joints in concrete in which no waterstop is specified shall conform to the following requirements:*

1. *Preformed joint filler shall be a non-extruding, neoprene sponge or polyurethane type conforming to the requirements of Section 51.*

2. *Elastomeric joint sealer shall conform to the requirements of Section 51.*

3. *Mastic joint sealer shall adhere to concrete surfaces, remain resilient and pliable, and seal the joints against moisture infiltration even when the joints are subject to movement. It shall not contain evaporating solvents, not contaminate potable water, and not be affected by continuous presence of water.*

2.04 MISCELLANEOUS MATERIALS

A. *Bonding agents shall be epoxy adhesives conforming to ASTM C881/C881M and the following:*

1. *For bonding freshly-mixed, plastic concrete to hardened concrete, use Sikadur 32 Hi-Mod Epoxy Adhesive by Sika Corporation, MasterEmaco ADH 326 (Formerly Concresive Liquid LPL) by Master Builders, or BurkEpoxy MV by The Burke Company.*

2. *For bonding hardened concrete or masonry to steel, use Sikadur 31 Hi- Mod Gel by Sika Corporation, BurkEpoxy NS by The Burke Company, or MasterEmaco ADH327 (formerly Concresive Paste LPL) as manufactured by Master Builders.*

3. *For grouting metal anchors and for overhead and vertical bonding and embedment, use Sikadur 31 Hi Mod Gel by Sika Corporation, or Select Products GP-3000 Select Products.*

4. *Use epoxy bonding agents produced by a single manufacturer unless otherwise approved by the Engineer.*

2.05 CONCRETE DESIGN REQUIREMENTS

A. *General: Concrete shall be composed of Portland cement, supplementary cementitious materials, admixtures, aggregates, and water. Workability of fresh concrete shall be adequate for the method used to transport, place, consolidate and finish. Aggregate gradations shall provide concrete that shall not result in rock pockets around reinforcing steel or embedded items. Change proportions, if necessary to meet the required results. All changes shall be approved by the Engineer.*

B. *Coarse Aggregate Gradation: Unless otherwise approved by the Engineer, coarse aggregate gradation shall comply with ASTM C33/C33M, No. 57 for nominal maximum aggregate size of one-inch (1") and No. 7 for nominal maximum aggregate size of one-half-inch (1/2"). Nominal maximum size aggregate is the smallest sieve opening through which the entire amount of the aggregate is permitted, but not required, to pass.*

C. *Unless indicated otherwise on the drawings, concrete shall be of the following classes, each meeting the mixture and compressive strength requirements as specified and shall be used as follows:*

1. *Class "A": Structural Concrete.*

2. *Class "B": Pea Gravel Concrete.*

3. *Class "C": Sitework concrete.*

4. *Class "D": Lean Concrete.*

5. *Class "E": (Not used)*

6. *Class "F": Structural Mass Concrete in Contact with Potable Water*

7. *Class "G": Structural Mass Concrete Considered in Contact with Potable Water (Roof)*

8. *Class "H": High Strength Structural Mass Concrete Considered in Contact with Potable Water (Roof)*

9. *Class "J": High Strength Structural Mass Concrete with PREVent-C or other as approved by the Engineer Considered in Contact with Potable Water (Roof)Class J Concrete shall be used for placing conditions #4, #5 and #6 or as defined by the contractor's Concrete Placement Plan for the roof of the hydraulic structure.*

2.06 MEASUREMENT

A. *All measurements shall be by weight. Contractor may request an increase in the cementitious materials content with a corresponding reduction in the weight of the aggregates, when there is a concern that the minimum strength specified cannot be met, at no additional expense to the Department. All mixture design changes require a new mixture design submittal and written approval by the Engineer*

B. *Determine the amount of cementitious materials and aggregates entering into each batch of concrete by direct weighing equipment acceptable to the Engineer.*

C. *Measure the quantity of water entering the mixer by a suitable water meter or other measuring device of a type acceptable to the Engineer. Water can be measured by weight or volume.*

D. *Unless otherwise specified or permitted, concrete at the point of delivery, shall have a slump of 4 in. Determine the slump by ASTM C143/C143M. Slump tolerances shall meet the requirements of ASTM C94/C94M. When a Type I or II plasticizing admixture conforming to ASTM C1017/C1017M or a Type A water- reducing, F or G high-range water-reducing admixtures conforming to ASTM C494/C494M is permitted to increase the slump of concrete, concrete shall have been proportioned to a slump of 2 to 4 in. before the admixture is added and a maximum slump of 8 in. at the point of delivery after the admixture is added, unless otherwise specified or allowed by the Engineer.*

2.07 COMPRESSIVE STRENGTH, WATER, AND CEMENT CONTENT

A. Unless otherwise shown on the drawings, the concrete shall meet the requirements as shown below in Table 2.07.1:

Table 2.07.1 Requirements for each Concrete Class

Class	Specified Minimum 28-Day Compressive Strength (psi)	Nominal Maximum Size Aggregate (in)	Maximum 28-day Dry Shrinkage (%)
A	5,000	1	0.052
B	5,000	1/2	NA
C	4,000	1	NA
D	2,000	1	NA
E	-	-	

F	5,000 @ 28 or 56 days	1	0.035
G	5,000 @ 28 or 56 days	1	0.035
H	8,000 @ 28, 56 or 90 days	1	0.040
J	8,000 @ 28, 56 or 90 days	1	0.040

B. Specified minimum compressive strength for concrete used in hydraulic structure for Classes F and G may be taken at 56-day instead of the 28-day measurement. For Class H and J, specified minimum compressive strength for concrete used in hydraulic structure may be taken at either 56-day or 90-day instead of the 28-day measurement. For concretes with 56-day or 90-day specified minimum compressive strengths, develop and submit strength versus time curves showing at a minimum the measured compressive strengths at 7, 14, 28, and 56 days and if applicable, 90 days.

