STANDARD PLANS

STATE OF CALIFORNIA
TRANSPORTATION AGENCY

DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

NOVEMBER, 1966

EDMUND G. BROWN
GOVERNOR

ROBERT B. BRADFORD
ADMINISTRATOR—TRANSPORTATION AGENCY

ISSUED BY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

JOHN ERRECA
Director of Public Works

J. C. WOMACK
State Highway Engineer

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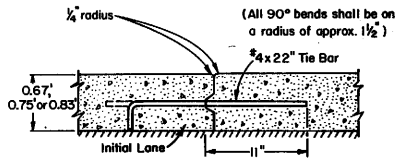
GENERAL ROAD WORK

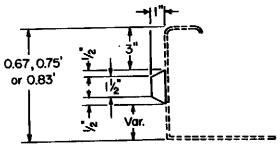


SECTION A-A

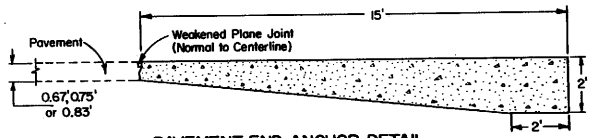
TIE BAR

TRANSVERSE CONTACT JOINT WITH KEYWAY AND TIE BARS

NOTE- Transverse Contact Joints with Keyway and Tie Bars shall be used at all construction joints, and elsewhere if ordered by the Engineer. Tie Bars to be placed in the middle 1/3 of the slab thickness.

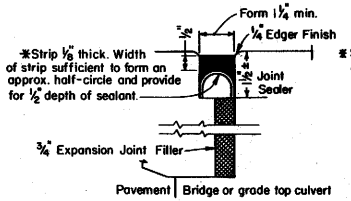


DETAIL OF METAL OR WOODEN INSERT TO BE PLACED ON FORM



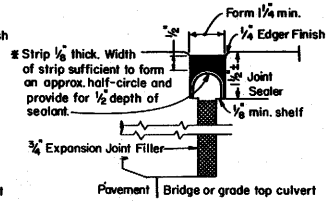
PAVEMENT END ANCHOR DETAIL

NOTE- Pavement end anchors shall be constructed as the terminal panels of all pavement not abutting existing pavements or structures, and elsewhere if ordered by the Engineer.



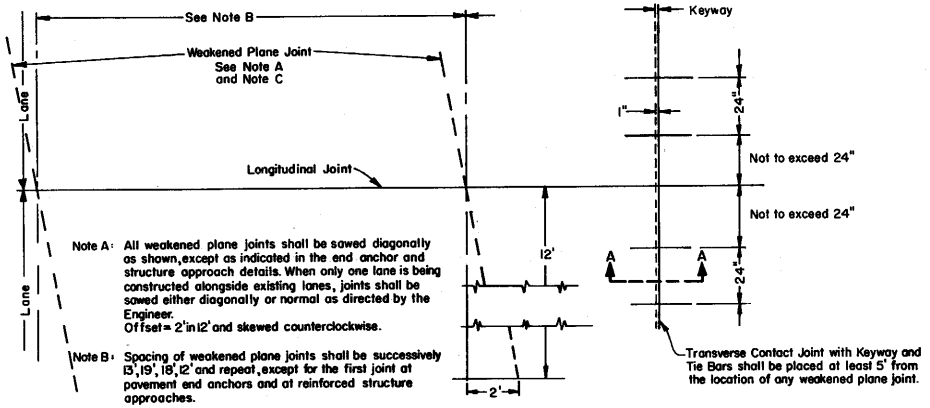
SEALED EXPANSION JOINT
Detail A

NOTE- To be used only when the bridge abutment does not provide the shelf shown on Detail B



SEALED EXPANSION JOINT
Detail B

* Strip material: See Standard Specifications or Special Provisions.



Note A: All weakened plane joints shall be sawed diagonally as shown, except as indicated in the end anchor and structure approach details. When only one lane is being constructed alongside existing lanes, joints shall be sawed either diagonally or normal as directed by the Engineer.
Offset = 2' in 12' and skewed counterclockwise.

Note B: Spacing of weakened plane joints shall be successively 13', 19', 18', 12' and repeat, except for the first joint at pavement end anchors and at reinforced structure approaches.

Note C: Weakened plane joints shall be constructed at least 5' from any transverse contact joint.

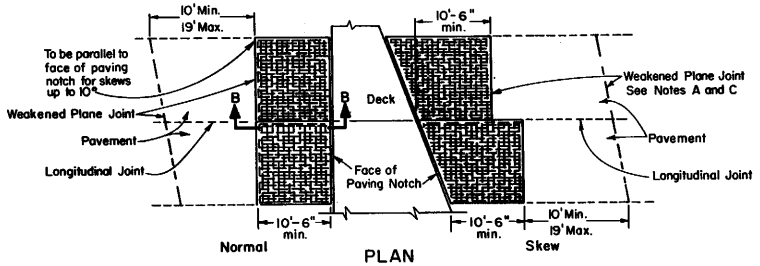
PLAN

APPROVAL RECOMMENDED

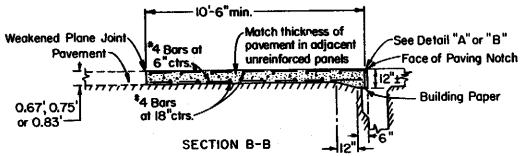
Engineer of Design
Registered Civil Engineer No. 9837

Approved September 1, 1966

State Highway Engineer
Registered Civil Engineer No. 5945



PLAN



SECTION B-B

DETAIL OF PAVEMENT REINFORCEMENT AT STRUCTURE APPROACHES

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

P.C.C. PAVING DETAILS | A35-6

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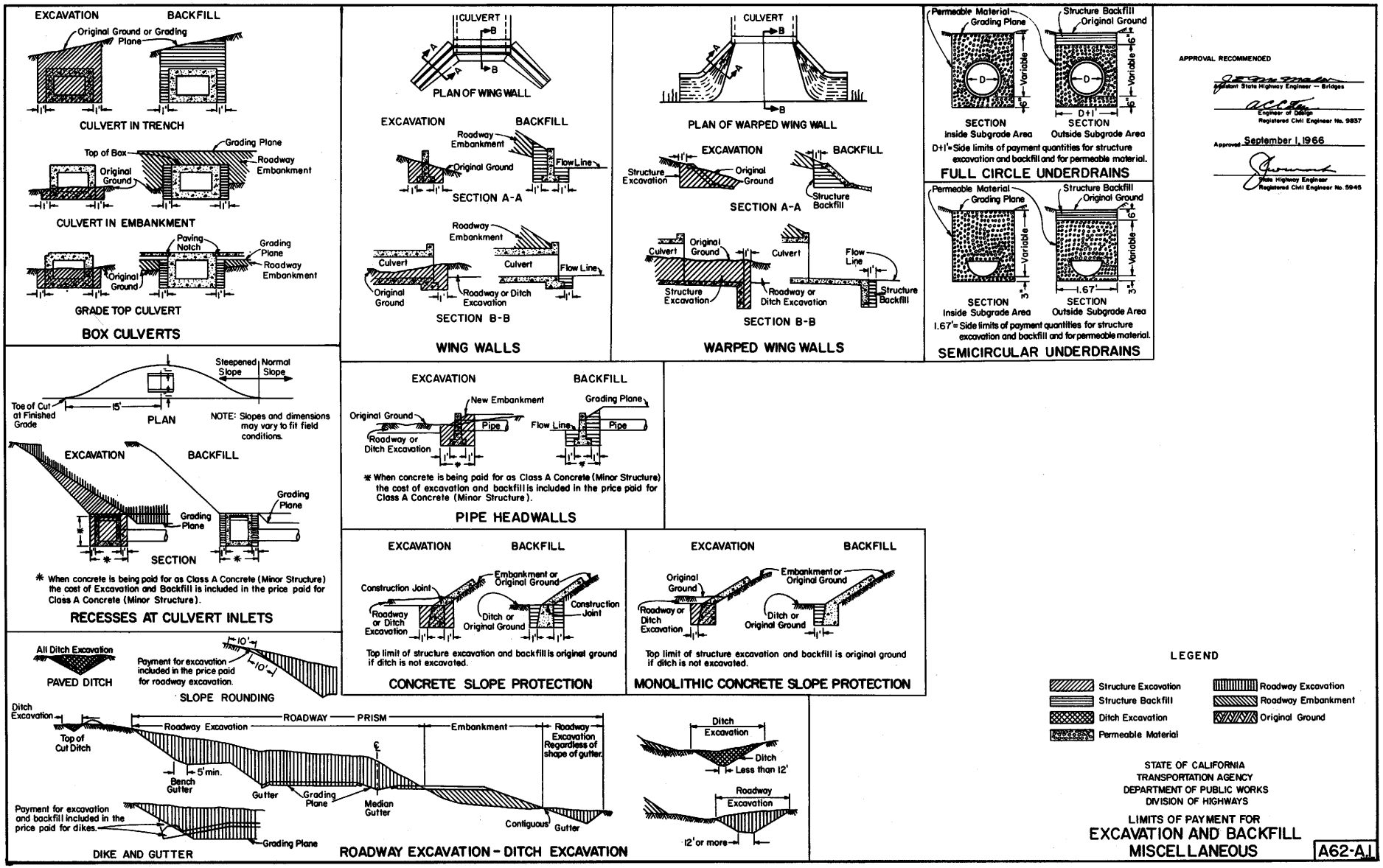

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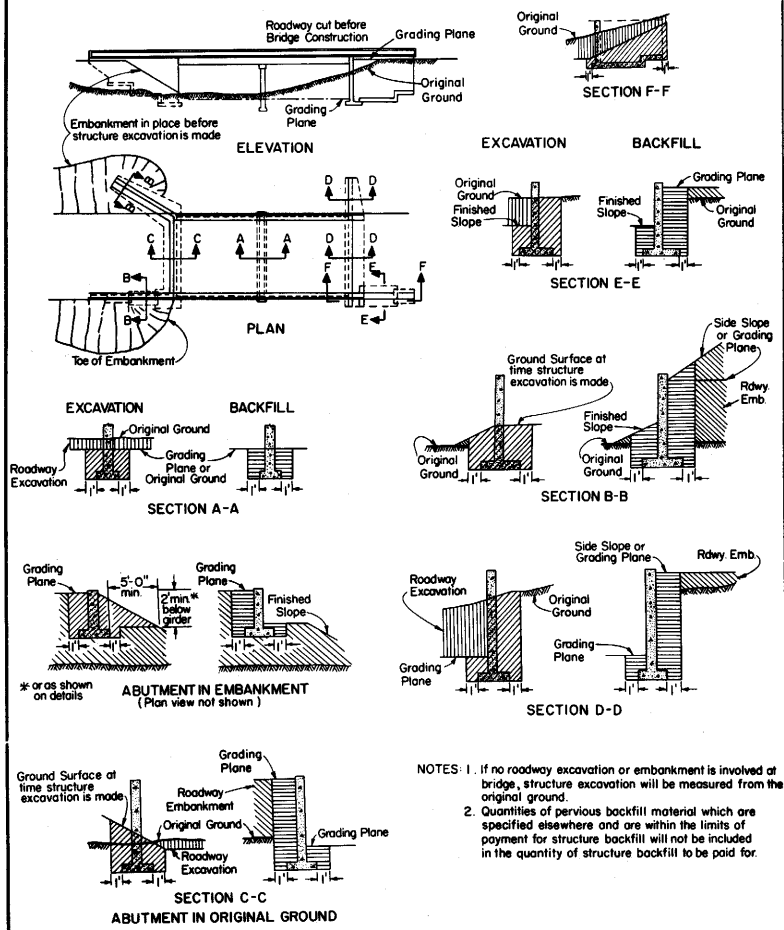
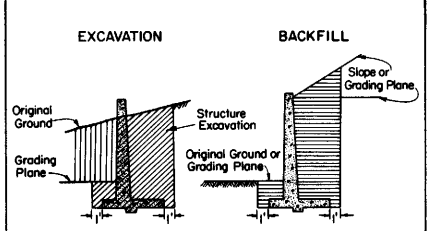


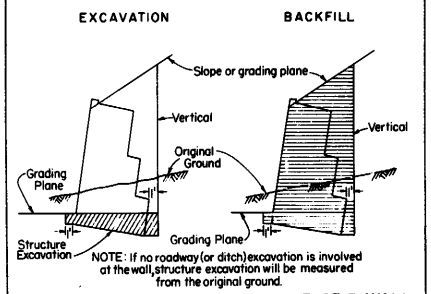
NOTES: 1. If no roadway excavation or embankment is involved at bridge, structure excavation will be measured from the original ground.
2. Quantities of pervious backfill material which are specified elsewhere and are within the limits of payment for structure backfill will not be included in the quantity of structure backfill to be paid for.

BRIDGE PIERS, ABUTMENTS & ADJOINING WING WALLS



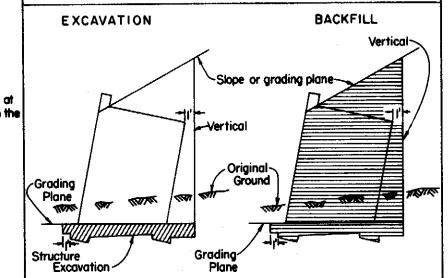
NOTE: If no roadway excavation is involved at the wall, structure excavation will be measured from the original ground.

RETAINING WALLS



NOTE: If no roadway (or ditch) excavation is involved at the wall, structure excavation will be measured from the original ground.

REINFORCED CONCRETE or TIMBER CRIB WALL



NOTE: If no roadway (or ditch) excavation is involved at the wall, structure excavation will be measured from the original ground.

METAL CRIB WALL

Approval Recommended

Assistant State Highway Engineer — Bridges

Engineer of Design
Registered Civil Engineer No. 9837

Approved September 1, 1966

State Highway Engineer
Registered Civil Engineer No. 5945

LEGEND

- Structure Excavation
- Structure Backfill
- Original Ground
- Roadway Excavation
- Roadway Embankment

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

LIMITS OF PAYMENT FOR

EXCAVATION AND BACKFILL BRIDGES AND WALLS

A62-B.1

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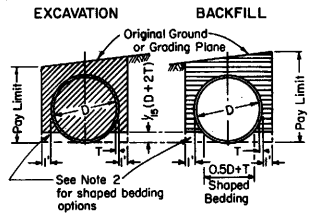
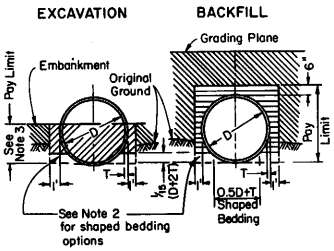


Pipes 42"diameter and less than 72"diameter with 50' or more depth of cover. Pipes 72"diameter and over, with any depth of cover.

SHAPED BEDDING

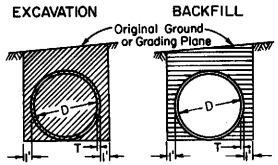
IN TRENCH



Pipes 42"diameter and less than 72"diameter with 50' or more depth of cover. Pipes 72"diameter and over, with any depth of cover.

SHAPED BEDDING

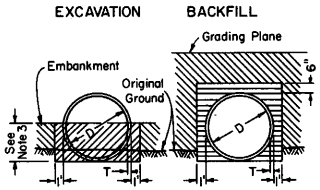
IN EMBANKMENT



Pipes less than 42"diameter. Pipes 42"diameter and less than 72"diameter with less than 50' depth of cover.

FLAT BEDDING

IN TRENCH



Pipes less than 42"diameter. Pipes 42"diameter and less than 72"diameter with less than 50' depth of cover. Rods and deadmen.

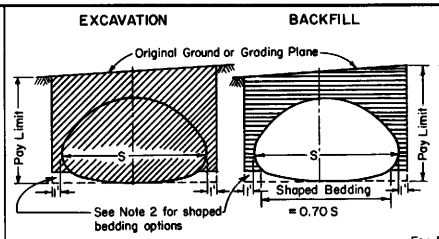
FLAT BEDDING

IN EMBANKMENT

CIRCULAR PIPES

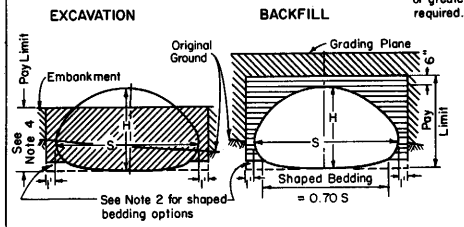
NOTES

1. For payment quantities excavation and backfill concrete pipe, T= minimum wall thickness as shown in A.A.S.H.O. M170 for Class III Pipe, Wall A.
   For C.M.P. and S.P.P. T=0.00
2. Shaped Bedding
   Option 1 – Provide shaped bedding in excavation.
   Option 2 – Excavate full depth, backfill and shape bedding in backfill material.
3. Embankment 6"above top of pipe for diameters of 24"and less. 30"minimum for diameters from 27"to 42"inclusive.
   ⅔D for diameters of 45"or more.
4. Embankment 6"above top of pipe, arch for height (H) less than 27". 30"minimum for height (H) from 27"to 57"inclusive.
   ½H for heights of 60"and over.
5. Depth of Baled straw = 0.02 x fill depth in feet, 2'minimum, but not greater than 0.60 span. Omit Baled straw when fill depth over crown is less than 1.4 x Span + 12'.
6. Corrugated metal pipe-arches and structural plate pedestrian underpasses to be placed in flat bedding, pay limit is to the flow line of the pipe.
7. Diagrams for circular pipes, above, do not apply to overside drains.



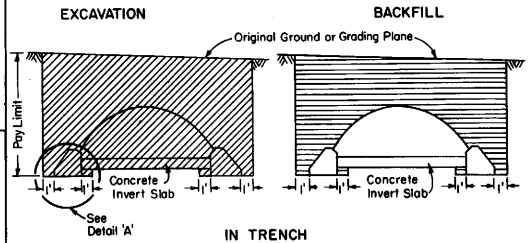
IN TRENCH

For Pipe arch, Structural plate pipe-arch and Vehicular underpass with S equal to or greater than 72", shaped bedding is required.



IN EMBANKMENT

STRUCTURAL PLATE PIPE-ARCHES, AND VEHICULAR UNDERPASSES



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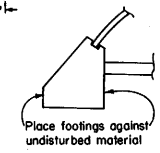
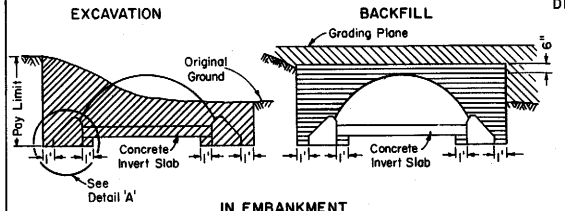


DETAIL 'A'



IN EMBANKMENT

STRUCTURAL PLATE ARCHES

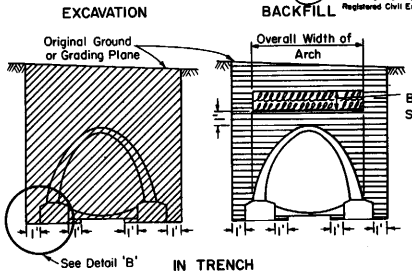
APPROVAL RECOMMENDED

Assistant State Highway Engineer — Bridges

Engineer of Design
Registered Civil Engineer No. 9837

Approved September 1, 1966

State Highway Engineer
Registered Civil Engineer No. 5945



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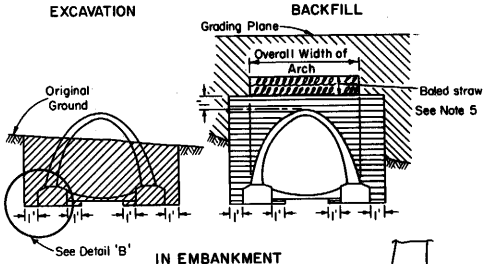
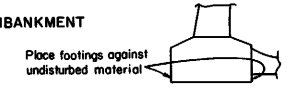


IN EMBANKMENT



DETAIL 'B'

R.C. ARCH CULVERTS

LEGEND

- Structure Excavation
- Structure Backfill
- Baled Straw Backfill
- Roadway Excavation
- Roadway Embankment
- Original Ground

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

LIMITS OF PAYMENT FOR
EXCAVATION AND BACKFILL CULVERT, PIPE and ARCH

A62-C.1

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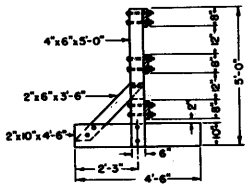
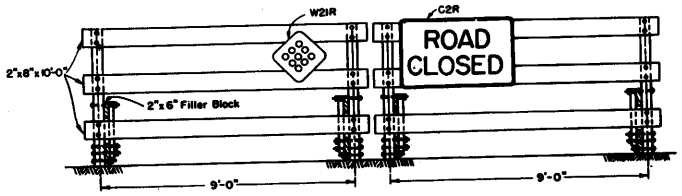


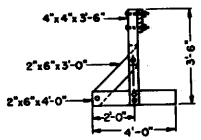
END VIEW

NOTE: All signs when required to be furnished by State.
All timber to be S4S
Use ½" Carriage bolts with cut washers and nuts.

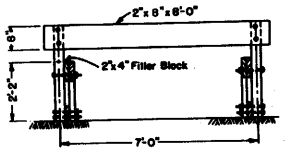


FRONT VIEW

CLASS I
TIMBER BARRICADES
10' SECTIONS



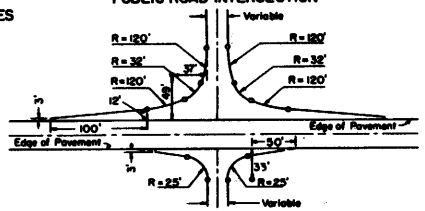
END VIEW



FRONT VIEW

CLASS II
TIMBER BARRICADE
8' SECTION

PUBLIC ROAD INTERSECTION



PRIVATE ROAD INTERSECTION

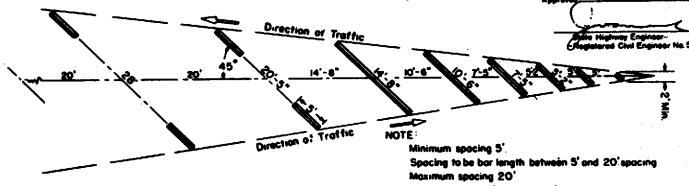
APPROVAL RECOMMENDED

Assistant Traffic Engineer
Registered Civil Engineer No. 9930

Engineer of Design
Registered Civil Engineer No. 9837

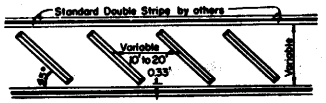
Approved September 1, 1966

State Highway Engineer
Registered Civil Engineer No. 5945

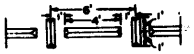


NOTE:
Minimum spacing 5'
Spacing to be bar length between 5' and 20' spacing
Maximum spacing 20'
When length is 15' or more a 5' bar shall be used at each end

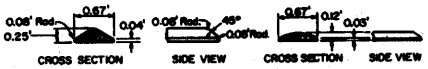
TRANSITION 2 TO 4 LANE



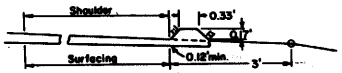
DIAGONAL RAISED BARS



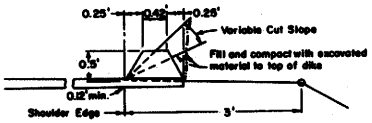
T-TRAFFIC BARS



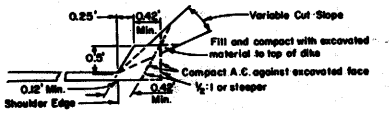
RAISED TRAFFIC BARS



0.17' DIKE



0.5' DIKE - TYPE A



0.5' DIKE - TYPE B

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TRANSPORTATION AGENCY
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DIVISION OF HIGHWAYS

TIMBER BARRICADES, RAISED TRAFFIC BARS AND DIKES

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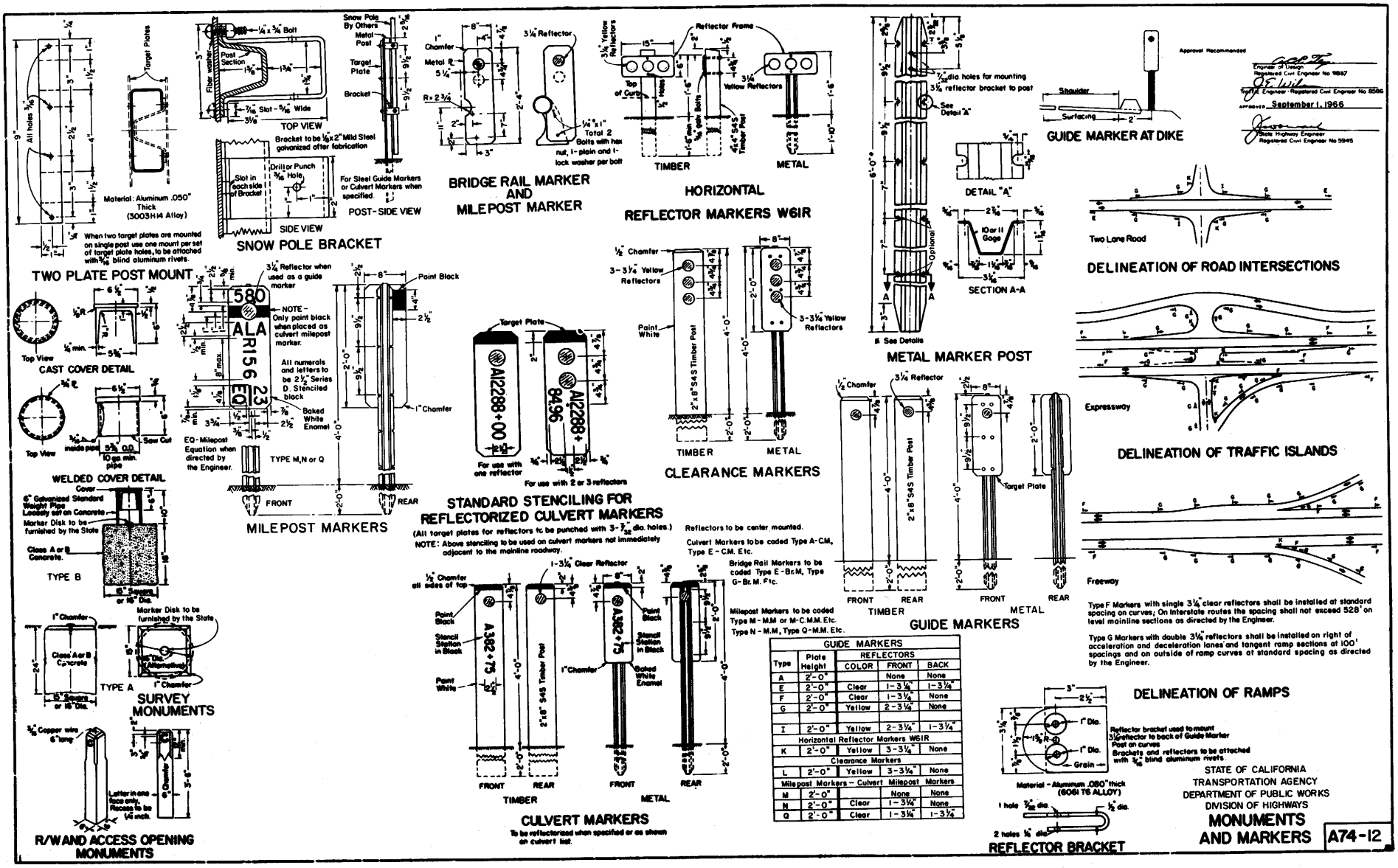

GUIDE MARKERS				
Type	Plate Height	REFLECTORS COLOR	FRONT	BACK
A	2'-0"		None	None
E	2'-0"	Clear	1-3 1/4"	1-3 1/4"
F	2'-0"	Clear	1-3 1/4"	None
G	2'-0"	Yellow	2-3 1/4"	None
I	2'-0"	Yellow	2-3 1/4"	1-3 1/4"
Horizontal Reflector Markers W61R				
K	2'-0"	Yellow	3-3 1/4"	None
Clearance Markers				
L	2'-0"	Yellow	3-3 1/4"	None
Milepost Markers — Culvert Milepost Markers				
M	2'-0"		None	None
N	2'-0"	Clear	1-3 1/4"	None
Q	2'-0"	Clear	1-3 1/4"	1-3 1/4"

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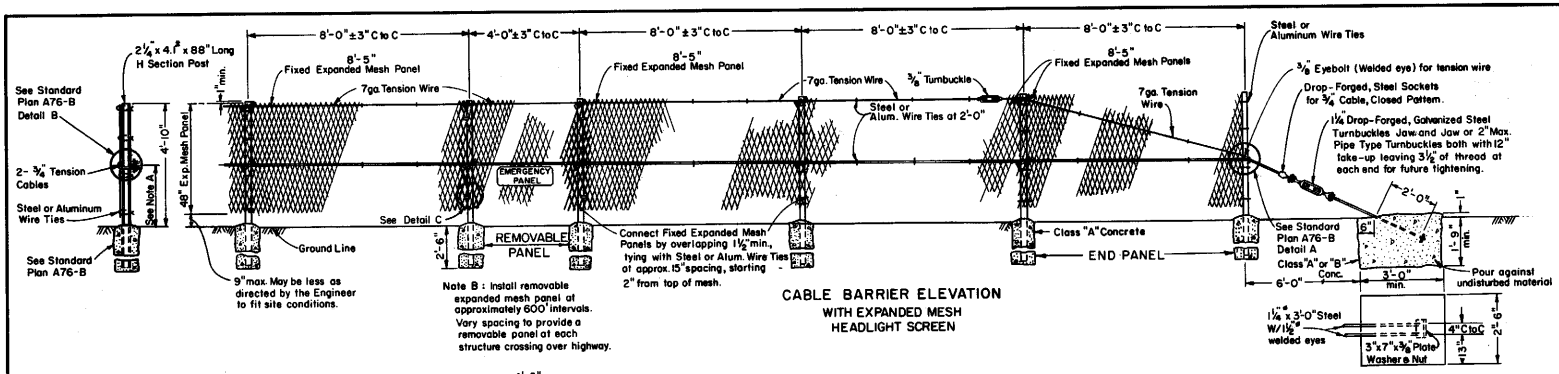


CABLE BARRIER ELEVATION
WITH EXPANDED MESH
HEADLIGHT SCREEN

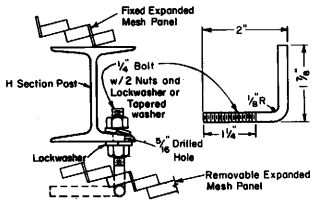
ANCHOR BLOCK PLAN

APPROVAL RECOMMENDED

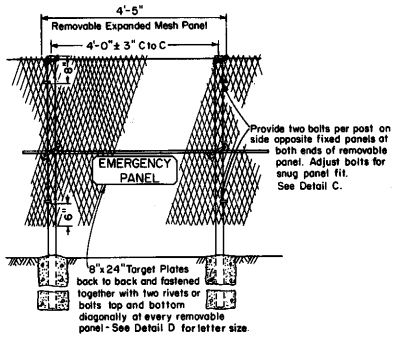
Engineer of Design
Registered Civil Engineer No. 9837

Approved September 1, 1966

State Highway Engineer
Registered Civil Engineer No. 5945



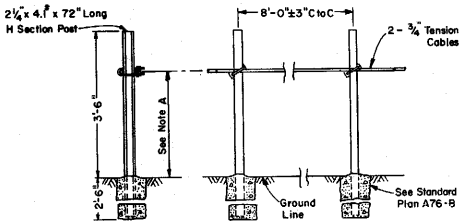
DETAIL C



REMOVABLE EXPANDED MESH PANEL DETAIL

DETAIL D

Note A: Normal height 2'-3" to 2'-4", 2'-6" for special cases where directed by the Engineer.



CABLE BARRIER
WITHOUT EXPANDED MESH
HEADLIGHT SCREEN

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

CABLE BARRIER A76-A.1

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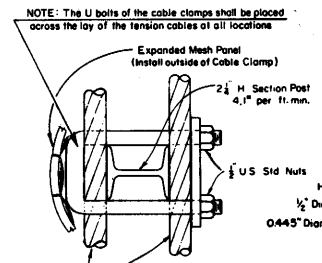
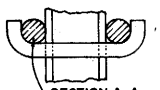
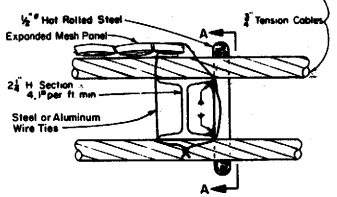


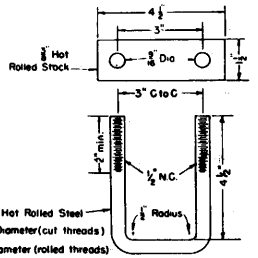
DETAIL B
LINE POST ASSEMBLY



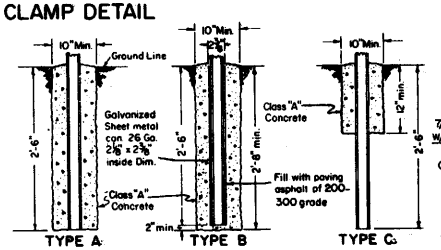
SECTION A-A



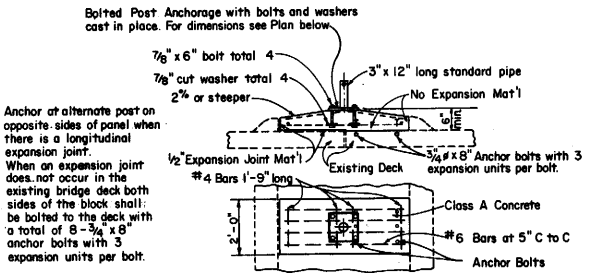
DETAIL A
END POST ASSEMBLY



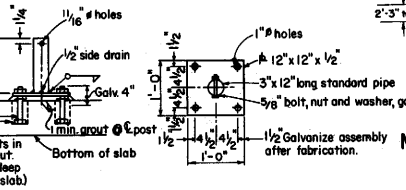
CABLE CLAMP DETAIL



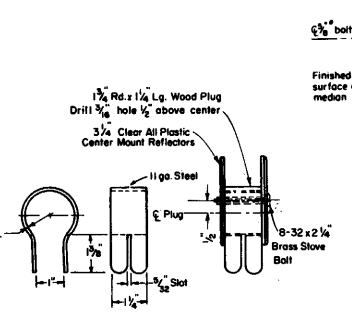
POST FOOTINGS



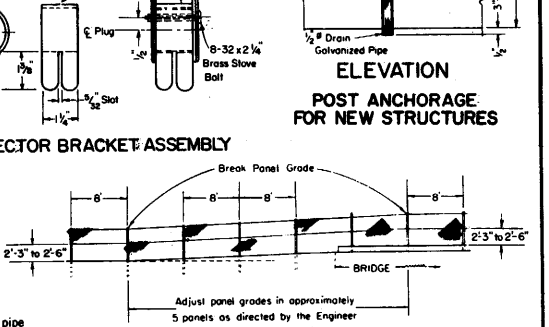
CONCRETE PAD ANCHORAGE
FOR EXISTING STRUCTURES
(Use only with curbed median)



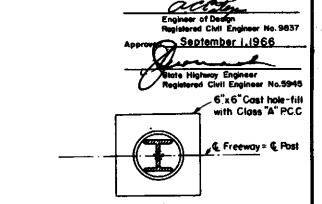
ELEVATION PLAN
BOLTED POST ANCHORAGE FOR EXISTING STRUCTURES
(When longitudinal joint is located on ℄ of freeway offset anchorage 9")



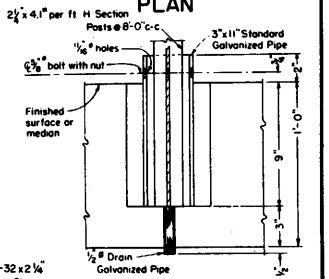
REFLECTOR BRACKET ASSEMBLY



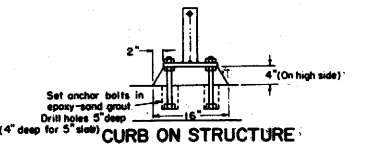
TRANSITION
MEDIAN GRADE TO MEDIAN CURB ON BRIDGE DECK



PLAN



ELEVATION
POST ANCHORAGE
FOR NEW STRUCTURES



CURB ON STRUCTURE
(To be used only when drainage is across median)

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
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CABLE BARRIER

A76-B.1

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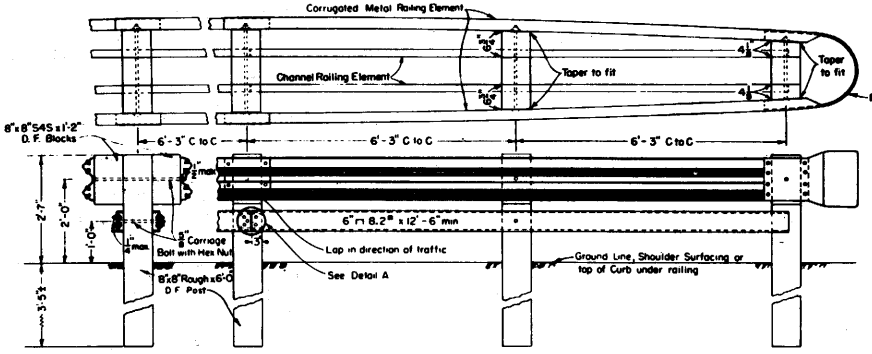
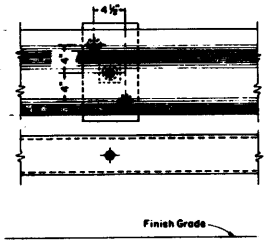
GENERAL NOTES

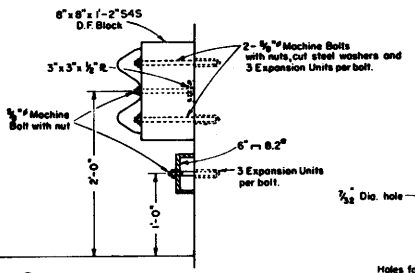
Except where noted, cut washers are required at all bolt installations where nut would bear on wood.

Engineer of Design
Registered Civil Engineer No
Traffic Engineer
Registered Civil Engineer No 8286
APPROVED September 1, 1966
State Highway Engineer
Registered Civil Engineer No 5945

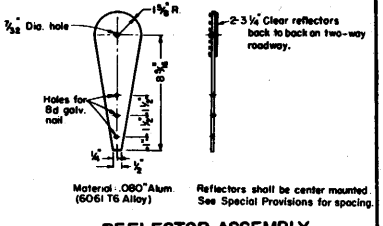


DOUBLE METAL BEAM BARRIER

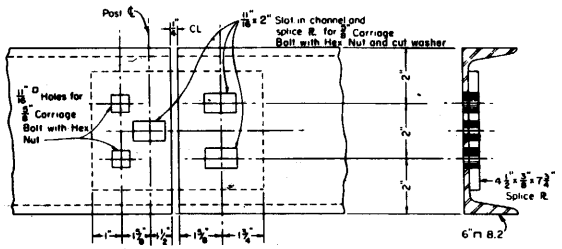




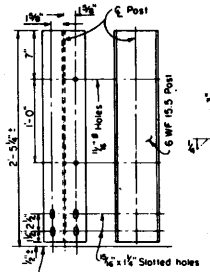
DETAIL B
(Used only when necessary)



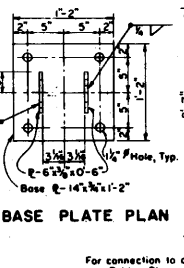
REFLECTOR ASSEMBLY



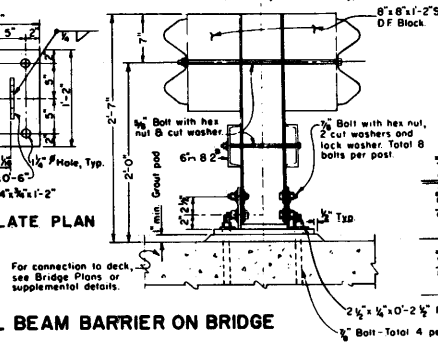
DETAIL "A" OF BOTTOM RAIL SPLICE
(Rail Splices to occur at Posts only)



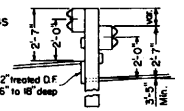
POST DETAILS



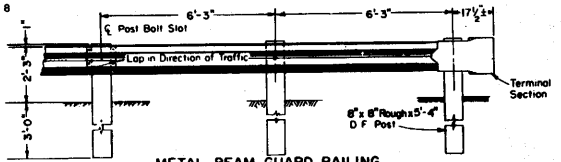
BASE PLATE PLAN



DOUBLE METAL BEAM BARRIER ON BRIDGE



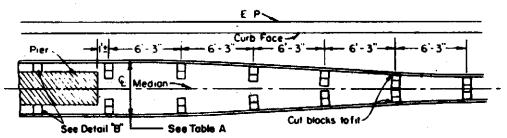
SAW TOOTH INSTALLATIONS



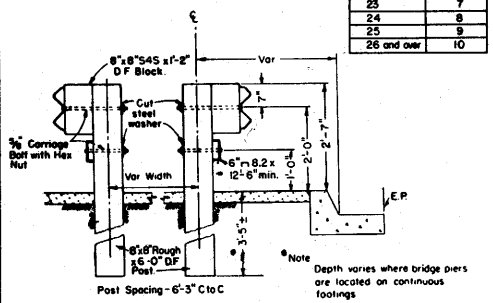
METAL BEAM GUARD RAILING

TABLE A

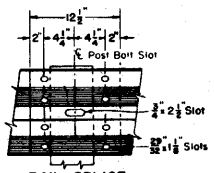
Median Width Ft.	Deflector Width - Ft.
22	6
23	7
24	8
25	9
26 and over	10



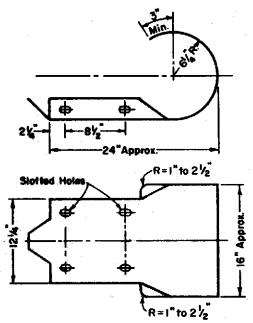
METAL BEAM BARRIER OBSTRUCTION DEFLECTOR
PLAN AT BRIDGE PIERS OR MEDIAN OBSTRUCTIONS



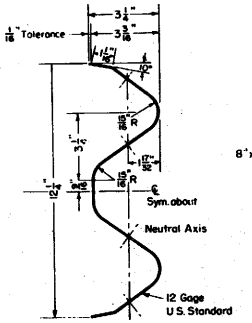
SINGLE
METAL BEAM BARRIER



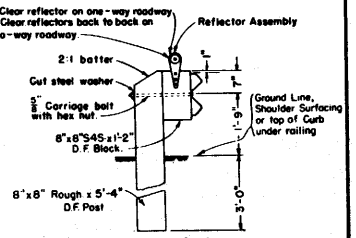
RAIL SPLICE
5/8" x 1 1/4" button head oval shoulder bolts with 1 1/4" recessed hex nuts. Total - 8 per splice and 4 per terminal section.



TERMINAL SECTION



SECTION THRU
RAIL ELEMENT



METAL BEAM GUARD RAILING

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

METAL BEAM GUARD RAILING AND METAL BEAM BARRIER | A77-A.1

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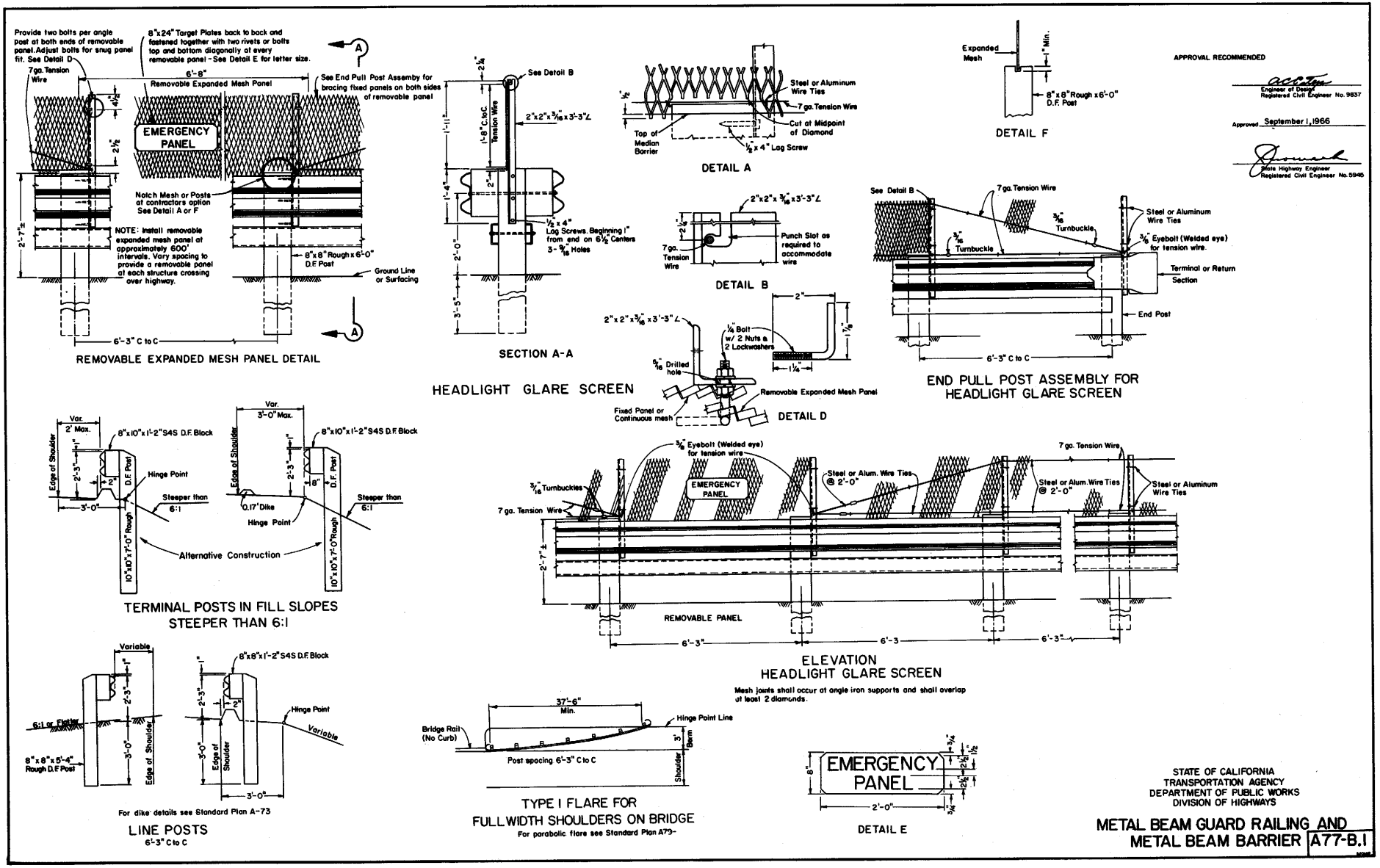

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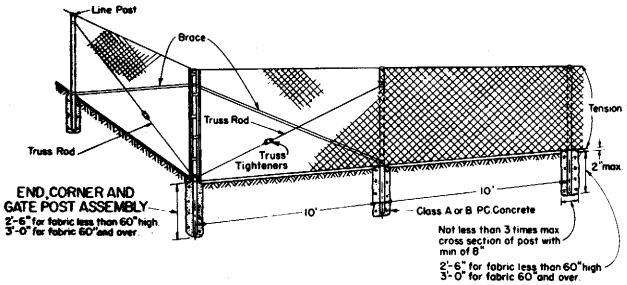
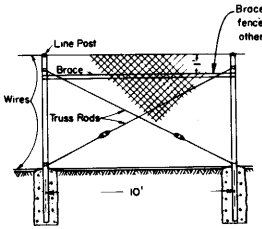
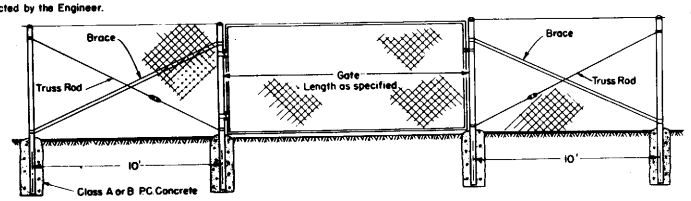


END, CORNER AND GATE POST ASSEMBLY



Line posts at 1000' maximum intervals braced and trussed in both directions.

Brace to be removed after all other fence construction is completed unless otherwise directed by the Engineer.



Type CL-4 = 48" fabric
Type CL-6 = 72" fabric

CHAIN LINK FENCE

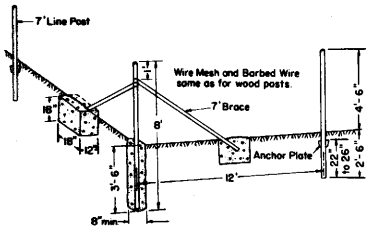
FREEWAY OR PROPERTY

APPROVAL RECOMMENDED

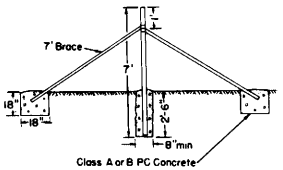
Engineer of Design
Registered Civil Engineer No. 9837

APPROVED September 1, 1966

State Highway Engineer
Registered Civil Engineer No. 5945

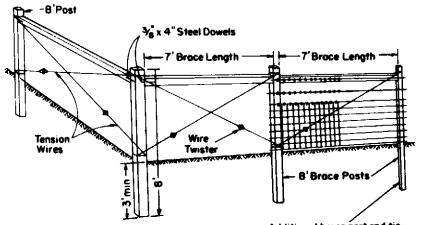


END, CORNER AND GATE POST ASSEMBLY



PULL POST ASSEMBLY
at 500' maximum intervals

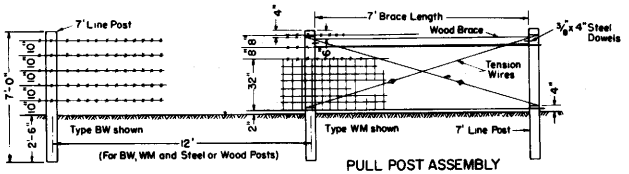
METAL POST INSTALLATION



END, CORNER AND GATE POST ASSEMBLY

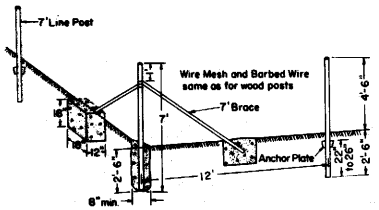
Type BW = 5 lines of barbed wire
Type WM = Wire mesh and 3 lines of barbed wire

FREEWAY FENCE

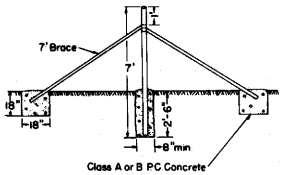


PULL POST ASSEMBLY
at 500' maximum intervals
(for both BW and WM)

WOOD POST INSTALLATION

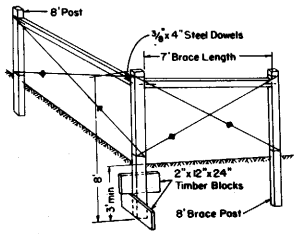


END, CORNER AND GATE POST ASSEMBLY



PULL POST ASSEMBLY
at 500' maximum intervals

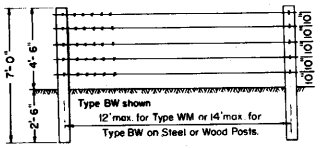
METAL POST INSTALLATION



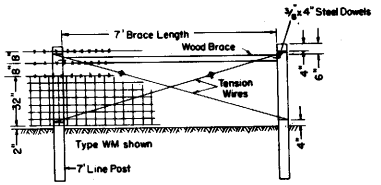
END, CORNER AND GATE POST ASSEMBLY

Type BW = 5 lines of barbed wire
Type WM = Wire mesh and 3 lines of barbed wire

PROPERTY FENCE

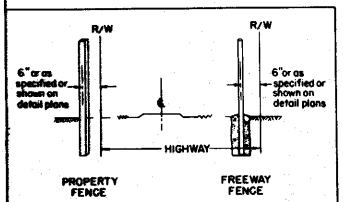


LINE POSTS



PULL POST ASSEMBLY
at 1000' maximum intervals
(for both BW and WM)

WOOD POST INSTALLATION



STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

FENCES

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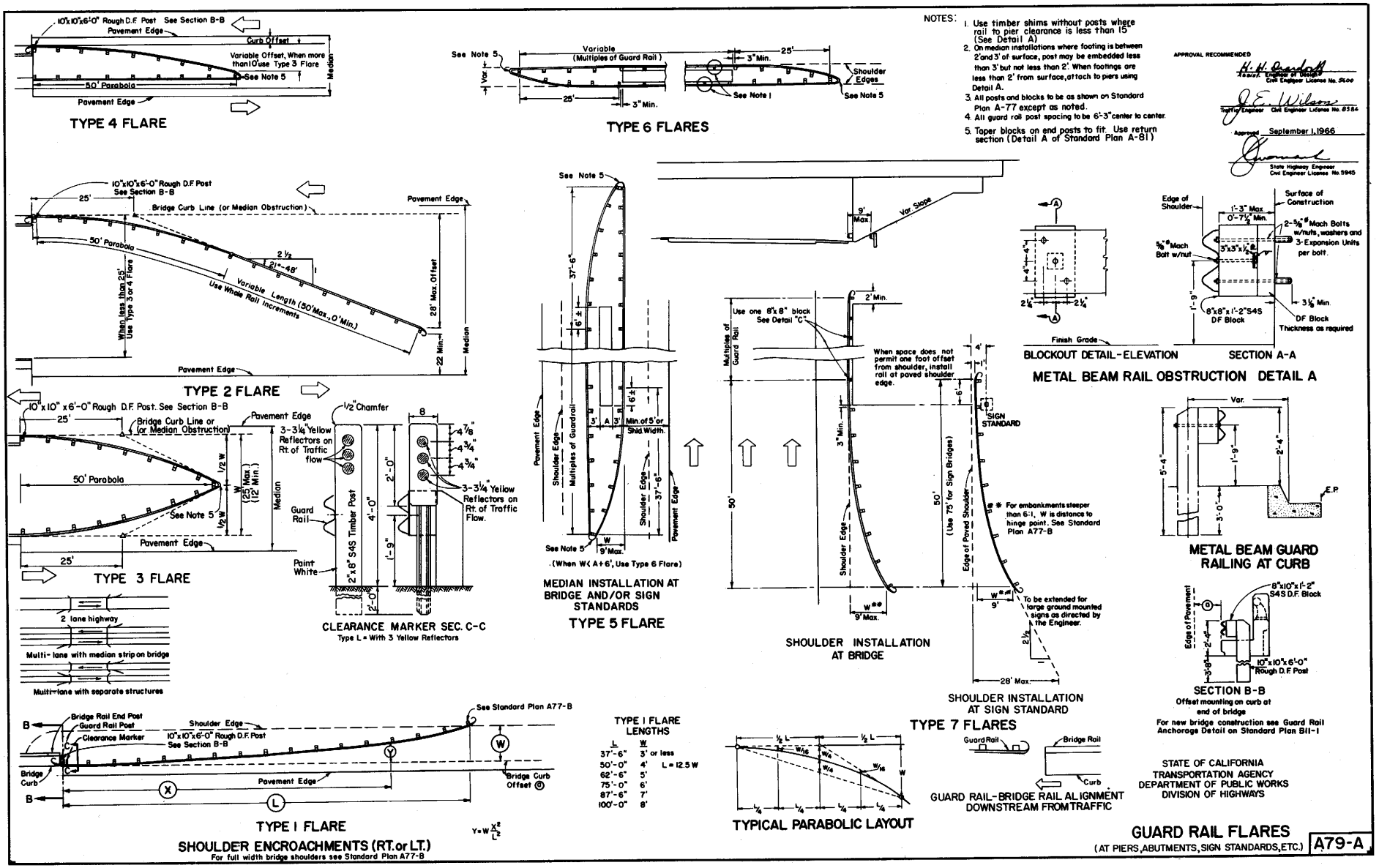

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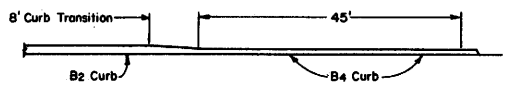
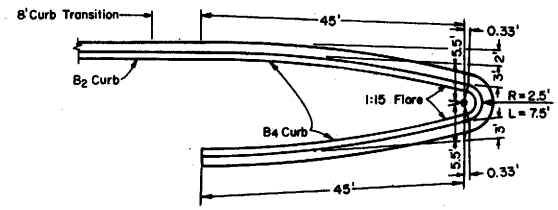
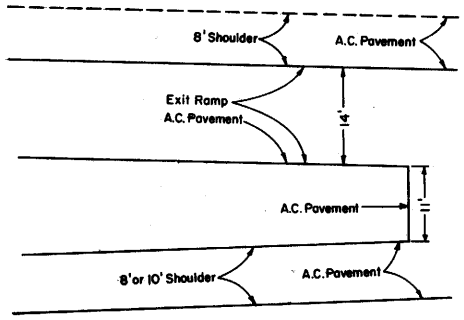


CURB PROFILE
8' CURB TRANSITION AT GORE



CURBED EXIT GORE



UNCURBED EXIT GORE

APPROVAL RECOMMENDED

Engineer of Design
Registered Civil Engineer No. 9837

Approved September 1, 1966

State Highway Engineer
Registered Civil Engineer No. 5945

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

EXIT GORE INSTALLATIONS A79-B

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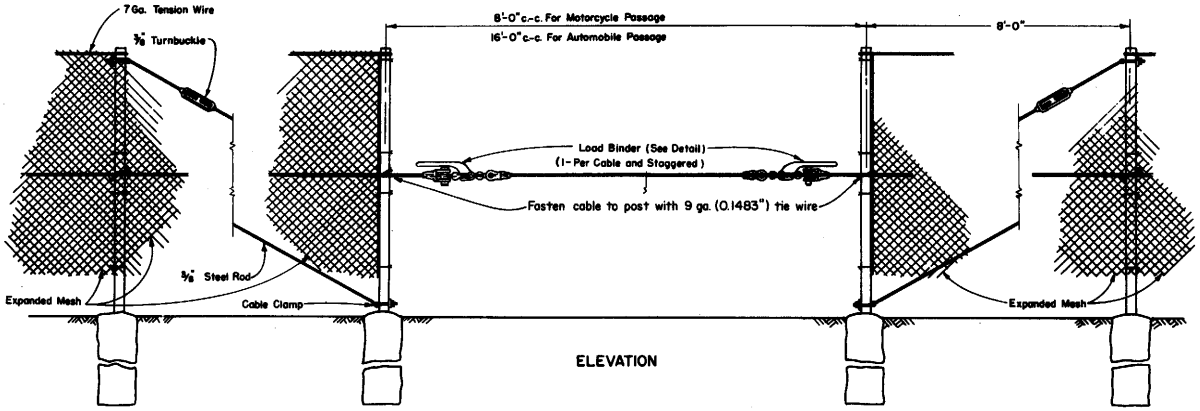
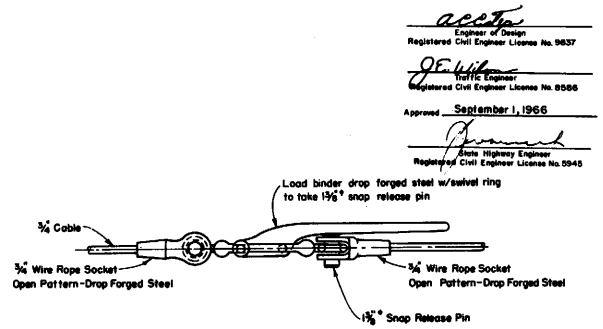


PASSAGEWAY IN CABLE MEDIAN BARRIER



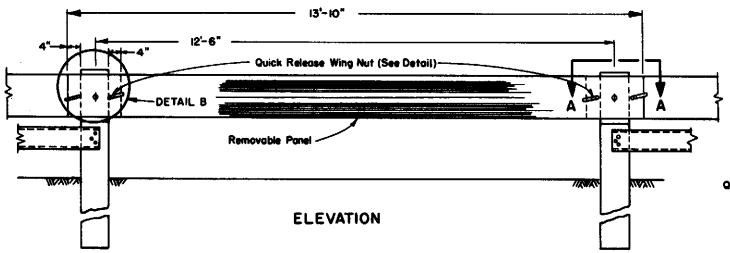
LOAD BINDER CABLE RELEASE

Engineer of Design
Registered Civil Engineer License No. 9837

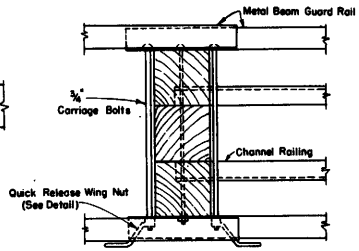
Traffic Engineer
Registered Civil Engineer License No. 8586

Approved September 1, 1966

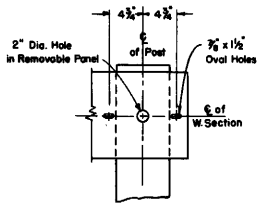
State Highway Engineer
Registered Civil Engineer License No. 5945



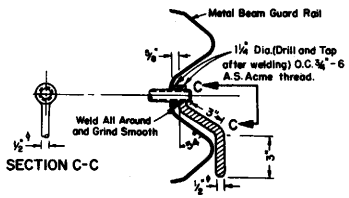
PASSAGEWAY IN METAL BEAM MEDIAN BARRIER



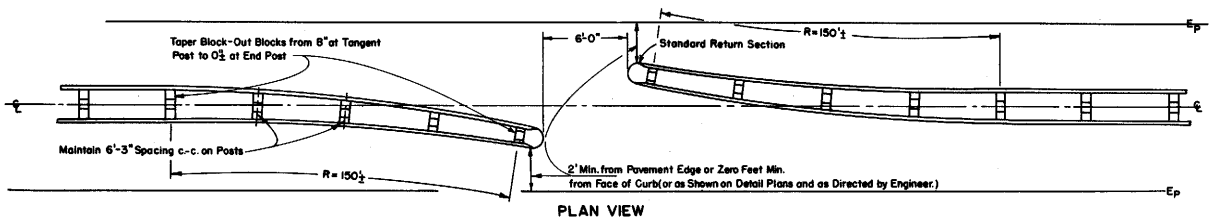
SECTION A-A



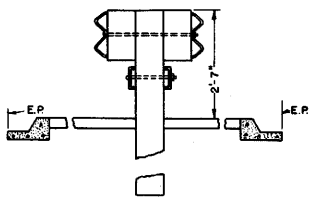
DETAIL B



QUICK RELEASE WING NUT



MOTORCYCLE PASSAGEWAY IN METAL BEAM MEDIAN BARRIER



TYPICAL SECTION

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

EMERGENCY PASSAGEWAYS | A80-1

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GENERAL NOTES

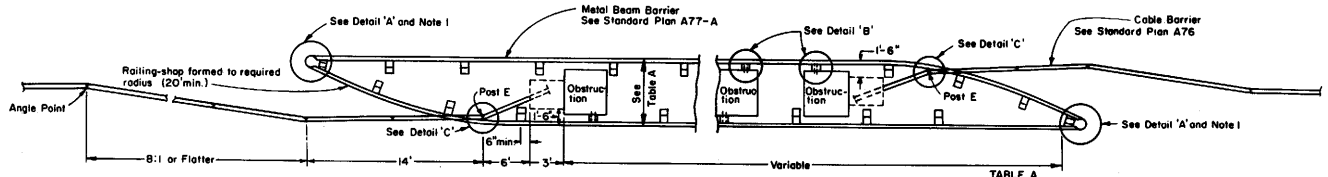
1. Shape blocks to fit.
2. Metal Beam Barrier Posts to be placed at 6'-3" centers.

APPROVAL RECOMMENDED

Engineer of Design
Registered Civil Engineer No. 9857

Approved September 1, 1966

State Highway Engineer
Registered Civil Engineer No. 5946

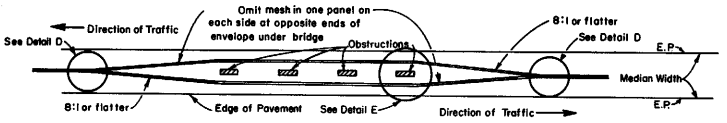


MEDIAN OBSTRUCTION DEFLECTOR-TYPE B

To be used when edge of pavement to obstruction clearance is less than 16'. For clearance 16' or more see Median Obstruction Deflector Type "A"

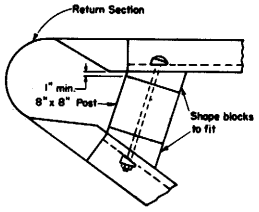
TABLE A

Median Width Ft.	Deflector Width - Ft.
22	6
23	7
24	8
25	9
26 and over	10

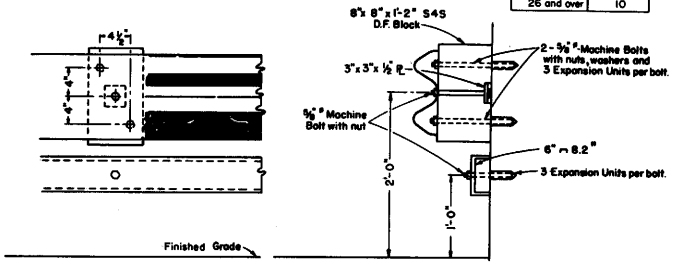


MEDIAN OBSTRUCTION DEFLECTOR-TYPE A

When median width is less than W+32 feet, use Median Obstruction Deflector Type "B"

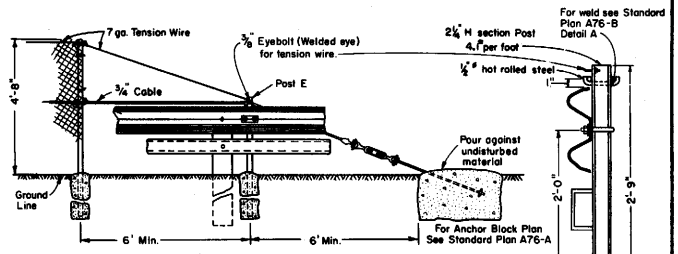


DETAIL A

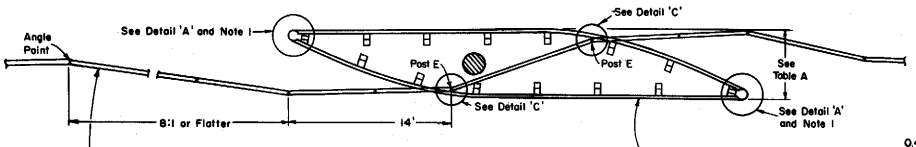


DETAIL B

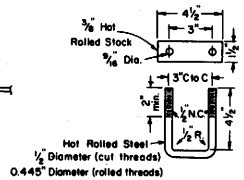
(Used only where necessary)



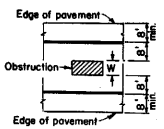
ELEVATION



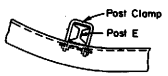
POST BARRIER



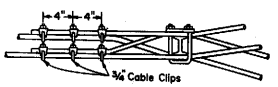
POST CLAMP



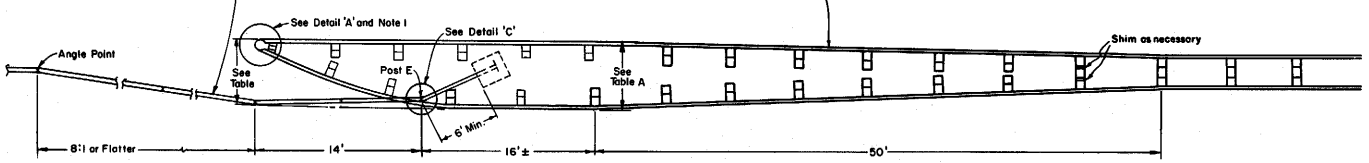
DETAIL E



DETAIL C



DETAIL D



TRANSITION - CABLE TO METAL BEAM BARRIERS

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

OBSTRUCTION DEFLECTORS AND METAL BEAM BARRIER TRANSITIONS

A 81-3

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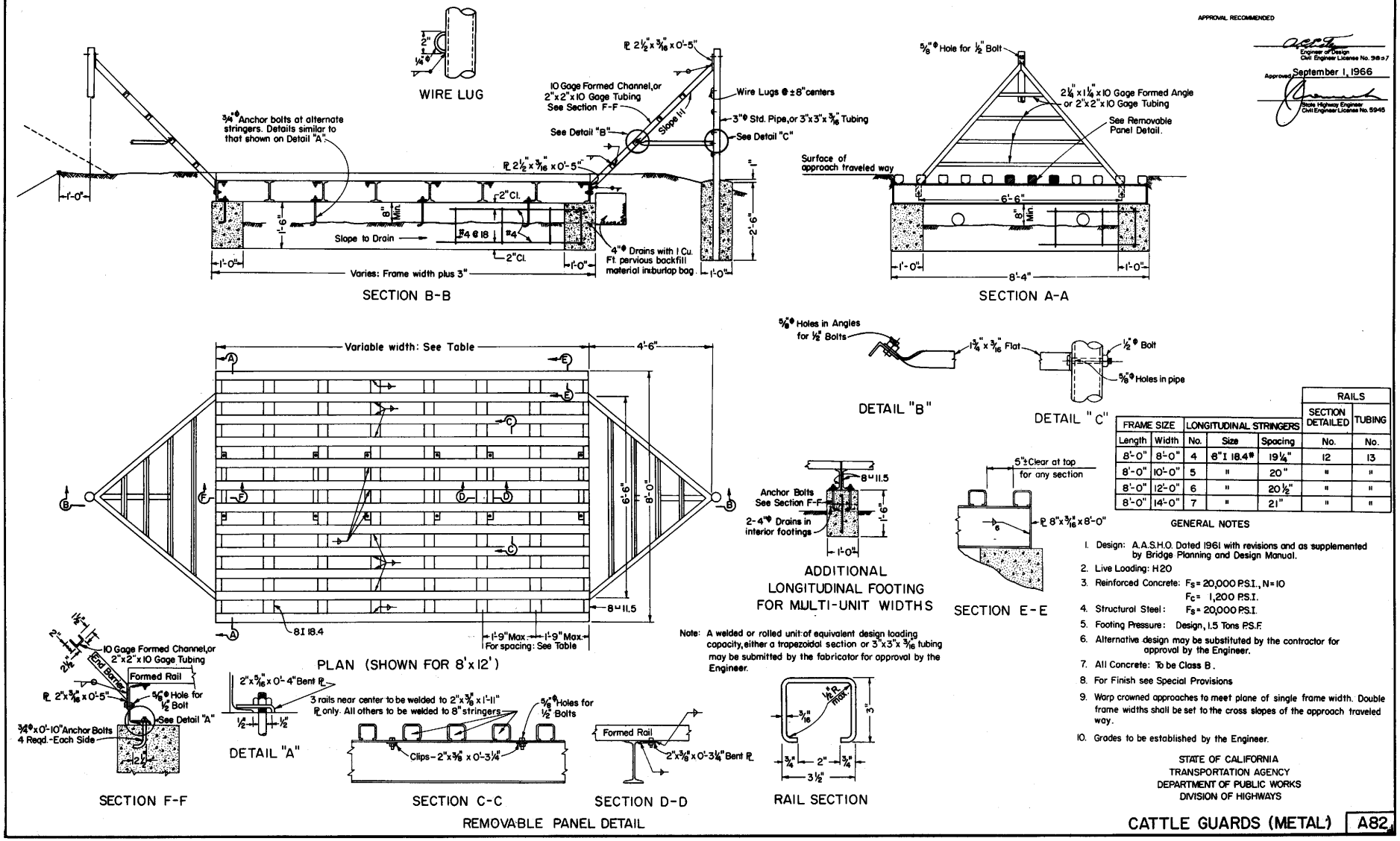

Note: A welded or rolled unit of equivalent design loading capacity, either a trapezoidal section or 3"x3"x3/16" tubing may be submitted by the fabricator for approval by the Engineer.

APPROVAL RECOMMENDED

Engineer of Design
Civil Engineer License No. 9857

Approved September 1, 1966

State Highway Engineer
Civil Engineer License No. 5945

FRAME SIZE		LONGITUDINAL STRINGERS			RAILS	
					SECTION DETAILED	TUBING
Length	Width	No.	Size	Spacing	No.	No.
8'-0"	8'-0"	4	8" I 18.4#	19 1/4"	12	13
8'-0"	10'-0"	5	"	20"	"	"
8'-0"	12'-0"	6	"	20 1/2"	"	"
8'-0"	14'-0"	7	"	21"	"	"

GENERAL NOTES

1. Design: A.A.S.H.O. Dated 1961 with revisions and as supplemented by Bridge Planning and Design Manual.
2. Live Loading: H20
3. Reinforced Concrete: F_s = 20,000 P.S.I., N = 10
   F_c = 1,200 P.S.I.
4. Structural Steel: F_s = 20,000 P.S.I.
5. Footing Pressure: Design, 1.5 Tons P.S.F.
6. Alternative design may be substituted by the contractor for approval by the Engineer.
7. All Concrete: To be Class B.
8. For Finish see Special Provisions
9. Warp crowned approaches to meet plane of single frame width. Double frame widths shall be set to the cross slopes of the approach traveled way.
10. Grades to be established by the Engineer.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

CATTLE GUARDS (METAL) A82

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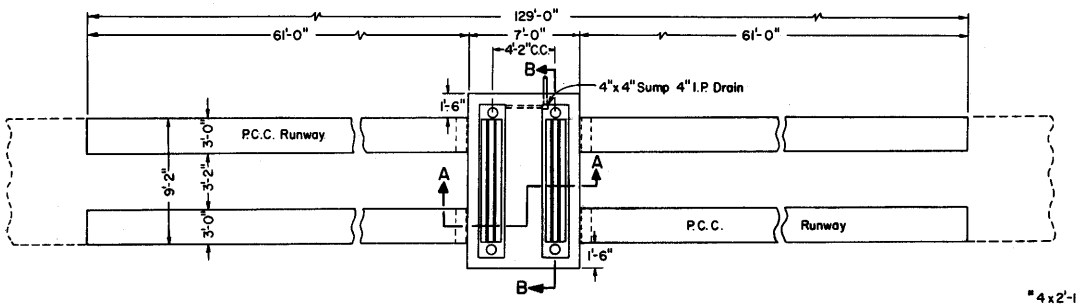
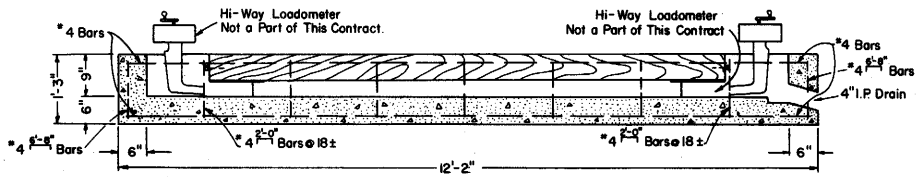
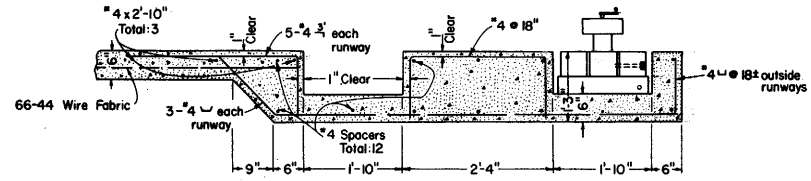


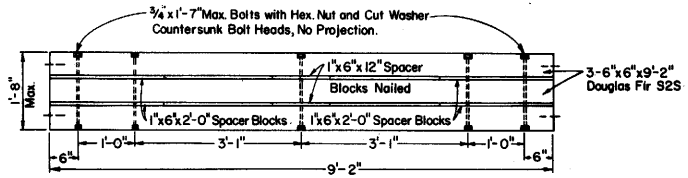
PLAN VIEW

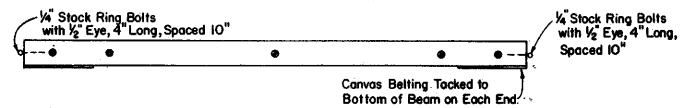


SECTION B-B

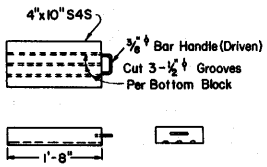


SECTION A-A

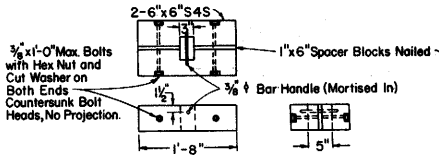




DETAILS OF BEAM CONSTRUCTION

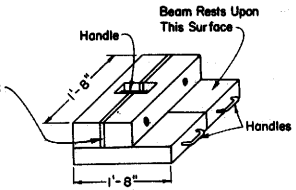


TIMBER FILLER BLOCK
(Make - 8 per installation)



TIMBER FILLER BLOCK
(Make - 4 per installation)

To fill space when Loadometer is not in use.



FILLER BLOCK ASSEMBLY

APPROVAL RECOMMENDED

Assistant State Highway Engineer
Civil Engineer License No. 6692

Approved September 1, 1966

State Highway Engineer
Civil Engineer License No. 5945

Note: Installation to be level in all directions for full length of runways.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

LOADOMETER SCALE PIT

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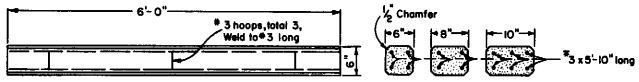
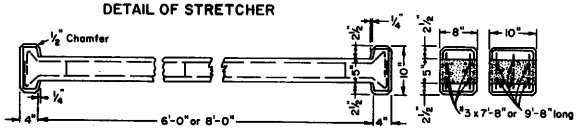
NUMBER OF UNITS REQUIRED FOR ONE INTERMEDIATE 6' PANEL OF HEIGHTS AS SHOWN

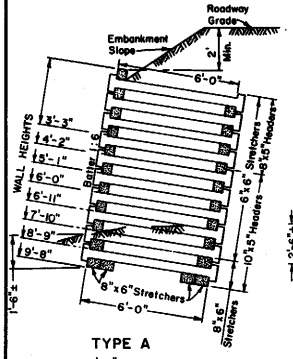
HEIGHT OF WALL	FRONT CRIB						1ST. ANCHOR CRIB			2ND. ANC. CR		ONE COMPLETE PANEL					
	HEADERS		STRETCHERS			BLOCKS	HDRS.	STRETCHERS		HDRS.	STRS.	HEADERS		STRETCHERS			BLOCKS
	8"x5"	10"x5"	6"x6"	8"x6"	10"x6"	10"x6"x10"	10"x5"	8"x6"	10"x6"	10"x5"	10"x6"	8"x5"	10"x5"	6"x6"	8"x6"	10"x6"	10"x6"x10"
3'-3"	3		9									3		9			
4-2	4		11									4		11			
5-1	4		13									4		13			
6-0	4	2	15									4	1	15			
6-11	4	3	17									4	3	17			
7-10	4	4	19									4	4	19			
8-9	4	5	17	4								4	5	17	4		
9-8	4	6	17	6								4	6	17	6		
10-7	4	7	17	9		1						4	7	17	9		1
11-6	4	8	17	11								4	8	17	11		
12-5	4	9	17	13		2						4	9	17	13		2
13-4	4	10	17	15		3						4	10	17	15		3
14-3	4	11	17	17		4						4	11	17	17		4
15-2	4	12	17	19		5						4	12	17	19		5
16-1	4	13	17	11	10		6	7				4	19	17	18	10	
17-0	4	14	17	12	12		7	8				4	21	17	19	12	
17-11	4	15	17	11	14		8	9				4	23	17	20	14	
18-10	4	16	17	11	16		9	10				4	25	17	21	16	
19-9	4	17	17	11	18	1	10	11				4	27	17	22	18	1
20-8	4	18	17	11	20	2	11	12				4	29	17	23	20	2
21-7	4	19	17	11	23	3	12	10	3	2	3	4	33	17	21	29	3
22-6	4	20	17	11	25	4	13	10	4	2	3	4	35	17	21	32	4
23-5	4	21	17	11	27	5	14	10	5	3	4	4	38	17	21	36	5
24-4	4	22	17	11	29	6	15	10	6	4	5	4	41	17	21	40	6
25-3	4	23	17	11	31	7	16	10	7	5	6	4	44	17	21	44	7
26-2	4	24	17	11	33	9	17	10	8	6	7	4	47	17	21	48	9
27-1	4	25	17	11	35		18	10	9	7	8	4	50	17	21	52	11
28-0	4	26	17	11	37	13	19	10	10	8	9	4	53	17	21	56	13
28-11	4	27	17	11	39	15	20	10	11	9	10	4	56	17	21	60	15
29-10	4	28	17	11	41	17	21	10	12	10	11	4	59	17	21	64	17



DETAIL OF STRETCHER

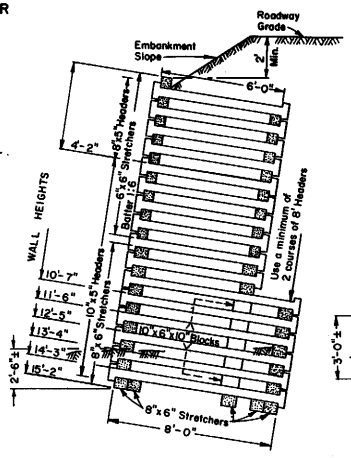


DETAIL OF HEADER



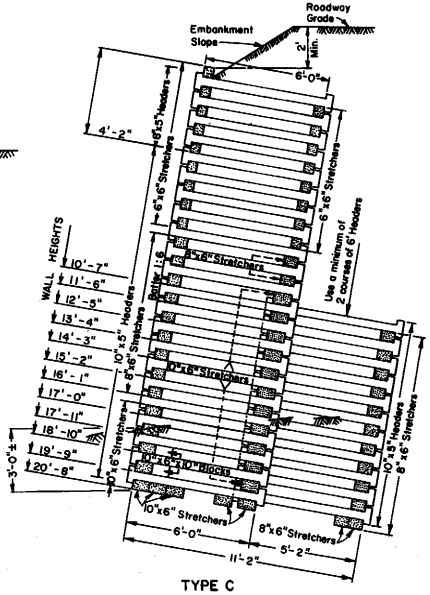
TYPE A

Walls 9'-8" or less in height



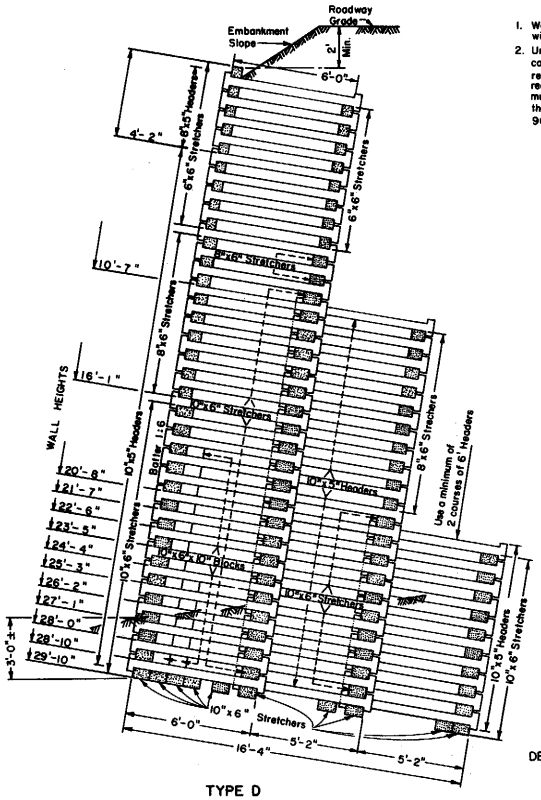
TYPE B

Walls between 10'-7" and 15'-2" in height



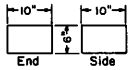
TYPE C

Walls between 16'-1" and 20'-8" in height



TYPE D

Walls between 21'-7" and 29'-10" in height



DETAIL OF FILLER BLOCK

APPROVAL RECOMMENDED

Engineer of Design
Registered Civil Engineer No. 9837

Approved September 1, 1966

State Highway Engineer
Registered Civil Engineer No. 5945

GENERAL NOTES

1. Walls 12'-5" or less in height may be constructed with no batter.
2. Units shown in Table are for intermediate Panels. In computing a wall of say 7 panels, it is necessary to remember that 7+1 or 8 vertical rows of headers are required. In addition, another vertical row of headers must be added whenever in the case of long walls, the wall is "broken" at panel points of approximately 96 feet.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

REINFORCED CONCRETE CRIB WALL C7-2

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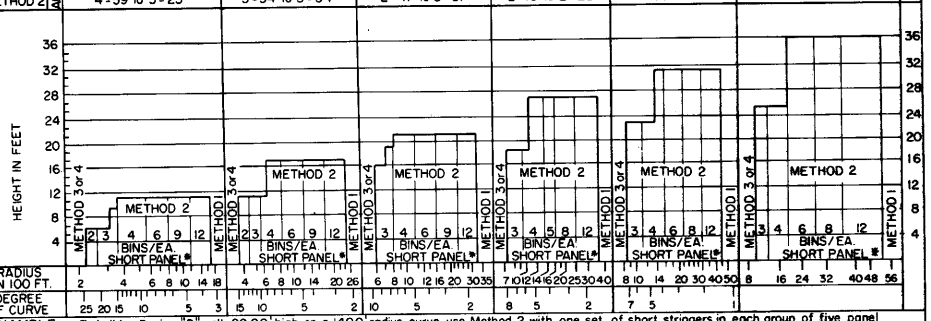
CURVATURE CHART - 1 TO 6 BATTER

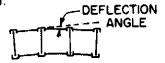
THIS DATA, OMITTING HEIGHT RESTRICTIONS, CAN BE USED FOR VERTICAL WALLS

DESIGN	A BASE WIDTH 5.5'	B BASE WIDTH 7.7'	C BASE WIDTH 9.9'	D BASE WIDTH 12.1'	E BASE WIDTH 14.3'	F BASE WIDTH 16.5'
METHOD 1 (ANGLE)	0° to 0°-26'	0° to 0°-20'	0° to 0°-14'	0° to 0°-12'	0° to 0°-10'	0° to 0°-8'
METHOD 2 (ANGLE)	4°-59' to 5° 25'	3°-34' to 3° 54'	2°-47' to 3°-01'	2°-16' to 2° 28'	1°-55' to 2° 05'	1°-18' to 1°-26'



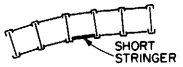
EXAMPLE- To build a Design "D" wall 20.00' high on a 1400' radius curve, use Method 2 with one set of short stringers in each group of five panel sections.

METHOD 1.



Use normal play in bolt holes of standard parts. Maximum deflection shown at top of table can be obtained at each column in vertical or battered walls. Chart shows smallest radius which can be used for each design of wall.

METHOD 2.

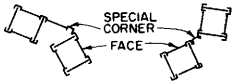


Use short panel sections (9'-6" face or rear) in addition to play in bolt holes. Curvature chart indicates number* of bins in each group, including a modified bin, necessary to build a curved wall at a required height and radius.

METHOD 3.

Use stringers field cut (with saber saw) and drilled to fit wall dimensions as it is assembled. Any radius can be fitted on any height of wall, battered or vertical. Generally standard panels are used between field cut panels. With very short radii the spacing of the transverse sections can be shortened so that two pieces can be cut from each stringer. This method is applicable to large single deflections.

METHOD 4



Use special shop fabricated corner connection pieces. Batter, height, angle, direction of turn, and base width determine the dimension limitations applicable on this method. Manufacturer should be contacted before detailing design for a specific turn. Rear stringers are omitted and it may be necessary to increase the base width of adjacent bins to provide needed stability. This method is an alternative for Method 3.

Right angle turns in vertical walls can be made by starting a new wall at the rear of the first wall and using the end transverse section for a face panel.

Right angle turns in battered walls can be made by erecting one complete bin vertically in the corner.

NOTE- Use Chart X and Table Y shown on Standard Plan C8-B to determine base width to height ratio for the various surcharges on both vertical and batter walls.

UNITS REQUIRED PER SHORT PANEL SECTION

WALL HEIGHT	SHORT STRINGERS IN FRONT OF WALL										SHORT STRINGERS IN REAR OF WALL									
	16 Ga.		14 Ga.		12 Ga.		10 Ga.		Sh't.		16 Ga.		14 Ga.		12 Ga.		10 Ga.		Sh'd	
	St'd	Short	St'd	Short	St'd	Short	St'd	Short	Str		St'd	Short	St'd	Short	St'd	Short	St'd	Short	Str	
FEET	9.5'	9.0'	9.5'	9.0'	9.5'	9.0'	9.5'	9.0'			9.5'	9.0'	9.5'	9.0'	9.5'	9.0'	9.5'	9.0'		
4.00	1	3								1	3	1								1
5.33	2	4								1	4	2								1
6.67	3	5								1	5	3								1
8.00	4	6								1	6	4								1
9.33	5	7								1	7	5								1
10.67	6	8								1	8	6								1
12.00	6	8								1	8	6								1
13.33	6	8	2	2						1	8	6	2	2						1
14.67	6	8	3	3						1	8	6	3	3						1
16.00	6	8	4	4						1	8	6	4	4						1
17.33	6	8	4	4	1	1				1	8	6	4	4	1	1				1
18.67	6	8	4	4	2	2				1	8	6	4	4	2	2				1
20.00	6	8	4	4	3	3				1	8	6	4	4	3	3				1
21.33	6	8	4	4	4	4				1	8	6	4	4	4	4				1
22.67	6	8	4	4	5	5				1	8	6	4	4	5	5				1
24.00	6	8	4	4	6	6				1	8	6	4	4	6	6				1
25.33	6	8	4	4	7	7				1	8	6	4	4	7	7				1
26.67	6	8	4	4	7	7	1	1		1	8	6	4	4	7	7	1	1		1
28.00	6	8	4	4	7	7	2	2		1	8	6	4	4	7	7	2	2		1
29.33	6	8	4	4	7	7	3	3		1	8	6	4	4	7	7	3	3		1
30.67	6	8	4	4	7	7	4	4		1	8	6	4	4	7	7	4	4		1
32.00	6	8	4	4	7	7	5	5		1	8	6	4	4	7	7	5	5		1
33.33	6	8	4	4	7	7	6	6		1	8	6	4	4	7	7	6	6		1
34.67	6	8	4	4	7	7	7	7		1	8	6	4	4	7	7	7	7		1
36.00	6	8	4	4	7	7	8	8		1	8	6	4	4	7	7	8	8		1

NOTE- This table applies only to short panel sections for curved walls and includes units for both front and rear of a 9.5' element of wall.

APPROVAL RECOMMENDED

Assistant State Highway Engineer
Registered Civil Engineer No. 5390

APPROVED September 1, 1966

State Highway Engineer
Registered Civil Engineer No. 5945

UNITS REQUIRED PER TRANSVERSE SECTION

WALL HEIGHT	BEARING PLATE	FRONT COLUMN HEIGHT IN FEET				REAR COLUMN HEIGHT IN FEET				Total Col. Length in Feet	Column Splice	Column Cap	SPACERS Gage & Length						BOT SPACER Gage & Length						UNITS REQUIRED PER PANEL SECTION: STRINGERS					St'r.	WALL HEIGHT
FEET	16" x 22"	1st Lift	2nd Lift	3rd Lift	Total Height	1st Lift	2nd Lift	3rd Lift	Total Height				16	16	14	12	12	12	16	16	14	12	12	12	16 Ga	14 Ga	12 Ga	10 Ga		St'r.	FEET
													5.2	7.4	9.6	11.8	14.0	16.2	5.2	7.4	9.6	11.8	14.0	16.2	9.5'	9.5'	9.5'	9.5'		9.5'	
4.00	2	4.00			4.00	1.33			1.33	5.33		1							1						4					1	4.00
5.33	2	5.33			5.33	2.67			2.67	8.00		1	1						1						6					1	5.33
6.67	2	6.67			6.67	4.00			4.00	10.67		1	2						1						8					1	6.67
8.00	2	8.00			8.00	5.33			5.33	13.33		1	3						1						10					1	8.00
9.33	2	9.33			9.33	6.67			6.67	16.00		1	4						1						12					1	9.33
10.67	2	10.67			10.67	8.00			8.00	18.67		1		5						1					14					1	10.67
12.00	2	12.00			12.00	9.33			9.33	21.33	1	1		6						1					14	2				1	12.00
13.33	2	8.00	5.33		13.33	10.67			10.67	24.00	1	1		7						1					14	4				1	13.33
14.67	2	8.00	6.67		14.67	12.00			12.00	26.67	1	1				8						1			14	6				1	14.67
16.00	2	8.00	8.00		16.00	8.00	5.33		13.33	29.33	2	1				9						1			14	8				1	16.00
17.33	2	12.00	5.33		17.33	8.00	6.67		14.67	32.00	2	1				10						1			14	8	2			1	17.33
18.67	2	12.00	6.67		18.67	8.00	8.00		16.00	34.67	2	1					11						1		14	8	4			1	18.67
20.00	2	12.00	8.00		20.00	12.00	5.33		17.33	37.33	2	1					12						1		14	8	6			1	20.00
21.33	2	12.00	9.33		21.33	12.00	6.67		18.67	40.00	2	1					13						1		14	8	8			1	21.33
22.67	2	12.00	10.67		22.67	12.00	8.00		20.67	42.67	2	1						14						1	14	8	10			1	22.67
24.00	2	12.00	12.00		24.00	12.00	9.33		21.33	45.33	2	1						15						1	14	8	12			1	24.00
25.33	2	12.00	8.00	5.33	25.33	12.00	10.67		22.67	48.00	3	1						16						1	14	8	14			1	25.33
26.67	2	12.00	8.00	6.67	26.67	12.00	12.00		24.00	50.67	3	1						17						1	14	8	14	2		1	26.67
28.00	2	12.00	8.00	8.00	28.00	12.00	8.00	5.33	25.33	53.33	4	1						18						1	14	8	14	4		1	28.00
29.33	2	12.00	12.00	5.33	29.33	12.00	8.00	6.67	26.67	56.00	4	1						19						1	14	8	14	6		1	29.33
30.67	2	12.00	12.00	6.67	30.67	12.00	8.00	8.00	28.00	58.67	4	1						20						1	14	8	14	8		1	30.67
32.00	2	12.00	12.00	8.00	32.00	12.00	12.00	5.33	29.33	61.34	4	1						21						1	14	8	14	10		1	32.00
33.33	2	12.00	12.00	9.33	33.33	12.00	12.00	6.67	30.67	64.01	4	1						22						1	14	8	14	12		1	33.33
34.67	2	12.00	12.00	10.67	34.67	12.00	12.00	8.00	32.00	66.68	4	1						23						1	14	8	14	14		1	34.67
36.00	2	12.00	12.00	12.00	36.00	12.00	12.00	9.33	33.33	69.35	4	1						24						1	14	8	14	16		1	36.00

NOTE- This table applies only to standard panel sections and includes units for both front and rear of a 10' element of wall.

NOTE- For Construction Details See Standard Plan C8-B

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

DESIGN DATA FOR

METAL CRIB WALL | C8-A.1

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Surcharge / Batter	Level No Live Load	With Superimposed Load	Unlimited
Wall On 1:6 Batter	① R=.45	② R=.50	③ R=.55
Wall Vertical	④ R=.55	⑤ R=.60	⑥ R=.65

$R = \frac{\text{base width}}{\text{height}}$

① Curve number

TABLE Y

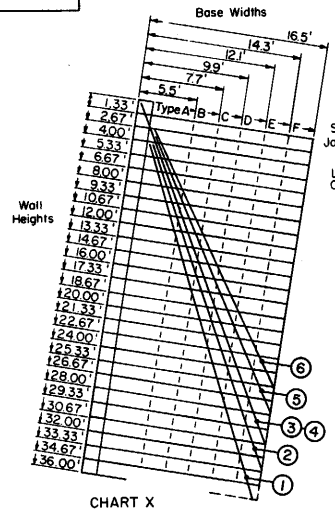
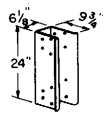
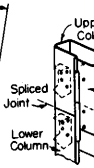


CHART X

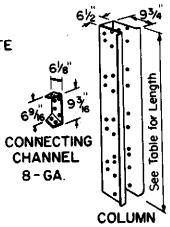


COLUMN SPLICE PLATE
10 GA.



ASSEMBLY at
COLUMN SPLICE

* COLUMN CAP-12 GA.

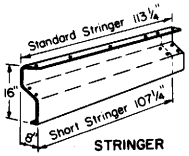


CONNECTING
CHANNEL
8-GA.

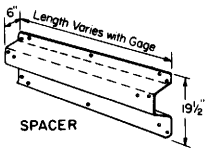
COLUMN
8-GA.

* Column Cap to be placed if requested by Engineer

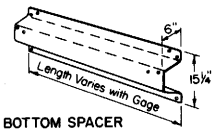
STRINGER STIFFENER-8GA.



STRINGER

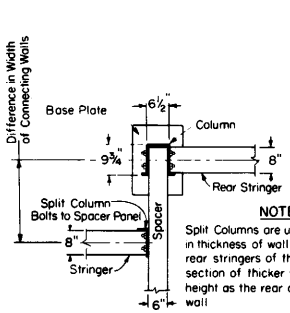


SPACER



BOTTOM SPACER

NOTE - See Table on for Gage and Length



NOTE

Split Columns are used where changes in thickness of wall are made to connect rear stringers of thinner wall to transverse section of thicker wall. They are the same height as the rear columns for the thinner wall.

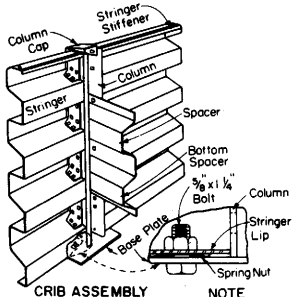
DETAIL
SPLIT COLUMN ATTACHMENT

APPROVAL RECOMMENDED

Assistant State Highway Engineer
Registered Civil Engineer No. 5390

Approved September 1, 1966

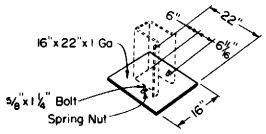
State Highway Engineer
Registered Civil Engineer No. 5945



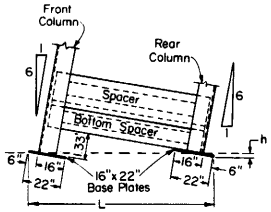
CRIB ASSEMBLY
FRONT COLUMN
Rear Column Similar

NOTE

Before Setting Base Plate, insert Bolt and Fasten with Spring Nut



BASE PLATE ARRANGEMENT



DETAIL - BASE PLATE PLACEMENT

WALL WIDTH / TYPE	h	L
"A"	* 3"	6'-7⅝"
"B"	1⅜"	8'-9⅝"
"C"	5 13/16"	10'-11 13/16"
"D"	10 3/16"	13'-2 1/16"
"E"	14⅝"	15'-4 5/16"
"F"	18¾"	17'-8½"

* NOTE - Distance "h" for Type "A" is a Minus Quantity --- that is, Front Column Base is LOWER than Rear Column Base

All bolts to be ⅝" with a minimum length of 1¼"

GENERAL NOTES

Design "Type" to be shown on all crib layouts.

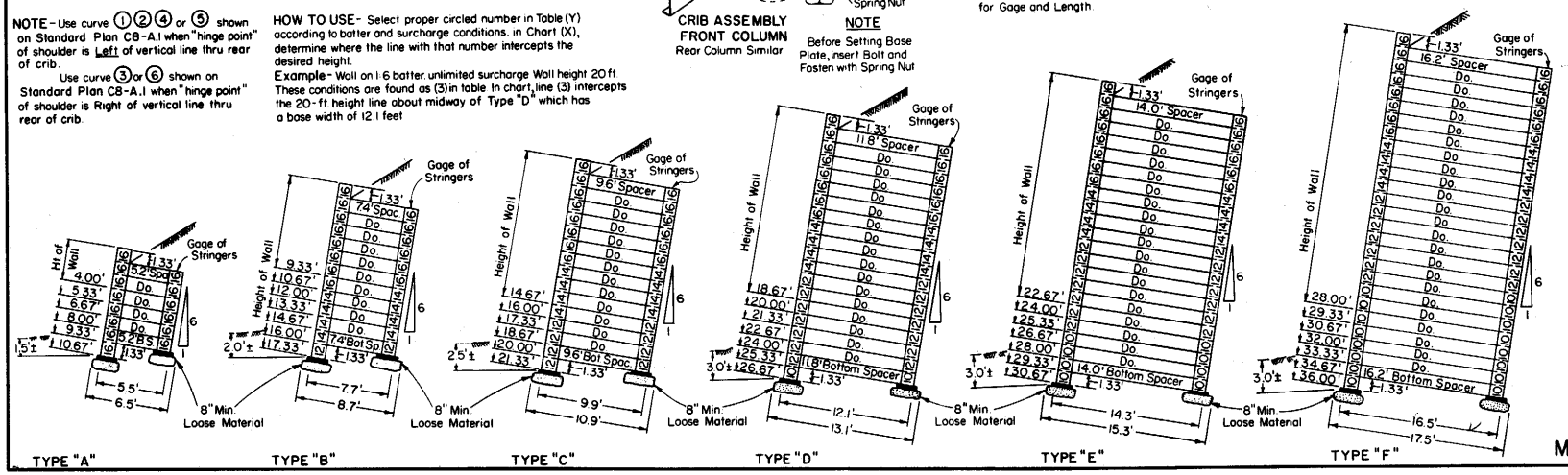
For Design Data see Standard Plan C8-A.1

NOTE - Use curve ①②④ or ⑤ shown on Standard Plan C8-A.1 when "hinge point" of shoulder is Left of vertical line thru rear of crib.

