STATE OF NEVADA

STANDARD PLANS

FOR

ROAD AND BRIDGE CONSTRUCTION

1988
REVISED

NEVADA
DEPARTMENT OF TRANSPORTATION

DEPARTMENT OF TRANSPORTATION
CARSON CITY, NEVADA 89712

STANDARD PLANS

FOR
ROAD AND BRIDGE
CONSTRUCTION

RICHARD H. BRYAN, GOVERNOR, CHAIRMAN

BRIAN McKAY, ATTORNEY GENERAL

DARRELL R. DAINES, STATE CONTROLLER

DIRECTOR
GARTH F. DULL

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION
1263 SOUTH STEWART STREET
CARSON CITY, NEVADA, 89712

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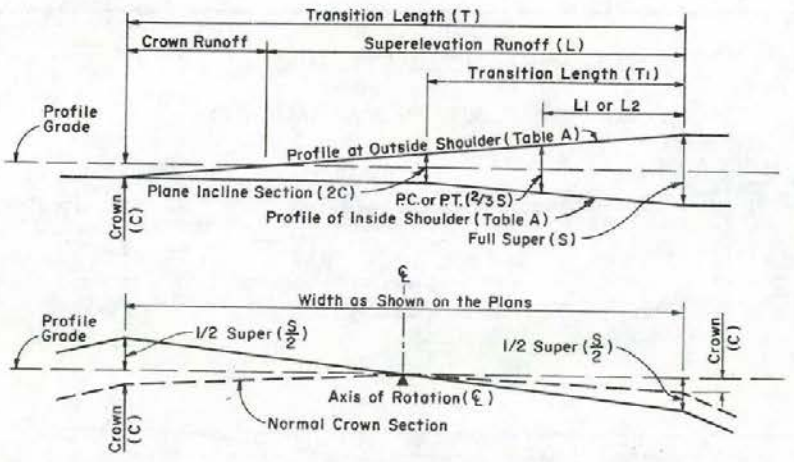
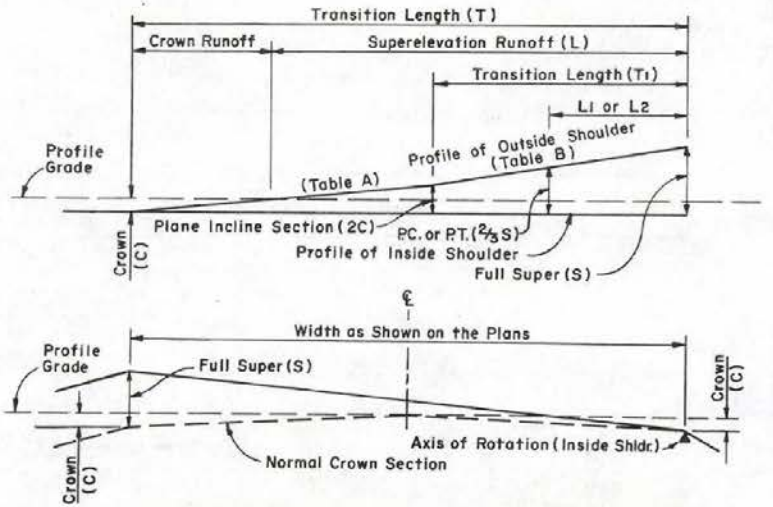


CASE NO. 1 — ROTATION ABOUT CENTER LINE



CASE NO. 2 — ROTATION ABOUT INSIDE SHOULDER

SUPERELEVATION TRANSITION

FORMULAE

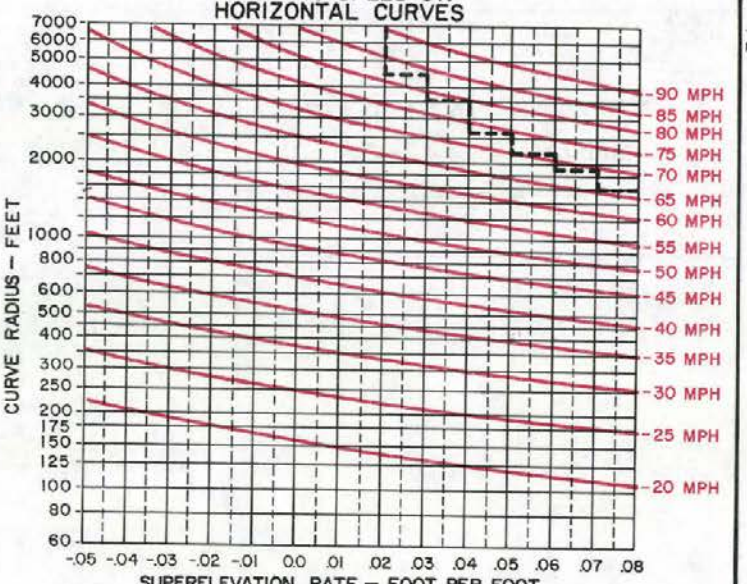
Rate of Easement		Length in Feet
TABLE A Ft. per Ft.	TABLE B Ft. per Ft.	
.004	.008	$T=250(\frac{S}{2}+C)$
.004	.008	$T_1=250(\frac{S}{2}-C)$
.004	.008	$L=125\ S$
.004	.008	$L_1=\frac{S}{.024}$
.004	—	$L_2=T-250(\frac{2}{3}S)$

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. TO P.T. TO FULL SUPERELEVATION WHERE SUPER RATE IS .03 FT. PER FT. OR GREATER.
L_2=LENGTH FROM P.C. OR P.T. TO FULL SUPERELEVATION WHERE SUPER RATE IS LESS THAN .03 FT. PER FT.

SPEED	FRICTION FACTOR
30	0.16
40	0.15
50	0.14
55	0.13 (INTERPOLATED)
60	0.12
70	0.10
80	0.08
90	0.06

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.

LIMITING SPEED ON HORIZONTAL CURVES



NOTE: BROKEN LINE INDICATES STANDARD SUPERELEVATION RATE. HIGHER VALUE AT STEPS IS THE PROPER SUPERELEVATION FOR INDICATED CURVE RADIUS.

DESIGN SPEED (MPH)	MINIMUM RADIUS USING MAXIMUM SUPER. (.08) (FEET)	*MINIMIM RADIUS USING NORMAL CROWN (-2%) (FEET)
30	250	430
40	470	825
50	760	1400
55	965	1850
60	1200	2450
70	1825	4100
80	2700	7200

*NORMAL CROWN MAY BE USED ON CITY STREETS WHERE SPEED IS CONTROLLED

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

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

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

SUPERELEVATION 2-LANE

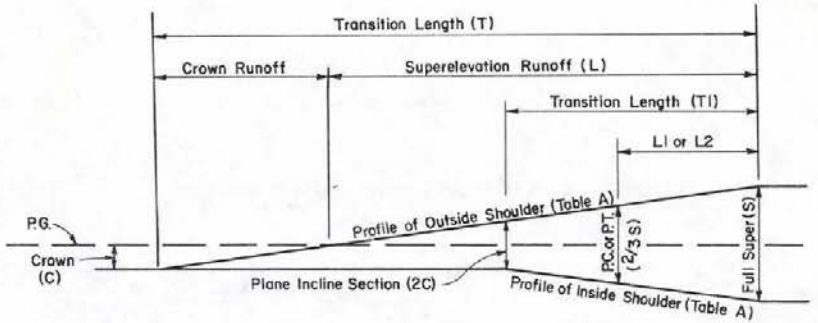
CHIEF ROAD DESIGN ENGR.

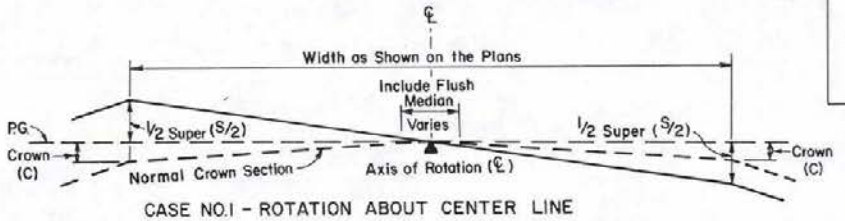
R-S1.1-(000)

ADOPTED: 1/79

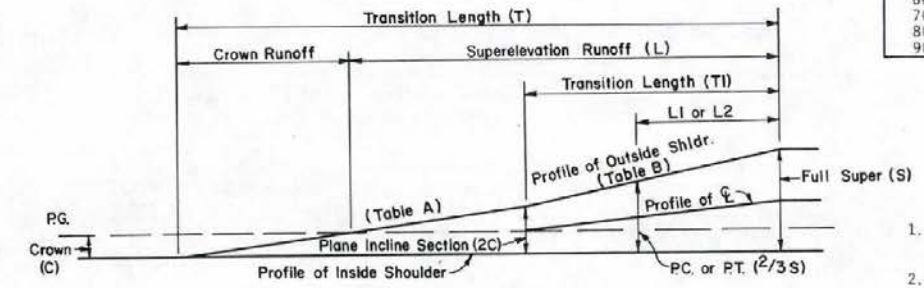
REVISION 2-11/86

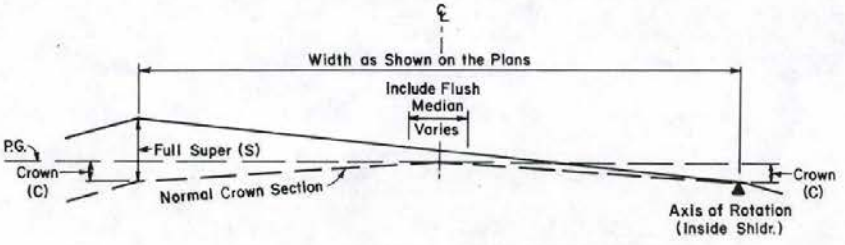
R1





CASE NO.1 - ROTATION ABOUT CENTER LINE





CASE NO.2 - ROTATION ABOUT INSIDE SHOULDER

SUPERELEVATION TRANSITION

FORMULAE

Rate of Easement TABLE A ft. per ft.	Rate of Easement TABLE B ft. per ft.	Length in Feet
.005	.01	$T = 200(S/2 + C)$
.005	.01	$TI = 200(S/2 - C)$
.005	.01	$L = 100\,S$
.005	.01	$LI = S/.03$
.005	—	$L2 = T - 200(2/3\,S)$

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 .03 FT. PER FT. OR GREATER.
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30	0.16
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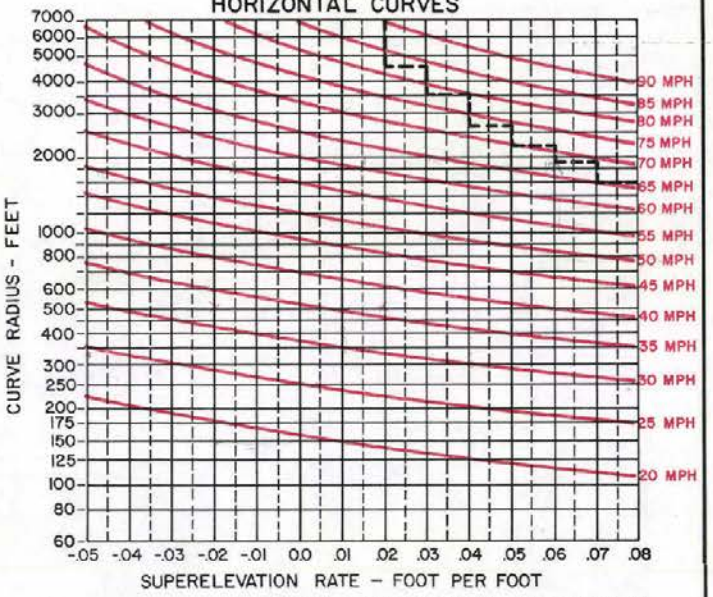
4. SHORT VERTICAL CURVES SHALL BE INSERTED BY EYE ADJUSTMENT OF STAKES AT BEGINNING AND END OF EASEMENT.
5. WHEN THE TANGENT BETWEEN CURVES IS TOO SHORT TO PERMIT EASEMENT LENGTHS SHOWN, THE TRANSITION MAY BE EXTENDED ONTO THE CURVE OR THE EASEMENT LENGTH MAY BE DECREASED.

LIMITING SPEED ON HORIZONTAL CURVES



NOTE: BROKEN LINE INDICATES STANDARD SUPERELEVATION RATE. HIGHER VALUE AT STEPS IS THE PROPER SUPERELEVATION FOR INDICATED CURVE RADIUS.

DESIGN SPEED (MPH)	MINIMUM RADIUS USING MAXIMUM SUPER. (.08) (FEET)	*MINIMUM RADIUS USING NORMAL CROWN (-2%) (FEET)
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50	760	1400
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*NORMAL CROWN MAY BE USED ON CITY STREETS WHERE SPEED IS CONTROLLED

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

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

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

SUPERELEVATION
MULTI-LANE, UNDIVIDED

Scott F. Dull
CHIEF ROAD DESIGN ENGR.

R-S1.2-(000)
ADOPTED: 1/79
REVISION 4-11/86

R2

DESIGN SPEED (MPH)	MINIMUM RADIUS USING MAXIMUM SUPER. (.08) (FEET)	*MINIUM RADIUS USING NORMAL CROWN (-2%) (FEET)
30	250	430
40	470	825
50	760	1400
55	965	1850
60	1200	2450
70	1825	4100
80	2700	7200

*NORMAL CROWN MAY BE USED ON CITY STREETS WHERE SPEED IS CONTROLLED

GENERAL NOTES

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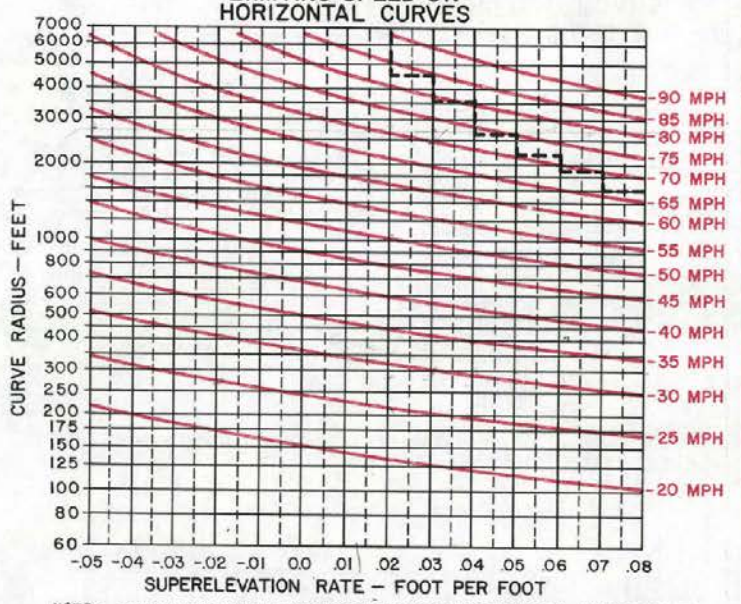
LIMITING SPEED ON HORIZONTAL CURVES

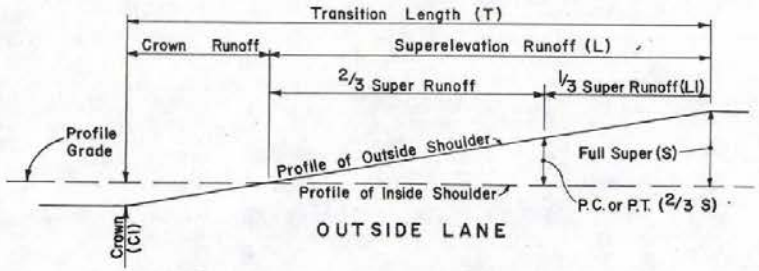


NOTE: BROKEN LINE INDICATES STANDARD SUPERELEVATION RATE. HIGHER VALUE AT STEPS IS THE PROPER SUPERELEVATION FOR INDICATED CURVE RADIUS.

