STATE OF NEVADA

STANDARD PLANS

FOR

ROAD AND BRIDGE
CONSTRUCTION

1974

DEPARTMENT OF HIGHWAYS
CARSON CITY, NEVADA 89701

STANDARD PLANS

FOR

ROAD AND BRIDGE CONSTRUCTION

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS
1263 SOUTH STEWART STREET
CARSON CITY, NEVADA 89701

April 1, 1974

INTRODUCTION

The standards contained in this publication have been formally approved for State highway construction and to be instigated for use on all future roadway construction projects.

The user of this publication is cautioned to consult other contractural documents (special provisions, plans, Standard Specifications, etc.) for additional details which may be pertinent to the application of specific standard plans to any given project.

Additional copies of this standard book and full size sheets may be obtained from the Headquarters Building, State of Nevada, Department of Highways, 1263 South Stewart Street, Carson City, Nevada 89701 at the following costs:

Book of Standards----------$3.00
Full Size Standards (22" x 36")-------- 0.50 each

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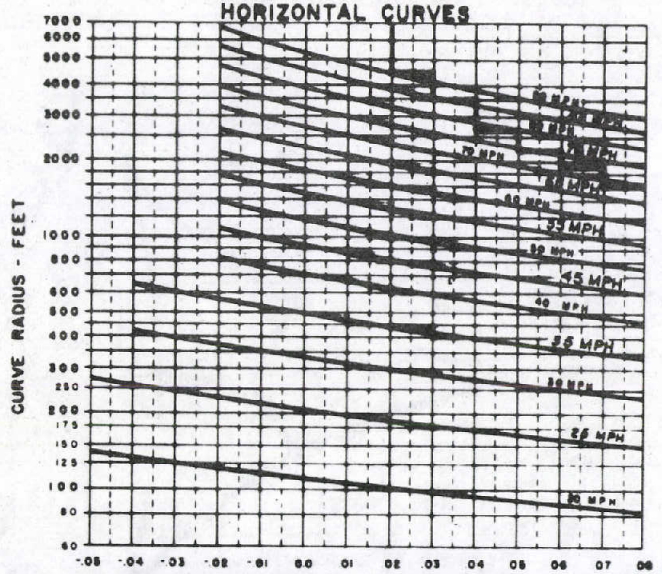


SUPERELEVATION RATE – FOOT PER FOOT

SPEED	FRICTION FACTOR
30	0.16
40	0.15
50	0.14
60	0.13
70	0.12
80	0.11
90	0.10 (EXTRAPOLATED)

NOTE

Broken Line indicates standard superelevation rate. Higher value at steps is the proper superelevation for indicated curve radius.

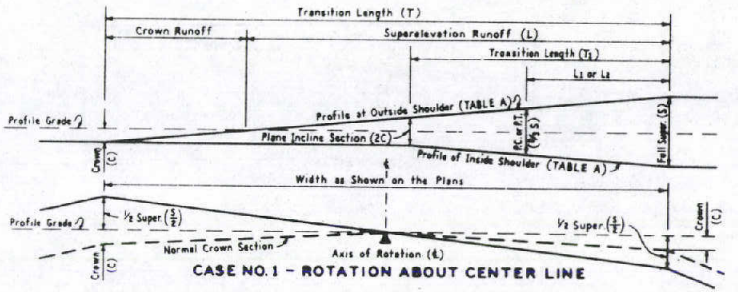
E=SUPERELEVATION
F=FRICTION FACTOR
V=SPEED IN MILES PER HOUR
R=RADIUS IN FEET

$$E+F=\frac{0.067V^2}{R}$$

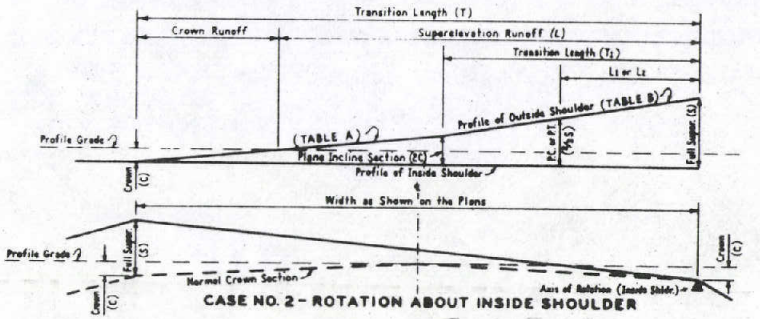
MINIMUM RADIUS CURVES
(SIGHT DISTANCE NEGLECTED)

DESIGN SPEED (mph)	MINIMUM RADIUS USING MAXIMUM SUPER. (.08) (feet)	*MINIMUM RADIUS USING NORMAL CROWN (-2%) (feet)
30	250	430
40	464	820
50	758	1390
60	1143	2180
70	1633	3270
80	2245	4740

* Normal crown may be used on city streets where speed is controlled.



CASE NO. 1 – ROTATION ABOUT CENTER LINE



CASE NO. 2 – ROTATION ABOUT INSIDE SHOULDER

SUPERELEVATION TRANSITION

GENERAL NOTES

1. All curves shall be superelevated as shown unless otherwise noted on plans.
2. The axis of rotation shall be the center line of the roadbed on grades of one percent or greater and shall be the inside shoulder on grades flatter than one percent.
3. Superelevation may cause drainage pockets where easement occurs. Drainage shall be checked and pockets eliminated by constructing roadway ditches to grade, changing the axis of rotation, or, in extreme cases, by installing pipe culverts.
4. Short vertical curves shall be inserted by eye adjustment of stakes at beginning and end of easement.
5. When the tangent between curves is too short to permit easement lengths shown, the transition may be extended onto the curve or the easement length may be decreased.

FORMULAE

Rate of Easement		Length in Feet
TABLE A Ft. per Ft.	TABLE B Ft. per Ft.	
.004	.008	$T=250\left(\frac{S}{2}+C\right)$
.004	.008	$T_1=250\left(\frac{S}{2}-C\right)$
.004	.008	$L=125\,S$
.004	.008	$L_1=\frac{S}{.004}$
.004	—	$L_2=T-250\left(\frac{S}{2}\right)$

Where:
S = Full Superelevation (Ft.)
C = Crown (Ft.)
T = Total Length of Transition
T_1 = Transition Length – Plane Incline Section to Full Super
L = Total Length of Superelevation Runoff
L_1 = Length from P.C. or P.T. to Full Superelevation where Super Rate is .08 Ft. per Ft. or greater.
L_2 = Length from P.C. or P.T. to Full Superelevation where Super Rate is less than .08 Ft. per Ft.

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

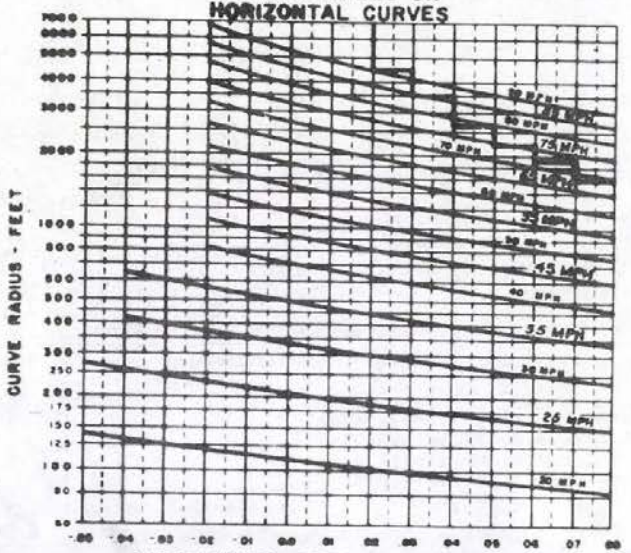
SUPERELEVATION
2-LANE

Robert L. Sharp
CHIEF ROAD DESIGN ENGR.

R-S1.1-(000)
ADOPTED 2/74 REVISION

R 1

LIMITING SPEED ON HORIZONTAL CURVES



SPEED	FRICTION FACTOR
30	0.16
40	0.15
50	0.14
60	0.13
70	0.12
80	0.11
90	0.10 (EXTRAPOLATED)

NOTE

Broken Line indicates standard superelevation rate. Higher value at steps is the proper superelevation for indicated curve radius.

E=SUPERELEVATION F=FRICTION FACTOR V=SPEED IN MILES PER HOUR R=RADIUS IN FEET	$E+F=\frac{0.067V^2}{R}$

MINIMUM RADIUS CURVES
(SIGHT DISTANCE NEGLECTED)

DESIGN SPEED (mph)	MINIMUM RADIUS USING MAXIMUM SUPER (.08) (feet)	*MINIMUM RADIUS USING NORMAL CROWN (-2%) (feet)
30	250	430
40	464	820
50	758	1390
60	1143	2180
70	1633	3270
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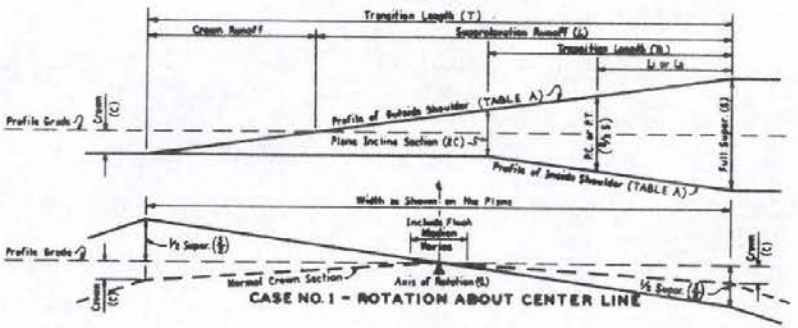
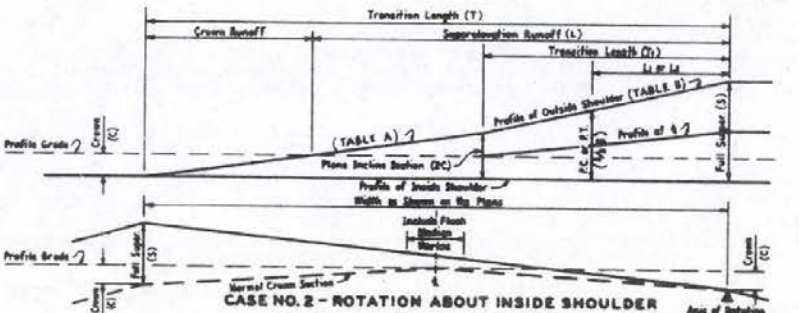
* Normal crown may be used on city streets where speed is controlled.





SUPERELEVATION TRANSITION

GENERAL NOTES

1. All curves shall be superelevated as shown unless otherwise noted on plans.
2. The axis of rotation shall be the center line of the roadbed on grades of one percent or greater and shall be the inside shoulder on grades flatter than one percent.
3. Superelevation may cause drainage pockets where pavement occurs. Drainage shall be checked and pockets eliminated by constructing roadway ditches to grade, changing the axis of rotation, or, in extreme cases, by installing pipe culverts.
4. Short vertical curves shall be inserted by age adjustment of stakes at beginning and end of pavement.
5. When the tangent between curves is too short to permit pavement lengths shown, the transition may be extended onto the curve or the pavement length may be decreased.

FORMULAE

Rate of Pavement		Length in Feet
TABLE A ft. per ft.	TABLE B ft. per ft.	
.006	.01	$T=200\left(\frac{S}{.06}+C\right)$
.005	.01	$Ts=200\left(\frac{S}{.06}-C\right)$
.006	.01	$L=100\,S$
.005	.01	$Ls=\frac{S}{.06}$
.005	—	$Ls=T-200\left(\frac{S}{.06}\right)$

Where:
S = Full Superelevation (Ft.)
C = Crown (Ft.)
T = Total Length of Transition
Ts = Transition Length – Plane Incline Section to Full Super.
L = Total Length of Superelevation Runoff
Ls = Length from P.C. or P.T. to Full Superelevation where Super Rate is .06 ft per ft or greater
Le = Length from P.C. or P.T. to Full Superelevation where Super Rate is less than .06 ft per ft

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

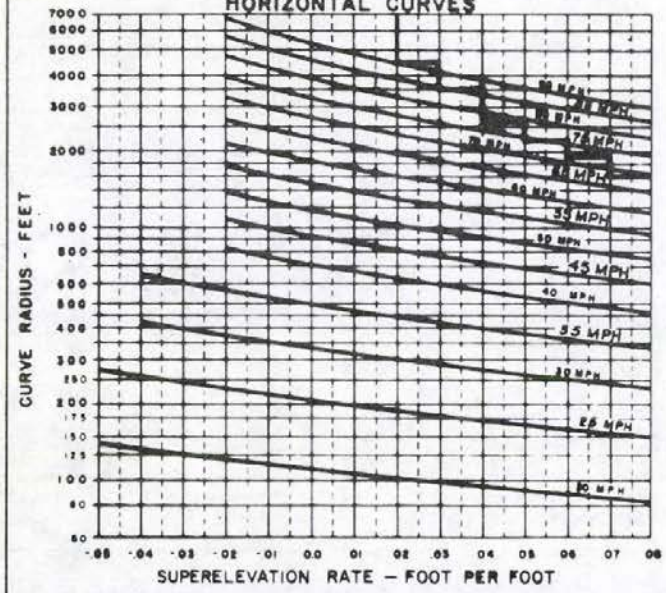
SUPERELEVATION
4-LANE, UNDIVIDED

Robert F. Baker
CHIEF ROAD DESIGN ENGR.

R-S1.2-(000)
ADOPTED: 2/74
REVISION 1

R2

LIMITING SPEED ON HORIZONTAL CURVES



SPEED	FRICTION FACTOR
30	0.16
40	0.15
50	0.14
60	0.13
70	0.12
80	0.11
90	0.10 (EXTRAPOLATED)

NOTE

Broken Line indicates standard superelevation rate. Higher value at steps is the proper superelevation for indicated curve radius.

E = SUPERELEVATION
F = FRICTION FACTOR
V = SPEED IN MILES PER HOUR
R = RADIUS IN FEET

$$E+F=\frac{0.067V^2}{R}$$

MINIMUM RADIUS CURVES
(SIGHT DISTANCE NEGLECTED)

DESIGN SPEED (mph)	MINIMUM RADIUS USING MAXIMUM SUPER. (.08) (Feet)	*MINIMUM RADIUS USING NORMAL CROWN (-2%) (Feet)
30	250	430
40	464	820
50	758	1390
60	1143	2180
70	1633	3270
80	2245	4740

* Normal crown may be used on city streets where speed is controlled.

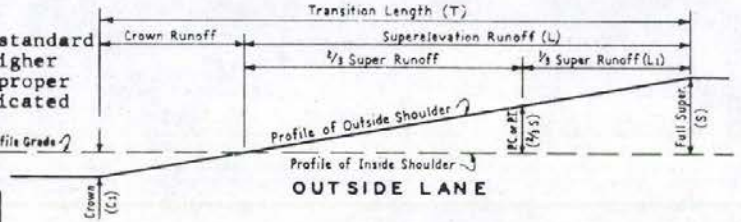
FORMULAE

OUTSIDE LANE		INSIDE LANE	
Rate of Easement	Length in Feet	Rate of Easement	Length in Feet
.005	$T=200(S+C_1)$	.005	$T_1=200(S-C_2)$
.005	$L=200\,S$	.005	$L_1=\frac{S-C_2}{.015}$
.005	$L_1=\frac{S}{.015}$		

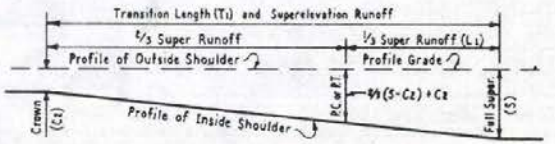
Where:
S = Full Superelevation (Ft.)
C_1 & C_2 = Crown (Ft.)
T = Total Length of Transition
T_1 = Total Length of Transition and Superelevation Runoff
L = Total Length of Superelevation Runoff
L_1 = Length from P.C. or P.T. to Full Superelevation

GENERAL NOTES

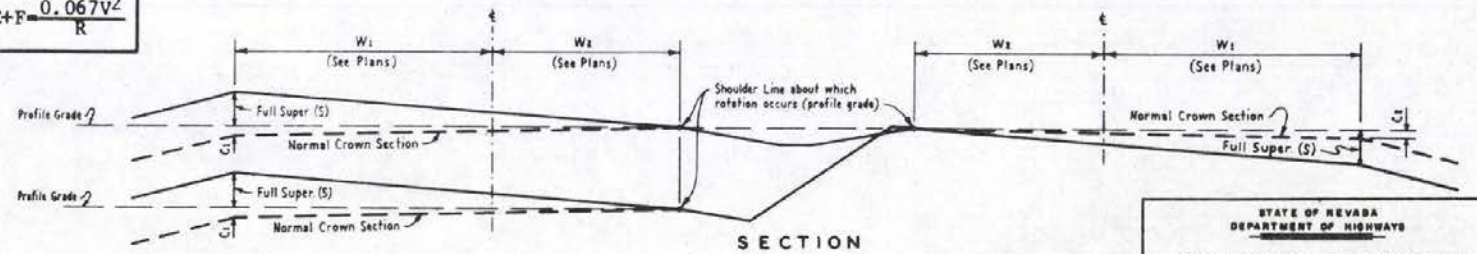
1. All curves shall be superelevated as shown unless otherwise noted on plans.
2. Superelevation may cause drainage pockets where easement occurs. Drainage shall be checked and pockets eliminated by constructing roadway ditches to grade, changing the axis of rotation, or, in extreme cases, by installing pipe culverts.
3. Short vertical curves shall be inserted by eye adjustment of stakes at beginning and end of easement.
4. When the tangent between curves is too short to permit easement lengths shown, the transition may be extended onto the curve or the easement length may be decreased.



OUTSIDE LANE



INSIDE LANE



SECTION

SUPERELEVATION TRANSITION

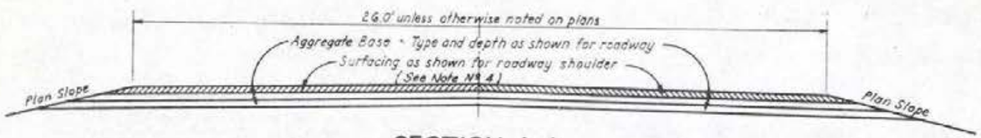
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

SUPERELEVATION
4-LANE, DIVIDED

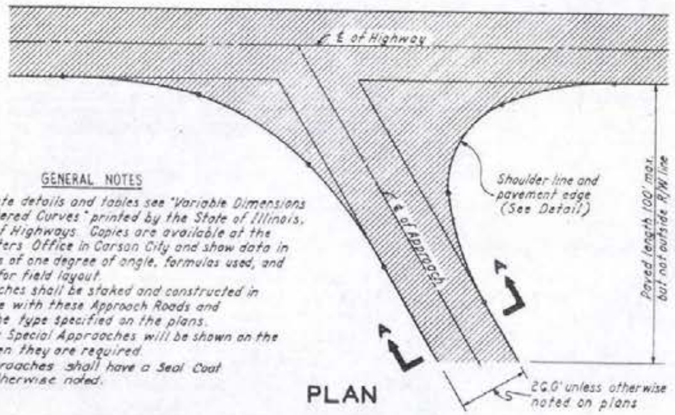
Robert F. Stokes
CHIEF ROAD DESIGN ENGR.

R-31.3-(000)
ADOPTED 2/74 REVISION

R3



SECTION A-A

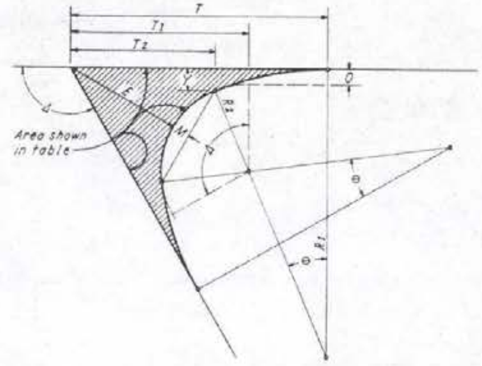


PLAN

TYPE 1 APPROACH

GENERAL NOTES

1- For complete details and tables see "Variable Dimensions of 3-Centered Curves" printed by the State of Illinois, Division of Highways. Copies are available at the Headquarters Office in Carson City and show data in increments of one degree of angle, formulas used, and a method for field layout.
2- All approaches shall be staked and constructed in accordance with these Approach Roads and shall be the type specified on the plans.
3- Details for Special Approaches will be shown on the plans when they are required.
4- Paved Approaches shall have a Seal Coat unless otherwise noted.



DETAIL OF PAVEMENT EDGE

DIMENSIONS FOR 3-CENTERED CURVES

TYPE 1-P APPROACH (PASSENGER)

Δ	θ	R1	R2	O	Y	T2	T1	T	E	M	AREA *	AREA *
DEGREE	DEGREE	LENGTH IN FEET									SQ FT	SQ YD
60	13°15.66'	100	25	2.0	2.67	3.86	16.59	32.79	6.18	1.06	108.8	12.1
70	13°15.66'	100	25	2.0	2.67	13.17	18.51	36.11	7.86	1.78	143.8	16.0
80	13°15.66'	100	25	2.0	2.67	16.92	22.66	39.86	10.23	2.67	190.5	21.2
90	14°21.72'	100	20	2.5	3.13	17.54	22.50	42.34	11.82	2.79	216.6	24.1
100	14°21.72'	100	20	2.5	3.13	21.85	26.81	46.66	15.00	3.75	278.8	31.0
110	14°21.72'	100	20	2.5	3.13	27.17	32.13	51.98	19.23	4.82	363.5	40.4
120	12°50.34'	100	20	2.0	2.50	33.46	38.11	55.88	24.00	6.40	437.0	48.6

TYPE 1-SU APPROACH (SINGLE UNIT)

Δ	θ	R1	R2	O	Y	T2	T1	T	E	M	AREA *	AREA *
DEGREE	DEGREE	LENGTH IN FEET									SQ FT	SQ YD
60	13°15.66'	120	45	2.0	3.20	16.82	27.14	44.34	9.27	1.31	224.0	24.9
70	13°15.66'	120	45	2.0	3.20	22.59	32.51	50.11	12.38	3.20	316.7	35.2
80	13°15.66'	120	45	2.0	3.20	29.12	39.44	56.64	16.35	4.81	448.3	49.8
90	12°50.34'	120	40	2.0	3.00	33.11	42.00	59.78	19.40	5.14	519.0	57.7
100	17°28.50'	100	35	3.0	4.62	34.78	45.29	64.81	24.12	5.63	669.1	74.3
110	17°28.50'	100	35	3.0	4.62	43.76	54.27	73.79	31.25	7.24	903.6	100.4
120	21°47.22'	100	30	5.0	7.14	49.49	60.92	86.60	40.00	6.43	1226.4	136.3

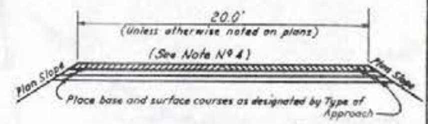
TYPE 1-C43 APPROACH (SEMITRAILER COMBINATION INTERMEDIATE)

Δ	θ	R1	R2	O	Y	T2	T1	T	E	M	AREA *	AREA *
DEGREE	DEGREE	LENGTH IN FEET									SQ FT	SQ YD
60	18°47.82'	120	45	4.0	6.40	13.75	28.35	52.46	11.55	0.86	350.0	38.9
70	18°47.82'	120	45	4.0	6.40	19.81	34.31	58.43	14.82	1.73	468.6	52.1
80	18°47.82'	120	45	4.0	6.40	26.62	41.12	65.28	18.87	3.05	625.2	69.5
90	20°21.84'	120	40	5.0	7.50	31.08	45.00	72.84	23.64	3.64	812.4	90.3
100	22°37.20'	100	35	5.0	7.69	34.21	47.67	72.47	27.23	3.32	873.5	97.1
110	22°37.20'	100	35	5.0	7.69	43.66	57.13	82.13	34.74	5.44	1144.8	127.2
120	22°51.84'	100	30	5.5	7.86	49.89	61.49	88.69	41.00	6.08	1294.3	143.8

TYPE 1-C50 APPROACH (SEMITRAILER COMBINATION LARGE)

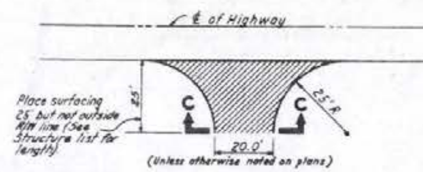
Δ	θ	R1	R2	O	Y	T2	T1	T	E	M	AREA *	AREA *
DEGREE	DEGREE	LENGTH IN FEET									SQ FT	SQ YD
60	13°35.40'	200	75	3.5	5.60	27.70	45.32	74.70	15.64	3.05	639.1	71.0
70	13°05.46'	150	50	5.5	8.25	22.51	38.86	71.57	17.75	1.92	686.9	76.3
80	13°05.46'	150	50	5.5	8.25	30.22	46.57	79.28	22.45	3.25	836.6	93.6
90	18°11.70'	150	50	5.0	7.50	39.39	55.00	86.23	27.78	3.37	1111.4	123.5
100	19°47.70'	150	40	6.5	8.86	41.87	55.42	92.67	32.34	5.43	1280.0	142.2
110	19°47.70'	150	40	6.5	8.86	52.86	66.41	103.66	41.07	7.32	1651.5	183.5
120	23°26.90'	120	35	7.0	9.88	58.84	72.75	106.53	45.00	6.90	1860.4	206.7

* Total approach area equals area shown in table for Δ plus area shown for 180° minus Δ plus pavement area for rectangular portion of approach.

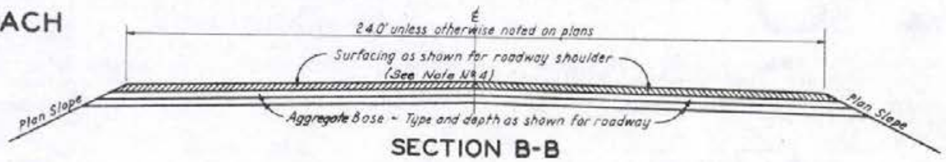


SECTION C-C

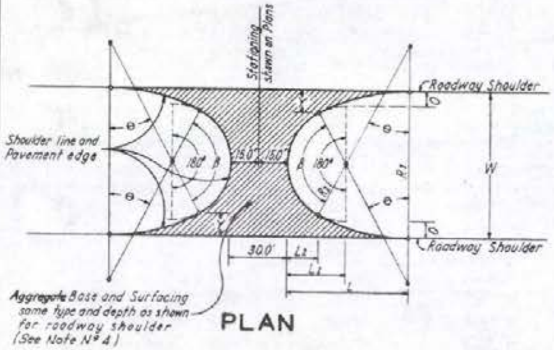
Type 2A - Aggregate base and surfacing courses same type and depth as adjacent roadway shoulder.
Type 2B - Place aggregate base course only.
Type 3 - Grade approach area only.



TYPE 2 & 3 APPROACHES



SECTION B-B



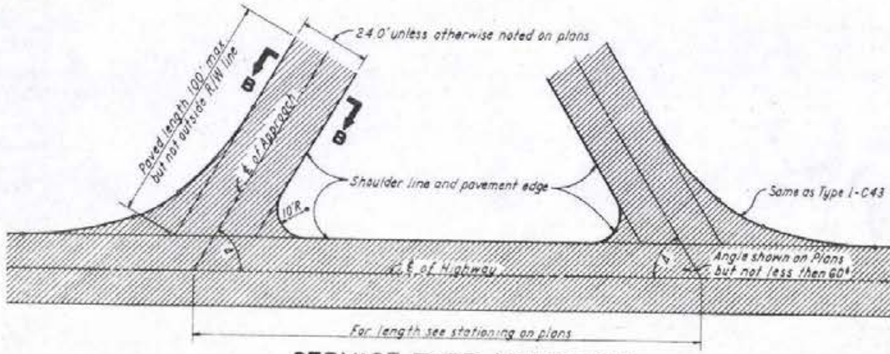
PLAN

DIMENSIONS FOR 3 CENTERED CURVES FOR MEDIAN U-TURN

W	β	θ	R1	R2	O	Y	L2	L1	L	AREA**	AREA**
LIN FT	DEGREE	DEGREE	LENGTH IN FEET							SQ FT	SQ YD
52.0	125°58.53'	27°00.73'	75'	20'	6.0'	8.18'	10.92'	20.00'	44.38'	2503.3	278.1
76.0	124°45.75'	27°35.63'	100'	30'	8.0'	11.43'	16.07'	30.00'	62.50'	4135.1	464.1
100.0	112°53.13'	33°33.43'	100'	40'	10.0'	16.67'	17.83'	40.00'	78.17'	6082.3	675.8

** Area shown is total area for Median U-Turn

MEDIAN U-TURN

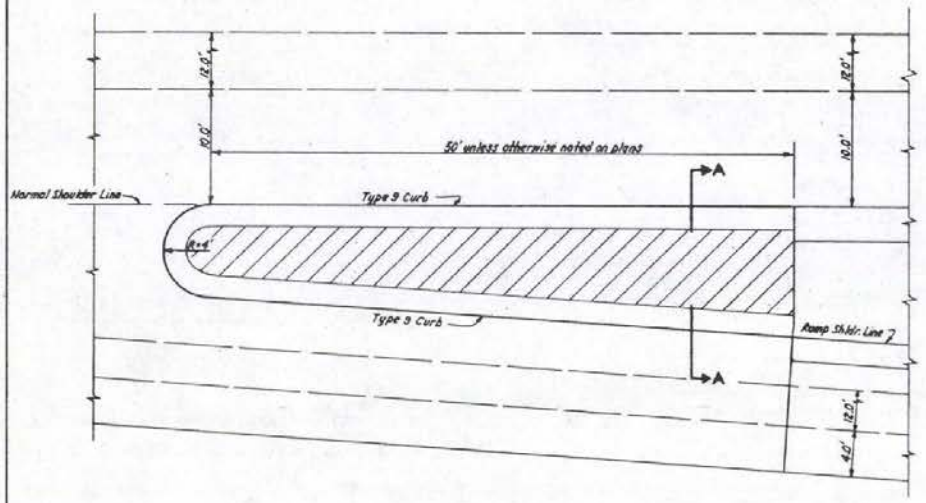


SERVICE TYPE APPROACH

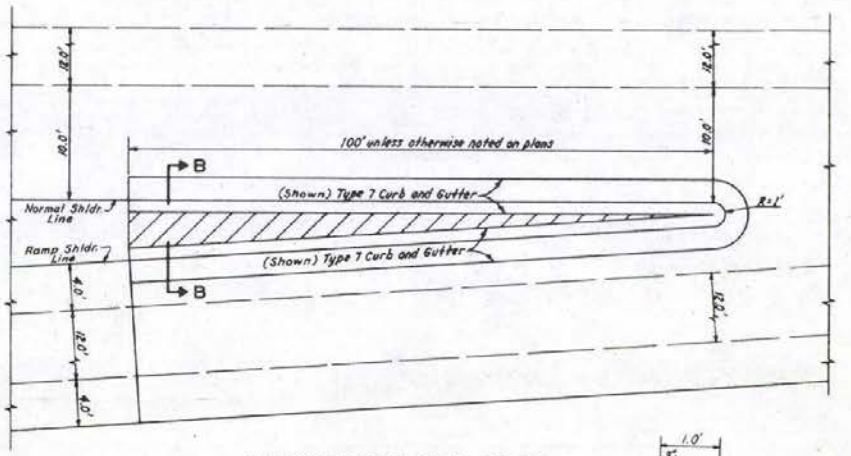
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

APPROACH ROADS

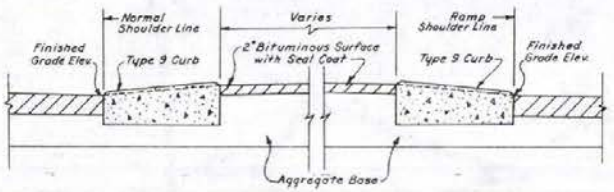
CHIEF ROAD DESIGN ENGR.	R-52.1-(000)	
	ADOPTED 8/69	REVISION 2 3/73



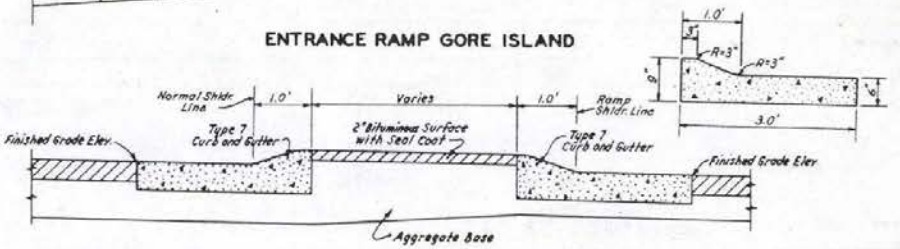
EXIT RAMP GORE ISLAND



ENTRANCE RAMP GORE ISLAND

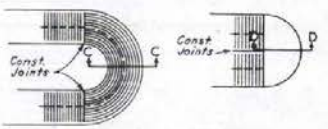


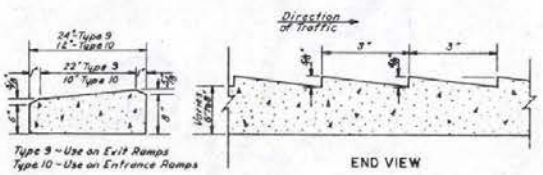
SECTION A-A



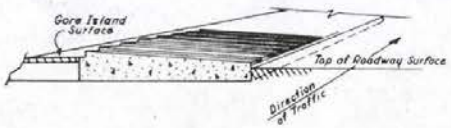
SECTION B-B

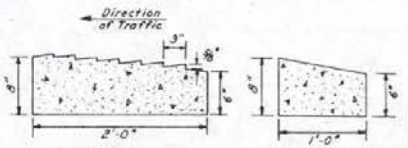
FOR INFORMATION ONLY	
TYPE	AMOUNT OF CONCRETE
7 C & G	0.0613 CU. YD. PER FT.
9 CURB	0.0470 CU. YD. PER FT.
10 CURB	0.0235 CU. YD. PER FT.





TYPE 9 AND 10 CURB





END DETAILS

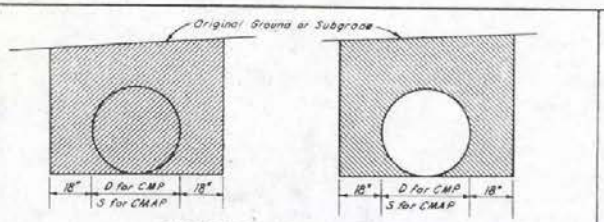
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

EXIT AND ENTRANCE GORE ISLANDS

CHIEF ROAD DESIGNER

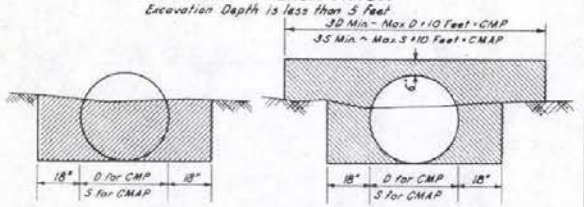
R-53.1-(000)
ADOPTED: 5/73
REVISION

R 5



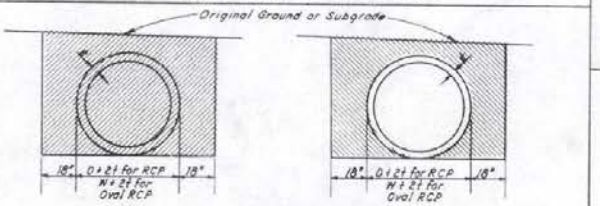
CULVERT IN EXCAVATION

Excavation Depth is less than 5 feet



CULVERT IN EMBANKMENT

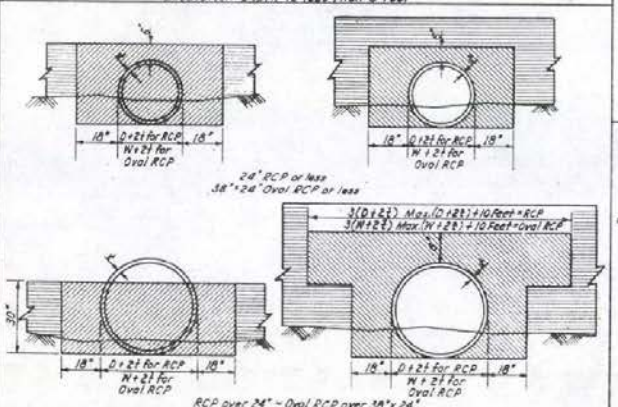
CMP OR CMAP CULVERTS



CONCRETE PIPE CULVERT IN EXCAVATION

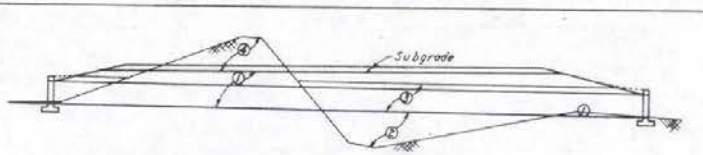
All RCP and Oval RCP sizes

Excavation Depth is less than 5 feet



CONCRETE PIPE CULVERT IN EMBANKMENT

(METHOD A)



① Structure Excavation and Backfill in excavation to be paid below subgrade and within designated limits.
② Embankment to be constructed to flowline prior to installation.
③ Backfill in embankment to be paid from flowline to the designated maximum limits.
④ Roadway Excavation to be paid to subgrade.

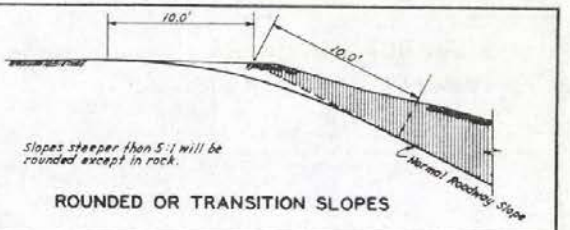
CULVERT INSTALLATION IN ROUGH TERRAIN

⑥ CMP or RCP ~ When the pipe is laid in a trench in rock, hard clay, shale or other hard material, the unsuitable material shall be removed to a depth of not less than 12" below the bottom of the pipe grade and the trench backfilled with suitable material. In no place shall the pipe be laid directly on unsuitable material.

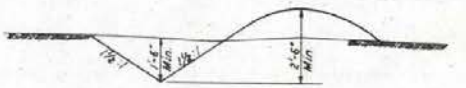
⑦ No additional excavation is necessary under headwalls when rock or other hard material is encountered.

⑧ When a firm foundation is not encountered, all soft, spongy or other unsuitable material under the culvert shall be removed, and the space filled with Foundation Fill. (Depth of Foundation Fill as indicated on the plans or ordered by the Engineer, but not less than 1'-6").

CULVERT INSTALLATION WITH UNSUITABLE FOUNDATIONS

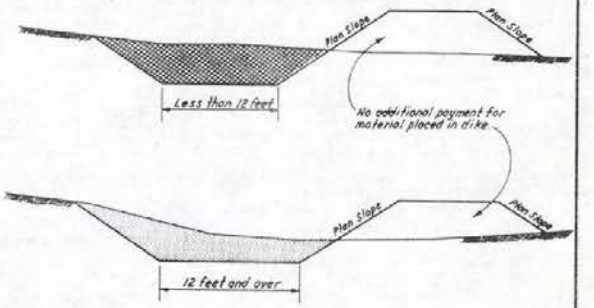


ROUNDED OR TRANSITION SLOPES



Dike material placed on the downhill side is included in the price for ditching.

V-TYPE DITCH AND DIKE



FLAT BOTTOM DITCH EXCAVATION

GENERAL NOTES

1. Excavation for multiple pipe, or RCB, installations exceeding 12 feet in width will be paid as Channel or Roadway Excavation.

LEGEND

- Structure Excavation
- Backfill
- Roadway Excavation
- Channel Excavation
- Drainage Excavation
- Roadway Embankment

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

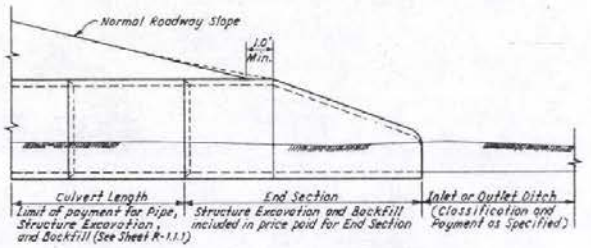
STRUCTURE EXCAVATION AND BACKFILL

(METHOD OF MEASUREMENT)

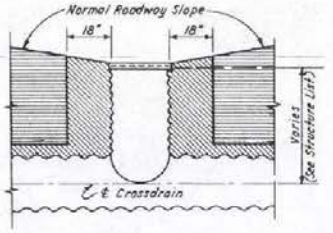
Robert L. Mayo
CHIEF ROAD DESIGN ENGR.

R-1.1.1 - (206, 207)
ADOPTED: 8/88
REVISION 2 4/94

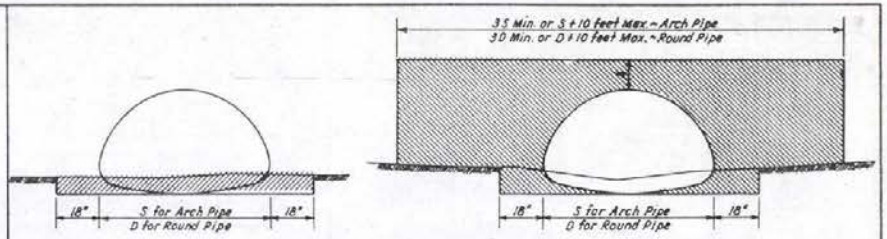
R6



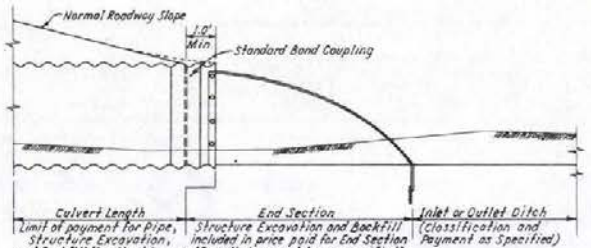
PRECAST CONCRETE END SECTIONS



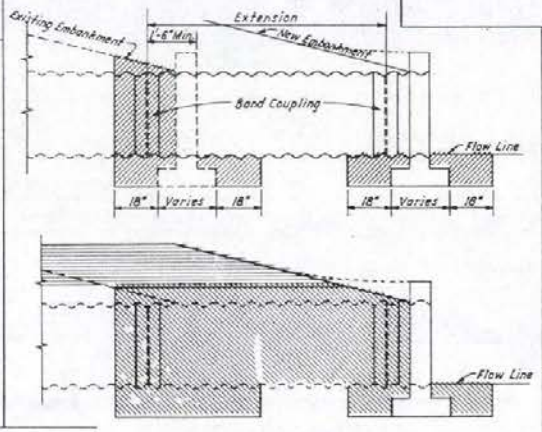
MEDIAN RISER



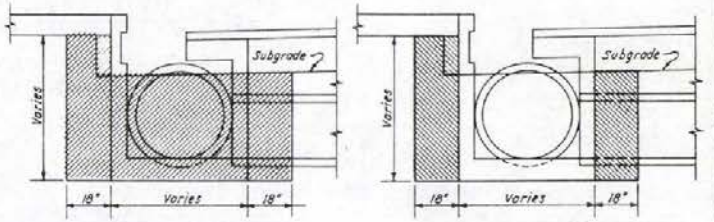
STRUCTURAL PLATE PIPE



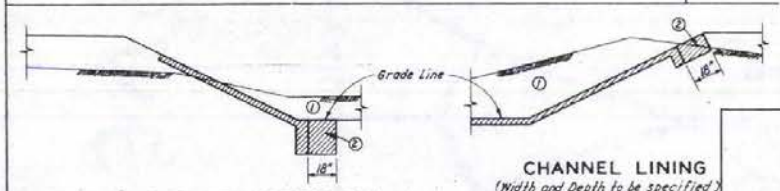
PREFABRICATED METAL END SECTION
(Type 3 Connection used for illustration)



CULVERT EXTENSION
WHEN MOVING HEADWALL

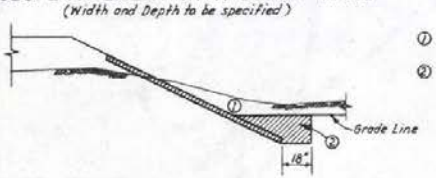


DROP INLETS IN EXCAVATION
(Type 3 Drop Inlet Illustrated)



SLOPE PAVEMENT WITH CUTOFF WALL
(Width and Depth to be specified)

CHANNEL LINING
(Width and Depth to be specified)

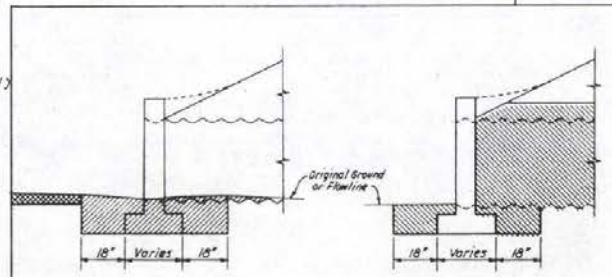


CONCRETE APRON
(Width and Depth to be specified)

① Roadway, Channel Excavation, or Drainage Excavation.

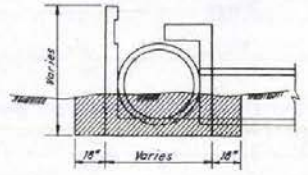
② Payment for Backfill to be included in price paid for Slope Paving or Channel Lining.

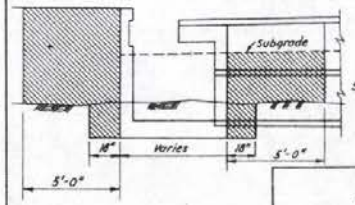
CHANNEL LINING AND SLOPE PAVEMENT



IN EXCAVATION IN EMBANKMENT

CULVERT HEADWALLS





DROP INLETS IN EMBANKMENT
(Type 3 Drop Inlet Illustrated)

LEGEND

- Structure Excavation
- Backfill
- Roadway Excavation
- Channel Excavation
- Drainage Excavation
- Roadway Embankment

See R-1.1.1 for General Notes.

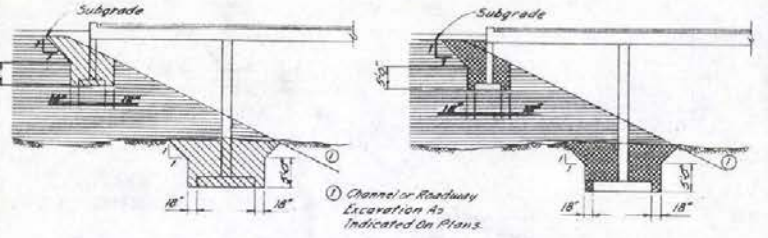
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

STRUCTURE EXCAVATION AND BACKFILL
(METHOD OF MEASUREMENT)

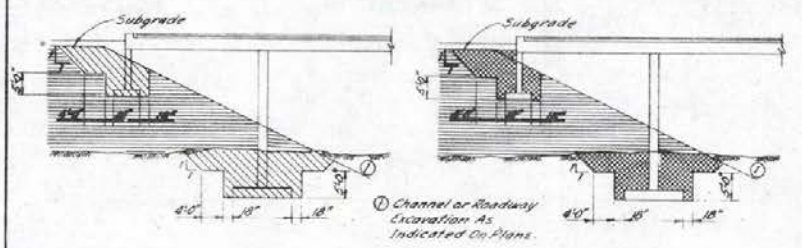
Robert L. Hanson
CHIEF ROAD DESIGN ENGR.

R-1.1.2 - (206, 207)
ADOPTED: 8/68
REVISION 2

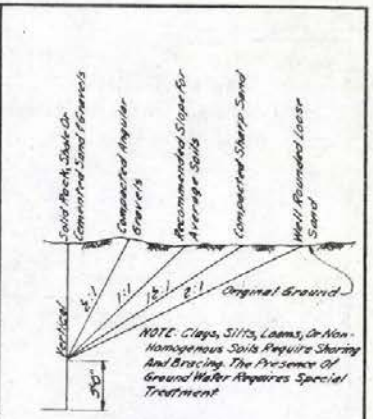
R 7



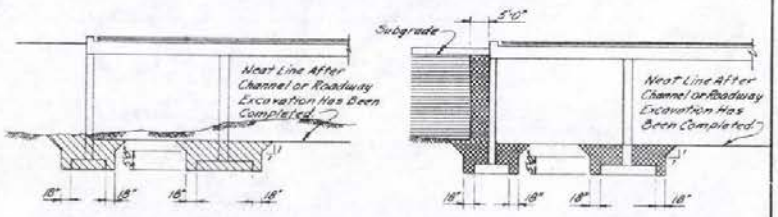
OPEN ABUTMENT BRIDGES
FOOTING WIDTH IS 6 FEET OR LESS



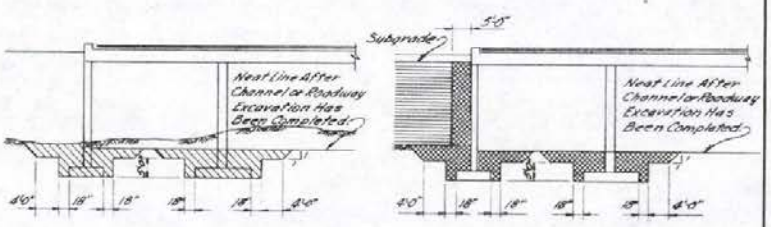
OPEN ABUTMENT BRIDGES
FOOTING WIDTH IS GREATER THAN 6 FEET



APPROXIMATE ANGLE OF REPOSE FOR SLOPING OF SIDES OF EXCAVATIONS



CLOSED ABUTMENT BRIDGES
FOOTING WIDTH IS 6 FEET OR LESS



CLOSED ABUTMENT BRIDGES
FOOTING WIDTH IS GREATER THAN 6 FEET

GENERAL NOTES

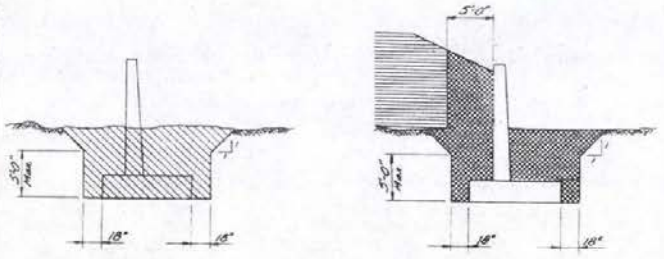
1) TRENCHES MORE THAN 5 FEET DEEP SHALL BE SHORED, LAID BACK TO AT LEAST THE ANGLE OF REPOSE FOR EXISTING FIELD CONDITIONS, OR SOME OTHER MEANS OF PROTECTION SHALL BE PROVIDED.

2) IF HAZARDOUS FIELD CONDITIONS INDICATE GROUND MOVEMENT MAY BE EXPECTED, TRENCHES LESS THAN 5 FEET DEEP SHALL ALSO BE PROTECTED AS INDICATED IN NOTE 1.

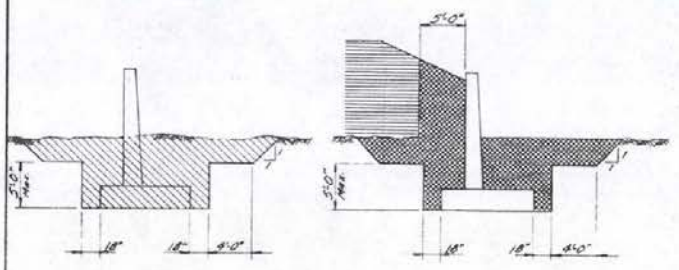
3) FOR THE PURPOSE OF PAYMENT, STRUCTURE EXCAVATION AND BACKFILL QUANTITIES ARE BASED ON THESE STANDARD DRAWINGS AND NO ADDITIONAL PAYMENT WILL BE MADE.

4) IF SHORING IS USED, PAYMENT WILL BE MADE FOR STRUCTURE EXCAVATION AND BACKFILL BASED ON THESE STANDARD DRAWINGS AND NO ADDITIONAL PAYMENT WILL BE MADE FOR SHORING.

5) MINIMUM REQUIREMENTS FOR SHORING ARE AS SHOWN IN THE TABLE ON SHEET R-1.1.4.



RETAINING WALLS
FOOTING WIDTH IS 6 FEET OR LESS



RETAINING WALLS
FOOTING WIDTH IS GREATER THAN 6 FEET

Structure Excavation.

Backfill.

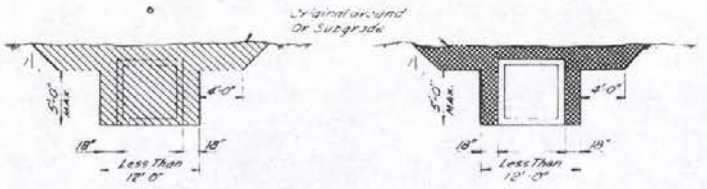
Roadway Embankment

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

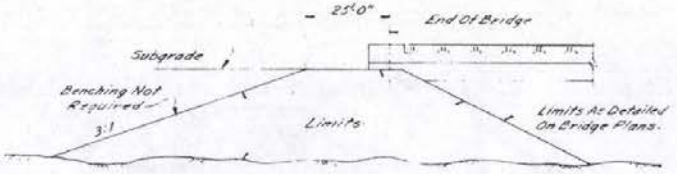
STRUCTURE EXCAVATION AND BACKFILL
(METHOD OF MEASUREMENT)

CHIEF ROAD DESIGN ENGR.	R-1.1.3-(206.207)
	ADOPTED: 11/73 REVISION

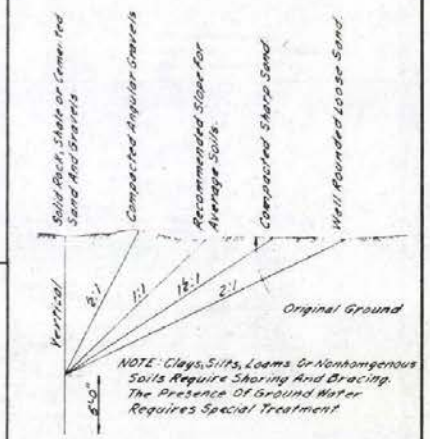
R8



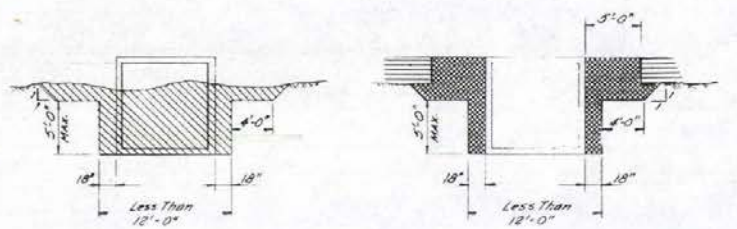
CULVERT IN EXCAVATION



LIMITS OF SELECTED BORROW AT BRIDGE ABUTMENTS



APPROXIMATE ANGLE OF REPOSE FOR SLOPING OF SIDES OF EXCAVATIONS

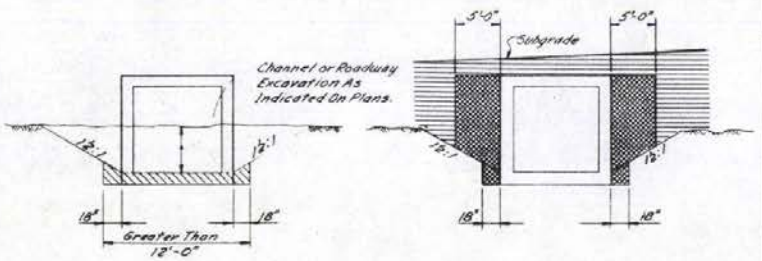


CULVERT IN EMBANKMENT

TRENCH SHORING - MINIMUM REQUIREMENTS

Depth of Trench	Kind or condition of earth	Size and spacing of members										
		Uprights		Stringers		Cross Braces				Maximum Spacing		
						Width of Trench						
		Min. Dim.	Max. Spac.	Min. Dim.	Max. Spac.	Up to 3 Ft.	3 to 6 Ft.	6 to 9 Ft.	9 to 12 Ft.	12 to 15 Ft.	Vert.	Horiz.
Feet		Inches	Feet	Inches	Feet	Inches	Inches	Inches	Inches	Inches	Feet	Feet
5 to 10	Hard, compact	3x4 or 2x6	6	----	----	2x6	4x4	4x6	6x6	6x8	4	6
	Likely to crack	3x4 or 2x6	3	4x6	4	2x6	4x4	4x6	6x6	6x8	4	6
	Soft, sandy, or filled	3x4 or 2x6	Close Sheeting	4x6	4	4x4	4x6	6x6	6x8	8x8	4	6
	Hydrostatic pressure	3x4 or 2x6	Close Sheeting	6x8	4	4x4	4x6	6x6	6x8	8x8	4	6
10 to 15	Hard	3x4 or 2x6	4	4x6	4	4x4	4x6	6x6	6x8	8x8	4	6
	Likely to crack	3x4 or 2x6	2	4x6	4	4x4	4x6	6x6	6x8	8x8	4	6
	Soft, sandy, or filled	3x4 or 2x6	Close Sheeting	4x6	4	4x6	6x6	6x8	8x8	8x10	4	6
	Hydrostatic pressure	3x6	Close Sheeting	8x10	4	4x6	6x6	6x8	8x8	8x10	4	6
15 to 20	All kinds or conditions	3x6	Close Sheeting	4x12	4	4x12	6x8	8x8	8x10	10x10	4	6
Over 20	All kinds or conditions	3x6	Close Sheeting	6x8	4	4x12	8x8	8x10	10x10	10x12	4	6

Trench jacks may be used in lieu of, or in combination with, cross braces.
Shoring is not required in solid rock, hard shale, or hard slag.
Where desirable, steel sheet piling and bracing of equal strength may be substituted for wood.



CULVERT IN EXCAVATION OR EMBANKMENT

GENERAL NOTES

1) TRENCHES MORE THAN 5 FEET DEEP SHALL BE SHORED, LAID BACK TO AT LEAST THE ANGLE OF REPOSE FOR EXISTING FIELD CONDITIONS, OR SOME OTHER MEANS OF PROTECTION SHALL BE PROVIDED.

2) IF HAZARDOUS FIELD CONDITIONS INDICATE GROUND MOVEMENT MAY BE EXPECTED, TRENCHES LESS THAN 5 FEET DEEP SHALL ALSO BE PROTECTED AS INDICATED IN NOTE 1.

3) FOR THE PURPOSE OF PAYMENT, STRUCTURE EXCAVATION AND BACKFILL QUANTITIES ARE BASED ON THESE STANDARD DRAWINGS AND NO ADDITIONAL PAYMENT WILL BE MADE.

4) IF SHORING IS USED, PAYMENT WILL BE MADE FOR STRUCTURE EXCAVATION AND BACKFILL BASED ON THESE STANDARD DRAWINGS AND NO ADDITIONAL PAYMENT WILL BE MADE FOR SHORING.

5) MINIMUM REQUIREMENTS FOR SHORING ARE AS SHOWN IN THE TABLE ON THIS SHEET.

Structure Excavation.

Backfill.

Roadway Embankment.

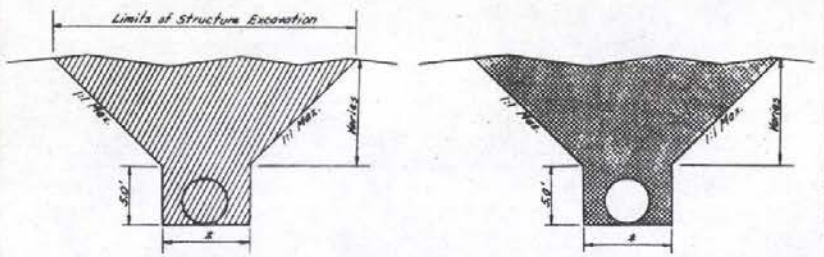
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

STRUCTURE EXCAVATION AND BACKFILL (METHOD OF MEASUREMENT)

CHIEF ROAD DESIGN ENGR.

R-1.1.4-(206.207)
ADOPTED: 11/73 REVISION

R9



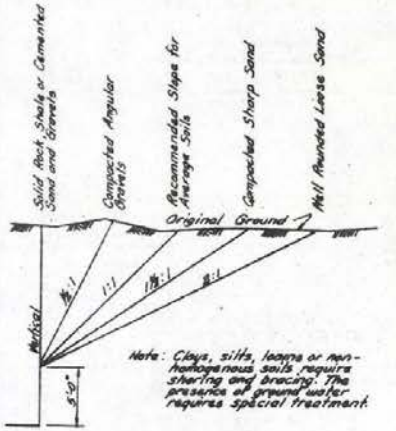
* D ≤ 3.0' for C.M.P.
S ≤ 3.0' for C.M.A.P.
D ≤ 2.5' for R.C.P.
W ≤ 2.6' for Oval R.C.P.

OUTSIDE DIAMETER IS 6 FEET OR LESS

TRENCH SHORING - MINIMUM REQUIREMENTS

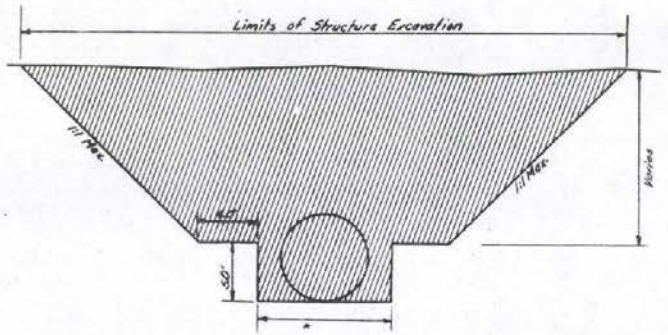
Depth of Trench	Kind or Condition of Earth	Size and Spacing of Members										
		Uprights		Stringers		Cross Braces					Maximum Spacing	
		Min. Dim.	Max. Spac.	Min. Dim.	Max. Spac.	Width of Trench						
						Up to 3 Ft.	3 to 6 Ft.	6 to 9 Ft.	9 to 12 Ft.	12 to 15 Ft.	Vert.	Horiz.
Feet		Inches	Feet	Inches	Feet	Inches	Inches	Inches	Inches	Inches	Feet	Feet
5 to 10	Hard, compact	2x6 to 2x8	8	---	--	2x6	4x4	4x6	6x6	6x8	4	6
	Likely to crack	2x6 to 2x8	3	4x6	4	2x6	4x4	4x6	6x6	6x8	4	6
	Soft, sandy, or filled	2x6 or 2x8	Close Sheeting	4x6	4	4x6	4x6	6x6	6x8	8x8	4	6
	Hydrostatic pressure	2x6 or 2x8	Close Sheeting	6x8	4	4x6	4x6	6x6	6x8	8x8	4	6
10 to 15	Hard	2x6 or 2x8	4	4x6	4	4x6	4x6	6x6	6x8	8x8	4	6
	Likely to crack	2x6 or 2x8	2	4x6	4	4x6	4x6	6x6	6x8	8x8	4	6
	Soft, sandy, or filled	2x6 or 2x8	Close Sheeting	4x6	4	4x6	6x6	6x8	8x8	8x10	4	6
	Hydrostatic pressure	2x6	Close Sheeting	8x10	4	4x6	6x6	6x8	8x8	8x10	4	6
15 to 20	All kinds or conditions	2x6	Close Sheeting	4x12	4	4x12	6x8	8x8	8x10	10x10	4	6
Over 20	All kinds or conditions	2x6	Close Sheeting	6x8	4	4x12	8x8	8x10	10x10	10x12	4	6

Trench jacks may be used in lieu of, or in combination with, cross braces.
Shoring is not required in solid rock, hard shale, or hard slag.
Where desirable, steel sheet piling and bracing of equal strength may be substituted for wood.

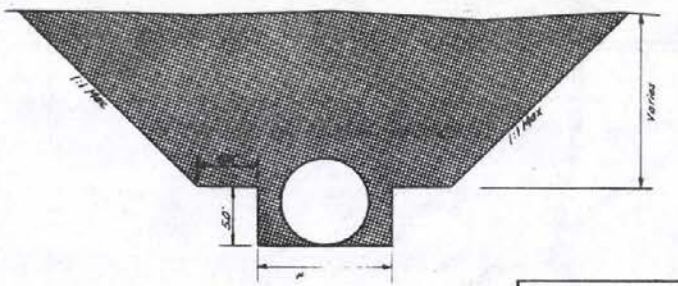


Note: Clays, silts, loams or non-homogeneous soils require sheeting and bracing. The presence of ground water requires special treatment.

APPROXIMATE ANGLE OF REPOSE FOR SLOPING OF SIDES OF EXCAVATION



* D ≤ 3.0' for C.M.P.
S ≤ 3.0' for C.M.A.P.
D ≤ 2.5' for R.C.P.
W ≤ 2.6' for Oval R.C.P.



Granular backfill to be placed for a depth of 6" above the top of the pipe for a width of the trench as shown by the symbol x.

OUTSIDE DIAMETER IS GREATER THAN 6 FEET

GENERAL NOTES

1) TRENCHES MORE THAN 5 FEET DEEP SHALL BE SHORED, LAID BACK TO AT LEAST THE ANGLE OF REPOSE FOR EXISTING FIELD CONDITIONS, OR SOME OTHER MEANS OF PROTECTION SHALL BE PROVIDED.

2) IF HAZARDOUS FIELD CONDITIONS INDICATE GROUND MOVEMENT MAY BE EXPECTED, TRENCHES LESS THAN 5 FEET DEEP SHALL ALSO BE PROTECTED AS INDICATED IN NOTE 1.

3) FOR THE PURPOSE OF PAYMENT, STRUCTURE EXCAVATION AND BACKFILL QUANTITIES ARE BASED ON THESE STANDARD DRAWINGS AND NO ADDITIONAL PAYMENT WILL BE MADE.

4) IF SHORING IS USED, PAYMENT WILL BE MADE FOR STRUCTURE EXCAVATION AND BACKFILL BASED ON THESE STANDARD DRAWINGS AND NO ADDITIONAL PAYMENT WILL BE MADE FOR SHORING.

5) MINIMUM REQUIREMENTS FOR SHORING ARE AS SHOWN IN THE TABLE ON THIS SHEET.

LEGEND

Structure Excavation

Backfill

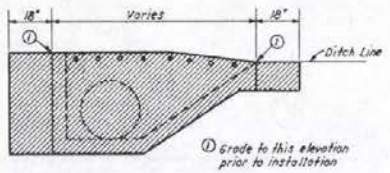
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

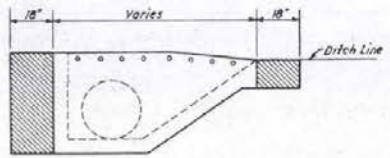
STRUCTURE EXCAVATION AND BACKFILL (METHOD OF MEASUREMENT)

M 1.1.5 (206,207)

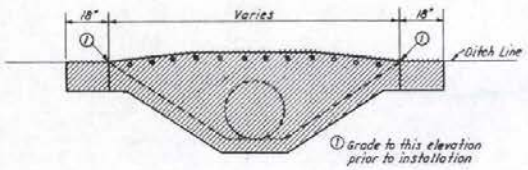
CHIEF ROAD DESIGN ENGINEER | APPROVED: 10/72 | REVISED 1 1973

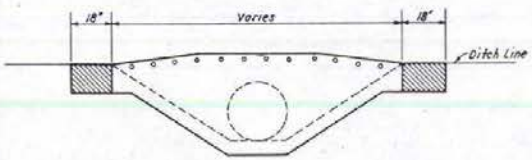
R9A



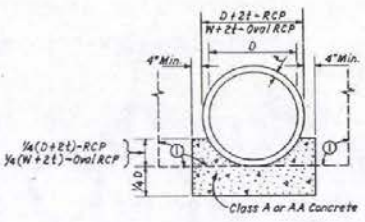


TYPE 7 DROP INLET



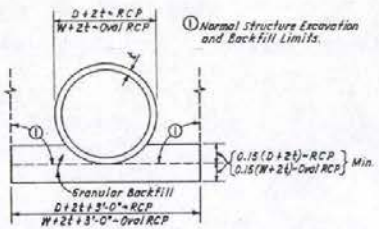


TYPE 8 DROP INLET



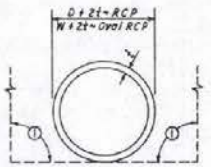
CLASS A BEDDING

Payment for excavated area below the bottom of the pipe grade to be included in the unit bid price per cubic yard of concrete.



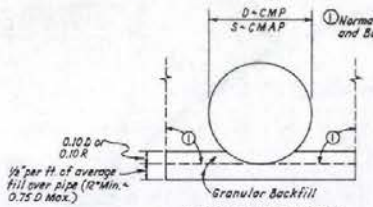
CLASS B BEDDING

Payment for excavated area below the bottom of the pipe grade and the backfill indicated above the flow line is to be included in the unit bid price for granular backfill. Bedding shall be carefully shaped to fit pipe prior to installation. No direct payment for shaping the trench.



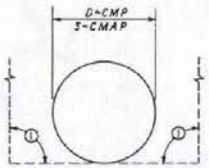
CLASS C BEDDING

BEDDING FOR CONCRETE CULVERT



CLASS B BEDDING

Payment for excavated area below the bottom of the pipe grade and the backfill indicated above the flow line is to be included in the unit bid price for granular backfill. Bedding shall be carefully shaped to fit pipe prior to installation. No direct payment for shaping the trench.



CLASS C BEDDING

BEDDING FOR CMP OR CMAP

GENERAL NOTES

1.- Minimum depths as specified in "Culvert Installation with Unsuitable Foundations" on Sheet R-1.1.1, Notes Nº 6 and 8 will prevail when these conditions are encountered.

2.- Excavation for multiple pipe or RCB installations exceeding 12 feet in width shall be paid for as channel excavation or roadway excavation.

LEGEND

- Structure Excavation
- Backfill
- Roadway Excavation
- Channel Excavation
- Drainage Excavation
- Roadway Embankment

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

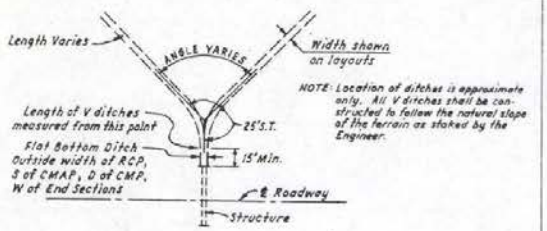
STRUCTURE EXCAVATION AND BACKFILL

(METHOD OF MEASUREMENT)

Robert F. Hoog
CHIEF ROAD DESIGN ENGR.

R-1.1.6-(206, 207)
ADOPTED: 8/69
REVISION 5 4/79

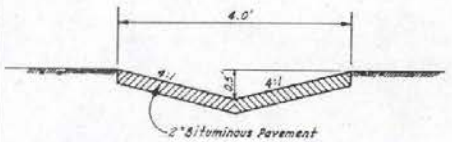
R 10



NOTE: Location of ditches is approximate only. All V ditches shall be constructed to follow the natural slope of the terrain as staked by the Engineer.

PLAN

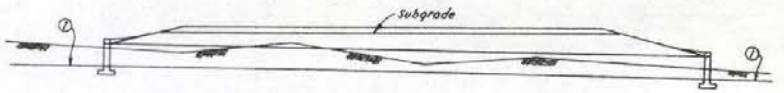
DRAINAGE DITCHES



SECTION

BITUMINOUS TURNOUT DITCH

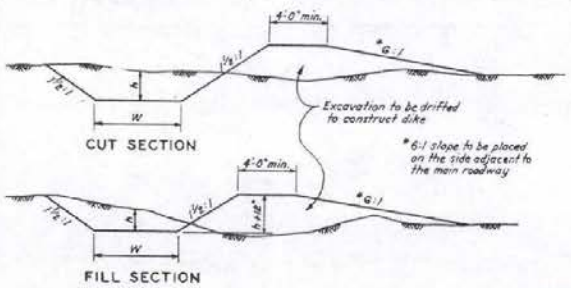
(Plantmix or Roadmix with Seal Coat)



① Inlet and Outlet Ditches to be on same grade as culvert for a distance of 25' minimum.

CULVERT INSTALLATION

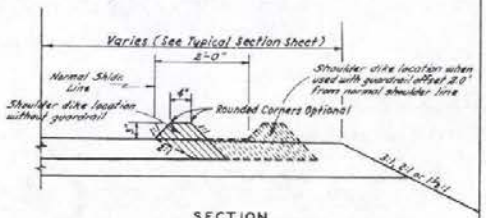
(PREFERRED)



FLAT BOTTOM DITCH AND DIKE

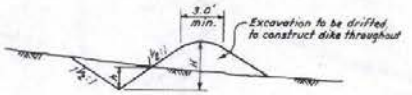
h = Depth of ditch or height of dike as indicated on the plans or as directed by the Engineer.

W = Width of ditch as indicated on the plans or as directed by the Engineer.



BITUMINOUS SHOULDER DIKE

(Plantmix or Roadmix with Seal Coat)

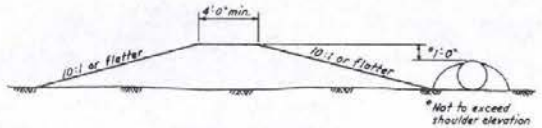


V TYPE DITCH AND DIKE

To be used for surface ditches and where ordered by the Engineer.

h = Depth as ordered by the Engineer (1'-6" min.)

H = Height as ordered by the Engineer (2'-6" min.)



DIKE DETAIL

Inlet and outlet dikes within 30' of roadway shoulder, and median dikes. Location as indicated on plans.

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

DRAINAGE DITCHES AND DIKES

CHIEF ROAD DESIGN ENGR.

R-1.2.1-(203)

ADOPTED: 8/69 REVISION 2 11/79

R11

*ROUND CORRUGATED STEEL PIPE
2 2/3"x 1/2" CORRUGATIONS

PIPE DIAMETER	** MIN COVER	PLATE THICKNESS IN INCHES									
		0.064		0.079		0.109		0.138		0.168	
		R	E	R	E	R	E	R	E	R	E
INCHES	INCHES	MAX. FILL HTS. ABOVE TOP OF PIPE IN FEET									
12	12	63		83							
15	12	50		66							
18	12	42		55		84					
24	12	32		42		61		75			
30	12	25		33		49		60		74	
36	12	21		28		41		50		62	
42	12	41		44		46	72	48	76	50	80
48	12		35		38	45	63	46	67	47	70
54	12				34	43	56	44	59	45	63
60	12					42	50	43	53	44	56
66	12					41	46	42	49	43	51
72	12							41	45	42	47
78	12								43	36	44
84	12								40	31	42

*ROUND CORRUGATED STEEL PIPE
3" x 1" CORRUGATIONS

PIPE DIAMETER	** MIN. COVER	PLATE THICKNESS IN INCHES									
		0.064		0.079		0.109		0.138		0.168	
		R	E	R	E	R	E	R	E	R	E
INCHES	INCHES	MAX. FILL HTS. ABOVE TOP OF PIPE IN FEET									
36	12	37	39	46	48	73	75	85	88	96	100
42	12	33	35	42	44	62	72	69	84	76	87
48	12	30	32	39	41	58	64	59	77	66	79
54	12	27	29	36	38	56	59	57	64	65	71
60	12	25	26	32	34	50	53	51	56	58	64
66	12	22	23	29	31	45	48	46	52	53	58
72	12	21	22	28	29	42	44	43	48	49	53
78	12	19	20	25	26	38	41	42	44	44	49
84	18			23	25	36	38	40	42	42	46
90	18			21	23	33	35	38	40	41	43
96	18					30	33	37	38	40	42
102	24					26	28	34	35	38	41
108	24					22	24	32	34	35	37
114	24					21	23	31	32	34	36
120	24					20	22	29	30	32	32

*ROUND ALUMINUM ALLOY PIPE
2 2/3" x 1/2" CORRUGATIONS

PIPE DIAMETER	** MIN. COVER	PLATE THICKNESS IN INCHES									
		0.060		0.075		0.105		0.135		0.164	
		R	E	R	E	R	E	R	E	R	E
INCHES	INCHES	MAX. FILL HT. ABOVE TOP OF PIPE IN FEET									
12	12	41		43		70		73		75	
18	12	27		29		47		49		50	
24	12	20		21		35		37		38	
30	12	16		17		28		29		31	
36	12	14		15		23		24		25	
42	12			23		39		40		41	
48	12					36		37		39	
54	12					31		33		34	
60	12							30		31	
66	12							27		28	
72	12									26	

* RIVETED, WELDED OR HELICAL FABRICATION
** TOP OF PIPE TO TOP OF FINISHED GRADE AT SHOULDER LINE.
R = ROUND E = ELONGATED

*CORRUGATED STEEL PIPE ARCH
2 2/3" x 1/2" CORRUGATIONS

PIPE DIMENSIONS SPAN - RISE	** MIN. COVER	CORNER RADIUS	MIN. THICKNESS	MAX. COVER FOR CORNER PRESSURES IN TONS PER SQ. FT.	
INCHES	INCHES	INCHES	INCHES	2 TONS	*** 3 TONS
18x11	18	3½	0.064	13	19
22x13	18	4	0.064	12	18
25x16	18	4	0.064	10	16
29x18	18	4½	0.064	10	15
36x22	18	5	0.064	9	14
43x27	18	5½	0.064	9	12
50x31	18	6	0.079	8	12
58x36	18	7	0.109	8	12
65x40	18	8	0.109	8	12
72x44	18	9	0.138	8	12
79x49	18	10	0.168	8	12
85x54	18	11	0.168	9	13

*CORRUGATED STEEL PIPE ARCH
3" x 1" CORRUGATIONS

PIPE DIMENSIONS SPAN - RISE	** MIN. COVER	CORNER RADIUS	MIN. THICKNESS	MAX. COVER FOR CORNER PRESSURES IN TONS PER SQ. FT.	
INCHES	INCHES	INCHES	INCHES	2 TONS	*** 3 TONS
43x27	18	7½	0.064	12	18
50x31	18	9	0.064	12	18
58x36	18	10½	0.064	12	18
65x40	18	12	0.064	12	18
72x44	18	13½	0.064	12	18
73x55	18	18	0.064	16	22
81x59	18	18	0.079	15	21
87x63	18	18	0.079	14	20
95x67	18	18	0.109	13	18
103x71	24	18	0.109	12	17
112x75	24	18	0.109	11	16
117x79	24	18	0.109	10	15
128x83	24	18	0.138	9	14

*CORRUGATED ALUMINUM ALLOY PIPE ARCH
2 2/3" x 1/2" CORRUGATIONS

PIPE DIMENSIONS SPAN - RISE	** MIN. COVER	CORNER RADIUS	MIN. THICKNESS	MAX. COVER FOR CORNER PRESSURES IN TONS PER SQ. FT.	
INCHES	INCHES	INCHES	INCHES	2 TONS	*** 3 TONS
18x11	18	4	0.060	13	
22x13	18	4	0.060	12	
25x16	18	4	0.060	10	16
29x18	18	4½	0.060	10	15
36x22	18	5	0.060	9	13
43x27	18	5½	0.075	9	12
50x31	18	6	0.105	8	12
58x36	18	7	0.135	8	12
65x40	18	8	0.135	8	12
72x44	18	9	0.164	8	12

* RIVETED OR HELICAL FABRICATION
** TOP OF PIPE TO TOP OF FINISHED GRADE AT SHOULDER LINE FOR 2 TONS PER SQ. FT.
*** SHALL BE USED ONLY AFTER FOUNDATION INVESTIGATION

EQUIVALENT GAGE NUMBERS

GAGE NUMBER	THICKNESS IN INCHES		
	STEEL		AL.
	ZN. COAT	UNCOATED	
16	0.064	0.0598	0.060
14	0.079	0.0747	0.075
12	0.109	0.1046	0.105
10	0.138	0.1345	0.135
8	0.168	0.1644	0.164
7	0.188	0.1838	
5	0.218	0.2145	
3	0.249	0.2451	
1	0.280	0.2758	

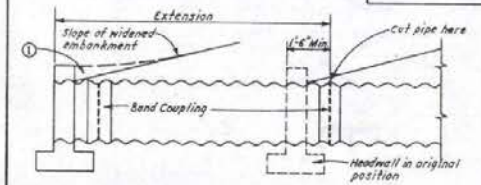
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

ALLOWABLE FILL HEIGHTS FOR CULVERTS

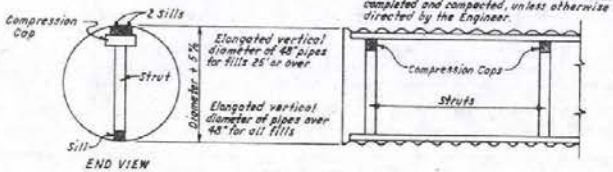
Robert L. Sharp
CHIEF ROAD DESIGN ENGR.

R-1.3.1 (601, 606)
ADOPTED: 7/73

R 12

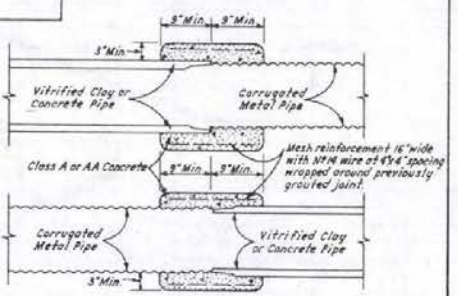


PIPE CULVERT EXTENSION
(Headwall to be moved and reset)

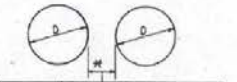


STRUTTING CMP

Note: For strut, cap, sill size and spacing use manufacturers recommendations. Struts, caps and sills to be the same dimension.

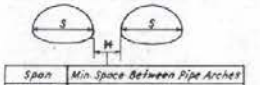


CONCRETE COLLAR
(CMP to RCP or Vitrified Pipe Extensions)



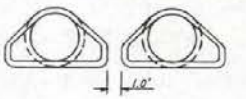
Diameter	Minimum Space Between Pipes
12" to 24"	1'-0"
30" to 66"	One Half Diameter of Pipe
72" to 84"	3'-0"

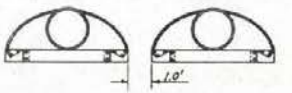
* When headwalls are used or anticipated for future use, space as per headwalls standard.



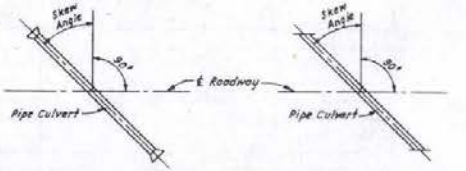
Span	Min. Space Between Pipe Arches
18" to 36"	1'-0"
43" to 72"	One Third Span of Pipe Arch

MULTIPLE INSTALLATIONS WITHOUT HEADWALLS



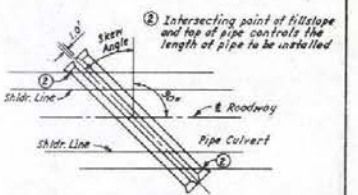


MULTIPLE INSTALLATIONS WITH END SECTIONS

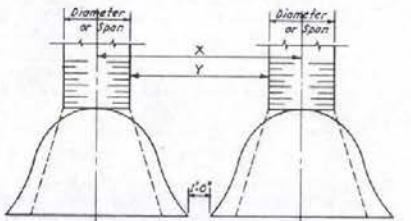


SINGLE CULVERT WITH END SECTIONS

SINGLE CULVERT WITH HEADWALLS



MULTIPLE CULVERT WITH END SECTIONS



Note: When Y distance exceeds 3'-0", Structure Excavation and Backfill quantities shall be calculated for each culvert.

CMP			CMAP			RCP		
DIA	X	Y	SPAN	X	Y	DIA	X	Y
12"	4'-0"	3'-0"	18"x11"	4'-8"	3'-2"	12"	3'-0"	2'-0"
15"	4'-8"	3'-5"	22"x13"	5'-2"	3'-6"	15"	4'-0"	2'-6"
18"	5'-4"	3'-10"	25"x16"	5'-10"	3'-9"	18"	5'-0"	3'-0"
21"	6'-0"	4'-3"	29"x18"	6'-6"	4'-1"	21"	6'-0"	3'-6"
24"	6'-8"	4'-8"	36"x22"	7'-8"	4'-8"	24"	7'-0"	4'-0"
30"	8'-0"	5'-6"	43"x27"	9'-2"	5'-8"	30"	7'-6"	4'-0"
36"	9'-4"	6'-4"	50"x31"	10'-2"	6'-1"	48"	8'-0"	4'-0"
42"	10'-8"	7'-2"	58"x36"	11'-6"	6'-8"	54"	7'-10"	3'-9"
48"	11'-6"	7'-6"	65"x40"	12'-6"	7'-1"			
54"	12'-2"	7'-10"	72"x44"	13'-6"	7'-6"			
60"	13'-6"	8'-6"	79"x49"	14'-6"	7'-11"			
66"	14'-0"	8'-6"	85"x54"	15'-6"	8'-5"			
72"	14'-6"	8'-6"						
78"	15'-0"	8'-6"						
84"	15'-6"	8'-6"						

TABLE OF SEPARATION FOR MULTIPLE INSTALLATIONS

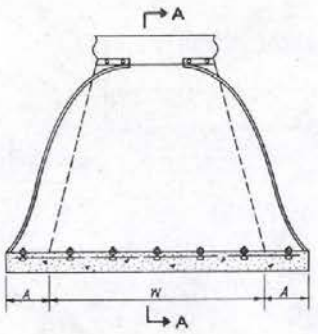
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

CULVERT INSTALLATION

Robert F. Rhoads
CHIEF ROAD DESIGN ENGR.

R-21.1 (601 THRU 606)
ADOPTED: 8/69
REVISION 2

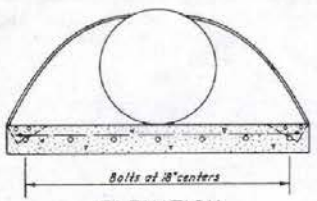
R 13



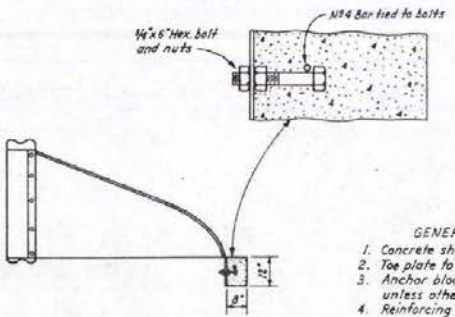
PLAN

DIMENSIONS				*Concrete Cu. Yd.
Pipe Diam.	Gage	A (1" Tol.)	W (2" Tol.)	
48"	12	18"	90"	0.26
54"	12	18"	102"	0.29
60"	12	18"	114"	0.31
66"	12	18"	120"	0.32
72"	12	18"	126"	0.34
78"	12	18"	132"	0.35
84"	12	18"	138"	0.36

* For information only.



ELEVATION



SECTION A-A

GENERAL NOTES

1. Concrete shall be Class A or AA.
2. Toe plate to be eliminated when anchor block is used.
3. Anchor block is to be installed on inlet end only, unless otherwise specified.
4. Reinforcing steel bar to clear 2" on ends of concrete block.

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

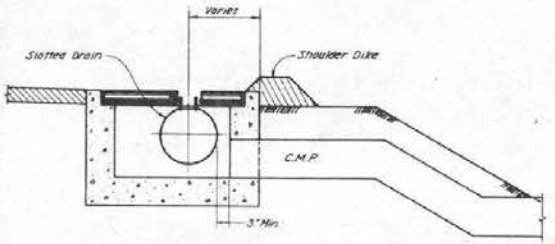
CULVERT INSTALLATION
ANCHOR BLOCK FOR CULVERTS 48" TO 84"

CHIEF ROAD DESIGN ENGR.

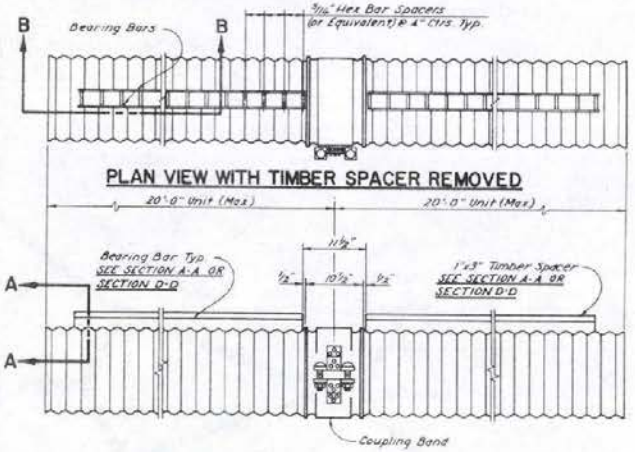
R-21.2-(604)

ADOPTED: 8/69 | REVISION

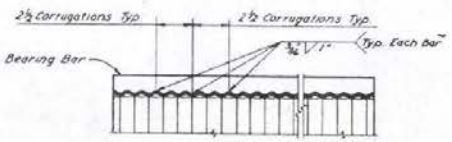
R-14



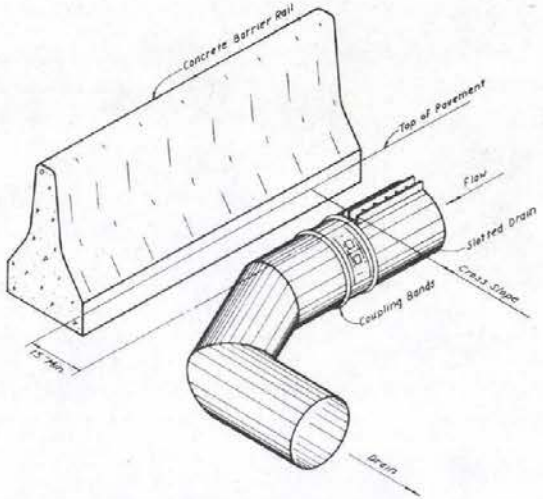
TYPE 4 EMBANKMENT PROTECTOR & SLOTTED DRAIN



SLOTTED DRAIN DETAIL

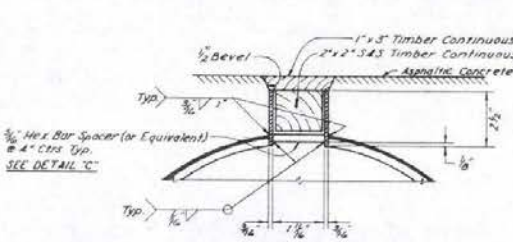


SECTION B-B

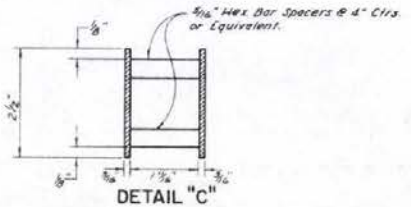


45° ANGLE SLOTTED DRAIN & CONCRETE BARRIER RAIL

(CAN BE USED WITH SHOULDER DIKE)

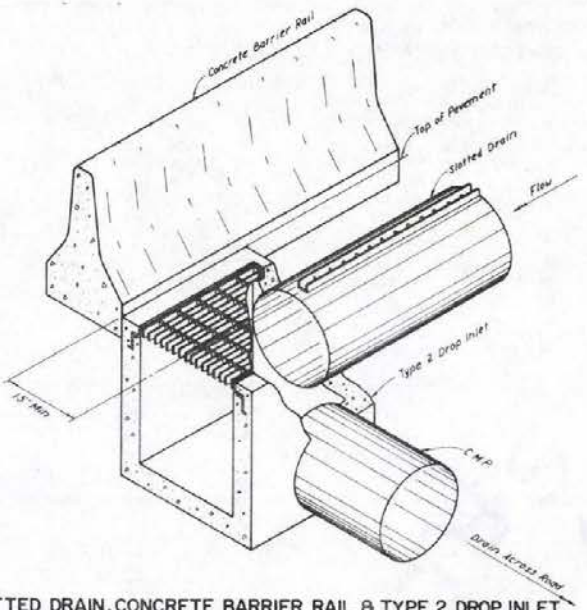


SECTION A-A

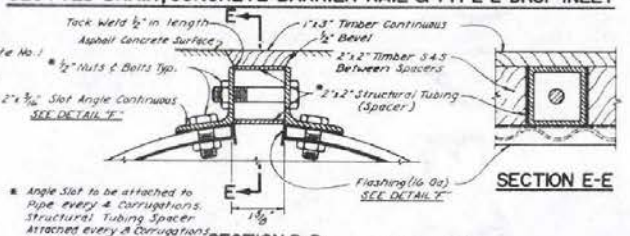


DETAIL "C"

(DOUBLE BAR SPACERS TO BE USED IN URBAN AREAS)

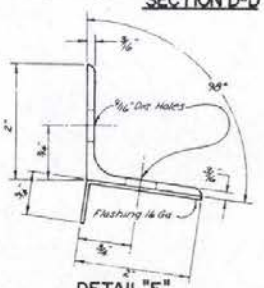


SLOTTED DRAIN, CONCRETE BARRIER RAIL & TYPE 2 DROP INLET



SECTION D-D

SECTION E-E



DETAIL "F"

GENERAL NOTES:

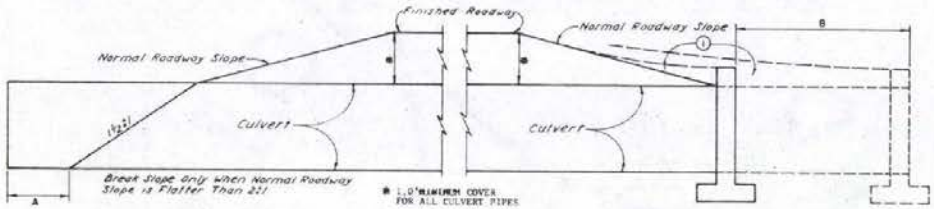
1. This continuous timber is nailed together & left in place as shown during paving operations. Remove after compaction.