Use curve ③ or ⑥ shown on Standard Plan C8-A.1 when "hinge point" of shoulder is Right of vertical line thru rear of crib.

HOW TO USE - Select proper circled number in Table (Y) according to batter and surcharge conditions. in Chart (X), determine where the line with that number intercepts the desired height.

Example - Wall on 1:6 batter. unlimited surcharge Wall height 20 ft. These conditions are found as (3) in table. In chart, line (3) intercepts the 20-ft height line about midway of Type "D" which has a base width of 12.1 feet



STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

CONSTRUCTION DETAILS FOR
METAL CRIB WALL C8-B

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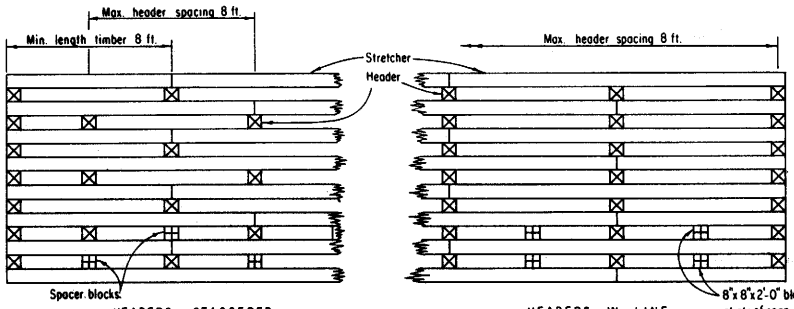
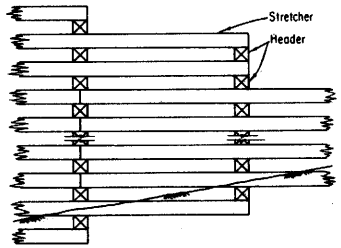


HEADERS STAGGERED (ALTERNATIVE)

HEADERS IN LINE (ALTERNATIVE)

OPEN FACE CRIB ELEVATION



WALL STEP DETAILS

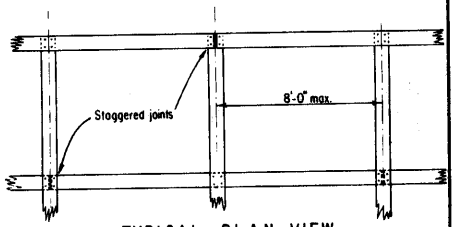
Wall stability based on 1½ : 1 unlimited sloping surcharge

APPROVAL RECOMMENDED

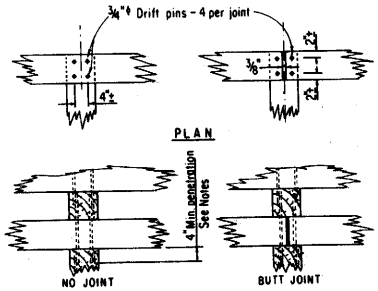
Engineer of Design
Civil Engineer License No

Approved September 1, 1966

State Highway Engineer
Civil Engineer License No. 53465

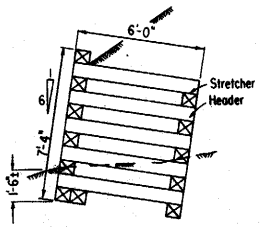


TYPICAL PLAN VIEW

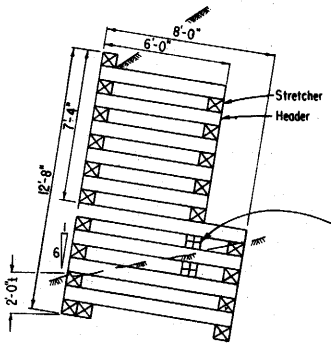


TYPICAL END CONNECTIONS

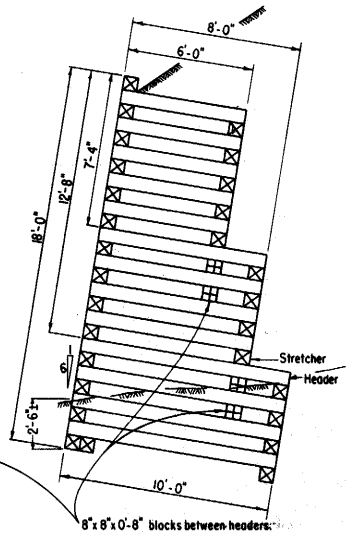
TIMBER PER 8 FT. CRIB SECTION					
HEIGHT OF WALL	HEADERS 6'-0"	8'-0"	10'-0"	12'-0"	STRETCHERS
4'-8"	3				7
6'-0"	4				9
7'-4"	5				11
8'-8"	4	2			13
10'-0"	5	2			15
11'-4"	5	3			17
12'-8"	5	4			20
14'-0"	5	3	2		22
15'-4"	5	4	2		24
16'-8"	5	4	3		26
18'-0"	5	4	4		28
19'-4"	5	4	3	2	32
20'-8"	5	4	4	2	38
22'-0"	5	4	4	3	43



TYPE A

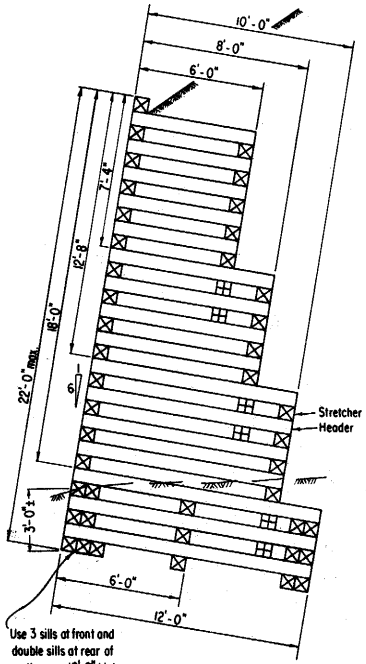


TYPE B



8"x8"x0'-8" blocks between headers. Use two courses at each change in crib section. Blocks to be toe-nailed with 2-16d nails

TYPE C



Use 3 sills at front and double sills at rear of walls over 18'-0" high.

TYPE D

NOTES:

1. All timber to be 8"x8" rough, construction grade Douglas Fir, treated after fabrication. All required cuts or bored holes to be swabbed with 2 coats of the same type of preservative used for treating the timber.
2. Drift pins and holes to be ¾" ϕ
3. Drift pins to be of sufficient length to penetrate thru 2 members and 4" min. into the third member.
4. All stretchers to be laid horizontal.
5. Walls 12'-8" or less in height may be constructed with no batter.
6. Maximum allowable wall height is 22'-0".
7. All walls 18'-0" high or under shall have double sills at front and single sill at rear. When wall exceeds 7'-4", 12'-8" or 18'-0", use a minimum of two courses of next longer headers.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

TIMBER CRIB WALL

C9-1

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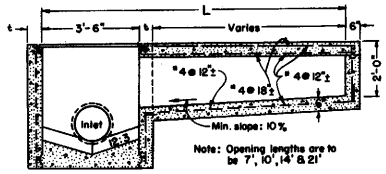
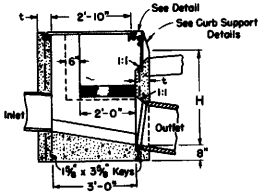
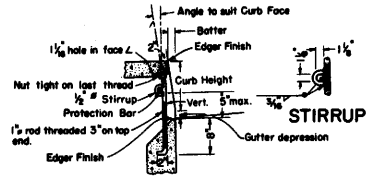


SECTION A-A



SECTION B-B



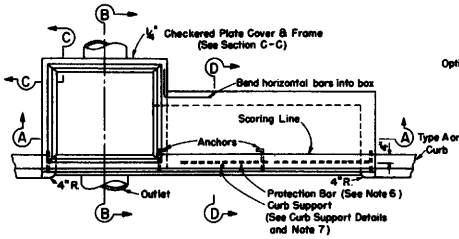
CURB SUPPORT DETAILS
(Shown for Type A Curbs)

APPROVAL RECOMMENDED

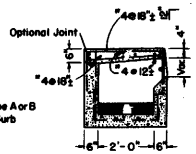
Engineer of Design
Registered Civil Engineer No. 9837

APPROVED September 1, 1966

State Highway Engineer
Registered Civil Engineer No. 5945

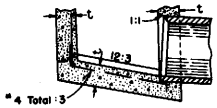


PLAN

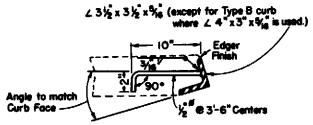


SECTION D-D

INLET TYPE OL



ALTERNATIVE REINFORCED BOTTOM



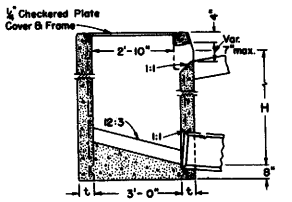
FACE ANGLE ANCHOR DETAIL

Length of Curb Opening	No. of Anchors
3'-6" or less	2
7'-0"	3
10'-0"	4
14'-0"	5
21'-0"	7

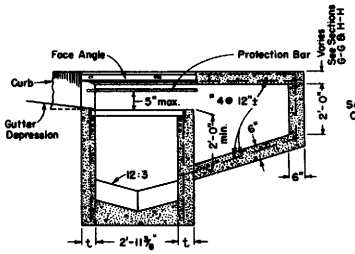
H	t
8'-0" or Less	6"
8'-1" to 20'-0"	8"

GENERAL NOTES

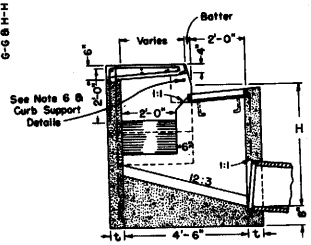
1. "H" is the difference in elevation between the outlet pipe flow line and the normal gutter grade line undepressed at the curb face.
2. For "t" wall thickness see Table.
3. Height of curb opening will vary with the type of curb and the depth of the local depression.
4. Reinforcing steel in walls shall be #4 bars @ 18" centers placed 1½" clear to inside of box unless otherwise shown.
5. Steps - None required where "H" is 3'-6" or less. Install one step 16" above floor when "H" is more than 3'-6" and less than 5'-0". Where "H" is more than 5'-0", steps shall be evenly spaced @ 12" intervals from 16" above floor to within 12" of the top of the box. Place steps in wall without pipe openings.
6. When shown on the plans, Place a #5 protection bar horizontally across the entire length of the opening and bend back 4" into the inlet wall on each side.
7. Curb openings longer than 7' shall have one curb support for each 7' increment or fraction thereof, evenly spaced.
8. Pipe (s) can be placed in any wall.
9. Curb section shall match adjacent curb.
10. Except for inlets used as junction boxes, basin floors shall have a minimum slope of 12:3 from all directions toward outlet pipe and shall have a wood trowel finish.
11. Galvanizing: See Standard Specifications or Special Provisions.
12. See "Standard Grate Details" D77- for Grate and Frame Details and Weights of Miscellaneous Iron and Steel.
13. See Standard Plan D78- or D79- for Depression Details.
14. Full penetration butt welds may be substituted for the fillet welds on all anchors.
15. Standard square, hexagon, round or equivalent headed anchors may be substituted for the right angle hooks on the anchors shown on this plan.



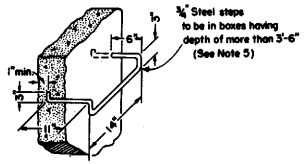
SECTION E-E



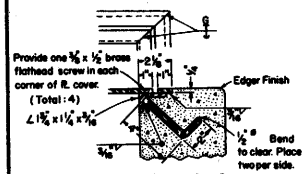
SECTION F-F



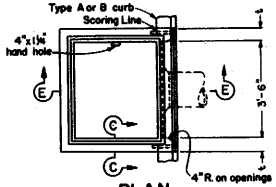
SECTION G-G



STEP DETAIL

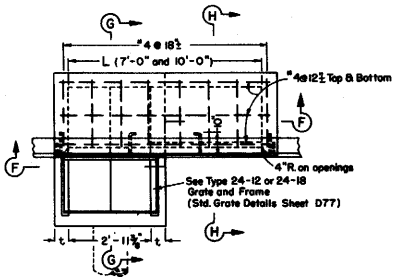


SECTION C-C



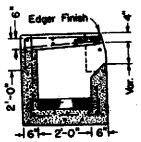
PLAN

INLET TYPE OS

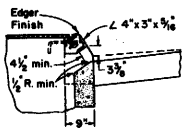


PLAN

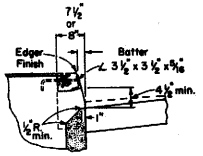
INLET TYPE GOL



SECTION H-H



TYPE B CURBS



TYPE A CURBS

CURB OPENING DETAILS

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

STORM DRAIN INLETS D72-5

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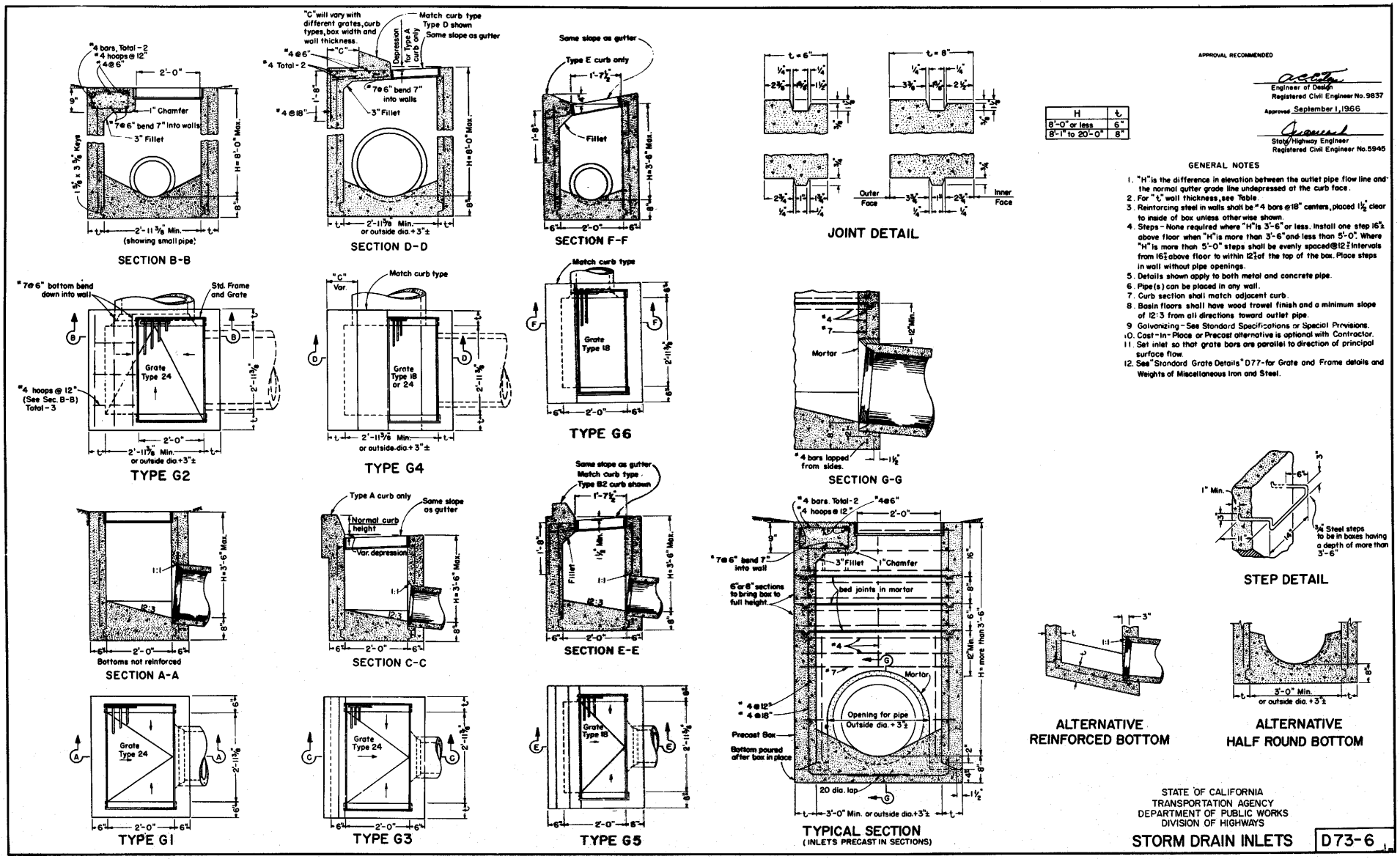

H	t
8'-0" or less	6"
8'-1" to 20'-0"	8"

APPROVAL RECOMMENDED

Engineer of Design
Registered Civil Engineer No. 9837

Approved September 1, 1966

State Highway Engineer
Registered Civil Engineer No. 5945

GENERAL NOTES

1. "H" is the difference in elevation between the outlet pipe flow line and the normal gutter grade line undepressed at the curb face.
2. For "t" wall thickness, see Table.
3. Reinforcing steel in walls shall be #4 bars @18" centers, placed 1½" clear to inside of box unless otherwise shown.
4. Steps - None required where "H" is 3'-6" or less. Install one step 16½" above floor when "H" is more than 3'-6" and less than 5'-0". Where "H" is more than 5'-0" steps shall be evenly spaced @12½" intervals from 16½" above floor to within 12½" of the top of the box. Place steps in wall without pipe openings.
5. Details shown apply to both metal and concrete pipe.
6. Pipe(s) can be placed in any wall.
7. Curb section shall match adjacent curb.
8. Basin floors shall have wood trowel finish and a minimum slope of 12:3 from all directions toward outlet pipe.
9. Galvanizing - See Standard Specifications or Special Provisions.
10. Cast-in-Place or Precast alternative is optional with Contractor.
11. Set inlet so that grate bars are parallel to direction of principal surface flow.
12. See "Standard Grate Details" D77 - for Grate and Frame details and Weights of Miscellaneous Iron and Steel.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

STORM DRAIN INLETS

D73-6

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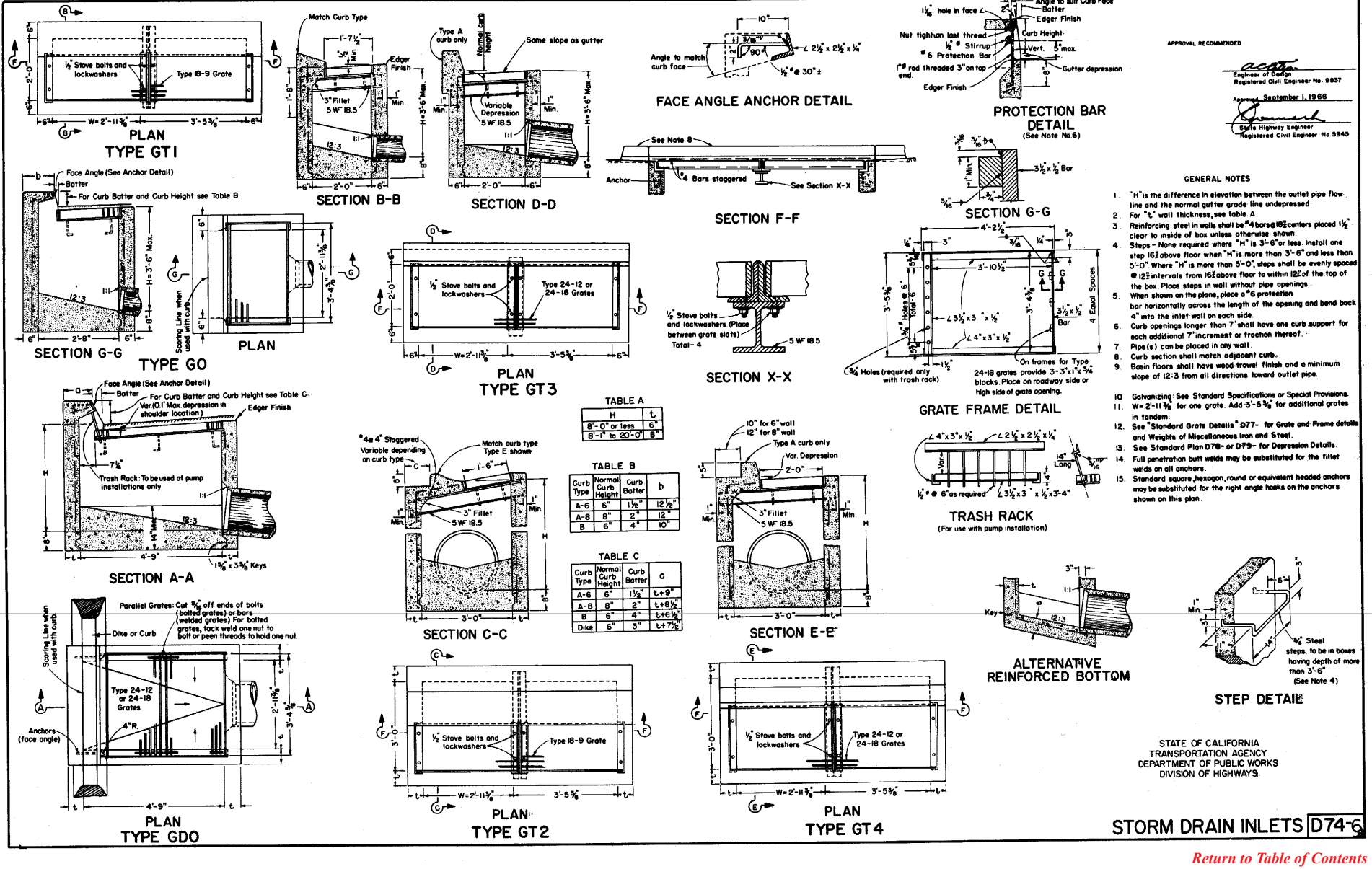

APPROVAL RECOMMENDED

Engineer of Design
Registered Civil Engineer No. 9837

Approved September 1, 1966

State Highway Engineer
Registered Civil Engineer No. 5945

GENERAL NOTES

1. "H" is the difference in elevation between the outlet pipe flow line and the normal gutter grade line undepressed.
2. For "t" wall thickness, see table A.
3. Reinforcing steel in walls shall be #4 bars @ 18" centers placed 1½" clear to inside of box unless otherwise shown.
4. Steps - None required where "H" is 3'-6" or less. Install one step 16" above floor when "H" is more than 3'-6" and less than 5'-0". Where "H" is more than 5'-0", steps shall be evenly spaced @ 12" intervals from 16" above floor to within 12" of the top of the box. Place steps in wall without pipe openings.
5. When shown on the plans, place a #6 protection bar horizontally across the length of the opening and bend back 4" into the inlet wall on each side.
6. Curb openings longer than 7' shall have one curb support for each additional 7' increment or fraction thereof.
7. Pipe(s) can be placed in any wall.
8. Curb section shall match adjacent curb.
9. Basin floors shall have wood trowel finish and a minimum slope of 12:3 from all directions toward outlet pipe.
10. Galvanizing: See Standard Specifications or Special Provisions.
11. W = 2'-11⅜" for one grate. Add 3'-5⅜" for additional grates in tandem.
12. See "Standard Grate Details" D77- for Grate and Frame details and Weights of Miscellaneous Iron and Steel.
13. See Standard Plan D78- or D79- for Depression Details.
14. Full penetration butt welds may be substituted for the fillet welds on all anchors.
15. Standard square, hexagon, round or equivalent headed anchors may be substituted for the right angle hooks on the anchors shown on this plan.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

STORM DRAIN INLETS D74-6

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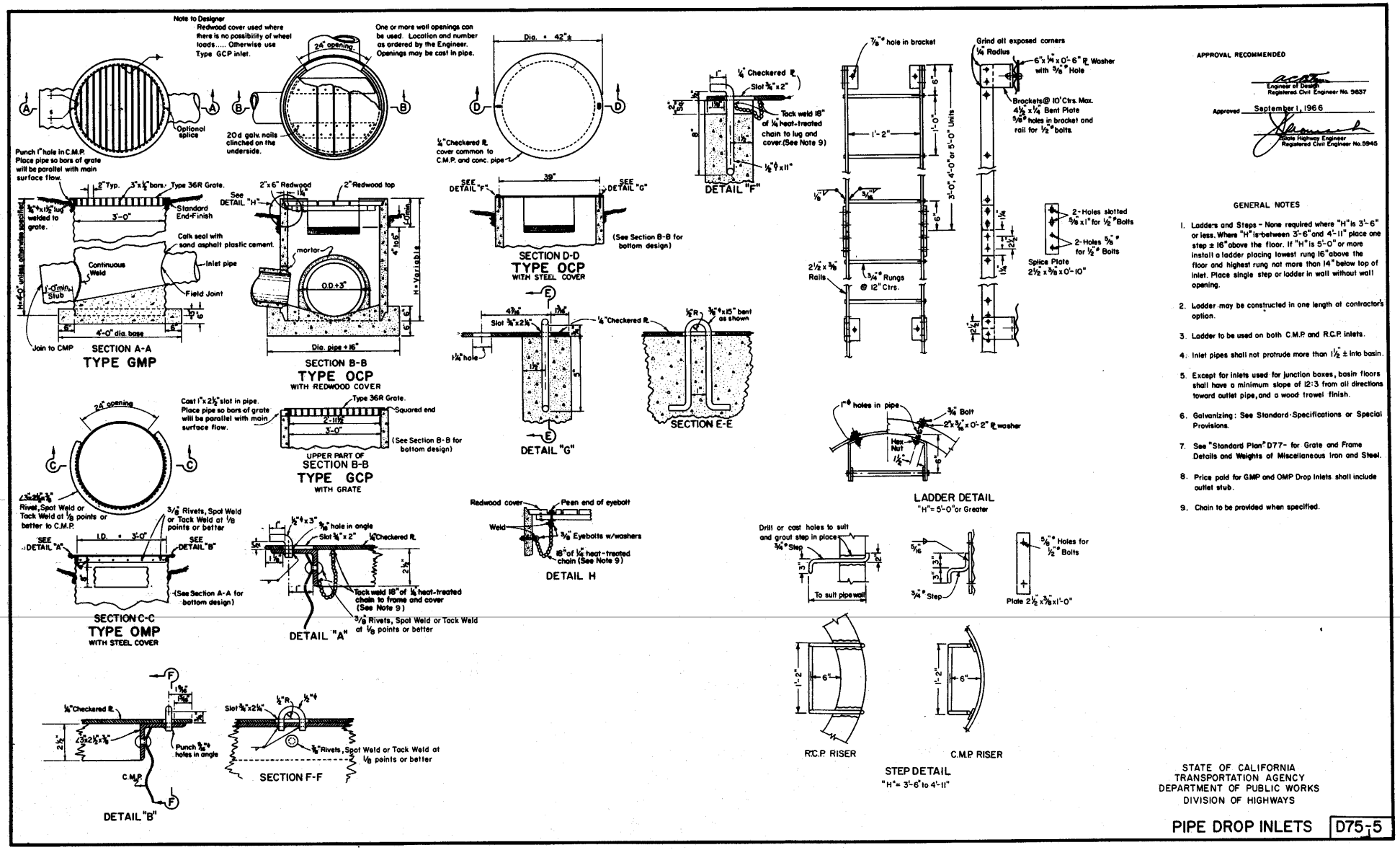

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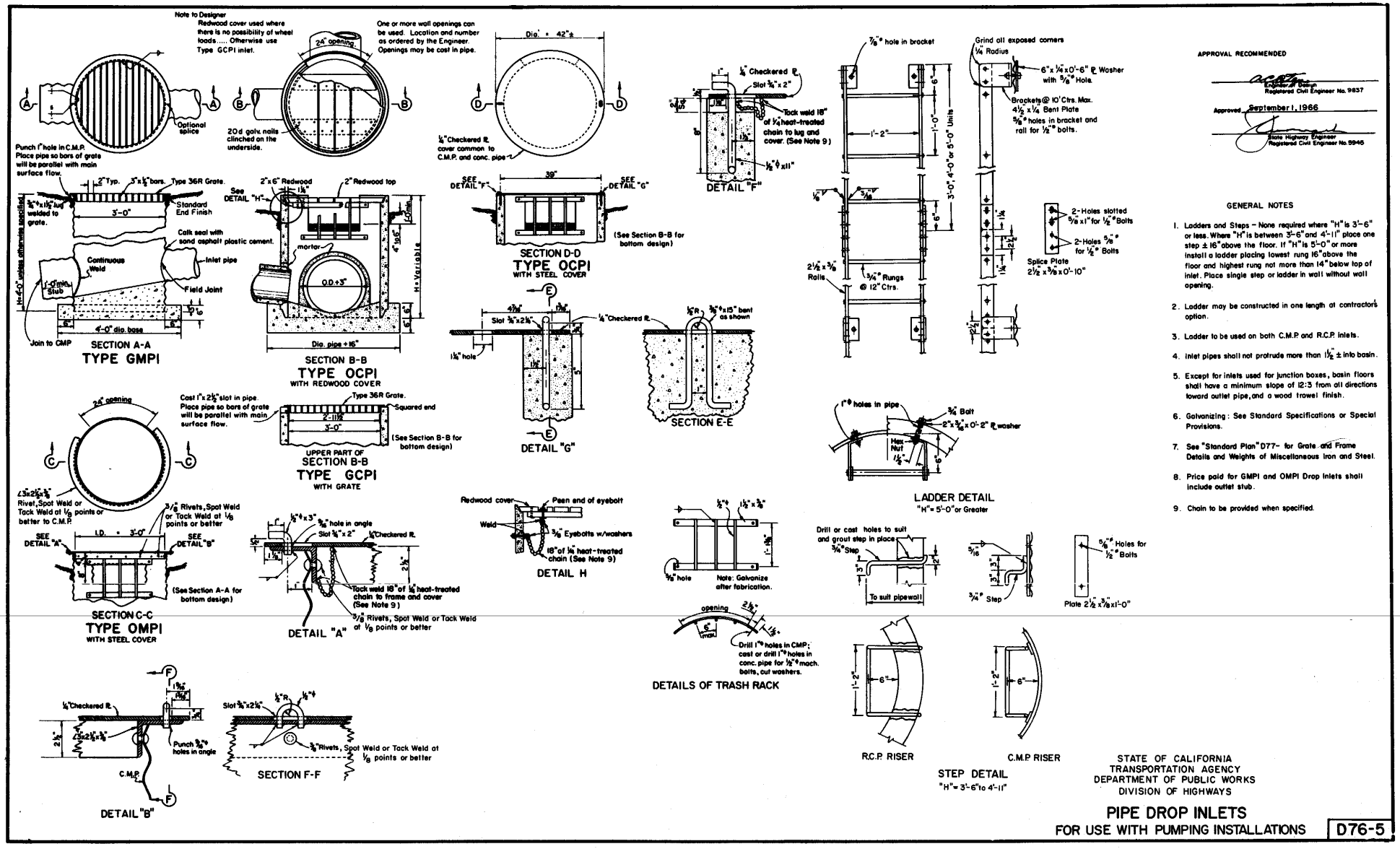

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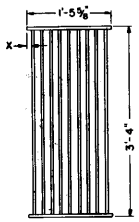
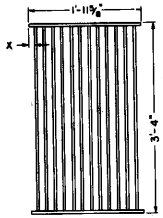


TYPE 18-9
1 3/8" Clear Spacing
Use within the roadbed on highways where bicycles and pedestrians are excluded – or for rural conditions.

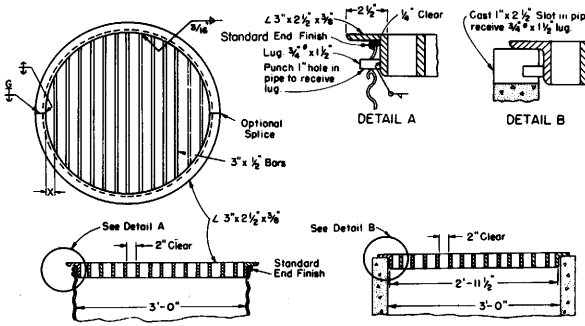


TYPE 24-18
3/4" Clear Spacing
Use within the roadbed under urban conditions where bicycles and pedestrians are permitted.

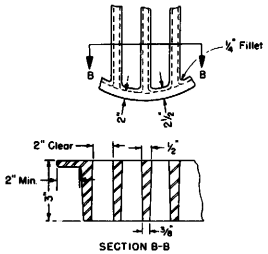
TYPE 24-12
1 3/8" Clear Spacing
Use within the roadbed on highways where bicycles and pedestrians are excluded – or for rural conditions.

TYPE 24-9
2" Clear Spacing
Use in locations off the roadbed on all types of highways.

RECTANGULAR GRATE DETAILS
(SEE TABLE BELOW)



TYPE 36R GRATE DETAILS



ALTERNATIVE CAST NODULAR IRON GRATE OR CAST STEEL GRATE TYPE 36R

APPROVAL RECOMMENDED

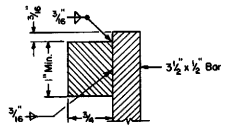
Engineer of Design
Registered Civil Engineer No.

Approved September 1, 1966

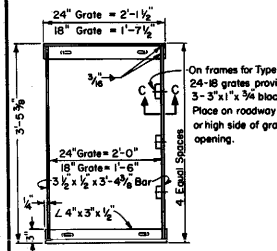
State Highway Engineer
Registered Civil Engineer No. 5945

GENERAL NOTES

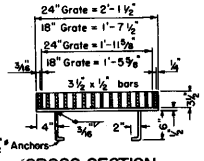
1. Grate type numbers refer to width of grate in inches and number of bars, respectively.
2. Contractor has the option of using cast nodular iron, cast steel, welded, bolted or cast end block grate.
3. Grates and frames may be galvanized or asphalt dipped See Standard Specifications or Special Provisions.
4. Rounded top of bars optional on all grates.
5. Pipe drop inlets with a grate shall be placed so that bars parallel direction of principle surface flow.
6. Full penetration butt welds may be substituted for the fillet welds on all anchors.
7. Standard square, hexagon, round or equivalent headed anchors may be substituted for the right angle hooks on the anchors shown on this plan.



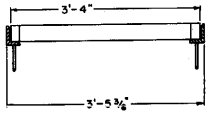
SECTION C-C



TYPICAL FRAME

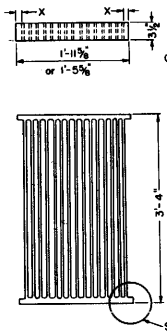


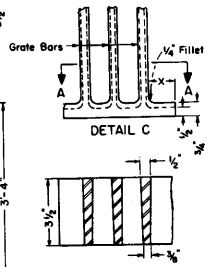
CROSS SECTION
(Thru Frame and Grate)



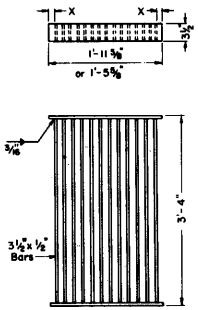
LONGITUDINAL SECTION
(Thru Frame and Grate)

RECTANGULAR FRAME DETAILS
(For all Rectangular Grates)

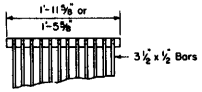




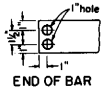
ALTERNATIVE CAST NODULAR IRON GRATE OR CAST STEEL GRATE



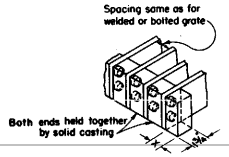
ALTERNATIVE WELDED GRATE



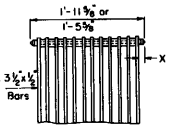
CAST END BLOCK



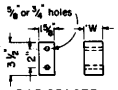
END OF BAR



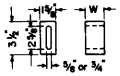
ALTERNATIVE CAST NODULAR IRON OR CAST STEEL END BLOCK GRATE



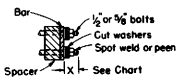
BOLTED END BLOCK



BAR SPACER



ALTERNATIVE SPACER
3/4", 1 3/8" or 2"



BOLTING DETAIL

ALTERNATIVE BOLTED GRATE

TYPE	NO. BARS	CLEAR BAR SPACING	X
18-9	9	1 7/8"	1 1/16"
24-9	9	2"	1 9/16"
24-12	12	1 3/8"	1 1/4"
24-18	18	3/4"	15/16"
36R	13	2"	2 1/8"

GRATE BAR SPACING TABLE

INLET TYPE	COVER TYPE	WEIGHT	PROTECT. BAR WT.
OS	PLATE	184	6
OL-7	PLATE	210	12
OL-10	PLATE	236	16
OL-14	PLATE	265	22
OL-21	PLATE	321	33
OCP	PLATE	109	
OCPI	PLATE	122	
OCPI	REDWOOD	13	
OMP	PLATE	180	
OMPI	PLATE	193	

INLET TYPE	GRATE TYPE	WEIGHT	PROTECT. BAR WT.
GDO	24-12	642	5
	24-18	787	5
GOL-7	24-12	360	12
	24-18	477	12
GOL-10	24-12	406	16
	24-18	503	16
G1,G2,G3,G4(24")	24-9	270	
	24-12	321	
	24-18	418	
G4(18") G5,G6	18-9	251	
GT-1	18-9	555	
GT-2	18-9	573	
GT-3	24-12	693	
	24-18	842	
GT-4	24-12	712	
	24-18	860	
GMP,GCP	36R	224	
GMPI,GCPI	36R	224	

BASIS FOR MISC. IRON & STEEL FINAL PAY WEIGHTS FOR STORM DRAIN INLETS

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

GRATE DETAILS

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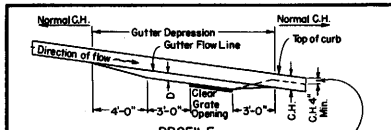
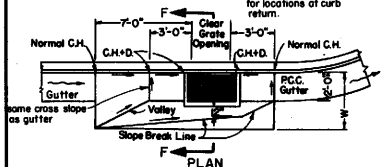


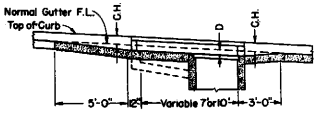
PROFILE

Alternative Gutter Line for locations at curb return.

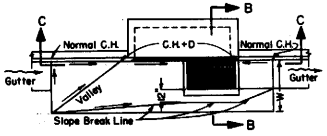


PLAN

TYPE G_1 THRU G_6 INLETS ON GRADE

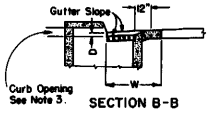


SECTION C-C

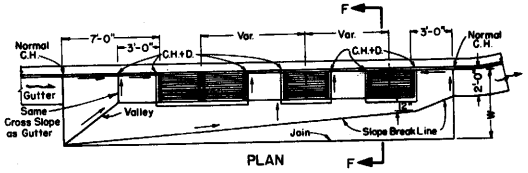


PLAN

TYPE GOL INLET ON GRADE

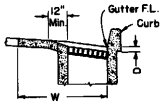


SECTION B-B

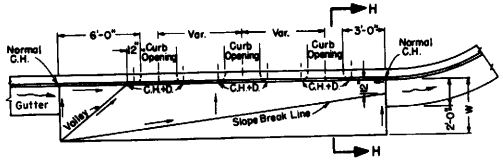


PLAN

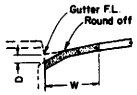
GRATE INLET IN SERIES



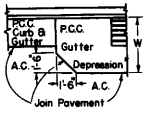
SECTION F-F



TYPE OS & OL INLETS IN SERIES ON GRADE

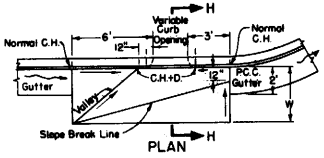


SECTION H-H



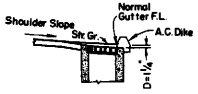
DETAIL OF ASPHALT CONCRETE PAVEMENT

(See Note 4)



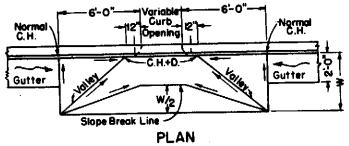
PLAN

TYPE OS & OL INLETS ON GRADE



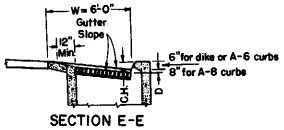
DETAIL OF INLET WITH DIKE

(SINGLE GRATE SHOWN)

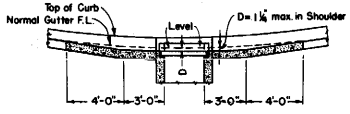


PLAN

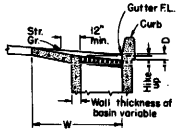
TYPE OS & OL INLETS IN GRADE SAG



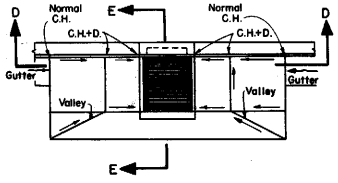
SECTION E-E



SECTION D-D

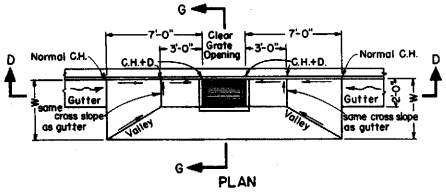


SECTION G-G



PLAN

TYPE GDO INLET IN GRADE SAG



PLAN

TYPE G_1 THRU G_6, GT3 & GT4 INLETS IN GRADE SAG

APPROVAL RECOMMENDED

Engineer of Design
Registered Civil Engineer No. 9837

Approved September 1, 1966

State Highway Engineer
Registered Civil Engineer No. 5945

GENERAL NOTES

1. W = Width of depressed apron and shall be 4' on shoulders and 4' to 6' in city street gutters unless otherwise shown.
   D = Gutter Depression. It shall be 1¼" for shoulders and 1¼" to 3" in city street gutters or locations outside of shoulders unless otherwise shown.
   C.H. = Curb Height.
   —→ = Straight Grade, Downward Slope.
   —·→ = Gutter or Shoulder direction of flow.
2. Gutter depressions shall be Class "B" P.C.C. 8" thick.
3. Establish curb opening height at midpoint of grate.
4. Details shown for P.C.C. pavement. When A.C. pavement is used corners to be cut off as shown on Detail of Asphalt Concrete Pavement.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

GUTTER DEPRESSIONS

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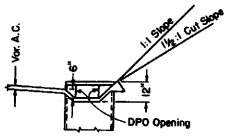
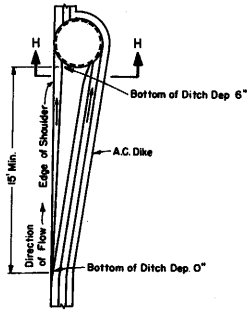
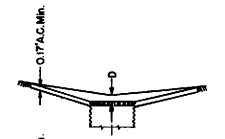


SECTION H-H

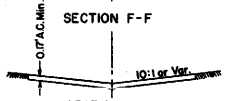


PLAN

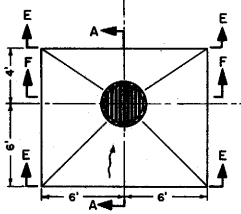
TYPE OCP & OMP INLETS ON A GRADE IN CUT



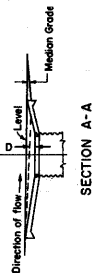
SECTION F-F



SECTION E-E



PLAN



SECTION A-A

TYPE GCP & GMP INLETS
(In Wide Median)

APPROVAL RECOMMENDED

Engineer of Design
Registered Civil Engineer No. 9857

Approved September 1, 1966

State Highway Engineer
Registered Civil Engineer No. 5945

GENERAL NOTES

1. D = Median Depression is 0.35' for grades flatter than 2% and 0.50' for grades 2% and steeper.
   → = Straight Grade, Downward Slope.
   ⇝ = Gutter or Shoulder direction of flow.
2. Depression aprons shall be constructed of a minimum of 0.17' asphalt concrete unless otherwise noted.
3. No depression shall encroach on shoulder area.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

PIPE INLET DEPRESSIONS D79-1

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SPAN	2'		3'			4'					
HEIGHT	1'-6"	2'	2'	3'		2'	3'		4'		
STRENGTH CLASSIFICATION	A	A	A	A	B	A	A	B	A	B	C
MAX. FILL OVER TOP	66		38	38	66	28	28	37	28	37	50
Conc. Top Slab T_1	6	6	6¼	6¼	8	7	7	8	7	8	9
Conc. Bottom Slab T_2	6	6	6¼	6¼	8	7	7	8	7	8	9
Conc. Sidewalls T_3	6	6	6	6	6	6	6	6	6	6	6
Reinforcing Steel "a" Size: Bar #	4	4	4	4	5	5	5	5	5	5	6
"a" Spacing	3½	3½	3½	3½	4	5	5	4½	5	4½	5
"a" Length	3-2	3-2	4-2	4-2	4-3	5-3	5-3	5-3	5-3	5-3	5-2
"d" Dist. Bars Top Slab-No. of	2	2	3	3	2	5	5	3	5	3	3
"d" Dist. Bars Bottom Slab-No. of	2	2	2	2	2	3	3		3		3
"e" Bars Spacing	18	18	18	18	12½	18	18	18	17	13	9½
Spacers Number	12	12	12	12		12	12		14		
Quan. Concrete: C.Y. per lin. ft.	.17	.18	.23	.27	.31	.29	.33	.36	.36	.40	.43
Quan. Reinf. lbs. per lin. ft.	27	29	34	36	46	44	45	47	48	52	64
Hydraulics Area A	3	4	6	9		8	12		16		
Hydraulic Radius R	.43	.50	.60	.75		.67	.86		1.00		
Neutral Slope %	.83	.91	.73	.82		.64	.70		.77		
Head Factor k	1.30	1.07	.85	.65		.75	.55		.45		
Entrance Capacity Q_{10}	11	17	26	48		35	64		99		
Design Discharge Q_{100}	18	28	43	79		58	107		163		

SPAN	5'											
HEIGHT	2'		3'		4'				5'			
STRENGTH CLASSIFICATION	A	B	A	B	A	B	C	D	A	B	C	D
MAX. FILL OVER TOP	12	27	12	27	11	26	35	46	11	25	35	46
Conc. Top Slab T_1	7½	8	7½	8	7½	8	9½	10½	7¼	8	9½	10½
Conc. Bottom Slab T_2	6	8	6	8	6	8	10	10¾	6	8	10	10¾
Conc. Sidewalls T_3	6	6	6	6	6	6	6	6	6	6	6	6
Reinforcing Steel "a" Size: Bar #	5	5	5	5	5	5	6	6	5	5	6	6
"a" Spacing	4	4	4	4	4	4	5	4½	4	4	5	4½
"a" Length	6-3	6-3	6-3	6-3	6-3	6-3	6-2	6-2	6-3	6-3	6-2	6-2
"d" Dist. Bars Top Slab-No. of	7	3	7	3	7	3		3	7	3		3
"d" Dist. Bars Bottom Slab-No. of	3		3		3			3	3	3		3
"e" Bars Spacing	18	18	18	18	18	17	13	11	18	12	8½	6½
Spacers Number	14		14		14				16			
Quan. Concrete: C.Y. per lin. ft.	.32	.37	.36	.41	.40	.44	.51	.54	.43	.48	.55	.57
Quan. Reinf. lbs. per lin. ft.	57	56	59	57	61	60	68	75	63	65	77	87
Hydraulics Area A	10		15		20				25			
Hydraulic Radius R	.71		.94		1.11				1.25			
Neutral Slope %	.59		.62		.67				.73			
Head Factor k	.69		.49		.39				.34			
Entrance Capacity Q_{10}	43		80		123				172			
Design Discharge Q_{100}	71		132		203				284			

SPAN	6'																				
HEIGHT	2'		3'		4'			5'				6'					7'				
STRENGTH CLASSIFICATION	A	B	A	B	A	B	C	A	B	C	D	A	B	C	D	E	A	B	C	D	E
MAX. FILL OVER TOP	10	18	10	18	10	18	25	9	18	25	36	9	17	25	36	45	9	17	25	36	45
Conc. Top Slab T_1	8¼	8¼	8¼	8¼	8¼	8¼	9¼	8¼	8¼	9¼	11	8¼	8¼	9¼	11	12	8¼	8¼	9¼	11	12
Conc. Bottom Slab T_2	6¾	8	6¾	8	6¾	8	9¾	7¼	8¼	10	11¼	7¼	8¼	10½	11¼	12¼	7¼	8¼	10½	11¼	12¼
Conc. Sidewalls T_3	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6¼	7	6	6	6¼	7	7¾
Reinforcing Steel "a" Size: Bar #	5	5	5	5	5	5	6	5	5	6	6	5	5	6	7	7	5	5	6	7	7
"a" Spacing	4	4	4	4	4	4	5	4	4	5	4½	4	4	5	5½	5	4	4	5	5½	5
"a" Length	7-3	7-3	7-3	7-3	7-3	7-3	7-2	7-3	7-3	7-2	7-2	7-3	7-3	7-2	7-3	7-5	7-3	7-3	7-2	7-5	7-6
"d" Dist. Bars Top Slab-No. of	7	4	7	4	7	4		7	4		4	7	4		4	4	7	4		4	4
"d" Dist. Bars Bottom Slab-No. of	4		4		4			4			4	4			4	4	4			4	4
"e" Bars Spacing	18	18	18	18	18	18	17	18	15½	11½	8½	17	10½	7½	6	5	12	7½	7	5	4½
Spacers Number	12		12		14			16				16					18				
Quan. Concrete: C.Y. per lin. ft.	.40	.42	.43	.46	.47	.50	.58	.52	.54	.60	.66	.56	.58	.65	.71	.78	.59	.61	.70	.78	.88
Quan. Reinf. lbs. per lin. ft.	64	63	66	65	69	67	74	70	70	80	91	73	78	92	112	127	81	90	99	126	139
Hydraulics Area A	12		18		24			30				36					42				
Hydraulic Radius R	.75		1.00		1.20			1.36				1.50					1.62				
Neutral Slope %	.53		.56		.59			.62				.66					.71				
Head Factor k	.645		.45		.358			.305				.271					.247				
Entrance Capacity Q_{10}	52		96		148			207				272					343				
Design Discharge Q_{100}	86		159		244			341				448					565				

Note:

For boxes of height less than that shown in table, use next greater table height slabs, wall dimensions and reinforcing steel, and make necessary changes in bar lengths, number of spacers and quantities.

APPROVAL RECOMMENDED

(signature)

BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO. 5585

APPROVED SEPTEMBER 1, 1966

(signature)

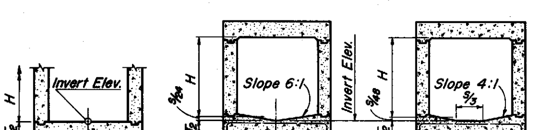
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5945

SPAN	7'												
HEIGHT	3'		4'		5'			6'			7'		
STRENGTH CLASSIFICATION	A	B	A	B	A	B	C	A	B	C	A	B	C
MAX. FILL OVER TOP	16	26	16	26	16	26	35	16	26	35	16	26	35
Conc. Top Slab T_1	7¼	8¼	7¼	8¼	7¼	8¼	9¾	7¼	8¼	9¾	7¼	8¼	9¾
Conc. Bottom Slab T_2	7½	8¾	7½	8¾	7½	8¾	10½	7½	8¾	10½	7½	8¾	10½
Conc. Sidewalls T_3	6	7	6	7	6	7	8½	6	7	8½	6	7	8½
Reinforcing Steel "a" Size: Bar #	5	5	5	5	5	5	6	5	5	6	5	5	6
"a" Spacing	9	7	9	7	9	7	9	9	7	9	9	7	9
"a" Length	6-8	6-9	6-8	6-9	6-8	6-9	6-10	6-8	6-9	6-10	6-8	6-9	6-10
"b" Size: Bar #	5	5	5	5	5	5	6	5	5	6	5	5	6
"b" Spacing	9	7	9	7	9	7	9	9	7	9	9	7	9
"b" Dimension "X"	1-3	1-4	1-3	1-4	1-3	1-4	1-8	1-3	1-4	1-8	1-3	1-4	1-8
"b" Length	3-1	3-2	3-1	3-2	3-1	3-2	3-10	3-1	3-2	3-10	3-1	3-2	3-10
"c" Size: Bar #	5	5	5	5	5	5	6	5	5	6	5	5	6
"c" Spacing	9	7	9	7	9	7	9	9	7	9	9	7	9
"c" Dimension "Y"	1-10	1-11	1-10	1-11	1-10	1-11	2-3	1-10	1-11	2-3	1-10	1-11	2-3
"c" Length	5-2	5-4	6-2	6-4	7-2	7-4	7-10	8-2	8-4	8-10	9-2	9-4	9-10
"c1" Size: Bar #	5	5	5	5	5	5	6	5	5	6	5	5	6
"c1" Spacing	9	7	9	7	9	7	9	9	7	9	9	7	9
"c1" Dimension "Y"	1-10	1-11	1-10	1-11	1-10	1-11	2-3	1-10	1-11	2-3	1-10	1-11	2-3
"c1" Length	3-8	3-10	3-8	3-10	3-8	3-10	4-6	3-8	3-10	4-6	3-8	3-10	4-6
"d" Bars Top Slab-No. of	7	4	7	4	7	4	4	7	4	4	7	4	4
"d" Bars Bottom Slab-No. of	4	4	4	4	4	4	4	4	4	4	4	4	4
"e" Bars Spacing	18	18	18	18	18	18	18	18	18	18	18	18	18
Spacers Total Number	24		28		28			32			36		
Quan. Concrete: C.Y. per lin. ft.	.47	.56	.51	.60	.55	.64	.78	.58	.68	.84	.62	.73	.89
Quan. Reinf: lbs. per lin. ft.	107	130	114	138	118	143	168	125	150	176	132	158	184
Hydraulics Area A	21		28		35			42			49		
Hydraulic Radius R	1.05		1.27		1.46			1.62			1.75		
Neutral Slope %	0.52		0.54		0.57			0.61			0.64		
Head Factor k	0.423		0.332		0.281			0.247			0.224		
Entrance Capacity Q_{10}	112		173		241			317			400		
Design Discharge Q_{100}	185		285		398			523			659		

SPAN	8'														
HEIGHT	3'		4'		5'		6'			7'			8'		
STRENGTH CLASSIFICATION	A	B	A	B	A	B	A	B	C	A	B	C	A	B	C
MAX. FILL OVER TOP	13	21	13	21	13	21	13	21	31	13	21	31	13	21	31
Conc. Top Slab T_1	7¼	8½	7¼	8½	7¼	8½	7¼	8½	10¼	7¼	8½	10¼	7¼	8½	10¼
Conc. Bottom Slab T_2	7¼	9½	7¼	9½	7¼	9½	7½	9½	11½	7½	9½	11½	7½	9½	11½
Conc. Sidewalls T_3	6½	7½	6½	7½	6½	7½	6½	7½	9¾	6½	7½	9¾	6½	7½	9¾
Reinforcing Steel "a" Size: Bar #	5	5	5	5	5	5	5	5	6	5	5	6	5	5	6
"a" Spacing	9	7	9	7	9	7	9	7	8	9	7	8	9	7	8
"a" Length	7-7	7-8	7-7	7-8	7-7	7-8	7-7	7-8	7-10	7-7	7-8	7-10	7-7	7-8	7-10
"b" Size: Bar #	5	5	5	5	5	5	5	5	6	5	5	6	5	5	6
"b" Spacing	9	7	9	7	9	7	9	7	8	9	7	8	9	7	8
"b" Dimension "X"	1-6	1-7	1-6	1-7	1-6	1-7	1-6	1-7	1-8	1-6	1-7	1-8	1-6	1-7	1-8
"b" Length	3-4	3-5	3-4	3-5	3-4	3-5	3-4	3-5	3-10	3-4	3-5	3-10	3-4	3-5	3-10
"c" Size: Bar #	5	5	5	5	5	5	5	5	6	5	5	6	5	5	6
"c" Spacing	9	7	9	7	9	7	9	7	8	9	7	8	9	7	8
"c" Dimension "Y"	2-0	2-5	2-0	2-5	2-0	2-5	2-0	2-5	2-8	2-0	2-5	2-8	2-0	2-5	2-8
"c" Length	5-4	5-10	6-4	6-10	7-4	7-10	8-4	8-10	9-3	9-4	9-10	10-3	10-4	10-10	11-3
"c1" Size: Bar #	5	5	5	5	5	5	5	5	6	5	5	6	5	5	6
"c1" Spacing	9	7	9	7	9	7	9	7	8	9	7	8	9	7	8
"c1" Dimension "Y"	2-0	2-5	2-0	2-5	2-0	2-5	2-0	2-5	2-8	2-0	2-5	2-8	2-0	2-5	2-8
"c1" Length	3-9	4-5	3-9	4-5	3-9	4-5	3-9	4-5	5-0	3-9	4-5	5-0	3-9	4-5	5-0
"d" Bars Top Slab-No. of	7	5	7	5	7	5	7	5	5	7	5	5	7	5	5
"d" Bars Bottom Slab-No. of	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
"e" Bars Spacing	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Spacers Total Number	28		32		32		36			40			40		
Quan. Concrete: C.Y. per lin. ft.	.52	.65	.56	.70	.60	.74	.65	.79	1.00	.69	.83	1.06	.73	.88	1.12
Quan. Reinf: lbs. per lin. ft.	118	146	125	154	129	159	136	167	211	143	174	220	147	179	225
Hydraulics Area A	24		32		40		48			56			64		
Hydraulic Radius R	1.09		1.33		1.54		1.71			1.87			2.00		
Neutral Slope %	0.50		0.52		0.54		0.56			0.59			0.62		
Head Factor k	0.404		0.314		0.262		0.229			0.206			0.189		
Entrance Capacity Q_{10}	128		197		276		362			457			558		
Design Discharge Q_{100}	212		326		455		597			753			921		

SPAN	10'																
HEIGHT	4'		5'		6'		7'		8'			9'			10'		
STRENGTH CLASSIFICATION	A	B	A	B	A	B	A	B	A	B	C	A	B	C	A	B	C
MAX. FILL OVER TOP	9	18	9	18	9	18	9	18	8	18	28	8	18	28	8	18	28
Conc. Top Slab T_1	8	9½	8¼	9¾	8¼	9¾	8½	9¾	8½	9¾	12¼	8½	9¾	12¼	8½	9¾	12¼
Conc. Bottom Slab T_2	8¾	10½	9	10¾	9	10¾	9¼	11	9¼	11	13¼	9¼	11	13¼	9¼	11	13½
Conc. Sidewalls T_3	7¼	9½	7¼	9½	7¼	9½	7¼	9½	7¼	9½	11½	8	9½	11½	9	9½	11½
Reinforcing Steel "a" Size: Bar #	6	6	6	6	6	6	6	6	6	6	7	6	6	7	6	6	7
"a" Spacing	11	8	11	8	11	8	11	8	11	8	9	11	8	9	11	8	9
"a" Length	9-5	9-8	9-5	9-8	9-5	9-8	9-5	9-8	9-5	9-8	9-9	9-6	9-8	9-9	9-7	9-8	9-9
"b" Size: Bar #	5	6	5	6	5	6	5	6	5	6	6	5	6	6	5	6	6
"b" Spacing	11	8	11	8	11	8	11	8	11	8	9	11	8	9	11	8	9
"b" Dimension "X"	2-0	2-0	2-0	2-0	2-0	2-0	2-0	2-0	2-0	2-0	2-6	2-0	2-0	2-6	2-0	2-0	2-6
"b" Length	3-10	4-2	3-10	4-2	3-10	4-2	3-10	4-2	3-10	4-2	4-8	3-10	4-2	4-8	3-10	4-2	4-8
"c" Size: Bar #	5	6	5	6	5	6	5	6	5	6	6	5	6	6	5	6	6
"c" Spacing	11	8	11	8	11	8	11	8	11	8	9	11	8	9	11	8	9
"c" Dimension "Y"	2-8	3-4	2-8	3-4	2-8	3-4	2-8	3-4	2-8	3-4	3-6	2-8	3-4	3-6	2-8	3-4	3-6
"c" Length	6-11	7-10	8-1	8-10	9-1	9-10	10-1	10-10	11-1	11-10	12-3	12-1	12-10	13-3	13-1	13-10	14-3
"c1" Size: Bar #	5	6	5	6	5	6	5	6	5	6	6	5	6	6	5	6	6
"c1" Spacing	11	8	11	8	11	8	11	8	11	8	9	11	8	9	11	8	9
"c1" Dimension "Y"	2-8	3-4	2-8	3-4	2-8	3-4	2-8	3-4	2-8	3-4	3-6	2-8	3-4	3-6	2-8	3-4	3-6
"c1" Length	4-7	5-8	4-7	5-8	4-7	5-8	4-7	5-8	4-7	5-8	6-0	4-7	5-8	6-0	4-7	5-8	6-2
"d" Bars Top Slab-No. of	9	5	9	5	9	5	9	5	9	5	5	9	5	5	9	5	5
"d" Bars Bottom Slab-No. of	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
"e" Bars Spacing	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Spacers Total Number	32		34		36		40		40			44			48		
Quan. Concrete: C.Y. per lin. ft.	.75	.94	.82	1.02	.86	1.08	.92	1.15	.97	1.21	1.50	1.06	1.26	1.57	1.18	1.32	1.65
Quan. Reinf: lbs. per lin. ft.	143	221	148	228	154	235	160	244	164	250	265	170	259	273	178	267	281
Hydraulics Area A	40		50		60		70		80			90			100		
Hydraulic Radius R	1.43		1.67		1.88		2.06		2.22			2.37			2.50		
Neutral Slope %	0.47		0.49		0.51		0.52		0.54			0.56			0.58		
Head Factor k	0.288		0.238		0.205		0.183		0.165			0.153			0.143		
Entrance Capacity Q_{10}	247		345		453		571		698			834			976		
Design Discharge Q_{100}	407		568		747		941		1150			1380			1610		

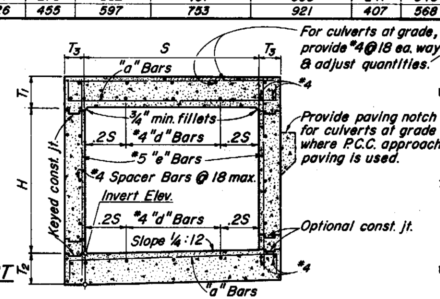
SPAN	12'														
HEIGHT	6'		7'		8'		9'			10'			12'		
STRENGTH CLASSIFICATION	A	B	A	B	A	B	A	B	C	A	B	C	A	B	C
MAX. FILL OVER TOP	5	16	5	16	5	16	5	16	24	5	16	24	5	16	24
Conc. Top Slab T_1	8¾	11¼	8¾	11¼	8¾	11¼	9	11¼	13¼	9	11¼	13¼	9	11¼	13¼
Conc. Bottom Slab T_2	8¾	12¼	8¾	12¼	8¾	12½	9	12½	14¾	9	12½	14¾	9	12½	14¾
Conc. Sidewalls T_3	7½	10½	7½	10½	7½	10½	8	10½	12½	9	10½	12½	9	10½	12½
Reinforcing Steel "a" Size: Bar #	6	7	6	7	6	7	6	7	7	6	7	7	6	7	7
"a" Spacing	11	10	11	10	11	10	11	10	8	11	10	8	11	10	8
"a" Length	11-3	11-6	11-3	11-6	11-3	11-6	11-4	11-6	11-8	11-5	11-6	11-8	11-5	11-6	11-8
"b" Size: Bar #	6	7	6	7	6	7	6	7	7	6	7	7	6	7	7
"b" Spacing	11	10	11	10	11	10	11	10	8	11	10	8	11	10	8
"b" Dimension "X"	2-8	3-0	2-8	3-0	2-8	3-0	2-8	3-0	3-0	2-8	3-0	3-0	2-8	3-0	3-0
"b" Length	4-10	5-7	4-10	5-7	4-10	5-7	4-10	5-7	5-7	4-10	5-7	5-7	4-10	5-7	5-7
"c" Size: Bar #	6	7	6	7	6	7	6	7	7	6	7	7	6	7	7
"c" Spacing	11	10	11	10	11	10	11	10	8	11	10	8	11	10	8
"c" Dimension "Y"	3-9	3-9	3-9	3-9	3-9	3-9	3-9	3-9	3-9	3-9	3-9	3-9	3-9	3-9	3-9
"c" Length	10-2	10-4	11-2	11-4	12-2	12-4	13-2	13-4	13-6	14-2	14-4	14-6	16-2	16-4	16-6
"c1" Size: Bar #	6	7	6	7	6	7	6	7	7	6	7	7	6	7	7
"c1" Spacing	11	10	11	10	11	10	11	10	8	11	10	8	11	10	8
"c1" Dimension "Y"	3-9	3-9	3-9	3-9	3-9	3-9	3-9	3-9	3-9	3-9	3-9	3-9	3-9	3-9	3-9
"c1" Length	5-11	6-5	5-11	6-5	5-11	6-6	5-11	6-6	6-8	5-11	6-6	6-8	5-11	6-6	6-8
"d" Bars Top Slab-No. of	10	6	10	6	10	6	10	6	6	10	6	6	10	6	6
"d" Bars Bottom Slab-No. of	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
"e" Bars Spacing	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Spacers Total Number	36		44		44		44			48			52		
Quan. Concrete: C.Y. per lin. ft.	.99	1.38	1.03	1.44	1.08	1.52	1.18	1.58	1.90	1.30	1.65	1.98	1.41	1.78	2.13
Quan. Reinf: lbs. per lin. ft.	203	293	213	304	218	311	223	317	387	231	326	397	243	341	415
Hydraulics Area A	72		84		96		108			120			144		
Hydraulic Radius R	2.00		2.21		2.40		2.57			2.73			3.00		
Neutral Slope %	0.46		0.48		0.49		0.51			0.52			0.56		
Head Factor k	0.189		0.167		0.151		0.138			0.128			0.114		
Entrance Capacity Q_{10}	543		686		838		1000			1170			1540		
Design Discharge Q_{100}	896		1130		1380		1650			1930			2540		



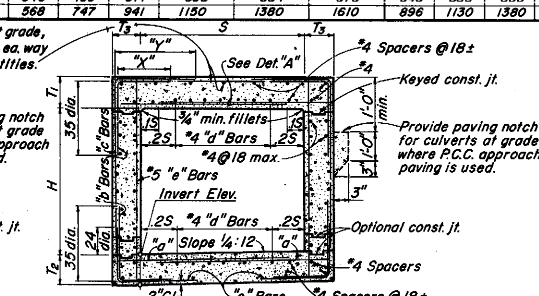
ALTERNATIVE FLAT INVERT

ALTERNATIVE V INVERT

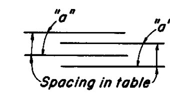
ALTERNATIVE TRAPEZOIDAL INVERT



TYPICAL SECTIONS 2' THRU 6' SPANS



TYPICAL SECTION 7' THRU 12' SPANS



DETAIL "A"

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

SINGLE BOX CULVERTS | D 80

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SPAN	4'												5'												6'												8'											
HEIGHT	2'			3'				4'					2'			3'				4'					5'												4'				5'				6'				7'				8'			
STRENGTH CLASSIFICATION	A	B	C	A	B	C	D	A	B	C	D		A	B	C	A	B	C	D	A	B	C	D		A	B	C	D	A	B	C	D	A	B	C	D		A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
MAX. FILL OVER TOP	11	21	32	11	23	34	46	11	23	34	46		6	24	36	6	24	36	6	23	34	46	6	23	34	46	4	20	34	4	20	34	4	19	33	43	4	19	33	43	3	14	25	3	14	25	3	14	25	3	14	25	3	14	25	37	3	14	25	37
Conc. Top Slab T_1	6½	6½	7½	6½	6½	7½	8½	6½	6½	7½	8½		6¾	7¾	9¼	6¾	7¾	9¼	10¼	6¾	7¾	9	10¼		6¾	7¾	9¼	10¼	7½	8¼	10½	12	7½	8¼	10½	12		7½	8¼	10½	12	8½	9½	12	8½	9½	12	8½	9½	12	8½	9½	12¼	14¼	8½	9½	12¼	14¼
Conc. Bottom Slab T_2	6	7¼	8½	6	7½	8½	9½	6	7½	8½	9½		6½	8¾	10¼	6½	8¾	10¼	11¾	6½	8¾	10	11¾		6½	8¾	10¼	11¾	7¼	9½	11½	13¾	7¼	9½	11½	13¾		7¼	9½	11½	13¾	7½	10¼	12¾	7½	10¼	12¾	7½	10¼	12¾	7½	10¼	12¾	13	15	7½	10¼	13	15¼
Conc. Sidewalls T_3	6	6	6	6	6	6	6	6	6	6	6		6	6	6	6	6	6	6	6	6	6	6		6	6	6	6	6	6	6	6	6	6	6	6		6	6	6	6	6	6	6	6	6	6	6	6	7	7	7	8	7	7	8	8½
Steel a Size: Bar #	5	4	4	5	4	4	4	5	4	4	4		5	4	4	5	4	4	4	5	4	4	4		5	4	4	4	5	4	4	4	5	4	4	4		5	4	4	4	6	4	4	6	4	4	6	4	4	6	4	4	6	4	4	6	4	4
Steel a Spacing	11	11	9	11	10½	8½	7½	11	10½	8½	7½		10	8½	10	10	8½	10	10	10	8½	10	9		10	8½	10	9	9½	11	8½	9½	11	8½	9½	11		9½	11	8½	9½	12	9½	10½	12	9½	10	12	9½	10	11½	9½	10	8½	11½	9½	10	8½
Steel a Length	10-3	10-2	10-2	10-3	10-2	10-2	10-2	10-3	10-2	10-2	10-2		12-3	12-2	12-2	12-3	12-2	12-2	12-2	12-3	12-2	12-2	12-2		12-3	12-2	12-2	12-2	14-3	14-2	14-2	14-3	14-2	14-2	14-2	14-3		14-3	14-2	14-2	14-3	18-4	18-2	18-2	18-4	18-2	18-2	18-4	18-2	18-2	18-4	18-2	18-2	18-7	18-5	18-5	18-8	18-7	18-5	18-8	18-7
Steel b or b_1 Size: Bar #	5	5	5	5	5	5	5	5	5	5	5		5	5	6	5	5	6	6	5	5	6	6		5	5	6	6	5	6	6	6	5	6	6	7		5	6	6	7	6	6	7	6	6	7	6	6	7	6	6	7	7	6	6	7	7
Steel b or b_1 Spacing	11	11	9	11	10½	8½	7½	11	10½	8½	7½		10	8½	10	10	8½	10	10	10	8½	10	9		10	8½	10½	9	9½	11	8½	9½	11	8½	9½	11		9½	11	8½	9½	12	9½	10½	12	9½	10	12	9½	10	11½	9½	10	8½	11½	9½	10	8½
Steel b or b_1 Length "b"	9-4	9-4	9-6	9-4	9-4	9-6	9-7	9-4	9-4	9-6	9-7		11-5	11-6	11-7	11-5	11-6	11-7	11-7	11-5	11-6	11-7	11-8		11-5	11-6	11-7	11-8	13-6	13-6	13-8	13-6	13-6	13-8	13-6	13-6		13-6	13-6	13-8	14-2	17-7	17-8	17-9	17-7	17-8	17-9	17-7	17-8	17-9	17-10	17-10	18-0	18-5	17-10	17-10	18-3	18-6
Steel b or b_1 Length "b_1"	9-4	9-5	9-6	9-4	9-5	9-6	9-7	9-4	9-5	9-6	9-7		11-4	11-6	11-7	11-4	11-6	11-7	11-8	11-4	11-6	11-7	11-8		11-4	11-6	11-7	11-8	13-5	13-7	13-8	13-5	13-6	13-8	13-5	13-6		13-5	13-6	13-8	14-2	17-5	17-8	17-9	17-5	17-8	17-9	17-5	17-8	17-9	17-8	17-11	18-0	18-5	17-8	17-11	18-0	18-7
Steel c Size: Bar #	4	5	5	4	5	5	5	4	5	5	5		4	5	6	4	5	6	6	4	5	6	6		4	5	6	6	4	6	6	6	4	6	6	7		4	6	6	7	4	6	7	4	6	7	4	6	7	4	6	7	7	4	6	7	7
Steel c Spacing	11	11	9	11	10½	8½	7½	11	10½	8½	7½		10	8½	10	10	8½	10	10	10	8½	10	9		10	8½	10½	9	9½	11	8½	9½	11	8½	9½	11		9½	11	8½	9½	12	9½	10½	12	9½	10	12	9½	10	11½	9½	10	8½	11½	9½	10	8½
Steel c Length	4-6	4-6	4-6	4-6	4-6	4-6	4-6	4-6	4-6	4-6	4-6		5-6	5-6	5-6	5-6	5-6	5-6	5-6	5-6	5-6	5-6	5-6		5-6	5-6	5-6	5-6	6-6	6-6	6-6	6-6	6-6	6-6	6-6	6-6		6-6	6-6	6-6	6-6	8-6	8-6	8-6	8-6	8-6	8-6	8-6	8-6	8-6	8-7	8-7	8-7	8-8	8-7	8-7	8-8	8-9
Steel "d" Dist. Bars Top Slab-Tot. No.	10	6	6	10	6	6	6	10	6	6	6		12	6	6	12	6	6	12	6	6	12	6		6	6	12	6	12	6	6	12	6	6	12	6		12	6	6	12	16	8	8	16	8	8	16	8	8	16	8	8	16	8	8	16	8	8
Steel "d" Dist. Bars Bottom Slab-Tot. No.	6	6	6	6	6	6	6	6	6	6	6		6	6	6	6	6	6	6	6	6	6	6		6	6	6	6	6	6	6	6	6	6	6	6		6	6	6	6	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Steel "e" Bars Size: Bar #	4	4	4	4	4	4	4	4	4	4	5		4	4	4	4	4	4	4	4	4	5	4		4	4	4	4	4	4	4	4	4	4	5	4		4	5	6	6	4	4	4	4	5	6	4	5	6	4	5	6	7	4	5	6	7
Steel "e" Bars Spacing	18	18	18	18	18	16	12	18	12	9	10		18	18	18	18	18	16	18	12	10	10½	18		8½	9	9	18	18	16	18	14	8½	18	10	9½		7	18	11	9	6	18	18	10½	18	12	10	18	11½	10	14	9½	7½	8½	11½	8½	7½	8
Steel Spacers Number	23			26				29					23			26				29					32				30				33				36				41				44				44				47				50			60
Quan. Concrete: C.Y. per lin. ft.	0.47	0.51	0.57	0.53	0.57	0.63	0.69	0.59	0.63	0.69	0.75		0.58	0.69	0.80	0.63	0.75	0.86	0.69	0.80	0.89	0.98	0.74		0.86	0.97	1.04	0.77	0.90	1.08	0.82	0.96	1.13	0.88	1.01	1.19		1.30	0.93	1.07	1.25	1.47	1.08	1.30	1.55	1.14	1.37	1.61	1.19	1.42	1.66	1.32	1.56	1.83	2.14	1.39	1.62	1.99	2.27
Quan. Reinf. : Lbs. per lin. ft.	81	74	84	84	79	91	101	87	85	99	111		99	100	109	103	104	112	106	109	119	133	109		116	126	148	121	119	147	125	124	155	128	131	164		175	129	137	177	201	169	175	200	172	181	218	173	188	229	185	199	248	299	191	207	284	314
Hydraulics Area A	16			24				32					20			30				40					50				36				48				60				72				64				80				96				112				128			
Hydraulics Hydraulic Radius R	0.67			0.86				1.00					0.71			0.94				1.11					1.25				1.00				1.20				1.33				1.50				1.33				1.54				1.71				1.87				2.00			
Hydraulics Neutral Slope %	0.64			0.70				0.77					0.59			0.62				0.67					0.73				0.56				0.59				0.62				0.66				0.52				0.54				0.56				0.59				0.62			
Hydraulics Head Factor k	0.75			0.55				0.45					0.69			0.49				0.39					0.34				0.450				0.358				0.305				0.271				0.314				0.262				0.229				0.206				0.189			
Hydraulics Entrance Capacity Q_{10}	70			128				198					86			160				246					344				192				296				414				544				394				552				724				914				1116			
Hydraulics Design Discharge Q_{100}	116			214				326					142			264				406					568				318				488				682				896								910				1194				1506				1842			

SPAN	10'												12'																							
HEIGHT	5'			6'				7'				8'				10'				6'				7'				8'				9'				10'				12'			
STRENGTH CLASSIFICATION	A	B	C	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
MAX. FILL OVER TOP	2	17	30	2	17	30	2	17	30	2	16	29	36	2	16	29	36	2	14	26	2	14	26	2	14	26	2	14	26	36	2	14	26	36	2	14	26	36
Conc. Top Slab T_1	8¾	12¾	16	8¾	12¾	16	8¾	12¾	16	8¾	12¾	16	17¼	8¾	12¾	16	17½	10	14	17½	10	14¼	17½	10¼	14¼	17¾	10¼	14¼	17¾	20¾	10¼	14¼	17¾	20¾	10¼	14¼	17¾	20¾	14½	18¼	21¼
Conc. Bottom Slab T_2	8¼	13½	16½	8¼	13½	16½	8¼	13¾	16¾	8¾	13½	16½	18¼	8¾	13½	16½	18½	9¼	14¾	18	9¼	15	18¼	9¾	15	18½	10	15¼	18¾	21¼	10¼	15¼	18¾	21¼	10¼	15¼	18¾	21¼	19¼	19¼	22
Conc. Sidewalls T_3	6	6	6	6	6	6	6½	7	7	7	7½	8	8	8	9	10	6	6	6½	7	7	7	8	8	8½	9	9	9	10	9	9	9½	11	9	10	11	12
Steel a Size: Bar #	6	4	4	6	4	4	6	4	4	6	4	4	4	6	4	4	4	6	4	4	6	4	4	6	4	4	6	4	4	6	4	4	6	4	4	6	4	4	6	4	4	6	4	4
Steel a Spacing	11	10	10	11	9½	10	11	9½	10	11	10	10	9	11	10	10	9	9	11½	9	9	11½	9	9	11	8½	9	11	8½	9	9	11	8½	9	9	11	8½	9	9	11	8½	9	9	11	8½
Steel a Length	22-4	22-2	22-2	22-4	22-2	22-2	22-4	22-4	22-5	22-7	22-5	22-7	22-10	22-10	22-8	22-11	23-2	26-4	26-2	26-4	26-7	26-5	26-5	26-10	26-8	26-10	26-8	26-10	27-1	26-11	26-11	27-1	27-1	26-11	27-3	27-5	27-1	27-2	27-5	27-8
Steel b or b_1 Size: Bar #	6	7	8	6	7	8	6	7	8	6	7	8	8	6	7	8	8	6	8	8	6	8	8	6	8	8	6	8	8	9	6	8	8	9	6	8	8	9	6	8	8	9
Steel b or b_1 Spacing	11	10	10	11	9½	10	11	9½	10	11	10	10	9	11	10	10	9	9	11½	9	9	11½	9	9	11	8½	9	11	8½	9	9	11	8½	9	9	11	8½	9	9	11	8½	9	9	11	8½
Steel b or b_1 Length "b"	21-7	21-0	22-0	21-7	21-0	22-0	21-7	21-1	22-3	21-10	21-1	22-4	22-9	22-1	22-4	22-9	23-1	25-8	25-10	26-3	25-11	26-1	26-4	26-6	26-4	26-9	26-5	26-8	27-1	27-4	26-5	26-8	27-2	27-6	26-5	26-11	27-5	27-10
Steel b or b_1 Length "b_1"	21-5	21-0	22-0	21-5	21-0	22-0	21-5	21-1	22-3	21-9	22-0	22-4	22-9	22-0	22-3	22-8	23-2	25-6	25-10	26-3	25-9	26-2	26-4	26-1	26-5	26-9	26-4	26-8	27-1	27-4	26-4	26-8	27-2	27-7	26-4	26-11	27-5	27-11
Steel c Size: Bar #	6	7	8	6	7	8	6	7	8	6	7	8	8	6	7	8	8	5	8	8	5	8	8	5	8	8	5	8	8	9	5	8	8	9	5	8	8	9	5	8	8	9
Steel c Spacing	11	10	10	11	9½	10	11	9½	10	11	10	10	9	11	10	10	9	9	11½	9	9	11½	9	9	11	8½	9	11	8½	9	9	11	8½	9	9	11	8½	9	9	11	8½	9	9	11	8½
Steel c Length	10-6	10-6	10-6	10-6	10-6	10-6	10-6	10-7	10-7	10-7	10-7	10-8	10-9	10-8	10-8	10-9	10-10	12-6	12-6	12-7	12-7	12-7	12-7	12-8	12-8	12-8	12-9	12-9	12-9	12-9	12-9	12-9	12-9	12-9	12-9	12-9	12-9	12-9	12-10	12-10	12-11	12-9	12-10	12-11	13-0
Steel "d" Dist. Bars Top Slab-Tot. No.	18	10	10	18	10	10	18	10	10	18	10	10	10	18	10	10	10	24	10	10	24	10	10	24	10	10	24	10	10	10	24	10	10	10	24	10	10	10	24	10	10	10
Steel "d" Dist. Bars Bottom Slab-Tot. No.	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Steel "e" Bars Size: Bar #	4	4	5	4	4	5	4	4	6	4	5	6	7	4	6	6	7	4	4	5	4	4	5	4	4	5	4	5	4	5	7	8	4	7	8	8	6	7	8	9	7	8	9	9
Steel "e" Bars Spacing	18	10	10	18	6	6½	14	6	8	11	8½	6	6	7½	7	5½	5	18	8	8	15	6	6½	12	5½	6	9	7½	8½	8	8½	11	8½	9	12	8	7	7							
Steel Spacers Number	48			48				51				54				64		68			52			55				68				68				72				76			
Quan. Concrete: C.Y. per lin. ft.	1.40	2.05	2.46	1.45	2.07	2.49	1.51	2.18	2.64	1.68	2.27	2.74	3.04	1.92	2.51	3.05	3.41	1.84	2.59	3.16	1.97	2.77	3.28	2.19	2.93	3.59	2.38	3.15	3.69	4.25	2.48	3.23	3.86	4.49	2.67	3.53	4.30	4.92				
Quan. Reinf. : Lbs. per lin. ft.	236	254	310	238	274	324	243	280	339	252	278	355	430	279	327	400	476	309	317	401	316	330	415	336	363	460	345	374	485	578	351	394	519	582	371	427	567	673				
Hydraulics Area A	100			120				140				160				200		144			168			192				216				240				288							
Hydraulics Hydraulic Radius R	1.67			1.88				2.06				2.22				2.50		2.00			2.21			2.40				2.57				2.73				3.00							
Hydraulics Neutral Slope %	0.49			0.51				0.52				0.54				0.58		0.46			0.48			0.49				0.51				0.52				0.56							
Hydraulics Head Factor k	0.238			0.205				0.183				0.165				0.143		0.189			0.167			0.151				0.138				0.128				0.114							
Hydraulics Entrance Capacity Q_{10}	690			906				1142				1396				1952		1086			1372			1676				2000				2340				3080							
Hydraulics Design Discharge Q_{100}	1136			1494				1882				2300				3220		1792			2260			2760				3300				3860				5080							

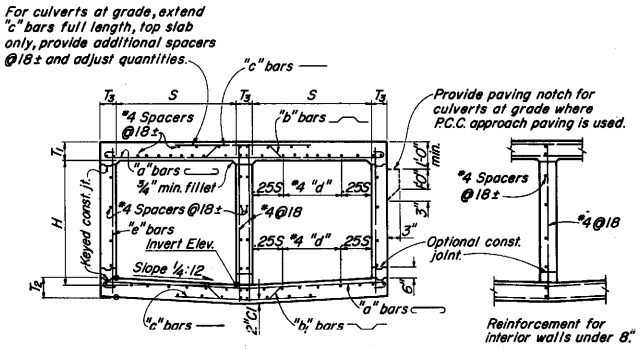
APPROVAL RECOMMENDED

BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO.5585

APPROVED SEPTEMBER 1, 1966

STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO.5945

Note: For boxes of height less than that shown in table, use next greater table height slabs, wall dimensions and reinforcing steel, and make necessary changes in bar lengths, number of spacers and quantities.



TYPICAL SECTION

(Showing reinforcement for interior walls 8" and over.)

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

DOUBLE BOX CULVERTS | D 81

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SPAN		4'									5'										6'										8'									
HEIGHT		2'			3'			4'			2'			3'			4'			5'			3'			4'			5'			6'			4'			5'			6'			7'			8'		
STRENGTH CLASSIFICATION		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	D	A	B	C	D	A	B	C	A	B	C	D	A	B	C	D	A	B	C	A	B	C	D
MAX. FILL OVER TOP		10	24	38	10	24	38	10	24	38	8	17	26	8	17	26	8	17	26	35	8	17	26	35	3	13	23	3	13	23	30	3	13	23	30	3	13	23	30	3	13	23	30	2	11	20	2	11	20	2	11	20	28	2	11	20	28
Conc.	Top Slab T_1	6¼	6¼	7¼	6¼	6¼	7¼	6¼	6¼	7¼	6¾	6¾	7½	6¾	6¾	7½	6¾	6¾	7½	8¼	6¾	6¾	7½	8¼	7½	7½	8¼	7½	7½	8¼	9¼	7½	7½	8¼	9¼	8¼	8¼	10¼	8¼	8¼	10¼	11½	8¼	8¼	10¼	11½	8¼	8¼	10¼	11½	8¼	8¼	10¼	11½
	Bottom Slab T_2	6	7	8¼	6	7	8¼	6	7	8¼	6¼	7¼	8½	6¼	7¼	8½	6¼	7¼	8½	9½	6¼	7¼	8½	9½	6	7¾	9¼	6	7¾	9¼	10	6	8	9¼	10	6½	9	11	6½	9¼	11	6½	9¼	11	12¼	6¾	9¼	11	12¼	6¾	9¼	11	12¼
	Sidewalls T_3	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6½	6½	7	7	7½	8½
Steel	a Size: Bar #	5	4	5	5	4	5	5	4	5	5	4	5	5	4	5	5	4	5	5	5	4	5	5	5	5	6	5	5	6	5	5	5	5	5	6	5	5	6	5	5	6	5	5	6	5	5	6	5	5	6	5	5	6
	a Spacing	11	11½	13	11	11½	13	11	11½	13	10	11½	13	10	11½	13	10	11	13	11½	10	11	13	11½	13	14	11½	13	14	11½	10	13	14	11½	10	11½	12	12	11½	12	12	11½	12	12	10½	11½	11½	12	10½	11½	11½	12	10½
	a Length	14-9	14-8	14-9	14-9	14-8	14-9	14-9	14-8	14-9	17-9	17-8	17-9	17-9	17-8	17-9	17-9	17-8	17-9	17-9	17-9	17-8	17-9	17-9	20-10	20-9	20-9	20-10	20-9	20-9	20-9	20-10	20-9	20-9	20-9	26-10	26-9	26-9	26-10	26-9	26-9	26-10	26-9	26-9	26-10	26-9	26-9	26-10	26-9	26-9	26-10	26-9	26-9	26-10
	b or b_1 Size: Bar #	5	5	6	5	5	6	5	5	6	5	5	6	5	5	6	5	5	6	6	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	7	6	6	7	6	6	7	7	6	6	7	7	6	6	7	7	6
	b or b_1 Spacing	11	11½	13	11	11½	13	11	11½	13	10	11½	13	10	11½	13	10	11	13	11½	10	11	13	11½	13	14	11½	13	14	11½	10	13	14	11½	10	11½	12	12	11½	12	12	11½	12	12	10½	11½	11½	12	10½	11½	11½	12	10½
	b or b_1 Length "b"	14-2	14-2	14-3	14-2	14-2	14-3	14-2	14-2	14-3	17-3	17-3	17-3	17-3	17-3	17-3	17-3	17-3	17-3	17-5	17-3	17-3	17-3	17-5	20-3	20-3	20-5	20-3	20-3	20-5	20-6	20-3	20-3	20-5	20-6	26-5	26-5	26-7	26-5	26-5	26-7	26-5	26-5	26-7	26-9	26-5	26-9	27-3	26-9	26-9	27-1	27-7
	b or b_1 Length "b_1"	14-0	14-2	14-3	14-0	14-2	14-3	14-0	14-2	14-3	17-0	17-2	17-4	17-0	17-2	17-4	17-0	17-2	17-4	17-5	17-0	17-2	17-4	17-5	20-0	20-5	20-5	20-0	20-5	20-5	20-6	20-0	20-0	20-5	20-7	26-0	26-4	26-7	26-0	26-5	26-7	26-0	26-5	26-7	26-1	26-5	26-9	27-3	26-5	26-9	27-1	27-7
	c Size: Bar #	4	5	6	4	5	6	4	5	6	4	5	6	4	5	6	4	5	6	6	4	5	6	6	4	6	6	4	6	6	6	4	6	6	6	4	6	7	4	6	7	4	6	7	7	4	6	7	7	4	6	7	7	4
	c Spacing	11	11½	13	11	11½	13	11	11½	13	10	11½	13	10	11½	13	10	11	13	11½	10	11	13	11½	13	14	11½	13	14	11½	10	13	14	11½	10	11½	12	12	11½	12	12	11½	12	12	10½	11½	11½	12	10½	11½	11½	12	10½
	c Length	9-0	9-0	9-0	9-0	9-0	9-0	9-0	9-0	9-0	11-0	11-0	11-0	11-0	11-0	11-0	11-0	11-0	11-0	11-0	11-0	11-0	11-0	11-0	13-0	13-0	13-0	13-0	13-0	13-0	13-0	13-0	13-0	13-0	13-0	17-0	17-0	17-0	17-0	17-0	17-0	17-0	17-0	17-0	17-1	17-3	17-2	17-2	17-3	17-5
Reinforcing	"d" Dist. Bars Top Slab-Tot. No.	15	9	9	15	9	9	15	9	9	18	9	9	18	9	9	18	9	9	9	18	9	9	9	18	9	9	18	9	9	9	18	9	9	9	24	12	12	24	12	12	24	12	12	12	24	12	12	12	24	12	12	12
	"d" Dist. Bars Bottom Slab-Tot. No.	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	"e" Bars Size: Bar #	4	4	4	4	4	4	4	4	5	4	4	4	4	4	4	4	4	5	5	4	4	6	6	4	4	4	4	4	4	5	5	4	4	6	6	4	4	4	4	4	5	4	5	6	4	6	7	7	4	6	7	7
	"e" Bars Spacing	18	18	18	18	18	18	11½	13	18	18	18	18	18	18	18	18	17	11½	11½	18	11	7	11½	18	18	18	18	18	11½	18	10	18	8	12	10	18	8	12	10	18	8	12	10	12	11½	12	12	10½	11½	11½	12	10½
	Spacers Number	34			38			42			34			38			38				42				40			40			44			48			58			62			62			66			70			88
Quan.	Concrete: C.Y. per lin. ft.	0.67	0.71	0.81	0.79	0.79	0.89	0.82	0.86	0.96	0.82	0.87	0.98	0.90	0.95	1.05	0.97	1.02	1.13	1.23	1.04	1.11	1.20	1.31	1.05	1.15	1.29	1.12	1.23	1.37	1.19	1.32	1.44	1.55	1.27	1.39	1.52	1.64	1.47	1.67	1.99	1.54	1.76	2.06	1.62	1.84	2.14	1.71	1.91	2.26	2.57	1.90	2.10	2.46	2.79
	Reinf. : Lbs. per lin. ft.	122	110	133	127	115	138	131	122	147	150	126	153	155	130	157	157	136	161	181	161	143	171	192	181	168	196	183	170	200	187	177	209	235	192	187	221	249	261	250	301	266	257	310	267	264	320	276	277	336	409	283	295	347	441
Hydraulics	Area A	24			36			48			30			45			60				75				54			72			90			108			96			120			144			168			192			
	Hydraulic Radius R	.67			.86			1.00			.71			.94			1.11				1.25				1.00			1.20			1.36			1.50			1.33			1.54			1.71			1.87			2.00			
	Neutral Slope %	.64			.70			.77			.59			.62			.67				.73				.56			.59			.62			.66			.52			.54			.56			.59			.62			
	Head Factor k	.75			.55			.45			.69			.49			.39				.34				.450			.358			.305			.271			.314			.262			.229			.206			.189			
	Entrance Capacity Q_{10}	105			192			297			129			240			369				516				288			444			621			816			591			828			1086			1371			1674			
	Design Discharge Q_{100}	174			321			489			213			396			609				852				477			732			1023			1344			978			1365			1791			2259			2763			

APPROVAL RECOMMENDED

BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO. 5585

APPROVED SEPTEMBER 1, 1966

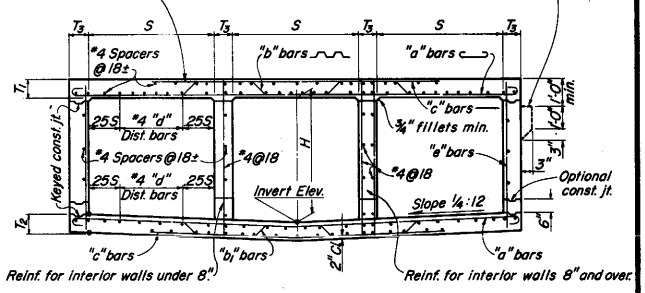
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5945

Note: For boxes of height less than that shown in table, use next greater table height slabs, wall dimensions and reinforcing steel, and make necessary changes in bar lengths, number of spacers and quantities.

SPAN		10'															12'																								
HEIGHT		5'			6'			7'			8'				10'					6'			7'			8'			9'				10'				12'				
STRENGTH CLASSIFICATION		A	B	C	A	B	C	A	B	C	A	B	C	D	A	B	C	D	A	B	C	A	B	C	A	B	C	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
MAX. FILL OVER TOP		2	11	20	2	11	20	2	11	20	2	11	20	28	2	11	20	28	2	10	18	2	10	18	2	10	18	2	10	18	2	10	18	2	10	18	2	11	20	30	2	11	20	30
Conc.	Top Slab T_1	9	10	12	9	10	12	9	10	12	9	10	12	14½	9	10½	12½	14½	10¼	11½	14	10¼	11½	14	10¼	11½	14	10¼	12	14¾	17¾	10¼	12	14¾	17¾	10¼	12	14¾	17¾	10¼	12	14¾	17¾
	Bottom Slab T_2	7½	10¾	13	7½	10¾	13	7½	10¾	13	7¾	11	13	15	8	11	13½	15	8¼	12	14½	8¼	12	14¾	8¼	12	14¾	8¼	12½	15½	18¼	8¼	12½	15½	18¼	9	12¾	15¾	18¼	9	12¾	15¾	18¼
	Sidewalls T_3	6	6	6	6	6	6	6	6	6	6½	7	7	7½	8½	8	8½	9	10	6	6	6½	6	6	7	7	7	7½	8	8	9	10	8	8	9	10½	9	9	10½	12				
Steel	a Size: Bar #	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	7	6	7	6	7	8	7	6	7	8	7	6	7	8	7	6	7	8							
	a Spacing	10½	13	10	10½	13	10	10½	13	10	10½	13	10	11	10½	13	10	11	12	11	11½	12	11	11½	12	11	11½	12	10½	11	11½	12	10½	11	11½	12	10½	11	11½				
	a Length	32-0	32-0	32-0	32-0	32-0	32-0	32-0	32-0	32-0	33-0	33-2	33-2	33-4	33-8	33-6	33-8	33-10	34-2	39-1	39-0	39-3	39-1	39-4	39-10	39-5	39-5	39-8	39-7	39-9	39-9	40-1	40-0	39-9	39-6	40-1	40-0	40-7	41-6				
	b or b_1 Size: Bar #	6	7	7	6	7	7	6	7	7	6	7	7	8	6	7	7	8	7	7	8	7	7	8	7	7	8	7	7	8	9	7	7	8	9	7	7	8	9				
	b or b_1 Spacing	10½	13	10	10½	13	10	10½	13	10	10½	13	10	11	10½	13	10	11	12	11	11½	12	11	11½	12	11	11½	12	10½	11	11½	12	10½	11	11½	12	10½	11	11½				
	b or b_1 Length "b"	32-6	32-7	32-10	32-6	32-7	32-10	32-6	32-7	32-10	33-0	32-10	32-11	33-4	33-1	33-2	33-5	33-1	34-5	38-7	38-9	39-3	38-7	38-9	39-5	38-1	39-1	39-7	39-3	39-6	40-2	40-10	39-3	39-6	40-2	41-0	39-7	39-10	40-8	41-6				
	b or b_1 Length "b_1"	32-2	32-7	32-11	32-2	32-7	32-11	32-2	32-7	32-11	33-1	32-6	32-11	33-5	33-1	32-11	33-5	33-1	34-5	38-3	38-7	39-2	38-3	38-9	39-5	38-7	39-1	39-7	39-0	39-6	40-2	40-10	39-0	39-6	40-2	41-0	39-4	39-10	40-9	41-6				
	c Size: Bar #	5	7	7	5	7	7	5	7	7	5	7	7	8	5	7	7	8	6	7	8	6	7	8	6	7	8	6	7	8	9	6	7	8	9	6	7	8	9				
	c Spacing	10½	13	10	10½	13	10	10½	13	10	10½	13	10	11	10½	13	10	11	12	11	11½	12	11	11½	12	11	11½	12	10½	11	11½	12	10½	11	11½	12	10½	11	11½				
	c Length	21-0	21-0	21-0	21-0	21-0	21-0	21-0	21-0	21-0	21-1	21-2	21-2	21-3	21-5	21-4	21-5	21-6	21-8	25-0	25-0	25-1	25-0	25-0	25-2	25-2	25-2	25-3	25-4	25-4	25-6	25-8	25-4	25-4	25-6	25-8	25-6	25-6	25-9	26-0				
Reinforcing	"d" Dist. Bars Top Slab-Tot. No.	27	15	15	27	15	15	27	15	15	27	15	15	27	15	15	15	36	15	15	36	15	15	36	15	15	36	15	15	15	36	15	15	15	36	15	15	15	36				
	"d" Dist. Bars Bottom Slab-Tot. No.	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15				
	"e" Bars Size: Bar #	4	4	5	4	5	6	4	6	7	4	6	7	8	5	6	8	8	4	6	4	4	6	4	4	6	4	4	6	7	8	5	7	8	8	6	7	9	9				
	"e" Bars Spacing	18	13	10	18	13	10	13	13	10	10½	12	10	11	10½	9	10	9	18	7	11½	12	5¾	11½	12	5½	9	10	10½	11	11½	12	10½	11	11½	12	10½	11	11½				
	Spacers Number	68			68			72			76			94			102		76			80			84			104			110			116									
Quan.	Concrete: C.Y. per lin. ft.	1.98	2.40	2.82	2.06	2.48	2.90	2.13	2.55	3.03	2.34	2.77	3.23	3.78	2.68	3.18	3.73	4.28	2.60	3.18	3.82	2.70	3.26	3.96	2.88	3.45	4.13	3.13	3.79	4.61	5.45	3.23	3.89	4.72	5.65	3.62	4.28	5.24	6.18				
	Reinf. : Lbs. per lin. ft.	358	372	470	359	379	482	367	391	502	377	402	514	590	421	453	577	632	489	505	628	497	516	637	505	527	654	536	582	719	872	548	606	745	939	575	636	793	963				
Hydraulics	Area A	150			180			210			240				300				216			252			288			324				360				432							
	Hydraulic Radius R	1.67			1.88			2.06			2.22				2.50				2.00			2.21			2.40			2.57				2.73				3.00							
	Neutral Slope %	.49			.51			.52			.54				.58				.46			.48			.49			.51				.52				.56							
	Head Factor k	.238			.205			.183			.165				.143				.189			.167			.151			.138				.128				.114							
	Entrance Capacity Q_{10}	1035			1359			1713			2094				2928				1629			2058			2514			3000				3510				4620							
	Design Discharge Q_{100}	1704			2241			2823			3450				4830				2688			3390			4140			4950				5790				7620							

For culverts at grade, extend "c" bars full length, provide additional spacers @ 18± and adjust quantities.

Provide paving notch for culverts at grade where P.C.C. approach paving is used.



TYPICAL SECTION

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

TRIPLE BOX CULVERTS | D 82

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DESIGN NOTES

SPECIFICATIONS:

DESIGN: A.A.S.H.O. DATED 1957 WITH REVISIONS AND AS SUPPLEMENTED BY BRIDGE PLANNING AND DESIGN MANUAL.

SECTIONS DESIGNED FOR CULVERT IN A TRENCH ON HARD FOUNDATION, OR CULVERT UNTRENCHED ON YIELDING FOUNDATION. FOR CULVERTS ON PILES OR ROCK FOUNDATIONS SPECIAL DESIGN WILL BE REQUIRED.

LOADING:

LIVE LOAD = H20-S16-44 OR ALTERNATIVE WITH 30% IMPACT FOR ALL COVER DEPTHS. NEGLECT LIVE LOAD WHEN ON SINGLE SPANS, COVER IS MORE THAN 8' AND EXCEEDS SPAN, AND ON MULTIPLE SPANS WHEN COVER EXCEEDS DISTANCE BETWEEN EXTERIOR WALLS.

CULVERTS AT GRADE TREATED AS A BRIDGE, WITH THE WHEEL LOAD ON THE INVERT SLAB DISTRIBUTED OVER 7.5' TRANSVERSLY AND THE BREADTH OF THE CULVERT LONGITUDINALLY.