C. For concrete in contact with water where low permeability is required as designated on the Drawings, concrete mixtures shall comply with the requirements of the Exposure Class "W1" in Table 19.3.2.1-Requirements for Concrete by Exposure Class (f'c 4000 psi, w/cm 0.50), ACI 318. The maximum w/cm for Exposure Class "W1" may be increased to 0.55 if the maximum chloride permeability measured in accordance with ASTM 1202 satisfies the requirements specified in Table 2.08 A1 in Article 2.08 A and approved by the Engineer.

D. For concrete in contact with soil or water containing deleterious amounts of watersoluble sulfate ions as designated in the Contract Documents, concrete mixtures shall comply with the requirements of the Exposure Class for Sulfates (S) in Table 19.3.2.1-Requirements for Concrete by Exposure Class, ACI 318 or as determined by the Engineer.

E. Adjustments to Mixture Design: The Contractor may make modifications to the approved mixture designs to achieve the strength or workability requirements. The mixtures shall be changed whenever such change is necessary or desirable to secure the required strength, workability, and surface finish, and the Contractor shall be entitled to no additional compensation because of such changes. Changes to the accepted concrete mixture design shall be tested in accordance with these specifications and submitted 10 working days prior to placement for review and approval by the Engineer.

F. High Early Strength: The Contractor may use Type III cement, High Early Strength, in lieu of Type II cement in the same batch quantities as specified in this Article for concrete placed for encasement of PVC. Such substitution shall be at no additional expense to the Department.

2.08 Additional Requirements for Mass Concrete (Classes F, G, H and J) and Example Mixture Designs

A. Classes F & G: Structural Mass Concrete

1. Concrete Requirements

Table 2.08 A.1 Required Structural Mass Concrete Properties		
Property	**Value**	**ASTM Reference**

Strength, f'c @ 28 or 56 days, psi	5,000	ASTM C39
Maximum Slump, inch	8.00	ASTM C143
Maximum Shrinkage (28-day), %	0.035	ASTM C157 (Modified)
Maximum measured adiabatic temperature rise of concrete, °F	60	See 1.07, C2
Maximum Coefficient of Thermal Expansion, inch/inch per °F	4.2E-06	AASHTO T336-11
Maximum Chloride Permeability (56-day cure), Coulombs	2,000	ASTM 1202
Maximum Wet Density, lb/cuft	160.0	ASTM C138

2. Example Mixture Design (LB15-0051)

Table 2.08 A.2 Example Mixture Design for Structural Mass Concrete per Cubic Yard of Concrete (SSD Basis)

Materials	SP. Gravity	ABS. Vol. (cuft)	Batch WT. (lbs)
Cement: Calportland, Type II/V	3.15	1.85	364
Fly Ash: Headwaters, Class F (25.6%)	2.35	0.85	125
Washed Concrete Sand: Orca Quarry	2.78	8.43	1462
1" MSA: Orca Quarry	2.88	11.58	2008
Total Water (31.0 gallons) w/cm ratio = 0.53	1.0	4.15	259
Air (2%)		0.54	
Admixtures			fl oz
WRDA 64: WR Grace			17.1
ADVA 195: WR Grace			14.0
Measured Concrete Properties			
Wet Density, 156.8 lb/cuft			
Maximum Adiabatic Measured Temperature, 140F (from 3 ft. adiabatic concrete cube test with R20 insulation on all sides); Concrete Placing Temperature, 80F; Adiabatic Temperature Rise, 60F (140F - 80F = 60F)			
Time of Setting by Penetration Resistance (ASTM C403) Initial Set: 330 minutes, Final Set: 435 minutes			

Compressive Strengths, psi 1-day 1430, 4-day 2860, 7-day 4080, 14-day 5140, 28-day 6020, 56-day 7450, 90-day 7830
Drying Shrinkage, % (Drying Days) ASTM C157 Modified 1-Day Initial Reading: 1-day 0.000, 7-day 0.005, 14-day -0.011, 21-day -0.019, 28-day -0.022, 35-day -0.024 7-Day Initial Reading: 7-day 0.000, 14-day -0.015, 21-day -0.024, 28-day -0.027, 35-day -0.028
Chloride Permeability, 834 Coulombs at 56-days
NSF/ANSI 61 Compliance, NSF Sample ID J-00221265 (August 19, 2016)

B. Class H: High Strength Structural Mass Concrete

1. Required Concrete Properties

Table 2.08 B.1 Required High Strength Structural Mass Concrete Properties

Property	Value	ASTM Reference
Strength, f'c @ 28, 56 or 90 days, psi	8,000	ASTM C39
Maximum Slump, inch	8.00	ASTM C143
Maximum Shrinkage (28-day), %	0.040	ASTM C157 (Modified)
Maximum measured adiabatic temperature rise of concrete, ^{o}F	70	See 1.07, C2
Maximum Thermal Coefficient of Expansion, inch/inch per ^{o}F	4.2E-06	AASHTO T336-11
Maximum Chloride Permeability (56-day cure), Coulombs	2,000	ASTM 1202
Maximum Wet Density, lb/cuft	160.0	ASTM C138

2. Example Mixture Design (LB15-0050)

Table 2.08 B.2 Example Mixture Design for High Strength Structural Mass Concrete per Cubic Yard of Concrete (SSD Basis)

Materials	SP. Gravity	ABS. Vol. (cuft)	Batch WT. (lbs)
Cement: Calportland, Type II/V	3.15	2.61	514
Fly Ash: Headwaters, Class F (35.0%)	2.35	1.89	277
Washed Concrete Sand	2.78	7.29	1265
1" MSA: Orca Quarry	2.88	10.49	1886
Total Water (31.3 gallons) w/cm = 0.33	1.0	4.18	261