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

SLOTTED C.M.P. DRAIN DETAILS

CHIEF ROAD DESIGN ENGR.	R-2.1.3(604)	REVISION
	ADOPTED 6-71	

R 15



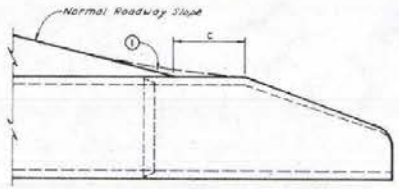
WITHOUT HEADWALL

WITH CONCRETE HEADWALL

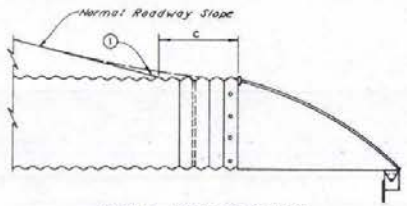
A – LENGTH OF CULVERT SHALL BE INCREASED AS FOLLOWS; CONSIDER EACH SIDE SEPARATELY. MEASURE PIPE FROM ROADBED CENTERLINE TO THE INTERSECTION OF PIPE FLOW LINE AND FILLSLOPE. TO THIS DIMENSION ADD 2.0' WHEN COVER AT SHOULDER IS 1.0' TO 10.0', ADD AN ADDITIONAL 0.5' FOR EACH SUCCEEDING 5.0' OF COVER OR PORTION THEREOF.

B – LENGTH OF CULVERTS SHALL BE INCREASED AS FOLLOWS; CONSIDER EACH SIDE SEPARATELY. MEASURE PIPE FROM ROADWAY CENTERLINE TO THE INTERSECTION OF THE TOP OF PIPE AND FILLSLOPE PLUS HEADWALL THICKNESS. TO THIS DIMENSION ADD 1.0' WHEN COVER AT SHOULDER IS 5.0' TO 10.0'. ADD AN ADDITIONAL 0.5' FOR EACH SUCCEEDING 5.0' OF COVER OR PORTION THEREOF.

① CONTOUR THIS AREA TO PROVIDE THE MINIMUM AMOUNT OF OBSTRUCTION EXPOSURE.



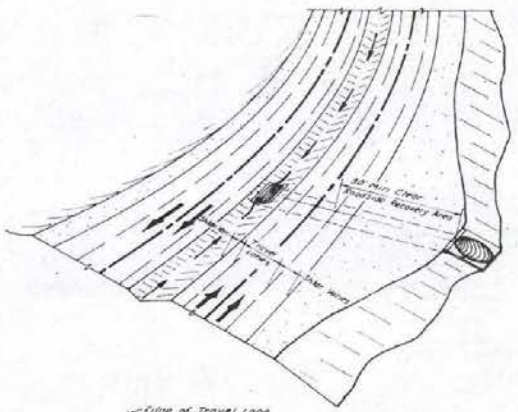
PRECAST CONCRETE END SECTION

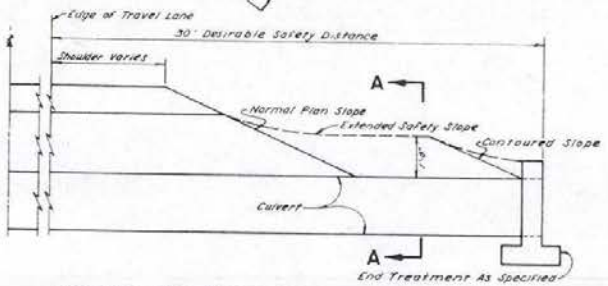


METAL END SECTION

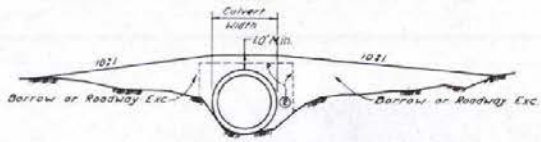
C – LENGTH OF CULVERT SHALL BE INCREASED AS FOLLOWS; CONSIDER EACH SIDE SEPARATELY. MEASURE PIPE FROM ROADWAY CENTERLINE TO THE INTERSECTION OF THE TOP OF PIPE AND FILLSLOPE. TO THIS DIMENSION ADD 1.0' WHEN COVER AT SHOULDER IS 1.0' TO 10.0', ADD AN ADDITIONAL 0.5' FOR EACH SUCCEEDING 5.0' OR PORTION THEREOF.

MINIMUM CULVERT INSTALLATION





METHOD OF CONTOURING OVER CULVERTS



SECTION A-A

SAFETY CULVERT INSTALLATION
(TO PROVIDE OBSTRUCTION CLEARANCE)

NOTE: 1. SOMETIMES DUE TO THE RIGHT OF WAY LIMITS OR DRAINAGE CONTROLS, A CULVERT MAY BE EXTENDED A SAFE DISTANCE, AS NOTED ON THE PLANS, AND THE FILL SLOPE WARPED FOR SAFETY AND A PLEASING APPEARANCE, BUT NOT MEET THE 30' MINIMUM SAFETY REQUIREMENTS. IF SUCH CONSTRUCTION IS NOT POSSIBLE, THEN VEHICLES MAY BE PROTECTED BY GUARDRAIL OR SOME OTHER TYPE OF BARRIER.

2. NORMAL STRUCTURE EXCAVATION AND BACKFILL LIMITS

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

CULVERT INSTALLATION

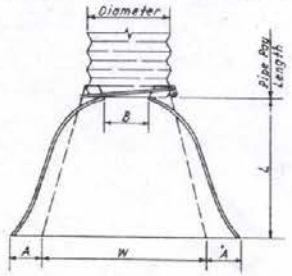
Robert L. Shaw
CHIEF ROAD DESIGN ENGINEER

R-2.1.6 (601 THRU 606)
ADOPTED 6-72
REVISION

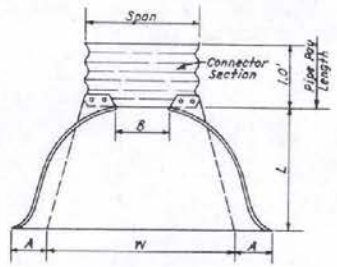
R16

TYPE CONNECTION	PIPE DIAM.	GAGE	DIMENSIONS A 1" TOL	B MAX.	H 1" TOL	L 1½" TOL	W 2" TOL	APPROX. SLOPE
TYPE 1	12"	16	6"	6"	6"	21"	24"	2½:1
	15"	16	7"	8"	6"	26"	30"	2½:1
	18"	16	8"	10"	6"	31"	36"	2½:1
	21"	16	9"	12"	6"	36"	42"	2½:1
	24"	16	10"	13"	6"	41"	48"	2½:1
TYPE 2	30"	14	12"	16"	8"	51"	60"	2½:1
	36"	14	14"	19"	9"	60"	72"	2½:1
TYPE 3	42"	12	16"	22"	11"	69"	84"	2½:1
	48"	12	18"	27"	12"	78"	90"	2¼:1
	54"	12	18"	30"	12"	84"	102"	2:1
	60"	12	18"	33"	12"	87"	114"	1¾:1
	66"	12	18"	36"	12"	87"	120"	1½:1
	72"	12	18"	39"	12"	87"	126"	1⅓:1
	78"	12	18"	42"	12"	87"	132"	1¼:1
	84"	12	18"	45"	12"	87"	138"	1⅛:1

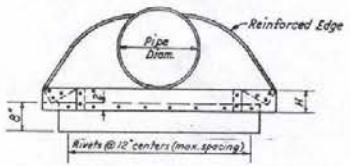
TYPE CONNECTION	PIPE ARCH DIMENSIONS SPAN	RISE	GAGE	DIMENSIONS A 1" TOL	B MAX.	H 1" TOL	L 1½" TOL	W 2" TOL	APPROX. SLOPE
TYPE 2	18"	11"	16	7"	9"	6"	19"	30"	2½:1
	22"	13"	16	7"	10"	6"	23"	36"	2½:1
	25"	16"	16	9"	12"	6"	28"	42"	2½:1
	29"	18"	16	9"	14"	6"	32"	48"	2½:1
	36"	22"	14	10"	16"	6"	39"	60"	2½:1
	43"	27"	14	12"	18"	8"	46"	75"	2½:1
	50"	31"	12	13"	21"	9"	53"	86"	2½:1
	58"	36"	12	18"	26"	12"	63"	90"	2½:1
TYPE 3	65"	40"	12	18"	30"	12"	70"	102"	2¼:1
	72"	44"	12	18"	33"	12"	77"	114"	2¼:1
	79"	49"	12	18"	36"	12"	77"	126"	2:1
	85"	54"	12	18"	39"	12"	77"	138"	2:1



PLAN

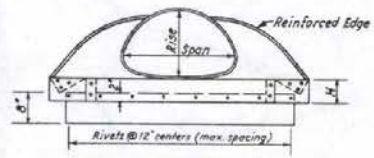


PLAN



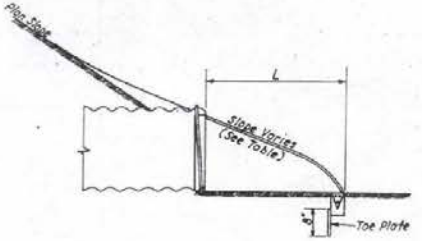
Length of toe plate to be W + 10" Min. for 12" to 30" diameter pipe inclusive and W + 22" Min. for 36" diameter pipes and larger.

ELEVATION



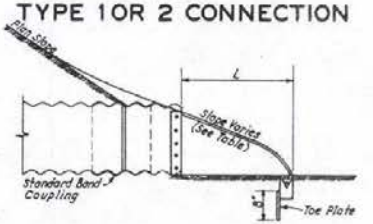
Length of toe plate to be W + 10" Min. for pipe arches with rise of 11" to 27" inclusive and W + 18" Min. for pipe arches with rise of 31" and larger.

ELEVATION



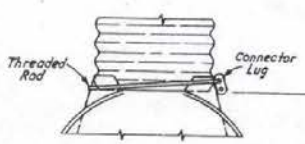
SECTION

TYPE 1 OR 2 CONNECTION



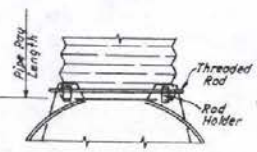
SECTION

TYPE 3 CONNECTION



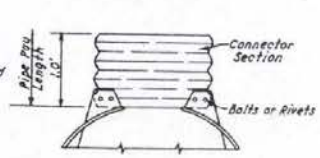
TYPE 1

For 12" CMP through 24" CMP only



TYPE 2

For 30" CMP through 36" CMP only
For 18" x 11" CMAP through 58" x 36" CMAP only



TYPE 3

For 42" CMP through 84" CMP only
For 65" x 40" CMAP through 85" x 54" CMAP only

GENERAL NOTES

1. The culvert lengths shown on the plans and structure list shall be the pay length as indicated on the standard sheet including connector section lengths when used.
2. Pipe on skew shall not be mitered. Sufficient additional length of pipe shall be allowed to provide clearance for end sections.
3. Toe plates required on round pipe 24" and over in diameter and on arch pipe 29" x 18" and over unless otherwise specified on the plans or in the Special Provisions.
4. Toe plate shall be punched with 7/16" holes to match holes in lip of end section and bolted with ⅜" galvanized bolts.

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

METAL END SECTIONS
12" CMP TO 84" CMP AND 18" X 11" CMAP TO 85" X 54" CMAP

CHIEF ROAD DESIGN ENGR. | R-2.21-(604) | ADOPTED: 8/63 | REVISION

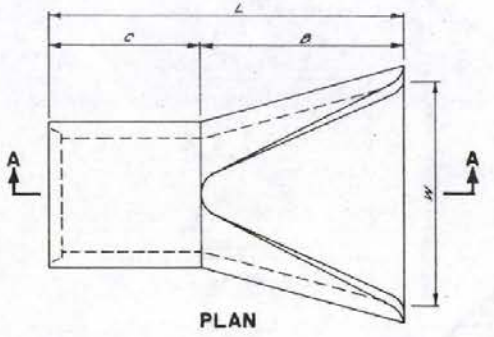
STANDARD CONNECTIONS

R17

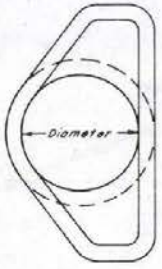
DIAMETER	WEIGHT	A	B	C	L	W
12"	340	4"	1'-10"	2'-0"	3'-10"	2'-0"
18"	470	9"	2'-1"	2'-1"	4'-2"	3'-0"
24"	1300	9½"	3'-6"	2'-6"	6'-0"	4'-0"
30"	1850	1'-0"	4'-5"	1'-8"	6'-1"	5'-0"
36"	3500	1'-3"	5'-2"	2'-11"	8'-1"	6'-0"
42"	4330	1'-9"	5'-3"	2'-11"	8'-2"	6'-6"
48"	6700	2'-0"	6'-0"	2'-2"	8'-2"	7'-0"
54"	7150	2'-3"	5'-6"	2'-3"	8'-3"	8'-10"

GENERAL NOTES

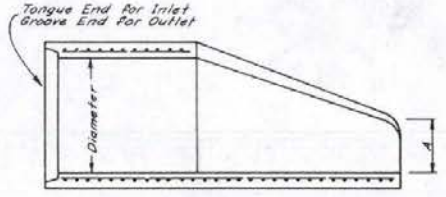
1. ~ Class and type of concrete shall be as specified for Reinforced Concrete Pipe.
2. ~ Structural design of end section shall conform to that of Standard Reinforced Concrete Culvert Pipe.
3. ~ Length of pipe shown on the plans does not include connector section (Length C).



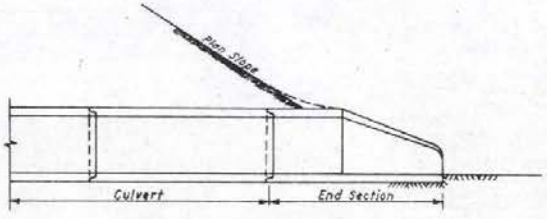
PLAN



END VIEW



SECTION A-A



CROSS SECTION VIEW

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

END SECTIONS
12" RCP TO 54" RCP

CHIEF ROAD DESIGN ENGR.

R-2.3.1- (603)

ADOPTED: 8/69

REVISION

R 18

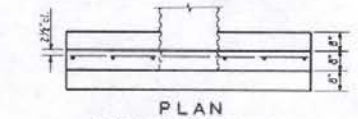
CMP SIZE D	CORR CMAP S X R	CMP AREA SQ FT	L	SINGLE CMP								DOUBLE CMP							
				0° SKEW		15° SKEW		30° SKEW		45° SKEW		0° SKEW		15° SKEW		30° SKEW		45° SKEW	
				CONC CU YD	STEEL LB	CONC CU YD	STEEL LB	CONC CU YD	STEEL LB	CONC CU YD	STEEL LB	CONC CU YD	STEEL LB	CONC CU YD	STEEL LB	CONC CU YD	STEEL LB	CONC CU YD	STEEL LB
12"		0.79	3'-6"	0.85	35	0.93	37	0.94	37	0.99	39	1.21	46	1.30	43	1.35	50	1.49	53
15"	18"X11"	1.23	4'-3"	1.09	48	1.19	50	1.21	51	1.27	52	1.51	61	1.62	64	1.68	65	1.85	69
18"	22"X13"	1.77	5'-0"	1.36	55	1.48	59	1.51	59	1.57	61	1.83	70	1.96	73	2.05	75	2.24	80
24"	29"X18"	3.14	6'-6"	1.95	78	2.12	83	2.16	84	2.25	86	2.53	95	2.73	100	2.84	103	3.08	108
30"	36"X22"	4.91	8'-0"	2.61	105	2.86	111	2.90	112	3.01	115	3.39	126	3.65	132	3.79	135	4.11	142
36"	43"X27"	7.07	9'-6"	3.36	122	3.66	129	3.72	131	3.86	134	4.34	147	4.68	155	4.85	158	5.25	167
42"	50"X31"	9.62	11'-0"	4.18	161	4.56	177	4.64	179	4.81	182	5.39	196	5.81	206	6.03	210	6.52	220

Quantities shown above are for two headwalls

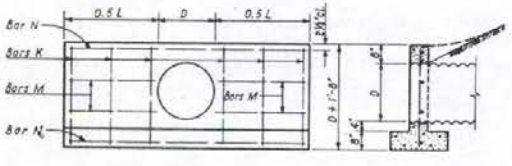
Quantities shown below are for one headwall

LENGTH OF REINFORCING BARS

CMP SIZE D	SINGLE CMP					SINGLE OR DOUBLE CMP							DOUBLE CMP				
	0°-45°	0°	15°	30°	45°	0°	15°		30°		45°		0°-45°	0°	15°	30°	45°
	NO. 4	NO. 5	NO. 5	NO. 5	NO. 5	NO. 4	NO. 4	NO. 4	NO. 4	NO. 4	NO. 4	NO. 4	NO. 4	NO. 5	NO. 5	NO. 5	NO. 5
	K	N	N	N	N	M	M	Q	M	Q	M	Q	K	N	N	N	N
12"	4@2'-5"	2@4'-3"	2@4'-8"	2@4'-9"	2@5'-0"	2@1'-6"	1@1'-4"	1@2'-0"	1@1'-3"	1@2'-1"	1@1'-0"	1@2'-4"	5@2'-6"	2@6'-3"	2@6'-9"	2@7'-1"	2@7'-10"
15"	6@2'-8"	2@5'-3"	2@5'-9"	2@5'-11"	2@6'-2"	2@1'-8"	1@1'-6"	1@2'-2"	1@1'-5"	1@2'-3"	1@1'-2"	1@2'-6"	7@2'-8"	2@7'-6"	2@8'-1"	2@8'-6"	2@9'-5"
18"	6@2'-11"	2@6'-3"	2@6'-10"	2@7'-0"	2@7'-4"	2@2'-3"	1@2'-1"	1@2'-11"	1@2'-0"	1@3'-0"	1@1'-3"	1@3'-3"	7@2'-11"	2@8'-9"	2@9'-5"	2@9'-10"	2@10'-11"
24"	6@3'-5"	2@8'-3"	2@9'-0"	2@9'-3"	2@9'-8"	4@3'-0"	2@2'-10"	2@3'-5"	2@3'-5"	2@3'-10"	2@2'-6"	2@4'-1"	7@3'-5"	2@11'-3"	2@12'-1"	2@12'-8"	2@14'-0"
30"	8@3'-11"	2@10'-3"	2@11'-2"	2@11'-5"	2@12'-1"	4@3'-9"	2@3'-7"	2@4'-6"	2@4'-6"	2@4'-9"	2@3'-3"	2@5'-0"	9@3'-11"	2@14'-0"	2@15'-0"	2@15'-9"	2@17'-5"
36"	8@4'-5"	2@12'-3"	2@13'-4"	2@13'-8"	2@14'-5"	4@4'-6"	2@4'-4"	2@5'-7"	2@4'-3"	2@5'-8"	2@4'-0"	2@5'-11"	9@4'-5"	2@16'-9"	2@18'-0"	2@18'-10"	2@20'-10"
42"	10@4'-11"	2@14'-3"	2@15'-6"	2@15'-11"	2@16'-10"	6@5'-3"	3@5'-1"	3@6'-6"	3@5'-0"	3@6'-7"	3@4'-9"	3@6'-10"	11@4'-11"	2@19'-6"	2@20'-11"	2@21'-11"	2@24'-3"

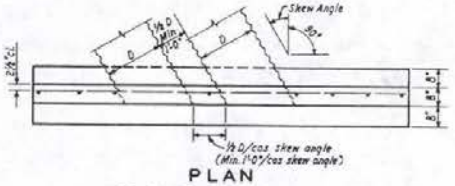


PLAN
SINGLE CMP

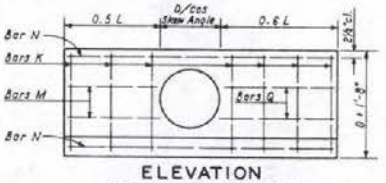


ELEVATION
SINGLE CMP

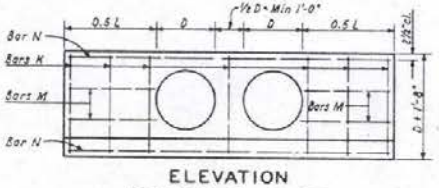
SECTION
(For All Headwalls)



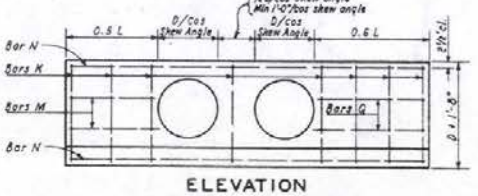
PLAN
DOUBLE CMP



ELEVATION
SINGLE CMP



ELEVATION
DOUBLE CMP
0° SKEW



ELEVATION
DOUBLE CMP
15° TO 45° SKEW

GENERAL NOTES

1 ~ Concrete shall be Class A or AA.
2 ~ Reinforcing steel shall be deformed bars with maximum spacing of 18" set 2½" clear of surface of concrete except as noted. Bar ends shall be kept 1½" clear of surface of concrete. Reinforcing bars may be cut and bent in field.
3 ~ Footings shown are of minimum depth and shall be extended if soil is unsuitable or liable to scour.
4 ~ Culvert pipes to be set on a skew shall be mitered when headwalls are constructed. When headwalls are not constructed the pipes shall not be mitered except in overflow section.
5 ~ For estimating headwall quantities on skewed culverts:
0° to 10° ~ Use quantities for 0° skew.
11° to 25° ~ Use quantities for 15° skew.
26° to 40° ~ Use quantities for 30° skew.
41° to 55° ~ Use quantities for 45° skew.
Over 55° ~ Calculate quantities required.
Culverts should be installed on 0°, 15°, 30° or 45° where it is feasible.

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

CULVERT HEADWALLS
12" CMP TO 42" CMP

William L. Nagel
CHIEF ROAD DESIGN ENGR.

R-2.41-(502)
ADOPTED: 8/63
REVISION

R 19

CMP SIZE D	CORR CMAP S X R	CMP AREA SQ FT	L	SINGLE CMP								DOUBLE CMP							
				0° SKEW		15° SKEW		30° SKEW		45° SKEW		0° SKEW		15° SKEW		30° SKEW		45° SKEW	
				CONC CU YD	STEEL LB	CONC CU YD	STEEL LB	CONC CU YD	STEEL LB	CONC CU YD	STEEL LB	CONC CU YD	STEEL LB	CONC CU YD	STEEL LB	CONC CU YD	STEEL LB	CONC CU YD	STEEL LB
48"	58"X36"	12.57	12'-6"	6.72	597	7.31	651	7.45	656	7.75	696	8.76	715	9.43	772	9.82	815	10.65	874
54"	65"X40"	15.90	14'-0"	7.30	706	8.60	766	8.76	802	9.10	814	10.28	841	11.07	904	11.51	950	12.47	1045
60"	72"X44"	19.64	15'-6"	10.17	993	11.07	1089	11.28	1096	11.74	1147	13.28	1229	14.30	1328	14.87	1381	16.13	1547
72"		28.27	18'-6"	13.13	1265	14.30	1377	14.56	1424	15.12	1481	17.07	1538	18.38	1654	19.11	1753	20.70	1937

Quantities shown above are for two headwalls

Quantities shown below are for one headwall.

LENGTH OF REINFORCING BARS
SINGLE CMP

CMP SIZE D	0° SKEW					15° SKEW								30° SKEW						45° SKEW					
	NO. 5	NO. 5	NO. 4	NO. 4	NO. 4	NO. 5		NO. 4						NO. 5		NO. 4				NO. 5		NO. 4			
	F	G	M	N	K	F	G	M	Q	N	K			F	G	M	Q	N	K	F	G	M	Q	N	K
48"	12 @ 2'-9"	10 @ 7'-7"	12 @ 6'-0"	9 @ 16'-3"	10 @ 5'-10"	13 @ 2'-9"	11 @ 7'-7"	6 @ 5'-10"	6 @ 7'-3"	9 @ 17'-8"	11 @ 5'-10"			13 @ 2'-9"	11 @ 7'-7"	6 @ 5'-8"	6 @ 7'-3"	9 @ 18'-2"	11 @ 5'-10"	14 @ 2'-9"	12 @ 7'-7"	6 @ 5'-6"	6 @ 7'-3"	9 @ 19'-2"	12 @ 5'-10"
54"	13 @ 2'-9"	12 @ 8'-1"	12 @ 6'-9"	9 @ 18'-3"	12 @ 6'-4"	14 @ 2'-9"	13 @ 8'-1"	6 @ 6'-7"	6 @ 8'-1"	9 @ 19'-10"	13 @ 6'-4"			15 @ 2'-8"	14 @ 8'-1"	6 @ 6'-5"	6 @ 8'-1"	9 @ 20'-4"	14 @ 6'-4"	15 @ 2'-9"	14 @ 8'-1"	6 @ 6'-3"	6 @ 8'-1"	9 @ 21'-6"	14 @ 6'-4"
60"	21 @ 3'-3"	18 @ 8'-9"	12 @ 7'-6"	10 @ 20'-3"	12 @ 6'-10"	23 @ 3'-9"	20 @ 8'-9"	6 @ 7'-4"	6 @ 9'-0"	10 @ 22'-0"	13 @ 6'-10"			23 @ 3'-9"	20 @ 8'-9"	6 @ 7'-2"	6 @ 9'-0"	10 @ 22'-7"	13 @ 6'-10"	24 @ 3'-9"	21 @ 8'-9"	6 @ 7'-0"	6 @ 9'-0"	10 @ 23'-11"	14 @ 6'-10"
72"	25 @ 3'-9"	20 @ 9'-9"	16 @ 9'-0"	10 @ 24'-3"	14 @ 7'-10"	27 @ 3'-9"	22 @ 9'-9"	8 @ 8'-10"	8 @ 10'-10"	10 @ 26'-4"	15 @ 7'-10"			28 @ 3'-9"	23 @ 9'-9"	8 @ 8'-8"	8 @ 10'-10"	10 @ 27'-0"	16 @ 7'-10"	29 @ 3'-9"	24 @ 9'-9"	8 @ 8'-6"	8 @ 10'-10"	10 @ 28'-1"	17 @ 7'-10"

DOUBLE CMP

48"	16 @ 2'-9"	11 @ 7'-7"	12 @ 6'-0"	9 @ 22'-3"	11 @ 5'-10"	17 @ 2'-9"	12 @ 7'-7"	6 @ 5'-10"	6 @ 7'-3"	9 @ 23'-10"	12 @ 5'-10"			18 @ 2'-8"	13 @ 7'-7"	6 @ 5'-8"	6 @ 7'-3"	9 @ 25'-1"	13 @ 5'-10"	19 @ 2'-9"	14 @ 7'-7"	6 @ 5'-6"	6 @ 7'-3"	9 @ 27'-8"	14 @ 5'-10"
54"	18 @ 2'-9"	13 @ 8'-1"	12 @ 6'-9"	9 @ 23'-0"	13 @ 6'-4"	19 @ 2'-9"	14 @ 8'-1"	6 @ 6'-7"	6 @ 8'-1"	9 @ 26'-10"	14 @ 6'-4"			20 @ 2'-9"	15 @ 8'-1"	6 @ 6'-5"	6 @ 8'-1"	9 @ 28'-2"	15 @ 6'-4"	22 @ 2'-9"	17 @ 8'-1"	6 @ 6'-3"	6 @ 8'-1"	9 @ 31'-1"	17 @ 6'-4"
60"	29 @ 3'-9"	21 @ 8'-9"	12 @ 7'-6"	10 @ 27'-9"	14 @ 6'-10"	31 @ 3'-9"	23 @ 8'-3"	6 @ 7'-4"	6 @ 9'-0"	10 @ 29'-9"	15 @ 6'-10"			32 @ 3'-9"	24 @ 8'-9"	6 @ 7'-2"	6 @ 9'-0"	10 @ 31'-3"	16 @ 6'-10"	36 @ 3'-9"	28 @ 8'-9"	6 @ 7'-0"	6 @ 9'-0"	10 @ 34'-6"	18 @ 6'-10"
72"	34 @ 3'-9"	23 @ 9'-9"	16 @ 9'-0"	10 @ 33'-3"	16 @ 7'-10"	36 @ 3'-9"	25 @ 9'-9"	8 @ 8'-10"	8 @ 10'-10"	10 @ 35'-6"	17 @ 7'-10"			38 @ 3'-9"	27 @ 9'-9"	8 @ 8'-8"	8 @ 10'-10"	10 @ 37'-5"	19 @ 7'-10"	42 @ 3'-9"	31 @ 9'-9"	8 @ 8'-6"	8 @ 10'-10"	10 @ 41'-4"	21 @ 7'-10"

GENERAL NOTES

1 - Concrete shall be Class A or AA.

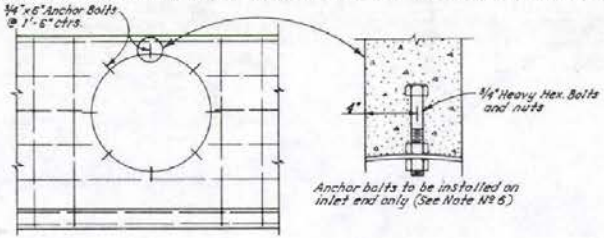
2 - Reinforcing steel shall be deformed bars with maximum spacing of 18" set 2½" clear of surface of concrete except as noted. Bar ends shall be kept 1½" clear of surface of concrete. Reinforcing bars may be cut and bent in field.

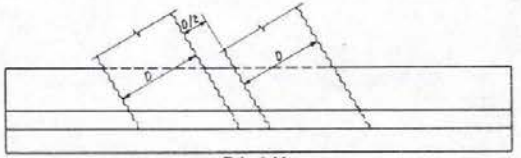
3 - Footings shown are of minimum depth and shall be extended if soil is unsuitable or liable to scour.

4 - Culvert pipes to be set on a skew shall be mitered when headwalls are constructed. When headwalls are not constructed the pipes shall not be mitered except in overflow section.

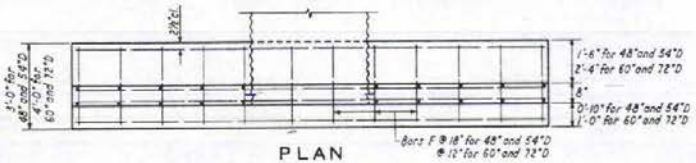
5 - For estimating headwall quantities on skewed culverts:
0° to 10° - Use quantities for 0° skew.
11° to 25° - Use quantities for 15° skew.
26° to 40° - Use quantities for 30° skew.
41° to 55° - Use quantities for 45° skew.
Over 55° - Calculate quantities required.
Culverts should be installed on 0°, 15°, 30° or 45° where it is feasible.

6 - No Direct Payment for anchor bolts.

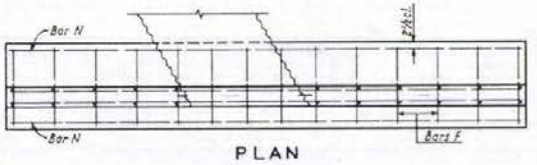




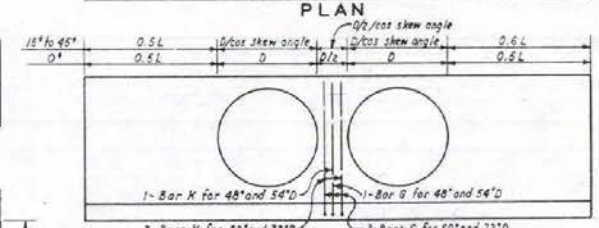
PLAN



PLAN



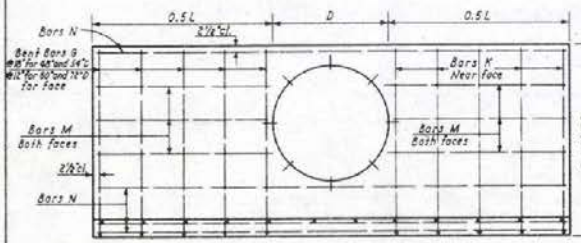
PLAN



ELEVATION

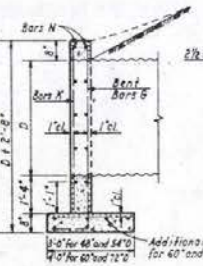
DOUBLE CMP
0° TO 45° SKEW

NOTE: For details of other reinforcing bars see Single Culvert Headwalls.

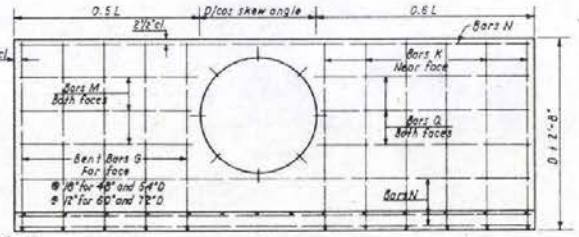


ELEVATION

SINGLE CMP
0° SKEW



SECTION



ELEVATION

SINGLE CMP
15° TO 45° SKEW

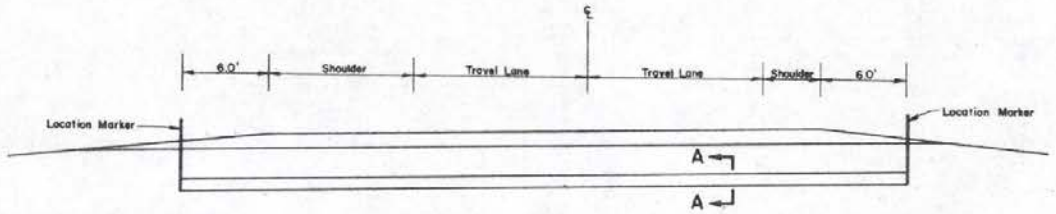
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

CULVERT HEADWALLS
48" CMP TO 72" CMP

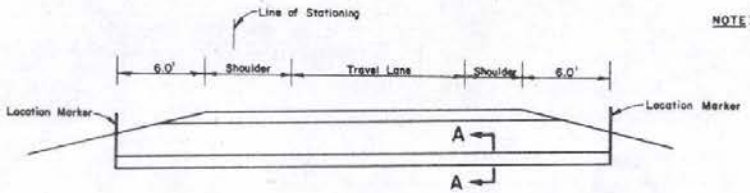
CHIEF ROAD DESIGN ENGR.

R-2.4.2-(502)
ADOPTED: 8/69
REVISION

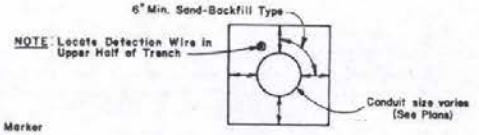
R 20



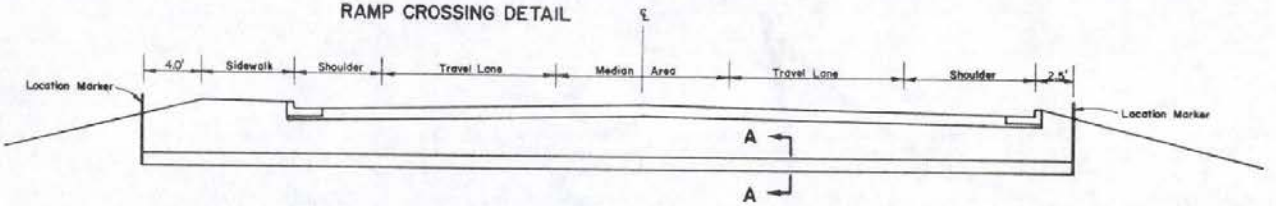
FREEWAY CROSSING DETAIL



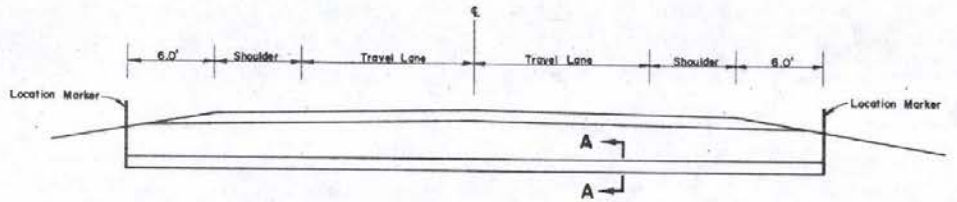
RAMP CROSSING DETAIL



SECTION A-A



CROSSROAD DETAIL



FRONTAGE ROAD DETAIL

GENERAL NOTES

1. MINIMUM 3.0' COVER OVER TOP OF CONDUIT AT SHOULDER LINE.
2. 12 GAUGE DETECTION WIRE TO LAY IN TRENCH ADJACENT TO CONDUIT AND ATTACH TO LOCATION MARKER AT EACH END.
3. LOCATION MARKER SHALL BE 5.0' STEEL FENCE LINE POST.

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

CONDUIT INSTALLATION FOR FUTURE WATER LINES

CHIEF ROAD DESIGN ENGR.

R-2.4.3 (213)
ADOPTED: 5/73 REVISION

R 21

Quantities shown below are for two headwalls

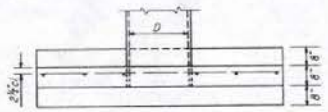
RCP SIZE D	RCP AREA SQ. FT.	SINGLE RCP 0° SKEW CONC CU YD	SINGLE RCP 0° SKEW STEEL LB	SINGLE RCP 15° SKEW CONC CU YD	SINGLE RCP 15° SKEW STEEL LB	SINGLE RCP 30° SKEW CONC CU YD	SINGLE RCP 30° SKEW STEEL LB	SINGLE RCP 45° SKEW CONC CU YD	SINGLE RCP 45° SKEW STEEL LB	DOUBLE RCP 0° SKEW CONC CU YD	DOUBLE RCP 0° SKEW STEEL LB	DOUBLE RCP 15° SKEW CONG CU YD	DOUBLE RCP 15° SKEW STEEL LB	DOUBLE RCP 30° SKEW CONC CU YD	DOUBLE RCP 30° SKEW STEEL LB	DOUBLE RCP 45° SKEW CONC CU YD	DOUBLE RCP 45° SKEW STEEL LB	X	Y	L	h
12"	0.79	1.00	46	1.09	49	1.10	49	1.14	50	1.41	59	1.52	62	1.58	64	1.73	67	0'-10"	1'-2"	4'-0"	3'-0"
15"	1.23	1.32	55	1.45	58	1.47	59	1.52	60	1.80	70	1.93	73	2.01	75	2.18	79	0'-10¾"	1'-2¾"	5'-0"	3'-3½"
18"	1.77	1.62	69	1.77	73	1.80	74	1.85	75	2.15	85	2.31	89	2.40	91	2.60	96	0'-10½"	1'-2½"	5'-9"	3'-7"
21"	2.41	1.95	77	2.13	82	2.16	83	2.23	85	2.59	95	2.79	101	2.90	103	3.13	108	0'-10¾"	1'-2¾"	6'-6"	3'-10½"
24"	3.14	2.27	96	2.48	102	2.52	103	2.60	105	3.01	116	3.24	122	3.37	125	3.64	131	0'-11"	1'-3"	7'-3"	4'-2"
27"	3.98	2.62	105	2.86	111	2.90	112	2.93	114	3.48	128	3.75	134	3.89	137	4.21	144	0'-11"	1'-3"	8'-0"	4'-5"
30"	4.91	3.08	117	3.37	123	3.41	124	3.44	127	4.07	141	4.38	148	4.55	152	4.90	159	0'-11½"	1'-3½"	9'-0"	4'-9"
33"	5.94	3.50	125	3.82	132	3.87	134	3.88	137	4.62	153	4.98	160	5.17	164	5.56	172	0'-11¾"	1'-3¾"	9'-9"	5'-1½"
36"	7.07	3.93	141	4.29	149	4.34	151	4.47	154	5.19	190	5.59	200	5.80	204	6.24	213	1'-0"	1'-4"	10'-6"	5'-4"

GENERAL NOTES

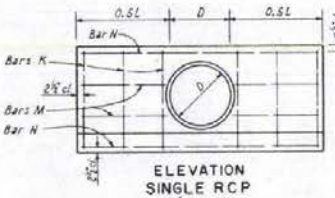
1 - Concrete shall be Class A or AA.
2 - Reinforcing steel shall be deformed bars with maximum spacing of 18" set 2½" clear of surface of concrete except as noted. Bar ends shall be kept 1½" clear of surface of concrete. Reinforcing bars may be cut and bent in field.
3 - Footings shown are of minimum depth and shall be extended if soil is unsuitable or liable to scour.
4 - Culvert pipes to be set on a skew shall be mitered when headwalls are constructed. When headwalls are not constructed the pipes shall not be mitered except in overflow section.
5 - For estimating headwall quantities on skewed culverts:
0° to 10° - Use quantities for 0° skew.
11° to 25° - Use quantities for 15° skew.
26° to 40° - Use quantities for 30° skew.
41° to 55° - Use quantities for 45° skew.
Over 55° - Calculate quantities required.
Culverts should be installed on 0°, 15°, 30° or 45° where it is feasible.
6 - Dimensions X, Y, L and h to remain constant regardless of minor variations in wall thickness due to class of pipe used.

Quantities shown below are for one headwall

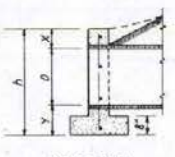
RCP SIZE	LENGTH OF REINFORCING BARS SINGLE 0° To 45°	SINGLE 0°	SINGLE 15°	SINGLE 30°	SINGLE 45°	SINGLE OR DOUBLE 0°	SINGLE OR DOUBLE 15°		SINGLE OR DOUBLE 30°		SINGLE OR DOUBLE 45°		DOUBLE 0° To 45°	DOUBLE 0°	DOUBLE 15°	DOUBLE 30°	DOUBLE 45°
	Nº 4	Nº 5	Nº 5	Nº 5	Nº 5	Nº 4	Nº 4	Nº 4	Nº 4	Nº 4	Nº 4	Nº 4	Nº 4	Nº 5	Nº 5	Nº 5	Nº 5
	K	N	N	N	N	M	M	Q	M	Q	M	Q	K	N	N	N	N
12"	6@2'-9"	2@4'-9"	2@ 5'-2"	2@ 5'-4"	2@ 5'-7"	2@1'-7"	1@1'-5"	1@2'-1"	1@1'-4"	1@2'-2"	1@1'-1"	1@2'-5"	7@2'-9"	2@ 7'-0"	2@ 7'-6"	2@ 7'-11"	2@ 8'-9"
15"	6@3'-1"	2@6'-0"	2@ 6'-6"	2@ 6'-8"	2@ 7'-0"	2@2'-1"	1@1'-11"	1@2'-8"	1@1'-10"	1@2'-9"	1@1'-7"	1@3'-0"	7@3'-1"	2@ 8'-6"	2@ 9'-2"	2@ 9'-7"	2@10'-7"
18"	6@3'-4"	2@7'-0"	2@ 7'-8"	2@ 7'-10"	2@ 8'-2"	4@2'-5"	2@2'-3"	2@3'-1"	2@2'-2"	2@3'-2"	2@1'-11"	2@3'-5"	7@3'-4"	2@ 9'-3"	2@10'-6"	2@11'-0"	2@12'-1"
21"	6@3'-8"	2@8'-0"	2@ 8'-3"	2@ 8'-11"	2@ 9'-5"	4@2'-9"	2@2'-7"	2@3'-6"	2@2'-6"	2@3'-7"	2@2'-3"	2@3'-10"	7@3'-8"	2@11'-2"	2@12'-0"	2@12'-7"	2@13'-10"
24"	8@3'-11"	2@9'-0"	2@ 9'-10"	2@10'-1"	2@10'-7"	4@3'-2"	2@3'-0"	2@4'-0"	2@2'-11"	2@4'-1"	2@2'-8"	2@4'-4"	9@3'-11"	2@12'-7"	2@13'-7"	2@14'-2"	2@15'-8"
27"	8@4'-2"	2@10'-0"	2@10'-11"	2@11'-2"	2@11'-9"	4@3'-6"	2@3'-4"	2@4'-6"	2@3'-3"	2@4'-5"	2@3'-0"	2@4'-8"	9@4'-2"	2@14'-1"	2@15'-1"	2@15'-10"	2@17'-6"
30"	8@4'-6"	2@11'-3"	2@12'-3"	2@12'-7"	2@13'-2"	4@4'-0"	2@3'-10"	2@5'-0"	2@3'-9"	2@5'-1"	2@3'-6"	2@5'-4"	9@4'-6"	2@15'-5"	2@16'-11"	2@17'-9"	2@19'-7"
33"	8@4'-10"	2@12'-3"	2@13'-4"	2@13'-8"	2@14'-4"	4@4'-3"	2@4'-1"	2@5'-3"	2@4'-0"	2@5'-4"	2@3'-9"	2@5'-7"	9@4'-10"	2@17'-3"	2@18'-6"	2@19'-5"	2@21'-5"
36"	10@5'-1"	2@13'-3"	2@14'-5"	2@14'-9"	2@15'-7"	6@4'-8"	3@4'-6"	2@5'-9"	3@4'-5"	3@5'-10"	3@4'-2"	3@6'-1"	11@5'-1"	2@18'-8"	2@20'-0"	2@21'-0"	2@23'-2"



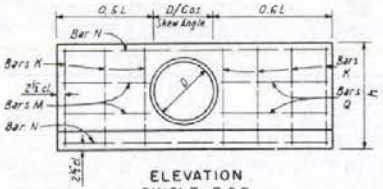
PLAN



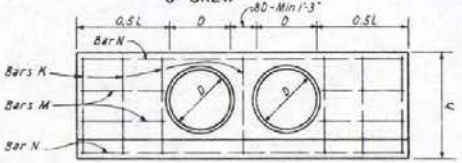
ELEVATION
SINGLE RCP
0° SKEW



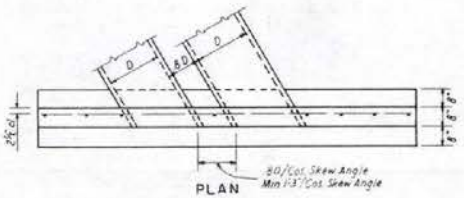
SECTION
(For All Headwalls)



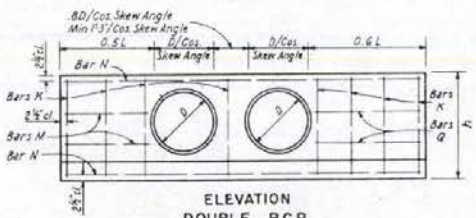
ELEVATION
SINGLE RCP
15° TO 45° SKEW



ELEVATION
DOUBLE RCP
0° SKEW



PLAN



ELEVATION
DOUBLE RCP
15° TO 45° SKEW

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

CULVERT HEADWALLS
12" RCP TO 36" RCP

CHIEF ROAD DESIGN ENGR.

R-2.5.1-(502)
ADOPTED: 8/68
REVISION

R 22

Quantities shown below are for two headwalls

RCP SIZE D	RCP AREA SQ. FT.	SINGLE RCP 0° SKEW CONC CU YD	0° SKEW STEEL LB	15° SKEW CONC CU YD	15° SKEW STEEL LB	30° SKEW CONC CU YD	30° SKEW STEEL LB	45° SKEW CONC CU YD	45° SKEW STEEL LB	DOUBLE RCP 0° SKEW CONC CU YD	0° SKEW STEEL LB	15° SKEW CONC CU YD	15° SKEW STEEL LB	30° SKEW CONC CU YD	30° SKEW STEEL LB	45° SKEW CONC CU YD	45° SKEW STEEL LB	X	Y	L	h	RCP SIZE D
42"	9.62	6.10	571	6.66	624	6.76	627	6.98	666	8.18	692	8.80	748	9.15	790	9.91	877	1'-0¾"	2'-0¾"	12'-0"	6'-8½"	42"
48"	12.57	7.41	688	8.10	745	8.21	781	8.46	792	9.88	829	10.65	883	11.07	935	11.96	1030	1'-1"	2'-1"	13'-9"	7'-3"	48"
54"	15.90	9.81	930	10.71	1091	10.87	1096	11.21	1146	13.11	1236	14.12	1340	14.68	1395	15.86	1562	1'-1½"	2'-1½"	15'-6"	7'-9"	54"
60"	19.64	11.29	1137	12.32	1244	12.50	1250	12.88	1332	15.08	1407	16.25	1537	16.88	1596	18.25	1774	1'-2"	2'-2"	17'-0"	8'-4"	60"
72"	28.27	15.62	1825	17.05	2002	17.30	2045	17.83	2170	20.87	2247	22.49	2464	23.36	2596	25.26	2881	1'-3"	2'-3"	20'-3"	9'-6"	72"

Quantities shown below are for one headwall

LENGTH OF REINFORCING BARS

SINGLE RCP

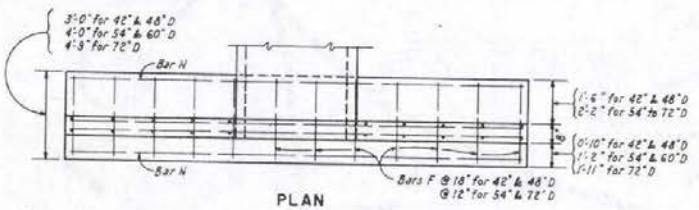
RCP SIZE	0° SKEW Nº 5 F	0° SKEW Nº 5 G	0° SKEW Nº 4 M	0° SKEW Nº 4 N	0° SKEW Nº 4 K	15° SKEW Nº 5 F	15° SKEW Nº 5 G	15° SKEW Nº 4 M	15° SKEW Nº 4 Q	15° SKEW Nº 4 N	15° SKEW Nº 4 K	30° SKEW Nº 5 F	30° SKEW Nº 5 G	30° SKEW Nº 4 M	30° SKEW Nº 4 Q	30° SKEW Nº 4 N	30° SKEW Nº 4 K	45° SKEW Nº 5 F	45° SKEW Nº 5 G	45° SKEW Nº 4 M	45° SKEW Nº 4 Q	45° SKEW Nº 4 N	45° SKEW Nº 4 K
42"	12@2'-9"	10@7'-6"	12@5'-5"	3@15'-3"	10@5'-8"	13@2'-9"	11@7'-6"	6@5'-3"	6@6'-6"	3@16'-7"	11@5'-8"	13@2'-9"	11@7'-6"	6@5'-1"	6@6'-6"	3@17'-0"	11@5'-8"	14@2'-9"	12@7'-6"	6@4'-11"	6@6'-6"	3@17'-11"	12@5'-8"
48"	13@2'-9"	12@8'-1"	12@6'-3"	3@17'-6"	12@6'-3"	14@2'-8"	13@8'-1"	6@6'-1"	6@7'-5"	3@19'-0"	13@6'-3"	15@2'-9"	14@8'-1"	6@5'-11"	6@7'-5"	3@18'-6"	14@6'-3"	15@2'-9"	14@8'-1"	6@5'-5"	6@7'-5"	3@20'-6"	14@6'-3"
54"	21@3'-9"	16@8'-1"	16@7'-1"	10@19'-9"	12@6'-10"	23@3'-3"	18@9'-1"	8@6'-11"	8@8'-5"	10@21'-6"	13@6'-10"	23@3'-3"	18@9'-1"	8@6'-3"	8@8'-5"	10@22'-0"	13@6'-10"	24@3'-9"	19@9'-1"	8@6'-7"	8@8'-5"	10@23'-2"	14@6'-10"
60"	23@3'-8"	18@9'-8"	16@7'-9"	10@21'-9"	14@7'-5"	25@3'-9"	20@9'-8"	8@7'-7"	8@9'-4"	10@23'-8"	15@7'-5"	25@3'-9"	20@9'-8"	8@7'-5"	8@9'-4"	10@24'-3"	15@7'-5"	27@3'-9"	22@9'-8"	8@7'-8"	8@9'-4"	10@25'-6"	16@7'-5"
72"	27@4'-6"	30@11'-7"	20@9'-11"	12@26'-0"	16@8'-7"	25@4'-6"	33@11'-7"	10@9'-2"	10@11'3"	12@28'-3"	18@8'-7"	30@4'-6"	34@11'-7"	10@9'-10"	10@11'5"	12@29'-0"	18@8'-7"	32@4'-6"	37@11'-7"	10@8'10"	10@11'-3"	12@30'-6"	19@8'-7"

DOUBLE RCP

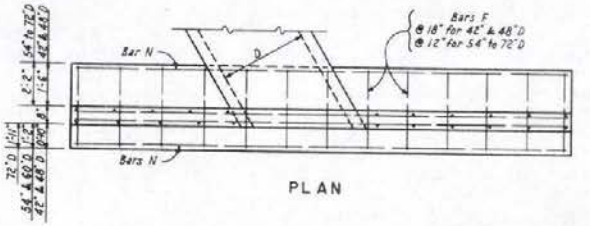
RCP SIZE	0° SKEW Nº 5 F	0° SKEW Nº 5 G	0° SKEW Nº 4 M	0° SKEW Nº 4 N	0° SKEW Nº 4 K	15° SKEW Nº 5 F	15° SKEW Nº 5 G	15° SKEW Nº 4 M	15° SKEW Nº 4 Q	15° SKEW Nº 4 N	15° SKEW Nº 4 K	30° SKEW Nº 5 F	30° SKEW Nº 5 G	30° SKEW Nº 4 M	30° SKEW Nº 4 Q	30° SKEW Nº 4 N	30° SKEW Nº 4 K	45° SKEW Nº 5 F	45° SKEW Nº 5 G	45° SKEW Nº 4 M	45° SKEW Nº 4 Q	45° SKEW Nº 4 N	45° SKEW Nº 4 K
42"	16@2'-9"	11@7'-6"	12@5'5"	3@21'6"	11@5'-8"	17@2'-9"	12@7'-6"	6@5'-3"	6@6'-6"	3@23'-1"	12@5'-8"	18@2'-9"	13@7'-6"	6@5'-1"	6@6'-6"	3@24'3"	13@5'-8"	20@2'-9"	15@7'-6"	6@4'-11"	6@6'-6"	3@26'-10"	15@5'-8"
48"	18@2'-8"	13@8'-1"	12@6'-3"	3@24'-9"	13@6'-3"	19@2'-9"	14@8'-1"	6@6'-1"	6@7'-5"	3@26'-6"	14@6'-3"	20@2'-9"	15@8'-1"	6@5'-11"	6@7'-5"	3@27'10"	15@6'-3"	22@2'-9"	17@8'-1"	6@5'-9"	6@7'-5"	3@30'-9"	17@6'-3"
54"	25@3'-3"	19@9'-1"	16@7'-0"	10@27'10"	14@6'-10"	31@3'-3"	21@9'-1"	8@6'-11"	8@8'5"	10@29'10"	15@6'-10"	32@3'-9"	22@9'-1"	8@6'-9"	8@8'-5"	10@31'4"	16@6'-10"	36@3'-3"	26@9'-1"	8@6'-7"	8@8'-5"	10@34'-8"	18@6'-10"
60"	32@3'-8"	21@9'-8"	16@7'-9"	10@30'-8"	14@7'-5"	35@3'-9"	24@9'-8"	8@7'-7"	8@9'-4"	10@33'-0"	16@7'-5"	36@3'-9"	25@9'-8"	8@7'-5"	8@9'-4"	10@34'-8"	17@7'-5"	40@3'-8"	23@9'-8"	8@7'-3"	8@9'-4"	10@38'-3"	19@7'-5"
72"	37@4'-6"	35@11'-7"	20@9'-11"	12@36'10"	13@8'-7"	40@4'-6"	33@11'-7"	10@9'-2"	10@11'3"	12@33'6"	21@8'-7"	42@4'-6"	42@11'-7"	10@9'-0"	10@11'-3"	12@41'-5"	22@8'-7"	46@4'-6"	48@11'-7"	10@8'10"	10@11'-3"	12@45'10"	25@8'-7"

GENERAL NOTES

1 - Concrete shall be class A or AA.
2 - Reinforcing steel shall be deformed bars with maximum spacing of 18" set 2½" clear of surface of concrete except as noted. Bar ends shall be kept 1¼" clear of surface of concrete. Reinforcing bars may be cut and bent in field.
3 - Footings shown are of minimum depth and shall be extended if soil is unsuitable or liable to scour.
4 - Culvert pipes to be set on a skew shall be mitered when headwalls are constructed. When headwalls are not constructed the pipes shall not be mitered except in overflow section.
5 - For estimating headwall quantities on skewed culverts:
  0° to 10° - Use quantities for 0° skew.
  11° to 25° - Use quantities for 15° skew.
  26° to 40° - Use quantities for 30° skew.
  41° to 55° - Use quantities for 45° skew.
  Over 55° - Calculate quantities required.
  Culverts should be installed on 0°, 15°, 30°, or 45° where it is feasible.
6 - Dimensions X, Y, L and h to remain constant regardless of minor variations in wall thickness due to class of pipe used.



PLAN



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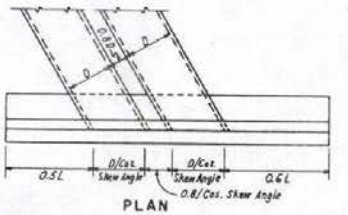

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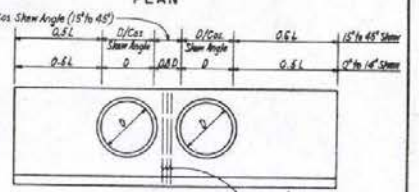
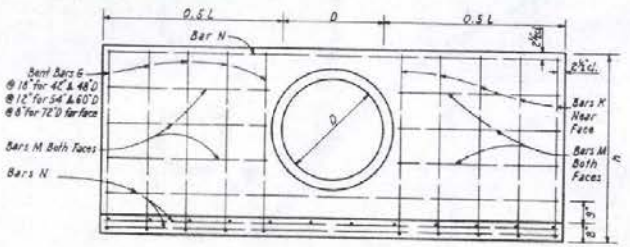
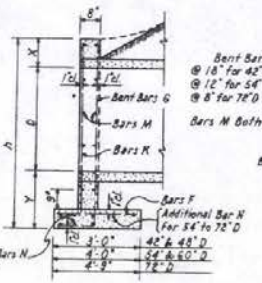


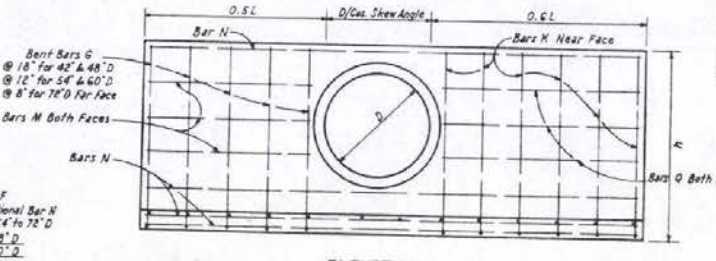
ELEVATION
DOUBLE RCP
0° TO 45° SKEW



ELEVATION
SINGLE RCP
0° SKEW



SECTION



ELEVATION
SINGLE RCP
15° TO 45° SKEW

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

CULVERT HEADWALLS
42" RCP TO 72" RCP

CHIEF ROAD DESIGN ENGR.

R-252-(502)
ADOPTED: 8/69
REVISED

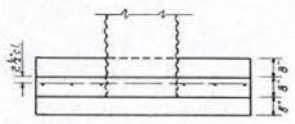
R 23

CMAP SIZE SXR	CMP DIA	CMAP AREA SQFT	L	SINGLE CMAP								DOUBLE CMAP							
				0° SKEW		15° SKEW		30° SKEW		45° SKEW		0° SKEW		15° SKEW		30° SKEW		45° SKEW	
				CONC CU YD	STEEL LB	CONC CU YD	STEEL LB	CONC CU YD	STEEL LB	CONC CU YD	STEEL LB	CONC CU YD	STEEL LB	CONC CU YD	STEEL LB	CONC CU YD	STEEL LB	CONC CU YD	STEEL LB
18"x11"	15"	1.10	3'-3"	0.87	35	0.94	37	0.97	38	1.03	33	1.30	48	1.38	51	1.46	53	1.64	57
22"x13"	18"	1.58	3'-9"	1.05	40	1.13	42	1.17	43	1.24	45	1.54	55	1.64	58	1.74	60	1.94	65
29"x18"	24"	2.80	5'-0"	1.51	59	1.64	63	1.68	64	1.79	66	2.13	77	2.29	81	2.40	84	2.67	90
36"x22"	30"	4.40	6'-0"	1.93	70	2.09	74	2.15	75	2.28	79	2.67	91	2.86	95	3.00	99	3.32	106
43"x27"	36"	6.39	7'-3"	2.49	101	2.70	107	2.78	109	2.94	112	3.41	126	3.66	132	3.84	136	4.24	145
50"x31"	42"	8.70	8'-3"	2.99	114	3.25	120	3.34	122	3.52	127	4.10	143	4.39	150	4.61	155	5.08	165
58"x36"	48"	11.40	9'-6"	3.69	130	4.00	137	4.10	140	4.33	145	5.03	163	5.39	171	5.66	177	6.24	189
65"x40"	54"	14.30	10'-6"	4.27	156	4.63	164	4.75	166	5.01	172	5.82	195	6.24	208	6.55	214	7.21	228
72"x44"	60"	17.60	11'-6"	4.90	184	5.32	194	5.45	197	5.74	204	6.66	231	7.14	242	7.49	249	8.24	265

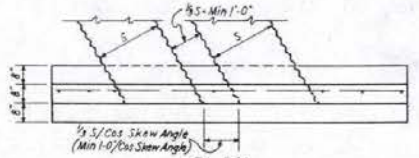
Quantities shown above are for two headwalls

Quantities shown below are for one headwall.

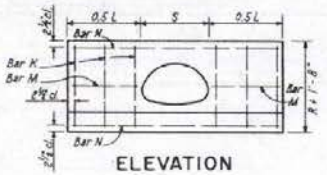
CMAP SIZE SXR	LENGTH OF REINFORCING BARS																
	SINGLE CMAP					SINGLE OR DOUBLE CMAP							DOUBLE CMAP				
	0°-45°	0°	15°	30°	45°	0°	15°		30°		45°		0°-45°	0°	15°	30°	45°
	Nº4	Nº5	Nº5	Nº5	Nº5	Nº4	Nº4	Nº4	Nº4	Nº4	Nº4	Nº4	Nº4	Nº5	Nº5	Nº5	Nº5
	K	N	N	N	N	M	M	Q	M	Q	M	Q	K	N	N	N	N
18"x11"	4@2'-4"	2@4'-6"	2@4'-11"	2@5'-1"	2@5'-6"	2@1'-4"	1@1'-2"	1@1'-9"	1@1'-1"	1@1'-10"	1@0'-10"	1@2'-1"	5@2'-4"	2@7'-0"	2@7'-6"	2@7'-11"	2@8'-0"
22"x13"	4@2'-6"	2@5'-4"	2@5'-9"	2@6'-0"	2@6'-6"	2@1'-7"	1@1'-5"	1@2'-1"	1@1'-4"	1@2'-2"	1@1'-1"	1@2'-5"	5@2'-6"	2@8'-2"	2@8'-8"	2@9'-3"	2@10'-6"
29"x18"	6@2'-11"	2@7'-2"	2@7'-9"	2@8'-0"	2@8'-8"	2@2'-3"	1@2'-1"	1@2'-10"	1@2'-0"	1@2'-11"	1@1'-3"	1@3'-2"	7@2'-11"	2@10'-7"	2@11'-4"	2@12'-0"	2@13'-6"
36"x22"	6@3'-3"	2@8'-3"	2@8'-9"	2@9'-10"	2@10'-7"	2@2'-9"	1@2'-7"	1@3'-6"	1@2'-6"	1@3'-7"	1@2'-3"	1@3'-10"	7@3'-3"	2@12'-9"	2@13'-7"	2@14'-5"	2@16'-3"
43"x27"	8@3'-8"	2@10'-7"	2@11'-5"	2@11'-10"	2@12'-9"	4@3'-4"	2@3'-2"	2@4'-2"	2@3'-1"	2@4'-3"	2@2'-10"	2@4'-6"	9@3'-8"	2@15'-4"	2@16'-5"	2@17'-4"	2@19'-6"
50"x31"	8@4'-0"	2@12'-2"	2@13'-2"	2@13'-8"	2@14'-9"	4@3'-10"	2@3'-8"	2@4'-9"	2@3'-7"	2@4'-10"	2@3'-4"	2@5'-1"	9@4'-0"	2@17'-8"	2@18'-11"	2@20'-1"	2@22'-7"
58"x36"	8@4'-5"	2@14'-1"	2@15'-2"	2@15'-9"	2@17'-0"	4@4'-6"	2@4'-4"	2@5'-7"	2@4'-3"	2@5'-8"	2@4'-0"	2@5'-11"	9@4'-5"	2@20'-6"	2@21'-11"	2@23'-3"	2@26'-2"
65"x40"	10@4'-9"	2@15'-8"	2@16'-11"	2@17'-7"	2@19'-0"	4@5'-0"	2@4'-10"	2@6'-2"	2@4'-9"	2@6'-3"	2@4'-6"	2@6'-6"	12@4'-9"	2@22'-10"	2@24'-5"	2@25'-11"	2@29'-2"
72"x44"	10@5'-1"	2@17'-3"	2@18'-7"	2@19'-4"	2@20'-11"	6@5'-6"	3@5'-4"	3@6'-3"	3@5'-3"	3@6'-10"	3@5'-0"	3@7'-1"	12@5'-1"	2@25'-3"	2@26'-11"	2@28'-7"	2@32'-3"



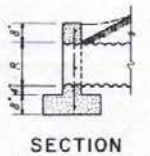
PLAN
SINGLE CMAP



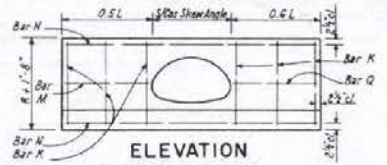
PLAN
DOUBLE CMAP



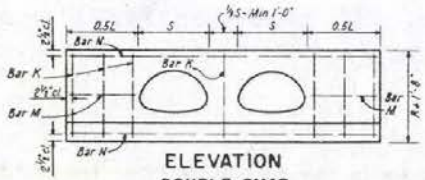
ELEVATION
SINGLE CMAP



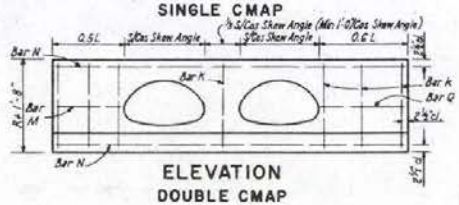
SECTION
(For all Headwalls)



ELEVATION
SINGLE CMAP



ELEVATION
DOUBLE CMAP
0° SKEW



ELEVATION
DOUBLE CMAP
15° TO 45° SKEW

GENERAL NOTES

1- Concrete shall be class A or AA.
2- Reinforcing steel shall be deformed bars with maximum spacing of 18" set 2½" clear of surface of concrete except as noted. Bar ends shall be kept 1½" clear of surface of concrete. Reinforcing bars may be cut and bent in field.
3- Footings shown are of minimum depth and shall be extended if soil is unsuitable or liable to scour.
4- Culvert pipes to be set on a skew shall be mitered when headwalls are constructed. When headwalls are not constructed the pipes shall not be mitered except in overflow section.
5- For estimating headwall quantities on skewed culverts:
   0° to 10° - Use quantities for 0° skew.
   11° to 25° - Use quantities for 15° skew.
   26° to 40° - Use quantities for 30° skew.
   41° to 55° - Use quantities for 45° skew.
   Over 55° - Calculate quantities required.
6- Culverts should be installed on 0°, 15°, 30° or 45° where it is feasible.

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

CULVERT HEADWALLS
18"X11" CMAP TO 72"X44" CMAP

CHIEF ROAD DESIGN ENGR.

R-26.1-(502)
ADOPTED: 8/63
REVISION

R 24

Quantities shown below are for two headwalls

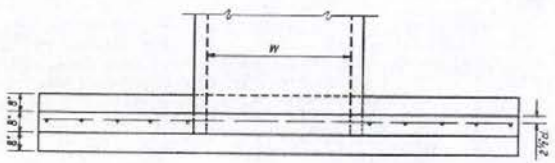
OVAL RCP SIZE W & H	RCP SIZE	OVAL RCP AREA SQ FT	SINGLE OVAL RCP								DOUBLE OVAL RCP								X	Y	L	h
			0° SKEW		15° SKEW		30° SKEW		45° SKEW		0° SKEW		15° SKEW		30° SKEW		45° SKEW					
			CONC CU YD	STEEL LB	CONC CU YD	STEEL LB	CONC CU YD	STEEL LB	CONC CU YD	STEEL LB	CONC CU YD	STEEL LB	CONC CU YD	STEEL LB	CONC CU YD	STEEL LB	CONC CU YD	STEEL LB				
23"x14"	18"	1.82	1.37	57	1.43	60	1.52	61	1.60	63	1.94	74	2.08	77	2.18	80	2.40	86	10¾"	1'-2¾"	4'-9"	3'-3½"
30"x19"	24"	3.21	1.95	79	2.13	82	2.17	83	2.27	86	2.64	98	2.85	103	2.97	106	3.25	113	11¾"	1'-3¾"	6'-3"	3'-9½"
34"x22"	27"	4.20	2.30	87	2.50	92	2.55	93	2.66	96	3.11	110	3.34	116	3.43	119	3.81	127	11½"	1'-3½"	7'-0"	4'-1"
38"x24"	30"	5.15	2.57	93	2.79	98	2.85	100	2.98	104	3.49	119	3.75	125	4.07	129	4.28	137	11¾"	1'-3¾"	7'-6"	4'-3½"
42"x27"	33"	6.39	2.84	113	3.20	120	3.26	121	3.40	125	4.00	141	4.30	148	4.49	153	2.91	162	11¾"	1'-3¾"	8'-3"	4'-8½"
45"x29"	36"	7.37	3.31	122	3.53	128	3.68	130	3.82	134	4.48	152	4.81	153	5.04	164	5.47	174	1'-0½"	1'-4½"	9'-0"	4'-10"
53"x34"	42"	10.15	4.06	164	4.42	173	4.50	175	4.68	180	5.48	199	5.90	209	6.14	214	6.63	226	1'-1"	1'-5"	10'-3"	5'-4"
60"x38"	48"	12.86	4.81	182	5.24	192	5.33	194	5.54	199	6.43	221	6.98	231	7.26	238	7.90	251	1'-1½"	1'-5½"	11'-6"	5'-9"

Quantities shown below are for one headwall

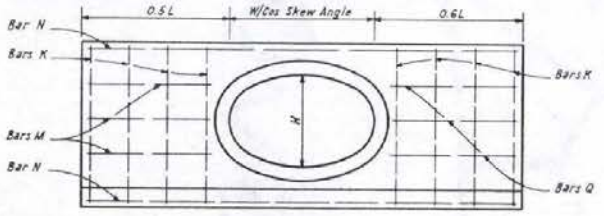
OVAL RCP SIZE W & H	LENGTH OF REINFORCING BARS																
	SINGLE OVAL RCP					SINGLE OR DOUBLE OVAL RCP							DOUBLE OVAL RCP				
	0°-45°	0°	15°	30°	45°	0°	15°		30°		45°		0°-45°	0°	15°	30°	45°
	N° 4	N° 5	N° 5	N° 5	N° 5	N° 4	N° 4	N° 4	N° 4	N° 4	N° 4	N° 4	N° 4	N° 5	N° 5	N° 5	N° 5
	K	N	N	N	N	M	M	Q	M	Q	M	Q	K	N	N	N	N
23"x14"	6@3'-1"	2@6'-5"	2@ 7'-0"	2@ 7'-2"	2@ 7'-8"	2@1'-11"	1@1'-9"	1@2'-6"	1@1'-8"	1@2'-7"	1@ 1'-5"	1@2'-10"	7@3'-1"	2@ 9'-7"	2@10'-3"	2@10'-10"	2@12'-2"
30"x18"	6@3'-6"	2@8'-6"	2@ 9'-3"	2@ 9'-6"	2@10'-2"	4@2'-7"	2@2'-5"	2@3'-3"	2@2'-4"	2@3'-4"	2@ 2'-1"	2@3'-7"	7@3'-6"	2@12'-3"	2@13'-1"	2@13'-11"	2@15'-6"
34"x22"	6@3'-10"	2@9'-7"	2@10'-4"	2@10'-9"	2@11'-5"	4@3'-0"	2@2'-10"	2@3'-9"	2@2'-9"	2@3'-10"	2@ 2'-6"	2@4'-1"	7@3'-10"	2@13'-11"	2@14'-10"	2@15'-8"	2@17'-6"
38"x24"	6@4'-1"	2@10'-5"	2@11'-3"	2@11'-8"	2@12'-6"	4@3'-2"	2@3'-0"	2@4'-0"	2@2'-11"	2@4'-1"	2@ 2'-8"	2@4'-4"	7@4'-1"	2@15'-2"	2@16'-3"	2@17'-2"	2@19'-3"
42"x27"	8@4'-4"	2@11'-6"	2@12'-5"	2@12'-11"	2@13'-9"	4@3'-7"	2@3'-5"	2@4'-6"	2@3'-6"	2@4'-9"	2@ 3'-3"	2@5'-0"	9@4'-4"	2@16'-10"	2@17'-11"	2@19'-0"	2@21'-3"
45"x29"	8@4'-7"	2@12'-6"	2@13'-6"	2@14'-0"	2@14'-11"	4@3'-10"	2@3'-8"	2@4'-9"	2@3'-7"	2@4'10"	2@ 3'-4"	2@5'-1"	9@4'-7"	2@18'-2"	2@19'-5"	2@20'-7"	2@23'-0"
53"x34"	10@5'-1"	2@14'-5"	2@15'-7"	2@16'-2"	2@17'-3"	6@4'-6"	3@4'-4"	3@5'-7"	3@4'-3"	3@5'-8"	3@ 4'-0"	3@5'-11"	11@5'-1"	2@21'-1"	2@22'-6"	2@23'-10"	2@26'-9"
60"x38"	10@5'-6"	2@16'-3"	2@17'-7"	2@18'-2"	2@19'-6"	6@5'-1"	3@4'-11"	3@6'-3"	3@4'10"	3@6'-4"	3@ 4'-7"	3@6'-7"	11@5'-6"	2@23'-9"	2@25'-5"	2@26'10"	2@30'-2"

GENERAL NOTES

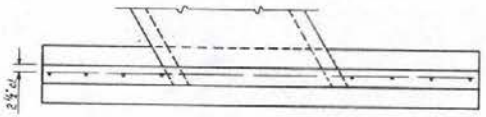
1- Concrete shall be class A or AA.
2- Reinforcing steel shall be deformed bars with maximum spacing of 18" set 2½" clear of surface of concrete except as noted. Bar ends shall be kept 1½" clear of surface of concrete. Reinforcing bars may be cut and bent in field.
3- Footings shown are of minimum depth and shall be extended if soil is unsuitable or liable to scour.
4- Culvert pipes to be set on a skew shall be mitered when headwalls are constructed. When headwalls are not constructed the pipes shall not be mitered except in overflow section.
5- Dimension X, Y, L and h to remain constant regardless of minor variations in wall thickness due to class of pipe used.
6- For estimating headwall quantities on skewed culverts:
   0° to 10° - Use quantities for 0° skew.
   11° to 25° - Use quantities for 15° skew.
   26° to 40° - Use quantities for 30° skew.
   41° to 55° - Use quantities for 45° skew.
   Over 55° - Calculate quantities required.
   Culverts should be installed on 0°, 15°, 30° or 45° where it is feasible.



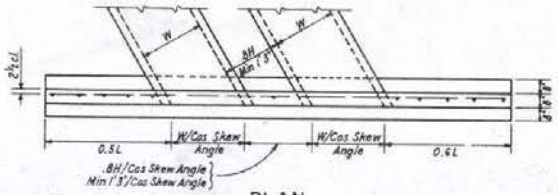
PLAN



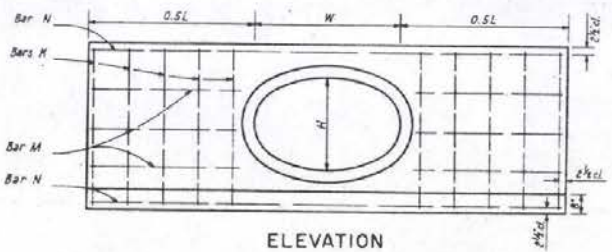
ELEVATION
SINGLE OVAL RCP
15° TO 45° SKEW



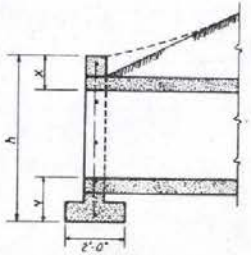
PLAN



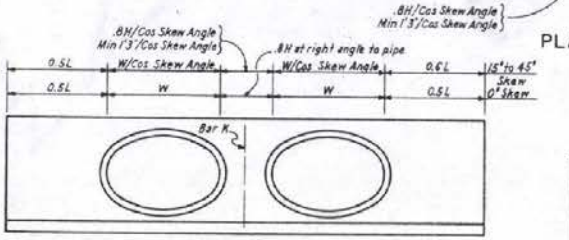
PLAN



ELEVATION
SINGLE OVAL RCP
0° SKEW



SECTION
(For all Headwalls)



ELEVATION
DOUBLE OVAL RCP
0° TO 45° SKEW

NOTE: For Details of other Reinforcing Bars, See Single Culvert Headwalls

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

CULVERT HEADWALLS
23"X14" OVAL RCP TO 60"X38" OVAL RCP

William L. Maack
CHIEF ROAD DESIGN ENGR.

R-2.7.1-(502)
ADOPTED: 8/65
REVISION

R 25

Quantities shown below are for two headwalls

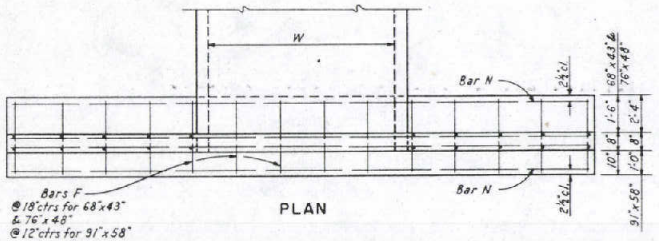
OVAL RCP SIZE W & H	RCP SIZE	OVAL RCP AREA SQ FT	SINGLE OVAL RCP 0° SKEW CONC CU YD	SINGLE OVAL RCP 0° SKEW STEEL LB	SINGLE OVAL RCP 15° SKEW CONC CU YD	SINGLE OVAL RCP 15° SKEW STEEL LB	SINGLE OVAL RCP 30° SKEW CONC CU YD	SINGLE OVAL RCP 30° SKEW STEEL LB	SINGLE OVAL RCP 45° SKEW CONC CU YD	SINGLE OVAL RCP 45° SKEW STEEL LB	DOUBLE OVAL RCP 0° SKEW CONC CU YD	DOUBLE OVAL RCP 0° SKEW STEEL LB	DOUBLE OVAL RCP 15° SKEW CONC CU YD	DOUBLE OVAL RCP 15° SKEW STEEL LB	DOUBLE OVAL RCP 30° SKEW CONC CU YD	DOUBLE OVAL RCP 30° SKEW STEEL LB	DOUBLE OVAL RCP 45° SKEW CONC CU YD	DOUBLE OVAL RCP 45° SKEW STEEL LB	X	Y	L	h
68"x 43"	54"	16.62	7.19	628	7.82	683	7.98	720	8.34	767	9.86	789	10.58	848	11.07	897	12.11	1031	1'-2½"	2'-2"	12'-9"	6'-11"
76"x 48"	60"	20.55	8.39	746	9.13	805	9.32	813	9.71	889	11.47	921	12.31	985	13.06	1075	15.66	1207	1'-2 1/2"	2'-2 1/2"	14'-3"	7'-5"
91"x 58"	72"	29.71	12.11	1168	13.18	1273	13.43	1321	14.02	1412	16.59	1495	17.82	1616	18.61	1730	20.36	1965	1'-3½"	2'-3½"	17'-0"	8'-5"

Quantities Shown below are for one headwall

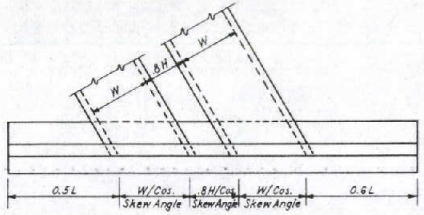
OVAL RCP SIZE W & H	LENGTH OF REINFORCING BARS SINGLE OVAL RCP 0° SKEW Nº 5 F	Nº 5 G	Nº 4 M	Nº 4 N	Nº 4 K	15° SKEW Nº 5 F	Nº 5 G	Nº 4 M	Nº 4 Q	Nº 4 N	Nº 4 K	30° SKEW Nº 5 F	Nº 5 G	Nº 4 M	Nº 4 Q	Nº 4 N	Nº 4 K	45° SKEW Nº 5 F	Nº 5 G	Nº 4 M	Nº 4 Q	Nº 4 N	Nº 4 K
68"x 43"	13@2'-9"	10@7'-10"	12@5'-8"	9@18'-8"	10@6'-0"	14@2'-9"	12@7'-10"	6@5'-6"	6@6'-10"	9@19'-8"	11@6'-0"	15@2'-9"	12@7'10"	6@5'-4"	6@6'-10"	9@20'-4"	12@6'-0"	16@2'-9"	13@7'-10"	6@5'-2"	6@6'-10"	9@21'-10"	13@6'-0"
76"x 48"	15@2'-9"	12@8'-4"	12@6'-4"	9@20'-4"	12@6'-6"	16@2'-9"	13@8'-4"	6@6'-2"	6@7'-7"	9@22'-0"	13@6'-6"	16@2'-9"	13@8'-4"	6@6'-0"	6@7'-7"	9@22'-9"	13@6'-6"	17@2'-9"	15@8'-4"	6@5'-10"	6@7'-7"	9@24'-5"	15@6'-6"
91"x 58"	25@3'-9"	18@3'-8"	16@7'-7"	10@20'-4"	12@7'-6"	27@3'-9"	20@9'-8"	8@7'-5"	8@9'-1"	10@26'-4"	13@7'-6"	28@3'-9"	21@9'-8"	8@7'-3"	8@9'-1"	10@27'9"	14@7'-6"	30@3'-9"	23@9'-8"	8@7'-1"	8@9'-1"	10@29'-2"	15@7'-6"
DOUBLE OVAL RCP																							
68"x 43"	19@2'-9"	11@7'-10"	12@6'-8"	9@26'-8"	11@6'-0"	20@2'-9"	12@7'-10"	6@5'-6"	6@6'-10"	9@28'-6"	12@6'-0"	21@2'-9"	13@7'-10"	6@5'-4"	6@6'-11"	9@30'-2"	13@6'-0"	24@2'-9"	16@7'-10"	6@5'-2"	6@6'-10"	9@33'-10"	16@6'-0"
76"x 48"	21@2'-9"	13@8'-4"	12@6'-4"	9@29'10"	13@6'-6"	22@2'-9"	14@8'-4"	6@6'-2"	6@7'-7"	9@31'-10"	14@6'-6"	24@2'-9"	16@8'-4"	6@6'-0"	6@7'-7"	9@34'-2"	13@6'-6"	26@2'-9"	19@8'-4"	6@5'10"	6@7'-7"	9@37'-10"	19@6'-6"
91"x 58"	37@3'-9"	21@9'-8"	16@7'-7"	10@35'-9"	14@7'-6"	39@3'-9"	23@9'-8"	8@7'-5"	8@9'-1"	10@38'-2"	16@7'-6"	41@3'-9"	26@9'-8"	8@7'-3"	8@9'-1"	10@40'5"	17@7'-6"	46@3'-9"	31@9'-8"	8@7'-1"	8@9'-1"	10@45'-4"	20@7'-6"

GENERAL NOTES

1- Concrete shall be class A or AA.
2- Reinforcing steel shall be deformed bars with maximum spacing of 18" set 2½" clear of surface of concrete except as noted. Bar ends shall be kept 1½" clear of surface of concrete. Reinforcing bars may be cut and bent in field.
3- Footings shown are of minimum depth and shall be extended if soil is unsuitable or liable to scour.
4- Culvert pipes to be set on a skew shall be mitered when headwalls are constructed. When headwalls are not constructed the pipes shall not be mitered except in overflow section.
5- Dimensions X, Y, L and h to remain constant regardless of minor variations in wall thickness due to class of pipe used.
6- For estimating headwall quantities on skewed culverts :
0° to 10° ~ Use quantities for 0° skew.
11° to 25° ~ Use quantities for 15° skew.
26° to 40° ~ Use quantities for 30° skew.
41° to 55° ~ Use quantities for 45° skew.
Over 55° ~ Calculate quantities required.
Culverts should be installed on 0°, 15°, 30° or 45° where it is feasible.



PLAN



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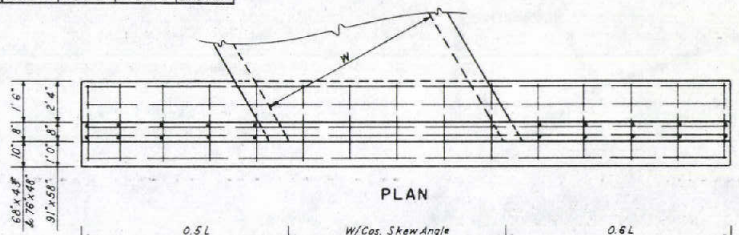
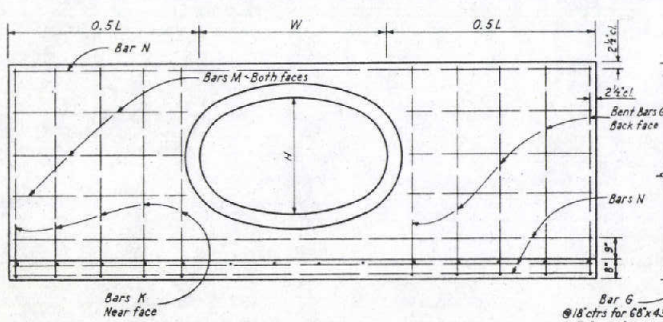
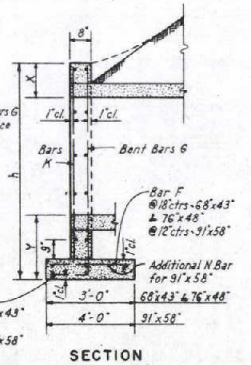


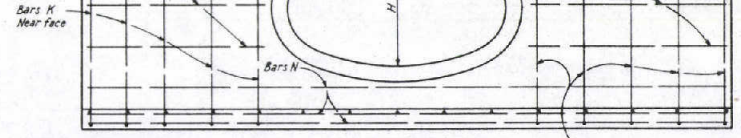
PLAN



ELEVATION
SINGLE OVAL RCP
0° SKEW



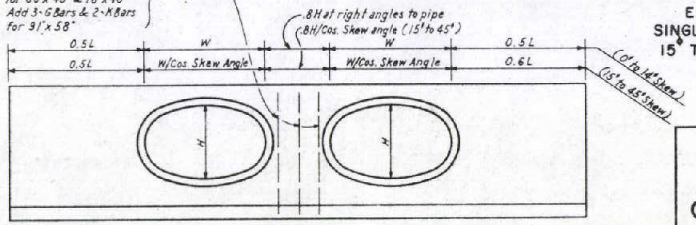
SECTION



ELEVATION
SINGLE OVAL RCP
15° TO 45° SKEW

0° Skew
Add 1~G Bar & 1~K Bar for 68"x 43" & 76"x 48"
Add 3~G Bars & 2~K Bars for 91"x 58"

15° to 45° Skew
Add 1~G Bar & 1~K Bar for 68"x 43" & 76"x 48"
Add 3~G Bars & 2~K Bars for 91"x 58"



ELEVATION
DOUBLE OVAL RCP
0° TO 45° SKEW

NOTE: For Details of other Reinforcing Bars, See Single Culvert Headwalls

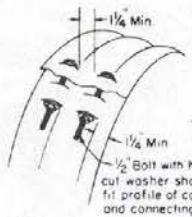
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

CULVERT HEADWALLS
68"X43" OVAL RCP TO 91"X58" OVAL RCP

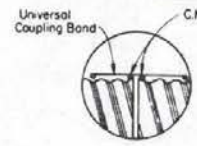
William L. Maak
CHIEF ROAD DESIGN ENGR.