WHEEL LOADS DISTRIBUTED UNIFORMLY OVER A SQUARE, THE SIDES OF WHICH ARE 1.75 TIMES THE DEPTH OF FILL, BUT NOT LESS TRANSVERSLY THAN THE DIMENSION FOR GRADE TOP ON THE TOP SLAB, AND NOT LESS THAN 7.5' ON THE INVERT SLAB. WHEN SUCH AREAS FROM SEVERAL CONCENTRATIONS OVERLAP, THE TOTAL LOAD SHALL BE CONSIDERED AS UNIFORMLY DISTRIBUTED OVER THE AREA DEFINED BY THE OUTSIDE LIMITS OF THE INDIVIDUAL AREAS, BUT THE TOTAL WIDTH SHALL NOT EXCEED THE TOTAL WIDTH OF THE SUPPORTING SLAB.

DEAD LOAD: EARTH LOAD OF 120 LBS. PER CU. FT. AND AN EQUIVALENT FLUID PRESSURE OF 36 LBS. PER SQ. FT. (BOTH REDUCED 30% FOR BALANCED DESIGN).
DISTRIBUTION OF WHEEL AT GRADE, $E = .175S + 3.2$

UNIT STRESSES: F_s = 20,000 P.S.I., N = 10
F_c = 1,200 P.S.I.

REINFORCEMENT EMBEDMENT IS 1 1/2 DIA. CLEAR, MIN. 1", EXCEPT AS NOTED.

DISTRIBUTION "d" BARS EXPRESSED AS A % OF MAIN REINFORCEMENT:

CLASSIFICATION "A" TOP SLAB = $\frac{100}{\sqrt{SPAN}}$, MAX. 50%

CLASSIFICATION "A" BOTTOM SLAB = MIN. #4 @ 18

CLASSIFICATION "B", OR ABOVE, TOP AND BOTTOM SLABS MIN. #4 @ 18

CONSTRUCTION NOTES

SPECIFICATIONS: STANDARD SPECIFICATIONS, DIVISION OF HIGHWAYS, CURRENT EDITION AND SPECIAL PROVISIONS ACCOMPANYING PLANS.

EXPANSION JOINTS: NONE IN INVERT SLAB. UNDER COVER LESS THAN SPAN LENGTH, PLACE 1/2" EXPANSION JOINT FILLER IN TOP SLAB AND SIDE WALLS IN DIVIDING STRIP OR OUTSIDE SHOULDER. UNDER COVER MORE THAN SPAN LENGTH, PLACE EXPANSION JOINTS IN TOP SLAB AND SIDE WALLS ONLY AT 30' ± CENTERS, AND ADDITIONAL JOINTS AS DIRECTED BY THE ENGINEER AT LOCATIONS OF CHANGE OF FOUNDATION CHARACTER.

CONSTRUCTION LOADS: CONSTRUCTION LOADS HEAVIER THAN LEGAL LOADS NOT PERMITTED UNTIL CONCRETE HAS REACHED A STRENGTH OF 3,000 P.S.I. AND STRUCTURE STRUTTED AND CUSHIONED AS DIRECTED BY THE ENGINEER.

LOCATION NOTES

HYDRAULICS: IF SLOPE OF NATURAL CHANNEL EXCEEDS "NEUTRAL SLOPE" OF CULVERT ENTRANCE, CAPACITY FOR 10 YEAR FLOOD (Q10) WILL USUALLY DETEMINE SIZE. OTHERWISE COMPUTE TOTAL HEAD = $\left(\frac{Q100}{8A}\right)^2\left(1.05+\frac{kL}{100}\right)$ WHERE "k" IS HEAD FACTOR "A" IS AREA, "L" IS LENGTH OF CULVERT AND Q100 THE 100 YEAR FLOOD, AND COMPARE WITH ALLOWABLE HEAD. TABULATED ELEMENTS ARE FOR FULL NOMINAL SECTION.

DESIGNATION: SHOW ON PLANS AS SPAN X HEIGHT STRENGTH CLASSIFICATION X LENGTH: THUS 4 x 4 -A x 60', FOLLOWED BY ALTERNATIVES.

ALTERNATIVES: INVERT WILL BE SLOPED UNLESS "TRAPEZOIDAL INVERT", "FLAT INVERT" OR "V INVERT" IS INCLUDED IN DESIGNATION. ENDS OF CULVERT WILL BE ROUNDED UNLESS "SQUARE ENDS" ARE DESIGNATED. PARAPET ON CULVERTS WITH OVER 2' COVER WILL BE 0'-9" UNLESS "___ FT. PARAPET" IS DESIGNATED. SUCH DESIGNATIONS MAY BE DIFFERENT FOR INLET AND OUTLET ENDS.

QUANTITIES: QUANTITIES ARE FOR ESTIMATING ONLY. THEY ARE FOR THE SLOPED INVERT SLAB AND DO NOT INCLUDE SPLICES IN LONGITUDINAL BARS NOR CONCRETE AND REINFORCEMENT FOR SPECIAL COVERAGE, NOR TEMPERATURE REINFORCEMENT FOR GRADE TOP CULVERT.

SPECIAL COVERAGE: WHERE CULVERTS ARE EXPOSED TO ACTION OF SALT WATER THICKNESS OF CONCRETE SHALL BE INCREASED TO PROVIDE 4" COVERAGE BETWEEN STEEL AND EXPOSED SURFACES. WHERE SCOUR IS ANTICIPATED, THICKNESS OF BOTTOM SLAB SHALL BE INCREASED TO PROVIDE 2" MINIMUM COVERAGE BETWEEN STEEL AND EXPOSED SURFACE.

USE OF STANDARD PLAN

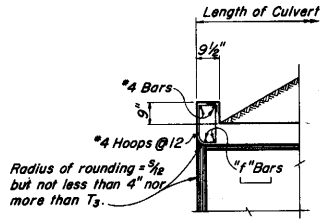
"STRENGTH CLASSIFICATION", SYMBOLIZED BY THE LETTERS "A", "B", "C" ETC., AT THE TOP OF THE DATA TABLE IS MERELY A CONVENIENT DESIGNATION FOR A PARTICULAR STRUCTURAL SECTION FOR A CULVERT OF ANY GIVEN OPENING. IT IS DICTATED BY THE COVER OR DEPTH OF FILL OVER THE TOP SLAB.

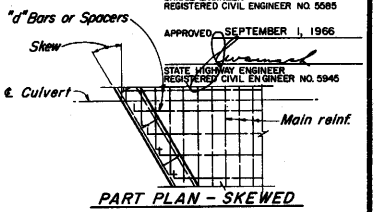
APPROVAL RECOMMENDED

BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO. 5585

APPROVED SEPTEMBER 1, 1966

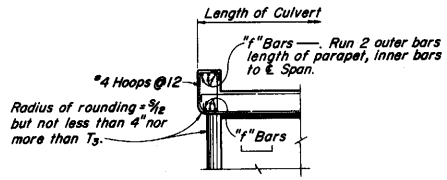
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5945

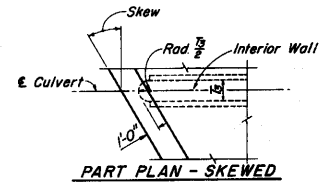




PART PLAN - SKEWED

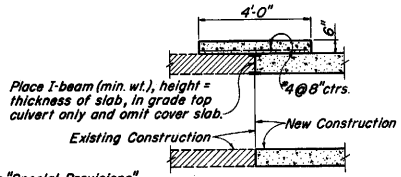
PARAPET DETAILS FOR SINGLE SPAN CULVERTS





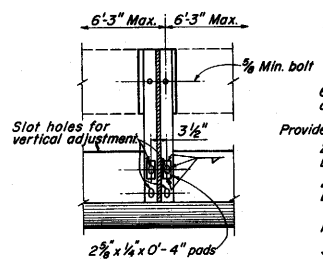
PART PLAN - SKEWED

PARAPET DETAILS FOR MULTIPLE SPAN CULVERTS



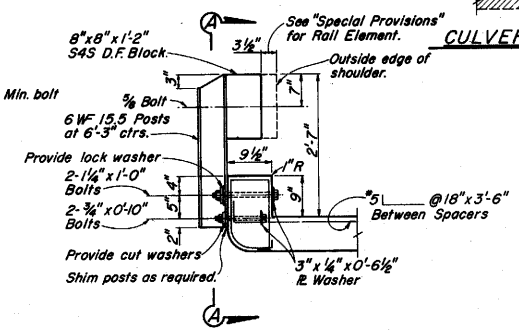
CULVERT EXTENSION

SKEWED PARAPETS								
Skew Angle	Span	3	4	5	6	8	10	12
0°-15°	"f" Bars: Bar No.	4	4	5	6	6	7	8
	"f" Bars: No. of bars	2	2	2	2	3	3	3
16°-30°	"f" Bars: Bar No.	4	4	5	6	7	8	8
	"f" Bars: No. of bars	2	3	3	3	3	3	3
31°-45°	"f" Bars: Bar No.	4	4	6	6	7	8	8
	"f" Bars: No. of bars	3	3	3	3	3	3	3
0°-45°	#4 Hoops	12" ctrs.						



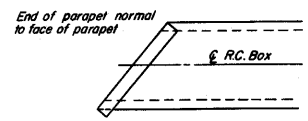
SECTION A-A

Scale: 1" = 1'-0"



RAILING DETAILS

Scale: 1" = 1'-0"



PARAPET DETAIL FOR SKEWED CULVERTS

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

BOX CULVERT MISCELLANEOUS DETAILS

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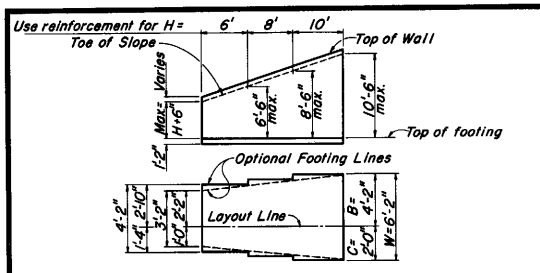
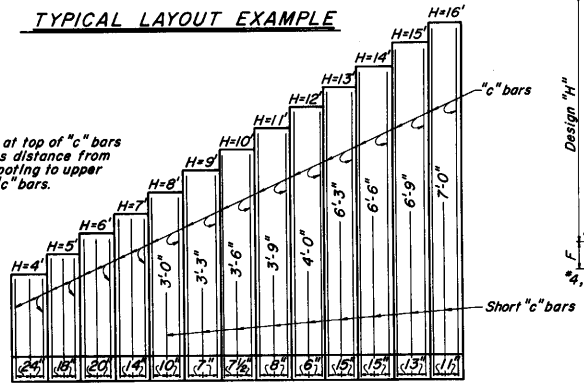
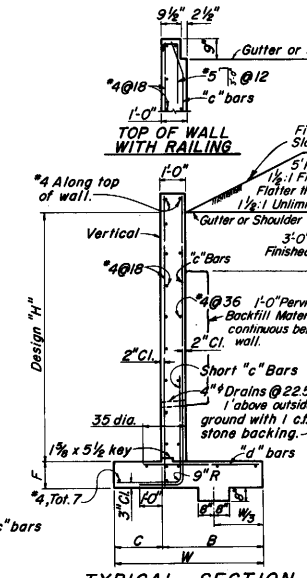
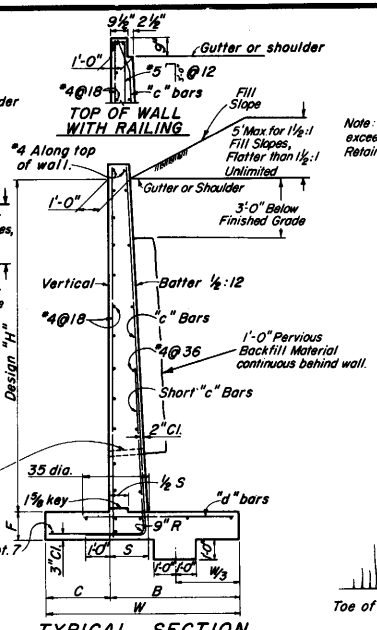


TYPICAL LAYOUT EXAMPLE

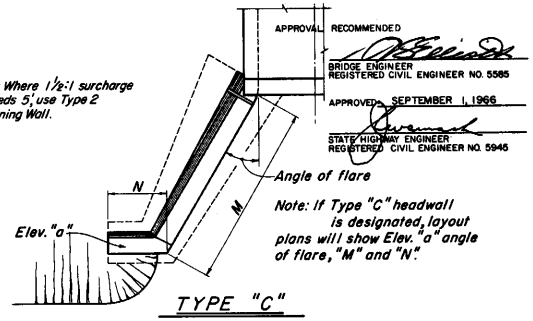




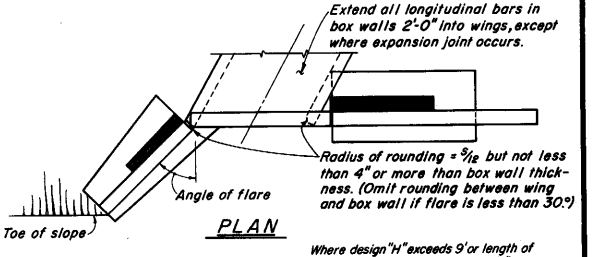
TYPICAL SECTION
H=4' THRU 12'



TYPICAL SECTION
H=13' THRU 16'



TYPE "C"



PLAN

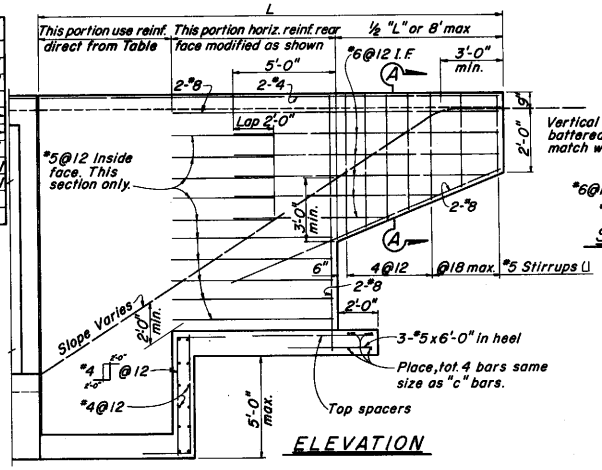
REINFORCED CONCRETE WING HEADWALLS													
H	4'	5'	6'	7'	8'	9'	10'	11'	12'	13'	14'	15'	16'
W	3'-2"	3'-8"	4'-2"	4'-8"	5'-2"	5'-8"	6'-2"	6'-8"	7'-2"	7'-8"	8'-2"	8'-8"	9'-2"
C	1'-0"	1'-2"	1'-4"	1'-6"	1'-8"	1'-10"	2'-0"	2'-2"	2'-4"	2'-6"	2'-8"	2'-10"	3'-0"
B	2'-2"	2'-8"	2'-10"	3'-2"	3'-6"	3'-10"	4'-2"	4'-6"	4'-10"	5'-2"	5'-6"	5'-10"	6'-2"
F	1'-2"												
Batter	None									½:12			
S	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-6½"	1'-7"	1'-7½"	1'-8"
"c" Bars	*4@24	*4@18	*5@20	*5@14	*5@10	*5@7	*6@7½	*7@8	*7@6	*9@15	*10@15	*10@13	*10@11
"d" Bars	*4@24	*4@18	*5@20	*5@14	*5@10	*6@14	*7@15	*8@16	*7@12	*8@15	*9@15	*9@13	*9@11
Conc. C.Y./L.F.	0.32	0.38	0.44	0.49	0.55	0.61	0.67	0.73	0.79	1.02	1.10	1.18	1.26
Reinf. #/L.F.	13	16	19	25	30	37	49	62	76	70	89	104	125

Deign Notes:

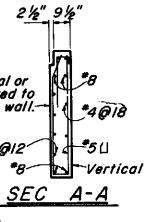
Unit Stresses: $f_s = 20{,}000$ p.s.i, $f_c = 1200$ p.s.i, n=10

Maximum Toe Pressure = 1½ Tons/sq. ft.

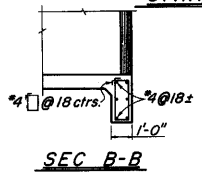
Elevations, length and angle of flare of wings may be varied by the Engineer to suit conditions encountered in the field. Walls designed for 2' liveload surcharge, 1½:1 sloping surcharge not to exceed 5' in elevation plus 2' liveload surcharge, or unlimited 2:1 surcharge.



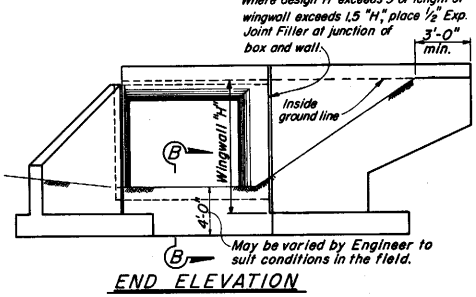
ELEVATION



SEC A-A



SEC B-B



END ELEVATION

TYPE "A" TYPE "B"

STRAIGHT WING HEADWALLS

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

CULVERT HEADWALLS
TYPES "A", "B" & "C"

D 84-1

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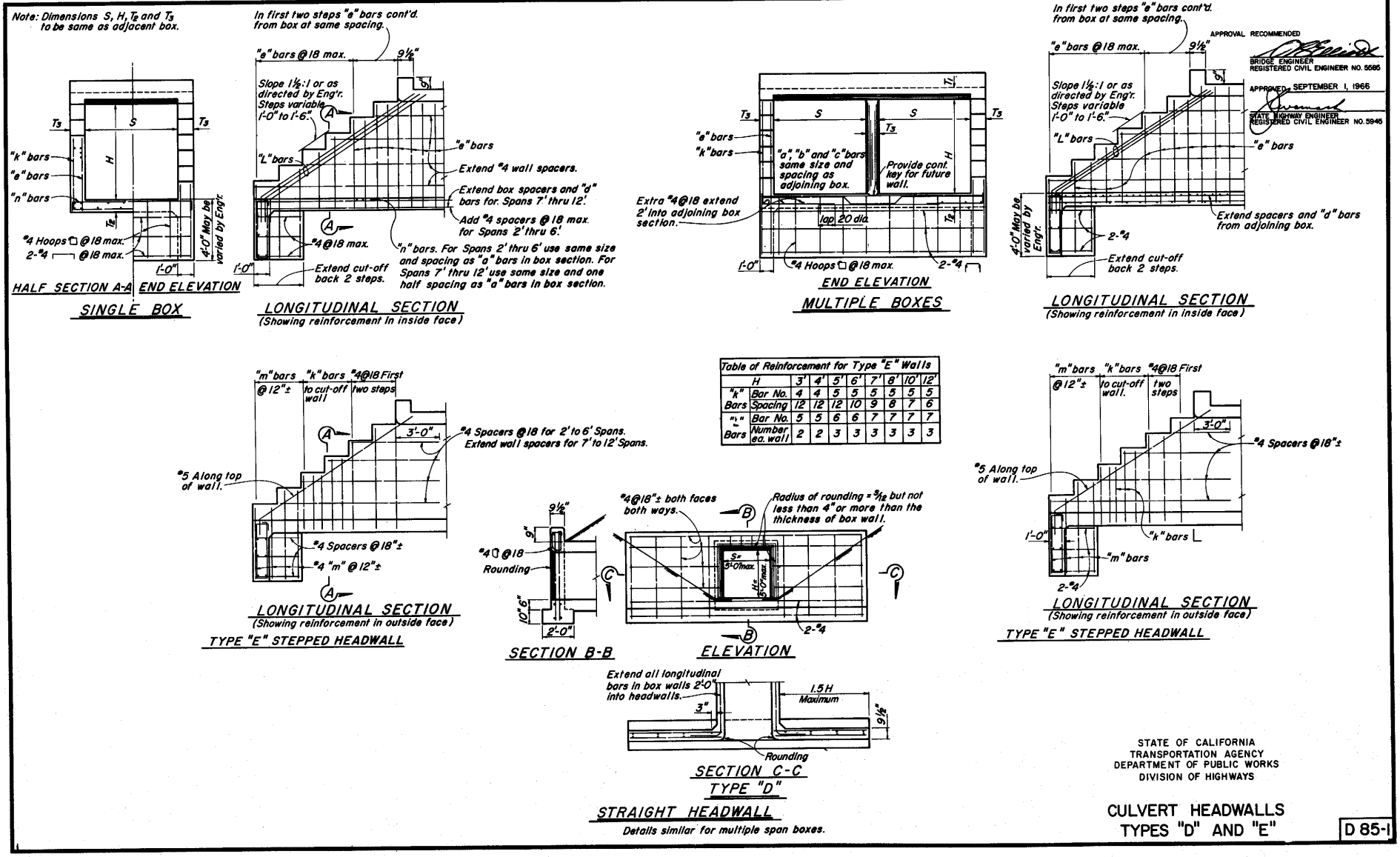

Table of Reinforcement for Type "E" Walls

	H	3'	4'	5'	6'	7'	8'	10'	12'
"k" Bars	Bar No.	4	4	5	5	5	5	5	5
	Spacing	12	12	12	10	9	8	7	6
"n" Bars	Bar No.	5	5	6	6	7	7	7	7
	Number ea. wall	2	2	3	3	3	3	3	3

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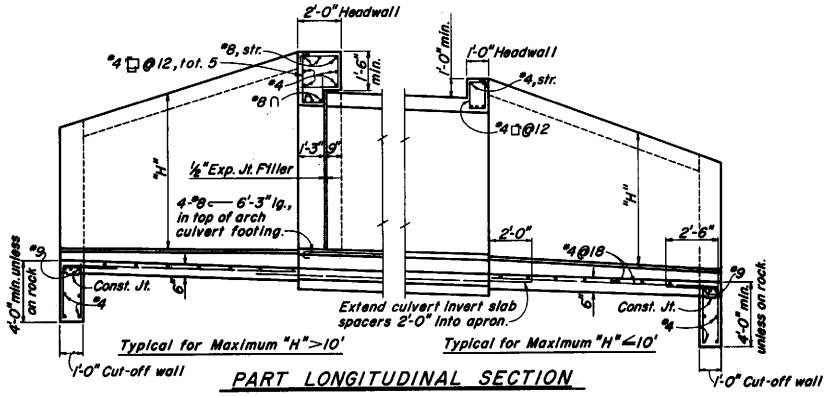
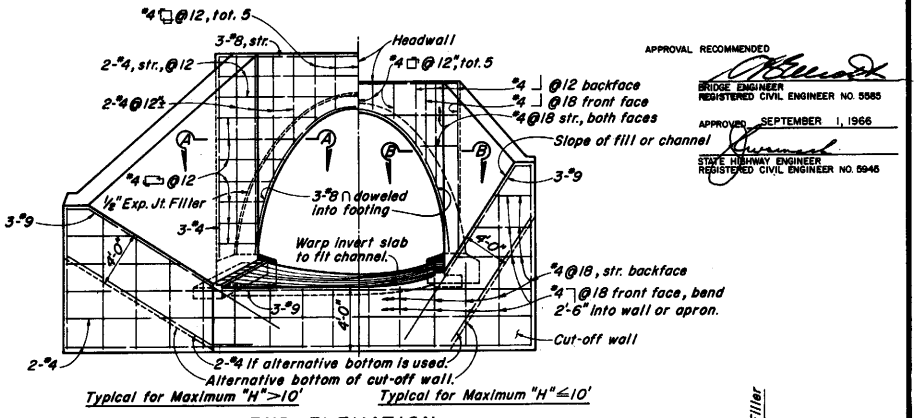
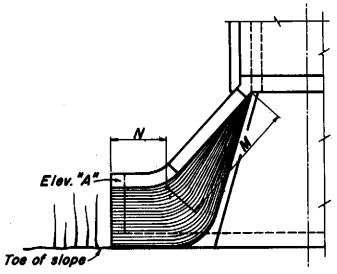


PART LONGITUDINAL SECTION



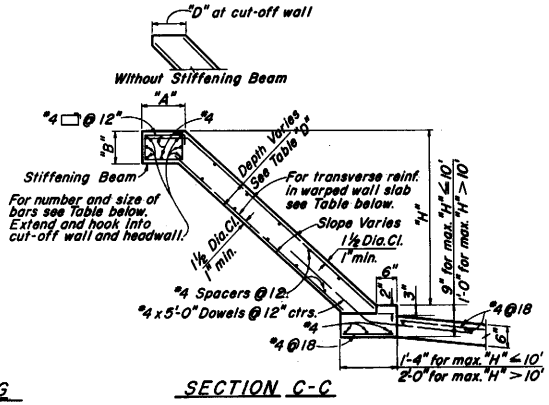
END ELEVATION

APPROVAL RECOMMENDED
BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO. 5585
APPROVED SEPTEMBER 1, 1966
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5945

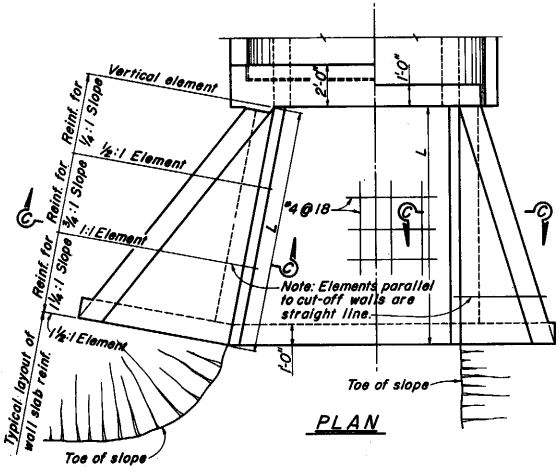


ALTERNATIVE WARPED WING

(Use where additional protection to toe of embankment is required.)

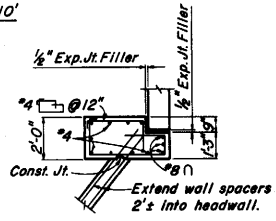


SECTION C-C

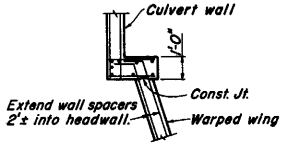


PLAN

Note: Details similar for box culverts.



SECTION A-A



SECTION B-B

WARPED WINGWALLS

Element Slope	H	8' or less	10'	12'	14'	16'	18'	20'
		WALL SLAB DIMENSIONS AND REINFORCING						
1/4:1	Front face reinf.	#4 @ 12	#4 @ 7	#5 @ 7	#5 @ 5	#6 @ 6	#7 @ 7	#7 @ 6
	Rear face reinf.	#4 @ 12	#4 @ 12	#4 @ 12	#4 @ 12	#4 @ 12	#4 @ 12	#4 @ 12
3/4:1	Front face reinf.	#4 @ 12	#4 @ 12	#4 @ 12	#4 @ 12	#4 @ 10	#4 @ 8	#4 @ 6
	Rear face reinf.	#4 @ 12	#4 @ 12	#4 @ 12	#4 @ 10	#4 @ 7	#4 @ 6	#5 @ 8
1 1/4:1	Front face reinf.	#4 @ 12	#4 @ 12	#4 @ 12	#4 @ 12	#4 @ 12	#4 @ 12	#4 @ 12
	Rear face reinf.	#4 @ 8	#4 @ 8	#4 @ 5	#5 @ 6	#6 @ 7	#6 @ 6	#7 @ 6
Slab at Cut-off Wall "D"		6"	6"	6"	7 1/2"	8"	9 1/2"	11"
Slab at Headwall "D"		6"	6"	6"	8"	9 1/2"	11"	1'-1"

H' max	L	12'	14'	16'	18'	20'	25'	30'	35'	40' or more
		STIFFENING BEAM DIMENSIONS & REINFORCING								
6'		No beam. Place 2-#6 in each								
8'		face along top of								
10'		wall	A = 1'-0"							
12'			B = 9"							
14'			Tot. 6-#6				A = 1'-6" B = 1'-0"			
16'					Tot. 6-#7			B = 1'-0"	A = 1'-10"	
18'							Tot. 6-#8			A = 2'-0" B = 1'-6"
20'								Tot. 8-#9		

Note: Walls designed for 2' surcharge; earth load = 120 #/cu. ft.; equivalent fluid pressure = 36 #/cu. ft.
Vary depth of warped slab uniformly from depth at cut-off wall to that at headwall.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

REINFORCED CONCRETE
WARPED WING HEADWALLS & ENDWALLS

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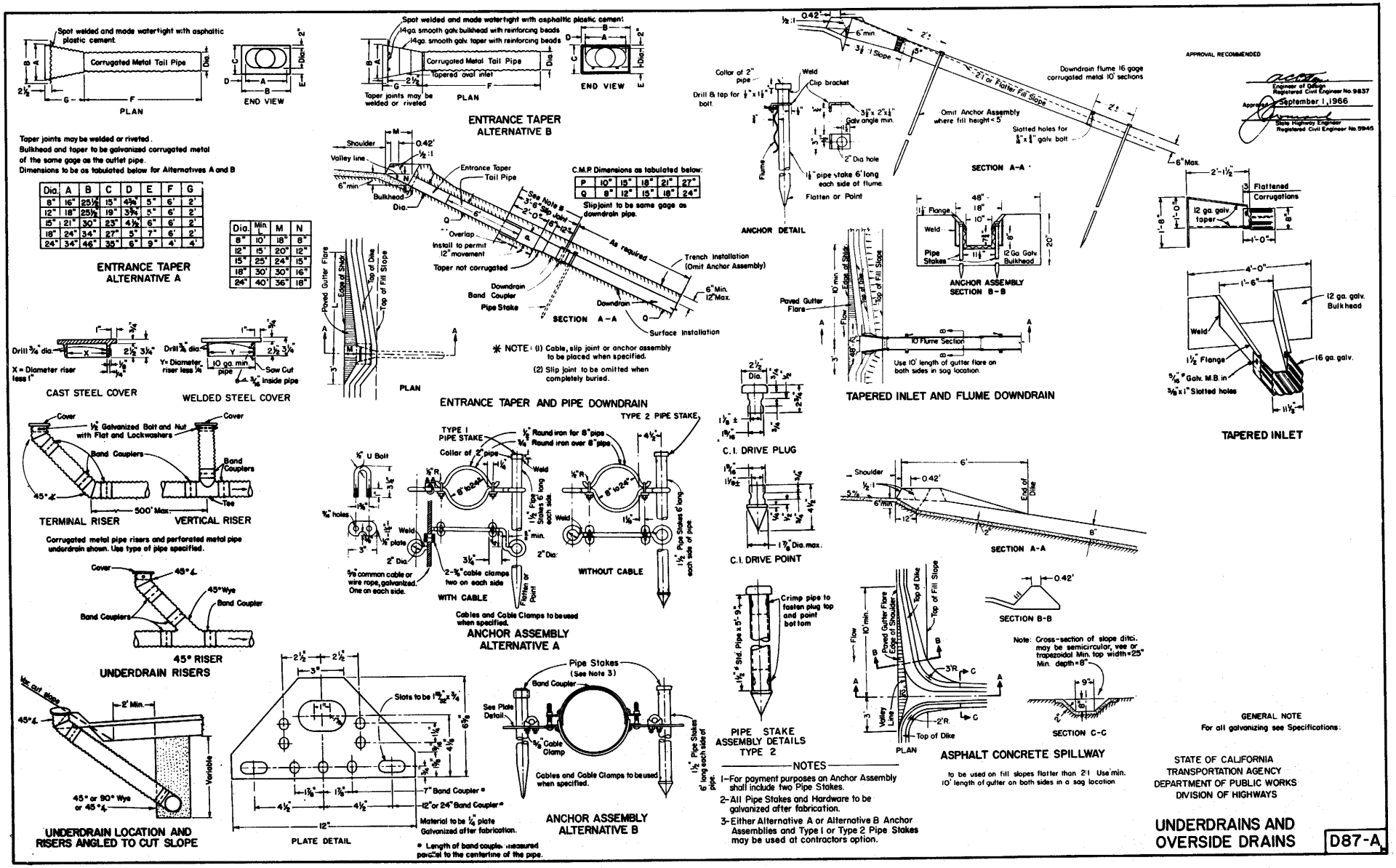

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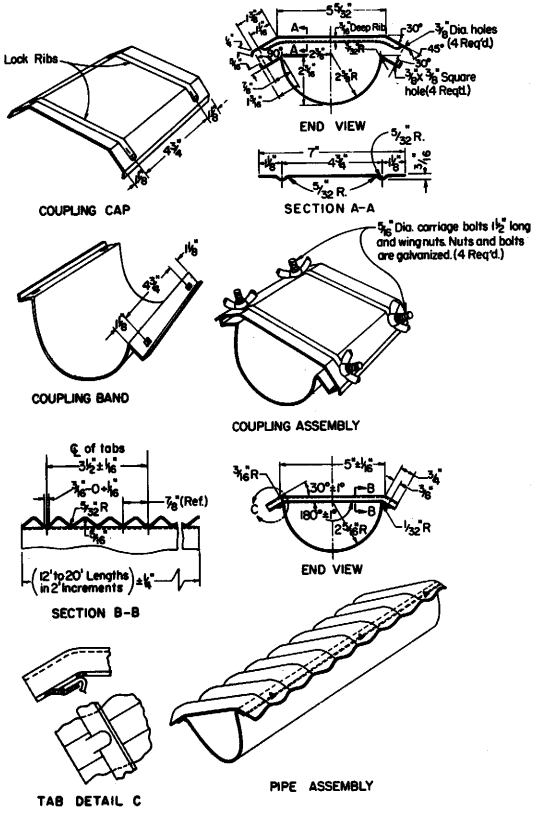

SEMICIRCULAR PIPE UNDERDRAIN

Notes:
1. Tolerance on all dimensions is ± 1/32" except as shown.
2. Corrugated lips at ends of underdrain may fall up, down or at any intermediate position.
3. Corrugated top section shall be attached to bottom section by tabbing as shown.

APPROVAL RECOMMENDED

Engineer of Design
Registered Civil Engineer No. 9837

Approved: September 1, 1966

State Highway Engineer
Registered Civil Engineer No. 5945

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

UNDERDRAINS

D87-B

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	CLASSIFICATION	18 – 50k AXLE					50 – 75k AXLE				
		SPAN	TYPE	MIN. COVER	STRUTS REQ'D	STRUT SIZE & SPACING	SPAN	TYPE	MIN. COVER	STRUTS REQ'D	STRUT SIZE & SPACING
BOX CULVERTS	A	2' to 5'	Single	4'	—	—	2' to 5'	Single	5'	—	—
	A	6'	Single	5'	—	—	6'	Single	5'	½ Pt.	Posts 4x6 @ 3' Sills 4x6, Cont.
	A	7' to 8'	Single	5'	—	—	7' to 8'	Single	5'	—	—
	A	10' to 12'	Single	5'	—	—	10' to 12'	Single	5'	—	—
	A	14'	Single	3'	—	—	14'	Single	3'	⅓ Pts.	Posts 6x6 @ 3'-6" Sills 6x8, Cont.
	A	4' to 12'	Multiple	5'	—	—	4' to 12'	Multiple	5'	—	—
	B, C, D, E	All	All	Span/1.75 or 5' Min.	—	—	All	All	Span/1.75 or 5' Min.	—	—
R.C. PIPES	12" to 39"	Min. Cover = 2'					Min. Cover = 3'				
	42" to 108"	Dia./1.75 or 4' Min.					Dia./1.75 or 4' Min.				
METAL CULVERTS	PIPES	To 120"	Min. Cover = 2'				Min. Cover = 2'				
		Over 120"	Dia./5 or 2' Min.				Dia./5 or 2' Min.				
	Arches, Pipe-Arches	All Spans	Span/7 or 2' Min.				Span/7 or 2' Min.				
R.C. ARCH CULVERTS	Spans to 14'	Span/2.5 or 4' Min.					Span/2.5 or 4' Min.				
	Spans to 22'	Span/3.5 or 5' Min.					Span/3.5 or 5' Min.				

	CLASSIFICATION	75 – 110k AXLE					110 – 150k AXLE				
		SPAN	TYPE	MIN. COVER	STRUTS REQ'D	STRUT SIZE & SPACING	SPAN	TYPE	MIN. COVER	STRUTS REQ'D	STRUT SIZE & SPACING
BOX CULVERTS	A	2' to 4'	Single	3'	—	—	2' to 4'	Single	4'	—	—
	A	5' to 6'	Single	5'	⅓ Pts.	Posts 4x6 @ 3' Sills 4x6, Cont.	5' to 6'	Single	5'	⅓ Pts.	Posts 4x6 @ 3' Sills 4x6, Cont.
	A	7' to 8'	Single	5'	—	—	7' to 8'	Single	5'	¼ Pts.	Posts 4x6 @ 3' Sills 4x6, Cont.
	A	10' to 12'	Single	5'	⅕ Pts.	Posts 6x6 @ 3'-6" Sills 6x6, Cont.	10' to 12'	Single	5'	⅕ Pts.	Posts 6x6 @ 3' Sills 6x6, Cont.
	A	14'	Single	3'	⅕ Pts.	Posts 6x8 @ 3'-6" Sills 6x8, Cont.	14'	Single	4'	⅕ Pts.	Posts 6x8 @ 3'-6" Sills 6x8, Cont.
	A	4' to 12'	Multiple	5'	—	—	4' to 12'	Multiple	5'	—	—
	B, C, D, E	All	All	Span/1.75 or 5' Min.	—	—	All	All	Span/1.75 or 5' Min.	—	—
R.C. PIPES	12" to 39"	Min. Cover = 4'					Min. Cover = 4'				
	42" to 108"	Dia./1.75 or 4' Min.					Dia./1.75 or 4' Min.				
METAL CULVERTS	PIPES	Dia./3 or 2' Min.					Dia./3 or 3' Min.				
		Dia./3 or 4' Min.					Dia./3 or 4' Min.				
	Arches, Pipe-Arches	Span/3 or 2' Min.					Span/3 or 3' Min.				
R.C. ARCH CULVERTS	Spans to 14'	Span/2.5 or 4' Min.					Span/2.5 or 4' Min.				
	Spans to 22'	Span/3.5 or 5' Min.					Span/3.5 or 5' Min.				

APPROVAL RECOMMENDED

Assistant State Highway Engineer
Registered Civil Engineer No. 5590

Approved September 1, 1966

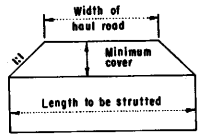
State Highway Engineer
Registered Civil Engineer No. 5945

Notes: Limits of strutting to be determined by Engineer, but shall not be less than as shown in sketch below.
Reference-Std. Box Culverts dated Oct. 4, 1960
Assumed tire patterns _____:

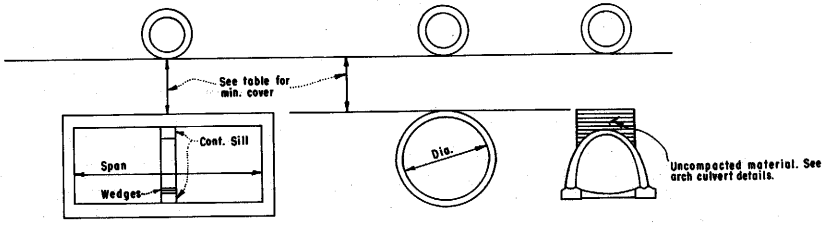
50k Axle	2.0' x 1.5'
75k Axle	3.0' x 2.0'
110k Axle	3.0' x 2.5'
150k Axle	3.0' x 3.0'

Impact = 50%
Timber sills & posts to be D.F., 1450f. Sills to be glued-laminated or solid timbers.

All strutting and removal to be at expense of the contractor.



MINIMUM LENGTH OF STRUTTING



BOX CULVERTS

R.C. PIPES & METAL CULVERTS

R.C. ARCH CULVERTS

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

CONSTRUCTION LOADS ON CULVERTS D88

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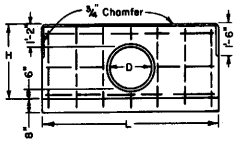
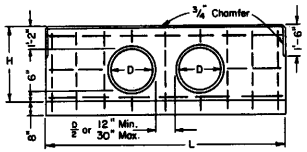
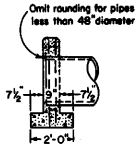


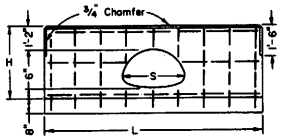
FRONT ELEV. SINGLE HEADWALL



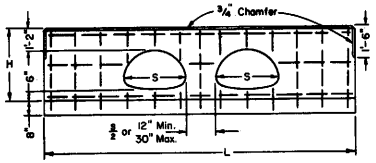
FRONT ELEV. DOUBLE HEADWALL



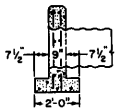
SECTION, SINGLE & DOUBLE HEADWALLS



FRONT ELEV. SINGLE HEADWALL



FRONT ELEV. DOUBLE HEADWALL



SECTION, SINGLE & DOUBLE HEADWALLS

APPROVAL RECOMMENDED

H. H. Dunshee
Assistant Engineer of Design
Registered Civil Engineer No. 5600

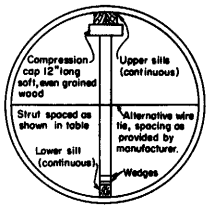
Approved September 1, 1966

Chief
State Highway Engineer
Registered Civil Engineer No. 5945

D in.	H ft.-in.	SINGLE L ft.-in.	SINGLE Steel Lbs.	SINGLE Conc. Cu.Yds.	DOUBLE L ft.-in.	DOUBLE Steel Lbs.	DOUBLE Conc. Cu. Yds.
12	2-8	5-0	35	0.60	7-0	45	0.82
15	2-11	6-0	40	0.75	8-6	55	1.04
18	3-2	7-0	50	0.91	9-6	65	1.21
21	3-5	7-6	60	1.02	10-6	80	1.38
24	3-8	8-6	75	1.20	11-6	90	1.57
27	3-11	9-6	85	1.39	13-0	105	1.84
30	4-2	10-0	85	1.52	14-0	115	2.04
33	4-5	11-0	100	1.73	15-0	120	2.25
36	4-8	12-0	105	1.95	16-6	140	2.56
39	4-11	12-6	130	2.09	17-6	165	2.79
42	5-2	13-6	140	2.34	18-6	180	3.03
45	5-5	14-6	150	2.60	20-0	195	3.38
48	5-8	15-0	160	2.75	21-0	200	3.64
51	5-11	16-0	180	3.03	22-6	225	4.02
54	6-2	17-0	190	3.31	23-6	240	4.30

STRAIGHT HEADWALLS

NOTE: Compression caps and sills to be some dimension timber as struts. Timber for struts and sills shall be Douglas Fir, "Construction Grade."

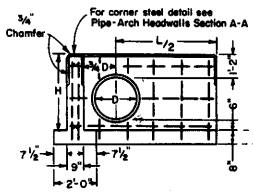


STRUT DETAILS

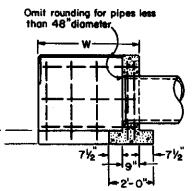
C.M.P.-ARCH SIZE	SINGLE H	SINGLE L	SINGLE Steel Lbs.	SINGLE Conc. Cu.Yds.	DOUBLE L	DOUBLE Steel Lbs.	DOUBLE Conc. Cu.Yds.
18"x11"	2'-7"	5'-6"	37	.64	8'-0"	52	.91
22"x13"	2'-9"	6'-6"	45	.77	9'-0"	56	1.04
25"x16"	3'-0"	7'-6"	50	.93	10'-6"	66	1.27
29"x18"	3'-2"	8'-6"	58	1.08	12'-6"	82	1.56
36"x22"	3'-6"	10'-6"	84	1.42	15'-0"	113	1.96
43"x27"	3'-11"	12'-6"	107	1.70	18'-0"	140	2.49
50"x31"	4'-3"	14'-6"	125	2.19	21'-0"	166	3.03
58"x36"	4'-8"	17'-0"	153	2.73	24'-6"	203	3.75
65"x40"	5'-0"	19'-0"	171	3.18	27'-0"	222	4.29
72"x44"	5'-4"	21'-0"	188	3.66	30'-0"	246	4.95

STRAIGHT HEADWALLS

NOTES:
1. No deduction made in quantities for thickness of pipe walls
2. All reinforcing steel #4 bars. All vertical and horizontal tie bars 18" maximum spacing.
3. Length of wall "W" may be varied to suit conditions encountered in the field, and straight line interpolation may be used to calculate quantities.



FRONT ELEV. "L" HEADWALL



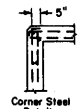
SECTION "L" HEADWALL

D in.	H ft.-in.	L/2 ft.-in.	3'-4" Steel Lbs.	3'-4" Conc. Cu.Yds.	4'-10" Steel Lbs.	4'-10" Conc. Cu.Yds.	6'-4" Steel Lbs.	6'-4" Conc. Cu.Yds.	7'-10" Steel Lbs.	7'-10" Conc. Cu.Yds.	9'-4" Steel Lbs.	9'-4" Conc. Cu.Yds.
12	2-8	2-6	50	.79	60	.98						
15	2-11	3-0	55	.91	65	1.11						
18	3-2	3-6	65	1.04	75	1.25						
21	3-5	3-9	75	1.15	90	1.36						
24	3-8	4-3	85	1.29	100	1.51	110	1.74				
27	3-11	4-9	90	1.44	105	1.67	115	1.91				
30	4-2	5-0	95	1.55	110	1.80	120	2.05	135	2.29		
33	4-5	5-6	105	1.71	120	1.97	135	2.23	150	2.48		
36	4-8	6-0	110	1.88	125	2.15	140	2.41	155	2.68	170	2.95
39	4-11	6-3			150	2.28	170	2.56	185	2.84	200	3.12
42	5-2	6-9			155	2.42	175	2.76	190	3.05	210	3.34
45	5-5	7-3					180	2.97	200	3.27	215	3.57
48	5-8	7-6					190	3.13	216	3.44	230	3.75
51	5-11	8-0							220	3.67	235	3.99
54	6-2	8-6							235	3.91	250	4.24

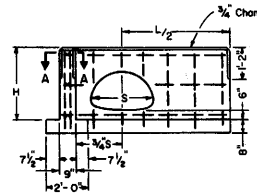
"L" HEADWALLS

FULL CIRCLE PIPE CULVERT HEADWALLS

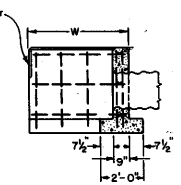
SPACING IN FEET OF TIMBER STRUTS FOR CORRUGATED METAL AND STRUCTURAL PLATE PIPE								
PIPE DIA.	STRUT SIZE	HEIGHT OF FILL IN FEET 0-20	30	40	50	60	70	80	100+
48"	4"x4"		5.0	3.5					
	4 x 6		6.0	5.0	4.0	3.5	3.0		
	6 x 6				6.0	5.0	4.5		
	6 x 8								
60	4 x 4	6.0	4.0	3.0					
	4 x 6		6.0	4.5	3.5	3.0			
	6 x 6				5.5	4.5	4.0	3.5	3.0
	6 x 8						5.5	4.5	4.0
72	4 x 4	5.0	3.0						
	4 x 6	6.0	5.0	3.5	3.0				
	6 x 6			6.0	4.5	4.0	3.5	3.0	3.0
	6 x 8					5.0	4.5	4.0	3.5
84	6 x 6	6.0	6.0	5.0	4.0	3.5	3.0		
	6 x 8				5.0	4.5	4.0	3.5	3.0
	8 x 8							4.5	3.5
96	6 x 6	6.0	5.5	4.5	3.5	3.0			
	6 x 8			5.5	4.5	4.0	3.5	3.0	
	8 x 8						4.5	4.0	3.0
108	6 x 6	6.0	5.0	3.5	3.0				
	6 x 8		6.0	5.0	4.0	3.5	3.0		
	8 x 8					4.5	4.0	3.5	3.0
120	6 x 6	6.0	4.0	3.0					
	6 x 8	6.0	5.5	4.0	3.5	3.0			
	8 x 8				5.0	4.0	3.5	3.0	3.0
132	6 x 6	5.0	3.5						
	6 x 8	6.0	4.5	3.5	3.0				
	8 x 8			5.5	4.5	4.0	3.5	3.0	
144	6 x 6	4.5	3.0						
	6 x 8	5.5	4.0	3.0					
	8 x 8			5.0	4.0	3.5	3.0	3.0	
156	6 x 8	4.5	3.0						
	8 x 8		6.0	4.5	3.5	3.0	3.0	3.0	
168	6 x 8	3.5							
	8 x 8	6.0	5.0	4.0	3.0	3.0	3.0		
180	6 x 8	3.0							
	8 x 8	6.0	4.5	3.5	3.0	3.0	3.0		
Thru 252	8 x 8	5.0	3.0	3.0	3.0	3.0			
	10 x 10	8.0	4.5	4.5	4.5	4.5			



SECTION A-A



FRONT ELEV. "L" HEADWALL



SECTION "L" HEADWALL

C.M.P.-ARCH SIZE	H	L/2	3'-4" Steel Lbs.	3'-4" Conc. Cu.Yds.	4'-10" Steel Lbs.	4'-10" Conc. Cu.Yds.	6'-4" Steel Lbs.	6'-4" Conc. Cu.Yds.	7'-10" Steel Lbs.	7'-10" Conc. Cu.Yds.	9'-4" Steel Lbs.	9'-4" Conc. Cu.Yds.
18"x11"	2'-7"	2'-9"	50	0.84	60	1.03	70	1.21	80	1.39	90	1.57
22"x13"	2'-9"	3'-3"	60	.96	65	1.14	75	1.33	85	1.52	95	1.71
25"x16"	3'-0"	3'-9"	60	1.03	70	1.28	80	1.48	95	1.68	105	1.88
29"x18"	3'-2"	4'-3"	70	1.21	80	1.42	90	1.62	100	1.83	110	2.04
36"x22"	3'-6"	5'-3"	95	1.46	110	1.69	120	1.91	135	2.13	150	2.35
43"x27"	3'-11"	6'-3"	110	1.76	125	2.00	135	2.24	150	2.47	165	2.75
50"x31"	4'-3"	7'-3"	125	2.05	140	2.30	150	2.56	165	2.81	180	3.06
58"x36"	4'-8"	8'-6"	140	2.45	155	2.72	170	2.99	185	3.26	200	3.52
65"x40"	5'-0"	9'-6"	180	2.78	195	3.07	210	3.35	230	3.63	245	3.91
72"x44"	5'-4"	10'-6"	195	3.13	210	3.43	230	3.72	245	4.02	265	4.32

"L" HEADWALLS

CORRUGATED METAL PIPE-ARCH CULVERT HEADWALLS

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

PIPE HEADWALLS AND STRUT DETAILS

D89-1

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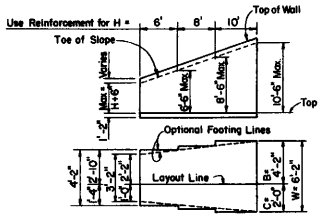
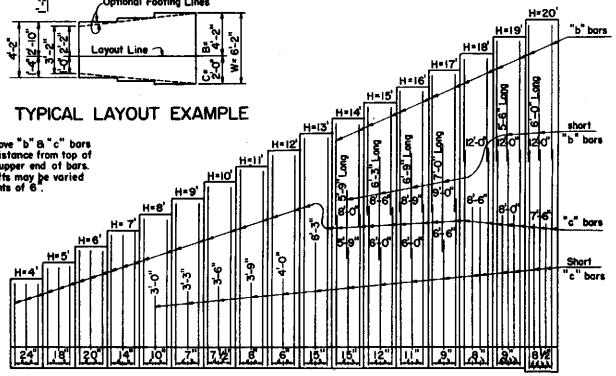
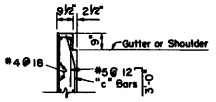
Design Notes:
Unit Stresses: f_s = 20,000 psi, f_c = 1200 psi, n = 10
Maximum Toe Pressure = 1 ½ Tons/sq.ft.
Elevations, length and angle of flare of wings may be varied by the Engineer to suit conditions encountered in the field.
Walls designed for 2' live load surcharge, 1 ½:1 sloping surcharge not to exceed 5' in elevation plus 2' live load surcharge, or unlimited 2:1 surcharge.



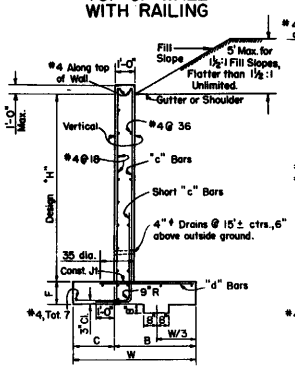
TYPICAL LAYOUT EXAMPLE



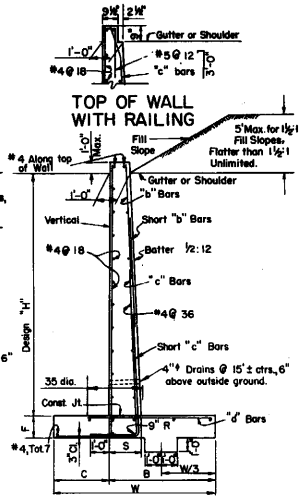
Number above "b" & "c" bars indicates distance from top of footing to upper end of bars. Bar cut-offs may be varied in increments of 6".



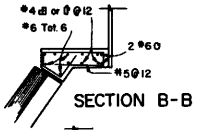
TOP OF WALL WITH RAILING



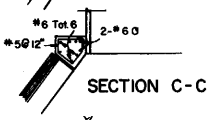
TYPICAL SECTION H=4' THRU 12'



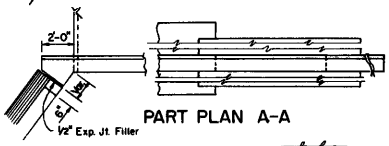
TYPICAL SECTION H=13' THRU 20'



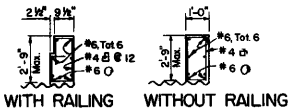
SECTION B-B



SECTION C-C

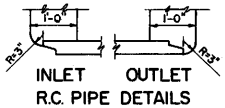


PART PLAN A-A



WITH RAILING WITHOUT RAILING

SECTION D-D



INLET OUTLET
R.C. PIPE DETAILS

APPROVAL RECOMMENDED

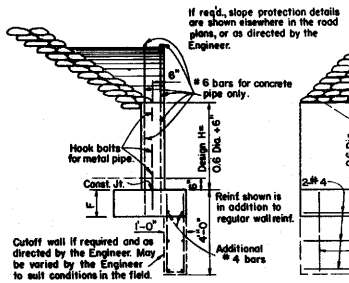
Bridge Engineer Civil Engineer - License 5985

Approved September 1, 1966

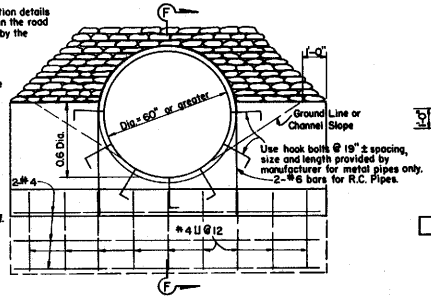
State Highway Engineer
Registered Civil Engineer License No. 5945

REINFORCED CONCRETE WING HEADWALLS AND ENDWALLS

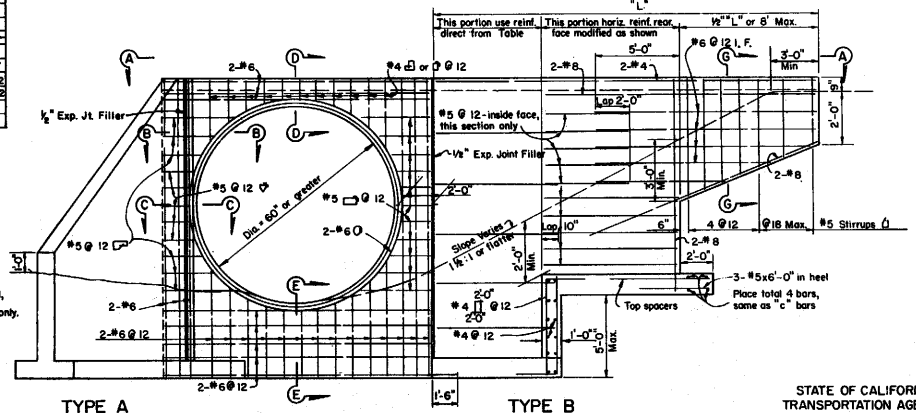
H	4'	5'	6'	7'	8'	9'	10'	11'	12'	13'	14'	15'	16'	17'	18'	19'	20'
W	3'-2"	3'-8"	4'-2"	4'-8"	5'-2"	5'-8"	6'-2"	6'-8"	7'-2"	7'-8"	8'-0"	8'-8"	9'-4"	10'-0"	10'-8"	11'-4"	12'-0"
C	1'-0"	1'-2"	1'-4"	1'-6"	1'-8"	1'-10"	2'-0"	2'-2"	2'-4"	2'-6"	2'-8"	3'-0"	3'-4"	3'-8"	4'-0"	4'-4"	4'-8"
B	2'-2"	2'-6"	2'-10"	3'-2"	3'-6"	3'-10"	4'-2"	4'-6"	4'-10"	5'-2"	5'-4"	5'-8"	6'-0"	6'-4"	6'-8"	7'-0"	7'-4"
F	1'-2"																1'-4"
Batter	None									½:12							
S	1'-0"									1'-6½"	1'-7"	1'-7½"	1'-8"	1'-8½"	1'-9"	1'-9½"	1'-10"
"b" bars	None										#5@15	#5@12	#5@11	#5@9	#6@24	#6@18	#7@17
"c" bars	#4@24	#4@18	#5@20	#5@14	#5@10	#5@7	#6@7½	#7@8	#7@6	#9@15	#9@15	#9@12	#9@11	#9@9	#9@8	#11@9	#11@7½
"d" bars	#4@24	#4@18	#5@20	#5@14	#5@10	#6@14	#7@15	#8@16	#7@12	#8@15	#9@15	#9@12	#9@11	#9@9	#9@8	#10@9	#10@7½
Conc. $CY_{/L.F.}$	0.32	0.38	0.44	0.49	0.55	0.61	0.67	0.73	0.79	1.02	1.10	1.18	1.26	1.36	1.45	1.55	1.72
Reinf. $LB_{/L.F.}$	13	16	19	25	30	37	49	62	76	73	90	104	123	141	170	189	206



SECTION F-F

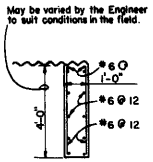


TYPE C HEADWALL

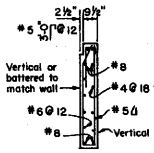


TYPE A END ELEVATION TYPE B

STRAIGHT WING HEADWALLS



SECTION E-E



SECTION G-G

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

PIPE CULVERT HEADWALLS TYPES "A" "B" & "C"

D90-1

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SPAN	5'												6'									
HEIGHT	6'				7'				8'				8'					9				
Strength Classification	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	E	A	B	C	D	E
Max. Fill Over Top	9	22	33	45	9	24	34	45	9	26	35	45	5	25	32	39	45	4	25	32	39	45
Conc. Top Slab T1	7	7	8	9	7	7	8	9	7	7	8	9	7½	7½	8	8½	9¼	7½	7½	8	8¾	9¼
Conc. Bottom Slab T2	6	7¼	8¼	9¼	6	7¼	8¼	9¼	6	7½	8½	9¼	6½	8	8½	9½	10¼	6	8½	9	9¾	10½
Conc. Sidewalls T3	6	6	6¾	7½	6	6½	7¼	8	6	6¾	7¾	8½	6	6¾	7½	8½	9¼	6½	7½	8	8¾	9½
Reinforcing Steel "a" Size: Bar#	5	5	5	6	5	5	5	6	5	5	5	6	6	6	6	6	6	6	6	6	6	7
"a" Spacing	5	7	5½	6	5	7	5½	6	5	7	5½	5½	6½	6½	6	5½	5	6½	7	6	5½	6½
"a" Length	5-8	5-8	5-10	5-11	5-8	5-9	5-11	6-0	5-8	5-10	6-0	6-1	6-8	6-10	6-11	7-1	7-3	6-9	6-11	7-0	7-2	7-3
"a1" Size: Bar#	5	5	5	6	5	5	5	6	5	5	5	6	5	6	6	7	6	5	6	6	6	7
"a1" Spacing	8	7	5½	6	8	7	5½	6	8	6½	5½	5½	8	6	5½	7	5	6½	7	5½	5½	6½
"a1" Length	5-8	5-8	5-10	5-11	5-8	5-9	5-11	6-0	5-8	5-10	6-0	6-1	6-8	6-10	6-11	7-1	7-3	6-9	6-11	7-0	7-2	7-3
"b" Size: Bar#	5	5	5	5	5	5	5	6	5	5	6	6	5	6	6	6	6	5	6	6	6	7
"b" Spacing	16	14	11	11	16	11	11	12	16	10	12	11	16	13	13	11	10	15	14	12	10	12
"b" Dimension "X"	1-3	1-4	1-5	1-5	1-3	1-4	1-6	1-7	1-3	1-4	1-6	1-8	1-5	1-6	1-7	1-8	1-9	1-5	1-5	1-7	1-9	1-10
"b" Length	3-1	3-2	3-3	3-3	3-1	3-2	3-4	3-9	3-1	3-2	3-9	3-10	3-3	3-9	3-9	3-10	3-11	3-3	3-7	3-9	3-11	4-5
"c" Size: Bar#	5	5	5	5	5	5	5	6	5	5	6	6	5	6	6	6	6	5	6	6	6	7
"c" Spacing	16	14	11	11	16	11	11	12	16	10	12	11	16	13	13	11	10	15	14	12	10	12
"c" Dimension "Y"	1-9	1-9	1-10	1-10	1-9	1-10	1-11	2-0	1-9	1-10	2-0	2-2	1-9	2-0	2-2	2-3	2-4	1-9	2-0	2-2	2-4	2-5
"c" Length	8-1	8-1	8-4	8-4	9-1	9-2	9-4	9-6	10-1	10-2	10-5	10-8	10-2	10-4	10-7	10-9	10-10	11-2	11-5	11-7	11-10	11-11
"c1" Size: Bar#	5	5	5	5	5	5	5	6	5	5	6	6	5	6	6	6	6	5	6	6	6	7
"c1" Spacing	16	14	11	11	16	11	11	12	16	10	12	11	16	13	13	11	10	15	14	12	10	12
"c1" Dimension "Y"	1-8	1-9	1-9	1-9	1-8	1-9	1-11	2-0	1-8	1-9	2-0	2-2	1-10	2-0	2-1	2-2	2-3	1-11	2-0	2-2	2-4	2-5
"c1" Length	3-3	3-5	3-6	3-7	3-3	3-5	3-9	4-1	3-3	3-6	4-1	4-3	3-6	4-0	4-2	4-4	4-5	3-6	4-1	4-3	4-6	4-11
"d" bars Tot. No. Top Slab	7	3	3	3	7	3	3	3	7	3	3	3	8	4	4	4	4	8	4	4	4	4
"d" bars Tot. No. Bot. Slab	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4
"e" bars Spacing	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Spacers Total No.	32	32	32	32	36	36	36	36	40	40	40	40	44	44	44	44	44	44	44	44	44	44
Quan. Concrete: C.Y. per lin. ft.	.46	.49	.57	.63	.50	.55	.63	.70	.54	.61	.70	.78	.61	.67	.74	.83	.91	.66	.78	.83	.91	.99
Quan. Reinf: Lbs. per lin. ft.	88	87	103	113	93	102	111	139	99	114	136	157	110	146	152	170	183	118	142	163	182	208

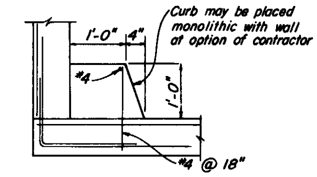
SPAN	7'												8'															
HEIGHT	8				9				10'				9'				10'				11'				12'			
Strength Classification	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
Max. Fill Over Top	3	22	29	35	3	22	29	35	3	23	29	35	3	20	25	30	2	19	24	30	2	18	24	30	2	15	23	30
Conc. Top Slab T1	7½	7½	8½	9¾	7½	7½	8½	10	7½	7½	8½	10	7¾	7¾	8½	10½	7¾	7¾	9	10¼	7¾	7¾	9¼	10	7¾	7¾	9½	10½
Conc. Bottom Slab T2	6¼	8¼	9¼	10¾	6½	8¼	9	11	6½	8¾	9¾	11	6½	8¾	9½	11¼	6¾	9	9¾	11	6¾	9	10	10¾	7	9¼	10½	11½
Conc. Sidewalls T3	6½	7½	8	9½	6¾	7¾	8½	10	7	8	8¾	10¼	7	8¼	8¾	9¾	7½	8½	9¼	10¼	8	8½	9½	10½	8½	8¾	10	11
Reinforcing Steel "a" Size: Bar#	6	6	6	7	6	6	6	6	6	5	6	7	6	6	6	7	6	6	6	7	6	6	6	7	6	5	6	6
"a" Spacing	6	6	5	6	6	6	5½	5	6½	5	6	6½	6	5½	5½	6	5½	6	5	6½	6	6½	5	6½	6½	6	7	5
"a" Length	7-9	7-11	8-0	8-3	7-10	8-0	8-1	8-4	7-10	8-0	8-2	8-5	8-10	9-1	9-2	9-4	8-11	9-1	9-3	9-5	9-0	9-1	9-3	9-5	9-1	9-2	9-4	9-6
"a1" Size: Bar#	6	6	6	7	5	6	6	6	5	6	7	7	6	6	6	7	5	6	6	7	5	6	6	7	5	6	7	7
"a1" Spacing	8	5½	5	6	6	6	5½	5	6½	6	7½	6½	8	5½	5	6	5½	5½	5	6	5½	6	5	6	6	6	7	6
"a1" Length	7-9	7-11	8-0	8-3	7-10	8-0	8-1	8-4	7-10	8-0	8-2	8-5	8-10	9-1	9-2	9-4	8-11	9-1	9-3	9-5	9-0	9-1	9-3	9-5	9-1	9-2	9-4	9-6
"b" Size: Bar#	5	6	6	7	5	6	6	7	6	6	6	7	6	6	6	6	6	6	6	7	5	6	6	7	6	6	7	7
"b" Spacing	12	12	12	12	13	12	10½	13	16	11	10½	13	18	11	11	12	18	11	10½	13	12	11	10	12	16	12	13	12
"b" Dimension "X"	1-4	1-5	1-8	1-11	1-5	1-7	1-9	2-0	1-5	1-8	1-10	2-0	1-8	1-8	1-9	1-10	1-9	1-9	1-10	2-0	1-9	1-9	1-10	2-1	1-11	1-10	2-0	2-3
"b" Length	3-2	3-7	3-10	4-6	3-3	3-9	3-11	4-7	3-7	3-10	4-0	4-7	3-10	3-10	3-11	4-0	3-11	3-11	4-0	4-7	3-7	3-11	4-0	4-8	4-1	4-0	4-7	4-10
"c" Size: Bar#	5	6	6	7	5	6	6	7	6	6	6	7	6	6	6	6	6	6	6	7	5	6	6	7	6	6	7	7
"c" Spacing	12	12	12	12	13	12	10½	13	16	11	10½	13	18	11	11	12	18	11	10½	13	12	11	10	12	16	12	13	12
"c" Dimension "Y"	1-6	1-11	2-2	2-5	1-7	2-2	2-5	2-7	1-8	2-5	2-7	2-8	1-10	2-4	2-5	2-5	1-10	2-5	2-6	2-7	1-10	2-6	2-6	2-8	2-4	2-9	2-11	2-11
"c" Length	9-11	10-4	10-8	11-0	11-0	11-7	11-11	12-2	12-1	12-10	13-1	13-3	11-3	11-9	11-10	12-1	12-3	12-10	13-0	13-2	13-3	13-11	14-0	14-3	14-9	15-2	15-5	15-6
"c1" Size: Bar#	5	6	6	7	5	6	6	7	6	6	6	7	6	6	6	6	6	6	6	7	5	6	6	7	6	6	7	7
"c1" Spacing	12	12	12	12	13	12	10½	13	16	11	10½	13	18	11	11	12	18	11	10½	13	12	11	10	12	16	12	13	12
"c1" Dimension "Y"	1-9	1-11	2-3	2-7	1-11	2-2	2-4	2-7	2-1	2-3	2-5	2-7	2-3	2-3	2-3	2-3	2-4	2-4	2-4	2-7	2-4	2-4	2-5	2-10	2-11	2-6	2-9	2-11
"c1" Length	3-4	3-11	4-4	5-1	3-7	4-2	4-5	5-1	4-0	4-4	4-7	5-1	4-2	4-4	4-5	4-6	4-3	4-5	4-6	5-1	4-0	4-5	4-7	5-4	4-10	4-7	5-3	5-6
"d" bars Tot. No. Top Slab	9	4	4	4	9	4	4	4	9	4	4	4	9	5	5	5	9	5	5	5	9	5	5	5	9	5	5	5
"d" bars Tot. No. Bot. Slab	4	4	4	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
"e" bars Spacing	18	18	18	18	18	16	18	18	18	15	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	13	15	14
Spacers Total No.	44	44	44	44	44	44	44	44	48	48	48	48	44	44	44	44	48	48	48	48	48	48	48	48	52	52	52	52
Quan. Concrete: C.Y. per lin. ft.	.66	.77	.85	1.01	.73	.83	.93	1.12	.79	.91	1.02	1.20	.79	.94	1.01	1.19	.88	1.01	1.12	1.27	.96	1.06	1.21	1.34	1.06	1.15	1.34	1.48
Quan. Reinf: Lbs. per lin. ft.	132	161	173	217	132	168	184	208	145	181	192	220	145	187	192	200	155	193	208	231	156	193	218	247	168	196	232	263

APPROVAL RECOMMENDED

BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO. 5585

APPROVED SEPTEMBER 1, 1966

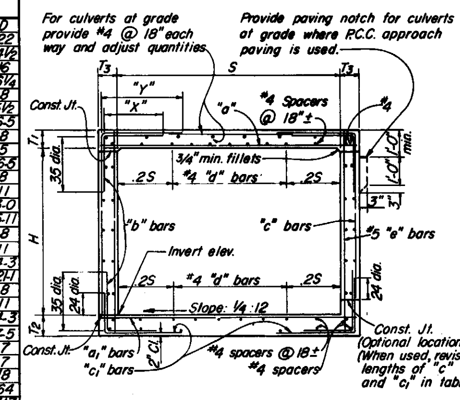
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5945



EQUIPMENT PASS CURB DETAILS

SPAN	10																			
HEIGHT	11				12				13				14				15			
Strength Classification	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
Max. Fill Over Top	2	12	20	28	2	12	20	28	2	12	20	28	2	11	19	28	3	11	19	28
Conc. Top Slab T1	8½	8½	10½	12¼	8½	8½	10½	12¼	8½	8½	10½	12¼	8¼	8¾	10¾	12½	8	8¾	10¾	12¾
Conc. Bottom Slab T2	7½	9	11½	13¼	8½	9¼	11¾	13½	8	9½	11¾	13½	8¼	10	12¼	13¾	9	10½	12½	13¾
Conc. Sidewalls T3	8	8½	10½	12½	8½	8¾	11	13¼	9	9	11½	13¾	11	10½	12	14	12	12	12½	14
Reinforcing Steel "a" Size: Bar#	6	6	7	7	6	6	7	7	6	6	7	7	6	6	7	7	6	5	7	7
"a" Spacing	5½	5½	6	5	5½	5½	5½	5	6	7	6	5½	6	8½	6	6	6	6½	8	6½
"a" Length	11-0	11-1	11-5	11-9	11-1	11-2	11-6	11-11	11-2	11-2	11-7	12-0	11-6	11-5	11-8	12-0	11-8	11-8	11-9	12-0
"a1" Size: Bar#	6	7	7	8	6	7	7	8	5	7	7	8	6	7	7	8	6	7	7	8
"a1" Spacing	6½	7	6	6	6½	7	5½	5½	5	7	5½	6½	7	8½	5½	7	9	6½	7	6
"a1" Length	11-0	11-1	11-5	11-9	11-1	11-2	11-6	11-11	11-2	11-2	11-7	12-0	11-6	11-5	11-8	12-0	11-8	11-8	11-9	12-0
"b" Size: Bar#	5	6	7	7	5	6	7	7	5	7	7	8	6	7	7	8	6	6	7	7
"b" Spacing	10	11	13	12	10	11	12	10	10	14	11	12	12	13	10	12	12	13	10	12
"b" Dimension "X"	1-9	1-9	2-1	2-3	1-10	1-11	2-2	2-5	1-11	2-1	2-3	2-6	2-0	2-5	2-4	2-6	2-1	2-8	2-5	2-6
"b" Length	3-7	3-11	4-8	4-10	3-8	4-1	4-9	5-0	3-9	4-8	4-10	5-5	4-2	5-0	4-11	5-5	4-3	5-3	5-0	5-5
"c" Size: Bar#	5	6	7	7	5	6	7	7	5	7	7	8	6	7	7	8	6	7	7	8
"c" Spacing	10	11	13	12	10	11	12	10	10	14	11	12	12	13	10	12	12	13	10	12
"c" Dimension "Y"	2-1	2-5	2-11	3-0	2-4	2-9	3-0	3-4	2-7	3-1	3-1	3-7	2-11	3-4	3-3	2-6	3-3	3-8	3-5	3-7
"c" Length	13-6	13-10	14-6	14-9	14-9	15-2	15-7	16-1	16-0	16-6	16-8	17-4	17-4	17-9	17-10	17-3	18-8	19-1	18-11	19-4
"c1" Size: Bar#	5	6	7	7	5	6	7	7	5	7	7	8	6	7	7	8	6	7	7	8
"c1" Spacing	10	11	13	12	10	11	12	10	10	14	11	12	12	13	10	12	12	13	10	12
"c1" Dimension "Y"	2-5	2-5	2-11	3-0	2-8	2-9	3-0	3-4	2-10	3-0	3-1	3-7	3-4	3-4	3-4	2-6	3-9	3-8	3-6	3-7
"c1" Length	4-2	4-6	5-6	5-9	4-6	4-10	5-7	6-1	4-7	5-5	5-8	6-7	5-4	5-9	5-11	5-6	5-10	6-2	6-2	6-7
"d" bars Tot. No. Top Slab	10	5	5	5	10	5	5	5	9	5	5	5	9	5	5	5	9	5	5	5
"d" bars Tot. No. Bot. Slab	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
"e" bars Spacing	18	18	18	18	18	18	18	18	18	18	18	18	18	18	16	15	18	18	14	12
Spacers Total No.	48	48	48	48	52	52	52	52	56	56	56	56	60	60	60	60	60	60	60	60
Quan. Concrete: C.Y. per lin. ft.	1.10	1.19	1.51	1.80	1.23	1.28	1.63	1.95	1.31	1.36	1.74	2.08	1.55	1.59	1.89	2.21	1.74	1.82	2.03	2.31
Quan. Reinf: Lbs. per lin. ft.	187	216	259	299	196	227	287	345	198	240	305	362	227	251	335	356	229	258	325	372

SPAN	12																14											
HEIGHT	13				14				15				16				14				15				16			
Strength Classification	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
Max. Fill Over Top	2	9	16	24	2	8	15	23	2	8	15	22	2	7	14	22	2	8	15	22	2	8	15	22	2	8	15	22
Conc. Top Slab T1	8¾	9½	11	12¾	8¾	9½	11	12¾	8¾	9¼	11	12¾	8¾	9½	11¼	13	9	10¼	11¾	14½	9	10½	12	14½	9	10¾	12¼	14½
Conc. Bottom Slab T2	8½	10¼	12	14	9	10½	12¼	14	9½	10¾	12¼	14	10	11	13	14½	9½	11½	13½	15½	10	11¾	13¾	15¾	10¼	12	13¾	16
Conc. Sidewalls T3	9	9	11¾	14	11	11	12¼	14¼	12	12	12½	14½	13	13	13	14¾	11	11¼	13	15½	11½	11¾	13½	16	12	12	13¾	16¼
Reinforcing Steel "a" Size: Bar#	6	7	7	8	6	6	7	7	6	6	7	7	6	6	6	8	6	7	7	8	6	7	7	8	6	7	8	8
"a" Spacing	5	6½	5½	6	5½	6	6	5	6	6	6	5	6	6	5½	7	5	6	5	5½	5	6	5	5½	5½	6	7	5½
"a" Length	13-2	13-2	13-8	14-0	13-6	13-6	13-9	14-1	13-8	13-8	13-9	14-1	13-11	13-11	13-11	14-2	15-6	15-5	15-10	16-3	15-7	15-8	15-11	16-4	15-8	15-8	16-0	16-5
"a1" Size: Bar#	6	7	8	8	6	7	8	8	6	7	7	8	6	7	7	8	6	7	8	8	6	7	8	8	6	7	8	8
"a1" Spacing	6	6	6½	5½	6½	6½	7	6	6½	7	5	6	6½	6½	6½	6	5½	5	6	5	5½	5½	6	5	5½	5½	6	5
"a1" Length	13-2	13-2	13-8	14-0	13-6	13-6	13-9	14-1	13-8	13-8	13-9	14-1	13-11	13-11	13-11	14-2	15-6	15-5	15-10	16-3	15-7	15-8	15-11	16-4	15-8	15-8	16-0	16-5
"b" Size: Bar#	6	7	7	8	6	7	7	8	7	7	7	8	6	7	7	8	6	7	7	8	6	7	7	8	6	7	8	8
"b" Spacing	12	14	11	12	11½	13	11	12	15	12	11	12	10	12	11	12	11	11	10	11	10	11	10	11	10	12	12	11
"b" Dimension "X"	1-11	2-3	2-4	2-9	2-1	2-3	2-5	2-10	2-3	2-3	2-6	2-10	2-6	2-8	2-9	2-11	2-4	2-6	2-8	3-0	2-5	2-8	2-9	3-0	2-5	2-9	2-10	3-0
"b" Length	4-1	4-10	4-11	5-8	4-3	4-10	5-0	5-9	4-10	4-10	5-1	5-9	4-8	5-3	5-4	5-10	4-6	5-1	5-3	5-11	4-7	5-3	5-4	5-11	4-7	5-4	5-9	5-11
"c" Size: Bar#	6	7	7	8	6	7	7	8	7	7	7	8	6	7	7	8	6	7	7	8	6	7	7	8	6	7	8	8
"c" Spacing	12	14	11	12	11½	13	11	12	15	12	11	12	10	12	11	12	11	11	10	11	10	11	10	11	10	12	12	11
"c" Dimension "Y"	2-10	2-9	3-2	3-0	3-1	3-1	3-5	3-6	3-4	3-5	3-8	4-0	3-7	3-9	3-10	4-0	3-3	3-9	3-10	4-4	3-5	3-9	4-0	4-4	3-6	3-8	4-1	4-3
"c" Length	16-3	16-3	16-9	16-9	17-6	17-7	18-0	18-3	18-9	18-11	19-3	19-9	20-0	20-3	20-6	20-9	17-8	18-3	18-6	19-2	18-10	19-3	19-8	20-2	19-11	20-3	20-9	21-1
"c1" Size: Bar#	6	7	7	8	6	7	7	8	7	7	7	8	6	7	7	8	6	7	7	8	6	7	7	8	6	7	8	8
"c1" Spacing	12	14	11	12	11½	13	11	12	15	12	11	12	10	12	11	12	11	11	10	11	10	11	10	11	10	12	12	11
"c1" Dimension "Y"	3-0	3-2	3-2	3-9	3-4	3-4	3-4	3-11	3-8	3-6	3-6	4-0	3-10	3-10	3-11	4-0	3-6	3-8	3-9	4-3	3-9	3-10	3-11	4-3	3-11	3-11	4-1	4-3
"c1" Length	5-1	5-7	5-9	6-9	5-5	5-10	5-11	6-11	6-1	6-0	6-1	7-0	6-0	6-4	6-7	7-1	5-8	6-3	6-6	7-5	5-11	6-5	6-8	7-5	6-1	6-6	7-1	7-5
"d" bars Tot. No. Top Slab	12	6	6	6	11	6	6	6	11	6	6	6	11	6	6	6	13	7	7	7	13	7	7	7	12	7	7	7
"d" bars Tot. No. Bot. Slab	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	7	7	7	7	7	7	7	7	7	7	7	7
"e" bars Spacing	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Spacers Total No.	56	56	56	56	60	60	60	60	60	60	60	60	64	64	64	64	60	60	60	60	60	60	60	60	64	64	64	64
Quan. Concrete: C.Y. per lin. ft.	1.44	1.55	1.93	2.31	1.71	1.81	2.07	2.42	1.90	1.97	2.17	2.52	2.10	2.18	2.34	2.68	1.85	2.04	2.38	2.87	2.00	2.18	2.54	3.03	2.13	2.31	2.67	3.17
Quan. Reinf: Lbs. per lin. ft.	225	278	337	408	252	285	339	409	265	300	352	419	285	320	341	426	287	364	406	494	305	367	417	502	309	363	444	512



TYPICAL SECTION

NOTE:

For boxes of height less than that shown in the table, use next greater table height slabs, wall dimensions and reinforcing steel, and make necessary changes in bar lengths, number of spacers and quantities.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

SPECIAL SINGLE BOX CULVERTS & EQUIP. PASSES | D91

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SPAN	5'				6'				7'				8'				9'				10'				11'				12'			
HEIGHT	6'				7'				8'				9'				10'				11'				12'				13'			
Strength Classification	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
Max. Fill Over Top	4	16	30	45	3	16	30	45	3	16	30	45	3	16	30	45	3	16	30	45	2	7	18	30	2	8	19	30	2	9	20	30
Conc. Top Slab T_1	7	7	8½	10¼	7	7	8½	10¼	7	7	8½	10¼	7½	7½	9¼	11¼	7½	7½	9¼	11¼	7½	7½	9	11	7¾	7¾	10¼	12¼	7¾	7¾	10½	12½	7¾	7¾	10½	12¼	7¾	7¾	10½	12¼
Conc. Bottom Slab T_2	6	8	9¾	11½	6	8	9¾	11½	6	8	9¾	11½	6	8	10½	12½	6¼	8¼	10½	12½	6¼	8½	10½	12¼	7¼	8¾	11	13½	7½	9	11¼	13½	7½	9¼	11½	13½	7½	9	11½	13½
Conc. Sidewalls T_3	6	6	6½	7	6	6	7¼	8¼	6	6	7¾	9½	6	6	7¼	8½	6¼	6½	8	9¼	6½	7	8½	10	7	7	7½	9	7¾	7¾	8¼	9¾	8½	8½	9¾	10½	9	9	10	12
REINFORCING STEEL "a" or "a_1" Size: Bar # "a"	5	4	4	4	6	4	4	4	6	4	4	4	6	4	4	5	6	4	4	5	6	4	5	5	6	4	5	5	6	4	5	6
Spacing "a"	12	14	12	10½	11½	11½	12	10	11½	11½	13	11	13	11½	10	11	13	11½	12	11	11½	11	10	11½	12	12	13	11½	12	14	13	11½	11	13	11	12	10	12	12	9
Size: Bar # "a_1"	4	5	5	4	4	5	4	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Spacing "a_1"	12	14	12	10½	11	11½	12	10	11	11½	12	10½	11½	11	11½	10½	13	12	13	10	13	12	10	12	11	12	11	11	11	11	12	11½	11	13	12	11½	11	11½	12	10
Length "a" or "a_1"	11-2	11-2	11-3	11-5	11-2	11-2	11-6	11-9	11-2	11-2	11-7	12-1	13-2	13-2	13-6	13-10	13-3	13-3	13-8	14-0	13-3	13-3	13-8	14-0	17-5	17-5	17-7	17-11	17-7	17-7	17-9	18-1	17-10	17-10	17-10	18-3	17-11	17-11	18-2	18-8
"b" Size: Bar #	6	5	6	6	5	5	6	6	5	5	6	6	6	5	6	7	6	5	6	6	5	5	6	7	6	6	7	7	6	6	7	7	6	6	6	7	6	6	6	6
Spacing	12	14	12	10½	11½	11½	12	10	11½	11½	13	11	13	11½	10	11	13	11½	12	11	11½	11	10	11½	12	12	13	11½	12	14	13	11½	11	13	11	12	10	12	12	9
Length	11-5	11-6	11-8	11-11	11-6	11-6	11-10	12-3	11-6	11-6	12-0	12-7	13-6	13-6	13-11	14-4	13-6	13-8	14-1	14-7	13-8	13-9	14-3	14-8	17-9	17-9	18-0	18-7	17-11	17-11	18-2	18-9	18-2	18-2	18-5	18-11	18-3	18-3	18-8	19-4
"b_1" Size: Bar #	6	5	6	6	5	5	6	6	5	5	6	6	4	5	6	7	5	6	7	6	5	6	7	7	5	6	7	8	5	6	7	7	5	6	7	7	6	6	7	7
Spacing	12	14	12	10½	11	11½	12	10	11	11½	12	10½	11½	11	11½	10½	13	12	13	10	13	12	10	12	11	12	11	11	11	11	12	11½	11	13	12	11½	11	11½	12	10
Length	11-4	11-6	11-9	11-11	11-4	11-6	11-11	12-3	11-4	11-6	12-0	12-7	13-4	13-6	13-11	14-4	13-5	13-7	14-1	14-7	13-6	13-9	14-3	14-9	17-8	17-9	18-0	18-6	17-10	18-0	18-3	18-9	18-1	18-2	18-4	18-11	18-2	18-3	18-8	19-4
"c" or "c_1" Size: Bar "c"	4	6	6	6	4	6	6	6	4	5	6	6	5	6	6	7	5	6	7	7	5	5	6	7	5	6	7	8	5	7	7	8	4	6	7	8	4	6	7	7
Spacing "c"	12	14	12	10½	11½	11½	12	10	11½	11½	12	10½	11½	11	11½	10½	13	11½	10	11	13	11½	11	10	11½	12	12	13	11½	12	14	13	11½	11	13	11	12	10	12	9
Size: Bar # "c_1"	4	6	6	6	5	6	6	6	5	5	6	6	6	6	7	7	5	6	7	7	5	6	6	8	5	6	6	7	5	6	7	8	5	7	7	8	4	6	7	7
Spacing "c_1"	12	14	12	10½	11½	11½	12	10	11½	11½	12	10½	11½	11	11½	10½	13	12	13	10	13	12	10	12	11	12	11	11	11	11	12	11½	11	13	12	11½	11	11	12	10
Length "c" or "c_1"	4-6	4-6	5-0	5-6	5-0	4-6	5-0	5-6	5-0	5-0	5-0	5-0	4-6	5-0	5-6	5-8	4-6	5-0	5-6	5-8	4-6	5-0	5-0	5-6	5-6	6-0	6-6	7-0	5-6	6-6	6-6	7-0	5-6	6-6	7-0	7-0	5-6	6-6	7-0	7-6
"d" Dist. Bars Top Slab-Tot. No.	12	6	6	6	12	6	6	6	12	6	6	6	12	6	6	6	12	6	6	6	10	6	6	6	14	8	8	8	14	8	8	8	14	8	8	8	16	8	8	8
Bot. Slab-Tot. No.	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
"e" Bars Spacing	18	18	18	18	18	16	15	14	18	15	12	11½	18	18	18	18	18	16	15	14	18	14	11	10	18	18	16	18	18	18	15	14	18	18	12	11	18	18	11½	11
"f" Size: Bar #	5	5	4	5	5	5	5	6	4	5	5	6	4	5	6	6	4	4	6	6	4	5	6	6	5	5	6	6	5	5	6	7	5	5	6	7	6	5	6	7
Spacing	16	18	12	11	16	16	12	13	12	13	11	12	11½	15	15	13	12	10½	13	11	10	11½	12	12	13	15	15	11½	13	14	13	14	10½	12	14	10½	12	14	10½	12
Length	3-1	3-1	2-5	3-3	3-1	3-2	3-0	3-8	2-8	3-3	3-2	3-9	2-6	3-1	3-8	3-11	2-7	2-10	3-9	4-0	2-8	3-4	3-9	4-0	3-6	3-6	3-10	4-0	3-6	3-5	3-11	4-7	3-6	3-4	3-11	4-10	4-3	3-10	4-4	4-9
Dimension "X"	1-3	1-3	1-0	1-5	1-3	1-4	1-2	1-6	1-3	1-5	1-4	1-7	1-1	1-3	1-6	1-9	1-2	1-5	1-7	1-10	1-3	1-6	1-7	1-10	1-8	1-8	1-8	1-10	1-8	1-7	1-9	2-0	1-8	1-6	1-9	2-3	2-1	2-0	2-2	2-2
"g" or "g_1" Size: Bar #	5	5	5	5	5	5	5	6	4	5	5	6	4	5	6	6	4	5	6	6	4	5	6	6	5	5	6	6	5	5	6	7	5	5	6	7	5	5	6	7
Spacing	16	18	12	11	16	16	12	13	12	13	11	12	11½	15	15	13	12	10½	13	11	10	11½	12	12	13	15	15	11½	13	14	13	14	10½	12	14	10½	12	14	10½	12
Length "g"	8-3	8-0	8-1	8-6	9-6	9-6	9-4	9-9	10-8	10-6	10-7	10-11	9-0	9-2	9-8	10-1	10-2	10-5	10-10	11-4	11-3	11-8	11-10	12-5	11-9	11-9	11-9	12-3	13-0	13-1	13-0	13-9	14-0	14-4	14-3	14-10	15-3	15-7	15-9	16-1
Length "g_1"	3-5	3-3	3-5	3-9	3-7	3-9	3-8	4-3	3-6	3-9	3-11	4-6	2-10	3-5	4-3	4-8	3-0	3-8	4-5	4-11	3-2	4-0	4-6	5-0	3-11	4-1	4-3	4-9	4-2	4-5	4-6	5-6	4-3	4-11	4-9	5-9	4-6	4-10	5-3	6-0
Dimension "Y"	1-10	1-6	1-6	1-9	2-0	2-0	1-9	2-0	2-2	2-0	2-0	2-2	1-6	1-8	2-0	2-3	1-8	1-11	2-2	2-6	1-9	2-2	2-3	2-8	2-3	2-3	2-0	2-4	2-5	2-7	2-3	2-10	2-6	2-10	2-6	3-0	2-9	3-0	3-0	3-3
Spacers Total No.	56	56	56	56	61	61	61	70	66	66	66	76	61	61	61	70	66	66	66	76	66	66	76	76	66	66	66	76	71	71	82	82	88	88	88	88	88	88	88	88
Quan. Concrete: C.Y. per lin. ft.	.80	.87	1.02	1.18	.85	.92	1.14	1.35	.91	.98	1.26	1.54	.95	1.04	1.32	1.58	1.04	1.15	1.45	1.74	1.13	1.26	1.56	1.88	1.41	1.49	1.80	2.23	1.58	1.67	1.98	2.39	1.72	1.82	2.13	2.56	1.86	1.95	2.37	2.85
Quan. Reinf. Lbs. per lin. ft.	149	131	159	180	157	154	172	225	158	162	187	234	157	160	204	248	164	181	233	268	171	185	255	279	226	206	258	328	227	211	285	355	250	257	304	366	268	267	335	380

SPAN	10'				12'											
HEIGHT	11'				12'				13'				14'			
Strength Classification	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
Max. Fill Over Top	2	6	14	22	2	6	14	22	2	6	14	22	2	6	14	22
Conc. Top Slab T_1	9¼	9¼	11½	13½	9¼	9¼	11½	13½	9¼	9¼	11½	13½	9¼	9¼	11½	13½
Conc. Bottom Slab T_2	8½	10½	12½	14½	8½	10½	12¾	14½	8¾	10¾	12¾	14½	9	11	12¾	14½
Conc. Sidewalls T_3	8½	8½	9½	9½	9¼	9¼	9½	10¾	10	10	10¼	12	11	11	11¼	13
REINFORCING STEEL "a" or "a_1" Size: Bar # "a"	6	5	5	5	5	5	4	4	5	5	4	4	6	5	4	4
Spacing "a"	12	12	11	12	13	14	15	12	13	14	15	12	13	14	15	12
Size: Bar # "a_1"	4	4	5	5	4	4	4	4	4	4	4	5	4	4	4	4
Spacing "a_1"	12	12	10½	11½	12	14	14	11	12	13	14	11	12	13	14	11
Length "a" or "a_1"	21-0	21-0	21-0	22-1	22-0	22-0	22-1	22-4	22-2	22-2	22-3	22-8	22-8	22-8	22-9	23-2
"b" Size: Bar #	7	6	6	7	7	6	7	7	7	6	7	7	7	6	7	7
Spacing	12	12	11	12	13	14	15	12	13	14	15	12	13	14	15	12
Length	22-2	22-3	22-5	22-9	22-5	22-5	22-7	23-1	22-7	22-7	22-9	23-4	22-0	22-0	23-0	23-7
"b_1" Size: Bar #	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7
Spacing	12	12	10½	11½	12	14	14	11	12	13	14	11	12	13	14	11
Length	22-1	22-3	22-5	22-9	22-4	22-5	22-8	23-1	22-6	22-7	22-10	23-5	22-9	22-10	23-1	23-8
"c" or "c_1" Size: Bar # "c"	5	7	7	8	6	7	8	8	6	7	8	8	7	7	8	8
Spacing "c"	12	12	11	12	13	14	15	12	13	14	15	12	13	14	15	12
Size: Bar # "c_1"	6	6	7	8	6	7	8	8	6	7	8	8	6	7	8	8
Spacing "c_1"	12	12	10½	11½	12	14	14	11	12	13	14	11	12	13	14	11
Length "c" or "c_1"	7-0	7-6	8-0	8-0	7-0	7-6	7-6	8-0	7-0	7-6	8-0	8-0	7-6	8-0	8-0	8-0
"d" Dist. Bars Top Slab-Tot. No.	22	10	10	10	22	10	10	10	22	10	10	10	22	10	10	10
Bot. Slab-Tot. No.	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
"e" Bars Spacing	18	18	18	15	18	18	16	14	18	18	15	14	18	16	12	12
"f" Size: Bar #	5	5	6	6	5	5	6	7	6	6	6	7	6	6	7	7
Spacing	12	12	14	12	12	12	13	14	14	15	12	14	14	12	12	13
Length	3-8	3-7	3-10	3-11	3-10	3-9	4-0	4-6	4-2	4-2	4-2	4-7	4-4	4-6	4-6	4-11
Dimension "X"	1-10	1-9	1-8	1-9	2-0	1-11	1-10	1-11	2-0	2-0	2-0	2-0	2-2	2-4	2-4	2-4
"g" or "g_1" Size: Bar #	5	5	6	6	5	5	6	7	6	6	6	7	6	6	7	7
Spacing	12	12	14	12	12	12	13	14	14	15	12	14	14	12	12	13
Length "g"	14-4	14-1	14-4	14-6	15-8	15-5	15-6	16-0	17-1	16-8	16-10	17-6	18-2	18-1	18-3	18-7
Length "g_1"	4-6	4-5	4-11	5-0	4-9	4-9	5-1	5-9	5-6	5-3	5-5	6-3	5-7	5-7	5-10	6-4
Dimension "Y"	2-8	2-5	2-6	2-6	3-0	2-9	2-8	3-0	3-5	3-0	3-0	3-6	3-6	3-5	3-5	3-7
Spacers Total No.	88	88	88	88	94	94	94	94	94	94	94	94	100	100	100	100
Quan. Concrete: C.Y. per lin. ft.	2.06	2.22	2.51	2.90	2.26	2.39	2.74	3.16	2.44	2.58	2.93	3.44	2.70	2.84	3.17	3.70
Quan. Reinf. Lbs. per lin. ft.	307	297	333	374	305	291	324	396	331	317	346	411	366	354	368	440

SPAN	14'				15'				13'				14'				15'				16'			
HEIGHT	13'				14'				15'				16'				17'				18'			
Strength Classification	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
Max. Fill Over Top	2	9	16	22	2	9	16	22	2	9	16	22	2	9	16	22	2	9	16	22	2	9	16	22
Conc. Top Slab T_1	11	11¼	14	15½	11	11½	14	15½	10¾	11½	14	15½	10¾	11½	14	15½	10¾	11½	14	15½	10¾	11½	14	15½
Conc. Bottom Slab T_2	9½	12¾	15	16¾	10	13	15	16¾	10	13	15	16¾	10	13	15	16¾	10	13	15	16¾	10	13	15	16½
Conc. Sidewalls T_3	10	10	10½	11	11	11	11¼	12	12	12	12	13	12	12	12	13	12	12	12	13	12	12	12	13
REINFORCING STEEL "a" or "a_1" Size: Bar # "a"	5	5	5	5	6	5	5	5	5	5	5	5	6	5	5	5	6	5	5	5	6	5	5	5
Spacing "a"	11½	15	11½	10½	16	15	12	10	17	15	12	11	12	15	13	9½	12	15	13	9½	12	15	13	9½
Size: Bar # "a_1"	5	5	5	5	4	5	5	4	5	5	5	4	5	5	5	4	5	5	5	4	5	5	5	5
Spacing "a_1"	16	14	11	10	15	13	11	10	14	13	11	10	14	13	11	10	14	13	11	10	14	11½	9	
Length "a" or "a_1"	26-2	26-2	26-4	26-5	26-5	26-6	26-8	26-8	26-8	26-8	26-8	26-8	26-8	26-8	26-8	26-8	26-8	26-8	26-8	26-8	26-8	26-8	26-8	26-1
"b" Size: Bar #	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	7	8	8	7
Spacing	11½	15	11½	10½	16	15	12	10	17	15	12	11	12	15	13	9½	12	15	13	9½	12	15	13	9½
Length	26-8	26-8	27-0	27-3	26-11	26-11	27-2	27-5	27-2	27-2	27-4	27-9	27-2	27-2	27-4	27-9	27-2	27-3	27-5	27-9	27-3	27-3	27-5	27-9
"b_1" Size: Bar #	7	8	8	8	7	8	8	8	7	8	8	8	7	8	8	8	7	8	8	8	7	8	8	8
Spacing	16	14	11	10	15	13	11	10	14	13	11	10	14	13	11	10	14	13	11	10	14	11½	9	
Length	26-6	26-9	27-0	27-3	26-10	27-0	27-2	27-6	27-3	27-3	27-5	27-9	27-3	27-3	27-5	27-9	27-3	27-3	27-5	27-9	27-3	27-3	27-5	27-9
"c" or "c_1" Size: Bar # "c"	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Spacing "c"	11½	15	11½	10½	16	15	12	10	17	15	12	11	12	15	13	9½	12	15	13	9½	12	15	13	9½
Size: Bar # "c_1"	7	8	8	8	7	8	8	8	7	8	8	8	7	8	8	8	7	8	8	8	7	8	8	8
Spacing "c_1"	16	14	11	10	15	13	11	10	14	13	11	10	14	13	11	10	14	13	11	10	14	11½	9	
Length "c" or "c_1"	8-6	9-6	9-6	9-6	8-6	9-6	9-6	9-6	9-6	9-6	9-6	9-6	9-6	9-6	9-6	9-6	9-6	9-6	9-6	9-6	9-6	9-6	9-6	9-6
"d" Dist. Bars Top Slab-Tot. No.	26	12	12	12	26	12	12	12	26	12	12	12	26	12	12	12	28	12	12	12				
Bot. Slab-Tot. No.	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12				
"e" Bars Spacing	18	18	18	13	18	18	14	11½	18	18	10½	9½	18	15	10½	9½								
"f" Size: Bar #	6	6	7	7	6	7	7	8	6	7	7	8												
Spacing	13	13	14	12	12	15	12	15	15	13	11½	14												
Length	4-2	3-11	4-9	4-10	4-5	4-10	5-1	5-4	5-4	5-4	5-4	5-11												
Dimension "X"	2-0	1-9	2-2	2-3	2-3	2-3	2-6	2-5	2-3	2-3	2-8	2-6												
"g" or "g_1" Size: Bar #	6	6	7	7	6	7	7	8	6	7	7	8												
Spacing	13	13	14	12	12	15	12	15	15	13	11½	14												
Length "g"	19-4	19-5	19-8	19-8	17-0	16-11	17-0	17-6	18-5	18-4	18-6	18-4												
Length "g_1"	5-9	6-0	6-3	6-6	5-4	5-6	5-10	6-4	5-10	6-2	6-4	6-6												
Dimension "Y"	3-8	3-9	3-10	3-8	3-3	3-1	3-0	3-4	3-8	3-6	3-6	3-3												
Spacers Total No.	100	100	100	100	106	106	106	106	94	94	94	94												
Quan. Concrete: C.Y. per lin. ft.	3.11	3.43	3.98	3.98	2.89	3.17	3.66	4.00	3.17	3.46	3.87	4.25												
Quan. Reinf. Lbs. per lin. ft.	372	402	480	480	396	404	496	556	402	447	534	592												

NOTE:

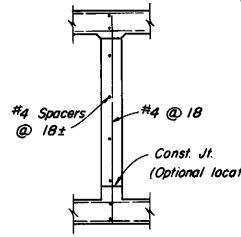
For boxes of height less than that shown in table, use next greater table height slabs, wall dimensions and reinforcing steel, and make necessary changes in bar lengths, number of spacers and quantities. Reinforcement embedment is 1½ dia., min. 1", except as noted.

APPROVAL RECOMMENDED

BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO. 5585

APPROVED SEPTEMBER 1, 1966

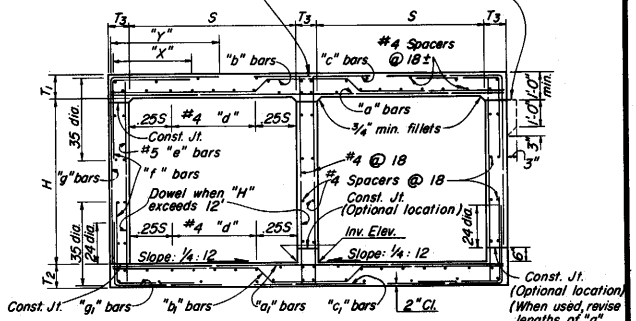
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5945



Reinforcement for interior walls under 8'.