Air (2%)		0.54	
Admixtures			fl oz
WRDA 64: WR Grace			27.7
ADVA 195: WR Grace			39.5
Measured Concrete Properties			
Wet Density, 157.3 lb/cuft			
Maximum Measured Adiabatic Temperature, 150F (from 3 ft. adiabatic concrete cube test with R20 insulation on all sides); Concrete Placing Temperature, 80F; Adiabatic Temperature Rise, 70F (150F - 80F = 70F)			
Time of Setting by Penetration Resistance (ASTM C403) Initial Set: 512 minutes, Final Set: not measured			
Compressive Strengths, psi 1-day 2180, 4-day 3690, 7-day 5030, 14-day 6040, 28-day 8470, 56-day 9140, 90-day 9830			
Drying Shrinkage, % (Drying Days) ASTM C157 Modified 1-Day Initial Reading: 1-day 0.000, 7-day 0.005, 14-day -0.011, 21-day -0.019, 28-day -0.023, 35-day -0.025 7-Day Initial Reading: 7-day 0.000, 14-day -0.016, 21-day -0.024, 28-day -0.028, 35-day -0.030			
Chloride Permeability, Not tested			
NSF/ANSI 61 Compliance, NSF Sample ID J-00221264 (August 19, 2016)			

C. Class J: High Strength Structural Mass Concrete with PREVent-C

1. Required Concrete Properties

Table 2.08 C.1 Required High Strength Structural Mass Concrete Properties		
Property	**Value**	**ASTM Reference**
Strength, f'c @ 28, 56 or 90 days, psi	8,000	ASTM C39
Maximum Slump, inch	8.00	ASTM C143
Maximum Shrinkage (28-day), %	0.040	ASTM C157 (Modified)
Maximum measured adiabatic temperature rise of concrete, ^{o}F	70	See 1.07, C2
Maximum Thermal Coefficient of Expansion, inch/inch per ^{o}F	4.2E-06	AASHTO T336-11
Maximum Chloride Permeability (56-day cure), Coulombs	2,000	ASTM 1202
Maximum Wet Density, lb/cuft	160	ASTM C138

2. Example Mixture Design (LB15-0050P3 with 3% PREVent-C)

Table 2.08 C.2 Example Mixture Design for High Strength Structural Mass Concrete per Cubic Yard of Concrete (SSD Basis)			
Materials	**SP. Gravity**	**ABS. Vol. (cuft)**	**Batch WT. (lbs)**
Cement: Calportland, Type II/V	3.15	2.61	514
Fly Ash: Headwaters, Class F (35.0%)	2.35	1.89	277
Washed Concrete Sand	2.78	7.36	1276
1" MSA: Orca Quarry	2.88	10.59	1903
Total Water (31.3 gallons) w/cm = 0.33	1.0	4.18	261
Air (1.4%)		0.38	
Admixtures			fl oz
WRDA 64: WR Grace			27.7
ADVA 195: WR Grace			47.4
PREVent-C 500: Premier Magnesia, LLC, Construction Products Group			15.4 lb
Measured Concrete Properties			
Wet Density 157.0 lb/cuft			
Maximum Measured Adiabatic Temperature, Not tested			

Time of Setting by Penetration Resistance (ASTM C403) Initial Set: 480 minutes, Final Set: 605 minutes
Compressive Strengths, psi 1-day 2830, 3-day 5060, 7-day 5600, 28-day 7990, 56-day 8860, 90-day Waiting on test results
Drying Shrinkage, % (Drying Days) ASTM C157 Modified 1-Day Initial Reading: 1-day 0.000, 7-day 0.030, 14-day 0.013, 21-day 0.004, 28-day 0.000, 35-day -0.002 7-Day Initial Reading: 7-day 0.000, 14-day -0.017, 21-day -0.026, 28-day -0.031, 35-day -0.033
Chloride Permeability, Not tested
PREVent-C 500, NSF Product and Service Listing (August 22, 2016), Certified for a level not to exceed 5 pounds per 100 pounds of cement. Additional information can be found at NSF International or at the following link**:** http://info.nsf.org/Certified/PwsComponents/Listings.asp?Company=C0188533&Standard=061&

D. General Requirements for Classes F, G, H and J Concretes

1. Mixtures shall comply with required concrete properties in Tables 2.08 A.1, B.1 and C.1.

2. Concrete mixtures shall comply with all applicable requirements of the Contract Documents including the Thermal Control Plan and Concrete Placing Plan.

3. Contractor shall assume full responsibility for all fresh and hardened concrete properties and performance of the approved concrete mixtures.

4. As specified in Article 1.06 of this Section, Contractor shall submit documentation including test results showing concrete mixtures comply with requirements of the Contract Documents as follows:

a. Table 2.08 A.1 for Classes F and G Concrete

b. Table 2.08 B.1 for Class H Concrete

c. Table 2.08 C.1 for Class J Concrete

d. For Class J Concrete, a strength versus time curve showing at a minimum the measured compressive strengths at 7, 14, 28 and 56 days and if applicable, 90 days.

e. For Class J Concrete, Engineer shall approve an admixture equivalent, if applicable.

f. Thermal Control Plan.

5. If the Contractor chooses to use the Example Mix Designs as shown in Table 2.08 A.2 (LB15-0051), Table 2.08 B.2 (LB15-0050) and/or Table 2.08 C.2 (LB15-0050P3 with 3% PREVent-C), the respective requirements under Subarticle C.4 of this Section, except C.4.f, are deemed satisfied. All other requirements under Subarticle C shall remain in effect. The Contractor shall submit a Letter of Intent stating which Example Mix Design(s) will be used to satisfy the requirements of Subarticle C.4 of this Section.

6. Concrete mixtures shall be approved by the Engineer prior to use.

2.09 SHRINKAGE LIMITATION

A. The maximum concrete shrinkage for laboratory cast specimens measured after 7 days of moist curing and 28 days of air drying and in accordance with ASTM C157 as modified by Structural Engineers Association of California (SEAOC) "Supplementary Recommendations for Control of Shrinkage in Concrete," shall be as set forth in Table 2.07.1. Specimens shall be moist cured for 7 days followed by 28 days of drying (50±4% relative humidity and 73±3°F [23±2°C]). The initial or zero reading shall be taken at the end of the 7-day moist curing period.