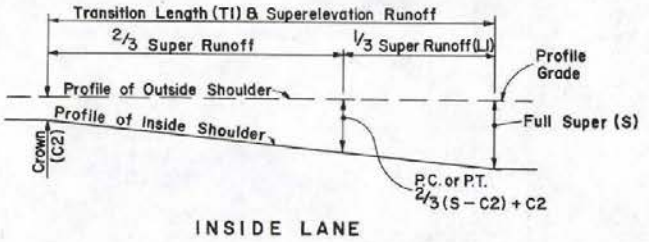
FORMULAE

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

OUTSIDE LANE		INSIDE LANE	
Rate of Easement	Length in Feet	Rate of Easement	Length in Feet
.005	$T=200(S+C1)$	.005	$T1=200(S-C2)$
.005	$L=200\,S$	.005	$L1=\frac{S-C2}{.015}$
.005	$L1=\frac{S}{.015}$		



OUTSIDE LANE



INSIDE LANE

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

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

SPEED	FRICTION FACTOR
30	0.16
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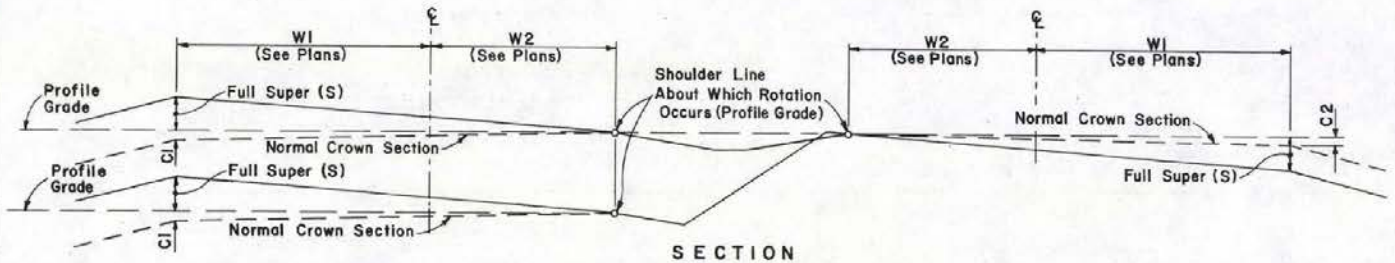


SECTION

SUPERELEVATION TRANSITION

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

SUPERELEVATION
MULTI-LANE, DIVIDED

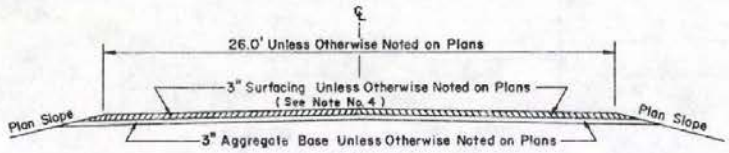
CHIEF ROAD DESIGN ENGR.

R-S1.3-(000)

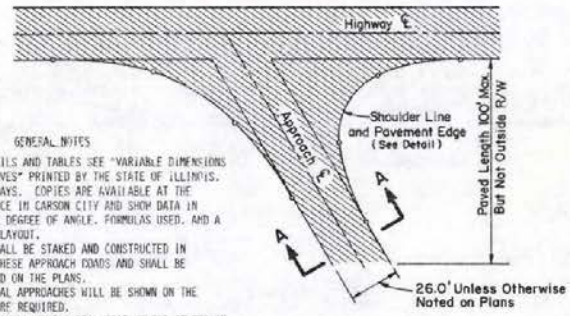
ADOPTED 8 1/79

REVISION 2-11/86

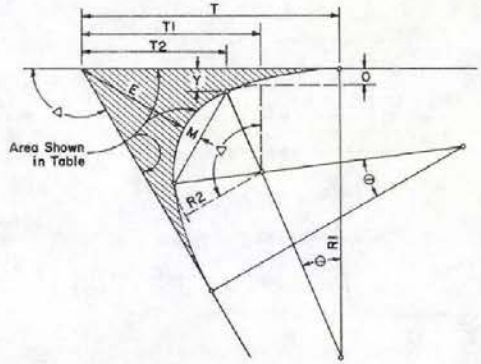
R3



SECTION A-A



PLAN



DETAIL OF PAVEMENT EDGE

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.

TYPE I APPROACH

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	9.86	15.59	52.79	6.18	1.06	108.9	12.1
70	13°15.66'	100	25	2.0	2.67	13.17	18.91	36.11	7.96	1.78	143.8	16.0
80	13°15.66'	100	25	2.0	2.67	16.92	22.66	39.86	10.25	2.67	190.5	21.2
90	14°21.72'	100	20	2.5	3.13	17.54	22.50	42.36	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	270.0	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	33.66	38.11	55.88	24.00	6.40	437.0	48.6

TYPE 1-SU APPROACH (SINGLE UNIT)

Δ	Θ	R 1	R2	O	Y	T2	T1	T	E	M	AREA*	AREA*
DEGREE	DEGREE	LENGTH IN FEET									SQ FT	SQ YD
60	15°15.66'	120	45	2.0	3.20	16.92	27.14	44.34	9.27	1.91	224.0	24.9
70	15°15.66'	120	45	2.0	3.20	22.59	32.91	50.11	12.38	3.20	318.7	35.4
80	15°15.66'	120	45	2.0	3.20	29.12	39.44	56.64	16.35	4.81	448.8	49.9
90	12°50.34'	120	40	2.0	3.00	33.11	42.00	59.78	19.40	6.14	519.0	57.7
100	17°28.50'	100	35	3.0	4.62	34.78	45.29	64.81	24.12	5.49	669.	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	60.62	86.60	40.00	6.43	1226.4	136.3

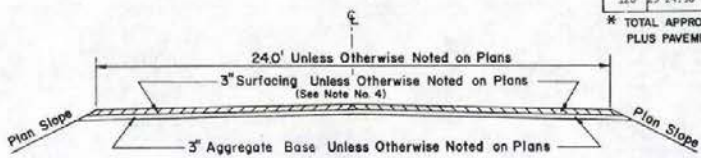
TYPE 1-C43 APPROACH (SEMITRAILER COMBINATION INTERMEDIATE)

Δ	Θ	R 1	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	13.79	28.29	52.46	11.58	0.86	350.0	38.9
70	18°47.82'	120	45	4.0	6.40	19.81	34.31	58.48	14.82	1.79	468.5	52.1
80	18°47.82'	120	45	4.0	6.40	26.62	41.12	65.28	18.97	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	72.67	27.23	3.92	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	49.83	61.49	88.69	41.00	6.08	1294.3	143.8

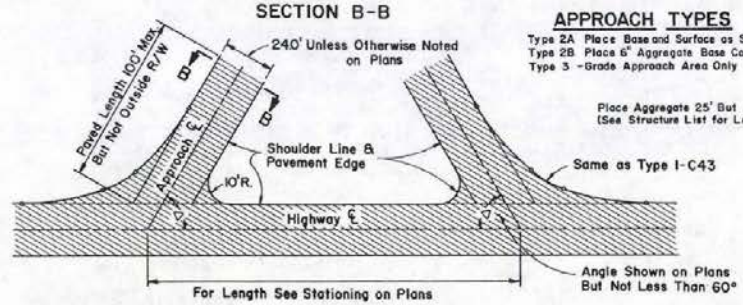
TYPE 1-C50 APPROACH (SEMITRAILER COMBINATION LARGE)

Δ	Θ	R 1	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	19°05.46'	150	50	5.5	8.25	22.51	38.86	71.57	17.75	1.92	686.9	76.3
80	19°05.46'	150	50	5.5	8.25	30.22	46.57	79.28	22.45	3.29	896.6	99.6
90	18°11.70'	150	50	5.0	7.50	39.30	55.00	86.23	27.78	5.37	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°24.90'	120	35	7.0	9.88	58.84	72.75	106.53	49.00	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.



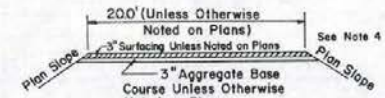
SECTION B-B



SERVICE TYPE APPROACH

APPROACH TYPES

Type 2A Place Base and Surface as Shown.
Type 2B Place 6" Aggregate Base Course Only
Type 3 -Grade Approach Area Only



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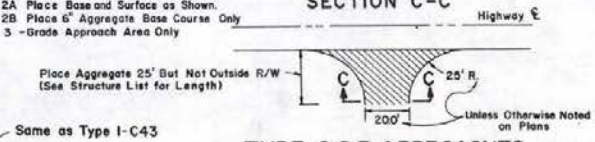


TYPE 2&3 APPROACHES

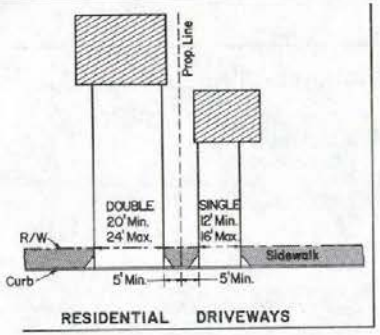
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

TYPES 1, 2 AND 3 APPROACH ROADS

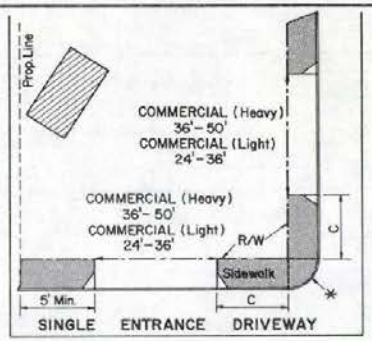
CHIEF ROAD DESIGN ENGR.

R-S2.1-(000)
ADOPTED-8/69
REVISION 5-8/82

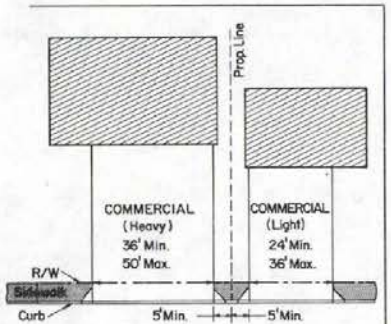
R-4



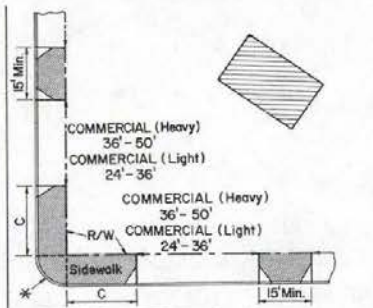
RESIDENTIAL DRIVEWAYS



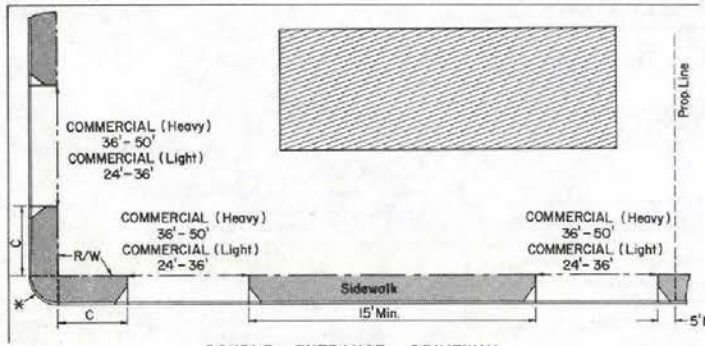
SINGLE ENTRANCE DRIVEWAY



COMMERCIAL DRIVEWAYS



DOUBLE ENTRANCE DRIVEWAY



DOUBLE ENTRANCE DRIVEWAY

* - Curb Return Radius

■ - Sidewalk Limits

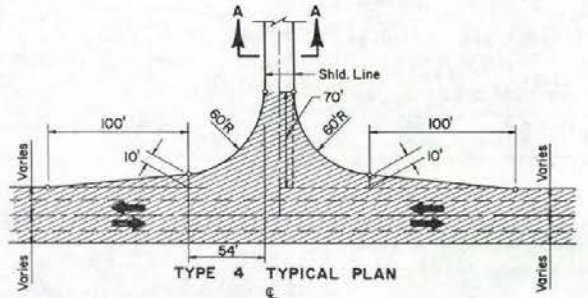
URBAN DRIVEWAYS

MINIMUM CORNER CLEARANCE (C)

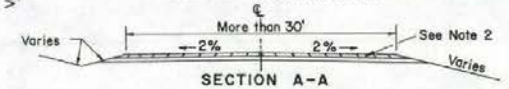
*CURB RADIUS	CLEARANCE (C)
UNDER 25'	10'
25' TO 60'	5'
OVER 60'	0'

1. REFER TO STANDARD SHEET R-S.1.1 FOR DESIGN AND TYPES OF CURB AND GUTTER AND DRIVEWAYS.

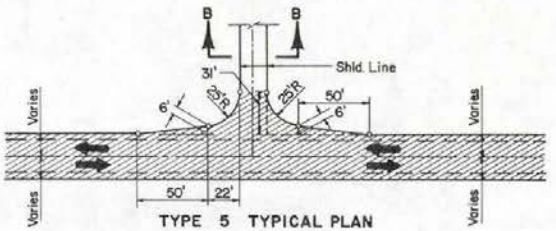
* FOR DESIRABLE CORNER CLEARANCE, CURB RADIUS SHALL BE CHECKED WITH TURNING TEMPLATE FOR THE DESIGN VEHICLE.



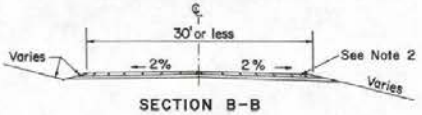
TYPE 4 TYPICAL PLAN



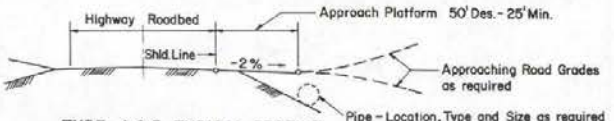
SECTION A-A



TYPE 5 TYPICAL PLAN



SECTION B-B



TYPE 4 & 5 TYPICAL PROFILE

RIGHT ANGLE ROAD CONNECTION

TYPE 4 AND 5 APPROACHES

1. REFER TO STANDARD SHEET R-S.2.1 FOR TYPE 1, 2 AND 3 APPROACH DESIGN.
2. MINIMUM DEPTH OR BASE AND SURFACE SHALL BE 4 INCHES AND 3 INCHES RESPECTIVELY. THICKER LIFTS SHALL BE SHOWN IN THE PLANS.
3. APPROACHES TO BE PAVED TO THE THROAT OR RIGHT-OF-WAY, WHICHEVER OCCURS FIRST, UNLESS OTHERWISE NOTED ON THE PLANS.
4. APPROACHES MAY REQUIRE THE STANDARD STOP SIGNS AND STOP BARS AS DIRECTED BY ENGINEER.

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

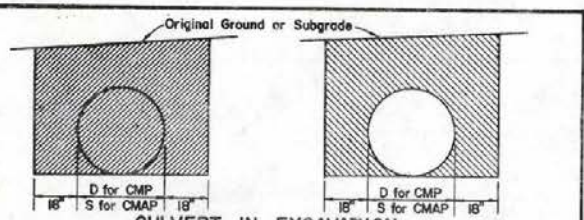
TYPE 4 AND TYPE 5 APPROACH ROAD - URBAN DRIVEWAY LOCATION DETAILS

Ronald J. Nice
CHIEF ROAD DESIGN ENGR.