R-2.7.2-(502)
ADOPTED: 8/69
REVISION

R 26

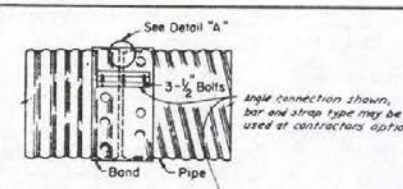


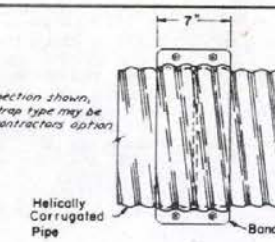
LUG DETAIL



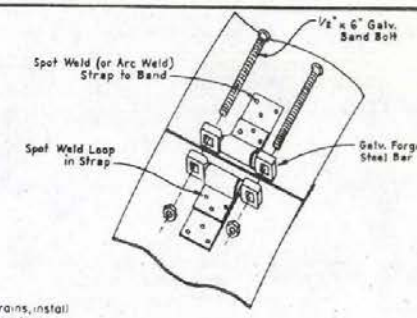
DETAIL "A"

NOTE: For H.C.M.P. Overside Drains and Slotted Drains

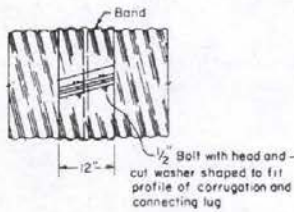


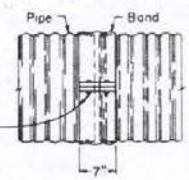


TOP VIEW



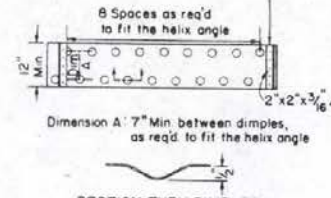
BAR & STRAP CONNECTOR





12" HELICALLY CORRUGATED BAND WITH INTEGRAL FORMED CONNECTING LUG FOR USE ON 12"-24" H.C.M.P.

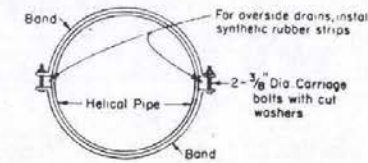
7" WIDE COUPLING BAND WITH INTEGRAL FORMED CONNECTING LUGS FOR USE ON C.M.P. THRU 30" INCLUSIVE



Dimension A: 7" Min. between dimples, as req'd. to fit the helix angle

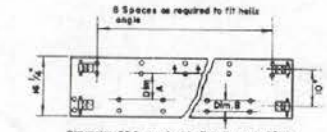
SECTION THRU DIMPLES

UNIVERSAL COUPLING BAND FOR USE ON C.M.P. THRU 36" INCLUSIVE

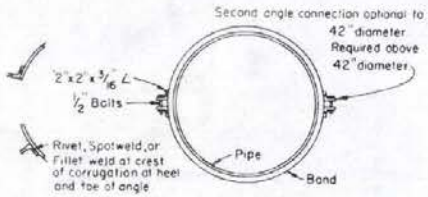


END VIEW

TWO PIECE INTEGRAL FLANGE DIE FORMED FOR USE ON 6", 8" & 10" H.C.M.P.

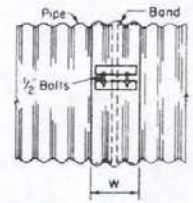


UNIVERSAL COUPLING BAND FOR USE ON C.S.P. 42" THRU 60" INCLUSIVE

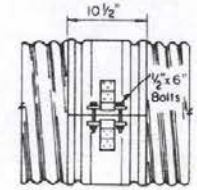


CONNECTION ANGLE DETAIL

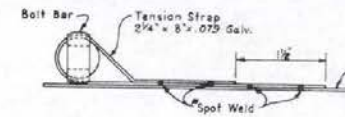
TYPICAL COUPLING BAND



ANNULAR COUPLING BAND

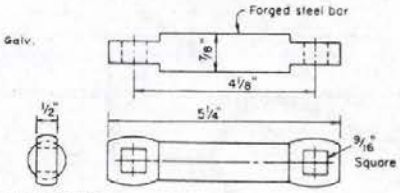


ALTERNATIVE ANNULAR COUPLING BAND FOR H.C.M.P THRU 84"



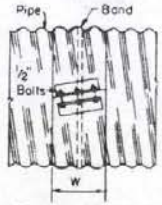
STRAP DETAIL

*Spot welds shall develop full strength of strap



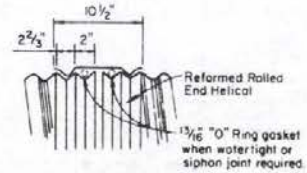
LEFT SIDE VIEW FRONT VIEW

BAR DETAIL

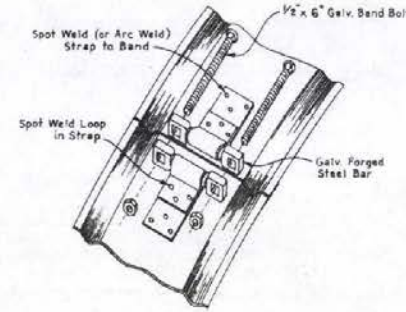


HELICAL COUPLING BAND

ANNULAR COUPLING BAND			
CORRUGATION	PIPE SIZE	W (In Min.)	½" BOLTS (No. each connection)
2⅔" x ½"	Thru 30"	7	2
2⅔" x ½"	Thru 60"	12	3
2⅔" x ½"	Thru 84"	24	5
3" x 1"	54" thru 60"	14	3
3" x 1"	Thru 96"	26	5
HELICAL COUPLING BAND			
2⅔" x ½"	12" thru 60"	12	3
2⅔" x ½"	Thru 84"	24	5



JOINT CROSS SECTION ALTERNATIVE ANNULAR COUPLING BAND FOR HELICAL WELD SEAM ONLY



BAR & STRAP CONNECTOR

GENERAL NOTES

1. All coupling band connecting hardware shall be galvanized.
2. For helically corrugated coupling bands, the connection angles may be oriented parallel to the pipe axis, provided connecting holes are slotted lengthwise sufficiently to allow adjustment for the helix angle.
3. For pipe arches use same width band as for round pipe of equal periphery.
4. For watertight and siphon joints on alternative annular coupling band place mastic sealant strip ⅞" thick x 1½" wide x 2" long in lap between bands.
5. For alternative annular coupling band, 2 bar and strap assemblies required for pipe greater than 42" diameter, optional for sizes less than 42".

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

COUPLING BAND DETAILS C.M.P. AND PIPE ARCHES

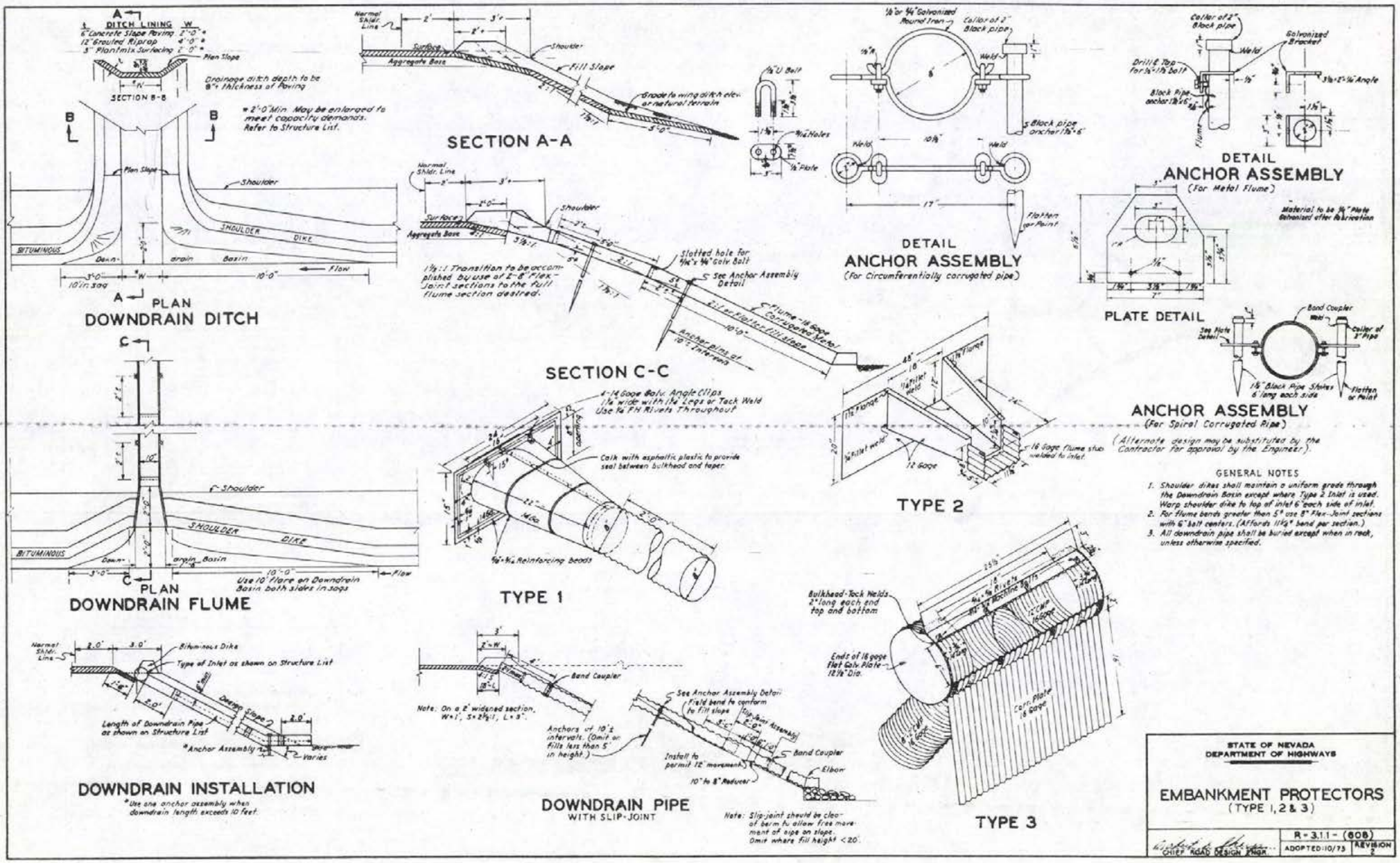
CHIEF ROAD DESIGN ENGR.

R-2.8.1-(604)

ADOPTED: 6/71

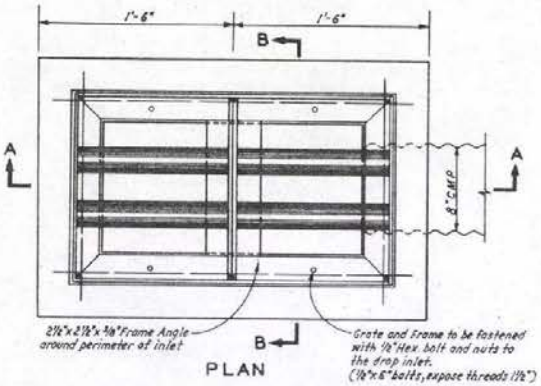
REVISION

R 27

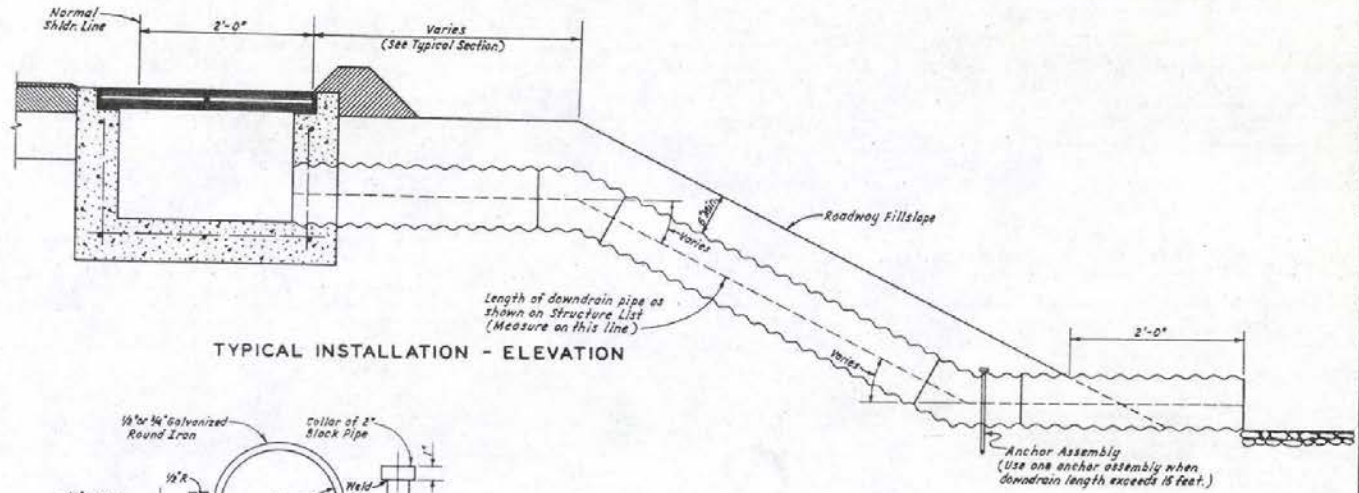


DITCH LINING W
6" Concrete Slope Paving 2'-0" *
12" Grouted Riprap 4'-0" *
3" Plantmix Surfacing 2'-0" *
SECTION B-B
Drainage ditch depth to be 8" + thickness of Paving
* 2'-0" Min. May be enlarged to meet capacity demands. Refer to Structure List.
PLAN
DOWNDRAIN DITCH
SECTION A-A
SECTION C-C
1½:1 Transition to be accomplished by use of 2-8" Flex-Joint sections to the full flume section desired.
DETAIL
ANCHOR ASSEMBLY
(For Circumferentially corrugated pipe)
DETAIL
ANCHOR ASSEMBLY
(For Metal Flume)
Material to be ¼" Plate Galvanized after fabrication
PLATE DETAIL
ANCHOR ASSEMBLY
(For Spiral Corrugated Pipe)
(Alternate design may be substituted by the Contractor for approval by the Engineer).
PLAN
DOWNDRAIN FLUME
TYPE 1
TYPE 2
TYPE 3
DOWNDRAIN INSTALLATION
*Use one anchor assembly when downdrain length exceeds 10 feet.
DOWNDRAIN PIPE
WITH SLIP-JOINT
Note: On a 2' widened section, W=1', S=2½:1, L=3'.
Note: Slip-joint should be clear of berm to allow free movement of pipe on slope. Omit where fill height <20'.
GENERAL NOTES
1. Shoulder dikes shall maintain a uniform grade through the Downdrain Basin except where Type 2 Inlet is used. Warp shoulder dike to top of inlet 6" each side of inlet.
2. For flume bends greater than 5° use 8" Flex-Joint sections with 6" bolt centers. (Affords 11¼° bend per section.)
3. All downdrain pipe shall be buried except when in rock, unless otherwise specified.
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS
EMBANKMENT PROTECTORS
(TYPE 1, 2 & 3)
R-3.1.1-(608)
CHIEF ROAD DESIGN ENGR.
ADOPTED 10/73
REVISION 2

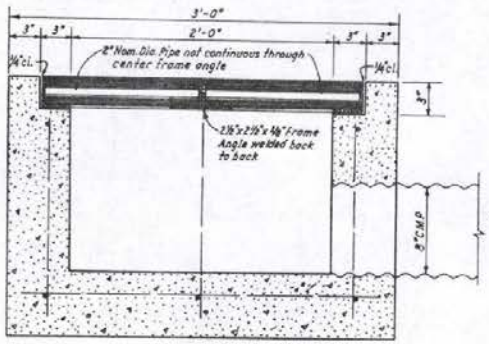
R 28



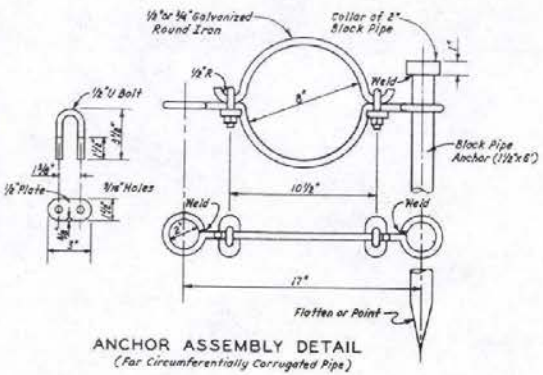
PLAN



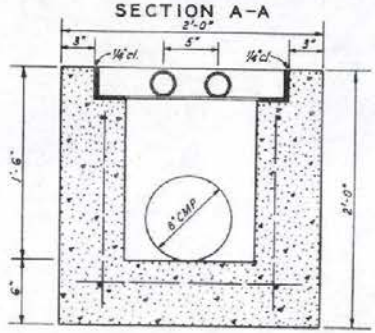
TYPICAL INSTALLATION - ELEVATION



SECTION A-A



ANCHOR ASSEMBLY DETAIL
(For Circumferentially Corrugated Pipe)



SECTION B-B

QUANTITIES*		
CONCRETE	REINF. STEEL	STRUCT. STEEL
0.27 cu.yd.	17 lbs.	95 lbs.

*For information only.

GENERAL NOTES

1. All concrete shall be Class A or AA.
2. Reinforcing bars shall be N°4 bars with maximum spacing at 18" centers. Bars to be embedded a minimum of two inches and bar ends must clear concrete surface by one and one half inch.
3. All exposed concrete edges shall be chamfered one inch.
4. Structural steel weight includes the 2" pipe and the 2½" x 2½" x ¼" frame angles.
5. Grate and frame angle and pipes to be welded at all contact points.

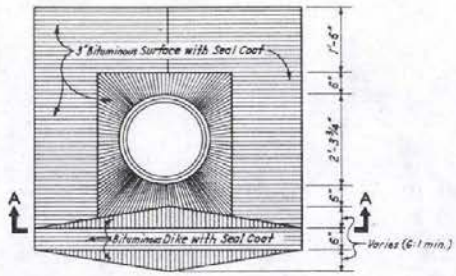
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

EMBANKMENT PROTECTORS
(TYPE 4)

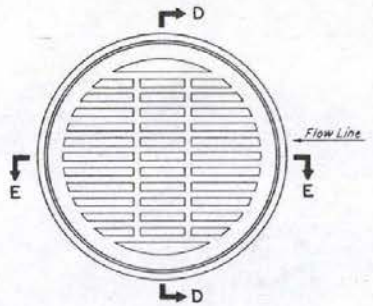
William L. Maud
CHIEF ROAD DESIGN ENGR.

R-3.1.2- (608)
ADOPTED: 8/69
REVISION

R 29

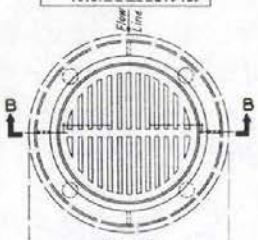


PLAN

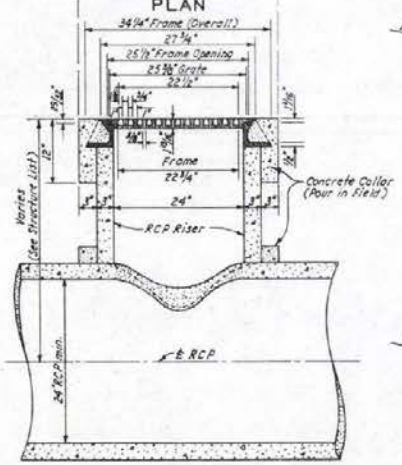


PLAN OF FRAME AND GRATE
(CASTING)

WEIGHT OF CASTINGS	
Grate	128 lbs.
Frame	142 lbs
Total	270 lbs

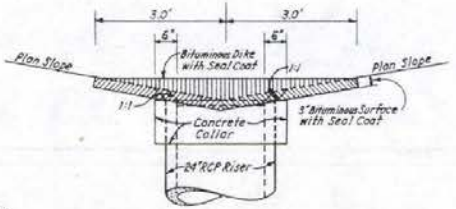


PLAN

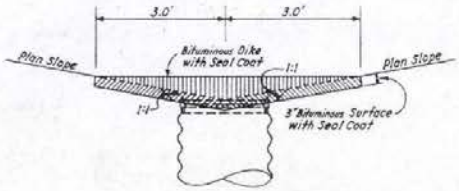


SECTION B-B

TYPE 1 RISER INLET

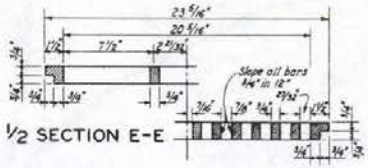


SECTION A-A
(With RCP Riser)

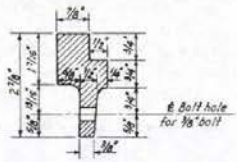


SECTION A-A
(With CMP Riser)

PAVED APRON AND DIKE
FOR TYPE 1 AND 2 RISER INLET



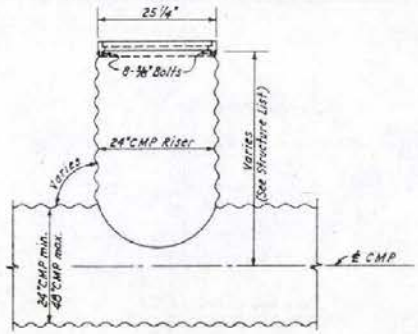
½ SECTION E-E



½ SECTION D-D

SECTION OF FRAME

WEIGHT OF CASTINGS	
Grate	99 lbs
Frame	36 lbs
Total	135 lbs



SECTION

TYPE 2 RISER INLET

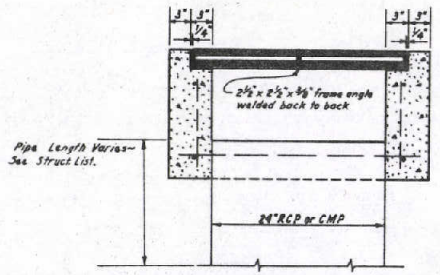
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

PIPE RISER INLET
(TYPE 1 & TYPE 2)

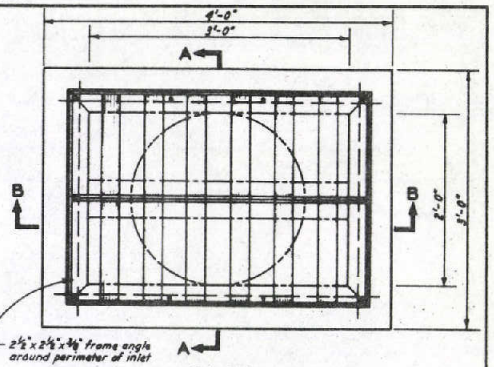
CHIEF ROAD DESIGN ENGR.

R-4.1.1-(609)
ADOPTED: 8/69
REVISION 1

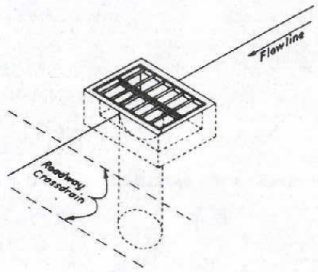
R 30



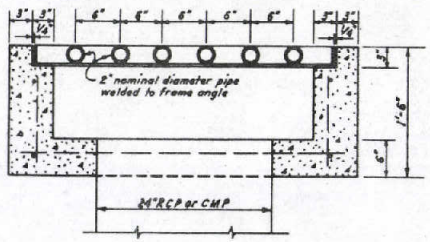
SECTION A-A



PLAN



TYPICAL INSTALLATION



SECTION B-B

QUANTITIES *		
Concrete	Reinf. Steel	Struct. Steel
0.36 cu. yd.	23 lbs.	170 lbs.

* For Information Only

GENERAL NOTES

1. All concrete shall be Class A or AA.
2. Reinforcing bars shall be N9 4 bars with maximum spacing at 18" centers. Bars to be embedded a minimum of two inches and bar ends must clear concrete surfaces by one and one half inch.
3. All exposed concrete edges shall be chamfered one inch.
4. Structural steel weight includes the 2" pipe and the 2½" x 2½" x 3/8" frame angles.

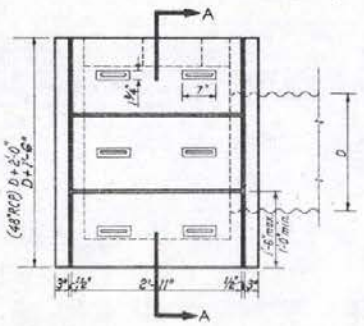
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

PIPE RISER INLET
(TYPE 3)

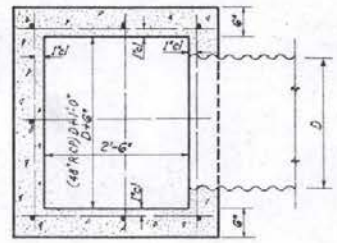
CHIEF ROAD DESIGN ENGR.

R-4.1.2-(609)
ADOPTED: 8/69
REVISION 2

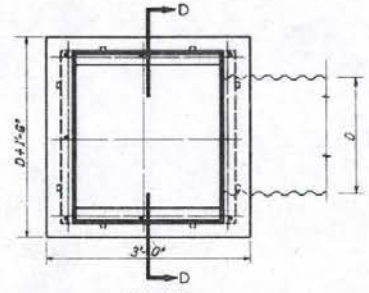
R 31



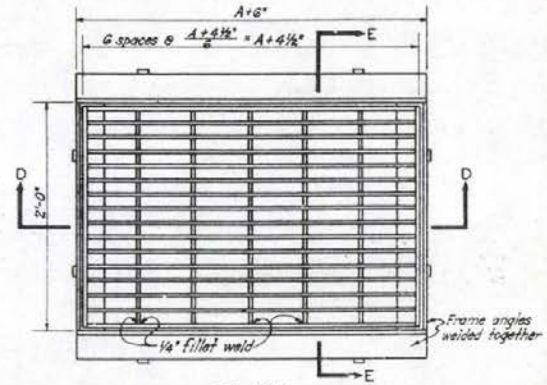
PLAN



SECTION C-C



PLAN



PLAN

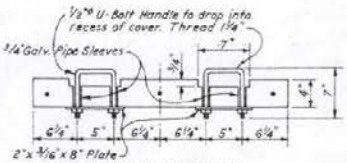
BILL OF MATERIALS

CMP Size	Concrete, cu yd. 1 Opening	Concrete, cu yd. 2 Openings	Reinforcing, lb. 1 Opening	Reinforcing, lb. 2 Openings
15"	0.67	0.63	57	54
18"	0.76	0.72	58	57
24"	0.95	0.91	70	67
30"	1.14	1.11	82	79
36"	1.35	1.31	88	96
42"	1.57	1.53	96	94
48"	1.80	1.76	120	117

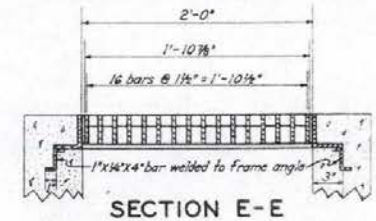
RCP Size	Concrete, cu yd. 1 Opening	Concrete, cu yd. 2 Openings	Reinforcing, lb. 1 Opening	Reinforcing, lb. 2 Openings
18"	0.74	0.71	58	55
18"	0.84	0.80	60	58
24"	1.03	0.99	91	68
30"	1.22	1.19	88	80
36"	1.43	1.40	89	87
42"	1.66	1.62	98	95
48"	2.03	2.00	185	123

BILL OF MATERIALS

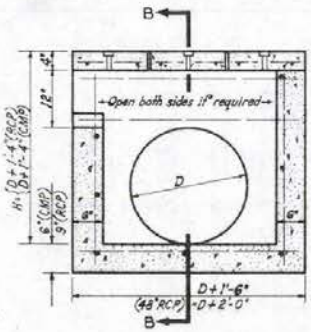
CMP Size	Concrete cu. yd.	Reinf. lb.	A	RCP Size	Concrete cu. yd.	Reinf. lb.	A	Main Bars inches	Frame Angles inches	Grate lb.	Frame lb.	Total lb.
18"	0.62	39	2'-0"	18"	0.68	40	2'-0"	½"x⅜"	3"x3"x⅜"	140	67	207
24"	0.77	44	2'-6"	24"	0.84	45	2'-6"	¾"x⅜"	3½"x3½"x⅜"	197	82	279
30"	0.93	53	3'-0"	30"	0.99	60	3'-0"	¾"x⅜"	4"x3½"x½"	264	76	340
36"	1.11	64	3'-6"	36"	1.17	65	3'-6"	4"x⅜"	5"x3½"x½"	341	113	454
42"	1.29	69	4'-0"	42"	1.35	70	4'-0"	4"x⅜"	6"x3½"x½"	382	123	504



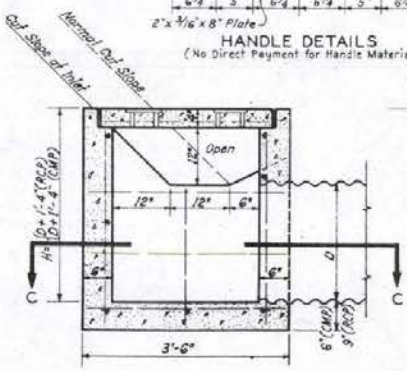
HANDLE DETAILS
(No Direct Payment for Handle Materials.)



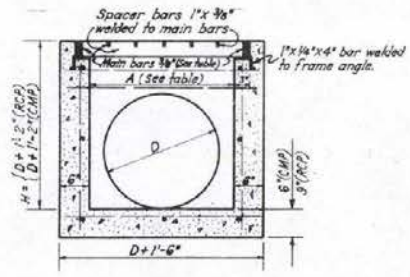
SECTION E-E
STANDARD STRUCTURAL STEEL GRATE AND FRAME



SECTION A-A



SECTION B-B



SECTION D-D

GENERAL NOTES

1- All concrete shall be Class A or AA.
2- Reinforcing Steel shall be N° 4 bars with maximum space of 18" centers, wired tightly at all intersections, and embedded at least one inch clear of concrete surface.
3- Exposed edges of concrete shall be chamfered one inch.
4- Dimensions may be varied to fit local conditions if ordered by the Engineer.
5- Commercial prefabricated gratings approved by the Bridge Division may be used in lieu of the field-welded grating shown above.

TYPE 1 DROP INLET

TYPE 2 DROP INLET

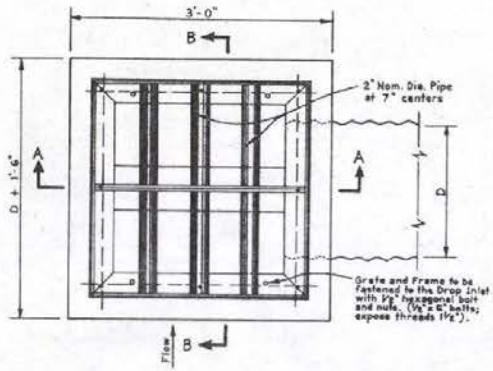
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

TYPE 1 & 2 DROP INLETS

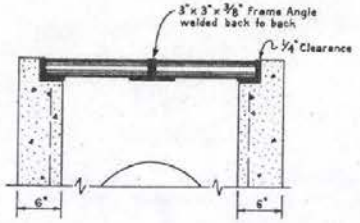
CHIEF ROAD DESIGN ENGR.

R-4.2.1-(609)
ADOPTED: 8/69
REVISION 2

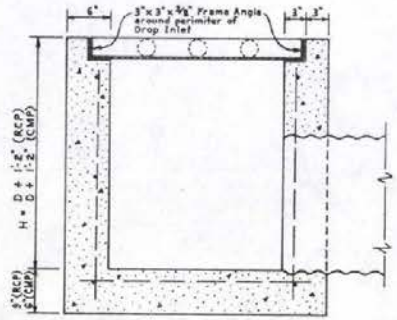
R-32



PLAN



SECTION B-B



SECTION A-A

CMP Size	Concrete Cu.Yd.	Reinf. Lb.	Struct. Steel Lb.
18"	0.62	39	98
24"	0.77	44	110
30"	0.93	59	123
36"	1.11	64	136
42"	1.29	69	146

RCP Size	Concrete Cu.Yd.	Reinf. Lb.	Struct. Steel Lb.
18"	0.68	40	98
24"	0.84	45	110
30"	0.99	60	123
36"	1.17	65	136
42"	1.35	70	146

GENERAL NOTES

1. All concrete shall be Class A or AA.
2. Reinforcing bars shall be No. 4 bars with maximum spacing at 18" centers. Bars to be embedded a minimum of two inches and bar ends must clear concrete surfaces by one and one half inch.
3. All exposed concrete edges shall be chamfered one inch.
4. Structural steel weight includes the 2" pipe and the 3" x 3" x 3/8" frame angles.

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

TYPE 2A DROP INLET

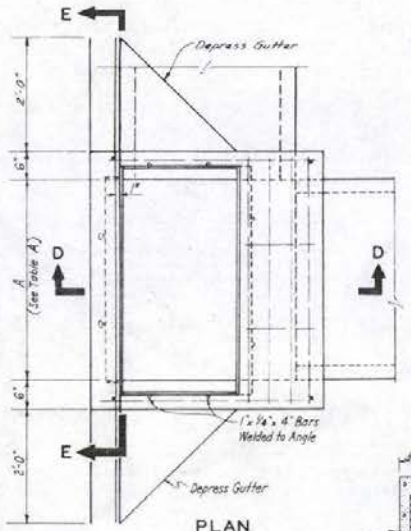
CHIEF ROAD DESIGN ENGR.

R-4.2.2- (609)

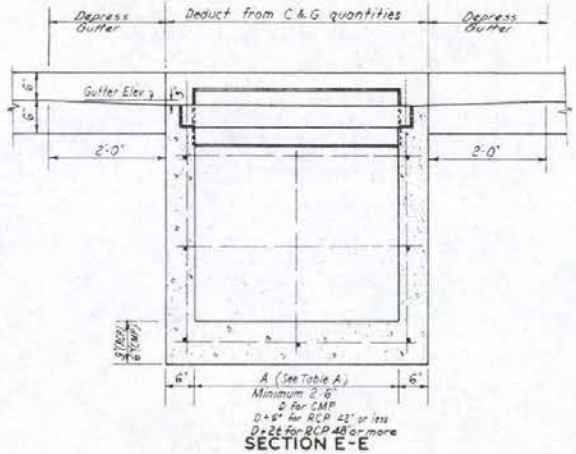
ADOPTED: 11/70

REVISION

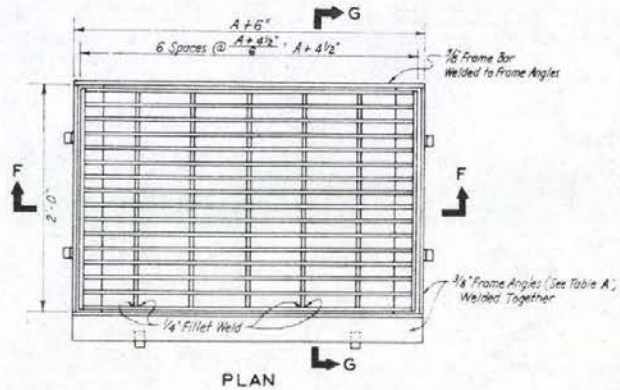
R-33



PLAN



SECTION E-E



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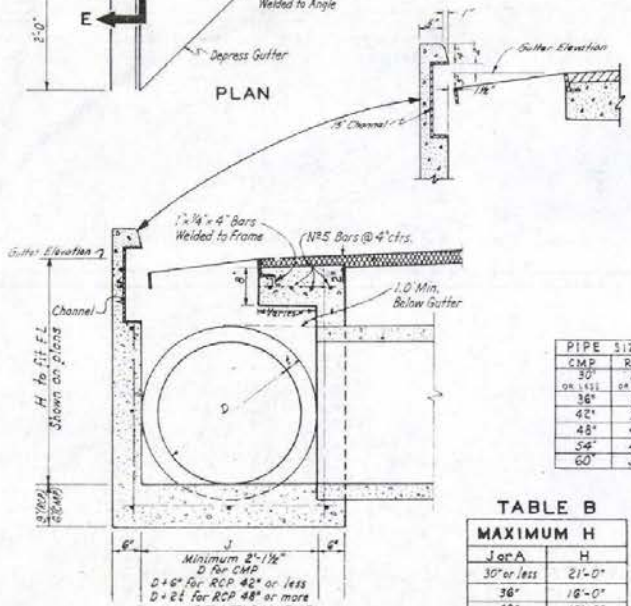
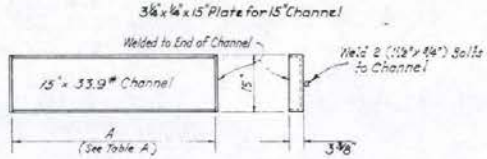
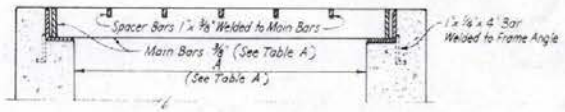


SECTION D-D



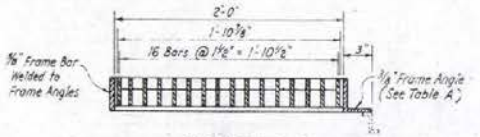
CHANNEL DETAIL



SECTION F-F

STRUCTURAL STEEL (TABLE A)

PIPE SIZE CMP	PIPE SIZE RCP	A	MAIN BARS	FRAME ANGLES	FRAME BAR	GRATE LBS	FRAME LBS	CHANNEL & PLATES, LBS	TOTAL LBS
30" OR LESS	24" OR LESS	2'-6"	3 x ⅜"	3½"x3"x⅜"	3½" x ⅜"	199	67	107	373
36"	30"	3'-0"	3½"x⅜"	4"x3"x⅜"	4" x ⅜"	265	79	123	467
42"	36"	3'-6"	4" x ⅜"	4½"x3"x⅜"	4½" x ⅜"	346	96	141	583
48"	42"	4'-0"	4" x ⅜"	4½"x3"x⅜"	4½" x ⅜"	387	103	150	640
54"	48"	4'-6"	4½"x⅜"	5"x3"x⅜"	5" x ½"	473	119	175	767
60"	54"	5'-0"	5" x ⅜"	5½"x3"x⅜"	5½" x ½"	575	137	202	914

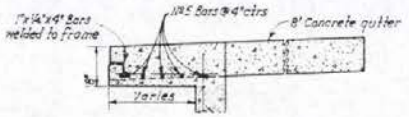


SECTION G-G

GRATE AND FRAME DETAIL

TABLE B

MAXIMUM H	
J or A	H
30" or less	21'-0"
36"	18'-0"
42"	12'-0"
48"	9'-0"
54"	7'-0"
60"	7'-0" (With #4 bars @ 12" centers)



SECTION

8' CONCRETE GUTTER

GENERAL NOTES

1. All concrete shall be Class A or AA.
2. All reinforcing steel shall be tightly wired and embedded 1½" clear of concrete surface Except as noted, all reinforcing steel shall be №4 bars with maximum space at 18" centers, for all values of H to the maximum as shown in table B. If H exceeds these maximums, drop inlet will require special design.
3. Exposed edges of concrete shall be chamfered one inch.
4. Where pipe intersects drop inlet on a 12° or larger skew increase J to "cos skew ∠". Redesign for skews at A.

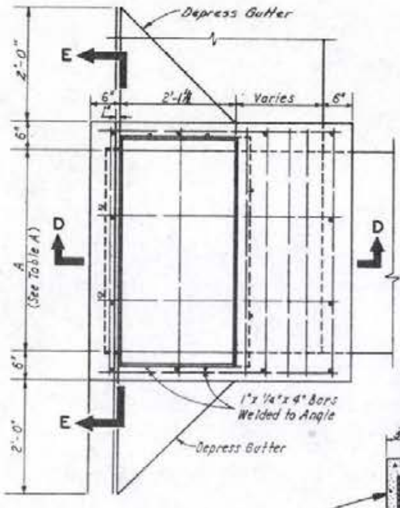
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

TYPE 3 DROP INLET

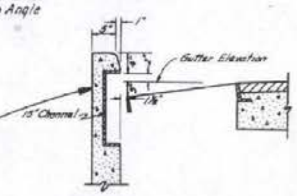
CHIEF ROAD DESIGN ENGR.

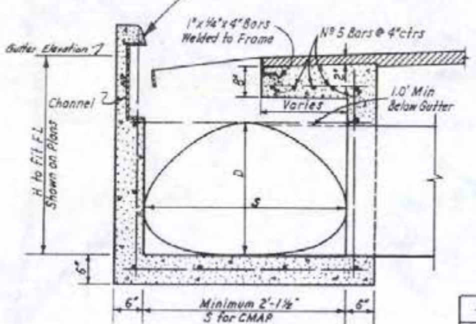
R-4.3.1-(609)
ADOPTED 8/69
REVISION 2 7/79

R 34

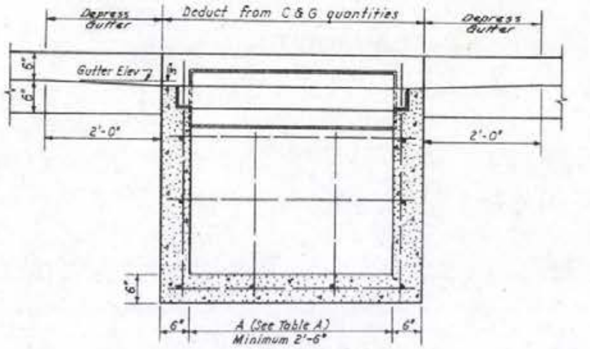


PLAN

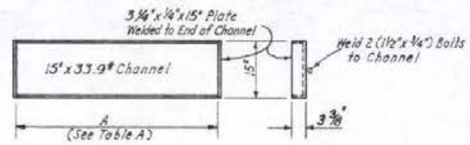




SECTION D-D



SECTION E-E



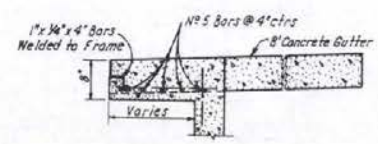
CHANNEL DETAIL

STRUCTURAL STEEL (TABLE A)

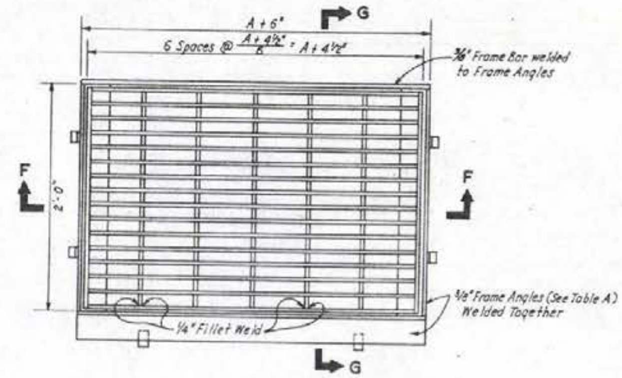
PIPE SIZE CMAP	A	MAIN BARS	FRAME ANGLES	FRAME BAR	GRATE LBS	FRAME LBS	CHANNEL & PLATES, LBS	TOTAL LBS
29"x 18" or Less	2'-6"	3"x ⅜"	3½"x 3"x ⅜"	3½"x ⅜"	193	67	107	373
36"x 22"	3'-0"	3½"x ⅜"	4"x 3"x ⅜"	4"x ⅜"	265	79	123	467
43"x 27"	3'-6"	4"x ⅜"	4½"x 3"x ⅜"	4½"x ⅜"	346	96	141	583

TABLE B

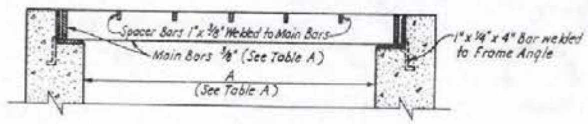
MAXIMUM H	
CMAP SIZE	H
29"x 18" or Less	21'-0"
36"x 22"	16'-0"
43"x 27"	12'-0"



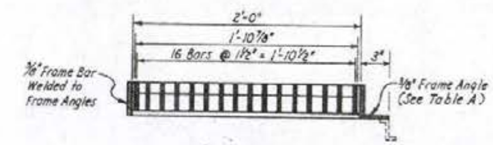
SECTION
8' CONCRETE GUTTER



PLAN



SECTION F-F



SECTION G-G

GRATE AND FRAME DETAIL

GENERAL NOTES

1. All concrete shall be Class A or AA.
2. Exposed edges of concrete shall be chamfered one inch.
3. All reinforcing steel shall be tightly wired and embedded 1½" clear of concrete surface. Except as noted, all reinforcing steel shall be Nº 4 bars with maximum space at 18" centers.
4. If H exceeds maximum shown on Table B, drop inlet will require special design.

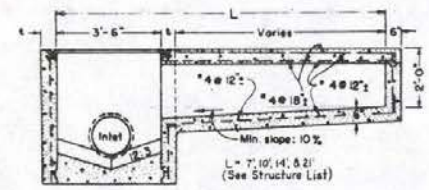
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

TYPE 3A DROP INLET

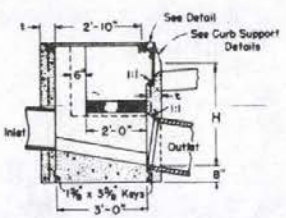
Robert L. Sharp [signature]
CHIEF ROAD DESIGN ENGR.

R-4.4.1-(609)
ADOPTED: 8/69
REVISION 2 4/79

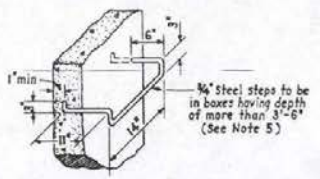
R-35



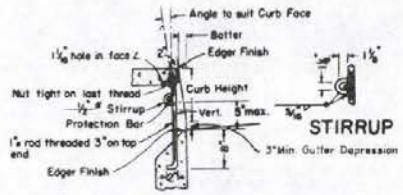
SECTION A-A



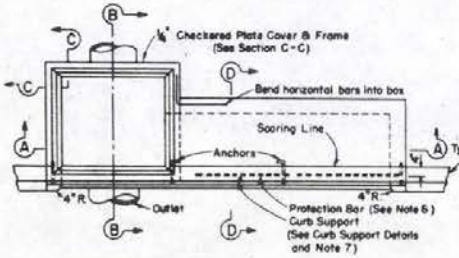
SECTION B-B



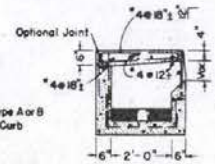
STEP DETAIL



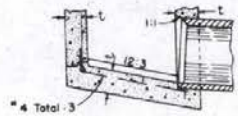
CURB SUPPORT DETAILS



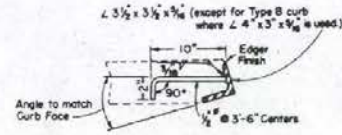
PLAN



SECTION D-D



ALTERNATIVE REINFORCED BOTTOM



FACE ANGLE ANCHOR DETAIL

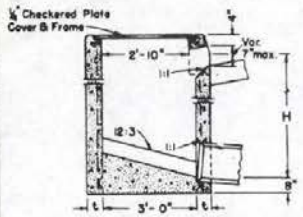
TYPE 4 DROP INLET

H	t
5'-0" or Less	6"
5'-1" to 20'-0"	8"

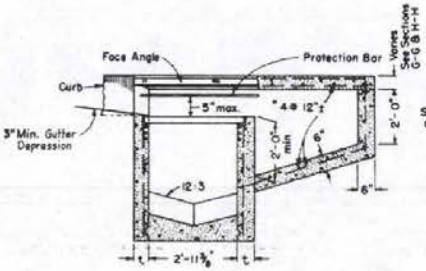
Length of Curb Opening	No. of Anchors
3'-6" or less	2
7'-0"	3
10'-0"	4
14'-0"	5
21'-0"	7

GENERAL NOTES

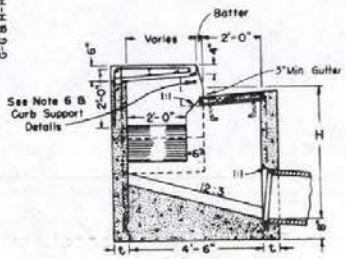
1. "H" is the difference in elevation between the outlet pipe flow line and the normal gutter grade line undepressed at the curb face.
2. For "t" wall thickness see Table.
3. Height of curb opening will vary with the type of curb and the depth of the local depression.
4. Reinforcing steel in walls shall 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 details, Place a 6" ø 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. Full penetration butt welds may be substituted for the fillet welds on all anchors.
13. Standard square, hexagon, round or equivalent headed anchors may be substituted for the right angle hooks on the anchors shown on this plan.



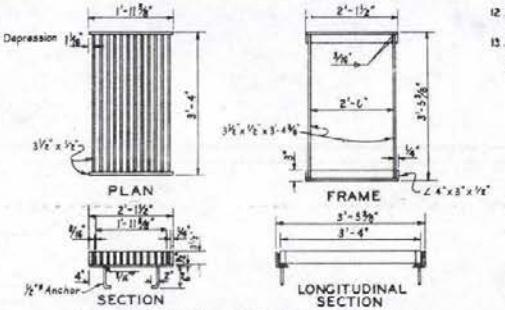
SECTION E-E



SECTION F-F

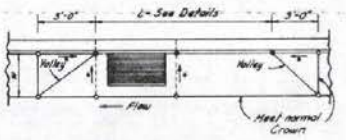


SECTION G-G



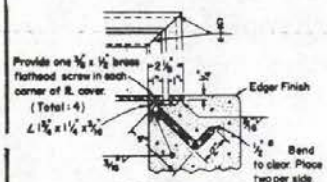
FRAME AND GRATE DETAILS

Weight of Frame and Grate = 371 Lbs.

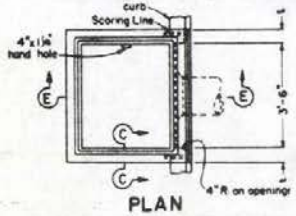


DROP INLET

o = Depressed elevation
o = Normal crown or gutter flowline elevation
w = Normal gutter width

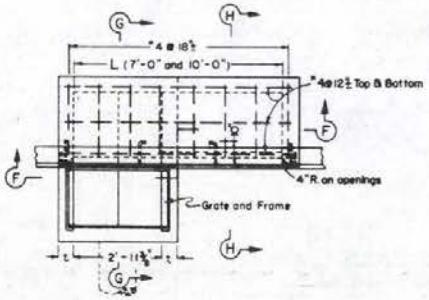


SECTION C-C



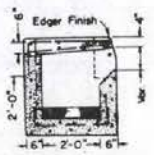
PLAN

TYPE 5 DROP INLET

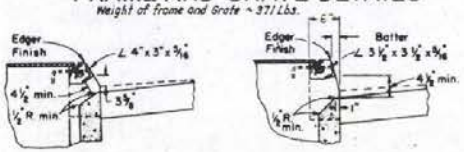


PLAN

TYPE 6 DROP INLET



SECTION H-H



CURB OPENING DETAILS

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

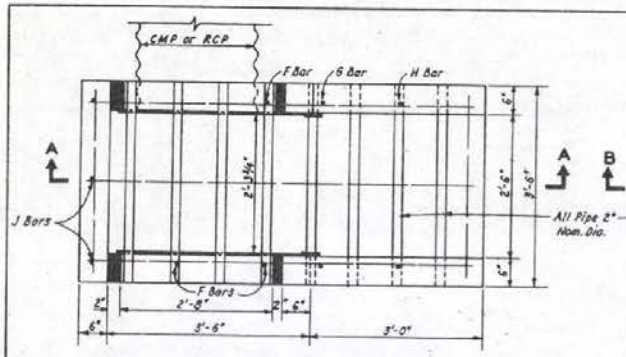
TYPE 4, 5 & 6 DROP INLETS

R-4.5.1-(609)

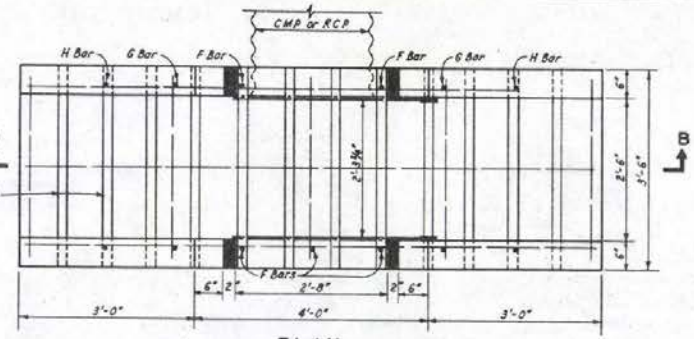
Robert F. Sharp
CHIEF ROAD DESIGN ENGR.

ADOPTED: 5/71

REVISION 1/79



PLAN



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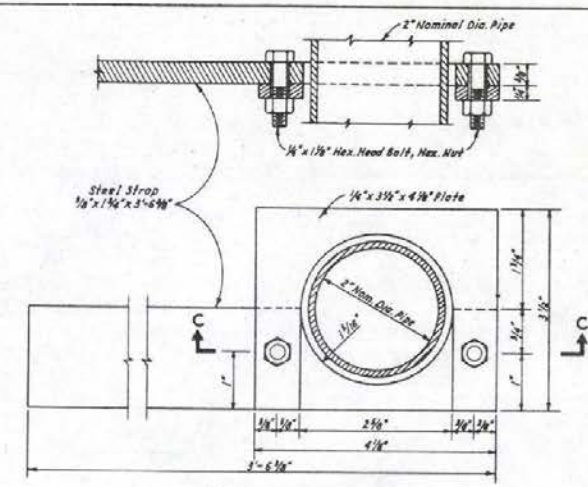
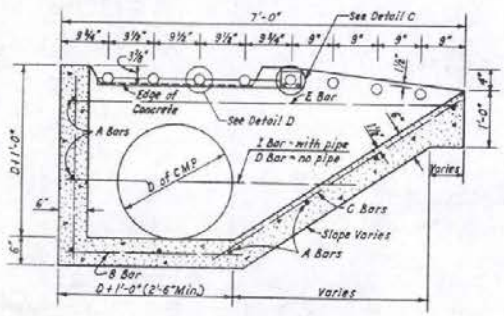
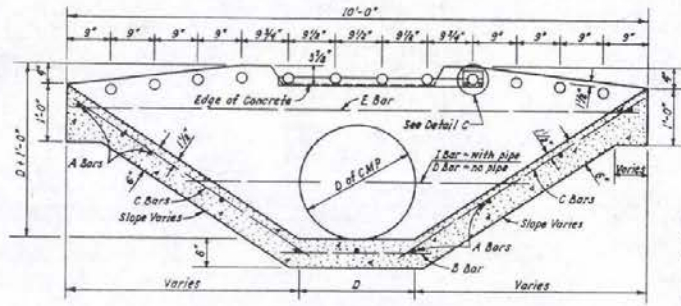


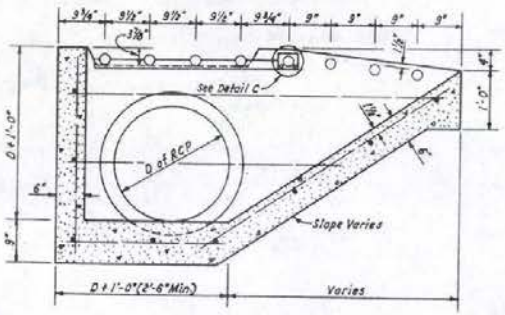
DETAIL C



SECTION A-A

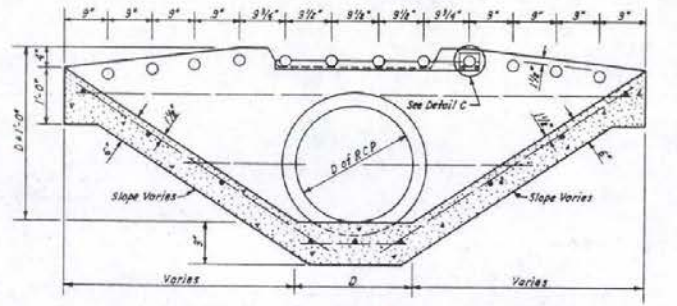


SECTION B-B



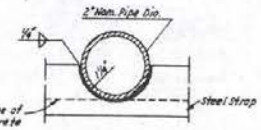
SECTION A-A

TYPE 7 DROP INLET

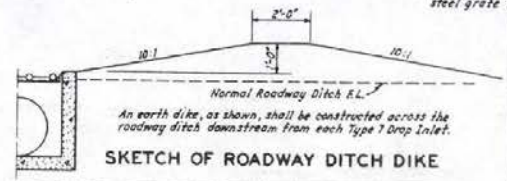


SECTION B-B

TYPE 8 DROP INLET



DETAIL D



An earth dike, as shown, shall be constructed across the roadway ditch downstream from each Type 7 Drop Inlet.

SKETCH OF ROADWAY DITCH DIKE

TABLE OF QUANTITIES
TYPE 7 DROP INLET

CMP

SIZE	A	B	C	D	E	F	G	H	I	J	CONC. CU. YD.	REINF. STEEL LB.	STR. STEEL GRATE LB.
18"	8 @ 3'-2"	3 @ 2'-3"	3 @ 4'-9"	1 @ 5'-0"	2 @ 6'-8"	3 @ 2'-5"	2 @ 1'-10"	2 @ 1'-2"	1 @ 2'-4"	3 @ 3'-8"	1.11	61	117
24"	8 @ 3'-2"	3 @ 2'-9"	3 @ 4'-3"	1 @ 5'-0"	2 @ 6'-8"	3 @ 2'-9"	2 @ 2'-0"	2 @ 1'-6"	1 @ 2'-3"	3 @ 3'-2"	1.21	63	117
30"	8 @ 3'-2"	3 @ 3'-4"	3 @ 4'-9"	1 @ 5'-6"	2 @ 6'-8"	3 @ 3'-3"	2 @ 2'-6"	2 @ 1'-9"	1 @ 1'-10"	3 @ 3'-8"	1.34	67	117
18"	8 @ 3'-2"	3 @ 3'-4"	3 @ 5'-0"	1 @ 5'-0"	2 @ 6'-8"	3 @ 2'-6"	2 @ 1'-10"	2 @ 1'-2"	1 @ 2'-1"	3 @ 2'-11"	1.18	62	117
24"	8 @ 3'-2"	3 @ 3'-4"	3 @ 5'-0"	1 @ 5'-0"	2 @ 6'-8"	3 @ 3'-0"	2 @ 2'-0"	2 @ 1'-6"	1 @ 2'-0"	3 @ 3'-5"	1.27	65	117
30"	8 @ 3'-2"	3 @ 3'-4"	3 @ 5'-0"	1 @ 5'-6"	2 @ 6'-8"	3 @ 3'-5"	2 @ 2'-8"	2 @ 1'-9"	1 @ 1'-8"	3 @ 3'-11"	1.41	68	117

RCP

SIZE	A	B	C	D	E	F	G	H	I	J	CONC. CU. YD.	REINF. STEEL LB.	STR. STEEL GRATE LB.
18"	8 @ 3'-2"	3 @ 2'-0"	4 @ 4'-8"	1 @ 6'-6"	2 @ 9'-8"	5 @ 2'-3"	4 @ 1'-10"	4 @ 1'-2"	2 @ 2'-4"	Not Applicable	1.33	78	168
24"	8 @ 3'-2"	3 @ 2'-6"	4 @ 4'-9"	1 @ 6'-10"	2 @ 9'-8"	5 @ 2'-3"	4 @ 2'-0"	4 @ 1'-6"	2 @ 2'-5"		1.45	82	168
30"	8 @ 3'-2"	3 @ 3'-0"	4 @ 4'-9"	1 @ 7'-0"	2 @ 9'-8"	5 @ 2'-3"	4 @ 2'-8"	4 @ 1'-9"	2 @ 1'-10"		1.59	87	168
18"	8 @ 3'-2"	3 @ 2'-0"	4 @ 5'-0"	1 @ 6'-6"	2 @ 9'-8"	5 @ 2'-6"	4 @ 1'-10"	4 @ 1'-2"	2 @ 2'-1"		1.35	80	168
24"	8 @ 3'-2"	3 @ 2'-6"	4 @ 5'-0"	1 @ 6'-10"	2 @ 9'-8"	5 @ 2'-3"	4 @ 2'-0"	4 @ 1'-6"	2 @ 2'-0"		1.48	84	168
30"	8 @ 3'-2"	3 @ 3'-0"	4 @ 5'-0"	1 @ 7'-0"	2 @ 9'-8"	5 @ 2'-6"	4 @ 2'-8"	4 @ 1'-9"	2 @ 1'-8"		1.63	89	168

GENERAL NOTES

1. - All concrete shall be Class A or AA.
2. - Reinforcing steel shall be No. 4 bars with maximum spacing of 18" centers, wired tightly at all intersections and embedded at least one and one half inch clear of concrete surface.
3. - Dimensions may be varied by the Engineer to fit local conditions.
4. - No deductions in concrete shall be made for the 2" crossbars.
5. - All exposed edges of concrete shall be chamfered one inch.
6. - Steel strap and pipe for crossbars are included in the structural steel grate quantities.

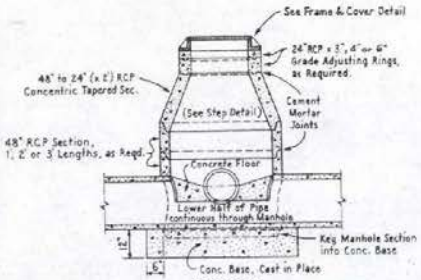
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

TYPE 7 & 8 DROP INLETS

Robert L. Sharp
CHIEF ROAD DESIGN ENGR.

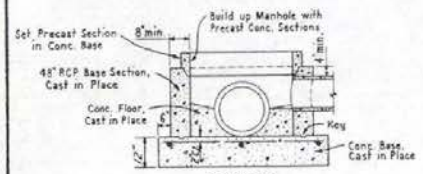
R-4.6.1-(609)
ADOPTED: 8/89
REVISION 1

R 37



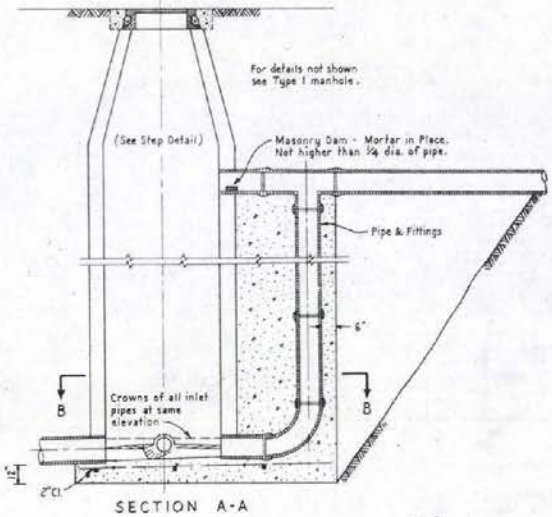
SECTION

TYPE 1 MANHOLE

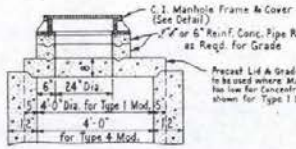


SECTION

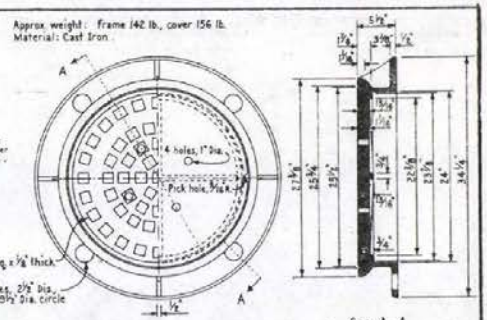
ALTERNATE BASE CONST.



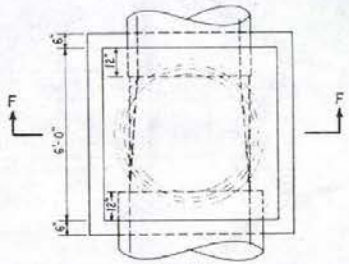
SECTION A-A



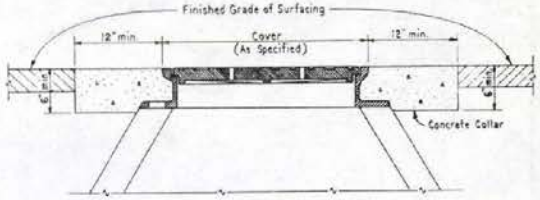
TYPE 1 OR 4 MODIFIED MANHOLE



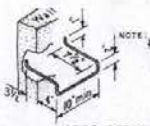
TYPICAL TRAFFIC-STRENGTH MANHOLE FRAME & COVER



PLAN

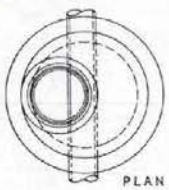


TYPICAL METHOD OF ADJUSTING MANHOLES AND WATER VALVES
(Adjusted collars may be poured square or round.)

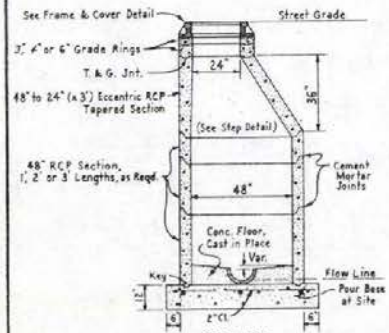


STEP DETAIL

NOTE: COMMERCIAL PREFABRICATED ADJUSTMENT RINGS FOR MANHOLES MAY BE USED WHEN APPROVED BY THE ENGINEER.

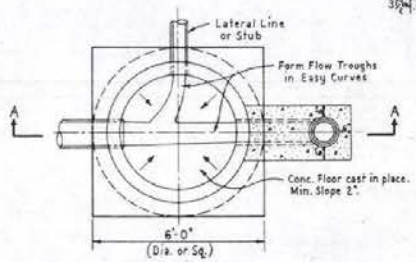


PLAN



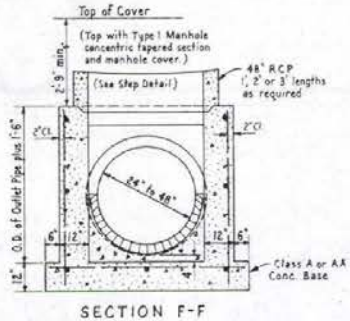
SECTION

TYPE 2 MANHOLE



SECTION B-B

TYPE 3 MANHOLE



SECTION F-F

TYPE 4 MANHOLE

GENERAL NOTES

1. ALLOW A DROP OF .01 FT. IN A THROUGH MANHOLE & ALLOW A DROP OF .02 FT. IN THE PRESENCE OF ONE LATERAL OR BEND.
2. ALL REINFORCING STEEL TO BE NO. 4 BARS AT 18" MAXIMUM SPACING UNLESS OTHERWISE NOTED.
3. ALL CONCRETE SHALL BE CLASS A OR AA.

TYPE 1, 2, 3 & 4 MANHOLES

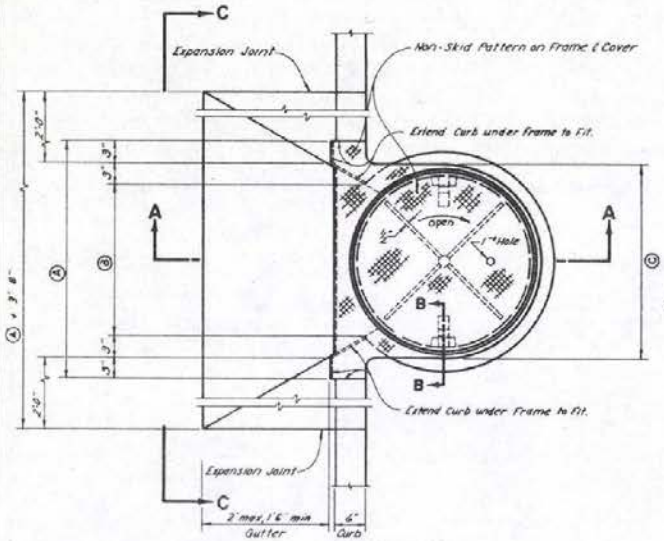
R-4.7.1-(609)

ADOPTED: 8/69

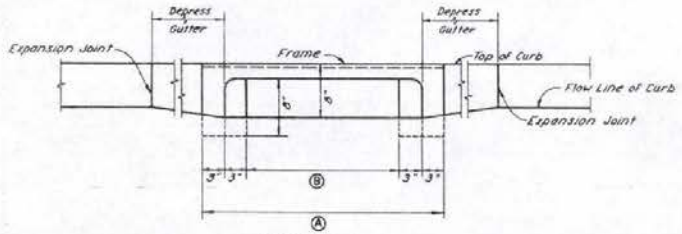
REVISION 4

CHIEF ROAD DESIGN ENGR.

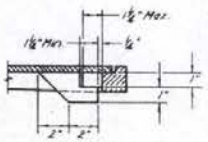
R 38



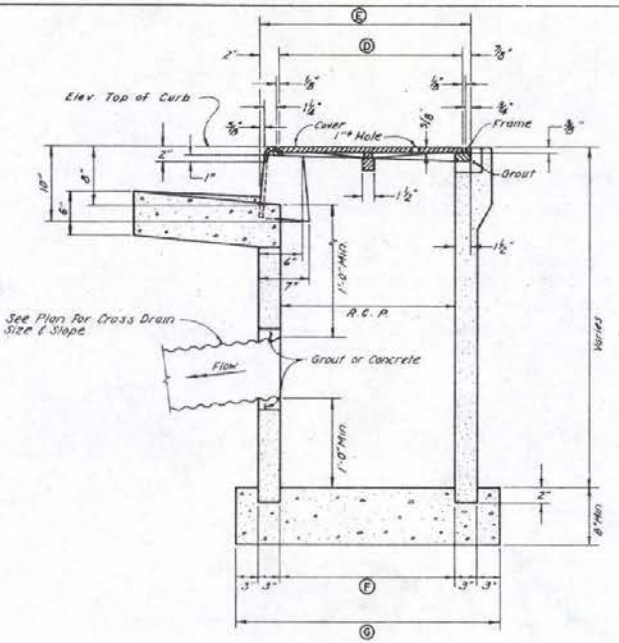
PLAN VIEW



VIEW C-C



SECTION B-B
WEDGE LOCK HOLD DOWN



SECTION A-A

DROP INLET	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓕ	Ⓖ
TYPE 10	2'-9"	1'-9"	2'-3"	25¼"	28⅞"	24"	36"
TYPE 9	2'-3"	1'-3"	1'-9"	19¼"	22⅞"	18"	30"

CASTINGS *	FRAME	COVER
TYPE 10	90 Lbs.	70 Lbs.
TYPE 9	66 Lbs.	34 Lbs.

* For Info. Only

GENERAL NOTES

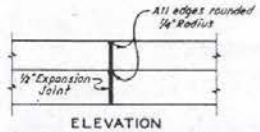
1. All Concrete Shall be A or AA.
2. Forming of the Base Will not be Required.

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

DROP INLET
TYPE 9 & 10

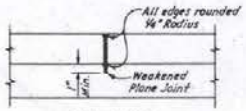
CHIEF ROAD DESIGN ENGR.	R-4.8.1 ADOPTED: 11/71	(609) REVISION

R 39

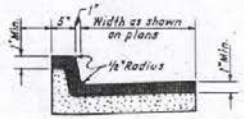


ELEVATION

EXPANSION JOINT



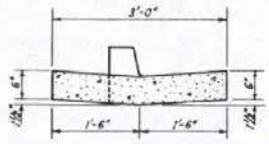
ELEVATION



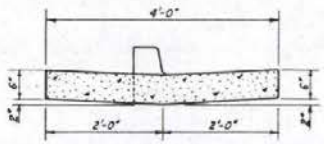
END VIEW

WEAKENED PLANE JOINT

For use in concrete curb and gutter

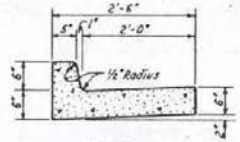


SECTION
TYPE 1
(0.0556 cu yd per ft)

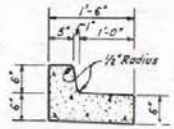


SECTION
TYPE 2
(0.07402 cu yd per ft)

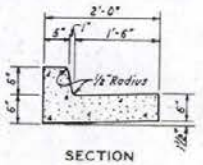
VALLEY GUTTER



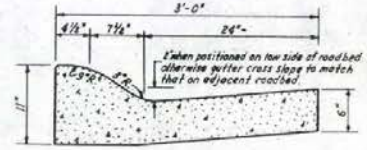
SECTION
TYPE 1
(0.05478 cu yd per ft)



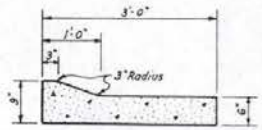
SECTION
TYPE 4
(0.03627 cu yd per ft)



SECTION
TYPE 5
(0.04552 cu yd per ft)



SECTION
TYPE 6
(0.06599 cu yd per ft)



SECTION
TYPE 7
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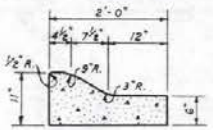
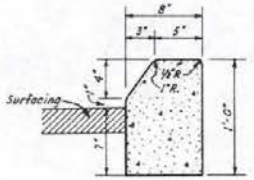
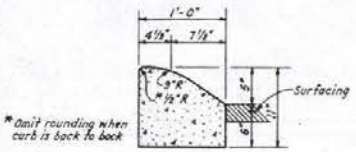


SECTION
TYPE 8
(0.04747 cu yd per ft)

CURB AND GUTTER

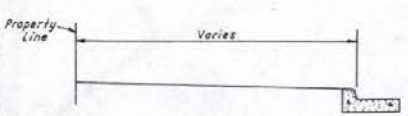


SECTION
TYPE 2
(0.02315 cu yd per ft)

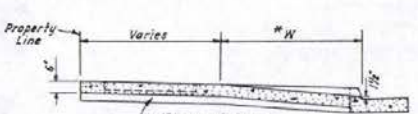


SECTION
TYPE 3
(0.02894 cu yd per ft)

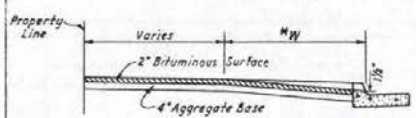
CURB



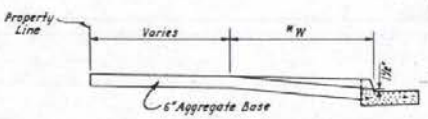
SECTION A-A



SEC. B-B (CONCRETE)

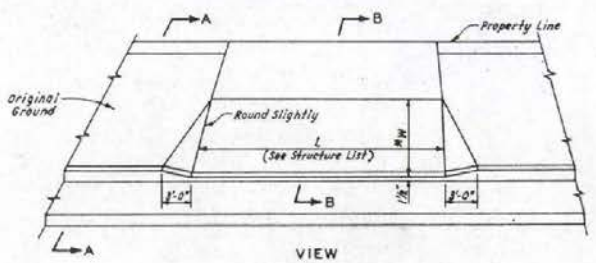


SEC. B-B (BITUMINOUS SURFACE)



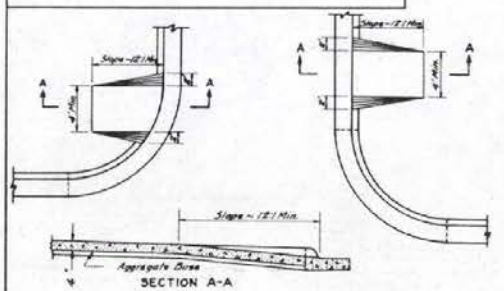
SEC. B-B (AGGREGATE)

*W = See Project Typical Sections



VIEW

DRIVEWAYS



SECTION A-A

CURB CUT RAMPS

GENERAL NOTES

1. Curb cuts can be varied to fit the needs at a particular location
2. Curb cut ramps should be located closely adjacent to an within marked crosswalks to insure their use as part of the established pedestrian control of the intersection. Specific location should be adapted to site conditions.

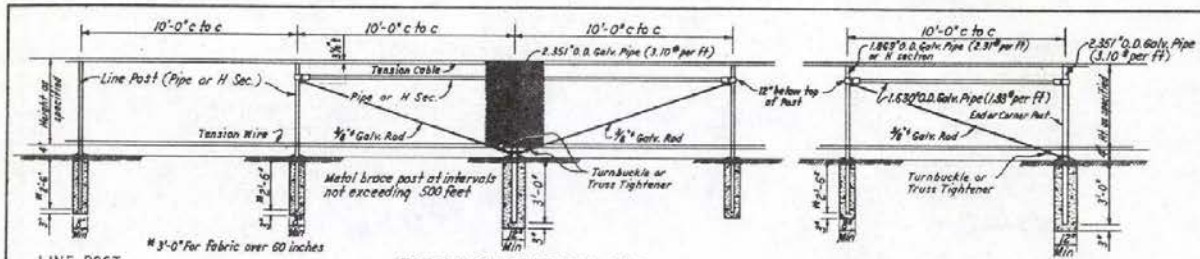
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

CURB AND GUTTER AND DRIVEWAYS

Robert L. Thomas
CHIEF ROAD DESIGN ENGR.

R-S.I.-(613)
ADOPTED: 8/69
REVISION 12/75

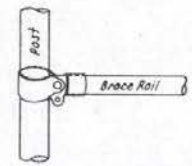
R 40



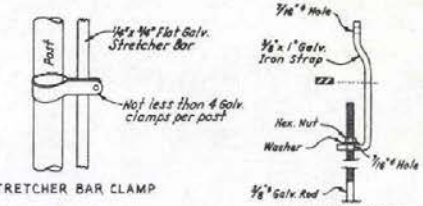
LINE POST

INTERMEDIATE BRACED POST

CORNER OR END POST



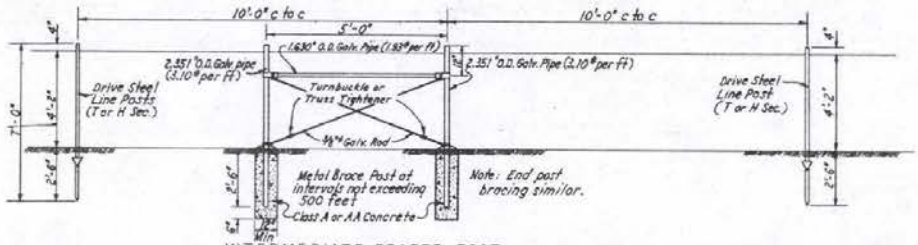
BRACE CLAMP



STRETCHER BAR CLAMP

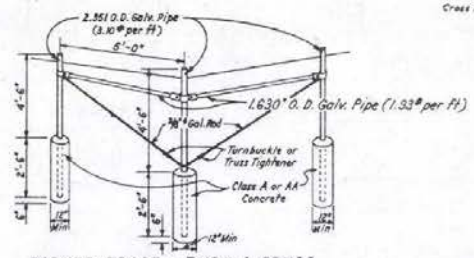
TRUSS TIGHTENER

CHAIN LINK FENCE

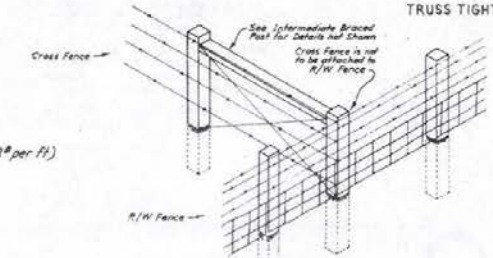


INTERMEDIATE BRACED POST

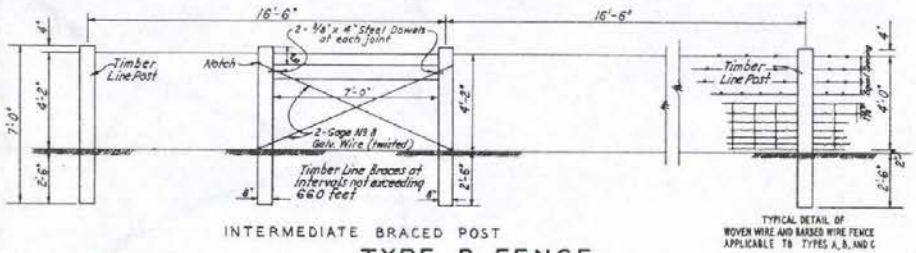
TYPE A FENCE



CORNER BRACE - TYPE A FENCE



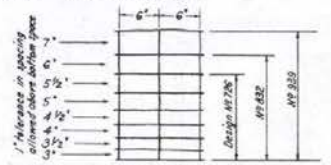
TYPICAL EXISTING CROSS FENCE TIE TO R/W FENCE



INTERMEDIATE BRACED POST

TYPICAL DETAIL OF WOVEN WIRE AND BARBED WIRE FENCE APPLICABLE TO TYPES A, B, AND C

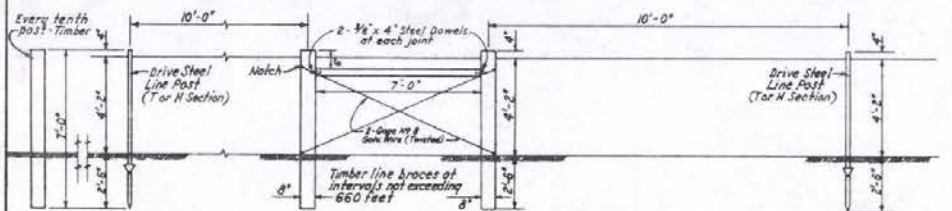
TYPE B FENCE



WOVEN WIRE (FARM FENCE) FABRIC

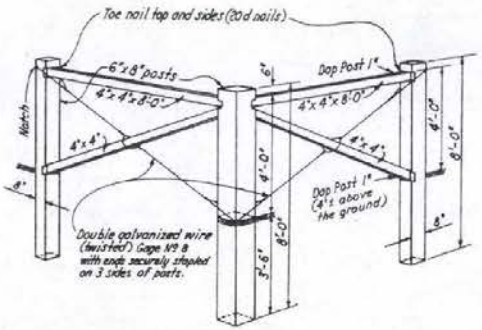
GENERAL NOTES

1. Fence posts and materials shall conform to the requirements of Standard Specifications and Supplements.
2. Fencing shall be: (a) Standard, (b) chain-link:
   (a) Standard fencing shall consist of galvanized barbed wire, galvanized woven wire (farm fence) or a combination of both on wood or metal posts or combinations of posts.
   (b) Chain-link fencing shall consist of galvanized chain-link fabric on steel posts (H-column or tubular).
3. Barbed wire shall be spaced as follows:
   3 wires: bottom wire 16" above ground, other spacing 16".
   4 wires: bottom wire 12½" above ground, other spacing 11½".
   5 wires: bottom wire 10" above ground, other spacing 10".
4. Standard fencing will be designated by type, design of fabric, and/or number of barbed wires, thus:
   Type A-830-33 designates metal posts, 39" woven (farm) wire, and 3 barbed wires;
   Type B-43 designates wood posts, 4 barbed wires;
   Type C-720-43 designates combination of wood and metal posts, 26" woven (farm) wire, 4 barbed wires;
5. Chain-link fence:
   (a) All posts shall be set in Class A or AA concrete.
   (b) All post tops shall be fitted with weirable finials.
   (c) Braces shall be spaced approximately 12" below top of terminal posts and shall extend from end, gate or corner posts to first adjacent line post.
   (d) All fittings shall be hot-dipped galvanized malleable, cast iron, or pressed steel.
   (e) Fabric shall be fastened to line posts with fabric bands spaced approximately 14" apart, and to top tension cable and bottom tension wire with hog rings or tie wires spaced approximately 24" apart.



INTERMEDIATE BRACED POST

TYPE C FENCE



TIMBER CORNER BRACE

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

FENCE DETAILS

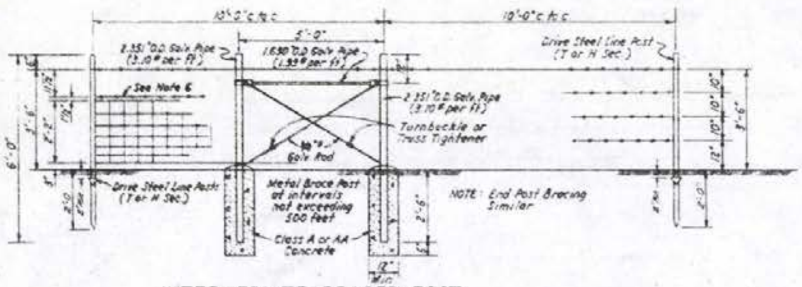
R-6.1.1- (616)

CHIEF ROAD DESIGN ENGR.

ADOPTED: 8/69

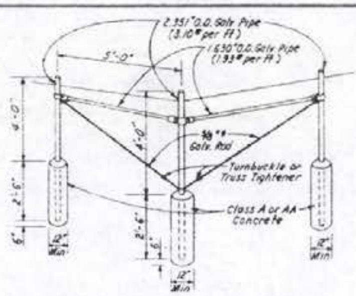
REVISION 2-9/72

R 41

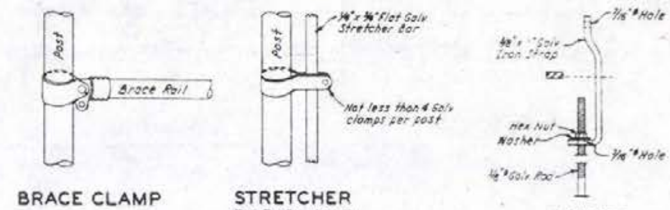


INTERMEDIATE BRACED POST

TYPE DA FENCE



CORNER BRACE- TYPE DA FENCE



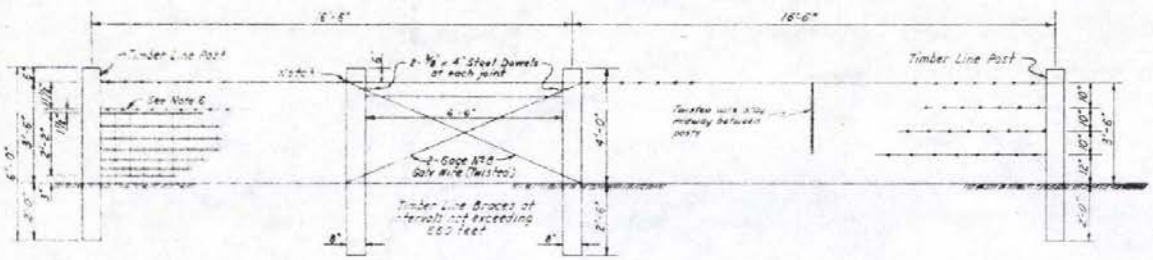
BRACE CLAMP

STRETCHER BAR CLAMP

TRUSS TIGHTENER

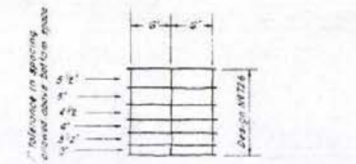
GENERAL NOTES

1. Fence posts and material shall conform to the requirements of Standard Specifications and Supplements.
2. Standard fencing shall consist of galvanized barbed wire, galvanized woven wire (farm fence), or a combination of both on wood or metal posts or combination of posts.
3. Barbed wire shall be spaced as follows:
   Type DA, DB, DC
   4 wires: bottom wire 12" above ground, others spacing 10"
4. Standard fencing will be designated by type, design of fabric and/or number of barbed wires, thus:
   Type DA-726-2B designates metal posts, 26" woven (farm) wire and 2 barbed wires;
   Type DB-726-2B designates wooden posts, 26" woven (farm) wire and 2 barbed wires;
   Type DC-726-2B designates combination of wood and metal posts, 26" woven (farm) wire, and 2 barbed wires.
5. Use same size gates and gate posts as shown on Sheet R-6.1.3.
6. The first line of barbed wire [illegible] shall be tied to the top wire of [illegible] 17 gage galvanized steel wire [illegible] rings. One tie to be made [illegible] spacing and [illegible] post spacing.

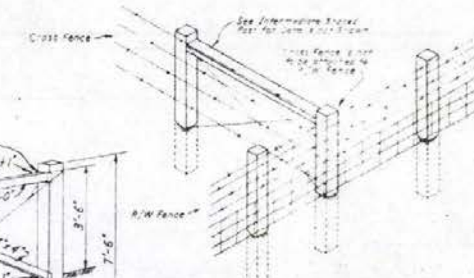


INTERMEDIATE BRACED POST

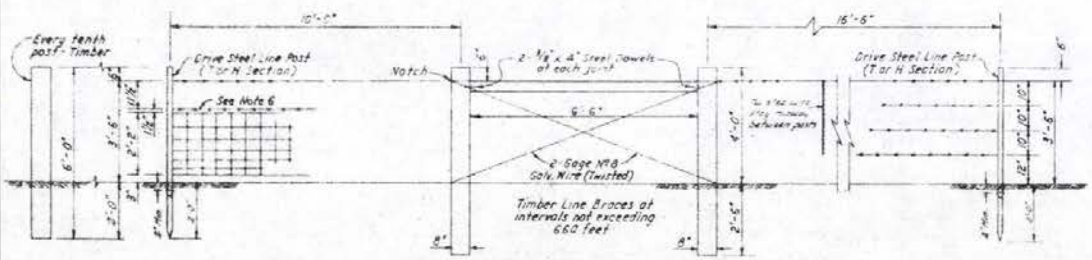
TYPE DB FENCE



WOVEN WIRE (FARM FENCE) FABRIC

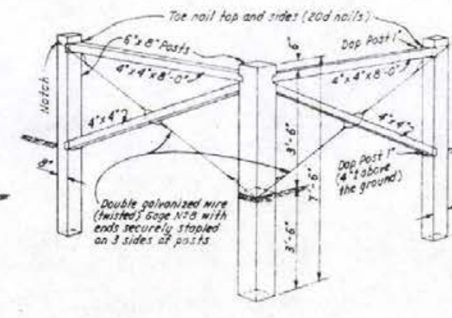


TYPICAL EXISTING CROSS FENCE TIE TO R/W FENCE



INTERMEDIATE BRACED POST

TYPE DC FENCE



TIMBER CORNER BRACE

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

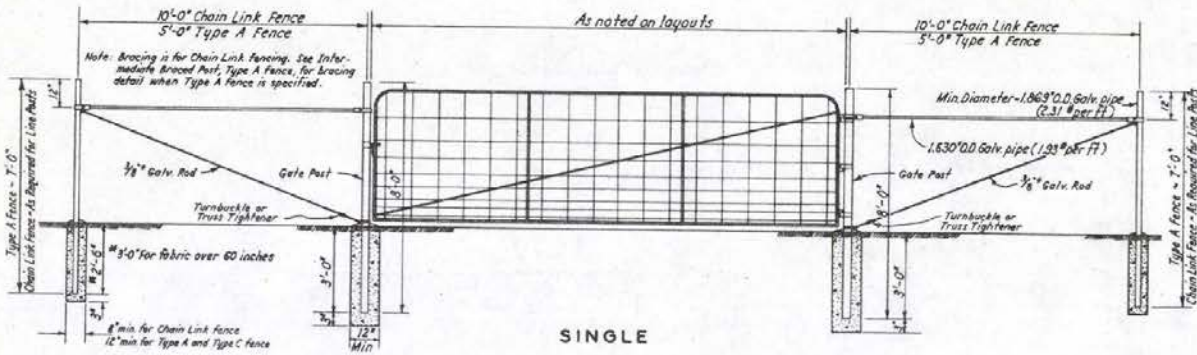
FENCE DETAILS

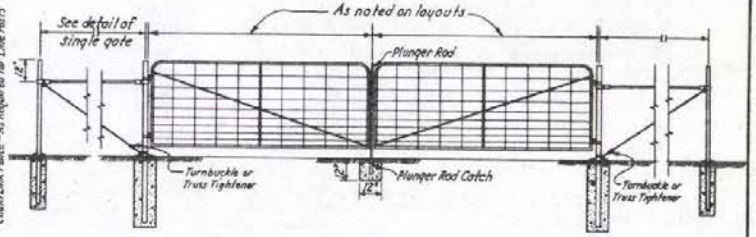
CHIEF ROAD DESIGN ENGR.