B. Obtain field samples of cementitious materials, aggregates and all admixtures and perform concrete shrinkage tests for laboratory cast specimens in accordance Subarticle 2.09A of this Section. The maximum concrete shrinkage for laboratory cast specimens shall not exceed the mixture design maximum shrinkage requirements shown in Tables 2.07.1, 2.08 A.1 and 2.08 B.1.

C. If the required shrinkage limitation is not met, the Contractor shall take any or all of the following actions, at no cost to the Department, to establish compliance: Adjust aggregates, cementitious materials, and admixtures; adjust water content; wash coarse and fine aggregate to reduce fines; or take other actions designed to control shrinkage.

2.10 READY-MIXED CONCRETE

A. Ready-mixed concrete shall meet the requirements as to materials, batching, mixing, transporting, and placing as indicated herein and in accordance with ASTM C94/C94M, including the following supplementary requirements:

1. Use truck mixers equipped with electrically-actuated counters by which the number of revolutions of the drum or blades may be readily verified.

2. Mix each batch of concrete in a truck mixer for not less than 85 and not more than 250 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of equipment prior to discharge of concrete for placement operations. Place all materials including mixing water in the mixer drum before actuating the revolution counter for determining the number of revolution of mixing.

3. Concrete shall satisfy the uniformity requirements as specified in Appendix A1 - Concrete Uniformity Requirements and Table A1.1 - Requirements for Uniformity of Concrete as specified in ASTM C94/C94M.

4. Do not use non-agitating equipment for transporting ready-mixed concrete. Do not use combination truck and trailer equipment for transporting ready-mixed concrete.

5. Furnish a delivery ticket for ready mixed concrete to the Engineer for each truck as it arrives. Each ticket shall provide the following:

a. Name of ready-mix company, batch plant or batch plant number

b. Serial number of ticket

c. Date

d. Truck number

e. Name of purchaser

f. Name and location of job

g. Specific class or designation of the concrete in conformance with the contract documents

h. Amount of concrete in cubic yards

i. Weight of cement, supplementary cementitous materials, each aggregate (fine and coarse), water, and ice as batched individually

j. Moisture content of fine and coarse aggregates

k. Time loaded or of first mixing of cement and aggregates and time of discharge

l. Time and amount of water added by purchaser of the concrete or the purchaser's designated representative and his/her initials

m. For trucks equipped with automated water measurement and slump or slump flow monitoring equipment, the total amount of water added by said equipment

n. Numerical sequence of the delivery

o. Number of revolutions of the truck mixer

2.11 TEMPERATURE LIMITS

A. For mass concrete sections with a minimum specified dimension that is greater than or equal to 2 feet 0 inches, and unless otherwise permitted:

1. Provide documentation that maximum concrete temperature in the structure shall not exceed that listed in the Thermal Control Plan.

2. Provide documentation that maximum temperature differential shall not exceed that listed in the Thermal Control Plan.

2.12 MONITORING CONCRETE TEMERATURE

A. At a minimum, place one temperature sensor at the center mass of placement and one temperature sensor at a depth 2 in. from center of nearest exterior surface for each mass concrete placement. Place an additional sensor at each location to serve as a backup in the event a sensor fails. In addition, provide a temperature sensor in a shaded location for monitoring ambient on-site temperature.

B. At a minimum, monitor temperatures hourly using electronic sensors capable of measuring temperature from 32^{o}F to 212^{o}F to an accuracy of 2^{o}F. Ensure temperature sensors are operational before placing concrete. Provide data from temperature sensors to Owner on a daily basis or as directed by the Engineer.

PART 3 - EXECUTION

3.01 PREPARATION

A. *Construction Joints: Comply with the following except as modified herein. Provide construction joints only where approved by the Engineer or indicated on the drawings. Cold joints will not be permitted.*

a. *Joint surfaces shall be cleaned by wet sandblasting or hydro-blasting (minimum pressure of 6,000 psi) to remove all laitance and foreign substances that may*

affect bond of new concrete to the existing concrete. Cleaning shall expose the sand particles.

b. *Cleaned joint surfaces shall be continuously moist-cured until the next concrete placement or until the specified curing period has elapsed.*

c. *The clean concrete joint surface shall be saturated surface dry (SSD) at the time new concrete is placed.*

B. *Embedded Items: Complete all formwork, installation of embedded parts, reinforcement steel, anchor bolts, sleeves, and surface preparation before notifying engineer of readiness to place concrete. Obtain the Engineer's approval prior to starting placement of concrete. Clean surfaces of forms and embedded items that have become encrusted with dried grout from previous usage prior to placing the surrounding or adjacent concrete.*

C. *Casting New Concrete Against Old (other than construction joints): Where casting new concrete against concrete greater than 60 days of age, thoroughly clean and roughen the surface of the existing concrete by hydro-blasting or wet sandblasting to remove laitance and expose sand particles. The clean concrete joint surface shall be saturated surface dry (SSD) at the time new concrete is placed.*

D. *Unless approved by DSOD and Engineer, epoxy-bonding agents shall not be used.*

E. *Dewater structures, forms, and concrete spaces prior to placing concrete. Dewatering methods shall be subject to the approval of the Engineer. Do not place concrete underwater and do not allow still water to rise on any concrete until the concrete has attained its initial set. Do not permit water to flow over the surface of any concrete in such manner and at such velocity as will damage the surface finish.*

F. *Corrosion Protection: Pipe, conduit, dowels, and other ferrous items embedded in concrete construction shall be positioned and supported prior to placement of concrete such that there will be a minimum of 3-inch clearance between said items and any part of the concrete reinforcement. Do not secure such items in position by wiring or welding them to the reinforcement.*

G. *Provide openings for pipes, inserts for pipe hangers and brackets, and anchors during the placing of concrete.*

H. *Set and maintain position of embedded anchor bolts with templates.*

I. *Thoroughly clean the surfaces of all metalwork in contact with concrete. Remove all dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before the concrete is placed.*