R-S2.2 (000)

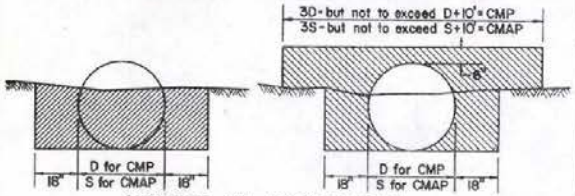
ADOPTED: 6/75 REVISION 3-3.88

R5



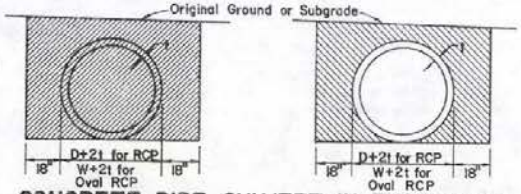
CULVERT IN EXCAVATION

Excavation Depth is Less than 5 feet



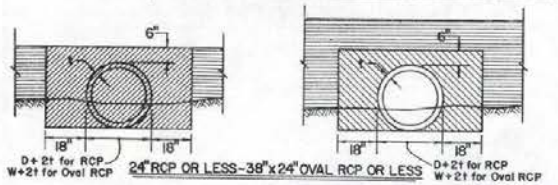
CULVERT IN EMBANKMENT

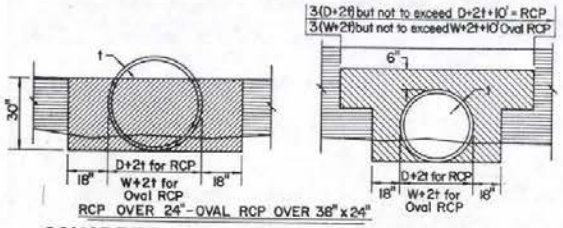
CMP OR CMAP CULVERTS



CONCRETE PIPE CULVERT IN EXCAVATION

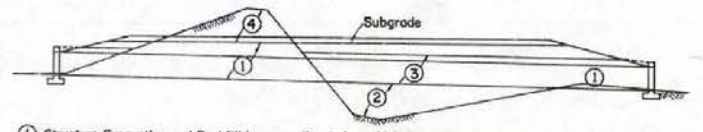
All RCP and Oval RCP sizes
Excavation Depth is Less than 5 feet





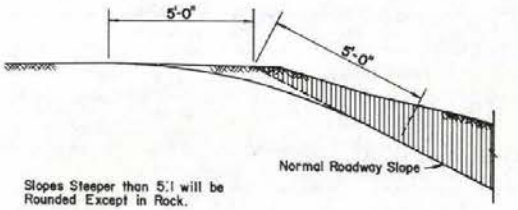
CONCRETE PIPE CULVERT IN EMBANKMENT

(METHOD A)



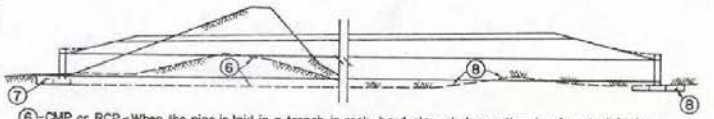
1 - Structure Excavation and Backfill in excavation to be paid below subgrade and within designated limits.
2 - Embankment to be constructed to flowline prior to installation.
3 - Backfill in embankment to be paid from flowline to the designated maximum limits.
4 - Roadway Excavation to be paid to subgrade.

CULVERT INSTALLATION IN ROUGH TERRAIN



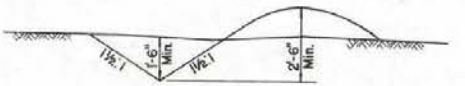
Slopes Steeper than 5:1 will be Rounded Except in Rock.

ROUNDED OR TRANSITION SLOPES



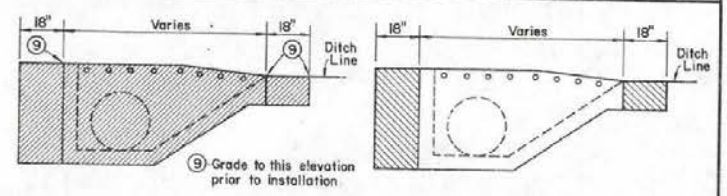
6 - CMP or RCP - When the pipe is laid in a trench in rock, hard clay, shale or other hard material, the unsuitable material shall be removed to a depth of not less than 6" for RCP & 12" for CMP below the bottom of the pipe grade and the trench backfilled with suitable material. In no place shall the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



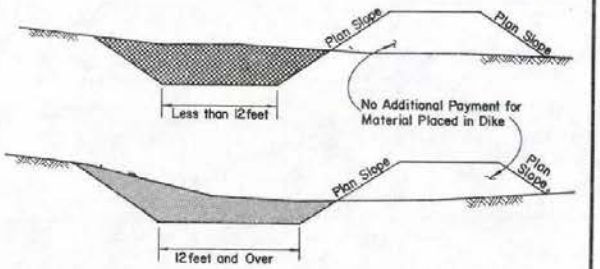
Dike Material Placed on the Downhill side Is Included in the Price for Ditching.

V-TYPE DITCH AND DIKE

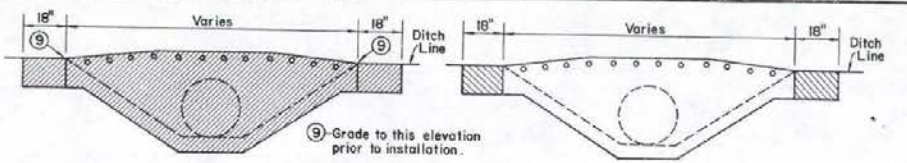


9 - Grade to this elevation prior to installation.

TYPE 7 DROP INLET



FLAT BOTTOM DITCH EXCAVATION



9 - Grade to this elevation prior to installation.

TYPE 8 DROP INLET

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
- GRANULAR BACKFILL
- ROADWAY EXCAVATION
- CHANNEL EXCAVATION
- DRAINAGE EXCAVATION
- ROADWAY EMBANKMENT

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

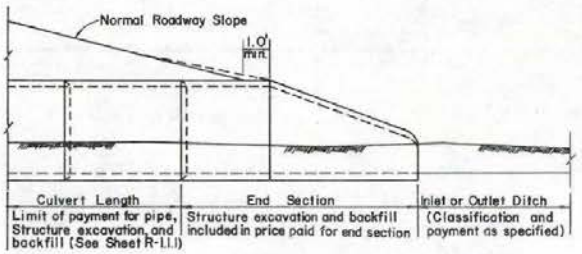
STRUCTURE EXCAVATION & BACKFILL

(METHOD OF MEASUREMENT)

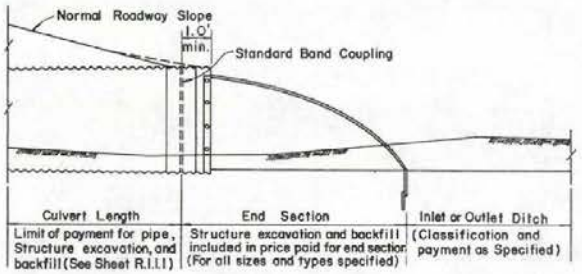
Ronald W. Wilson
CHIEF ROAD DESIGN ENGINEER

R-1.1.1-(206,207)
ADOPTED: 8/69
REVISION 4-8/82

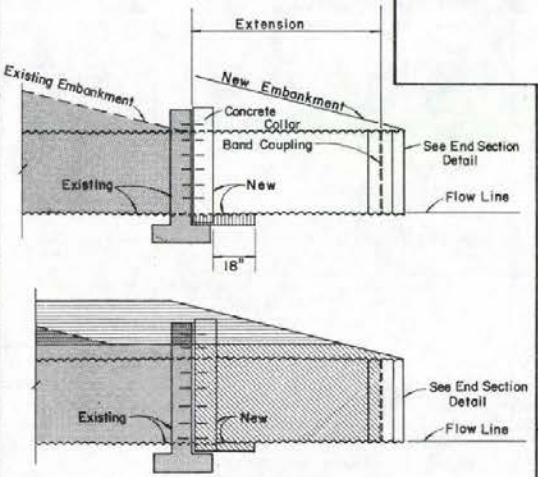
R-6



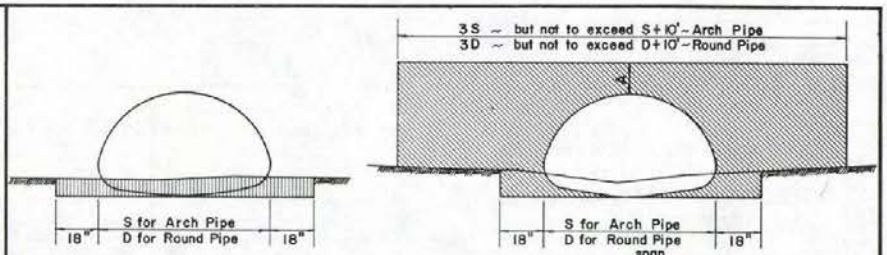
PRECAST CONCRETE END SECTIONS



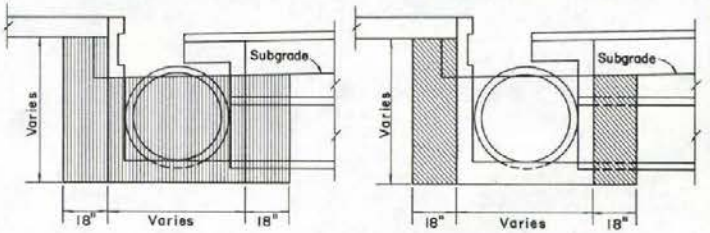
PREFABRICATED METAL END SECTION
(Type 3 Connection)



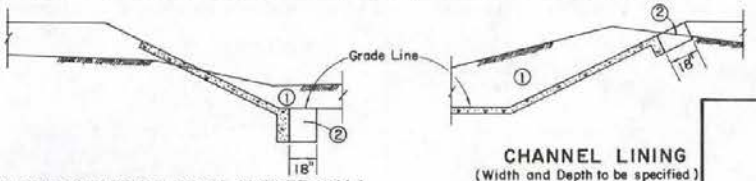
CULVERT EXTENSION OF EXISTING HEADWALL
(SEE SHEET R-2.1.1)



STRUCTURAL PLATE PIPE

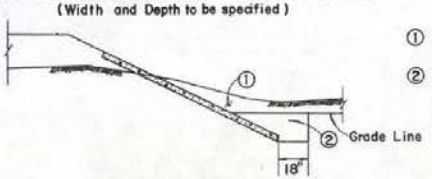


DROP INLETS IN EXCAVATION
(Type 3 Drop Inlet Illustrated)



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

CHANNEL LINING
(Width and Depth to be specified)

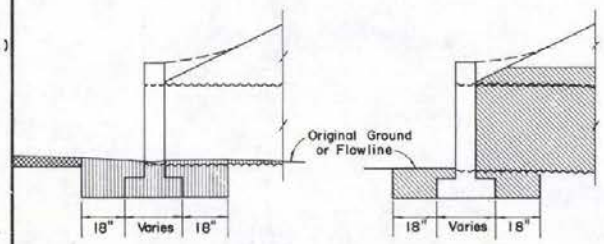


CONCRETE APRON
(Width and Depth to be specified)

① Roadway, Channel Excavation, or Drainage Excavation.

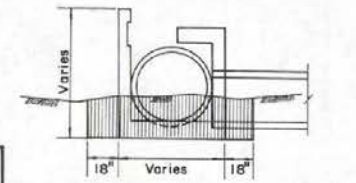
② Payment for backfill and structure excavation to be included in price paid for slope paving or channel lining.

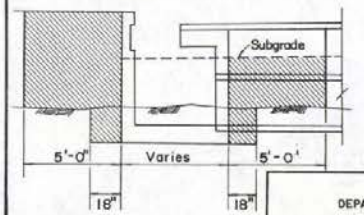
CHANNEL LINING AND SLOPE PAVEMENT



IN EXCAVATION IN EMBANKMENT

CULVERT HEADWALLS





DROP INLETS IN EMBANKMENT
(Type 3 Drop Inlet Illustrated)

LEGEND

- GRANULAR BACKFILL
- Structure Excavation
- Limits of Existing
- Drainage or Channel Excavation
- Roadway Embankment

See R.1.1.1 for General Notes.

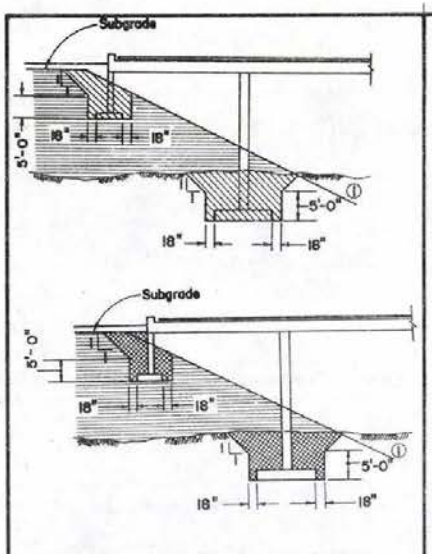
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

STRUCTURE EXCAVATION AND BACKFILL
(METHOD OF MEASUREMENT)

Arnold W. Lee
CHIEF ROAD DESIGN ENGR.

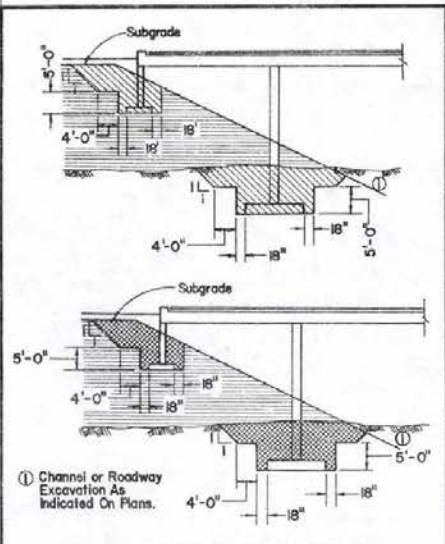
R-1.1.2-(206.207)
ADOPTED 6/69
REVISION 5-11/82

R-7



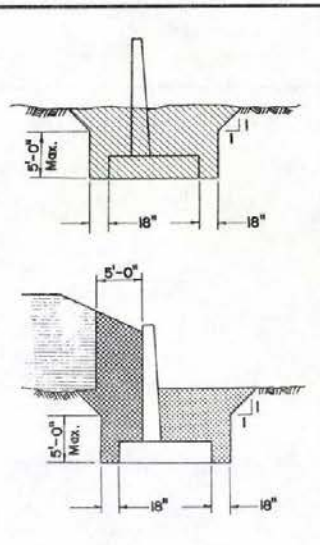
OPEN ABUTMENT BRIDGES WITH SPREAD FOOTING

FOOTING WIDTH IS 6 FEET OR LESS



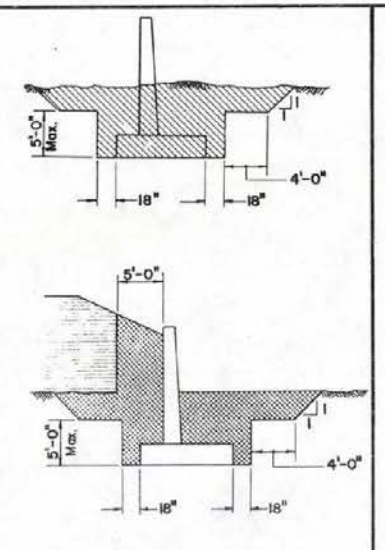
OPEN ABUTMENT BRIDGES WITH SPREAD FOOTING

FOOTING WIDTH IS GREATER THAN 6 FEET



RETAINING WALLS

FOOTING WIDTH IS 6 FEET OR LESS

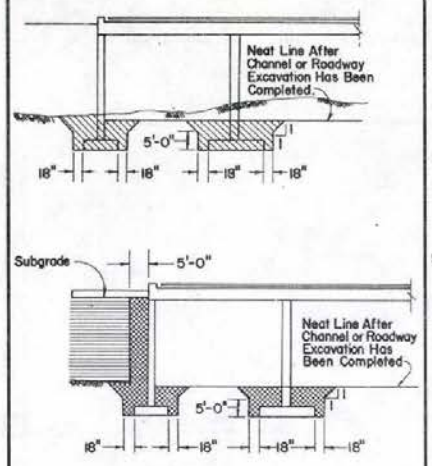


RETAINING WALLS

FOOTING WIDTH IS GREATER THAN 6 FEET

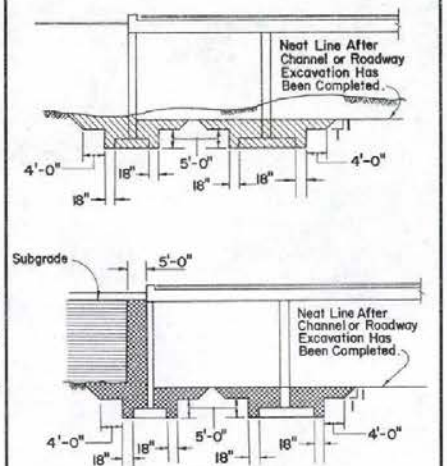
GENERAL NOTES

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.
6. THE QUANTITY OF STRUCTURE EXCAVATION AND BACKFILL MEASURED FOR PAYMENT SHALL BE THE NUMBER OF CUBIC YARDS CALCULATED MINUS ANY DUPLICATION OF LIMITS WHICH OVERLAP.