For culverts at grade, extend "c" bars full length, top slab only, provide additional spacers @ 18± and adjust quantities.

Provide paving notch for culverts at grade where P.C.C. approach paving is used.



TYPICAL SECTION

(Showing reinforcement for interior walls 8" and over)

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

SPECIAL DOUBLE BOX CULVERTS

D 92

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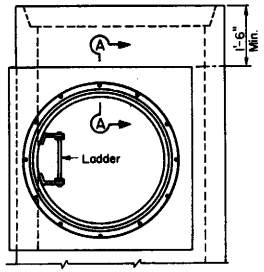
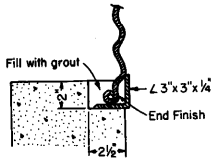
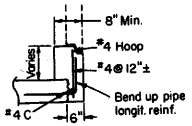


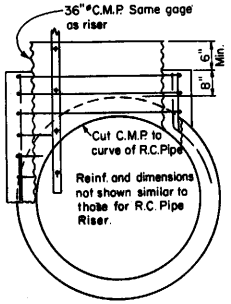
PLAN



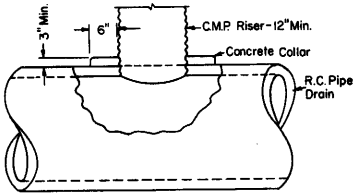
DETAIL A



SECTION A-A



WITH 36" C.M.P. RISER
ALTERNATIVE COLLAR DETAIL



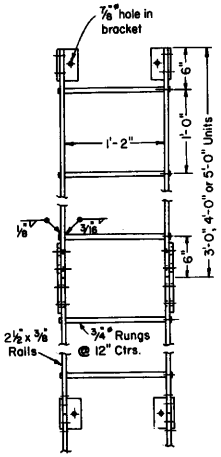
WITH C.M.P. RISER
WHERE NO ACCESS IS REQUIRED

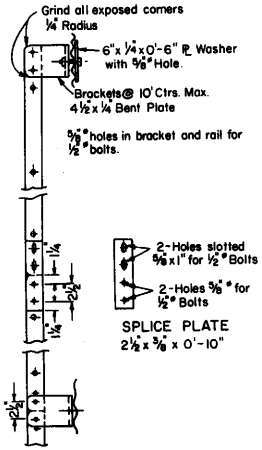
APPROVAL RECOMMENDED

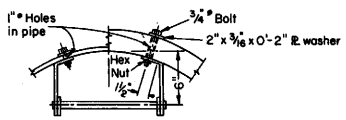
Engineer of Design
Registered Civil Engineer No. 9837

Approved September 1, 1966

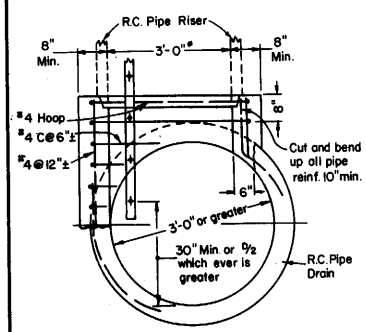
State Highway Engineer
Registered Civil Engineer No. 5945



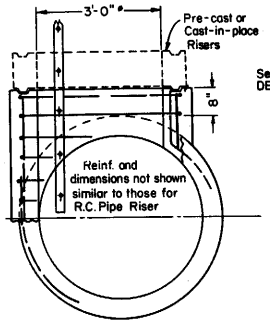




LADDER DETAIL

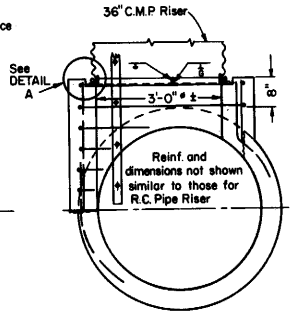


WITH 36" R.C. PIPE RISER

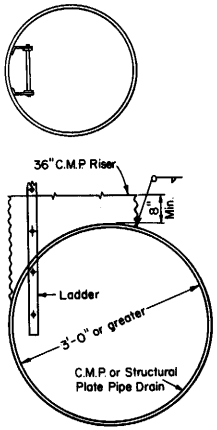


WITH 36" PRE-CAST RISERS

R.C. PIPE DRAIN



WITH 36" C.M.P. RISER



WITH 36" C.M.P. RISER

C.M.P. OR STRUCTURAL PLATE PIPE DRAIN

GENERAL NOTES

1. Structure at top of riser may be any standard storm drain inlet, round grate or manhole.
2. Galvanizing: See Standard Specifications or Special Provisions.
3. Ladder may be constructed in one length at contractor's option.
4. Ladder to be used on both C.M.P. and R.C.P. inlets.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

STORM DRAIN
RISER CONNECTIONS

D93-3

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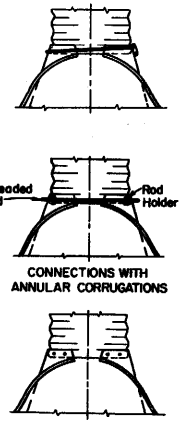
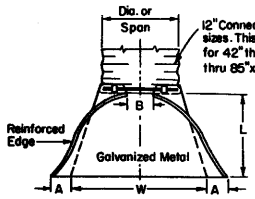
NOTES

1. All 3 pc. bodies to have 12 Ga. sides and 10 Ga. center panels. Width of center panels to be greater than 20% of the pipe periphery. Multiple panel bodies to have lap seams which are to be tightly joined by 3/16" galvanized rivets or bolts.
2. Reinforced edges to be supplemented with galvanized stiffener angles for the 60" thru 84" round, 79" x 49" and 85" x 54" pipe-arch sizes. The angles will be 2" x 2" x 1/4" for the 60" thru 72" round, 79" x 49" and 85" x 54" pipe-arch sizes and 2 1/2" x 2 1/2" x 1/4" for 78" and 84" round. The angles to be attached by 3/8" galvanized nuts and bolts.
3. Angle reinforcement will be placed under the center panel seams on the 79" x 49" and 85" x 54" pipe-arch sizes.
4. Galvanized toe plate to be available as an accessory when specified.
5. End of pipe to be finished with annular corrugations to conform to flared end section so that no leakage results from the connection. Other designs may be used with approval of the Engineer.

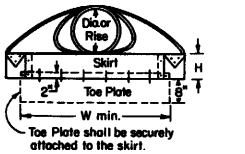


CONNECTIONS WITH ANNULAR CORRUGATIONS

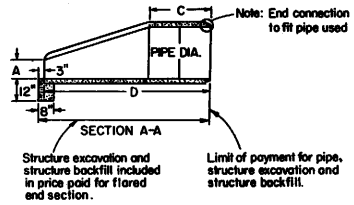
ALTERNATIVE CONNECTIONS
Minimum 1' stub - Connector to be helical or annular as required.

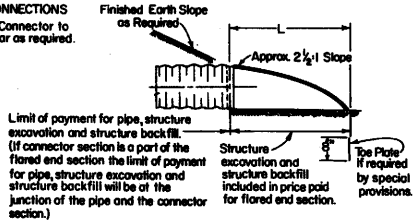


PLAN

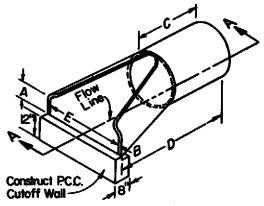


ELEVATION





TYPICAL CROSS-SECTION



CIRCULAR PIPES						
PIPE DIA.	Ga.	DIMENSIONS-INCHES				
		A	B	H	L	W
		1 3/4	Max.	1 1/2	1 1/2 & 1	2 1/2
12"	16	6	6	6	21	24
15	16	7	8	6	26	30
18	16	8	10	6	31	36
21	16	9	12	6	36	42
24	16	10	13	6	41	48
30	14	12	16	8	51	60
36	14	14	19	9	60	72
42	12	16	22	11	69	84
48	12	18	27	12	78	90
54	12	18	30	12	84	102
60	12	18	33	12	87	114
66	12	18	36	12	87	120
72	12	18	39	12	87	126
78	12	18	42	12	87	132
84	12	18	45	12	87	138

PIPE-ARCHES							
INCHES		Ga.	DIMENSIONS-INCHES				
			A	B	H	L	W
Span	Rise		1 3/4	Max.	1 1/2	1 1/2 & 1	2 1/2
18	11	16	7	9	6	19	30
22	13	16	7	10	6	23	36
25	16	16	8	12	6	28	42
29	18	16	9	14	6	32	48
36	22	14	10	16	6	39	60
43	27	14	12	18	8	46	75
50	31	12	13	21	9	53	85
58	36	12	18	26	12	63	90
65	40	12	18	30	12	70	102
72	44	12	18	33	12	77	114
79	49	12	18	36	12	77	126
85	54	12	18	39	12	77	138

FLARED END SECTIONS FOR C.M.P. CULVERTS

MINIMUM DIMENSIONS					
PIPE DIA.	A	B	C	D	E
12"	4"	1 3/4"	2'-0"	3'-10"	2'-0"
18"	9"	2"	2'-1"	4'-2"	3'-0"
24"	9 1/2"	2 1/2"	2'-6"	6'-0"	4'-0"
30"	1'-0"	3"	1'-8"	6'-1"	5'-0"
36"	1'-3"	3 3/8"	2'-11"	8'-1"	6'-0"
42"	1'-9"	3 3/4"	2'-11"	8'-2"	6'-6"
48"	2'-0"	4 1/4"	2'-2"	8'-2"	7'-0"
54"	2'-3"	4 5/8"	2'-9"	8'-3"	6'-10"

PRECAST CONCRETE FLARED END SECTION

APPROVAL RECOMMENDED

Engineer of Design
Registered Civil Engineer No. 9837

Approved September 1, 1966

State Highway Engineer
Registered Civil Engineer No. 5846

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

FLARED END SECTIONS

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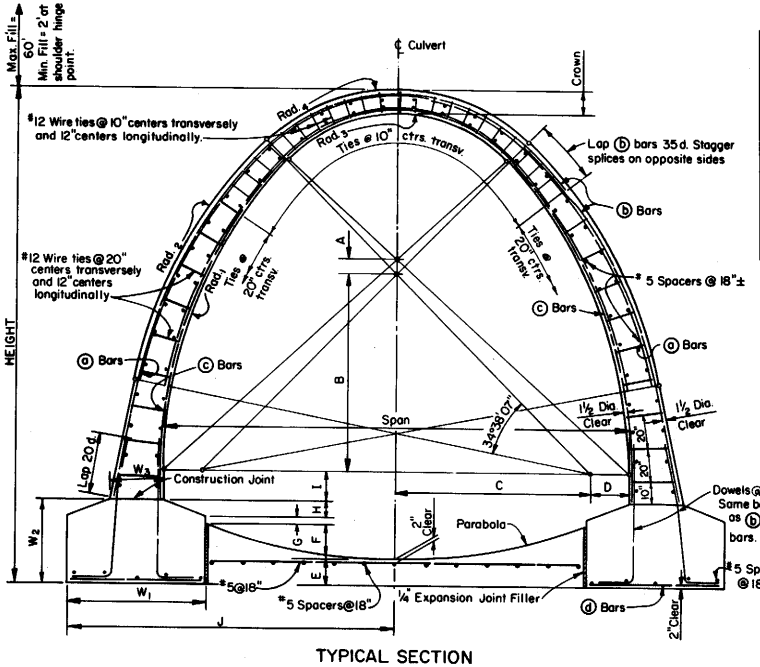
SPAN	Waterway Area Sq. Ft.	Rated Waterway Area-Sq.Ft.	HEIGHT	Crown	W_1	W_2	W_3	R_1	R_2	R_3	R_4	A	B	C	D	E	F	G	H	I	J	ⓐ Bars	ⓑ Bars	ⓒ Bars	ⓓ Bars	Concrete Cu. Yds. Per Lin. Ft.	Reinforcing Steel Lbs./Lin.Ft.
6	27	25	6'-10 13/16"	6"	2'-0"	1'-3 1/2"	11"	6'-0"	6'-2 3/8"	1'-11"	2'-7 1/4"	2 1/4"	2'-7 1/16"	2'-6"	6"	6"	5 1/2"	1 1/2"	2 1/2"	5"	4'-5 1/2"	#6 @ 12	#6 @ 12	#6 @ 12	#5 @ 12	0.59	139
7	37	33	7-10 7/8	6	2-3	1-5 1/2	11 5/8	7-0	7-1 3/4	2-2 3/4	2-11 1/2	2 3/4	3-0 1/4	2-11	7	6	6 1/2	2	3	5 5/8	5-1 1/4	6 @ 12	6 @ 12	6 @ 12	5 @ 12	0.74	152
8	48	42	8-10 3/8	6	2-6	1-7	1'-0 3/8"	8-0	8-1 1/4	2-6 5/8	3-3 5/8	3	3-5 3/8	3-4	8	6	7 1/2	2	3 1/2	6 3/8	5-9 1/8	6 @ 12	6 @ 12	6 @ 12	5 @ 12	0.89	172
9	61	54	9-9 11/16	6	2-9	1-8	1-1 1/4	9-0	9-0 5/8	2-10 1/2	3-7 7/8	3 3/8	3-10 9/16	3-9	9	6	8	2	4	7 1/4	6-5 1/8	6 @ 12	6 @ 12	6 @ 12	5 @ 12	1.05	187
10	74	65	10-9 3/4	6	3-0	1-10	1-2	10-0	10-0	3-2 1/4	4-0	3 3/4	4-3 3/4	4-2	10	6	10	2	4	8	7-1	6 @ 12	6 @ 12	6 @ 12	5 @ 12	1.23	205
11	92	73	11-10 9/16	6 5/8	3-4	2-0	1-3 3/8	11-0	11-0	3-6	4-4 7/8	4 1/4	4-8 5/16	4-7	11	6	10	3	5	8 3/4	7-9 11/16	6 @ 12	6 @ 12	6 @ 12	5 @ 12	1.46	224
12	110	85	12-10 3/8	7 1/4	3-8	2-1	1-5	12-0	12-0	3-10	4-9 5/8	4 3/8	5-2 1/8	5-0	1'-0"	6	11	3	5	9 5/8	8-6 1/2	6 @ 12	6 @ 12	6 @ 12	5 @ 12	1.70	239
13	127	98	13-11 1/8	7 7/8	4-0	2-3	1-6 1/4	13-0	13-0	4-1 3/4	5-2 1/2	4 7/8	5-7 1/4	5-5	1-1	7	1'-0"	3	5	10 3/8	9-3 1/8	7 @ 12	7 @ 12	7 @ 12	6 @ 12	2.02	333
14	148	112	14-10 13/16	8 3/8	4-3	2-4	1-7 5/8	14-0	14-0	4-5 1/2	5-7 1/4	5 3/8	6-0 7/8	5-10	1-2	7	1-0	3	6	11 1/4	9-11 5/16	7 @ 12	7 @ 12	7 @ 12	6 @ 12	2.26	358
15	169	127	15-11 5/8	9	4-6	2-6	1-9	15-0	15-0	4-9 3/8	6-0	5 5/8	6-5 5/8	6-3	1-3	7	1-2	3	6	1'-0"	10-7 1/2	7 @ 12	7 @ 12	7 @ 12	6 @ 12	2.59	382
16	192	143	17-0 7/16	9 5/8	4-10	2-8	1-10 3/8	16-0	16-0	5-1 1/4	6-4 7/8	6	6-10 13/16	6-8	1-4	7	1-3	3	7	1-0 3/4	11-4 3/16	7 @ 12	7 @ 12	7 @ 12	6 @ 12	2.92	403
17	217	160	18-2 3/8	10 1/4	5-2	2-11	2-0	17-0	17-0	5-5	6-9 3/4	6 1/2	7-4	7-1	1-5	8	1-4	4	7	1-1 5/8	12-1	8 @ 12	8 @ 12	8 @ 12	6 @ 12	3.38	530
18	244	177	19-3	11	5-5	3-1	2-1 1/4	18-0	18-0	5-8 7/8	7-2 1/2	6 5/8	7-9 1/8	7-6	1-6	8	1-5	4	8	1-2 3/8	12-9 1/8	8 @ 12	8 @ 12	8 @ 12	6 @ 12	3.76	561
19	272	196	20-3 13/16	11 3/8	5-8 1/2	3-3	2-2 5/8	19-0	19-0	6-0 3/4	7-7 1/4	7 1/8	8-2 5/16	7-11	1-7	9	1-6	4	8	1-3 1/4	13-5 9/16	8 @ 12	8 @ 12	8 @ 12	6 @ 12	4.19	591
20	301	216	21-3 1/2	1'-0"	6-0	3-4	2-4	20-0	20-0	6-4 1/2	8-0	7 1/2	8-7 1/2	8-4	1-8	9	1-6	4	9	1-4	14-2	8 @ 12	8 @ 12	8 @ 12	6 @ 12	4.56	617
21	334	236	22-5 5/16	1-0 5/8	6-3 5/8	3-7	2-5 3/8	21-0	21-0	6-8 3/8	8-4 7/8	7 7/8	9-0 11/16	8-9	1-9	9	1-9	4	9	1-4 3/4	14-10 1/2	8 @ 12	8 @ 12	8 @ 12	6 @ 12	5.09	649
22	363	257	23-4 1/4	1-1 1/4	6-7	3-7	2-7	22-0	22-0	7-0 1/4	8-9 3/4	8 1/4	9-5 7/8	9-2	1-10	9	1-9	4	9	1-5 5/8	15-7	8 @ 12	8 @ 12	8 @ 12	6 @ 12	5.47	676

APPROVAL RECOMMENDED

ASSISTANT STATE HIGHWAY ENGINEER - BRIDGE

APPROVED September 1, 1966

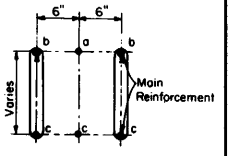
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO 5945



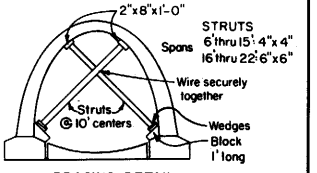
TYPICAL SECTION

REINFORCING BAR SCHEDULE

SPAN	6'	7'	8'	9'	10'	11'	12'	13'	14'	15'	16'	17'	18'	19'	20'	21'	22'
ⓐ Bars	11-2	12-10	14-6	16-5	17-11	19-9	21-6	23-3	25-2	27-6	29-0	30-9	32-5	34-0	36-0	38-0	39-8
ⓑ Bars	5-5 11-4	6-2 12-7	7-0 14-0	7-9 15-5	8-7 16-8	9-5 18-1	10-3 19-9	11-2 21-7	12-0 23-1	13-0 24-6	13-10 26-3	14-8 27-9	15-7 29-4	16-5 30-10	17-4 32-4	18-2 33-9	19-0 35-2
ⓒ Bars	12-0	13-10	15-7	17-6	19-7	21-3	23-5	25-1	27-3	29-0	30-10	32-8	34-9	36-6	38-7	40-6	42-4
ⓓ Bars	1-8	1-11	2-2	2-5	2-8	3-0	3-4	3-8	3-11	4-2	4-6	4-10	5-1	5-5	5-8	6-0	6-3
Invert Slab	4-8	5-6	6-3	7-1	7-11	8-9	9-6	10-3	11-1	12-0	12-9	13-7	14-5	15-3	16-1	16-11	17-9
Footing Dowels	3-3	3-4	3-6	3-7	3-9	3-11	4-0	4-6	4-8	4-10	5-0	5-6	5-8	5-10	5-11	6-2	6-2
Number of Spacers	32	33	39	40	44	49	49	56	60	65	66	70	75	81	82	87	91



WIRE TIE DETAIL
(Shown near crown)



BRACING DETAIL

Inner forms, with bracing, or bracing as shown, shall remain in place until fill has been placed to a depth over the crown equal to the span.

GENERAL NOTES

DESIGN: A.A.S.H.O. dated 1961 with revisions and as supplemented by Bridge Planning and Design Manual.

LIVE LOADING: HS20-44 and Alternative.

REINFORCED CONCRETE: FS = 20,000 P.S.I., N = 10

FC = 1,200 P.S.I.

REINFORCEMENT COVERAGE: Where culverts are constructed adjacent to salt water, thickness of concrete shall be increased to provide minimum 2" coverage between reinforcement and exposed surfaces. Where scour is anticipated, thickness of invert slab to be increased or reinforced as condition requires.

EXPANSION JOINTS: Place expansion joints with 1/4" expansion joint filler in arch rib only at 30'± centers. None in footings and invert slab.

EXCAVATION AND BACKFILL: See Standard Plan A62-C

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

CONCRETE ARCH CULVERTS

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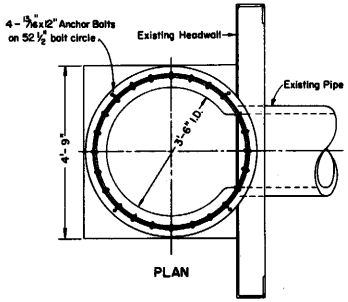
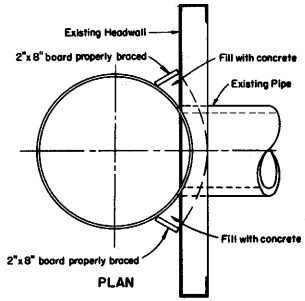


PLAN



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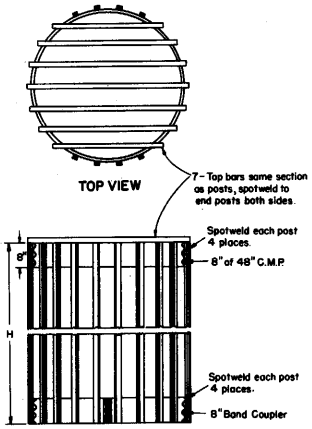
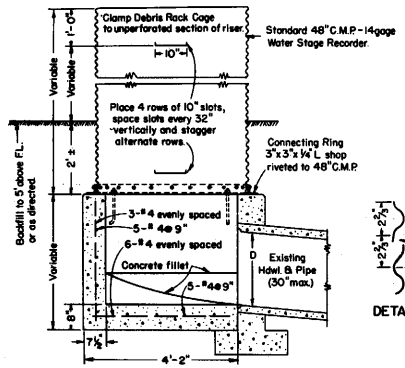


H = 22 posts - 6' lengths use 1.5" T section 1.8#/ft.
H = 22 posts - 8' lengths use 1.8" H section 2.67#/ft.
(Galvanized Fence Posts)

DEBRIS RACK CAGE

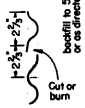


SECTION

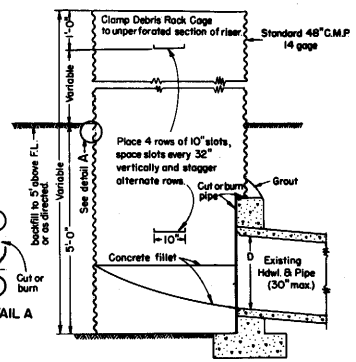
C.M.P. RISER

AND JUNCTION BOX

TYPE A



DETAIL A



SECTION

C.M.P. RISER

TYPE B

APPROVAL RECOMMENDED

Engineer of Design
Registered Civil Engineer No. 9837

Approved September 1, 1966

State Highway Engineer
Registered Civil Engineer No. 5945

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

PIPE RISER WITH DEBRIS RACK CAGE

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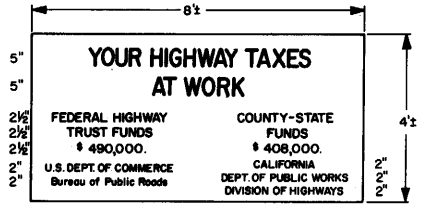
APPROVAL RECOMMENDED

J. E. Wilson
Traffic Engineer Registered Civil Engineer No. 8588

APPROVED: September 1, 1966

Leonard
State Highway Engineer
Registered Civil Engineer No. 5945



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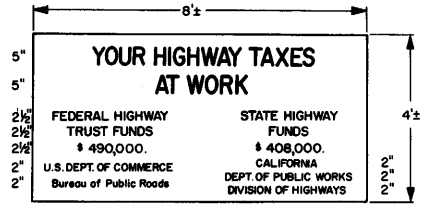
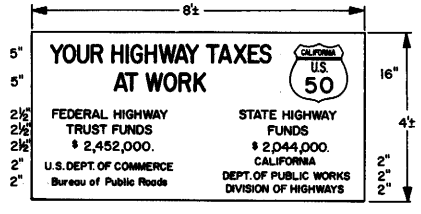


TYPE II



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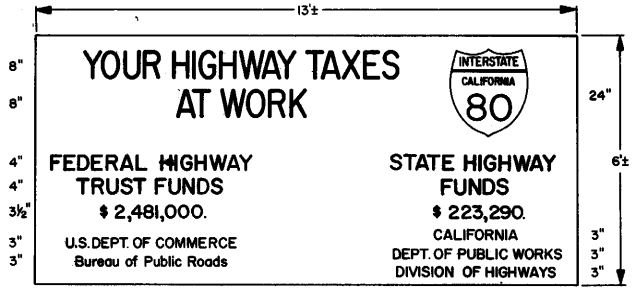

TYPE IV

NOTES: U.S. Standard capital and lower case "C" letters.
Stroke width 0.16" per inch of letter height.
Federal Highway Trust Funds, County-State Funds,
State Highway Funds and information on Route numbers
within the Interstate and U.S. shields to be furnished by
the Engineer and painted on the sign by the Contractor.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

FEDERAL CONSTRUCTION
IDENTIFICATION SIGNS | FSI-1

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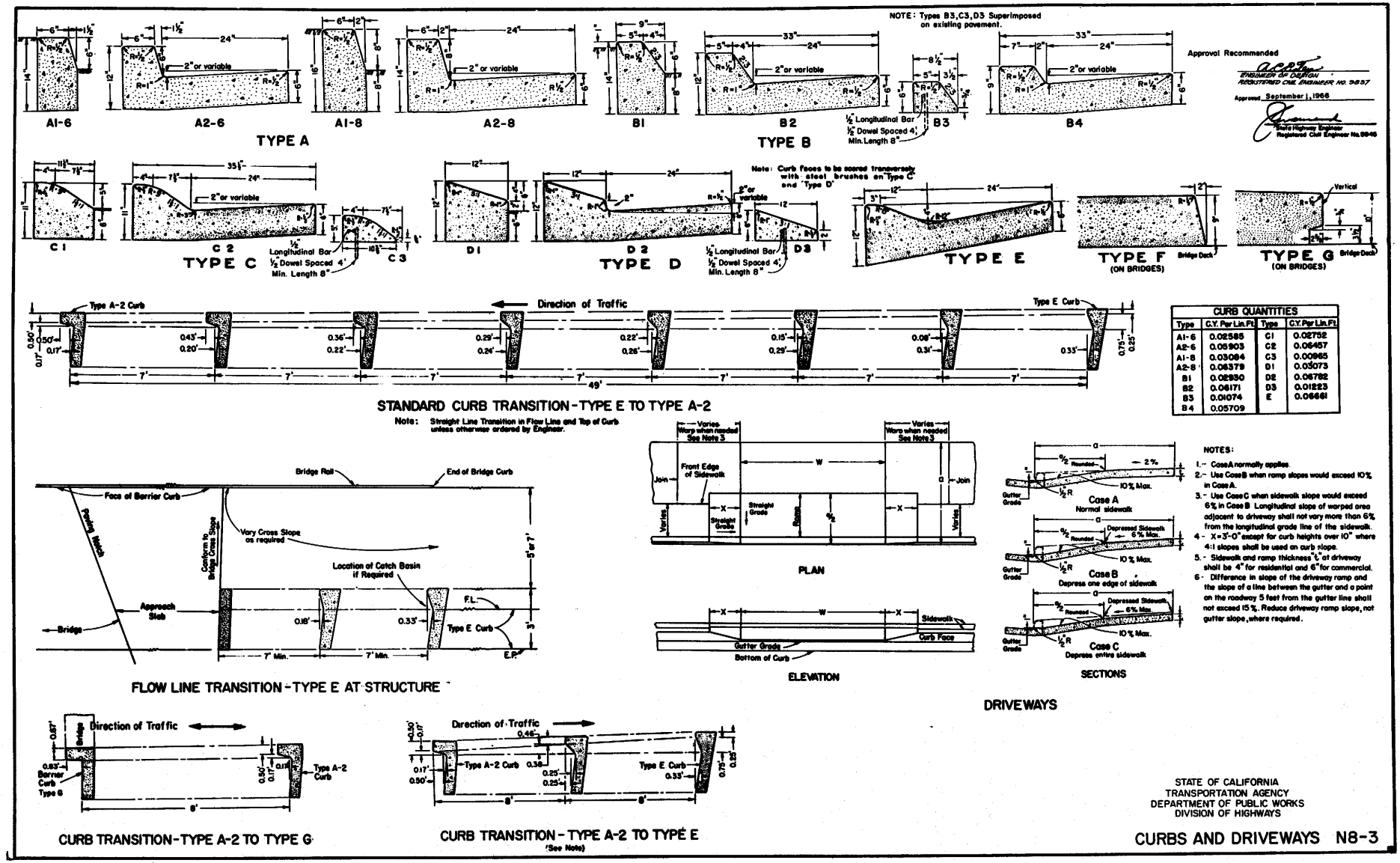

CURB QUANTITIES

Type	C.Y. Per Lin.Ft.	Type	C.Y. Per Lin.Ft.
A1-6	0.02585	C1	0.02752
A2-6	0.05903	C2	0.06457
A1-8	0.03084	C3	0.00965
A2-8	0.06379	D1	0.03073
B1	0.02930	D2	0.06782
B2	0.06171	D3	0.01223
B3	0.01074	E	0.06661
B4	0.05709		

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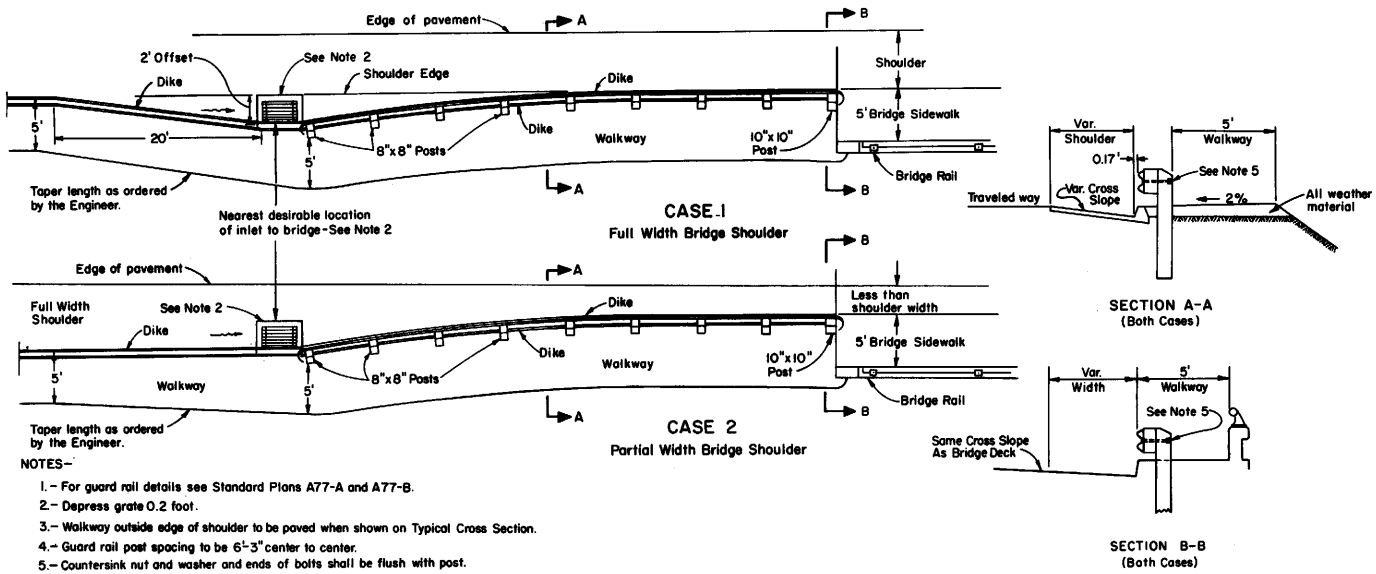

NOTES-

1.- For guard rail details see Standard Plans A77-A and A77-B.
2.- Depress grate 0.2 foot.
3.- Walkway outside edge of shoulder to be paved when shown on Typical Cross Section.
4.- Guard rail post spacing to be 6'-3" center to center.
5.- Countersink nut and washer and ends of bolts shall be flush with post.

APPROVAL RECOMMENDED

Engineer of Design
Registered Civil Engineer No. 9837

Approved September 1, 1966

State Highway Engineer
Registered Civil Engineer No. 5945

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

PEDESTRIAN WALKWAY APPROACH TO BRIDGE SIDEWALK

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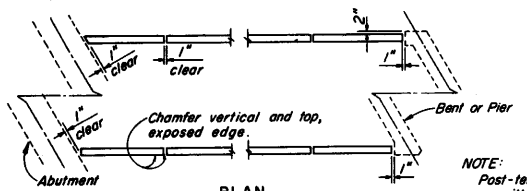
BRIDGE



PLAN

Skew not to scale

NOTE:

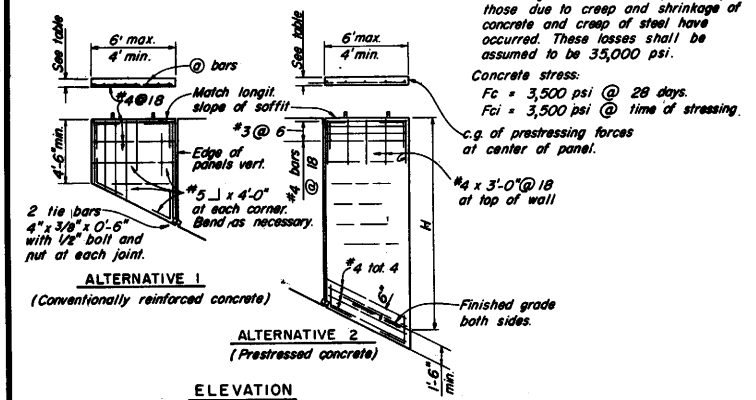
Post-tensioned prestressing will not be permitted.

Pf = the force, per foot of panel width, remaining after all losses, including those due to creep and shrinkage of concrete and creep of steel have occurred. These losses shall be assumed to be 35,000 psi.

Concrete stress:

Fc = 3,500 psi @ 28 days.

Fci = 3,500 psi @ time of stressing.



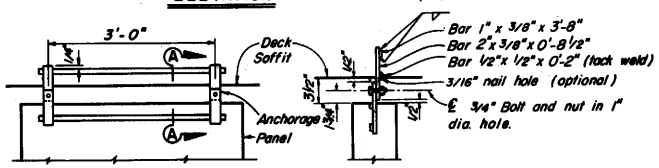
ALTERNATIVE 1

(Conventionally reinforced concrete)

ALTERNATIVE 2

(Prestressed concrete)

ELEVATION



ANCHORAGE DETAIL

Use with Alternative 1 or 2

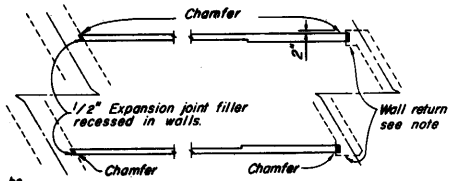
SECTION A-A

PRECAST PANELS, ALTERNATIVE 1 OR 2

VERTICAL REINFORCEMENT OR PRESTRESSING FORCE AND WALL THICKNESS				
H	Alt. 1	Alt. 2	Wall Thickness	
	ⓐ bars	Pf	Alt. 1	Alt. 2
10 & less	#4 @ 18	7,200 lbs.	6"	4"
12	#4 @ 18	10,600 lbs.	6"	4"
14	#4 @ 12	14,400 lbs.	6"	4"
16	#4 @ 10	18,200 lbs.	6"	4"
18	#4 @ 8	23,500 lbs.	6"	4"
20	#4 @ 6	28,800 lbs.	6"	4"
22	#4 @ 7	22,300 lbs.	8"	5"
24	#4 @ 6	26,600 lbs.	8"	5"
26	#4 @ 5	31,200 lbs.	8"	5"

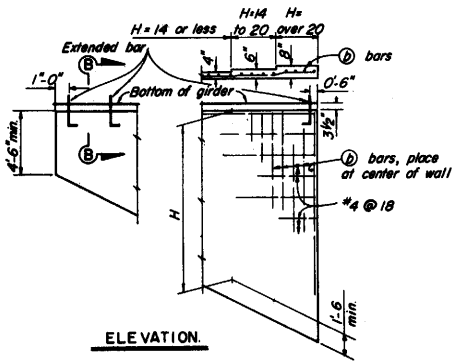
NOTES:

1. Contractor to determine size of panels and location of anchorages. Panels shall be approximately equal in width within limits shown. Maximum weight of any panel not to exceed 11,000 lbs.
2. Panels to be backfilled uniformly on each side.
3. Panels shall conform to horizontal and vertical alignment.
4. Panels to be erected vertically.
5. All parts of anchorages and tie bar assembly to be galvanized.
6. ⓐ bars or Pf may be selected for average H of any one panel.

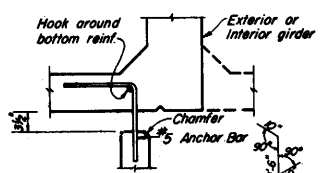


PLAN

Skew not to scale



ELEVATION.



SECTION B-B

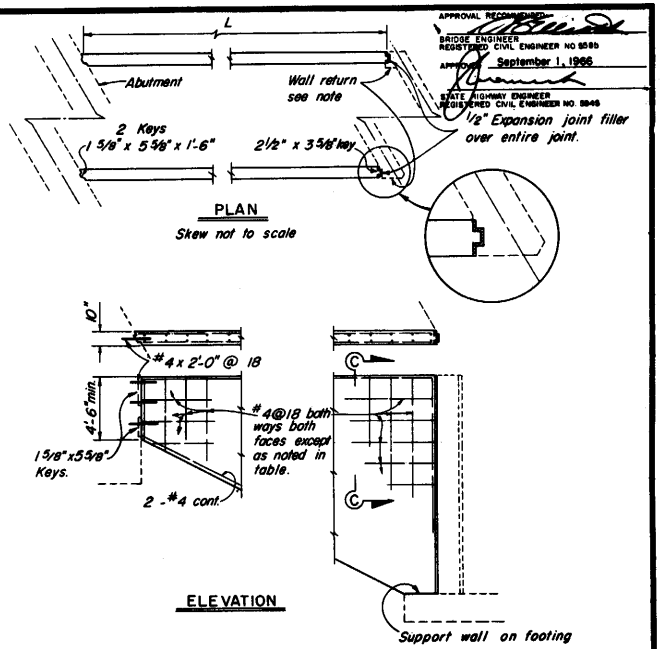
AIR BLOWN MORTAR, ALTERNATIVE 3

NOTES:

1. Welded wire fabric of equivalent area, and minimum spacing of 3 inches, may be substituted for reinforcement shown.
2. Wall return may be omitted for skews 20° or less.
3. Walls to be backfilled uniformly on each side.
4. Expansion joint filler to be cast into pier and abutment walls.
5. #5 anchor bar to be galvanized. Bar may be bent after removal of deck soffit forms.
6. Where anchor rods are located within the center half of a bay, measured face to face of girders, the maximum spacing is 12 inches.

VERTICAL REINFORCEMENT AND WALL THICKNESS			
H	ⓑ bars	Wall Thickness	Max. Spacing of Anchor Rods
10 & less	#4 @ 16	4"	*36"
12	#4 @ 12	4"	*36"
14	#4 @ 9	4"	*36"
16	#4 @ 10	6"	*24"
18	#4 @ 8	6"	*24"
20	#4 @ 6	6"	*24"
22	#4 @ 7	8"	12"
24	#4 @ 6	8"	12"
26	#4 @ 5	8"	12"

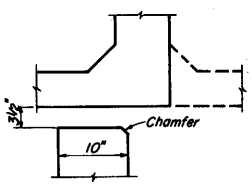
*See note 6.



PLAN

Skew not to scale

ELEVATION



SECTION C-C

HORIZONTAL REINFORCEMENT INSIDE FACE TOP 8 FEET OF WALL	
L	
to 20	#4 @ 18
20 to 25	#4 @ 12
25 to 30	#4 @ 9
30 to 35	#4 @ 6
35 to 40	#4 @ 5
40 to 45	#5 @ 6
45 to 50	#5 @ 5

CAST-IN-PLACE, ALTERNATIVE 4

1. Wall return may be omitted for skews 20° or less.
2. Wall to be placed after piers and abutments.

APPROVAL RECOMMENDED:
BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO. 8586
APPROVED September 1, 1966
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 8846

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

CLOSURE WALL DETAILS BOX GIRDER

B 1-11

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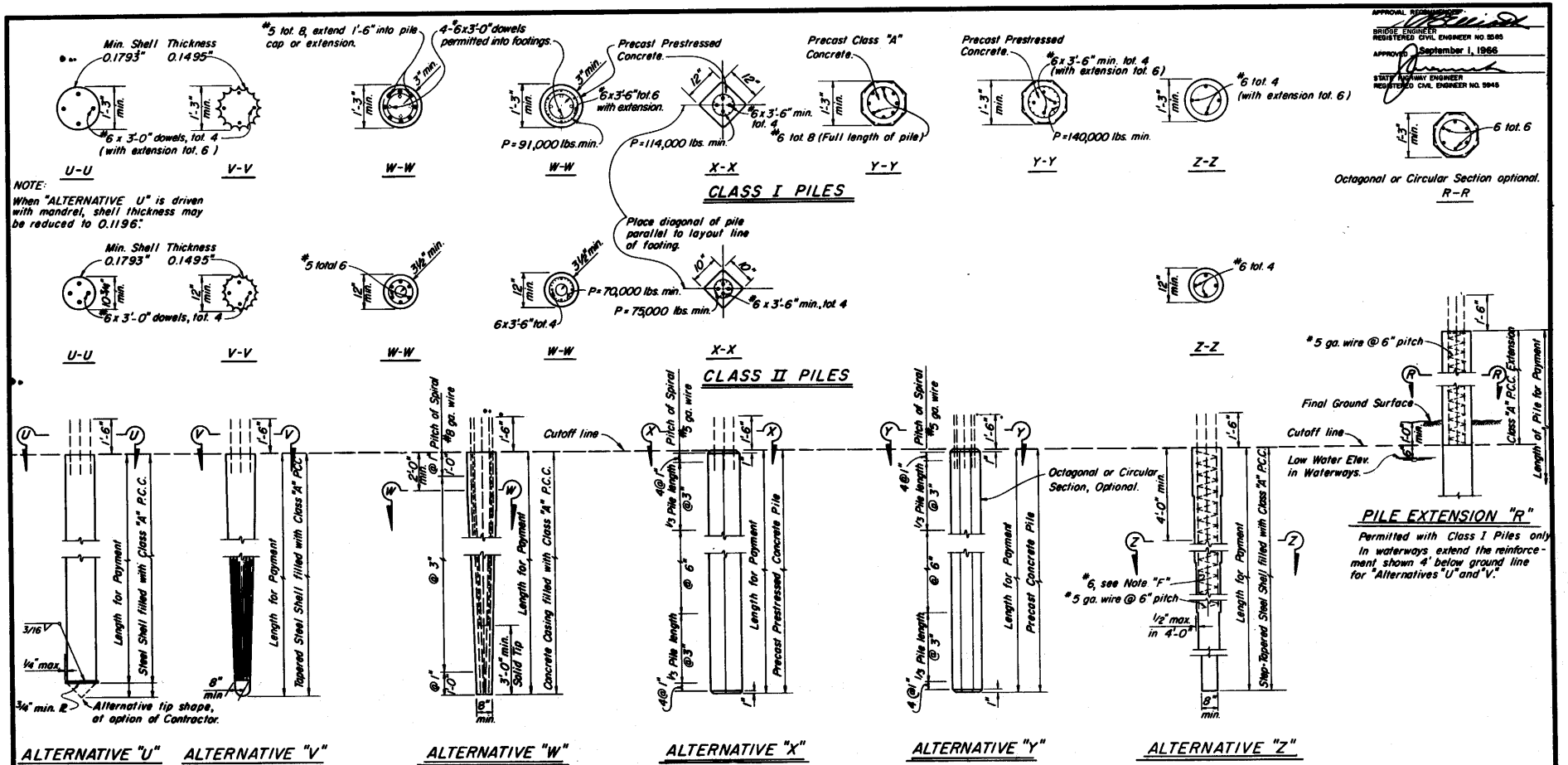

PILE NOTES :

Alternatives "W" and "Y" may be driven full length or may be extended.

All exposed piles or pile extensions shall be consistent in cross-section throughout the project.

PRECAST PRESTRESSED PILES:

P = Prestressing Force (After losses)

Concrete Stress: f'c @ 28 days = 6,000 p.s.i. (Alternative "X")
4,500 p.s.i. (Alternative "Y")
5,000 p.s.i. (Alternative "W")

Alternative "X" may not extend above ground line nor be used with pile extension "R".

NOTE F: In Alternative "Z" the No. 6 bars shall extend a minimum of 12' below the lowest of the following:

1. Bottom of footing.
2. Top of final ground surface.
3. Top of original ground surface when piles are driven through fills.

Unless indicated to the contrary all piles shall be Class I piles. Class I piles may be substituted for Class II piles.

A 10" minimum diameter pipe extension (thickness = 0.1793" min.) may be used at the tip of Alternatives "V" or "Z" when taper is 30' or more in length.

All dowels or bars extending into slab or footing having a depth less than 2'-0" shall be hooked.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

CONCRETE PILE DETAILS

DESIGN LOADING = 45 TONS

B 2-1

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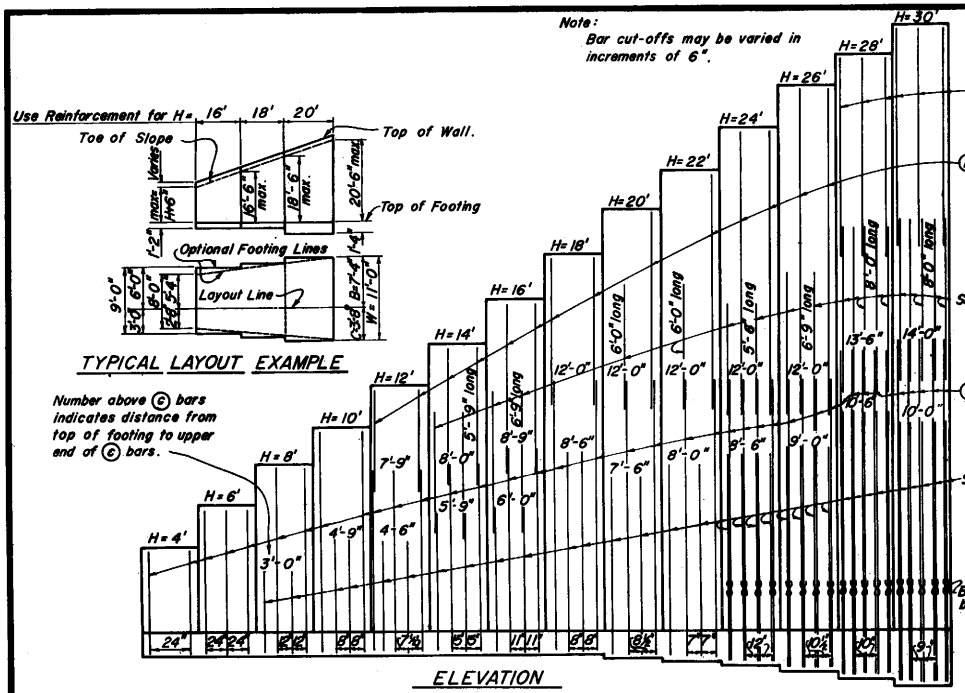

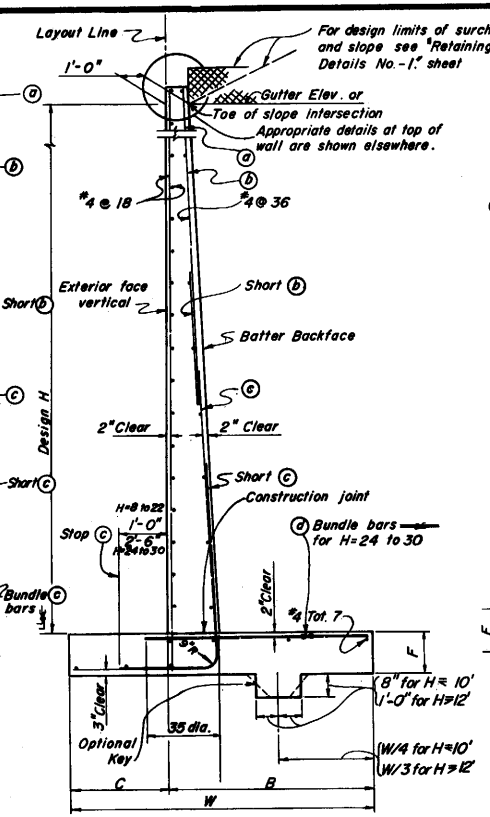

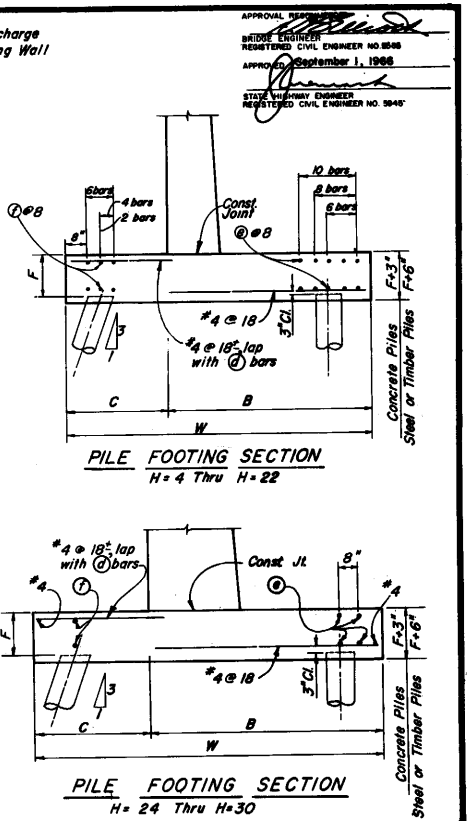

TABLE OF REINFORCING STEEL DIMENSIONS AND DATA

Design H		◉4'	6'	8'	10'	12'	14'	16'	18'	20'	22'	24'	26'	28'	30'
W		3'-2"	4'-2"	5'-2"	6'-2"	7'-2"	8'-0"	9'-0"	10'-0"	11'-0"	12'-0"	13'-3"	14'-3"	15'-3"	16'-3"
C		1'-0"	1'-4"	1'-8"	2'-0"	2'-4"	2'-8"	3'-0"	3'-4"	3'-8"	4'-0"	4'-5"	4'-9"	5'-1"	5'-5"
B		2'-2"	2'-10"	3'-6"	4'-2"	4'-10"	5'-4"	6'-0"	6'-8"	7'-4"	8'-0"	8'-10"	9'-6"	10'-2"	10'-10"
F Spread Ftg.		1'-2"	1'-2"	1'-2"	1'-2"	1'-2"	1'-2"	1'-2"	1'-2"	1'-4"	1'-6"	1'-8"	1'-11"	2'-2"	2'-4"
Batter		1/2:12	1/2:12	1/2:12	1/2:12	1/2:12	1/2:12	1/2:12	1/2:12	1/2:12	1/2:12	5/8:12	5/8:12	3/4:12	7/8:12
ⓐ	bars													#7@20	#7@18
ⓑ	bars					#5@30	#5@15	#5@11	#6@24	#7@17	#7@14	#8@12	#8@10½	#9@10	#9@9
ⓒ	bars	#5@24	#5@24	#5@12	#5@8	#6@7½	#10@15	#10@11	#10@8	#11@8½	#11@7	#11@12	#11@10½	#11@10	#11@9
ⓓ	bars	#5@24	#5@24	#4@12	#4@8	#5@7½	#9@15	#9@11	#9@8	#10@8½	#10@7	#10@12	#10@10½	#9@10	#9@9
Total ⓐ	bars	6-#6	6-#6	6-#6	10-#7	10-#7	10-#7	10-#7	8-#7	8-#7	8-#7	4-#7	4-#7	4-#7	4-#7
Total ⓕ	bars				6-#7	6-#7	6-#7	6-#7	4-#7	4-#7	4-#7	2-#7	2-#7	2-#7	2-#7
2' level surcharge	H Comp k	0.85	1.4	2.2	3.1	4.1	5.2	6.5	8.0	9.7	11.6	13.7	16.0	18.6	21.1
	V Comp k	2.3	3.8	5.6	7.7	10.2	12.6	15.6	19.0	24.9	27.3	32.8	38.1	43.9	50.0
	Toe Pr. k/ft	1.4	1.8	2.2	2.5	2.8	3.1	3.5	3.8	4.1	4.6	4.7	5.3	5.7	6.2
2:1 unlimited slope	H Comp k	0.7	1.4	2.3	3.4	4.8	6.3	8.1	10.2	12.6	15.3	18.4	21.7	25.4	29.1
	V Comp k	2.3	3.9	5.8	8.2	11.0	13.9	17.5	21.5	28.3	31.5	38.0	44.4	51.5	58.9
	Toe Pr. k/ft	1.1	1.5	2.0	2.5	2.9	3.4	3.8	4.3	4.8	5.5	5.9	6.5	7.1	7.8
1½:1 limited slope	H Comp k	1.1	2.0	3.1	4.1	5.4	6.9	8.4	10.0	11.8	13.9	16.2	18.6	21.1	23.4
	V Comp k	2.7	4.5	6.5	8.9	11.7	14.2	17.5	21.0	27.1	29.6	35.2	40.7	46.3	52.3
	Toe Pr. k/ft	1.3	1.9	2.4	2.8	3.5	3.8	4.2	4.6	4.9	5.5	5.8	6.4	6.9	7.5
Spread Footing	Steel lbs/ft	14	20	28	39	56	84	108	169	206	259	328	393	429	484
	Conc. cf/ft	8.9	12.6	16.3	20.2	24.3	29.5	33.8	38.5	45.0	52.1	63.1	73.0	87.6	102.7
Concrete pile ftg.	Steel lbs/ft	24	31	39	74	92	120	144	198	236	289	348	413	449	504
	Conc. cf/ft	8.8	12.8	16.7	20.8	25.2	29.5	34.1	39.0	45.8	53.1	64.4	74.6	89.4	104.8

Denotes a bundle of 2 bars

Note:
For details not shown and drainage notes see "Retaining Wall Details No. 1."

Quantities apply to Design H portion and exclude the added portion above "Gutter Elevation."

Note:
Reinforcement detailed is to be placed in addition to that shown for spread footing. All piles not shown, see Pile Layout on other sheets.

◉ For pile footing Design H=4' use same footing dimensions as Design H=6'

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

RETAINING WALL
TYPE 1-H=32'-36'

B 3-1

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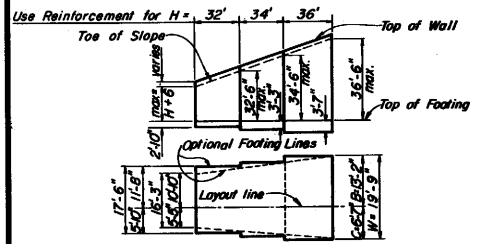
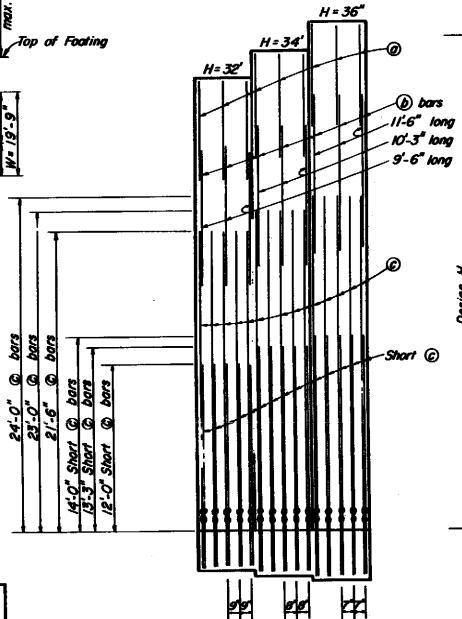
APPROVAL RECOMMENDED
BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO. 5560
APPROVED September 1, 1966
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5946

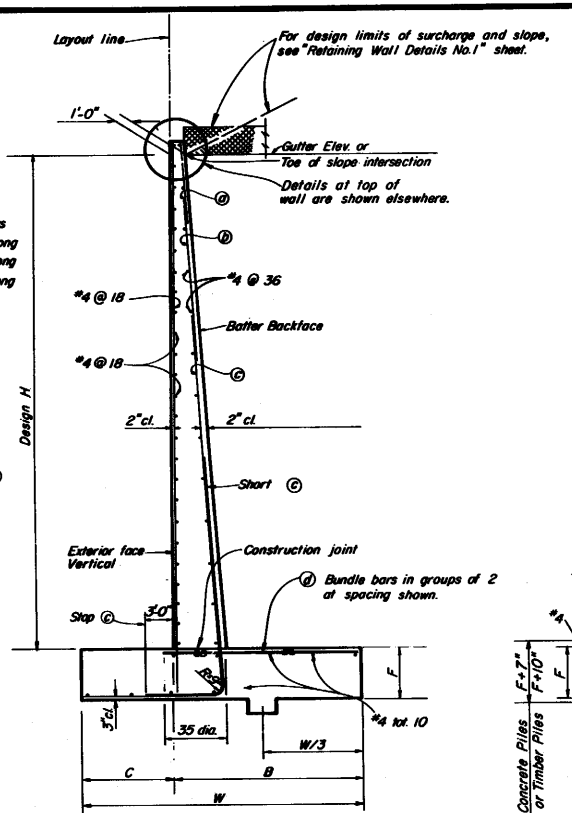


TYPICAL LAYOUT EXAMPLE

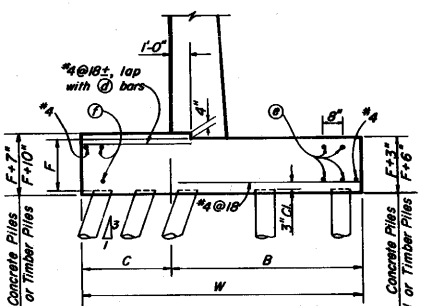
Note:
Bar cut-offs may be varied in increments of 6".



ELEVATION



TYPICAL SECTION



PILE FOOTING SECTION

H = 32' Thru H = 36'

TABLE OF REINFORCING STEEL DIMENSIONS AND DATA				
Design H		32'	34'	36'
W		17'-6"	18'-8"	19'-9"
C		5'-10"	6'-3"	6'-7"
B		11'-8"	12'-5"	13'-2"
F Spread Ftg.		2'-10"	3'-3"	3'-7"
Batter		1:12	1:12	1:12
ⓐ	bars	#4 @ 18	#4 @ 16	#4 @ 14
ⓑ	bars	#5 @ 18	#9 @ 16	#9 @ 14
ⓒ	bars	#11 @ 9‖	#11 @ 8‖	#11 @ 7‖
ⓓ	bars	#10 @ 9‖	#10 @ 8‖	#9 @ 7‖
Total ⓔ	bars	4-#7	4-#7	4-#7
Total ⓕ	bars	2-#7	2-#7	2-#7
2' level surcharge	H Comp k	24.3	27.7	31.0
	V Comp k	58.3	66.3	74.3
	Toe Pr. k/sf	6.6	7.1	7.5
2:1 unlimited slope	H Comp k	33.9	38.8	43.8
	V Comp k	68.8	78.5	88.4
	Toe Pr. k/sf	8.5	9.2	9.8
1½:1 limited slope	H Comp k	26.2	29.4	32.5
	V Comp k	60.2	68.7	77.4
	Toe Pr. k/sf	7.9	8.2	8.5
Spread Footing	Steel lbs/ft.	588	694	778
	Conc. c.f./ft.	127.4	145.4	163.7
Concrete pile ftg.	Steel lbs/ft.	606	716	800
	Conc. c.f./ft.	131.7	150.5	168.6

‖ Denotes a bundle of 2 bars.

Note:
For details not shown and drainage notes see "Retaining Wall Details No. 1".
Quantities apply to Design H portion and exclude the added portion above "Gutter Elevation."

Note:
Reinforcement detailed is to be placed in addition to that shown for spread footing. See Pile Layout on other sheets.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

RETAINING WALL
TYPE 1 - H=4'-30'

B 3-2

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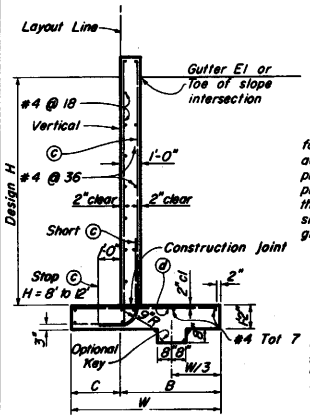
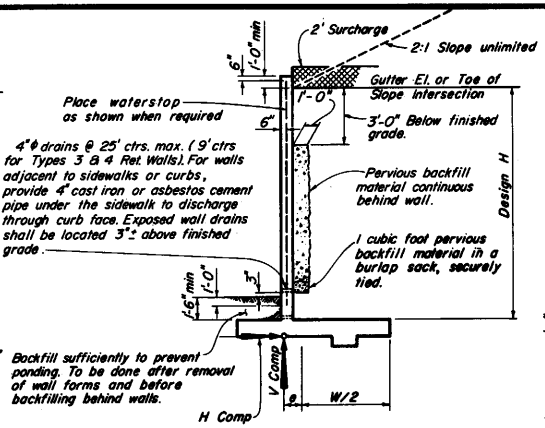
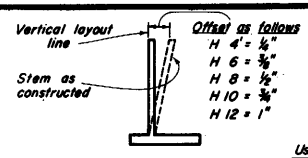


SPREAD FOOTING SECTION

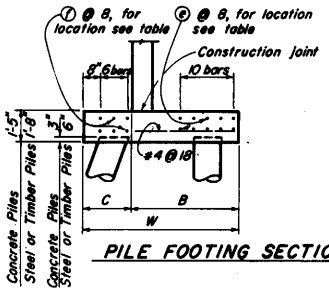


DESIGN AND DRAINAGE

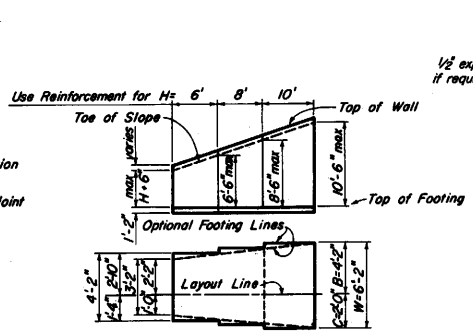
Place concrete in toe against undisturbed material, except as permitted by the Engineer.



WALL OFFSET

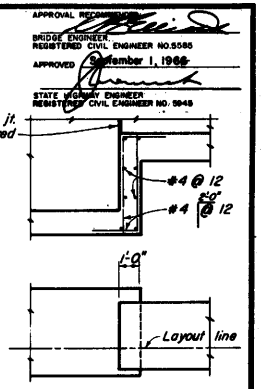


PILE FOOTING SECTION



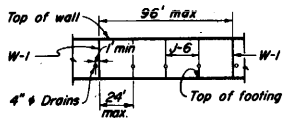
Note:
Bar cut-offs may be varied in increments of 6"

TYPICAL LAYOUT EXAMPLE

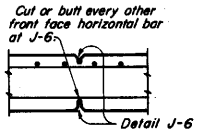


FOOTING STEP

PLAN
WALL WITH DETAIL W-1

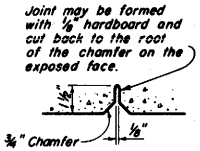


ELEVATION



SECTION

DETAIL J-6



PLAN

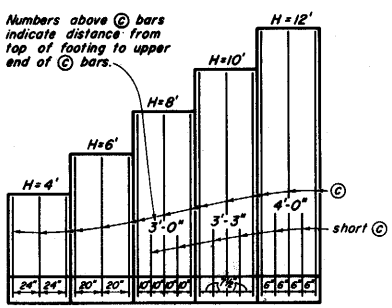
Note:
Reinforcement detailed is to be placed in addition to that shown for spread footing. All piles not shown, see Pile Layout on other sheet.

Ⓔ For pile footing Design H=4' use same footing dimensions as Design H=6'

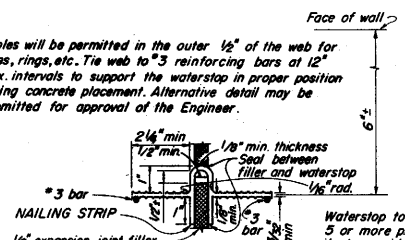
Note:
Quantities apply to Design H portion and exclude the added portion above "Gutter Elevation."

TABLE OF REINFORCING STEEL DIMENSIONS AND DATA

Design H		Ⓔ 4'	6'	8'	10'	12'
W		3'-2"	4'-2"	5'-2"	6'-2"	7'-2"
C		1'-0"	1'-4"	1'-8"	2'-0"	2'-4"
B		2'-2"	2'-10"	3'-6"	4'-2"	4'-10"
Ⓒ bars		#5 @ 24	#5 @ 20	#5 @ 10	#6 @ 7½	#7 @ 6
ⓓ bars		#5 @ 24	#5 @ 20	#5 @ 10	#7 @ 15	#7 @ 12
Total Ⓔ bars		6 - #6	6 - #6	6 - #6	10 - #7	10 - #7
Total Ⓕ bars					6 - #7	6 - #7
H Comp pounds		850	1440	2170	3050	4070
V Comp pounds		2020	3460	5230	7340	9760
e feet		.50	.60	.79	.94	1.07
Toe Pressure PSF		1240	1570	1930	2270	2640
Spread Footing	Steel lbs/ft	13	19	30	49	77
	Conc CF/ft	8.6	11.8	15.0	18.1	21.4
Conc Pile Ftg	Steel lbs/ft	24	30	41	82	112
	Conc CF/ft	9.9	11.9	15.4	18.8	22.2



ELEVATION



Holes will be permitted in the outer ½" of the web for wires, rings, etc. Tie web to #3 reinforcing bars at 12" max. intervals to support the waterstop in proper position during concrete placement. Alternative detail may be submitted for approval of the Engineer.

Waterstop to have 5 or more pairs of raised ribs to provide 0.1 sq. in. min. rib cross-section area on each half of the waterstop. Height of ribs to be 3/32" min.

DETAIL W-1

NOTES

Design Conditions

Design H may be exceeded by 6" before going to the next size. Footing key is required except when found unnecessary by the Engineer. Special footing design is required where foundation material is incapable of supporting toe pressure loads listed in table.

Design Data

fc = 1200 psi f'c = 3000 psi fs = 20,000 psi
n = 10 earth = 120 pcf

Equivalent fluid pressure =
36 psf max for determination of toe pressure.
27 psf min for determination of heel pressure.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

RETAINING WALL
TYPE I-A

B 3-3

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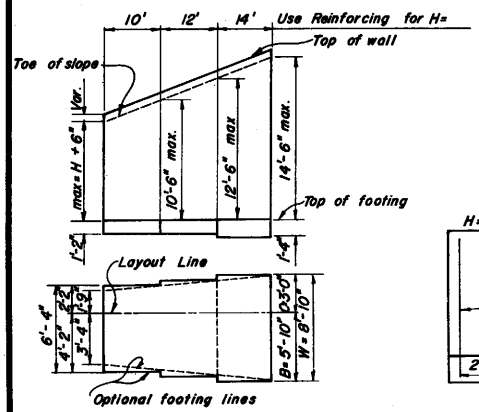
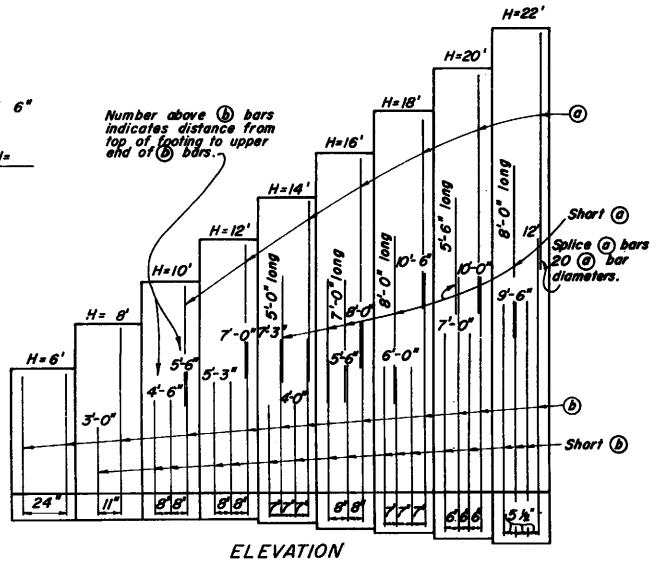
APPROVAL RECOMMENDED
BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO. 5565
APPROVED September 1, 1965
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5945

Note: Bar cut-offs may be varied in increments of 6"



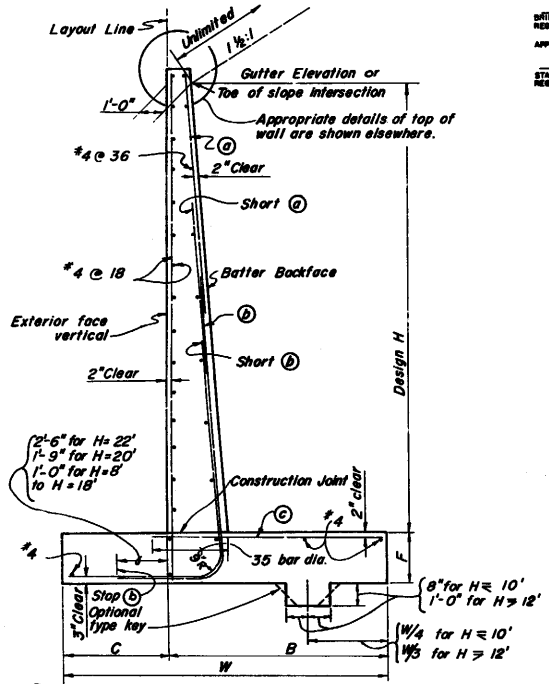
TYPICAL LAYOUT EXAMPLE



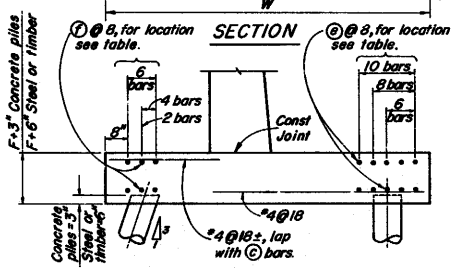
ELEVATION

TABLE OF REINFORCING STEEL DIMENSIONS AND DATA									
	Design H	6'	8'	10'	12'	14'	16'	18'	20'	22'
	W	3'-10"	5'-1"	6'-4"	7'-7"	8'-10"	10'-1"	11'-4"	13'-0"	14'-10"
	C	1'-4"	1'-9"	2'-2"	2'-7"	3'-0"	3'-5"	3'-10"	4'-8"	5'-8"
	B	2'-6"	3'-4"	4'-2"	5'-0"	5'-10"	6'-8	7'-6"	8'-4"	9'-2"
	F	1'-2"	1'-2"	1'-2"	1'-2"	1'-4"	1'-7"	1'-10"	2'-1"	2'-4"
	Batter	½:12	½:12	½:12	½:12	½:12	½:12	⅝:12	¾:12	⅞:12
	ⓐ bars			#5@24	#5@24	#6@14	#6@8	#8@14	#8@12	#8@11
	ⓑ bars	#5@24	#5@11	#6@8	#8@8	#9@7	#11@8	#11@7	#11@6	#11@5½
	ⓒ bars	#5@24	#5@11	#6@8	#8@8	#9@7	#11@8	#11@7	#11@6	#11@5½
	Tot. ⓐ bars	6-#6	6-#6	10-#7	10-#7	10-#7	10-#7	8-#7	8-#7	8-#7
	Tot. ⓕ bars			6-#7	6-#7	6-#7	6-#7	4-#7	4-#7	4-#7
	Toe Press	2350	2960	3570	4150	4970	5660	6590	6970	6980
	H Comp. lbs.	2780	4800	7360	10470	14450	18900	24250	30600	37400
	V Comp. lbs.	4670	7870	11900	16790	23030	29910	38390	48450	58780
	e	.59'	.77'	.94'	1.10'	1.33'	1.55'	1.79'	1.87'	1.84'
Spread footing	Conc. c.f./ft.	12.2	16.2	20.4	24.8	31.9	39.3	49.2	61.6	76.3
	Steel lbs./ft.	21	32	54	94	139	211	273	349	454
Conc. pile footing	Conc. c.f./ft.	12.2	16.2	20.4	25.5	32.1	39.8	50.0	62.8	77.8
	Steel lbs./ft.	32	43	89	129	175	247	302	379	485

Note:
For Design and Drainage notes and other details see "Retaining Wall Details No. 1."
Quantities apply to Design H portion and exclude the added portion above "Gutter Elevation."



SECTION



PILE FOOTING SECTION

Note:
Reinforcement detailed is to be placed in addition to that shown for spread footing. All piles not shown, see Pile Layout on other sheets.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

RETAINING WALL TYPE 2

B 3-4

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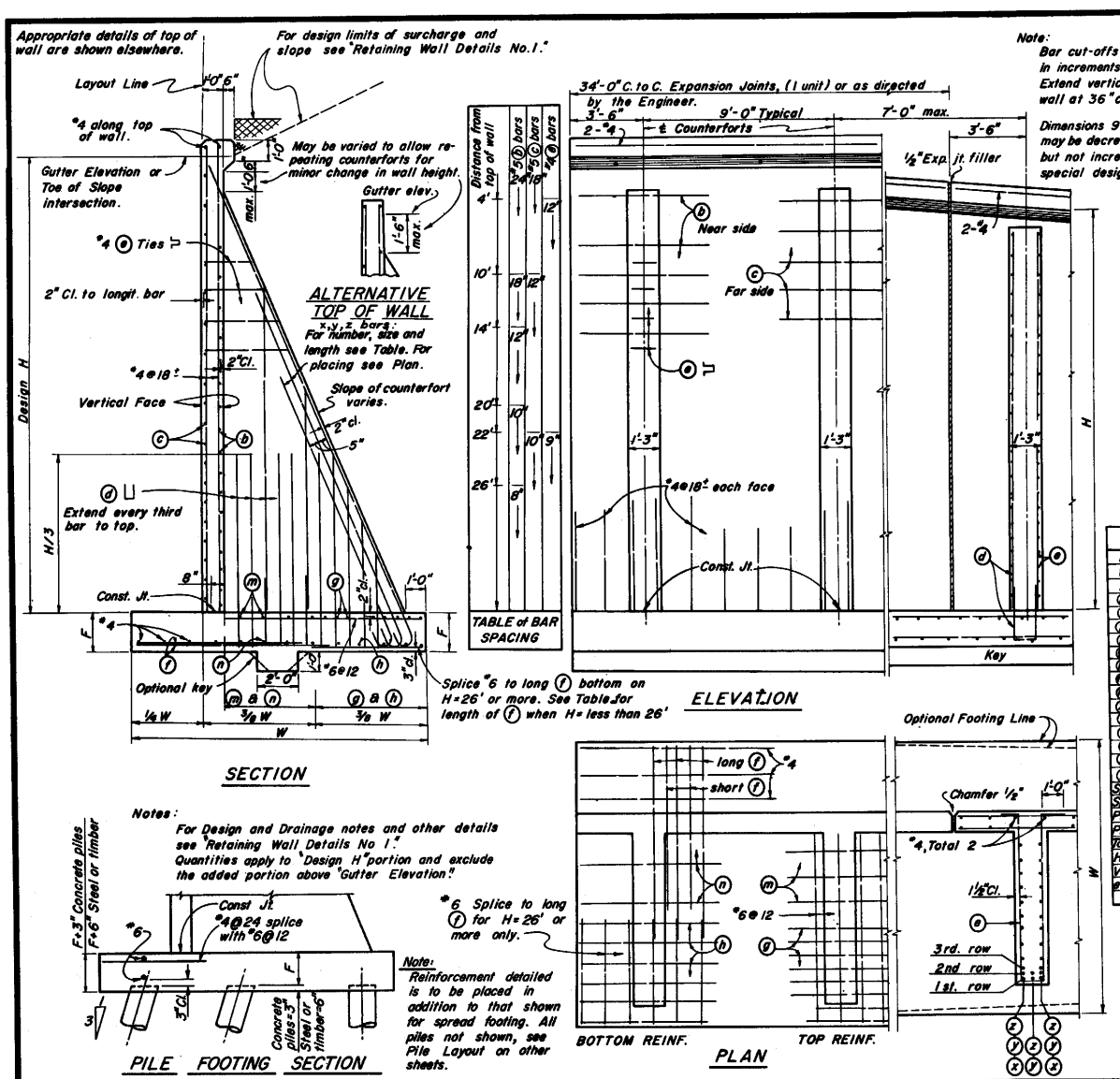

APPROVAL RECOMMENDED
BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO 5585
APPROVED September 1, 1966
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO 5945

TABLE OF REINFORCING STEEL DIMENSIONS AND DATA

Design H	18	20	22	24	26	28	30	32	34	36
W	11'-6"	12'-6"	13'-6"	14'-6"	15'-6"	16'-6"	17'-6"	18'-6"	19'-6"	20'-6"
F	1'-3"	1'-3"	1'-4"	1'-4"	1'-6"	1'-6"	1'-9"	1'-9"	2'-0"	2'-0"
(a) bars, cntrfort heel	#5@8					#6@8				
(f) bars, bottom toe	#6@7	#7@7	#8@8	#9@8	#9@7 1/2	#10@7 1/2	#10@7 1/2	#11@8	#11@8	#11@7
(f) bars, length	7'-4"	7'-8"	8'-0"	8'-3"	8'-6"	8'-10"	9'-2"	9'-6"	9'-9"	10'-0"
(f) bars, length	11'-0"	12'-0"	13'-0"	14'-0"	10'-0"	10'-4"	10'-8"	11'-0"	11'-3"	11'-6"
(g) bars, top of heel	#6@7 All heights									
(h) bars, bottom heel	#6@12 All heights									
(m) bars, top of heel	#6@14 All heights									
(n) bars, bottom of heel	#6@24 All heights									
(x) bar,	2#9	2#9	2#9	2#9	2#10	2#10	2#10	2#10	2#11	2#11
(x) bar, length	20'-6"	22'-6"	24'-10"	27'-0"	29'-6"	31'-9"	34'-0"	36'-2"	39'-0"	41'-0"
(y) bar,	2#9	2#9	3#9	2#9	2#10	2#10	2#10	2#10	2#11	3#11
(y) bar, length	11'-6"	13'-9"	16'-0"	18'-2"	18'-3"	20'-5"	22'-9"	24'-10"	26'-0"	28'-0"
(z) bar,				2#9	2#9	2#10	2#11	3#11	3#11	3#11
(z) bar, length				10'-10"	11'-0"	13'-5"	16'-0"	18'-0"	18'-9"	17'-2"
Spd. Ftg. Conc. cu. ft./lin. ft.	43.0	48.3	54.8	60.6	69.2	75.6	86.6	93.7	105.9	113.4
Spd. Ftg. Steel lbs./lin. ft.	162	193	229	268	310	375	418	480	533	601
Pile Ftg. Conc. cu. ft./lin. ft.										
Pile Ftg. Steel lbs./lin. ft.										
Toe pressure lbs./□'	3550	3910	4310	4650	5070	5410	5850	6250	6680	7040
Horiz. comp. lbs.	8060	9650	11,490	13,400	15,600	17,960	20,440	22,900	25,930	28,750
Vertical comp. lbs.	24,470	28,890	33,880	39,050	45,170	50,990	57,940	64,640	72,320	80,040
e (eccentricity of resultant)	1.30	1.44	1.61	1.75	1.91	2.06	2.24	2.43	2.60	2.74

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

COUNTERFORT RETAINING WALL
TYPE 3

B 3-5

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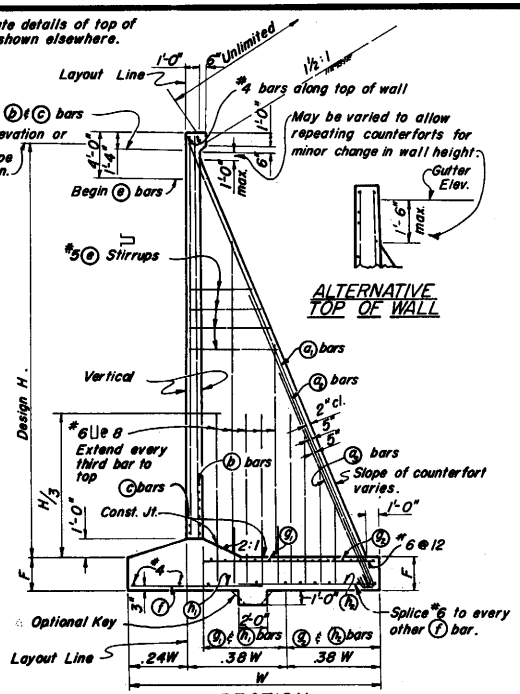
APPROVAL RECOMMENDED
BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO. 5565
APPROVED September 1, 1966
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5945

Appropriate details of top of wall are shown elsewhere.

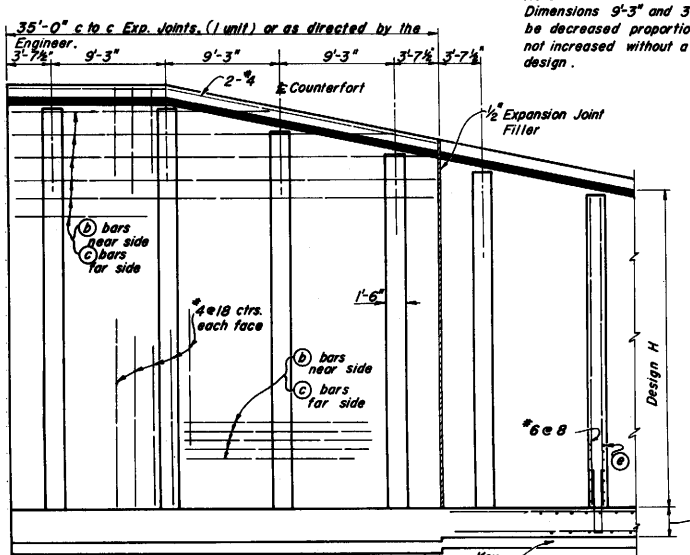


SECTION

Top of wall	ⓑ	ⓒ	ⓔ
2'	24	24	
4'	24	24	
6'	24	24	24
8'	18	24	24
10'	18	24	24
12'	15	18	18
14'	15	18	18
16'	12	18	18
18'	12	15	15
20'	12	15	15
22'	9	18	12
24'	9	12	12
26'	7	12	9
28'	7	12	9
30'	7	12	9

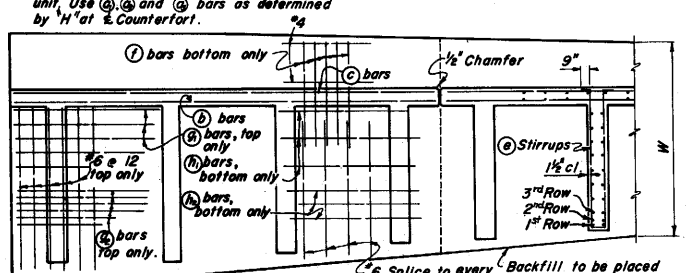
TABLE OF SPACING FOR ⓑ ⓒ & ⓔ BARS
Distance below top of wall

Note:
Dimensions 9'-3" and 3'-7½" may be decreased proportionally but not increased without a special design.

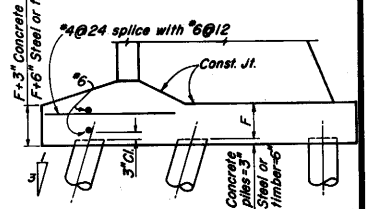


ELEVATION

Note: Use reinforcing in any unit as determined by maximum "H" in that unit. Use ⓐ, ⓐ and ⓐ bars as determined by "H" at ℄ Counterfort.



PLAN



PILE FOOTING SECTION

Note:
Reinforcement detailed is to be placed in addition to that shown for spread footing. All piles not shown, see Pile Layout on other sheets.

TABLE OF REINFORCING STEEL DIMENSIONS AND DATA

	Design H	18'	20'	22'	24'	26'	28'	30'
	W	12'-10"	14'-1"	15'-6"	16'-10"	18'-3"	19'-6"	21'-0"
	F	1'-9"	2'-0"	2'-0"	2'-0"	2'-3"	2'-3"	2'-6"
	ⓐ bars, edge counterfort	2-#11	3-#11	3-#11	3-#11	3-#11	3-#11	3-#11
	ⓐ bars, length	22'-2"	24'-3"	26'-10"	29'-0"	31'-9"	33'-10"	36'-4"
	ⓐ bars, edge counterfort	2-#11	2-#11	3-#11	3-#11	2-#11	3-#11	3-#11
	ⓐ bars, length	12'-0"	14'-0"	16'-0"	18'-0"	23'-0"	24'-0"	24'-6"
	ⓐ bars, edge counterfort					2-#11	2-#11	3-#11
	ⓐ bars, length					16'-6"	17'-6"	18'-3"
	ⓑ bars, back face wall	#6	See Table for spacing					
	ⓒ bars, front face wall	#6						
	ⓔ Stirrups counterfort	#5						
	ⓕ bars, toe	#11 @ 9½	#11 @ 9½	#11 @ 8½	#11 @ 8½	#11 @ 8½	#11 @ 8	#11 @ 8
	ⓕ bars, length	6'-2"	6'-9"	7'-8"	8'-0"	8'-9"	9'-0"	9'-5"
	ⓖ bars, top of heel	#5 @ 12	#5 @ 12	#6 @ 12	#6 @ 12	#6 @ 12	#6 @ 12	#6 @ 12
	ⓖ bars, top of heel	#5 @ 6	#5 @ 6	#6 @ 6	#6 @ 6	#6 @ 6	#6 @ 6	#6 @ 6
	ⓗ bars, bottom of heel	#5 @ 24	#5 @ 24	#6 @ 24	#6 @ 24	#6 @ 24	#6 @ 24	#6 @ 24
	ⓗ bars, bottom of heel	#5 @ 12	#5 @ 12	#6 @ 12	#6 @ 12	#6 @ 12	#6 @ 12	#6 @ 12
Spread Footing	Concrete, cu. ft. per lin. ft.	56.1	66.8	75.1	83.6	97.3	106.4	122.2
Spread Footing	Steel lbs. per lin. ft.	216	263	331	369	433	493	552
Conc Pile ftg.								
	Toe Pressure, lbs. per sq. ft.	6500	7200	8000	8700	9500	10100	11200
	Horizontal Comp. lbs.	27700	33700	41100	48300	57200	65200	77000
	Vertical Comp. lbs.	45000	56000	68000	81000	95000	110000	128000
	e (eccentricity of resultant)	1.70	1.85	2.00	2.20	2.40	2.60	3.00

Quantities based on 35'-0" wall unit including 4 Counterforts.

Notes: For Design and Drainage notes and other details see Retaining Wall Details No. 1. Quantities apply to Design H portion and exclude the added portion above Gutter Elev.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

COUNTERFORT RETAINING WALL

TYPE 4

B 3-6

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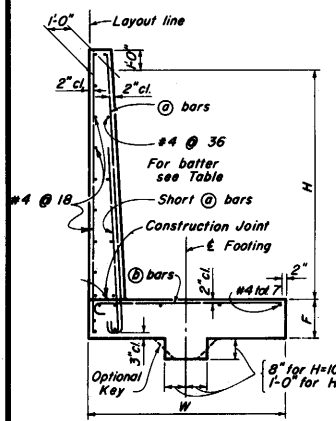
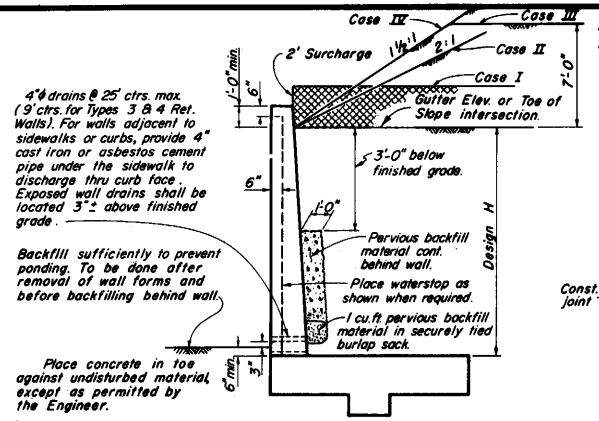


SPREAD FOOTING SECTION



4"ϕ drains @ 25' ctrs. max. (9' ctrs. for Types 3 & 4 Ret. Walls). For walls adjacent to sidewalks or curbs, provide 4" cast iron or asbestos cement pipe under the sidewalk to discharge thru curb face. Exposed wall drains shall be located 3"± above finished grade.

Backfill sufficiently to prevent ponding. To be done after removal of wall forms and before backfilling behind wall.

Place concrete in toe against undisturbed material, except as permitted by the Engineer.

Loading Conditions:

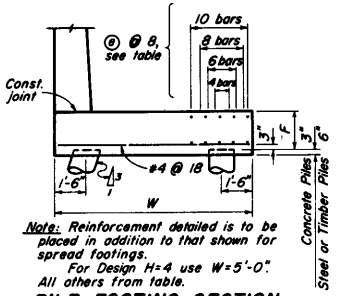
Case I	2' level surcharge
Case II	2:1 unlimited surcharge
Case III	1½:1 7' limited surcharge
Case IV	1½:1 unlimited surcharge

DESIGN AND DRAINAGE

MAX. PILE SPACING FOR 45 TON PILES

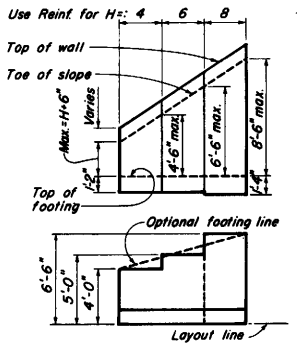
Design H	Front Row 1:3 Batter	Back Row Vertical
4	18'-0"	18'-0"
6	12'-0"	18'-0"
8	9'-0"	18'-0"
10	6'-0"	12'-0"
12	4'-0"	8'-0"

Note: For actual spacing see Wall Layout.

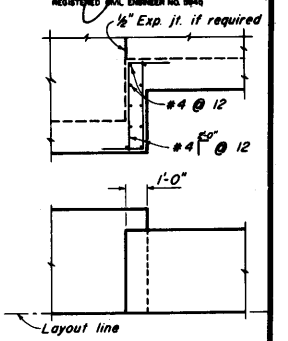


Note: Reinforcement detailed is to be placed in addition to that shown for spread footings.
For Design H=4 use W=5'-0".
All others from table.

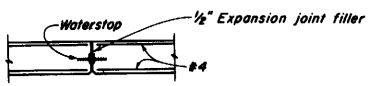
PILE FOOTING SECTION



TYPICAL LAYOUT EXAMPLE

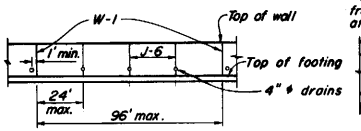


FOOTING STEP

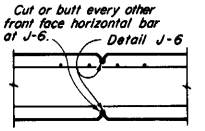


PLAN

WALL WITH DETAIL W-1

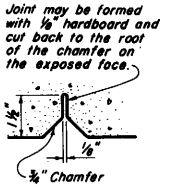


ELEVATION

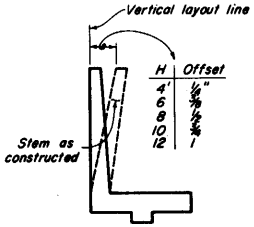


SECTION

DETAIL J-6



PLAN

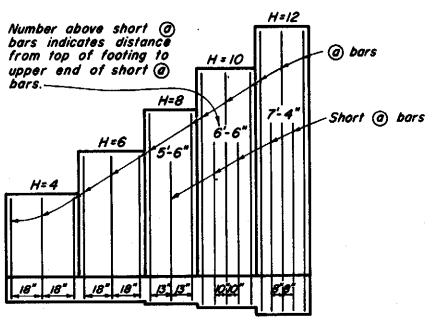


H	Offset
4'	½"
6	⅝
8	¾
10	⅞
12	1

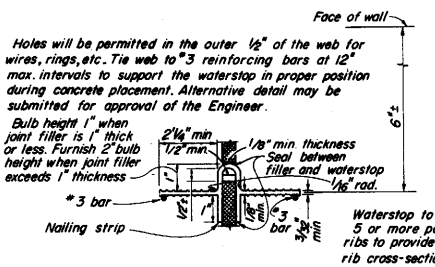
WALL OFFSET

TABLE OF REINFORCING STEEL DIMENSIONS AND DATA

Design H ft.		4	6	8	10	12
W		4'-0"	5'-0"	6'-6"	8'-0"	9'-6"
F Spread Ftg.		1'-2"	1'-2"	1'-4"	1'-6"	1'-10"
Batter		None	None	None	⅜:12	⅜:12
	ⓐ bars	#4 @ 18	#5 @ 18	#6 @ 26	#6 @ 20	#6 @ 16
Short ⓐ bars		None	None	#6 @ 26	#6 @ 20	#6 @ 16
	ⓑ bars	#4 @ 12	#6 @ 8	#7 @ 6	#10 @ 7	#10 @ 6
Total ⓐ bars		8 - #8	4 - #8	10 - #9	10 - #8	6 - #8
Toe Pressure	Case I k/sf	1.6	2.2	2.6	3.0	3.6
	Case II k/sf	1.5	2.2	2.8	3.4	4.3
	Case III k/sf	1.8	2.6	3.2	3.8	4.6
	Case IV k/sf	1.8	2.7	3.6	4.6	5.5
Spread Ftg.	Steel lbs.	16	28	64	104	138
	Conc. c.y.	10.6	13.7	18.5	25.6	37.3
Conc. Pile Ftg.	Steel lbs.	40	41	110	134	158
	Conc. c.y.	11.9	15.0	20.1	27.6	39.7
Steel or Timber Pile Ftg.	Steel lbs.	40	41	110	134	158
	Conc. c.y.	13.1	16.2	21.8	29.6	42.1



ELEVATION



Waterstop to have 5 or more pairs of raised ribs to provide 0.1 sq.in. min. rib cross-section area on each half of the waterstop. Height of ribs to be 3/32" min.

DETAIL W-1

NOTES

Design Conditions:
Design H may be exceeded by 6" before going to the next size. Footing key is required except when found unnecessary by the Engineer. Special footing design is required where foundation material is incapable of supporting toe pressure loads listed in table.

Design Data:
f_c = 1200 psi f'_c = 3000 psi f_s = 20,000 psi n = 10
earth = 120 pcf Case I - Wall design for equivalent fluid pressure = 27 and 36 pcf Case II, III, IV - Wall design for earth pressures from A.R.E.A. Manual, Chapter 8, Part 5, Appendix C, Soil Type I

Quantities:
Quantities apply to Design H portion and exclude the added portion above "Gutter Elevation."

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

RETAINING WALL
TYPE 5

B 3-7

APPROVAL RECOMMENDED
BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO 5385
APPROVED September 1, 1966
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 9946

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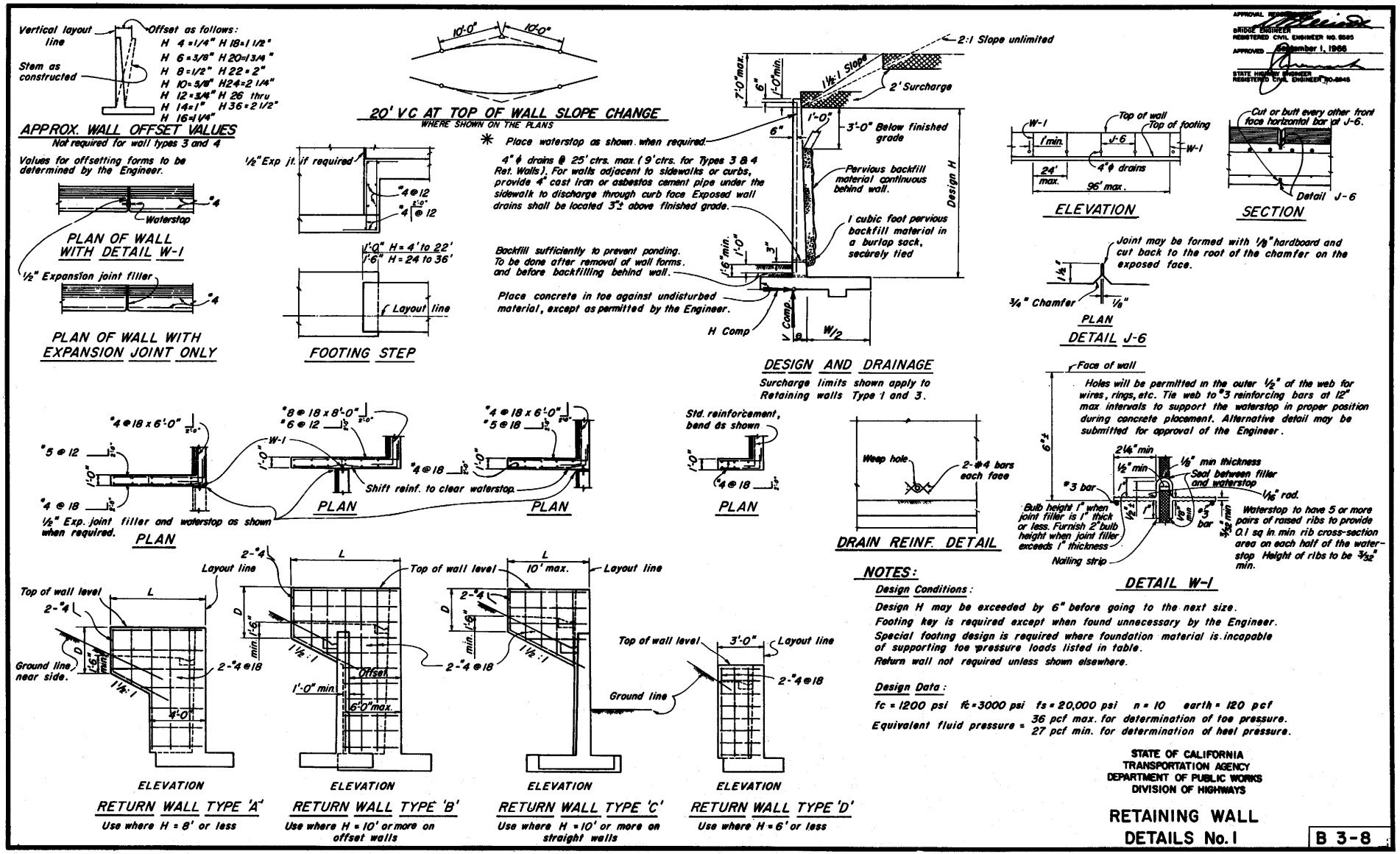
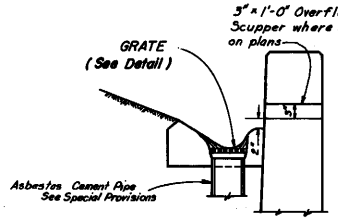
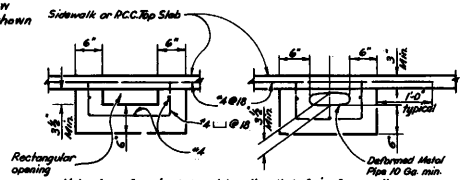


Return to Table of Contents



__" WALL DRAIN DETAIL

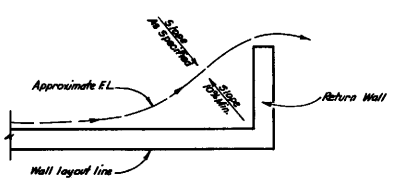
Scale: 1" = 1'-0"



Note: Area of opening to be not less than that of pipe from wall gutter. Make opening transition in wall. Edge opening in curb face to ½" Min. Radius.