3.02 CONCRETE QUALITY

A. *Concrete shall be uniformly dense and sound, free from defects, cracks with the exception below, honeycombing, and other imperfections at the time of concrete acceptance. Void sizes shall comply with the tolerances set forth in Article 3.09B of this Section for formed finishes and Article 3.09C of this Section for unformed finishes. Crack widths shall be in compliance with 1.07 C 1 of this Section and Table 3.02.1 below.*

Table 3.02.1 Maximum Crack Widths		
Exposure Condition	***Width (inch)***	***Width (mm)***

Dry air or protective membrane (surfaces not exposed to moisture)	*0.016*	*0.41*
Humidity, moist air, soil (surfaces exposed to moisture but not directly to water)	*0.012*	*0.30*
Hydraulic structure (surfaces directly exposed to water)	*0.008*	*0.20*

B. *Use weather predictions by the nearest National Oceanic and Atmospheric Administration Station to forecast if special protection measures are required during concrete placement and immediately thereafter per requirements of ACI 305.1 and ACI 306.1 and these specifications.*

3.03 MIXING

A. *Concrete shall be batched in fully automatic or semi-automatic stationary plants or approved portable batch type plants, and mixed in stationary or truck mixers. Mixing equipment and mixing procedures shall be subject to the approval of the Engineer.*

B. *Ice, if needed, shall be added during the batching process by an automatic or a semi-automatic process so that dosage amount, consistency and accuracy can be verified by the Engineer and the DSOD. Ice shall be crushed, chipped or shaved and added directly to the mixer in a manner to ensure uniform dispersal and melting during the mixing of the concrete. Ice shall be completely melted before discharging concrete.*

C. *Mixing shall conform to the requirements of ACI 301.*

D. *Do not retemper concrete or mortar.*

E. *Ready-Mixed Concrete:*

1. *Conform to the requirements of ASTM C94/C94M.*

3.04 PROTECTION FROM ABRASION OR FIRE

A. *Protect finished surfaces from abrasion or other damage. Protect concrete surfaces or edges likely to be damaged during the construction period by leaving the forms in place or by erecting satisfactory covers.*

B. *No flame will be permitted in direct contact with concrete.*

3.05 HANDLING, TRANSPORTING, AND PLACING

A. *General: Conform to the applicable requirements of ACI 301 and the requirements of this Section. No aluminum materials shall be used in conveying any concrete.*

B. *Schedule sufficient equipment for continuous concrete placement, program backup equipment as necessary, and take appropriate actions in case of an interruption in placement. Contingency Equipment Plan of backup equipment used during concrete placement is required under 1.06A12 of this Section.*

C. *Do not allow concrete to segregate during placing. In no case shall the free fall of concrete exceed 4 feet below the ends of ducts, chutes, or buggies.*

D. *Distribute concrete uniformly and do not displace concrete more than 6 feet in the horizontal direction during the process of placement.*

E. *Deposit concrete in wall forms in uniform horizontal layers. Maximum depth of the first layer shall be 18 inches. Maximum depth of all succeeding layers shall be 12 inches. Avoid inclined layers or inclined construction joints except where such are required for sloping members. Place each layer while the previous layer is still workable and has not obtained initial set.*

F. *Do not place concrete in wall forms at a rate exceeding 5 feet of vertical rise per hour, unless approved by the Engineer and consistent with the design submittals for falsework.*

G. *Provide sufficient illumination in the interior of all forms so that the concrete is visible from the deck or runway.*

H. *Cold joints shall not be permitted. Layers shall be continuously covered with new concrete and thoroughly integrated through vibration.*

I. *Uniformly place concrete in sloping slabs from the bottom of the slab to the top, for the full width of the placement. Vibrate and carefully work the concrete around slab reinforcement. Surface of slabs shall be screed in an up-slope direction.*

J. *For non-mass concrete, the maximum temperature of concrete at time and point of placement shall not exceed 90F. For mass concrete, see 1.07 D of this Section – Thermal Control Plan.*

K. *Concrete shall be placed within 90 minutes after the water/ice has been added to the cement and aggregates unless otherwise approved by the Engineer. Concrete shall be placed prior to stiffening or initial set. There shall be no segregation or loss of ingredients during placement.*

L. *No concrete shall be placed when the air temperature has fallen to, or is expected to fall below 40°F (4°C) during the protection period, or any day when the temperature is expected to fall or falls below freezing.*

3.06 PUMPING CONCRETE

A. *Pumping Equipment: The pumping equipment shall have 2 cylinders and be designed to operate with one cylinder in case the other one is not functioning. In lieu of this requirement, have a standby pump on the site during pumping.*

B. *Do not use aluminum conduits for conveying concrete.*

C. *Prior to beginning pumping operations, prime the delivery pipe or hose. Contractor shall properly dispose of all mortar or materials used for priming off the site.*

D. *Condition and operation of concrete pumps shall be such to minimize the temperature rise of fresh mass concrete due to pumping. As needed, contractor shall measure and monitor the temperature rise of mass concrete between points of concrete delivery into the pump and placement into the structure. Contractor shall ensure that at no time will the maximum concrete temperature exceed the maximum temperature allowed in 1.07D 3 of this Section at the point of placement into the structure.*

3.07 CONSOLIDATION

A. *Vibrators shall be Group 3 in accordance with ACI 309 – Guide for Consolidation of Concrete (Table 5.1), high-speed power vibrators (head dia. 2" to 3½" with 8,000 to 12,000 rpm) of an immersion type in sufficient number and with not less than one standby unit. Group 2 vibrators (head dia. 1¼" to 2½" with 8,500 to 12,500 rpm) may be used only at specific locations when accepted by the Engineer.*

B. *Consolidation by the proper use of vibrators shall be the primary means of consolidation of the concrete. Vibrate concrete until it fills the forms or excavations and closes against*

all surfaces and embedded items. Vibration shall be used to avoid cold joints and honeycombing. Spacing of immersion vibrator insertions shall not exceed 1-1/2 times the vibrator's radius of action in the concrete being consolidated.