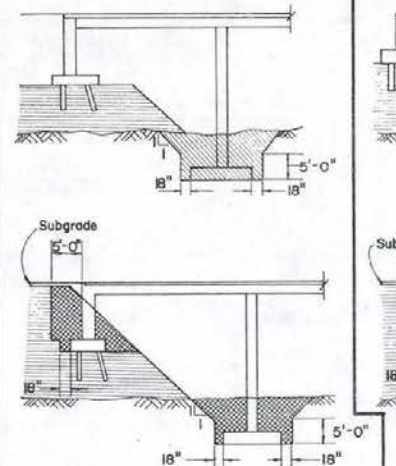
CLOSED ABUTMENT BRIDGES

FOOTING WIDTH IS LESS THAN 6 FEET



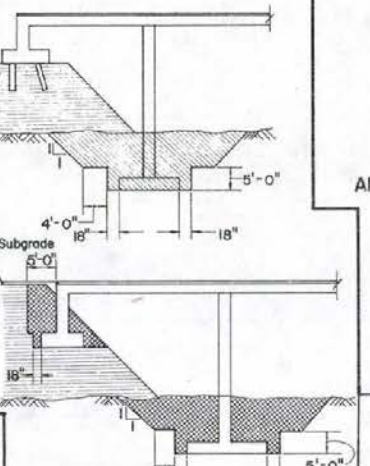
CLOSED ABUTMENT BRIDGES

FOOTING WIDTH IS GREATER THAN 6 FEET



OPEN ABUTMENT BRIDGES ON PILES

FOOTING WIDTH IS LESS THAN 6 FEET



OPEN ABUTMENT BRIDGES ON PILES

FOOTING WIDTH IS GREATER THAN 6 FEET

NOTE: Clays, Silts, Loams, Or Non-Homogenous Soils Require Shoring And Bracing. The Presence Of Ground Water Requires Special Treatment.

APPROXIMATE ANGLE OF REPOSE FOR SLOPING OF SIDES OF EXCAVATIONS

STRUCTURE EXCAVATION

GRANULAR BACKFILL

ROADWAY EMBANKMENT

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

STRUCTURE EXCAVATION AND BACKFILL (METHOD OF MEASUREMENT)

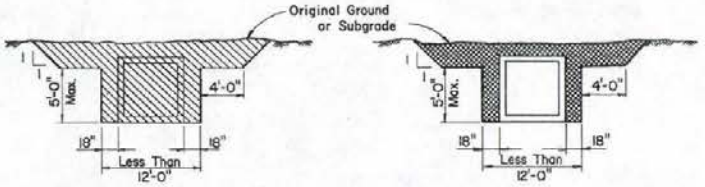
CHIEF ROAD DESIGN ENGR.

R-1.1.3 (206,207)

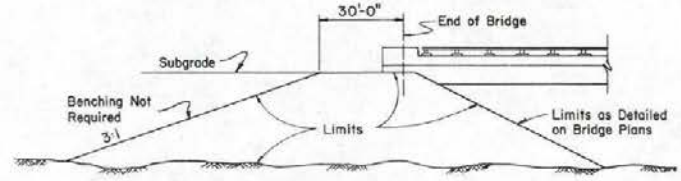
ADOPTED: 11/73

REVISION 2-1-82

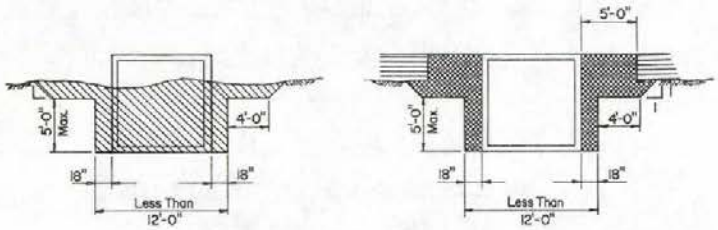
R-8



CULVERT IN EXCAVATION



LIMITS OF SELECTED BORROW AT BRIDGE ABUTMENTS

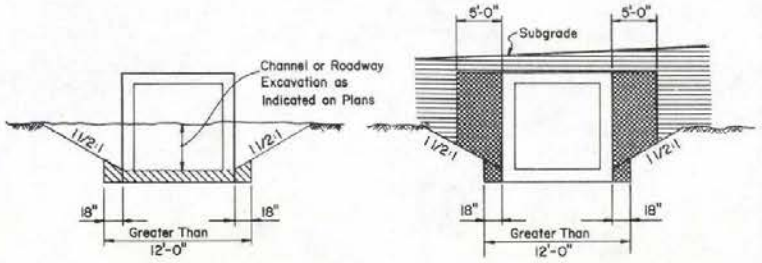


CULVERT IN EMBANKMENT

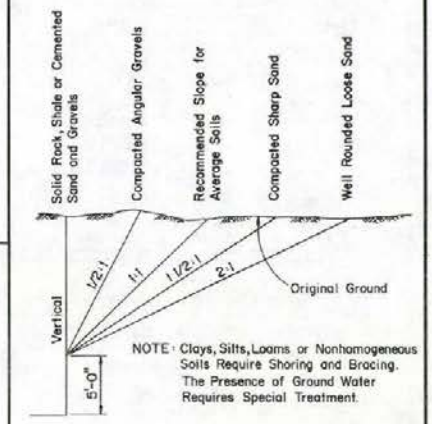
TRENCH SHORING - MINIMUM REQUIREMENTS

Depth of Trench	Kind or condition of earth	Size and spacing of Members										
		Uprights		Stringers		Cross Braces				Maximum Spacing		
		Min. Dim.	Max. Spac.	Min. Dim.	Max. Spac.	Width of Trench						
						Up to 3 ft.	3 to 5 ft.	5 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	2x4 or 2x6	Close Sheeting	4x6	4	4x6	6x6	6x8	8x8	8x10	4	6
	Hydrostatic pressure	3x6	Close Sheeting	8x10	4	4x6	6x8	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



NOTE: Clays, Silts, Loams or Nonhomogeneous Soils Require Shoring and Bracing. The Presence of Ground Water Requires Special Treatment.

APPROXIMATE ANGLE OF REPOSE FOR SLOPING OF SIDES OF EXCAVATIONS

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.

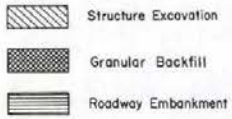
2) IF HAZARDOUS FIELD CONDITIONS INDICATE GROUND MOVEMENT MAY BE EXPECTED, TRENCHES LESS THAN 5 FEET DEEP SHALL ALSO BE PROTECTED AS INDICATED IN NOTE 1.

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.

6) THE QUANTITY OF STRUCTURE EXCAVATION AND BACKFILL MEASURED FOR PAYMENT SHALL BE THE NUMBER OF CUBIC YARDS CALCULATED MINUS ANY DUPLICATION OF LIMITS WHICH OVERLAP.



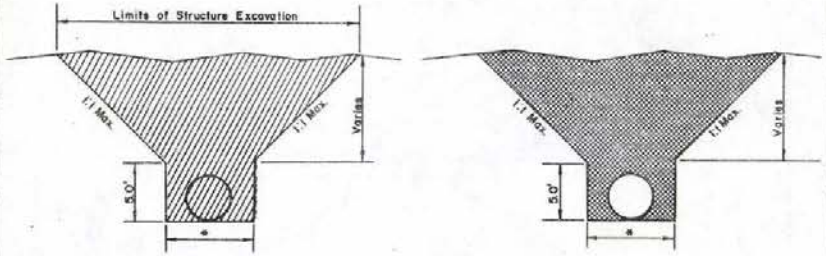
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

STRUCTURE EXCAVATION AND BACKFILL (METHOD OF MEASUREMENT)

Howard W. Hill
CHIEF ROAD DESIGN ENGR.

R-1.1.4-(206,207)
ADOPTED: 11/73
REVISION 2-4/82

R-9



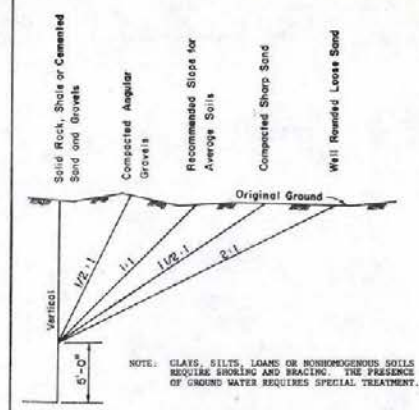
* D+3.0' FOR C.M.P.
S+3.0' FOR C.M.A.P.
D+2t+3.0' FOR R.C.P.
W+2t+3.0' FOR OVAL R.C.P.

OUTSIDE DIAMETER IS 6 FEET OR LESS

TRENCH SHORING - MINIMUM REQUIREMENTS

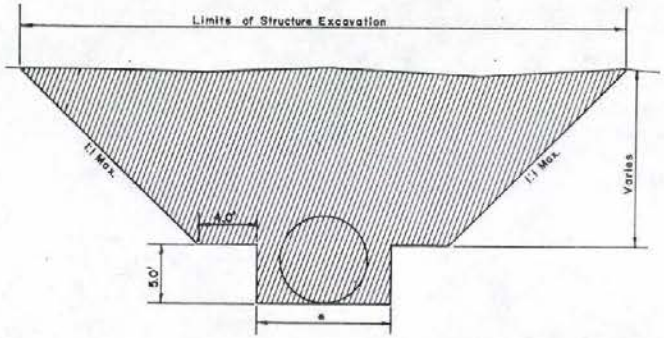
Depth of Trench	Kind or Condition of Earth	Size and Spacing of Members										
		Uprights		Stringers		Cross Braces					Maximum Spacing	
						Width of Trench						
		Min. Dim.	Max. Spac.	Min. Dim.	Max. Spac.	Up to 3 Ft.	3 to 6 Ft.	6 to 9 Ft.	9 to 12 Ft.	12 to 15 Ft.	Vert.	Horiz.
Feet		Inches	Feet	Inches	Feet	Inches	Inches	Inches	Inches	Inches	Feet	Feet
5 to 10	Hard, compact	3x6 to 2x6	6	---	---	2x6	4x6	4x6	6x6	8x8	4	6
	Likely to crack	3x6 to 2x6	3	4x6	4	2x6	4x6	4x6	6x6	8x8	4	6
	Soft, sandy, or filled	3x6 or 2x6	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	3x6 or 2x8	4	4x6	4	4x6	4x6	6x6	6x8	8x8	4	6
	Likely to crack	3x6 or 2x8	2	4x6	4	4x6	4x6	6x6	6x8	8x8	4	6
	Soft, sandy, or filled	3x6 or 2x8	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 clay.
Where desirable, steel sheet piling and bracing of equal strength may be substituted for wood.

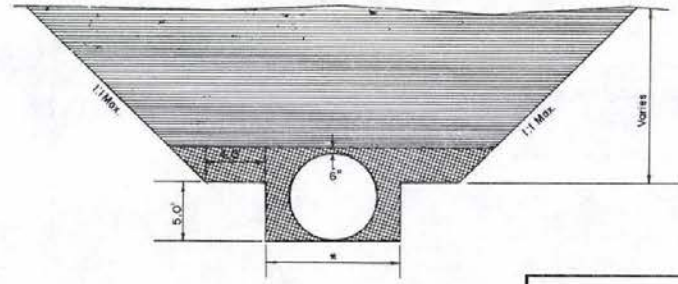


NOTE: CLAYS, SILTS, LOAMS OR NONHOMOGENEOUS SOILS REQUIRE SHORING AND BRACING. THE PRESENCE OF GROUND WATER REQUIRES SPECIAL TREATMENT.

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+2t+3.0' FOR R.C.P.
W+2t+3.0' FOR OVAL R.C.P.



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.
6) THE QUANTITY OF STRUCTURE EXCAVATION AND BACKFILL MEASURED FOR PAYMENT SHALL BE THE NUMBER OF CUBIC YARDS CALCULATED MINUS ANY DUPLICATION OF LIMITS WHICH OVERLAP.
7) GRANULAR BACKFILL TO BE PLACED FOR A DEPTH OF 6" ABOVE THE TOP OF THE PIPE FOR THE WIDTH OF THE TRENCH.

LEGEND

- Structure Excavation
- Granular Backfill
- Roadway Embankment or Borrow

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

STRUCTURE EXCAVATION AND BACKFILL (METHOD OF MEASUREMENT)

CHIEF ROAD DESIGN ENGR.