R-6.1.2- (616)

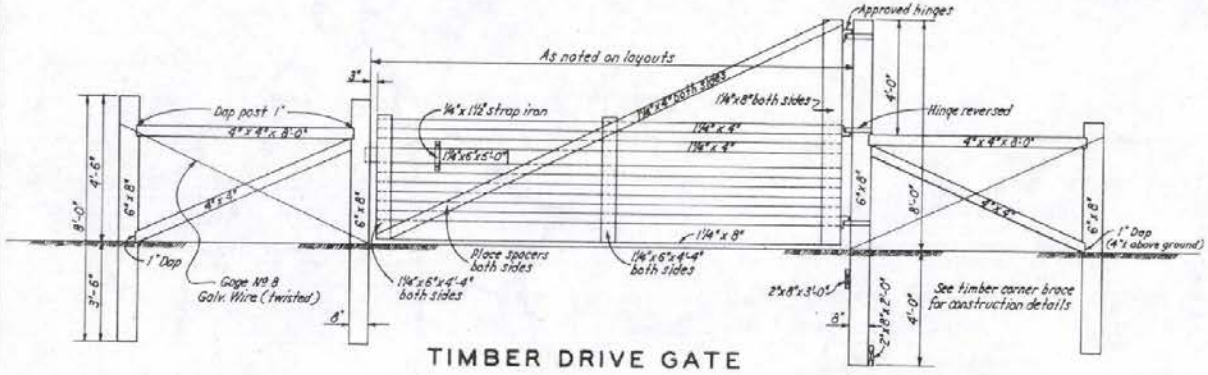
ADOPTED: 6/69 | REVISION 3

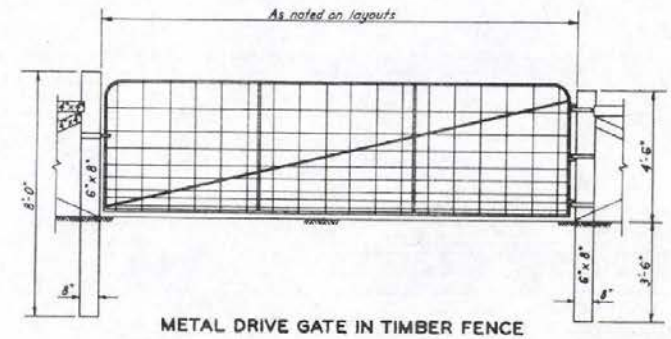
R 42

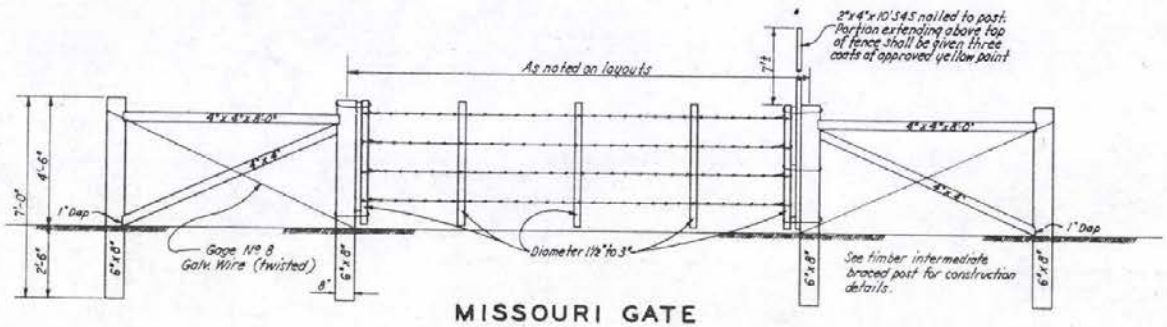


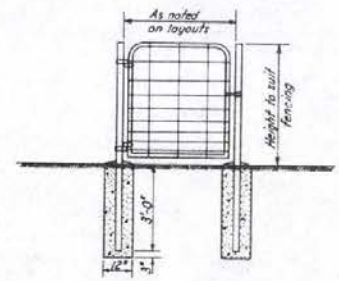


METAL DRIVE GATES









GENERAL NOTES

1. Standard gates, chain link gates, and walk gates shall be constructed as specified in the Standard Specifications.
2. Gate posts, braced posts, and braces shall conform to the requirements of the Standard Specifications.
3. Lumber used in the construction of timber gates shall conform to the requirements of the Standard Specifications.

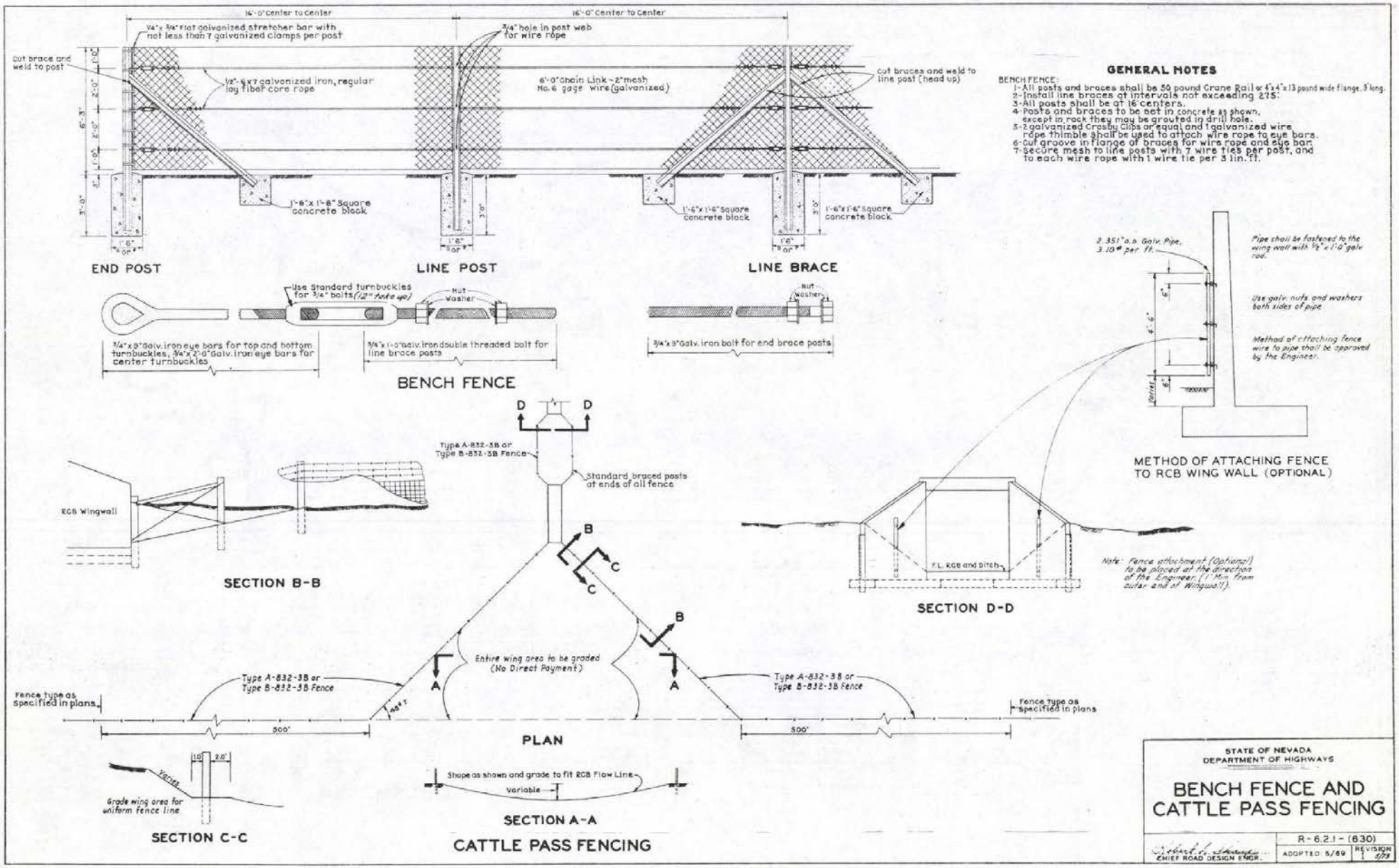
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

FENCE DETAILS

William L. Hagel
CHIEF ROAD DESIGN ENGR.

R-6.1.3 - (616)
ADOPTED: 8/69
REVISION 1

R-45


16'-0" Center to Center
16'-0" Center to Center
¼" x ¾" Flat galvanized stretcher bar with not less than 7 galvanized clamps per post
¾" hole in post web for wire rope
Cut brace and weld to post
½" - 6 x 7 galvanized iron, regular lay fiber core rope
6'-0" Chain Link - 2" mesh No. 6 gage wire (galvanized)
Cut braces and weld to line post (head up)
1'-6" x 1'-6" Square concrete block
1'-6" x 1'-6" Square concrete block
1'-6" x 1'-6" Square concrete block
END POST
LINE POST
LINE BRACE
Use Standard turnbuckles for ¾" bolts (1/2" take up)
Nut
Washer
¾" x 8" Galv. iron eye bars for top and bottom turnbuckles, ¾" x 2'-0" Galv. iron eye bars for center turnbuckles
¾" x 1'-0" Galv. iron double threaded bolt for line brace posts
¾" x 8" Galv. iron bolt for end brace posts
BENCH FENCE
GENERAL NOTES
BENCH FENCE:
1-All posts and braces shall be 50 pound Crane Rail or 4"x4"x13 pound wide flange, 5' long.
2-Install line braces at intervals not exceeding 275'.
3-All posts shall be at 16' centers.
4-Posts and braces to be set in concrete as shown, except in rock they may be grouted in drill hole.
5-2 galvanized Crosby Clips or equal and 1 galvanized wire rope thimble shall be used to attach wire rope to eye bars.
6-Cut groove in flange of braces for wire rope and eye bar.
7-Secure mesh to line posts with 7 wire ties per post, and to each wire rope with 1 wire tie per 3 lin. ft.
2.351" o.d. Galv. Pipe, 3.10# per ft.
Pipe shall be fastened to the wing wall with ½" x 1'-0" galv. rod.
Use galv. nuts and washers both sides of pipe.
Method of attaching fence wire to pipe shall be approved by the Engineer.
4'-6"
Varies
METHOD OF ATTACHING FENCE TO RCB WING WALL (OPTIONAL)
D
D
Type A-832-3B or Type B-832-3B Fence
Standard braced posts at ends of all fence
RCB Wingwall
SECTION B-B
B
C
C
B
Entire wing area to be graded (No Direct Payment)
A
A
Type A-832-3B or Type B-832-3B Fence
Type A-832-3B or Type B-832-3B Fence
Fence type as specified in plans.
Fence type as specified in plans
45°
500'
500'
PLAN
F.L. RCB and Ditch
Note: Fence attachment (Optional) to be placed at the direction of the Engineer. (1' Min. from outer end of Wingwall).
SECTION D-D
1.0
2.0'
Varies
Grade wing area for uniform fence line
SECTION C-C
Shape as shown and grade to fit RCB Flow Line
Variable
SECTION A-A
CATTLE PASS FENCING
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS
BENCH FENCE AND CATTLE PASS FENCING
R-6.2.1-(630)
CHIEF ROAD DESIGN ENGR.
ADOPTED: 5/69
REVISION 1 6/73

R 44

BILL OF MATERIALS

DOUGLAS FIR

ITEM	NO REQ'D	SIZE	LENGTH	FT B M
Wheel Guards	2	6"x6"	7'-3"	43.5
Wing Slope	4	2"x6"	8'-0"	32.0
Wing Slope	2	2"x6"	6'-4½"	12.8
Wing Braces	2	2"x6"	3'-4"	6.7
Wing Braces	4	2"x6"	5'-3"	21.0
Wing Braces	2	2"x6"	7'-3"	14.5
Wing Braces	2	2"x6"	2'-1"	4.2
Wing Braces	2	2"x6"	4'-0"	8.0
Wing Braces	2	2"x6"	5'-0"	10.0
Wing Post	2	4"x6"	As Required	
Nailing Strip	2	2"x2"	2'-0"	1.3

HARDWARE

ITEM	NO REQ'D	SIZE	LENGTH	WT LBS
Bolts	6	¾"ø	12"	15
Washers	6	¾"		6
Nails	50	40d		3
Nails	72	20d		2½
TOTAL				26¼

STRUCTURAL STEEL

12' ROADBED

ITEM	NO REQ'D	SIZE	LENGTH	WT LBS
I Beams	13	4"I-7.7#	15'-0"	1301
I Beams	6	7"I-15.3#	7'-3"	666
Spacers	72	2½"x5/16"	0'-6 5/16"	109
Anchor Bolts	12	⅝"ø	0'-9"	12
End Plates	2	7"x¼"	13'-0"	155
TOTAL				2243

14' ROADBED

ITEM	NO REQ'D	SIZE	LENGTH	WT LBS
I Beams	13	4"I-7.7#	15'-0"	1502
I Beams	7	7"I-15.3#	7'-3"	776
Spacers	84	2½"x5/16"	0'-6 5/16"	127
Anchor Bolts	14	⅝"ø	0'-9"	14
End Plates	2	7"x¼"	15'-0"	178
TOTAL				2597

16' ROADBED

ITEM	NO REQ'D	SIZE	LENGTH	WT LBS
I Beams	13	4"I-7.7#	17'-0"	1702
I Beams	8	7"I-15.3#	7'-3"	887
Spacers	84	2½"x5/16"	0'-6 5/16"	127
Anchor Bolts	14	⅝"ø	0'-9"	14
End Plates	2	7"x¼"	17'-0"	211
TOTAL				2941

20' ROADBED

ITEM	NO REQ'D	SIZE	LENGTH	WT LBS
I Beams	13	4"I-7.7#	21'-0"	2102
I Beams	9	7"I-15.3#	7'-3"	998
Spacers	100	2½"x5/16"	0'-6 5/16"	163
Anchor Bolts	18	⅝"ø	0'-9"	18
End Plates	2	7"x¼"	21'-0"	250
TOTAL				3531

REINFORCING

12' ROADBED

ITEM	NO REQ'D	SIZE	LENGTH	WT LBS
*Horizontal Bars	12	No.4	12'-6"	100
Horizontal Bars	12	No.4	7'-0"	56
Horizontal Bars	18	No.4	16'-9"	201
Vertical Bars	20	No.4	2'-9"	37
U-Bars	26	No.6	12'-1"	471
TOTAL				865

14' ROADBED

ITEM	NO REQ'D	SIZE	LENGTH	WT LBS
*Horizontal Bars	12	No.4	14'-6"	116
Horizontal Bars	13	No.4	7'-0"	61
Horizontal Bars	18	No.4	18'-9"	225
Vertical Bars	22	No.4	2'-9"	40
U-Bars	29	No.6	12'-1"	526
TOTAL				968

16' ROADBED

ITEM	NO REQ'D	SIZE	LENGTH	WT LBS
*Horizontal Bars	12	No.4	16'-6"	132
Horizontal Bars	13	No.4	7'-0"	70
Horizontal Bars	18	No.4	20'-9"	249
Vertical Bars	24	No.4	2'-9"	48
U-Bars	32	No.6	12'-1"	580
TOTAL				1079

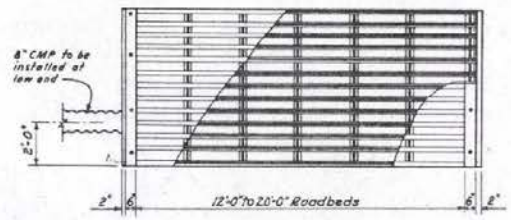
20' ROADBED

ITEM	NO REQ'D	SIZE	LENGTH	WT LBS
*Horizontal Bars	12	No.4	20'-6"	164
Horizontal Bars	17	No.4	7'-0"	79
Horizontal Bars	18	No.4	24'-9"	297
Vertical Bars	30	No.4	2'-9"	55
U-Bars	39	No.6	12'-1"	707
TOTAL				1302

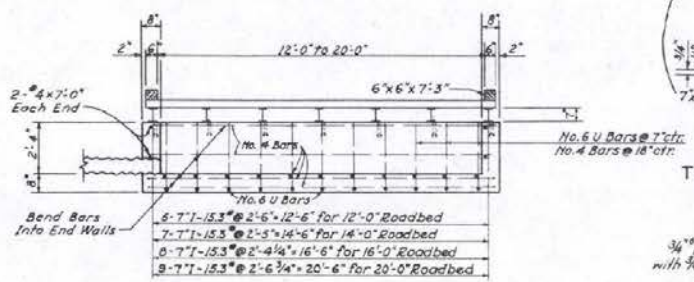
CONCRETE

12' Roadbed	5.00 Cu.Yd.
14' Roadbed	5.59 Cu.Yd.
16' Roadbed	6.17 Cu.Yd.
20' Roadbed	7.35 Cu.Yd.

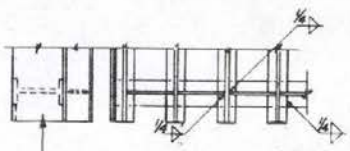
*No.4 Bars welded to 7"I Beams

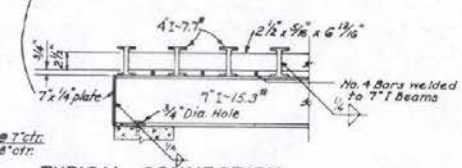


PLAN

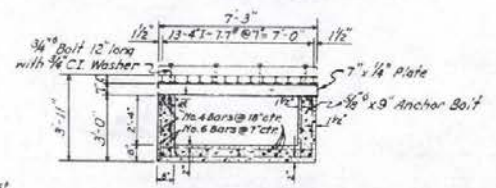


SECTION

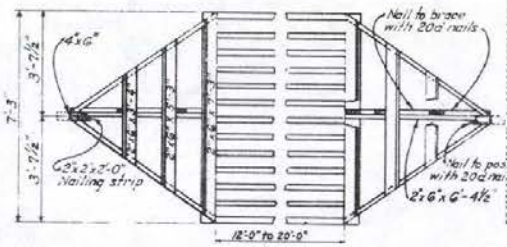




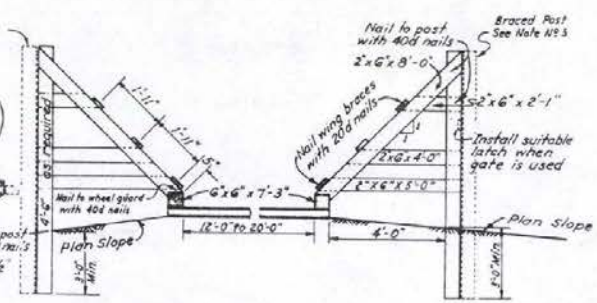
TYPICAL CONNECTION



SECTION ON CENTER LINE



PLAN OF WINGS



ELEVATION OF WINGS

GENERAL NOTES

1~ All concrete to be Class A or AA.
2~ Standard Metal or Timber gates shall be constructed when shown on plans or ordered by the engineer.
3~ All connections to be welded
4~ All timber shall be given two coats of approved outside white paint.
5~ When a gate is not specified. Install the required type of Intermediate Braced Post adjacent to the Wing Post. Fence wires to be tied to Braced Post only.

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

STEEL CATTLE GUARD
12' TO 20' ROADBED

Robert F. Sharp
CHIEF ROAD DESIGN ENGR.

R-7.11- (617)
ADOPTED: 8/69
REVISION 1

R 45

BILL OF MATERIALS

DOUGLAS FIR				
ITEM	NO. REQD.	SIZE	LENGTH	F.T.B.M.
Wheel Guards	2	6" x 6"	1'-3"	4.5
Wing Slope	4	2" x 6"	8'-0"	32.0
Wing Slope	2	2" x 6"	6'-4½"	12.8
Wing Braces	2	2" x 6"	3'-4	6.7
Wing Braces	4	2" x 6"	5'-3	21.0
Wing Braces	2	2" x 6"	7'-3"	14.5
Wing Braces	2	2" x 6"	2'-1"	4.2
Wing Braces	2	2" x 6"	4'-0"	8.0
Wing Braces	2	2" x 6"	5'-0"	10.0
Wing Post	2	4" X 6"	As Required	
Nailing Strip	2	2" X 8"	8'-0"	1.3

HARDWARE				
ITEM	NO. REQD.	SIZE	LENGTH	WT. LBS.
Bolts	8	¾" ø	12"	15
Washers	8	¾"		6
Nails	50	40d		3
Nails	72	20d		2¼
TOTAL				26¼

STRUCTURAL STEEL

26' ROADBED

ITEM	NO. REQD.	SIZE	LENGTH	WT. LBS.
I Beams	26	4" I - 7.7#	13'-5¾	2699
I Beams	12	7" I - 15.3#	7'-3"	1331
Spacers	144	2½" x ⅝"	0'-6⅞"	217
Anchor Bolts	24	⅝" ø	0'-9"	23
End Plates	4	7" x ¼"	13'-6"	320
TOTAL				4590

32' ROADBED

ITEM	NO. REQD.	SIZE	LENGTH	WT. LBS.
I Beams	26	4" I - 7.7#	16'-5⅜	3299
I Beams	14	7" I - 15.3#	7'-3"	1553
Spacers	108	2½" x ⅝"	0'-6⅞"	254
Anchor Bolts	28	⅝" ø	0'-9"	27
End Plates	4	7" x ¼"	16'-6"	392
TOTAL				5525

40' ROADBED

ITEM	NO. REQD.	SIZE	LENGTH	WT. LBS.
I Beams	26	4" I - 7.7#	20'-5¾	4100
I Beams	18	7" I - 15.3#	7'-3"	1997
Spacers	216	2½" x ⅝"	0'-6⅞"	326
Anchor Bolts	36	⅝" ø	0'-9"	35
End Plates	4	7" x ¼"	20'-6"	487
TOTAL				6945

REINFORCING

26' ROADBED

ITEM	NO. REQD.	SIZE	LENGTH	WT. LBS.
* Horizontal Bars	24	No. 4	13'-3"	212
Horizontal Bars	22	No. 4	7'-0"	103
Horizontal Bars	18	No. 4	30'-9"	370
Vertical Bars	40	No. 4	2'-9"	74
U-Bars	50	No. 6	12'-1"	907
TOTAL				1666

32' ROADBED

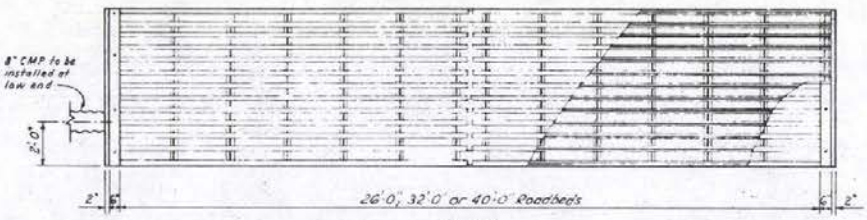
ITEM	NO. REQD.	SIZE	LENGTH	WT. LBS.
* Horizontal Bars	24	No. 4	16'-3"	260
Horizontal Bars	26	No. 4	7'-0"	122
Horizontal Bars	18	No. 4	36'-9"	442
Vertical Bars	48	No. 4	2'-9"	88
U-Bars	60	No. 6	12'-1"	1088
TOTAL				2000

40' ROADBED

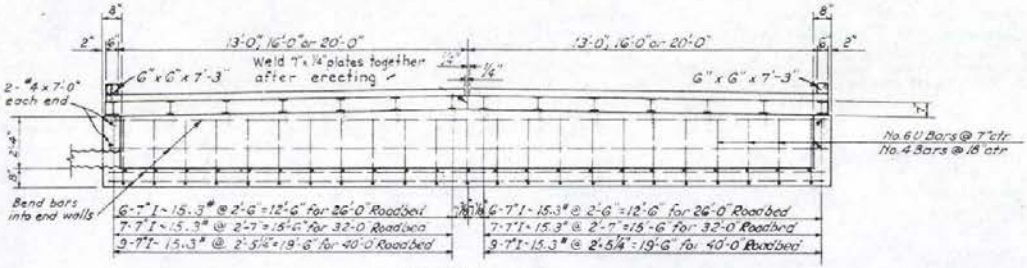
ITEM	NO. REQD.	SIZE	LENGTH	WT. LBS.
* Horizontal Bars	24	No. 4	20'-3"	325
Horizontal Bars	31	No. 4	7'-0"	145
Horizontal Bars	18	No. 4	44'-9"	538
Vertical Bars	58	No. 4	2'-9"	107
U-Bars	74	No. 6	12'-1"	1344
TOTAL				2459

CONCRETE

26' Roadbed	9.36 Cu. Yd.
32' Roadbed	11.23 Cu. Yd.
40' Roadbed	13.74 Cu. Yd.

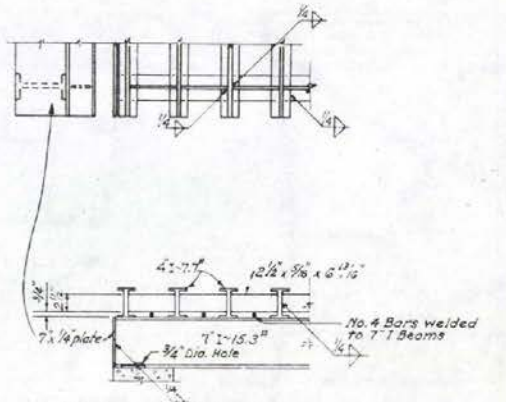


PLAN

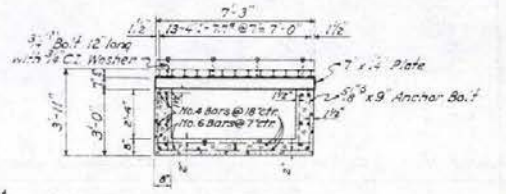


SECTION

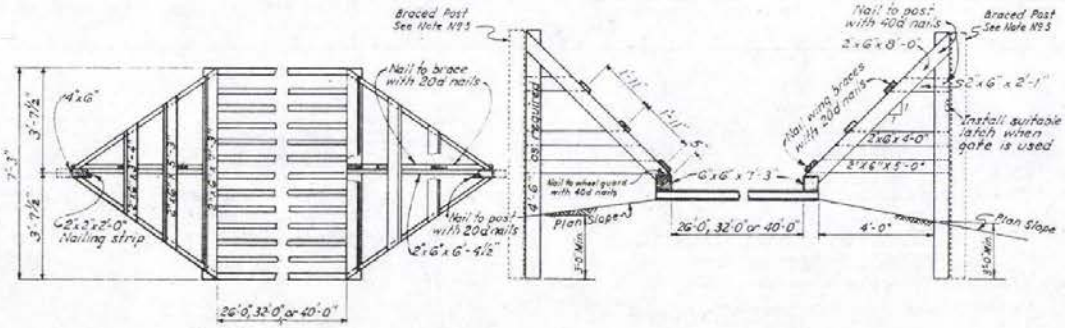
NOTE: Slope top of footing to fit crown of roadway.



TYPICAL CONNECTION



SECTION ON CENTER LINE



PLAN OF WINGS

ELEVATION OF WINGS

* No. 4 Bars welded to 7" I Beams

GENERAL NOTES

1- All concrete to be Class A or AA
2- Standard Metal or Timber gates shall be constructed when shown on plans or ordered by the engineer.
3- All connections to be welded.
4- All timber shall be given two coats of approved outside white paint.
5- When a gate is not specified, Install the required type of Intermediate Braced Post adjacent to the Wing Post. Fence wires to be tied to Braced Post only.

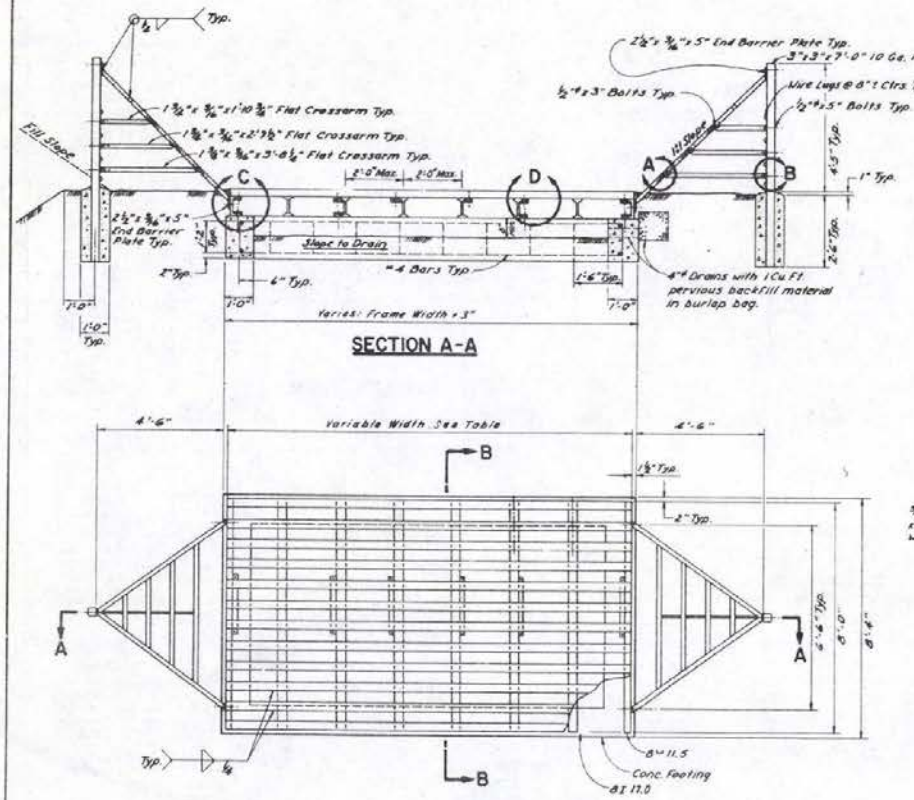
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

STEEL CATTLE GUARD
26 TO 40' ROADBED

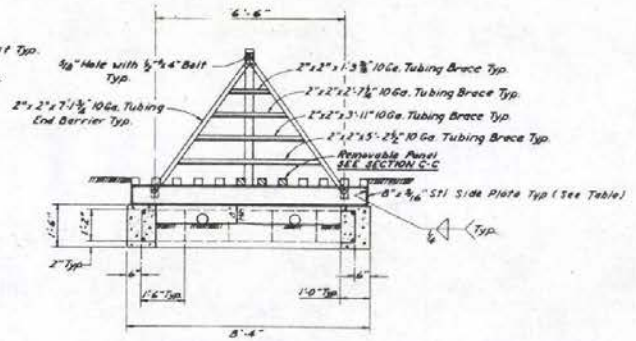
Robert L Sharp
CHIEF ROAD DESIGN ENGR

R - 7.1.2 - (617)
ADOPTED 5/69
REVISION 1

R 46

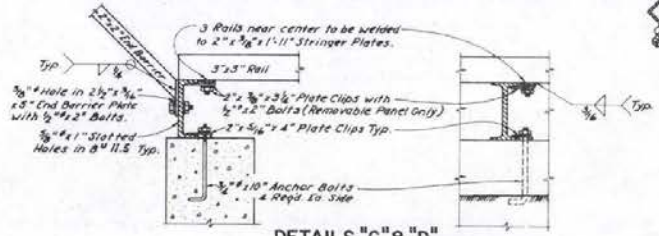


SECTION A-A

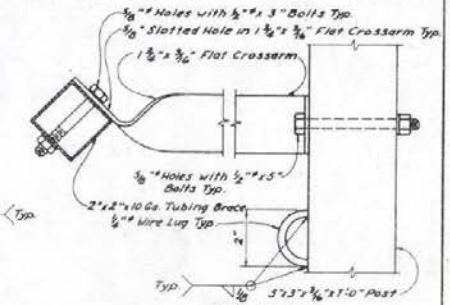


SECTION B-B

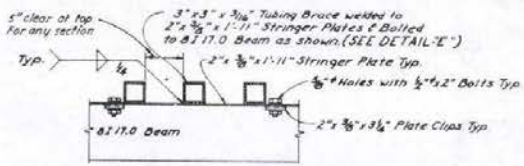
PLAN VIEW



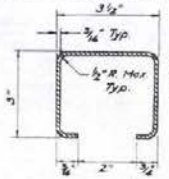
DETAILS "C" & "D"



DETAILS "A" & "B"



SECTION C-C
SHOWING REMOVABLE PANEL



DETAIL "E"

Note: A welded or rolled unit of equivalent design loading capacity, May submitted to the engineer for approval in place of 3" x 3" x 3/16" Tubing

GENERAL NOTES

1. ALL CONCRETE SHALL BE CLASS A OR AA.
2. ALTERNATIVE DESIGN MAY BE SUBSTITUTED BY THE CONTRACTOR FOR APPROVAL BY THE ENGINEER.
3. LIVE LOADING: H20.
4. CATTLE GUARD SLOPE IS TO CONFORM TO THE ROADWAY CROSS SLOPE AND GRADE.
5. SEE SPECIAL PROVISIONS FOR PROTECTIVE FINISH.
6. "FRAME WIDTH" COMBINATIONS MAY BE VARIED TO OBTAIN THE SPECIFIED WIDTH OF CATTLE GUARDS.

BILL OF MATERIALS

FRAME SIZE		LONGITUDINAL STRINGERS				STRUCTURAL STEEL				
LENGTH	WIDTH	NO. REQD.	SIZE	SPACING	WT. LBS.	ITEM	NO. REQ'D	SIZE	LENGTH	WT. LBS.
8'0"	14'0"	6	8I 17.0	EQUAL	816	RAILS	13	3"x3"x3/16"	14'0"	1264
						SIDE PLATES	2	8"x7/16"	12'0"	162
8'0"	12'0"	5	8I 17.0	EQUAL	680	RAILS	13	3"x3"x3/16"	12'0"	1132
						SIDE PLATES	2	8"x3/16"	12'0"	172
8'0"	10'0"	4	8I 17.0	EQUAL	544	RAILS	13	3"x3"x3/16"	10'0"	892
						SIDE PLATES	2	8"x3/16"	10'0"	109
8'0"	8'0"	3	8I 17.0	EQUAL	408	RAILS	13	3"x3"x3/16"	8'0"	713
						SIDE PLATES	2	8"x3/16"	8'0"	92

HARDWARE			
ITEM	NO. REQD.	SIZE	LENGTH
BOLTS	2	1/2"	3"
BOLTS	12	1/2"	4"
BOLTS	2	1/2"	5"
WASHERS	28	5 1/16"	
WASHERS	16	13/16"	
NUTS	28	1/2"	
NUTS	16	3/4"	
ANCHOR BOLTS	14	3/4"	

MATERIAL LIST FOR ALL SIZES				
ITEM	NO. REQD.	SIZE	LENGTH	WT. LBS.
CHANNELS	2	8" I 11.5	8'0"	184
STRINGER PLATES	5	2"x3/16"	1'11"	10
PLATE "C" TYPE	10	2"x3/16"	3 1/4"	7
ANCHOR BOLT CLIPS	16	2"x3/16"	4"	10

CONCRETE		REINFORCING STEEL
LENGTH	CU. YDS.	WT. LBS.
14'0"	2.29	82
12'0"	2.06	74
10'0"	1.84	67
8'0"	1.62	60

MATERIAL LIST FOR WINGS				
ITEM	REQD.	SIZE	LENGTH	WT. LBS.
FLAT CROSSARMS	2	1 3/4"x3/16"	1' 10 3/4"	4
FLAT CROSSARMS	2	1 3/4"x3/16"	2' 9 1/2"	6
FLAT CROSSARMS	2	1 3/4"x3/16"	3' 3 1/4"	8
BRACES	2	2"ø2"x10Ga	1' 3 3/8"	3
BRACES	2	2"ø2"x10Ga	2' 1 1/8"	5
BRACES	2	2"ø2"x10Ga	3' 11"	10
BRACES	2	2"ø2"x10Ga	5' 2 1/2"	15
END ANGLES	6	2"ø2"x10Ga	7' 1 3/4"	123
END BARRIER PLATES	6	2 1/2"x3/16"	5"	4
UPRIGHT POST	2	3"x3"x3/16"	7' 0"	96

NOTE: MATERIAL LIST IS FOR INFORMATION ONLY.

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

STEEL CATTLE GUARD
(TYPE B)

CHIEF ROAD DESIGN ENGR.

R-7.13-(617)

ADOPTED 3-71

REVISION 2

R 47

BILL OF MATERIALS

TIMBER

ITEM	Nº REQ'D.	SIZE	LENGTH	B. FT.
Wheel Guards	2	6"x6"	7'-3"	43.5
Wing Slope	4	2"x6"	8'-0"	32.0
Wing Slope	2	2"x6"	6'-4½"	12.8
Wing Braces	2	2"x6"	3'-4"	6.7
Wing Braces	4	2"x6"	5'-3"	21.0
Wing Braces	2	2"x6"	7'-3"	14.5
Wing Braces	2	2"x6"	2'-1"	4.2
Wing Braces	2	2"x6"	4'-0"	8.0
Wing Braces	2	2"x6"	5'-0"	10.0
Wing Post	2	4"x6"	As Required	
Nailing Strip	2	2"x2"	2'-0"	1.3

HARDWARE

ITEM	Nº REQ'D.	SIZE	LENGTH	WT. LBS.
Bolts	8	¾"ø	12"	15
Washers	8	¾"		6
Nails	50	40d		3
Nails	72	60d		2¼
Total				26¼

STRUCTURAL STEEL (1-10'-0" COMPONENT)

ITEM	Nº REQ'D.	SIZE	LENGTH	WT. LBS.
I Beams	5	7I 15.3#	7'x3"	554.6
Structural Tubing	13	4"x2"x¼"	9'-11½"	1139.3
Spacer Plate	60	2½"x5/16"	0'-5"	67.0
Anchor Bolts	10	⅝"	0'-9"	9.0
End Plates	2	7"x¼"	9'-11½"	118.5
Pipe Sleeves	8	2"	0'-6"	14.6
Connection Plates	As Req'd.	9"x4"x⅜"		
Connection Bolts	As Req'd.	1"	15"	

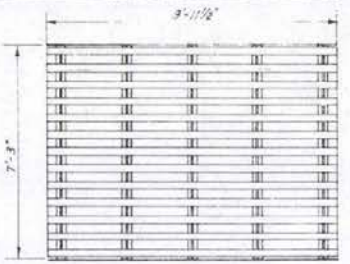
REINFORCING STEEL (1-10'-0" COMPONENT)

ITEM	Nº REQ'D.	SIZE	LENGTH	WT. LBS.
* Horizontal Bars	12	Nº4	9'-6"	76
Horizontal Bars	18	Nº4	3'-3"	117
Horizontal Bars	18	Nº4	7'-0"	84
Vertical Bars	44	Nº4	1'-3"	37
Lifting Lugs	4	Nº4	2'-8"	7
U Bars	18	Nº6	9'-6"	259
Total				580

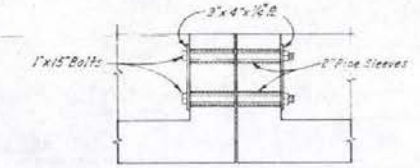
CONCRETE

1-10'-0" Component — 1.94 cu. yd.

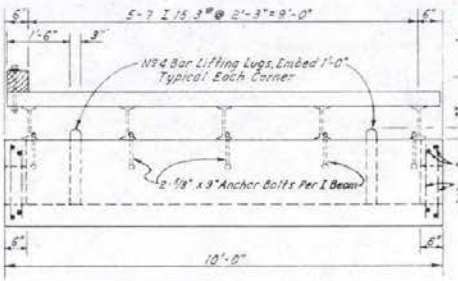
* Nº4 Bars welded to I Beams.



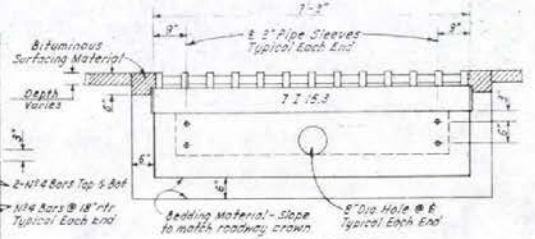
PLAN



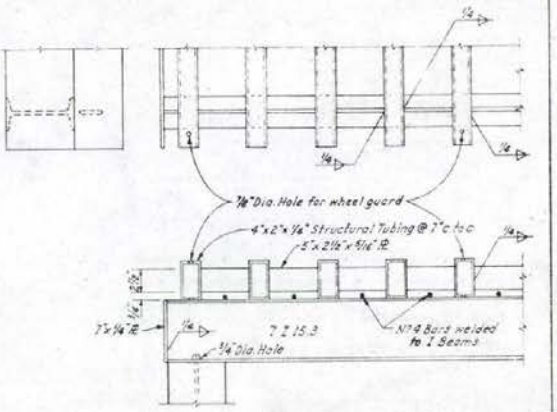
CONNECTION DETAIL



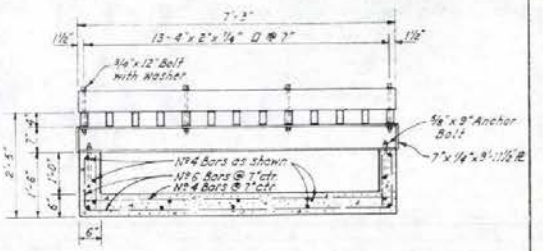
ELEVATION



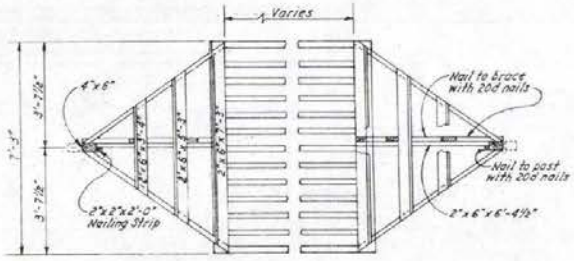
END VIEW



TYPICAL CONNECTION



SECTION



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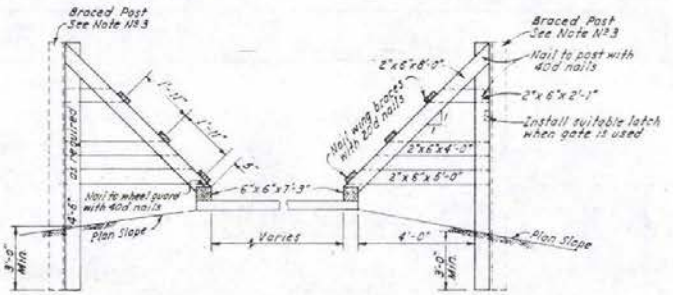


ELEVATION

TIMBER WINGS

GENERAL NOTES

1. All concrete to be Class 0A.
2. All connections to be Welded.
3. When a gate is not specified: Install the required type of Intermediate Braced Post adjacent to the Wing Post. Fence Wires to be tied to Braced Post only.

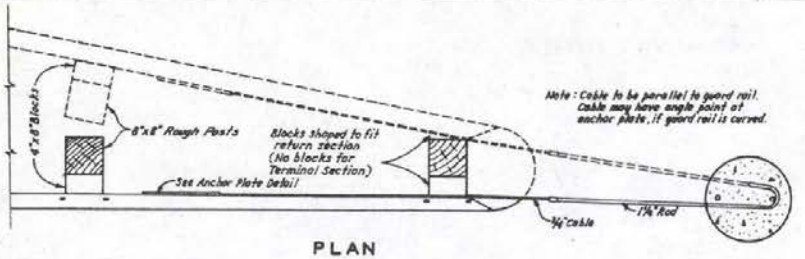
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

STEEL CATTLE GUARD (TYPE C)

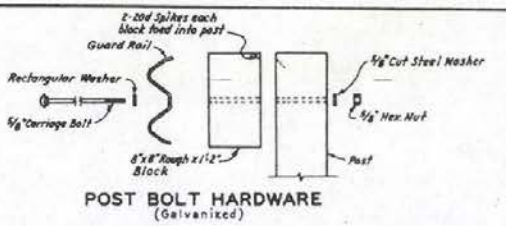
Robert L. Sharp
CHIEF ROAD DESIGN ENGR.

R-7.1.4-(617)
ADOPTED: 10/70
REVISION 1

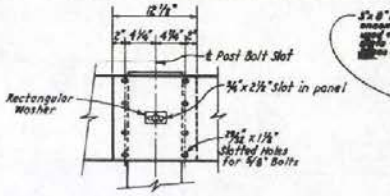
R 48



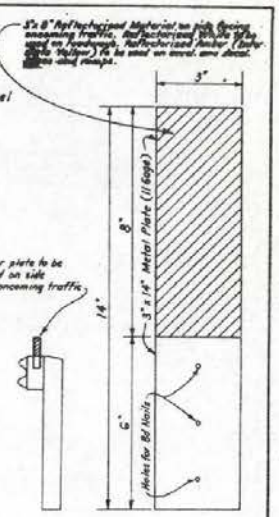
PLAN



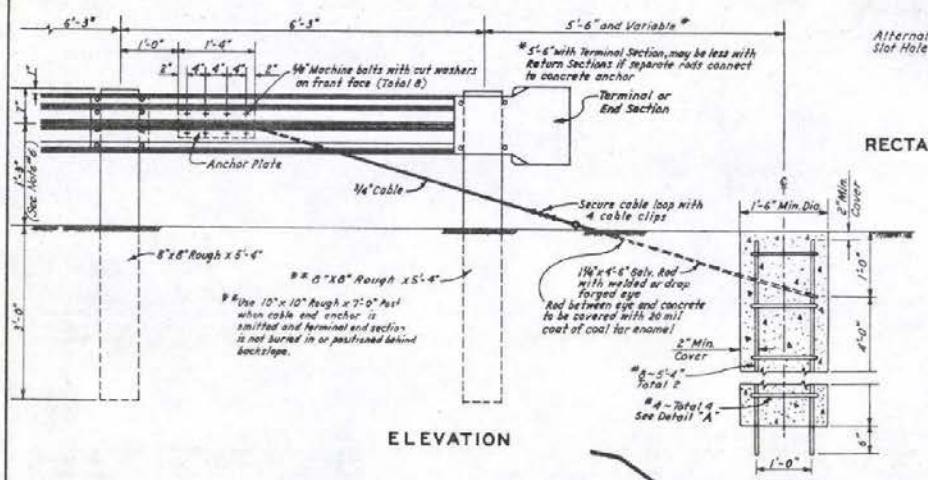
POST BOLT HARDWARE
(Galvanized)



RAIL SPLICE



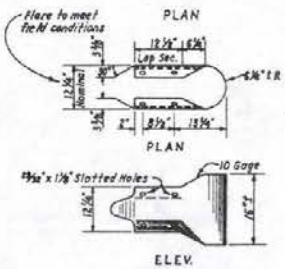
REFLECTOR PLATE DETAIL



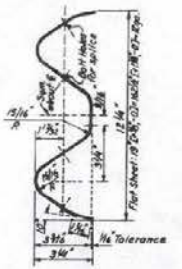
ELEVATION

DETAIL "A"

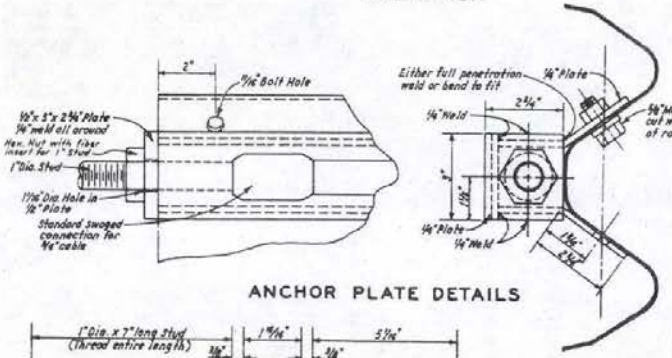
ANCHOR ASSEMBLY



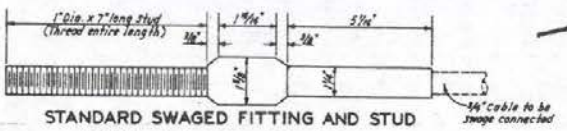
TERMINAL RETURN SECTION



SECTION THRU RAIL ELEMENT

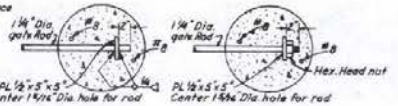


ANCHOR PLATE DETAILS

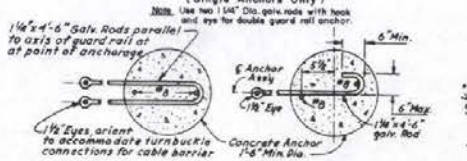


STANDARD SWAGED FITTING AND STUD

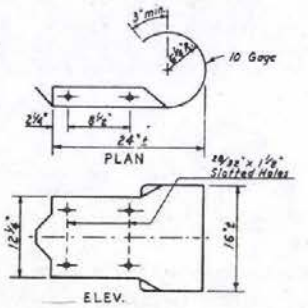
CABLE END ANCHOR



OPTIONAL ANCHOR ROD END DETAILS
(Single Anchors Only)



DOUBLE ANCHOR SINGLE ANCHOR



TERMINAL SECTION

GENERAL NOTES

1- Rail elements shall be furnished shop-curved for radius of 150 feet or less.

2- Post spacing shall be 6'-3" center to center except as noted.

3- Rail splices shall be lapped in direction of traffic.

4- Direction of traffic indicated by arrow: TRAFFIC

5- Cable End Anchors may be eliminated when guardrail is buried in the backslope, or when a minimum of 50' of guardrail is extended beyond the point of required need.

6- Height of Guardrail to be governed by final surfacing elevation on projects in stage construction.

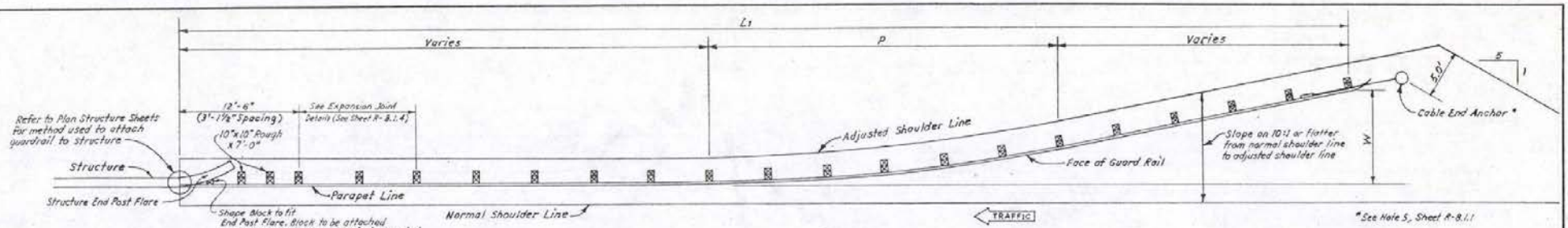
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

GUARDRAIL AND CABLE END ANCHORS

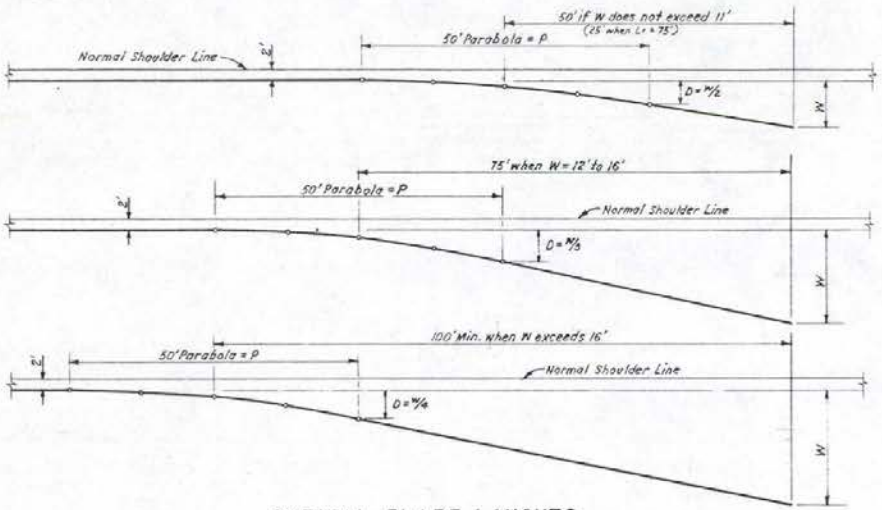
Robert L. Shaw
CHIEF ROAD DESIGN ENGR

R-8.1.1- (618)
ADOPTED 9/78
REVISION

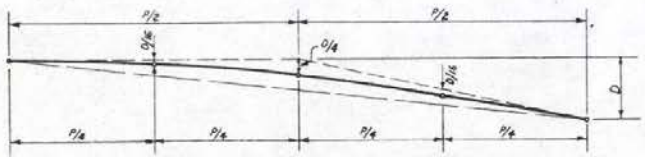
R 49



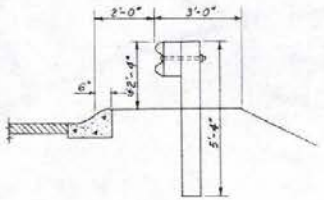
TYPICAL APPROACH INSTALLATION



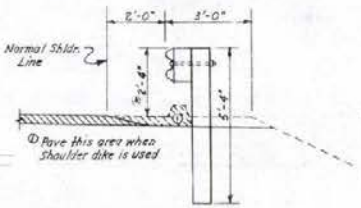
TYPICAL FLARE LAYOUTS



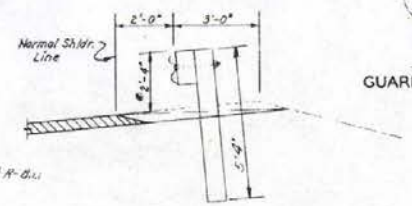
PARABOLIC LAYOUT



CURB INSTALLATION

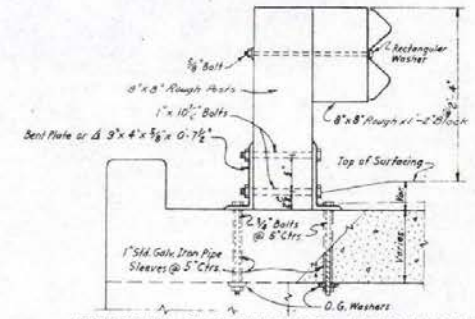


EMBANKMENT INSTALLATION

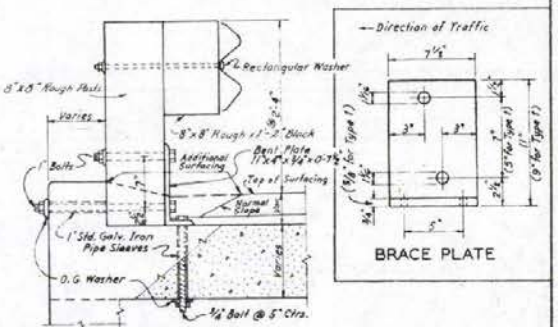


SUPERELEVATED INSTALLATION

@ See note number 6 on sheet R-8.1.1



GUARDRAIL ON STRUCTURES - TYPE 1 MOUNT



GUARDRAIL ON STRUCTURES - TYPE 2 MOUNT

See Sheet R-8.1.1 for General Notes.

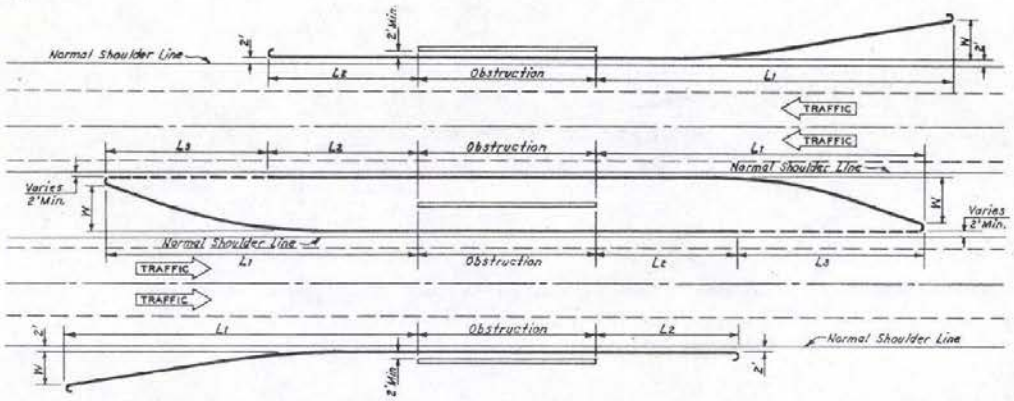
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

GUARDRAIL INSTALLATION

CHIEF ROAD DESIGN ENGR.

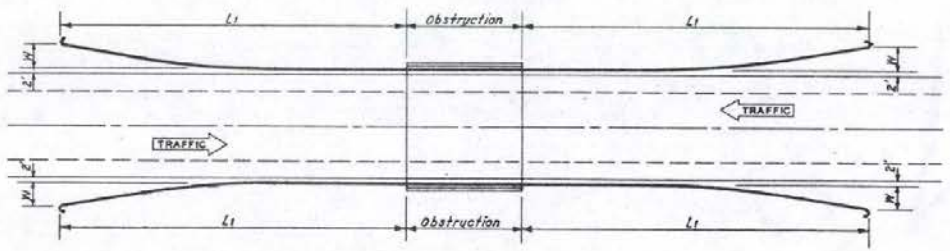
R-8.1.2 -(618)
ADOPTED: 8/68
REVISION 4

R 50

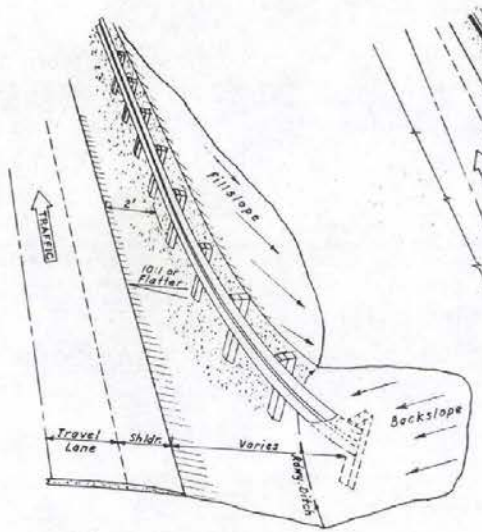


4 LANE DIVIDED HIGHWAY

DIMENSION	MINIMUM
W	4'
L1	75' or 10W (Use larger value)
L2	50' (Use 6' min. with end anchor)
L3	L1 minus L2 (Install when guardrail is adjacent to obstruction and/or terminal ends are within 30' of travel lane

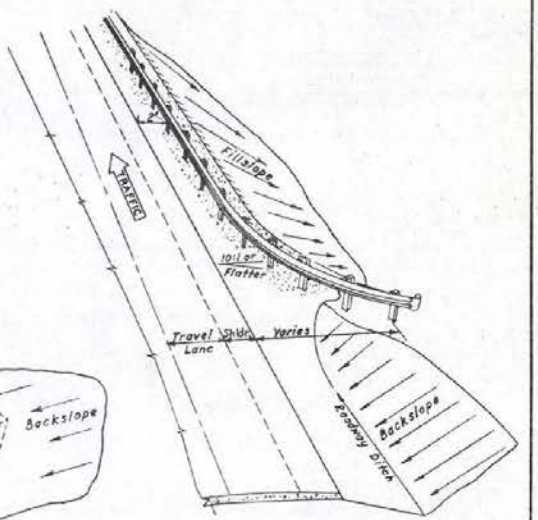


2 LANE HIGHWAY

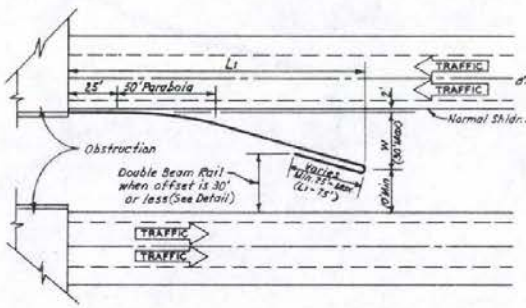


APPROACH END BURIED IN BACKSLOPE*

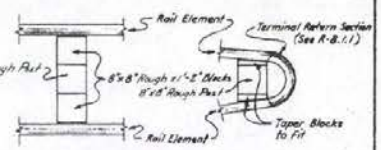
* See Note 5, Sheet R-8.1.1



APPROACH END POSITIONED BEHIND BACKSLOPE



DUAL BRIDGE WITH OPEN MEDIAN
(Median Slopes ~ 10:1 or flatter)



DOUBLE BEAM RAIL DETAIL

See Sheet R-8.1.1 for General Notes.

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

GUARDRAIL INSTALLATION

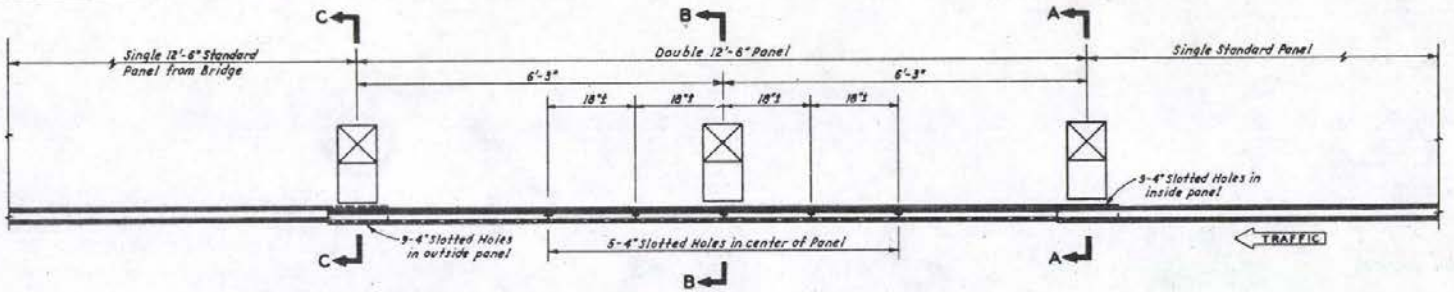
Chief Road Design Engr.

R-8.1.3 -(618)

ADOPTED: 8/69

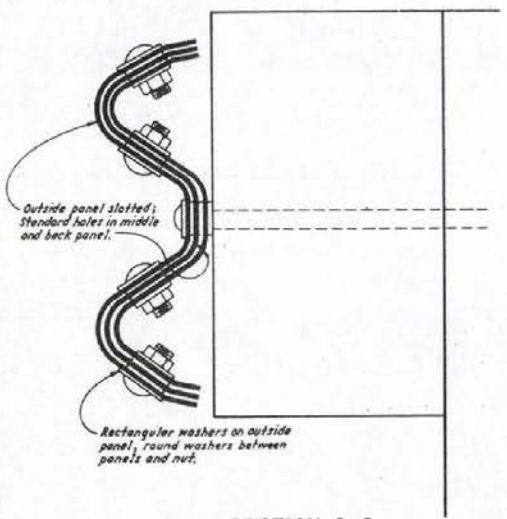
REVISION 1 3/79

R 51

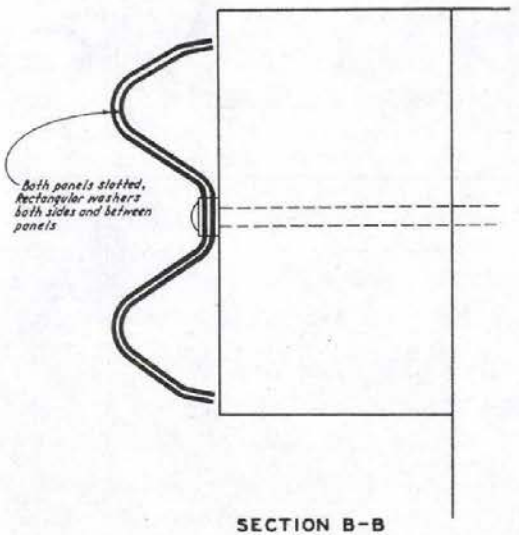


NOTE : All bolts through slotted holes should be torqued to 240 inch pounds or 20 foot pounds, or "finger tight" plus ½ turn.

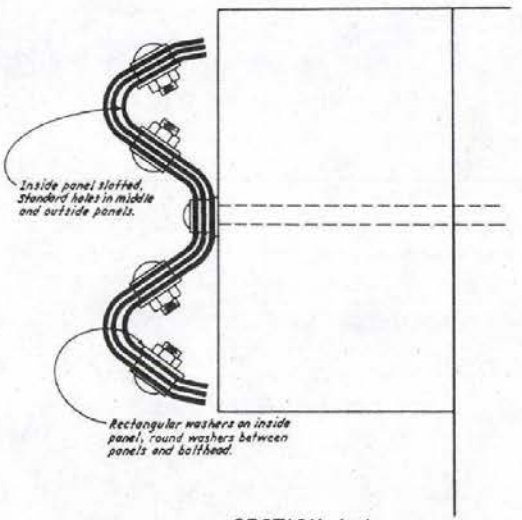
PLAN



SECTION C-C



SECTION B-B



SECTION A-A

GENERAL NOTES

1. Use expansion joint only when guardrail is rigidly attached to a structure and the length of guardrail run is 150' or greater.
2. In the case of continuous guardrail between structures, allow one expansion joint located at midpoint for lengths 300' or less and two expansion joints for lengths in excess of 300'.
3. See Sheet R-8.1.1 for additional General Notes.

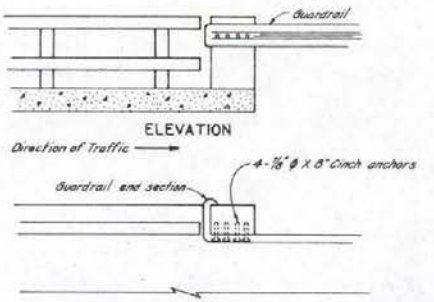
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

GUARDRAIL EXPANSION JOINT DETAILS

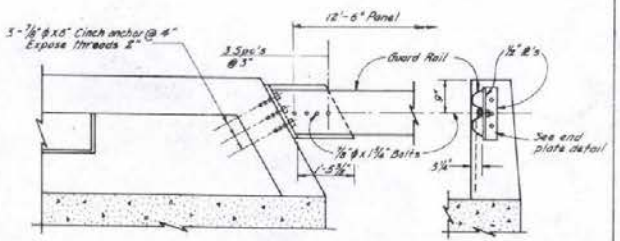
William L. Pugh
CHIEF ROAD DESIGN ENGR.

R-8.1.4 - (618)
ADOPTED: 8/88
REVISION 2

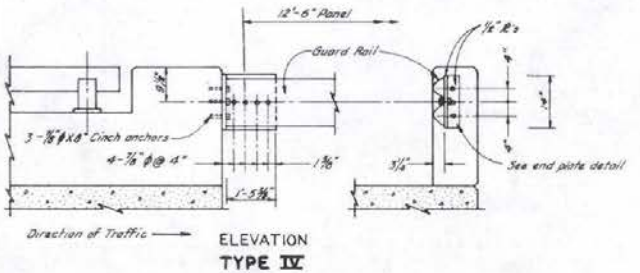
R 52



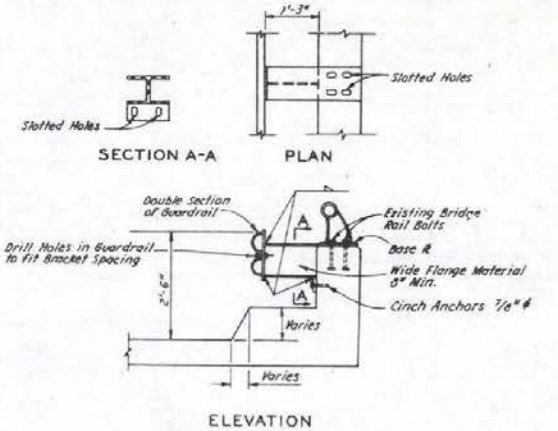
TYPE III



TYPE II



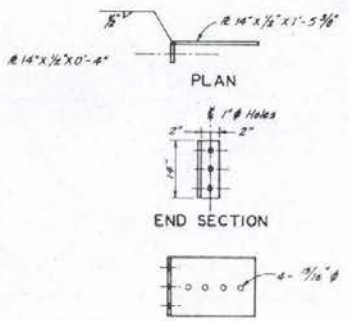
TYPE IV



DOUBLE GUARDRAIL

TYPE I

1. WHEN BRIDGE RAIL IS REPLACED WITH GUARDRAIL, THE EXISTING PIPE RAIL SHALL BE REPLACED ON TOP OF THE ASSEMBLY. IF THE ANCHOR BOLTS ARE NOT LONG ENOUGH, THE RAIL POST MAY BE WELDED TO THE BRACKETS.
2. USE GALVANIZED SHIMS FOR ADJUSTING VERTICAL AND HORIZONTAL ALIGNMENT OF BRACKETS.



END PLATES

GENERAL NOTES

1. TYPE I ATTACHMENTS SHALL BE USED ON STRUCTURES WITH PARAPET CURBS ONLY.
2. TYPE II, III AND IV ATTACHMENTS SHALL BE USED ON STRUCTURES WITHOUT PARAPET CURBS.
3. FOR STRUCTURES WITHOUT CURB AND WITH A CURVED END POST, A SPECIAL GUARDRAIL ATTACHMENT SHOULD BE DETAILED BY THE BRIDGE DIVISION.
4. SEE STANDARD GUARDRAIL SHEET R-8.1.2 FOR POST SPACING AND STANDARD SHEET R-8.1.4 FOR EXPANSION JOINT DETAILS.

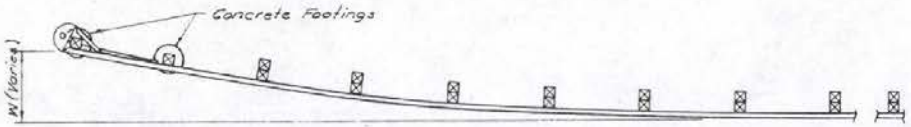
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

METHODS FOR ATTACHING GUARDRAIL TO EXISTING BRIDGE STUCTURES

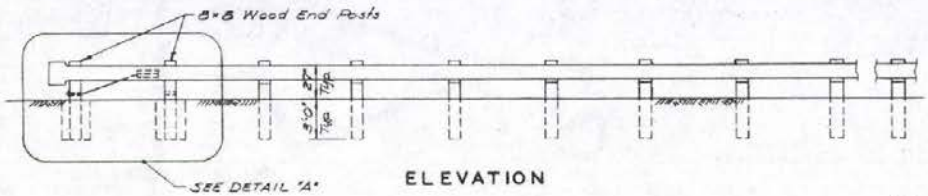
Robert L. Sharp
CHIEF ROAD DESIGN ENGR.

R-8.1.5 (618)
ADOPTED: 12/72
REVISION 1 5/73

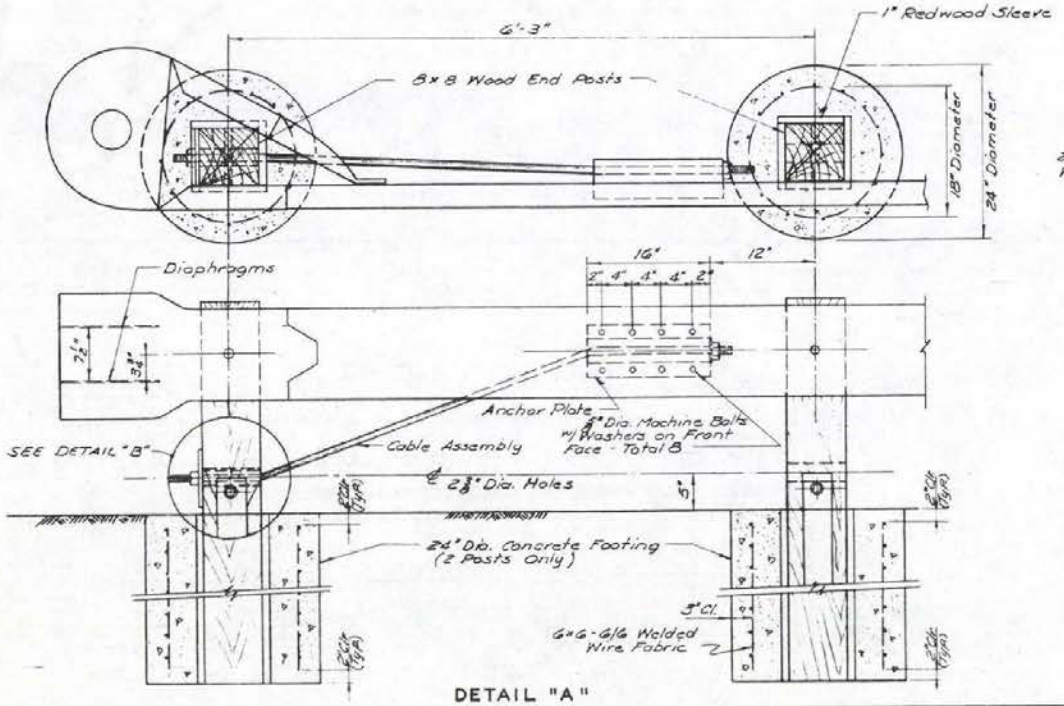
R 53



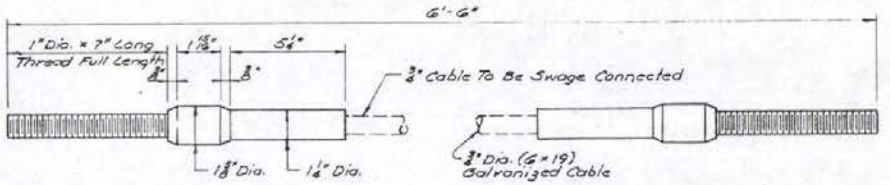
PLAN



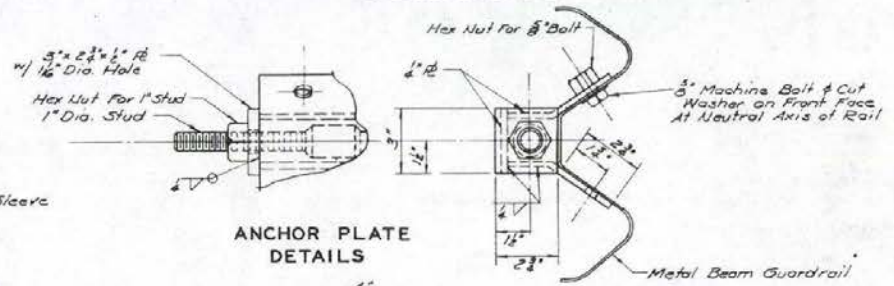
ELEVATION



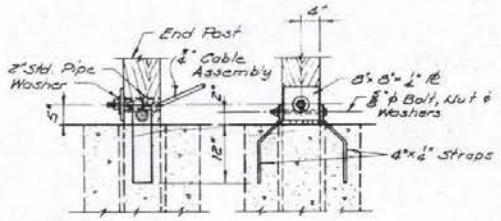
DETAIL "A"



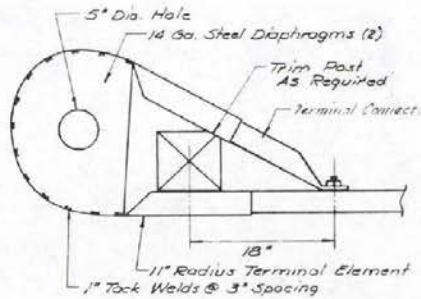
CABLE ASSEMBLY



ANCHOR PLATE DETAILS



DETAIL "B"



DIAPHRAGM DETAILS

— GENERAL NOTES —

1. POST SPACING SHALL BE 6' - 3" EXCEPT AS OTHERWISE NOTED.
2. FOR DETAIL NOT SHOWN REFER TO STANDARD GUARD RAIL SHEETS.

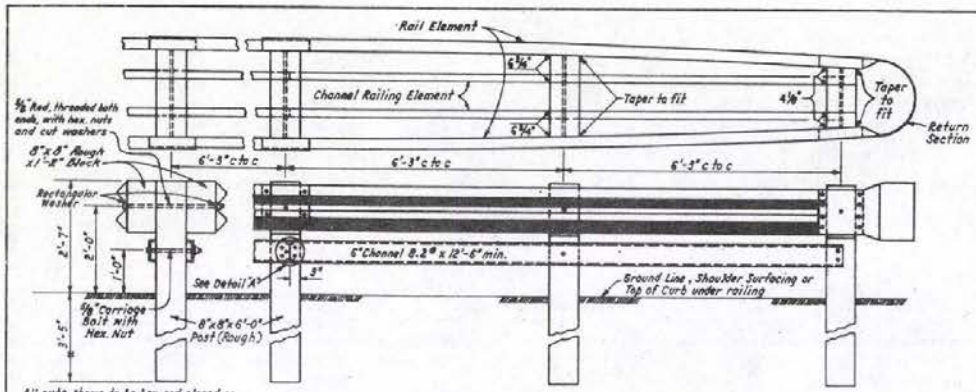
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

BREAKAWAY CABLE TERMINAL

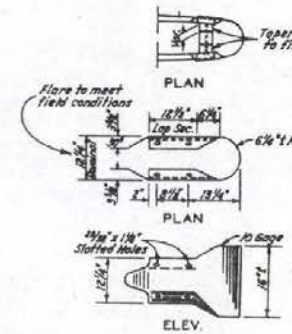
Robert L. Moore
CHIEF ROAD DESIGN ENGR.

R-8.16 (618)
ADOPTED: 7/73 REVISION

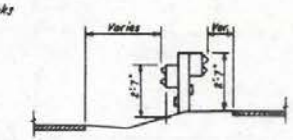
R 54



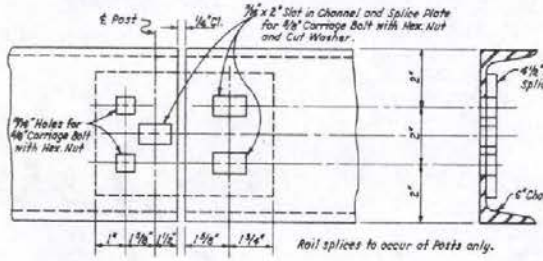
TIMBER POST MEDIAN BARRIER RAIL



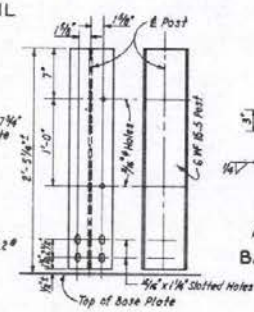
TERMINAL RETURN SECTION



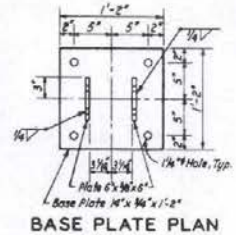
SAW TOOTH INSTALLATION



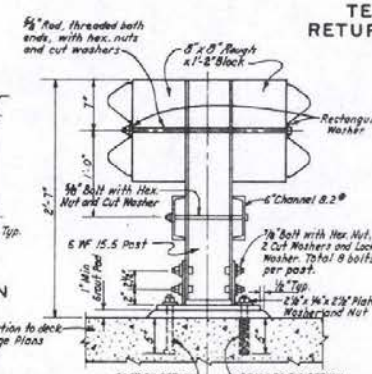
DETAIL "A" – CHANNEL RAIL SPLICE



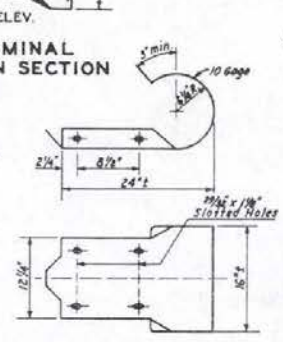
POST DETAILS



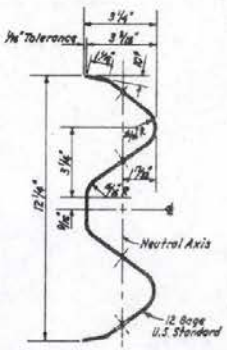
BASE PLATE PLAN



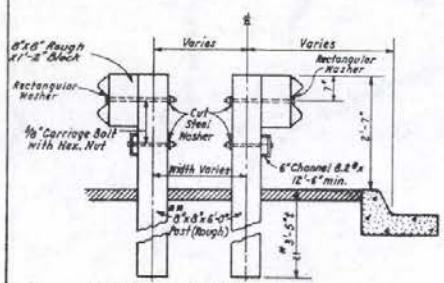
METAL POST MEDIAN BARRIER RAIL



TERMINAL SECTION

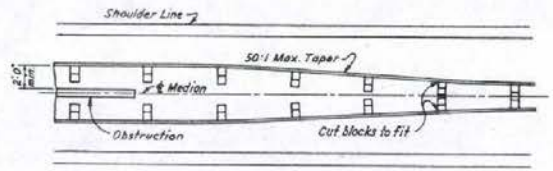


SECTION THRU RAIL ELEMENT

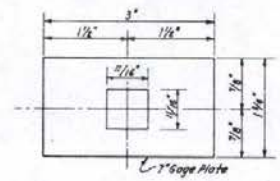


* Depth varies where bridge piers are located on continuous footings.
** On bridge deck use 6 WF 15.5 Post (See Double Rail Detail for applicable details).

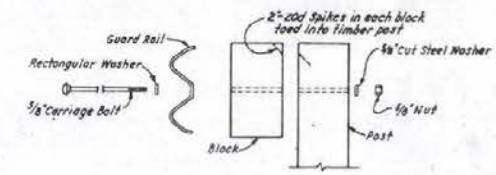
SINGLE METAL BEAM BARRIER RAIL



METAL BEAM BARRIER RAIL
PLAN AT MEDIAN OBSTRUCTIONS



RECTANGULAR POST BOLT WASHER



POST BOLT HARDWARE
(Galvanized)

NOTE: See Sheet R-8.1.1 for "General Notes" and "Reflector Plate Details", Sheet R-8.1.2, "Typical Approach Installation" for method of attachment to structures, and Sheet R-8.1.4 for "Expansion Joint" details.

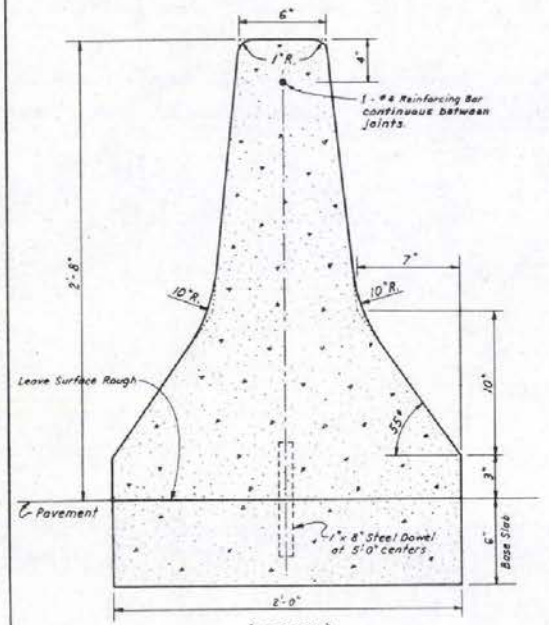
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

METAL BEAM BARRIER RAIL

William L. Maupin
CHIEF ROAD DESIGN ENGR.

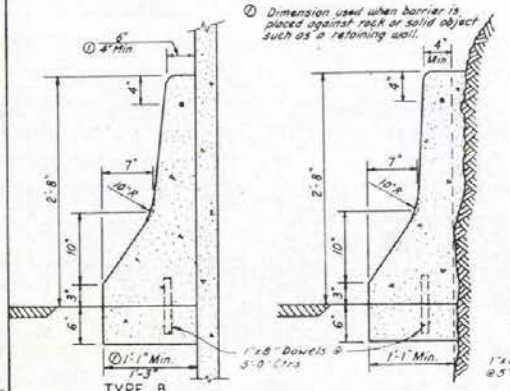
R-8.2.1-(618)
ADOPTED: 8/69
REVISION 3

R 55



(SECTION)
TYPE A

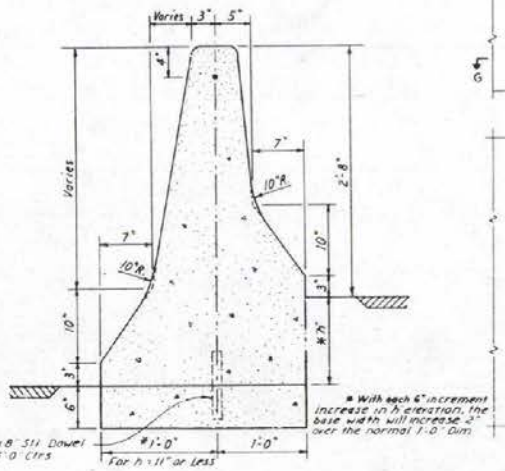
Concrete (Information Only)
0.1032 Cu Yd. Per Lin. Ft. without Base Slab
0.1402 Cu Yd. Per Lin. Ft. with Base Slab



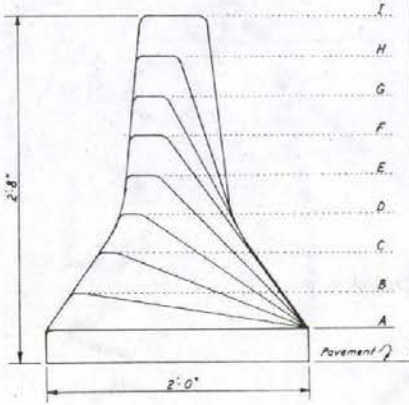
TYPE B

TYPE C

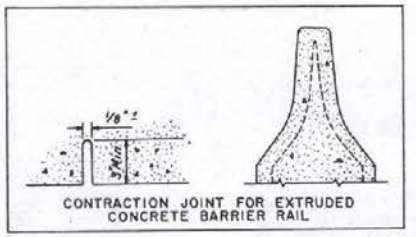
Concrete (Information Only)
4" Min. { 0.0598 cu yd per lin. ft. without Base Slab / 0.0801 cu yd per lin. ft. with Base Slab
6" Min. { 0.0765 cu yd per lin. ft. without Base Slab / 0.1000 cu yd per lin. ft. with Base Slab



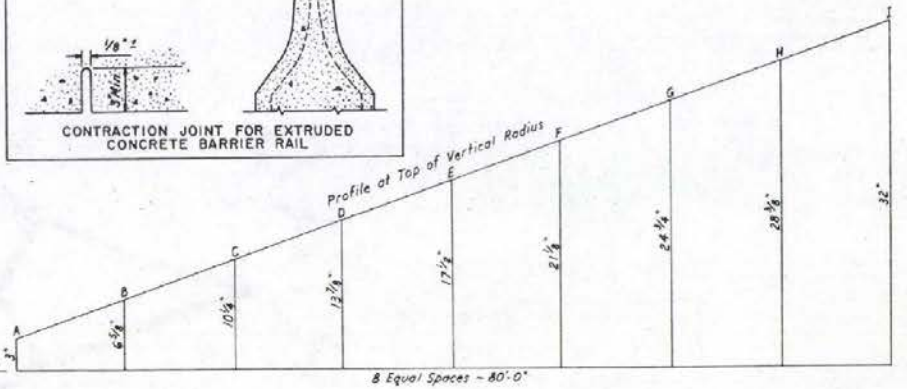
TYPE D



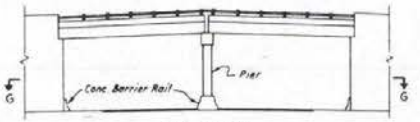
APPROACHING TRAFFIC DETAIL



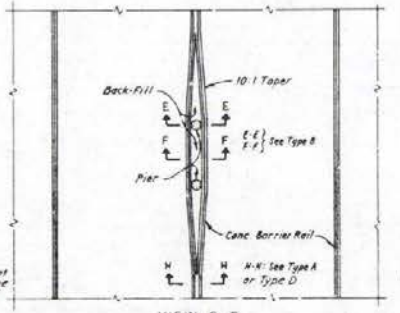
CONTRACTION JOINT FOR EXTRUDED CONCRETE BARRIER RAIL



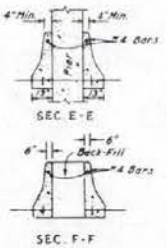
TRANSITION OF APPROACH END OF BARRIER



UNDERPASS



VIEW G-G



TREATMENT AT UNDERPASS PIERS

GENERAL NOTES

1. CONCRETE BASE SHALL BE CLASS A OR AA.
2. 6" BASE SLAB SHALL BE DELETED WHEN BARRIER RAIL IS PLACED ON A CONCRETE SURFACE. THE 1" x 8" DOWELS (AS SHOWN) WILL BE REQUIRED WHEN PLACED ON A CONCRETE SURFACE. THE SURFACE OF CONCRETE SHALL BE CLEAN PRIOR TO PLACEMENT OF BARRIER RAIL.
3. TRANSVERSE JOINTS WITH 1" PREMOLDED EXPANSION JOINTFILLER, OR OPEN TRANSVERSE JOINTS (1/4"), OR JOINTS APPROVED BY THE ENGINEER SHALL BE PLACED AT INTERVALS OF NOT LESS THAN 20 FEET NOR MORE THAN 40 FEET. JOINTS IN BARRIER RAIL OVER A STRUCTURE SHALL BE AT THE SAME LOCATION AND OF THE SAME DIMENSION AS THOSE ON THE STRUCTURES.
4. AT THE CONTRACTOR'S OPTION, THE BASE SLAB AND BARRIER MAY BE POURED MONOLITHIC, IN WHICH CASE THE DOWELS SHALL BE DELETED.
5. **ALL EXPOSED SURFACES SHALL HAVE A "FINE SURFACE FINISH".**
6. SEE SHEET R-8.4.1 FOR CONCRETE BARRIER RAIL GLARE SCREEN DETAILS.

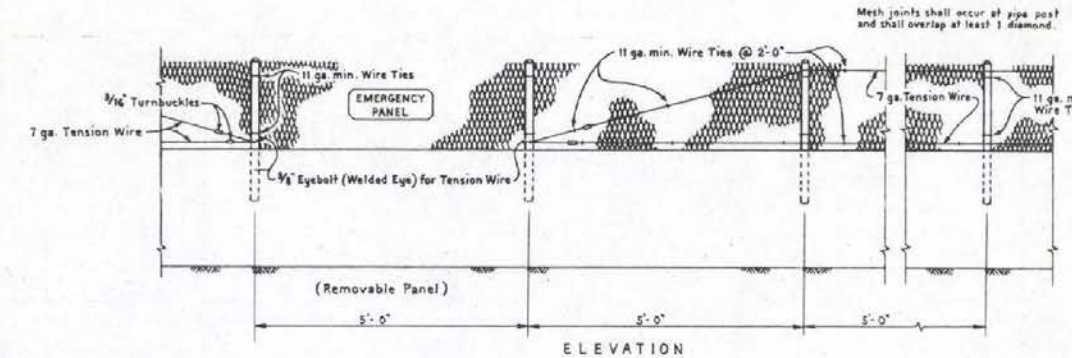
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

CONCRETE BARRIER RAIL

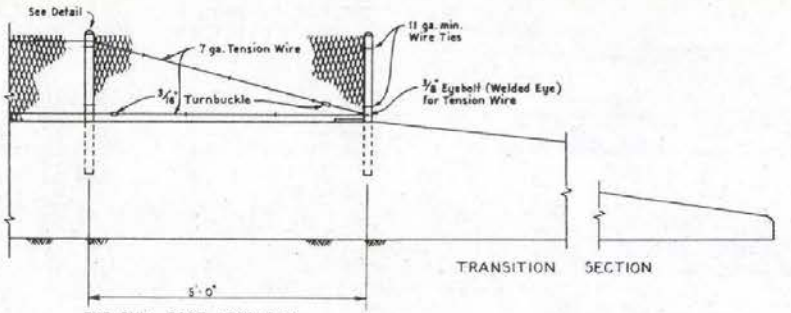
Robert L. Stamps
CHIEF ROAD DESIGN ENGR.