Vibrate each layer of concrete as required to achieve consolidation. Do not place subsequent layers of concrete until the previously placed layers have been thoroughly vibrated. Penetrate each previously place layer of concrete a minimum of 6 inches. Provide sufficient vibrators to accomplish the required results within 5 minutes after concrete of the prescribed consistency is placed in the forms. Do not vibrate concrete excessively or in any manner that causes segregation of its constituents.

C. *Allow concrete to thoroughly settle before top finishing.*

3.08 FINISHING CONCRETE SURFACES

A. *General: Finishes for concrete surfaces shall be as set forth in 3.09 B for Formed Surfaces and 3.09 C for Unformed Surfaces. Allowable deviations from plumb or level and from the alignment, profiles, and dimensions shown are defined as tolerances and are indicated in 1.07 B of this Section. Form savers or liners are prohibited unless approved by the Engineer. Do not use aluminum finishing tools.*

B. *Formed Surfaces: Produce as-cast formed finishes in accordance with Table 3.09.1 unless otherwise indicated on the drawings.*

Table 3.09.1 Formed Surface Finish Schedule

Area	***Surface Finish***
Exterior walls (exposed to view)	*SF-2.0*
Exterior walls (not exposed to view)	*SF-1.0*
Exterior walls (exposed to soil or backfill)	*SF-1.1*
Interior walls (exposed to view)	*SF-3.0*
Interior walls (not exposed to view)	*SF-1.0*
Exterior walls (hydraulic structure – exposed to view)	*SF-2.0*
Exterior walls (hydraulic structure – not exposed to view)	*SF-1.1*
Interior walls (hydraulic structure)	*SF-2.0*
Underside of roof slab (hydraulic structure)	*SF-2.0*
Vault	*SF-2.0*

1. *Surface finish-1.0 (SF-1.0)*

- ***a.*** *No formwork facing materials specified*
- ***b.*** *Patch voids larger than 1½ in. wide or ½ in. deep*

c. *Remove projections larger than 1 in.*

d. *Tie holes need not be patched*

e. *Surface tolerance Class D as specified in ACI 117 and Mockup not required*

2. *Surface finish-1.1 (SF-1.1)*

a. *Same as SF-1.0 except tie holes shall be patched*

3. *Surface finish-2.0 (SF-2.0)*

a. *Patch voids larger than 3/4 in. wide or 1/2 in. deep*

b. *Remove projections larger than 1/4 in.*

c. *Patch tie holes*

d. *Surface tolerance Class B as specified in ACI 117*

e. *If requested by the Engineer, provide a Mockup of the concrete surface appearance and texture; otherwise, a mockup is not required.*

4. *Surface finish-3.0 (SF-3.0)*

a. *Patch voids larger than 3/4 in. wide or 1/2 in. deep*

b. *Remove projections larger than 1/8 in.*

c. *Patch tie holes*

d. *Surface tolerance Class A as specified in ACI 117*

e. *Provide mockup of concrete surface appearance and texture*

5. *For unspecified as-cast finishes, apply the following finishes to concrete surfaces, unless otherwise specified:*

a. *SF-1.0 on concrete surfaces not exposed to view*

b. *SF-2.0 on concrete surfaces exposed to view*

6. *Architectural Finishes: Provide architectural finishes as required by the contract documents. When required, construct field mockups using the same procedures, equipment, and materials that will be used for production of cast- in-place architectural concrete. Field mock-ups shall be used as a sample of acceptable quality of finished product.*

7. *No treatment is required after form removal except for curing, repair of defective concrete and surface defects.*

C. *Unformed Surfaces: After vibration and tamping, bring all unformed top surfaces of slabs, floors, walls, and curbs to a uniform surface with suitable tools. Immediately after screeding, treat with a liquid evaporation retardant as needed. Use retardant again after each work operation as necessary to prevent plastic shrinkage cracks. Addition of water to surface to facilitate finishing is prohibited.*

Finish as follows:

TABLE 3.09.2 Unformed Surface Finish Schedule	
Area	***Finish***
Thrust blocks. Grade slabs and foundations to be covered with concrete or fill material.	*U1*
Water bearing slabs with slopes of 10 percent or less, and equipment pads.	*U3*
Top surface of roof slab (hydraulic structure)	*U2*
Top surface of walls.	*U3*
Floor slabs, sidewalks, curb, gutter, and swales.	*U4*
Construction joints between footings and wall, and between floor slabs and column or wall.	*U2 with wood float finish only*

1. *Finish U1: Sufficient leveling and screeding to produce an even, uniform surface with surface projections or voids not to exceed 3/8 inch in any dimension. No further special finish will be required.*

2. *Finish U2: After sufficient stiffening of the screeded concrete, surfaces shall be float finished with wood or metal floats or with a finishing machine using float blades. Excessive floating of surfaces while the concrete is plastic will not be permitted. Do not dust concrete surfaces with dry cement or sand to absorb excess moisture. Minimize floating to that necessary to produce a surface free from screed marks and uniform in texture. Surface projections or voids shall not exceed 1/4 inch in any dimension. Joints and edges shall be tooled where indicated on drawings or as determined by the Engineer.*

3. *Finish U3: After the Finish U2 surface has hardened sufficiently to prevent excess of fine material from being drawn to the surface, perform steel troweling with firm pressure such as will flatten the sandy texture of the floated surface and produce a dense, uniform surface free from blemishes, abrupt offsets, ripples, and trowel marks. Provide a smooth finish, free of all projections and voids.*

4. *Finish U4: Trowel the Finish U3 surface to remove local depressions or high points. In addition, give a light broom finish with brooming perpendicular to drainage unless otherwise indicated on the drawings. The resulting surface shall provide a nonskid finish.*

5. *Miscellaneous Surfaces: Finish miscellaneous surfaces not covered in this Section and not specifically designated on the drawings as directed by the Engineer.*

3.09 CURING

A. *General: Use only water curing or as approved by the Engineer for potable water structures.*

B. *For sections with a minimum specified dimension that is greater than 2 feet 0 inches, cure and protect in accordance with the approved Thermal Control Plan.*