R-1.15 (206, 207)
ADOPTED: 10/72 REVISION 3-7/77

R-10

2 2/3" x 1/2" ROUND CORRUGATED ALUMINUM PIPE

PIPE DIAMETER	MINIMUM COVER	PLATE THICKNESS				
		IN	.060	.075	.105	.135	.164
		GA	16	14	12	10	8
INCHES	INCHES	MAX FILL HEIGHTS ABOVE TOP OF PIPE IN FEET					
18	12	30	30	52			
24	12	22	22	39	41		
30	12		18	31	32		
36	12		15	26	27		
42	12			45	43		
48	18			40	41		43
54	18			35	37		38
60	18				33		34
66	24						31
72	24						28

* 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 2 TONS PER SQ. FT.
INCHES	INCHES	INCHES	INCHES	FEET
18x11	18	4	0.060	15
22x13	18	4	0.060	14
25x16	18	4	0.060	12
29x18	18	4 1/2	0.060	10
36x22	18	5	0.060	9
43x27	18	5 1/2	0.075	9
50x31	18	6	0.105	8
58x36	18	7	0.135	8
65x40	18	8	0.135	8
72x44	18	9	0.164	8

* Riveted Or Helical Fabrication

** Top Of Pipe To Top Of Finished Grade At Shoulder Line For 2 Tons Per Sq. Ft.

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	

3" x 1" ROUND CORRUGATED ALUMINUM PIPE

PIPE DIAMETER	MIN. COVER	PLATE THICKNESS				
		IN	.060	.075	.105	.135	.164
		GA	16	14	12	10	8
INCHES	INCHES	MAX. FILL HEIGHTS ABOVE TOP OF PIPE IN FT.					
30	12		33	41	56	70	
36	12		28	34	47	58	
42	18		24	24	40	52	
48	18		21	27	35	48	50
54	18		18	23	31	46	47
60	24		17	21	28	28	45
66	24			19	25	38	44
72	24			17	23	35	44
78	24				22	32	42
84	24				20	30	39
90	24				19	28	36
96	24				18	26	34
102	30					25	32
108	30					23	30
114	30						29
120	30						27

MAXIMUM HEIGHT COVER FOR STRUCTURAL ALUMINUM PLATE PIPE 9"x2 1/2" Corrugation

Diam Inches	Min. Cover	Min. Ga.	Metal Thickness — (Inches)								
			.100	.125	.150	.175	.200	.225	.250	.275	.300
60	1.0'	.100	26	35	44	53	60	66	72	79	86
66	1.0'	.100	24	32	40	48	55	60	66	72	79
72	1.0'	.100	22	29	37	44	50	63	64	67	69
78	1.0'	.100	20	27	34	41	46	51	55	61	67
84	1.5'	.100	19	25	32	38	43	47	51	57	59
90	1.5'	.100	18	23	30	35	40	44	48	53	58
96	1.5'	.100	17	22	28	33	38	41	45	50	53
102	2.0'	.100	16	21	26	31	35	39	42	47	51
108	2.0'	.100	15	19	25	29	33	37	40	44	48
114	2.0'	.100	14	18	23	28	32	35	38	42	46
120	2.0'	.100	13	17	22	26	30	33	36	40	43
126	2.0'	.100	13	17	21	25	29	31	34	38	41
132	2.0'	.100	12	16	20	24	27	30	33	36	39
138	2.0'	.100	11	15	19	23	26	29	31	34	38
144	2.0'	.125		14	18	22	25	28	30	33	36
150	2.0'	.125		14	18	21	24	26	29	32	35
156	2.0'	.150			17	20	23	25	28	30	33
162	2.0'	.150			16	20	22	25	27	29	32
168	2.0'	.150			16	19	21	24	26	28	31
174	2.0'	.175				18	21	23	25	27	30
180	3.0'	.175				18	20	22	24	26	29

6" x 1" ROUND CORRUGATED ALUMINUM PIPE

PIPE DIAMETER	MINIMUM COVER	PLATE THICKNESS				
		IN.	.060	.075	.105	.135	.164
		GA.	16	14	12	10	8
INCHES	INCHES	MAX FILL HEIGHTS ABOVE TOP OF PIPE IN FEET					
48	18	21	28	37	44	52
54	24	19	25	33	39	46
60	18		19	30	35	42
66	24		20	27	32	38
72	24			25	29	35
78	24			23	27	32
84	24				25	30
90	24				23	28
96	24					26
102	24					24

MAXIMUM HEIGHT OF COVER FOR ALUMINUM STRUCTURAL PLATE PIPE ARCH 31.8" CORNER RADIUS

Span Ft.	Min. Cover	Height Of Cover (Feet)																										
		1.5	2.0	2.5	3.0	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
6-0	1.5'	.100	.100	.100	.100	.100	.100	.100	.100	.100	.100	.100	.100	.125	.125	.125	.150	.150	.150	.150	.150	.175	.200	.225	.250	.275	.275	.300
7-0	1.5'	.100	.100	.100	.100	.100	.100	.100	.100	.100	.100	.100	.100	.125	.125	.150	.150	.150	.150	.175	.175	.200	.225	.250	.250	.300	.300	.300
8-0	2.0'		.125	.100	.100	.100	.100	.100	.100	.100	.100	.100	.125	.125	.125	.150	.150	.150	.175	.175	.200	.225	.250	.275	.275	.300	.300	
9-0	2.0'		.125	.100	.100	.100	.100	.100	.100	.100	.100	.100	.125	.125	.150	.150	.150	.175	.175	.200	.225	.250						
10-0	2.0'		.125	.100	.100	.100	.100	.100	.100	.100	.100	.125	.125	.125	.150	.150	.175	.175	.200	.225	.250	.275						
11-0	2.0'		.150	.125	.100	.100	.100	.100	.100	.100	.100	.125	.125	.150	.150	.150	.175	.200	.225	.250	.275							
12-0	2.0'		.175	.150	.125	.100	.100	.100	.100	.100	.100	.125	.125	.150	.175	.200	.225	.250										
13-0	2.0'		.175	.150	.125	.125	.125	.125	.125	.125	.125	.150	.150	.175	.200	.225	.250											
14-0	2.0'		.175	.150	.125	.125	.125	.125	.125	.125	.150	.175	.175	.200	.225	.250												
15-0	2.0'		.175	.150	.150	.150	.150	.150	.150	.150	.150	.175	.200	.225	.250													
16-0	3.0'				.175	.175	.175	.175	.175	.175	.175	.200	.225	.250														
17-0	3.0'				.175	.175	.175	.175	.175	.175	.200	.225	.250	.250														
18-0	3.0'				.200	.200	.200	.200	.200	.200	.225	.250																
19-0	3.0'				.250	.250	.250	.250	.250	.250	.250	.275																
20-0	3.0'				.275	.275	.275	.275	.275	.275	.275	.300																

Note: To determine proper metal thickness select the span in left hand column that is next larger to size structure required. EXAMPLE-If you need a 10'-8" span x 7'-5" rise structure, use the line for span 11'-0".

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

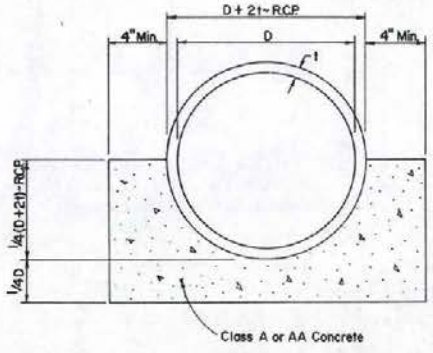
ALLOWABLE FILL HEIGHTS FOR ALUMINUM CULVERTS

CHIEF ROAD DESIGN ENGR.

R-1.3.1 (601, 605)

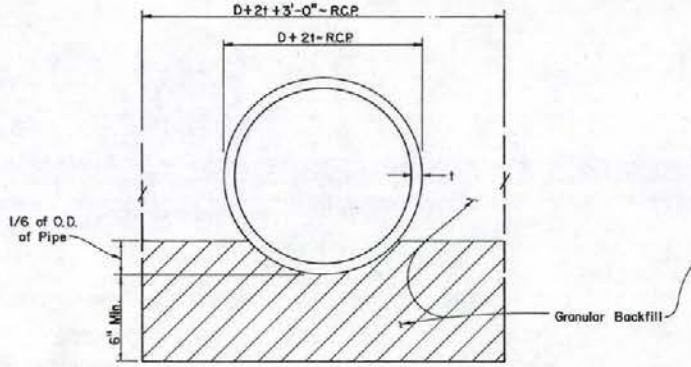
ADOPTED 12/19/78 REVISION

R-12



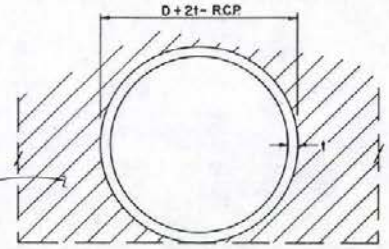
CLASS A BEDDING

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

Bedding Shall be Carefully Shaped to Fit Pipe Prior to Installation. No Direct Payment for Shaping the Trench.



CLASS C BEDDING

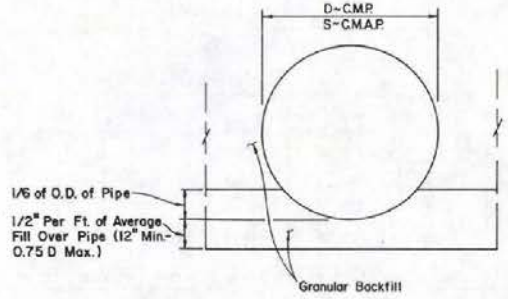
BEDDING FOR CONCRETE CULVERT

GENERAL NOTES

1. Minimum Depths as Specified in "Culvert Installation With Unsuitable Foundations" on Sheet R-1.1.1, Notes No. 6 & 8 Will Prevail When These Conditions are Encountered.
2. Excavation For Multiple Pipe or R.C.B. Installations Exceeding 12 Feet in Width Shall Be Paid For as Channel Excavation or Roadway Excavation.

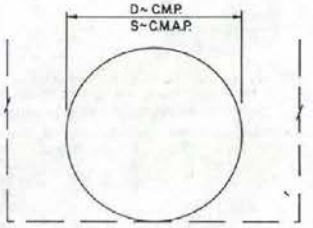
Allowable Fill Height Table For Reinforced Concrete Pipe 24" to 84"

Pipe Class	CLASS II			CLASS III			CLASS IV			CLASS V		
Bedding Class	A	B	C	A	B	C	A	B	C	A	B	C
Pipe Size												
24"	- - -	- - -	- - -	22	14	11	30	18	15	46	39	23
30"	- - -	- - -	- - -	22	14	11	32	20	16	47	30	23
36"	- - -	- - -	- - -	22	14	11	32	20	16	47	31	24
42"	- - -	- - -	- - -	22	14	11	32	21	16	47	31	24
48"	17	11	9	22	14	11	32	21	16	48	31	24
54"	17	11	10	22	14	12	32	21	17	49	31	24
60"	17	11	10	22	14	12	33	21	17	49	31	25
66"	17	12	11	22	14	13	33	22	17	49	31	25
72"	17	12	11	22	15	13	33	22	17	49	32	25
84"	17	12	11	22	15	14	33	22	17	50	32	25



CLASS B BEDDING

Bedding Shall be Carefully Shaped to Fit Pipe Prior to Installation. No Direct Payment for Shaping the Trench.



CLASS C BEDDING

BEDDING FOR C.M.P. OR C.M.A.P

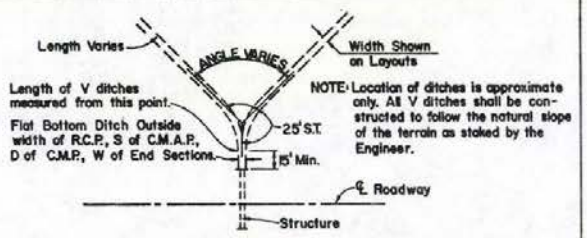
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

CULVERT BEDDING & ALLOWABLE FILL HEIGHT FOR R.C.P.

CHIEF ROAD DESIGN ENGR.

R-1.1.6 (603, 604)
ADOPTED: 8/88
REVISED: 6-10-88

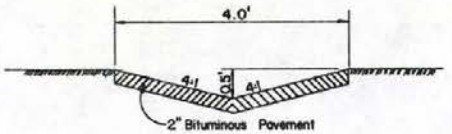
R-11



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

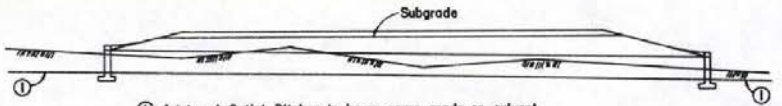
DRAINAGE DITCHES



SECTION

BITUMINOUS TURNOUT DITCH

(Plantmix or Roadmix with Seal Coat)

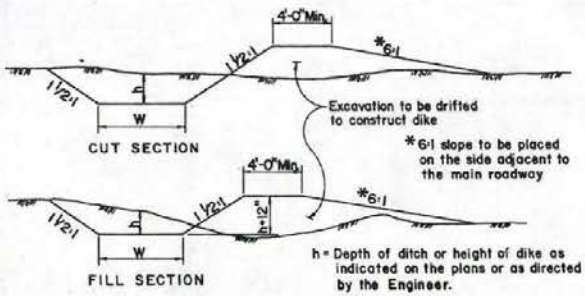


① Inlet and Outlet Ditches to be on same grade as culvert for a distance of 25' minimum.

(See detail below for design of ditches).

CULVERT INSTALLATION

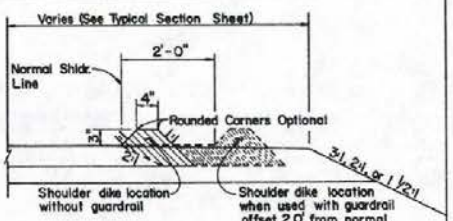
(PREFERRED)



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.

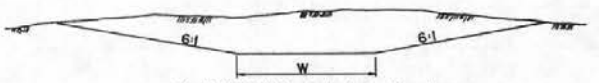
FLAT BOTTOM DITCH AND DIKE



SECTION

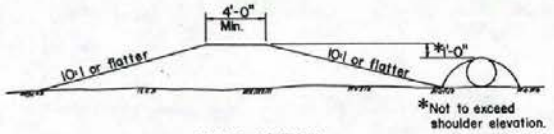
BITUMINOUS SHOULDER DIKE

(Plantmix or Roadmix with Seal Coat)



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

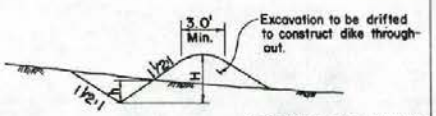
INLET, OUTLET, AND MEDIAN DITCH DETAILS



*Not to exceed shoulder elevation.

DIKE DETAIL

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



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

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

SECTION

V TYPE DITCH

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

NOTE: DIMENSIONS RELATING TO EXCAVATION (DITCHES) OR EMBANKMENT (DIKES) SHALL BE DESIGNATED AS W (WIDTH), X H (HEIGHT OR DEPTH), X L (LENGTH).

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

DRAINAGE DITCHES AND DIKES

CHIEF ROAD DESIGN ENGR.