R-8.3.1 (502)
ADOPTED: 11/70
REVISION 5 4/73

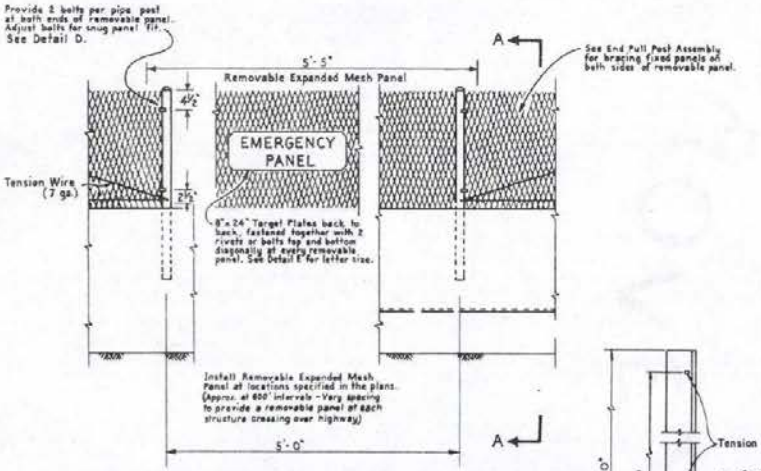
R 56



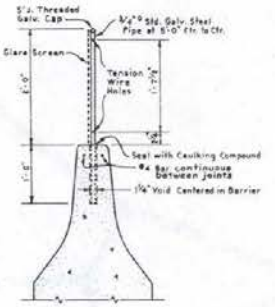
ELEVATION



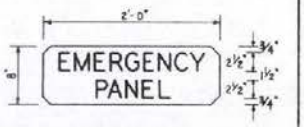
END PULL POST ASSEMBLY



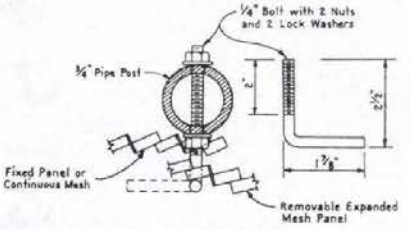
REMOVABLE EXPANDED MESH PANEL DETAIL



SECTION A-A



DETAIL E



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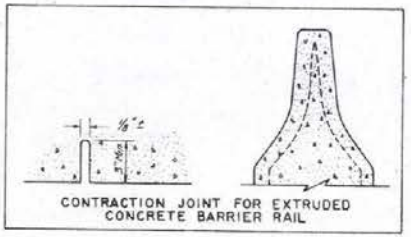
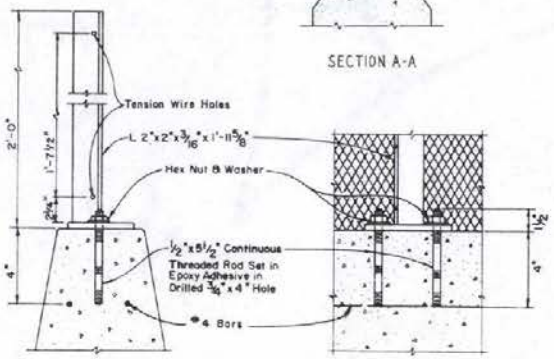
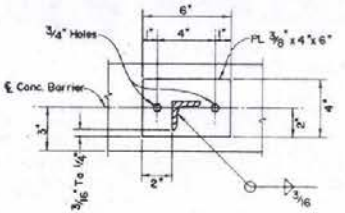






ALTERNATE GLARE SCREEN POST ANCHORAGE

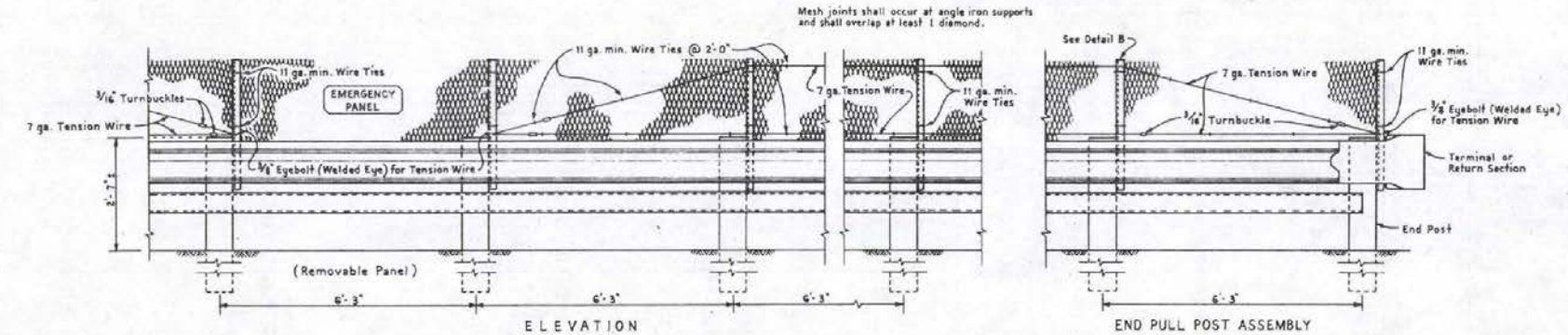
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

HEADLIGHT GLARE SCREEN
(TYPE B)

Robert L. Shaw
CHIEF ROAD DESIGN ENGR.

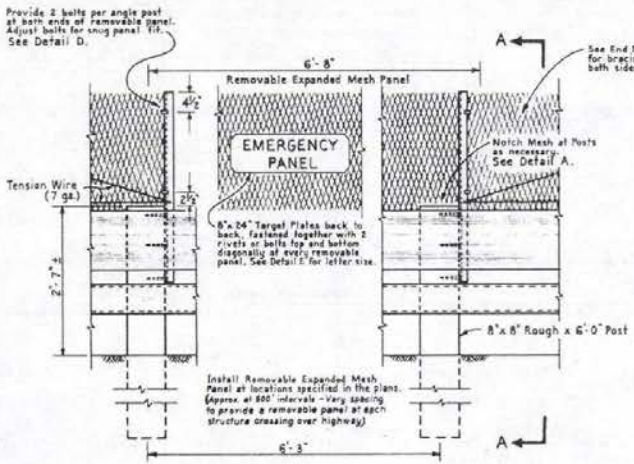
R-8.4.1 (632)
ADOPTED: 8/70
REVISION 3 10/76

R 57

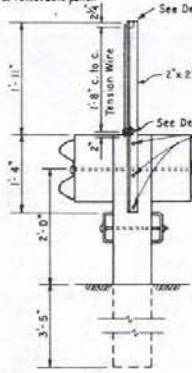


ELEVATION

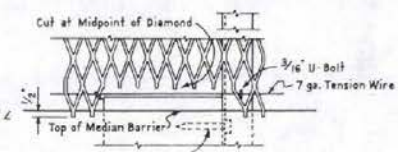
END PULL POST ASSEMBLY



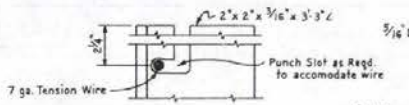
REMOVABLE EXPANDED MESH PANEL DETAIL



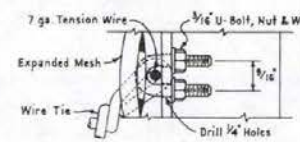
SEC. A-A



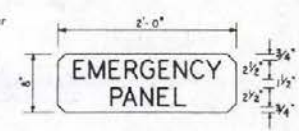
DETAIL A



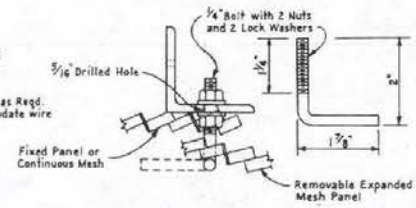
DETAIL B



DETAIL C



DETAIL E



DETAIL D

R 58

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

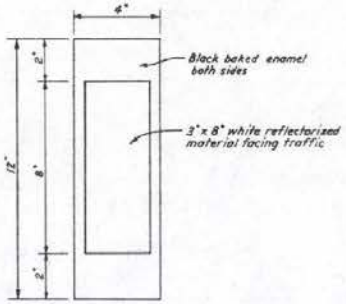
HEADLIGHT GLARE SCREEN (TYPE A)

CHIEF ROAD DESIGNER

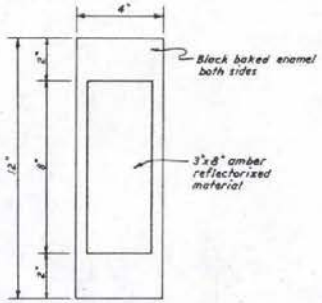
R-8.4.2 (632)

ADOPTED 7/89

REVISION 1

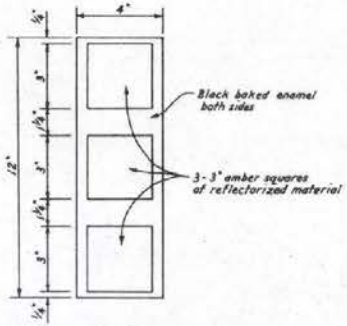


TYPE 1
(Roadway)



REFLECTORS

TYPE 2
(Ramps or Approaches)



TYPE 3
(Islands, Curbs, Shoulder Dikes)

Multi-Lane Divided Highway:
(Freeway Standards)

Unless otherwise noted on plans, guide posts on divided highways shall be set as follows:

a) On tangents, guide posts shall be installed along the sides of the through roadways at approximately 800 foot spacing along the median side and 400 foot spacing on the outside shoulder. The posts on the median side shall be placed opposite those on the outer shoulder.

b) See Table 1 for spacing on curves.

Two Lane and Four Lane Undivided Highways:
(Secondary and Primary)

a) Guide posts shall be installed on both sides of the roadbed at 400 foot intervals on tangents and on curves having a radius greater than 10,000 feet.

b) See Table 1 for spacing on curves.

Multi-Lane Divided Highways:
(Freeway Standards)

a) At interchanges, guide posts with amber reflectors shall be installed at a maximum spacing of 100' along the ramps acceleration or deceleration lanes and in accordance with Table 1 on turning ramps. They shall always be installed on the outside of the curve for turning ramps and may be used on both sides when needed for clear indication of alignment.

b) In rural areas where median crossovers are provided for official or emergency use, a single guide post with amber reflectors shall be placed on the left side of the through roadway on the far side of the crossover for each roadway.

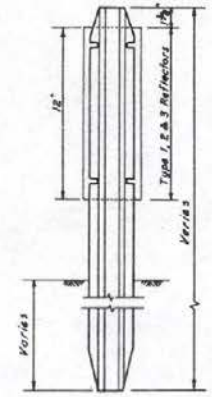
All Approaches:

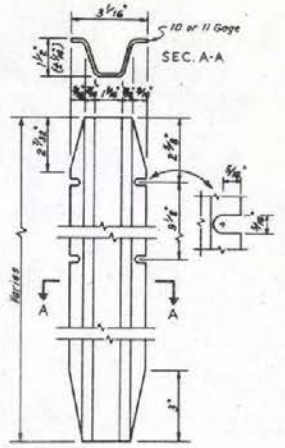
Where approaches are permitted, one guide post with amber reflectors shall be installed at the beginning and end limits of Type 1 and Type 2 approaches.

General:

a) At traffic islands, curbs, shoulder dikes, etc., a single guide post with triple amber reflectors shall be installed.

b) In urban or suburban areas where a raised and curbed median is provided, each project should be investigated to determine whether or not guide posts will be needed in the median.





POST DETAILS

MAXIMUM SPACING FOR HIGHWAY DELINEATORS
ON HORIZONTAL CURVES

(Distance in Feet Rounded to the Nearest 5 Feet)

RADIUS OF CURVE (IN FEET)	SPACING OF CURVE (IN FEET)	SPACING IN ADVANCE & BEYOND CURVE (IN FEET) 1st	2nd	3rd
50	20	40	65	125
150	30	60	90	180
200	35	70	110	215
250	40	85	125	250
300	50	95	145	290
400	55	110	170	300
500	65	125	190	300
600	70	140	210	300
700	75	150	230	300
800	80	165	245	300
900	85	175	260	300
1,000	90	185	275	300
1,200	100	200	300	300
1,400	110	220	300	300
1,600	120	240	300	300
1,800	125	250	300	300
2,000	130	260	300	300
2,500	150	300	300	300
3,000	165	300	300	300
5,000	210	300	300	300
10,000	300	300	300	300

Spacing for specific radii not shown may be interpolated from table or computed from the formula $S=3.14 R/30$. The minimum spacing should be 20 feet. The spacing on curves should not exceed 300 feet. The spacing of the first delineator approaching a curve is 2 S, the second 3 S, and the third 6S but not to exceed 300 feet. If a spacing less than 100 feet is used approaching the curve, the distance shown above should be adjusted accordingly.

TABLE 1

Placement of Guide Posts on Curves

Multi-Lane Divided Highways:
(Freeway Standards)

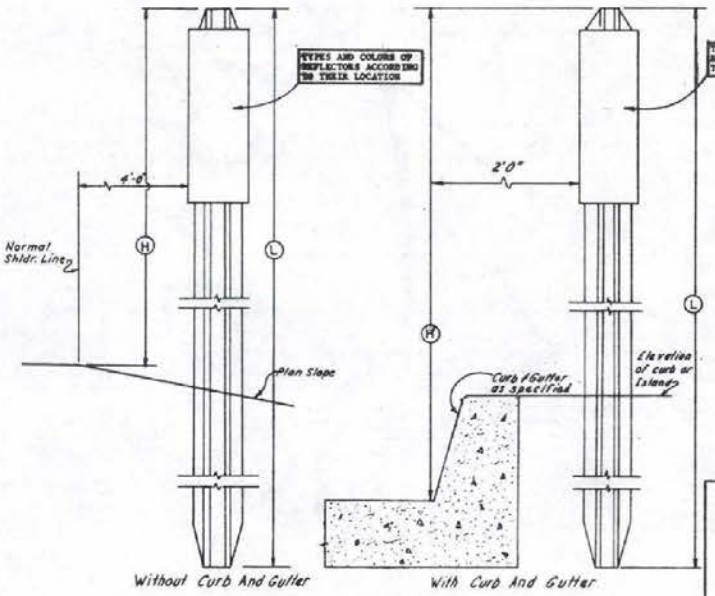
a) On curves, they shall be installed along both sides of the through roadways at 400 foot spacing on the outside shoulder and 800 foot spacing on the median shoulder for curves having a radius of more than 10,000 feet. For curves of 10,000 feet radius or less, they shall be spaced as shown in Table 1. The posts on the median side shall be placed directly opposite those along the outer shoulder. The spacing on the median side shall be adjusted where approaching or leaving a curve to accomplish the alternated spacing to be used on all tangents.

Two Lane and Four Lane Undivided Highways:
(Secondary and Primary)

a) On curves having a radius of 10,000 feet or less, guide posts shall be installed on the outside of the curve at the spacing shown in Table 1 and on the inside of the curve at double the spacing shown in the table.

b) Post spacing on recreational roadways may be varied to accommodate design considerations.

Note: Guide posts shall be installed at the beginning and end of each curve and the spacing adjusted, through the length of the curve, into equal spacing nearest to that specified in Table 1.



TYPICAL INSTALLATION

L = 5'6" WHEN H = 3'6"
L = 5'0" MIN WHEN H = 3'0"
H = 3'6" STANDARD HEIGHT FOR ALL ROADWAYS
H = 3'0" ABOVE GUTTER ELEVATION IN CURB & GUTTER SECTIONS

General Notes:

1. Where guardrail is to be installed, guide posts shall be omitted and reflector plates shall be installed (see Sheet R-8.1.1).

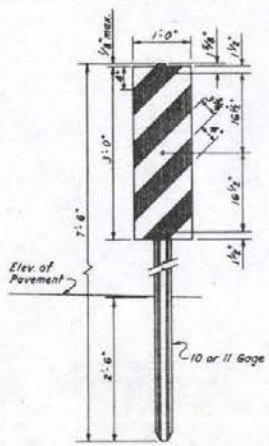
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

GUIDE POSTS

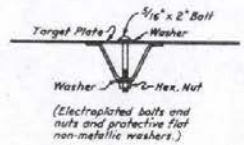
Robert F. Sharp
CHIEF ROAD DESIGN ENGR.

R-9.1.1-(819)
ADOPTED: 8/69
REVISION 2-9/72

R 59

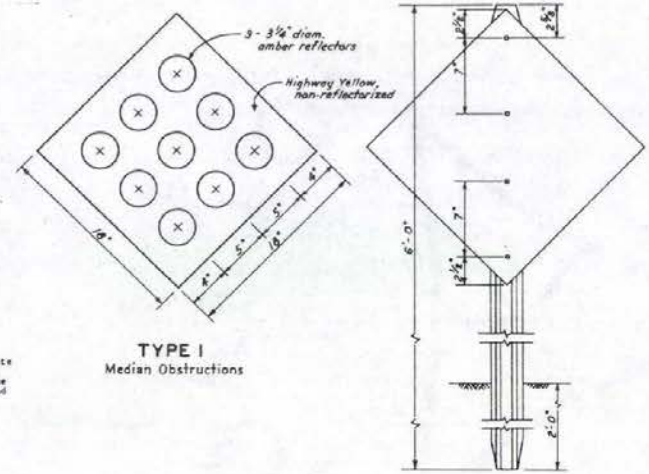


TYPE 3
Bridges, Piers, Abutments

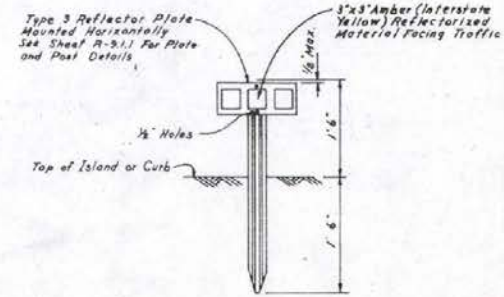


Object markers shall be installed to delineate bridge ends, underpass abutments and all other obstructions closely adjacent to the edges of the roadway. They may be omitted on the approach end of the guardrail when a flare is used.

For post details see Sheet R-9.1.1

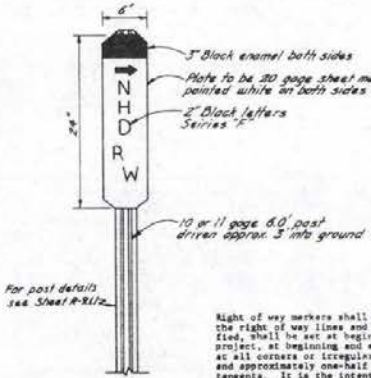


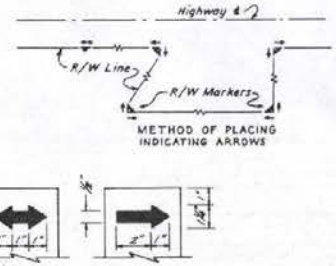
TYPE 1
Median Obstructions



TYPE 2
Curbs or Inlets

OBJECT MARKERS

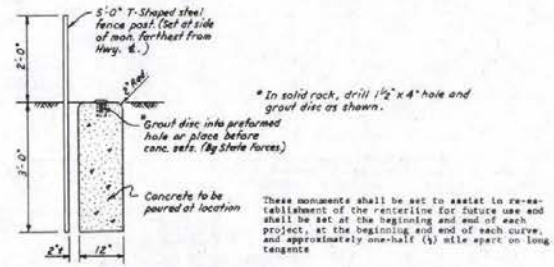




Right of way markers shall be erected to define the right of way lines and unless otherwise specified, shall be set at beginning and end of each project, at beginning and end of each curve, and at all corners or irregular right of way lines, and approximately one-half (½) mile apart on long tangents. It is the intent of these requirements that right of way markers are spaced so as to be clearly visible and erected so that the right of way line may be easily established.

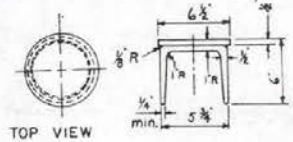
Right of way markers shall be omitted where right of way line is fenced.

RIGHT OF WAY MARKERS

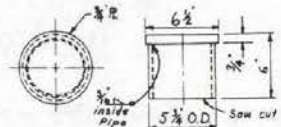


These monuments shall be set to assist in re-establishment of the centerline for future use and shall be set at the beginning and end of each project, at the beginning and end of each curve, and approximately one-half (½) mile apart on long tangents

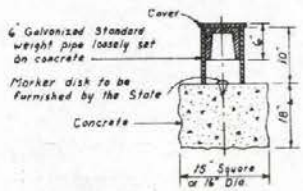
REFERENCE MONUMENT AND MARKER POST



CAST COVER DETAIL



WELDED COVER DETAIL



SURVEY MONUMENTS

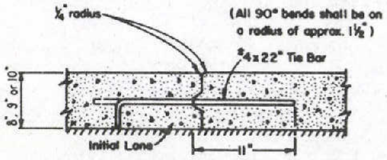
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

OBJECT MARKERS, RIGHT OF WAY MARKERS, SURVEY MONUMENTS AND REFERENCE MONUMENTS

Robert F. Stang
CHIEF ROAD DESIGN ENGR.

R-9.2.1-(619 THRU 621)
ADOPTED: 8/00
REVISION

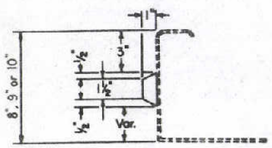
R 60



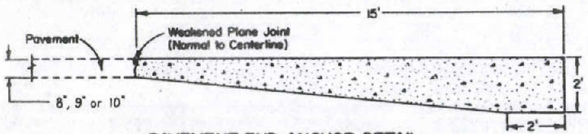
SECTION A-A
TIE BAR

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 ⅓ of the slab thickness.

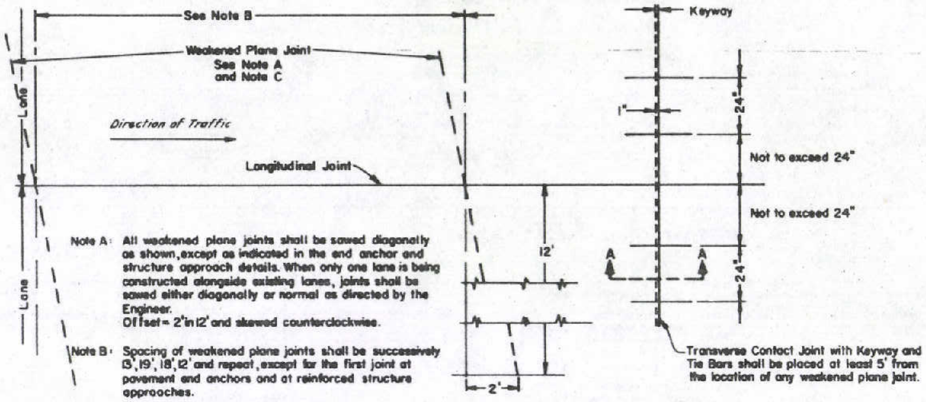


DETAIL OF METAL OR WOODEN INSERT TO BE PLACED ON FORM



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.

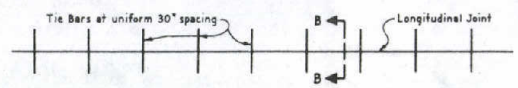


Note A: All weakened plane joints shall be sawed diagonally as shown, except as indicated in the end anchor and structure approach details. When only one lane is being constructed alongside existing lanes, joints shall be sawed either diagonally or normal as directed by the Engineer.
Offset = 2' in 12'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

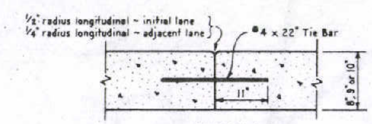
Note B: Spacing of weakened plane joints shall be successively 13', 19', 18', 12' and repeat, except for the first joint at pavement end anchors and at reinforced structure approaches.

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

PLAN



PLAN



SECTION B-B
Longitudinal Contact Joint without Keyway
(Tie Bar to be placed in middle ⅓ of slab.)

TIE BAR DETAIL

GENERAL NOTES
1. Refer to Plan Structure Sheets for "Approach Slab Details".

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

CONCRETE PAVEMENT

R-10.1.1-(409)
Robert L. Sharp
CHIEF ROAD DESIGN ENGR.
ADOPTED: 8/69
REVISION 5

STANDARD RCB GENERAL NOTES. REVISED 1970

DESIGN SPECIFICATIONS: AASHO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES," TENTH EDITION, DATED 1969. FOR CULVERTS ON PILES OR ROCK FOUNDATIONS SPECIAL DESIGN MAY BE REQUIRED.

CONSTRUCTION SPECIFICATIONS: STANDARD SPECIFICATIONS, STATE OF NEVADA DEPARTMENT OF HIGHWAYS, CURRENT EDITION, AND SPECIAL PROVISIONS ACCOMPANYING PLANS.

LOADING: LIVE LOAD: HS 20-44 OR INTERSTATE ALTERNATE LOADING.
DEAD LOAD: EARTH LOAD BASED ON 120 LBS. PER CU. FT. AND HORIZONTAL EQUIVALENT FLUID PRESSURE OF 36 LBS. PER SQ. FT., CONCRETE 150 LBS. PER CU. FT.

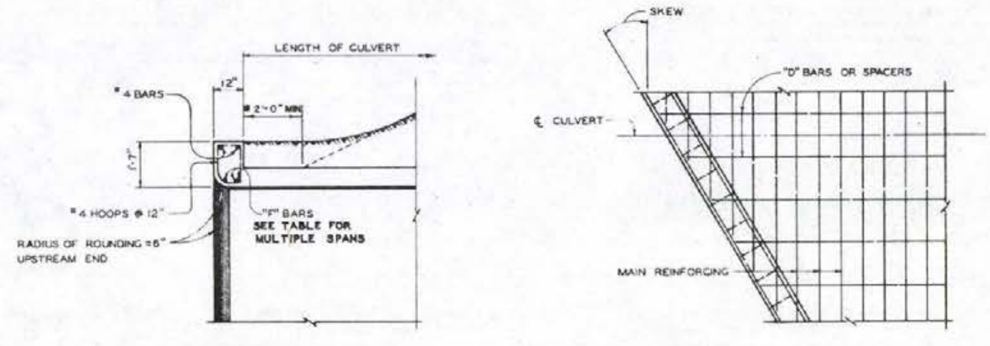
UNIT STRESSES: F_s = 20,000 P.S.I., n = 10, F_c = 1200 P.S.I.

HEADWALLS: ALL RCB CULVERTS SHALL HAVE TYPE I HEADWALLS UNLESS OTHERWISE NOTED ON THE PLANS.

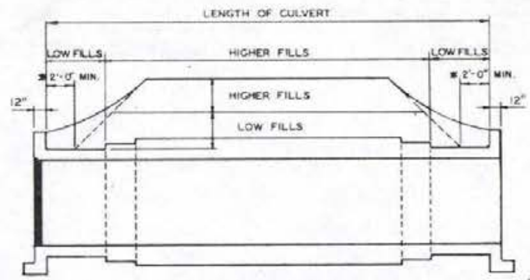
DESIGNATION: SHOW ON PLANS AS SPAN X HEIGHT X LENGTH.

* ADDITIONAL LENGTH: LENGTH OF CULVERT SHALL BE INCREASED AS FOLLOWS: ADD 2.0' TO EACH END AS SHOWN ON PLAN WHEN COVER AT SHOULDER IS 0' TO 5'. ADD AN ADDITIONAL 1.0 TO EACH END FOR EACH SUCCEEDING 5.0' OF COVER OR PORTION THEREOF.

REINFORCEMENT CLEARANCE: REINFORCEMENT EMBEDMENT IS 2 1/2" CLEAR ON BOTTOM OF BOTTOM SLAB AND 1 1/2" CLEAR ON REMAINDER OF STRUCTURE AND ITS APPURTENANCES EXCEPT AS NOTED.

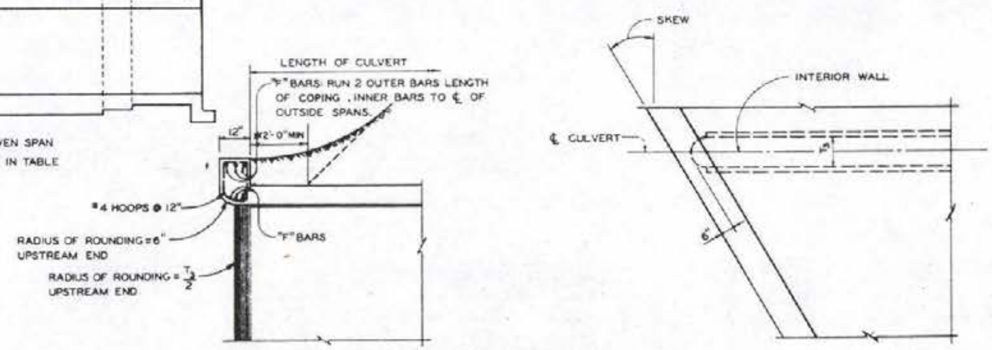


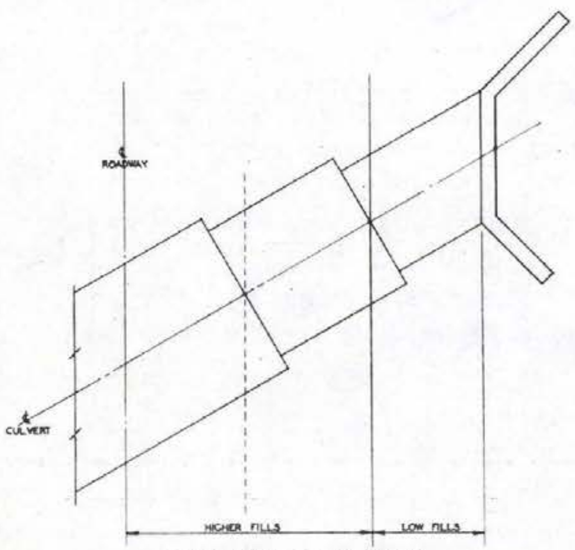
PARAPET DETAILS FOR SINGLE SPAN CULVERTS



LOW FILLS=LOWEST TABLE VALUE FOR GIVEN SPAN
HIGHER FILLS=SLAB INCREASE AS SHOWN IN TABLE

COPING REINFORCING QUANTITIES INCLUDED IN THE HEADWALL QUANTITIES





PLAN VIEW ON A SKEW

PARAPET DETAILS FOR MULTIPLE SPAN CULVERTS

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
		NUMBER OF BARS	2	2	2	2	3	3	3
16°-30°		BAR NO.	4	4	5	6	7	8	8
		NUMBER OF BARS	2	3	3	3	3	3	3
31°-45°		BAR NO.	4	4	6	6	7	8	8
		NUMBER OF BARS	3	3	3	3	3	3	3
0°-45°	# 4 HOOPS		12" CTRS.						

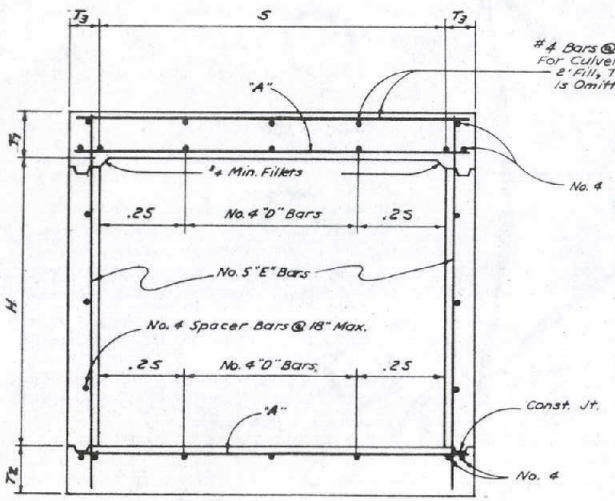
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

RCB CULVERTS, GENERAL NOTES

Hugh E. Briggs
CHIEF BRIDGE ENGR.

B-20.1.1-(502)
ADOPTED: 6/59 REVISION 7-4-70

SPAN			5'														6'																					
HEIGHT			3'					4'					5'					3'				4'				5'				6'					7'				
MAX. FILL OVER TOP			2	11	26	35	46	2	11	26	35	46	2	11	25	35	46	2	10	18	25	2	10	18	25	2	9	18	25	36	2	9	17	25	36	45	2	9	17	25	36	45
CONC.	TOP SLAB	T_1	7½	7½	8	9½	10½	7½	7½	8	9½	10½	7½	7½	8	9½	10½	8½	8½	8½	9½	8½	8½	8½	9½	8½	8½	8½	9½	11	8½	8½	8½	9½	11	12	8½	8½	8½	9½	11	12
	BOTTOM SLAB	T_2	7	7	9	11	11⅜	7	7	9	11	11⅜	7	7	9	11	11⅜	7⅜	7⅜	9	10⅜	7⅜	7⅜	9	10⅜	8½	8½	9½	11	12½	8½	8½	9½	11½	12½	13½	8½	8½	9½	11½	12½	13½
	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	6½	7	6	6	6	6½	7	7½
REINFORCING STEEL	"A"	SIZE BAR NO.	5	5	5	6	6	5	5	5	6	6	5	5	5	6	6	5	5	5	6	5	5	5	6	5	5	5	6	6	5	5	5	6	7	7	5	5	5	6	7	7
		SPACING	4	4	4	5	4½	4	4	4	5	4½	4	4	4	5	4½	4	4	4	5	4	4	4	5	4	4	4	5	4½	4	4	4	5	5½	5	4	4	4	5	5½	5
		LENGTH	5-9	5-9	5-9	5-9	5-9	5-9	5-9	5-9	5-9	5-9	5-9	5-9	5-9	5-9	5-9	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	6-11	7-0	6-9	6-9	6-9	6-9	6-11	7-0
	"D" DIST. BARS	TOP SLAB NO. OF	7	3	3	3	3	7	3	3	3	3	7	3	3	3	3	7	4	4	4	7	4	4	4	7	4	4	4	4	7	4	4	4	4	4	7	4	4	4	4	4	4
		BOT. SLAB NO. OF	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	"E" BARS	SPACING	18	18	17	13	11	18	18	17	13	11	18	18	12	8½	6½	18	18	18	17	18	18	18	17	18	18	15½	11½	8½	17	17	10½	7½	6	5	12	12	7½	7	5	4½
	SPACERS	NUMBER	12	12	12	12	12	12	14	14	14	14	16	16	16	16	16	12	12	12	12	14	14	14	14	16	16	16	16	16	16	16	16	16	16	16	18	18	18	18	18	18
QUAN.	CONCRETE: C.Y. PER LIN. FT.		.38	.38	.43	.50	.53	.42	.42	.47	.53	.56	.45	.45	.50	.57	.60	.46	.46	.49	.55	.50	.50	.53	.58	.55	.55	.57	.63	.69	.58	.58	.60	.67	.74	.82	.62	.62	.69	.73	.82	.91
	REINFORCING: LBS. PER LIN. FT.		65	57	57	65	72	70	59	60	68	75	70	63	65	77	87	75	66	65	71	78	69	67	74	79	70	70	80	91	79	73	78	92	112	127	90	81	90	99	126	139



#4 Bars @ 18" Maximum Spacing. For Culverts With More Than 2' Fill, The Top Mat Of Steel Is Omitted.

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

For General Notes See Sheet B-20.1.1

TYPICAL SECTION 5' AND 6' SPANS

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

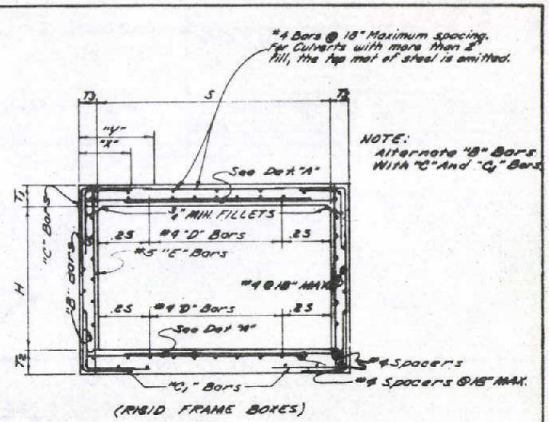
SINGLE
RCB CULVERTS
5' AND 6' SPANS

Hugh C. Briner
CHIEF BRIDGE ENGR.

B-20.1.2-(502)
ADOPTED 11/70
REVISION 3 10-79

82

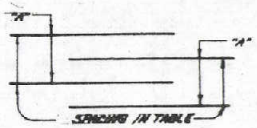
SPAN		7'										8'									
HEIGHT		3'		4'		5'		6'		7'		3'		4'		5'		6'		7'		8'	
MAX. FILL OVER TOP		2	16	2	16	2	16	2	18	2	16	2	13	2	13	2	13	2	13	2	13	2	13
		26	66	26	66	26	66	26	66	26	66	21	31	21	31	21	31	21	31	21	31	21	31
CONC.	TOP SLAB T_1	7½	8½	7½	8½	7½	8½	7½	8½	7½	8½	7½	8½	7½	8½	7½	8½	7½	8½	7½	8½	7½	8½
	BOTTOM SLAB T_2	8½	9½	8½	9½	8½	9½	11½	12½	8½	9½	8½	9½	8½	9½	8½	9½	10½	11½	8½	9½	10½	11½
	SIDEWALLS T_3	7	7	7	7	7	7	8½	7	7	8½	7	7	7	7	7	7½	7	7	7½	8	7½	8
REINFORCING STEEL	"A" SIZE: BAR NO.	5	5	5	5	5	5	6	5	5	6	5	5	5	5	5	5	5	5	5	6	5	6
	SPACING	9	9	7	9	9	7	9	9	7	9	9	7	9	9	7	9	9	7	8	9	9	7
	LENGTH	6-8	6-8	6-9	6-8	6-8	6-9	6-8	6-8	6-9	6-10	6-8	6-8	6-9	6-10	6-8	6-8	6-9	6-10	7-7	7-7	7-8	7-7
	"B" SIZE: BAR NO.	5	5	5	5	5	5	6	5	5	6	5	5	5	5	5	5	5	5	6	5	5	6
	SPACING	9	9	7	9	9	7	9	9	7	9	9	7	9	9	7	9	9	7	8	9	9	7
	DIMENSION "X"	1-3	1-8	1-6	1-3	1-3	1-6	1-3	1-3	1-6	1-8	1-3	1-3	1-6	1-8	1-3	1-3	1-6	1-8	1-6	1-7	1-6	1-7
	LENGTH	3-1	3-1	3-2	3-1	3-1	3-2	3-1	3-1	3-2	3-10	3-1	3-1	3-2	3-10	3-1	3-1	3-2	3-10	3-4	3-4	3-5	3-4
	"C" SIZE: BAR NO.	5	5	5	5	5	5	6	5	5	6	5	5	5	6	5	5	5	6	5	5	5	6
	SPACING	9	9	7	9	9	7	9	9	7	9	9	7	9	9	7	9	9	7	8	9	9	7
	DIMENSION "Y"	1-10	1-10	1-11	1-10	1-10	1-11	1-10	1-10	1-11	2-3	1-10	1-10	1-11	2-3	1-10	1-10	1-11	2-3	2-0	2-0	2-0	2-0
	LENGTH	6-2	6-2	6-4	6-2	6-2	6-4	7-2	7-2	7-4	7-10	6-2	6-2	6-4	6-10	6-2	6-2	6-4	6-10	7-1	7-1	7-1	7-1
	C_1 SIZE: BAR NO.	5	5	5	5	5	5	5	5	5	6	5	5	5	5	5	5	5	6	5	5	5	6
	SPACING	9	9	7	9	9	7	9	9	7	9	9	9	7	9	9	7	9	9	7	8	9	9
	DIMENSION "Y"	1-10	1-11	1-11	1-10	1-10	1-11	1-10	1-10	1-11	2-3	1-10	1-10	1-11	2-3	1-10	1-10	1-11	2-3	2-0	2-0	2-0	2-0
	LENGTH	3-6	3-8	3-10	3-8	3-8	3-10	3-8	3-8	3-10	4-6	3-8	3-8	3-10	4-6	3-8	3-8	3-10	4-6	3-9	3-9	4-5	3-9
	"D" DIST. TOP SLAB-TOT. NO.	7	4	4	7	4	4	7	4	4	4	7	4	4	4	7	4	4	4	7	5	5	7
	BARS BOT. SLAB-TOT. NO.	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	5	5	5
	"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.	24		28		28		32		36		28		32		32		36		40		40	
SUMM.	CONC. CY. PER LIN. FT.	.53	.53	.59	.57	.57	.63	.62	.62	.67	.82	.66	.66	.72	.87	.70	.70	.76	.92	.57	.57	.69	.60
	REINF. LBS. PER LIN. FT.	116	109	125	123	114	138	127	118	143	168	134	125	150	176	141	132	158	184	129	118	146	126



TYPICAL SECTION 7' THRU 12' SPANS

SPAN		10'												12'															
HEIGHT		3'		4'		5'		6'		7'		8'		9'		10'		4'		5'		6'		7'		8'		9'	
MAX. FILL OVER TOP		2	9	2	9	2	9	2	9	2	9	2	9	2	8	18	28	2	5	2	5	2	5	2	5	2	5	2	5
		18	96	18	96	18	96	18	96	18	96	18	96	18	96	18	96	16	24	16	24	16	24	16	24	16	24	16	24
CONC.	TOP SLAB T_1	8	8	9½	8	8	9½	8½	8½	9½	8½	8½	9½	8½	8½	9½	12½	8½	8½	9½	12½	8½	8½	9½	12½	8½	8½	11½	
	BOTTOM SLAB T_2	9½	9½	11½	9½	9½	11½	10	10	11½	10½	10½	12	10½	10½	12	14½	10½	10½	12	14½	10½	10½	12	14½	9½	9½	13½	
	SIDEWALLS T_3	7½	7½	9½	7½	7½	9½	7½	7½	9½	7½	7½	9½	7½	7½	9½	11½	7½	7½	10½	7½	7½	10½	7½	7½	10½	7½	7½	10½
REINFORCING STEEL	"A" SIZE: BAR NO.	6	6	6	6	6	6	6	6	6	6	6	6	6	6	7	8	6	6	6	7	6	6	7	7	6	6	7	7
	SPACING	11	11	8	11	11	8	11	11	8	11	11	8	11	11	8	9	11	11	8	9	11	11	8	9	11	11	10	8
	LENGTH	9-5	9-5	9-8	9-5	9-5	9-8	9-5	9-5	9-8	9-5	9-5	9-8	9-5	9-5	9-8	9-9	9-6	9-6	9-8	9-9	9-7	9-7	9-8	9-9	11-3	11-3	11-6	11-3
	"B" SIZE: BAR NO.	5	5	6	5	5	6	5	5	6	6	5	6	6	6	7	8	6	6	7	8	6	6	7	8	6	6	7	7
	SPACING	11	11	8	11	11	8	11	11	8	11	11	8	11	11	8	9	11	11	8	9	11	11	8	9	11	11	10	8
	DIMENSION "X"	2-0	2-0	2-0	2-0	2-0	2-0	2-0	2-0	2-0	2-0	2-0	2-0	2-0	2-0	2-6	2-6	2-0	2-0	2-0	2-6	2-8	2-8	3-0	2-8	2-8	3-0	2-8	2-8
	LENGTH	3-10	3-10	4-2	3-10	3-10	4-2	3-10	3-10	4-2	3-10	3-10	4-2	3-10	3-10	4-2	4-8	3-10	3-10	4-2	4-8	3-10	3-10	4-2	4-8	4-10	4-10	5-7	4-10
	"C" SIZE: BAR NO.	5	5	6	5	5	6	5	5	6	6	5	6	6	6	7	8	6	6	7	8	6	6	7	8	6	6	7	7
	SPACING	11	11	8	11	11	8	11	11	8	11	11	8	11	11	8	9	11	11	8	9	11	11	8	9	11	11	10	8
	DIMENSION "Y"	2-8	2-8	3-4	2-8	2-8	3-4	2-8	2-8	3-4	2-8	2-8	3-4	2-8	2-8	3-4	3-6	2-8	2-8	3-4	3-6	2-8	2-8	3-4	3-6	3-9	3-9	3-9	3-9
	LENGTH	5-11	5-11	6-10	6-11	6-11	7-10	8-1	8-1	8-10	9-1	9-1	9-10	10-1	10-1	10-10	11-1	11-1	11-10	12-3	12-1	12-1	12-10	13-3	13-1	13-1	13-10	14-3	8-2
	C_1 SIZE: BAR NO.	5	6	5	5	5	6	5	5	6	5	5	6	6	5	6	6	5	5	6	6	5	5	6	6	6	6	7	6
	SPACING	11	11	8	11	11	8	11	11	8	11	11	8	11	11	8	9	11	11	8	9	11	11	8	9	11	11	10	8
	DIMENSION "Y"	2-8	2-8	3-4	2-8	2-8	3-4	2-8	2-8	3-4	2-8	2-8	3-4	2-8	2-8	3-4	3-6	2-8	2-8	3-4	3-6	2-8	2-8	3-4	3-6	3-9	3-9	3-9	3-9
	LENGTH	4-7	4-7	5-6	4-7	4-7	5-6	4-7	4-7	5-6	4-7	4-7	5-6	4-7	4-7	5-6	6-0	4-7	4-7	5-8	6-0	4-7	4-7	5-8	6-2	5-11	5-11	6-5	5-11
	"D" DIST. TOP SLAB-TOT. NO.	9	5	5	9	5	5	9	5	5	9	5	5	9	5	5	9	5	5	5	9	5	5	5	10	6	6	6	10
	BARS BOT. SLAB-TOT. NO.	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	6	6	6	6	6
	"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.	30		32		34		36		40		40		44		48		32		36		36		44		44		44	
SUMM.	CONC. CY. PER LIN. FT.	.75	.75	.93	.80	.80	.99	.86	.86	1.07	.90	.90	1.12	.97	.97	1.19	1.01	1.01	1.01	1.25	1.10	1.10	1.31	1.62	1.23	1.23	1.37	1.70
	REINF. LBS. PER LIN. FT.	150	137	215	156	143	221	161	148	228	167	154	235	173	160	244	177	164	250	265	183	170	259	273	191	178	267	281	205

SPAN		12'																					
HEIGHT		4'		5'		6'		7'		8'		9'		10'		12'							
MAX. FILL OVER TOP		2	5	2	5	2	5	2	5	2	5	2	5	2	5	2	5	16	24	2	5	16	24
		16	26	16	26	16	26	16	26	16	26	16	26	16	26	16	26						
CONC.	TOP SLAB T_1	8½	8½	8½	8½	8½	8½	8½	8½	8½	8½	8½	8½	8½	8½	8½	8½	9	9	11½	13½	9	9
	BOTTOM SLAB T_2	9½	9½	9½	9½	9½	9½	9½	9½	9½	9½	9½	9½	9½	9½	9½	9½	10	10	13½	15½	10	10
	SIDEWALLS T_3	7½	7½	7½	7½	7½	7½	7½	7½	7½	7½	7½	7½	7½	7½	7½	7½	8	8	10½	12½	9	9
REINFORCING STEEL	"A" SIZE: BAR NO.	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	7	7	8	8	7	7
	SPACING	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	10	8	11	11	10	8
	LENGTH	11-3	11-6	11-3	11-6	11-3	11-6	11-3	11-6	11-3	11-6	11-3	11-6	11-3	11-6	11-3	11-6	11-4	11-4	11-5	11-5	11-6	11-4
	"B" SIZE: BAR NO.	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	7	7	8	8	7	7
	SPACING	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	10	8	11	11	10	8
	DIMENSION "X"	2-8	2-8	3-0	2-8	2-8	3-0	2-8	2-8	3-0	2-8	2-8	3-0	2-8	2-8	3-0	3-0	2-8	2-8	3-0	3-0	2-8	2-8
	LENGTH	4-10	4-10	5-7	4-10	4-10	5-7	4-10	4-10	5-7	4-10	4-10	5-7	4-10	4-10	5-7	5-7	4-10	4-10	5-7	5-7	4-10	4-10
	"C" SIZE: BAR NO.	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	7	7	8	8	7	7
	SPACING	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	10	8	11	11	10	8
	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	3-9	3-9	3-9	3-9	3-9	3-9	3-9
	LENGTH	8-2	8-2	8-4	9-2	9-2	9-4	10-2	10-2	10-4	11-2	11-2	11-4	12-2	12-2	12-4	13-2	8-2	8-4	9-2	9-4	10-2	10-2
	C_1 SIZE: BAR NO.	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	7	6	7	7	6	6
	SPACING	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	10	8	11	11	10	8
	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	3-9	3-9	3-9	3-9	3-9	3-9	3-9
	LENGTH	5-11	5-11	6-5	5-11	5-11	6-5	5-11	5-11	6-5	5-11	5-11	6-5	5-11	5-11	6-5	6-8	5-11	5-11	6-6	6-8	5-11	5-11
	"D" DIST. TOP 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
	BARS 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
	"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.	44		48		48		48		48		48		48		48		32		44		48	
SUMM.	CONC. CY. PER LIN. FT.	1.04	1.04	1.43	1.08	1.08	1.50	1.13	1.13	1.57	1.23	1.23	1.64	1.98	1.35	1.35	1.72	2.04	1.46	1.46	1.83	2.10	
	REINF. LBS. PER LIN. FT.	204	190	278	213	198	287	218	203	293	226	213	304	233	218	311	238	223	317	307	246	231	326



DETAIL "A"

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.

For general notes see sheet B-20.1.1

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

SINGLE RCB CULVERTS
7' TO 12' SPANS

Hugh E. Briscoe
CHIEF BRIDGE ENGR.

B-20.1.3-(502)

ADOPTED: 11/70

Span	5'													
Height	3'				4'					5'				
Max. Fill Over Top	2	6	24	36	2	6	28	34	48	2	6	29	34	46
Conc. Top Slab T_1	6¾	6¾	7¼	9¼	7	7	7¼	9	10¼	7	7	7¼	9¼	10¼
Conc. Bottom Slab T_2	7½	7½	9¼	11¼	8	8	9¼	11	12¼	8	8	9¼	11¼	12¼
Conc. Sidewalls T_3	6	6	6	6	6	6	6	6	6	6	6	6	6	6
"A" Size Bar No.	5	5	4	4	5	5	4	4	4	5	5	4	4	4
"A" Spacing	10	10	8½	10	10	10	8½	10	9	10	10	8½	10½	9
"A" Length	11-3	11-3	11-2	11-2	11-3	11-3	11-3	11-3	11-3	11-3	11-3	11-3	11-3	11-3
"B" Size Bar No.	5	5	5	6	5	5	5	6	6	5	5	5	6	6
"B" Spacing	10	10	8½	10	10	10	8½	10	9	10	10	8½	10½	9
Length "B"	11-5	11-5	11-6	11-7	11-5	11-5	11-6	11-7	11-8	11-5	11-5	11-6	11-7	11-8
"B_1" Length "B_1"	11-4	11-4	11-6	11-7	11-5	11-5	11-6	11-7	11-8	11-5	11-5	11-6	11-7	11-8
"C" Size Bar No.	4	4	5	6	4	4	5	6	6	4	4	5	6	6
"C" Spacing	10	10	8½	10	10	10	8½	10	9	10	10	8½	10½	9
"C" Length	11-3	5-6	5-6	5-6	11-3	5-6	5-6	5-6	5-6	11-3	5-6	5-6	5-6	5-6
"D" Dist. Bars Top Slab Tot. No.	12	6	6	6	12	6	6	6	6	12	6	6	6	6
"D" Dist. Bars Bot. Slab Tot. No.	6	6	6	6	6	6	6	6	6	6	6	6	6	6
"E" Bars Size Bar No.	4	4	4	4	4	4	4	4	5	4	4	4	5	6
"E" Bars Spacing	18	18	18	16	18	18	12	10	10½	18	18	8½	9	9
Spacers Number	30	26			38	29				36	32			
Quan. Concrete Cy. Per Lin. Ft.	0.68	0.68	0.79	0.90	0.76	0.76	0.85	0.94	1.03	0.81	0.81	0.90	1.01	1.08
Quan. Reinforcing Lbs. Per Lin. Ft.	110	103	104	112	113	106	109	119	139	116	109	116	126	148

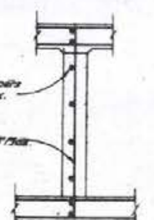
Span	6'																	
Height	3'				4'				5'					6'				
Max. Fill Over Top	2	4	20	34	2	4	20	34	2	4	19	33	43	2	4	19	33	43
Conc. Top Slab T_1	7¼	7¼	8¼	10½	7¼	7¼	8¼	10½	7¼	7¼	8¼	10½	12	7¼	7¼	8¼	10½	12
Conc. Bottom Slab T_2	8¼	8¼	10½	12½	8¼	8¼	10½	12½	8¼	8¼	10½	12½	13¾	8¼	8¼	10½	12½	13¾
Conc. Sidewalls T_3	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	7½
"A" Size Bar No.	5	5	4	4	5	5	4	4	5	5	4	4	4	5	5	4	4	4
"A" Spacing	9½	9½	11	8½	9½	9½	11	8½	9½	9½	11	8½	10½	9½	9½	11	8½	10½
"A" Length	13-3	13-3	14-2	14-2	13-3	13-3	13-3	13-3	13-3	13-3	13-3	13-3	13-3	13-3	13-3	13-3	13-3	13-3
"B" Size Bar No.	5	5	6	6	5	5	6	6	5	5	6	6	7	5	5	6	6	7
"B" Spacing	9½	9½	11	8½	9½	9½	11	8½	9½	9½	11	8½	10½	9½	9½	11	8½	10½
Length "B"	13-6	13-6	13-6	13-8	13-6	13-6	13-6	13-8	13-6	13-6	13-6	13-8	13-9	13-6	13-6	13-6	13-9	14-2
"B_1" Length "B_1"	13-5	13-5	13-7	13-8	13-5	13-5	13-7	13-8	13-5	13-5	13-6	13-8	13-9	13-5	13-5	13-6	13-8	14-2
"C" Size Bar No.	4	4	6	6	4	4	6	6	4	4	6	6	7	4	4	6	6	7
"C" Spacing	9½	9½	11	8½	9½	9½	11½	8½	9½	9½	11	8½	10½	9½	9½	11	8½	10½
"C" Length	13-3	6-6	6-6	6-6	13-3	6-6	6-6	6-6	13-3	6-6	6-6	6-6	6-6	13-3	6-6	6-6	6-6	6-8
"D" Dist. Bars Top Slab Tot. No.	12	6	6	6	12	6	6	6	12	6	6	6	6	12	6	6	6	6
"D" Dist. Bars Bot. Slab Tot. No.	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
"E" Bars Size Bar No.	4	4	4	4	4	4	4	4	4	4	4	5	5	4	4	5	6	6
"E" Bars Spacing	18	18	18	16	18	18	14	8½	18	18	10	9½	7	18	18	11	9	6
Spacers Number	34	30			37	33			40	36				40	36			
Quan. Concrete Cy. Per Lin. Ft.	0.82	0.82	0.95	1.13	0.87	0.87	1.01	1.18	0.93	0.93	1.06	1.24	1.36	0.98	0.98	1.12	1.30	1.52
Quan. Reinforcing Lbs. Per Lin. Ft.	129	121	118	147	134	125	124	155	136	128	131	164	175	137	129	137	177	201

Span	8'																			
Height	3'			4'				5'				6'				7'				
Max. Fill Over Top	2	14	25	2	3	14	25	2	3	14	25	2	3	14	25	2	3	14	25	37
Conc. Top Slab T_1	8½	9½	12	8½	8½	9½	12	8½	8½	9½	12	8½	8½	9½	12	8½	8½	9½	12¼	14¼
Conc. Bottom Slab T_2	8½	11½	13¾	8½	8½	11½	13¾	8½	8½	11¼	13¾	8½	8½	11¼	13¾	8½	8½	11¼	14	16
Conc. Sidewalls T_3	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	7	7	7	7	8
"A" Size Bar No.	6	4	4	6	6	4	4	6	6	4	4	6	6	4	4	6	6	4	4	4
"A" Spacing	12	9½	10½	12	12	9½	10½	12	12	9½	10	12	12	9½	10	11½	11½	9½	10	8½
"A" Length	17-3	17-3	17-3	17-3	17-3	17-3	17-3	17-3	17-3	17-3	17-3	17-3	17-3	17-3	17-3	17-6	17-6	17-6	17-6	17-9
"B" Size Bar No.	6	6	7	6	6	6	7	6	6	6	7	6	6	6	7	6	6	6	7	7
"B" Spacing	12	9½	10½	12	12	9½	10½	12	12	9½	10	12	12	9½	10	11½	11½	9½	10	9½
Length "B"	17-7	17-8	17-9	17-7	17-7	17-8	17-9	17-7	17-7	17-8	17-9	17-7	17-7	17-8	17-9	17-10	17-10	17-10	18-0	18-3
"B_1" Length "B_1"	17-5	17-8	17-9	17-5	17-5	17-8	17-9	17-5	17-5	17-8	17-9	17-5	17-5	17-8	17-9	17-8	17-8	17-11	18-0	18-5
"C" Size Bar No.	4	6	7	4	4	6	7	4	4	6	7	4	4	6	7	4	4	6	7	7
"C" Spacing	12	9½	10½	12	12	9½	10½	12	12	9½	10	12	12	9½	10	11½	11½	8½	10	8½
"C" Length	17-3	8-6	8-6	17-3	8-6	8-6	8-6	17-3	8-6	8-6	8-6	17-3	8-6	8-6	8-6	17-6	8-7	8-7	8-7	8-8
"D" Dist. Bars Top Slab Tot. No.	16	8	8	16	8	8	8	16	8	8	8	16	8	8	8	16	8	8	8	8
"D" Dist. Bars Bot. Slab Tot. No.	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
"E" Bars Size Bar No.	4	4	4	4	4	4	4	4	4	4	5	4	4	5	6	4	4	5	6	7
"E" Bars Spacing	18	18	10½	18	18	18	10½	18	18	12	10	18	18	11½	10	14	14	9½	7½	8½
Spacers Number	44	38		47	41			50	44			50	44			53	47			
Quan. Concrete Cy. Per Lin. Ft.	1.09	1.30	1.56	1.14	1.14	1.36	1.62	1.20	1.20	1.45	1.67	1.26	1.26	1.49	1.73	1.39	1.39	1.62	1.90	2.30
Quan. Reinforcing Lbs. Per Lin. Ft.	177	172	197	180	169	175	200	183	172	181	218	184	173	188	229	197	185	199	248	284

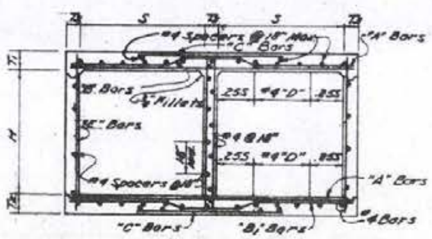
Span	8'				
Height	8'				
Max. Fill Over Top	2	3	14	25	37
Conc. Top Slab T_1	8½	8½	9½	12¼	14¼
Conc. Bottom Slab T_2	8½	8½	11¼	14	16½
Conc. Sidewalls T_3	7	7	7	8	8½
"A" Size Bar No.	6	6	4	4	4
"A" Spacing	11½	11½	9½	10	8½
"A" Length	18-7	17-6	17-6	17-9	17-10
"B" Size Bar No.	6	6	6	7	7
"B" Spacing	11½	11½	9½	10	8½
Length "B"	17-10	17-10	17-10	18-3	18-6
"B_1" Length "B_1"	17-8	17-8	17-11	18-0	18-7
"C" Size Bar No.	4	4	6	7	7
"C" Spacing	11½	11½	9½	10	8½
"C" Length	17-6	8-7	8-7	8-8	8-9
"D" Dist. Bars Top Slab Tot. No.	16	8	8	8	8
"D" Dist. Bars Bot. Slab Tot. No.	8	8	8	8	8
"E" Bars Size Bar No.	4	4	5	7	7
"E" Bars Spacing	11½	11½	8½	7½	8
Spacers Number	56	50		60	
Quan. Concrete Cy. Per Lin. Ft.	1.45	1.45	1.69	2.06	2.54
Quan. Reinforcing Lbs. Per Lin. Ft.	203	191	207	279	309

Span	10'																						
Height	3'			4'			5'			6'			7'			8'				10'			
Max. Fill Over Top	2	17	30	2	17	30	2	17	30	2	17	30	2	17	30	2	16	29	36	2	16	29	36
Conc. Top Slab T_1	8¾	12¾	16	8¾	12¾	16	8¾	12¾	16	8¾	12¾	16	8¾	12¾	16	8¾	12¾	16	17¼	8¾	12¾	16	17½
Conc. Bottom Slab T_2	9¼	14½	17½	9¼	14½	17½	9¼	14½	17½	9¼	14½	17½	9¼	14½	17¼	9¼	14½	17½	19¼	9¾	14½	17½	19½
Conc. Sidewalls T_3	6	6	6	6	6	6	6	6	6	6	6	6	6	6½	7	7	7	7½	8½	8	8	9	10
"A" Size Bar No.	6	4	4	6	4	4	6	4	4	6	4	4	6	4	4	6	4	4	4	6	4	4	4
"A" Spacing	11	10	10	11	10	10	11	10	10	11	9½	10	11	9½	10	11	10	10	9	11	10	10	9
"A" Length	21-3	21-3	21-3	21-3	21-3	21-3	21-3	21-3	21-3	21-3	21-3	21-3	21-3	21-3	21-3	21-6	21-6	21-7	21-10	21-9	21-9	22-0	22-3
"B" Size Bar No.	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8	8	6	7	8	8
"B" Spacing	11	10	10	11	10	10	11	10	10	11	9½	10	11	9½	10	11	10	10	9	11	10	10	9
Length "B"	21-7	21-10	22-0	21-7	21-10	22-0	21-7	21-10	22-0	21-7	21-10	22-0	21-7	21-11	22-3	21-10	21-10	22-4	22-9	22-1	22-4	22-9	23-1
"B_1" Length "B_1"	21-5	21-10	22-0	21-5	21-10	22-0	21-5	21-10	22-0	21-5	21-10	22-0	21-5	21-11	22-3	21-9	22-0	22-4	22-9	22-0	22-3	22-8	23-2
"C" Size Bar No.	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8	8	6	7	8	8
"C" Spacing	11	10	10	11	10	10	11	10	10	11	9½	10	11	9½	10	11	10	10	9	11	10	10	9
"C" Length	21-3	10-6	10-6	21-3	10-6	10-6	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
"D" Dist. Bars Top Slab Tot. No.	18	10	10	18	10	10	18	10	10	18	10	10	18	10	10	18	10	10	10	18	10	10	10
"D" Dist. Bars Bot. 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
"E" Bars Size Bar No.	4	4	5	4	4	5	4	4	5	4	4	5	4	4	6	4	5	6	7	4	6	6	7
"E" Bars Spacing	18	10	10	18	10	10	18	10	10	18	6	6½	14	6	8	11	8½	6	6	7½	7	5½	5
Spacers Number	49	42		53	46		48			48			51			54				60			
Quan. Concrete Cy. Per Lin. Ft.	1.57	1.98	2.39	1.92	2.03	2.45	1.48	2.09	2.51	1.53	2.15	2.56	1.59	2.20	2.72	1.76	2.35	2.85	3.13	2.00	2.60	3.14	3.50
Quan. Reinforcing Lbs. Per Lin. Ft.	247	244	300	252	249	305	236	254	310	238	274	324	243	280	339	252	278	355	425	274	322	395	471

Span	12'																										
Height	4'			5'			6'			7'			8'			9'				10'				12'			
Max. Fill Over Top	2	14	24	2	14	26	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	10	14	17½	10	14	17½	10	14	17½	10	14¼	17½	10¼	14¼	17¾	10¼	14½	17¾	20¼	10¼	14½	17¾	20¾	10¼	14½	18¼	21¼
Conc. Bottom Slab T_2	10¼	15¾	19	10¼	15¾	19	10¼	15¾	19	10½	16	19¼	10¾	16	19½	11	16¾	19¾	22¼	11¼	16¼	19¾	22½	11½	16¼	20¼	23
Conc. Sidewalls T_3	6	6	6½	6	6	6½	6	6	6½	7	7	7	8	9	8½	9	9	9	10	9	9	9½	11	9	10	11	12
"A" Size Bar No.	6	4	4	6	4	4	6	4	4	6	4	4	6	4	4	6	4	4	4	6	4	4	4	6	4	4	4
"A" Spacing	9	11½	9	9	11½	9	9	11½	9	9	11½	9	9	11	8½	9	11	8½	9	9	11	8½	9	9	11	8½	9
"A" Length	25-3	25-3	25-4	25-3	25-3	25-3	25-3	25-3	25-9	25-6	25-6	25-6	25-9	25-9	25-10	26-0	26-0	26-0	26-3	26-0	26-0	26-1	26-6	26-0	26-3	26-6	26-9
"B" Size Bar No.	6	8	8	6	8	8	6	8	8	6	8	8	6	8	8	6	8	8	9	6	8	8	9	6	8	8	9
"B" Spacing	9	11½	9	9	11½	9	9	11½	9	9	11½	9	9	11	8½	9	11	8½	9	9	11	8½	9	9	11	8½	9
Length "B"	25-8	25-10	26-3	25-8	25-10	26-3	25-9	25-10	26-3	25-11	26-1	26-4	26-2	26-4	26-9	26-5	26-8	26-10	27-4	26-5	26-9	27-2	27-6	26-5	26-11	27-5	27-10
"B_1" Length "B_1"	25-6	25-10	26-3	25-6	25-10	26-3	25-6	25-10	26-3	25-9	26-2	26-4	26-1	26-5	26-9	26-4	26-8	26-11	27-4	26-4	26-8	27-2	27-7	26-4	26-11	27-3	27-11
"C" Size Bar No.	5	8	8	5	8	8	5	8	8	5	8	8	5	8	8	5	8	8	9	5	8	8	9	5	8	8	9
"C" Spacing	9	11½	9	9	11½	9	9	11½	9	9	11½	9	9	11	8½	9	11	8½	9	9	11	8½	9	9	11	8½	9
"C" Length	25-3	12-6	12-7	25-3	12-6	12-7	12-6	12-6	12-7	12-7	12-7	12-7	12-8	12-8	12-9	12-9	12-9	12-9	12-10	12-9	12-9	12-10	12-11	12-9	12-10	12-11	13-0
"D" Dist. Bars Top Slab Tot. No.	24	10	10	24	10	10	24	10	10	24	10	10	24	10	10	24	10	10	10	24	10	10	10	24	10	10	10
"D" Dist. Bars Bot. 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
"E" Bars Size Bar No.	4	5	5	4	5	5	4	4	5	4	4	5	4	4	5	4	5	7	8	4	7	8	9	6	7	8	9
"E" Bars Spacing	12	8	8	18	8	8	18	8	8	15	6	6½	12	5½	6	9	7½	8½	8	8½	11	8½	9	12	8	7	7
Spacers Number	53	45		56	48		52			55			68			68				72				76			
Quan. Concrete Cy. Per Lin. Ft.	1.82	2.57	3.13	1.88	2.62	3.19	1.93	2.68	3.25	2.07	2.86	3.38	2.28	3.02	3.64	2.48	3.25	3.79	4.35	2.58	3.38	3.94	4.59	2.77	3.63	4.41	5.09
Quan. Reinforcing Lbs. Per Lin. Ft.	313	304	388	310	316	400	305	317	401	316	330	419	331	358	455	340	369	480	573	346	386	510	577	366	422	562	668



Reinforcement For Interior Walls Under 8"



Reinforcement For Interior Walls 8" And Over

TYPICAL SECTION

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.

NOTE: "B" And "B_1" Bars To Be Spaced Alternately With "A" And "C" Bars.
Extended "C" Bars Are NOT Included In Boxes Shown.

NOTE: For General Notes See Sheet B-20.1.

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

DOUBLE
RCB CULVERTS

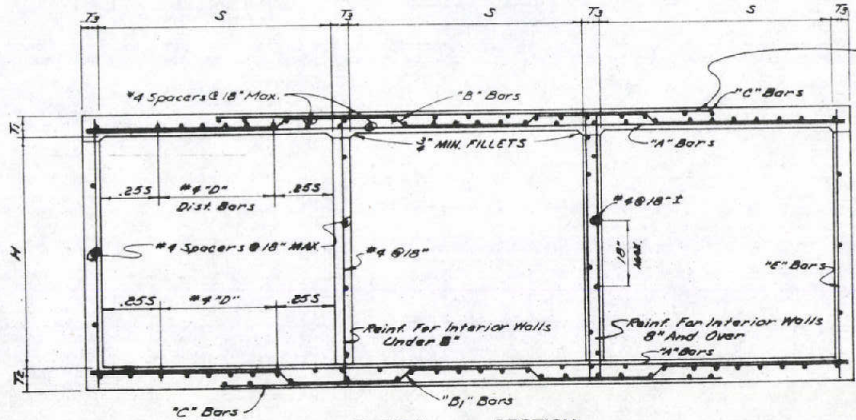
Hugh E. Brunson
CHIEF BRIDGE ENGR.

B-20.14-(502)
ADOPTED 11/1/71 REVISION 2 11/72

SPAN		5'							6'								8'												10'											
HEIGHT		4'			5'				4'			5'			6'		4'		5'		6'		7'		8'				5'		6'		7'		8'					
MAX. FILL OVER TOP		8	17	26	35	8	17	26	35	8	17	25	34	8	17	25	34	8	17	26	35	8	17	26	35	8	17	26	35	8	17	26	35	8	17	26	35	8	17	26	35
CONC.	TOP SLAB T_1	7	7	7½	8½	7	7	7½	8½	7½	7½	8½	9½	7½	7½	8½	9½	7½	7½	8½	9½	8½	8½	10½	11½	8½	8½	10½	11½	8½	8½	10½	11½	8½	8½	10½	11½	8½	8½	10½	11½
	BOTTOM SLAB T_2	7½	8½	9½	10½	8	8½	9½	10½	8	8½	10½	8	9	10½	11	8	9	10½	11½	8	10½	12	13½	8	10½	12	13½	8	10½	12	13½	8½	11½	14	8½	11½	14	8½	12	14	16
	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	6½	7	7	7½	8½	6	6	6	6
REINFORCING STEEL	"A" SIZE: BAR NO.	5	4	5	5	5	4	5	5	6	5	5	5	6	5	5	5	6	5	5	6	6	5	5	6	6	5	5	6	6	5	5	6	6	5	5	6	6	6	6	6
	SPACING	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	13	10	10½	13	10	10½	13	10	11
	LENGTH	16-9	16-8	16-9	16-9	16-9	16-8	16-9	16-9	19-10	19-9	19-9	19-10	19-9	19-9	19-9	19-9	19-10	19-9	19-9	19-9	25-10	25-9	25-9	25-10	25-9	25-9	25-9	25-10	25-9	25-9	25-9	25-10	31-10	31-10	31-10	31-10	31-10	31-10	31-10	32-0
	"B" SIZE: BAR NO.	5	5	6	6	5	5	6	6	6	6	6	6	6	6	6	6	6	6	7	6	6	7	6	6	7	6	6	7	7	6	6	7	7	6	7	7	6	7	7	8
	SPACING	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	13	10	10½	13	10	10½	13	10	11
	LENGTH "B"	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	20-7	26-5	26-5	26-7	26-5	26-5	26-7	26-5	26-5	26-6	26-9	27-3	26-9	26-9	27-1	27-7	32-6	32-7	32-10	33-6	32-7	32-10	32-6
	"B$_1$" SIZE: BAR NO.	4	5	6	6	4	5	6	6	4	6	6	4	6	6	6	4	6	6	6	6	4	6	7	4	6	7	4	6	7	7	4	6	7	7	5	7	7	5	7	7	5	7	7	8
	LENGTH "B$_1$"	17-0	17-2	17-4	17-5	17-0	17-2	17-4	17-5	20-0	20-2	20-3	20-0	20-2	20-3	20-5	20-0	20-0	20-3	20-5	20-7	26-0	26-4	26-7	26-0	26-5	26-7	26-0	26-5	26-5	26-9	27-3	26-5	26-9	27-1	27-7	32-5	32-7	32-11	33-5	32-7	32-11	32-5
	"C" SIZE: BAR NO.	4	5	6	6	4	5	6	6	4	6	6	4	6	6	6	4	6	6	6	6	4	6	7	4	6	7	4	6	7	7	4	6	7	7	5	7	7	5	7	7	5	7	7	8
	SPACING	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	13	10	10½	13	10	10½	13	10	11
	LENGTH	17-0	17-0	17-0	17-0	17-0	17-0	17-0	17-0	19-0	19-0	19-0	19-0	19-0	19-0	19-0	19-0	19-0	19-0	19-0	19-0	17-0	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	21-0	21-0	21-0	21-0	21-0	21-0	21-0	21-1
	"S" DIST. BARS TOP SLAB-TOT. NO.	18	9	9	9	18	9	9	9	18	9	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	27	15	15	27	15	15	15
	BOT. SLAB-TOT. NO.	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	18	12	12	12	12	12	12	12	12	12	12	12	12	12	12	15	15	15	15	15	15	15	15	15
	"E" SIZE: BAR NO.	4	4	4	5	4	4	4	5	4	4	4	5	4	4	4	6	4	4	4	6	4	5	6	4	5	6	4	6	7	7	4	6	7	7	4	6	7	4	6	7	4	6	8	8
	BARS SPACING	18	17	11½	11½	18	11	7	11½	18	18	11½	18	11½	12	10	18	8	12	10	12	18	18	12	18	12	12	18	12	12	10½	11½	11½	12	10½	15	13	10	18	13	10	13	13	10	10½
	SPACERS NUMBER	38			42				40			44			48		58		62		66			70			88	68			72			96	76			102				
QUAN.	CONCRETE: C.Y. PER LIN. FT.	1.04	1.10	1.19	1.30	1.16	1.19	1.27	1.37	1.26	1.30	1.44	1.33	1.39	1.52	1.62	1.41	1.47	1.59	1.71	1.60	1.77	2.09	1.68	1.86	2.16	1.75	1.93	2.23	1.83	2.01	2.36	2.56	2.02	2.20	2.56	2.89	2.10	2.52	2.96	2.18	2.60	3.02	2.25	2.67	3.15	2.47	2.89	3.35	3.91	2.81	3.31	3.87	4.35
	REINFORCING: LBS. PER LIN. FT.	157	136	161	181	161	148	171	192	183	170	200	187	177	209	234	192	187	221	249	261	250	301	286	257	310	267	264	320	278	277	336	409	293	295	347	441	358	372	470	359	379	482	367	391	502	377	402	514	590	421	453	577	632

SPAN		12'															
HEIGHT		6'			7'			8'			9'			10'			12'			
MAX. FILL OVER TOP		2	10	18	2	10	18	2	10	18	2	11	20	30	2	11	20	30	2	11	20	30
CONC.	TOP SLAB T_1	10½	11½	14	10½	11½	14	10½	11½	14	10½	12	14½	17½	10½	12	14½	17½	10½	12	14½	17½
	BOTTOM SLAB T_2	9½	13	15½	9½	13	15½	9½	13	15½	9½	13	16½	19½	9½	13½	16½	19½	10	13½	16½	19½
	SIDEWALLS T_3	6	6	6½	6	6	7	7	7	7½	8	8	8	10	8	8	9	10½	9	9	9	10½
REINFORCING STEEL	"A" SIZE: BAR NO.	7	6	7	7	6	7	7	6	7	7	6	7	8	7	6	7	8	7	6	7	8
	SPACING	12	11	11½	12	11	11½	12	11	11½	12	10½	11	11½	12	10½	11	11½	12	10½	11	11½
	LENGTH	38-1	37-10	38-3	38-1	37-10	38-5	38-5	38-2	38-7	38-9	38-6	39-1	39-10	38-9	38-6	39-1	40-0	39-1	38-10	39-7	40-6
	"B" SIZE: BAR NO.	7	7	8	7	7	8	7	7	8	7	7	8	9	7	7	8	9	7	7	8	9
	SPACING	12	11	11½	12	11	11½	12	11	11½	12	10½	11	11½	12	10½	11	11½	12	10½	11	11½
	LENGTH "B"	38-7	38-9	39-3	38-7	38-9	39-5	38-9	38-9	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$_1$" LENGTH "B$_1$"	38-3	38-7	39-2	38-3	38-7	39-5	38-7	38-7	39-7	39-0	39-6	40-2	40-10	39-0	39-6	40-2	41-0	39-6	39-10	40-9	41-6
	"C" SIZE: BAR NO.	6	7	8	6	7	8	6	7	8	6	7	8	9	6	7	8	9	6	7	8	9
	SPACING	12	11	11½	12	11	11½	12	11	11½	12	10½	11	11½	12	10½	11	11½	12	10½	11	11½
	LENGTH	25-0	25-0	25-1	25-0	25-0	25-2	25-2	25-2	25-3	25-4	25-6	25-6	25-8	25-4	25-6	25-6	25-9	25-6	25-6	25-9	26-0
	"D" DIST. BARS TOP SLAB-TOT. NO.	36	15	15	36	15	15	36	15	15	36	15	15	15	36	15	15	15	36	15	15	15
	BOT. SLAB-TOT. NO.	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
	"E" SIZE: BAR NO.	4	4	6	4	4	6	4	4	6	4	6	7	8	5	7	8	8	6	7	9	9
	BARS SPACING	18	7	11½	12	5½	11½	12	5½	9	10	10½	11	11½	12	10½	11	6½	12	9	11	9
	SPACERS NUMBER	76			80			84			104			110			116				
QUAN.	CONCRETE: C.Y. PER LIN. FT.	2.74	2.92	3.96	2.84	3.40	4.13	3.03	3.59	4.28	3.28	3.94	4.77	5.61	3.38	4.04	4.88	5.81	3.78	4.44	5.40	6.35
	REINFORCING: LBS. PER LIN. FT.	499	505	628	497	516	637	505	527	654	536	582	719	872	548	606	745	939	575	636	793	963

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 Spaces And Quantities.



TYPICAL SECTION

NOTE: "B" And "B1" Bars To Be Spaced Alternately With "A" And "C" Bars.

NOTE:
For General Notes See Sheet B-20.1.1

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

TRIPLE RCB CULVERTS

Hugh E. Brinson
CHIEF BRIDGE ENGR.

B-20.1.5-(502)
ADOPTED 11/70
REVISION 8/73

CUBIC YARDS OF CONCRETE AND POUNDS OF REINFORCING FOR TWO TYPE II HEADWALLS

SINGLE BOX

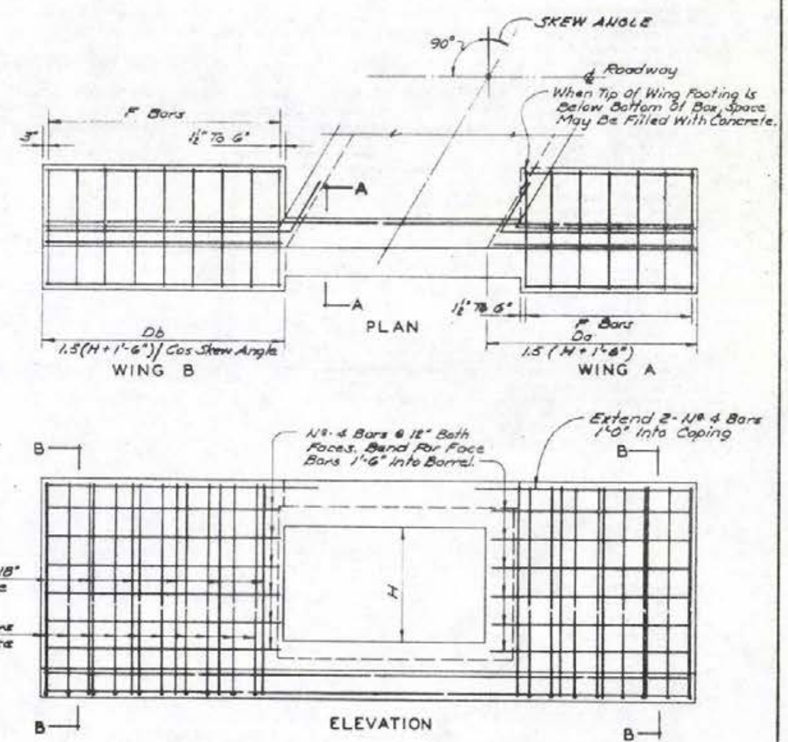
SPAN	HEIGHT	0 SKEW CONC.	0 SKEW REINF.	15 SKEW CONC.	15 SKEW REINF.	30 SKEW CONC.	30 SKEW REINF.	45 SKEW CONC.	45 SKEW REINF.
5	3	9.4	871	9.4	888	10.2	947	11.5	1073
	4	12.8	1141	12.8	1163	13.5	1237	15.6	1399
	5	16.4	1676	16.6	1707	17.5	1813	19.8	2044
6	3	9.8	886	9.8	903	10.6	963	12.1	1094
	4	13.2	1155	13.2	1178	14.1	1254	16.2	1419
	5	16.8	1690	17.8	1722	18.9	1830	20.5	2064
	6	25.8	2598	26.1	2646	27.6	2808	31.1	3160
	7	32.0	3666	32.3	3733	34.2	3960	38.6	4453
7	3	10.2	900	10.2	918	11.0	980	12.5	1114
	4	13.6	1170	13.6	1193	14.5	1270	16.6	1439
	5	17.2	1704	17.3	1736	19.3	1846	20.9	2085
	6	26.2	2612	26.3	2660	28.0	2824	31.7	3181
	7	32.2	3682	32.7	3750	34.6	3978	39.0	4486
8	3	10.6	914	10.6	933	11.4	996	13.1	1134
	4	14.0	1184	14.0	1207	14.9	1287	17.0	1460
	5	17.6	1718	17.7	1751	18.8	1863	21.3	2105
	6	26.4	2626	26.7	2676	28.4	2841	32.1	3201
	7	32.8	3697	33.0	3765	34.9	3995	39.3	4496
	8	40.4	4879	40.8	5070	43.3	5377	48.8	6046
10	3	11.4	943	11.4	962	12.5	1029	14.3	1174
	4	14.6	1212	14.7	1237	15.8	1320	18.1	1500
	5	18.4	1747	18.5	1781	19.8	1895	22.5	2145
	6	27.0	2655	27.2	2705	28.9	2874	32.8	3241
	7	33.4	3729	33.6	3799	36.1	4035	40.9	4542
	8	41.2	5015	41.5	5107	44.0	5419	48.6	6097
	9	49.8	5687	50.2	5791	53.1	6144	59.6	6909
	10	61.0	8535	61.4	8690	65.2	9216	73.2	10,358
12	4	15.4	1241	15.5	1266	16.6	1356	19.1	1540
	5	18.8	1775	18.9	1810	20.2	1929	22.9	2185
	6	28.0	2683	28.2	2734	29.9	2908	33.9	3281
	7	34.2	3761	33.8	3831	36.5	4069	41.3	4586
	8	42.0	5050	42.1	5143	44.8	5459	50.6	6147
	9	50.4	5722	50.8	5828	53.8	6187	60.6	6959
	10	61.8	8580	62.3	8736	65.9	9267	74.3	10,421
	12	88.0	12,939	88.8	13,172	94.0	13,963	105.7	15,682

DOUBLE BOX

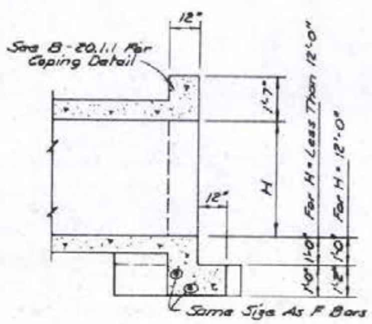
SPAN	HEIGHT	0 SKEW CONC.	0 SKEW REINF.	15 SKEW CONC.	15 SKEW REINF.	30 SKEW CONC.	30 SKEW REINF.	45 SKEW CONC.	45 SKEW REINF.
5	3	11.4	991	11.6	1013	12.4	1085	14.3	1243
	4	14.8	1261	15.0	1287	15.9	1376	18.6	1568
	5	18.6	1795	18.6	1831	19.9	1952	22.8	2214
6	3	12.2	1094	12.2	1119	13.2	1204	15.3	1389
	4	15.4	1364	15.6	1393	16.7	1495	19.6	1714
	5	20.0	1898	20.4	1937	21.7	2071	24.8	2360
	6	27.8	2806	28.5	2861	30.2	3049	34.5	3456
	7								
7	3								
	4								
	5								
	6								
	7								
8	3	13.8	1296	14.0	1328	15.2	1437	17.1	1675
	4	17.0	1566	17.2	1602	18.5	1728	21.6	2000
	5	20.8	2100	20.9	2146	22.6	2306	25.9	2646
	6	29.2	3008	29.9	3070	31.8	3282	36.3	3742
	7	35.8	4067	36.2	4147	38.5	4422	43.7	5019
	8	43.8	5332	44.2	5434	47.1	5785	53.3	6546
10	3	14.8	1604	15.0	1648	16.3	1793	18.9	2110
	4	18.2	1874	18.3	1922	19.8	2084	24.1	2435
	5	20.4	2408	22.0	2466	23.9	2660	26.8	3081
	6	30.4	3316	31.2	3390	33.1	3638	38.0	4117
	7	37.2	4375	37.6	4467	40.1	4778	45.7	5454
	8	44.4	5640	44.7	5726	47.8	6141	54.2	6981
	9								
	10	65.2	9109	65.8	9285	70.2	9878	78.2	11,169
12	4	19.6	2290	19.9	2352	21.4	2564	24.9	3033
	5	23.0	2824	23.1	2896	25.0	3140	28.9	3649
	6	32.2	3732	33.6	3820	35.1	4118	40.1	4766
	7	38.4	4791	39.0	4897	41.6	5258	47.5	6042
	8	46.6	6056	46.9	6140	50.2	6621	56.0	7569
	9	55.2	6720	55.8	6869	59.4	7346	67.4	8381
	10	66.6	9525	67.1	9715	71.7	10,358	81.1	11,757
	12	93.2	13,884	94.2	14,150	99.8	15,054	113.1	17,018

TRIPLE BOX

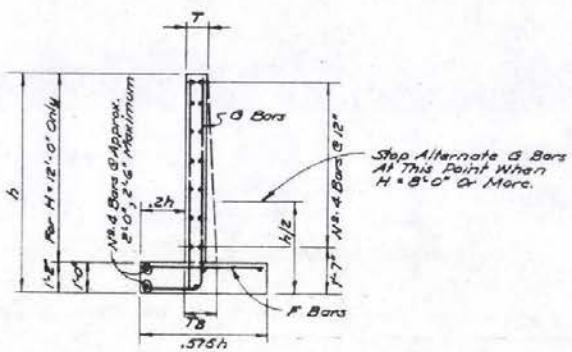
0 SKEW CONC.	0 SKEW REINF.	15 SKEW CONC.	15 SKEW REINF.	30 SKEW CONC.	30 SKEW REINF.	45 SKEW CONC.	45 SKEW REINF.	HEIGHT	SPAN
								3	5
16.8	1367	17.0	1397	18.5	1498	21.4	1718	4	
20.6	1901	20.8	1941	22.3	2074	25.6	2364	5	
								3	6
17.8	1536	18.0	1572	19.5	1693	22.8	1957	4	
22.4	2070	22.8	2116	24.5	2269	28.2	2603	5	
30.4	2978	31.1	3040	33.0	3247	38.3	3699	6	
								7	
								3	7
								4	
								5	
								6	
								7	
								3	8
20.2	1830	20.4	1876	24.1	2033	26.0	2373	4	
24.8	2364	25.1	2420	27.0	2609	31.5	3019	5	
32.4	3272	33.1	3344	35.4	3587	40.9	4115	6	
39.0	4331	39.6	4421	42.3	4727	48.3	5392	7	
47.0	5596	47.6	5708	50.9	6190	57.9	6919	8	
								3	10
								4	
25.6	2836	25.9	2909	28.2	3154	32.9	3686	5	
34.1	3744	35.0	3833	37.5	4132	43.4	4782	6	
41.0	4803	41.6	4910	44.5	5272	51.1	6059	7	
48.4	6068	48.9	6197	52.2	6635	59.8	7586	8	
								9	
69.6	9587	70.4	9728	75.2	10,372	85.4	11,774	10	
								4	12
								5	
36.8	4381	37.4	4492	40.3	4867	46.7	5683	6	
43.0	5440	43.8	5569	47.0	6007	54.1	6960	7	
51.2	6705	51.7	6856	55.6	7370	63.6	8487	8	
60.0	7377	60.8	7561	65.0	8095	74.2	9299	9	
71.4	10,174	72.3	10,387	77.5	11,107	88.1	12,675	10	
98.0	14,533	99.2	14,822	105.6	15,803	119.4	17,936	12	



H-FEET	T-INCHES	TB-INCHES	G BARS SIZE NO.	G BARS SPACE IN.	F BARS SIZE NO.	F BARS SPACE IN.
3	8	8	5	9½	4	12
4	8	8	5	9½	4	12
5	9	9	6	9½	4	11
6	10	10	7	10	4	6½
7	12	12	7	8½	5	7½
8	12	13	7	6½	6	8
9	12	14	7	7	6	7½
10	12	16	8	6½	8	10
12	12	20	9	7	8	8½



SECTION A - A



SECTION B - B

NOTE: For General Notes See Sheet B-20.1.1

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

RCB CULVERTS
TYPE II HEADWALLS

[signature]
CHIEF BRIDGE ENGR.