C. *Cure all concrete for not less than 7 days after placing in accordance with the following:*

Surface to be Cured or Damp-Proofed	***Method***
Wall sections with unstripped forms	*1*
Wall sections with forms removed	*6*
Construction joints between footings and walls, and between floor slab and columns	*2*
Encasement concrete and thrust blocks	*3*
All concrete surfaces not specifically indicated in this Article	*4*
Floor slabs on grade in hydraulic structures	*5*
Slabs not on grade	*6*

1. *Method 1: Wet wooden forms immediately after concrete has been placed and keep wet with water until removal. If steel forms are used, continuously wet the exposed concrete surfaces until the forms are removed. If forms are removed within 7 days of placing the concrete, continue curing in accordance with Method 6.*

2. *Method 2: Cover the surface with burlap or curing mats. Keep mats wet for the duration of the curing period, until the concrete in the walls has been placed. Do not apply curing compound.*

3. *Method 3: Cover the surface with at least 3 inches of dampened earth not less than 4 hours or more than 24 hours after the concrete is placed. Do not begin earthwork operations that may damage the concrete until not less than 7 days after placement of concrete.*

4. *Method 4: Spray the surface with a liquid curing compound.*

a. *Apply in accordance with the manufacturer's printed instructions or at a coverage rate of not more than 200 square feet per gallon and cover the surface with a uniform film that will seal thoroughly.*

b. *Where the curing compound method is used, avoid damage to the seal during the 7-day curing period. If the seal is damaged or broken during the curing period, repair the break immediately by the application of additional curing compound over the damaged portion.*

c. *Where curing compound is mistakenly applied to surfaces where subsequent concrete will be placed and must adhere, remove the curing compound by wet sandblasting just prior to placing the new concrete.*

d. *Apply curing compound as soon as the concrete has hardened enough to prevent marring on unformed surfaces and within 2 hours after removal of forms. Make repairs to formed surfaces within the 2-hour period. Delay any such repairs which cannot be made within said 2-hour period until after the curing compound has been applied. Wet-sandblast and remove curing compound prior to repairing any areas where curing compound has been applied.*

e. *At locations where concrete is placed adjacent to a panel that has been coated with curing compound, reapply curing compound to the area within 6 feet of the joint and to any other location where the curing membrane has been disturbed.*

f. *Prior to final acceptance of the work, remove all visible traces of curing compound from all surfaces. Do not damage the surface finish.*

5. *Method 5:*

a. *Until the concrete surface is covered with curing compound, keep the entire surface damp by fogging. Apply a coat of curing compound in accordance with Method 4. Not less than one hour, or more than 4 hours after the curing compound has been applied, wet the surface with water delivered through a fog nozzle, and place concrete-curing blankets on the slabs. Lay the blankets with the edges butted together and with the joints between strips sealed with 2-inch wide strips of sealing tape or with edges lapped not less than 3 inches and fastened together with a waterproof cement to form a continuous watertight joint.*

b. *Leave the curing blankets in place during the 7-day curing period. Do not remove until after concrete for adjacent work has been placed. Replace damaged curing blanket sections. During the first 3 days of the curing period, do not permit traffic across or storage of any materials on the curing blankets. During the remainder of the curing period, foot traffic and temporary storage of light materials will be permitted if the Contractor places 5/8-inch thick plywood sheets over the curing blanket. Add water under the curing blanket to maintain wet concrete surfaces.*

6. *Method 6: This method applies to both walls and slabs.*

a. *Keep the concrete wet for not less than 7 days beginning immediately after the concrete reaches final set or form removal.*

b. *Apply water to the entire surface until application of the curing medium. Do not mar or wash the surface.*

c. *Use heavy curing mats to retain the moisture during the curing period. Prevent the mats from losing contact with the concrete surface due to wind or other causes. Hold edges continuously in place.*

d. *Keep the curing mats and concrete wet by the use of sprinklers or other means at all times during the curing period.*

e. *Immediately after termination of water application at the end of the curing period, remove the curing medium, rewet any dry spots, and immediately apply curing compound in accordance with Method 4.*

f. *Dispose of excess water from the curing operation to avoid damage to the work.*

3.10 PROTECTION

A. *Protect fresh concrete from damage due to rain, hail, sleet, or snow while the concrete is still plastic or whenever precipitation is imminent or occurring.*

B. *Concrete encasement of PVC shall not be backfilled until the concrete has reached at least half of its 28-day compressive strength as confirmed by standard cured concrete cylinder tests (ASTM C31/C31M).*

3.11 TREATMENT OF CRACKS FOR HYDRAULIC STRUCTURE

A. *Prior to backfilling faces of members and prior to exposing interior faces to water or moisture, cracks exceeding the maximum widths specified in Table 3.02.1 of 3.02 of this Section shall be surface prepared and filled with sealing material conforming to the requirements of the Crack Repair Table 3.12.B below or as directed by the Engineer.*

B. *Crack Repair Table 3.12.B*

Table 3.12.B ***Crack Repair***	
Exposure Condition	***Method of Repair***
Dry air or protective membrane (surfaces not exposed to moisture)	*) Epoxy injection with a moisture tolerant epoxy meeting the requirements of ASTM C881 – Type IV that will seal the void space of the crack and approved by the Engineer.*
Humidity, moist air, soil (surfaces exposed to moisture but not directly to water)	*) Chemical grout (urethane activated by a catalysis or water) to from a gel, solid precipitate, or foam that will fill and seal the void space of the crack and approved by the Engineer.*
Hydraulic structure (surfaces directly exposed to water)	

C. *Cost of repairing cracks in work that is in compliance with the Contract Documents will be the responsibility of the Engineer. Cost of repairing cracks resulting from work that is not in compliance with the Contract Documents shall be the responsibility of the Contractor.*

Cost of repairing cracks resulting from inadequate construction techniques as determined by the Engineer shall be the responsibility of the Contractor.
Examples include plastic settlement cracks, plastic shrinkage and crazing cracks, formwork movement cracks, construction overload cracks and other cracks resulting from the Contractor's construction techniques.