R-141-(203)

ADOPTED: 8/69 REVISION 6-1/79

R-14

* 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

R Round Installation
E Vertical Elongation (See Standard Specification Sec. 604.03.02) ****

* ROUND CORRUGATED STEEL PIPE 5"x1" & 3"x1" 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									
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	30	32	32	33
126	24							26	27	31	33
132	24							25	26	30	31
138	24							23	24	28	29
144										25	26

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

PIPE DIMENSIONS SPAN-RISE	** MIN. COVER	EQUIV. DIA.	MIN. THICKNESS	MAX. COVER FOR CORNER PRESSURES IN TONS PER SQ. FT.	
INCHES	INCHES	INCHES	INCHES	2 TONS	*** 3 TONS
17 x 13	18	15	0.064	13	19
21 x 15	18	18	0.064	12	18
24 x 18	18	21	0.064	10	16
28 x 20	18	24	0.064	10	15
35 x 24	18	30	0.064	9	14
42 x 29	18	36	0.064	9	12
49 x 33	18	42	0.079	8	12
57 x 38	18	48	0.109	8	12
64 x 43	18	54	0.109	8	12
71 x 47	18	60	0.138	8	12
77 x 52	18	66	0.168	8	12
83 x 57	18	72	0.168	9	13

* CORRUGATED STEEL PIPE ARCH 3" x 1" CORRUGATIONS

PIPE DIMENSIONS SPAN-RISE	**MIN. COVER	EQUIV. DIA.	MIN. THICKNESS	MAX. COVER FOR CORNER PRESSURES IN TONS PER SQ. FT.	
INCHES	INCHES	INCHES	INCHES	2 TONS	*** 3 TONS
60 x 46	18	54	0.064	12	18
66 x 51	18	60	0.064	12	18
73 x 55	18	66	0.064	12	18
81 x 59	18	72	0.064	12	18
87 x 63	18	78	0.064	16	22
95 x 67	18	84	0.079	15	21
103 x 71	18	90	0.079	14	20
112 x 75	18	96	0.109	13	18
117 x 79	24	102	0.109	12	17
128 x 83	24	108	0.109	11	16
137 x 87	24	114	0.109	10	15
142 x 91	24	120	0.138	9	14

* 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

**** For Field Strutting C M P Detail See Standard Sheet R-2.1.1

MAXIMUM HEIGHT OF COVER FOR STRUCTURAL STEEL PLATE PIPE (5% ELONGATION) 6" x 2" CORRUGATIONS

DIAMETER IN INCHES	MIN. COVER INCHES	ALLOWABLE FILL HEIGHTS IN FEET						
		12 GAGE 0.109	10 GAGE 0.138	8 GAGE 0.168	7 GAGE 0.188	5 GAGE 0.218	3 GAGE 0.249	1 GAGE 0.280
60	12	42	62	80	93			
66	12	39	57	73	85			
72	12	35	52	67	78	94		
78	12	33	48	62	72	87		
84	18	30	45	57	67	80	95	
90	18	28	42	54	62	75	88	96
96	18	27	39	50	58	70	83	90
102	24	25	37	47	55	66	78	85
108	24	24	35	45	51	63	74	80
114	24	22	33	42	49	59	70	76
120	24	21	31	40	47	56	66	72
126	24	20	30	38	45	54	63	69
132	24	19	28	37	43	51	60	66
138	24	18	27	35	41	49	58	63
144	24	18	26	34	39	47	55	60
150	24	17	25	32	38	45	53	58
156	24	16	24	31	36	44	51	56
162	24	16	23	30	35	42	49	54
168	24	15	22	29	34	40	47	52
174	24	15	22	28	32	39	46	50
180	36	14	21	27	31	38	44	48
186	36	14	20	26	30	36	43	47
192	36		20	25	29	35	42	45
198	36		19	25	29	34	40	44

NOTE: ① Round Corrugated Steel Pipe
Fill Heights shown are for 3"x1" Corrugation
Fill Heights for 5"x1" Corrugation are 87% of those shown.

② Corrugated Steel Pipe Arch
Fill Heights for 5"x1" and 3"x"1" Corrugations are identical.

MAXIMUM HEIGHT OF COVER FOR STRUCTURAL STEEL PLATE PIPE ARCH WITH 31" CORNER RADIUS 6" x 2" CORRUGATIONS

SPAN	RISE	MIN. COVER INCHES	ALLOWABLE FILL HEIGHTS IN FEET							
			2 TONS/SQ. FT. BEARING PRESSURE				▲3 TONS/SQ. FT. BEARING PRESSURE			
			12 GAGE 0.109	10 GAGE 0.138	8 GAGE 0.168	7 GAGE 0.188	12 GAGE 0.109	10 GAGE 0.138	8 GAGE 0.168	7 GAGE 0.188
13'-3"	9'-4"	36	11				17			
14'-2"	9'-10"	36	11				17			
15'-4"	10'-4"	36		10				16		
16'-3"	10'-10"	36		9				16		
17'-2"	11'-4"	36		9				15		
18'-1"	11'-10"	36			8				14	
19'-3"	12'-4"	36			8				13	
19'-11"	12'-10"	36			7				13	
20'-7"	13'-2"	36			7					12

▲ May be Used Only When Supported by Foundation Study

MAXIMUM HEIGHT OF COVER FOR STRUCTURAL STEEL PLATE PIPE ARCH WITH 18" CORNER RADIUS 6" x 2" CORRUGATIONS

SPAN	RISE	MIN. COVER INCHES	ALLOWABLE FILL HEIGHTS IN FEET							
			2 TONS/SQ. FT. BEARING PRESSURE				▲3 TONS/SQ. FT. BEARING PRESSURE			
			12 GAGE 0.109	10 GAGE 0.138	8 GAGE 0.168	7 GAGE 0.188	12 GAGE 0.109	10 GAGE 0.138	8 GAGE 0.168	7 GAGE 0.188
6'-1"	4'-7"	18	15							
7'-0"	5'-1"	18	13							
7'-11"	5'-7"	18	12				16			
8'-10"	6'-1"	24	10				16			
9'-9"	6'-7"	24	9				15			
10'-11"	7'-1"	24	8				13			
12'-10"	8'-4"	24	8				11			
14'-1"	8'-9"	24	7				11			
15'-4"	9'-3"	24						10		
10'-10"	9'-10"	24						9		
16'-7"	10'-1"	36						8		

▲ May be Used Only When Supported by Foundation Study.

EQUIVALENT GAGE NUMBERS

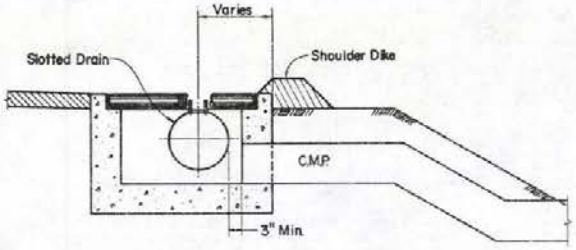
GAGE NUMBER	THICKNESS IN INCHES		
	STEEL		AL.
	ZN. COAT	UNCOATED	
16	0.064	0.0598	0.060
14	0.079	0.0747	0.075
12	0.109	0.1046	0.105
10	0.138	0.1345	0.135
8	0.168	0.1644	0.164
7	0.188	0.1838	
5	0.218	0.2145	
3	0.249	0.2451	
1	0.280	0.2758	

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

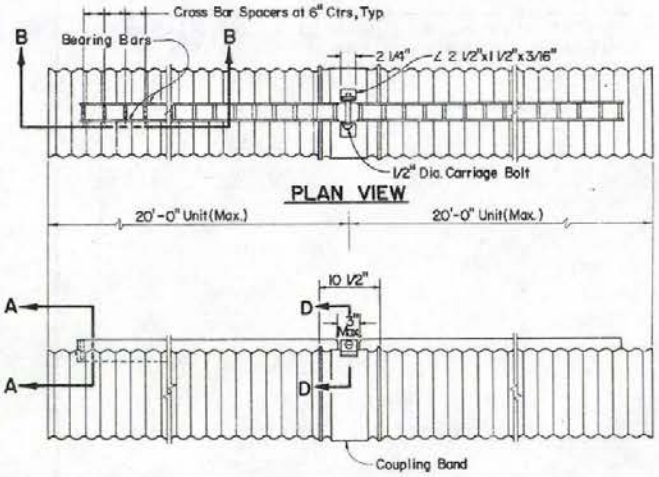
ALLOWABLE FILL HEIGHTS FOR STEEL CULVERTS

[signature]
CHIEF ROAD DESIGN ENGR.

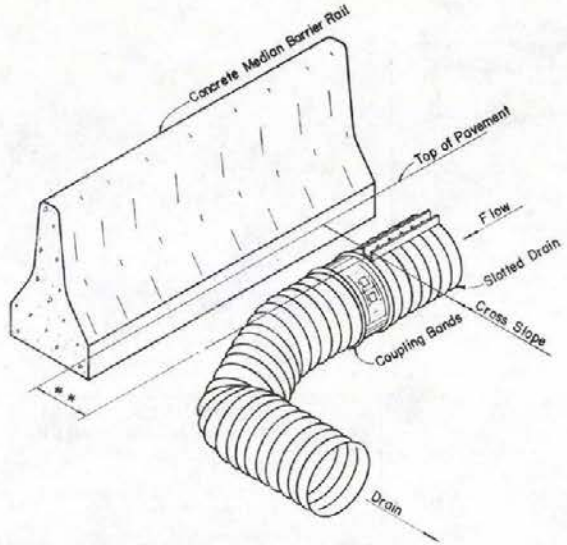
R-1.3.1.2 (600,604,606)
ADOPTED: 7/73 REVISION 2-10/85



EMBANKMENT PROTECTOR & SLOTTED DRAIN

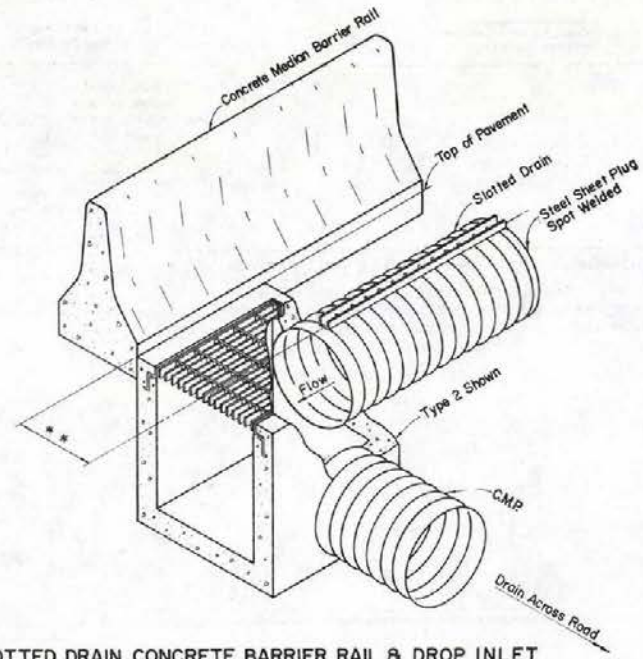


SLOTTED DRAIN DETAIL

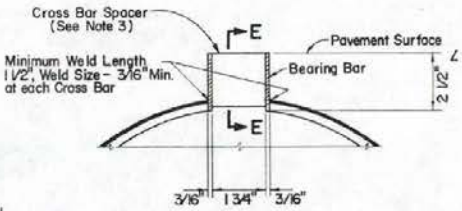


45° ANGLE SLOTTED DRAIN & CONCRETE BARRIER RAIL

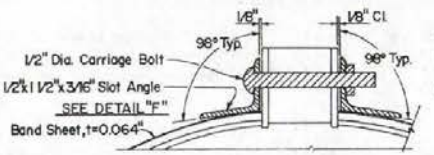
(CAN BE USED WITH SHOULDER DIKE)



SLOTTED DRAIN, CONCRETE BARRIER RAIL & DROP INLET

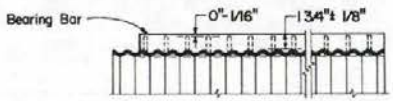


SECTION A-A

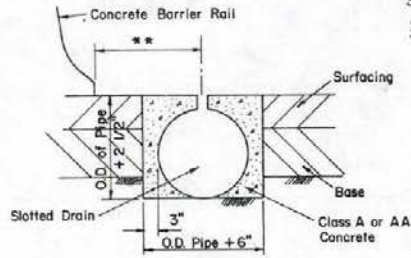


GENERAL NOTES

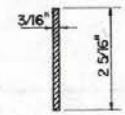
1. DRAIN PIPE SEAMS MAY BE CONTINUOUS HELICAL LOCK SEAM OR HELICAL WELD SEAM.
2. DRAIN SECTIONS SHALL BE ASSEMBLED WITH THE COUPLING BAND SHOWN.
3. THE CROSS BAR SPACER SHALL BE WELDED TO THE BEARING BARS IN SUCH A MANNER AS TO DEVELOP A MINIMUM TENSILE STRENGTH OF 12,000 LBS. NORMAL TO THE LONGITUDINAL AXIS OF THE BEARING BARS.
4. THE MAXIMUM VARIANCE FROM A STRAIGHT LINE BETWEEN THE EXTREME TOP CORNERS OF THE BEARING BARS SHALL BE 1/2" IN 20 FEET.
5. FOR CONTINUOUS RUNS OF S.C.M.P. IN EXCESS OF 200 FEET, CLEANOUT D.I. OR STANDARD FLUSHING INLETS SHALL BE INSTALLED AS SHOWN ON THE PLANS.
6. SPOT WELD SHALL DEVELOP MINIMUM REQUIRED STRENGTH OF STRAP.
7. DIMENSIONS SHOWN ARE MINIMUMS.
8. CONTRACTOR TO PROVIDE AN ADEQUATE METHOD OF KEEPING THE A.C. OUT OF PIPE, DURING PAVING OPERATIONS.



SECTION B-B

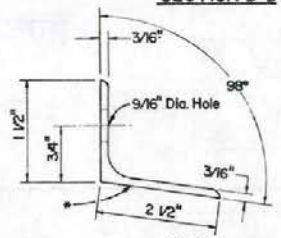


BEDDING DETAIL



SECTION E-E

SECTION D-D



DETAIL "F"

* Attach to Coupling Band With Tack or Fillet Welds or Rivets

** See Plan Structure List

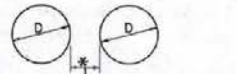
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

SLOTTED C.M.P. DRAIN DETAILS

R-2.1.3(604)

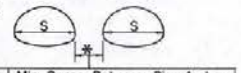
CHIEF ROAD DESIGN ENGR. | ADOPTED 6-71 | REVISION 5-1188

R-16



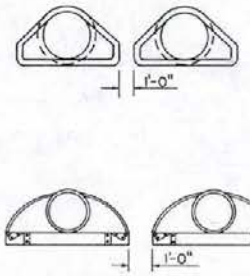
Diameter	Minimum Space Between Pipes
12" to 24"	1'-0"
30" to 66"	One Half Diameter of Pipe
72" to 84"	3'-0"

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

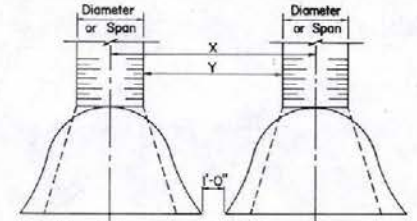


Span	Min. Space Between Pipe Arches
17" to 35"	1'-0"
42" to 83"	One Third Span of Pipe Arch

MULTIPLE INSTALLATIONS WITHOUT HEADWALLS



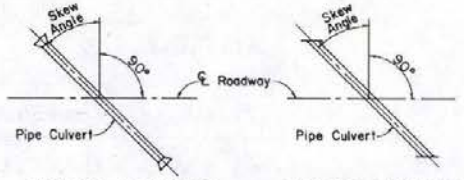
MULTIPLE INSTALLATIONS WITH END SECTIONS



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

TABLE OF SEPARATION FOR MULTIPLE INSTALLATIONS

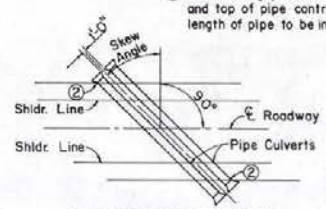
CMP			CMAP			RCP		
DIA.	X	Y	SPAN	X	Y	DIA.	X	Y
			21"x15"	5'- 2"	3'- 5"	18"	4'- 4"	2'- 6"
			24"x18"	5'-10"	3'-10"	24"	5'- 5"	3'- 0"
			28"x20"	6'- 6"	4'- 2"	30"	6'- 6"	3'- 6"
24"	6'- 8"	4'- 8"	35"x24"	7'- 8"	4'- 9"	36"	7'- 7"	4'- 0"
30"	8'- 0"	5'- 6"	42"x29"	9'- 3"	5'- 9"	42"	8'- 2"	4'- 0"
36"	9'- 4"	6'- 4"	49"x33"	10'- 3"	6'- 2"	48"	8'- 9"	4'- 0"
42"	10'- 8"	7'- 2"	57"x38"	11'- 6"	6'- 9"	54"	8'- 7"	3'- 4"
48"	11'- 6"	7'- 6"	64"x43"	12'- 6"	7'- 2"			
54"	12'- 6"	8'- 0"	71"x47"	13'- 6"	7'- 7"			
60"	13'- 6"	8'- 6"	77"x52"	14'- 6"	8'- 1"			
66"	14'- 0"	9'- 6"	83"x57"	15'- 6"	8'- 7"			
72"	14'- 6"	8'- 6"						
78"	15'- 0"	8'- 6"						
84"	15'- 6"	8'- 6"						



SINGLE CULVERT WITH END SECTIONS

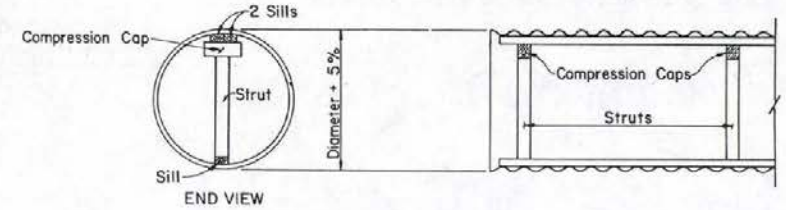
SINGLE CULVERT WITH HEADWALLS

② Intersecting point of fillslope and top of pipe controls the length of pipe to be installed.