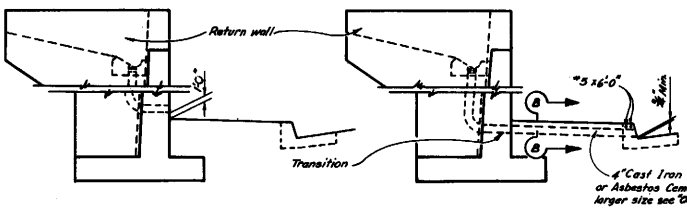
OUTLET DETAIL - SECTION B-B

Scale: 1" = 1'-0"



WALL DRAINAGE WHERE GUTTER NOT REQUIRED

Scale: ⅜" = 1'-0"

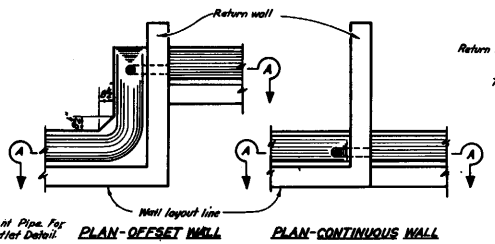


RETAINING WALL, FACE OF WALL OUTLET

Scale: ⅜" = 1'-0"

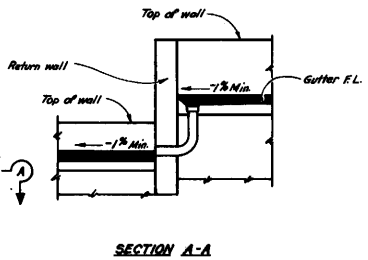
RETAINING WALL, GUTTER OUTLET

Scale: ⅜" = 1'-0"



PLAN - OFFSET WALL

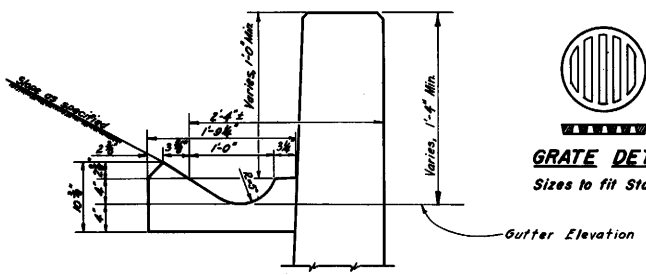
PLAN - CONTINUOUS WALL



SECTION A-A

DRAIN THROUGH RETURN WALL

Scale: ⅜" = 1'-0"

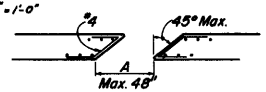


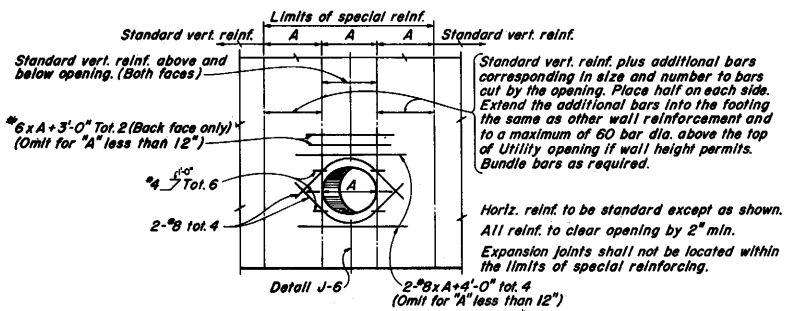
TYPICAL GUTTER DETAIL

Scale: 1½" = 1'-0"

GRATE DETAIL

Sizes to fit Standard Hubs





RETAINING WALL UTILITY OPENING

To be used in conjunction with the "Type I Cantilever Retaining Wall" sheet.
Max. size of Opening (A) = 48"

APPROVAL RECOMMENDED
BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO. 9585
APPROVED September 1, 1966
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5945

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

RETAINING WALL DETAILS No.2

B 3-9

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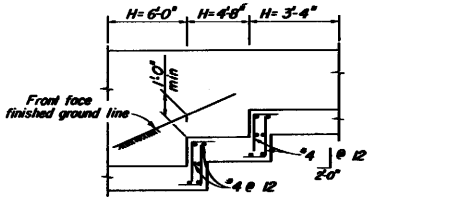
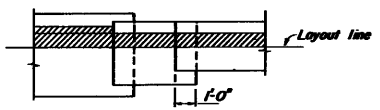
APPROVAL RECOMMENDED
BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO. 5365
APPROVED September 1, 1966
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5945

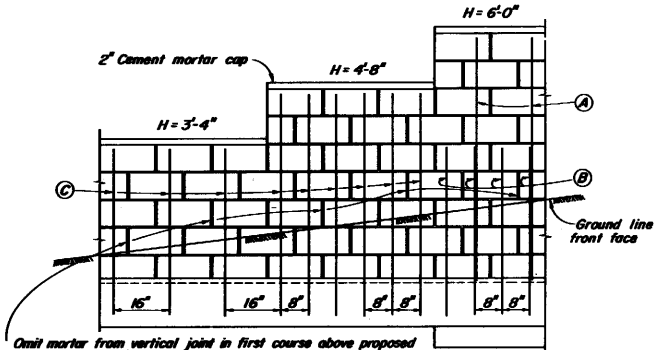


ELEVATION

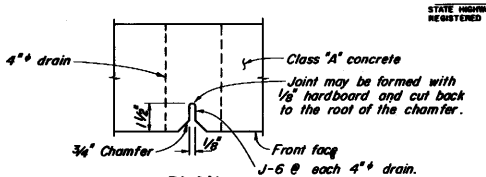


PLAN

FOOTING STEP DETAILS

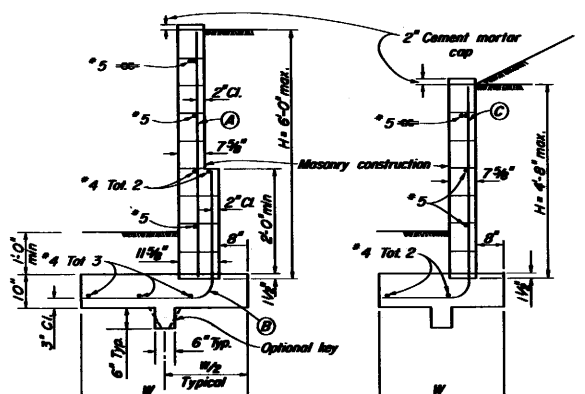


ELEVATION—MASONRY CONSTRUCTION

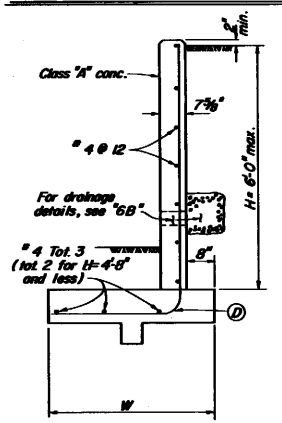


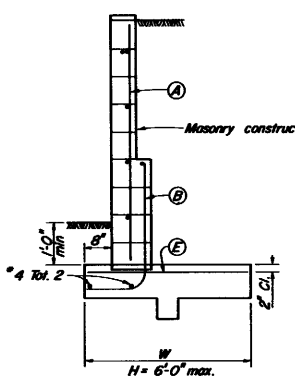
PLAN

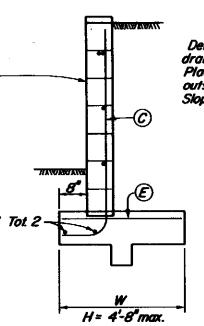
DETAIL J-6

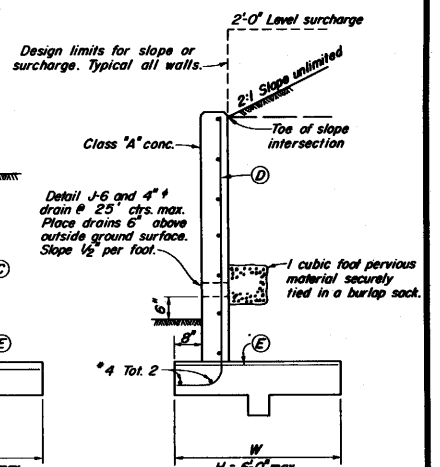


TYPE 6A WALL









TYPE 6B WALL

Type	Design H	3'-4"	4'-0"	4'-8"	5'-4"	6'-0"
6A	W	3'-2"	3'-6"	3'-10"	4-2"	4'-6"
6A	A				#4@16	#5@16
6A	B				#4@8	#4@8
6A	C	#4@16	#5@16	#4@8		
6A	D	#4@16	#4@12	#4@8	#5@10	#5@8
Footing conc. Cu. ft. / L.F.		2.9	3.2	3.4	3.7	4.0
Reinf. Lbs./L.F. Masonry		7.5	10.9	13.4	16.0	18.3
Class "A" PCC		7.1	9.4	12.9	17.6	22.6

NOTES

1. For details not shown at "6B", see "6A"
2. Area of wall for payment is based upon horizontal length and height from top of footing to top of wall.
3. Type 6 Retaining Wall shall be limited to use for walls of Design H of 6 feet or less.
4. Where traffic is adjacent to the top of wall, guard rails should be set back from the top front face of wall at least 3' for masonry walls or 2' for Class "A" PCC walls.
5. Unless otherwise stipulated, the contractor will have the option of constructing the Type 6 Walls of either Masonry or Class "A" PCC.

Type	Design	3'-4"	4'-0"	4'-8"	5'-4"	6'-0"
6B	W	2-8"	3'-0"	3'-4"	3'-8"	4'-0"
6B	A				#4@16	#5@16
6B	B				#4@8	#4@8
6B	C	#4@16	#5@16	#4@8		
6B	D	#4@16	#4@12	#4@8	#5@10	#5@8
6B	E	#4@16	#4@16	#4@8	#4@10	#4@8
Footing conc. Cu. Ft. / L.F.		2.5	2.8	3.0	3.3	3.6
Reinf. Lbs./L.F. Masonry		8.1	11.3	14.8	16.2	19.1
Class "A" PCC		7.7	9.7	14.8	16.9	21.3

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

RETAINING WALL
TYPE 6 - 6' MAX.

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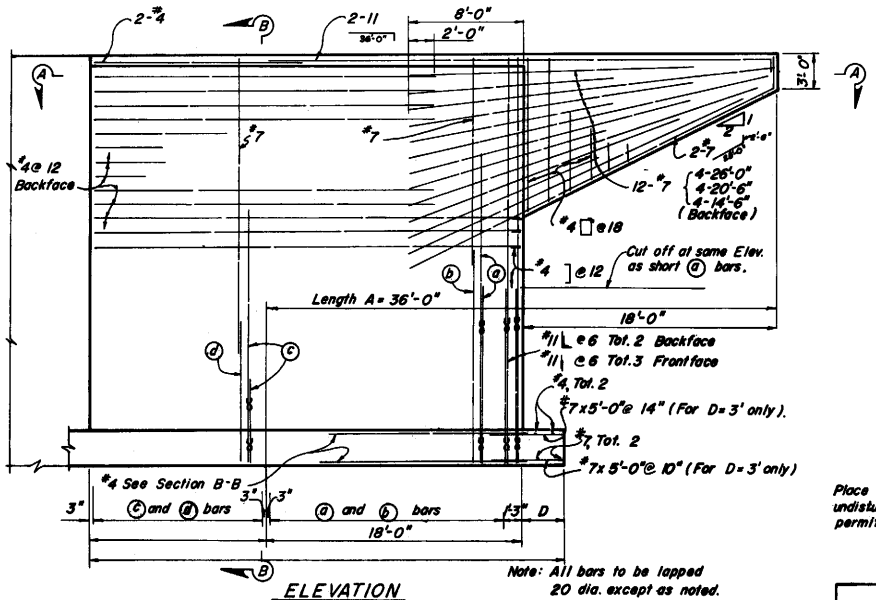
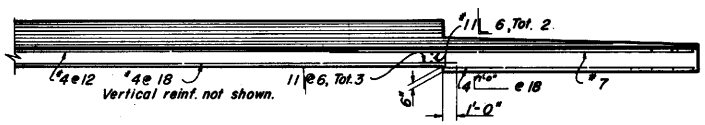
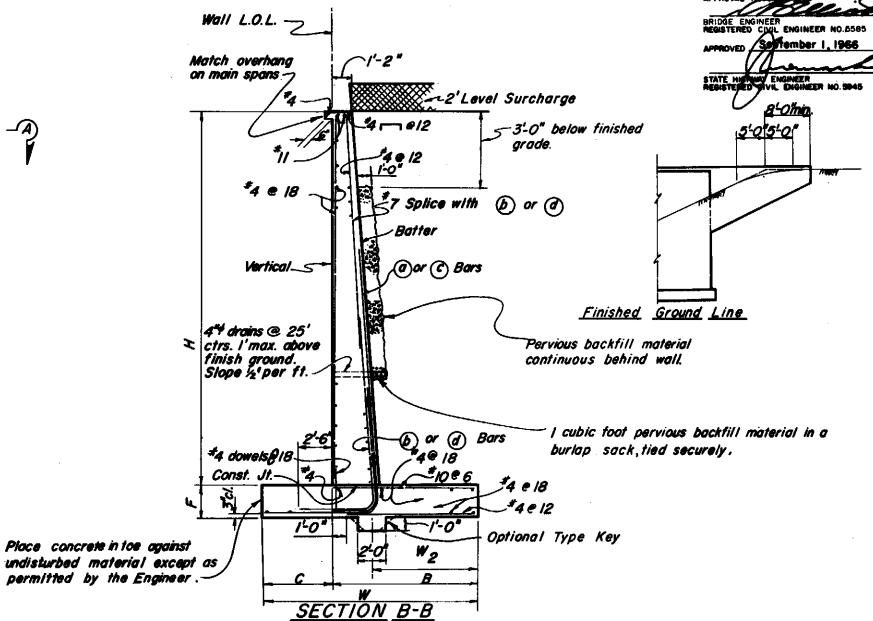


ELEVATION

Note: All bars to be lapped 20 dia. except as noted.



SECTION A-A



SECTION B-B

APPROVAL RECOMMENDED
BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO. 5565
APPROVED September 1, 1966
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 9945

H	22			24			26		28		30		32	
Footing Pressure	2½ Tons	3 Tons	4 Tons	2½ Tons	3 Tons	4 Tons	3 Tons	4 Tons	3 Tons	4 Tons	3 Tons	4 Tons	3 Tons	4 Tons
B	9'-0"	8'-0"	8'-0"	10'-0"	8'-10"	8'-10"	10'-0"	9'-6"	10'-6"	10'-2"	11'-3"	10'-10"	12'-0"	11'-6"
C	5'-0"	4'-6"	4'-0"	6'-0"	5'-2"	4'-5"	5'-9"	4'-9"	6'-6"	5'-1"	7'-0"	5'-5"	7'-6"	5'-9"
D	3'-0"	3'-0"	1'-0"	3'-0"	3'-0"	1'-0"	3'-0"	1'-0"	3'-0"	1'-0"	3'-0"	1'-0"	3'-0"	1'-0"
F	2'-0"	2'-0"	2'-0"	2'-1"	2'-1"	2'-1"	2'-3"	2'-3"	2'-5"	2'-5"	2'-7"	2'-7"	2'-9"	2'-9"
W	14'-0"	12'-6"	12'-0"	16'-0"	14'-0"	13'-3"	15'-9"	14'-3"	17'-0"	15'-3"	18'-3"	16'-3"	19'-6"	17'-3"
Conc. cu. ft. Length A	1610	1540	1470	1830	1750	1660	1980	1840	2230	2070	2470	2280	2820	2590
Conc. cu. ft 1' Additional	70	67	66	82	78	76	89	86	103	99	115	110	133	127
Reinf. Steel lbs. Length A	9410	9080	8710	10400	9970	9510	11130	10500	12110	11390	13110	12310	14150	13300
Reinf. Steel lbs 1' Add.	336	325	325	375	364	363	405	400	502	497	554	547	607	602
a bars 2-#11 @ 12 bundle	1-24'-0" lg. 1-10'-0" lg.	1-23'-6" lg. 1-9'-6" lg.	1-23'-0" lg. 1-9'-0" lg.	1-27'-0" lg. 1-12'-0" lg.	1-26'-2" lg. 1-11'-2" lg.	1-25'-5" lg. 1-10'-5" lg.	1-30'-0" lg. 1-14'-0" lg.	1-29'-0" lg. 1-13'-0" lg.	1-33'-0" lg. 1-16'-6" lg.	1-31'-7" lg. 1-15'-1" lg.	1-36'-0" lg. 1-19'-0" lg.	1-34'-5" lg. 1-17'-5" lg.	1-39'-0" lg. 1-22'-0" lg.	1-37'-3" lg. 1-20'-3" lg.
b bars	#11 @ 12 x 15'-0" lg.			#11 @ 12 x 17'-0" lg.			#11 @ 12 x 19'-0" lg.		#11 @ 12 x 21'-6" lg.		#11 @ 12 x 24'-0" lg.		#11 @ 12 x 26'-6" lg.	
c bars	#11 @ 12 x 20'-0" lg.			#11 @ 12 x 23'-0" lg.			#11 @ 12 x 26'-0" lg.		#11 @ 12 x 29'-0" lg. (#11 @ 12 x 12'-0" bundle)		#11 @ 12 x 32'-0" lg. (#11 @ 12 x 1'-6" bundle)		#11 @ 12 x 35'-0" lg. (#11 @ 12 x 17'-6" bundle)	
d bars	#11 @ 12 x 12'-0" lg.			#11 @ 12 x 14'-0" lg			#11 @ 12 x 16'-0" lg.		#11 @ 12 x 16'-6" lg.		#11 @ 12 x 19'-0" lg.		#11 @ 12 x 21'-6" lg.	
Batter	7/16 : 12			3/4 : 12			3/4 : 12		13/16 : 12		13/16 : 12		13/16 : 12	

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

WINGWALLS - SPREAD FOOTING

B3-15

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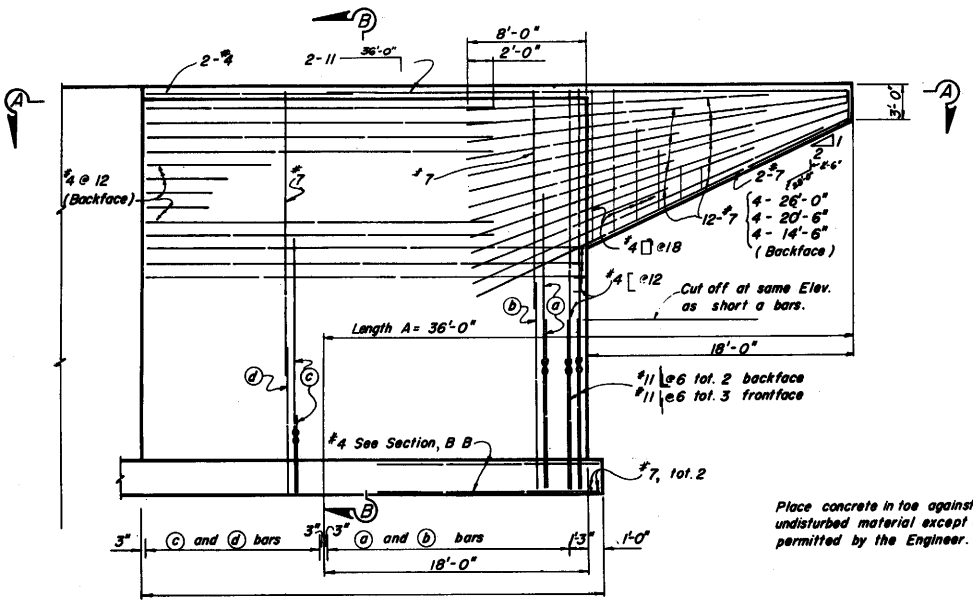
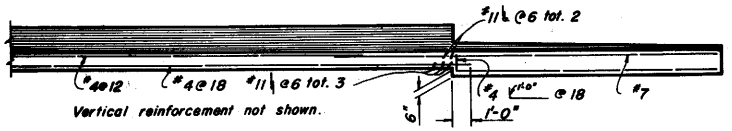
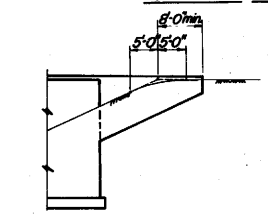


ELEVATION

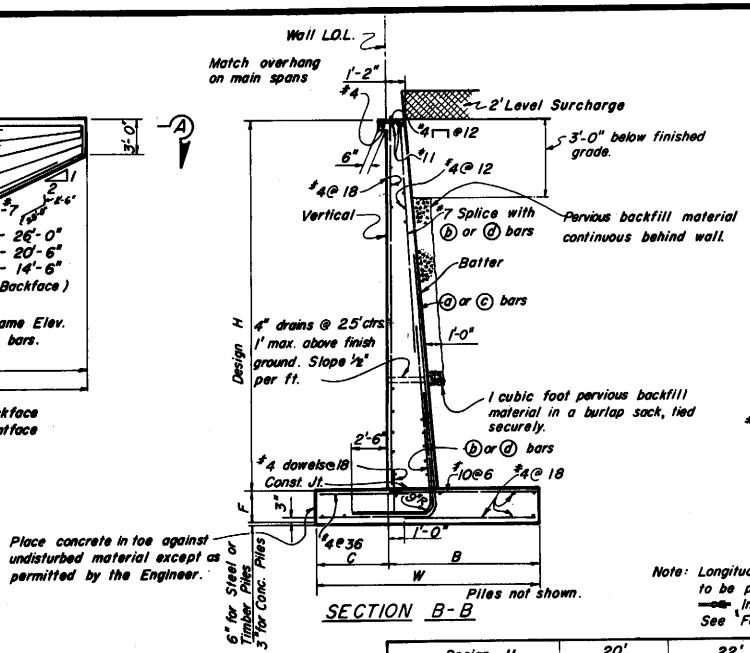


Vertical reinforcement not shown.

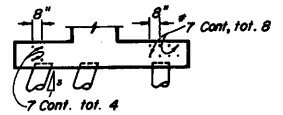
SECTION A-A



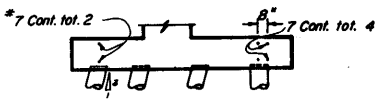
Finished Ground Line



SECTION B-B



TYPICAL SECTION TYPE I



TYPICAL SECTION TYPE II

Note: Longitudinal bars shown on "TYPICAL SECTIONS I and II" to be placed in addition to standard reinforcement.
Indicates a bundle of 2 bars.
See "Foundation Plan" for pile spacing.

	Design H	20'	22'	24'	26'	28'
	B	7'-0"	8'-0"	8'-10"	9'-6"	10'-2"
	C	3'-6"	4'-0"	4'-5"	4'-9"	5'-1"
	F	1'-10"	2'-0"	2'-1"	2'-3"	2'-5"
	W	10'-6"	12'-0"	13'-3"	14'-3"	15'-3"
	Type	I	I	II	II	II
	Wall Batter	11/16 : 12	11/16 : 12	3/4 : 12	3/4 : 12	13/16 : 12
	a bars	#11@12 × 20'-0"	#11@12 × 23'-0" #11@12 × 9'-0"	#11@12 × 25'-5" #11@12 × 10'-5"	#11@12 × 29'-0" #11@12 × 13'-0"	#11@12 × 31'-7" #11@12 × 15'-1"
	b bars	#11@12 × 12'-0"	#11@12 × 15'-0"	#11@12 × 17'-0"	#11@12 × 19'-0"	#11@12 × 21'-6"
	c bars	#11@12 × 16'-0"	#11@12 × 20'-0"	#11@12 × 23'-0"	#11@12 × 26'-0"	#11@12 × 29'-0" #11@12 × 12'-0"
	d bars	#11@12 × 10'-0"	#11@12 × 12'-0"	#11@12 × 14'-0"	#11@12 × 16'-0"	#11@12 × 16'-6"
Concrete Piles	Conc. cu.ft. Length A	1310	1490	1680	1870	2100
	" " " Additional 1'	57	67	77	87	100
	Reinf. Steel lbs. Length A	7710	9330	9900	10890	11800
	" " " Additional 1'	307	352	381	417	514
Steel Piles	Conc. cu.ft. Length A	1360	1550	1740	1940	2170
	" " " Additional 1'	60	70	81	91	104
	Reinf. Steel lbs. Length A	7710	9330	9900	10890	11800
	" " " Additional 1'	307	352	381	417	514

APPROVAL RECOMMENDED
ACTING CHIEF ENGINEER
REGISTERED CIVIL ENGINEER NO. 8585
APPROVED September 1, 1966
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 8945

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

WINGWALLS-PILE FOOTING

B 3-16

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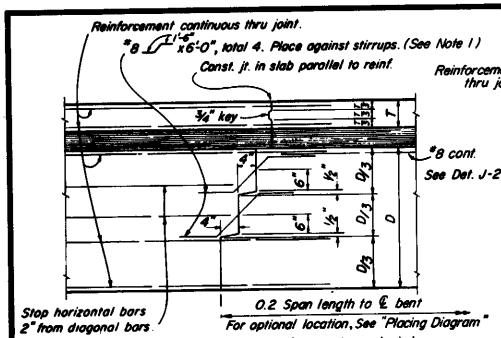
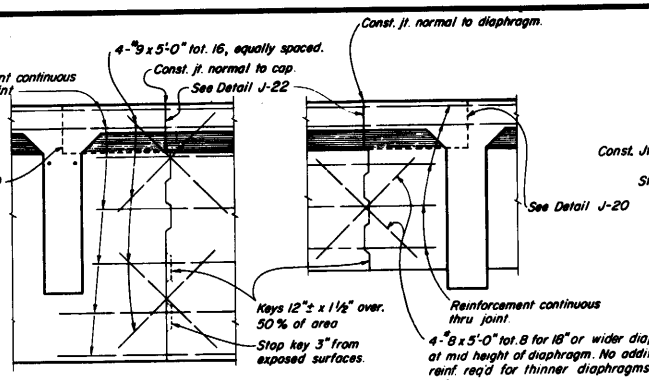
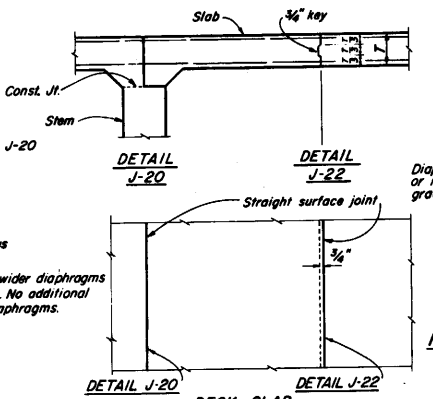


TRANSVERSE GIRDER CONSTRUCTION JOINTS
DETAIL J-3

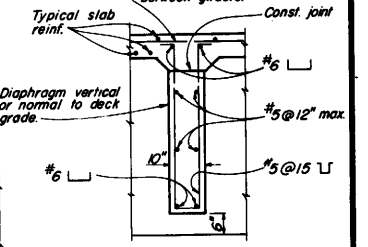


BENT CAP
LONGITUDINAL CONSTRUCTION JOINTS
DETAIL J-4

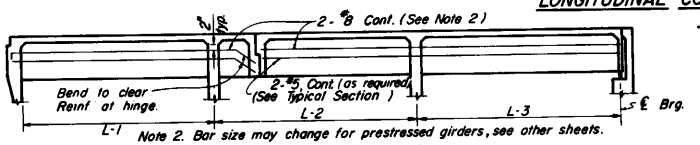
DIAPHRAGMS



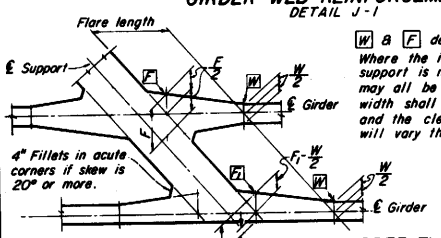
DECK SLAB
LONGITUDINAL CONSTRUCTION JOINTS
Note: Longitudinal construction joints in slab, if required, are to be located at edge of traffic lanes except as approved by the Engineer.



INTERMEDIATE DIAPHRAGM SECTION
DETAIL D-1

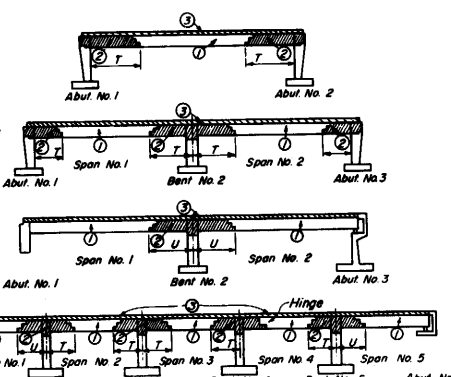


GIRDER WEB REINFORCEMENT
DETAIL J-1



TYPICAL GIRDER FLARE DIAGRAM

[W] & [F] denote girder width in inches.
Where the increase in stem width due to flare at the support is not more than 2 1/2" on a side, the stirrups may all be a constant width. In this case the stirrup width shall be determined by the minimum stem width, and the clearance from face of concrete to stirrup will vary throughout the flare.



TEE BEAM SUPERSTRUCTURE PLACING DIAGRAM

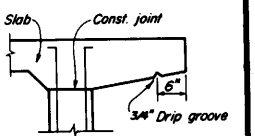
Numbers ① and ② indicate sequence of placing girder stem concrete when each section constitutes a separate pour. ① and ② sections may be placed in one continuous pour, progressing from one end, providing ① sections are placed on either side of the ② sections which are placed during this pour.

Top slab concrete ③ may be placed separately from ① and ②. ③ may be placed continuously or in parts as approved by the Engineer, providing no transverse construction joints fall within the ② areas.

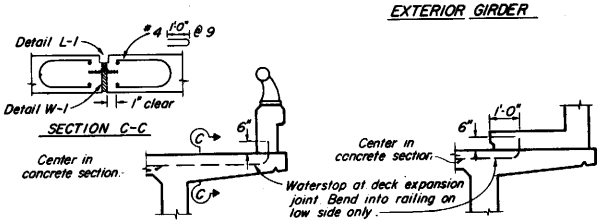
T = 1/5 span length

U = 1/4 span length

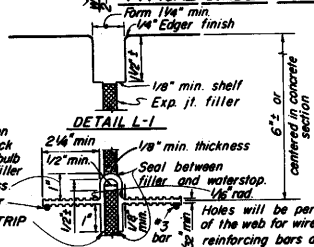
No deviations from the above may be made unless approved by the Engineer.



PART SECTION
EXTERIOR GIRDER



DECK AND SIDEWALK JOINTS
DETAIL C-1



DETAIL W-1

Waterstop to have 5 or more pairs of raised ribs to provide 0.1 sq. in min. rib cross-section area on each half of the waterstop. Height of ribs to be 3/32" min.

Holes will be permitted in the outer 1/2" of the web for wire, rings, etc. Tie web to #3 reinforcing bars at 12" max. intervals to support the waterstop in proper position during concrete placement. Alternative detail may be submitted for approval of the Engineer.

SEALED DECK JOINT

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

T - BEAM
DETAILS NO. 1 B 6 - 1

APPROVAL RECOMMENDED
BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO. 5585
APPROVED September 1, 1966
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5945

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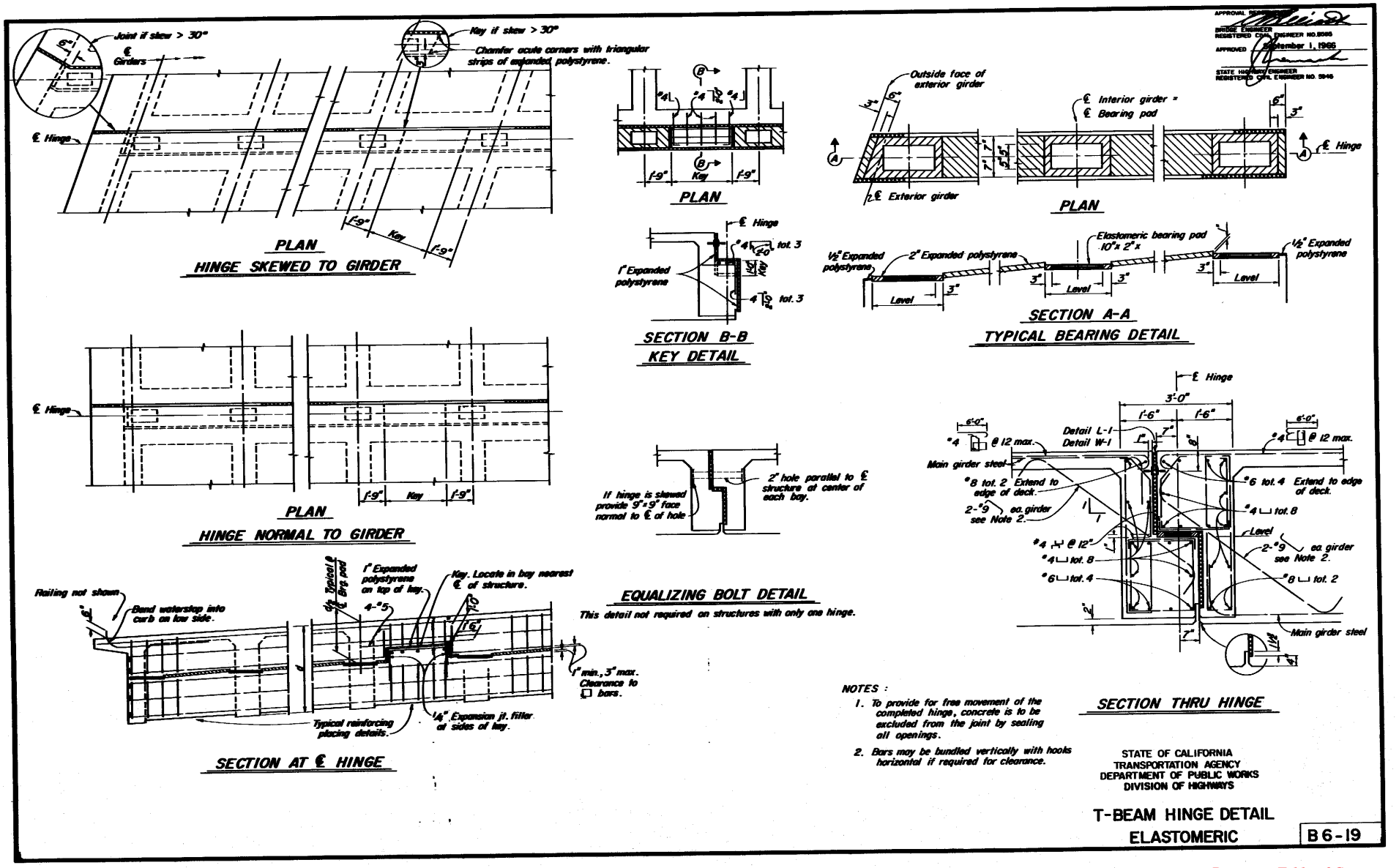

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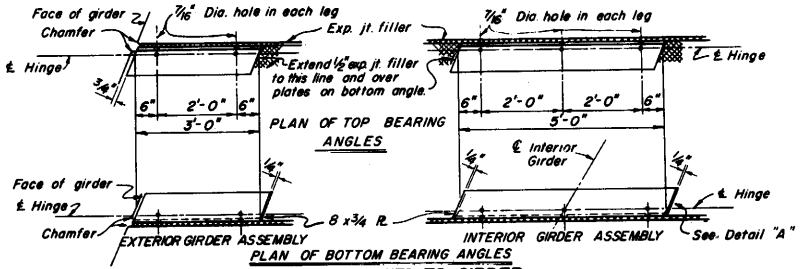
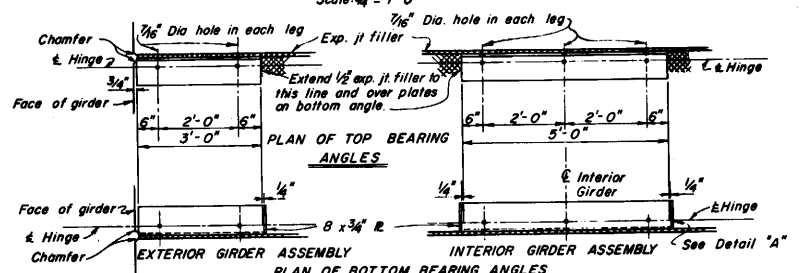


HINGE SKEWED TO GIRDER

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

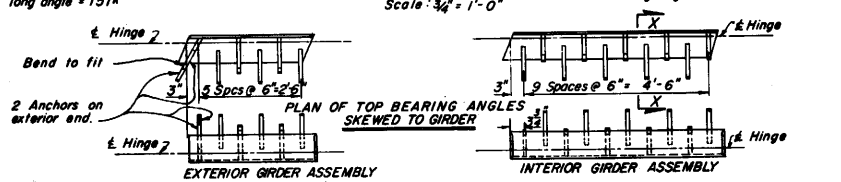


HINGE NORMAL TO GIRDER

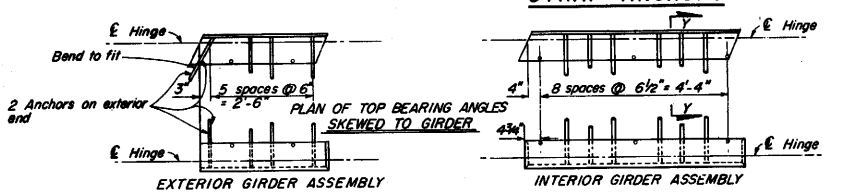
Scale: 3/4" = 1'-0"

Exterior Assembly Max. shear for 3'-0" long angle = 151k

Interior Assembly Max. shear for 5'-0" long angle = 252k



STRAP ANCHORS



STUD ANCHORS

ANCHOR ALTERNATIVES

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

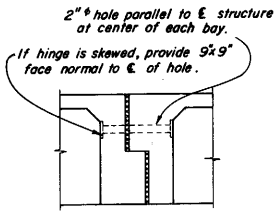
To provide for free movement of the completed hinge, abutting surfaces shall be separated with expansion filler. Caulk and tape the joints between steel angles and all remaining openings to prevent grout or concrete seepage between abutting surfaces of hinge.

APPROVAL RECOMMENDED: BRIDGE ENGINEER REGISTERED CIVIL ENGINEER NO. 5585

APPROVED September 1, 1966 STATE HIGHWAY ENGINEER REGISTERED CIVIL ENGINEER NO. 5845

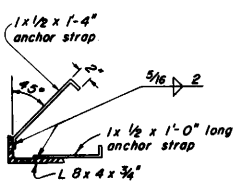
NOTE:

Remove sharp corners and burrs from ends of angles and end plates. Galvanize hinge assembly after fabrication.



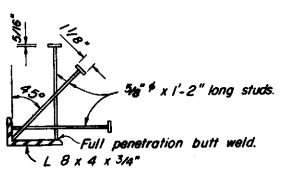
This detail not required on structures with only one hinge.

EQUALIZING BOLT HOLE DETAIL



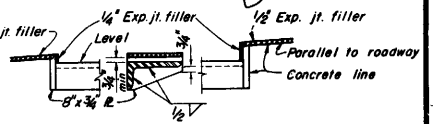
SECTION X-X

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



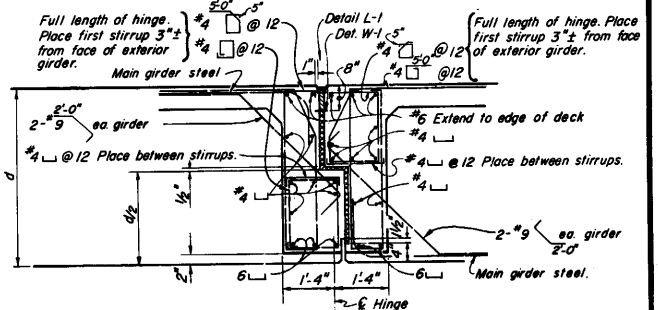
SECTION Y-Y

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



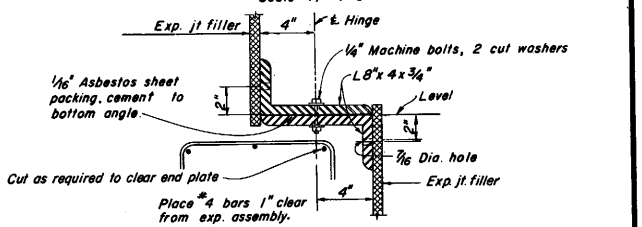
DETAIL "A"

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



TYPICAL EXPANSION HINGE

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



SECTION THRU EXPANSION ASSEMBLY

Scale: 3" = 1'-0"

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

STEEL HINGE DETAILS
T-BEAM

B 6 - 20

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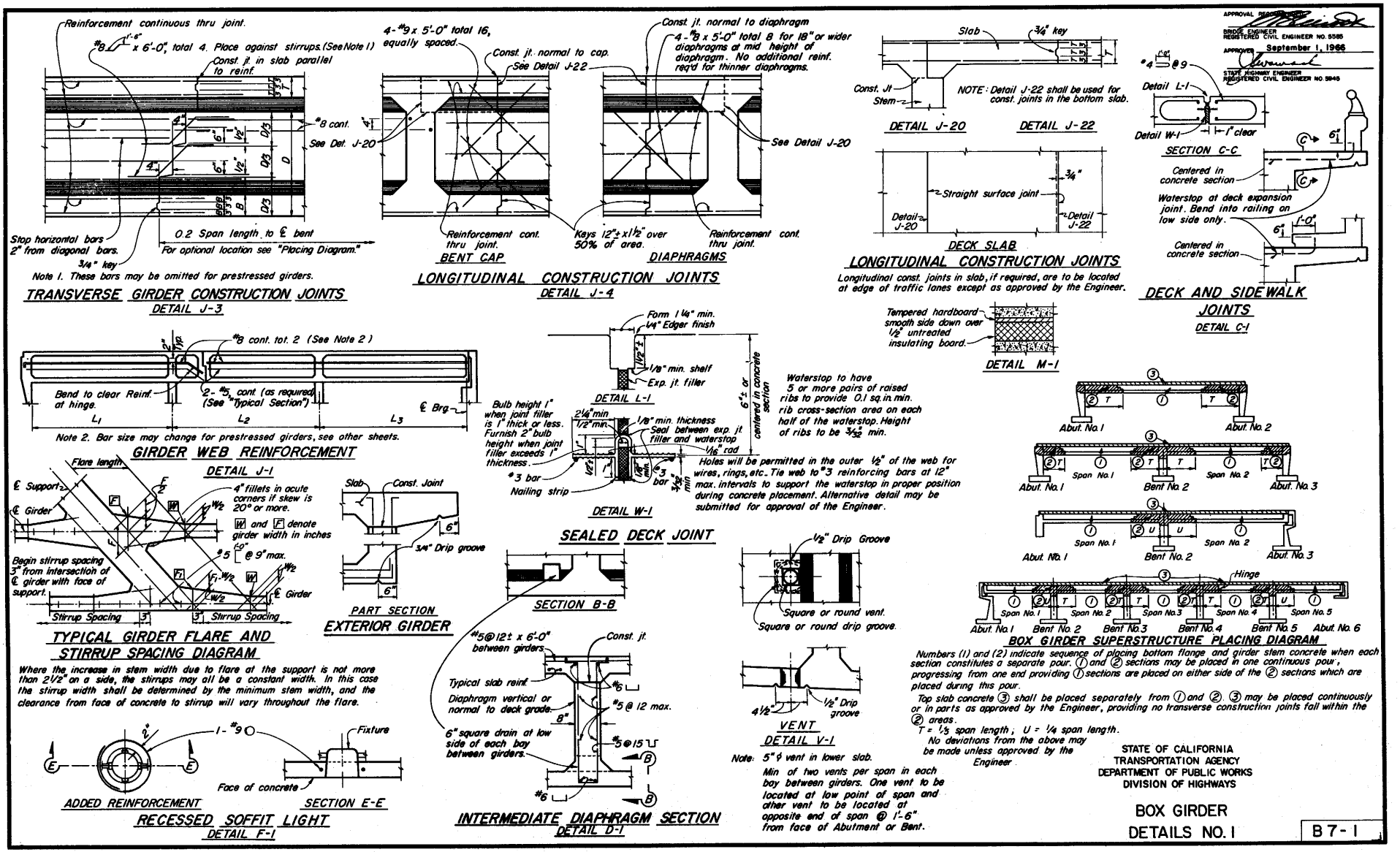

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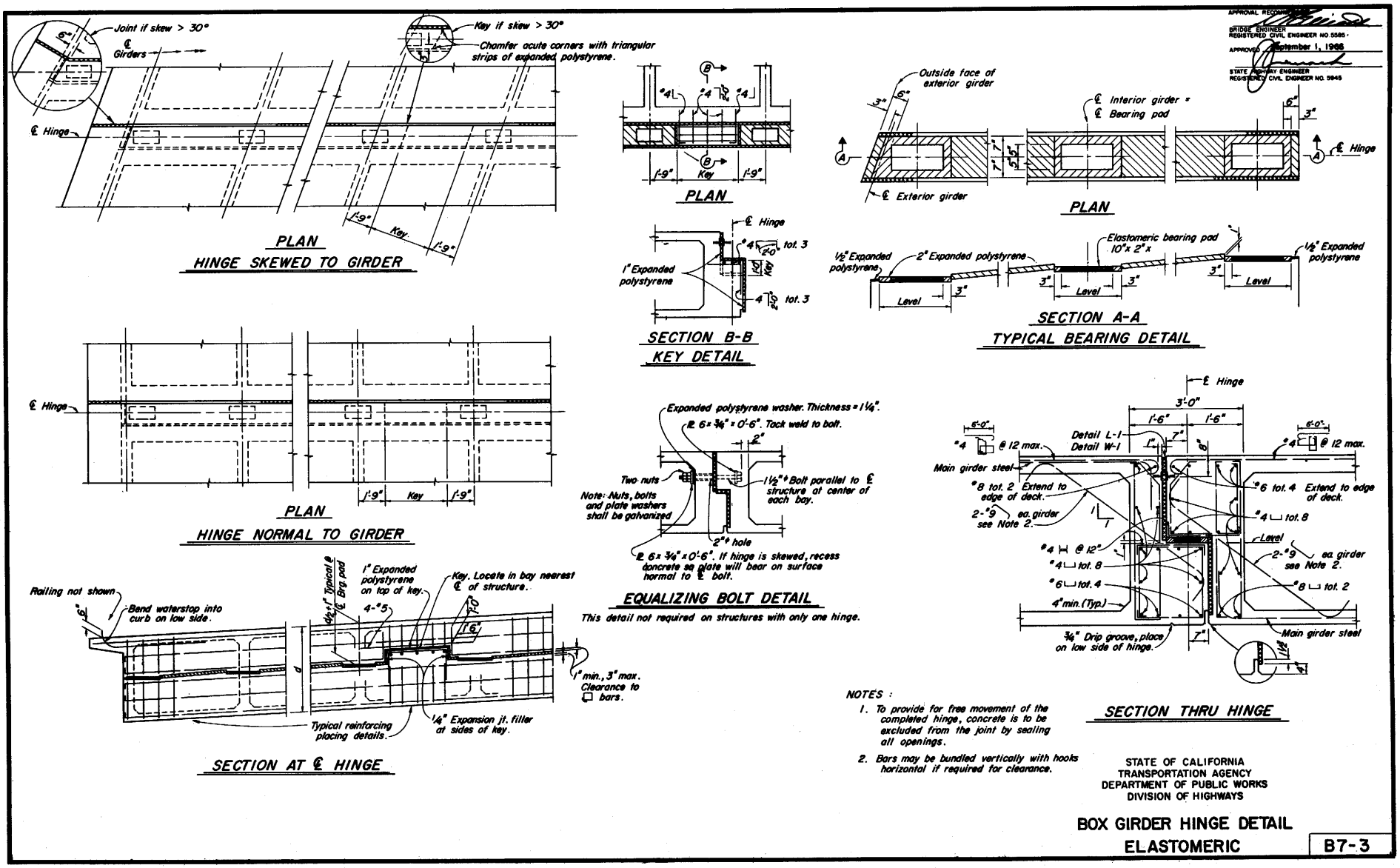

NOTES :

1. To provide for free movement of the completed hinge, concrete is to be excluded from the joint by sealing all openings.
2. Bars may be bundled vertically with hooks horizontal if required for clearance.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

BOX GIRDER HINGE DETAIL
ELASTOMERIC

B7-3

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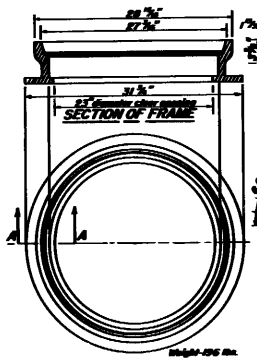
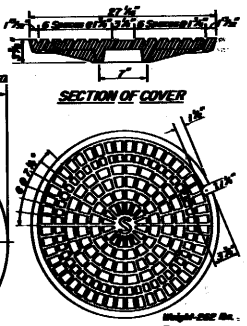
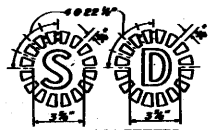


PLAN OF FRAME

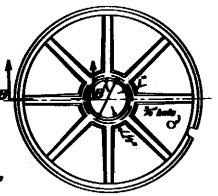


TOP PLAN OF COVER

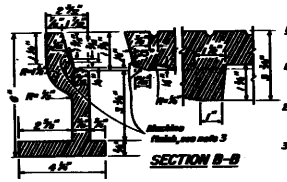


DETAILS OF LETTERS

Surface of letter shall be flush with finished surface



BOTTOM PLAN OF COVER

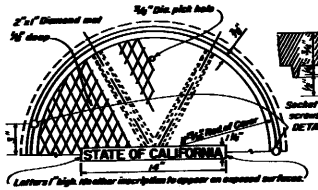


NOTES—

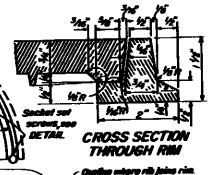
1. The manhole frame and cover shall be made of gray cast iron conforming to the latest specifications.
2. All parts of the manhole frame and cover except machined surfaces shall be coated with asphaltum paint.
3. The manhole frame and cover shall be tested for accuracy of fit and shall be marked in sets before delivery. The cover shall fit the frame snugly but not tightly.
4. Covers for use on cover structures shall have the letter "S"; on storm drain structures the letter "D"; on openings for utilities the letter "U".
5. The weights of the frame and cover shall not vary more than two per cent from those given hereon.

NON-ROCKING MANHOLE FRAME AND COVER FOR DECKS

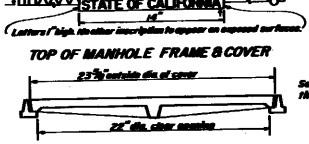
DETAIL U45



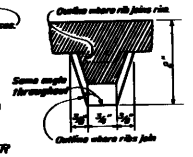
TOP OF MANHOLE FRAME & COVER



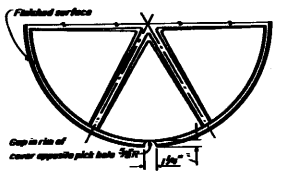
CROSS SECTION THROUGH RIM



CROSS SECTION THROUGH FRAME & COVER



CROSS SECTION THROUGH RIB AT MID RADIUS



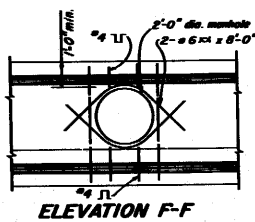
BOTTOM OF MANHOLE COVER

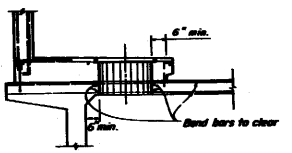
MANHOLE COVER LOCKING DEVICE DETAIL

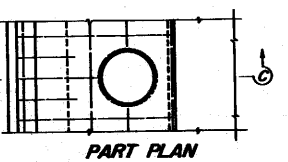
NOTE: Frame and cover shall be CAST IRON. Weight - 180 lbs.
Material and workmanship shall be in accordance with the latest specifications.
Galvanize complete assembly after fabrication.

MANHOLE FRAME AND COVER FOR SIDEWALKS

DETAIL U46

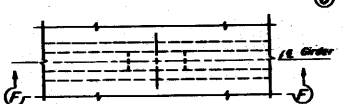






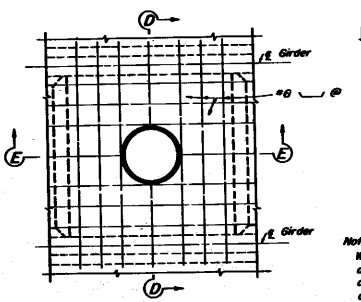
SIDEWALK ACCESS OPENING

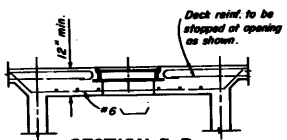
DETAIL U42

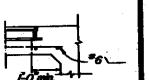


GIRDER STEM ACCESS OPENING

DETAIL U41



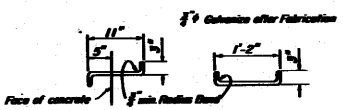




Note:
Where manhole is located adjacent to a diaphragm or abut., substitute Half Section E'-E' on one side of Section E-E.

DECK ACCESS OPENING

DETAIL U43



LADDER RUNG DETAIL

DETAIL U44

NOTES

1. For exact location of openings see other sheets.
2. Location and size of manholes may be modified as directed by the Engineer, provided minimum dimensions are maintained.
3. All reinforcement detailed to be placed in addition to reinforcement shown on other sheets.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

UTILITIES
DETAIL NO. 2

B 7-11

APPROVAL RECOMMENDED
BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO. 2565
APPROVED September 1, 1966
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5945

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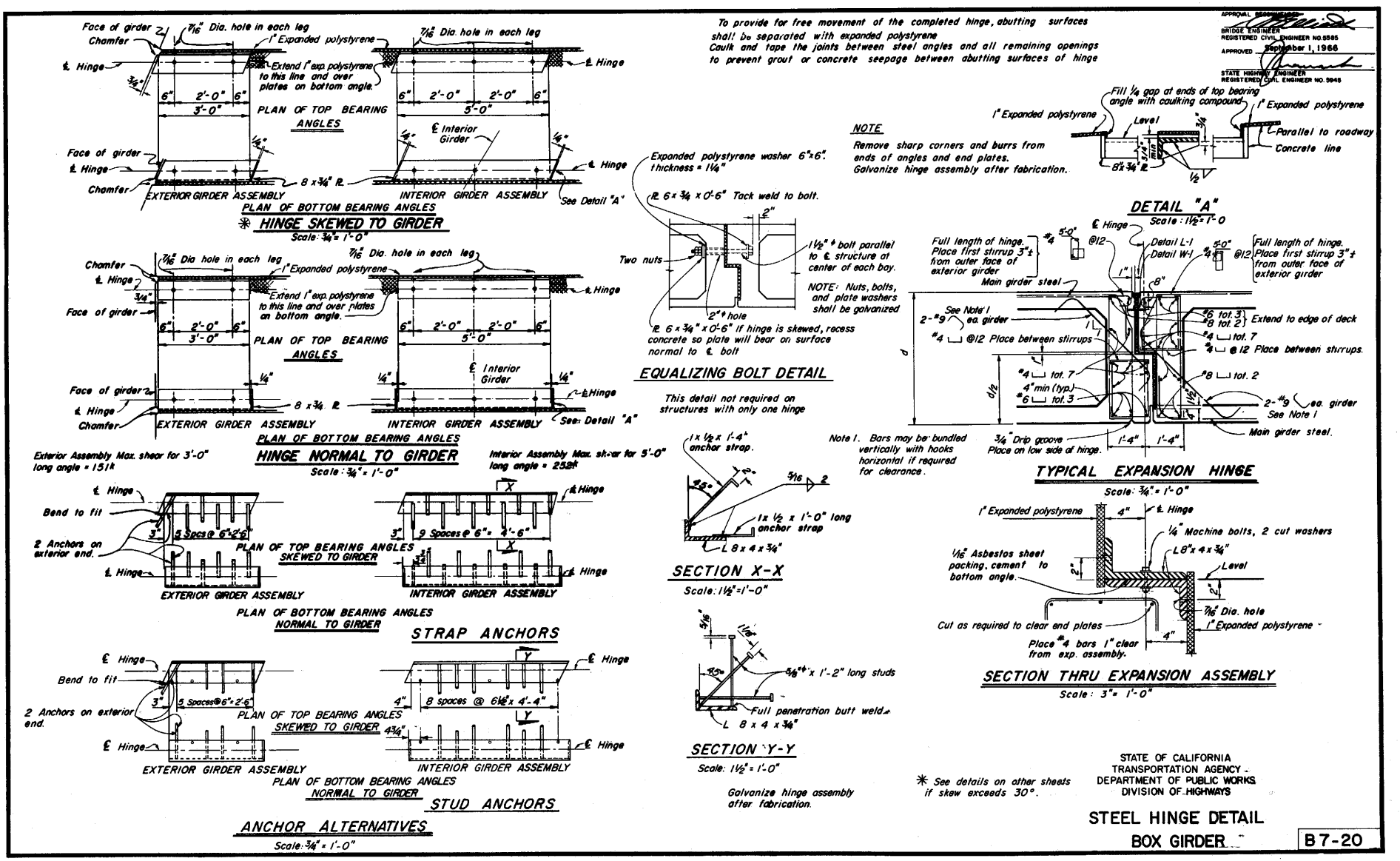

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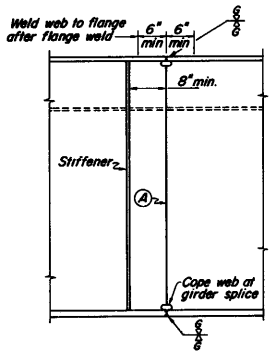
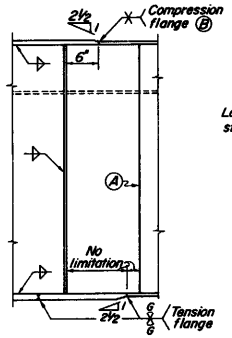
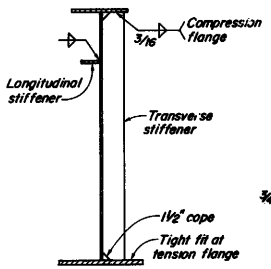
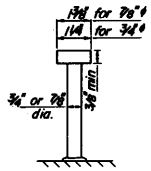


GIRDER SPLICE FIELD OR SHOP

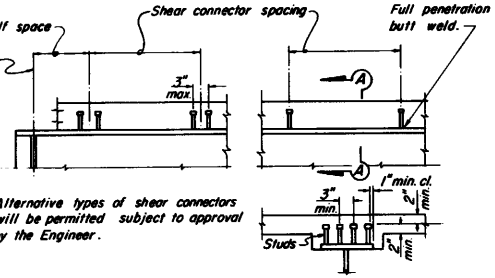


ASSEMBLY AND FABRICATION DETAILS





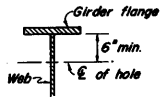
STUD CONNECTOR



SECTION A-A

SHEAR CONNECTOR DETAILS

Scale 1" = 1'-0"

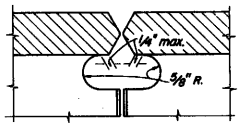


1" max. diameter hole at 4'± min. spacing to be used for falsework support when specified by the contractor. Contractor to determine location, size and spacing.

2" max. diameter hole to be drilled where lighting conduit passes through girder web. For location and size of hole see "Lighting Plan".

℄ of holes to be 6" min. from horizontal or vertical weld.

HOLES FOR CONDUIT AND FALSEWORK



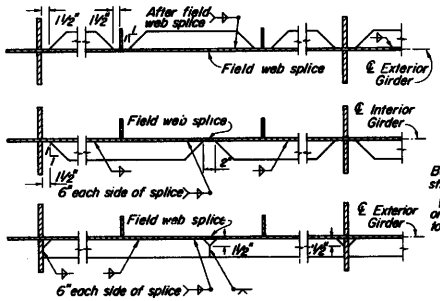
WEB COPE AT GIRDER SPLICE

NOTE: Alternative girder splices will be permitted subject to the approval by the Engineer.

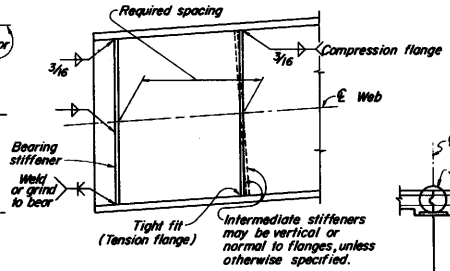
Ⓐ Web splices shall be full penetration butt welds. All weld areas on the exterior face of exterior girders shall be ground flush. Where welds on a girder interfere with longitudinal stiffeners, the weld areas shall be ground flush.

Under full dead load and deck shrinkage, as shown on the camber diagram, girder ends and bearing stiffeners shall be vertical except they may be normal to grade for grades less than two percent.

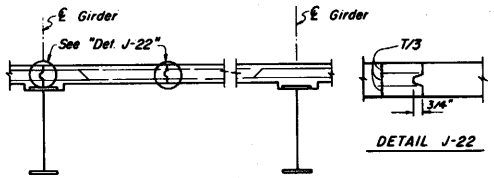
Ⓑ A minimum of 20% shall be ground flush, as determined by the Engineer, for radiographing.



LONGITUDINAL STIFFENER DETAILS



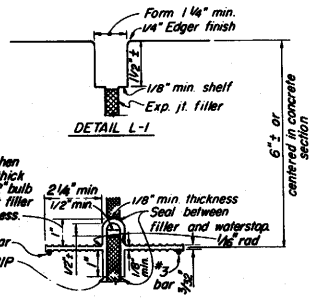
TRANSVERSE STIFFENERS



DETAIL J-22

1. When a placing schedule is not shown on the plans, or when the Contractor wishes to deviate from the placing schedule shown on the plans, the Contractor shall furnish a proposed placing schedule which shall be subject to approval by the Engineer.
2. Longitudinal construction joints in slab, if required, are to be located at edge of traffic lanes, except as otherwise approved by the Engineer.
3. Reinforcing shall be continuous through all construction joints.

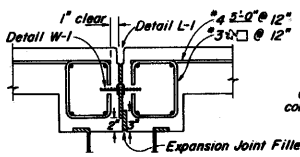
DECK CONSTRUCTION



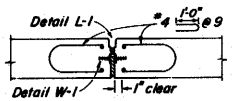
Waterstop to have 5 or more pairs of raised ribs to provide 0.1 sq. in. min. rib cross-section area on each half of the waterstop. Height of ribs to be 3/32" min.

Holes will be permitted in the outer ½" of the web for wires, rings, etc. Tie web to #3 reinforcing bars at 12" max. intervals to support the waterstop in proper position during concrete placement. Alternative detail may be submitted for approval of the Engineer.

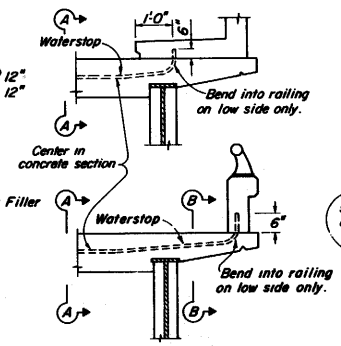
SEALED DECK JOINT



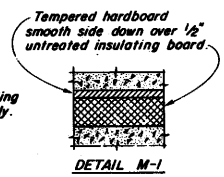
SECTION A-A



SECTION B-B



DECK JOINTS



DETAIL M-1

SLIDING JOINT

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

STEEL GIRDER DETAILS

B9-1

APPROVAL RECOMMENDED: BRIDGE ENGINEER REGISTERED CIVIL ENGINEER NO 5885
APPROVED: September 1, 1966
STATE HIGHWAY ENGINEER REGISTERED CIVIL ENGINEER NO. 5945

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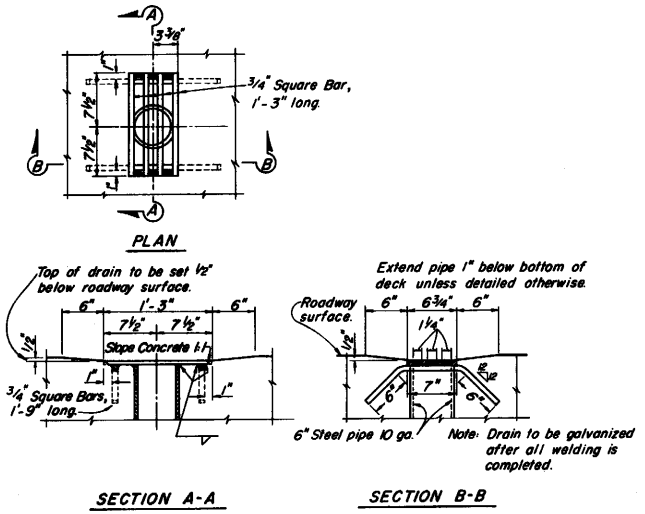
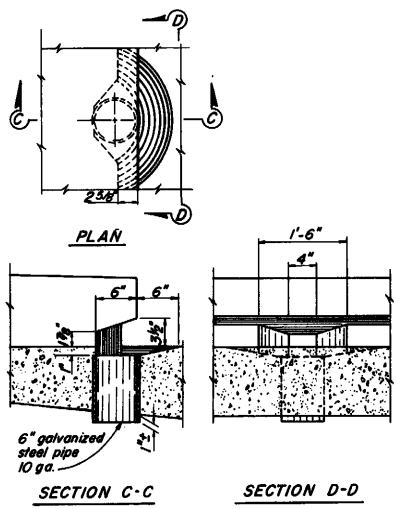
APPROVAL RECOMMENDED
BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO. 5585
APPROVED September 1, 1966
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5845



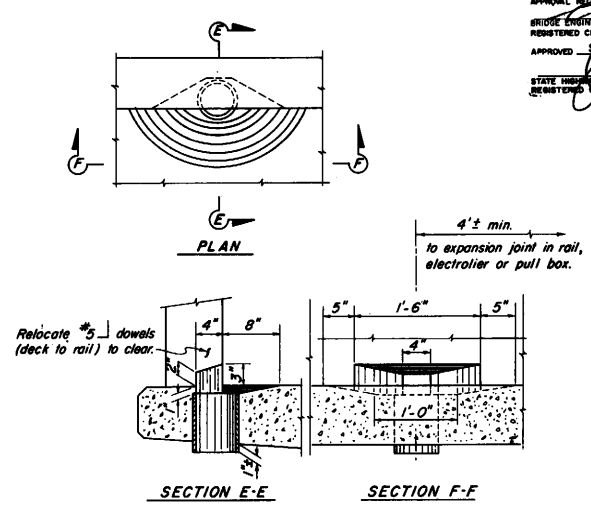
DRAIN DETAIL - TYPE "A"

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



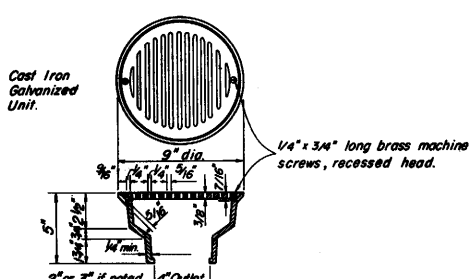
DRAIN DETAIL - TYPE "B"

FOR TYPES 2 AND 5 BARRIER RAILINGS



TYPE "B" DRAIN

FOR TYPE 1 BARRIER RAILING



AREA DRAIN

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

DRAIN DETAILS

B 9-2

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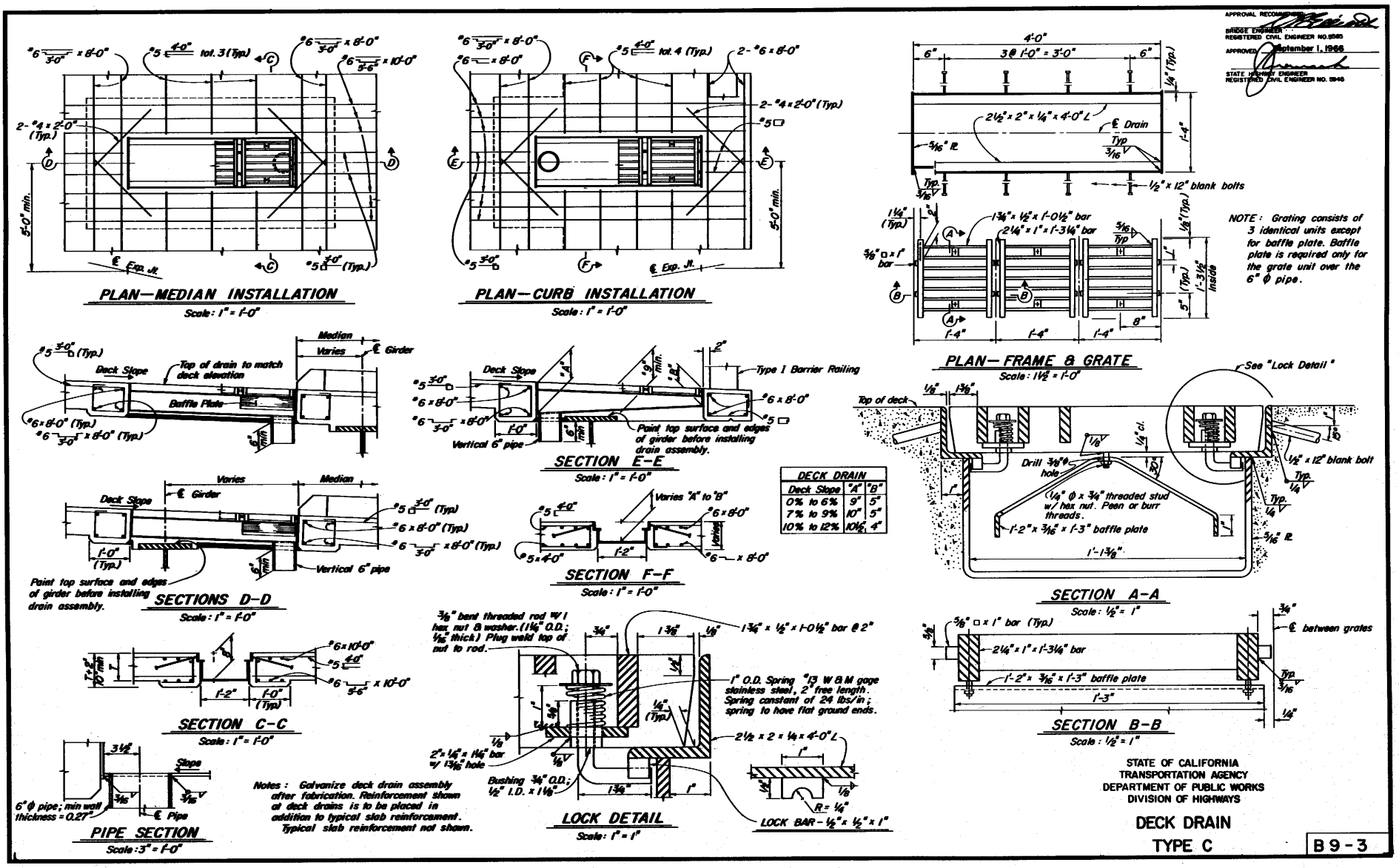

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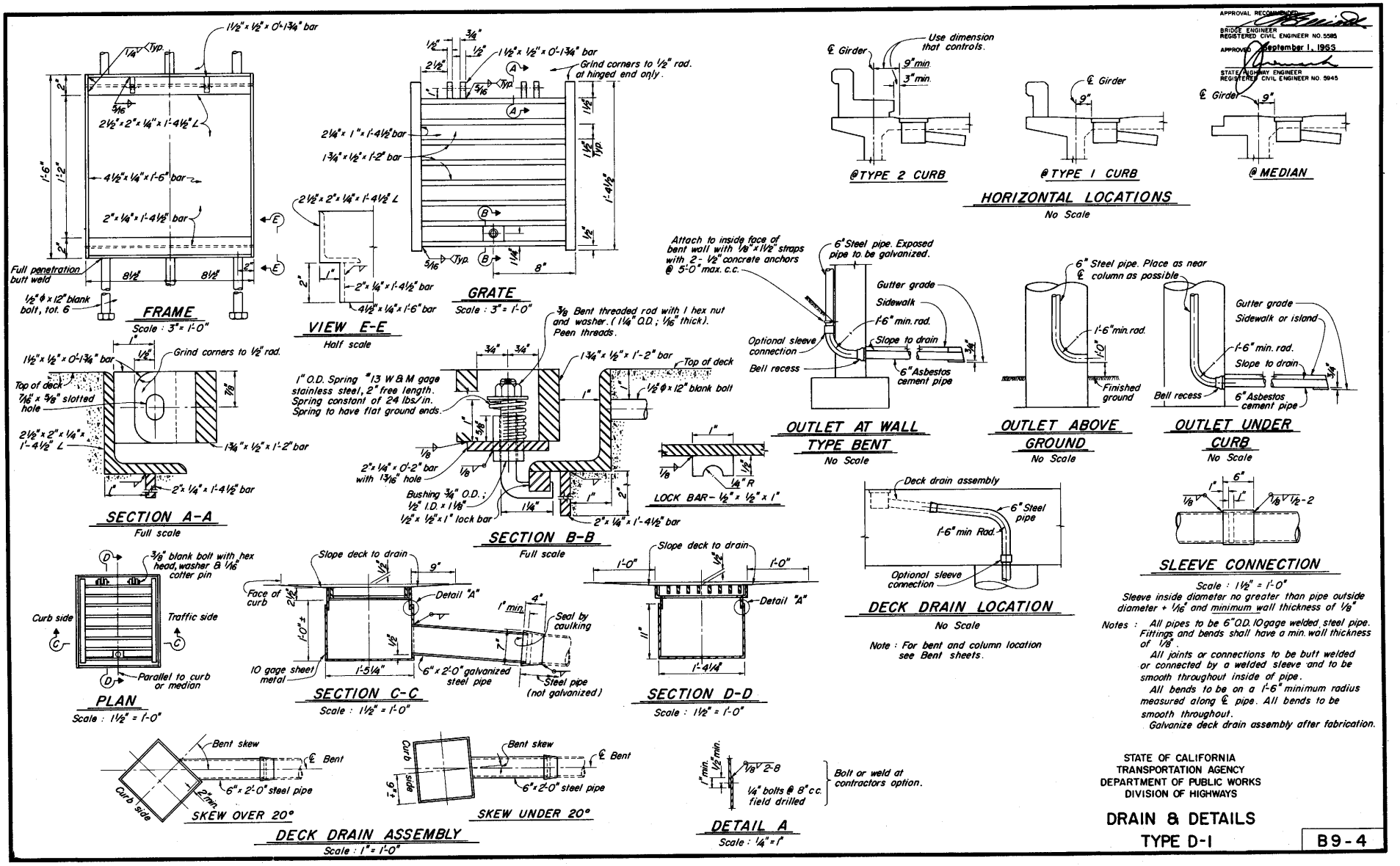

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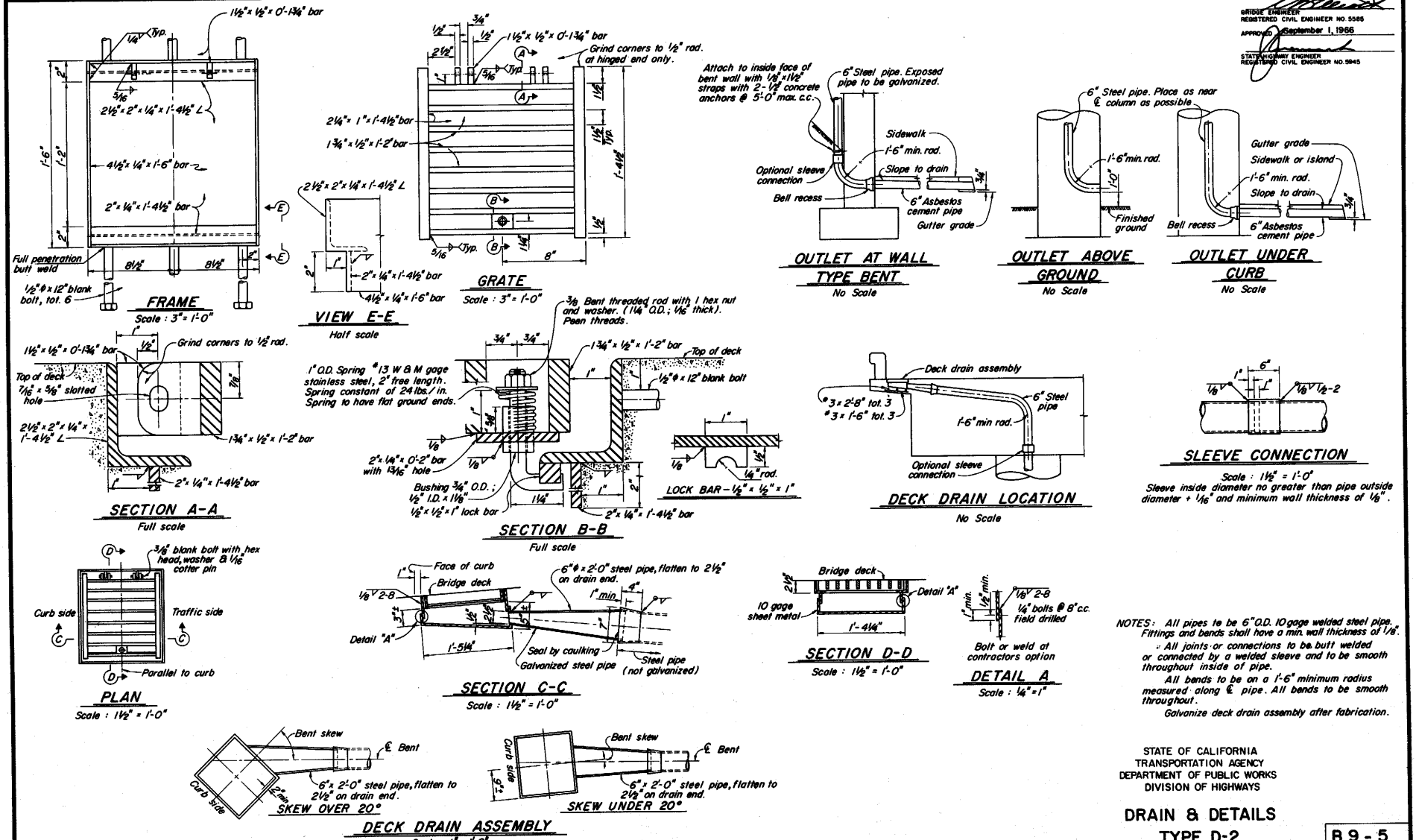
APPROVAL RECOMMENDED
BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO. 5586
APPROVED September 1, 1966
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5945



NOTES: All pipes to be 6" O.D. 10 gage welded steel pipe. Fittings and bends shall have a min. wall thickness of ⅛".

All joints or connections to be butt welded or connected by a welded sleeve and to be smooth throughout inside of pipe.

All bends to be on a 1'-6" minimum radius measured along ℄ pipe. All bends to be smooth throughout.

Galvanize deck drain assembly after fabrication.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

DRAIN & DETAILS TYPE D-2

B 9 - 5

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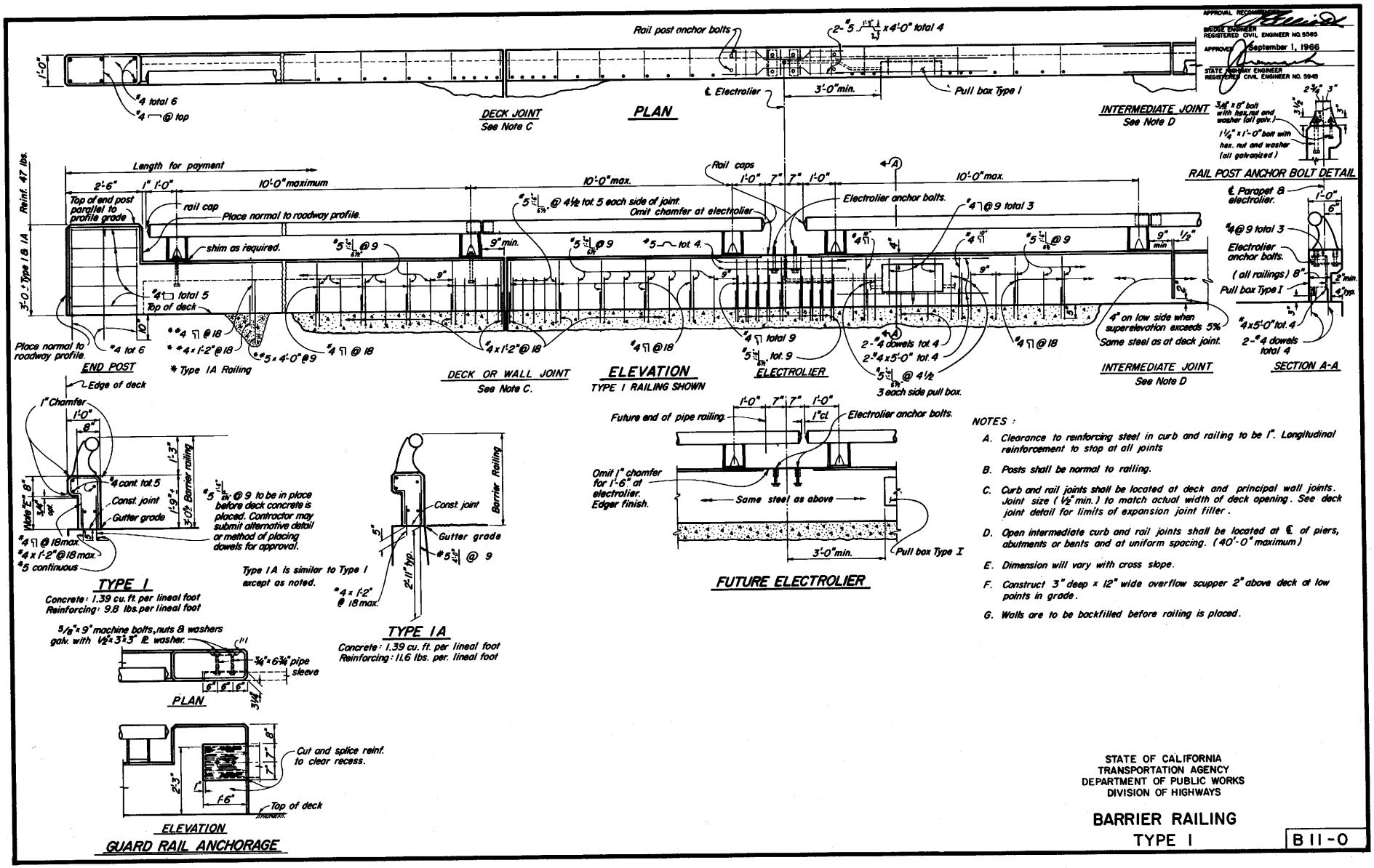

NOTES :

A. Clearance to reinforcing steel in curb and railing to be 1". Longitudinal reinforcement to stop at all joints

B. Posts shall be normal to railing.

C. Curb and rail joints shall be located at deck and principal wall joints. Joint size (½" min.) to match actual width of deck opening. See deck joint detail for limits of expansion joint filler.

D. Open intermediate curb and rail joints shall be located at ℄ of piers, abutments or bents and at uniform spacing. (40'-0" maximum)

E. Dimension will vary with cross slope.

F. Construct 3" deep x 12" wide overflow scupper 2" above deck at low points in grade.

G. Walls are to be backfilled before railing is placed.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

BARRIER RAILING
TYPE 1

B 11-0

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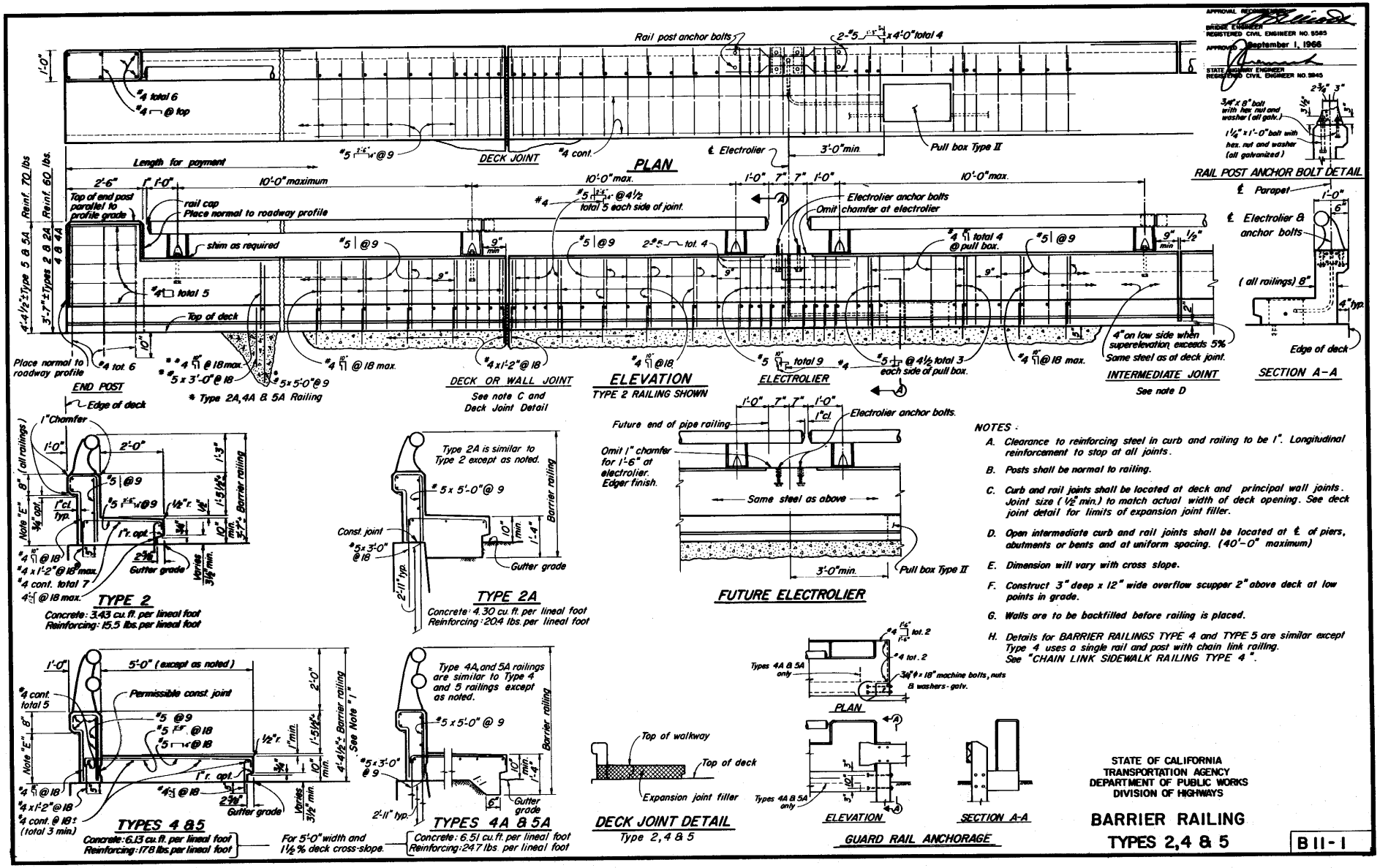

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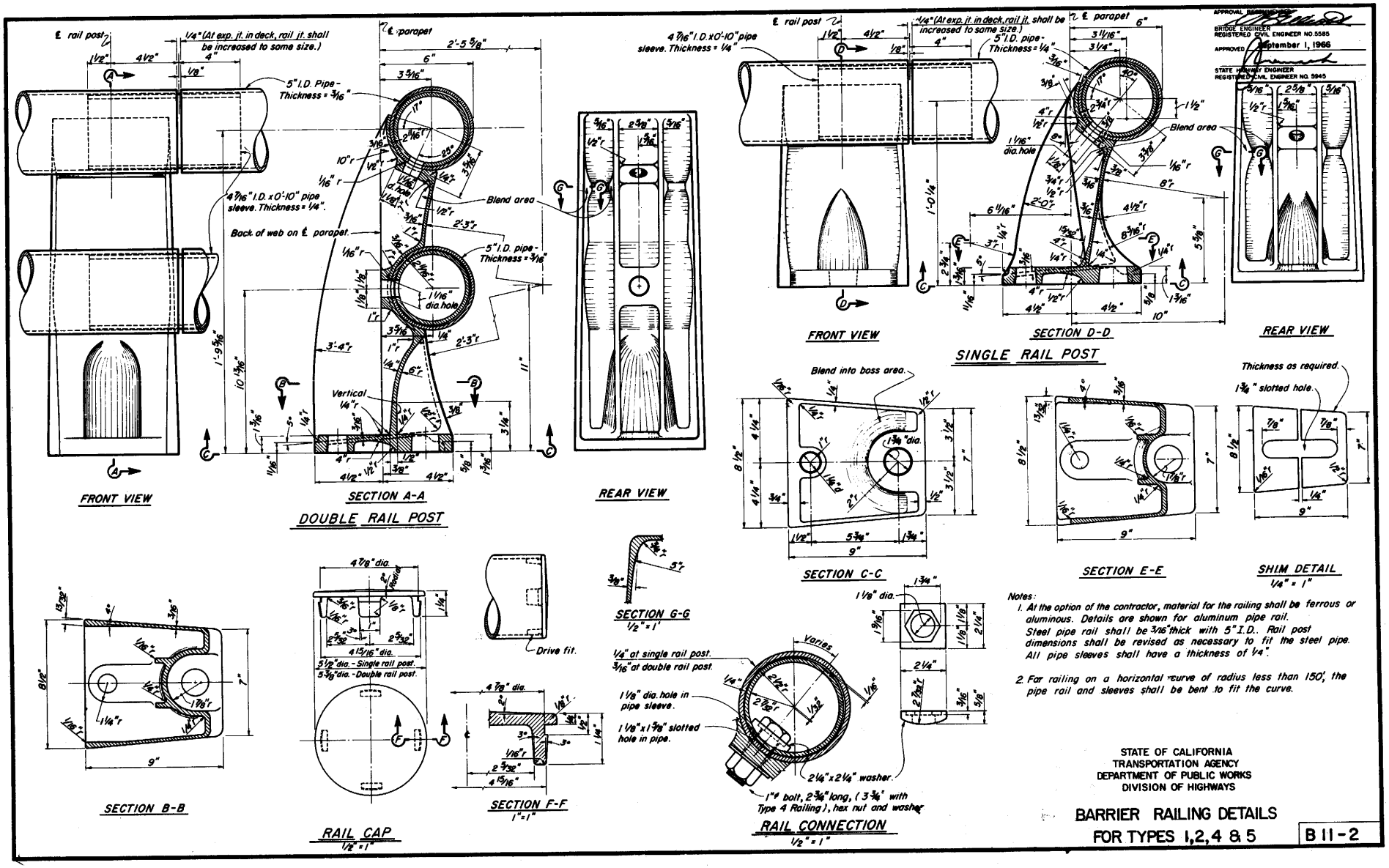

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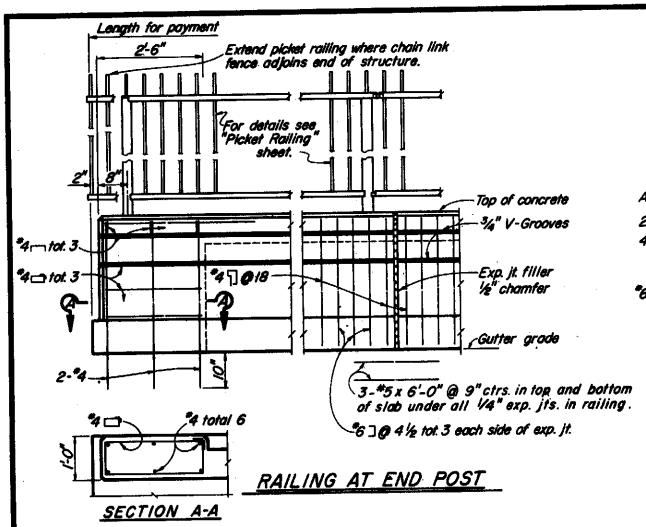
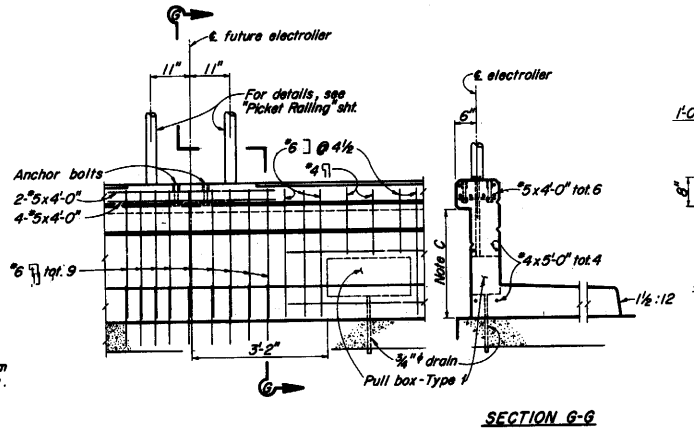
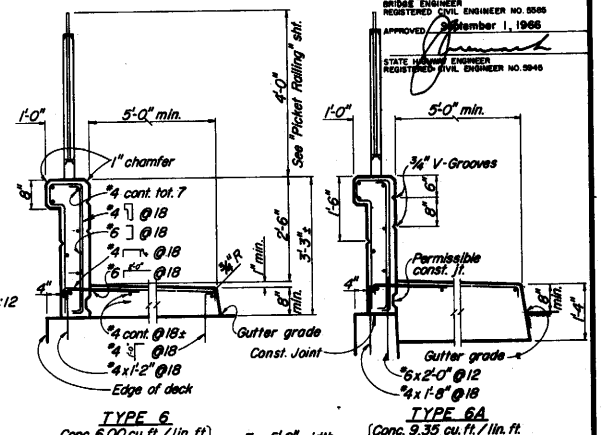






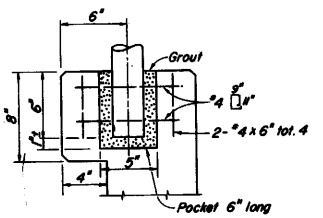
Notes: A. Railing shall conform to horizontal and vertical alignment.

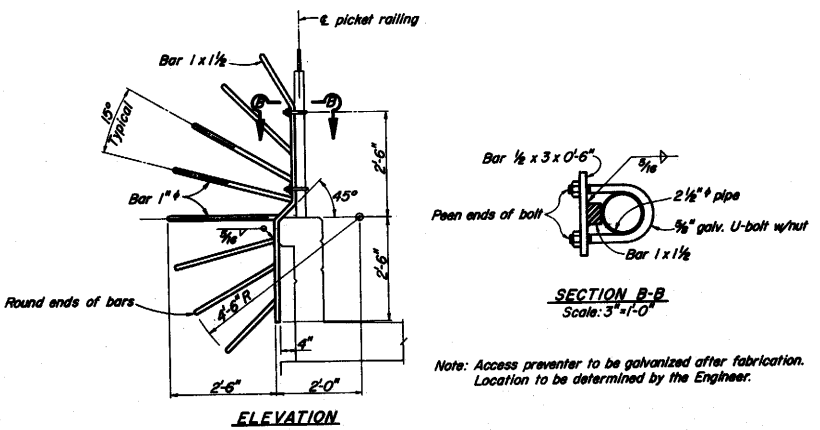
B. Construct 3" deep x 12" wide overflow scuppers 2" above deck at low points in grade.

C. Dimension will vary with cross-slope of deck.

D. Walls are to be backfilled before railing is placed.

E. Curb and wall exp. jts. to be located at all deck joints, at ℄ piers or bents and at uniform spacing (40' max.) between those specified. Joint size to be 1/4" min. and increased to match deck joints.





Note: Access preventer to be galvanized after fabrication. Location to be determined by the Engineer.

ACCESS PREVENTER DETAIL
Required

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

BARRIER RAILING
TYPE 6

B 11-3

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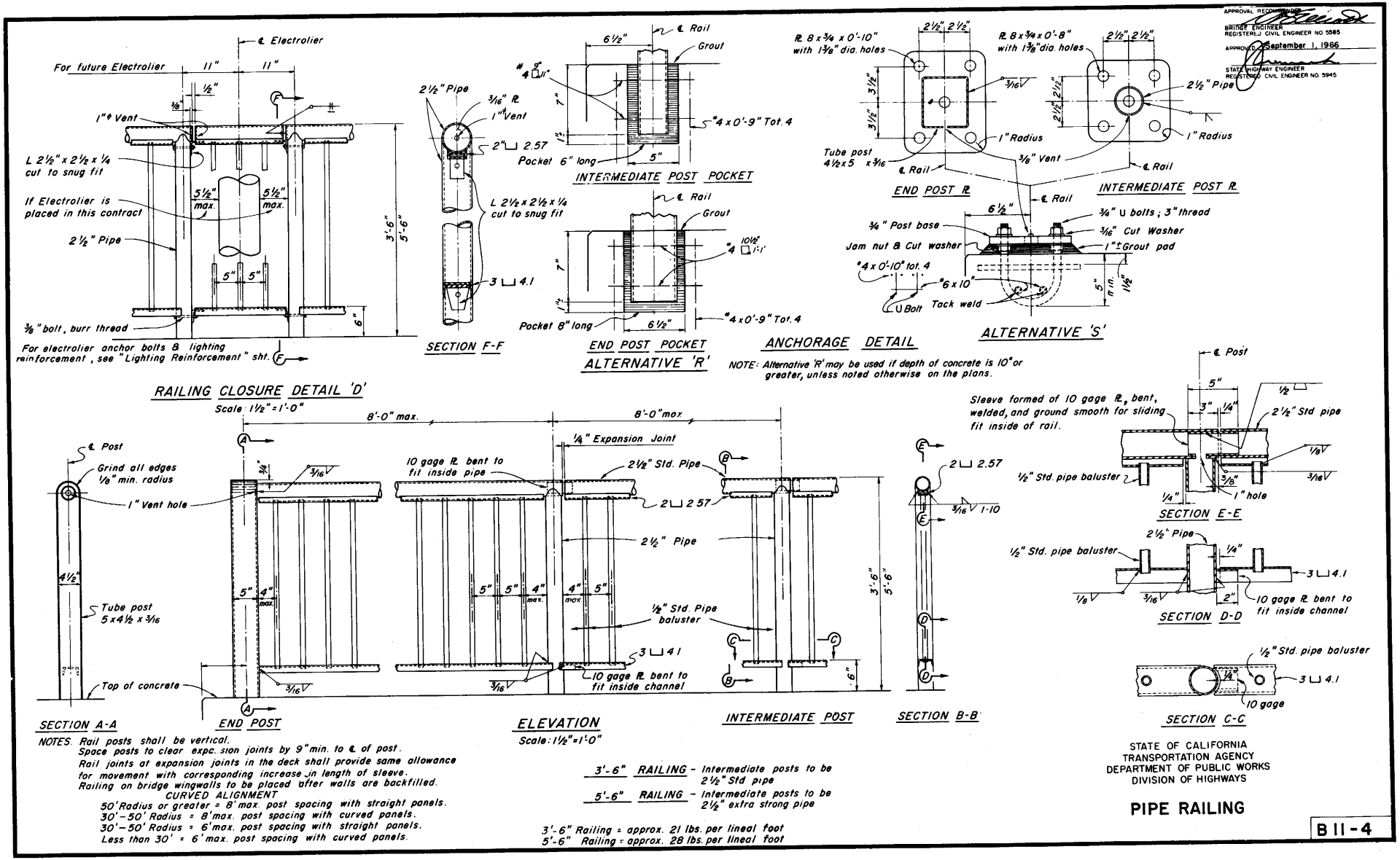

NOTES: Rail posts shall be vertical.
Space posts to clear expc. sion joints by 9" min. to ℄ of post.
Rail joints at expansion joints in the deck shall provide same allowance for movement with corresponding increase in length of sleeve.
Railing on bridge wingwalls to be placed after walls are backfilled.

CURVED ALIGNMENT
50' Radius or greater = 8' max. post spacing with straight panels.
30'-50' Radius = 8' max. post spacing with curved panels.
30'-50' Radius = 6' max. post spacing with straight panels.
Less than 30' = 6' max. post spacing with curved panels.