B-20.1.6 - (502)
ADOPTED 11/70 | REVISION

TYPE I HEADWALL DIMENSIONS AND REINFORCING STEEL

H = Height In Feet; h = All Wings Except B For 45° Skew

0° SKEW (Wings A & B)

H	h	AA & BB	CC & DD	C & D	E & K	F & L	G & M	J & N	G Bars Size	G Bars Spacing	F Bars Size	F Bars Spacing
3	6-7	4-0	4-2	8	1-4	0-10	2-1	3-4	4	12	4	12
4	7-7	5-0	5-8	8	1-6	1-2	2-10	3-10	4	12	4	12
5	8-7	6-2	6-2	8	1-9	1-3	3-1	4-4	4	12	4	12
6	9-7	7-2	6-8	8	1-11	1-4	3-4	4-10	4	10½	4	12
7	10-7	8-4	7-3	8	2-2	1-6	3-8	5-4	4	7	4	12
8	11-7	9-4	7-9	8	2-4	1-7	3-11	5-10	6	10½	4	11
9	12-7	10-5	8-3	9	2-6	1-8	4-2	6-4	6	9	4	9
10	13-7	11-6	8-10	10	2-9	1-9	4-5	6-10	6	7½	4	6½
12	15-7	13-7	9-11	12	3-2	2-0	5-0	7-10	7	7	5	6½

15° SKEW

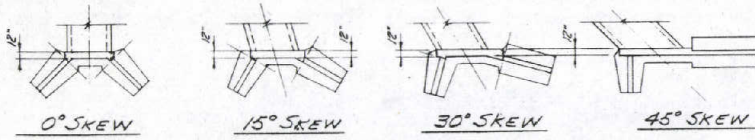
H	AA	BB	CC	DD	C	D	E & K	F	G	J & N	L	M	Wing A G Bars Size	Wing A G Bars Spacing	Wing A F Bars Size	Wing A F Bars Spacing	Wing B G Bars Size	Wing B G Bars Spacing	Wing B F Bars Size	Wing B F Bars Spacing
3	3-7	4-8	4-11	5-7	8	8	1-4	1-0	2-6	3-4	1-2	2-10	4	12	4	12	4	12	4	12
4	4-6	5-11	5-4	6-2	8	8	1-6	1-1	2-8	3-10	1-3	3-1	4	12	4	12	4	12	4	12
5	5-6	7-2	5-9	6-9	8	8	1-9	1-2	2-11	4-4	1-4	3-5	4	12	4	12	4	10	4	12
6	6-5	8-5	6-3	7-4	8	8	1-11	1-3	3-2	4-10	1-6	3-8	4	12	4	12	4	6½	4	12
7	7-6	9-9	6-9	8-0	8	8	2-2	1-4	3-5	5-4	1-7	4-0	4	8½	4	12	6	10	4	12
8	8-5	11-0	7-2	8-7	9	9	2-4	1-5	3-7	5-10	1-8	4-4	6	12	4	12	6	8	4	9½
9	9-4	12-3	7-7	9-2	9	10	2-6	1-6	3-10	6-4	1-10	4-7	6	10	4	10	7	9	4	8
10	10-4	13-6	8-1	9-11	9	12	2-9	1-7	4-1	6-10	2-0	5-0	6	8	4	8½	7	7½	4	6
12	12-3	15-11	9-1	11-4	11	15	3-2	1-10	4-7	7-10	2-3	5-8	7	7½	5	6½	7	6	5	6

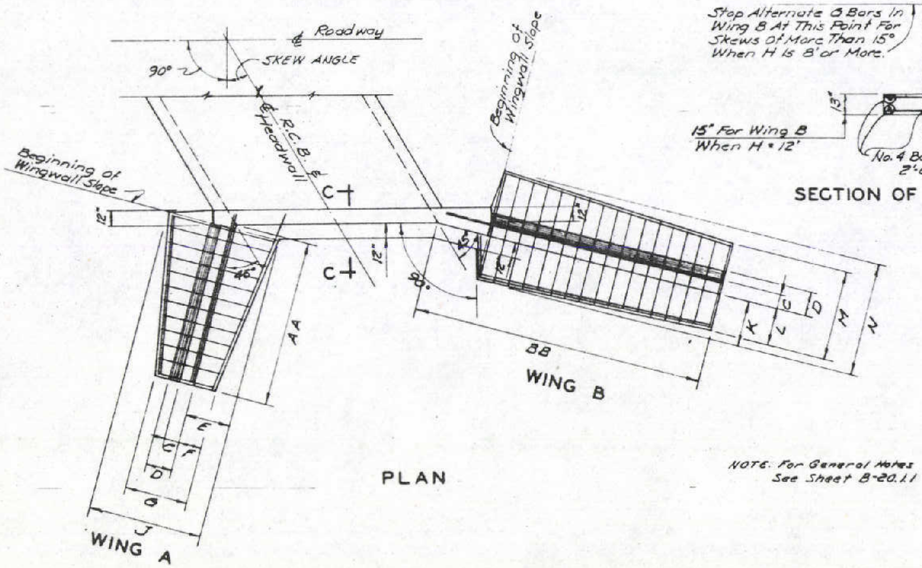
30° SKEW

H	AA	BB	CC	DD	C	D	E & K	F	G	J & N	L	M	Wing A G Bars Size	Wing A G Bars Spacing	Wing A F Bars Size	Wing A F Bars Spacing	Wing B G Bars Size	Wing B G Bars Spacing	Wing B F Bars Size	Wing B F Bars Spacing
3	3-4	5-10	4-8	6-2	8	8	1-4	0-11	2-4	3-4	1-3	3-4	4	12	4	12	4	12	4	12
4	4-3	7-5	5-2	6-11	8	8	1-6	1-0	2-7	3-10	1-6	3-10	4	12	4	12	4	8½	4	12
5	5-2	8-11	5-6	7-8	8	8	1-9	1-1	2-9	4-4	1-9	4-4	4	12	4	12	4	6½	4	12
6	6-1	10-6	5-11	8-4	8	8	1-11	1-2	3-0	4-10	1-8	4-10	4	12	4	12	6	12	4	12
7	7-0	12-2	6-5	9-3	9	9	2-2	1-4	3-3	5-4	1-10	5-4	4	10½	4	12	6	8½	4	10½
8	7-11	13-9	6-10	10-0	9	9	2-4	1-5	3-5	5-10	2-4	5-10	4	6	4	12	6	7	4	7½
9	8-10	15-3	7-3	10-9	9	12	2-6	1-6	3-8	6-4	2-6	6-4	5	7½	4	9	7	8	5	7
10	9-9	16-10	7-8	11-7	9	13	2-9	1-7	3-10	6-10	2-9	6-10	6	9	4	7½	7	6½	6	7½
12	11-6	19-11	8-7	13-3	11	16	3-2	1-9	4-4	7-10	3-2	7-10	7	9	5	7½	8	6½	6	7½

45° SKEW

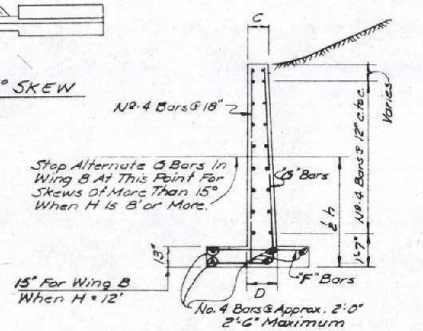
H	AA	BB	CC	DD	C	D	E & K & L	F	G	J & M & N	Wing B h	Wing B DD	Wing A G Bars Size	Wing A G Bars Spacing	Wing A F Bars Size	Wing A F Bars Spacing	Wing B G Bars Size	Wing B G Bars Spacing	Wing B F Bars Size	Wing B F Bars Spacing	H
3	3-4	8-4	4-7	6-7	8	8	1-4	0-11	2-4	3-4	6-7	6-7	4	12	4	12	4	12	4	12	3
4	4-2	10-5	5-0	7-7	8	8	1-6	1-0	2-6	3-10	7-7	7-7	4	12	4	12	5	9½	4	12	4
5	5-1	12-7	5-5	8-7	9	9	1-9	1-1	2-9	4-4	8-7	8-7	4	12	4	12	6	9½	4	11	5
6	5-11	14-8	5-10	9-7	10	10	1-11	1-2	2-11	4-10	9-7	9-7	4	12	4	12	7	10	4	6½	6
7	6-11	17-0	6-3	10-7	12	12	2-2	1-3	3-2	5-4	10-7	10-7	4	10½	4	12	7	8½	5	7½	7
8	7-9	19-1	6-8	11-7	12	12	2-4	1-4	3-4	5-10	11-7	11-7	4	7	4	12	7	6½	6	8	8
9	8-7	21-2	7-1	12-7	9	14	2-6	1-5	3-7	6-4	12-7	12-7	5	8	4	10	7	6	6	7½	9
10	9-6	23-4	7-6	13-7	9	16	2-9	1-6	3-9	6-10	13-7	13-7	6	9½	4	7½	8	6½	8	10	10
12	11-3	27-7	8-6	15-9	11	20	3-2	1-8	4-2	7-10	15-9	15-9	7	9	5	7	7	8	8	8½	12



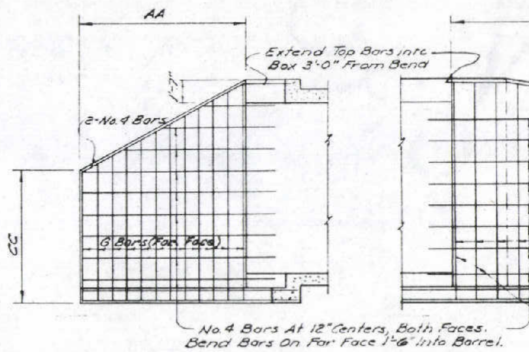


PLAN

NOTE: For General Notes See Sheet B-20.1.1

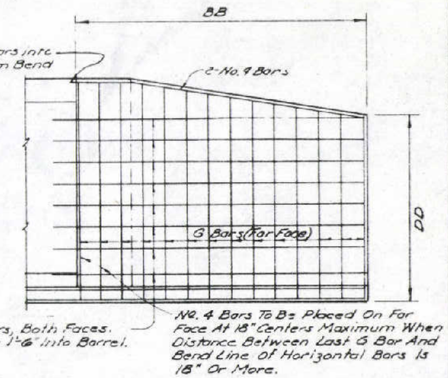


SECTION OF WINGS A AND B



SECTION WING A

NOTE: For Boxes With 0° Skew Both Wings Are As Shown For Wing A



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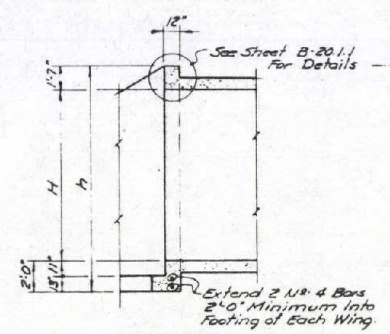
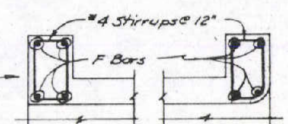


SECTION C-C



OUTLET INLET

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

RCB CULVERTS
TYPE I HEADWALLS

B-20.1.7-(502)

CHIEF BRIDGE ENGR. | ADOPTED 1/1/70 | REVISION

CUBIC YARDS OF CONCRETE AND POUNDS OF REINFORCING FOR TWO TYPE I HEADWALLS

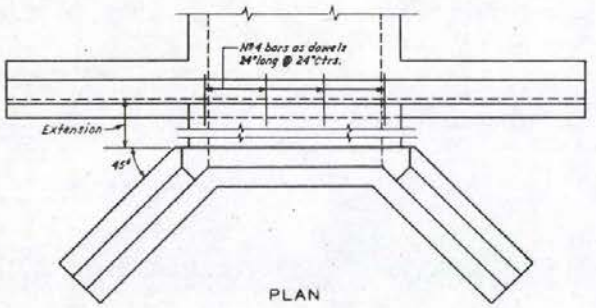
SPAN	HEIGHT	SINGLE BOX								DOUBLE BOX								TRIPLE BOX							
		0° SKEW		15° SKEW		30° SKEW		45° SKEW		0° SKEW		15° SKEW		30° SKEW		45° SKEW		0° SKEW		15° SKEW		30° SKEW		45° SKEW	
		CONC.	REINF.	CONC.	REINF.	CONC.	REINF.	CONC.	REINF.	CONC.	REINF.	CONC.	REINF.	CONC.	REINF.	CONC.	REINF.	CONC.	REINF.	CONC.	REINF.	CONC.	REINF.	CONC.	REINF.
5	3	5.6	393	6.9	476	7.2	563	8.9	739	7.7	508	8.5	597	9.5	700	11.8	910								
	4	7.6	609	8.0	644	9.4	778	11.6	946	9.7	726	10.1	767	12.0	912	14.6	1119	11.8	892	12.3	856	14.4	1045	17.6	1280
	5	9.6	705	10.2	782	11.8	942	15.0	1238	11.7	825	12.9	908	14.3	1085	18.0	1414	13.3	949	14.6	1030	16.8	1220	21.0	1578
6	3	6.0	418	6.8	504	7.6	595	9.4	779	8.3	600	9.2	699	10.3	817	12.7	1062								
	4	7.9	637	8.3	623	10.0	807	12.1	985	10.3	821	10.8	869	12.7	1032	15.5	1270	12.6	1009	13.2	1058	15.4	1243	18.8	1525
	5	9.9	730	10.6	809	12.2	974	15.4	1278	12.3	917	13.0	1009	15.0	1203	18.8	1546	14.7	1103	15.5	1193	17.7	1413	22.1	1823
	6	12.4	983	12.6	1106	15.5	1505	20.4	2158	14.8	1173	15.0	1310	18.3	1740	23.7	2449	17.2	1361	17.5	1502	21.0	1951	27.1	2708
	7	15.3	1400	14.0	1601	19.8	2155	26.5	3104																
7	3	6.3	442	7.1	532	8.0	626	9.9	820																
	4	8.3	665	8.7	702	10.4	839	12.6	1025																
	5	10.3	756	10.9	837	12.6	1006	15.9	1319																
	6	12.8	1011	12.9	1137	15.9	1544	20.8	2209																
	7	15.6	1832	16.3	1637	20.2	2199	27.0	3161																
8	3	6.7	467	7.5	559	8.4	658	10.4	861	7.8	617	10.7	1066	11.8	1109	14.5	1268								
	4	8.6	693	9.1	731	10.8	872	13.1	1065	11.8	1065	12.3	1078	14.3	1238	17.3	1475	14.9	1320	15.5	1345	17.8	1558	21.9	1858
	5	10.6	782	11.3	869	13.0	1038	16.9	1360	13.8	1137	14.5	1216	16.6	1405	20.6	1773	17.0	1514	17.8	1501	20.2	1720	25.0	2159
	6	13.1	1035	13.3	1169	16.3	1583	21.3	2261	16.4	1401	16.6	1525	19.9	1958	25.6	2676	19.6	1677	19.9	1814	23.6	2276	29.9	3065
	7	16.0	1468	16.7	1673	20.6	2242	27.5	3219	19.2	1834	21.0	2133	24.3	2620	31.8	3637	22.5	2107	24.4	2428	28.0	2946	36.1	4029
	8	17.9	1904	20.2	2234	24.2	2778	33.1	3938	21.2	2267	23.6	2552	27.9	3051	39.5	4359	24.5	2552	27.0	2856	31.7	3381	43.9	4753
10	3	7.3	515	8.2	612	9.2	721	11.4	942	11.2	1111	12.2	1227	13.6	1383	16.8	1739								
	4	9.3	749	9.8	789	11.6	936	14.1	1144	13.2	1348	13.8	1396	16.1	1608	19.6	1939								
	5	11.3	833	12.0	920	13.8	1101	17.4	1491	15.2	1434	16.1	1531	18.9	1770	23.0	2239	19.2	1876	20.1	1985	22.9	2274	28.5	2857
	6	13.8	1093	14.0	1233	17.1	1641	22.3	2345	17.8	1697	18.1	1775	21.7	2187	28.0	3165	21.8	2141	23.2	2219	26.3	2666	33.6	3786
	7	16.6	1528	17.9	1745	21.6	2329	28.9	3334	20.7	2135	21.6	2359	24.1	3006	34.1	4137	24.7	2582	25.8	2821	30.7	3519	39.8	4761
	8	18.6	1978	20.9	2314	25.0	2870	34.1	4054	22.7	2587	25.2	2935	29.7	3544	39.9	4890	26.8	3037	29.4	3309	34.9	4057	45.6	5486
	9	23.2	2117	25.4	2482	31.1	3244	41.4	4597																
	10	29.5	3352	31.6	3598	38.6	4397	51.7	5892	33.7	3967	36.0	4217	43.5	5077	57.6	6703	37.8	4422	40.3	4688	48.3	5598	63.5	7335
12	4	10.0	809	10.5	898	12.4	1001	15.1	1224	14.6	1732	15.2	1806	17.6	2090	21.5	2549								
	5	12.0	864	12.7	975	14.6	1165	18.4	1522	16.6	1815	17.5	1941	20.0	2247	24.9	2849								
	6	14.5	1198	14.7	1296	17.9	1738	23.3	2469	19.2	2084	19.6	2244	23.3	2817	32.9	3799	23.9	2744	24.4	2922	28.7	3576	36.5	4733
	7	17.3	1591	18.1	1817	22.2	2416	29.4	3499	22.1	2531	23.0	2775	27.7	3497	38.1	4782	26.8	3195	27.9	3460	33.1	4261	42.8	5719
	8	18.3	1945	21.8	2404	25.8	2962	35.1	4171	23.1	2889	26.7	3396	31.3	4068	41.8	5506	27.8	3559	31.6	4094	36.8	4830	48.6	6446
	9	23.9	2181	26.1	2553	31.9	3327	42.4	4704	28.7	3123	31.1	3522	37.5	4414	49.2	6042	33.5	3796	36.1	4218	43.0	5191	56.1	6980
	10	30.2	3429	32.3	3680	39.9	4988	52.7	6003	35.0	4373	37.9	4646	45.1	5580	59.6	7344	39.9	5049	42.8	5341	50.7	6353	66.5	8289
	12	42.8	5137	47.2	5372	56.9	6078	80.1	8129	47.8	6087	52.3	6390	62.2	7741	82.2	9970	52.7	6768	57.5	7045	67.9	7930	94.2	10,460

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

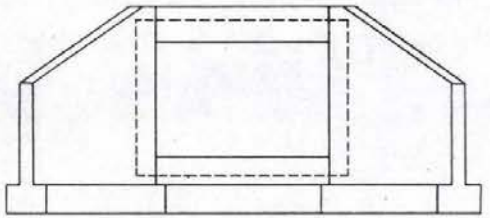
ESTIMATE OF QUANTITIES
TYPE I HEADWALLS

W. Glenn Hall
CHIEF BRIDGE ENGR.

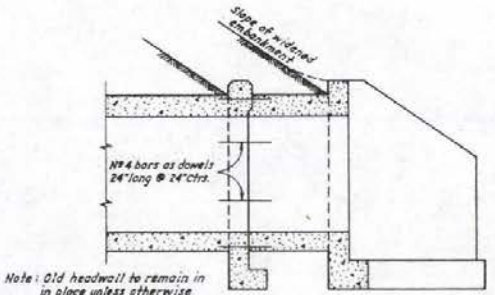
B-20.1.8-(502)
ADOPTED 11/70 REVISION



PLAN

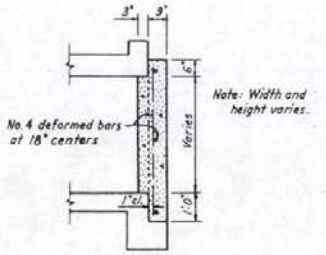


ELEVATION



PART LONGITUDINAL SECTION

R C B CULVERT EXTENSION



METHOD OF PLUGGING RCB'S

GENERAL NOTES

1. All concrete shall be Class A or AA.
2. Reinforcing steel shall be deformed bars wired tightly at all intersections and embedded at least 1" clear of concrete surface except as noted.
3. Footings shown are of minimum depth and shall be extended if soil is unstable.
4. Dowel holes shall be drilled to full depth and dowels carefully grouted in place with a thin neat cement mortar.

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

METHOD OF EXTENDING R C B CULVERTS

M. Adam Dahlberg
CHIEF BRIDGE ENGR.

B-20.1.9-(601)
ADOPTED: 1/1/70
REVISION

CURVATURE CHART - 1 TO 6 BATTER

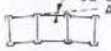
THIS DATA, OMITTING HEIGHT RESTRICTIONS, CAN BE USED FOR VERTICAL WALLS

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'
METHOD 1	DEFLECTION ANGLE					
METHOD 2	SHORT STRINGER					
METHOD 3						
BINS/EA SHORT PANEL*	2 3 4 6 9 12	2 3 4 6 9 12	3 4 6 9 12	3 4 6 8 12	3 4 6 8 12	3 4 6 8 12
RADIUS IN 100 FT	2 4 6 8 10 14 18	4 6 8 10 14 20 26	6 8 10 12 16 20 30 35	7 10 12 14 16 20 25 30 40	8 10 14 20 30 40 50	8 16 24 32 40 48 56
DEGREE OF CURVE	25 20 15 10 5 3	15 10 5 2	10 5 2	8 5 2	7 5 1	

HEIGHT IN FEET: 4, 8, 12, 16, 20, 24, 28, 32, 36

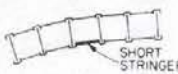
EXAMPLE - To build a Design "D" wall 20.00' high on a 1400' radius curve, use Method 2 with one set of short stringers in each group of five panel sections.

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.

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.

NOTE - Use Chart X and Table Y shown on Construction Details B-21.1.2 to determine base width to height ratio for the various surcharges on both vertical and battered walls.

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.

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		Sht		16 Ga		14 Ga		12 Ga		10 Ga		Std	
	Std	Short	Std	Short	Std	Short	Std	Short	Str		Std	Short	Std	Short	Std	Short	Std	Short	Str	
FEET	9.5'	9.0'	9.5'	9.0'	9.5'	9.0'	9.5'	9.0'	Str		9.5'	9.0'	9.5'	9.0'	9.5'	9.0'	9.5'	9.0'	Str	
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	6	1						1		6	5	1						1	
10.67	6	6	2						1		6	6	2						1	
12.00	6	6	3	1					1		6	6	3	1					1	
13.33	6	6	3	2	1				1		6	6	3	2	1				1	
14.67	6	6	3	3	2				1		6	6	3	3	2				1	
16.00	6	6	4	3	3				1		6	6	3	4	3				1	
17.33	6	6	4	3	4	1			1		6	6	3	4	4	1			1	
18.67	6	6	4	3	5	2			1		6	6	3	4	5	2			1	
20.00	6	6	4	3	5	3	1		1		6	6	3	4	5	3	1		1	
21.33	6	6	4	3	5	4	2		1		6	6	3	4	5	4	2		1	
22.67	6	6	4	3	5	5	3		1		6	6	3	4	5	5	3		1	
24.00 *	6	6	4	3	6	5	3		1		6	6	3	4	5	6	3		1	
25.33	6	6	4	3	7	5	3		1		6	6	3	4	5	7	3		1	
26.67	6	6	4	3	7	5	3	1	1		6	6	3	4	5	7	3	1	1	
28.00	6	6	4	3	7	5	3	2	1		6	6	3	4	5	7	3	2	1	
29.33	6	6	4	3	7	5	3	3	1		6	6	3	4	5	7	3	3	1	
30.67	6	6	4	3	7	5	4	3	1		6	6	3	4	5	7	3	4	1	
32.00	6	6	4	3	7	5	5	3	1		6	6	3	4	5	7	3	5	1	
33.33	6	6	4	3	7	5	6	3	1		6	6	3	4	5	7	3	6	1	
34.67	6	6	4	3	7	5	7	3	1		6	6	3	4	5	7	3	7	1	
36.00	6	6	4	3	7	5	8	3	1		6	6	3	4	5	7	3	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.

* Start 8 ga. panels in front of wall at 24.00 foot wall height.

UNITS REQUIRED PER TRANSVERSE SECTION

WALL HEIGHT	BEARING PLATE	FRONT COLUMN HEIGHT IN FEET				REAR COLUMN HEIGHT IN FEET				Col. Length in Feet	Column Splice	Column Cap	SPACERS Gage & Length						BOT SPACER Gage & Length						UNITS REQUIRED PER PANEL SECTION							UNITS REQUIRED PER PANEL SECTION						
																									STRINGERS					Str	WALL HEIGHT	STRINGERS					Str	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	14Ga	12 Ga	10Ga	8 Ga	Str	FEET	16 Ga	14Ga	12 Ga	10Ga	Str	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'	9.5'		9.5'	9.5'	9.5'	9.5'	9.5'	
4.00	2	4.00			4.00	1.33			1.33	5.33		1													3					1	4.00	1				1	4.00
5.33	2	5.33			5.33	2.67			2.67	8.00		1	1												4					1	5.33	2				1	5.33
6.67	2	6.67			6.67	4.00			4.00	10.67		1	2												5					1	6.67	3				1	6.67
8.00	2	8.00			8.00	5.33			5.33	13.33		1	3												6					1	8.00	4				1	8.00
9.33	2	9.33			9.33	6.67			6.67	16.00		1	4												6	1				1	9.33	5				1	9.33
10.67	2	10.67			10.67	8.00			8.00	18.67		1	5	5					1	1					6	2				1	10.67	6				1	10.67
12.00	2	12.00			12.00	9.33			9.33	21.33		1		6						1					6	3				1	12.00	6	1			1	12.00
13.33	2	8.00	5.33		13.33	10.67			10.67	24.00	1	1		7						1					6	3	1			1	13.33	6	2			1	13.33
14.67	2	8.00	6.67		14.67	12.00			12.00	26.67	1	1		8	8					1	1				6	3	2			1	14.67	6	3			1	14.67
16.00	2	8.00	8.00		16.00	8.00	5.33		13.33	29.33	2	1		9	9					1	1				6	3	3			1	16.00	6	4			1	16.00
17.33	2	12.00	5.33		17.33	8.00	6.67		14.67	32.00	2	1		10	10					1	1				6	3	4			1	17.33	6	4	1		1	17.33
18.67	2	12.00	6.67		18.67	8.00	8.00		16.00	34.67	2	1			11	11					1	1			6	3	5			1	18.67	6	4	2		1	18.67
20.00	2	12.00	8.00		20.00	12.00	5.33		17.33	37.33	2	1			12	12					1	1			6	3	5	1		1	20.00	6	4	3		1	20.00
21.33	2	12.00	9.33		21.33	12.00	6.67		18.67	40.00	2	1			13	13					1	1			6	3	5	2		1	21.33	6	4	4		1	21.33
22.67	2	12.00	10.67		22.67	12.00	8.00		20.67	42.67	2	1				14	14					1	1		6	3	5	3		1	22.67	6	4	5		1	22.67
24.00	2	12.00	12.00		24.00	12.00	9.33		21.33	45.33	2	1				15	15					1	1		6	3	5	3	1	1	24.00	6	4	6		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	16					1	1		6	3	5	3	2	1	25.33	6	4	7		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	17					1	1		6	3	5	3	3	1	26.67	6	4	7	1	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		6	3	5	3	4	1	28.00	6	4	7	2	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		6	3	5	3	5	1	29.33	6	4	7	3	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		6	3	5	3	6	1	30.67	6	4	7	4	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	6	3	5	3	7	1	32.00	6	4	7	5	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	6	3	5	3	8	1	33.33	6	4	7	6	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	6	3	5	3	9	1	34.67	6	4	7	7	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	6	3	5	3	10	1	36.00	6	4	7	8	1	36.00

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

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

NOTE - For Construction Details See B-21.1.2

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

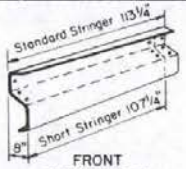
DESIGN DATA FOR METAL RETAINING WALL

W. Glenn Orbell
CHIEF BRIDGE ENGR.

B-21.1.1 -(612)
ADOPTED: 8/69
REVISION

Surcharge / Batter	Level No Live Load	With Superimposed Load
Wall On 1:6 Batter	7' ①	5' ②
Wall Vertical	7' ③	5' ④

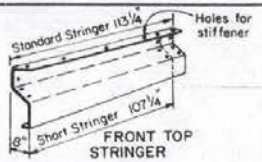
① Curve number. TABLE Y



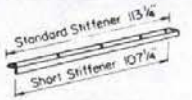
FRONT INTERMEDIATE STRINGER

COLUMN SPLICE PLATE 10 GA.

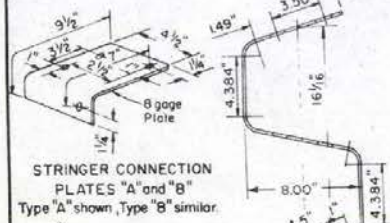
COLUMN CAP-12 GA



FRONT TOP STRINGER

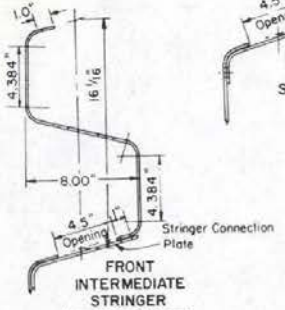


STRINGER STIFFENER-8GA



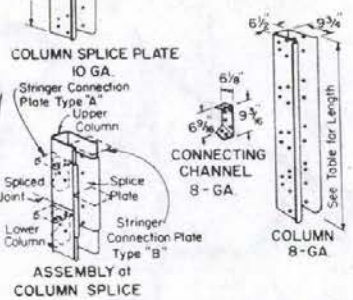
STRINGER CONNECTION PLATES "A" and "B"
Type "A" shown, Type "B" similar.

FRONT TOP STRINGER



FRONT INTERMEDIATE STRINGER
(Except Top Stringer)

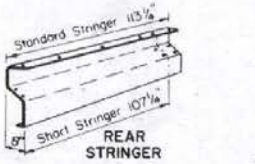
CHART X



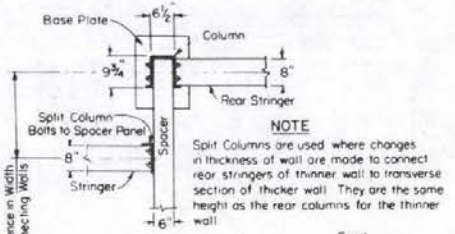
ASSEMBLY at COLUMN SPLICE

CONNECTING CHANNEL 8-GA

COLUMN 8-GA



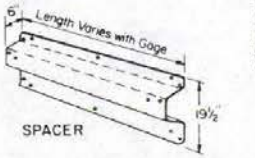
REAR STRINGER



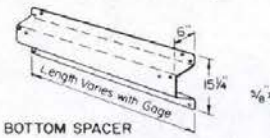
NOTE

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

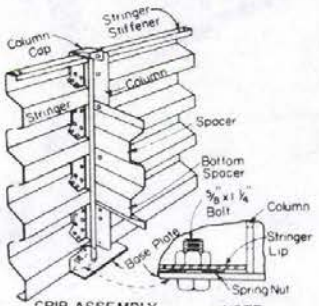


SPACER



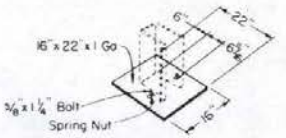
BOTTOM SPACER

NOTE - See Table on Sheet 1 for Gage and Length

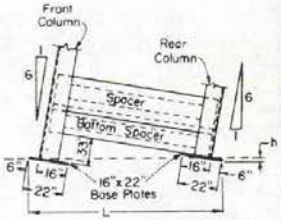


CRIB ASSEMBLY FRONT COLUMN
Rear Column Similar

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



BASE PLATE ARRANGEMENT



DETAIL - BASE PLATE PLACEMENT

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, with live load, wall height 18 ft. These conditions are found as (2) in table, in chart, line (2) intercepts the 18-ft. height line about midway of Type "C" which has a base width of 9.9 feet

WALL WIDTH / TYPE	h	L
"A"	* 3"	6'-7⅜"
"B"	1⅜"	8'-9⅞"
"C"	5⅜"	10'-11⅜"
"D"	10⅜"	13'-2⅛"
"E"	14⅝"	15'-4⅝"
"F"	18¾"	17'-8½"

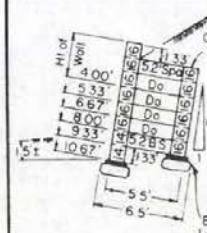
* NOTE - Distance "h" for Type "A" is a Minus Quantity --- that is, Front Column Base is LOWER than Rear Column Base

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

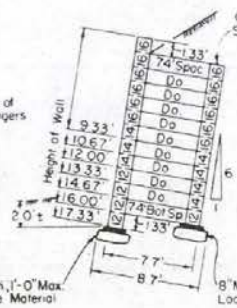
GENERAL NOTES

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

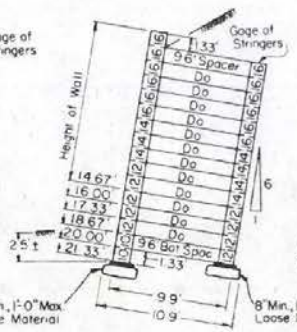
For Design Data see 8-21.1.1



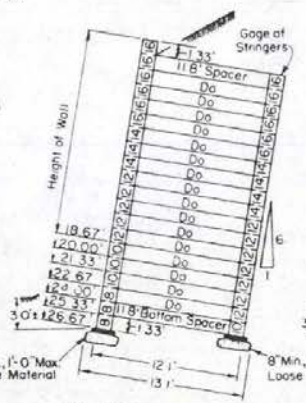
TYPE "A"



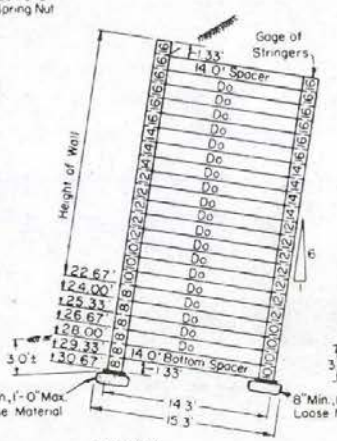
TYPE "B"



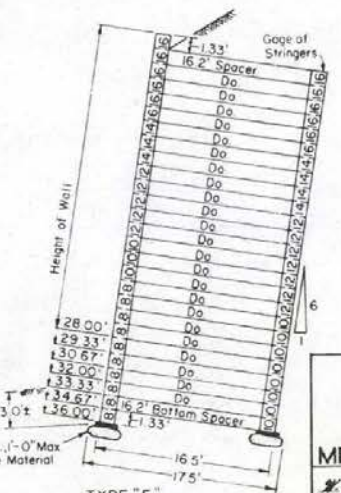
TYPE "C"



TYPE "D"



TYPE "E"



TYPE "F"

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

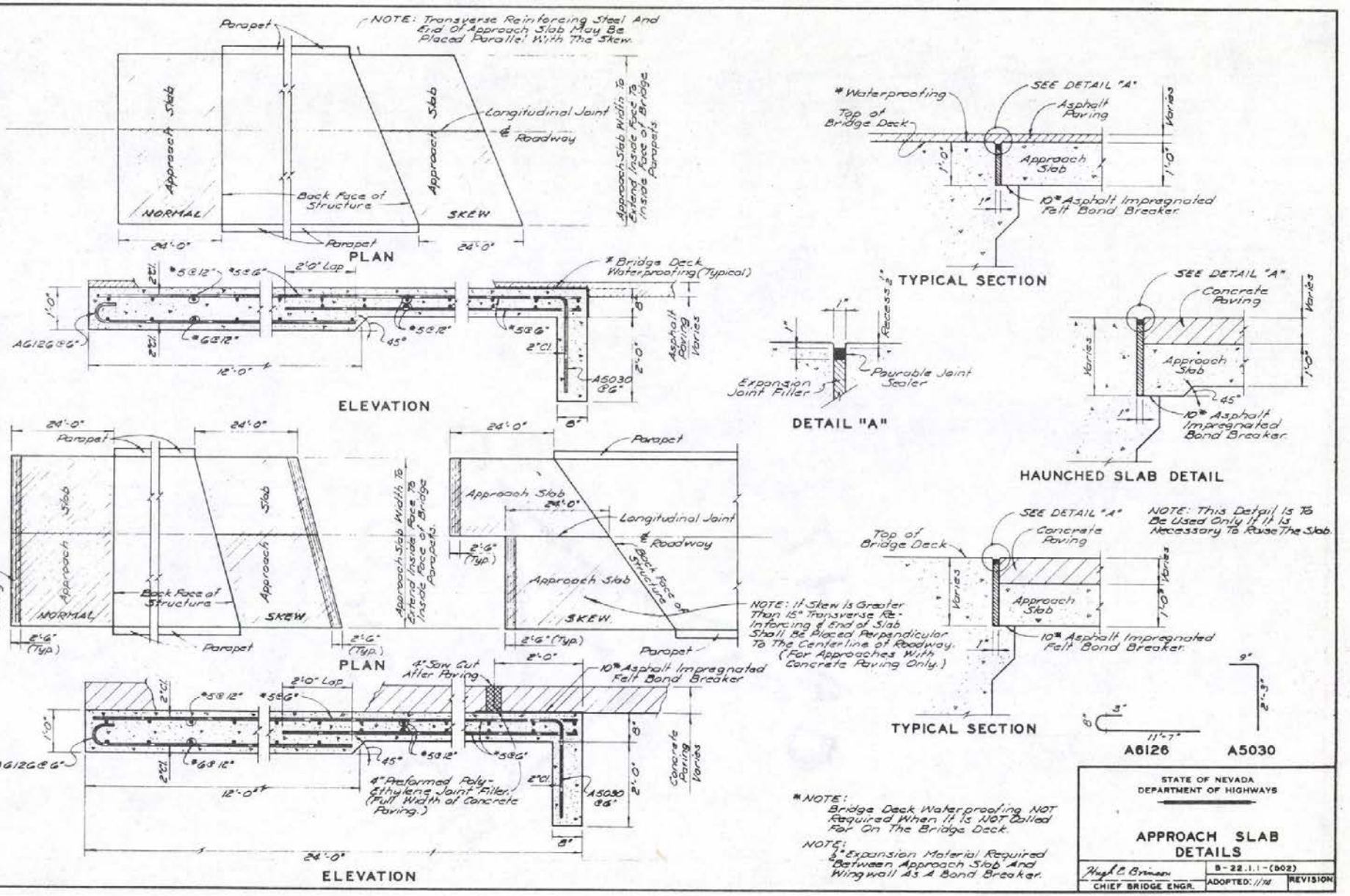
CONSTRUCTION DETAILS FOR METAL RETAINING WALL

B-21.1.2-(812)

W. Alan Cobb
CHIEF BRIDGE ENGR.

ADOPTED: 1/89 REVISION

811

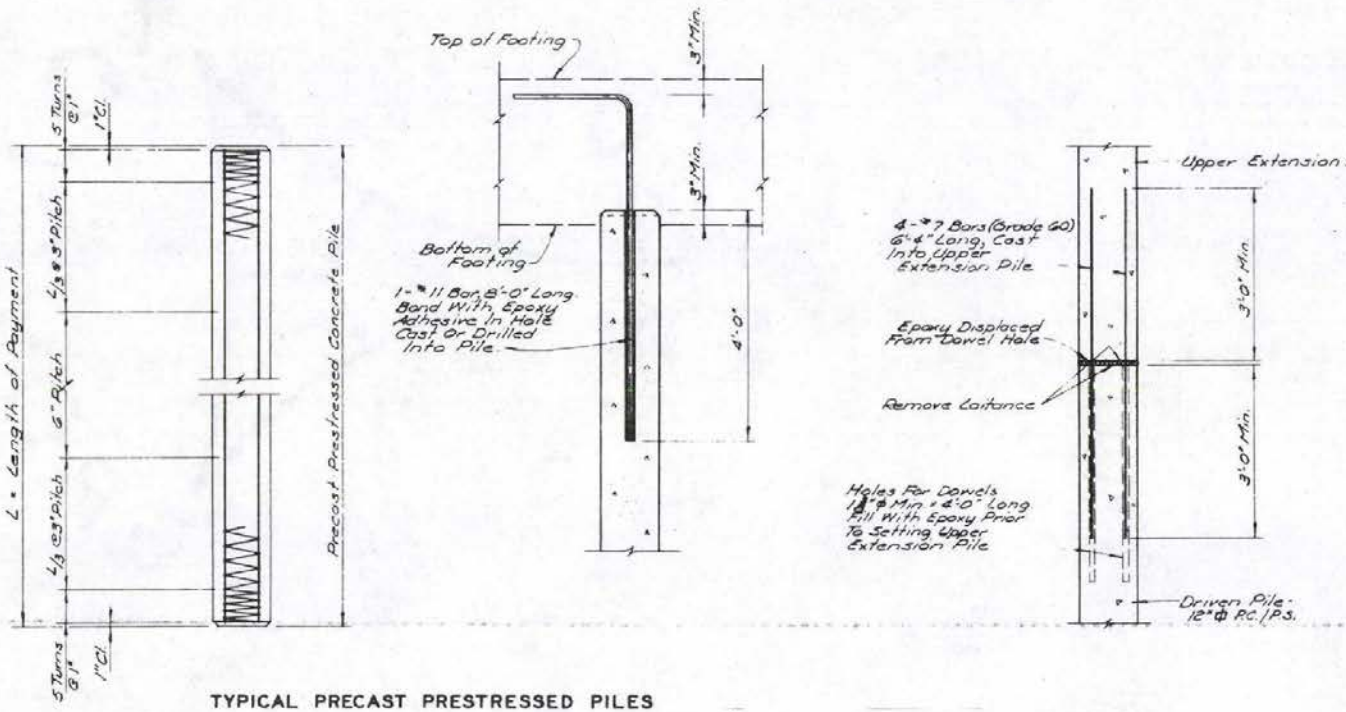


STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

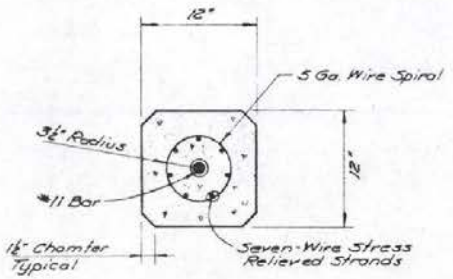
APPROACH SLAB DETAILS

Hugh C. Brinson	B-22.1.1-(802)	
CHIEF BRIDGE ENGR.	ADOPTED: 1/78	REVISION

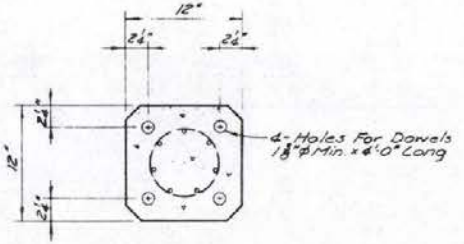
B12



TYPICAL PRECAST PRESTRESSED PILES



SECTION



PILE SPLICE DETAILS

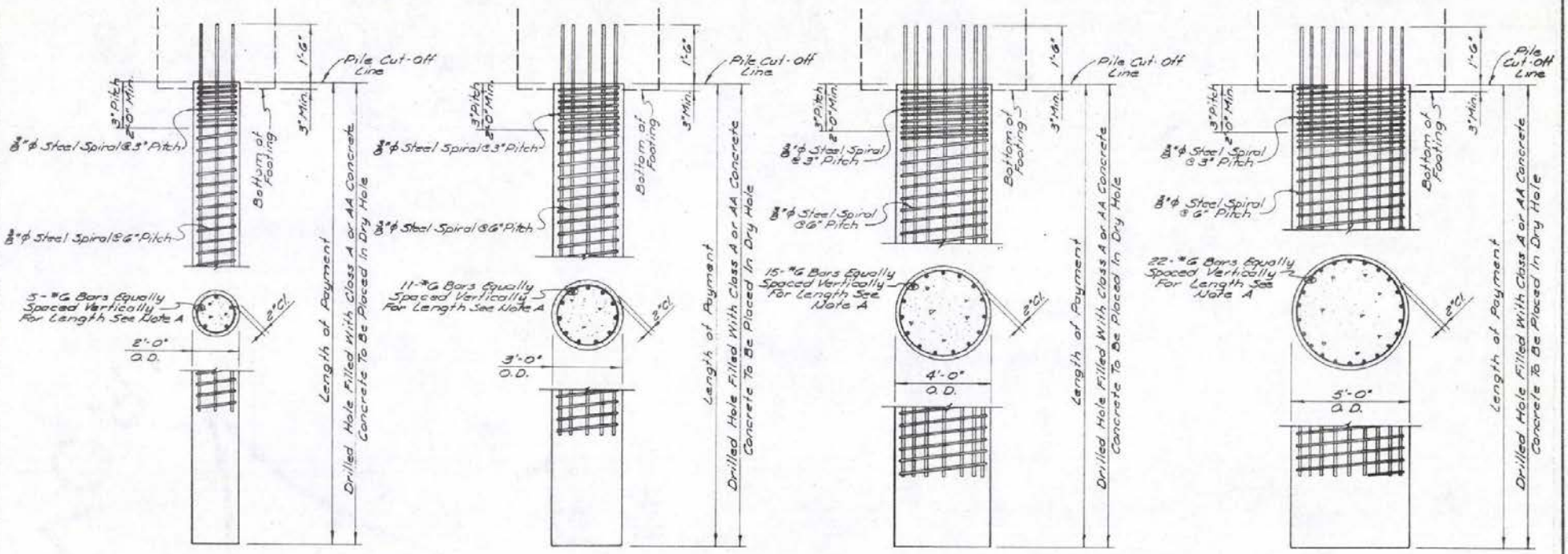
— GENERAL NOTES —

1. AASHO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES 1969 EDITION, INTERIM SPECIFICATIONS AASHO 1971 - PRESTRESSED CONCRETE.
2. THE UNIT PRESTRESS AFTER LOSSES SHALL BE NOT LESS THAN 700 p.s.i.
3. CONCRETE STRENGTH: f'_{ci} = 4,000 p.s.i.
   f'_c = 6,000 p.s.i.
4. PRESTRESSING REINFORCEMENT: SEVEN-WIRE STRESS RELIEVED STRANDS CONFORMING TO THE REQUIREMENTS OF ASTM DESIGNATION A416 SHALL BE USED.
5. STRANDS TO BE BURNED FLUSH.
6. CONCRETE MIX: ALL CONCRETE IN PILES AND PILE EXTENSIONS SHALL CONTAIN NOT LESS THAN 6 SACKS OF CEMENT PER CUBIC YARD. IF THE CLEARANCE TO ANY STEEL FROM THE SURFACE OF THE CONCRETE IS INCREASED TO 3", 7 SACKS OF CEMENT PER CUBIC YARD MAY BE USED.

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

PRECAST PRESTRESSED CONCRETE PILE DETAILS

Hugh E. Briare	B-23.1.1-(508)	
CHIEF BRIDGE ENGR.	ADOPTED: 1/74	REVISION



2'-0" DIAMETER PILES

3'-0" DIAMETER PILES

4'-0" DIAMETER PILES

5'-0" DIAMETER PILES

NOTE A: THE #6 BARS SHALL EXTEND TO:

1) 12" - 0" BELOW THE LOWEST OF THE FOLLOWING:

   A) BOTTOM OF FOOTING.

   B) TOP OF FINAL GROUND SURFACE.

   C) TOP OF ORIGINAL GROUND SURFACE WHER HOLES ARE DRILLED THROUGH EMBANKMENT CONSTRUCTED BY CONTRACTOR.

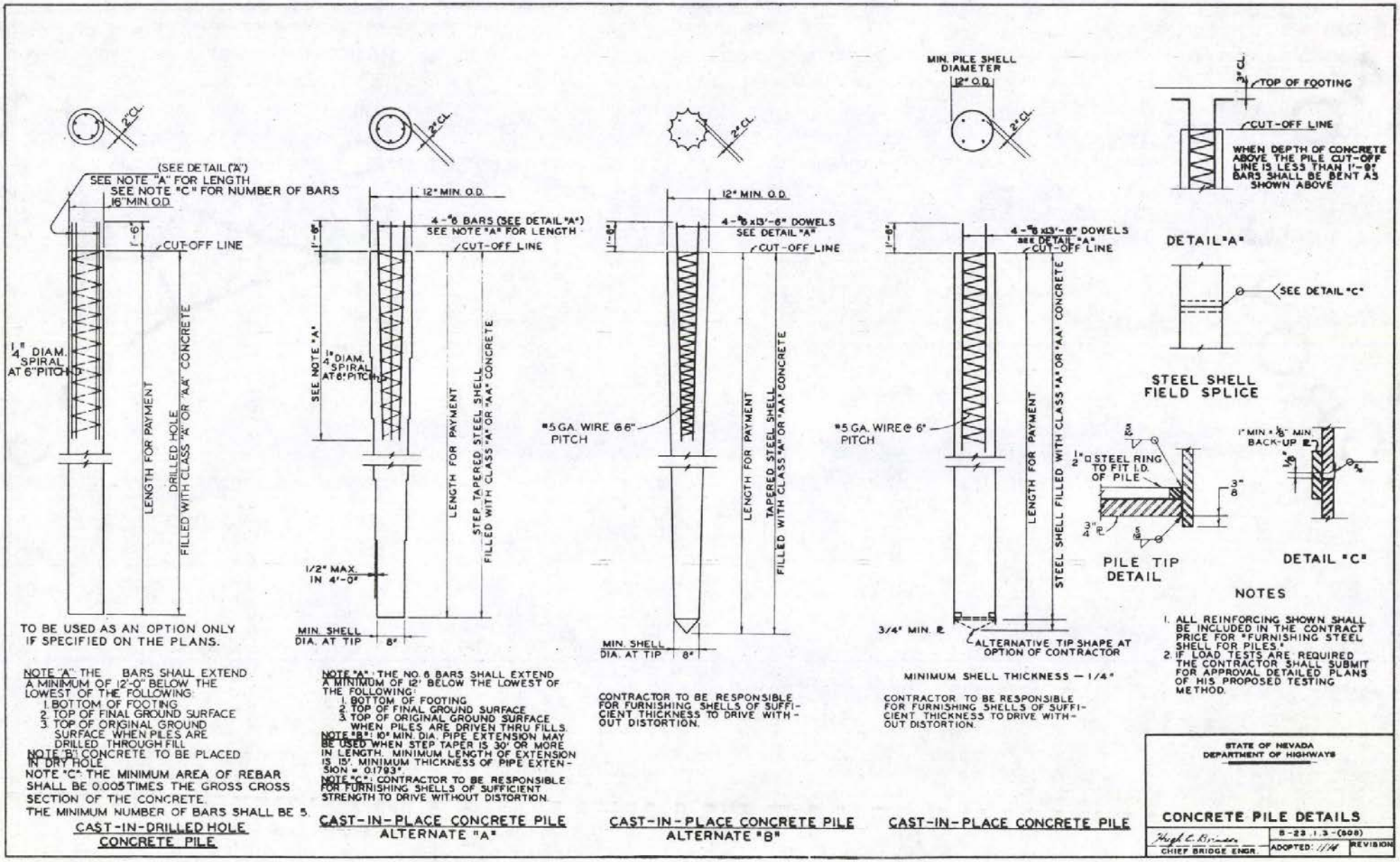
2) TO THE ELEVATION SHOWN ON THE PLANS OR SPECIFIED IN THE SPECIAL PROVISIONS.

NOTE B: ALL BARS EXTENDED INTO SLAB OR FOOTING SHALL BE HOOKED AS REQUIRED TO PROVIDE 2" MINIMUM CLEARANCE.

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

CAST-IN-DRILLED HOLE CONCRETE PILE DETAILS

Hugh E. Brinson	B-23.1.2-(506)	
CHIEF BRIDGE ENGR.	ADOPTED: 1/74	REVISION



NOTE "A": THE BARS SHALL EXTEND A MINIMUM OF 12'-0" 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 DRILLED THROUGH FILL

NOTE "B": CONCRETE TO BE PLACED IN DRY HOLE

NOTE "C": THE MINIMUM AREA OF REBAR SHALL BE 0.005 TIMES THE GROSS CROSS SECTION OF THE CONCRETE. THE MINIMUM NUMBER OF BARS SHALL BE 5.

CAST-IN-DRILLED HOLE CONCRETE PILE

NOTE "A": 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 THRU FILLS

NOTE "B": 10" MIN. DIA. PIPE EXTENSION MAY BE USED WHEN STEP TAPER IS 30' OR MORE IN LENGTH. MINIMUM LENGTH OF EXTENSION IS 15'. MINIMUM THICKNESS OF PIPE EXTENSION = 0.1793".

NOTE "C": CONTRACTOR TO BE RESPONSIBLE FOR FURNISHING SHELLS OF SUFFICIENT STRENGTH TO DRIVE WITHOUT DISTORTION.

CAST-IN-PLACE CONCRETE PILE
ALTERNATE "A"

CONTRACTOR TO BE RESPONSIBLE FOR FURNISHING SHELLS OF SUFFICIENT THICKNESS TO DRIVE WITHOUT DISTORTION.

CAST-IN-PLACE CONCRETE PILE
ALTERNATE "B"

MINIMUM SHELL THICKNESS — 1/4"

CONTRACTOR TO BE RESPONSIBLE FOR FURNISHING SHELLS OF SUFFICIENT THICKNESS TO DRIVE WITHOUT DISTORTION.

CAST-IN-PLACE CONCRETE PILE

NOTES

1. ALL REINFORCING SHOWN SHALL BE INCLUDED IN THE CONTRACT PRICE FOR "FURNISHING STEEL SHELL FOR PILES."
2. IF LOAD TESTS ARE REQUIRED THE CONTRACTOR SHALL SUBMIT FOR APPROVAL DETAILED PLANS OF HIS PROPOSED TESTING METHOD.

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

CONCRETE PILE DETAILS

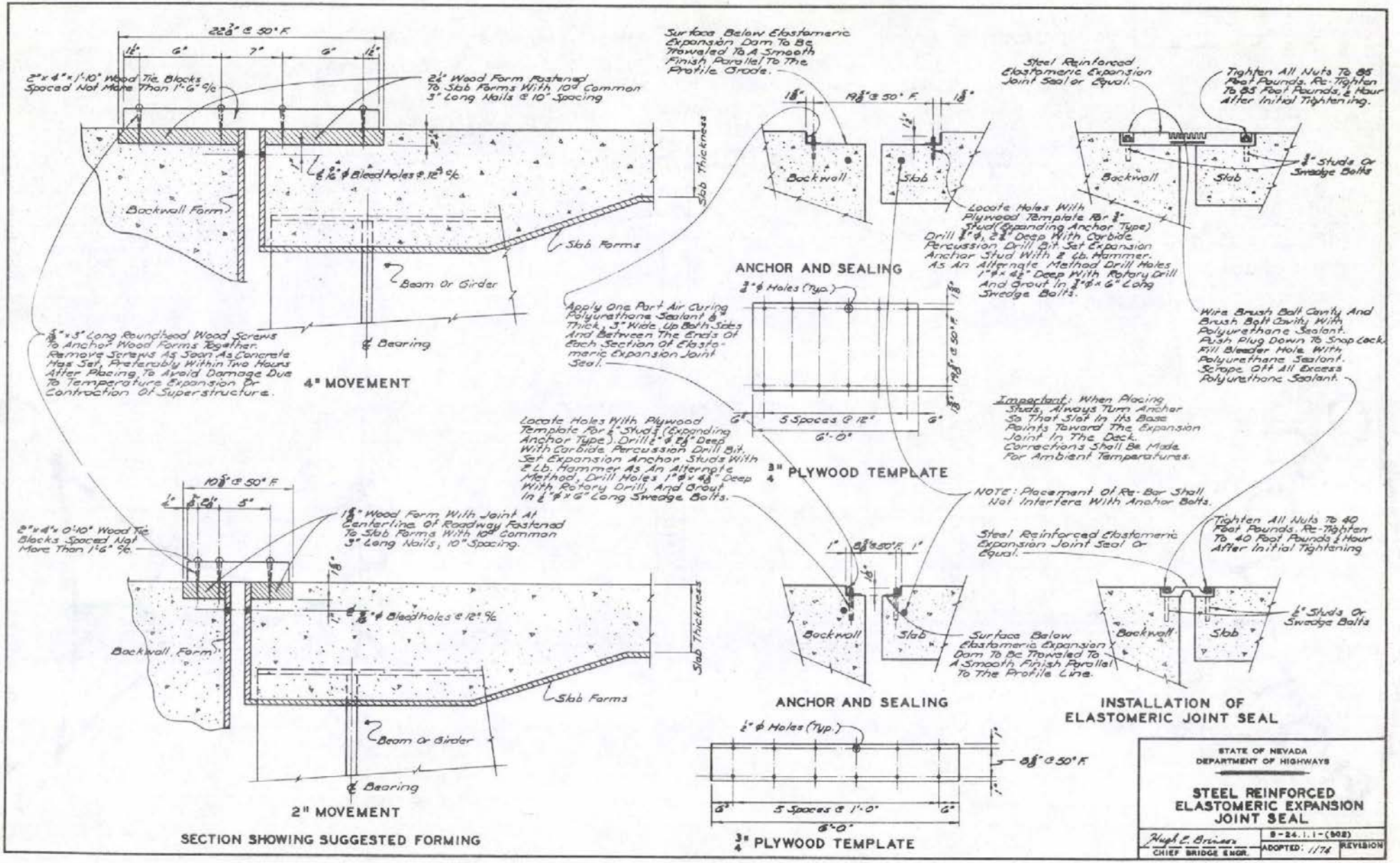
B-23.13-(508)

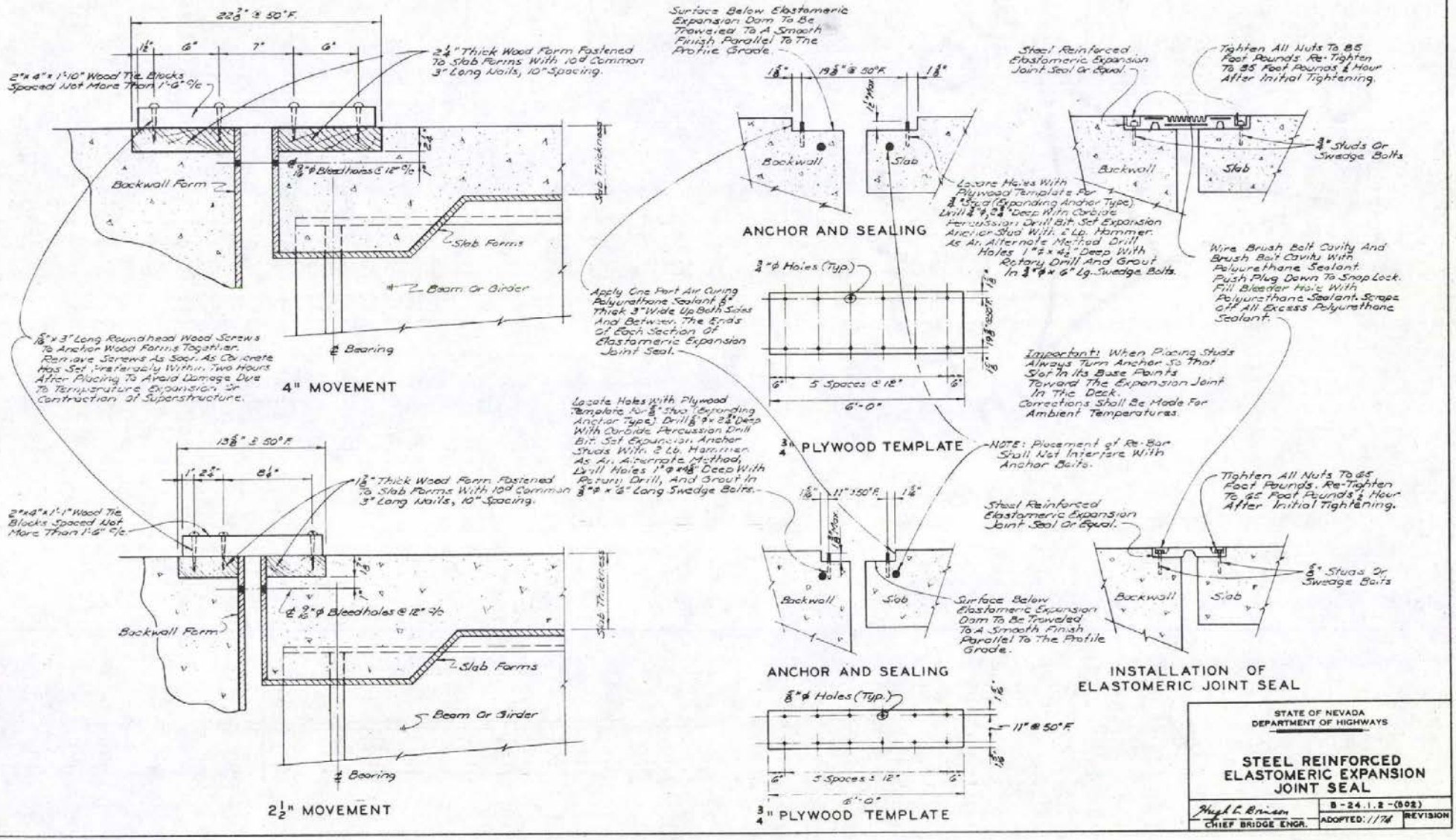
Hugh C. Bruner
CHIEF BRIDGE ENGR.

ADOPTED: 11/14

REVISION

815


22 3/8" @ 50° F.
1'-6"
7"
6"
1'-6"
2"x4"x1'-10" Wood Tie Blocks Spaced Not More Than 1'-6" c/c
2 1/2" Wood Form Fastened To Slab Forms With 10d Common 3" Long Nails @ 10" Spacing
2'-6"
1" ∅ Bleed Holes @ 12" c/c
Backwall Form
Slab Thickness
Slab Forms
Beam Or Girder
℄ Bearing
5/8"x3" Long Roundhead Wood Screws To Anchor Wood Forms Together. Remove Screws As Soon As Concrete Has Set, Preferably Within Two Hours After Placing, To Avoid Damage Due To Temperature Expansion Or Contraction Of Superstructure.
4" MOVEMENT
Surface Below Elastomeric Expansion Dam To Be Troweled To A Smooth Finish Parallel To The Profile Grade.
1 5/8"
19 3/8" @ 50° F.
1 5/8"
1 1/2"
Backwall
Slab
Steel Reinforced Elastomeric Expansion Joint Seal or Equal.
Tighten All Nuts To 85 Foot Pounds. Re-Tighten To 85 Foot Pounds, 1 Hour After Initial Tightening.
3/4" Studs Or Swedge Bolts
Locate Holes With Plywood Template For 3/4" Stud (Expanding Anchor Type) Drill 3/4" ∅, 2 3/4" Deep With Carbide Percussion Drill Bit. Set Expansion Anchor Stud With 2 Lb. Hammer. As An Alternate Method Drill Holes 1" ∅ x 4 1/2" Deep With Rotary Drill And Grout In 3/4" ∅ x 6" Long Swedge Bolts.
ANCHOR AND SEALING
3/4" ∅ Holes (Typ.)
1 5/8"
19 3/8" @ 50° F.
1 5/8"
Apply One Part Air Curing Polyurethane Sealant 1/8 Thick, 3" Wide Up Both Sides And Between The Ends Of Each Section Of Elastomeric Expansion Joint Seal.
6"
5 Spaces @ 12"
6"
6'-0"
Wire Brush Bolt Cavity And Brush Bolt Cavity With Polyurethane Sealant. Push Plug Down To Snap Lock. Fill Bleeder Hole With Polyurethane Sealant. Scrape Off All Excess Polyurethane Sealant.
Important: When Placing Studs, Always Turn Anchor So That Slot In Its Base Points Toward The Expansion Joint In The Deck. Corrections Shall Be Made For Ambient Temperatures.
Locate Holes With Plywood Template For 3/4" Stud (Expanding Anchor Type). Drill 2" ∅ 2 3/4" Deep With Carbide Percussion Drill Bit. Set Expansion Anchor Studs With 2 Lb. Hammer As An Alternate Method, Drill Holes 1" ∅ x 4 1/2" Deep With Rotary Drill, And Grout In 3/4" ∅ x 6" Long Swedge Bolts.
3/4" PLYWOOD TEMPLATE
NOTE: Placement Of Re-Bar Shall Not Interfere With Anchor Bolts.
10 3/8" @ 50° F.
1'
5"
2"x4"x 0'-10" Wood Tie Blocks Spaced Not More Than 1'-6" c/c.
1 5/8" Wood Form With Joint At Centerline Of Roadway Fastened To Slab Forms With 10d Common 3" Long Nails, 10" Spacing.
1'-6"
1" ∅ Bleedholes @ 12" c/c
Backwall Form
Slab Thickness
Slab Forms
Beam Or Girder
℄ Bearing
2" MOVEMENT
SECTION SHOWING SUGGESTED FORMING
1"
8 3/8" @ 50° F.
1"
1'-6"
Backwall
Slab
Surface Below Elastomeric Expansion Dam To Be Troweled To A Smooth Finish Parallel To The Profile Line.
Steel Reinforced Elastomeric Expansion Joint Seal Or Equal.
Tighten All Nuts To 40 Foot Pounds. Re-Tighten To 40 Foot Pounds 1 Hour After Initial Tightening
1" Studs Or Swedge Bolts
ANCHOR AND SEALING
INSTALLATION OF ELASTOMERIC JOINT SEAL
1" ∅ Holes (Typ.)
8 3/8" @ 50° F.
1"
1"
6"
5 Spaces @ 1'-0"
6"
6'-0"
3/4" PLYWOOD TEMPLATE
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS
STEEL REINFORCED ELASTOMERIC EXPANSION JOINT SEAL
Hugh E. Briner
CHIEF BRIDGE ENGR.
B-24.1.1-(502)
ADOPTED: 1/74
REVISION



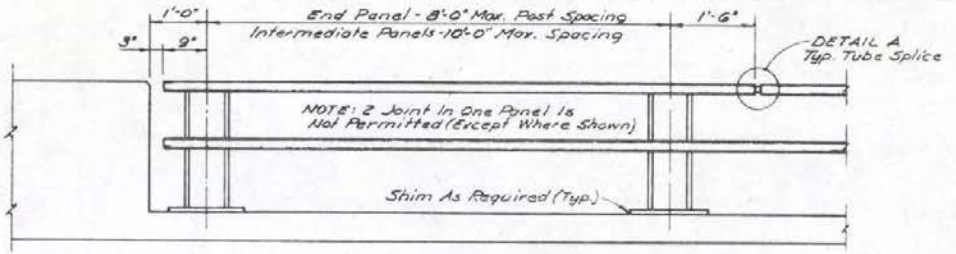
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

STEEL REINFORCED ELASTOMERIC EXPANSION JOINT SEAL

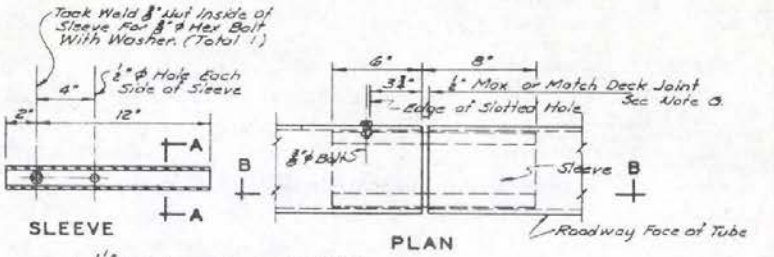
Hugh L. Benson
CHIEF BRIDGE ENGR.

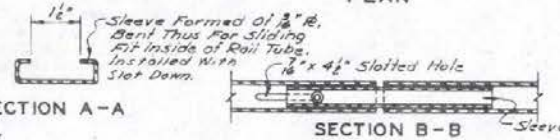
B-24.1.2-(502)
ADOPTED: 1/74
REVISION

B17



ELEVATION





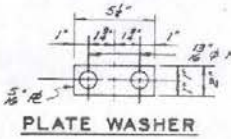
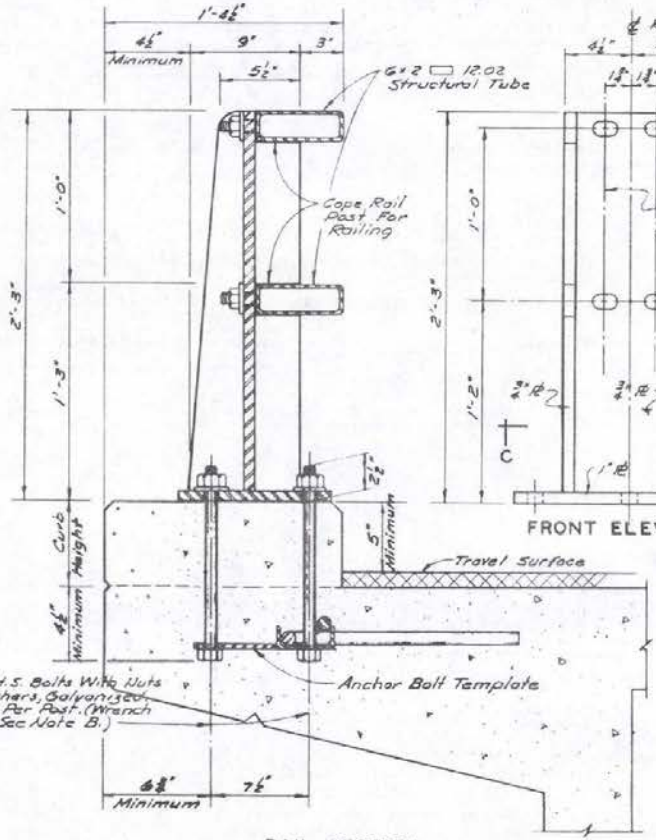
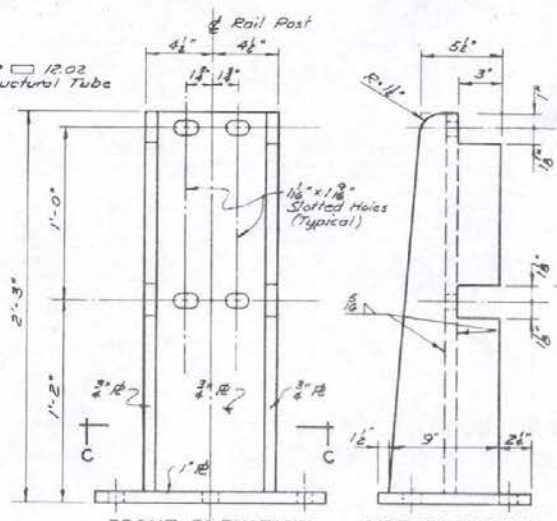


PLATE WASHER

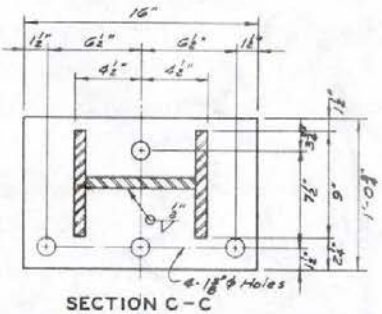
TUBE SPLICE DETAIL A



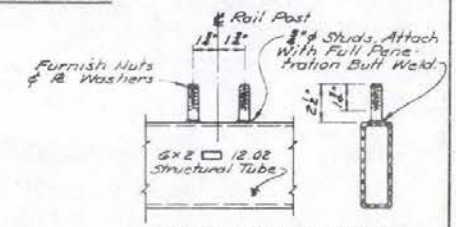
RAIL SECTION



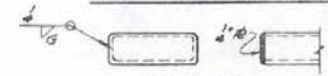
RAIL POST DETAILS



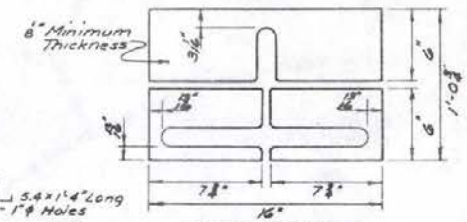
SECTION C-C



STUD BOLT DETAILS



RAIL CAP

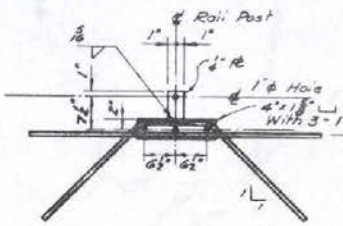


SHIM DETAIL

NOTES:
A. STRUCTURAL STEEL SHALL CONFORM TO ASTM DESIGNATION A36.
B. ANCHOR BOLTS SHALL BE HIGH STRENGTH CONFORMING TO ASTM DESIGNATION A325. HIGH STRENGTH RODS THREADED BOTH ENDS WITH 2 HEX NUTS AND WASHER MAY BE SUBSTITUTED FOR HIGH STRENGTH ANCHOR BOLTS.
C. STUD BOLT STEEL SHALL BE ASTM A108. TORQUE RAIL TO POST NUTS TO 175 FT. LBS.
D. POSTS SHALL BE NORMAL TO RAILING.
E. ALL EXPOSED CORNERS SHALL BE GROUND SMOOTH.
F. TUBING SHALL BE CONTINUOUS OVER NOT LESS THAN 2 INTERMEDIATE POSTS, WITH A MINIMUM LENGTH OF 2 PANELS, EXCEPT AS NOTED.
G. RAIL JOINTS IN TOP AND BOTTOM RAILS AT DECK EXPANSION JOINT, SHALL PROVIDE ALLOWANCE FOR MOVEMENT EQUAL TO WIDTH AT DECK JOINT WITH CORRESPONDING INCREASE IN LENGTH OF SLEEVE.
H. RAILING ASSEMBLY SHALL BE GALVANIZED AFTER FABRICATION.
I. ALL EXPOSED SURFACES OF RAILING ASSEMBLY SHALL BE PAINTED WHITE.

ALUMINUM ALTERNATE

AT THE OPTION OF THE CONTRACTOR, AND SUBJECT TO THE APPROVAL OF DESIGN AND DETAILS, AN ALTERNATE ALUMINUM TYPE RAILING WILL BE ACCEPTED. THE CONFIGURATION AND APPEARANCE SHALL, IN GENERAL, BE THE SAME AS FOR THE STEEL RAILING SHOWN. IT SHALL BE DESIGNED IN ACCORDANCE WITH AASHO INTERIM SPECIFICATIONS INT. (64). THE CONTRACTOR SHALL SUBMIT FOR APPROVAL TWO (2) COPIES OF THE DESIGN NOTES, DETAILS, AND ALL BACKUP INFORMATION RELATIVE TO THE ADEQUACY OF THE PROPOSED ALTERNATE RAILINGS.



ANCHOR BOLT TEMPLATE AND REINFORCING

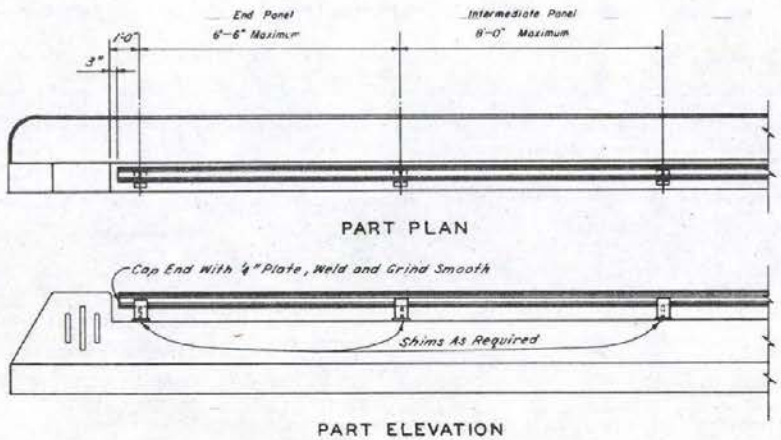
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

BRIDGE RAIL
TYPE "AC"

Hugh L. Brinson
CHIEF BRIDGE ENGR.

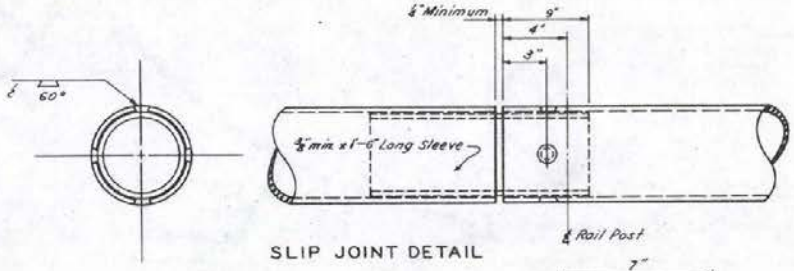
B-25.1.1-(506)
ADOPTED: 11-14
REVISION

818

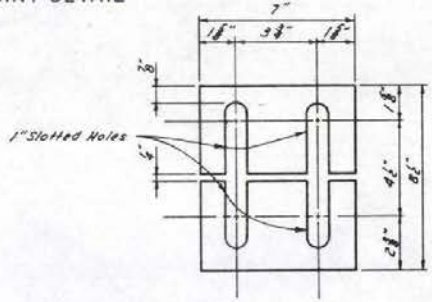


PART PLAN

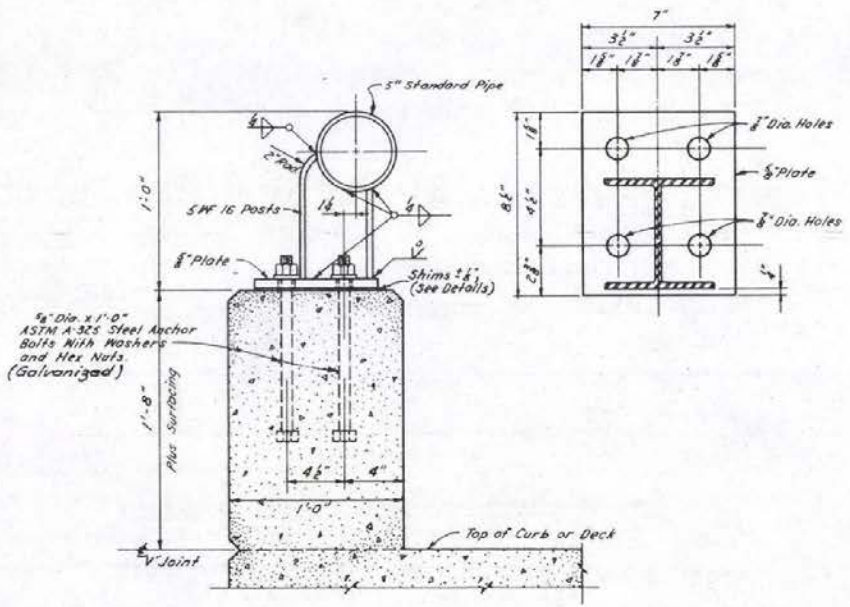
PART ELEVATION



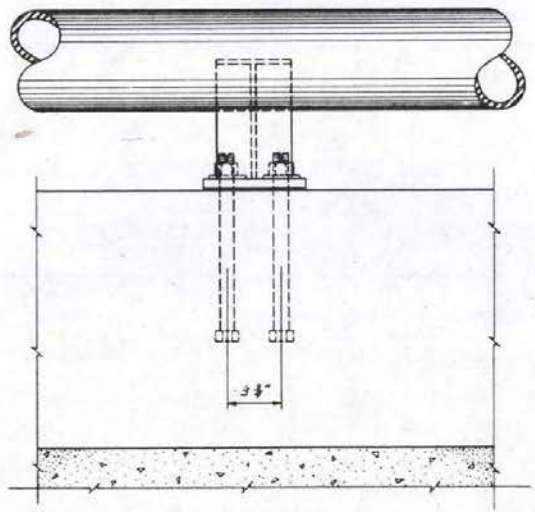
SLIP JOINT DETAIL



SHIM DETAIL



RAILING DETAILS



—GENERAL NOTES—

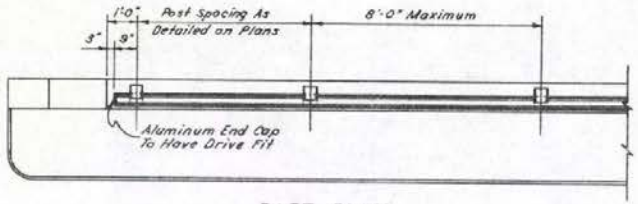
1. Railing to conform to vertical and horizontal alignment.
2. Joints to be spaced 40'0" center to center, maximum.
3. Slip Joints to be placed in panels to match expansion joints in deck, the ½" for movement will be changed to match allowance for movement in the deck and curb.
4. Design Weight: 17 lbs. per. ft.
5. Railing Assembly Shall Be Galvanized After Fabrication.
6. All Exposed Surfaces of Railing Assembly Shall Be Painted White.

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

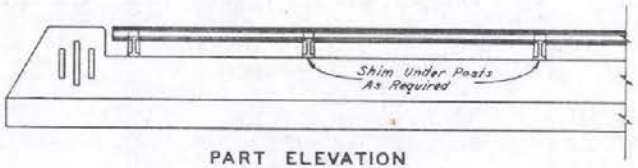
STEEL BRIDGE RAIL TYPE "H"

Hugh E. Briscoe, CHIEF BRIDGE ENGR.	B-25.1.2-(506) ADOPTED:	REVISION

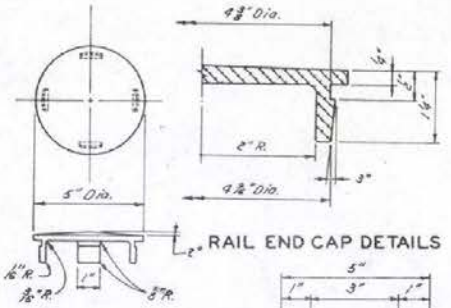
B19



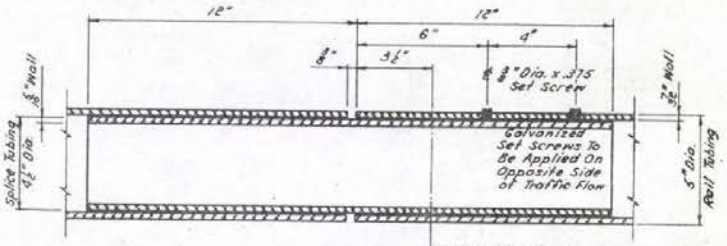
PART PLAN



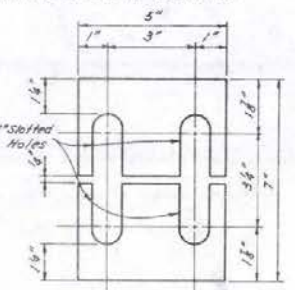
PART ELEVATION

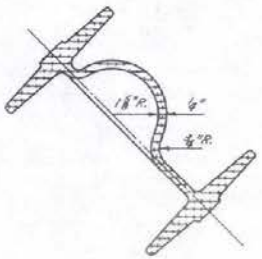


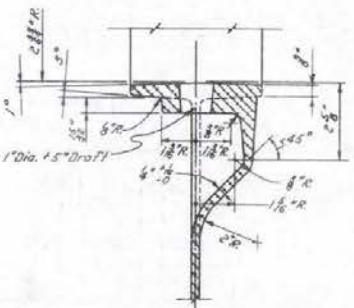
RAIL END CAP DETAILS

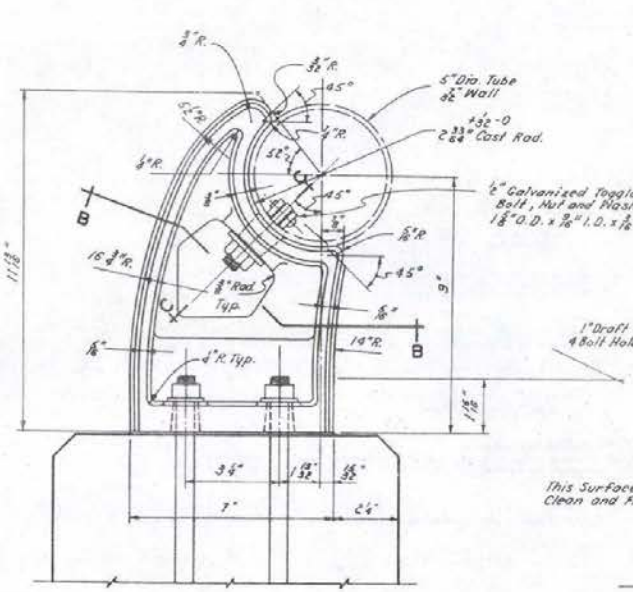


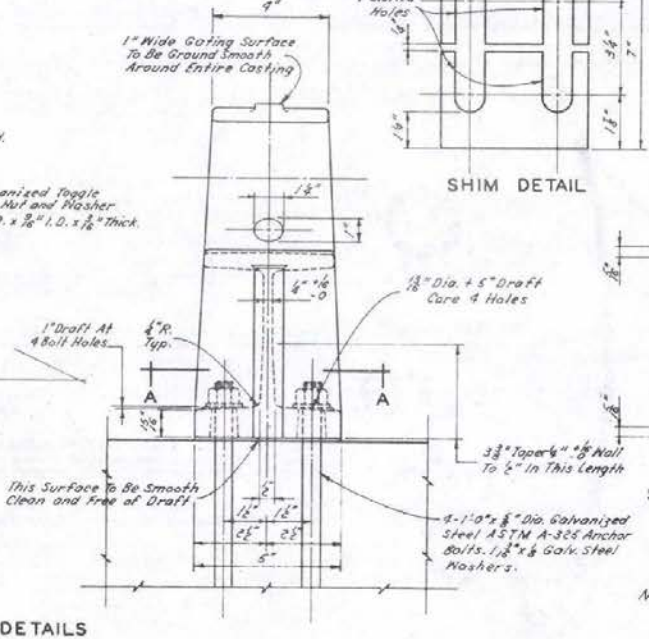
INSIDE SPLICE DETAIL



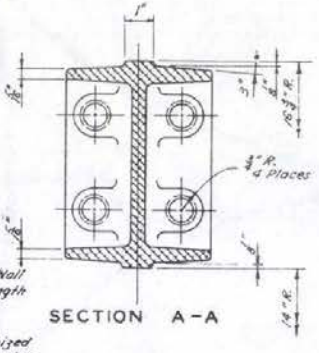








RAILING DETAILS



GENERAL NOTES

1. Railing To Conform To Vertical and Horizonal Alignment.
2. Joint To Be Placed 25'-0" Center To Center, Max.
3. Slip Joint To Be Placed in Panels To Match Expansion joints in Deck. The ¾" For Movement Will Be Changed To Match Allowances for Movement in The Deck and Curb.
4. Design Weight: 64 Lbs. Per Foot.

NOTE:
Unless Otherwise Specified
All Draft to be 3°
All Unmarked Radii To Be ½" R.

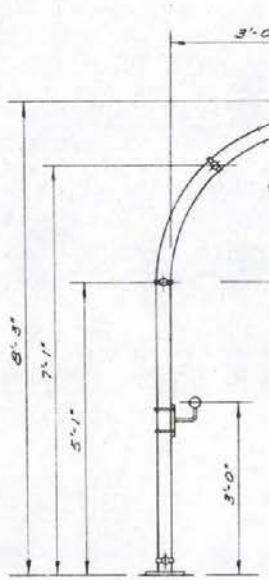
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

ALUMINUM BRIDGE RAIL TYPE "H"

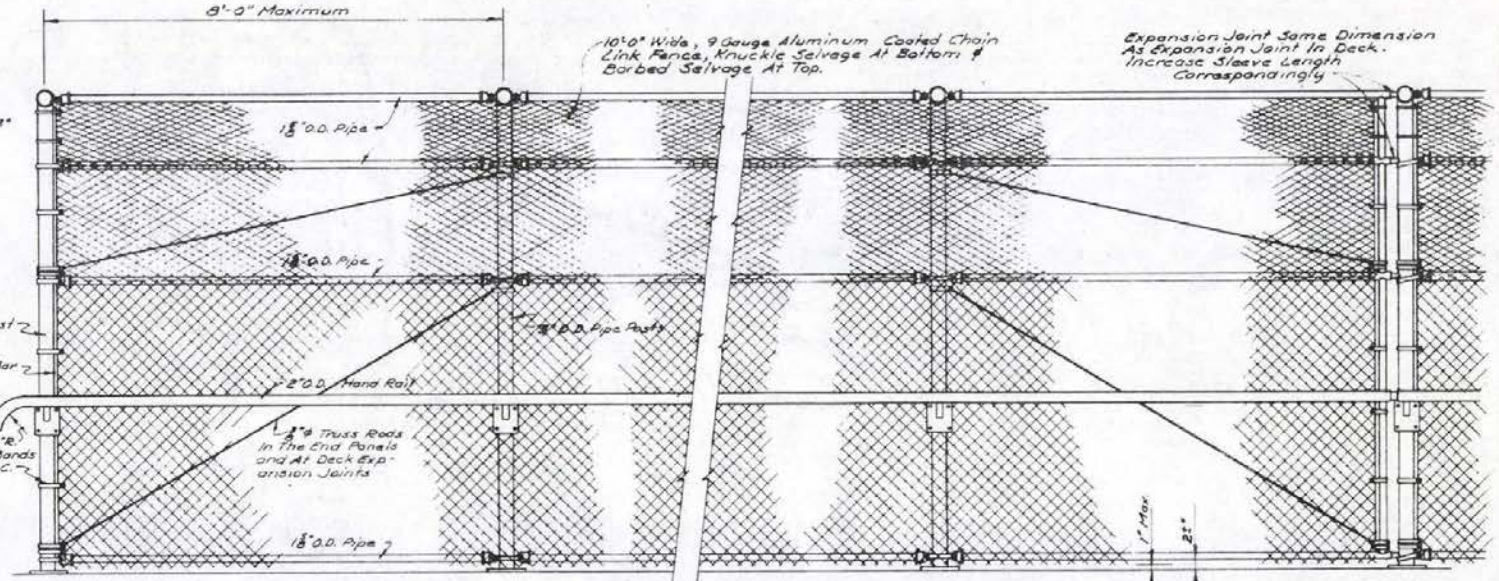
Hugh C. Brinson
CHIEF BRIDGE ENGR.

B-25.1 3-(506)
ADOPTED: 1/74
REVISION

B 20



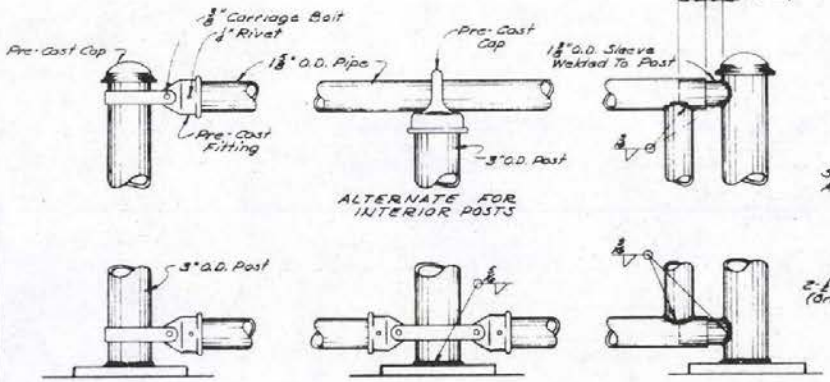
TYPICAL POST DETAILS



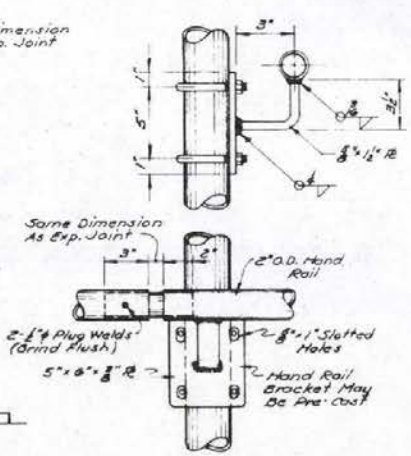
END POST

TYPICAL INTERIOR PANEL

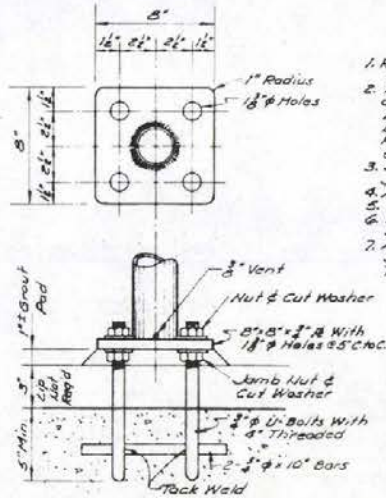
AT EXPANSION JOINT



TYPICAL CONNECTION DETAILS



HAND RAIL BRACKET



ANCHORAGE DETAILS

— GENERAL 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. Top, Intermediate and Bottom Pipes Shall Be Bent If The Radius is 150' or Less; May Be On 8' Chords If Radius Is Over 150'.
3. Space Posts To Clear Expansion Joints By 6" Minimum To ¢ Posts.
4. All Exposed Corners To Be Smooth.
5. Peen All ⅜" Bolts.
6. When Fence Is On Slope The 10' Fabric Shall Be Placed Parallel To The Slope.
7. Alternative Details May Be Submitted By The Contractor For The Engineer's Approval.