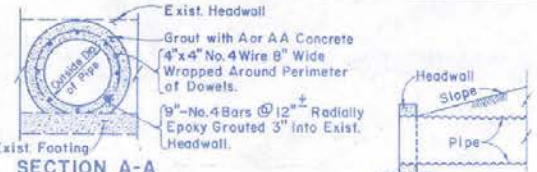
MULTIPLE CULVERT WITH END SECTIONS

Struts shall be left in place until fill has been completed and compacted, unless otherwise directed by the Engineer.

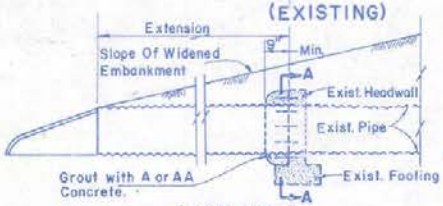


FIELD STRUTTING CMP

Note: For strut, cap, sill size and spacing use manufacturers recommendations. Struts, caps and sills to be the same dimension. For maximum fill heights, see standard sheet R-1.3.1.2 under columns designated "E".



SECTION A-A

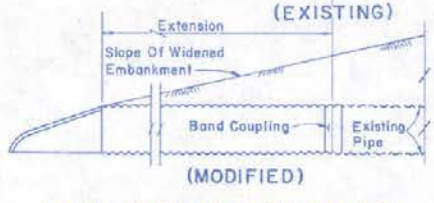


(MODIFIED)

PIPE CULVERT EXTENSION TYPE 2

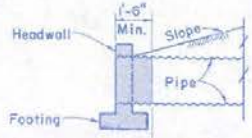
(EXISTING)

■ LIMITS OF REMOVAL



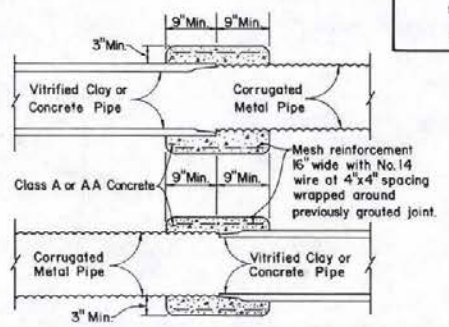
(MODIFIED)

PIPE CULVERT EXTENSION TYPE 1



(EXISTING)

(FOR ADDITIONAL INFORMATION SEE R-1.1.2)



CONCRETE COLLAR

CMP to RCP or Vitrified Clay Pipe Extensions

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

CULVERT INSTALLATION

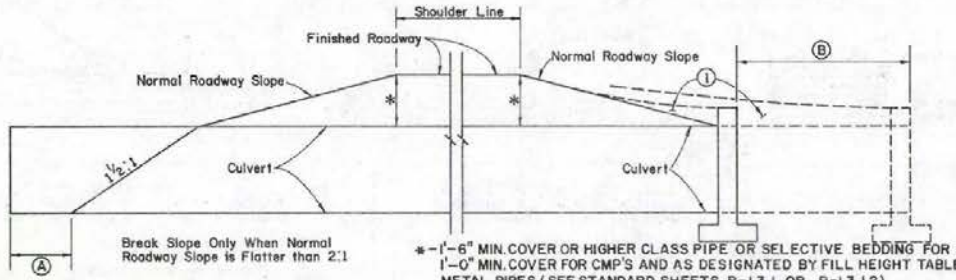
CHIEF ROAD DESIGN ENGR.

R-2.1.1 (601 THRU 606)

ADOPTED: 8/69

REVISION 6 1/88

R-15



WITHOUT HEADWALL

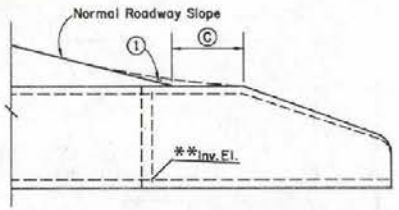
WITH CONCRETE HEADWALL

*-1'-6" MIN. COVER OR HIGHER CLASS PIPE OR SELECTIVE BEDDING FOR RCP'S. 1'-0" MIN. COVER FOR CMP'S AND AS DESIGNATED BY FILL HEIGHT TABLES FOR METAL PIPES (SEE STANDARD SHEETS R-1.3.1 OR R-1.3.1.2).

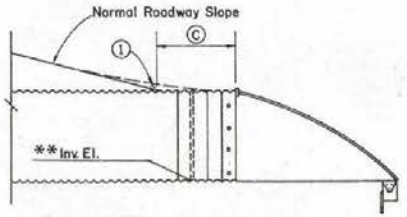
(A)-LENGTH OF CULVERT SHALL BE INCREASED AS FOLLOWS: CONSIDER EACH SIDE SEPARATELY. MEASURE PIPE FROM ROADBED CENTERLINE TO THE INTERSECTION OF PIPE FLOW LINE AND FILLSLOPE. TO THIS DIMENSION ADD 2.0' WHEN COVER AT SHOULDER IS 1.0' TO 10.0', ADD AN ADDITIONAL 0.5' FOR EACH SUCCEEDING 5.0' OF COVER OR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



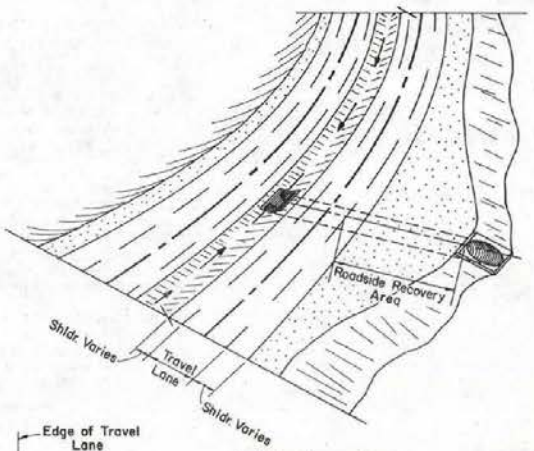
METAL END SECTION

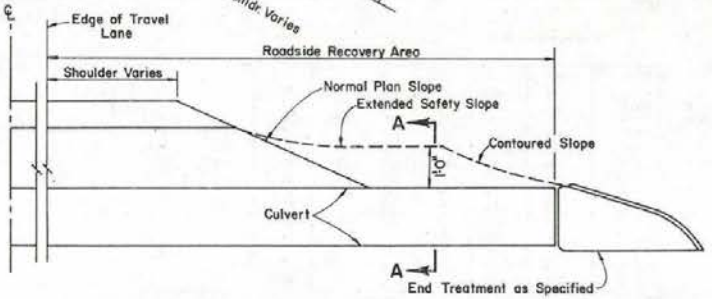
(C)-LENGTH OF CULVERT SHALL BE INCREASED AS FOLLOWS: CONSIDER EACH SIDE SEPARATELY. MEASURE PIPE FROM ROADWAY CENTERLINE TO THE INTERSECTION OF THE TOP OF PIPE AND FILLSLOPE. TO THIS DIMENSION ADD 1.0' WHEN COVER AT SHOULDER IS 1.0' TO 10.0' ADD AN ADDITIONAL 0.5' FOR EACH SUCCEEDING 5.0' OR PORTION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

MINIMUM CULVERT INSTALLATION

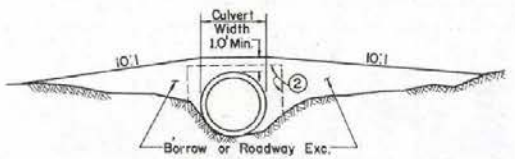
*RCP: USE 1'6" WHERE POSSIBLE. IF MINIMUM COVER IS RESTRICTIVE, COMPENSATE BY UTILIZING HIGHER CLASS PIPE OR SELECTIVE BEDDING AS RECOMMENDED BY THE HYDRAULICS SECTION.
ALUMINUM CULVERTS: SEE STANDARD SHEET R-1.3.1.
STEEL CULVERTS: SEE STANDARD SHEET R-1.3.1.2

** FOR INFORMATIONAL PURPOSES ONLY





METHOD OF CONTOURING OVER CULVERTS



SECTION A-A

SAFETY CULVERT INSTALLATION

(TO PROVIDE OBSTRUCTION CLEARANCE)

NOTE: (1)-IF, AFTER EXTENDING THE CULVERT AND/OR WARPING THE FILLSLOPE FOR SAFETY AND/OR AESTHETICS, THE EXTENSION DOES NOT FULFILL THE REQUIREMENTS FOR A CLEAR ROADSIDE RECOVERY AREA; THEN VEHICULAR TRAFFIC MAY BE PROTECTED BY SOME OTHER MEANS, SUCH AS GUARDRAIL, BARRIER RAIL OR ANOTHER ACCEPTABLE SAFETY FEATURE.
(2)-NORMAL STRUCTURE EXCAVATION AND BACKFILL LIMITS.

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

CULVERT INSTALLATION

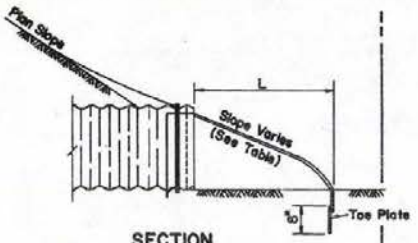
CHIEF ROAD DESIGN ENGINEER

R-2.1.4 (601 THRU 606)

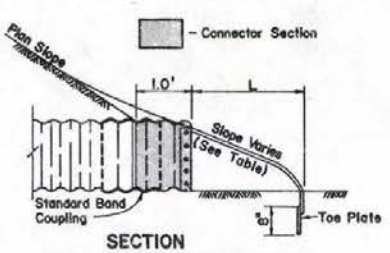
ADOPTED: 5/72

REVISION 5-10-82

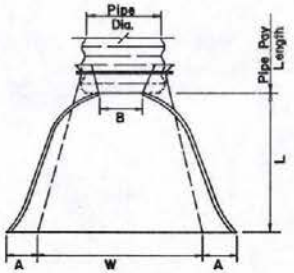
R-17



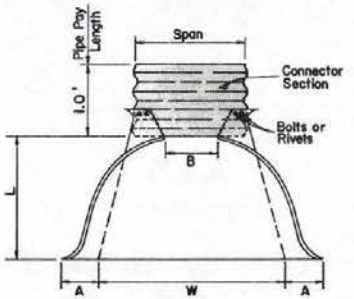
SECTION
TYPE 1 OR 2 CONNECTION



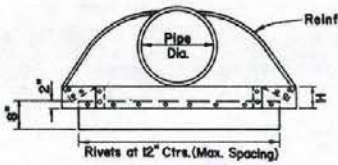
SECTION
TYPE 3 CONNECTION



PLAN

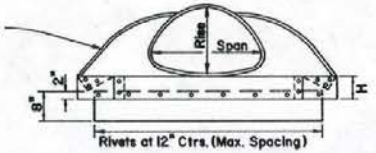


PLAN



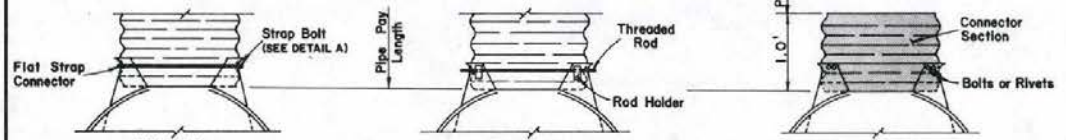
ELEVATION

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 13" TO 29" INCLUSIVE AND W + 18" MIN. FOR PIPE ARCHES WITH RISE OF 33" AND LARGER.

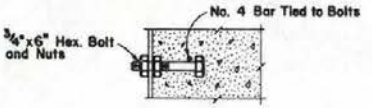


TYPE 1
FOR 12" CMP THROUGH 24" CMP ONLY

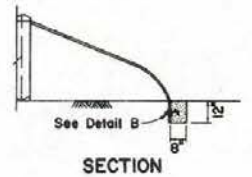
TYPE 2
FOR 30" CMP THROUGH 84" CMP.
AND
FOR 17" X 13" CMAP THRU 57" X 38" CMAP.