3'-6" RAILING - Intermediate posts to be 2 1/2" Std pipe
5'-6" RAILING - Intermediate posts to be 2 1/2" extra strong pipe

3'-6" Railing = approx. 21 lbs. per lineal foot
5'-6" Railing = approx. 28 lbs. per lineal foot

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

PIPE RAILING

B 11-4

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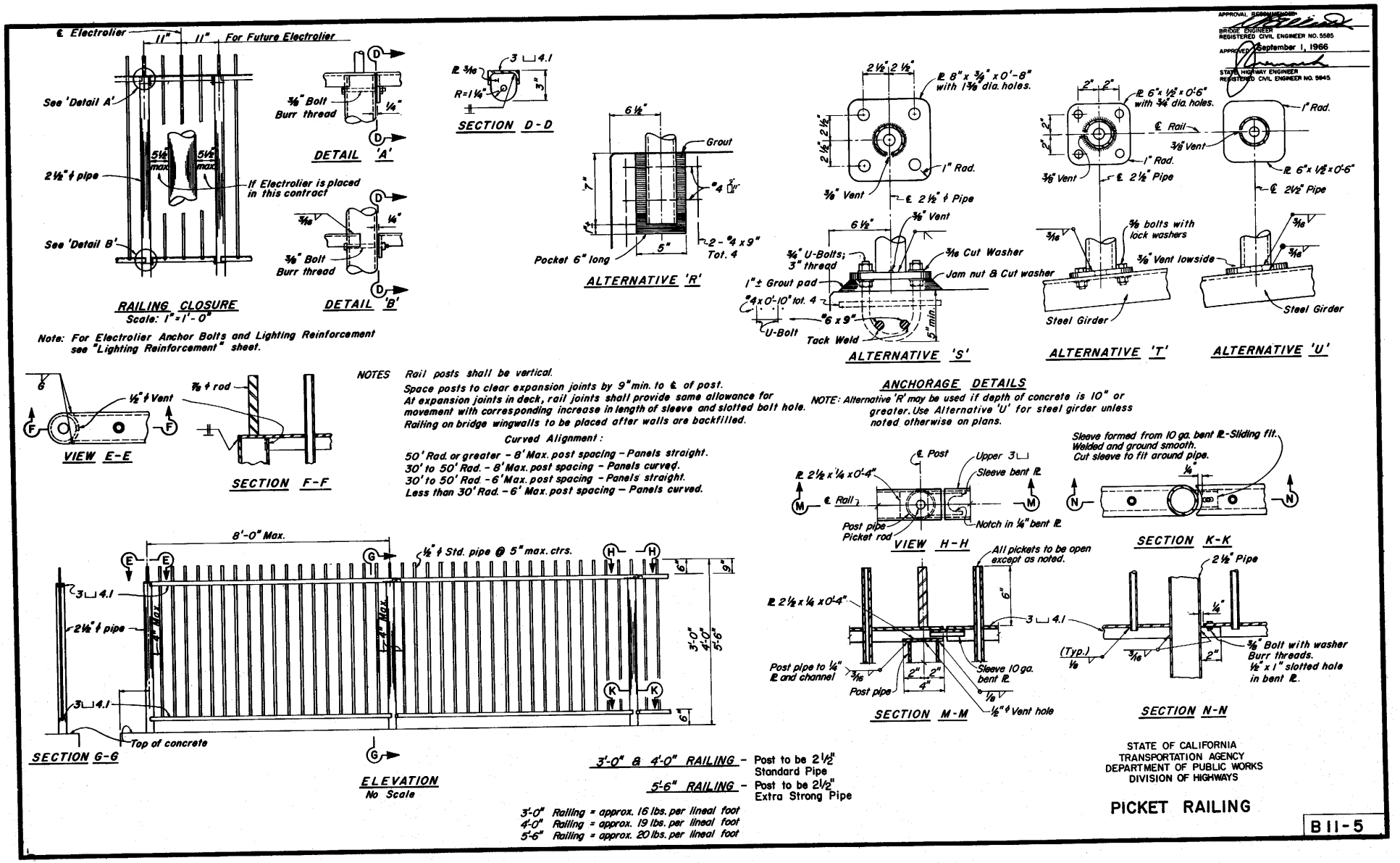

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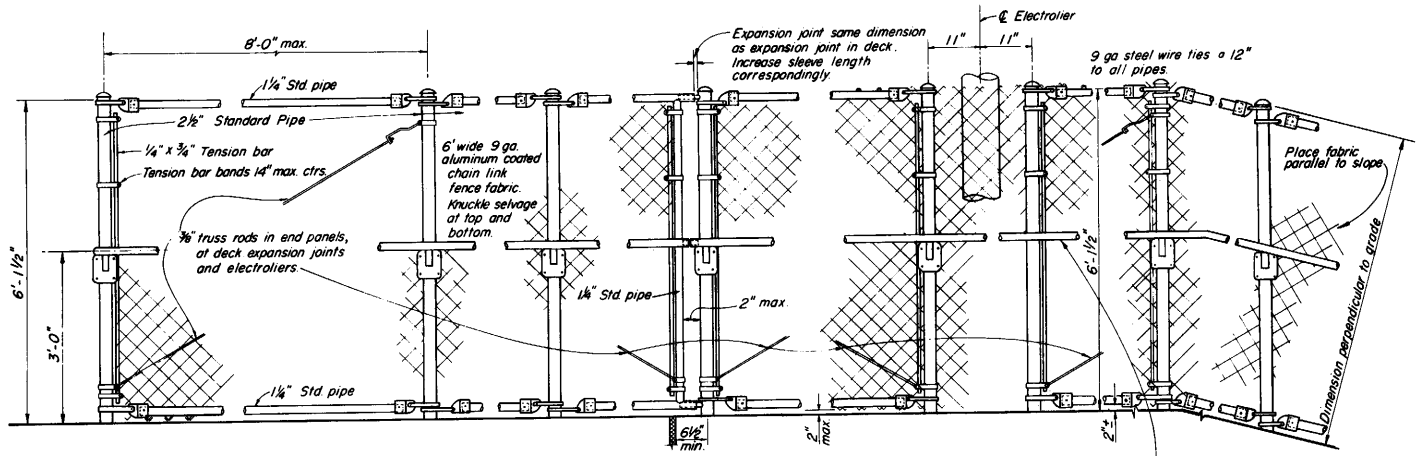
APPROVAL RECOMMENDED
BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO 5585
APPROVED September 1, 1966
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5945



END POST

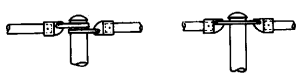
INTERMEDIATE POSTS

AT DECK EXPANSION JOINTS

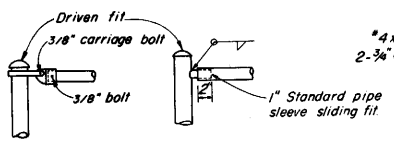
AT ELECTROLIER

ON SLOPES

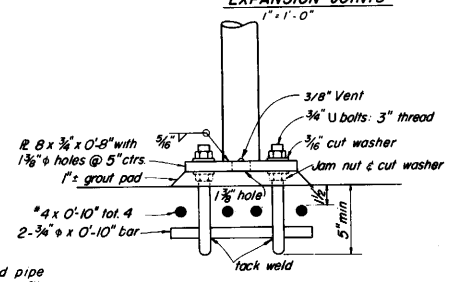
Handrail required only where slope is 8% or greater, or as indicated elsewhere in these plans.



ALTERNATIVE DETAILS

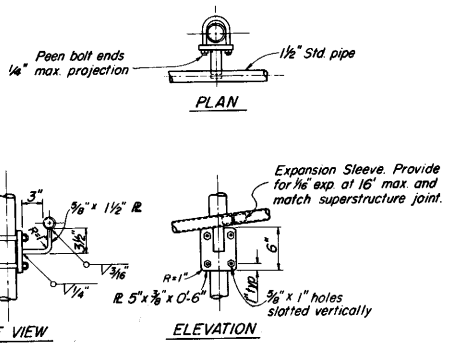


TYPICAL CONNECTION DETAILS

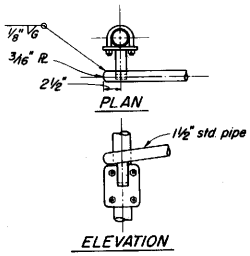


ANCHORAGE DETAIL

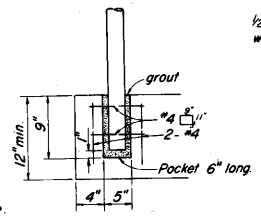
3" = 1'-0"



HAND RAIL BRACKET



HAND RAIL AT END



ALTERNATIVE ANCHORAGE DETAIL

May be used when thickness of concrete is 12" or more.

NOTES :

1. Railing assembly except chain link fabric to be galvanized after fabrication.
2. Peen all ⅜" bolts.
3. Railing shall conform to horizontal and vertical alignment. Posts shall be vertical. Top and bottom pipes shall be bent if radius is 150' or less -- may be on 8' chords if radius is over 150'.
4. When railing is on slope, 6' chain link fabric shall be placed parallel to slope.
5. All exposed corners to be smooth.
6. Alternative details may be submitted by Contractor for Engineer's approval.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

CHAIN LINK RAILING

B11-7

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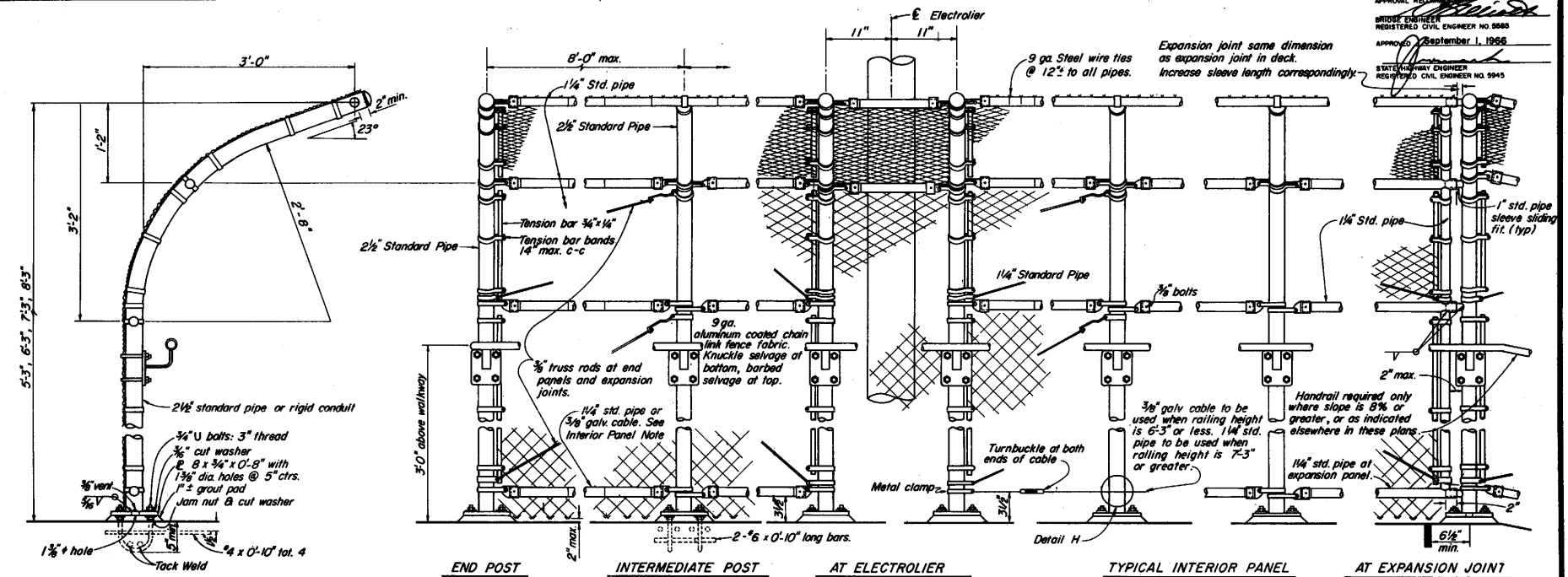
APPROVAL RECOMMENDED
BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO. 9685
APPROVED September 1, 1966
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5945



NOTES:

1. Railing assembly except chain link fabric to be galvanized after fabrication.
2. Railing shall conform to horizontal and vertical alignment. Posts shall be vertical. Horizontal pipes shall be bent if radius is 150' or less -- may be on 8' chords if radius is over 150'.
3. All exposed corners to be smooth.
4. Peen all 3/8" bolts.
5. When railing is on slope, fabric shall be placed parallel to slope.
6. Alternative details may be submitted by Contractor for Engineer's approval.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

CHAIN LINK SIDEWALK RAILING TYPE 3

B11-8

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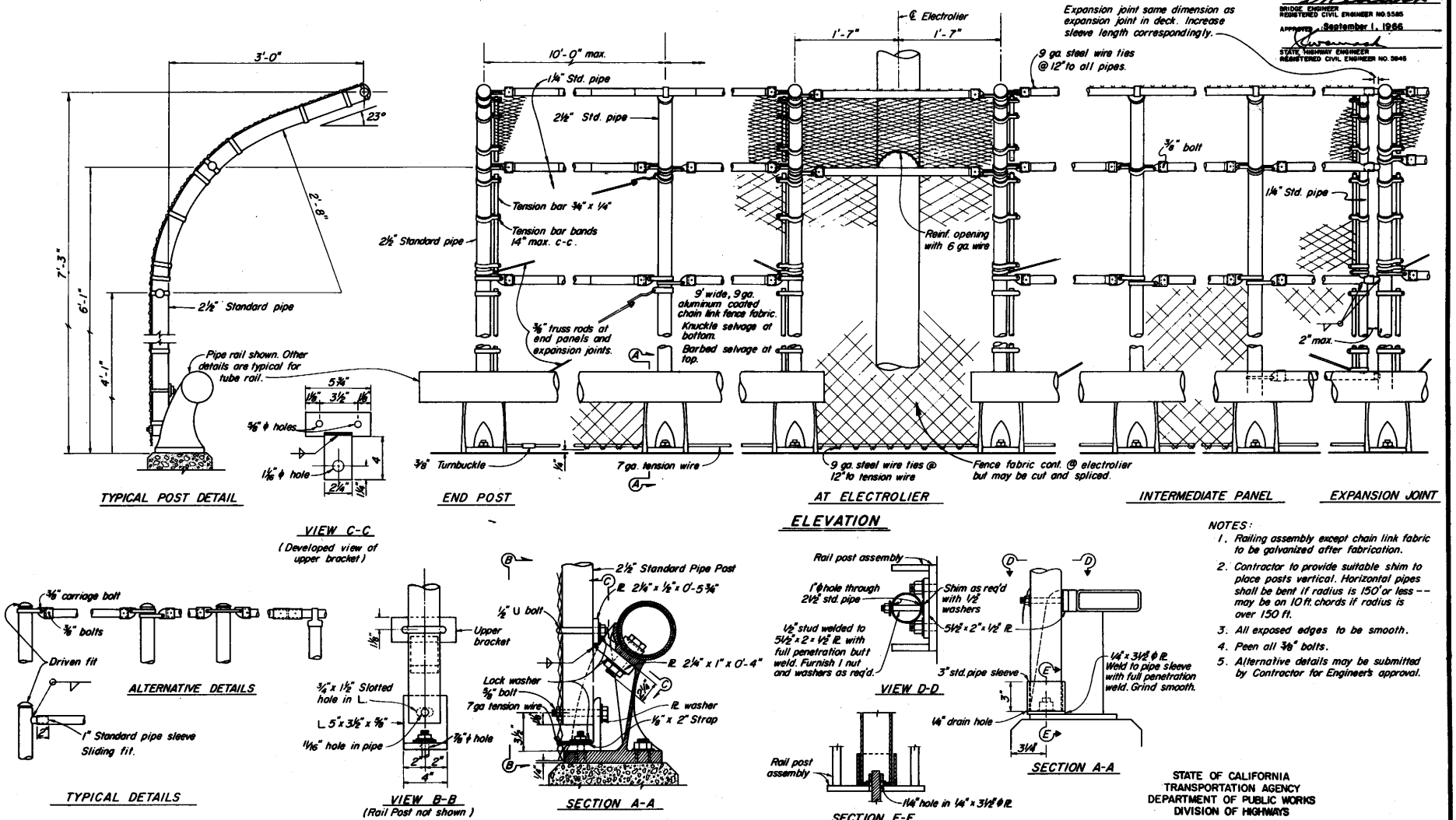
APPROVAL RECOMMENDED
BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO. 5585
APPROVED September 1, 1966
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 3845



NOTES:

1. Railing assembly except chain link fabric to be galvanized after fabrication.
2. Contractor to provide suitable shim to place posts vertical. Horizontal pipes shall be bent if radius is 150' or less -- may be on 10 ft. chords if radius is over 150 ft.
3. All exposed edges to be smooth.
4. Peen all ⅜" bolts.
5. Alternative details may be submitted by Contractor for Engineer's approval.

ATTACHMENT DETAILS (PIPE RAIL)
Scale: 3" = 1'-0"

ATTACHMENT DETAILS (TUBE RAIL)
Scale: 3" = 1'-0"

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

CHAIN LINK SIDEWALK RAILING
TYPE 4

B 11-9

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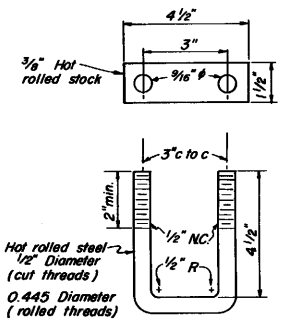
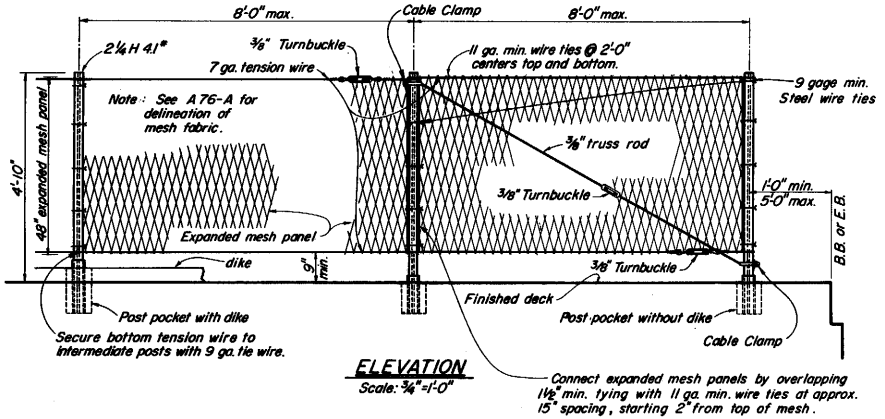
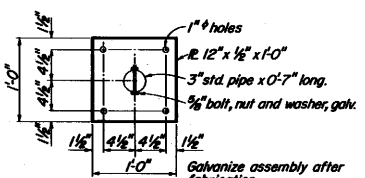
APPROVAL RECOMMENDED
BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO. 5585
APPROVED September 1, 1966
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5945



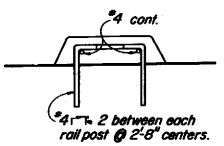
CABLE CLAMP DETAIL
SCALE: 1/2" = 1"



ELEVATION
Scale: 3/4" = 1'-0"

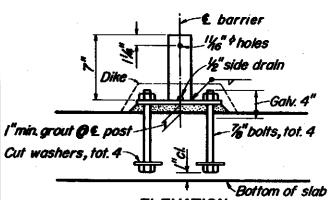


PLAN



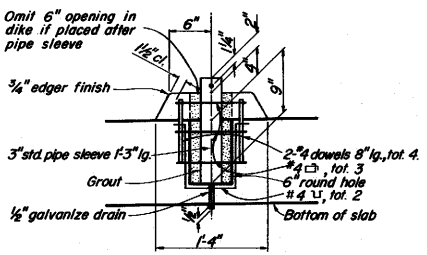
DIKE SECTION
Scale: 1 1/2" = 1'-0"

NOTE: All hardware except panels to be galvanized.

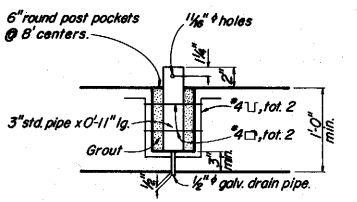


ELEVATION
BOLTED POST ANCHORAGE
Scale: 1 1/2" = 1'-0"

Use this detail when use of post pocket is precluded by type of structure or special details.



POST POCKET WITH DIKE
Scale: 1 1/2" = 1'-0"



POST POCKET WITHOUT DIKE
Scale: 1 1/2" = 1'-0"

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

MESH MEDIAN BARRIER

B 11-20

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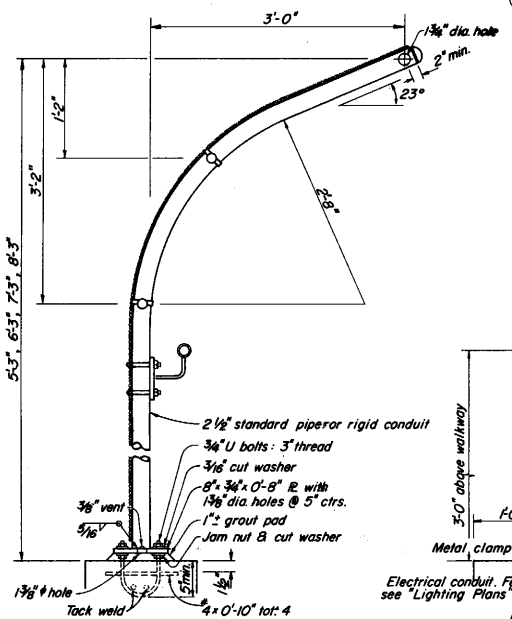
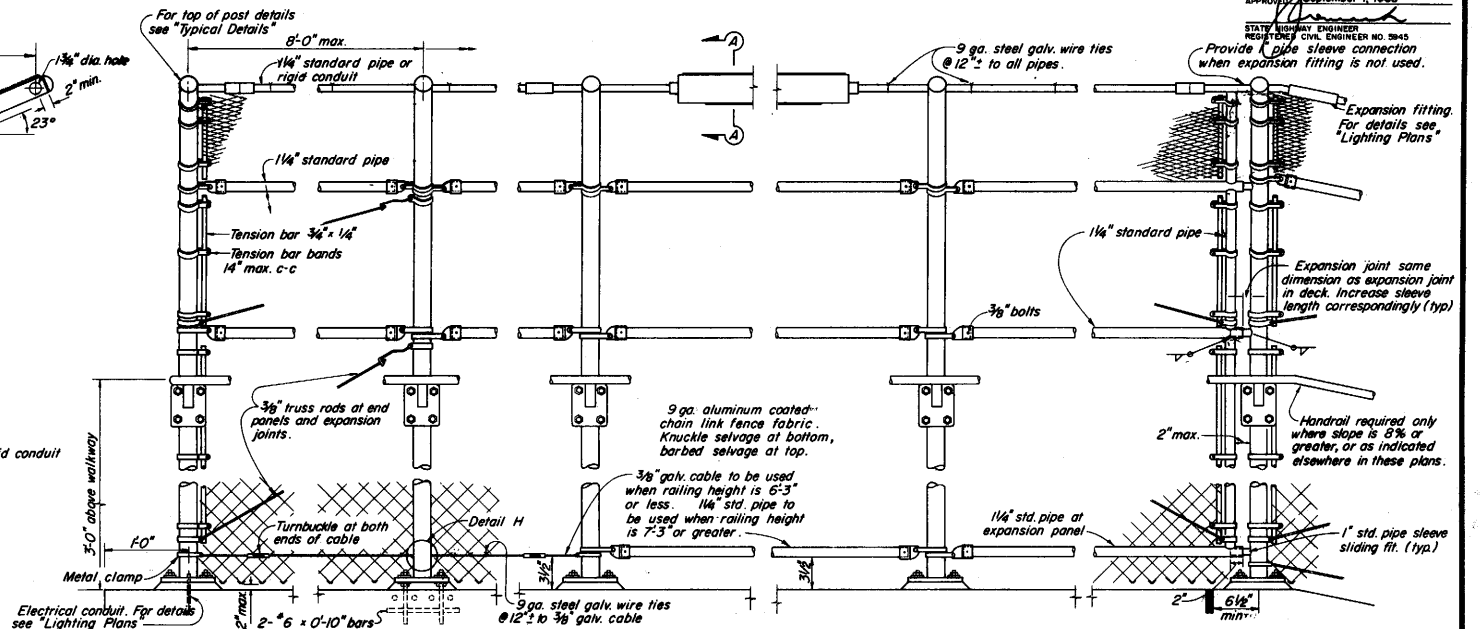
APPROVAL RECOMMENDED
BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO. 5585
APPROVED September 1, 1966
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5845



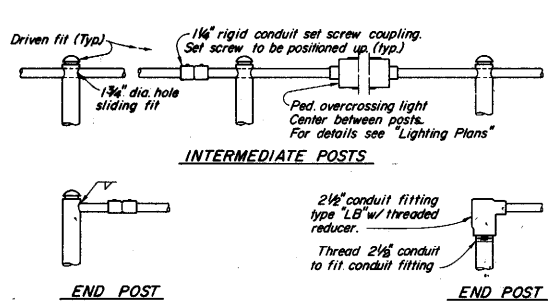
TYPICAL POST DETAIL



END POST — INTERMEDIATE POST — ELEVATION — EXPANSION JOINT

NOTES:

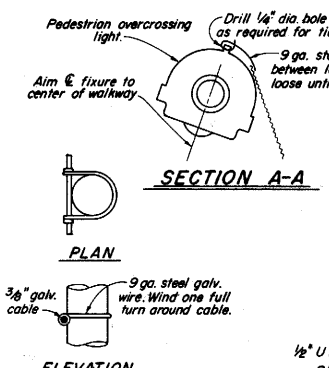
1. Railing assembly except chain link fabric to be galvanized after fabrication.
2. Railing shall conform to horizontal and vertical alignment. Posts shall be vertical. Horizontal pipes shall be bent if radius is 150' or less — may be on 8' chords if radius is over 150'.
3. All exposed corners to be smooth.
4. Peen all 3/8" bolts.
5. When railing is on slope, fabric shall be placed parallel to slope.
6. Alternative details may be submitted by contractor for Engineer's approval.
7. All pipe carrying electrical conductors shall be rigid conduit.
8. Details for Railing Type 3 & 3L are similar except Type 3 does not have light fixtures.



INTERMEDIATE POSTS

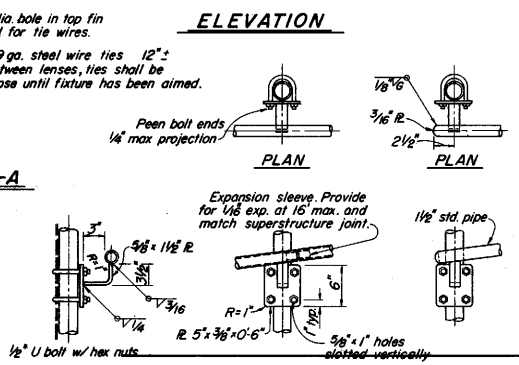
END POST (Without electrical conductors) — END POST (With electrical conductors)

TYPICAL DETAILS



SECTION A-A

DETAIL "H"



HAND RAIL BRACKET — HAND RAIL AT END

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

CHAIN LINK SIDEWALK RAILING
TYPE 3L

B11-28

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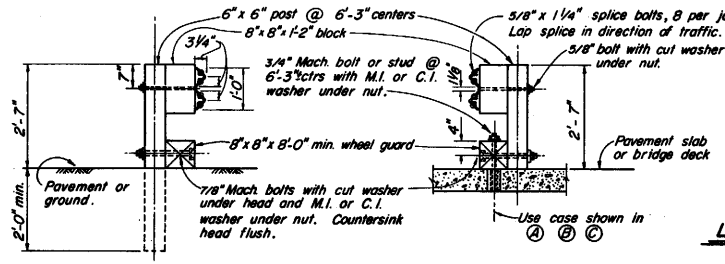
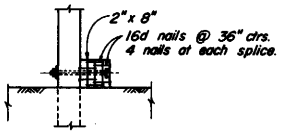
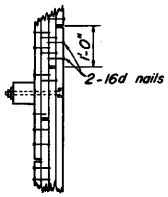
APPROVAL RECOMMENDED
BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO. 5585
APPROVED September 1, 1966
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5845



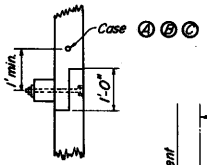
USE ON APPROACHES



LAMINATED WHEEL GUARD
(OPTIONAL)

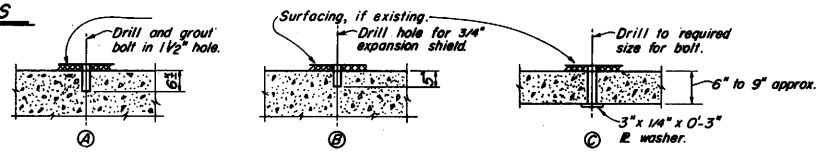


FOR LAMINATED WHEEL GUARD



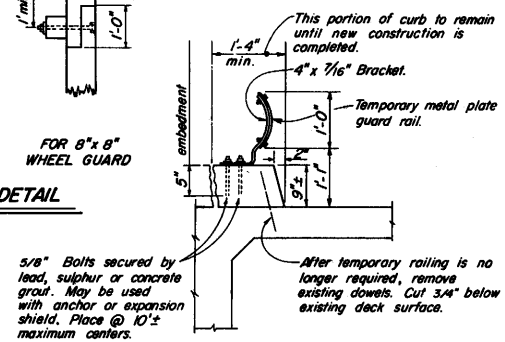
FOR 8"x 8" WHEEL GUARD

SPLICE DETAIL



ALTERNATIVE ANCHORS

TEMPORARY RAILING (METAL BEAM)



FOR USE ON EXISTING CURB

TEMPORARY RAILING (METAL PLATE)

1" = 1'-0"

NOTE:

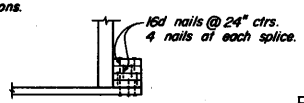
All bolts to have cut washers unless otherwise noted.

Paint entire unit white. See Special Provisions.

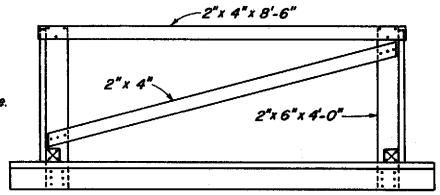
All timber to be S4S.

Remove bolts and fill holes with grout when railing is no longer needed.

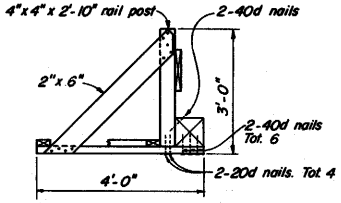
For Rail Element see Special Provisions.



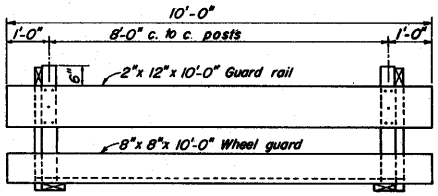
LAMINATED WHEEL GUARD
(OPTIONAL)



PLAN



END VIEW



ELEVATION

TEMPORARY TIMBER RAILING (PORTABLE)

NOTE:

All nails are 16d except as noted.

Paint entire unit white. See Special Provisions.

All timber to be S4S.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

TEMPORARY RAILINGS

B 11-30

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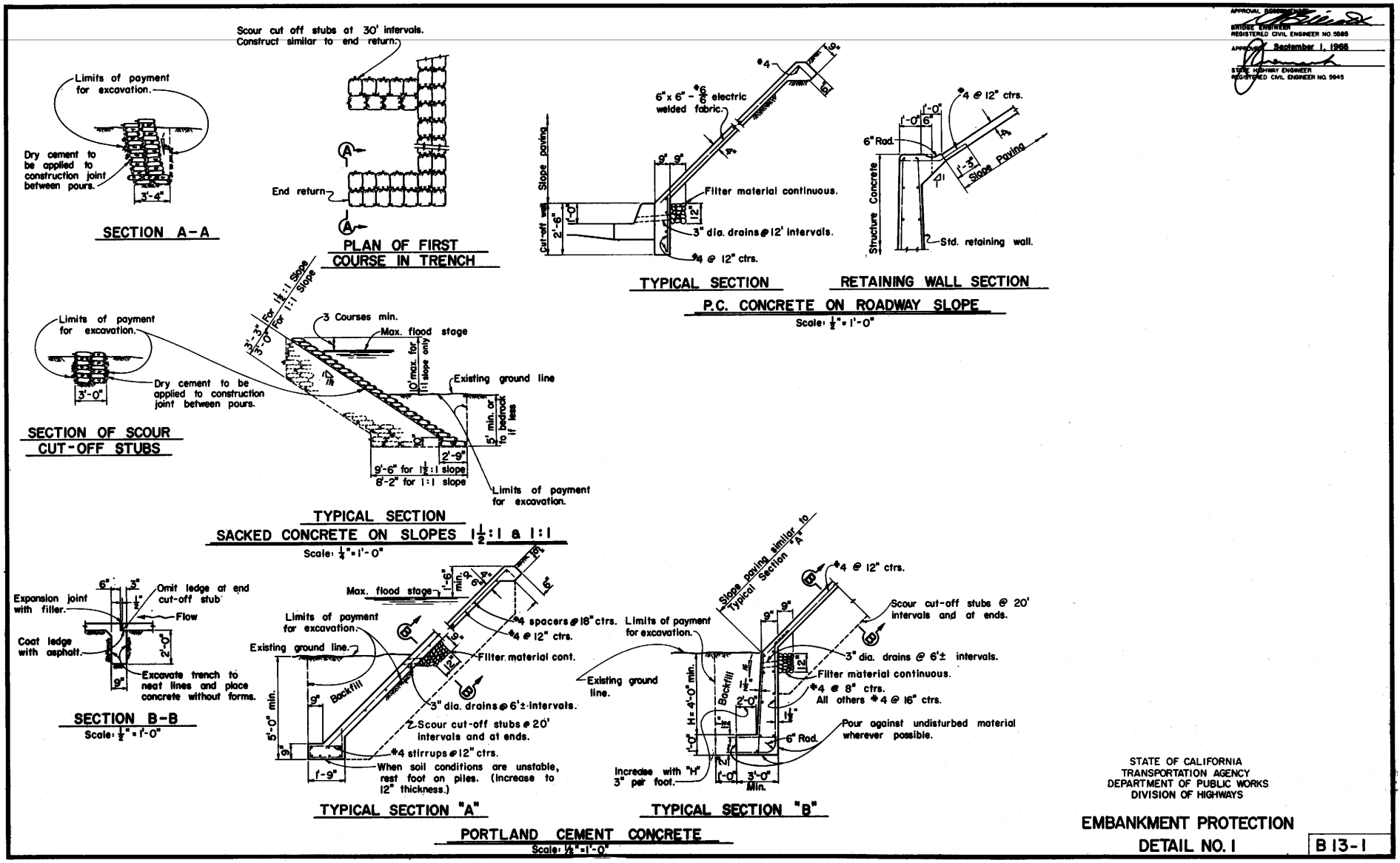
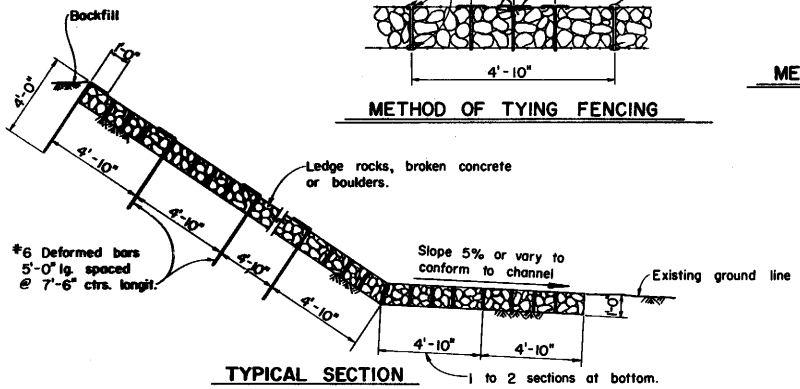
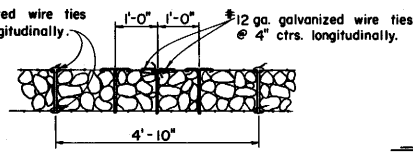


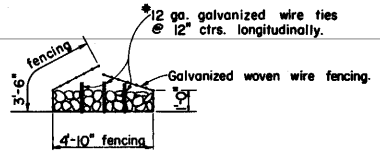
Return to Table of Contents



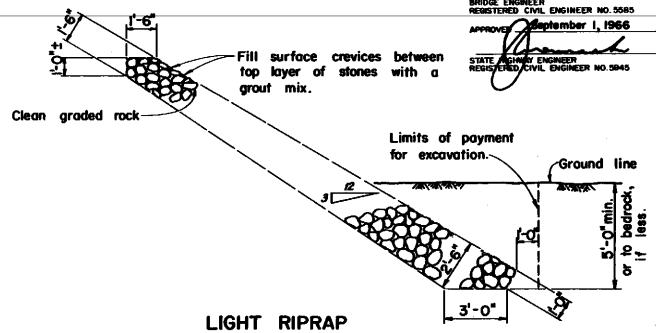
TYPICAL SECTION
WIRE AND ROCK MATTRESS



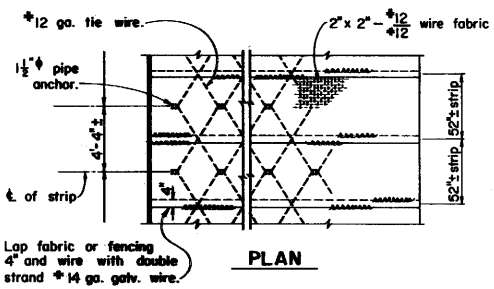
METHOD OF TYING FENCING



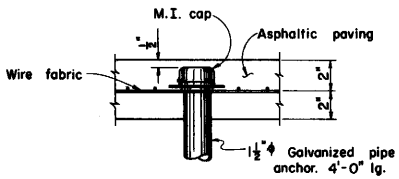
METHOD OF FORMING BASKETS



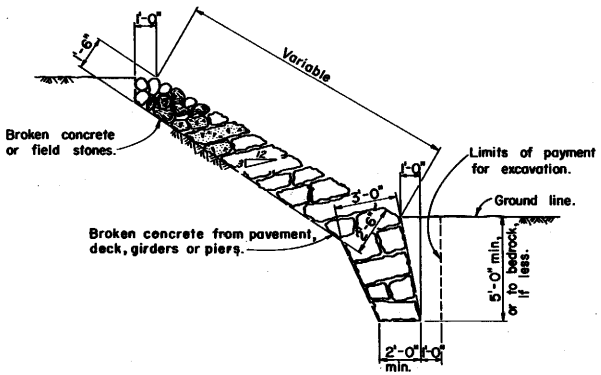
LIGHT RIPRAP



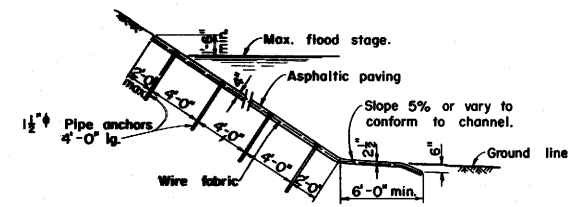
PLAN



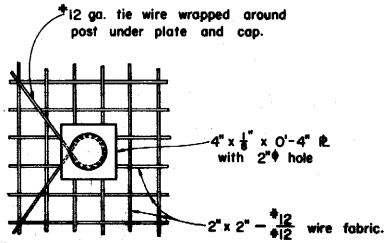
SECTIONAL ELEVATION



BROKEN CONCRETE RIPRAP SECTION



TYPICAL SECTION



PLAN OF PIPE ANCHOR

ASPHALTIC MIXTURE SLOPE PAVING

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

EMBANKMENT PROTECTION
DETAIL No. 2

B 13-2

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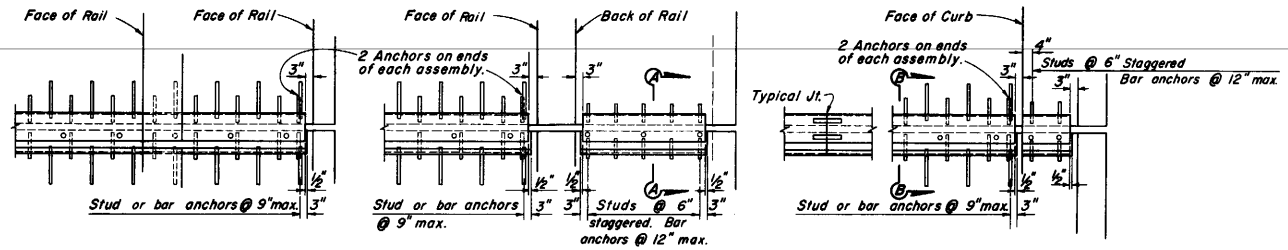
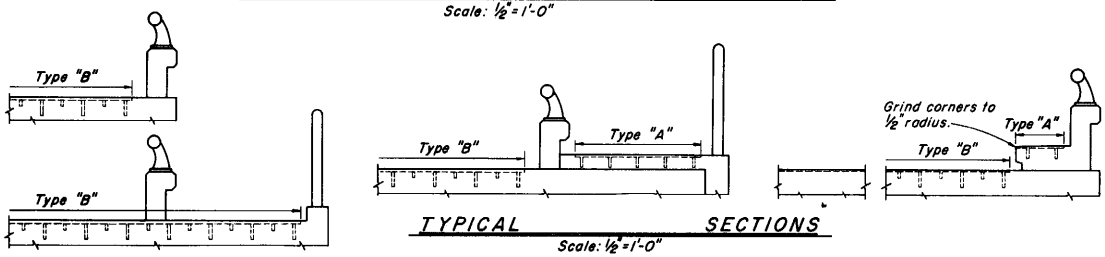
APPROVAL RECOMMENDED
BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO. 5595

APPROVED September 1, 1966
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5945



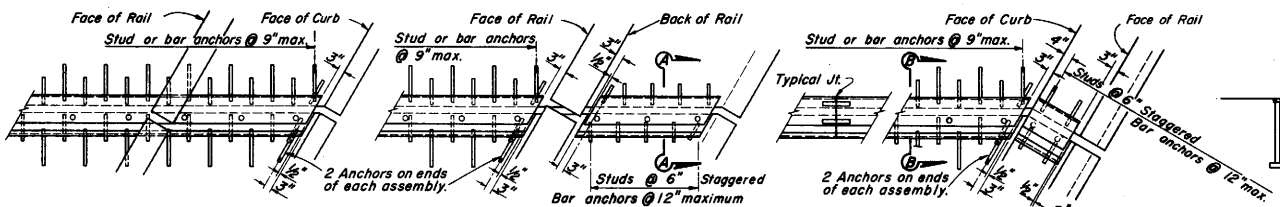
PART PLAN EXPANSION ARMOR NORMAL TO GIRDER

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



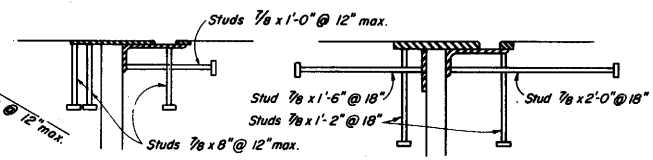
TYPICAL SECTIONS

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



PART PLAN EXPANSION ARMOR SKEWED TO GIRDER

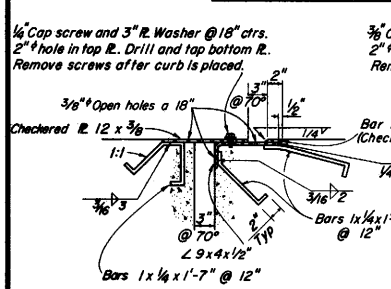
Scale: 1/2" = 1'-0"



TYPE A TYPE B

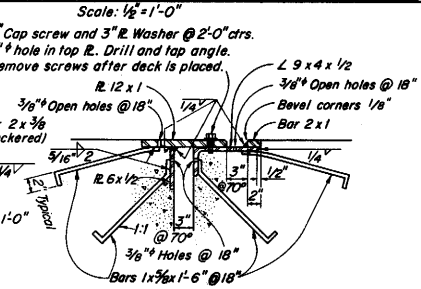
DETAIL OF STUD ANCHORS

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



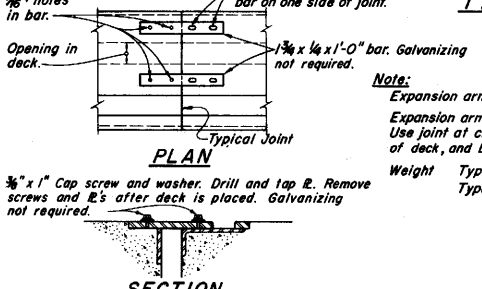
SECTION A-A

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



SECTION B-B

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



PLAN

SECTION

TYPICAL JOINT DETAILS

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

Note:

Expansion armor assembly to be galvanized after fabrication except as noted.

Expansion armor assembly to be fabricated in 12' max. lengths. Use joint at crown of roadway at any change in transverse slope of deck, and between 12' lengths.

Weight Type A 32 #/Lin. Ft.
Type B 88 #/Lin. Ft.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

EXPANSION JOINT ARMOR DETAIL

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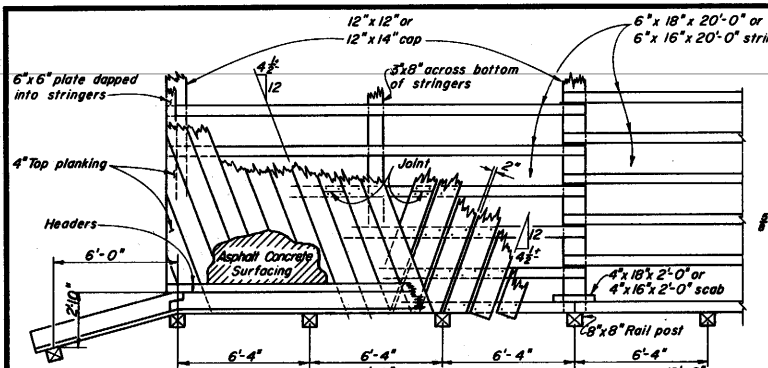
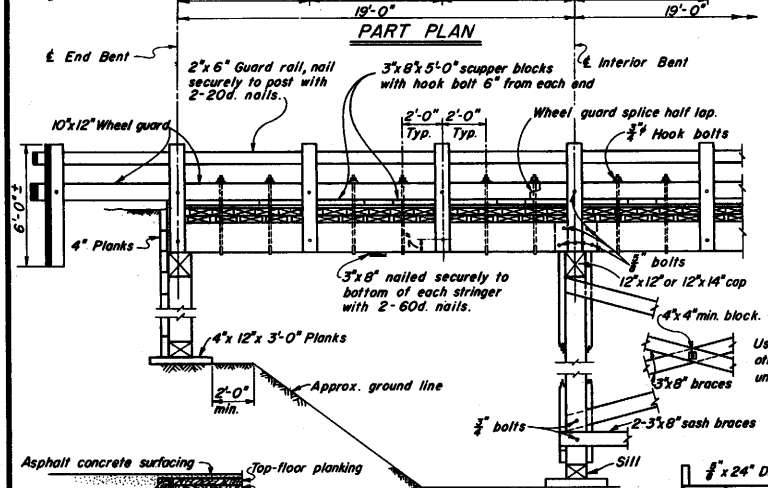
APPROVAL RECOMMENDED: BRIDGE ENGINEER REGISTERED CIVIL ENGINEER NO. 5565

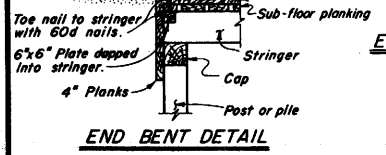
APPROVED: September 1, 1966 STATE HIGHWAY ENGINEER REGISTERED CIVIL ENGINEER NO. 5945



PART PLAN



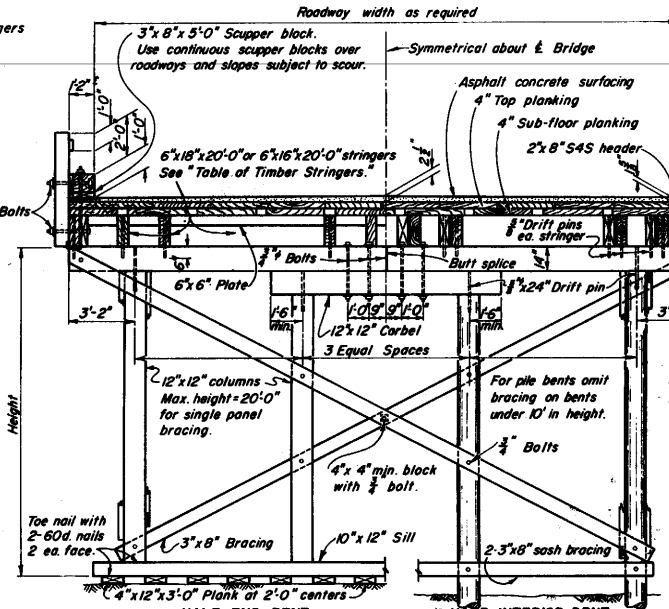
ELEVATION



END BENT DETAIL

TABLE OF TIMBER STRINGERS FOR 19'-0" SPANS					
ROADWAY WIDTH	28'-0"	26'-0"	24'-0"	22'-0"	20'-0"
NO. OF LINES 6"x18" STRINGERS	15	14	13	12	11
NO. OF LINES 6"x16" STRINGERS	19	18	17	16	15

NOTE: STRINGERS EQUALLY SPACED.

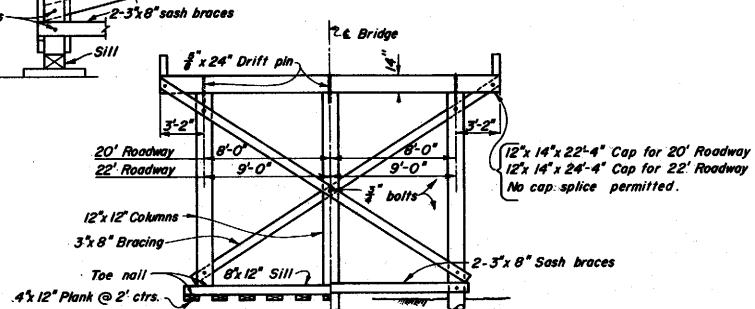


HALF END BENT SHOWING FRAME BENT

HALF INTERIOR BENT SHOWING PILE BENT

Use framed or pile bents as directed by the Engineer.

TYPICAL SECTION



HALF END BENT SHOWING FRAME BENT

HALF INTERIOR BENT SHOWING PILE BENT

OPTIONAL SECTION – 20' & 22' ROADWAY WIDTH

FLOORING NOTES

Top planks to be 4" thick, random widths 8" to 12". Fasten each plank to each stringer with 2-7" double grip spikes and 2-6"x6" end plates with 3-7" spikes. Use 4-7" spikes at joint, see plan.

Sub-floor planks to be 4" thick, random widths 8" to 12". Fasten each plank to each stringer with 2-7" round wire spikes. Use 4-7" spikes at joint see plan.

Prebore flooring for spikes if less than 12" from end of plank. Use 3/16" diameter bit.

Top and sub-floor planks may be random lengths with a maximum of 2 joints per run. Minimum length of plank to be 6'. Planks may be S4S or rough, or mixed S4S and rough. Except that sub-floor planks shall be of one thickness, S4S or rough.

Joint to be spaced so that there are at least 2 planks between joints on same stringer, and at least one stringer between joints on adjacent planks. Joints in top planks to be placed so that they do not occur directly over joint in sub-floor planks. Joint to occur at ℄ of stringer and to be parallel with stringer. See Plan.

GENERAL NOTES

Specifications:

Design: A.A.S.H.O. Dated 1961 with subsequent revisions.

Construction: Standard Specifications, Division of Highways, dated July 1964 and the special provisions.

Live Loading: H-15-44

Unit Stresses:

Lumber and Timber: Douglas fir or equal, graded according to use and conforming to applicable paragraphs in Standard Grading and Dressing Rules, current edition of The West Coast Lumber Inspection Bureau.

Railing & Stringers: Construction-Par. 124-b.

Wheel Guards, Caps and Posts: Construction Par.-125-b.

Flooring, Sills & Bracing: And any other pieces not listed above. Standard-Par. 123-c. Wheel guards, railing and railing post to be dressed (S4S). All other lumber and timber may be dressed (S4S) or rough, except as noted.

Hardware: All bolts fitted with suitable washers.

Pile Load: 20 Tons Type: Timber

Soil Pressure: 1,200 lbs. per sq. ft.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

TIMBER DETOUR BRIDGE

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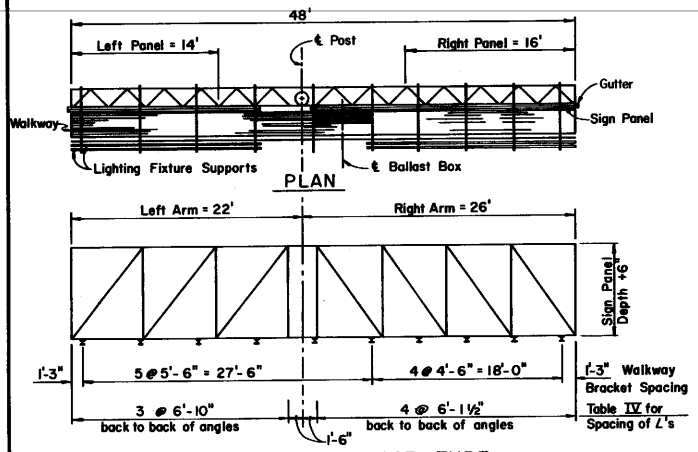
SIGNS SIGNALS AND LIGHTING



UNBALANCED SINGLE POST TYPE

EXAMPLE NO. 1

INSTRUCTIONS TO FABRICATOR

FORMAT SHEET SHOWS:

1. Sign structure location.
2. Length of structure frame.
3. Panel size and locations on structure.
4. Post type and height to bottom of frame.
5. Base plate elevation.
6. Footing elevation or location of alternate pile foundation.
7. Photo electric cell location if required, and number of ballast boxes.

REFER TO THE FOLLOWING SHEETS FOR DETAILS NOT SHOWN ON FORMAT SHEET:

S1. Instructions and examples.
S2. Post type II thru VIII.
S3. Post type I-s thru VIII-s.
S4. Structural frame members (single post type).
S5. Structural frame members (two post type).
S6. Structural frame details.
S7. Frame juncture details.
S8. Removable sign panel frames.
S9 & S10. Walkway details no. 1 & no. 2.
S11. Walkway safety railing details.
S12. Walkway mounted ballast box.
S13. Alternate pile foundations.

WALKWAY BRACKETS: The walkway bracket spacing where ballast boxes are located shall be 5'-6". Space all others to suit, maintaining uniform spacing where possible. Maximum spacing shall not exceed 5'-6".

BALLAST BOXES: Locate ballast boxes near the center of the area being served.

LIGHTING FIXTURE SUPPORTS: Where distance from walkway bracket to end of sign panel exceeds 1'-4", extend lighting fixture supports to next walkway bracket. See example 2.

WALKWAY AND SAFETY RAILING: Walkway to be continuous for entire length of frame for single post signs and for 2 post signs from the nearest post continuous across all the sign panels. Safety railing to protect entire walkway, but continuous for no more than 11' in one unit.

NOTE: Signs are shown and dimensioned looking in the direction of traffic. Double faced signs are shown and dimensioned looking ahead along stationing.

APPROVAL RECOMMENDED

BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO.5585

APPROVED September 1, 1966

STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO.5945

GENERAL NOTES

SPECIFICATIONS:

DESIGN: A.A.S.H.O. Specifications for the design and construction of structural supports for highway signs, dated November 1960.

CONSTRUCTION: Standard Specifications, Division of Highways, dated July 1964 and the special provisions.

LOADING:

WIND LOADING: Normal to face of sign: 30 P.S.F. Transverse to face of sign: 0.2 of normal force.

WALKWAY LOADING: Dead load + 500 lbs. concentrated live load.

UNIT STRESSES:

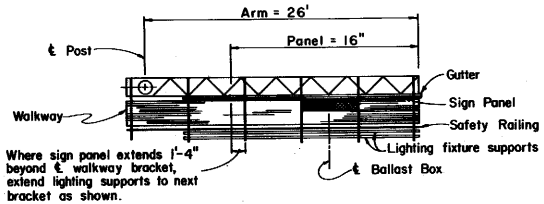
STRUCTURAL STEEL:	Fs = 20,000 P.S.I.
REINFORCED CONCRETE:	Fs = 20,000 P.S.I.; Fc = 1,200 P.S.I.
FOOTING SOIL PRESSURE:	1¼ tons/sq. ft.

Allowable unit stresses due to wind load, or wind load in combination with other forces, are increased 45%.

MINIMUM CLEARANCE: Vertical roadway clearance 18'-0".

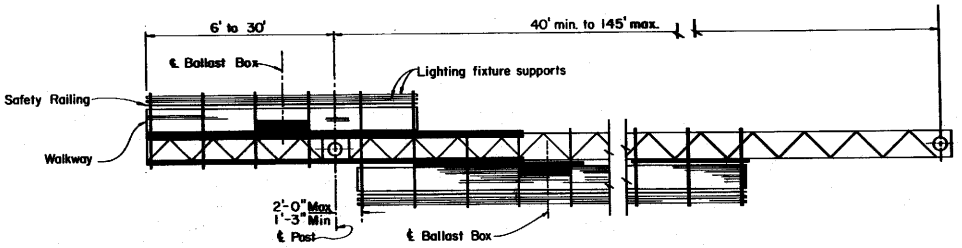
WELDING: All welding continuous unless otherwise noted on the plans. All welding to be done in accordance with the A.W.S. Specifications for Welded Highway and Railway Bridges, dated 1963.

FINISH: All steel parts to be hot-dipped galvanized after fabrication except as shown on plans or as called for in special provisions.



PLAN
CANTILEVER SINGLE POST TYPE

EXAMPLE NO. 2



PLAN
TWO POST TYPE WITH CANTILEVER
(PART DOUBLE-FACED)

EXAMPLE NO. 3

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

OVERHEAD SIGNS
INSTRUCTION AND EXAMPLES

SI-7

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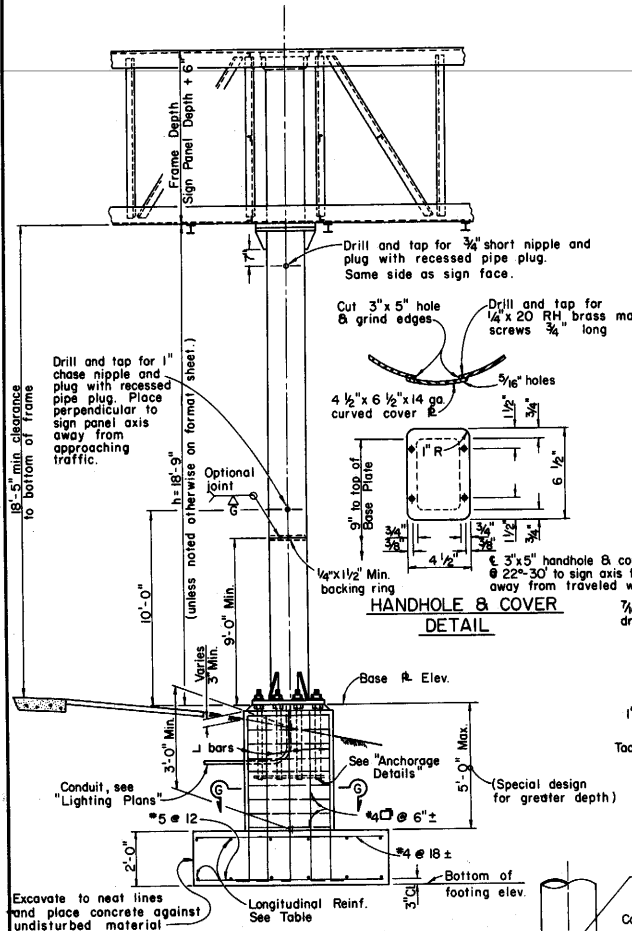
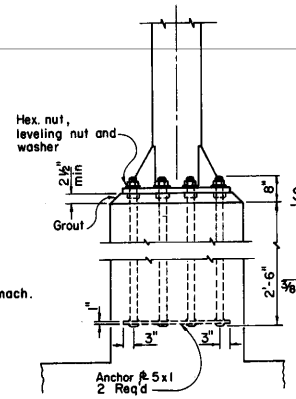
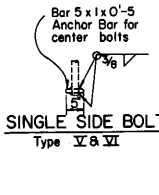
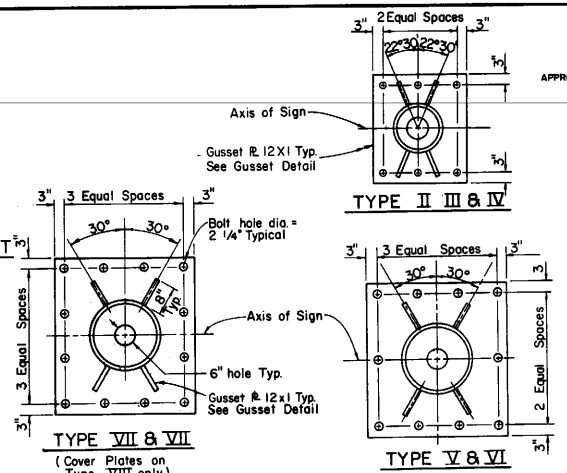




ANCHORAGE DETAILS





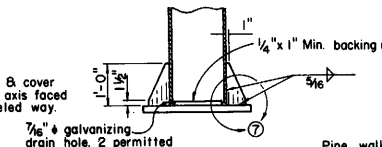
TYPICAL BASE PLATES

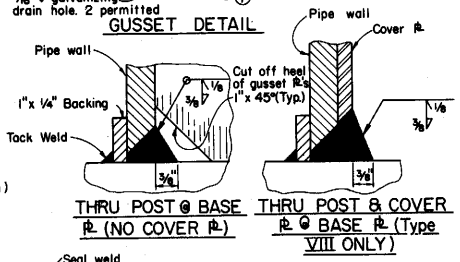
APPROVAL RECOMMENDED

BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO.5585

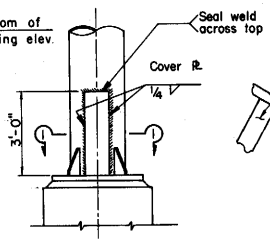
APPROVED September 1, 1966

STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO.5945

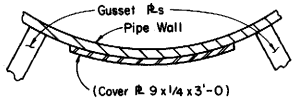




DETAIL 7



PARTIAL ELEVATION TYPE VIII POST
(Anchor bolts not shown)



SECTION 1-1

Post Type	Pipe Size	Cap Plate Size	Base Plate Size (Note #2)	2" ϕ Anchor Bolts	Pedestal Size (Note #2)	Footing Size (Note #2)	Longitudinal Footing Reinforcement Top	Longitudinal Footing Reinforcement Bottom	⌋ Bars
II	12" Std. @ 49.56	1'-7"x 1'-7"x 7/8"	2'-4"x 2'-1"x 2"	6	2'-11"x 2'-8"	7'-0"x 10'-0"	6-#4	9-#5 bars	#5
III	14" O.D. @ 72.09	1'-8"x 1'-8"x 7/8"	2'-7"x 2'-3"x 2"	6	3'-2"x 2'-10"	8'-0"x 12'-0"	6-#5 bars	8-#7 bars	#6
IV	16" O.D. @ 82.77	1'-10"x 1'-10"x 7/8"	3'-1"x 2'-9"x 2"	6	3'-8"x 3'-4"	8'-0"x 14'-0"	6-#5 bars	9-#8 bars	#6
V	18" O.D. @ 93.45	2'-0"x 2'-0"x 7/8"	3'-3"x 3'-0"x 2"	10	3'-10"x 3'-7"	9'-0"x 15'-0"	6-#5 bars	9-#9 bars	#7
VI	20" O.D. @ 104.13	2'-2"x 2'-2"x 1"	3'-3"x 3'-0"x 2"	10	3'-10"x 3'-7"	9'-0"x 16'-0"	6-#6 bars	8-#10 bars	#8
VII	24" O.D. @ 125.49	2'-6"x 2'-6"x 1"	3'-7"x 3'-3"x 2"	12	4'-3"x 3'-11"	10'-0"x 17'-0"	7-#6 bars	10-#10 bars	#10
VIII	24" O.D. @ 125.49 with cover ℞	2'-6"x 2'-6"x 1"	3'-9"x 3'-3"x 2"	12	4'-5"x 3'-11"	10'-0"x 18'-0"	10-#6 bars	11-#10 bars	#10

NOTES:
1. For "General Notes" see "Instructions and Examples" sheet.
2. Base Plates, Pedestals, & Footings; longer sides shall be normal to axis of sign.
3. Backfill shall be in place prior to erection of post.
4. Thread upper 8" of anchor bolts and galvanize upper 1'-0".
5. Spread footing shown, use Alternate Pile Foundation when shown on the Format sheet.
6. For reinforcement, embedment is clear to outside of bar and is 2" to main reinforcement, except as noted.
7. Anchor ℞s may be retained with hex. nut or formed head.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

OVERHEAD SIGNS SINGLE POST TYPE POST TYPES II THRU VIII

S2-6

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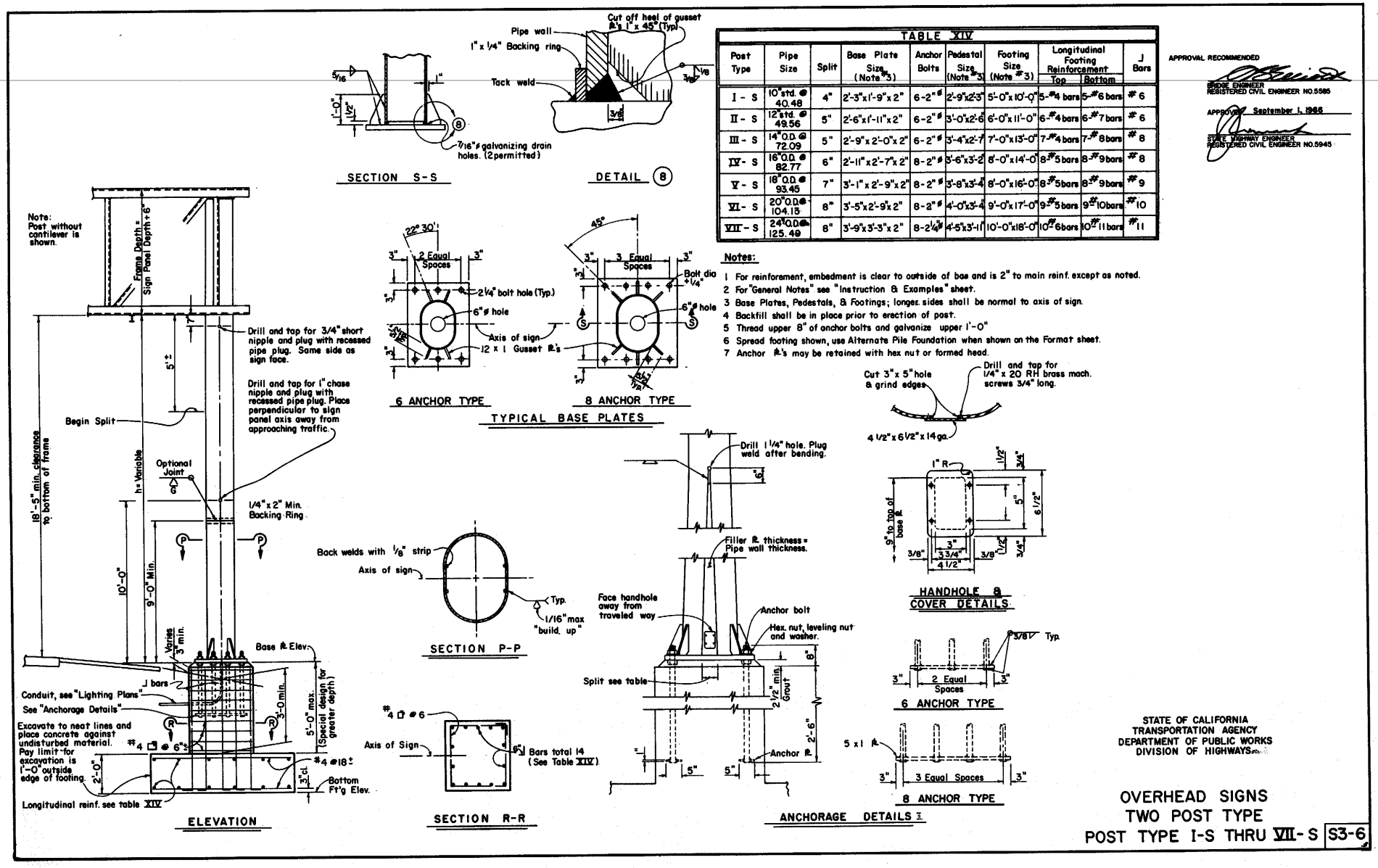

TABLE XIV									
Post Type	Pipe Size	Split	Base Plate Size (Note #3)	Anchor Bolts	Pedestal Size (Note #3)	Footing Size (Note #3)	Longitudinal Footing Reinforcement Top	Longitudinal Footing Reinforcement Bottom	J Bars
I - S	10" std. @ 40.48	4"	2'-3" x 1'-9" x 2"	6-2" ø	2'-9" x 2'-3"	5'-0" x 10'-0"	5-#4 bars	5-#6 bars	#6
II - S	12" std. @ 49.56	5"	2'-6" x 1'-11" x 2"	6-2" ø	3'-0" x 2'-6"	6'-0" x 11'-0"	6-#4 bars	6-#7 bars	#6
III - S	14" O.D. @ 72.09	5"	2'-9" x 2'-0" x 2"	6-2" ø	3'-4" x 2'-7"	7'-0" x 13'-0"	7-#4 bars	7-#8 bars	#8
IV - S	16" O.D. @ 82.77	6"	2'-11" x 2'-7" x 2"	8-2" ø	3'-6" x 3'-2"	8'-0" x 14'-0"	8-#5 bars	8-#9 bars	#8
V - S	18" O.D. @ 93.45	7"	3'-1" x 2'-9" x 2"	8-2" ø	3'-8" x 3'-4"	8'-0" x 16'-0"	8-#5 bars	8-#9 bars	#9
VI - S	20" O.D. @ 104.13	8"	3'-5" x 2'-9" x 2"	8-2" ø	4'-0" x 3'-4"	9'-0" x 17'-0"	9-#5 bars	9-#10 bars	#10
VII - S	24" O.D. @ 125.49	8"	3'-9" x 3'-3" x 2"	8-2 1/4" ø	4'-5" x 3'-11"	10'-0" x 18'-0"	10-#6 bars	10-#11 bars	#11

Notes:

1. For reinforcement, embedment is clear to outside of base and is 2" to main reinf. except as noted.
2. For "General Notes" see "Instruction & Examples" sheet.
3. Base Plates, Pedestals, & Footings; longer sides shall be normal to axis of sign.
4. Backfill shall be in place prior to erection of post.
5. Thread upper 8" of anchor bolts and galvanize upper 1'-0"
6. Spread footing shown, use Alternate Pile Foundation when shown on the Format sheet.
7. Anchor ℞'s may be retained with hex nut or formed head.

APPROVAL RECOMMENDED

BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO.5585

APPROVED September 1, 1966

STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO.5945

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

OVERHEAD SIGNS
TWO POST TYPE
POST TYPE I-S THRU VII-S

S3-6

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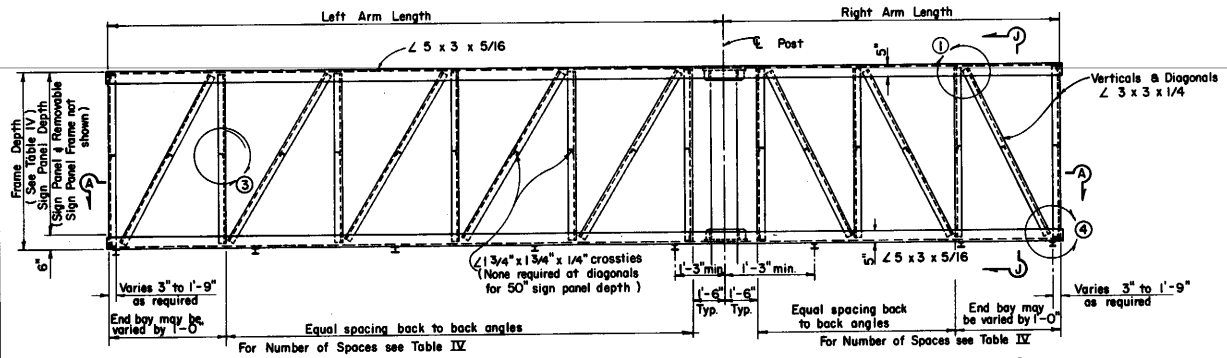
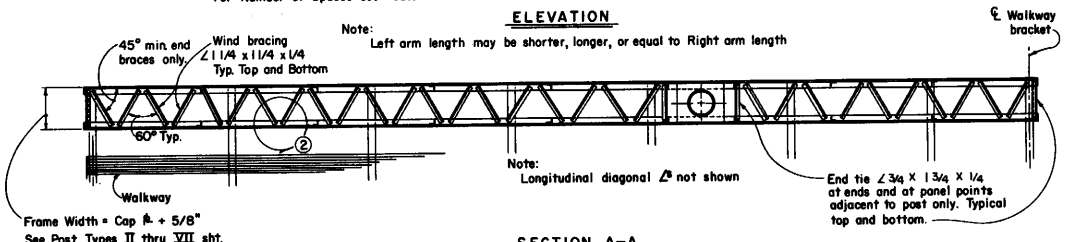


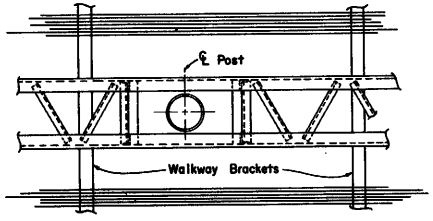
ELEVATION

Note:
Left arm length may be shorter, longer, or equal to Right arm length

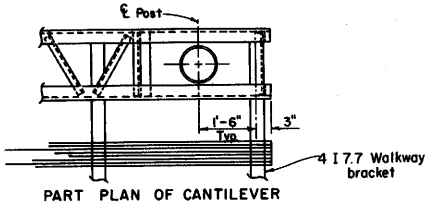


Note:
Longitudinal diagonal ⅊ not shown

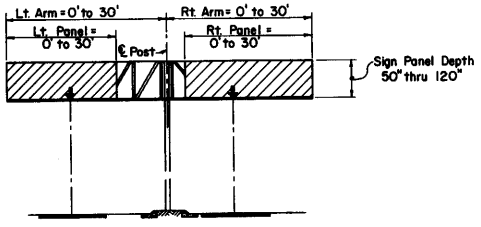
SECTION A-A



PART PLAN OF DOUBLE FACED TYPE AT POST



PART PLAN OF CANTILEVER TYPE AT POST



LIMITING DIMENSIONS OF FRAME & SIGN PANEL

APPROVAL RECOMMENDED

BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO.5585

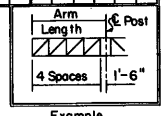
APPROVED September 1, 1966

STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO.5945

Sign Panel Depth	Frame Depth	Arm Length Left or Right (Feet) 2-4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
50"	4'-8"																										7 Spaces	
60"	5'-6"																								6 Spaces			
70"	6'-4"																			5 Spaces								
80"	7'-2"																											
90"	8'-0"	1 Space					2 Spaces						3 Spaces								4 Spaces							
100"	8'-10"																											
110"	9'-8"																											
120"	10'-6"																											

No. Diagonals

TABLE IV - NUMBER OF BRACING SPACES



Example

NOTES:

1. For Details ① thru ④ see "Structural Frame Details" sheet.
2. For sign panel frames see "Removable Sign Panel Frames" sheet.
3. For connection of frame to post see Frame Juncture Details sheet.
4. For walkway see "Standard Walkway Details #1 and #2" sheets.
5. For location of ballast, boxes, typical walkway arrangement, special instructions and examples, see "Instructions and Examples" sheet.
6. Minimum length of frame = 12'-0".
7. On single post sign structures the post shall be raked out of plumb, with the use of the leveling nuts to make the bottom of the sign frame level.
8. At final position of post all top and bottom nuts shall be tightened against base plate.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

OVERHEAD SIGNS
SINGLE POST TYPE
STRUCTURAL FRAME MEMBERS

S4-3

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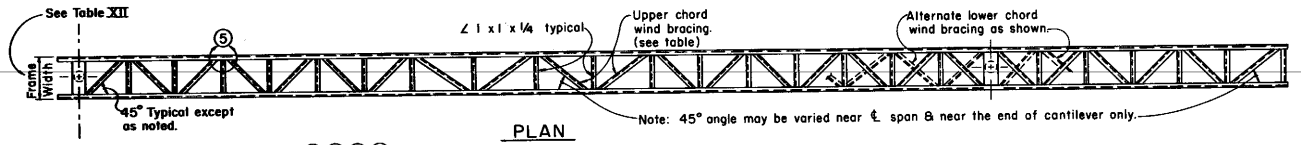
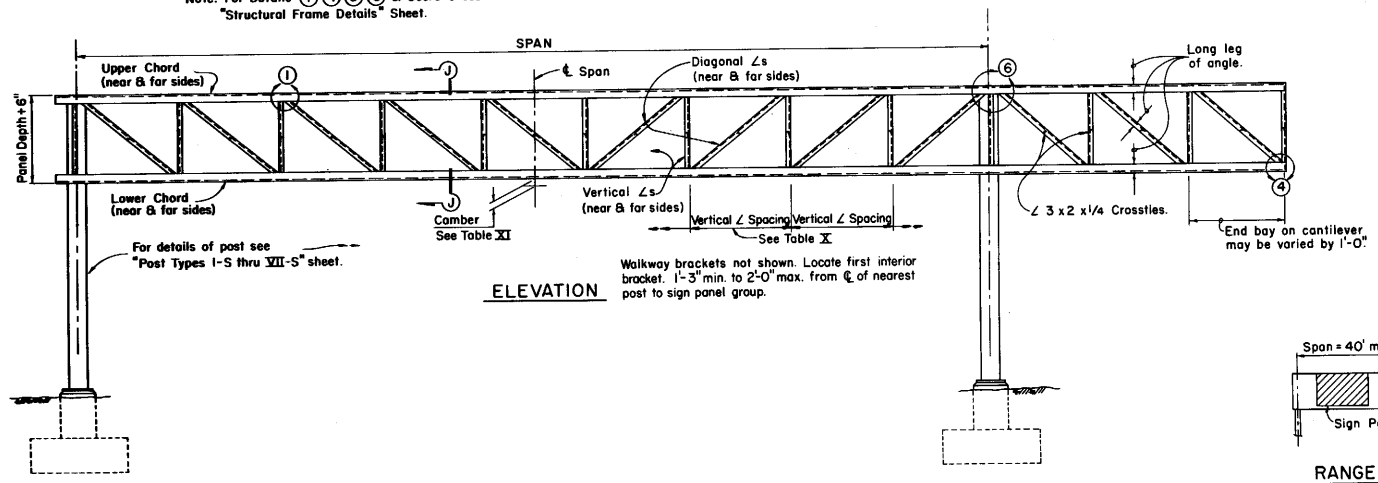


PLAN

Note: For Details ① ④ ⑤ ⑥ & Sec. J-J see "Structural Frame Details" Sheet.



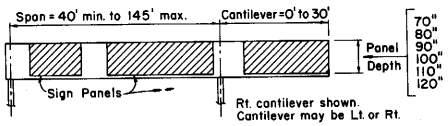
ELEVATION

APPROVAL RECOMMENDED

BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO.5585

APPROVED September 1, 1966

STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO.5945



RANGE OF STRUCTURE SIZES

Span	70" Panel Depth					80" Panel Depth					90" Panel Depth				
	Frame Width	Chord ∠s	Vertical ∠s	Diagonal ∠s	Wind Bracing	Frame Width	Chord ∠s	Vertical ∠s	Diagonal ∠s	Wind Bracing	Frame Width	Chord ∠s	Vertical ∠s	Diagonal ∠s	Wind Bracing
40'-50'	2'-0"❶	5x3½x5/16	3x3x1/4	3x3x1/4	1¼x1¼x1/4	2'-0"❶	5x3½x5/16	3x3x1/4	3x3x1/4	1¼x1¼x1/4	2'-0"❶	5x3½x5/16	3x3x5/16	3x3x5/16	1¼x1¼x1/4
51'-60'	2'-0"❶	5x3½x5/16			1¼x1¼x1/4	2'-0"❶	5x3½x5/16			1¼x1¼x1/4	2'-0"❶	5x3½x5/16			1¼x1¼x1/4
61'-70'	2'-6"❶	5x3½x5/16			1¼x1¼x1/4	2'-6"❶	5x3½x5/16			1¼x1¼x1/4	2'-6"❶	5x3½x5/16			1¼x1¼x1/4
71'-80'	2'-6"❶	6x4x3/8			1¼x1¼x1/4	2'-6"❶	6x4x3/8			1¼x1¼x1/4	3'-0"	6x4x3/8			1½x1½x1/4
81-90'	3'-0"	6x4x3/8			1½x1½x1/4	3'-0"	6x4x3/8			1½x1½x1/4	3'-0"	6x4x3/8			1¾x1¾x1/4
90'-100'	3'-0"	6x4x3/8			1½x1½x1/4	3'-0"	6x4x3/8			1½x1½x1/4	3'-0"	6x4x3/8			1¾x1¾x1/4
101'-110'	3'-0"	7x4x7/16			1¾x1¾x1/4	3'-0"	7x4x7/16			1¾x1¾x1/4	3'-0"	7x4x7/16			1¾x1¾x1/4
111'-120'	3'-0"	7x4x7/16			1¾x1¾x1/4	3'-0"	7x4x7/16			1¾x1¾x1/4	3'-0"	8x4x1/2			1¾x1¾x1/4
121'-132'	3'-0"	8x4x1/2			1¾x1¾x1/4	3'-0"	8x4x1/2			1¾x1¾x1/4	3'-6"	8x4x1/2			2x2x1/4
133'-145'	3'-0"	8x4x1/2	↓	↓	1¾x1¾x1/4	3'-0"	8x4x5/8	↓	↓	1¾x1¾x1/4	3'-6"	8x4x5/8	↓	↓	2x2x1/4

TABLE XII

Span	100" Panel Depth					110" Panel Depth					120" Panel Depth				
	Frame Width	Chord ∠s	Vertical ∠s	Diagonal ∠s	Wind Bracing	Frame Width	Chord ∠s	Vertical ∠s	Diagonal ∠s	Wind Bracing	Frame Width	Chord ∠s	Vertical ∠s	Diagonal ∠s	Wind Bracing
40'-50'	2'-0"❶	5x3½x5/16	3x3x5/16	3x3x5/16	1¼x1¼x1/4	2'-0"❶	5x3½x5/16	3½x3½x5/16	3½x3½x5/16	1¼x1¼x1/4	2'-0"❶	5x3½x5/16	3½x3½x5/16	4x3½x5/16	1¼x1¼x1/4
51'-60'	2'-0"❶	5x3½x5/16			1¼x1¼x1/4	2'-6"❶	5x3½x5/16			1¼x1¼x1/4	2'-6"❶	5x3½x5/16			1½x1½x1/4
61'-70'	2'-6"❶	5x3½x5/16			1½x1½x1/4	3'-0"	5x3½x5/16			1½x1½x1/4	3'-0"	6x4x3/8			1¾x1¾x1/4
71'-80'	3'-0"	6x4x3/8			1¾x1¾x1/4	3'-6"	6x4x3/8			2x2x1/4	3'-6"	6x4x3/8			2x2x1/4
81'-90'	3'-0"	6x4x3/8			1¾x1¾x1/4	3'-6"	6x4x3/8			2x2x1/4	3'-6"	6x4x3/8			2x2x1/4
91'-100'	3'-0"	6x4x3/8			1¾x1¾x1/4	3'-6"	6x4x3/8			2x2x1/4	3'-6"	7x4x7/16			2x2x1/4
101'-110'	3'-6"	7x4x7/16			2x2x1/4	3'-6"	7x4x7/16			2x2x1/4	3'-6"	7x4x7/16			2x2x1/4
111'-120'	3'-6"	7x4x7/16			2x2x1/4	3'-6"	8x4x1/2			2x2x1/4	3'-6"	8x4x1/2			2½x2½x1/4
121'-132'	3'-6"	8x4x1/2			2x2x1/4	3'-6"	8x4x5/8			2½x2½x1/4	3'-6"	8x4x5/8			2½x2½x1/4
133'-145'	3'-6"	8x4x5/8	↓	↓	2x2x1/4	3'-6"	8x4x5/8	↓	↓	2½x2½x1/4	3'-6"	8x4x5/8	↓	↓	2½x2½x1/4

TABLE XII

Panel Depth	Frame Depth	Max. Vertical ∠ Spacing
70"	6'-4"	72"
80"	7'-2"	72"
90"	8'-0"	90"
100"	8'-10"	90"
110"	9'-8"	120"
120"	10'-6"	120"

TABLE X

Camber For Fabrication At ℄ Span	
Span	Camber
40' - 50'	1/2"
51' - 100'	1"
101' - 145'	1½"

Fabricate camber to approximate parabola. Camber of cantilever arm = +1/2" for arms greater than 10'.

TABLE XI

NOTE:

Frame widths shown are nominal. These widths may be varied by 1/4" to standardize fabrication methods.

❶ Add 6" to frame width for Post Type V-S & VI-S; Add 1'-0" for Post Type VII-S.

❶ Add 6" to frame width for Post Type VII-S.

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TWO POST TYPE
STRUCTURAL FRAME MEMBERS

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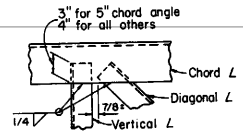
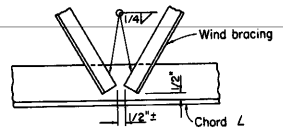
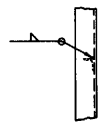


DETAIL ①



DETAIL ②



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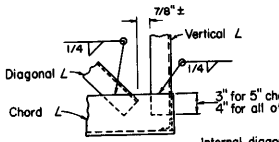

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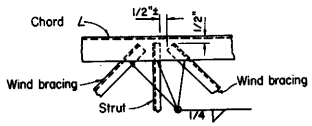
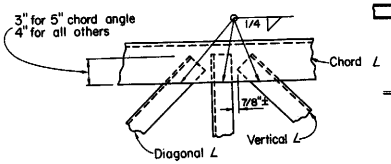
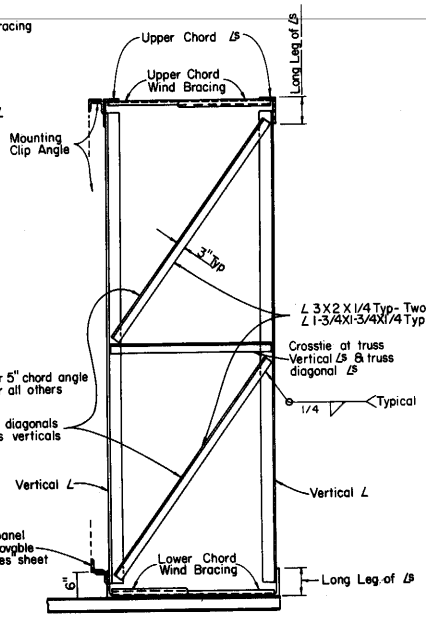


DETAIL ⑤

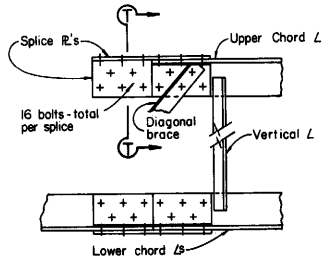


DETAIL ⑥

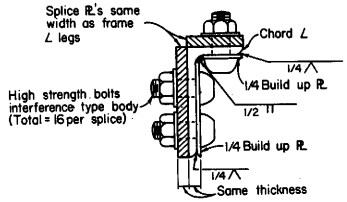


TYPICAL SECTION J-J

Note:
Diagonal ⅃s in plane of truss, not shown. Bracing shown is at all vertical ⅃s of truss.



OPTIONAL
BOLTED CHORD SPLICE



SECTION T-T

APPROVAL RECOMMENDED

BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO.5585

APPROVED September 1, 1966

STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO 5945

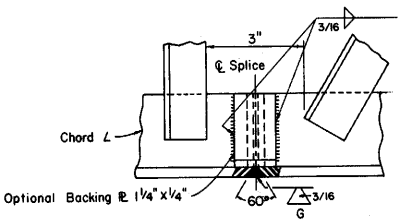
SPLICE NOTES

Specifications:
The bolted splice shall conform to current "Specifications for Structural Joints Using ASTM A325 Bolts", approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.

Location of Splices:
The splice shall be located so as not to interfere with mounting the walkway brackets or the clip angles for the removable sign panel frame. The wind bracing in the area of the bolted chord splice will be bolted to the chord angles with a 3/8" unfinished bolt, with hex head and nut, 2 cut washers and lock washer

Bolts:
The bolts shall be high strength with an interference type body and torqued to the required amount as stated in the above specifications.

Build Up Plate:
The plates welded to the angle legs on the inside shall be welded before punching the bolt holes. They shall be the same length as the cover plates The plates are not necessary on the single-post signs if the splice is located over 1/3 of the cantilever length from the post. Alternative splice details may be used if approved by the Engineer



WELDED CHORD SPLICE

Note
1. Prepare edges by beveling to angle shown
2. Weld to 100% full penetration.
3. Grind flush with base metal.

BOLTED CHORD SPLICE TWO POST SIGNS	
Chord L	Nominal Bolt Diam.
5X3 1/2 X 5/16	3/4"
6X4 X 3/8	7/8"
7X4 X 7/16	1"
8X4 X 1/2	1 1/8"
8X4 X 5/8	1 1/4"
SINGLE POST SIGNS	
Chord L	Nominal Bolt Diam.
5X3 X 5/16	3/4"

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STRUCTURAL FRAME DETAILS

S6-5

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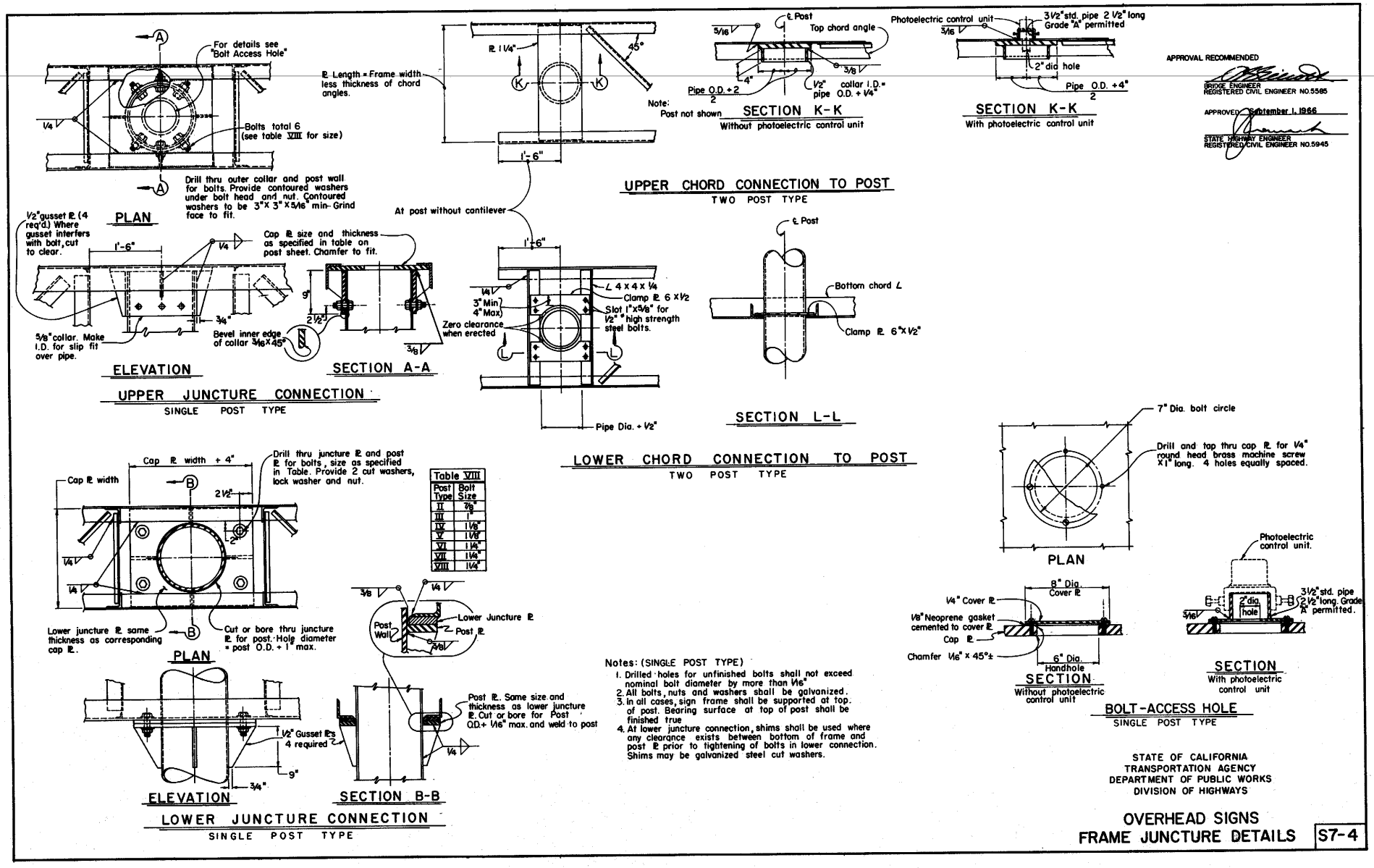

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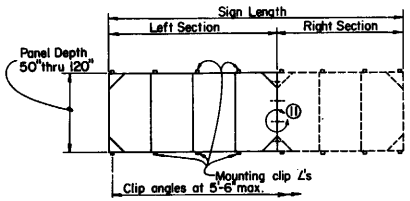
Note:
Panel mounting holes not shown.
Panel lengths available in 2'-0" increments.

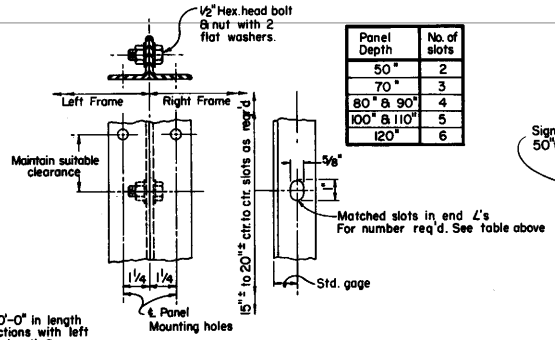
APPROVAL RECOMMENDED
BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO.5585
APPROVED September 1, 1966
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO.5945



REMOVABLE FRAME
GREATER THAN 20'-0"

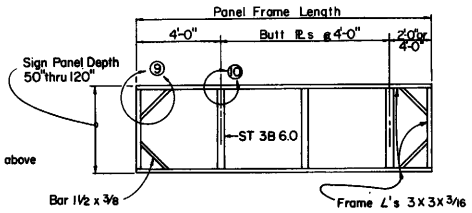
Sign Length	Left Section	Right Section
22'-0"	12'	10'
24'-0"	12'	12'
26'-0"	12'	14'
28'-0"	16'	12'
30'-0"	16'	14'
32'-0"	16'	16'
34'-0"	16'	18'
36'-0"	20'	16'
38'-0"	20'	18'
40'-0"	20'	20'

NOTES:
Frames for signs greater than 20'-0" in length shall be fabricated in two sections with left section a multiple of 4'-0" in length. See table above.
Sections shall be hoisted into place individually and bolted together as per detail ⑪ prior to tightening of mounting clip bolts.
Bolting two sections together and hoisting simultaneously will not be permitted.

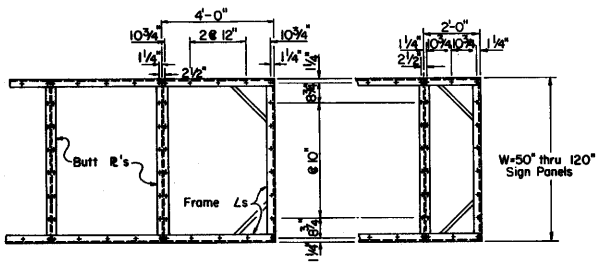


DETAIL ⑪
No Scale

Panel Depth	No. of slots
50"	2
70"	3
80" & 90"	4
100" & 110"	5
120"	6



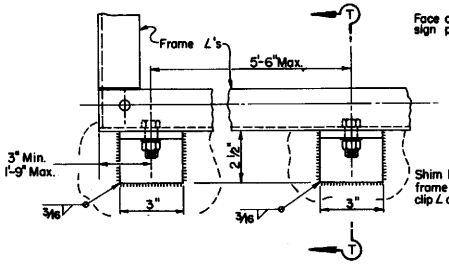
TYPICAL REMOVABLE FRAME
(4'-0" thru 20'-0")



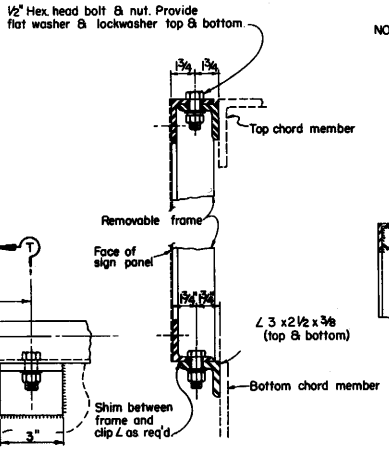
TYPICAL 4'-0" PANEL
TYPICAL 2'-0" PANEL

Note: All holes ½" diameter

MOUNTING HOLE SPACING FOR SIGN PANEL & FRAME
Scale: ½" = 1'-0"

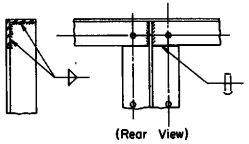


FRAME MOUNTING DETAILS
No Scale

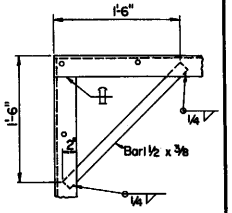


SECTION T-T

NOTES:
1. Frames shall be all-welded construction.
2. ½" Panel mounting holes shall be drilled by template. Sign panel may be considered a template.
3. Drilled and tapped holes (¼"-20 N.C.) may be used where interference due to weeds or structural members is encountered.
4. Butt plate faces shall be flush with faces of frame angles.
5. Mounting clip angles shall be located such as to allow the top and bottom frame angles of the removable sign panel frame to lie on a straight horizontal line.
6. Holes for mounting removable sign panel frame may be slotted 1" maximum parallel to the axis of the sign.
7. Butt plates may be crimped at ends to join frame angles. Fillet weld all around.



DETAIL ⑩



DETAIL ⑨

TYPICAL JOINT DETAILS

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REMOVABLE SIGN PANEL FRAMES S8-6

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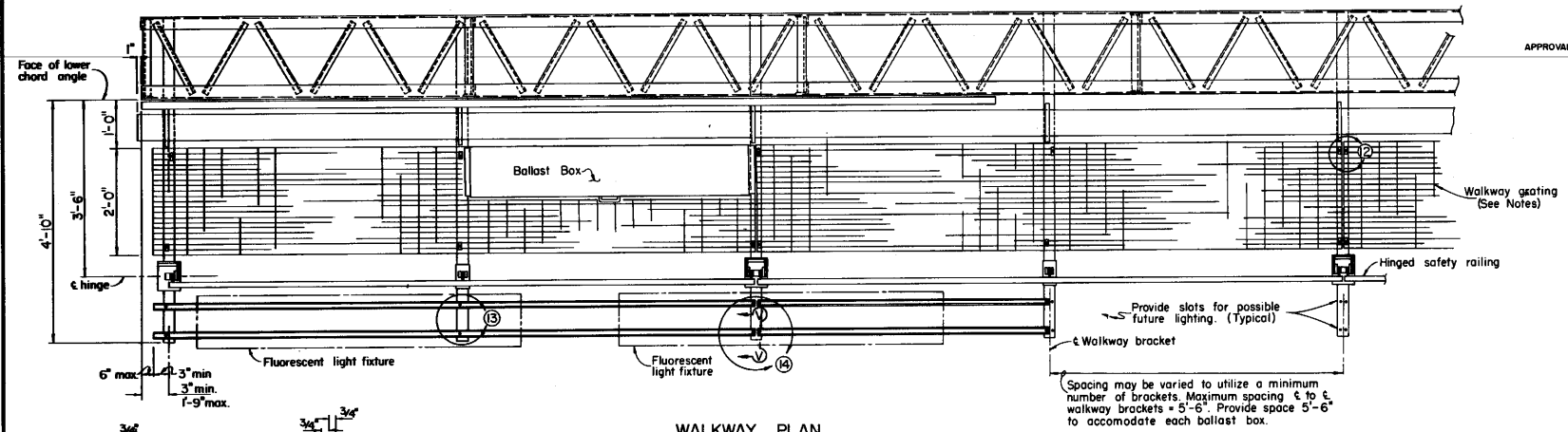


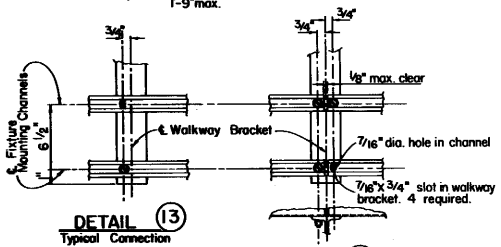
WALKWAY PLAN
Scale 1" = 1'-0"

APPROVAL RECOMMENDED

BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO.5585

APPROVED September 1, 1966

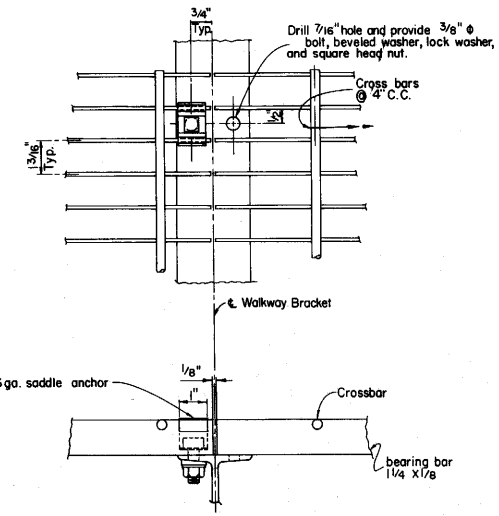
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO.5945



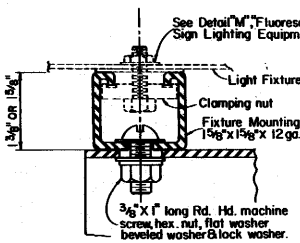
DETAIL (13)
Typical Connection

DETAIL (14)
Connection at Splice

1. Welded-type grating shall have 1 1/4" x 1/8" bearing bars @ 1 3/16" centers with 1/4" diameter (or equal) cross bars @ 4" centers. See detail (12). If mechanical lock grating is used it shall be equal in strength to the welded-type. Alternate hold-down clips may be submitted for approval.
2. For spacing of lighting fixtures see table of spacings on "fluorescent sign lighting equipment" sheet.
3. Walkway grating and light fixture mounting channels to be continuous (no splices) over as many walkway brackets as praticable consistent with fabrication, ease of handling and assembling.
4. Bolts, nuts, washers, etc. to be galvanized.