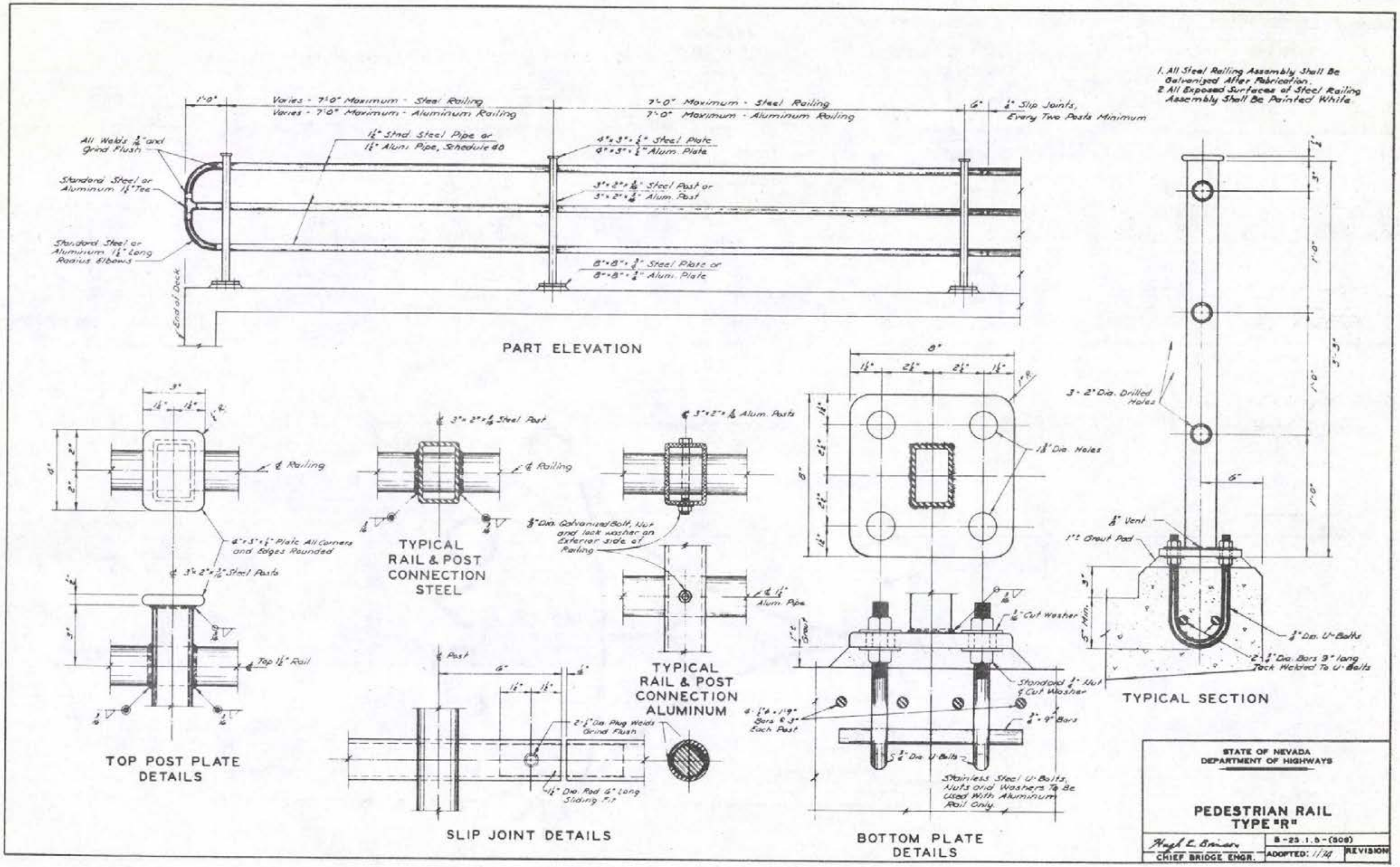
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

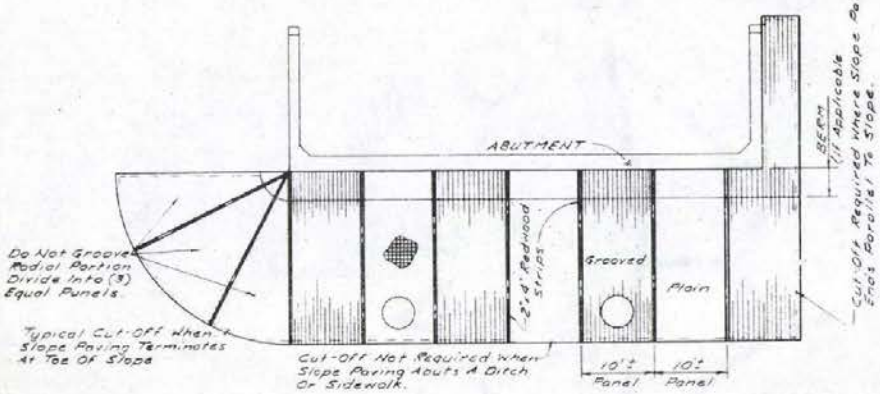
PEDESTRIAN RAIL TYPE "M"

Hugh C. Brisum
CHIEF BRIDGE ENGR.

B-23.1.4-(506)
ADOPTED: 1/74
REVISION

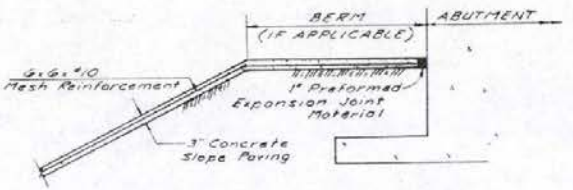
B21


1. All Steel Railing Assembly Shall Be Galvanized After Fabrication.
2. All Exposed Surfaces of Steel Railing Assembly Shall Be Painted White.
Varies - 7'-0" Maximum - Steel Railing
Varies - 7'-0" Maximum - Aluminum Railing
7'-0" Maximum - Steel Railing
7'-0" Maximum - Aluminum Railing
¼" Slip Joints, Every Two Posts Minimum
All Welds 3/16" and Grind Flush
1½" Stnd. Steel Pipe or 1½" Alum. Pipe, Schedule 40
4"×3"×½" Steel Plate
4"×3"×½" Alum. Plate
Standard Steel or Aluminum 1½" Tee
3"×2"×3/16" Steel Post or
3"×2"×¼" Alum. Post
Standard Steel or Aluminum 1½" Long Radius Elbows
8"×8"×¾" Steel Plate or
8"×8"×¾" Alum. Plate
End of Deck
PART ELEVATION
℄ Railing
4"×3"×½" Plate All Corners and Edges Rounded
℄ 3"×2"×3/16" Steel Posts
Top 1½" Rail
TOP POST PLATE DETAILS
℄ 3"×2"×3/16" Steel Post
TYPICAL RAIL & POST CONNECTION STEEL
℄ 3"×2"×¼" Alum. Posts
⅜" Dia. Galvanized Bolt, Nut and lock washer on Exterior side of Railing
℄ 1½" Alum. Pipe
TYPICAL RAIL & POST CONNECTION ALUMINUM
℄ Post
2-½" Dia. Plug Welds Grind Flush
1¼" Dia. Rod 6" Long Sliding Fit
SLIP JOINT DETAILS
1⅛" Dia. Holes
½" Cut Washer
Standard ⅞" Nut & Cut Washer
4-⅝"ø×1'-9" Bars & 3" Each Post
⅝"×9" Bars
⅝" Dia. U-Bolts
Stainless Steel U-Bolts, Nuts and Washers To Be Used With Aluminum Rail Only.
BOTTOM PLATE DETAILS
3-2" Dia. Drilled Holes
⅛" Vent
1"± Grout Pad
⅝" Dia. U-Bolts
2-⅝" Dia. Bars 9" long Tack Welded To U-Bolts
TYPICAL SECTION
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS
PEDESTRIAN RAIL
TYPE "R"
CHIEF BRIDGE ENGR.
B-23.1.5-(509)
ADOPTED: 1/74
REVISION

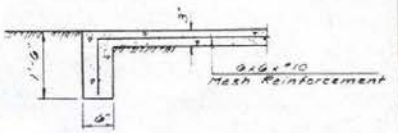


PLAN VIEW

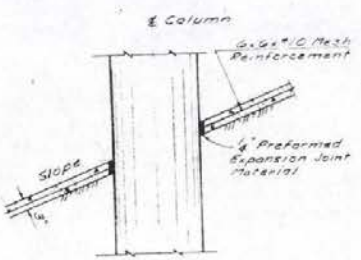
NOTE: SLOPE PAVING IS TO BE DIVIDED INTO EQUALLY SPACED PANELS. THE WIDTH OF EACH PANEL IS TO BE AS NEARLY 10' AS SITE DIMENSIONS WILL PERMIT. FOR PANELS WITH A GROOVED FINISH, CONCRETE MORTAR SHALL BE USED. IF ALTERNATELY GROOVED PANELS ARE CALLED FOR ON BRIDGE PLANS, THEN THE PANELS DIRECTLY BELOW STRUCTURE SHALL BE ALTERNATELY GROOVED AND PLAIN, SUCH THAT THE OUTER PANELS SHALL BE GROOVED.



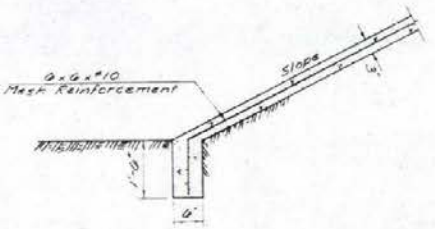
SECTION AT ABUTMENT



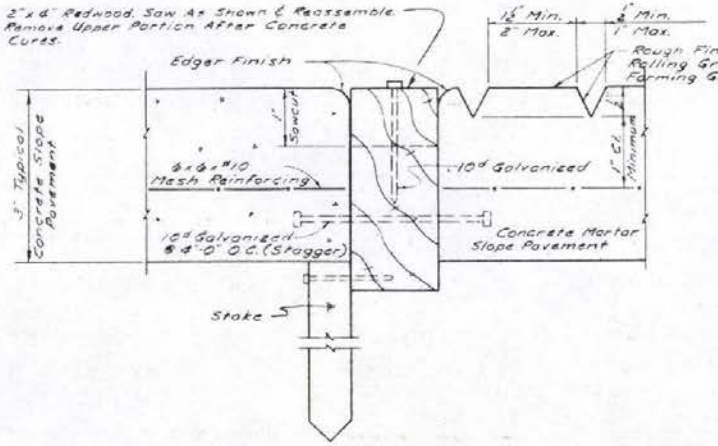
CUT-OFF AT EDGE OF SLOPE



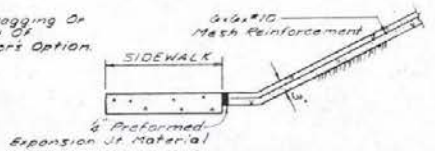
SECTION AT PIER



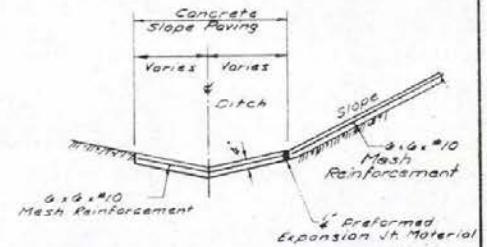
CUT-OFF AT TOE OF SLOPE



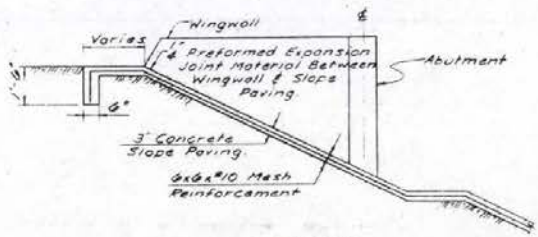
TYPICAL SECTION



SECTION AT SIDEWALK



SECTION AT DITCH



SECTION AT WINGWALL

NOTE: THESE DETAILS WILL NOT APPLY IN TOTAL TO ANY ONE SITE, BUT ARE INTENDED TO BE GENERAL ENOUGH TO COVER ALL POSSIBILITIES. TO OBTAIN LIMITS OF SLOPE PAVING FOR A SPECIFIC SITE, CONSULT THE DESIGN SHEETS.

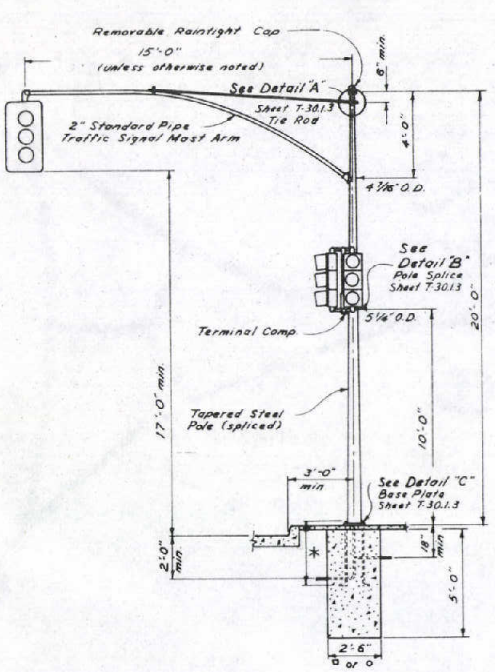
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

CONCRETE SLOPE PAVING DETAILS

Hugh E. Bronson
CHIEF BRIDGE ENGR.

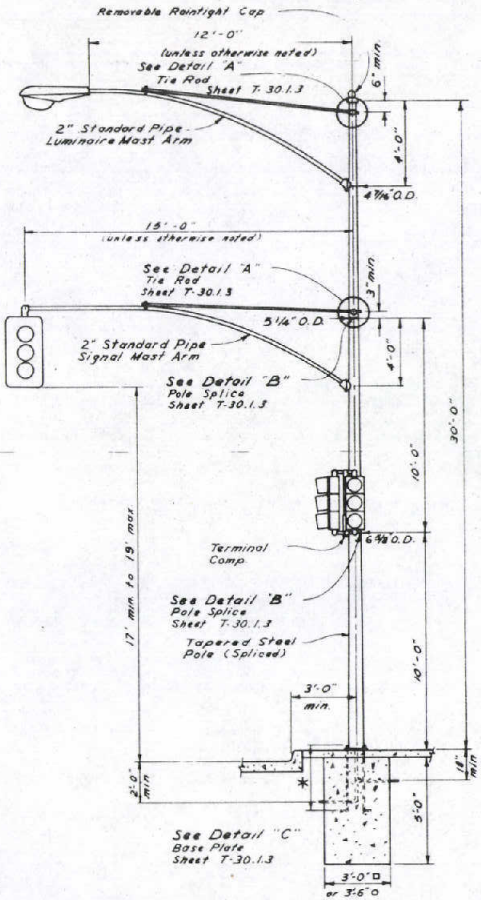
B-20.1.1-(611)
ADOPTED: 1/74
REVISION

B23

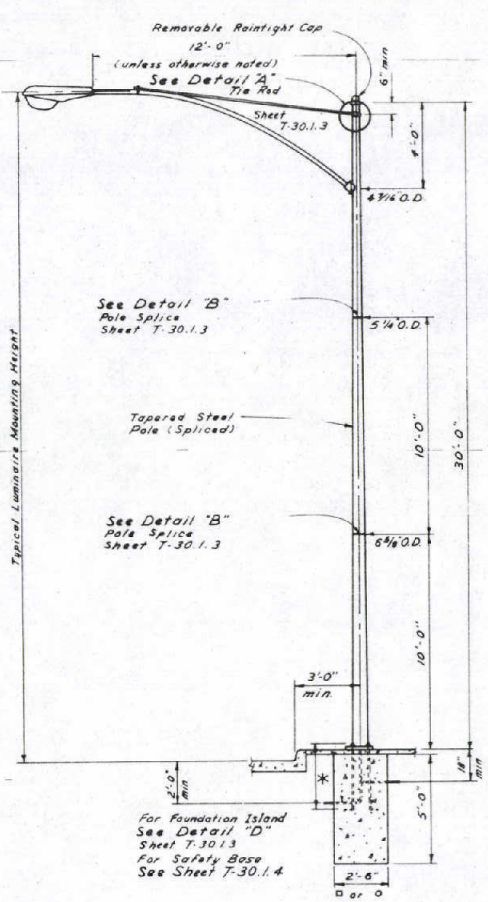


Type II

* See Sheet T-30.1.3 for Anchor Bolt length and dimensions



Type III



Type IV

POLE DATA

Pole Type	Pole Height & Gage	Pole Base O.D.	Signal Arm Data			Luminaire Arm Data		
			Proj. Length	Pipe Size	Mtg. Height	Proj. Length	Pipe Size	Mtg. Height
II	20' x 10 ga.	6 5/8"	15'-0"	2" Standard	See Pole Dwg	No Luminaire Arm		
III	30' x 7 ga.	8"	15'-0"	Pipe Sch. 40	See Pole Dwg	12'-0"	2" Standard	30'-6" to 32'-0"
IV	30' x 10 ga.	8"	No Signal Arm			12'-0"	Pipe Sch. 40	30'-6" to 32'-0"

GENERAL NOTES

GALVANIZING

1. All steel poles, mast arms, bolts, screws, nuts, washers and tie rods shall be galvanized.

STEEL MAST ARMS

1. Luminaire mast arms shall be so curved that when mast arm is fastened to pole the luminaire arm end shall not be below top of pole or more than 1'-5" above, for pole types III & IV.
2. The last 1' of the mast arm shall be straight and horizontal with luminaire or traffic signal attached. Connection between mast arm and pole shall be made by means of a raintight socket or a design permitting simple removal of the mast arm.
4. Mast arms for Type V, VI, and VII shall be round tapered steel tube with maximum taper of 0.15 inches per foot and a 7 1/8" O.D. end section for mounting hardware. Standard 2" pipe extensions of 3'-0" max. on 15'-20' sizes may be used at the option of the manufacturer.
5. Signal arms and luminaire arms for poles 18, 19, 21 and 24 shall be ASTM A-570 Gr. C. Steel.

TIE RODS (TYPES II, III, AND IV ONLY)

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, 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".

ANCHOR BOLTS

1. Each standard shall be supplied with 4 anchor bolts. Each anchor bolt shall have 6" of thread and a 4"-90° bend with the exception of poles 23 and 24 which shall have a 6"-90° bend.
2. One anchor bolt shall be bonded to conduit.
3. Threads may be cut or rolled. Bolts shall be galvanized or plated after threads are formed. Each bolt shall be provided with 6" of threads and furnished with two nuts and two washers.

STEEL POLES

1. Base covers required on all poles except where safety base is specified.

WELDS

1. Longitudinal welds by submerged arc; circumferential butt welds shall have permanent back-up rings. All exposed butt welds ground flush.

FOOTINGS

1. On sections without curb, bases shall be placed a minimum of 6' from shoulder or a minimum of 10' from traveled way, whichever is greater.

SAFETY BASE

1. Type IV and Type VII poles will require safety base assembly unless otherwise noted on plans.

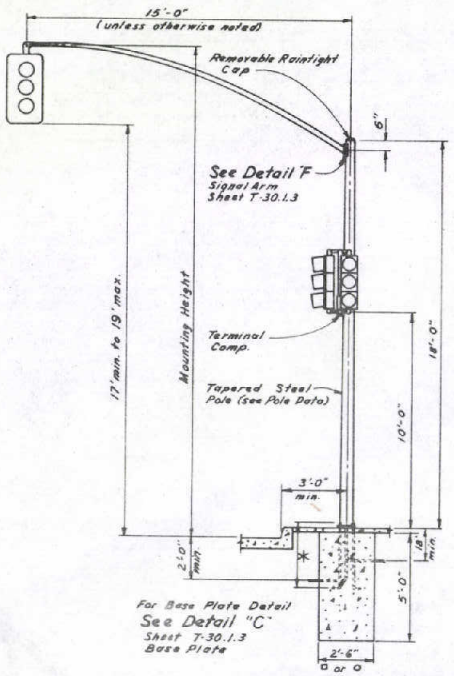
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

LIGHTING AND SIGNALS

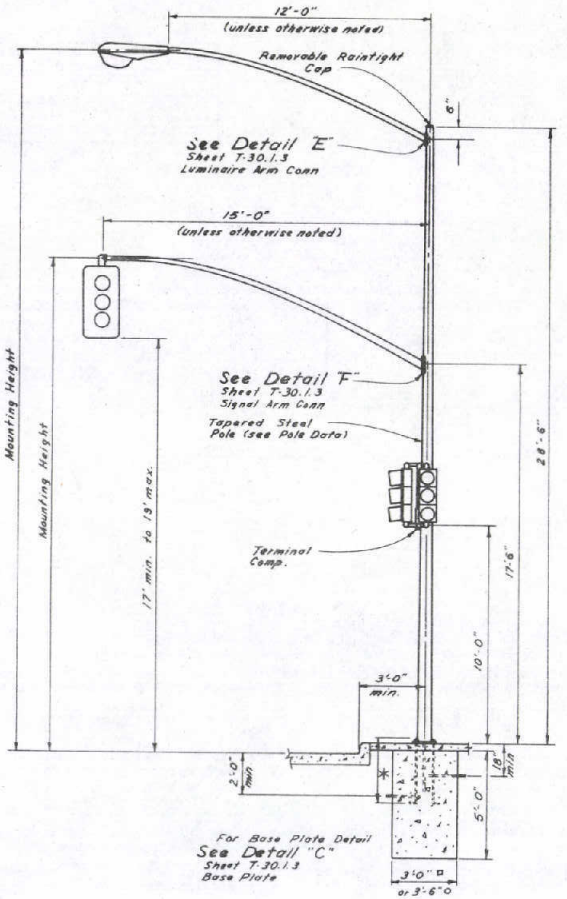
CHIEF TRAFFIC ENGR.

T-30.1.1 (6 2 3)
ADOPTED 2/71
REVISION 2

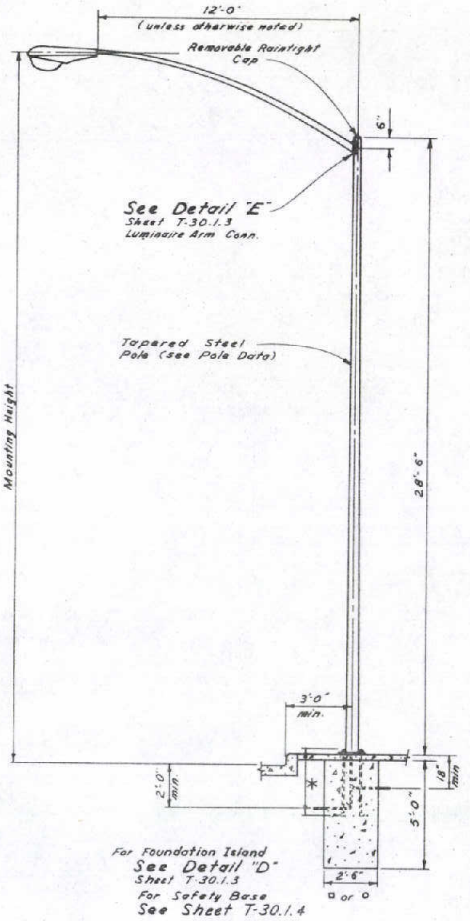
T1



Type V



Type VI



Type VII

* See Sheet T-30.1.3 for Anchor Bolt lengths and dimensions.

POLE DATA

Pole Type	Pole Height # Gage	Pole O.D. Base	Pole O.D. Top	Signal Arm Data: Proj. Length	Gage	Min O.D. @ Pole	Mtg Height	Luminaire Arm Data: Proj. Length	Gage	Min O.D. @ Pole	Mtg Height
V	18' x 10 ga.	7 9/16"	5 1/16"	15'-0"	10 ga.	4 3/16"	22'-4" ±	No Luminaire Arm			
VI	28'-6" x 7 ga.	7 1/16"	3 7/16"	15'-0"	10 ga.	4 1/16"	22'-4" ±	12'-0"	10 ga.	3 3/16"	32'-4" ±
VII	28'-6" x 10 ga.	7 1/16"	3 7/16"	No Signal Arm				12'-0"	10 ga.	3 3/16"	32'-4" ±

FOR GENERAL NOTES SEE SHEET T-30.1.1

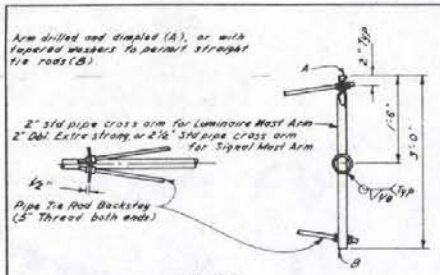
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

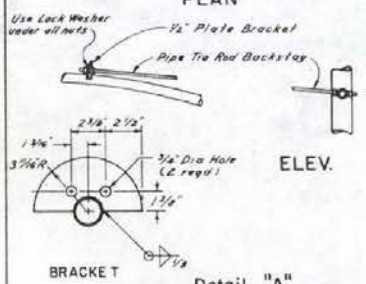
LIGHTING AND SIGNALS

Russell C. Hills
CHIEF TRAFFIC ENGR.

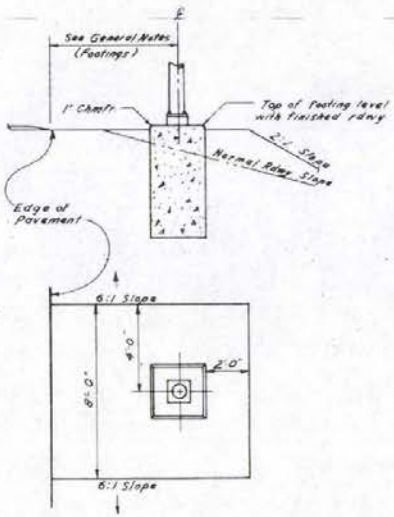
T-30.1.2 (623)
ADOPTED 2/71
REVISION 1

T 2

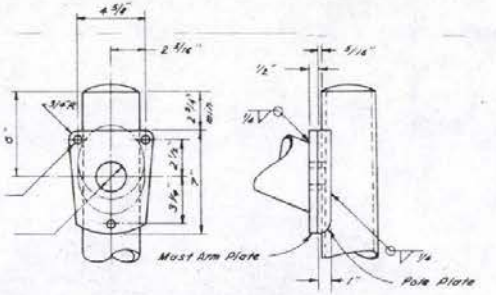




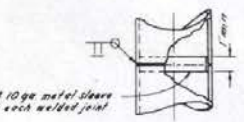
Detail "A"
MAST ARM TIE ROD AND CROSS ARM



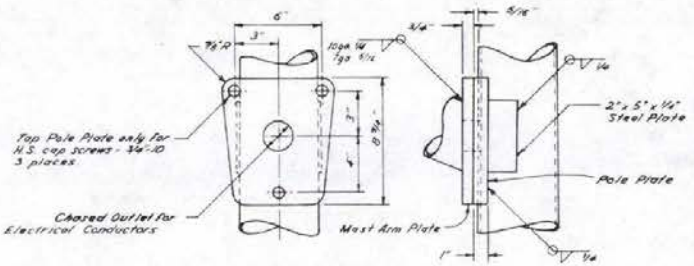
Detail "D"
TYPICAL FOUNDATION ISLAND



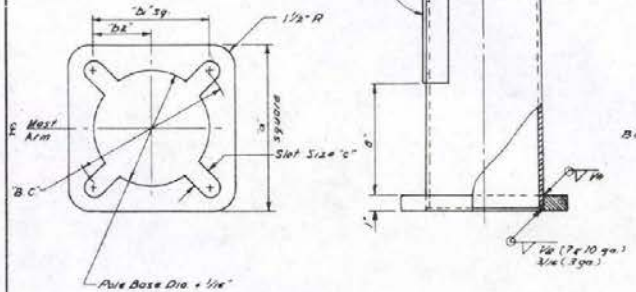
Detail "E"
LUMINAIRE ARM CONNECTION



Detail "B"
POLE SPLICE



Detail "F"
SIGNAL ARM CONNECTION
(Note: Alternative details approved by the Engineer may be substituted for the arm connections shown)



Base Plate						Anchor Bolt
Pole Type	"a"	"b1"	"b2"	"c"	"B.C."	Size
II	11½"	8¼"	4⅝"	1¾	9½	1"x35"x4"
III	11½"	8¼"	4⅝"	1⅜	11"	1⅛"x44"x4"
V	11½"	7¾"	3⅞"	1⅜"	11"	1"x36"x4"
VI	11½"	7¾"	3⅞"	1⅜"	11"	1⅛"x44"x4"

Base Plate Dim. for Types IV & VII When Mounted on Structures

IV	11½"	8¼"	4⅜"	1¾	11"	1"x36"x4"
VII	11½"	7¾"	3⅞"	1⅜	11"	1"x36"x4"

Note: Types IV & VII normally use Safety Base (Ref. Sheet T-30.14)

Detail "C"
BASE PLATE
(Pole Types II, III, V, VI)
(Used on Pole Types IV & VII When Mounted on Structures)

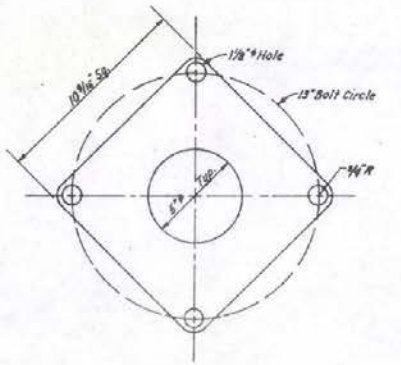
FOR GENERAL NOTES SEE SHEET T-30.11

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

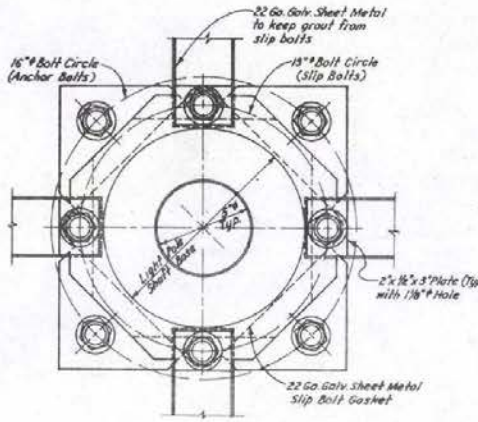
LIGHTING AND SIGNALS

Russell A. Hill
CHIEF TRAFFIC ENGR.

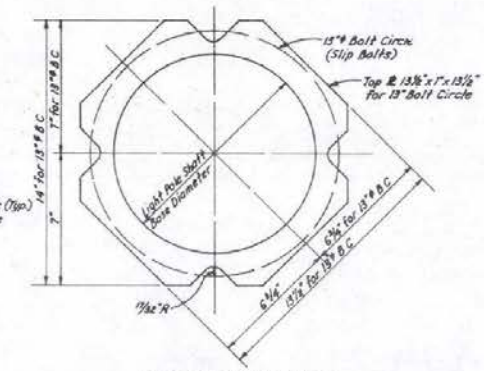
T-3013 (623)
ADOPTED 2/71
REVISION 2



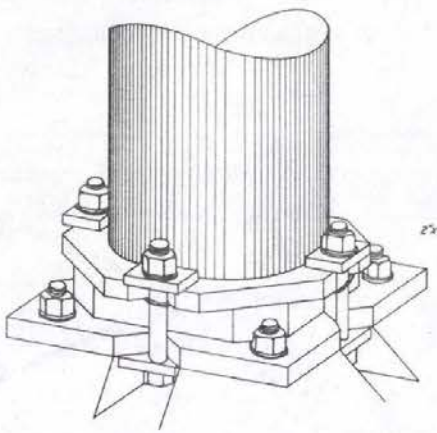
SLIP BOLT GASKET
22 Gage Galvanized Sheet Metal

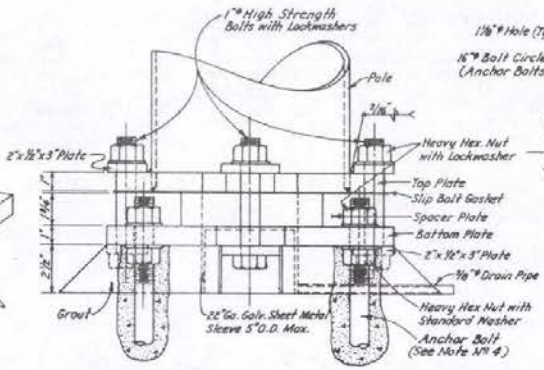


PLAN

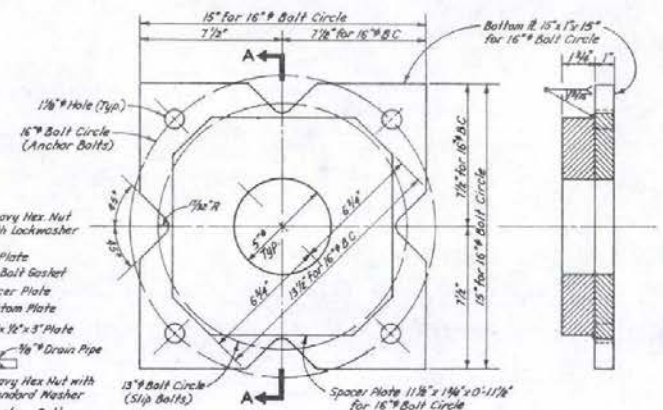


PLAN OF TOP PLATE





LIGHT POLE BASE



PLAN OF BOTTOM AND SPACER PLATE

GENERAL NOTES

1. Place bottom plate with spacer plate on leveling nuts on anchor bolts and fasten in place.
2. Top plate shall be furnished by light pole fabricator as light pole base plate with dimensions as shown in plan view.
3. Erect light pole and secure with 1" ϕ high strength bolts. Bolts shall be installed in the slots so that the bolt shanks are in contact with the plates.
4. See Sheet T-30.1.1 General Notes for anchor bolt sizes and lengths.
5. All steel plate assemblies shall be hot-dip galvanized after fabrication.
6. All nuts, bolts and washers shall be electro-plated cadmium in accordance with ASTM A-165, Type TS.
7. All contact areas of plates shall be free of galvanizing beads or runs.
8. Safety bases shall be utilized on all steel light poles except on structures or unless otherwise noted on the plans.
9. Slip bolts shall be forqued to 150 foot-pounds or 1800 inch-pounds.
10. Grouting shall be done after light pole has been located in final position.

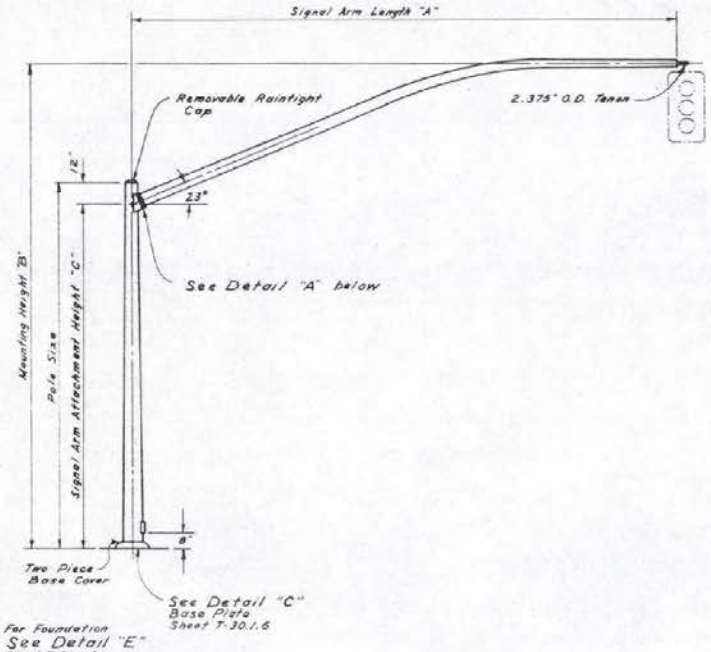
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

SAFETY BASE FOR LIGHT POLES

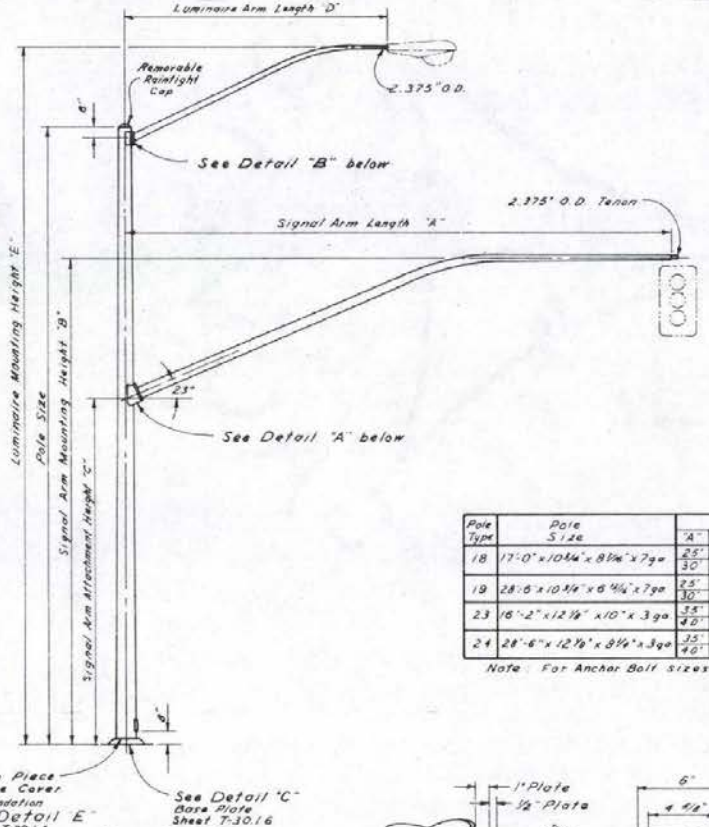
Russell C. Hill
CHIEF TRAFFIC ENGR

T-30.1.4 (623)
ADOPTED: 2/71
REVISION

T 4



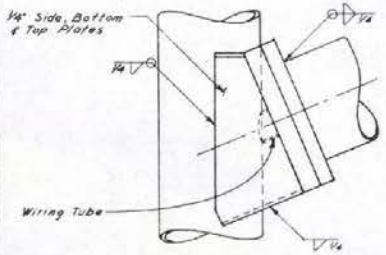
Type 18 & 23



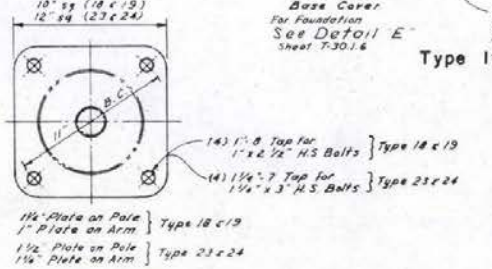
Type 19 & 24

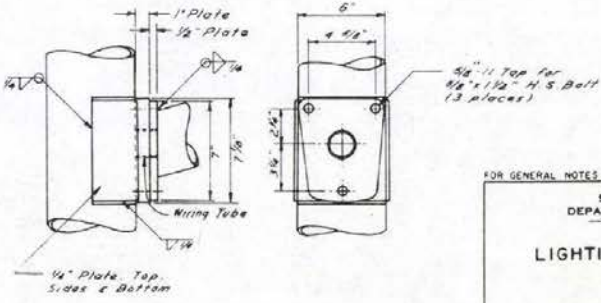
Pole Type	Pole Size	Signal Arm "A"	Signal Arm O.D. x O.D. x ga.	Signal Arm "B"	Signal Arm "C"	Luminaire Arm "D"	Luminaire Arm O.D. @ Pole x ga.	Luminaire Arm "E"
18	17'-0" x 10 3/4" x 8 1/16" x 7ga	25'	7 5/16" x 3 1/8" x 7ga	22'-5"	16'-0"	No Luminaire		
		30'	8" x 3 1/8" x 7ga	23'-0"	16'-0"			
19	28'-6" x 10 3/4" x 8 1/16" x 7ga	25'	7 5/16" x 3 1/8" x 7ga	22'-6"	16'-0"	12'-0"	4 5/16" x 10ga	32'-3"
		30'	8" x 3 1/8" x 7ga	23'-0"	16'-0"	12'-0"	4 5/16" x 10ga	32'-3"
23	16'-2" x 12 1/8" x 10" x 3ga	35'	8 5/16" x 3 1/8" x 3ga	23'-0"	15'-2"	No Luminaire		
		40'	9 1/8" x 3 1/8" x 3ga	23'-0"	15'-2"			
24	28'-6" x 12 1/8" x 8 1/4" x 3ga	35'	8 5/16" x 3 1/8" x 3ga	23'-0"	15'-2"	14'-0"	4 5/16" x 10ga	32'-3"
		40'	9 1/8" x 3 1/8" x 3ga	23'-0"	15'-2"	18'-0"	4 5/16" x 10ga	32'-3"

Note: For Anchor Bolt sizes see Detail "C" Sheet T-30.1.6



Detail "A"
SIGNAL ARM ATTACHMENT





Detail "B"
LUMINAIRE ARM ATTACHMENT

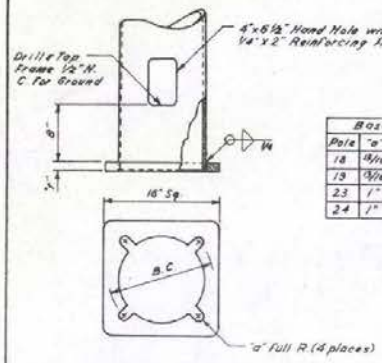
FOR GENERAL NOTES SEE SHEET T-30.1.1

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

LIGHTING AND SIGNALS

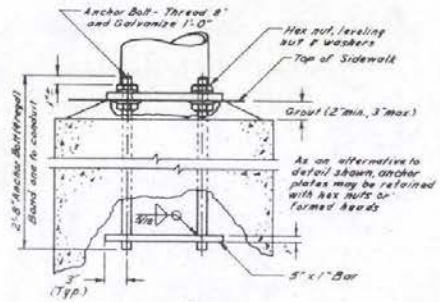
Donald C. Wells
CHIEF TRAFFIC ENGR

T-30.1.5 (623)
ADOPTED 2-1-71
REVISION

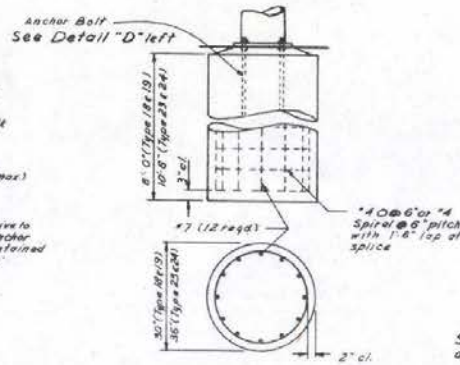


Base Plate				Anchor Bolts
Pole	"a"	"t"	B.C.	Size
18	13/16"	1¼"	14½"	1⅛"x48"x 4"
19	13/16"	1¾"	14½"	1⅛"x48"x4"
23	1"	1¾"	16½"	1¾"x60"x6"
24	1"	1¾"	16½"	1¾"x60"x6"

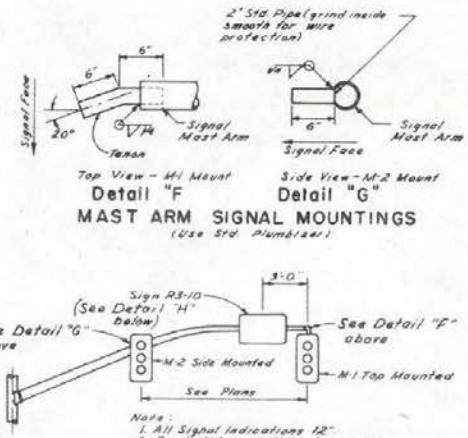
Detail "C"
BASE PLATE
(Pole Type 18, 19, 23 & 24)



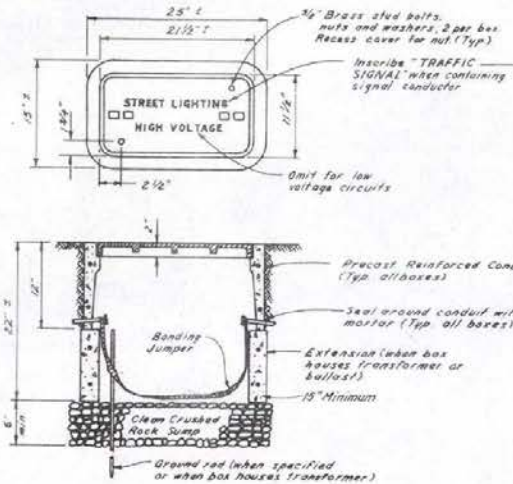
Detail "D"
ANCHOR BOLT DETAIL
(Optional Type 18, 19, 23 & 24)



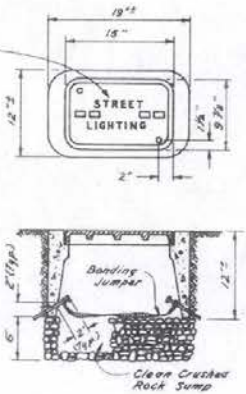
Detail "E"
CAST IN DRILLED HOLE PILE



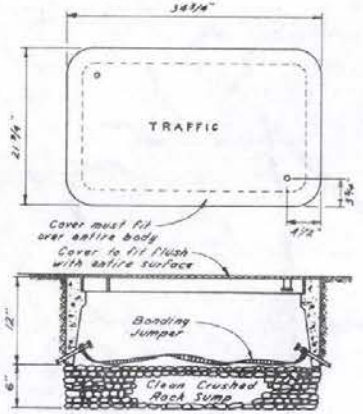
MAST ARM SIGNAL PLACEMENT



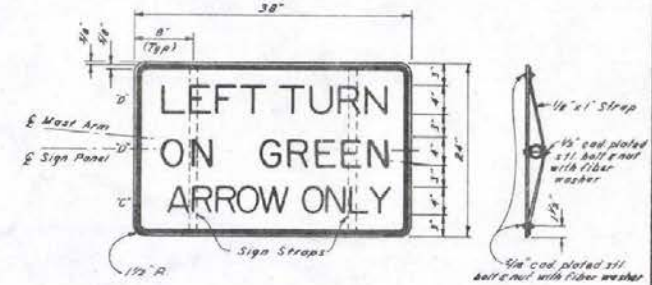
NO 5



NO 3½



NO 7



Detail "H"
SIGN R3-10
(Black on Reflectorized White)

DETAILS - PULL BOXES

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

LIGHTING AND SIGNALS

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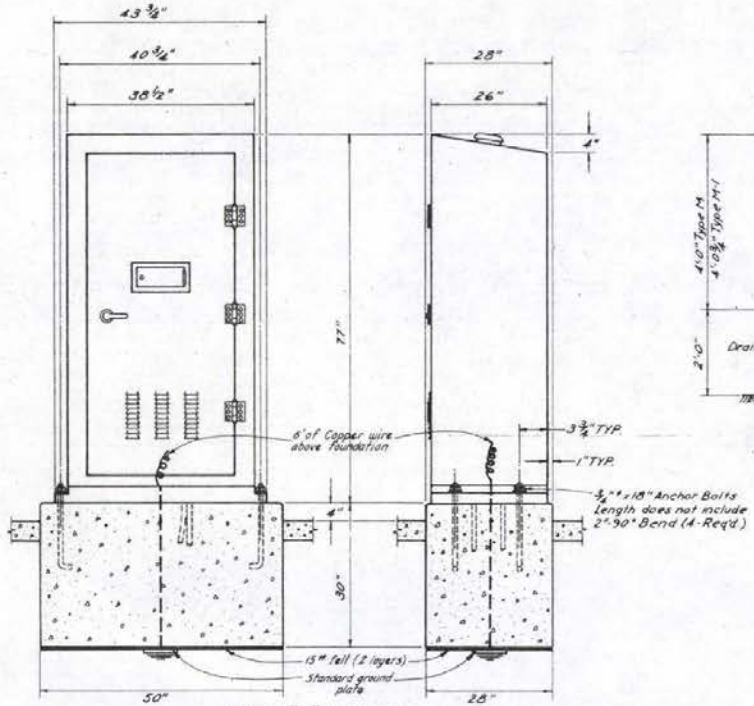
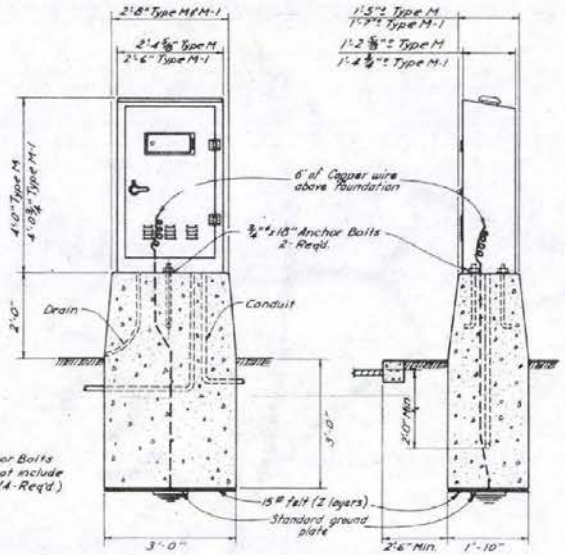
CHIEF TRAFFIC ENGR.

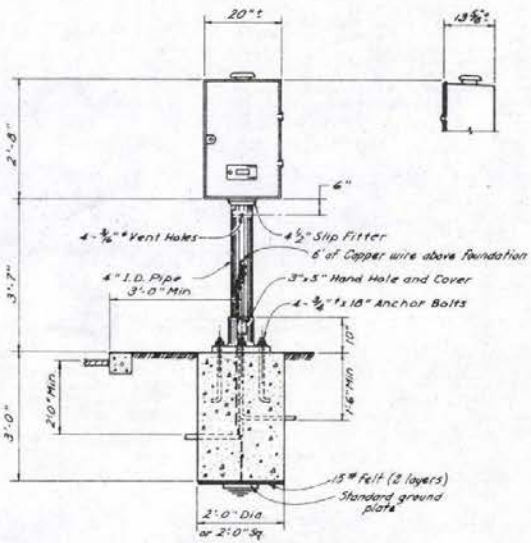
T-301.6 (623)
ADOPTED 2/71
REVISION 2 5/75



TYPE "R" CABINET



TYPE M & M-1 CABINET



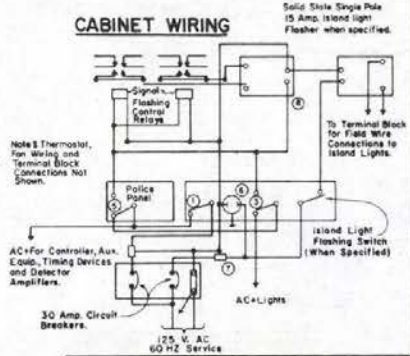
TYPE "G" CABINET

NOTES FOR TYPE M-1:

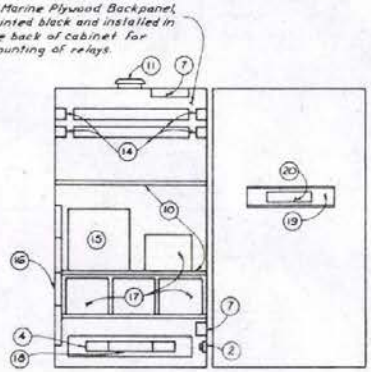
1. Material shall be 14 Ga. sheet steel.
2. Door shall lock at three points.

1. Main Switch.
2. Plug Fuse.
3. Signal Flash Switch Inside Cabinet.
4. Field Wire Terminal Blocks.
5. Auxiliary Door Flash Switch.
6. N.E.M.A. Standard Plug Receptacle with Grounding Contact.
7. Radio Interference Suppressor.
8. Solid State Signal Flasher (Cabinet Mfr. To Determine Poles & Capacity, Unless Otherwise Specified.)
9. External Light Relays.
10. Shelf.
11. Thermostat-Controlled Fan with T Vent.
12. Eight ½" Screened Vent Holes.
13. Instrument Terminal Strip.
14. Control Relays.
15. Dispatcher Unit.
16. Internal Interconnect Terminal Strips.
17. Minor Movement Units.
18. Slant Panel.
19. Police Panel.
20. Internal Power Panel and Recall Switches for all Detected Phases.

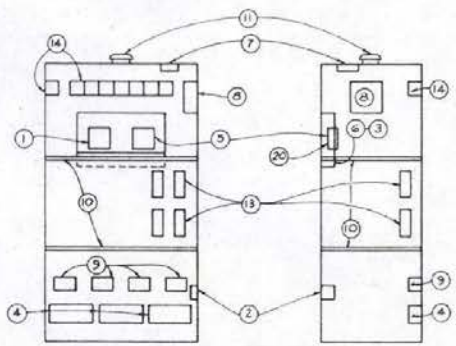
CABINET WIRING



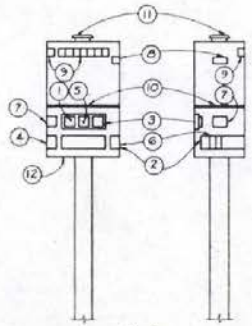
½" Marine Plywood Backpanel, painted black and installed in the back of cabinet for mounting of relays.



TYPE "R" CABINET



TYPE M & M-1 CABINET



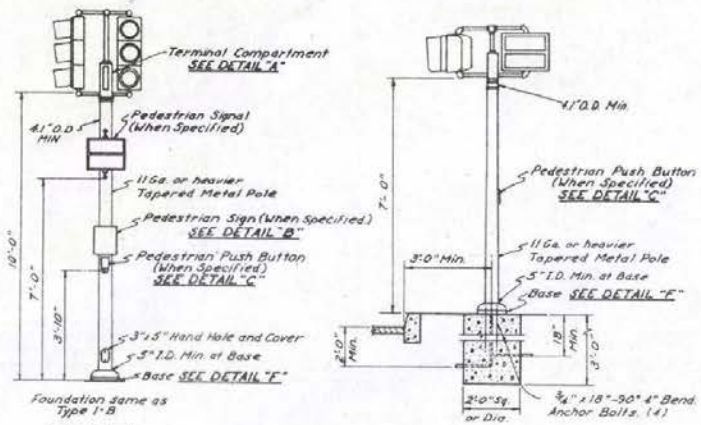
TYPE "G" CABINET

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

LIGHTING AND SIGNALS

CHIEF TRAFFIC ENGR.

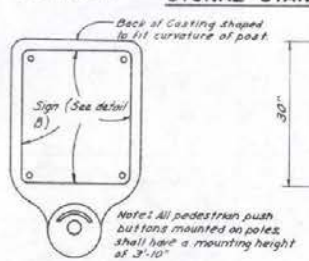
T-30.17 (62.3)
ADOPTED 2/71
REVISION 2 11/72



TYPE I-A

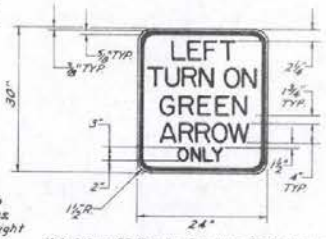
SIGNAL STANDARDS

TYPE I-B



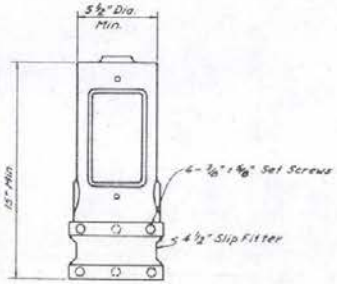
Note1 All pedestrian push buttons mounted on poles, shall have a mounting height of 3'-10"

DETAIL-"C"



Note2 Sign #3-10 to be Black on Reflectorized White.

DETAIL-"D"

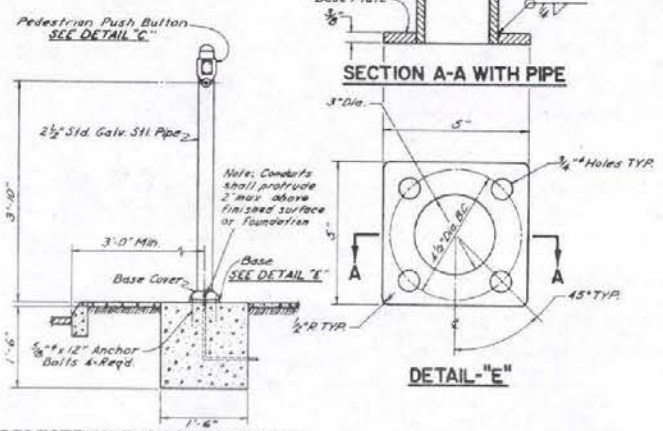


DETAIL-"A"

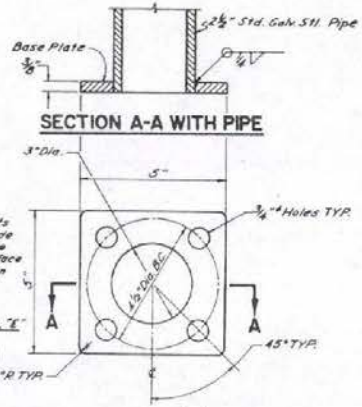
(For 3 Light Signal) (For Walk Signal)

NOTES:
1. Arrow to be left or right or both as required.
2. Porcelain enameled, 9"x12" sign, Black letters on white background.

DETAIL-"B"

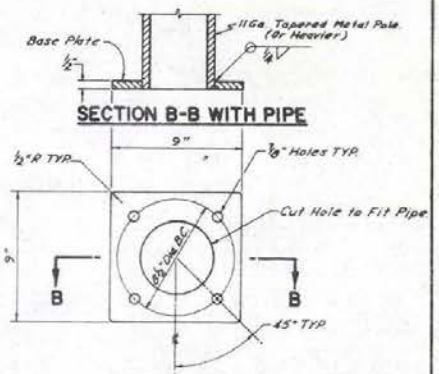


PEDESTRIAN PUSH BUTTON POST



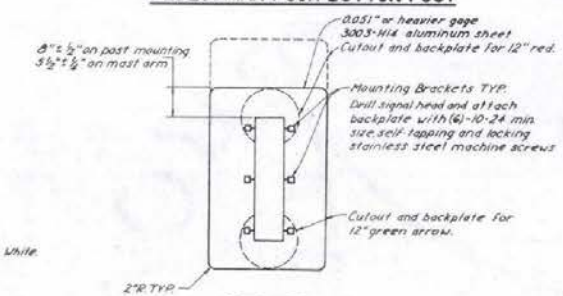
SECTION A-A WITH PIPE

DETAIL-"E"



SECTION B-B WITH PIPE

DETAIL-"F"

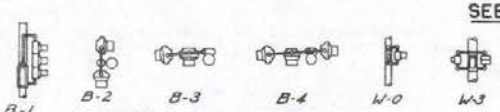


REAR VIEW

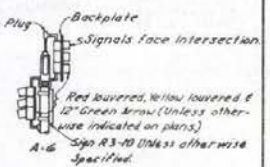
Note1 No background light to show between plate and head. Mast Arm. Backplates shall be louvered.

DETAIL-"G"

TYPICAL POST TOP MOUNTINGS



TYPICAL BRACKET MOUNTINGS



SEE DETAIL "D"

TYPICAL DIRECTIONAL LOUVER

TYPICAL ARROW LENS

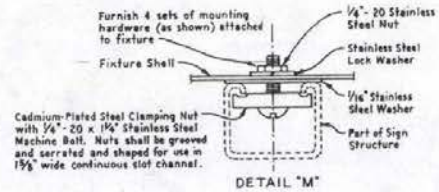
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

LIGHTING AND SIGNALS

Russell C. Hill
CHIEF TRAFFIC ENGR

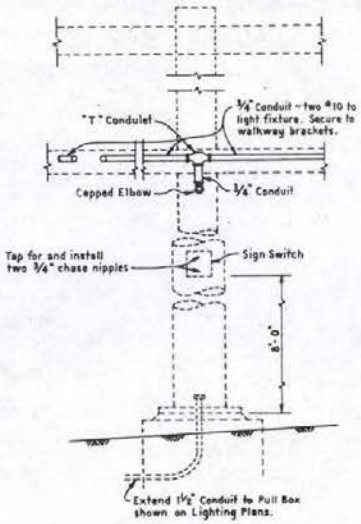
T-30.1.8 (6.23)
ADOPTED 2/71
REVISION 4-9/72

T8

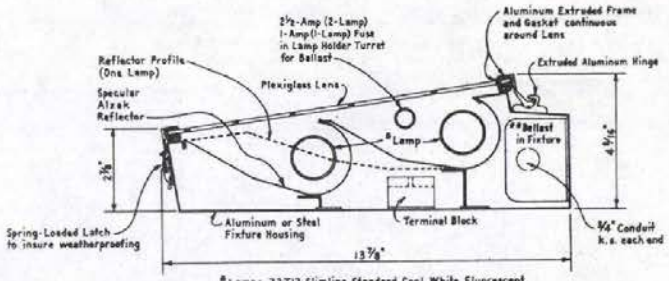


DETAIL "M"

FIXTURE MOUNTING ON CONTINUOUS SLOT CHANNEL



DETAILS OF TYPICAL WIRING AND SIGN SWITCH INSTALLATION



*Lamp: 72T12 Slimline Standard Cool White Fluorescent.
**Ballast: 425 ma. Z40 Y.A.C.

SECTION – LIGHTING FIXTURE

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	47.5-97
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

GENERAL NOTES

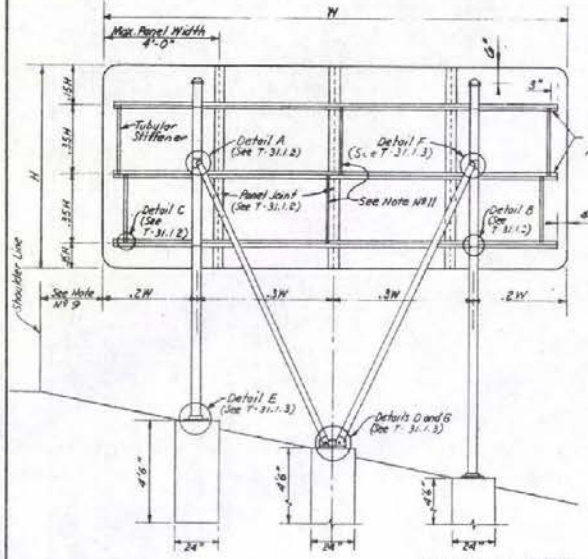
1. Where steel is indicated, part shall be hot-dipped galvanized after fabrication.
   Where sheet steel is indicated, part shall be fabricated from hot-dipped galvanized sheet steel. After fabrication, edges and flaws in galvanizing shall be cleaned and painted with two coats of Mil. Spec. Mil.-P-21035. Other metal parts shall be made of bronze, phosphor bronze, brass, copper beryllium or AISI Type 316 stainless steel, unless otherwise noted.
2. Wiring between fixtures shall be run in ½" liquid-tight flexible conduit. Flexible conduit shall be secured to nearest walkway structural member bracket using galvanized bonding strap and brass machine screws.
3. Two lamp fixtures shall be used for signs over 70" vertical dimension and one lamp fixture shall be used for signs with vertical dimension of 70" and less.
4. Alternate fixture fabrication methods and design details may be acceptable provided the light distribution, lamp size, mounting details and integral ballast are equivalent to the fixture shown. All variations must be approved by the Engineer.
5. Manufacturer shall submit five copies of shop drawings to the Engineer for approval prior to fabrication if fixtures have not previously been approved.
6. For method of mounting fluorescent fixtures see walkways plan titled "Walkway Details Nº 1" and "Walkway Details Nº 2" (T-36.1.9 and T-36.1.10).
7. See sign layout sheets for size of panels.

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

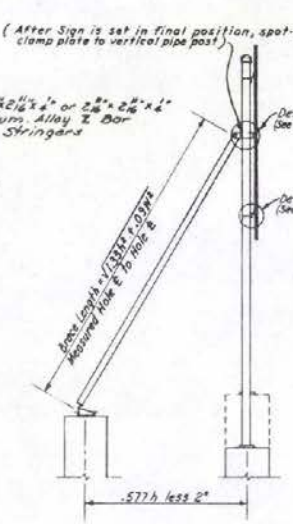
LIGHTING FIXTURES
OVERHEAD FLUORESCENT
INTEGRAL BALLAST

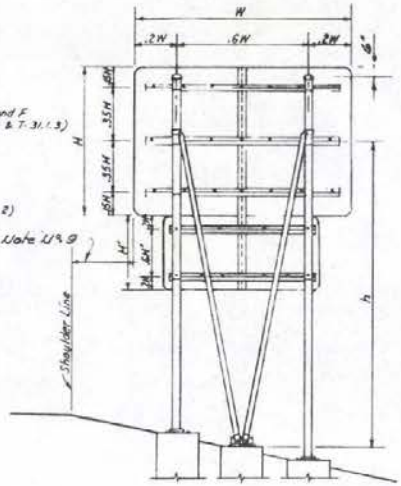
Russell C. Hill
CHIEF TRAFFIC ENGR.

T-301.9-(823)
ADOPTED: 1/73
REVISION



SINGLE SIGN





DOUBLE SIGN

PIPE SIZE FOR BRACED PIPE SUPPORTS

VERTICAL POST SIZE				
SIGN AREA SQ. FT.	H			
	0' to 5'	5' to 6'	6' to 10'	10' to 12'
0' to 70'	2"	2"	2"	2"
70' to 140'	2"	2"	3"	3"
140' to 200'	3"	3"	3"	–

BRACE SIZE					
SIGN AREA SQ. FT.	h				
	0' to 8'	8' to 9'	9' to 11'	11' to 13'	13' to 15'
0' to 70'	2"	2"	2"	3"	3"
70' to 140'	2"	2"	2"	3"	3"
140' to 200'	2"	2"	3"	3"	3"

NOTE: When pipe size from tables for Vertical posts and braces differ, use larger diameter indicated for both supports.

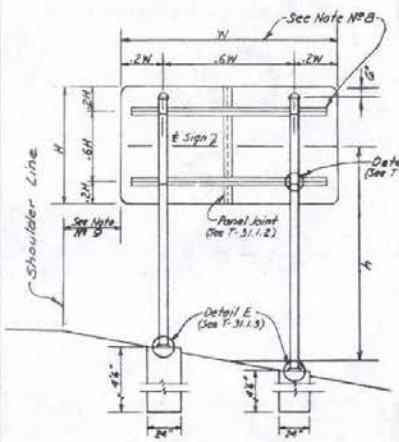
PIPE SIZE DETERMINATION FOR SINGLE POST AND DOUBLE POST WITHOUT BRACE

SIGN AREA SQ. FT.	h					
	0' to 8'	8' to 10'	10' to 12'	12' to 14'	14' to 15'	15' to 17'
0' to 5'	52"	52"	52"	52"	52"	52"
5' to 7.5'	52"	52"	52"	52"	53"	53"
7.5' to 10'	52"	52"	53"	53"	53"	53"
10' to 12.5'	52"	53"	53"	53"	53"	03"
12.5 to 15'	53"	53"	53"	03"	03"	03"
15' to 17.5'	53"	53"	53"	03"	03"	–
17.5 to 20'	53"	53"	03"	03"	03"	–
20' to 25'	53"	53"	03"	–	–	–
25' to 43'	53"	53"				

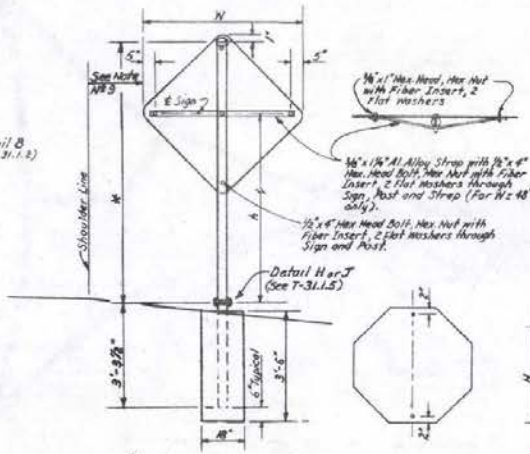
S = Single Pipe, Nom. Dia.
D = Double Pipe, No Braces, Nom. Dia.
h = Height of Sign 'E' above ground

GENERAL NOTES

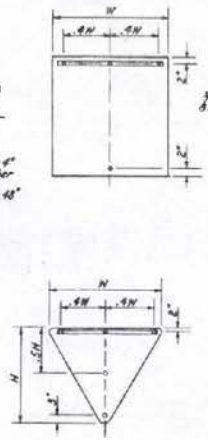
1. Sizes of signs, posts and braces are shown on Sign Summary Sheet.
2. For materials specifications see Special Provisions.
3. Footings to be drilled holes, as shown, and filled with Class A or Class AA concrete.
4. Sign panels for unbraced supports to be aluminum sheet construction. Sign panels for braced supports to be aluminum sheet or laminated sheet construction.
5. Tubular stiffeners required only when .2W exceeds 8'-0" on alum. sheet construction. Not required for laminated sheet.
6. Sign stand required only when h exceeds 15'-0". Island to be compacted to 95%. (See T-31.1.4 and Sign Summary Sheet.)
7. For double sign, double support with braces, area for tables is total area of two signs. 'W' is not considered part of H.
8. For W6-1 sign (48"x48" only) eliminate Z-bars and fasten sign directly to posts. Post spacing to be 8'-6" to 9'.
9. See Sign Summary Sheet for distance to edge of sign panel and see T-31.1.4 for sign placement.
10. See T-31.1.5 for anchor bolt details.
11. Tubular stiffeners to be added when "W" exceeds 10'-0".
12. For Alternate Double Support With Braces See Sheet T-31.1.5



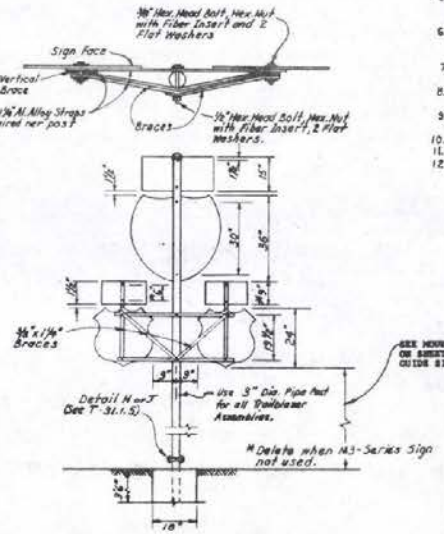
DOUBLE SUPPORT



*Post length as shown on Sign Summary Sheet



SINGLE SUPPORT



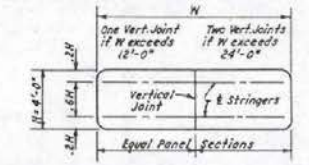
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

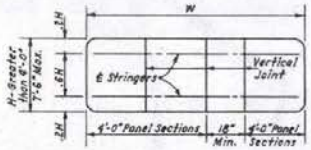
GROUND MOUNTED SIGN SUPPORTS

Russell Hill
CHIEF TRAFFIC ENGR.

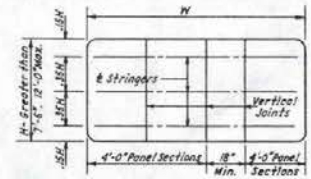
T-31.1.1 (627)
ADOPTED: 8/89
REVISION 7-1/96

T10

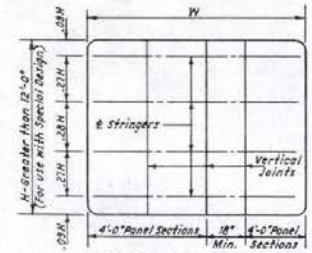




2 STRINGER MOUNTING



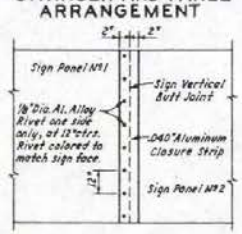
3 STRINGER MOUNTING



4 STRINGER MOUNTING

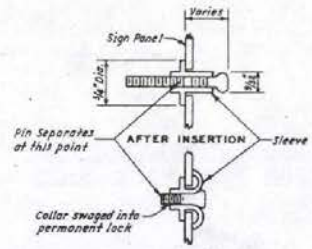
Note: To obtain desired panel width Max. of 2 panels may be cut less than 4'-0" (18" Min. each).

STRINGER AND PANEL ARRANGEMENT



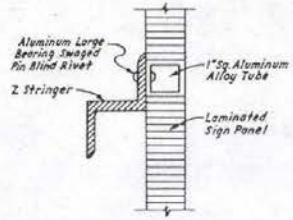
PANEL JOINT CLOSURE STRIP

ALUMINUM SHEET CONSTRUCTION

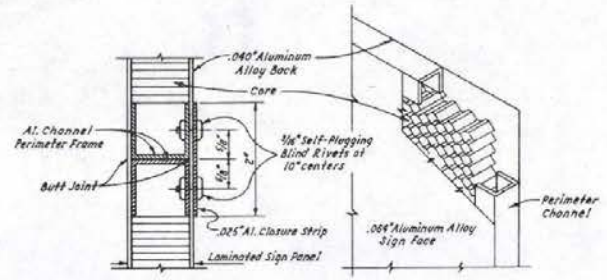


AFTER PULLING PIN

SWAGED PIN BLIND RIVET

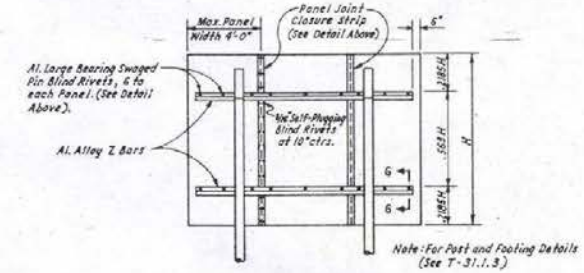


SECTION G-G



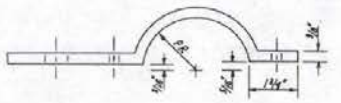
PANEL JOINT CLOSURE STRIP

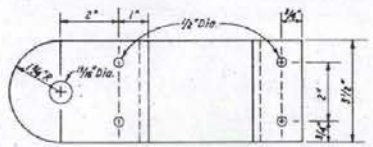
CUTAWAY DETAIL



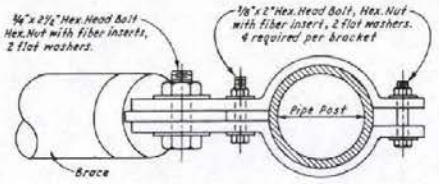
CONSTRUCTION

LAMINATED SHEET DETAILS





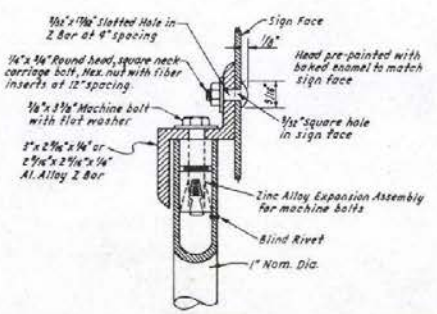
CLAMP PLATE



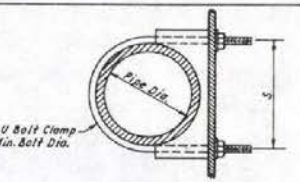
CLAMP ASSEMBLY

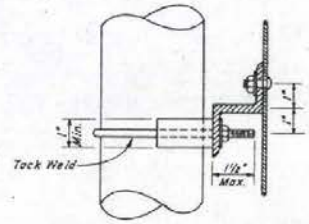
DETAIL A

(After Sign is set in final position, spot-weld clamp plate to vertical pipe post.)



DETAIL C





DETAIL B

POST NOM. DIA.	PR	PD	S
2"	1 3/16"	2 3/8"	2 5/8"
3"	1 3/4"	3 1/8"	3 3/4"

GENERAL NOTES

1- For materials not directly specified, See Special Provisions.

2- Flat washers required on all bolts, 1 or 2 as necessary.

3- All nuts to have fiber inserts.

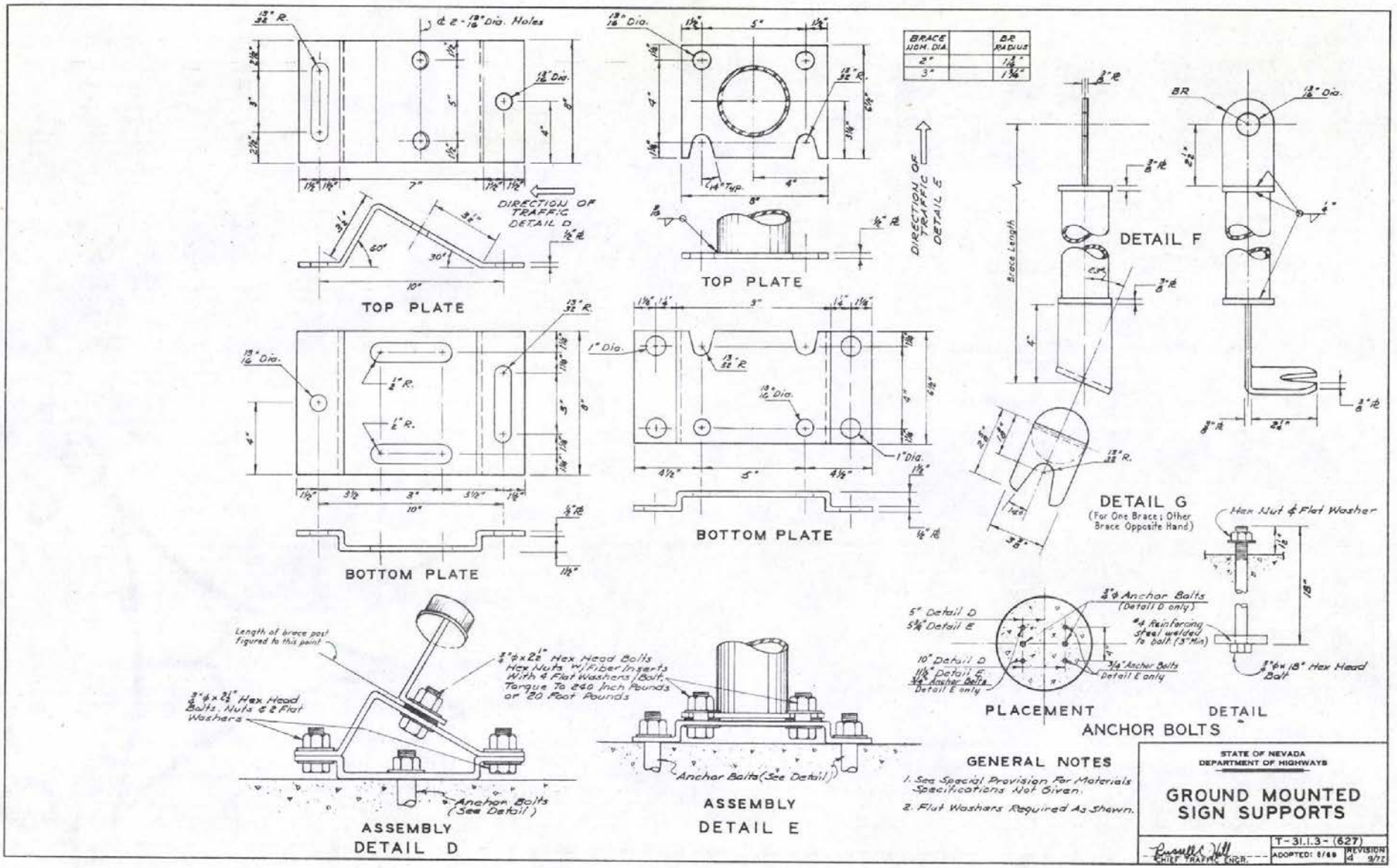
4- To obtain desired panel width, Max. of 2 panels may be cut less than 4'-0" (18" Min. each).

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

GROUND MOUNTED SIGN SUPPORTS

Russell Hill
CHIEF TRAFFIC ENGR.

T-31.1.2-(627)
ADOPTED: 5/88
REVISION 2 9/92



BRACE NOM. DIA.	BR RADIUS
2"	1 1/8"
3"	1 3/4"

GENERAL NOTES

1. See Special Provision For Materials Specifications Not Given.
2. Flat Washers Required As Shown.

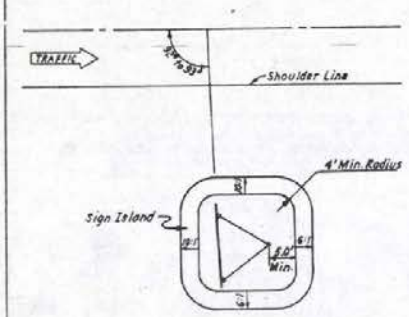
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

GROUND MOUNTED SIGN SUPPORTS

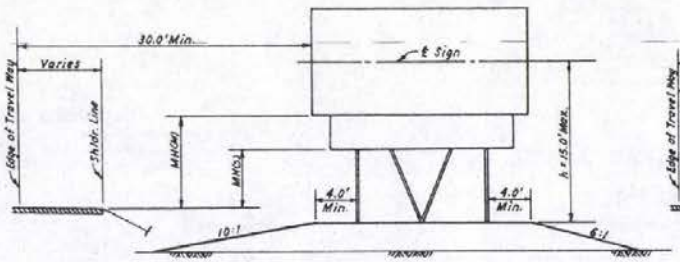
CHIEF TRAFFIC ENGR.

T-31.1.3-(627)
ADOPTED: 8/69
REVISION 4 9/72

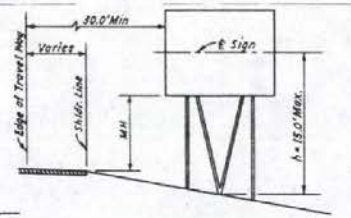
T12



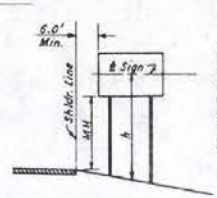
PLAN



LEVEL

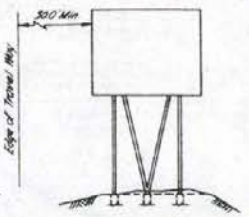


BRACED

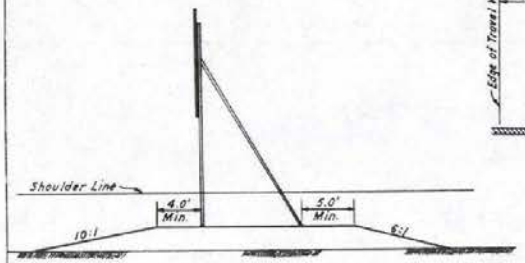


UNBRACED

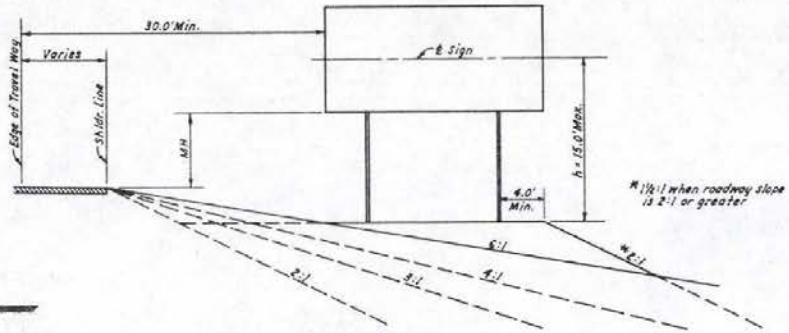
EMBANKMENT
(WITHOUT SIGN ISLAND)



When the sign location is in original ground, the area between the supports and the braces shall be leveled to maintain identical post lengths. (No Direct Payment For The Leveling)

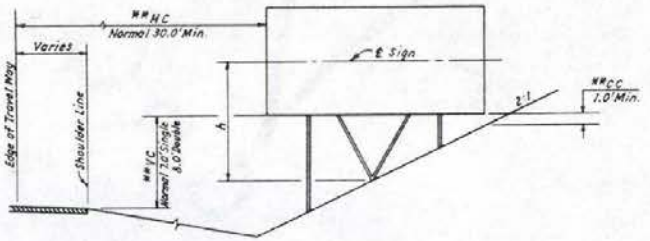


ELEVATION



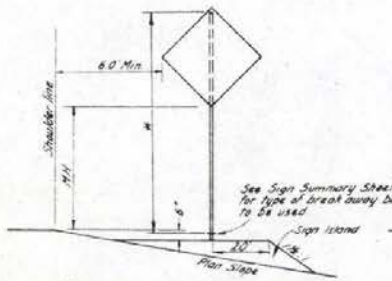
* 1½:1 when roadway slope is 2:1 or greater

EMBANKMENT

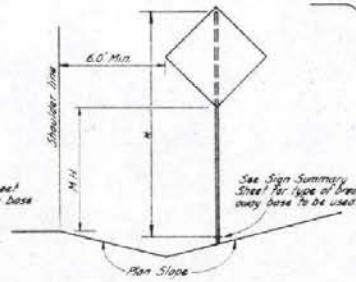


** NOTE: If CC is less than 1.0' Minimum
(1) Raise sign until CC = 1.0' or VC = 10.0' Max. for single sign, VC = 11.0' Max. for double sign, or h = 15.0' Max.
(2) Maintain VC = 10.0' or 11.0' and move sign toward shoulder until CC = 1.0', HC = 16.0' Min., or h = 15.0 Max.
(3) Special consideration is necessary if given limits are exceeded.

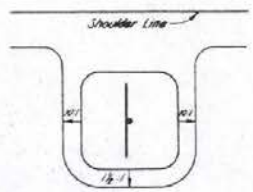
EXCAVATION



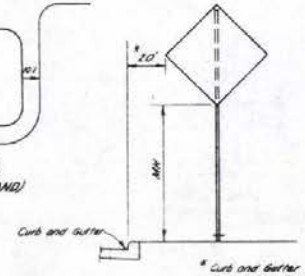
* Post length as shown on Sign Summary Sheet. Post length calculations are based on use of sign island. Sign island shall be used except when signpost is located in backslope.



TYPICAL SINGLE SIGN SUPPORT



PLAN
(SIGN ISLAND)



* Curb and Gutter Section 2.0' Min. When Sign is Placed in Gore With or Without Curb and Gutter

MOUNTING HEIGHTS (MH) FOR SIGNS

	SINGLE GUIDE SIGNS	ALL OTHER SINGLE SIGNS	DOUBLE GUIDE SIGNS	ALL OTHER DOUBLE SIGNS
FREEWAYS & EXPRESSWAYS	7' MIN	7' MIN	8' MIN (M) 5' MIN (S)	5' MIN (S)
COMMERCIAL RESIDENTIAL & CURB & GUTTER	7' MIN	7' MIN	7' MIN (M)	7' MIN (S)
RURAL	5' MIN	5' MIN	5' MIN (M)	5' MIN (S)

(M) = MAJOR SIGN (S) = SECONDARY SIGN

NOTE: FOR MOUNTING HEIGHTS (MH) FOR CONSTRUCTION SIGNS AND TEMPORARY SIGNS, (SEE SHEET T-31.1.63).

GENERAL NOTES

1. Sign island required only when h exceeds 15.0' without island. Island to be compacted to 95%.
2. Footing and sign details shown on Sheets T-31.1.1, T-31.1.2, T-31.1.3.
3. 30.0' min distance from edge of travel way to edge of sign panel may be reduced to 16.0' min. in special situations.
4. All sign supports shall be of break-away design.
5. Signs should not be closer than 8 ft from the edge of the shoulder, or if none, 12 ft from the edge of the traveled way. In urban area a lesser clearance may be used where necessary.

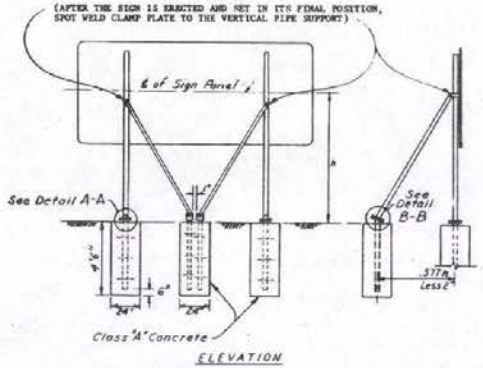
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

GROUND MOUNTED SIGN SUPPORTS

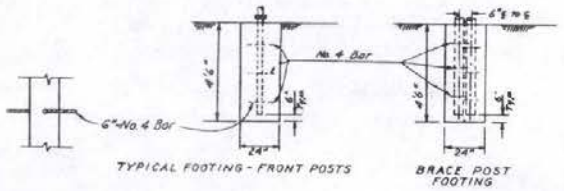
Russell C. Hall
CHIEF TRAFFIC ENGR.

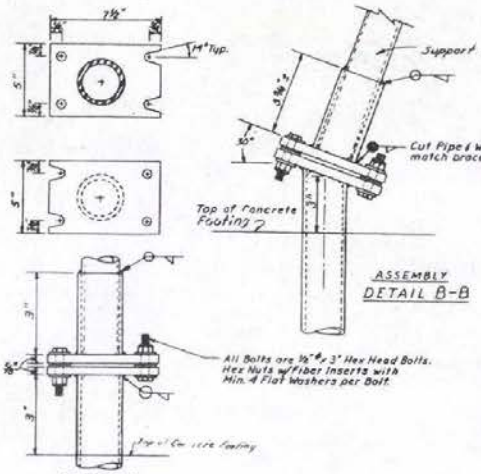
T-31.1.4 - (627)
ADOPTED: 5/69
REVISION 5 9/77

T13



ELEVATION





ASSEMBLY DETAIL B-B

ASSEMBLY DETAIL A-A

GENERAL NOTES

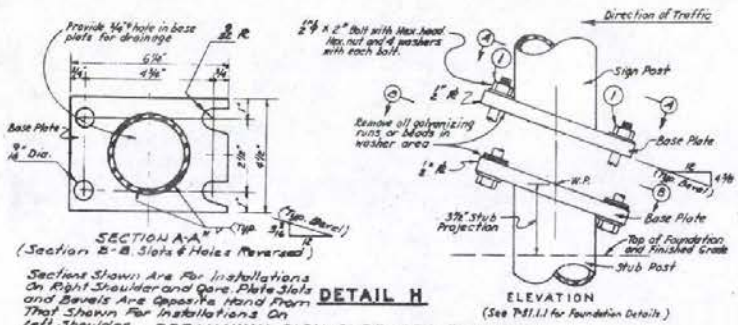
1. AT THE OPTION OF THE CONTRACTOR, PIPE SUPPORT SLEEVES MAY BE ELIMINATED AND THE SUPPORT PIPE MAY BE WELDED DIRECTLY TO THE SLIP BASE.
2. SEE STANDARD SHEETS T-31.1.1 THROUGH T-31.1.4 FOR DETAILS NOT SHOWN.

SLEEVE DIMENSIONS (MINIMUM)

1" PIPE SUPPORTS - 4" O.D., 3½" I.D.

2" PIPE SUPPORTS - 2 7/8" O.D., 2½" I.D.

ALTERNATE DOUBLE SUPPORT WITH BRACES



SECTION A-A
(Section B-B Slots & Holes Reversed)

ELEVATION
(See T-31.1.1 for Foundation Details)

Sections Shown Are For Installations On Right Shoulder and Gore. Plate Slots and Bevels Are Opposite Hand From That Shown For Installations On Left Shoulder.

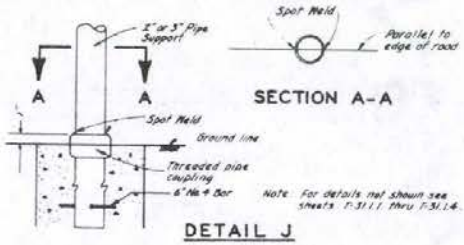
DETAIL H

BREAKAWAY SIGN SUPPORTS FOR PIPE

MONO-DIRECTIONAL SLIP BASE

(To be used on all 3" pipes located on main lines and portions of entrance and exit ramps).