3.12 TREATMENT OF SURFACE DEFECTS

A. *Surface defects are defined as surface holes or voids larger than tolerances prescribed in 3.08B of this Section for Formed Surfaces and 3.08C of this Section for Unformed Finishes. The Contractor shall submit for approval a Concrete Repair Plan for repairing surface defects for Formed and Unformed Surfaces.*

B. *As soon as forms are removed, inspect exposed surfaces, and remove and/or repair surface defects to secure the specified surface finish in 3.09 of this Section. Do not make repairs before inspection by the Engineer. Repair concrete containing voids, holes, honeycombing, or similar depression defects as directed herein or as stipulated in the approved Concrete Repair Plan.*

C. *As defined and as directed by the Engineer, promptly remove and replace concrete containing extensive voids, holes, honeycombing, or similar depression defects.*

D. *Sawcut perimeter using straight lines and cut back defective surfaces to be repaired a minimum depth of 1/2 inch over the entire area. Feathered edges will not be permitted. Prepare the surface for bonding by the removal of all laitance or soft material by wet sandblasting. After cutting and sandblasting, wet the surface sufficiently in advance of applying the repair material. The proposed repair material shall be non-shrink Portland cement based material as approved by the Engineer.*

E. *Ream holes left by tie-rod cones with suitable toothed reamers so as to leave the surfaces of the holes clean and rough. Repair holes with dry-packed Portland cement material as approved by the Engineer.*

F. *Do not ream holes left by form-tying devices having a rectangular cross-section and other imperfections having a depth greater than their least surface dimension. Repair with dry-packed Portland cement material as approved by the Engineer.*

G. *Repairs shall not disturb the bond, cause sagging or horizontal fractures of applied repair material. Cure the surfaces of repair in the same manner as required for the concrete in the repaired section.*

H. *Prior to backfilling faces of members in contact with fill, which are not covered with a waterproofing membrane, cracks with widths greater than 0.008 inches shall be "vee'd" as shown on the drawings and filled with sealant conforming to the requirements of Section 51.*

3.13 PATCHING HOLES IN CONCRETE

A. *Small Holes (Less Than 12 inches in the Least Dimension): Repair as directed in 3.12 or as approved by the Engineer.*

B. *Large Holes (Equal to or Greater Than 12 inches in the Least Dimension): In addition to the requirements of 3.12, repairs shall include the following unless otherwise approved by the Engineer.*

1. *Chip a keyway around the edge, unless a formed keyway exists.*

2. *Install reinforcing steel using approved grout or epoxy in drilled holes to repair any casting holes larger than 24 inches in the least dimension that do not have reinforcing steel extending from the existing concrete. Match the reinforcing in the existing wall unless directed otherwise by the Engineer.*

3. *Install a hydrophilic type waterstop material around the perimeter of holes larger than 24 inches in the least dimension in members that are water bearing or in contact with soil or other fill, unless there is an existing waterstop in place. Installation of waterstop shall comply with Section51.*

3.14 APPLICATION OF EPOXY ADHESIVE BONDING AGENTS

A. *Prepare surfaces and mix and apply epoxy adhesive bonding agents in accordance with the manufacturer's printed specifications and as required for the temperature and surface moisture conditions at the time of application.*

3.15 HYDROSTATIC TIGHTNESS TEST

A. *Hydrostatic tightness test shall be in accordance with ACI-350.1-10, Specification for Tightness Testing of Environmental Engineering Concrete Containment Structures and Commentary.*

1. *Test criteria shall be 0.050% of volume per day (other types) as specified in Section 2, Hydrostatic Tightness Test for Open or Covered Containment Structures, ACI 350.1-10.*

3.16 CLEANING AND STERILIZATION OF POTABLE WATER STRUCTURES

A. *Cleaning**:***

1. *Thoroughly clean interior surfaces before disinfection.*

2. *Cleaning shall:*

a. *Remove deposits of foreign nature.*

b. *Clean walls, floor and underside of roof and other surfaces in contact with potable water.*

c. *Avoid damage to the structure.*

d. *Avoid pollution or oil deposits by workers and equipment.*

B. *Disinfection: Potable water structures shall be disinfected using procedure provided in AWWA 652.*

END OF SECTION

STANDARD DETAILS AND PLANS LIST

Description	Standard Number

SANTA BARBARA COUNTY DEPARTMENT OF PUBLIC WORKS – TRANSPORTATION DIVISION STANDARD DETAILS

The Construction Standard Detail sheets (dated September 2011) applicable to this contract include, but are not limited to those indicated below.

General Trench Notes	2-010
Pipe Bedding Details	2-020
Concrete Manhole	3-080
Curbs & Gutters	4-030

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

The Standard Plan sheets (2021 Edition) applicable to this contract include, but are not limited to those indicated below.

24” Manhole Frame and Cover Locking Type	210-4
Manhole Pipe To Pipe	321-2
Junction Structure – Pipe to RCB	333-2
Concrete Collar for RCP (12” through 72”)	380-4
24” Manhole Frame and Cover	630-5

STATE DEPARTMENT OF TRANSPORTATION

The Standard Plan sheets (dated 20108) applicable to this contract include, but are not limited to those indicated below.

Abbreviations	A3A - A3C
Legend – Lines and Symbols	A10A – A10E
Excavation and Backfill	A62A – A62G
Chain Link Fence	A85, A85A, & A85B
Temporary Railing (Type K)	T3 A and T3B
Bridge Details	BO-1, BO-3, BO-5 and BO-13
16” and 24” Cast-in-Drilled-Hole Concrete Pile	B2-3
Joint Seals(Max Movement Rating=2”)	B6-21
Box Girder Details	B7-1
Utility Opening	B7-10
Cast-in-Place Post Tensioning Girder Details	B8-5
Cable Railing	B11-47
Concrete Barrier Type 732	B11-55