DETAIL (12)
Scale 1/2" = 1"



SECTION V-V
Full Scale

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OVERHEAD SIGNS
WALKWAY DETAILS

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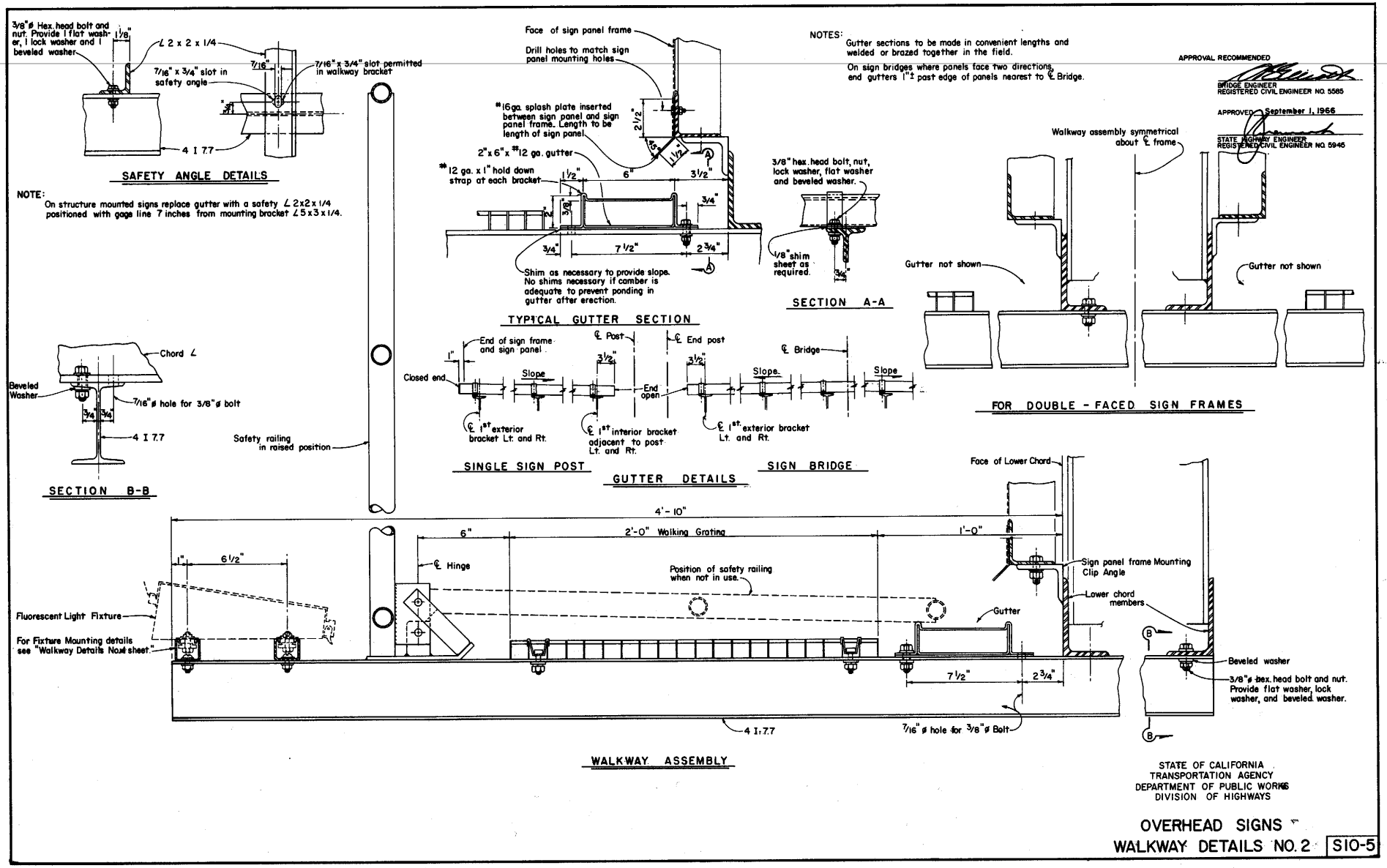

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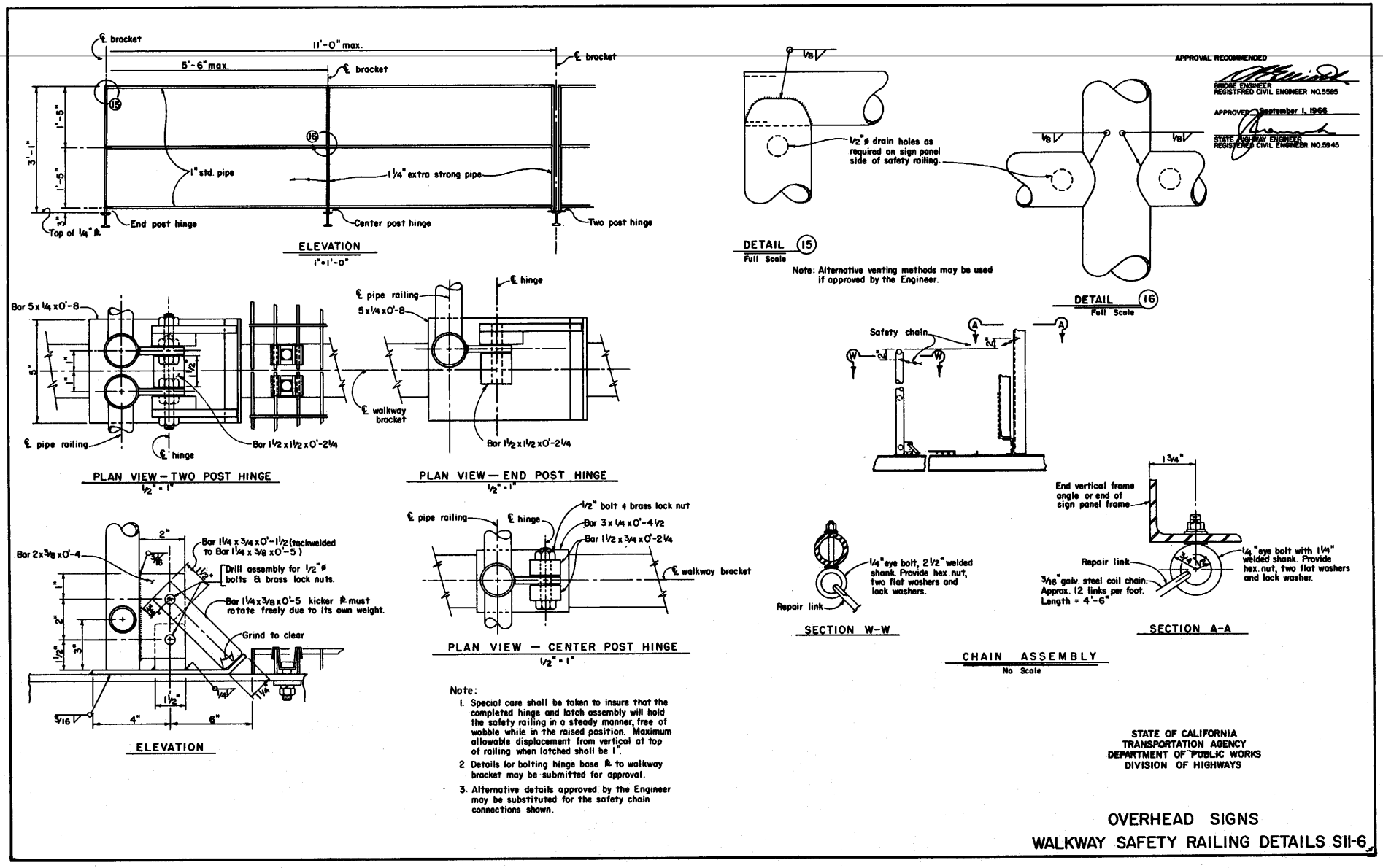

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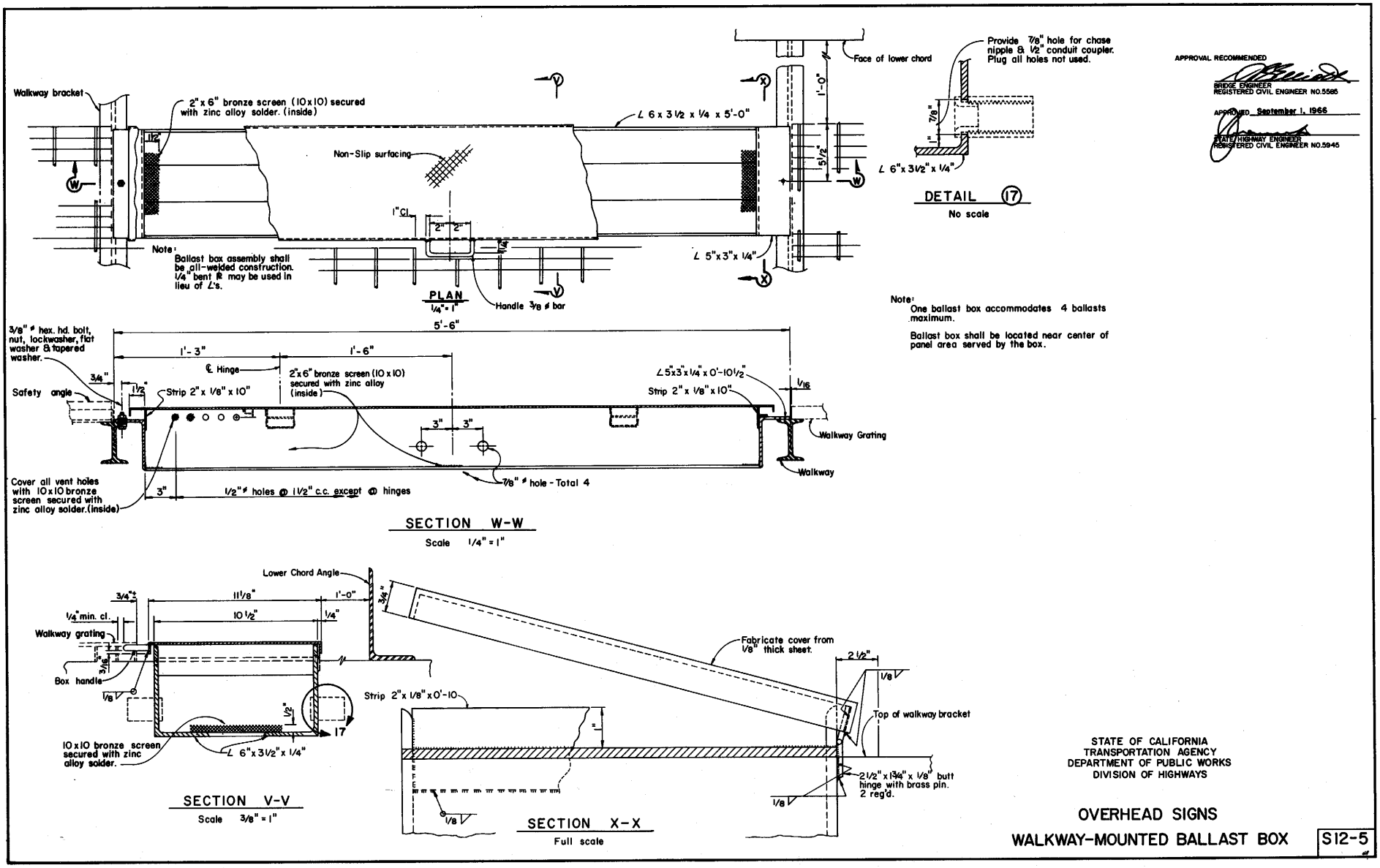

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DIVISION OF HIGHWAYS

OVERHEAD SIGNS

WALKWAY-MOUNTED BALLAST BOX

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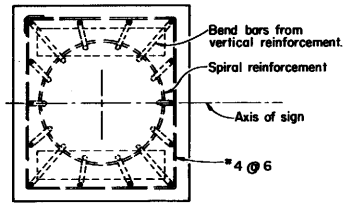
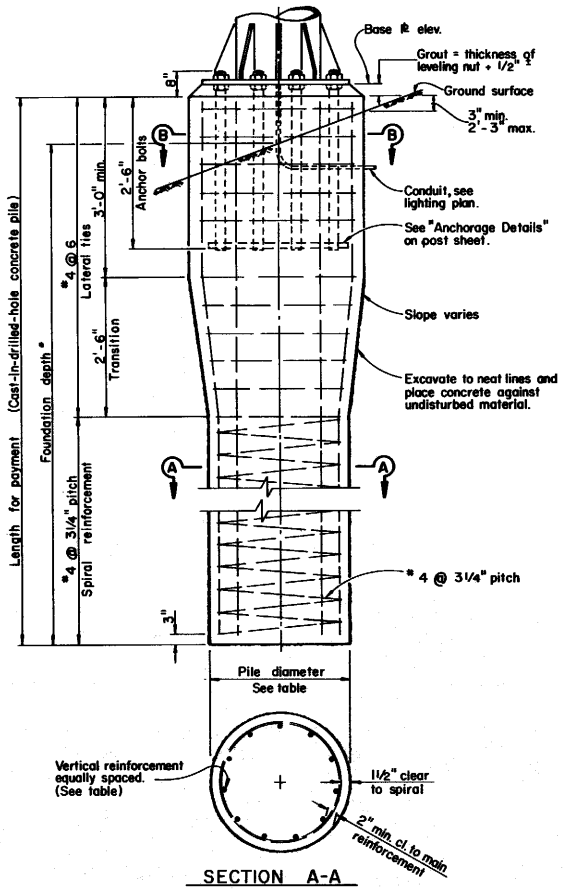


SECTION B-B



SECTION A-A

Post Type	Anchor Bolts	Pedestal Size	Reinforcing Steel Vertical	Pile Diameter	Foundation Depth*
II	6 - 2" ø	2'-11" x 2'-8"	14 - # 7	30"	12'
III	6 - 2" ø	3'-2" x 2'-10"	14 - # 8	30"	12'
IV	6 - 2" ø	3'-8" x 3'-4"	16 - # 8	36"	12'
V	10 - 2" ø	3'-10" x 3'-7"	16 - # 9	36"	15'
VI	10 - 2" ø	3'-10" x 3'-7"	16 - #10	36"	16'
VII	12 - 2" ø	4'-3" x 3'-11"	16 - #11	36"	19'
VIII	12 - 2" ø	4'-5" x 3'-11"	16 - #14	36"	20'
I-S	6 - 2" ø	2'-7" x 2'-3"	14 - # 7	30"	12'
II-S	6 - 2" ø	3'-0" x 2'-6"	14 - # 8	30"	14'
III-S	6 - 2" ø	3'-4" x 2'-7"	14 - #10	30"	16'
IV-S	8 - 2" ø	3'-6" x 3'-2"	16 - #10	36"	17'
V-S	8 - 2" ø	3'-8" x 3'-4"	16 - #11	36"	20'
VI-S	8 - 2" ø	4'-0" x 3'-4"	16 - #11	36"	21'
VII-S	8 - 2 1/4" ø	4'-5" x 3'-11"	16 - #14	36"	23'

* Use Foundation Depth shown in table unless otherwise shown on the Format Sheet.

NOTES

1. For anchor bolt layout see Post Sheet.
2. For "Base ℞ Elev." see Format Sheet.
3. Pedestal and pipe shall be Class "A" P.C.C.
4. Pedestals & Base Plates; longer sides shall be normal to axis of sign.
5. The excavation around the formed pedestal shall be backfilled & compacted with material equivalent to the surrounding material.
6. Pedestal shall be formed 6" min. below ground surface.

APPROVAL RECOMMENDED

BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO.5585

APPROVED September 1, 1966

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OVERHEAD SIGNS
ALTERNATE PILE FOUNDATION

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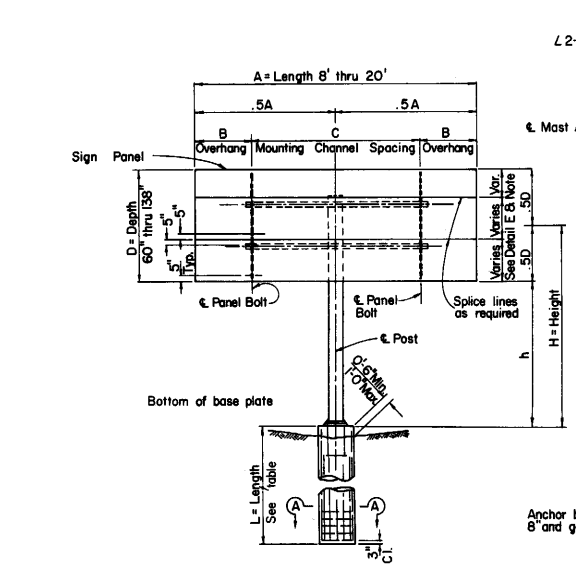
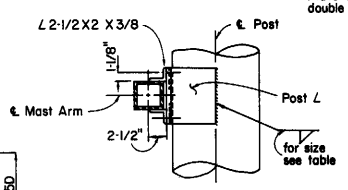
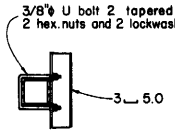


ELEVATION

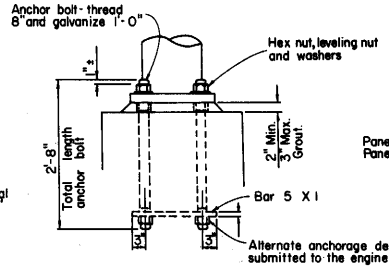


SECTION B-B

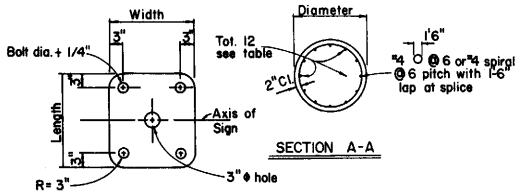


SECTION D-D

Typical connection for single faced signs

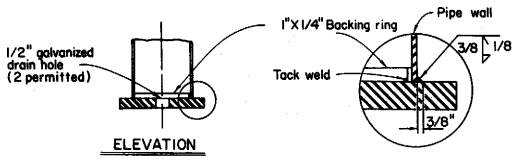


ANCHORAGE DETAILS



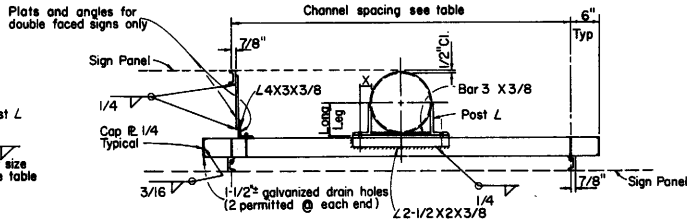
PLAN

SECTION A-A

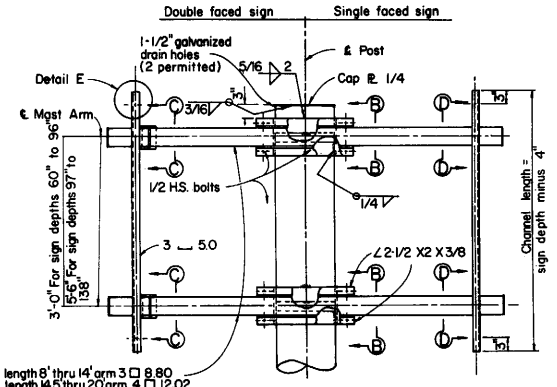


ELEVATION

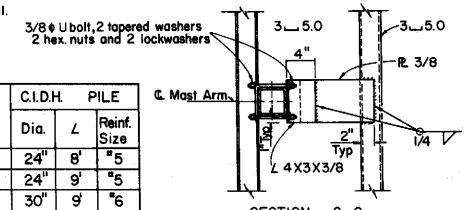
BASE PLATE DETAILS



PLAN



PART ELEVATION



SECTION C-C

Typical for double faced signs

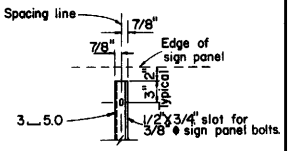
POST SIZE (Pipe)	POST ANGLES			BASE PLATE	ANCHOR BOLT DIA.	C.I.D.H. PILE		
	ANGLE	X	WELD			Dia.	∠	Reinf. Size
6 @ 18.97	∠4X3X1/2	1-3/4"	1/4	1'-2"X1'-2"X1/2"	1-1/4"	24"	8'	#5
6 @ 28.57	∠4X3X1/2	1-3/4"	1/4	1'-2"X1'-2"X1/2"	1-1/2"	24"	9'	#5
8 @ 28.55	∠5X3X1/2	1-3/4"	1/4	1'-6"X1'-4"X1/2"	1-1/2"	30"	9'	#6
8 @ 43.39	∠5X3X1/2	1-3/4"	1/4	1'-6"X1'-4"X2"	1-3/4"	30"	11'	#7
10 @ 54.74	∠6X4X5/8	2 1/2"	1/4	1'-8"X1'-6"X2"	2"	30"	13'	#8
12 @ 65.42	∠7X4X5/8	2 1/2"	5/16	1'-8"X1'-6"X2"	2-1/2"	30"	15'	#10
14 @ 72.09	∠8X4X5/8	2 1/2"	5/16	1'-10"X1'-6"X2-1/4"	2-1/2"	36"	15'	#10

APPROVAL RECOMMENDED

BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO.5585

APPROVED September 1, 1966

STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO.5945



DETAIL E

Sign panel depths more than 60" require additional mounting holes located 5" each side of sign panel splice lines. Exact location is dependent on sign panel manufacturer and must be determined at time of sign erection.

SIGN PANEL LENGTH	SIGN PANEL OVERHANG	MOUNTING CHANNEL SPACING
A	B	C
8'-0"	18"	5'-0"
8'-6"	20"	5'-2"
9'-0"	22"	5'-4"
9'-6"	23"	5'-8"
10'-0"	24"	6'-0"
10'-6"	24"	6'-6"
11'-0", 11'-6" & 12'-0"	24", 27" & 30"	7'-0"
12'-6"	30"	7'-6"
13'-0"	30"	8'-0"
13'-6" & 14'-6"	30" & 36"	8'-6"
14'-0" & 15'-0"	30" & 36"	9'-0"
15'-6" & 16'-0"	36" & 39"	9'-6"
16'-6"	39"	10'-0"
17'-0" & 17'-6"	39" & 42"	10'-6"
18'-0" & 18'-6"	42" & 45"	11'-0"
19'-0"	45"	11'-6"
19'-6" & 20'-0"	45" & 48"	12'-0"

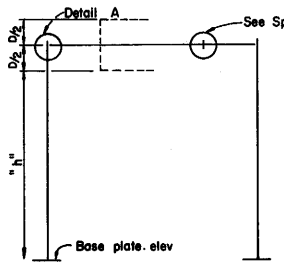
MOUNTING CHANNEL SPACING
LAMINATED PANEL SIGNS

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

BALANCED LIGHTWEIGHT SIGNS
(SINGLE STEEL POST)
POST FOUNDATION AND MOUNTING DETAILS

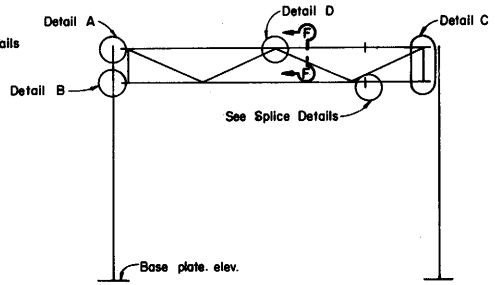
S14-2

Return to Table of Contents



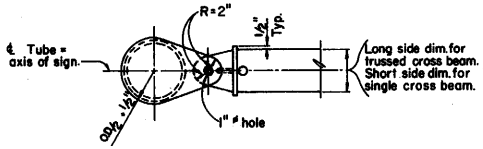
SINGLE CROSS BEAM SERIES

TYPE A-1

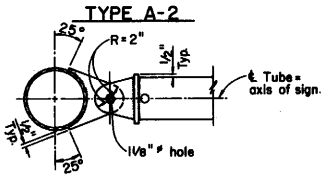


TRUSSED CROSS BEAM SERIES

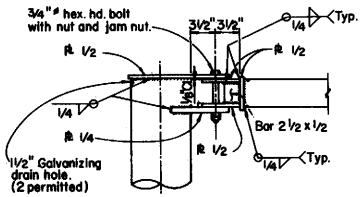
TYPE A-2



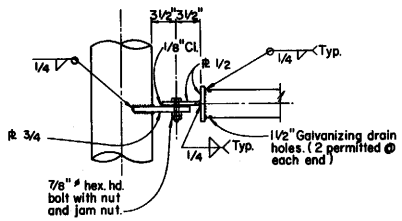
PLAN



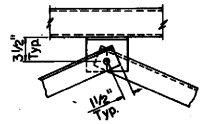
PLAN



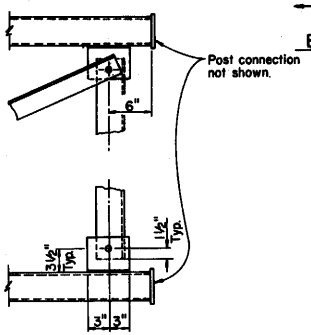
DETAIL A



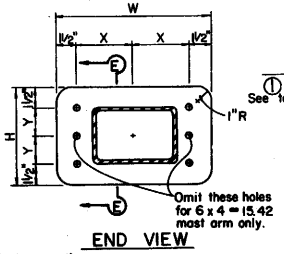
DETAIL B



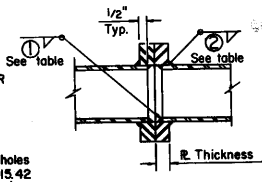
DETAIL D



DETAIL C



END VIEW



SECTION E-E

SPLICE DETAILS*

APPROVAL RECOMMENDED

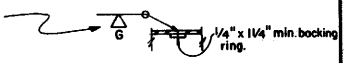
BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO.5585

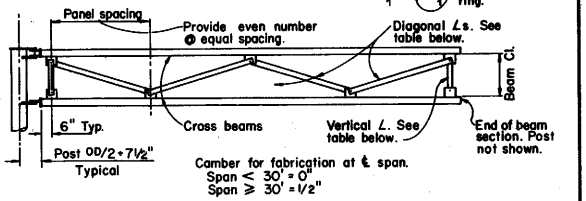
APPROVED September 1, 1966

STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO.5945

SPLICE DATA									
TUBULAR CROSS BEAM SIZE	HIGH STRENGTH BOLTS				A-36 PLATES			WELDING	
	NO.	SIZE	X	Y	W	H	THICKNESS	①	②
6 x 4 = 15.42	4	5/8"	4 1/4"	2"	11 1/2"	7"	1"	3/16	5/16
8 x 4 = 18.82	6	5/8"	5 1/4"	2"	1'-11 1/2"	7"	1"	3/16	5/16
8 x 6 = 22.04	6	5/8"	5 1/4"	2 1/2"	1'-11 1/2"	8"	1 1/8"	3/16	3/8
8 x 6 = 31.73	6	5/8"	4 1/4"	3 1/2"	11 1/2"	10"	1 1/8"	1/4	5/16
10 x 6 = 25.44	6	5/8"	6 1/2"	2 1/2"	1'-4"	8"	1 3/8"	3/16	3/8
10 x 6 = 36.83	6	3/4"	6 1/2"	3"	1'-4"	9"	1 5/8"	5/16	1/2

*Optional welded splice.

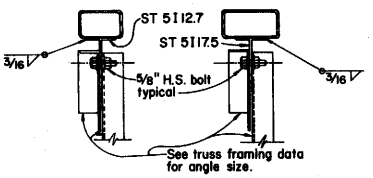




SIGN DEPTH	BEAM CLEARANCE	MAX. PANEL SPACING	VERTICAL ANGLE	DIAGONAL ANGLE
40" - 72"	2'-0"	5'-6"	∠3 1/2 x 2 1/2 x 1/4*	∠3 1/2 x 2 1/2 x 1/4*
73" - 100"	4'-6"	6'-6"	∠3 1/2 x 2 1/2 x 1/4*	∠3 1/2 x 2 1/2 x 1/4*

* Short leg outstanding.

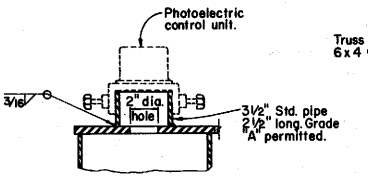
TRUSS FRAMING DATA



Truss cross beam 6 x 4 = 15.42 only.

Truss cross beam except 6 x 4 = 15.42.

SECTION F-F



PHOTOELECTRIC CONTROL UNIT

Note:
For post connection to base ℞ see "Standard Lightweight Signs - Foundation" sheet.
For cross beam to sign panel connections see "Standard Lightweight - Sign Panel Mounting Details" sheet.

See format sheet for:
1. Sign type and location.
2. Panel type and location on structure.
3. Post size and dimension "h".
4. Cross beam size.
5. Foundation type.
6. Illumination if required.

For General Notes see "Standard Lightweight Signs - Foundation" sheet.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

LIGHTWEIGHT SIGNS
TYPE A
CONNECTION DETAILS

S 15-3

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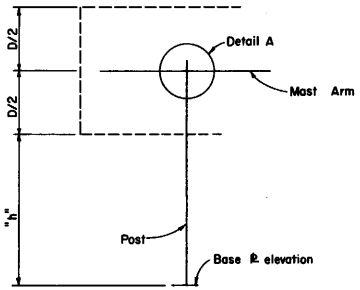
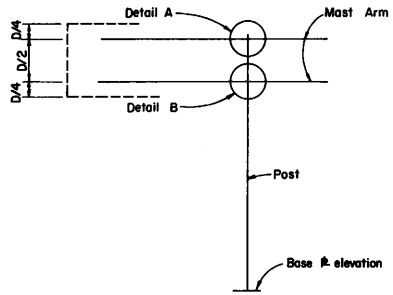
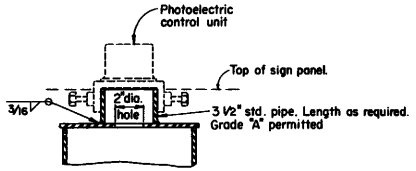


SINGLE ARM SERIES
TYPE B-1



DOUBLE ARM SERIES
TYPE B-2



PHOTOELECTRIC CONTROL UNIT

APPROVAL RECOMMENDED

BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO.5585

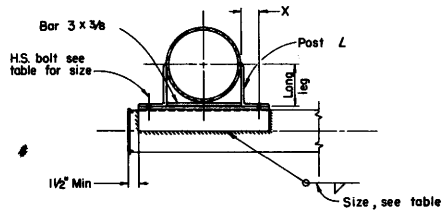
APPROVED September 1, 1966

STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO.5945

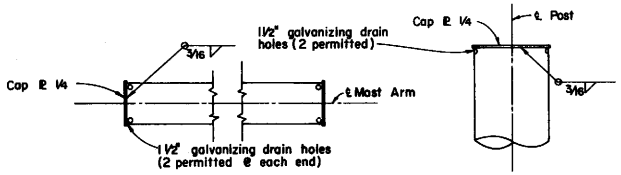
POST ANGLES			
POST SIZE	ANGLE	X	WELD
6	∠ 4 x 3 x 1/2	1 3/4"	1/4
8	∠ 5 x 3 x 1/2	1 3/4"	1/4
10	∠ 6 x 4 x 5/8	2 1/2"	1/4
12	∠ 7 x 4 x 5/8	2 1/2"	5/16
14	∠ 8 x 4 x 3/4	2 1/2"	5/16

MAST ARM ANGLES				
ARM SIZE	ANGLE	H.S. BOLT	Y	WELD
3 □ 8.80	∠ 2 x 2 x 3/8	1/2	1 1/8"	1/4
4 □ 12.02	∠ 2 1/2 x 2 x 3/8	1/2	1 1/8"	1/4
5 □ 15.42	∠ 3 x 2 1/2 x 3/8	5/8	1 3/8"	1/4
6 □ 18.82	∠ 3 1/2 x 2 1/2 x 3/8	5/8	1 3/8"	1/4
7 □ 22.04	∠ 4 x 3 x 1/2	3/4	1 3/4"	5/16
8 □ 25.44	∠ 5 x 3 x 1/2	7/8	1 3/4"	5/16
10 □ 32.23	∠ 6 x 4 x 5/8	7/8	2 1/2"	5/16

POST TO ARM FRAMING DATA



SECTION D-D

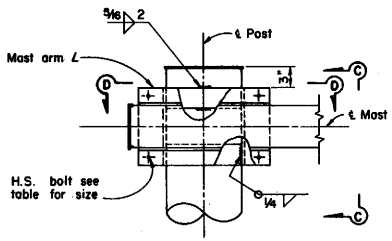


MAST ARM

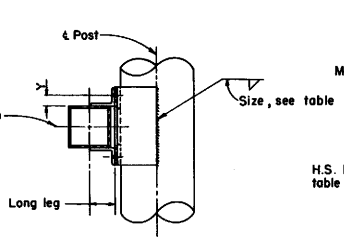
POST

END DETAIL

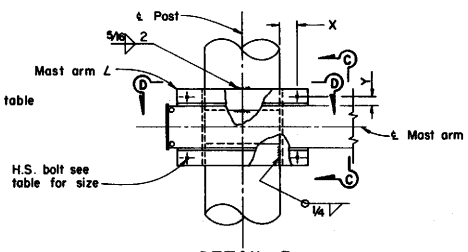
SEE FORMAT SHEET FOR:
1. Sign type and location.
2. Panel type and location on structure.
3. Post size and dimension "h".
4. Mast arm size.
5. Foundation type.
6. Illumination if reqired.



DETAIL A



VIEW C-C



DETAIL B

NOTE:
For post connection to base plate see "Standard Lightweight Signs — Foundation" sheet.
For mast arm to sign panel connections see "Standard Lightweight Signs — Sign Panel Mounting Details" sheet.
For mast arm length see "Standard Lightweight Signs — Sign Panel Mounting Details" sheet.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

LIGHTWEIGHT SIGNS
TYPE B
CONNECTION DETAILS

S 16-3

For General Notes See "Standard Lightweight Signs – Foundation" sheet

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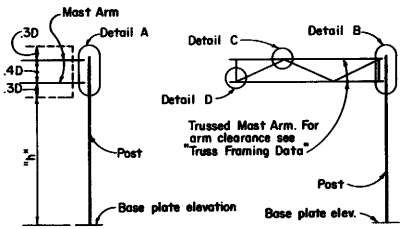
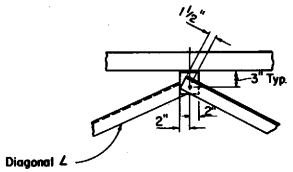
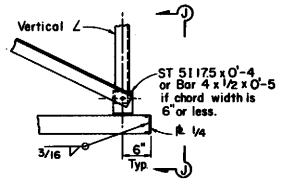


DOUBLE MAST ARM SERIES
TYPE C-1

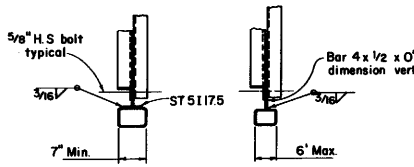
TRUSSED MAST ARM SERIES
TYPE C-2



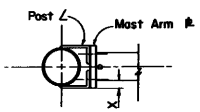
DETAIL C



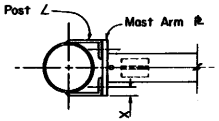
DETAIL D



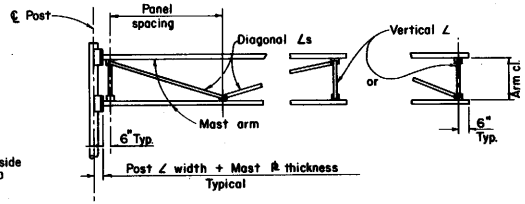
VIEW J-J

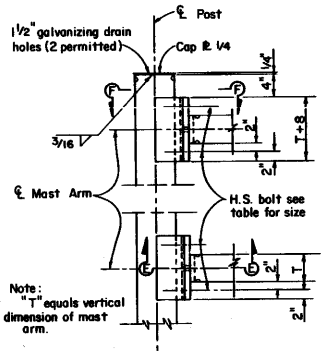


SECTION F-F

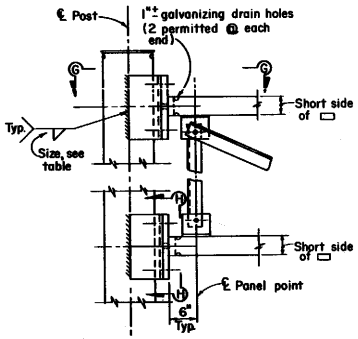


SECTION G-G





DETAIL A

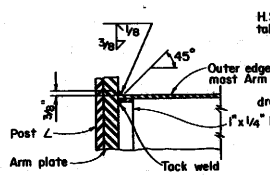


DETAIL B

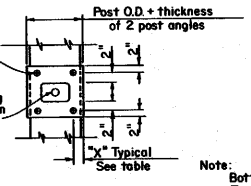
SIGN DEPTH INCHES	ARM CLEARANCE	MAX. PANEL SPACING	VERTICAL ANGLE	DIAGONAL ANGLE
D = 40"-72	2'-0"	4'-4"	∠2 x 2 x ¼	∠2 x 2 x ¼
D = 73"-100"	3'-0"	6'-6"	∠3½ x 2½ x ¼*	∠3½ x 2½ x ¼*

* Short leg outstanding

TRUSS FRAMING DATA

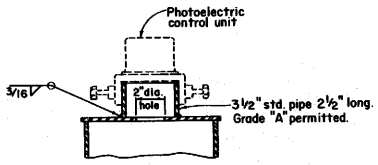


SECTION E-E



SECTION H-H

Note:
Bottom connection shown.
Top similar



PHOTOELECTRIC CONTROL UNIT

APPROVAL RECOMMENDED

BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO.5585

APPROVED September 1, 1966

STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO.5945

POST ANGLES			
POST SIZE	ANGLE	X	WELD
6	∠5 x 3 x ½	1¾"	¼
8	∠6 x 4 x ⅝	2¼"	¼
10	∠7 x 4 x ⅝	2¼"	¼
12	∠8 x 4 x ¾	2¼"	5/16
14	∠8 x 4 x ¾	2¼"	5/16

MAST ARM PLATE			
TWO ARMS	TRUSSED ARMS	PLATE	H.S. BOLT
3 ▭ 8.80		3/4"	1/2"
4 ▭ 12.02		1"	5/8"
5 ▭ 15.42		1"	3/4"
6 ▭ 18.82		1"	3/4"
7 ▭ 22.04	5 x 3 ▭ 16.84	1¼"	3/4"
	6 x 4 ▭ 21.94	1¼"	7/8"
	7 x 5 ▭ 27.04	1¼"	7/8"
	8 x 6 ▭ 31.73	1¼"	7/8"
	10 x 6 ▭ 36.83	1¼"	1"

POST TO ARM FRAMING DATA

Note:
For post connection to base ℄ see "Standard Lightweight Signs - Foundation" sheet.

For mast arm to sign panel connections see "Standard Lightweight Sign Panel Mounting Details" sheet.

For mast arm length see "Standard Lightweight Signs - Sign Panel Mounting Details" sheet.

See format sheet for:
1. Sign type and location.
2. Panel type and location on structure.
3. Post size and dimension "h".
4. Mast Arm size.
5. Foundation type.
6. Illumination if required.

For General Notes see "Standard Lightweight Signs - Foundation" sheet.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

LIGHTWEIGHT SIGNS
TYPE C
CONNECTION DETAILS S 17-3

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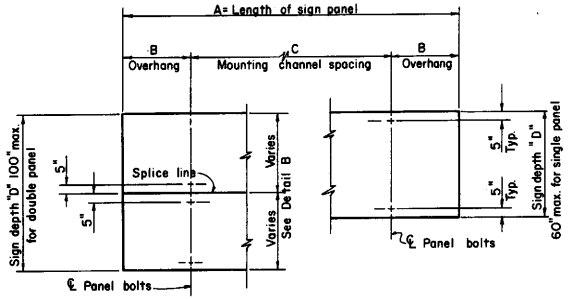
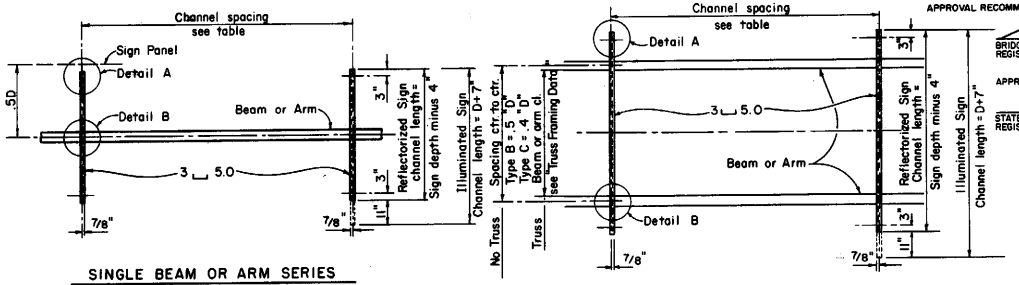


LAMINATED PANEL SIGN - ELEVATION



SINGLE BEAM OR ARM SERIES

DOUBLE BEAM OR ARM SERIES

APPROVAL RECOMMENDED

BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO. 5565

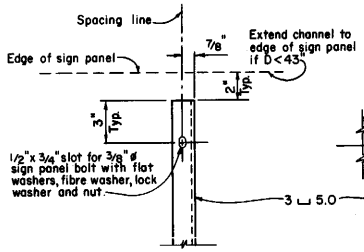
APPROVED September 1, 1966

STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5945

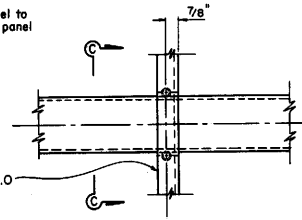
SIGN PANEL LENGTH *	SIGN PANEL OVERHANG	MOUNTING CHANNEL SPACING
A	B	C
4'-6", 5'-0" & 5'-6"	6", 9" & 12"	3'-6"
6'-0" & 6'-6"	12" & 15"	4'-0"
7'-0" & 7'-6"	15" & 18"	4'-6"
8'-0"	18"	5'-0"
8'-6"	20"	5'-2"
9'-0"	22"	5'-4"
9'-6"	23"	5'-8"
10'-0"	24"	6'-0"
10'-6"	24"	6'-6"
11'-0", 11'-6" & 12'-0"	24", 27" & 30"	7'-0"
12'-6"	30"	7'-6"
13'-0"	30"	8'-0"
13'-6" & 14'-6"	30" & 36"	8'-6"
14'-0" & 15'-0"	30" & 36"	9'-0"
15'-6" & 16'-0"	36" & 39"	9'-6"
16'-6"	39"	10'-0"
17'-0" & 17'-6"	39" & 42"	10'-6"
18'-0" & 18'-6"	42" & 45"	11'-0"
19'-0"	45"	11'-6"
19'-6" & 20'-0"	45" & 48"	12'-0"
20'-6" & 21'-0"	48" & 51"	12'-6"
21'-6"	51"	13'-0"
22'-0" & 22'-6"	51" & 54"	13'-6"
23'-0"	54"	14'-0"
23'-6" & 24'-0"	54" & 57"	14'-6"

*Signs longer than 24' are fabricated and mounted as adjoining single panels.

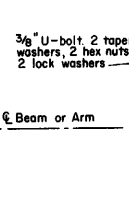
MOUNTING CHANNEL SPACING
LAMINATED PANEL SIGNS



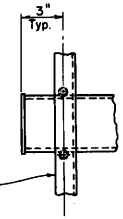
DETAIL A



DETAIL B



SECTION C-C

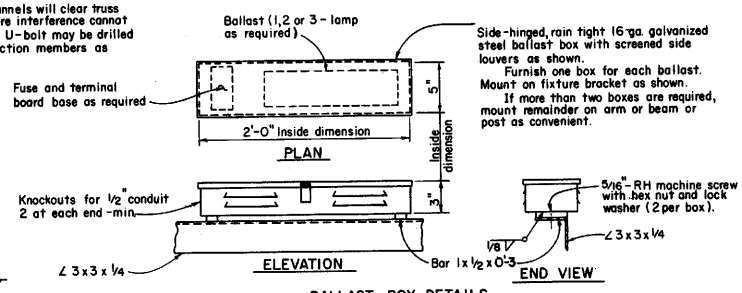


END ARM DETAIL
SINGLE POST SIGNS

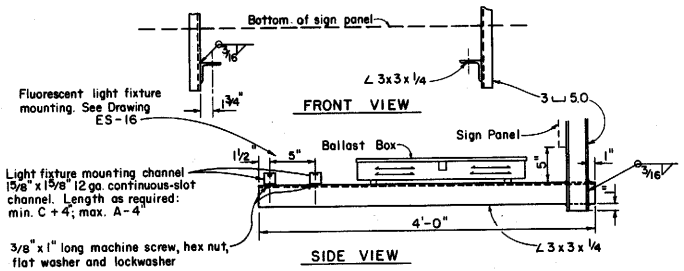
SINGLE AND DOUBLE SERIES

Sign panel depths more than 60" require additional mounting holes located 5" each side of sign panel splice line. Exact location is dependent on sign panel manufacturer and must be determined at time of sign erection.

Note:
Position sign panel so that mounting channels will clear truss connections and arm to post joints. Where interference cannot be avoided, 1/2" ø holes to pass the 3/8" ø U-bolt may be drilled through mast arm angles or truss connection members as necessary.



BALLAST BOX DETAILS



LIGHT FIXTURE MOUNTING DETAIL

For General Notes see "Standard Lightweight Signs - Foundation" sheet.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

LIGHTWEIGHT SIGNS
(LAMINATED PANEL)
SIGN PANEL MOUNTING DETAIL

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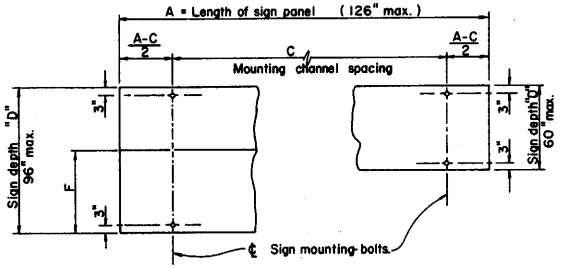
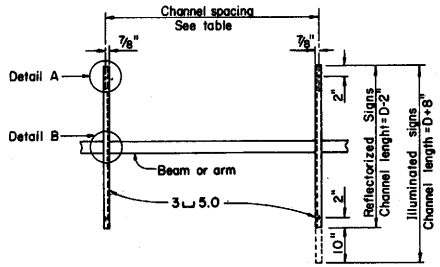
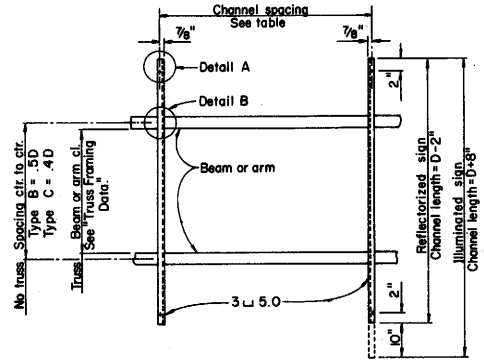


FRAMED SHEET METAL SIGNS



SINGLE BEAM OR ARM SERIES



DOUBLE BEAM OR ARM SERIES

APPROVAL RECOMMENDED

BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO.5585

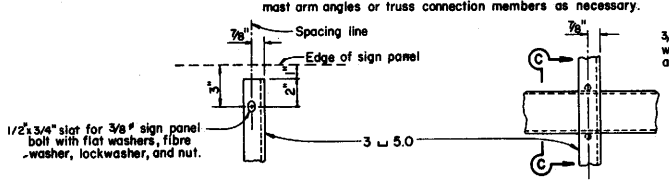
APPROVED September 1, 1966

STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO.5945

LENGTH OF SIGN *	DEPTH OF SIGN	MOUNTING CHANNEL SPACING		BOTTOM TO INTERIOR FRAME ℄
A	D	C		F
42" Special (R-59 & R-60)	50"	36"		—
54" 60" or 66"	36"-48"	42"		—
	49"-60"	42"		36"
	61"-96"	42"		48"
72" or 78"	36"-48"	48"		—
	49"-60"	48"		36"
	61"-72"	48"		48"
	73"-96"	48"		48"
84" or 90"	36"-48"	54"		—
	49"-60"	54"		36"
	61"-72"	54"		48"
	73"-96"	54"		48"
96"	36"-48"	60"		—
	49"-60"	60"		36"
	61"-96"	60"		48"
102"	36"-48"	62"		—
	49"-60"	62"		36"
	61"-96"	62"		48"
108"	36"-48"	64"		—
	49"-60"	64"		36"
	61"-96"	64"		48"
114"	36"-48"	68"		—
	49"-60"	68"		36"
	61"-96"	68"		48"
120"	36"-48"	72"		—
	49"-60"	72"		36"
	61"-96"	72"		48"
126"	36"-48"	78"		—
	49"-60"	78"		36"
	61"-96"	78"		48"

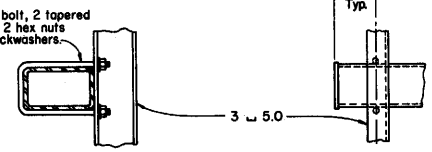
MOUNTING CHANNEL LAYOUT
FRAMED SHEET METAL SIGNS

* Signs longer than 126" are fabricated and mounted as adjoining single panels.



DETAIL A

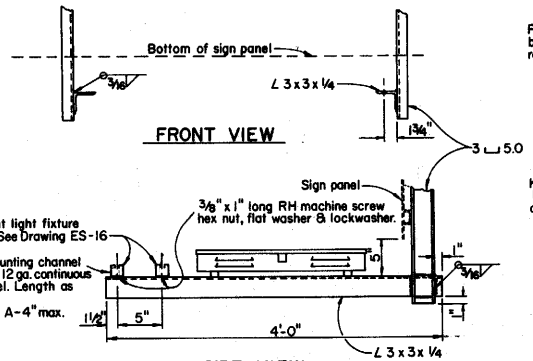
DETAIL B



SECTION C-C

END ARM DETAIL
SINGLE POST SIGNS

Note: Position sign panel so that mounting channels will clear truss connections and arm to post joints. Where interference cannot be avoided, 1/2" ø holes to pass the 3/8" ø U-bolts may be drilled through mast arm angles or truss connection members as necessary.

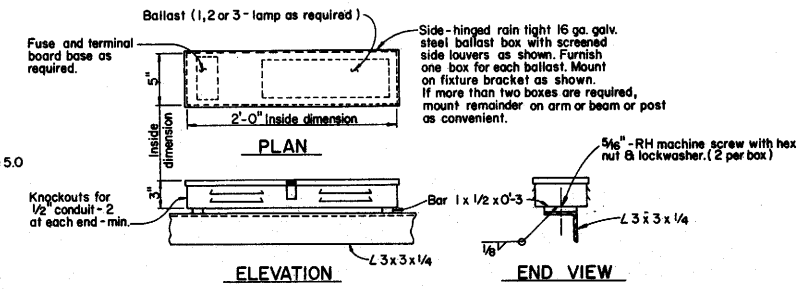


FRONT VIEW

SIDE VIEW

LIGHT FIXTURE MOUNTING DETAIL

For General Notes see "Standard Lightweight Signs - Foundation" sheet.



PLAN

ELEVATION

END VIEW

BALLAST BOX DETAILS

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

LIGHTWEIGHT SIGNS
(FRAMED SHEET METAL)
SIGN PANEL MOUNTING DETAIL

Scale - None

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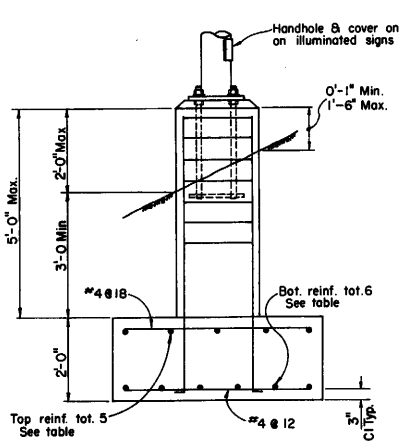
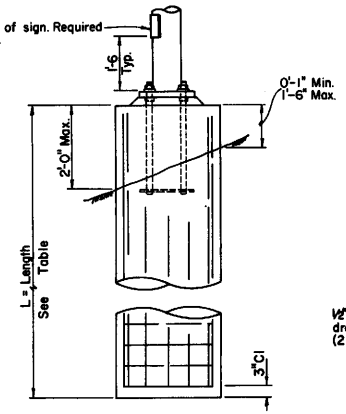
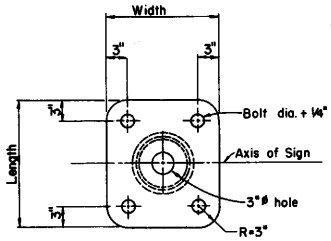


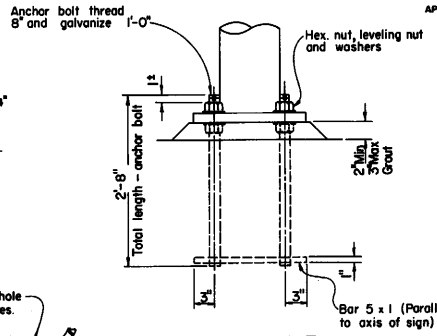
ELEVATION



ELEVATION



PLAN



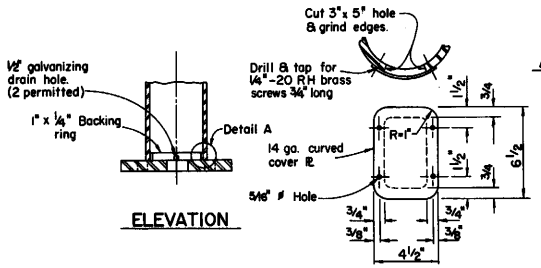
ANCHOR BOLT

APPROVAL RECOMMENDED

BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO.5585

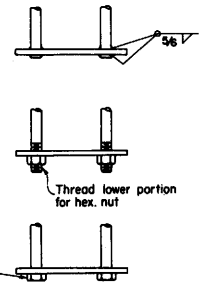
APPROVED September 1, 1966

STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO.5945



ELEVATION

HANDHOLE DETAILS

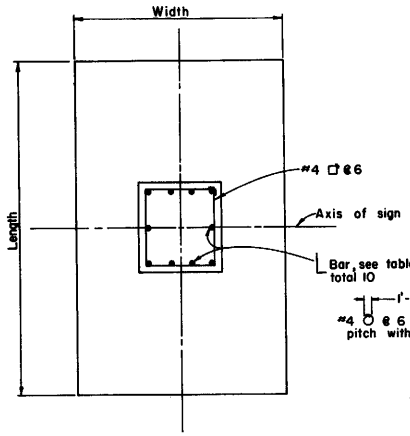


ALTERNATE BAR CONNECTIONS

ANCHORAGE DETAILS

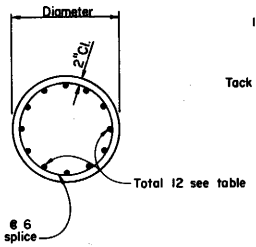
POST SIZE	BASE PLATE	ANCHOR BOLT DIA.	C.I.D.H. PILE			SPREAD FOOTING				
			Dia.	L	Reinf. Size	Pedestal	Footing	Reinf. Top	Reinf. Bot.	Reinf. L Bar
6 ¢ 18.97	1'-2" x 1'-2" x 1 1/2"	1 1/4"	24"	8'	#5	1'-10" x 1'-10"	4'-0" x 6'-0"	#4	#4	#5
6 ¢ 28.57	1'-2" x 1' 2" x 1 1/2"	1 1/2"	24"	9'	#5	1'-10" x 1'-10"	4'-0" x 7'-0"	#4	#4	#5
8 ¢ 28.55	1'-6" x 1'-4" x 1 1/2"	1 1/2"	30"	9'	#6	2'-2" x 2'-0"	5'-0" x 8'-0"	#4	#4	#5
8 ¢ 43.39	1'-6" x 1'-4" x 2"	1 3/4"	30"	11'	#7	2'-2" x 2'-0"	6'-0" x 9'-0"	#4	#5	#5
10 ¢ 54.74	1'-8" x 1'-6" x 2"	2"	30"	13'	#8	2'-4" x 2'-2"	7'-0" x 10'-0"	#5	#7	#7
12 ¢ 65.42	1'-8" x 1'-6" x 2"	2 1/2"	30"	15'	#10	2'-4" x 2'-2"	7'-0" x 12'-0"	#6	#8	#8
14 ¢ 72.09	1'-10" x 1'-6" x 2 1/4"	2 1/2"	36"	15'	#10	2'-6" x 2'-2"	7'-0" x 13'-0"	#7	#9	#8

NOTE: Base plates, pedestals and footings shall be placed with long dimensions normal to axis of sign. On single post signs the post shall be raked out of plumb with the use of the leveling nuts to make the botom of the sign frame level. Backfill shall be in place prior to erection of post.



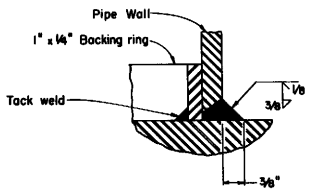
PLAN

SPREAD FOOTING



PLAN

CAST-IN-DRILLED-HOLE PILE



DETAIL A

BASE PLATE DETAILS

GENERAL NOTES

DESIGN: A.A.S.H.O. Specifications for the Design and Construction of Structural Supports for Highway Signs, dated November 1960.

CONSTRUCTION: Standard Specifications, Division of Highways, dated July 1964 and the special provisions.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

LIGHTWEIGHT SIGNS FOUNDATION

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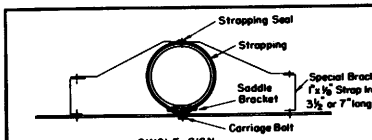
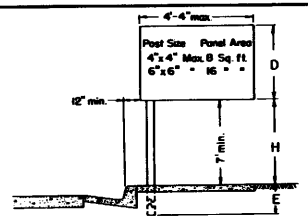


SINGLE SIGN

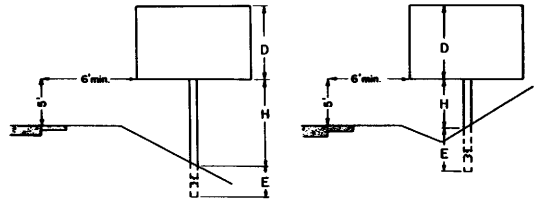
MULTIPLE SIGNS

INSTALLATION ON LIGHTING STANDARD



SIDEWALK LOCATIONS

NOTE: Lateral distance to sign edge should be 2' beyond the improved shoulder. The distance from the pavement must allow sufficent clearance for trucks or wide vehicles to park clear of pavement.



RURAL LOCATIONS

APPROVAL RECOMMENDED

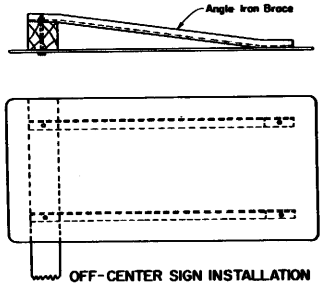
J. E. Wilson
Traffic Engineer
Registered Civil Engineer License No 8586

Approved SEPTEMBER 1, 1966

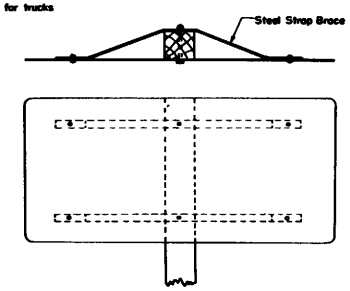
State Highway Engineer
Registered Civil Engineer License No 5945

NOTES

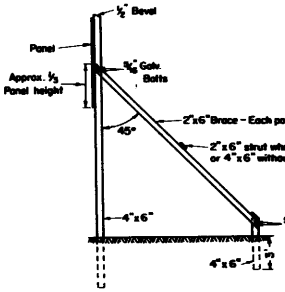
1. - Attach 2"x6" to concrete by means of 1/2" bolts at 4 1/2' centers cast into the concrete or fastened by approved expansion anchorage devices. Embedment of anchorage devices shall be 3 1/2" minimum. Holes shall be drilled by non-percussion methods.
2. - Contractor shall furnish anchorages, bolts, nuts and lumber necessary to attach panels to bridge.



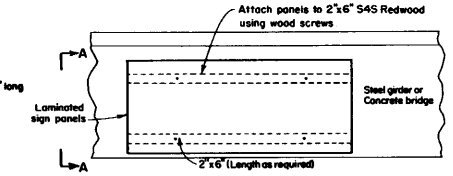
OFF-CENTER SIGN INSTALLATION

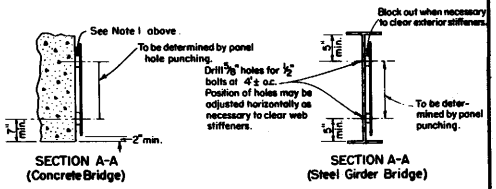


BALANCED SIGN INSTALLATION



BRACE FOR SIGNS IN EXCESS OF H=10' & 30 SQUARE FOOT PANEL



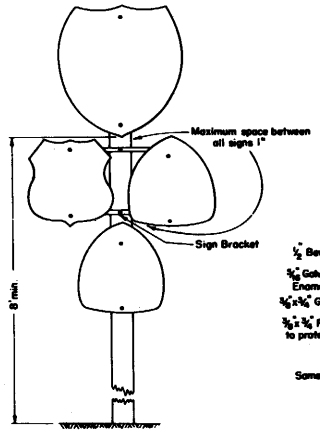


SECTION A-A (Concrete Bridge)

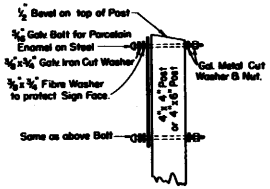
SECTION A-A (Steel Girder Bridge)

(See Note 2 above)

SIGN INSTALLATION ON BRIDGES

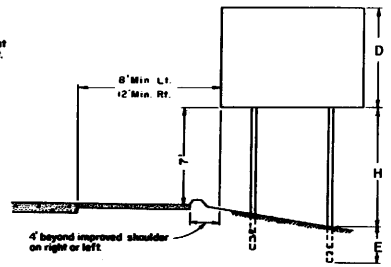


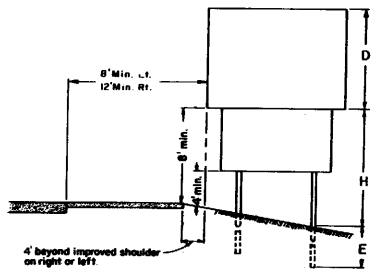
MULTIPLE INSTALLATION



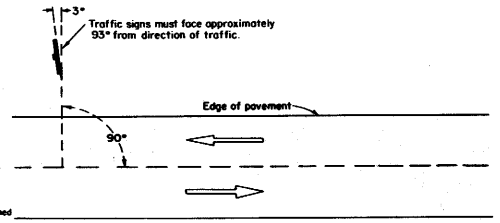
POST SPACING TABLE

Length of Sign A	Type of Panel	No. Posts	Overhang B	Post Spacing C
4'-6"	Horizontal	2	6"	3'-6"
5'-0"	"	2	9"	3'-6"
5'-6"	"	2	12"	3'-6"
6'-0"	"	2	12"	4'-0"
6'-6"	"	2	15"	4'-0"
7'-0"	"	2	15"	4'-6"
7'-6"	"	2	18"	4'-6"
8'-0"	"	2	18"	5'-0"
8'-6"	"	2	20"	5'-2"
9'-0"	"	2	22"	5'-4"
9'-6"	"	2	23"	5'-8"
10'-0"	"	2	24"	6'-0"
10'-6"	"	2	24"	6'-6"
11'-0"	"	2	24"	7'-0"
11'-6"	"	2	27"	7'-0"
12'-0"	"	2	30"	7'-0"
12'-6"	"	2	30"	7'-6"
13'-0"	"	2	30"	8'-0"
13'-6"	"	2	30"	8'-6"
14'-0"	"	2	30"	9'-0"
14'-6"	"	2	36"	8'-6"
15'-0"	"	2	36"	9'-0"





FREEWAY AND EXPRESSWAY LOCATIONS



POSITION WITH RELATION TO DIRECTION OF TRAFFIC

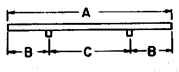
Use braces for posts shown in heavy outline.

SIGN Length	SIGN Square Feet Panel Area	No. of Posts		H+D 6'	8'	10'	12'	14'	16'
Max. 4'-4"	Max. 8 Sq. ft.	1	Post Size	4"x4"	4"x4"	4"x6"	4"x6"	4"x6"	4"x6"
			E	3.0'	3.0'	3.5'	3.5'	3.5'	3.5'
	8 to 20	1	Post Size	4"x4"	4"x6"	4"x6"	4"x6"	6"x6"	6"x6"
			E	3.5'	3.5'	3.5'	4.0'	4.0'	4.0'
4'-4" to 10'	8 to 16	2	Post Size	4"x4"	4"x4"	4"x6"	4"x6"	4"x6"	4"x6"
			E	3.5'	3.5'	4.0'	4.0'	4.0'	4.0'
4'-4" to 15'	16 to 30	2	Post Size	4"x6"	4"x6"	4"x6"	6"x6"	6"x6"	6"x6"
			E	3.5'	4.0'	4.0'	4.5'	5.0'	5.0'
4'-4" to 15'	30 to 60	2	Post Size	4"x6"	4"x6"	4"x6"	4"x6"	4"x6"	4"x6"
			E	4.0'	4.0'	3.0'	3.0'	3.5'	3.5'
4'-4" to 15'	30 to 60	2	Post Size			5@14	5@14	5@14	6@18
			E			6'	6'	6'	6'

Steel posts for signs 30 s.f. to 60 s.f. when indicated elsewhere on the Plans.

NOTES:

1. All sign panels to be furnished by State.
2. Exact size and location of sign posts to be determined by the engineer.
3. All lumber shall be S4S.
4. When using 4"x6" post, place 6" side normal to sign.
5. For steel post details see "Post & Pole Details" sheet.
6. Place steel post in 12" dia. hole and fill with Class "C" concrete.
7. Unframed sheet signs 36" or more in width require back bracing. A single brick brace shall be used for signs 36" or less in height, and unframed diamond signs. Two braces shall be used for signs in excess of 36" in height.



STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

TYPICAL INSTALLATION DETAILS
ROADSIDE SIGNS MAX. L=15' WOOD POSTS

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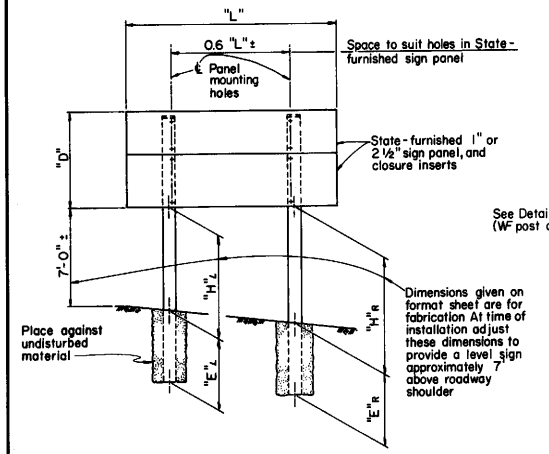
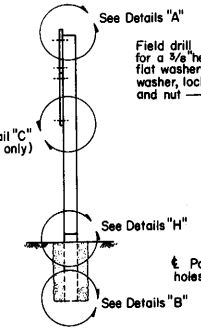
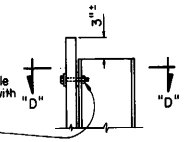


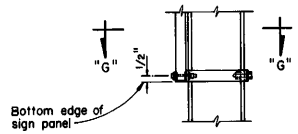
ELEVATION



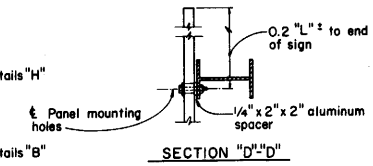
END VIEW



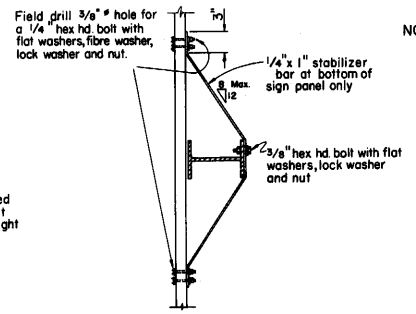
DETAIL "A" - WF POST



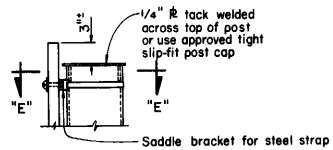
DETAIL "C"



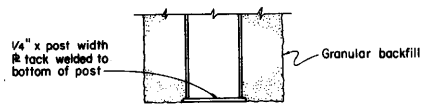
SECTION "D"-"D"



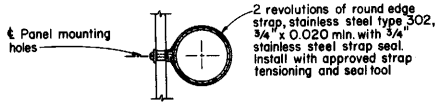
SECTION "G"-"G"



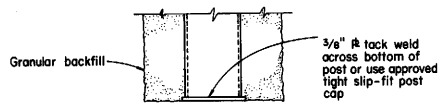
DETAIL "A"-PIPE POST



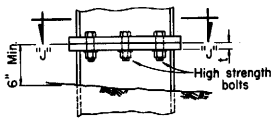
DETAIL "B"-WF POST



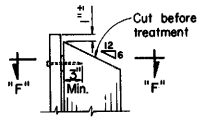
SECTION "E"-"E"



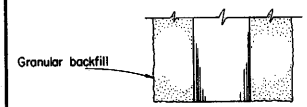
DETAIL "B"-PIPE POST



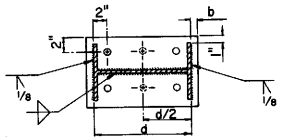
DETAIL "H"
Optional splice for WF posts



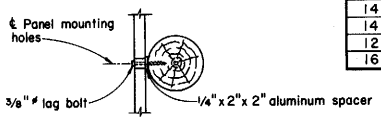
DETAIL "A"- TIMBER POLE



DETAIL "B"- TIMBER POLE



SECTION "J"-"J"



SECTION "F"-"F"

SECTION	PLATE "t"	FILLET WELD SIZE	NO. OF BOLTS	BOLT SIZE	"b"
6 WF 15.5	3/4"	3/16"	4"	1"	1/2"
8 WF 17	3/4"	3/16"	4"	1"	1/2"
8 WF 20	3/4"	3/16"	4"	1"	1/2"
10 WF 21	3/4"	3/16"	4"	1"	1/2"
8 WF 24	3/4"	3/16"	4"	1 1/8"	1/2"
10 WF 25	3/4"	3/16"	4"	1 1/8"	1/2"
12 WF 27	1"	3/16"	4"	1 1/8"	1/2"
12 WF 31	1"	3/16"	4"	1 1/8"	1/2"
14 WF 34	1"	1/4"	4"	1 1/4"	1/2"
16 WF 36	1"	1/4"	4"	1 1/4"	1/2"
12 WF 40	1"	1/4"	4"	1 1/4"	1"
14 WF 43	1"	1/4"	4"	1 1/4"	1"
14 WF 48	1"	1/4"	6"	1 1/4"	1"
12 WF 53	1"	1/4"	6"	1 1/4"	1 1/2"
16 WF 58	1"	5/16"	6"	1 1/4"	1 1/2"

POST SPLICES

APPROVAL RECOMMENDED

BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO.5585

APPROVED September 1, 1966

STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO.5945

NOTES:

See roadside sign format and/or sign location and quantities sheet for:

1. Station of each sign.
2. Distance from edge of pavement or other layout line.
3. Length of sign (L).
4. Depth of sign (D).
5. Height (H) of each post or pole above ground.
6. Depth of embedment (E) for each post or pole.
7. Diameter of granular backfill.
8. Size and shape of post or class of timber pole.

When steel pipe shapes are indicated for posts on the roadside sign format sheet the contractor may elect to provide aluminum pipe section (alloy 6061-T6 or 6062-T6) having equal cross sectional area and size. All posts on any one sign shall be of the same material.

When WF shapes are specified for posts the contractor may submit to the engineer his proposal for an equivalent section of steel or aluminum. Sections will be approved which, in the opinion of the engineer, provide resistance to bending equal to that provided by the steel WF called for on the plans.

Contractor may submit details and location of splice for metal posts to the engineer for approval. Splices which do not develop the design stress of the post will not be approved. An approved splice for steel WF shapes is shown below.

Complete shop plans shall be submitted for all contractor-proposed splice details and substitute sections.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

ROADSIDE SIGNS
POST AND POLE DETAILS | S 43-6

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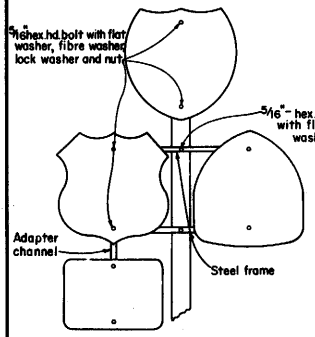
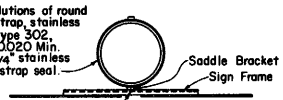
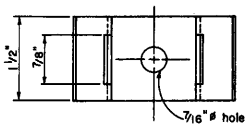


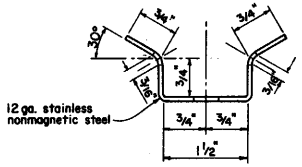
MULTIPLE INSTALLATION



PLAN

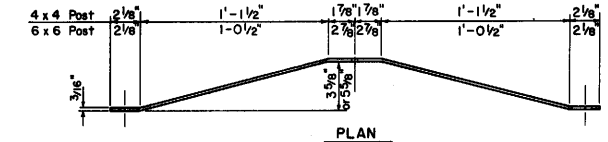
MULTIPLE SIGNS ON LIGHTING STANDARD



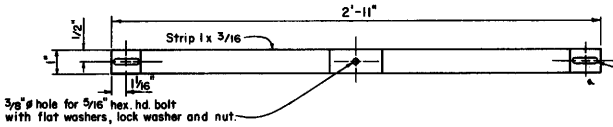


PLAN VIEWS

SADDLE BRACKET



PLAN



ELEVATION

BACK BRACE DETAILS

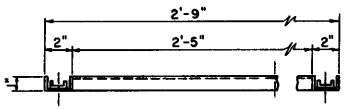
FOR BALANCED SIGN INSTALLATION

APPROVAL RECOMMENDED

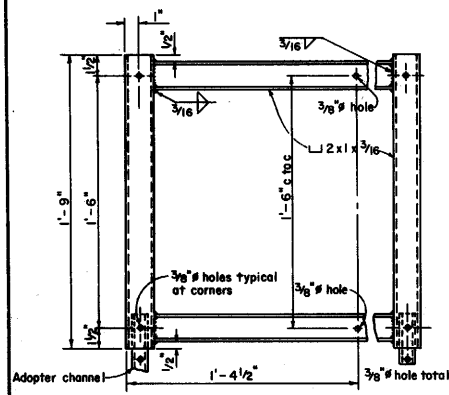
BRIDGE ENGINEER
REGISTERED CIVIL ENGINEER NO.5585

APPROVED September 1, 1966

STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO.5945



PLAN



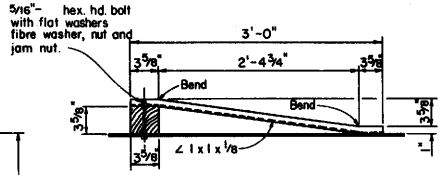
ELEVATION

STEEL FRAME

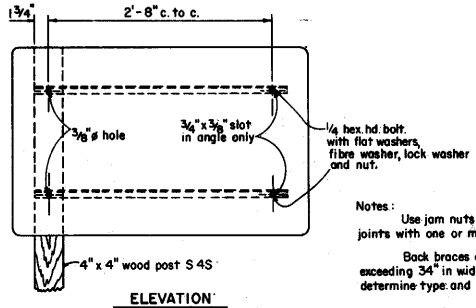
FOR ROUTE MARKER ASSEMBLY

ADAPTER CHANNEL FOR ARROWS AND PLATES

Note: Adapter channel nests inside frame channel when used.



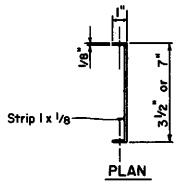
PLAN



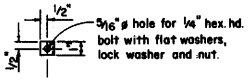
ELEVATION

OFF-CENTER SIGN INSTALLATION

(Wood post shown; metal post similar)



PLAN

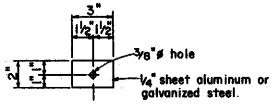


ELEVATION

SPECIAL BRACKET

FOR SINGLE SINGLE SIGN ON LIGHTING STANDARD

(see sheet "S42")



SPECIAL SPACER BLOCK

FOR SINGLE SHEET REFLECTORIZED SIGNS WITH BACKPANS

Notes:

Use jam nuts in lieu of lock washers in bolted joints with one or more wood members.

Back braces are required on single post signs exceeding 34" in width - holes provided in sign metal determine type and number.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

ROADSIDE SIGNS

TYPICAL MOUNTING HARDWARE

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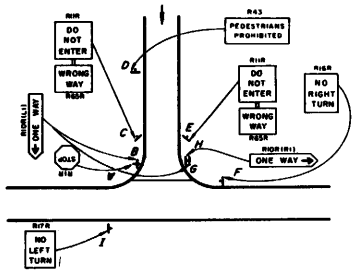
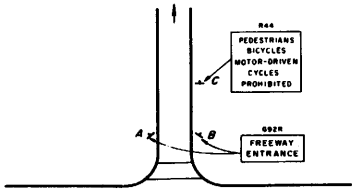
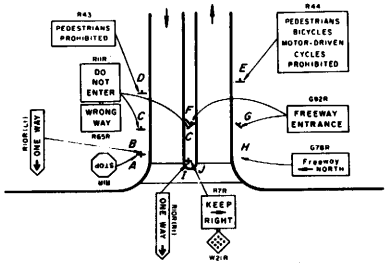
OFF-RAMP DETAIL "A"



ON - RAMP DETAIL "B"



ON AND OFF-RAMP DETAIL "C"



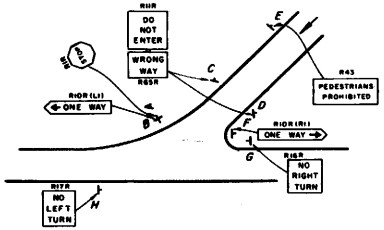
APPROVAL RECOMMENDED

Traffic Engineer
Registered Civil Engineer No. 8586

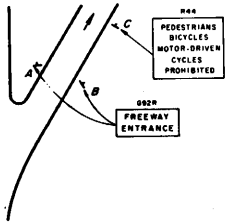
Approved SEPTEMBER 1, 1966

State Highway Engineer
Registered Civil Engineer No. 5945

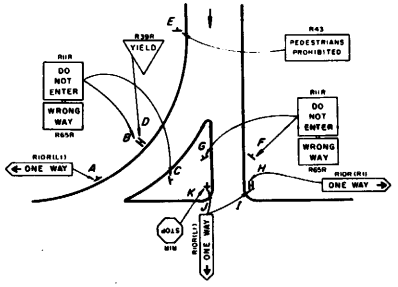
OFF-RAMP DETAIL "D"



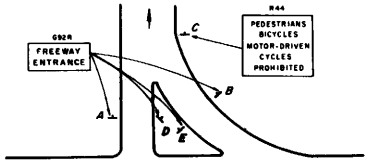
ON-RAMP DETAIL "E"



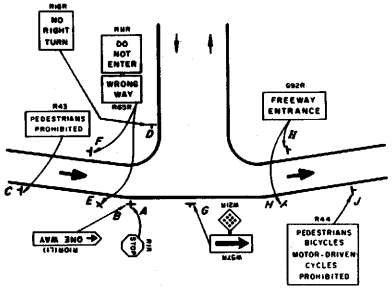
OFF-RAMP DETAIL "F"



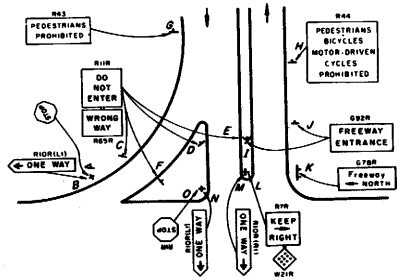
ON - RAMP DETAIL "G"



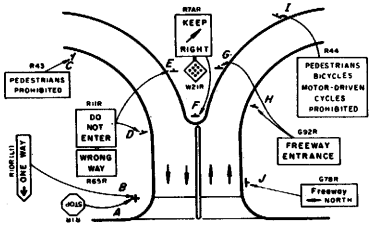
ON AND OFF-RAMP DETAIL "H"



ON AND OFF-RAMP DETAIL "I"



ON AND OFF-RAMP DETAIL "J"



NOTES:

1. R43 or R44 shall be installed for enough up the ramps to avoid conflict with the signs nearer the entrance (75'-100' from other signs)
2. The G92R "FREEWAY ENTRANCE" signs shall be installed as near the actual entrance as is practicable
3. Standard mounting height of primary signs 5', except R11R to be 6' to provide for R65R below.
4. Omit R11R at signalized intersections.
5. Where an off-ramp has a free right turn lane as in Details F & I, a single set of R11R, R65R signs may be used further up the ramp where it becomes a single roadway. Optimum location to be determined by engineer.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

MINOR ROADSIDE SIGNS
TYPICAL LOCATION DETAILS S45-2

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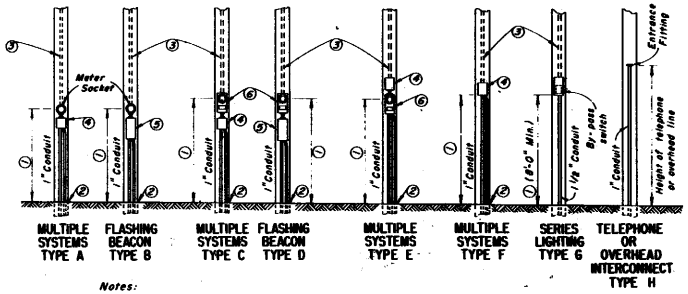
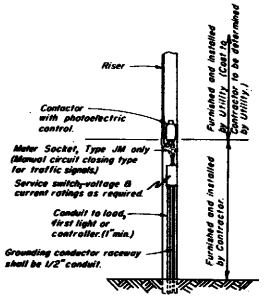
APPROVAL RECOMMENDED

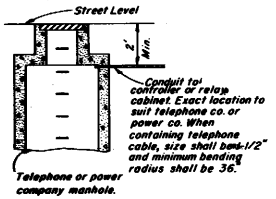
TRAFFIC ENGINEER
REGISTERED CIVIL ENGINEER NO. 8586

APPROVED SEPTEMBER 1, 1966

STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5945





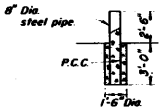


Notes:

1. Position of service equipment to be determined by serving utility.
2. See "Service Grounding" detail.
3. If service pole is utility owned, service riser shall be furnished by contractor and installed by serving utility. On state owned poles, the service riser shall be furnished and installed by contractor. Service riser conduit shall be terminated with a service head and shall be sealed to prevent the entrance of water, as approved by serving utility.
4. Service switch.
5. Flashing beacon control with service switch.
6. Meter socket box with either manual circuit closing device or space for test block as specified.

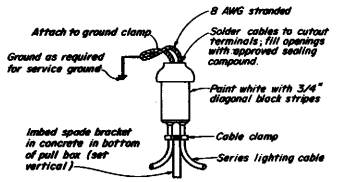
ELECTRICAL AND TELEPHONE SERVICE DETAILS

NO SCALE

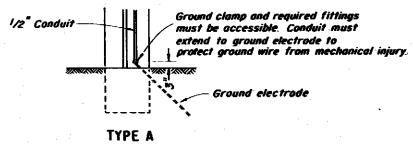


GUARD POST

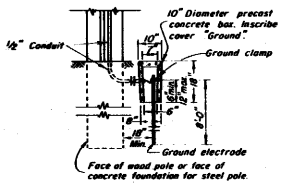
NO SCALE



GROUNDING CUTOUT



TYPE A



TYPE B

(Use where serving utility requires 18" between electrode and pole.)

Installation shown is for sidewalk or paved areas. Omit concrete box and locate ground clamp and fittings above ground in unpaved areas.

Notes:

When water pipe is used for ground, wire shall be enclosed in galvanized rigid conduit, or equivalent mechanical protection.

Rod or pipe electrodes shall be driven to a depth of at least 8 ft. below surrounding grade.

SERVICE GROUNDING

NO SCALE

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

TRAFFIC SIGNAL AND HIGHWAY LIGHTING INSTALLATIONS DETAILS NO. 1

ES-1-3

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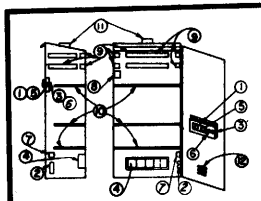
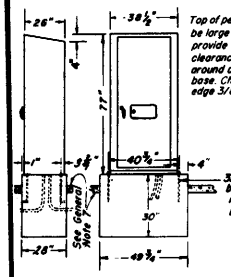
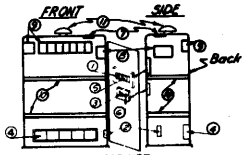
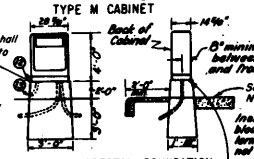




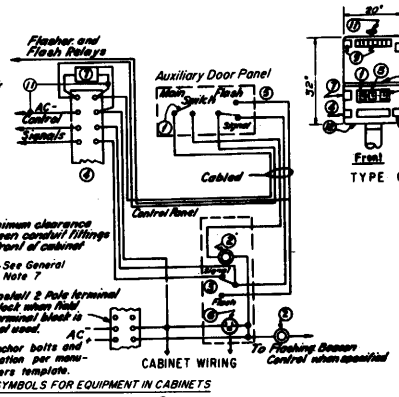
TYPE R CABINET



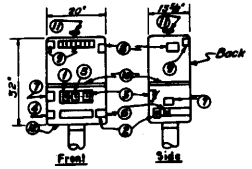
TYPE M CABINET



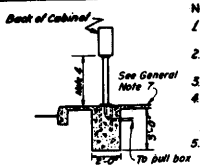
P.C.C. PEDESTAL FOUNDATION
TYPE M CABINET



CABINET WIRING



TYPE G CABINET



PEDESTAL AND FOUNDATION
TYPE G AND PRE-TIMED CONTROLLER CABINETS

NOTES:

1. Pedestal, base, and foundation details similar to Type 1 Standard. (Unless otherwise specified.)
2. Cabinets shall be provided with slip fitter to permit mounting on 4½" O.D. pedestal.
3. Upper end of pedestal shall be 4½" O.D.
4. The distance between the bottom of the controller cabinet and top of the foundation shall be:
   3'-7" for pre-timed controllers.
   3'-0" for traffic actuated controllers.
5. Conduit between foundation and adjacent pull box shall be 2" size minimum.

APPROVAL RECOMMENDED

TRAFFIC ENGINEER
REGISTERED CIVIL ENGINEER NO. 8586

APPROVED SEPTEMBER 1, 1966

STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5945

SYMBOLS FOR EQUIPMENT IN CABINETS

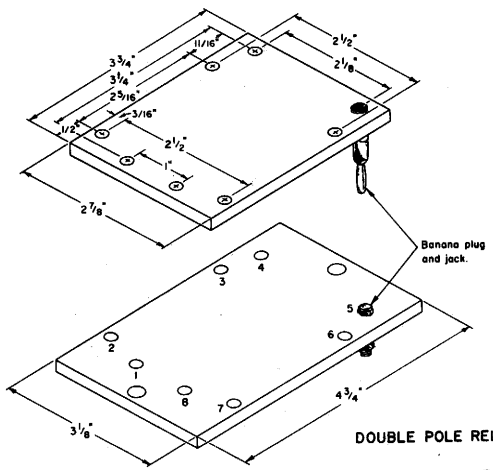
1. Main switch
2. Fuse receptacle. Cartridge fuses in Type R cabinet. Plug fuses in other cabinets.
3. Controller - Flash - Signal switch
4. Field wire terminal blocks. Mount on metal shelf when specified.
5. Auxiliary door flash switch
6. N.E.M.A. Standard plug receptacle with grounding contact
7. Radio interference suppressor
8. Flasher
9. External light and control relays
10. Shelf (adjustable every 2" in Type R cabinet) Controller unit located on top shelf.
11. Rainlight vent (and cabinet fan when specified)
12. Screened vent, 8-1/2" holes or louvers
13. 1" Drain pipe with screen

GENERAL INSTALLATION NOTES - ALL CABINETS

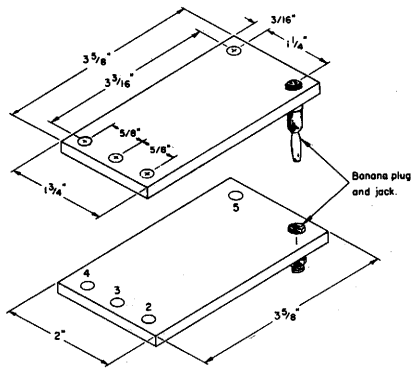
1. All cabinet dimensions are nominal.
2. Foundations shall be located to provide 2'-0" minimum clearance between face of curb and back of cabinet.
3. One anchor bolt shall be bonded to conduit or ground wire.
4. If telephone interconnect is specified a minimum of 5 inches clear vertical space shall be left beneath all other equipment inside cabinet.
5. Not more than two conductors from a detector or push-button circuit shall be connected to a terminal on the terminal board in the controller cabinet.
6. For telephone interconnect a 3/4" conduit shall be installed inside the steel or P.C.C. pedestal to a point 1 inch above the cabinet or finished surface of the P.C.C. pedestal. Conduit shall terminate in a No. 3-1/2 pull box adjacent to the foundation.
7. In unpaved areas, a raised P.C.C. pad of 2'-6" x 3'-0" x 0'-4" for Type G, M and Pre-timed controller cabinets and of 4'-1" x 3'-0" x 0'-4" for Type R cabinets shall be placed in front of each controller cabinet.
8. In all unpaved areas top of foundation for G, R and Pre-timed controller cabinets shall be 6" above surrounding grade. In paved areas top of foundation for G and Pre-timed controller cabinet/pedestal shall be level with surrounding grade.
9. Anchor bolts, nuts and washers shall be galvanized.
10. Locations shown for equipment is typical only.
11. Controllers and relays shall be located to permit easy and safe removal from plug-in mounting.

DETAILS OF CONTROLLER CABINETS

NO SCALE



DOUBLE POLE RELAY



SINGLE POLE RELAY

DETAILS OF SIGNAL LIGHT RELAY

BASES AND RECEPTACLES

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

TRAFFIC SIGNAL AND HIGHWAY LIGHTING INSTALLATIONS
DETAILS NO. 2A

ES-2A-2

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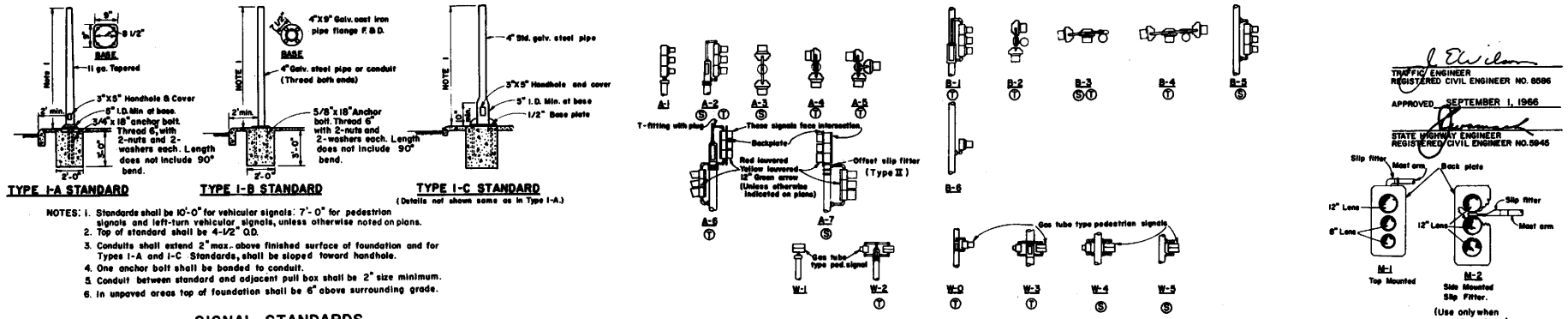

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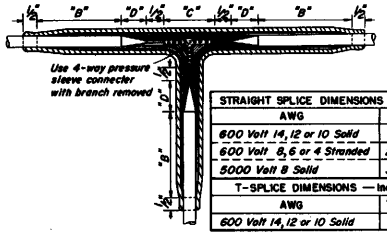
STRAIGHT SPLICE (600 V or 5000 V)



STRAIGHT SPLICE DIMENSIONS — Inches		
AWG	"B"	"D"
600 Volt 14, 12 or 10 Solid	2"	½"
600 Volt 8, 6 or 4 Stranded	2½"	½"
5000 Volt 8 Solid	3¼"	1"
T-SPLICE DIMENSIONS — Inches		
AWG	"B"	"D"
600 Volt 14, 12 or 10 Solid	2"	½"

"C" = Connector length

600 VOLT "T" SPLICE

PROCEDURE

A. Remove insulation from each conductor to distance ½ C + ½" and pencil to dimension D. Roughen penciling.

B. Train conductors and place connector, centering over butted cable ends

C. Crimp connector. If crimping tool is not ratchet type, solder crimp connection.

D. Insulate. Use method "A" on high voltage circuits unless otherwise specified.

INSULATING METHODS

Low Voltage Circuits (0-600 volts) Method "A"

1. Apply one coat of rubber cement and allow to dry.
2. Apply low voltage tape to a thickness equal to original insulation.

High Voltage Circuits (601-5000 volts) Method "A"

1. Apply one coat of rubber cement and allow to dry.
2. Apply high voltage tape to a thickness equal to original insulation.
3. Apply two layers of low voltage tape, half lapped.

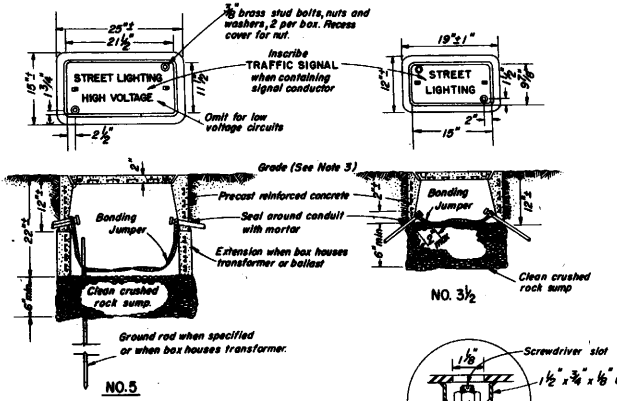
High Voltage or Low Voltage Circuits — Method "B"

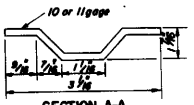
1. Apply two layers, half lapped, of synthetic, oil resistant, self fusing rubber tape.
2. Apply .007" thick P.V.C. tape to a thickness equal to original insulation.
3. Apply two layers of asphalt impregnated, open meshed fabric tape and fuse in.

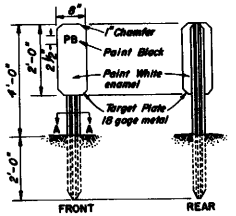
GENERAL NOTES

1. All dimensions are nominal.
2. Rubber tapes shall be rolled after application.
3. If P.V.C. low voltage tape is used as a final layer, paint finished splice with electrical insulating coating.

SPLICING

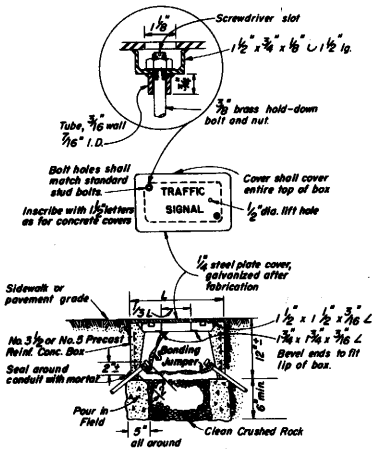






(Type A Guide Marker - No Reflectors)

PULL BOX MARKER



PULL BOX WITH TRAFFIC COVER

NOTES

1. Use steel cover and special concrete footing, as shown, when box is to be installed where subject to traffic loads. Steel cover shall have embossed non-skid pattern when box is placed in paved or sidewalk areas.
2. Steel reinforcing shall be as regularly used in the standard products of the respective manufacturer.
3. Top of pull boxes shall be flush with surrounding grade or top of adjacent curb, except that in unpaved areas where pull box is not immediately adjacent to and protected by a concrete foundation, pole or other protective construction, the box shall be buried 12 inches below grade and shall be marked by a pull box marker placed adjacent to the pull box. Where practicable, pull boxes shown in the vicinity of curbs shall be placed adjacent to the back of curb, and pull boxes shown adjacent to standards shall be placed on side of foundation facing traffic, unless otherwise noted.

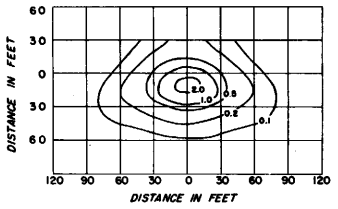
PULL BOXES

APPROVAL RECOMMENDED

TRAFFIC ENGINEER
REGISTERED CIVIL ENGINEER NO. 8586

APPROVED SEPTEMBER 1, 1966

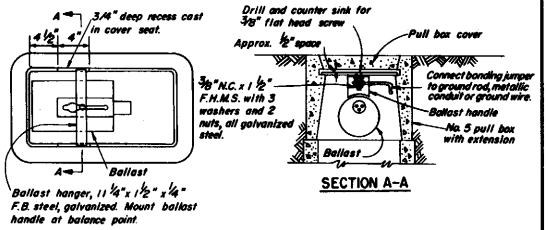
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5945



TYPE III

Shielded Highway Lighting Luminaire, 30' Mounting Height, 20,000 Lumen Mercury Vapor Lamp

ISOLUX LINES OF MINIMUM HORIZONTAL FOOT CANDLES



SECTION A-A

BALLAST INSTALLATION IN PULL BOX

No Scale

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

TRAFFIC SIGNAL AND HIGHWAY LIGHTING INSTALLATIONS DETAILS NO. 3A

ES-3A-1

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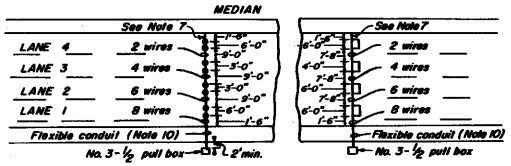
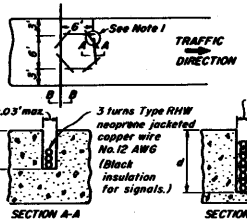




TRAFFIC COUNTING CONDUCTOR COLOR CODE

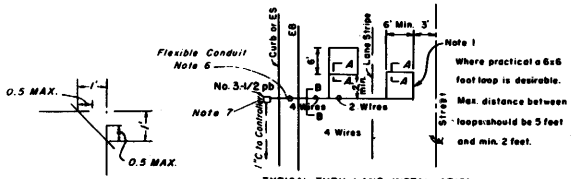
Lane	Color
1	Red
2	Yellow
3	Green
4	Blue
5	White

Notes: For Loop Installations

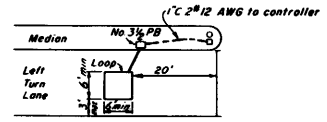
1. Saw groove in pavement for loops. Corners may be diagonal as shown in detail "C".
2. Overlap cuts at all corners so slots are full depth at corners.
3. Push wire in with wood. Do not use screwdriver or other metallic instrument.
4. Pour clean dry white silica sand in slot to cover conductors. Fill slot with flexible epoxy resin conforming to specifications. Repeat pouring clean dry white silica sand to cover slot.
6. Maximum slot depth shall be 0.23'.
7. Make cut all the way across pavement.
9. Provide a minimum of 5' of slack in each conductor at pull box.
10. Flexible conduit (size as required) to be placed in sawed channel slot or rigid conduit may be placed under curb or shoulder to pull box.
11. Lead-in conductors from each loop to pull box shall be twisted together a minimum of two turns per foot from point of leaving pavement to inductive loop detector.
12. TESTS:
    (a.) Test each loop for continuity.
    (b.) A megger test shall be made between loops. Insulation resistance shall be not less than two megohms.

lanes	d
2	0.12' min.
3	0.14' min.
4	0.18' min.
5	0.21' min.