TYPE H BASE



Note: For details not shown see sheets T-31.1.1 thru T-31.1.4.

DETAIL J

MULTI-DIRECTIONAL PIPE COLLAR

(To be used on single pipe supports on signs placed on two lane roadways, frontage roads, crossroads and portions of entrance and exit ramps or connections).

TYPE J BASE

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

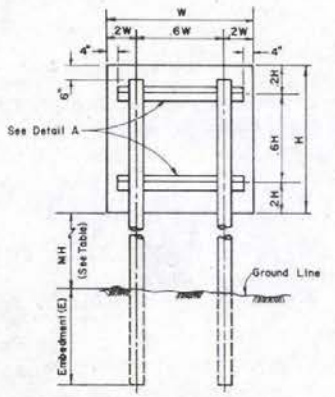
GROUND MOUNTED SIGN SUPPORTS

Russell C. Hill
CHIEF TRAFFIC ENGR.

T-31.1.5-(627)

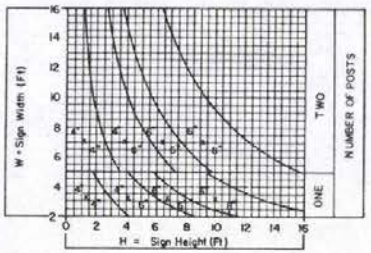
ADOPTED: 9/72

REVISION 1 9/73

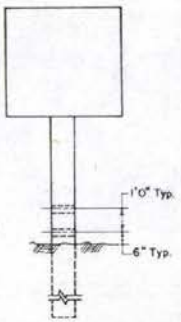


SIGN POST EMBEDMENTS	
4" x 4" = 3'-0"	4" x 6" = 4'-0"
6" x 6" = 5'-0"	6" x 8" = 6'-0"

RECTANGULAR TIMBER POST SELECTION



MOUNTING HEIGHTS (MH) FOR SIGNS			
	SINGLE SIGN	DOUBLE SIGN	
COMMERCIAL			SIDEWALK OR PEDESTRIAN AREAS
RESIDENTIAL	7' MIN.	7' MIN.	
OUTSKIRTS			
RURAL	5' MIN.	5' MIN.	



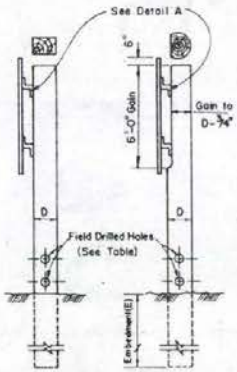
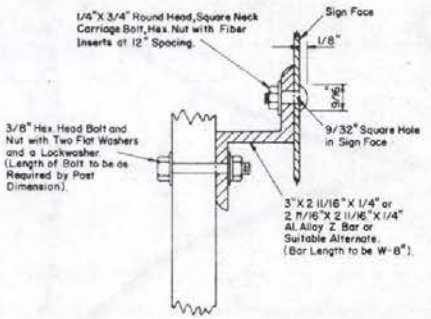
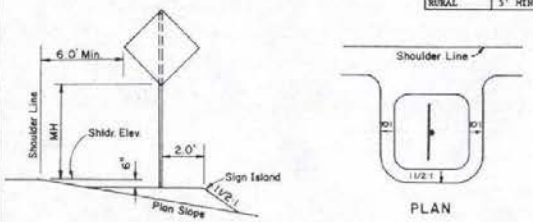


TABLE OF HOLE DIAMETERS		
POST SIZE	LESS THAN 6"x6"	6" x 8" OR 6" ø
HOLE DIA.	NO HOLE	¾"

TIMBER POST SIGN SUPPORT



DETAIL A



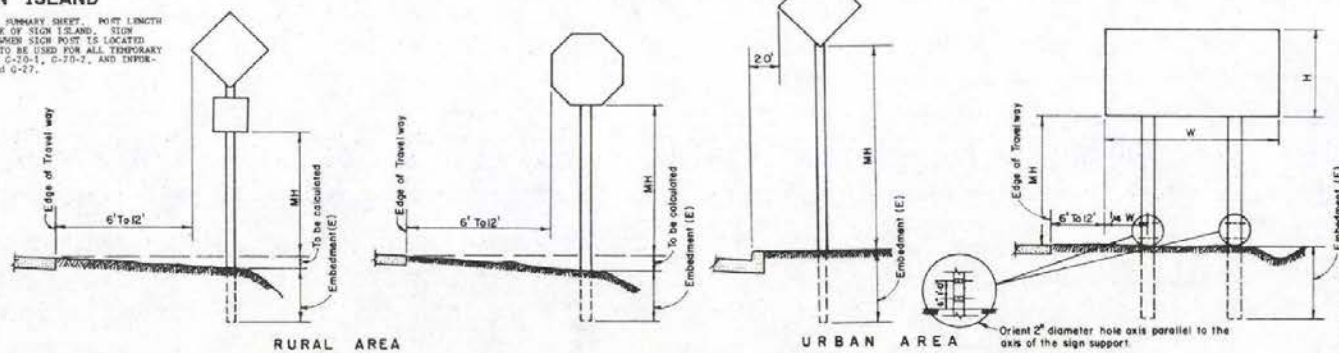
PLAN

SIGN ISLAND

POST LENGTH AS SHOWN ON SIGN SUMMARY SHEET. POST LENGTH CALCULATIONS ARE BASED ON USE OF SIGN ISLAND. SIGN ISLAND SHALL BE USED EXCEPT WHEN SIGN POST IS LOCATED IN BACKSLOPE. SIGN ISLANDS TO BE USED FOR ALL TEMPORARY SIGNS AND CONSTRUCTION SIGNS G-20-1, G-20-2, AND INFORMATIONAL SIGNS G-25, G-26 and G-27.

GENERAL NOTES

1. ALL BOLTS, NUTS AND WASHERS TO BE GALVANIZED.
2. ALL POSTS WITH CROSS SECTIONAL AREA LARGER THAN 24 SQUARE INCHES ARE TO BE DRILLED AS SHOWN.



RURAL AREA

URBAN AREA

TYPICAL SIGN ERECTION

RURAL AND URBAN

ERECTION: RIGHT-HAND SIDE OF ROADWAY; FACING AND AT RIGHT ANGLES TO DIRECTION OF TRAFFIC.

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

CONSTRUCTION SIGN AND TEMPORARY SIGN ERECTION

Russell C. Hill
CHIEF TRAFFIC ENGR.

T-311.6	(625)
ADOPTED: 8/73	REVISION

T 15

GENERAL NOTES:

1. ALL WARNING SIGNS ("W" SERIES) SHALL BE BLACK ON REFLECTIVE ORANGE.
2. SPEED LIMITS FOR CURVES SHALL BE DETERMINED BY THE USE OF A BALL BANK INDICATOR OR OTHER APPROVED METHOD. (SEE TABLE)
3. TRAFFIC CONES SHALL BE PLACED IN ACCORDANCE WITH THE TABLE FOR SPACING OF TRAFFIC CONES AND TRAFFIC DELINEATORS AND SHALL BE NO CLOSER THAN 2'-0" NOR MORE THAN 6'-0" OUTSIDE THE SOLID WHITE LINE OR THE DOUBLE YELLOW LINES. TRAFFIC CONES SHALL BE ORANGE IN COLOR AND SHALL BE REFLECTORIZED WITH 3" WHITE PRISMATIC REFLECTORS WHEN USED WITH WHITE LINE AND 3" YELLOW PRISMATIC REFLECTORS WHEN USED WITH THE YELLOW LINE DURING NIGHTTIME HOURS.
4. WHENEVER A TWO LANE ROADWAY PARALLELS A FOUR LANE ROADWAY OR WHENEVER A TWO LANE ROAD MAY BE CONFUSED WITH A FOUR LANE ROADWAY, USE WARNING SIGN W6-3 AT ONE MILE INTERVALS.
5. TEMPORARY PAVEMENT STRIPING TAPE SHALL BE USED WHERE SURFACES ARE TO REMAIN AS FINAL SURFACE OR WHERE THE STRIPING PATTERN IS TO BE CHANGED OR AS OTHERWISE NOTED.
6. "END CONSTRUCTION" (G20-2) SHALL BE USED WHERE APPLICABLE.

TABLE FOR SPACING TRAFFIC CONES & TRAFFIC DELINEATORS

DEGREE OF CURVE	RADIUS	SPEED	SPACING	DEGREE OF CURVE	RADIUS	SPEED	SPACING
	10,000				900		
2		80	100	9		45	50
	2,500				600		
		75	80			40	45
	2,000				500		
3		70	75	15		35	40
	1,800				350		
4		65	70	21		30	30
	1,400				250		
		60	65	25		25	20
	1,200				200		
5		55	60	40		20	10
	1,000				100		
7		50	55				
	800						

1. Spacing may be closer where conditions warrant.
2. When used on inside of curves, double the spacing.

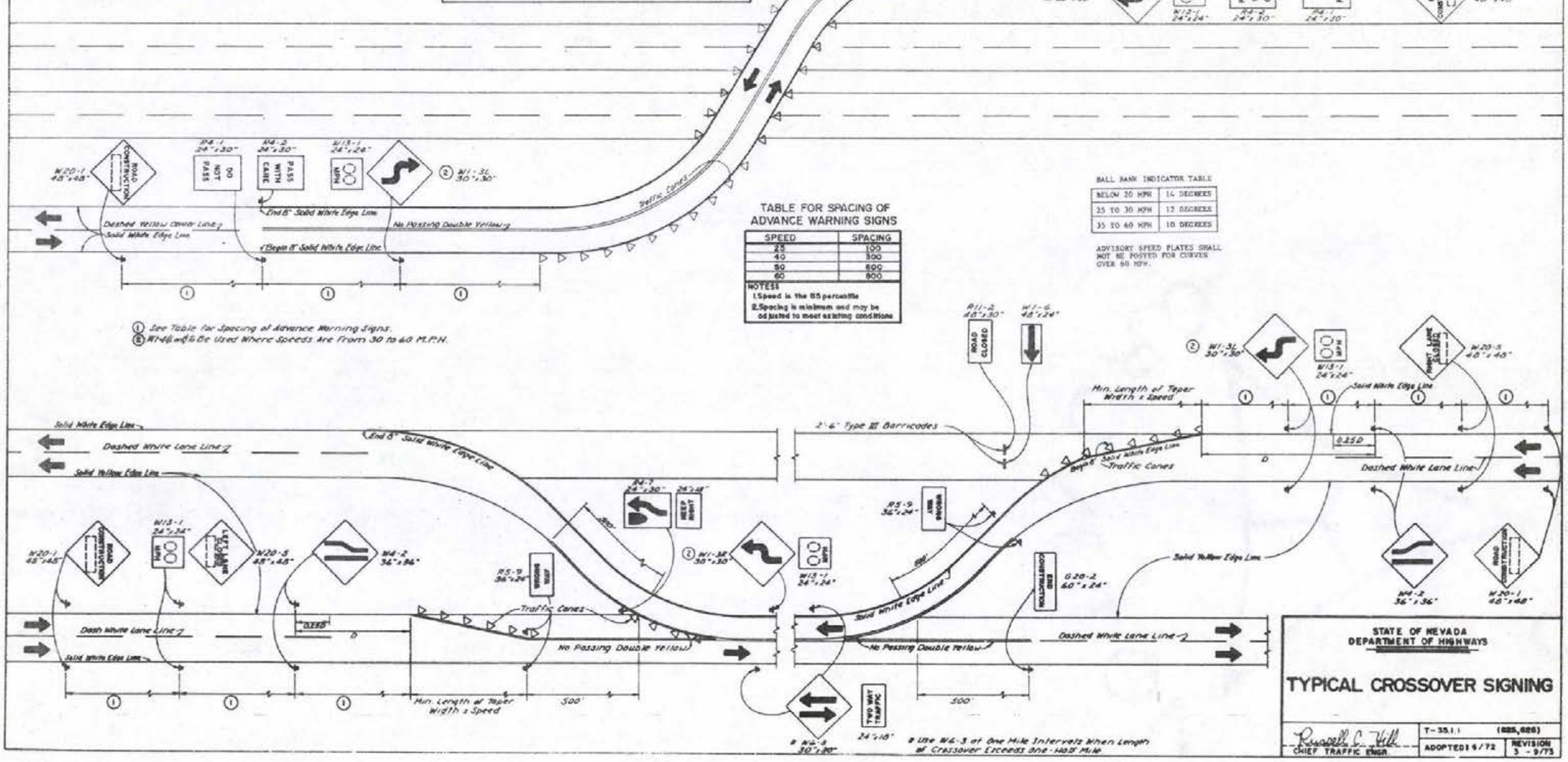


TABLE FOR SPACING OF ADVANCE WARNING SIGNS

SPEED	SPACING
25	100
40	300
50	500
60	800

NOTES:
1. Speed is the 85 percentile
2. Spacing is minimum and may be adjusted to meet existing conditions

BALL BANK INDICATOR TABLE

BELOW 20 MPH	14 DEGREES
25 TO 30 MPH	12 DEGREES
35 TO 60 MPH	10 DEGREES

ADVISORY SPEED PLATES SHALL NOT BE POSTED FOR CURVES OVER 60 MPH.

① See Table for Spacing of Advance Warning Signs.
② W1-4L or R to Be Used Where Speeds Are From 30 to 60 M.P.H.

Use W6-3 at One Mile Intervals When Length of Crossover Exceeds One-Half Mile

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

TYPICAL CROSSOVER SIGNING

Russell C. Hill
CHIEF TRAFFIC ENGR.

T-35.1.1 (625,626)
ADOPTED: 4/72
REVISION 3 - 9/73

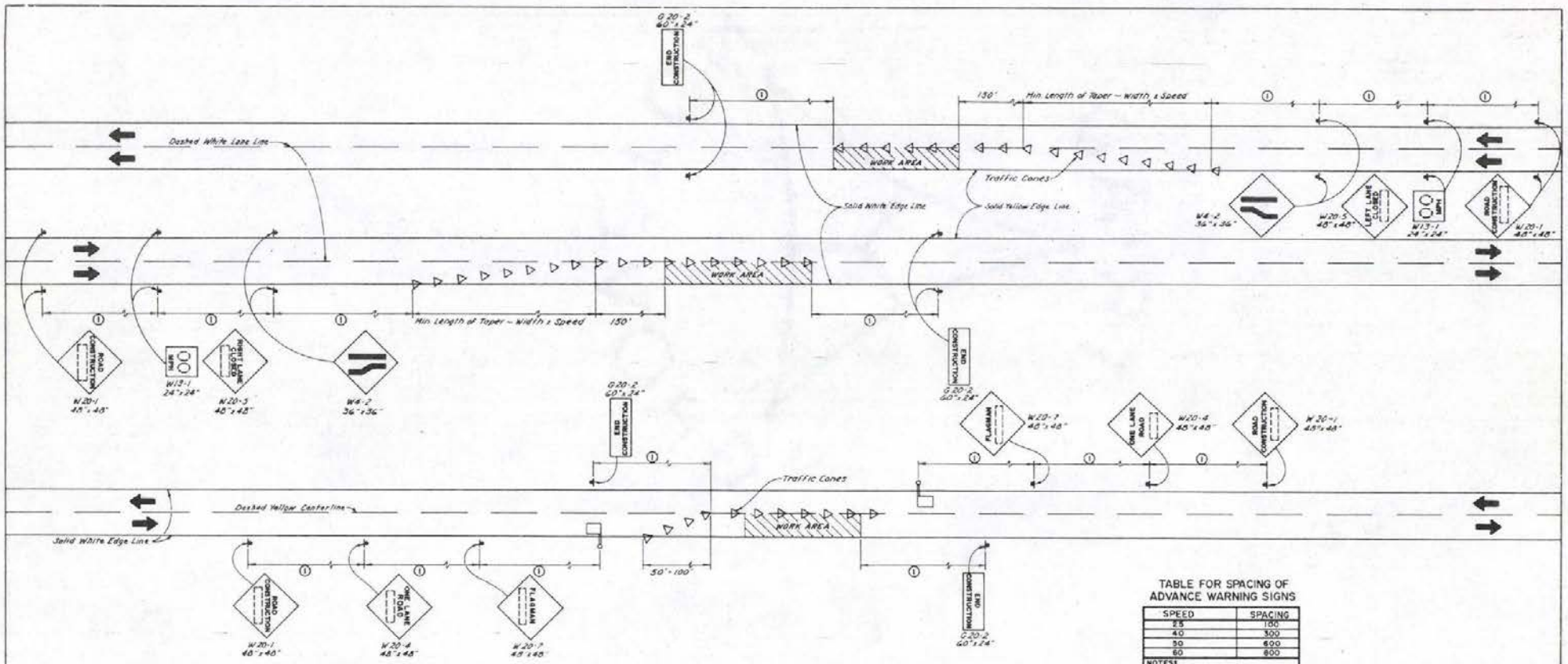


TABLE FOR SPACING OF ADVANCE WARNING SIGNS

SPEED	SPACING
25	150
40	300
50	600
60	800

NOTES:
1. Speed is the 85 percentile
2. Spacing is minimum and may be adjusted to meet existing conditions

① See Table For Spacing of Advance Warning Signs

TABLE FOR SPACING TRAFFIC CONES & TRAFFIC DELINEATORS

DEGREE OF CURVE	RADIUS	SPEED	SPACING	DEGREE OF CURVE	RADIUS	SPEED	SPACING
	10,000				800		
2		80	100	9		45	50
	2,500				600		
		75	80			40	45
	2,000				520		
3		70	75	15		35	40
	1,800				350		
4		65	70	21		30	30
	1,400				250		
		60	65	25		25	20
	1,200				200		
5		55	60	40		20	10
	1,000				100		
7		50	55				
	800						

1. Spacing may be closer where conditions warrant
2. When used on inside of curves, double the spacing

GENERAL NOTES

1. ALL WARNING SIGNS ("W" SERIES) SHALL BE BLACK ON REFLECTIVE ORANGE
2. TRAFFIC CONES SHALL BE PLACED IN ACCORDANCE WITH THE TABLE FOR SPACING OF TRAFFIC CONES AND TRAFFIC DELINEATORS. TRAFFIC CONES SHALL BE ORANGE IN COLOR.
3. "END CONSTRUCTION" (G20-2) SHALL BE USED WHERE APPLICABLE.

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

TYPICAL LANE CLOSURE SIGNING

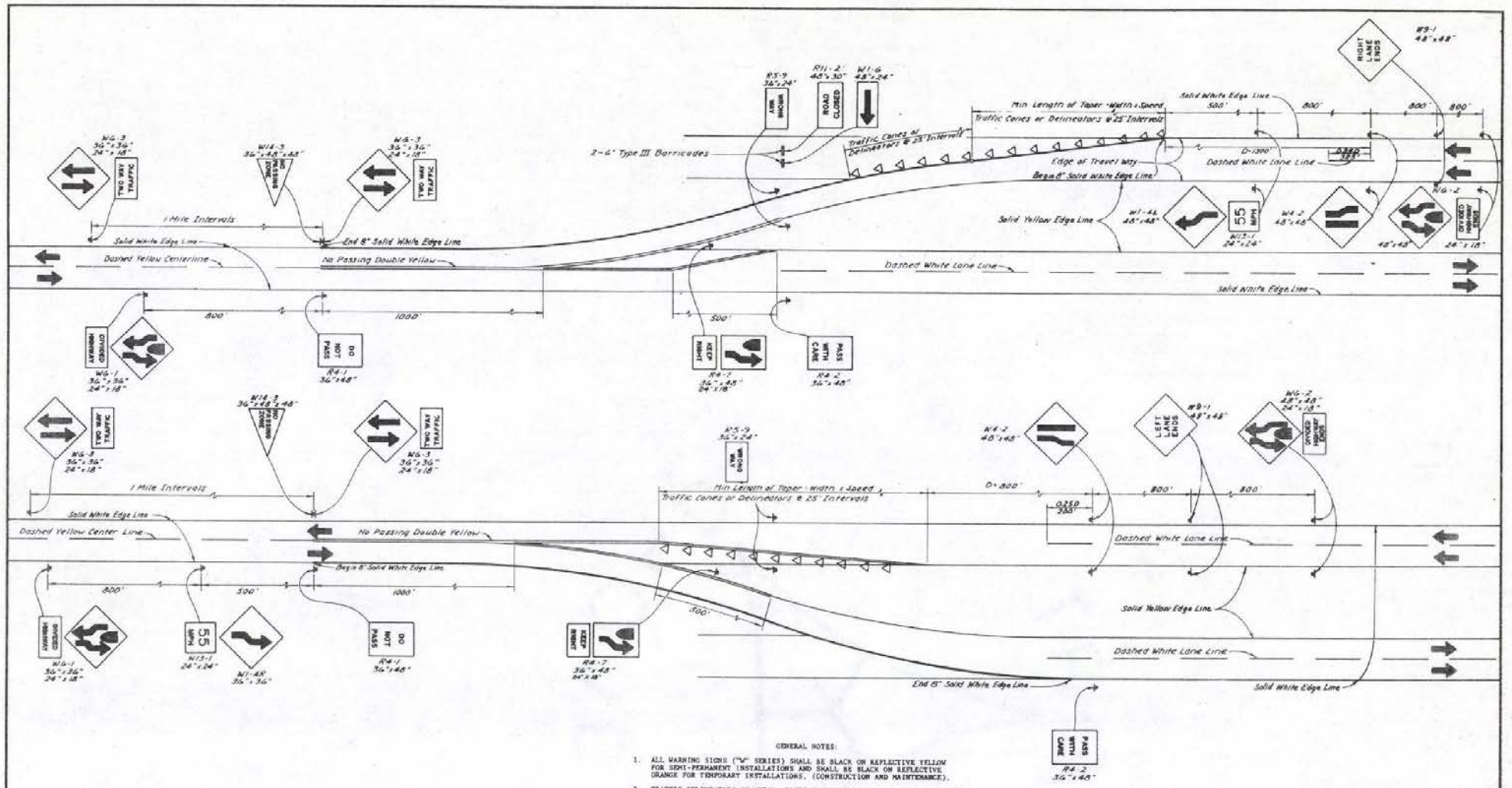
CHIEF TRAFFIC ENGR.

T-35.1.2 (625,626)

ADOPTED: 6/72

REVISION 2 - 9/73

T17



GENERAL NOTES:

1. ALL WARNING SIGNS ("W" SERIES) SHALL BE BLACK ON REFLECTIVE YELLOW FOR SEMI-PERMANENT INSTALLATIONS AND SHALL BE BLACK ON REFLECTIVE ORANGE FOR TEMPORARY INSTALLATIONS. (CONSTRUCTION AND MAINTENANCE).
2. TRAFFIC DELINEATORS ON METAL POSTS SHALL BE USED TO OUTLINE LANE DROP TAPERS FOR SEMI-PERMANENT INSTALLATIONS AND TRAFFIC CONES FOR TEMPORARY INSTALLATIONS. THEY SHALL BE NO CLOSER THAN 2'-0" NOR MORE THAN 5'-0" OUTSIDE THE SOLID WHITE LINE OR DOUBLE YELLOW LINES. TRAFFIC DELINEATORS SHALL CONSIST OF A 3" PRISMATIC YELLOW OR WHITE REFLECTOR AND SHALL BE USED WITH THEIR RESPECTIVE LINES DURING NIGHTTIME HOURS. TRAFFIC CONES SHALL BE ORANGE IN COLOR AND ALSO EQUIPPED WITH REFLECTORS AND USED IN THE SAME MANNER AS THE TRAFFIC DELINEATORS.
3. SPEED LIMITS THROUGH TRANSITION CURVES SHALL BE 55 MPH UNLESS DETERMINED TO BE LESS BY THE USE OF A BALL BANK INDICATOR OR OTHER APPROVED METHOD. (SEE TABLE)
4. [illegible] SHOWN ARE FOR HIGH SPEED TRANSITIONS AND MAY BE REDUCED PROPORTIONALLY TO FIT EXISTING CONDITIONS.
5. CURVE SIGN W1-3 (LOR R) SHALL BE USED WHEN SPEEDS ARE FROM 0-30 MPH AND SIGN W1-4 (LOR R) WHEN SPEEDS ARE FROM 30-60 MPH.
6. "END CONSTRUCTION" (G20-2) SHALL BE USED WHERE APPLICABLE.

BALL BANK INDICATOR TABLE

BELOW 20 MPH	14 DEGREES
25 TO 30 MPH	12 DEGREES
35 TO 60 MPH	10 DEGREES

ADVISORY SPEED PLATES SHALL NOT BE POSTED FOR CURVES OVER 60 MPH.

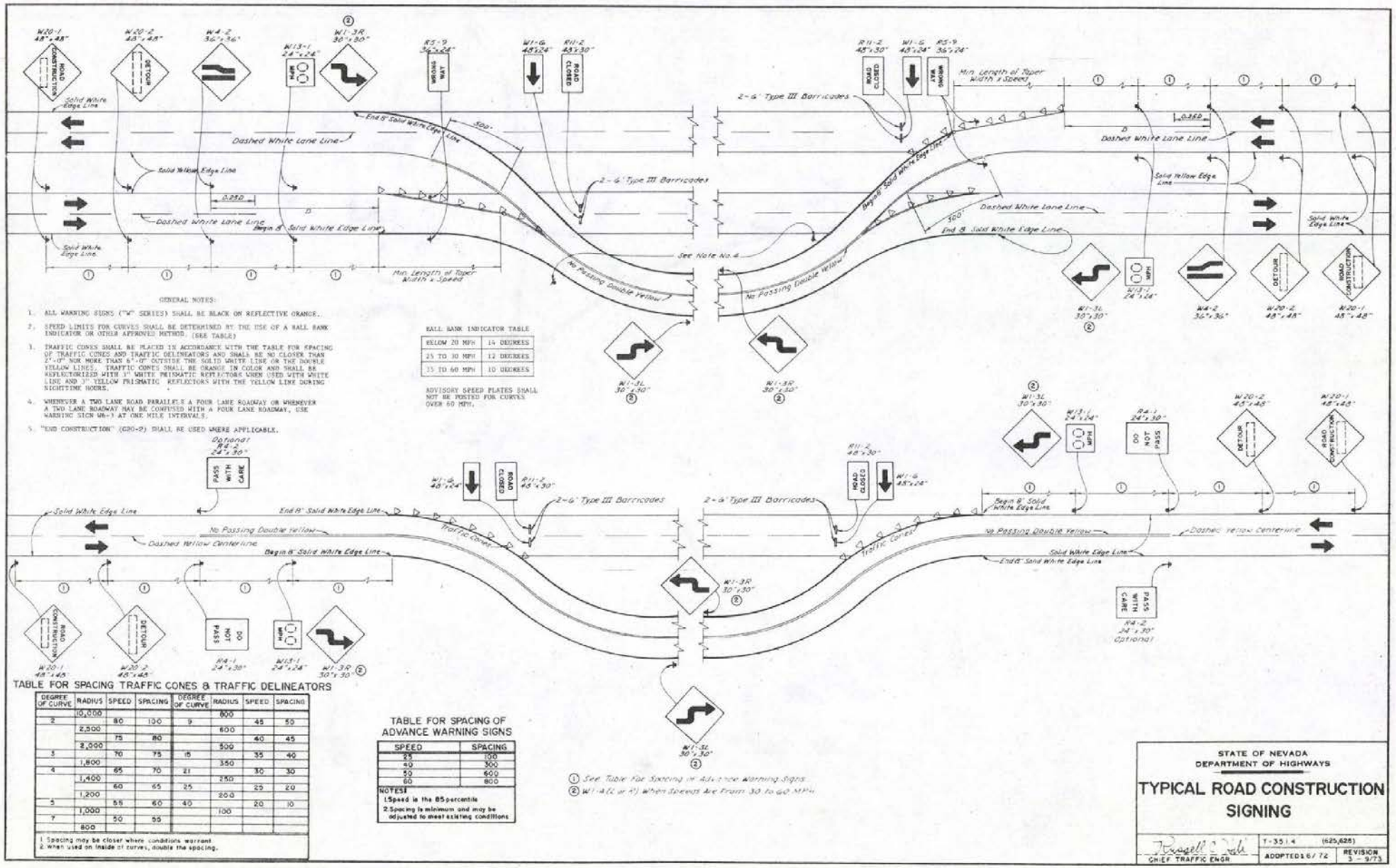
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

TYPICAL 2 LANE TO 4 LANE CONNECTION SIGNING (RURAL)

Russell C. Hill
CHIEF TRAFFIC ENGR

T-35.1.3 (620,626)
ADOPTED 8/6/72
REVISION 5-9-73

T18



GENERAL NOTES:

1. ALL WARNING SIGNS ("W" SERIES) SHALL BE BLACK ON REFLECTIVE ORANGE.
2. SPEED LIMITS FOR CURVES SHALL BE DETERMINED BY THE USE OF A BALL BANK INDICATOR OR OTHER APPROVED METHOD. (SEE TABLE)
3. TRAFFIC CONES SHALL BE PLACED IN ACCORDANCE WITH THE TABLE FOR SPACING OF TRAFFIC CONES AND TRAFFIC DELINEATORS AND SHALL BE NO CLOSER THAN 2'-0" NOR MORE THAN 6'-0" OUTSIDE THE SOLID WHITE LINE OR THE DOUBLE YELLOW LINES. TRAFFIC CONES SHALL BE ORANGE IN COLOR AND SHALL BE REFLECTORIZED WITH 3" WHITE PRISMATIC REFLECTORS WHEN USED WITH WHITE LINE AND 3" YELLOW PRISMATIC REFLECTORS WITH THE YELLOW LINE DURING NIGHTTIME HOURS.
4. WHENEVER A TWO LANE ROAD PARALLELS A FOUR LANE ROADWAY OR WHENEVER A TWO LANE ROADWAY MAY BE CONFUSED WITH A FOUR LANE ROADWAY, USE WARNING SIGN W6-1 AT ONE MILE INTERVALS.
5. "END CONSTRUCTION" (G20-2) SHALL BE USED WHERE APPLICABLE.

BALL BANK INDICATOR TABLE

BELOW 20 MPH	14 DEGREES
25 TO 30 MPH	12 DEGREES
35 TO 60 MPH	10 DEGREES

ADVISORY SPEED PLATES SHALL NOT BE POSTED FOR CURVES OVER 60 MPH.

TABLE FOR SPACING TRAFFIC CONES & TRAFFIC DELINEATORS

DEGREE OF CURVE	RADIUS	SPEED	SPACING	DEGREE OF CURVE	RADIUS	SPEED	SPACING
	10,000				600		
2		80	100	9		45	50
	2,500				600		
		75	80			40	45
	2,000				500		
3		70	75	15		35	40
	1,800				350		
4		65	70	21		30	30
	1,400				250		
		60	65	25		25	20
	1,200				200		
5		55	60	40		20	10
	1,000				100		
7		50	55				
	800						

1. Spacing may be closer where conditions warrant.
2. When used on inside of curves, double the spacing.

TABLE FOR SPACING OF ADVANCE WARNING SIGNS

SPEED	SPACING
25	100
40	300
50	400
60	800

NOTES:
1. Speed is the 85 percentile
2. Spacing is minimum and may be adjusted to meet existing conditions

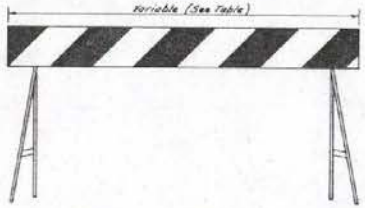
① See Table For Spacing of Advance Warning Signs.
② W1-4 (L or R) When Speeds Are From 30 To 60 MPH.

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

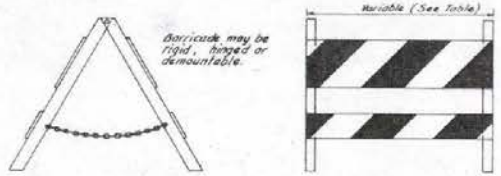
TYPICAL ROAD CONSTRUCTION SIGNING

Russell V. Hall
CHIEF TRAFFIC ENGR

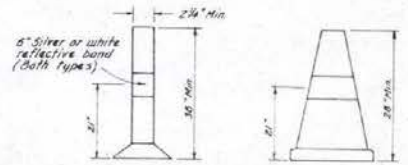
T-351.4 (625,628)
ADOPTED 1 6 / 72
REVISION 3 - 9/73



TYPE I BARRICADE



TYPE II BARRICADE
(FRAMEWORK TO BE PAINTED WHITE)

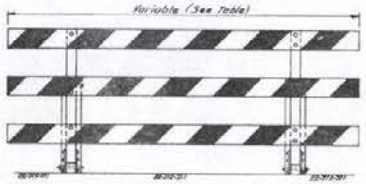


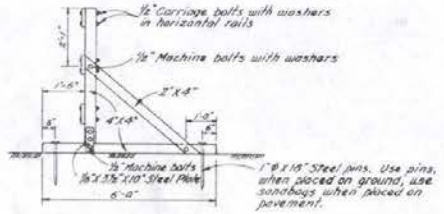
TRAFFIC CONES

1. CONES TO BE PREDOMINATELY ORANGE.
2. CONES TO BE USED DURING HOURS OF DARKNESS SHALL HAVE 6" REFLECTIVE BAND.
3. GENERALLY CONES SHALL HAVE WEIGHTED BASES, HOWEVER, IF THE CONTRACTOR WISHES, HE MAY EPOXY OR NAIL THE CONES IN PLACE.

GENERAL NOTES

1. SUITABLE ALTERNATES WHICH MAINTAIN THE BASIC DESIGN CONCEPT WILL BE ACCEPTABLE WHEN APPROVED BY THE ENGINEER.



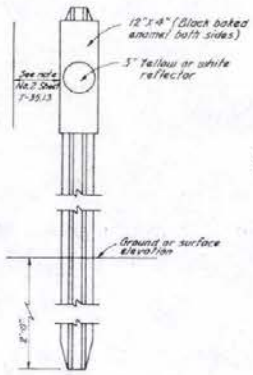


TYPE III BARRICADE

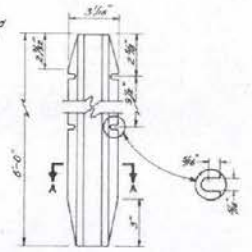
TABLE--BARRICADES--CHARACTERISTICS

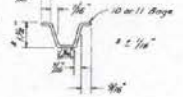
	TYPE I	TYPE II	TYPE III
WIDTH OF RAIL	8" MIN--12" MAX	8" MIN--12" MAX	8" MIN--12" MAX
LENGTH OF RAIL	6'--8'	3' MIN--6' MAX	3' MIN--6' MAX
WIDTH OF STRIPES	6 IN	6 IN	6 IN
HEIGHT	3 FT	3 FT	3 FT
TYPE OF FRAME	DEMOUNTABLE OR HEAVY "A" FRAME	LIGHT "A" FRAME	POST OR SKIDS
FLEXIBILITY	ESSENTIALLY MOVABLE	PORTABLE	ESSENTIALLY PERMANENT

MARKINGS FOR BARRIER RAILS SHALL BE ALTERNATE REFLECTORIZED ORANGE AND REFLECTORIZED WHITE STRIPES SLOPING DOWNWARD AT AN ANGLE OF 45 DEGREES IN THE DIRECTION OF TRAFFIC.

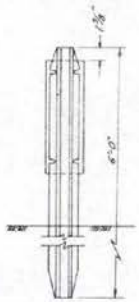


TRAFFIC DELINEATOR





SECTION A-A



POST DETAILS

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

BARRICADES

CHIEF TRAFFIC ENGINEER

T-35.1.1 (825-826)
ADOPTED 6/72
REVISION

T 20

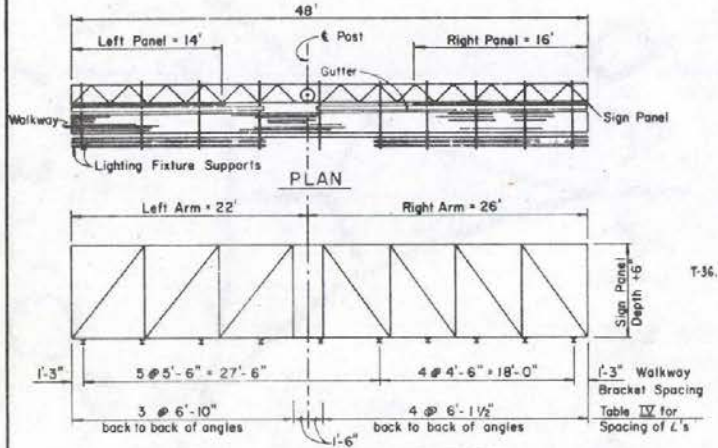
INSTRUCTIONS TO FABRICATOR

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.

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

T-36.1.1 - Instructions and examples
T-36.1.2 - Post type II thru XIII
T-36.1.3 - Post type I-s thru XII-s
T-36.1.4 - Structural frame members (single post type)
T-36.1.5 - Structural frame members (two post type)
T-36.1.6 - Structural frame details
T-36.1.7 - Frame juncture details
T-36.1.8 - Removable sign panel frames
T-36.1.9 & T-36.1.10 - Walkway details no. 1 & no. 2
T-36.1.11 - Walkway safety railing details.
T-36.1.12 - Alternate pile foundations.



UNBALANCED SINGLE POST TYPE

EXAMPLE NO. 1

WALKWAY BRACKETS: Maintain uniform spacing where possible. Maximum spacing shall not exceed 5'-6".

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.

GENERAL NOTES

SPECIFICATIONS:

DESIGN: A.A.S.H.O. Specifications for the design and construction of structural supports for highway signs, dated 1968.

CONSTRUCTION: Standard Specifications for Road and Bridge Construction, Current Edition and Supplements There to.

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.

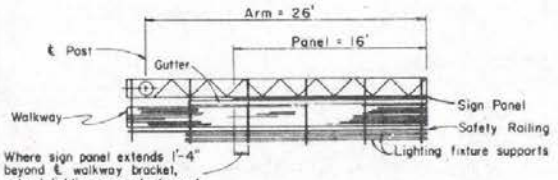
UNIT STRESSES:

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.

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

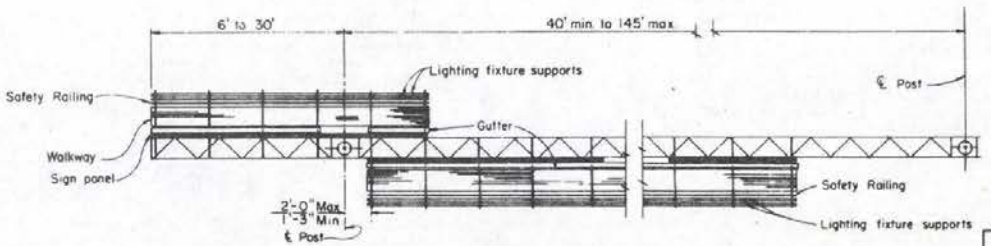
WELDING: All welding continuous unless otherwise noted on the plans. All welding to be done in accordance with the standard specifications for road and bridge construction.

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

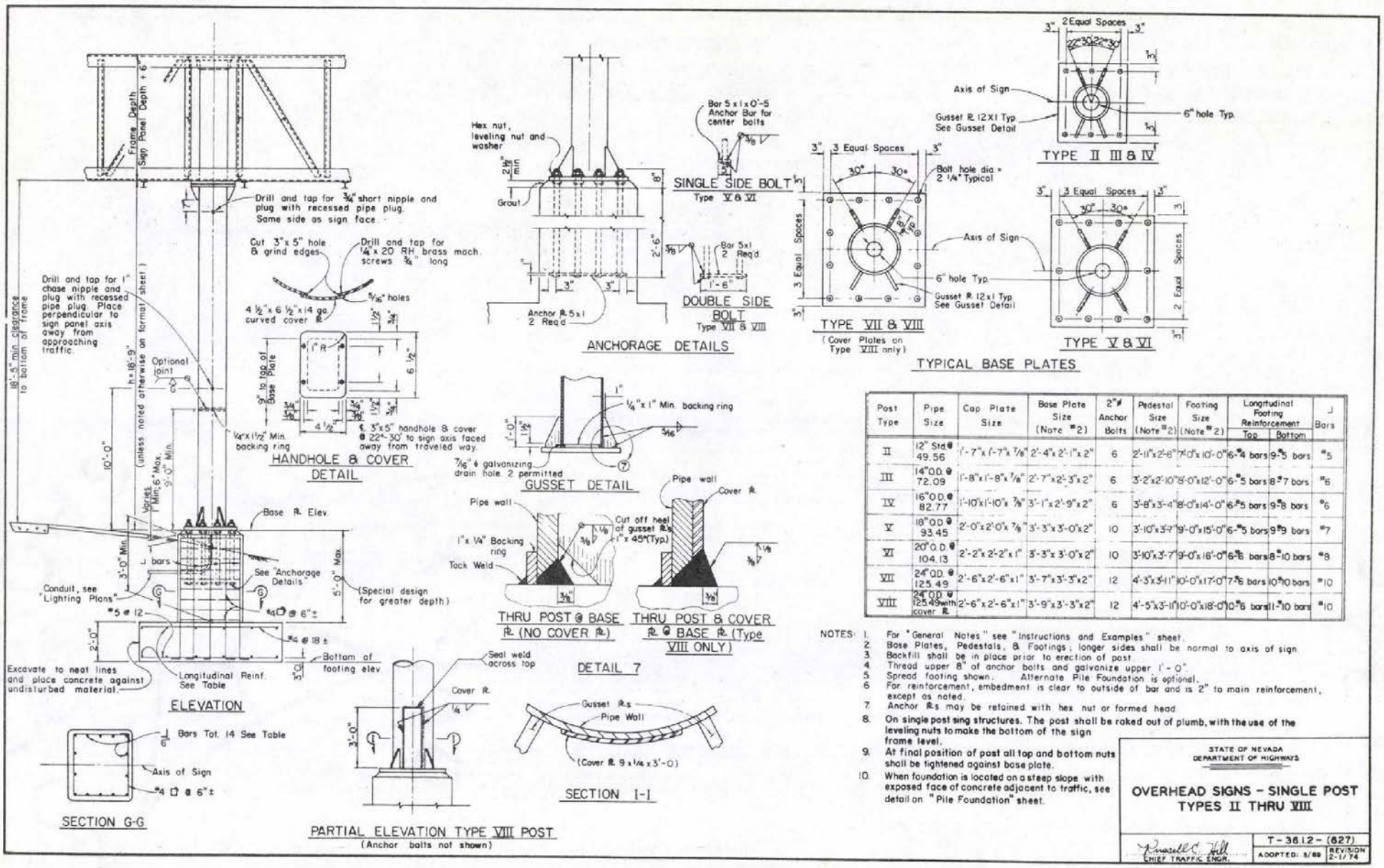
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

OVERHEAD SIGNS
INSTRUCTIONS & EXAMPLES

Russell S. Hill
CHIEF TRAFFIC ENGR.

T-36.1.1 - (827)
ADOPTED: 3/68
REVISION 2-1/74

T21



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	J Bars
II	12" Std @ 49.56	1'-7"x1'-7"x 7/8"	2'-4"x2'-1"x2"	6	2'-11"x2'-6"	7'-0"x10'-0"	6-#4 bars	9-#5 bars	#5
III	14"O.D.@ 72.09	1'-8"x1'-8"x 7/8"	2'-7"x2'-3"x2"	6	3'-2"x2'-10"	8'-0"x12'-0"	6-#5 bars	8-#7 bars	#6
IV	16"O.D.@ 82.77	1'-10"x1'-10"x 7/8"	3'-1"x2'-9"x2"	6	3'-8"x3'-4"	8'-0"x14'-0"	6-#5 bars	9-#8 bars	#6
V	18"O.D.@ 93.45	2'-0"x2'-0"x 7/8"	3'-3"x3'-0"x2"	10	3'-10"x3'-7"	9'-0"x15'-0"	6-#5 bars	9-#9 bars	#7
VI	20"O.D.@ 104.13	2'-2"x2'-2"x1"	3'-3"x3'-0"x2"	10	3'-10"x3'-7"	9'-0"x16'-0"	6-#6 bars	8-#10 bars	#8
VII	24"O.D.@ 125.49	2'-6"x2'-6"x1"	3'-7"x3'-3"x2"	12	4'-3"x3'-11"	10'-0"x17'-0"	7-#6 bars	10-#10 bars	#10
VIII	24"O.D.@ 125.49 with cover ℞	2'-6"x2'-6"x1"	3'-9"x3'-3"x2"	12	4'-5"x3'-11"	10'-0"x18'-0"	10-#6 bars	11-#10 bars	#10

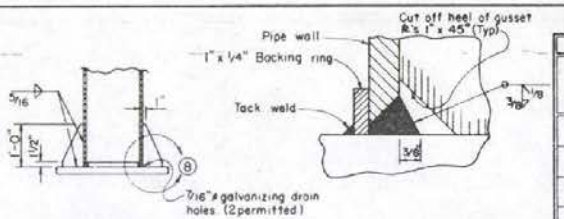
NOTES:
1. For "General Notes" see "Instructions and Examples" sheet.
2. Base Plates, Pedestals, & Footings; longer sides shall be normal to axis of sign.
3. Backfill shall be in place prior to erection of post.
4. Thread upper 8" of anchor bolts and galvanize upper 1'-0".
5. Spread footing shown. Alternate Pile Foundation is optional.
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.
8. **On single post sing 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.**
9. At final position of post all top and bottom nuts shall be tightened against base plate.
10. When foundation is located on a steep slope with exposed face of concrete adjacent to traffic, see detail on "Pile Foundation" sheet.

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

OVERHEAD SIGNS - SINGLE POST TYPES II THRU VIII

Russell C. Hill
CHIEF TRAFFIC ENGR.

T-36.12-(627)
ADOPTED: 5/69
REVISION 2-1-74



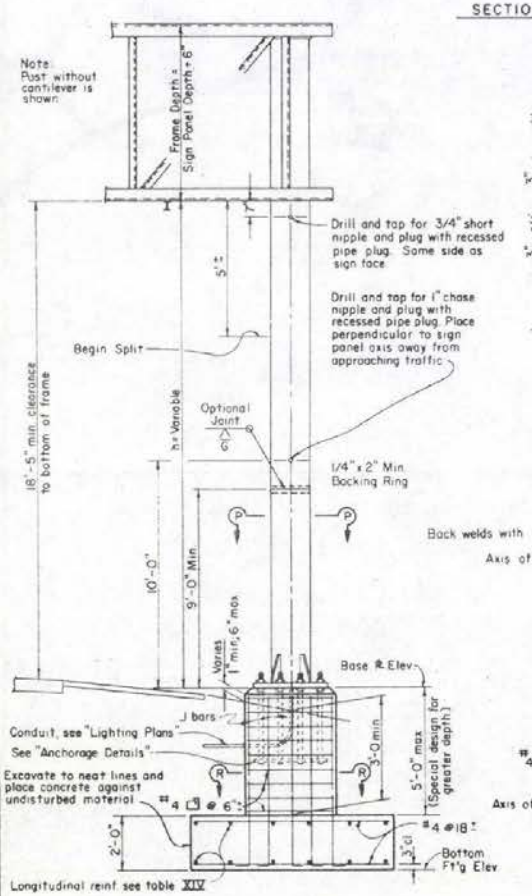
SECTION S-S

DETAIL (8)

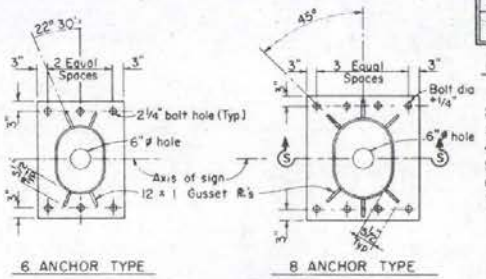
TABLE XIV									
Post Type	Pipe Size	Split	Base Plate Size (Note #3)	Anchor Bolts	Pedestal Size (Note #3)	Footing Size (Note #3)	Longitudinal Footing Reinforcement Top	Longitudinal Footing Reinforcement Bottom	J Bars
I - S	10" std @ 40.48	4"	2'-3"x1'-9"x 2"	6-2" ø	2'-9"x2'-3"	5'-0"x10'-0"	5-#4 bars	5-#6 bars	#6
II - S	12" std @ 49.56	5"	2'-6"x1'-11"x 2"	6-2" ø	3'-0"x2'-6"	6'-0"x11'-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"x2'-9"	7'-0"x13'-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"x3'-2"	8'-0"x14'-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"x3'-4"	8'-0"x16'-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"x3'-4"	9'-0"x17'-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"x3'-11"	10'-0"x18'-0"	10-#6 bars	10-#11 bars	#11

Notes:

1. For reinforcement, embedment is clear to outside of bar 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. Alternate Pile Foundation is optional.
7. Anchor R's may be retained with hex nut or formed head.



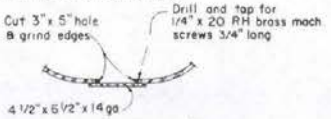
ELEVATION

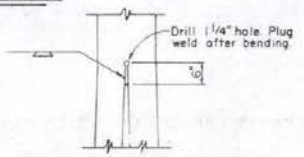


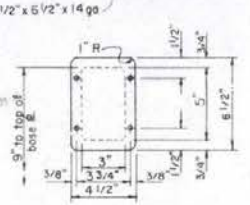
6 ANCHOR TYPE

8 ANCHOR TYPE

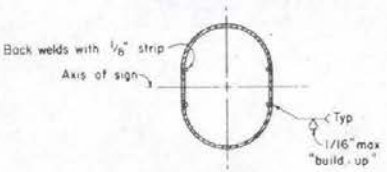
TYPICAL BASE PLATES



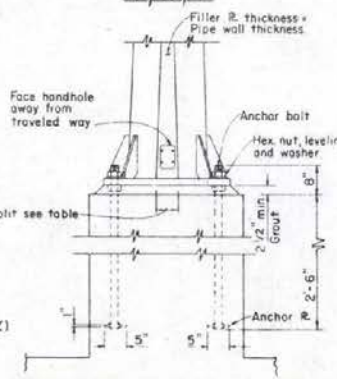


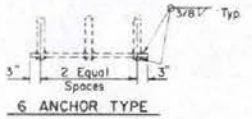


HANDHOLE & COVER DETAILS

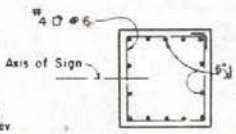


SECTION P-P

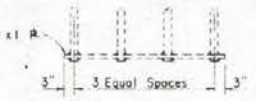




6 ANCHOR TYPE



SECTION R-R



8 ANCHOR TYPE

ANCHORAGE DETAILS

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

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

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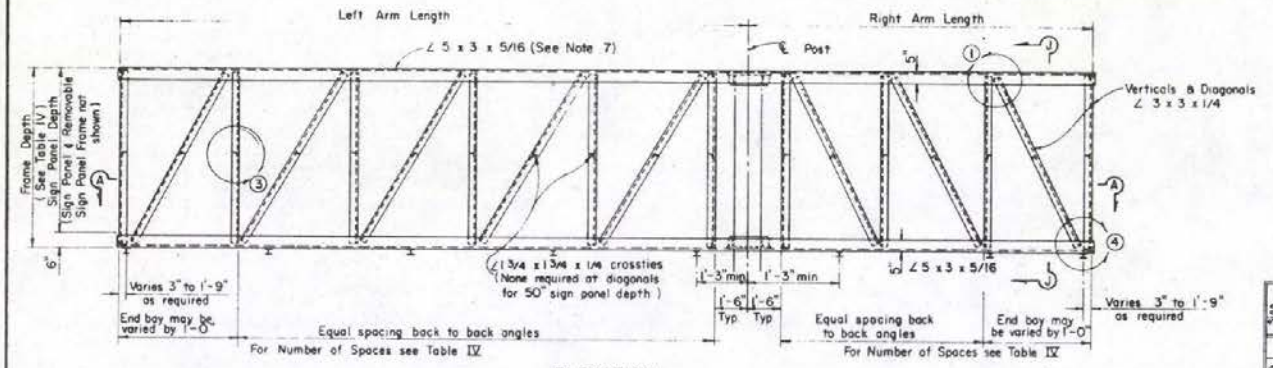
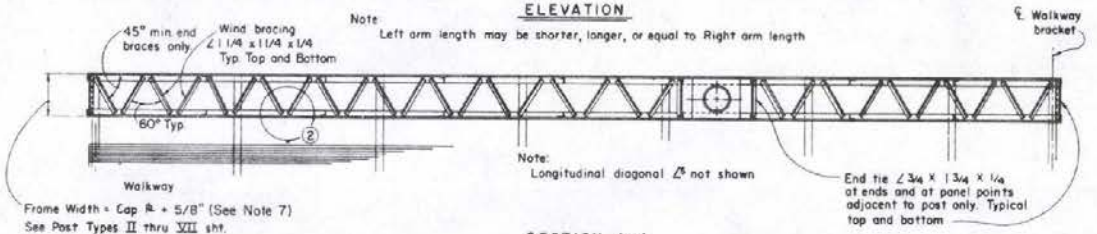
T - 36.1.3 - (627)
ADOPTED 5/88 REVISION



ELEVATION

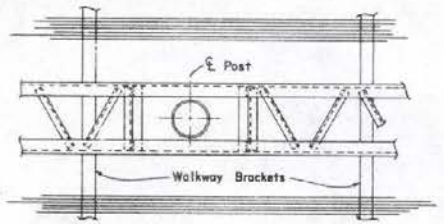
Note:
Left arm length may be shorter, longer, or equal to Right arm length



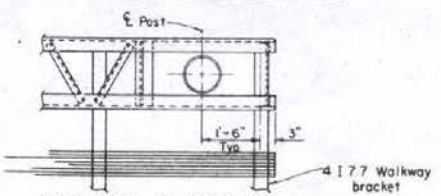
SECTION A-A

Sign Panel Depth	Frame Depth	Maximum Vertical ∠ Spacing	Arm Length	
60"	5'-6"	5'-0"	4'	
70"	6'-4"	5'-6"	4'	
80"	7'-2"	6'-0"	5'	
90"	8'-0"	7'-0"	5'	
100"	8'-10"	7'-0"	6'	
110"	9'-8"	7'-6"	6'	
120"	10'-6"	7'-6"	6'	No. diagonals required

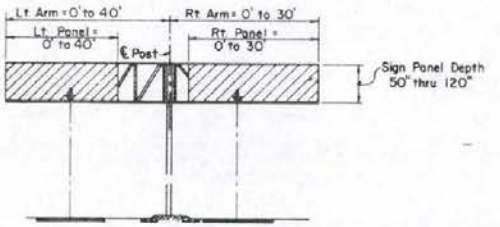
TABLE IV



PART PLAN OF DOUBLE FACED TYPE AT POST



PART PLAN OF CANTILEVER TYPE AT POST



LIMITING DIMENSIONS OF FRAME & SIGN PANEL

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 typical walkway arrangement, special instructions and examples, see "Instructions and Examples" sheet (T-36.1.1).
6. Minimum length of frame = 12'-0"
7. **For arm lengths 35' to 40' and sign depths 80" thru 120"**
   a. Use 5x3x5/16 chord ∠s.
   b. Frame width = Cap ℄ + 3/8".
8. 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.
9. At final position of post all top and bottom nuts shall be tightened against base plate.

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

OVERHEAD SIGNS - SINGLE POST STRUCTURAL FRAME MEMBERS

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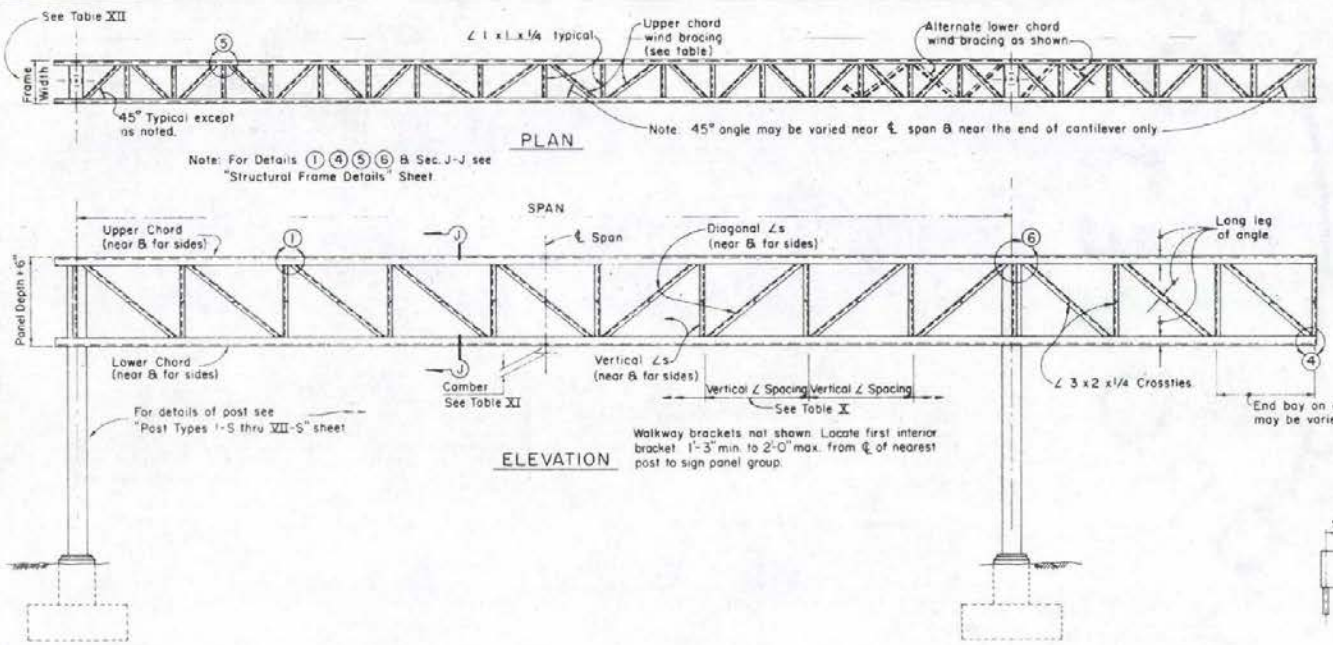
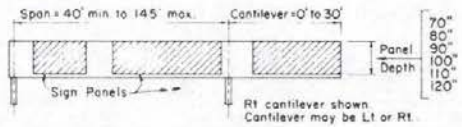
T - 36.1.4 - (627)
ADOPTED: 8/69
REVISION 2-1/74

T-24





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"	9x4x1/2			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.

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

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

OVERHEAD SIGNS - TWO POST STRUCTURAL FRAME MEMBERS

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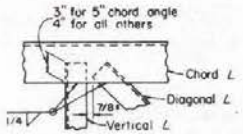
ADOPTED 5/80 | REVISION



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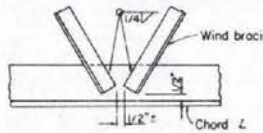

DETAIL (2)

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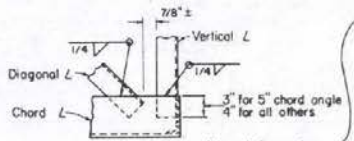

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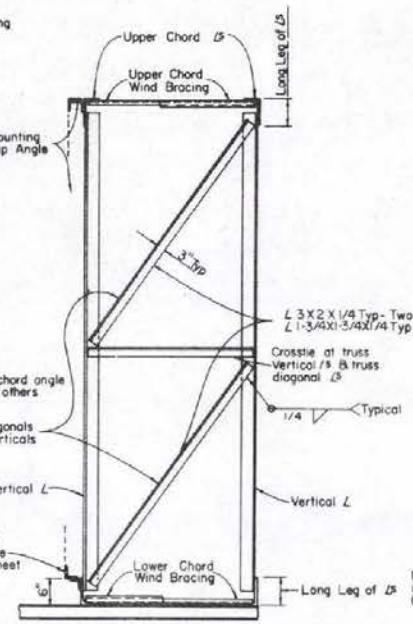
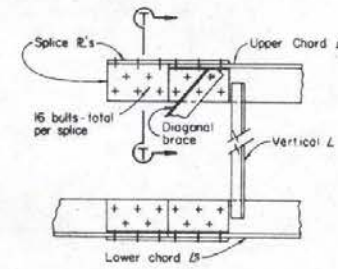
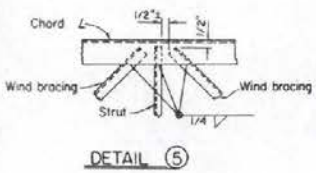




OPTIONAL
BOLTED CHORD SPLICE



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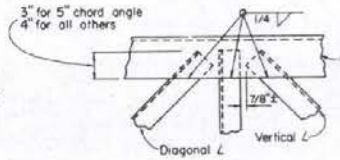

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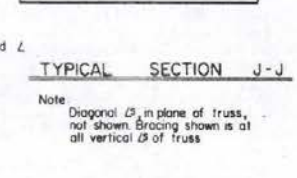
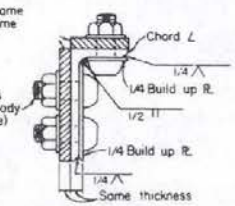


TYPICAL SECTION J-J

Note
Diagonal L in plane of truss, not shown. Bracing shown is at all vertical L of truss



SECTION T-T

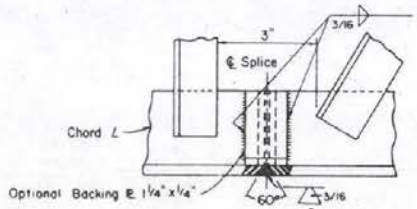
SPLICE NOTES

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
5 X 3 1/2 - 5/16	3/4"
6 X 4 X 3/8	7/8"
7 X 4 X 7/16	1"
8 X 4 X 1/2	1 1/8"
8 X 4 X 5/8	1 1/4"

SINGLE POST SIGNS	
Chord L	Nominal Bolt Diam
5 X 3 X 5/16	3/4"
5 X 3 X 7/16	3/4"

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

OVERHEAD SIGNS
STRUCTURAL FRAME DETAILS

Russell C. Hill
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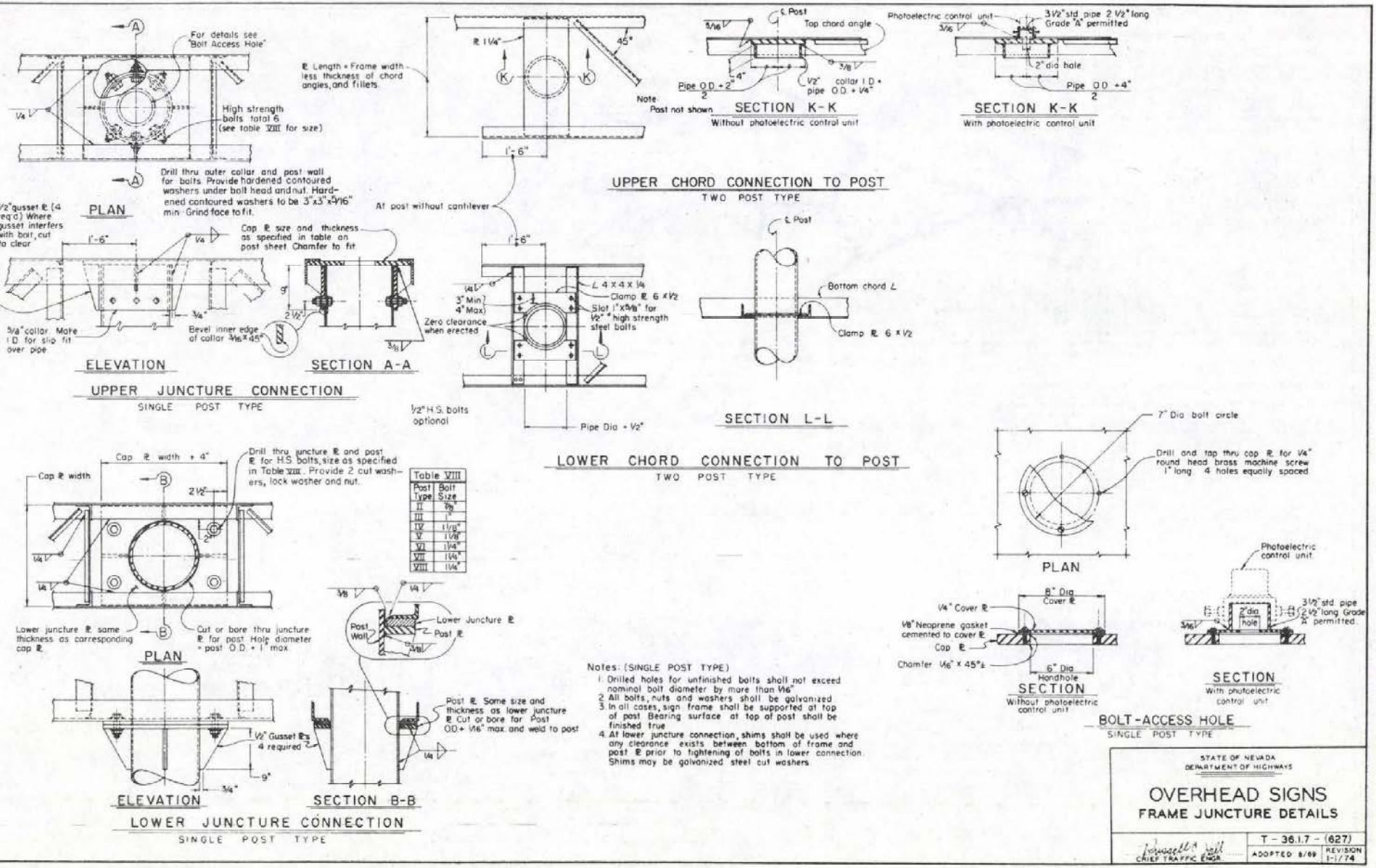
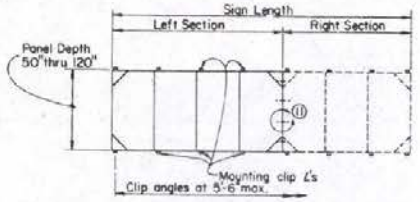
T - 36.1.6 - (627)
ADOPTED: 8/88 | REVISION 1-1/74


For details see "Bolt Access Hole"
High strength bolts total 6 (see table VIII for size)
PLAN
Drill thru outer collar and post wall for bolts. Provide hardened contoured washers under bolt head and nut. Hardened contoured washers to be 3"x3"x5/16" min. Grind face to fit.
1/2"gusset ℄ (4 req'd.) Where gusset interfers with bolt, cut to clear
Cap ℄ size and thickness as specified in table on post sheet. Chamfer to fit
5/8" collar. Make I.D. for slip fit over pipe
Bevel inner edge of collar 3/16"x45°
ELEVATION
SECTION A-A
UPPER JUNCTURE CONNECTION
SINGLE POST TYPE
℄ Length = Frame width less thickness of chord angles, and fillets
45°
Note Post not shown
At post without cantilever
Zero clearance when erected
∠ 4 x 4 x 1/4
Clamp ℄ 6 x 1/2
Slot 1"x3/8" for 1/2" ϕ high strength steel bolts
1/2" H.S. bolts optional
Pipe Dia + 1/2"
UPPER CHORD CONNECTION TO POST
TWO POST TYPE
℄ Post
Top chord angle
Pipe O.D. + 2" / 2
1/2" collar I.D. = pipe O.D. + 1/4"
SECTION K-K
Without photoelectric control unit
Photoelectric control unit
3 1/2" std. pipe 2 1/2" long Grade "A" permitted
2" dia hole
Pipe O.D. + 4" / 2
SECTION K-K
With photoelectric control unit
Bottom chord ∠
Clamp ℄ 6 x 1/2
SECTION L-L
LOWER CHORD CONNECTION TO POST
TWO POST TYPE
Cap ℄ width + 4"
Cap ℄ width
2 1/2"
Drill thru juncture ℄ and post ℄ for H.S. bolts, size as specified in Table VIII. Provide 2 cut washers, lock washer and nut.
Lower juncture ℄ same thickness as corresponding cap ℄
Cut or bore thru juncture ℄ for post. Hole diameter = post O.D. + 1" max.
PLAN
Post Wall
Lower Juncture ℄
Post ℄
1/2" Gusset ℄'s 4 required
9"
3/4"
ELEVATION
SECTION B-B
Post ℄ Same size and thickness as lower juncture ℄ Cut or bore for Post O.D. + 1/16" max. and weld to post
LOWER JUNCTURE CONNECTION
SINGLE POST TYPE
Table VIII

Post Type	Bolt Size
II	7/8"
III	1"
IV	1 1/8"
V	1 1/8"
VI	1 1/4"
VII	1 1/4"
VIII	1 1/4"

Notes: (SINGLE POST TYPE)
1. Drilled holes for unfinished bolts shall not exceed nominal bolt diameter by more than 1/16"
2. All bolts, nuts and washers shall be galvanized.
3. In all cases, sign frame shall be supported at top of post. Bearing surface at top of post shall be finished true.
4. At lower juncture connection, shims shall be used where any clearance exists between bottom of frame and post ℄ prior to tightening of bolts in lower connection. Shims may be galvanized steel cut washers.
7" Dia bolt circle
Drill and tap thru cap ℄ for 1/4" round head brass machine screw 1" long. 4 holes equally spaced
PLAN
8" Dia Cover ℄
1/4" Cover ℄
1/8" Neoprene gasket cemented to cover ℄
Cap ℄
Chamfer 1/16" x 45°±
6" Dia Handhole
SECTION
Without photoelectric control unit
Photoelectric control unit
2" dia hole
3 1/2" std. pipe 2 1/2" long Grade "A" permitted
SECTION
With photoelectric control unit
BOLT-ACCESS HOLE
SINGLE POST TYPE
STATE OF NEVADA
DEPARTMENT OF HIGHWAYS
OVERHEAD SIGNS
FRAME JUNCTURE DETAILS
CHIEF TRAFFIC ENGR
T - 36.1.7 - (627)
ADOPTED 8/69
REVISION 1-1/74

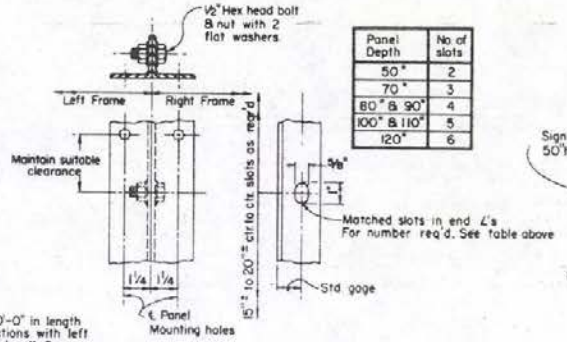
T 27



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'

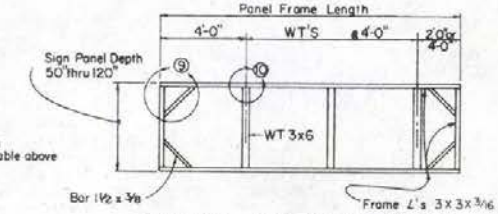
NOTES:
Frames for signs greater than 20'-0" in length shall be fabricated in two sections with left section a multiple of 4'-0" in length. See table above.
Sections shall be hoisted into place individually and bolted together as per detail (11) prior to tightening of mounting clip bolts.
Bolting two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



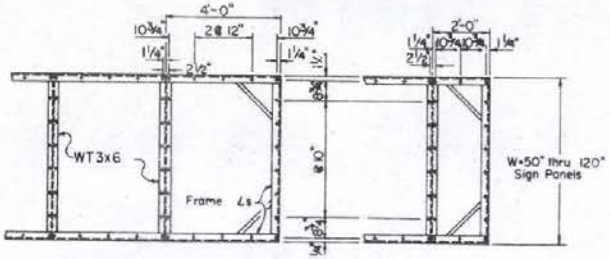
Panel Depth	No. of slots
50"	2
70"	3
80" & 90"	4
100" & 110"	5
120"	6

DETAIL (11)
No Scale

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



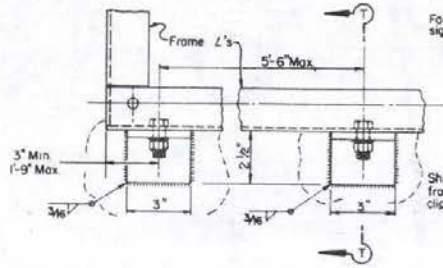
TYPICAL REMOVABLE FRAME
(4'-0" thru 20'-0")



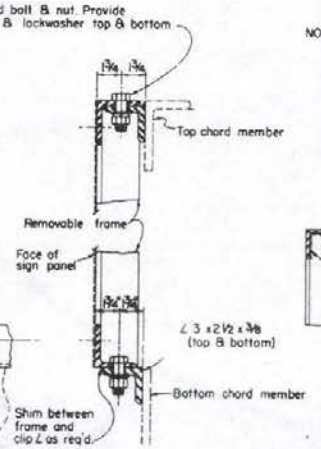
TYPICAL 4'-0" PANEL TYPICAL 2'-0" PANEL

Note: All holes ½" diameter

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

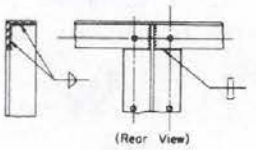


FRAME MOUNTING DETAILS
No Scale

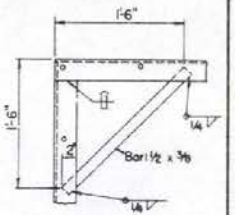


SECTION T-T

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 (⅛"-20 N.C.) may be used where interference due to welds or structural members is encountered.
4. WT 3x6 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. WT 3x6 may be crimped at ends to join frame angles. Fillet weld all around.



DETAIL (10)



DETAIL (9)

TYPICAL JOINT DETAILS

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

OVERHEAD SIGNS
REMOVABLE SIGN PANEL FRAMES

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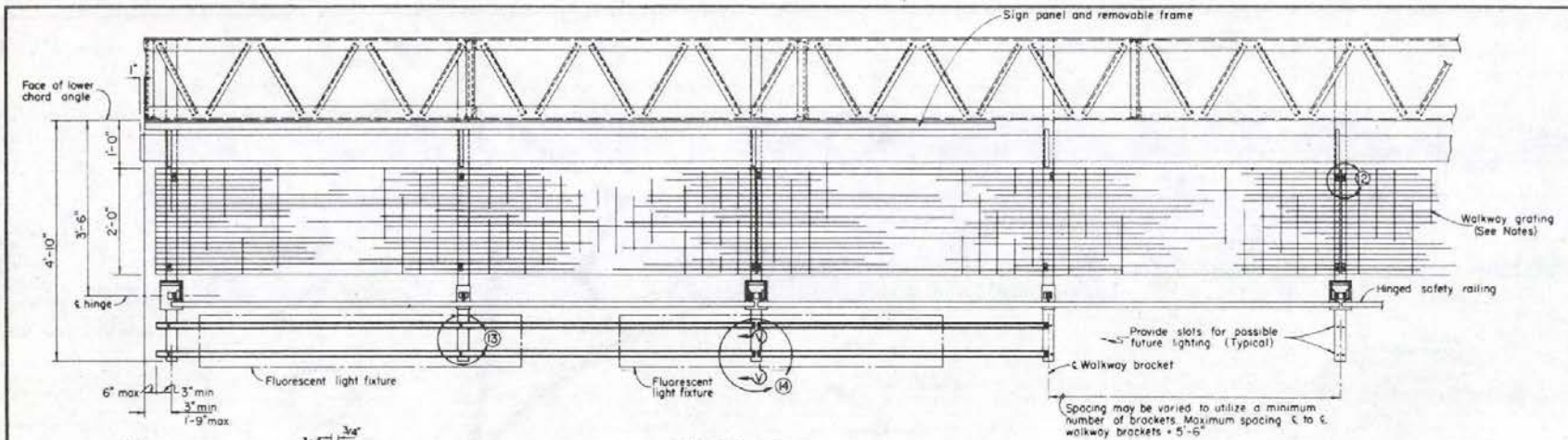
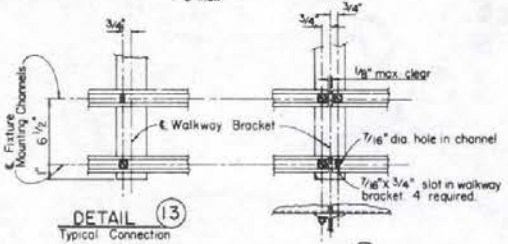
T - 36.1.8 - (627)
ADOPTED 8/69 REVISION 1-1-74

T 28

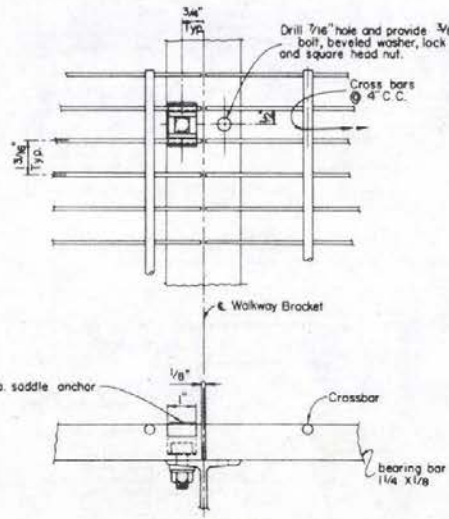


WALKWAY PLAN
Scale 1" = 1'-0"

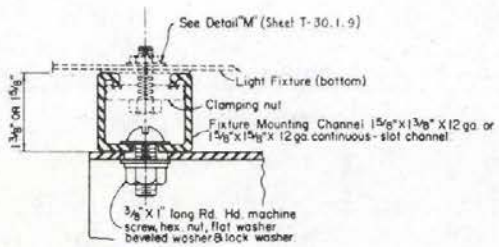


DETAIL (13)
Typical Connection

DETAIL (14)
Connection at Splice



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



SECTION V-V
Full Scale

1. Welded-type grating shall have 1 1/8" x 1/8" bearing bars @ 1 3/16" centers with 1/4" diameter (or equal) cross bars @ 4" centers. See detail (2). 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 practicable consistent with fabrication, ease of handling and assembling.
4. Bolts, nuts, washers, etc. to be galvanized.

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

OVERHEAD SIGNS
WALKWAY DETAILS NO. 1

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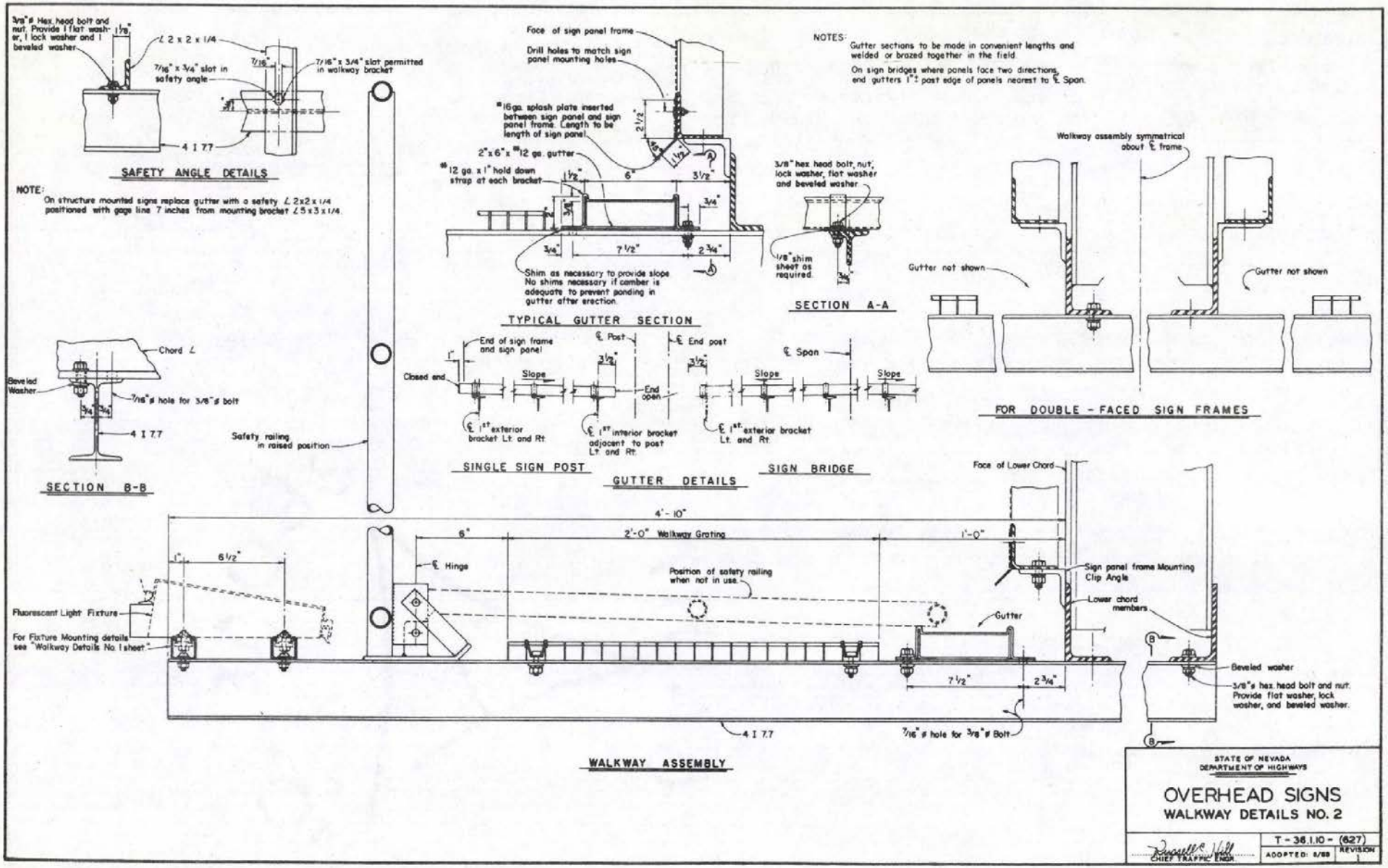
T - 36.1.9 - (627)
ADOPTED 8/89
REVISION 2 1/93

T 29



STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

OVERHEAD SIGNS
WALKWAY DETAILS NO. 2

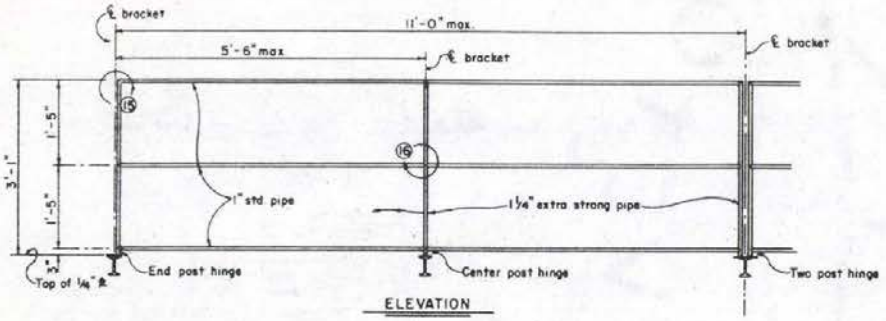
CHIEF TRAFFIC ENGR.

T - 36.1.10 - (627)

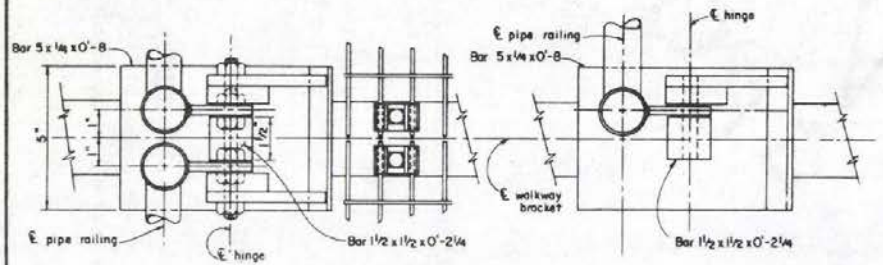
ADOPTED: 5/88

REVISION 1

T 30

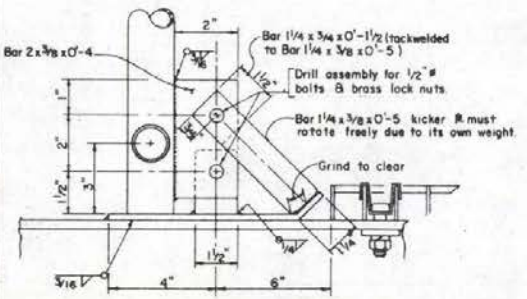


ELEVATION

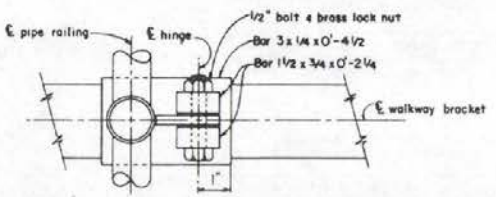


PLAN VIEW — TWO POST HINGE

PLAN VIEW — END POST HINGE



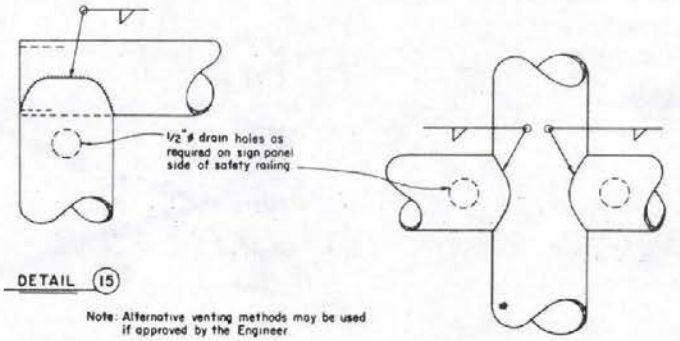
ELEVATION



PLAN VIEW — CENTER POST HINGE

Note:

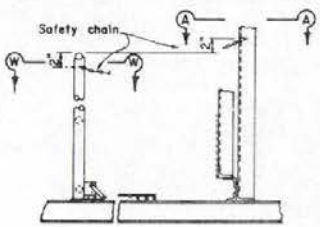
1. Special care shall be taken to insure that the completed hinge and latch assembly will hold the safety railing in a steady manner, free of wobble while in the raised position. Maximum allowable displacement from vertical at top of railing when latched shall be 1".
2. Details for bolting hinge base ℝ to walkway bracket may be submitted for approval.
3. Alternative details approved by the Engineer may be substituted for the safety chain connections shown.

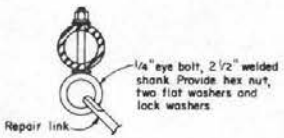


DETAIL (15)

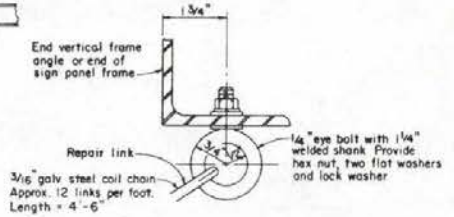
Note: Alternative venting methods may be used if approved by the Engineer.

DETAIL (16)





SECTION W-W



SECTION A-A

CHAIN ASSEMBLY

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

OVERHEAD SIGNS
WALKWAY SAFETY RAILING DETAILS

Russell S. Hill
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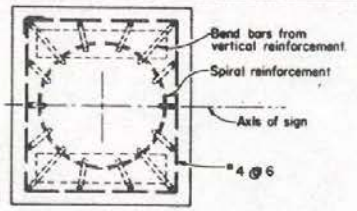
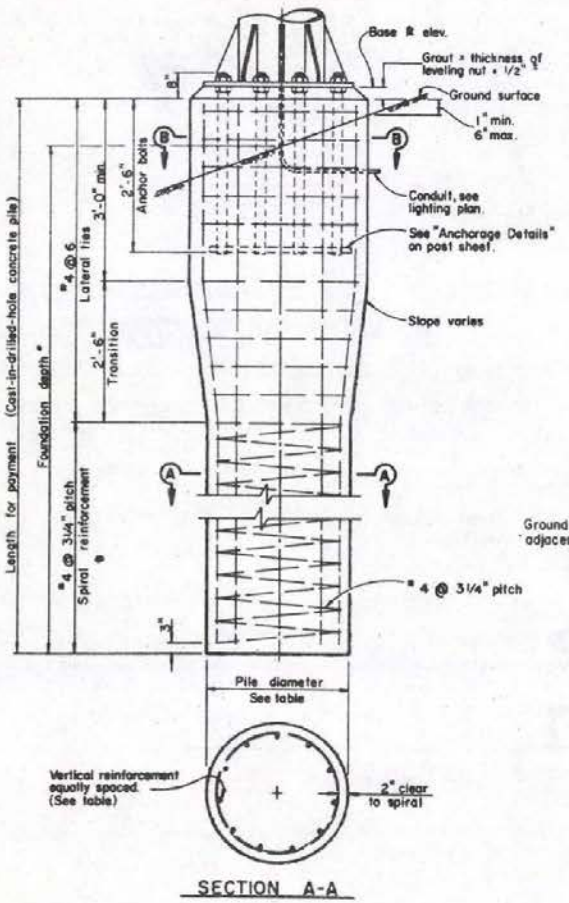
T - 36.1.11 - (627)
ADOPTED: 8/69
REVISION 1-1/74

T 31



SECTION B-B



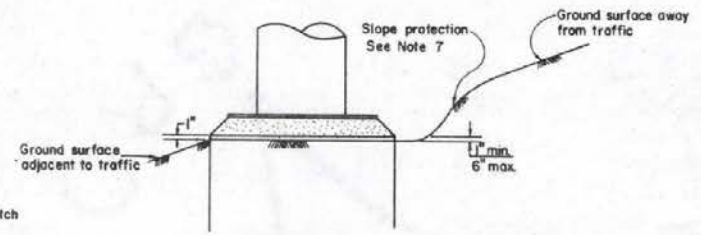
SECTION A-A

Post Type	Anchor Bolts	Pedestal Size	Reinforcing Steel Vertical	Pile Diameter	Foundation Depth*
I	6 - 2" ϕ	2'-11" x 2'-8"	14 - # 7	30"	14'
II	6 - 2" ϕ	3'-2" x 2'-10"	14 - # 8	30"	14'
III	6 - 2" ϕ	3'-8" x 3'-4"	16 - # 8	36"	14'
IV	10 - 2" ϕ	3'-10" x 3'-7"	16 - # 9	36"	17'
V	10 - 2" ϕ	3'-10" x 3'-7"	16 - #10	36"	18'
VI	12 - 2" ϕ	4'-3" x 3'-11"	16 - #11	36"	21'
VII	12 - 2" ϕ	4'-5" x 3'-11"	16 - #14	36"	22'
I-S	6 - 2" ϕ	2'-7" x 2'-3"	14 - # 7	30"	14'
II-S	6 - 2" ϕ	3'-0" x 2'-6"	14 - # 8	30"	16'
III-S	6 - 2" ϕ	3'-4" x 2'-7"	14 - #10	30"	18'
IV-S	8 - 2" ϕ	3'-6" x 3'-2"	16 - #10	36"	19'
V-S	8 - 2" ϕ	3'-8" x 3'-4"	16 - #11	36"	22'
VI-S	8 - 2" ϕ	4'-0" x 3'-4"	16 - #11	36"	23'
VII-S	8 - 2 1/4" ϕ	4'-5" x 3'-11"	16 - #14	36"	25'

* 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 suface.
7. Slope protection required when indicated on the plans. See Detail "C"



DETAIL C

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS

OVERHEAD SIGNS
ALTERNATE PILE FOUNDATION

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T - 38.1.12 - (627)
ADOPTED: 8/88
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