DETAIL "C"- DIAGONAL CORNER CUTS



TYPICAL THRU LANE INSTALLATION



TYPICAL LEFT TURN LANE INSTALLATION

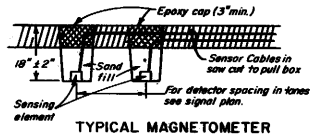
TYPICAL LOOP DETECTOR INSTALLATIONS

APPROVAL RECOMMENDED

TRAFFIC ENGINEER
REGISTERED CIVIL ENGINEER NO. 8586

APPROVED SEPTEMBER 1, 1966

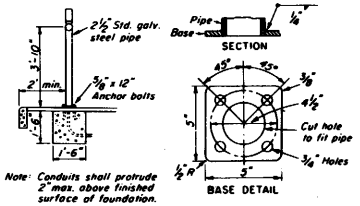
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5945



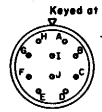
TYPICAL MAGNETOMETER DETECTOR INSTALLATION

Notes: For Loop Installations

1. Saw groove in pavement for loops. Corners may be diagonal as shown in Detail "C".
2. Overlap cuts at all corners so slots are full depth at corners.
3. Push wire in with wood. Do not use screwdriver or other metallic instrument.
4. Pour clean dry white silica sand in slot to cover conductors. Fill slot with flexible epoxy resin conforming to specifications. Repeat pouring clean dry white silica sand to fill slot.
5. Provide a minimum of 5' of slack in each conductor at pull box.
6. Flexible conduit (size as required) to be placed in sawed channel slot or rigid conduit may be placed under curb or shoulder to pull box.
7. Lead-in conductors from each loop to pull box shall be twisted together a minimum of two turns per foot.
8. In pull-box, splice conductors from loop to a cable of 2 No. 12 AWG conductors to sensor unit. In controller cabinet.
9. Sections A-A and B-B shall be as shown for traffic counting detectors.
10. Pressure type terminals applied to inductive loop detector terminals shall be soldered.
11. Tests:
    (a) Test each loop for continuity.
    (b) A megger test shall be made between loops. Insulation resistance shall be not less than two megohms.



PEDESTRIAN PUSH BUTTON POST



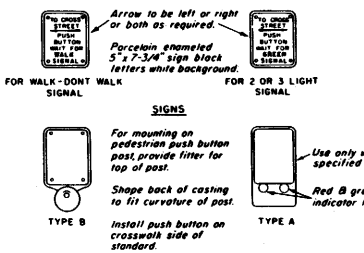
Type MS 3102A-18-1P plug

A-AC.
B-Relay common
C-AC
D
E } Loop
F-Normally closed
G-Normally open
H-Chassis ground
I-24 DC+
J-24 DC−

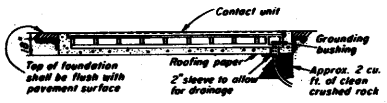
PLUG CONNECTOR FOR SENSOR UNIT WITH INTEGRAL POWER SUPPLY

DETECTOR INSTALLATIONS
TRAFFIC COUNTING

DETECTOR INSTALLATIONS
TRAFFIC SIGNAL



PEDESTRIAN PUSH BUTTON & SIGN

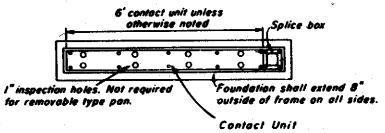


ELEVATION

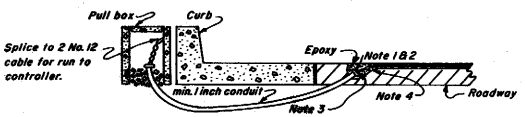
Installation Notes:

1. Detector position dimensions refer to contact unit.
2. Concrete under removable contact unit mounting pan shall be finished flush with top of gun supporting angles.
3. Detector contact unit surface shall be flush with rim of housing or no more than 1/8" higher, if low, unit shall be raised using one-piece, galvanized, sheet metal shims with dimensions the same as the bottom surface of the contact unit.
4. Screw threads shall be coated with anti-seize compound. All screws shall be tightened securely.

PRESSURE SENSITIVE DETECTOR



PLAN



1. Non-metallic bushing shall be used at roadway end of conduit.
2. Tape wire 3 inches each side of roadway bushing.
3. Install flexible compound on low side of roadway conduit before installing wire.
4. Round all sharp edges where wire has to pass.
5. End of roadway conduit shall be 2 inches below roadway.

TYPICAL DETAIL OF RIGID CONDUIT BETWEEN ROADWAY AND PULL BOX

VEHICLE DETECTORS

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

TRAFFIC SIGNAL AND HIGHWAY LIGHTING INSTALLATIONS
DETAILS NO. 3B

ES-3B-8

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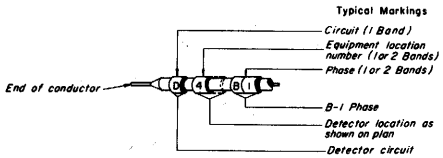
SYMBOLS

PROPOSED	EXISTING	
		Ultra-sonic detector (Side fire type Existing)
		Magnetometer Detector
		Inductive loop detector
		Non-directional pressure detector
		Non-directional magnetic detector
		Directional pressure detector
		Traffic signal with all colors louvered
		Traffic signal each arrow one-way three color (On Type 1-A standard unless otherwise specified)
		Traffic signal one way three color with backplate (On Type 1-A standard unless otherwise specified)
		Traffic signal one way three-color with green arrow (On Type 1 standard unless otherwise specified. Red and yellow louvered.)
		Walk-Don't Walk pedestrian signal (7' Type 1 standard unless otherwise indicated.)
		Pedestrian signal, 2 color head. (Existing).
		Mast arm traffic signal with backplate, Type XXI, Standard unless otherwise specified.
		Electrolier, mast arm type with mast arm traffic signal with backplate Type XXII Standard unless otherwise specified.
		Electrolier, mast arm type Type XX Standard unless otherwise specified.
		Electrolier, upright type
PPB	ppb	Pedestrian push button
PPB	ppb	Pedestrian push button on special push button post
		Telephone pole
		Power pole
		Flashing beacon, one-way
		Fire hydrant
		Overhead conductor
		Signal conduit
		Lighting conduit
		Pull box
		Controller
		Flush soffit luminaire, Detail "F," (arrow indicates "street" side)
		Pendant soffit luminaire, Detail "P," (arrow - "street" side.)
		Wall-mounted luminaire, Detail "W"

Typical Markings



TYPICAL BANDING OF CONDUCTOR ENDS

CONDUIT

1. Unless otherwise indicated, conduit in service and detector runs shall be 1 inch and all other conduit shall be 1-1/2 inch.
2. Conduit shall be installed 18" minimum below curb grade in sidewalk areas and 30" minimum below grade or finished surface in all other areas except that conduit installed within curbed dividing strips constructed on existing pavement may be laid on and secured to the pavement.
3. Conduit runs parallel to curbs shall be placed adjacent to back of curb, except where in conflict with existing facilities. Minimum depth shall be 12 inches.
4. Existing underground conduit to be incorporated into new systems shall be cleaned with a mandrel and blown out with compressed air.
5. Conduit terminating in standards and pedestals shall extend 2" max. above finished top of foundation and shall slope toward the handhole.
6. Conduit entering controller cabinets shall be sealed with paraffin or other approved sealing compound.
7. Service risers shall be terminated with a service head and shall be sealed to prevent the entrance of water, as approved by the serving utility.
8. Conduit shall not be run through foundations for standards.

PULL BOXES

1. Pull boxes shall be No. 5 except as noted.

CONDUCTORS AND WIRING

1. Signal neutral shall be #10 AWG conductor.
2. Conductors between ballasts or transformers and luminaires shall be #10 AWG, 600 volt.
3. Conductors between series-to-multiple transformers and sign fixture ballasts shall be #12 AWG, 600 volt or larger.
4. Number of conductors indicated in signal system conduit includes three #14 AWG spares.
5. Conductors shall be identified with bands.
6. Underground conductors to signals shall be run without splices, except that where existing signals are being modified, signal conductors may be spliced where indicated.
7. Neutral conductors may be spliced in pull box.
8. Two feet of slack shall be provided in each conductor in each pull box.
9. A separate conductor, other than neutral, shall be run from each pressure detector to controller cabinet.
10. Connection to each terminal of a pedestrian push button shall be by a single conductor. Splices shall be made in nearest pull box.
11. Color coding for wiring to pedestrian signals shall be as specified for corresponding vehicular green and red indications.
12. One side of secondary circuit of series-to-multiple and step-down transformers shall be grounded. On structures the grounding electrode shall be the conduit system. Off structures, it shall be 1/2" x 8' ground rod installed through bottom of pull box.

SIGNAL EQUIPMENT

1. Vehicular and pedestrian signal mountings shall be oriented so as to provide maximum horizontal clearance to adjacent roadway.

ELECTROLIERS

1. A mercury-vapor lamp ballast shall be installed in a pull box adjacent to each electrolier, unless integral ballast type luminaires are used.

FOUNDATIONS

1. Top of foundations for standards shall be level with top of curb in curbed areas or 6 inches above surrounding grade in other areas.
2. Except as indicated, standards shall be installed with 2 foot clearance to face of curb, edge of shoulder, back of dikes, and back of ditches.

APPROVAL RECOMMENDED

TRAFFIC ENGINEER
REGISTERED CIVIL ENGINEER NO. 8586

APPROVED SEPTEMBER 1, 1966

STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5945

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

TRAFFIC SIGNAL AND HIGHWAY LIGHTING INSTALLATIONS DETAILS NO. 4

ES-4-3

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POLE TYPE	POLE HEIGHT & GAUGE	POLE BASE DIAMETER "c"	BASE PLATE DIMENSIONS "a"	BASE PLATE DIMENSIONS "b1"	BASE PLATE DIMENSIONS "b2"	BASE PLATE SLOT SIZE "f"	ANCHOR BOLTS DIMENSIONS ②	ANCHOR BOLTS BOLT CIRCLE DIAMETER
II	20' x 10ga. ①	6 5/8"	11 1/2"	9 1/2"	11 1/2"	1 1/4"	1" x 36"	9 1/2
II-a	25' x 10ga. ①	7 5/16"	11 1/2"	9 1/2"	11 1/2"	1 1/4"	1" x 36"	10"
III	30' x 7ga.	8"	11 1/2"	9 1/2"	11 1/2"	1 3/8"	1 1/4" x 40"	11"
XIII-a	35' x 7ga.	8 11/16"	13 1/2"	11"	12 1/2"	1 1/2"	1 1/4" x 44"	11 1/2"
X	30' x 10ga. ①	8"	11 1/2"	9 1/2"	11 1/2"	1 1/4"	1" x 36"	11"
X-a	35' x 10ga. ①	8 11/16"	13 1/2"	11"	12 1/2"	1 1/4"	1" x 36"	11 1/2"
XIV	20' x .188" thick	7"	11"	8 1/2"	11 1/2"	1 1/4"	③	10"

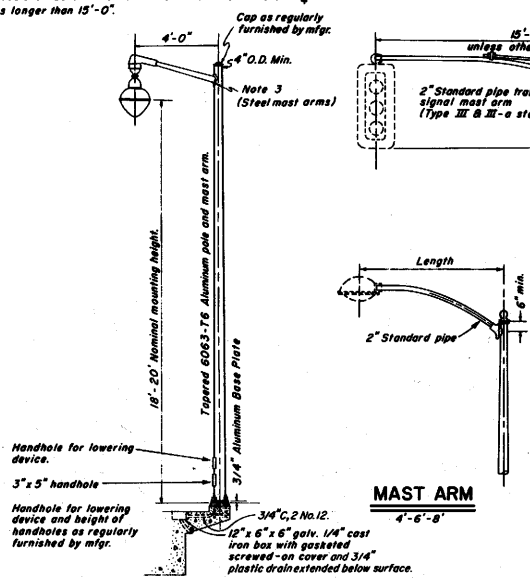
BASE AND ANCHOR BOLT SCHEDULE

NOTE

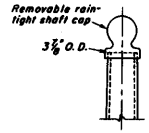
1. 11 gage acceptable if fabricated from sheet steel of 40,000 p.s.i. minimum yield.
2. Length indicated does not include required 4"-90° bend.
3. See Standard Electrical Details-Bridge (ES-7) for structure mounted standard.

TIE RODS

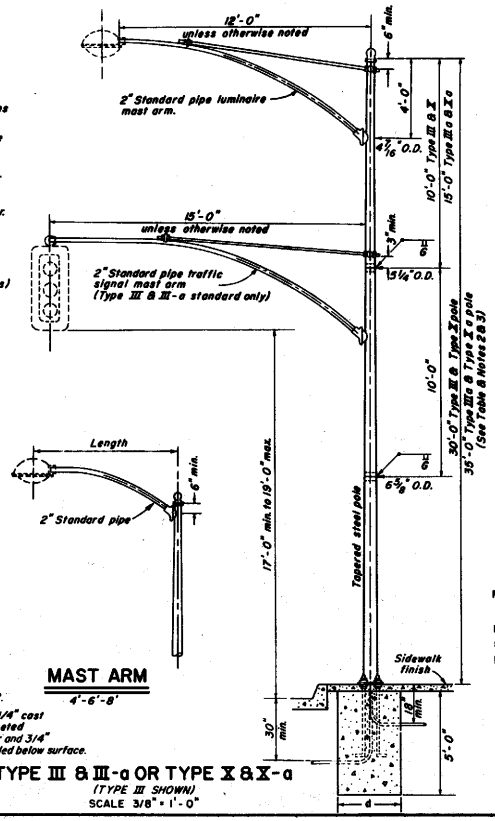
1. All traffic signal mast arms and mast arms 12' and longer for luminaires with integral ballasts shall be equipped with standard pipe tie rods with welded 5/8" round bolt tips on each end, threaded 5". Weld shall be coated with zinc-oxide paint or galvanized.
2. Pipe tie rods shall be 3/4" for 12'-0" to 15'-0" mast arms and 1 1/4" for mast arms longer than 15'-0".



TYPE XIV
(P.O.C. Electrolier)
SCALE 3/8" = 1'-0"

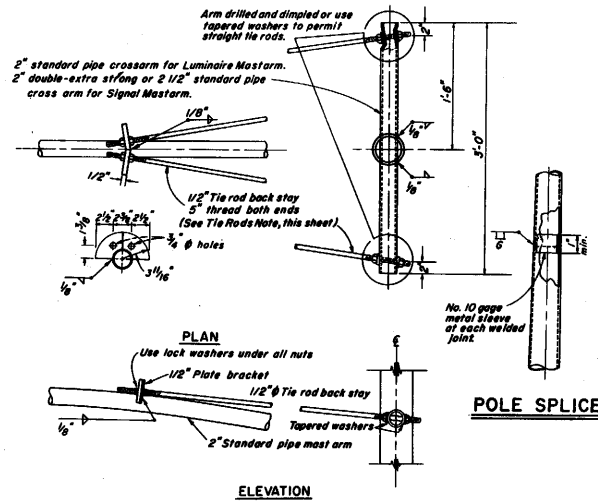


POLE TOP

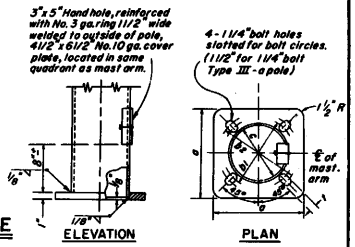


MAST ARM
4'-6"-8'

TYPE III & III-a OR TYPE X & X-a
(TYPE III SHOWN)
SCALE 3/8" = 1'-0"



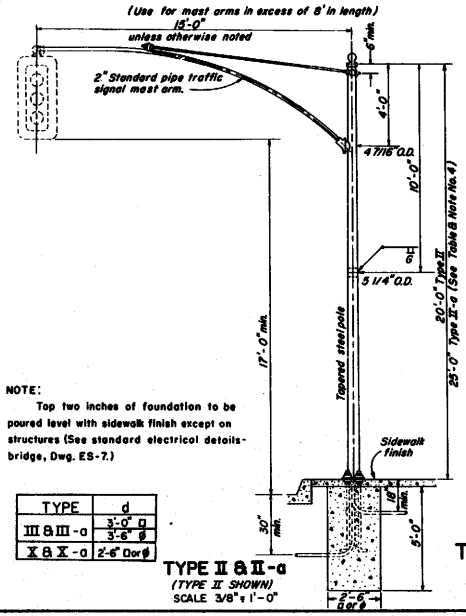
POLE SPLICE



POLE BASE

MAST ARM TIE RODS AND CROSS ARM

(Use for mast arms in excess of 8' in length)



NOTE:
Top two inches of foundation to be poured level with sidewalk finish except on structures (See standard electrical details-bridge, Dwg. ES-7.)

TYPE	d
III & III-a	3'-0" □ / 3'-6" ϕ
X & X-a	2'-6" □ or ϕ

TYPE II & II-a
(TYPE II SHOWN)
SCALE 3/8" = 1'-0"

APPROVAL RECOMMENDED

TRAFFIC ENGINEER
REGISTERED CIVIL ENGINEER NO. 8586

APPROVED SEPTEMBER 1, 1966

STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5945

CALIF-TYPE STANDARDS

GENERAL AND INSTALLATION NOTES

1. All steel shafts and mast arms shall be galvanized. Bolts, screws, nuts, washers and tie rods shall be galvanized.
2. The lower 5' length of a 35' Type III-a pole shall consist of a 5'-7 gage tapered section (8" O.D. to 8 11/16" O.D.) butt welded to the lower end of a 30' Type III pole.
3. The lower 5' length of a 35' Type X-a pole shall consist of a 5'-10 gage tapered section (8" O.D. to 8 11/16" O.D.) butt welded to the lower end of a 30' Type X pole.
4. The lower 5' length of a 25' Type II-a pole shall consist of a 5'-10 gage tapered section (6-5/8" to 7-5/16" O.D.) butt welded to the lower end of a 20' Type II pole.
5. For standards to be installed on structures, see Drwg. ES-7.

STEEL MAST ARMS

1. Luminaire mast arms shall be so curved that when mast arm is fastened to pole the luminaire end shall not be below top of pole or more than 1'-6" above.
2. The last 3" of the mast arm shall be straight and shall be horizontal with luminaire or traffic signal attached.
3. Connection between mast arm and pole shall be made by means of a raintight socket of a design permitting simple removal of the mast arm and providing a chased outlet for electrical conductors.

ANCHOR BOLTS

1. Each standard shall be supplied with 4 anchor bolts.
2. Each anchor bolt shall be provided with 6" of thread and an 4"-90° bend and shall be furnished with two nuts and two washers. Washers shall be 11/16" x 2-1/2" min.
3. Threads may be cut or rolled. Bolts shall be galvanized or plated after threads are formed.
4. One anchor bolt shall be bonded to conduit.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

TRAFFIC SIGNAL AND LIGHTING STANDARDS
TYPES II, II-a, III, III-a, X, X-a & XIV
DETAILS NO. 6

ES-6-5

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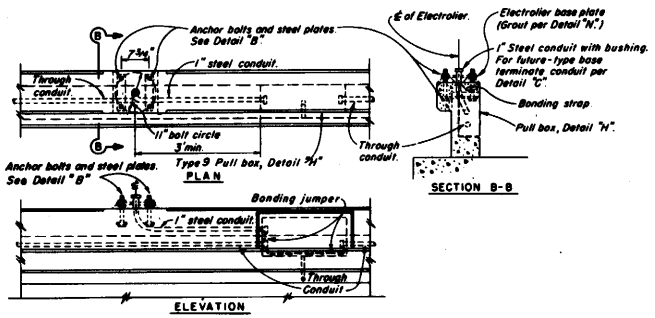
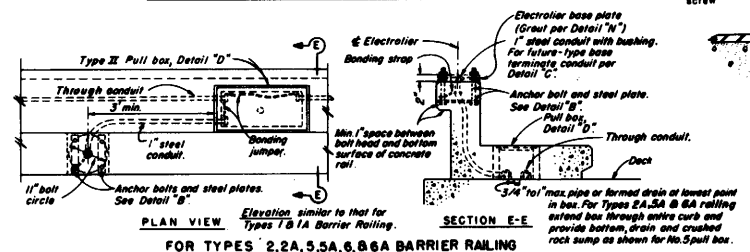


FOR TYPES 1, 1A AND 9 BARRIER RAILING

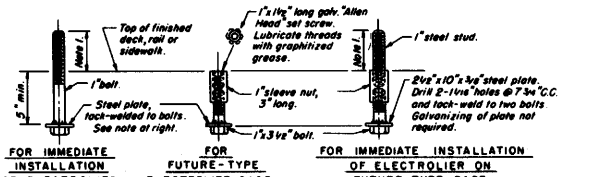


FOR TYPES 2, 2A, 5, 5A, 6, & 6A BARRIER RAILING

See sheet titled "Barrier Railing" for structural details at electrolier.

DETAIL "A" ELECTROLIER BASE AND PULL BOX INSTALLATION

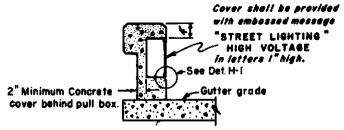
Scale: 3/4" = 1'-0"



Notes:
1. Anchor bolt or stud length shall be such that thread extends 1/8" maximum above nut on level base plate after grouting. See Detail "N".
2. Electrolier anchor bolts shall be held in position for pouring by means of suitable templates. Deviation from the true position, vertical and height, shall not exceed 1/16".
3. Nuts, threaded ends of anchor bolts, and studs shall be galvanized. The threads shall accept nuts without requiring use of tools or removal of protective galvanizing. Threads shall be 1" N.C.

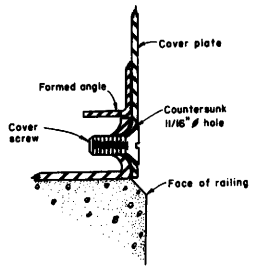
DETAIL "B" ELECTROLIER ANCHOR BOLTS

Scale: 3/16" = 1"



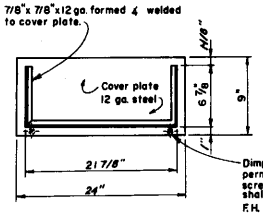
INSTALLATION FOR TYPES 1 AND 1A RAILING

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



DETAIL H-1

No Scale



COVER DETAIL

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

INSTALLATION NOTES

1. Box axis shall be parallel to top of railing.
2. Close box during pouring with 1/4" plywood of sufficient size to provide 1:1 chamfer on 3 sides of cover. Upper edge of of plywood shall fit against lower edge of raintight hood.

FABRICATION NOTES

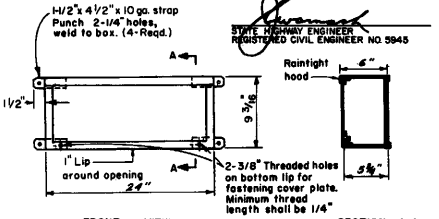
1. Box and cover shall be hot-dip galvanized after fabrication. Slot in raintight hood shall be cleaned out to permit cover to fit under.

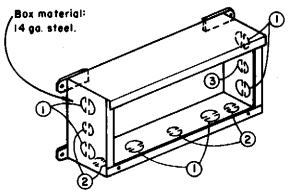
APPROVAL RECOMMENDED

TRAFFIC ENGINEER
REGISTERED CIVIL ENGINEER NO. 8586

APPROVED SEPTEMBER 1, 1966

STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5945





GENERAL DETAILS

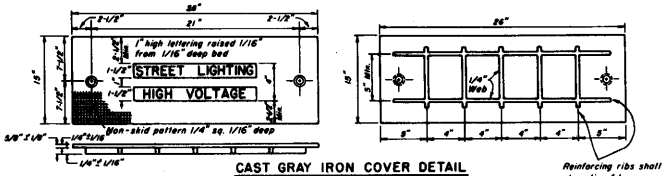
Scale: 1 1/2" = 1'-0"

Knockout Schedule

1. 1 1/2" conduit, 2-each end, 2 on bottom.
2. 1/2" drain, 3 in bottom. Use one at center if box is horizontal, at low end box is inclined.
3. 1" conduit, 1-each end.

Pound knockouts flat after punching.

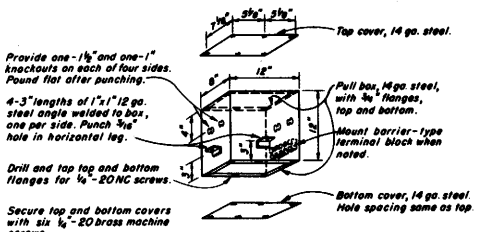
DETAIL "H" STRUCTURE PULL BOX (TYPE 9)



CAST GRAY IRON COVER DETAIL

Hot Dip Galv. After Fabrication

(No Scale)

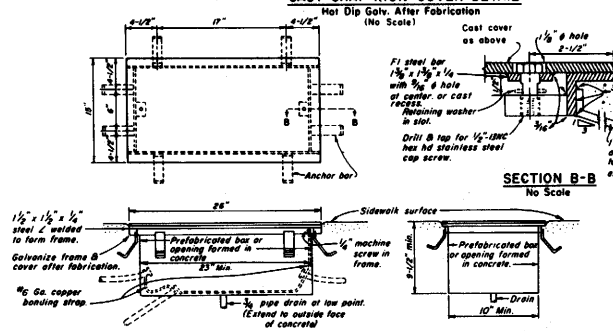


Notes:
1. Install with bottom flange flush with concrete.
2. Galvanize after fabrication.
3. Both covers shall be on box during pouring.

DETAIL "K" CEILING PULL BOX

No Scale

See Drawing No. ES-4 for symbols and installation notes.



Note: Prefabricated Boxes
1. Boxes may be concrete or galvanized steel.
2. Alternate methods of attaching covers may be used on prefabricated boxes.
3. Metal covers shall be grounded by means of a 3 foot flexible braid between conduit and cover.

DETAIL "D" STRUCTURE PULL BOX (TYPE II)

No Scale

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

ELECTRICAL DETAILS BRIDGE SHEET 1

ES-7A-3

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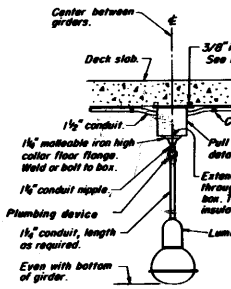
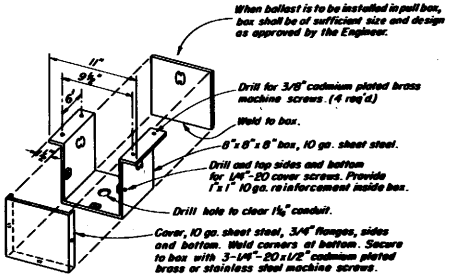
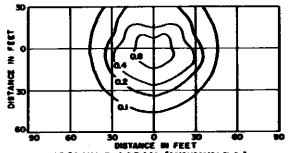


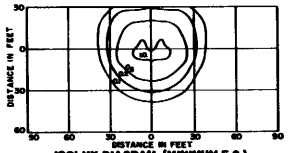


Notes:
1. Cast-in-place malleable iron wedge inserts or self-drilling expansion steel anchor.
2. Galvanize box and cover after fabrication.
3. Provide one 1½" knock-out 6" up on each side and back. Pound flat after punching.
4. For future installation, omit suspension conduit and luminaire, closed flange with galv. plug.

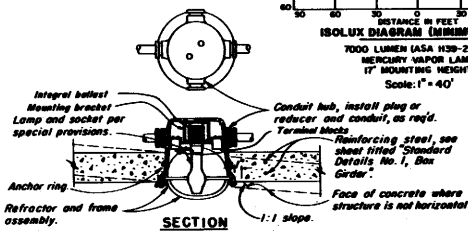


ISOLUX DIAGRAM (MINIMUM F.C.)
7000 LUMEN (ASA H39-22KB)
MERCURY VAPOR LAMP
17' MOUNTING HEIGHT
Scale: 1"=40'

DETAIL "P"
PENDANT SOFFIT LUMINAIRE
Scale: 1" = 1'-0"



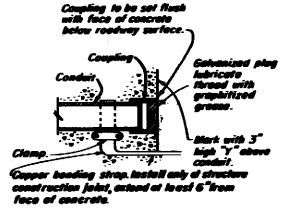
ISOLUX DIAGRAM (MINIMUM F.C.)
7000 LUMEN (ASA H39-22KB)
MERCURY VAPOR LAMP
17' MOUNTING HEIGHT
Scale: 1" = 40'



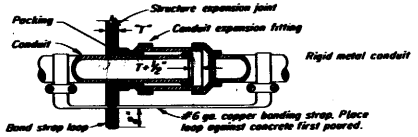
SECTION

Notes:
1. Place 1/4" plywood disk in body opening during pouring.
2. Install luminaire with axis vertical and "street side" of refractor oriented as indicated on lighting layout.
3. Luminaire shall be located so as to provide minimum clearance of 2 ft. from inside surface of girders and 1 ft. from near face of diaphragm.

DETAIL "F"
FLUSH SOFFIT LUMINAIRE
Scale: 3/32"=1"



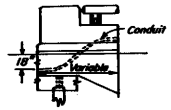
DETAIL "C"
CONDUIT TERMINATION
No Scale



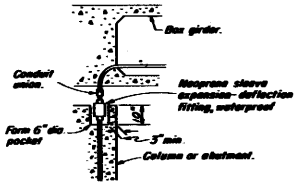
NOTES
1. Except for sidewalk joints, a conduit expansion fitting shall be installed at each 1/2-inch or greater structure joint, hinge or abutment.
2. Expansion fitting shall be installed parallel to superstructure girders.
3. When conduit is installed thru rail joints of bridges having skews greater than 30° or where lateral movement greater than 1/4" may occur, install neoprene sleeve expansion-deflection fitting straddling joint.

DETAIL "X"
CONDUIT EXPANSION JOINT
No Scale

APPROVAL RECOMMENDED
TRAFFIC ENGINEER
REGISTERED CIVIL ENGINEER NO. 8586
APPROVED SEPTEMBER 1, 1966
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5946

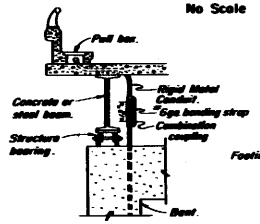


DETAIL I
CONDUIT TERMINATION AT END OF STRUCTURE

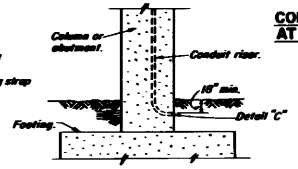


Notes:
1. Fitting and pocket required only where movement can occur between girder and column or abutment.
2. Fill pocket around fitting with resilient waterproof compound.

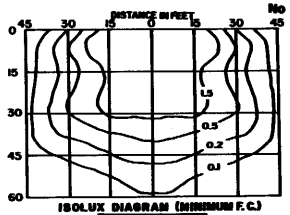
CONDUIT RISER CONNECTION AT COLUMN OR ABUTMENT
No Scale



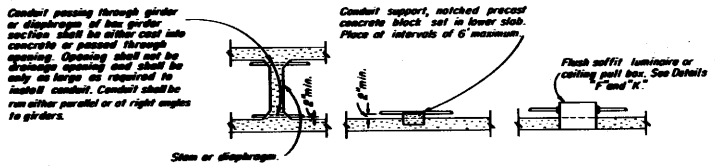
CONDUIT RISER CONNECTION
No Scale



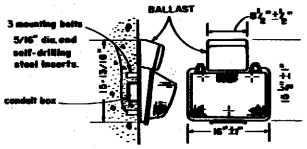
LOWER END OF CONDUIT RISER AT COLUMN OR ABUTMENT
No Scale



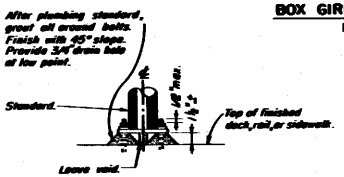
ISOLUX DIAGRAM (MINIMUM F.C.)
12000 LUMEN (ASA H37-3KB)
MERCURY VAPOR LAMP
15' MOUNTING HEIGHT
Scale: 1" =20'



CONDUIT INSTALLATION IN BOX GIRDER SECTIONS
No Scale



DETAIL "W"
WALL LUMINAIRE
Not to Scale



DETAIL "N"
GROUTING AT ELECTROLIER
No Scale

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

ELECTRICAL DETAILS
BRIDGE SHEET 2

ES-7B-1

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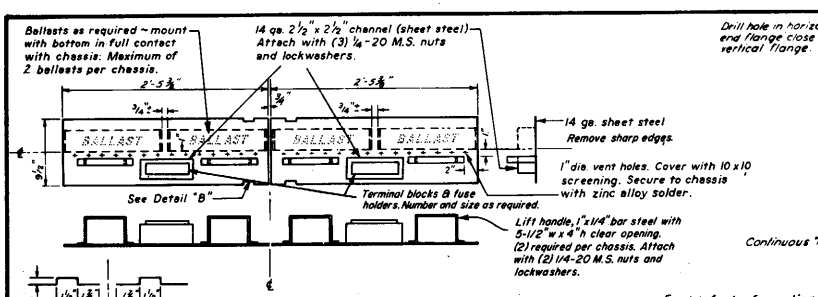


BALLAST MOUNTING CHASSIS

No Scale

BALLAST NOTES

Each ballast shall be fused with a 1 1/4" x 1/4" slow-blow glass tube fuse - 2 1/2 amp for 2-lamp ballast and 1 amp for 1-lamp ballast.

Ballasts shall be rated at 300 ma.

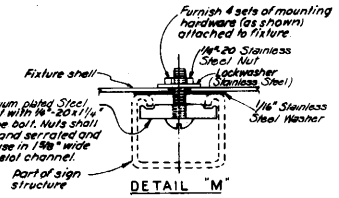
Ballasts shall be secured by 8-32 machine screw studs soldered to chassis with nuts and lockwashers.

Fuseholders shall be a panel mounted type, with screw type knob.

For number of ballast boxes see "Overhead Sign Format and Quantities" sheet.

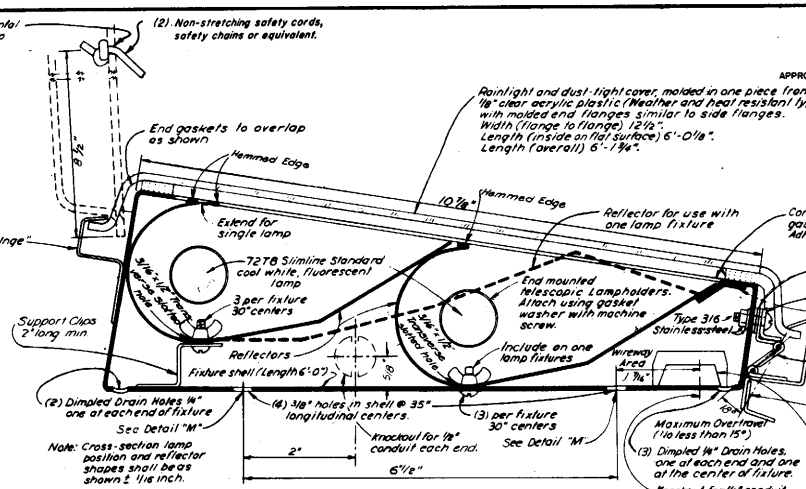
Chassis not requiring ballasts shall be furnished with lift handles, terminal channel and screened vents.

Two chassis shall be installed in each ballast box.



FIXTURE MOUNTING ON CONTINUOUS SLOT CHANNEL

Full Scale



APPROVAL RECOMMENDED

TRAFFIC ENGINEER
REGISTERED CIVIL ENGINEER NO. 8586

APPROVED SEPTEMBER 1, 1966

STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5945

SECTION - LIGHTING FIXTURE

Full Scale

FIXTURE NOTES

Two lamp fixtures shall be used for signs over 70" in vertical dimension. One lamp fixtures for 70" signs and smaller.

Lighting fixtures shall be fabricated of 0.064" clad 3003 H-14 aluminum, unless otherwise indicated. Machine screw parts and lockwashers for fixture shall be stainless steel, unless otherwise indicated.

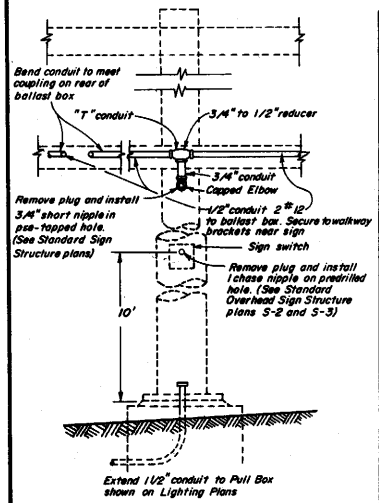
Reflectors shall be made of 0.020" (min.) thickness aluminum with specular finish, and shall be 69" long. The finish shall be as described in the special provisions. Remove protective coverings before installation.

Alternate fixture fabrication methods and design details may be acceptable provided the light distribution, lamp size, and the mounting details are equivalent to the fixture shown. All variations must be approved by the Engineer.

Machine screws shall be 8-32 with nuts and lockwashers (except as noted). Manufacturer shall submit five copies of shop drawings to the Engineer for approval prior to fabrication if fixtures have not previously been approved.

For method of mounting fluorescent fixtures see Walkways plan titled "Walkway Details No. 2".

After fabrication metal parts shall be thoroughly cleaned and degreased and shall have a well finished appearance. Painting will not be required.



TYPICAL WIRING AND SIGN SWITCH INSTALLATION DETAILS

No Scale

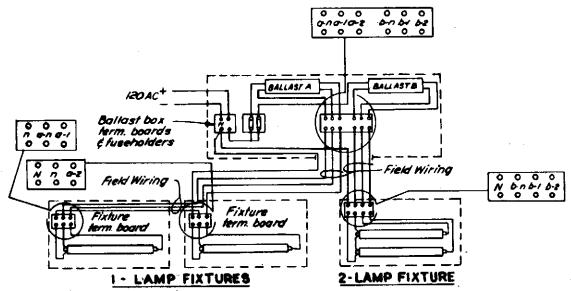
LIGHTING FIXTURE DATA

LENGTH OF PANEL (FEET)	HEIGHT OF PANEL (INCHES)	NUMBER OF FIXTURES	NUMBER OF LAMPS	CONSECUTIVE SPACING FROM LEFT EDGE OF PANEL TO CENTER OF FIXTURES (INCHES)
10	40-70 80-120	1	1 2	60
12	40-70 80-120	2	2 4	36.5,74
14	40-70 80-120	2	2 4	42,84
16	40-70 80-120	2	2 4	475,97
18	40-70 80-120	3	3 6	36.5,74 74
20	40-70 80-120	3	3 6	40,80 80
22	40-70 80-120	3	3 6	44,88,88
24	40-70 80-120	4	4 8	36.5,74,74,74
26	40-70 80-120	4	4 8	39,78,78,78
28	40-70 80-120	4	4 8	42,84,84,84
30	40-70 80-120	4	4 8	45,90,90,90
32	40-70 80-120	5	5 10	38,77,77,77,77
34	40-70 80-120	5	5 10	42,81,81,81,81
36	40-70 80-120	5	5 10	44,86,86,86,86
38	40-70 80-120	6	6 12	38,76,76,76,76,76
40	40-70 80-120	6	6 12	40,80,80,80,80,80
42	40-70 80-120	6	6 12	42,84,84,84 84,84
44	40-70 80-120	7	7 14	38,76,76,76,76 76,76
46	40-70 80-120	7	7 14	36.5,80,80,80, 80,80,80

TRANSFORMER AND LOAD DATA

TOTAL NUMBER OF LAMPS	SM TRANSFORMER SIZE (VA)	SIGN* LOAD (WATTS)
1	75	70
2	150	131
3	225	201
4	300	262
5	375	332
6	450	398
7	525	463
8	600	524
9	750	594
10	750	655
11	900	726
12	900	786
13	1050	856
14	1050	917
15	1200	987
16	1200	1048
17	1350	1118
18	1350	1179
19	1500	1249
20	1500	1310

Notes
For sign structure with 21 or more lamps the load shall be split into two ballast box groups with separate switching supplied independently from two SM transformers in separate pull boxes.
See Sign Format Sheet for size of panels.
Use one SM transformer for each sign structure unless otherwise indicated or required.
Use two 2-lamp ballasts wherever possible. Input to ballasts (90% pf) average 75 VA per lamp.
* Does not include SM transformer losses which are approximately 10% of load.



TYPICAL FIXTURE WIRING DIAGRAM

WIRING NOTES

Wiring between ballast box and nearest fixture and between fixtures shall be run in 1/2" liquid-tight flexible conduit. Flexible conduit shall be secured to the nearest walkway bracket using one-hole galvanized malleable iron or steel straps and brass machine screws tapped into the bracket.

Ballasts and terminal boards shall be marked with legible symbols, conductors shall be tagged and their identification marked on the corresponding terminal on the terminal board as shown on the Typical Fixture Wiring Diagram.

See Special Provisions for additional specifications.

GENERAL NOTE - METALS

Where steel is indicated, part shall be hot-dip galvanized after fabrication. Where sheet steel is indicated, part shall be fabricated from hot-dipped galvanized sheet steel. After fabrication, edges and flaws in galvanizing shall be cleaned and painted with two coats of Mil Spec. Mil-P-21035. Other metal parts shall be made of bronze, phosphor bronze, brass, copper, beryllium, or AISI Type 316 stainless steel unless otherwise noted.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

FLUORESCENT SIGN LIGHTING EQUIPMENT

ES-8-9

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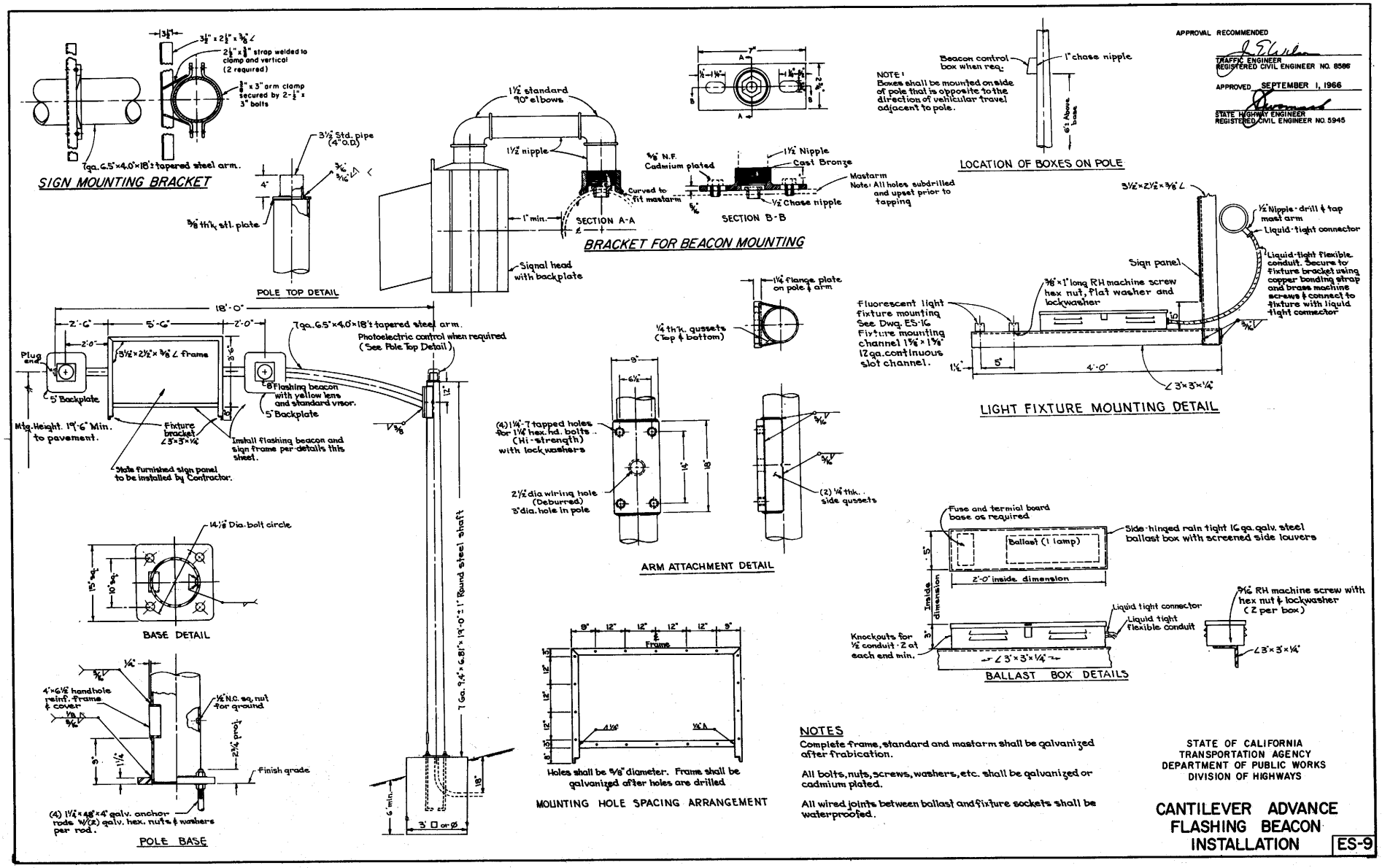

NOTES

Complete frame, standard and mastarm shall be galvanized after fabrication.

All bolts, nuts, screws, washers, etc. shall be galvanized or cadmium plated.

All wired joints between ballast and fixture sockets shall be waterproofed.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

CANTILEVER ADVANCE FLASHING BEACON INSTALLATION

ES-9

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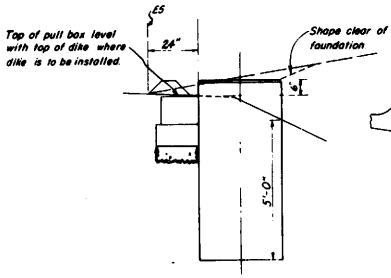
APPROVAL RECOMMENDED

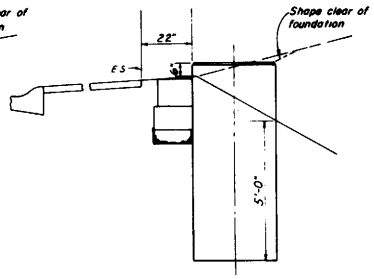
TRAFFIC ENGINEER
REGISTERED CIVIL ENGINEER NO. 8566

APPROVED SEPTEMBER 1, 1966

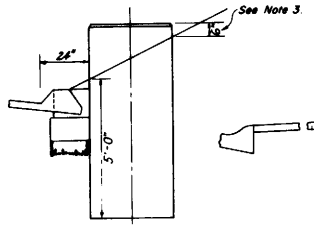
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5945



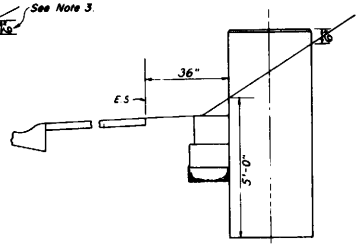
SHOULDER
(CUT SLOPES 6:1 AND FLATTER)*



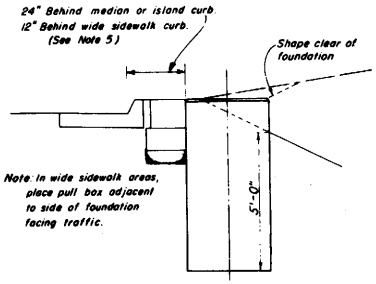
TYPE E CURB
WITH 5 FOOT SHOULDER
(CUT SLOPES 4:1 AND FLATTER)*



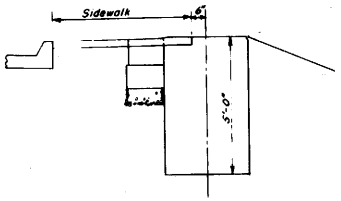
SHOULDER OR DITCH WITH DIKE
(SLOPES STEEPER THAN 6:1)



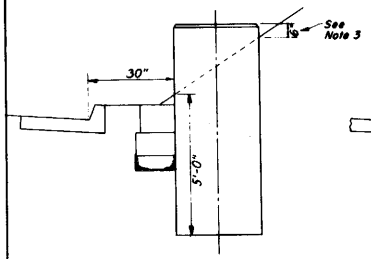
TYPE E CURB
(SLOPES STEEPER THAN 4:1)



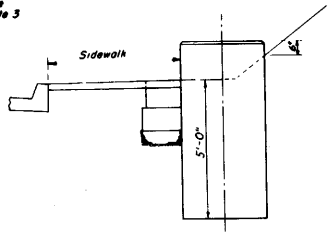
BARRIER CURB
(CUT SLOPES 6:1 AND FLATTER)*



BARRIER CURB
WITH NARROW SIDEWALK
(CUT SLOPES 3:1 AND FLATTER)*
See Note 5



BARRIER CURB
(SLOPES STEEPER THAN 6:1)



BARRIER CURB
WITH NARROW SIDEWALK
(SLOPES STEEPER THAN 3:1)
See Note 5

*ALL FILL SLOPES, LEVEL AREAS AND CUT SLOPES AS INDICATED

CUT SLOPES AS INDICATED

NOTES

1. Where all, or a portion, of the foundation is above grade, the top edges shall have a 1" chamfer and the exposed faces of foundation shall be finished with mortar to provide a uniform appearance.
2. Pull boxes shall be centered in front of foundation.
3. For slopes flatter than 4:1 this dimension may be approximately 1".
4. Conduit in foundation shall be 1 1/2" size (2" size if signals are mounted on electrolier) and shall extend 2" above top of foundation.
5. Narrow sidewalk: less than 8 feet wide.
   Wide sidewalk: 8 feet wide and greater.
6. See Drawing ES-6 or ES-13 for details of anchor bolt installation.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

TYPICAL ELECTROLIER FOUNDATION DETAILS NO. 11

ES-11

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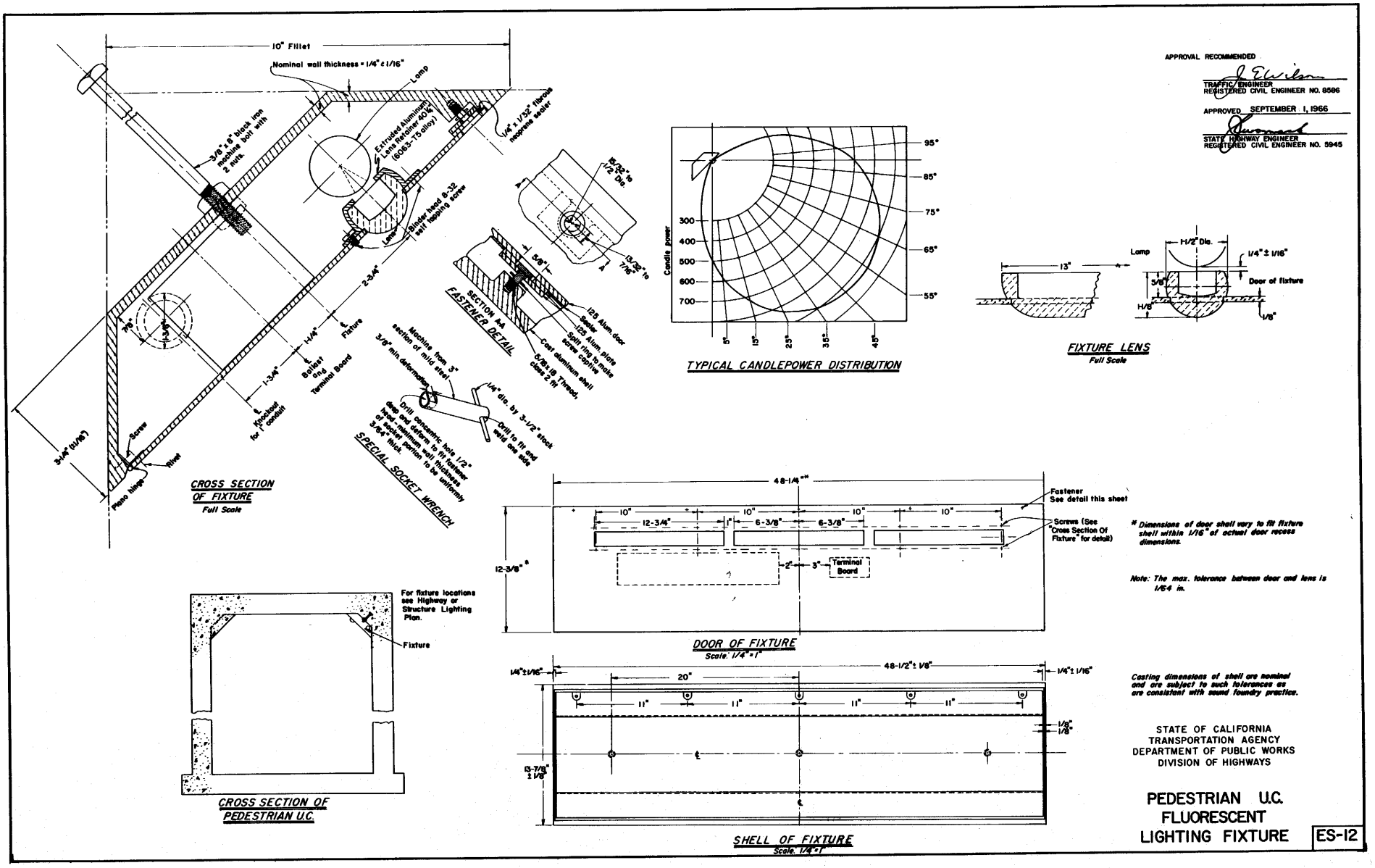

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ROUND TAPERED STEEL POLE					LUMINAIRE ARM LGT.	SIGNAL ARM LGT.	BASE PLATE				ANCHOR BOLTS	
TYPE	HGT	GAGE	MIN. O.D. Base	MIN. O.D. Top			a	b	c	t	Size ③	BC
XV	28'-6"	10ga ②	7 3/4"	3 7/8	6'—15'	None	11 1/2	5/8"	1 1/4"	1"	1"x36"	11"
XVI	18'-0"	10ga ②	7 3/4"	5 1/4"	None	15'—20	11 1/2	5/8"	1 3/4"	1"	1"x36"	11"
XVII	28'-6"	7ga.	7 3/4"	3 7/8	6'—15'	15	11 1/2	3/4	1 1/2"	1"	1 1/4x44	11"
					6'—12'	18						
					6'—10'	20						
		3ga.	7 3/4	3 7/8	15'	18	11 1/2"	3/4"	1 1/2"	1 1/4"	1 1/4x44	11"
					12'—15'	20						

POLE AND ANCHORAGE SCHEDULE

LUMINAIRE ARM DATA ①			
PROJECTED LENGTH	GAGE	MINIMUM O.D. @ POLE	MOUNTING HEIGHT
6'-0"	10ga ②	3.2"	30.0±'
8'-0"		3.5"	30.5±'
10'-0"		3.8"	31.3±'
12'-0"		3.8"	32.9±'
15'-0"		4.2"	32.8±'

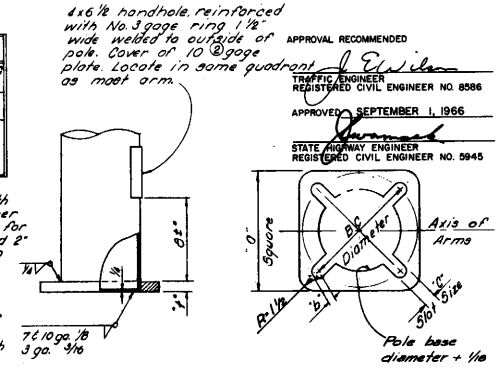
SIGNAL ARM DATA ①			
PROJECTED LENGTH	GAGE	MINIMUM O.D. @ POLE	MOUNTING HEIGHT
15'-0"	10ga ②	4.6"	22.3±'
18'-0		5.2"	23.3±'
20'-0	7ga	5.0"	

③ 4 anchor bolts each base plate. Length indicated does not include required 4"-90° bend. Top threaded 6" and furnished with 8 nuts and 2 washers. One anchor bolt bonded to Conduit. Threads may be cut or rolled. All steel shafts, mast arms, bolts, screws, nuts and washers shall be galvanized. Washers shall be 1/16 x 2 1/2 min.

NOTES

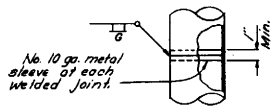
① Round tapered steel tube with maximum taper of .15 inches per foot. End section O.D. of 2 3/8 for mounting hardware. Standard 2" pipe extensions of 1'-0" max. on 6'-10' sizes and 3'-0 max. on 12'-20' sizes may be used at the option of manufacturer.

② No. 11 gage sheet steel of weldable grade acceptable if the steel after fabrication has a minimum yield strength of 40,000 psi.

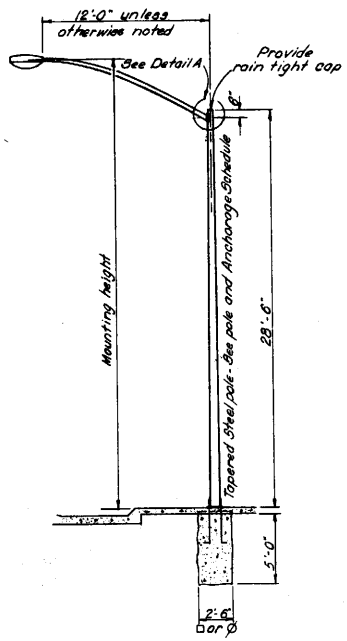


POLE BASE PLATE

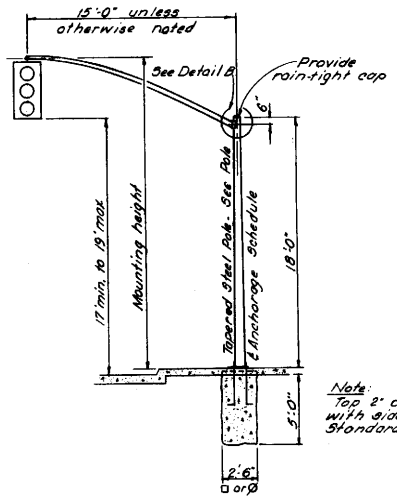
APPROVAL RECOMMENDED
TRAFFIC ENGINEER
REGISTERED CIVIL ENGINEER NO. 8586
APPROVED SEPTEMBER 1, 1966
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5945



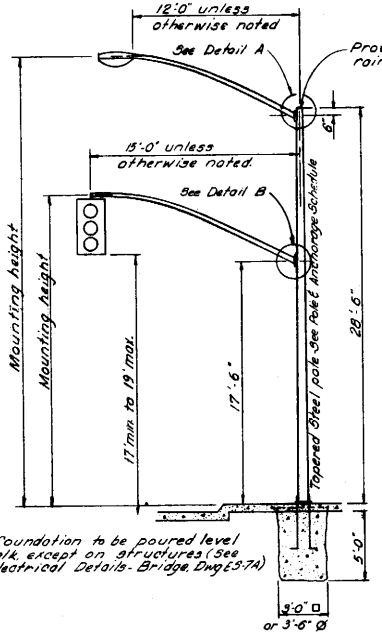
POLE SPLICE



TYPE XV

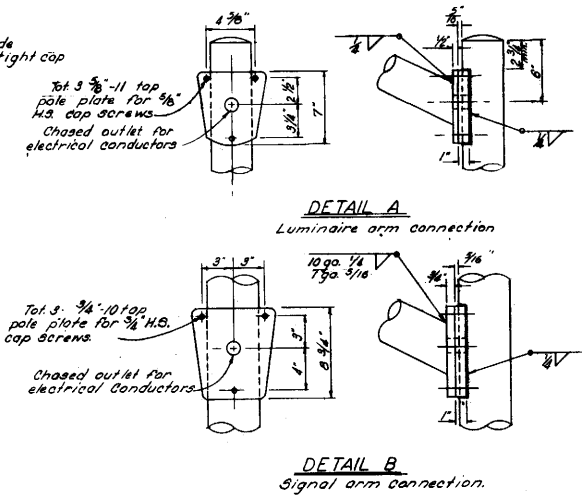


TYPE XVI



TYPE XVII

Note: Top 2' of foundation to be poured level with sidewalk, except on structures (See Standard Electrical Details - Bridge Dwg. ES-7A)



Note: Alternative details approved by the Engineer may be substituted for the arm connections shown.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

TRAFFIC SIGNAL AND LIGHTING STANDARDS TYPES - XV, XVI AND XVII

ES-13-1

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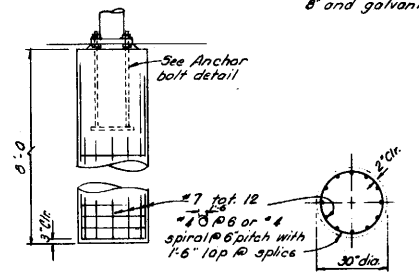
LUMINAIRE ARM DATA ①			
PROJECTED LENGTH	GAGE	MINIMUM O.D. @ POLE	MOUNTING HEIGHT
6'-0"	10ga. ②	3.2"	32.1 ±
8'-0"		3.5"	32.7 ±
10'-0"		3.8"	33.2 ±
12'-0		3.8"	33.7 ±
15'-0"		4.2"	34.2 ±

NOTES

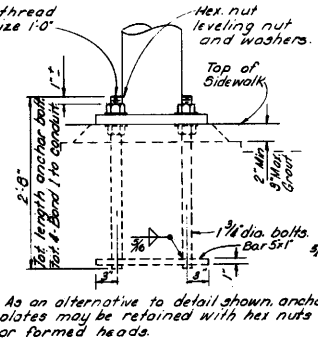
① Round tapered steel tube with maximum taper of 0.15 inches per foot.

② No. 11 gage sheet steel of weldable grade acceptable if the steel after fabrication has a minimum yield strength of 40,000 psi.

SIGNAL ARM DATA ①			
PROJECTED LENGTH	GAGE	MINIMUM O.D. @ POLE	MOUNTING HEIGHT
25'-0"	7ga.	7 5/16"	22.6±'
30'-0"		8"	23.0±'

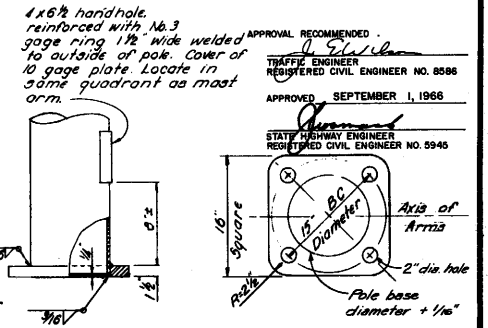


CAST-IN-DRILLED-HOLE PILE



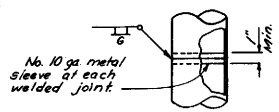
As an alternative to detail shown, anchor plates may be retained with hex nuts or formed heads.

ANCHOR BOLT

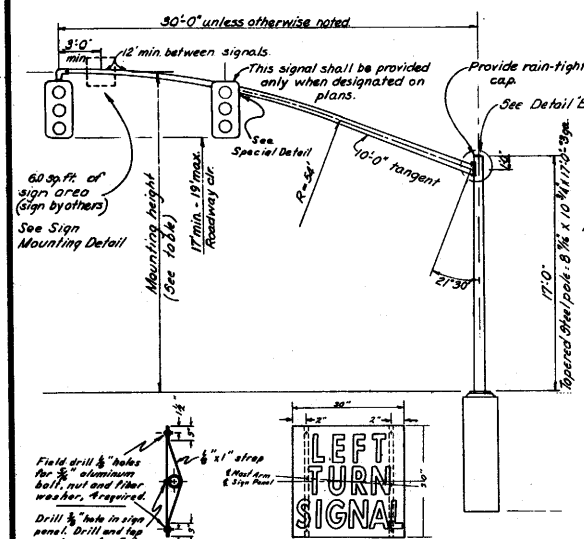


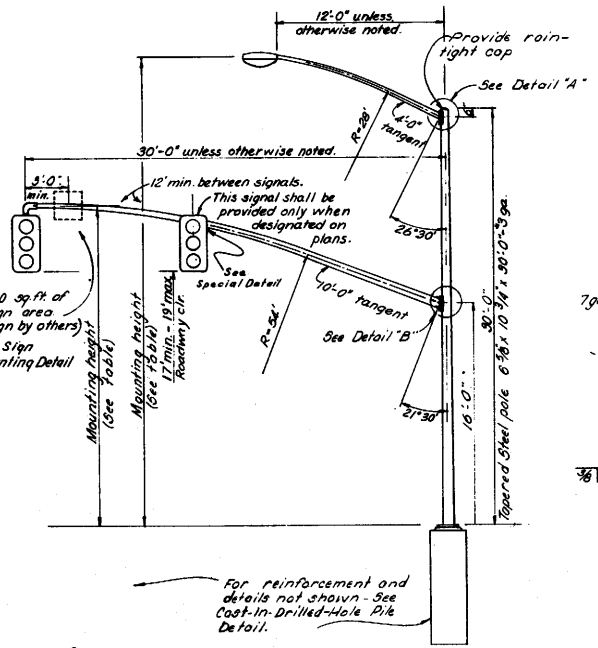
POLE BASE PLATE

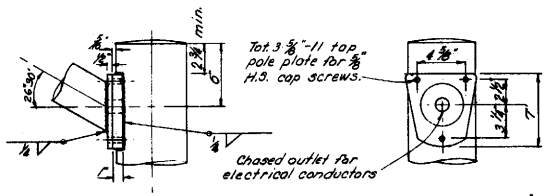
APPROVAL RECOMMENDED
TRAFFIC ENGINEER
REGISTERED CIVIL ENGINEER NO. 8586
APPROVED SEPTEMBER 1, 1966
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5945



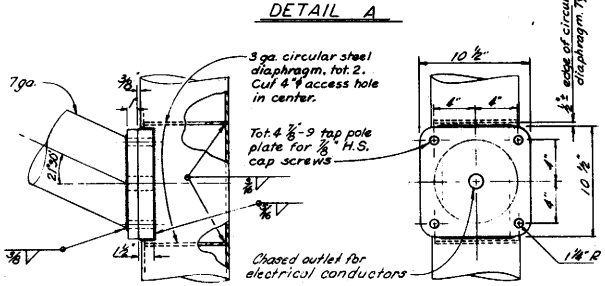
POLE SPLICE





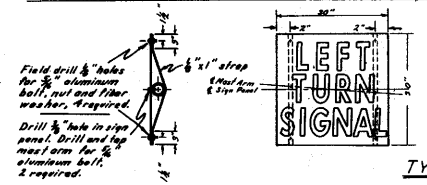


DETAIL A



DETAIL B

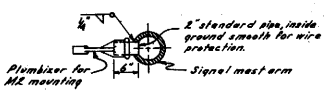
Note: Alternative details approved by the Engineer may be substituted for the arm connections shown.



TYPE XVIII

SIGN MOUNTING DETAIL

Sign panel will be state furnished. Contractor shall furnish mounting hardware and shall install sign.



SPECIAL DETAIL
FOR MOUNTING SIGNAL HEAD

TYPE XIX

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

TRAFFIC SIGNAL AND LIGHTING STANDARDS
TYPES XVIII AND XIX

ES-14-2

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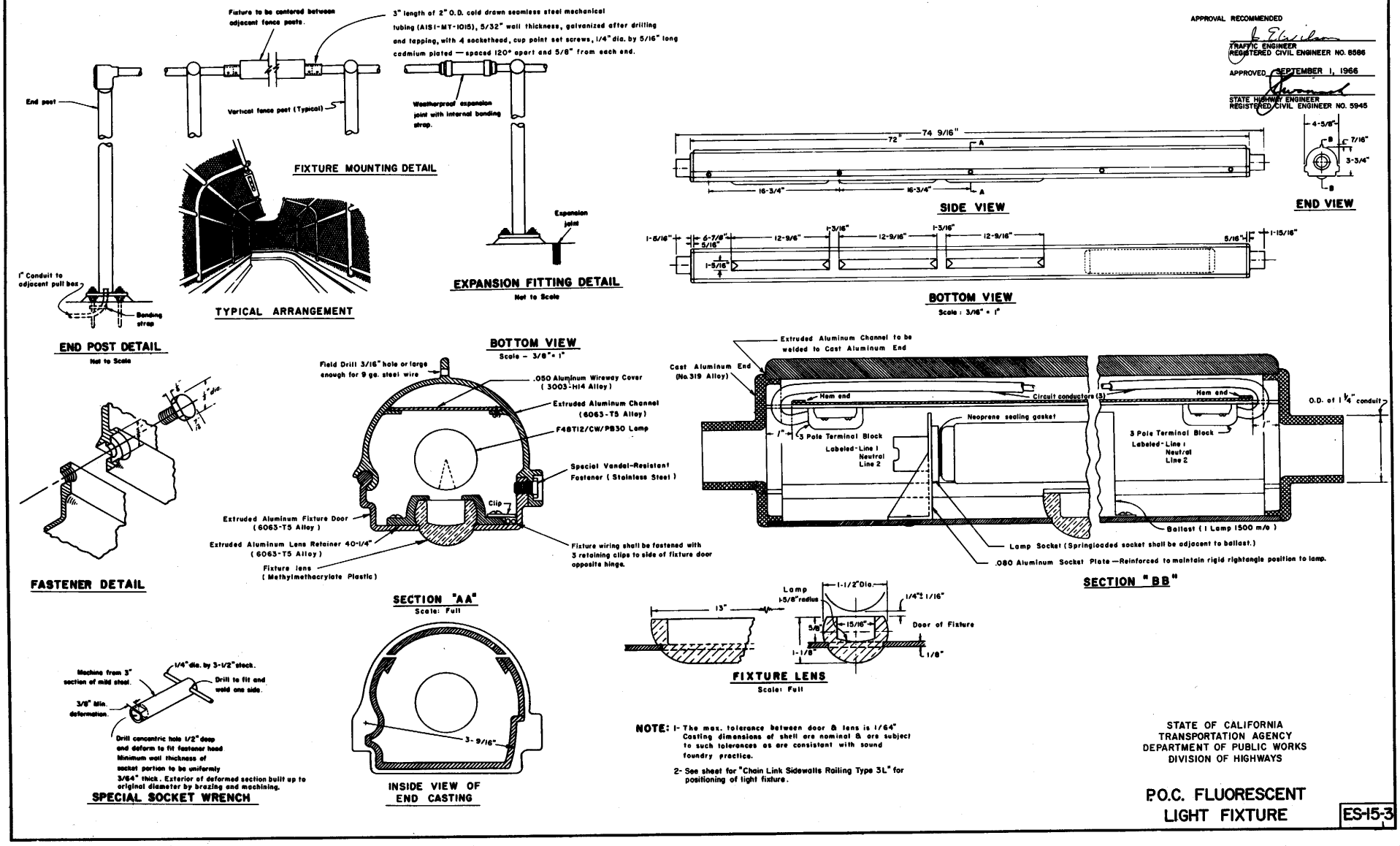

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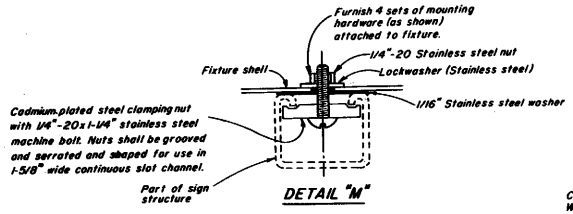
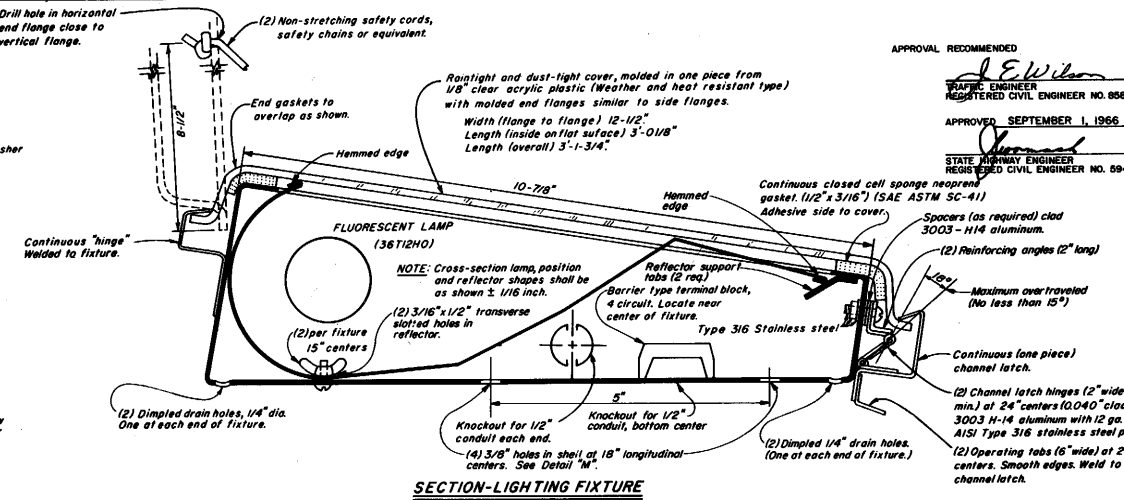


DETAIL "M"

FIXTURE MOUNTING ON CONTINUOUS SLOT CHANNEL

FULL SCALE



SECTION-LIGHTING FIXTURE

FULL SCALE

APPROVAL RECOMMENDED

J. E. Wilson

TRAFFIC ENGINEER
REGISTERED CIVIL ENGINEER NO. 8586

APPROVED SEPTEMBER 1, 1966

STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5945

LIGHTING FIXTURE DATA

LENGTH OF PANEL (inches)	NUMBER OF FIXTURES	CONSECUTIVE SPACING FROM LEFT EDGE OF PANEL TO CENTER OF FIXTURES (inches)
42	1	21
48	1	24
54	1	27
60	1	30
66	1	33
72	2	15.5, 54.5
78	2	19.5, 58.5
84	2	20.5, 63.5
90	2	23.5, 66.5
96	2	24.5, 71.5
102	2	27.5, 74.5
108	3	18, 56, 94
114	3	18.5, 57, 95
120	3	19, 57, 95
126	3	21, 63, 105
132	3	20, 63, 106
138	3	25, 69, 113
144	3	28.5, 72, 115.5
150	3	29.5, 75, 119.5
156	4	18.5, 57.5, 96.5, 135.5
162	4	21, 61, 101, 141
168	4	21, 63, 105, 147
174	4	22.5, 65.5, 108.5, 151.5
180	4	22.5, 67.5, 112.5, 157.5
186	4	22.5, 69.5, 116.5, 163.5
192	4	23.5, 71.5, 119.5, 167.5
198	4	23.5, 74.5, 123.5, 172.5
204	5	20, 61, 102, 143, 184
210	5	21, 63, 105, 147, 189
216	5	20, 64, 108, 152, 196
222	5	19, 65, 111, 157, 203
228	5	22, 68, 114, 160, 206
234	5	23, 70, 117, 164, 211
240	6	20, 60, 100, 140, 180, 220
246	6	20.5, 61.5, 102.5, 143.5, 184.5, 225.5
252	6	21, 63, 105, 147, 189, 231
258	6	21.5, 64.5, 107.5, 150.5, 193.5, 236.5
264	6	22, 66, 110, 154, 198, 242
270	6	22.5, 67.5, 112.5, 157.5, 202.5
276	6	23, 69, 115, 161, 207, 253
282	7	21, 61, 101, 141, 181, 221, 261
288	7	21, 62, 103, 144, 185, 226, 267

SIGN LOAD (WATTS)

1 Lamp and ballast — 75
2 Lamps and ballast — 150
3 Lamps and ballast — 215

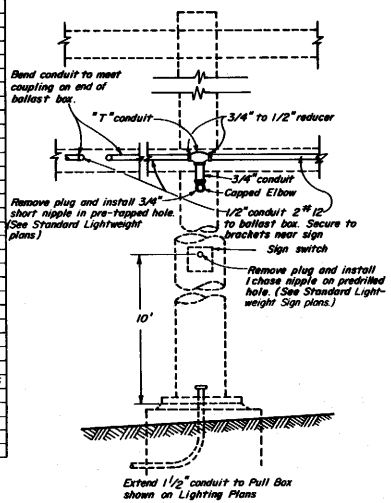
BALLAST NOTES

Ballasts shall be one, two or three lamp types as required, rated at 800 ma.

Each ballast shall be fused with a 1-1/4" x 1/4" slow-blow glass tube fuse, 3 amp. for 3 lamp ballast, 2-1/2 amp. for 2 lamp ballast and 1 amp. for 1 lamp ballast.

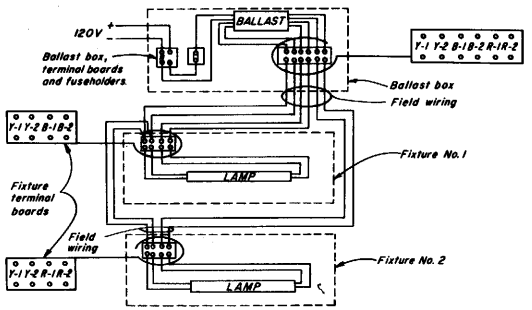
Fuseholder shall be a panel mounted type, with screw type finger knob.

For ballast box locations and fabrication details see plan titled "Sign Panel Mounting Details."



TYPICAL WIRING AND SIGN SWITCH INSTALLATION DETAILS

No Scale



TYPICAL FIXTURE WIRING DIAGRAM (TWO LAMP)

WIRING NOTES

Wiring between ballast box and nearest fixture and between fixtures shall be run in 1/2" liquid-tight flexible conduit.

Conduit shall be secured to nearest sign member using one-hole galvanized malleable iron or steel straps at 5 foot maximum centers and brass machine screws tapped into the member.

Ballasts and terminal boards shall be marked with legible symbols. Conductors shall be tagged and their identification marked on the corresponding terminal on the terminal board as shown on the Typical Fixture Wiring Diagram.

See Special Provisions for additional specifications.

FIXTURE NOTES

Lighting fixtures shall be fabricated of 0.064" clad 3003-H14 aluminum unless otherwise indicated. Machine screw parts and lockwashers for fixture shall be stainless steel, unless otherwise indicated.

Reflectors shall be made of 0.020" (min.) thickness aluminum with specular finish, and shall be 33" long. The finish shall be as described in the special provisions. Remove protective coverings before installation. Alternate fixture fabrication methods and design details may be acceptable provided the light distribution, lamp size, mounting details and other design features are equivalent to the fixture shown. All variations must be approved by the Engineer.

Machine screws shall be 8-32 with nuts and lockwashers (except as noted).

Manufacturer shall submit five copies of shop drawings to the Engineer for approval prior to fabrication if fixtures have not been previously approved.

For method of mounting fluorescent fixtures see plan titled "Sign Panel Mounting Details."

After fabrication, metal parts shall be thoroughly cleaned and degreased and shall have a well finished appearance. Painting will not be required.

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

FLUORESCENT SIGN LIGHTING EQUIPMENT (36 INCH)

ES-16-1

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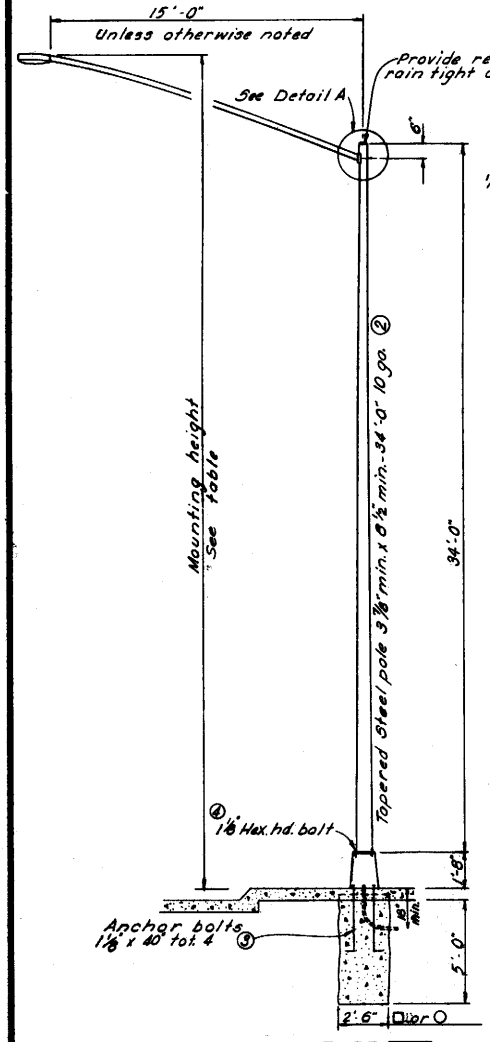
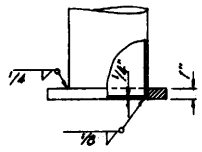
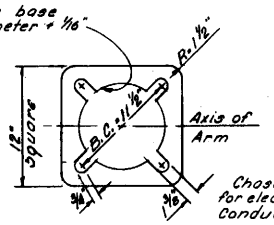
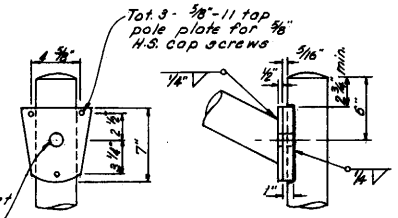


TYPE XXI

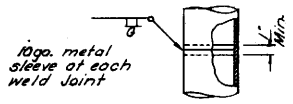




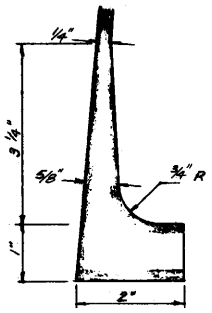
POLE BASE PLATE



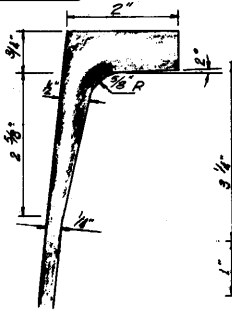
DETAIL A



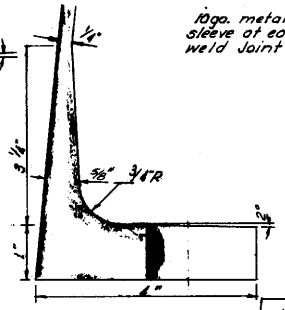
POLE SPLICE



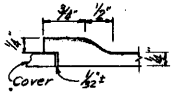
SECTION A-A



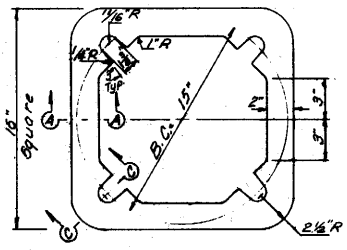
SECTION B-B



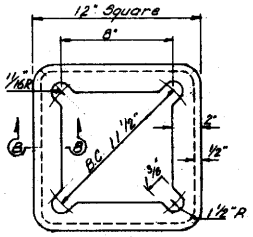
SECTION C-C



SECTION D-D

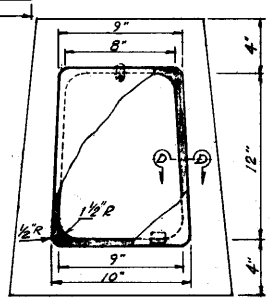


BOTTOM



TOP

TRANSFORMER BASE LAYOUT



ELEVATION

LUMINAIRE ARM DATA ①			
PROJECTED LENGTH	GAGE	MINIMUM O.D. AT POLE	MOUNTING HEIGHT
6'-0"	10 ga. ②	3.2"	37.2±'
8'-0"		3.5"	37.7±'
10'-0"		3.8"	38.5±'
12'-0"		3.8"	39.5±'
15'-0"		4.2"	40.0±'

NOTES

① Round tapered steel tube with maximum taper of .15 inches per foot. End section O.D. of 2 3/8" for mounting hardware. Standard 2" pipe extensions of 1'-0 max. on 6'-10' sizes and 3'-0" max. on 12'-15' sizes may be used at the option of the manufacturer.

② No. 11 gage sheet steel of weldable grade acceptable if the steel after fabrication has a minimum yield strength of 40,000 psi.

③ 4 Anchor bolts at bottom of transformer base, top threaded 6" and each furnished with hex nut, leveling nut, washer and tapered washer. Length indicated does not include required 4"-90° bend.

④ 4 Hex hd. bolts, each furnished with hex nut, plain washer and tapered washer.

Transformer base and door cover shall be aluminum alloy 356-T4, tempered to T-6 after fabrication.

Top 2" of foundation to be poured with sidewalk.

Alternative details approved by the Engineer may be substituted for the arm connection and transformer base shown.

TRAFFIC ENGINEER
REGISTERED CIVIL ENGINEER NO. 8596
APPROVED: SEPTEMBER 1, 1966
STATE HIGHWAY ENGINEER
REGISTERED CIVIL ENGINEER NO. 5945

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

LIGHTING STANDARD
TYPE XXI

ES-17

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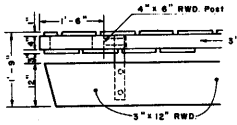
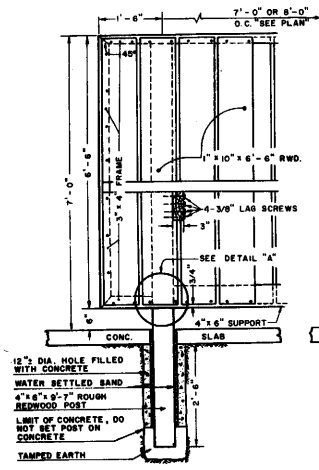
SAFETY ROADSIDE REST

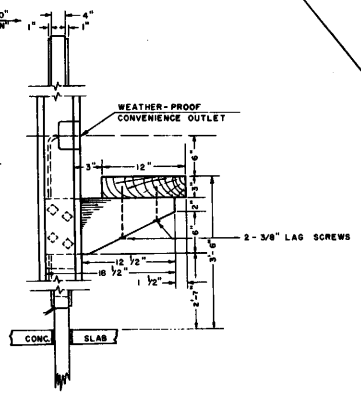


TOP VIEW



FRONT VIEW

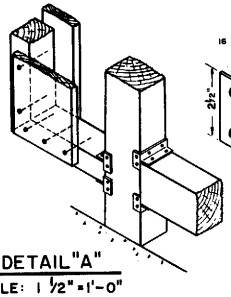
SCALE: 3/4" = 1'-0"



SIDE VIEW

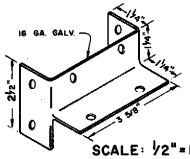
SCALE: 1 1/2" = 1'-0"

FENCE & BENCH DETAIL

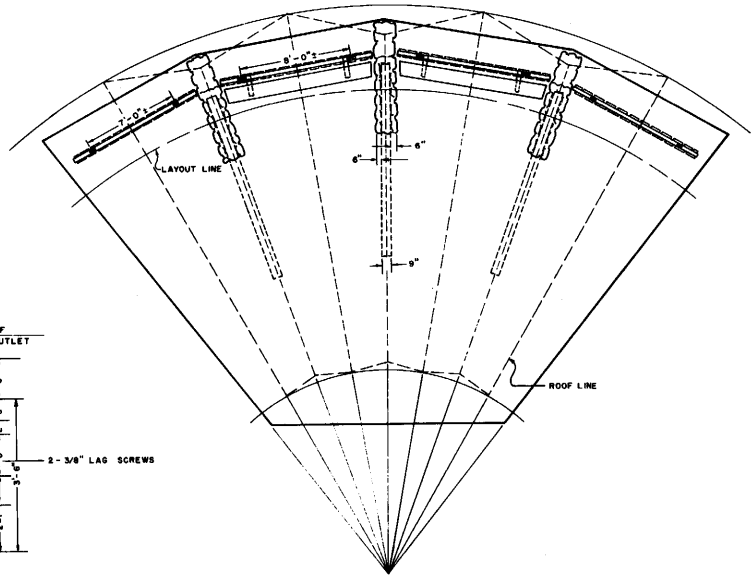


DETAIL "A"

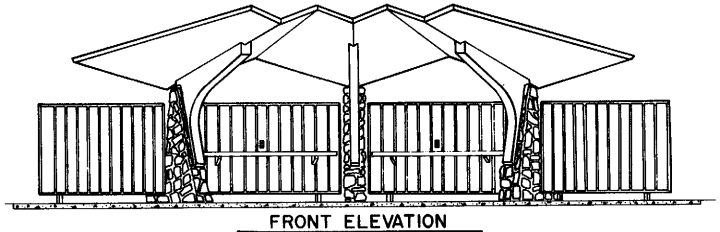
SCALE: 1 1/2" = 1'-0"



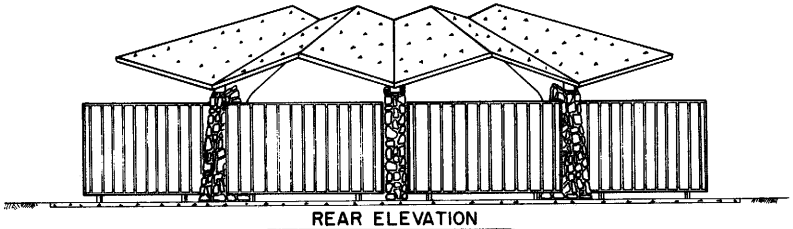
SCALE: 1/2" = 1"



FLOOR PLAN

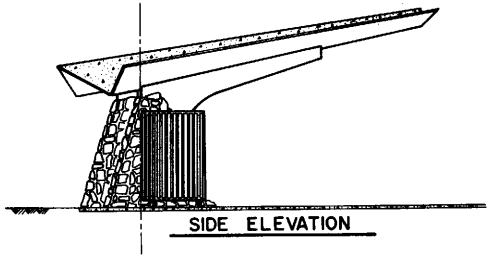


FRONT ELEVATION

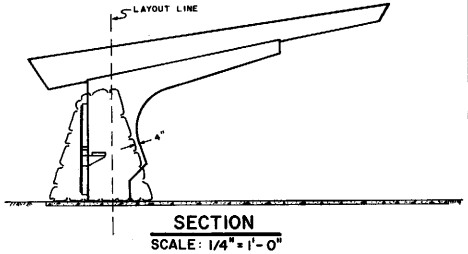


REAR ELEVATION

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



SIDE ELEVATION



SECTION

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

APPROVAL RECOMMENDED

Registered Landscape Architect No. 76

Approved SEPTEMBER 1, 1966

State Highway Engineer
Registered Civil Engineer No. 5945

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

PICNIC SHELTER
SAFETY ROADSIDE REST
ARCHITECTURAL DETAIL

PS-A-1

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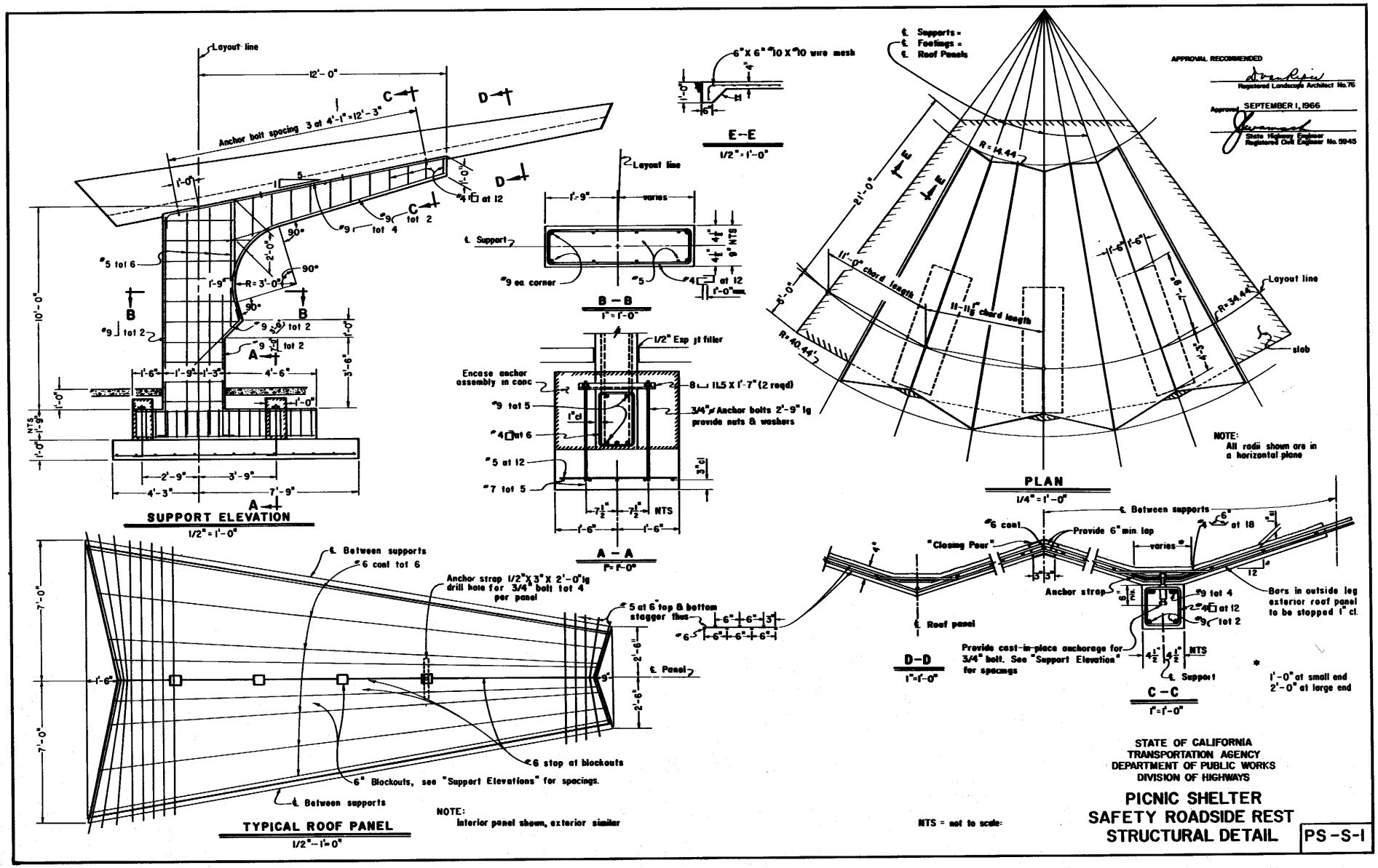

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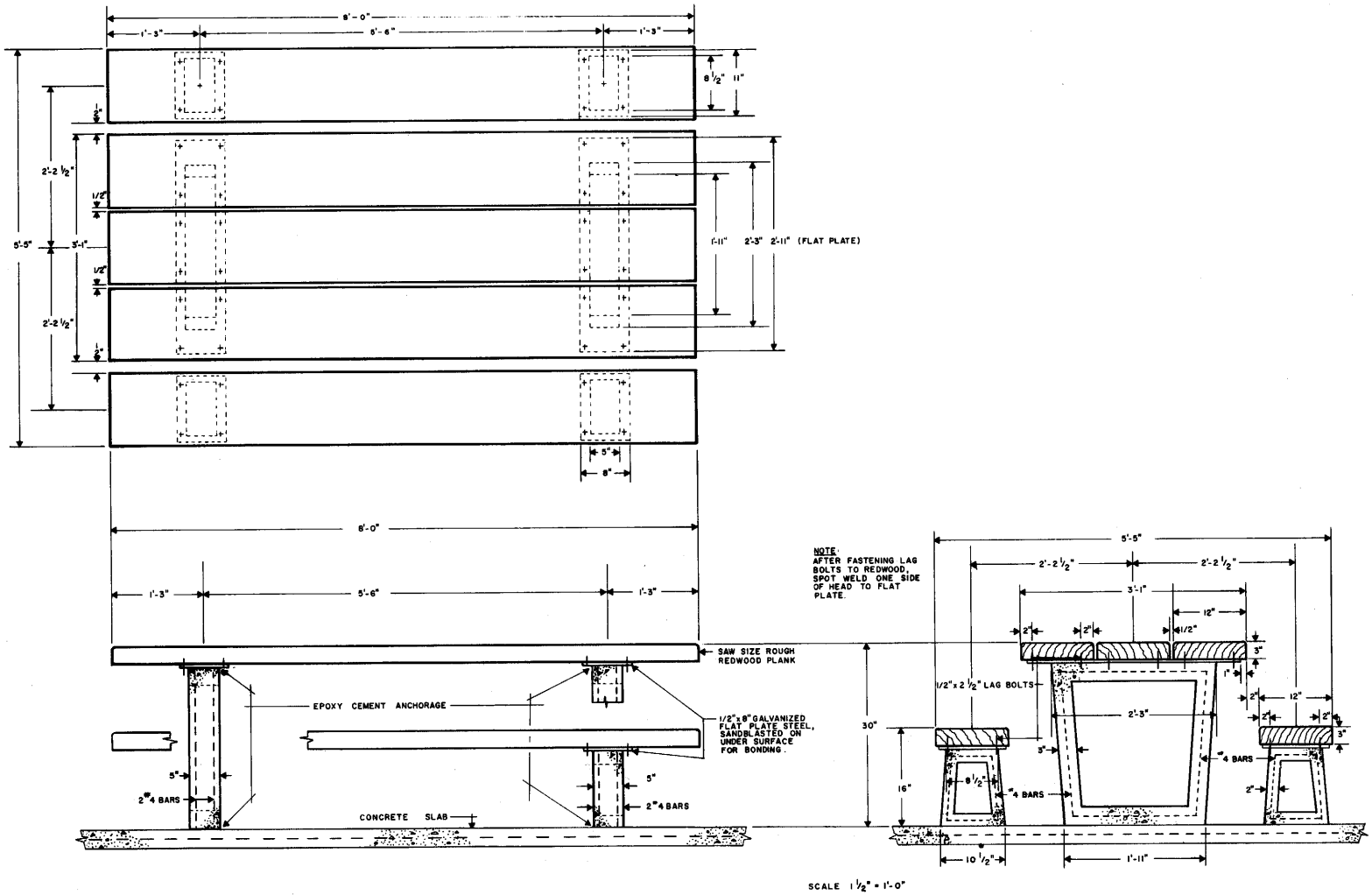
APPROVAL RECOMMENDED

Registered Landscape Architect No. 76

Approved SEPTEMBER 1, 1966

State Highway Engineer
Registered Civil Engineer No. 5945



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

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

PICNIC TABLE
SAFETY ROADSIDE REST

PT-1

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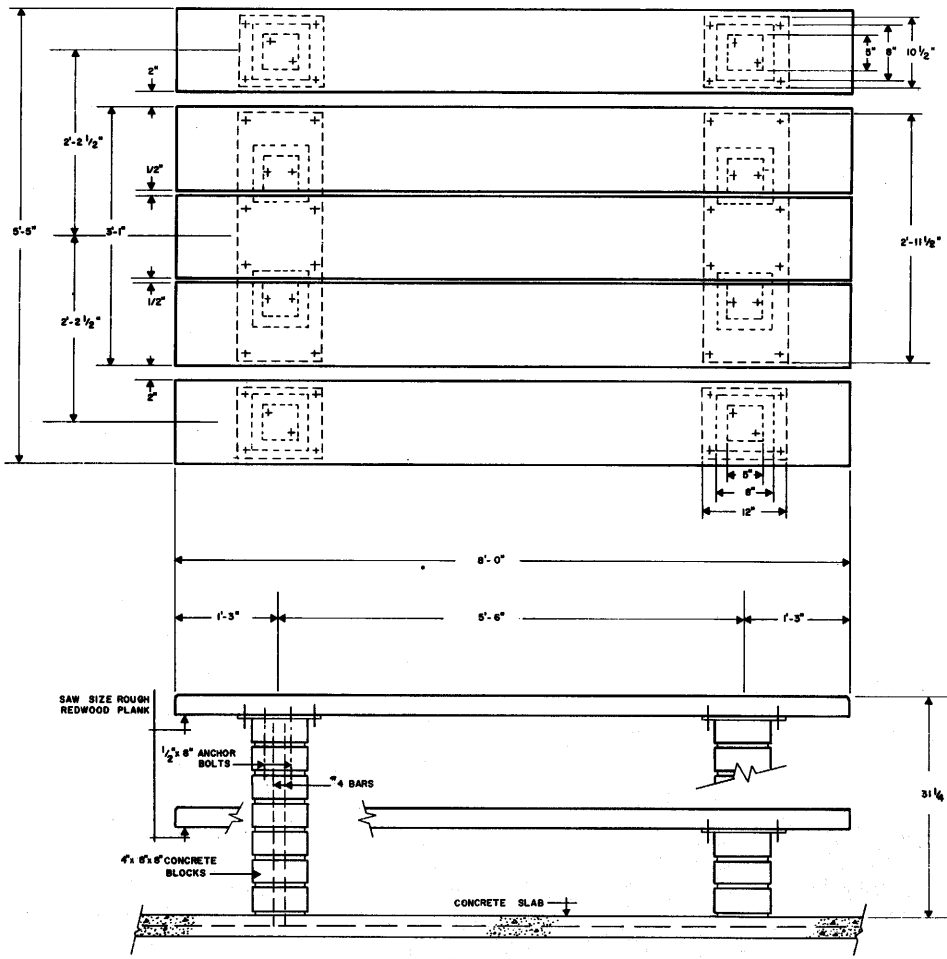
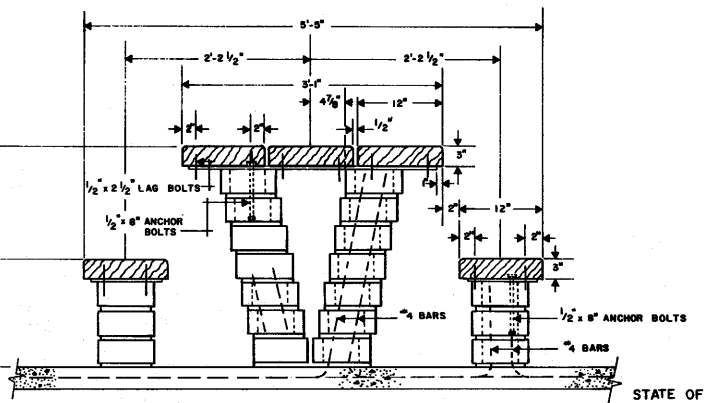
APPROVAL RECOMMENDED

Registered Landscape Architect No.76

Approved SEPTEMBER 1, 1966

State Highway Engineer
Registered Civil Engineer No. 5945





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

NOTE:
AFTER FASTENING LAG BOLTS TO REDWOOD, SPOT WELD ONE SIDE OF HEAD TO FLAT PLATE

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

PICNIC TABLE
SAFETY ROADSIDE REST

PT-2

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