TYPE 3
FOR 64" X 43" CMAP THROUGH 83" X 57" CMAP
OR
FOR 42" CMP THROUGH 84" CMP (OPTIONAL)

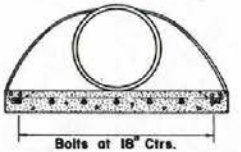
STANDARD CONNECTIONS



DETAIL B



SECTION



ELEVATION

ANCHOR BLOCK DETAIL
(See Notes 6 Thru 9)

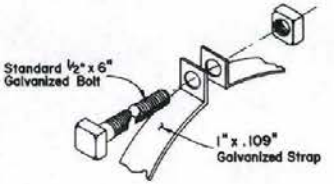
TYPE CONNECTION	PIPE ARCH DIMENSIONS SPAN	RISE	GAGE	DIMENSIONS A 1" TOL.	B MAX.	H 1" TOL.	L 1½" TOL.	W 2" TOL.	APPROX. SLOPE	* CONCRETE CU.YD.
TYPE 2	17"	13"	16	7"	9"	6"	19"	30"	2½:1	
	21"	15"	16	7"	10"	6"	23"	36"	2½:1	
	24"	18"	16	8"	12"	6"	28"	42"	2½:1	
	28"	20"	16	9"	14"	6"	32"	48"	2½:1	
	35"	24"	14	10"	16"	6"	39"	60"	2½:1	
	42"	29"	14	12"	18"	8"	46"	75"	2½:1	
	49"	33"	12	13"	21"	9"	53"	85"	2½:1	
	57"	38"	12	18"	26"	12"	63"	90"	2½:1	0.26
TYPE 3	64"	43"	12	18"	30"	12"	70"	102"	2¼:1	0.29
	71"	47"	12	18"	33"	12"	77"	114"	2¼:1	0.31
	77"	52"	12	18"	36"	12"	77"	126"	2:1	0.34
	83"	57"	12	18"	39"	12"	77"	138"	2:1	0.36

TYPE CONNECTION	PIPE DIAM.	GAGE	DIMENSIONS A 1" TOL.	B MAX.	H 1" TOL.	L 1½" TOL.	W 2" TOL.	APPROX. SLOPE	*CONCRETE CU. YD.
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 2 OR TYPE 3	42"	12	16"	22"	11"	69"	84"	2½:1	
	48"	12	18"	27"	12"	78"	90"	2¼:1	0.26
	54"	12	18"	30"	12"	84"	102"	2:1	0.29
	60"	12	18"	33"	12"	87"	114"	1 3/4:1	0.31
	66"	12	18"	36"	12"	87"	120"	1 ¾:1	0.32
	72"	12	18"	39"	12"	87"	126"	1 1/3:1	0.34
	78"	12	18"	42"	12"	87"	132"	1 ¼:1	0.35
	84"	12	18"	45"	12"	87"	138"	1 1/8:1	0.36

*FOR INFORMATION 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 28" x 20" AND OVER UNLESS OTHERWISE SPECIFIED ON THE PLANS OR IN THE SPECIAL PROVISIONS.
4. TOE PLATES SHALL BE PUNCHED WITH 7/16" HOLES TO MATCH HOLES IN LIP OF END SECTION AND BOLTED WITH 3/8" GALVANIZED BOLTS.
5. REINFORCED EDGES TO BE SUPPLEMENTED WITH GALVANIZED STIFFENER ANGLES FOR THE 60" THRU 84" ROUND, 77" x 52" AND 83" x 57" PIPE-ARCH SIZES. THE ANGLES WILL BE 2" x 2" x ¼" FOR THE 60" THRU 72" ROUND, 77" x 52" AND 83" x 57" PIPE ARCH SIZES AND 2½" x 2½" x ¼" FOR 78" AND 84" ROUND. THE ANGLES TO BE ATTACHED BY 3/8" GALVANIZED NUTS AND BOLTS.
6. ANCHOR BLOCK SHALL BE USED ON INLET END ONLY FOR 48" CMP AND OVER AND FOR 57" x 38" CMAP AND OVER UNLESS OTHERWISE SPECIFIED (SEE ANCHOR BLOCK DETAILS).
7. CONCRETE SHALL BE CLASS A OR AA.
8. TOE PLATE TO BE ELIMINATED WHEN ANCHOR BLOCK IS USED.
9. REINFORCING STEEL BAR TO CLEAR 2" ON ENDS OF CONCRETE ANCHOR BLOCK.



DETAIL A

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

METAL END SECTIONS
12" CMP TO 84" CMP AND 17"x13" CMAP TO 83"x57" CMAP

CHIEF ROAD DESIGN ENGR.

R-2.2.1 - (604)
ADOPTED: 8/75 REVISION 2 9/81

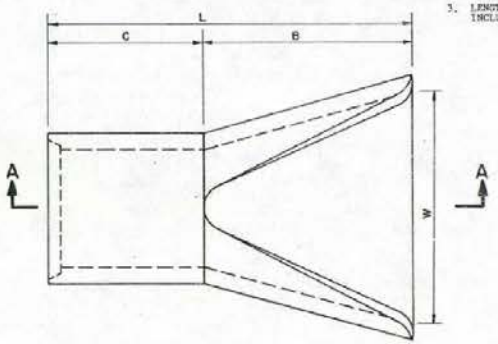
R-18

DIAMETER	WEIGHT	A	B	C *	L	W
18"	670	9"	2'-1"	3'-1"	4'-0"	3'-0"
24"	1300	9"	3'-6"	2'-6"	6'-0"	4'-0"
30"	1850	1'-0"	4'-3"	1'-8"	6'-1"	5'-0"
36"	2500	1'-3"	5'-2"	2'-1"	8'-1"	6'-0"
42"	4930	1'-3"	5'-3"	2'-1"	8'-2"	7'-0"
48"	6700	2'-0"	6'-0"	2'-2"	8'-2"	8'-0"
54"	7150	2'-3"	5'-6"	2'-9"	8'-3"	9'-0"

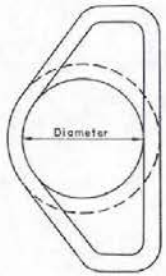
* For Reference Only

GENERAL NOTES

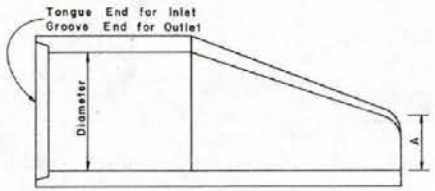
1. CLASS AND TYPE OF CONCRETE SHALL BE AS SPECIFIED FOR REINFORCED CONCRETE PIPE.
2. STRUCTURAL DESIGN OF END SECTION SHALL CONFORM TO THAT OF STANDARD REINFORCED CONCRETE CULVERT PIPE.
3. LENGTH OF PIPE SHOWN ON THE PLANS DOES NOT INCLUDE CONNECTOR SECTION (LENGTH C).



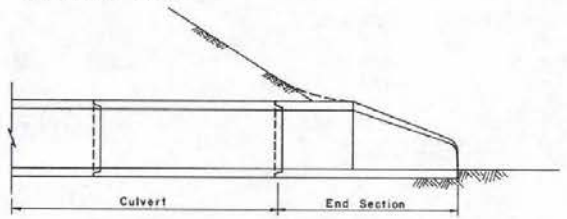
PLAN



END VIEW



SECTION A-A



CROSS SECTION VIEW

18" RCP TO 54" RCP

R-9

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

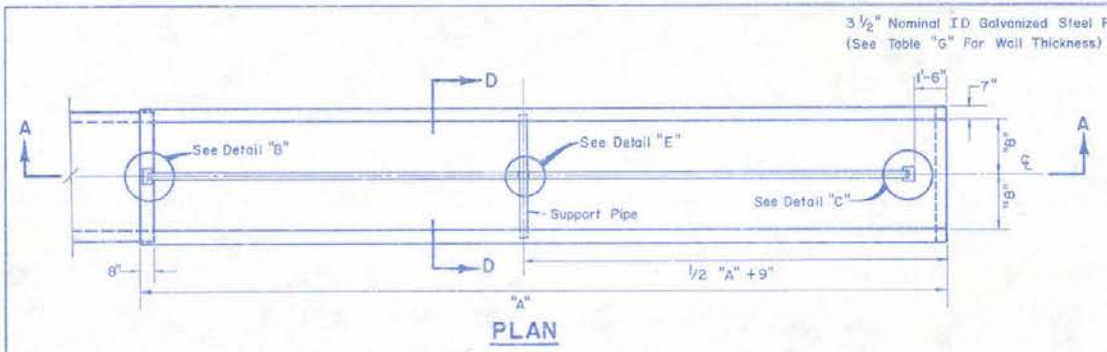
RCP END SECTION
12" RCP TO 54" RCP

CHIEF ROAD DESIGN ENGR.

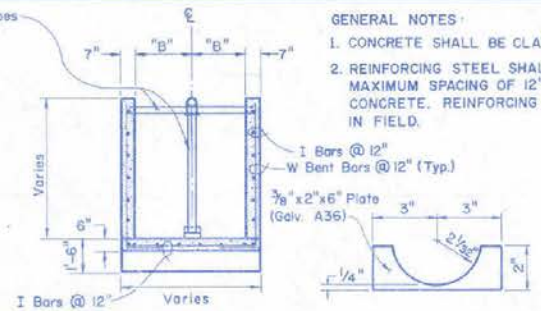
R-2.3.1-(603)

ADOPTED: 1/75

REVISION 1-12/82



PLAN

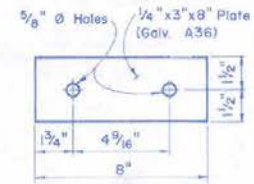


SECTION D-D

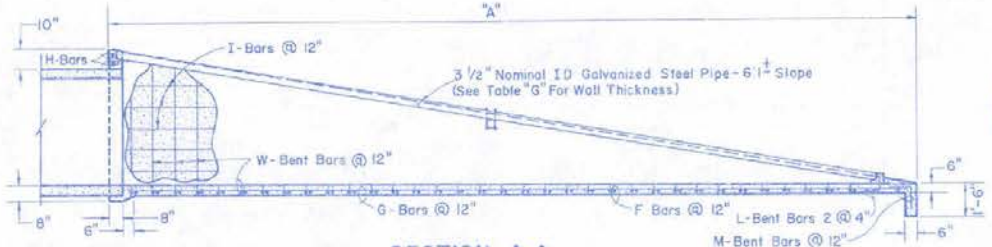
GENERAL NOTES:

1. CONCRETE SHALL BE CLASS A OR CLASS AA.
2. REINFORCING STEEL SHALL BE DEFORMED BARS WITH THE MAXIMUM SPACING OF 12" SET 2" CLEAR OF SURFACE OF CONCRETE. REINFORCING BARS MAY BE CUT AND BENT IN FIELD.

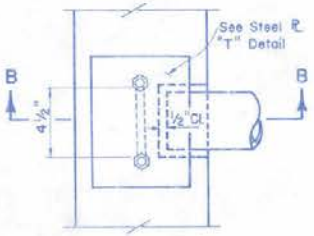
SADDLE ℄ DETAIL



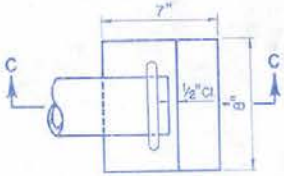
ANCHOR ℄ DETAIL



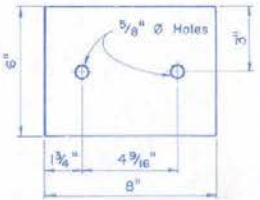
SECTION A-A



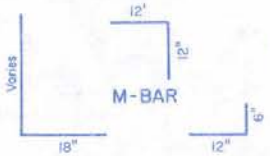
DETAIL "B"
(PLAN)



DETAIL "C"
(PLAN)



STEEL ℄ "T" DETAIL

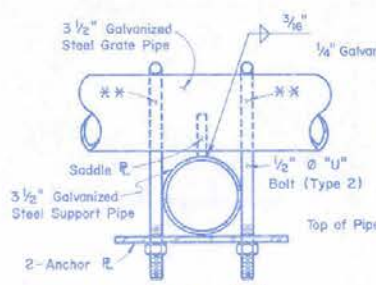


LENGTH OF REINFORCING BARS

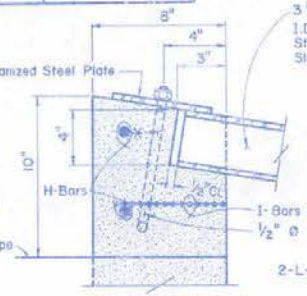
DIA. OF PIPE	F NO. 4 BARS	G NO. 4 BARS	H NO. 4 BARS	I NO. 4 BARS	M NO. 4 BARS	W NO. 4 BARS
30"	22'-2"-2"	4-21'-6"	2-3'-3"	3-19'-10" TO 2'-6"	4-2'-0"	19-4'-11" TO 2'-0"
33"	23-2'-5"	4-23'-0"	2-3'-7"	3-20'-10" TO 2'-6"	4-3'-0"	20-5'-3" TO 2'-0"
36"	24-2'-8"	5-23'-6"	2-3'-10"	3-22'-4" TO 2'-6"	5-2'-0"	22-5'-5" TO 2'-0"
39"	25-2'-11"	5-25'-6"	3-4'-1"	4-24'-4" TO 2'-6"	5-2'-0"	24-5'-9" TO 2'-0"
42"	28-3'-2"	3-27'-0"	2-4'-4"	3-25'-10" TO 2'-6"	5-2'-0"	25-6'-6" TO 2'-0"
45"	29-3'-5"	6-28'-6"	3-4'-7"	5-27'-4" TO 2'-6"	6-2'-0"	27-6'-3" TO 2'-0"
48"	31-4'-10"	6-30'-0"	3-4'-10"	5-28'-10" TO 2'-6"	6-2'-0"	28-6'-6" TO 2'-0"
51"	33-4'-10"	6-32'-0"	3-5'-1"	6-30'-10" TO 3'-4"	6-2'-0"	30-6'-10" TO 2'-0"
54"	34-5'-4"	6-33'-6"	3-5'-4"	6-32'-4 TO 2'-6"	6-2'-0"	32-7'-1" TO 2'-0"
57"	37-5'-7"	7-35'-0"	3-5'-7"	6-33'-10" TO 2'-6"	7-2'-0"	33-7'-4" TO 2'-0"
60"	38-5'-10"	7-37'-6"	3-5'-10"	7-35'-10 TO 2'-6"	7-2'-0"	35-7'-8" TO 2'-0"

TABLE "G"

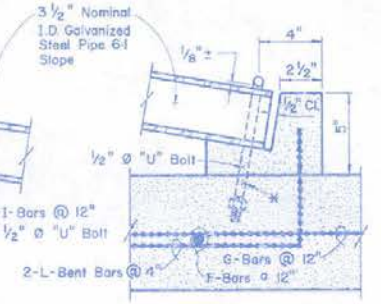
DIA. OF PIPE	DEM "A"	DEM "B"	PIPE WALL THICKNESS SCHEDULE
30"	22'0"	1'3"	40
33"	23'0"	1'4½"	40
36"	24'6"	1'6"	40
39"	26'6"	1'7½"	40
42"	28'0"	1'9"	40
45"	29'6"	1'10½"	40
48"	31'0"	2'0	40
51"	33'0"	2'1½"	80
54"	34'6"	2'3"	80
57"	36'0"	2'4½"	80
60"	38'0"	2'6"	80



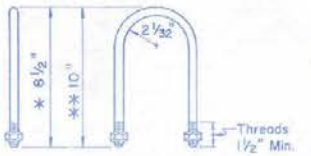
DETAIL "E"



SECTION B-B



SECTION C-C



U BOLT DETAIL

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

CULVERT END SAFETY GRATE 30"-60" CMP OR RCP

Michael J. Dell
CHIEF ROAD DESIGN ENGR

R-2.3.1.1(601)
ADOPTED 1/88 REVISION

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CMP SIZE Dia.	CORR CMAP SXR	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	49	1.35	50	1.49	53
15"	18" X 11"	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" X 13"	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" X 18"	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" X 22"	4.91	8'-0"	2.61	105	2.85	111	2.90	112	3.01	115	3.39	126	3.65	132	3.79	135	4.11	142
36"	43" X 27"	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" X 31"	9.62	11'-0"	4.18	167	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.

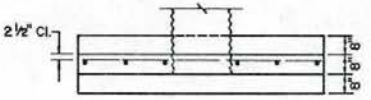
Quantities shown below are for one headwall.

LENGTH OF REINFORCING BARS

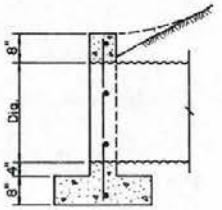
CMP SIZE Dia.	SINGLE CMP					SINGLE OR DOUBLE CMP							DOUBLE CMP				
	0°-45°	0°	15°	30°	45°	0°	15°		30°		45°		0°-45°	0°	15°	30°	45°
	NO. 4	NO. 5	NO. 5	NO. 5	NO. 5	NO. 4	NO. 4	NO. 4	NO. 4	NO. 4	NO. 4	NO. 4	NO. 4	NO. 5	NO. 5	NO. 5	NO. 5
	K	N	N	N	N	M	M	Q	M	Q	M	Q	K	N	N	N	N
12"	4@2'-5"	2@4'-3"	2@4'-6"	2@4'-9"	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'-5"	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'-9"	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'-9"	4@3'-0"	2@2'-10"	2@3'-9"	2@2'-9"	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'-6"	2@12'-1"	4@3'-9"	2@3'-7"	2@4'-8"	2@3'-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@3'-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"

GENERAL NOTES

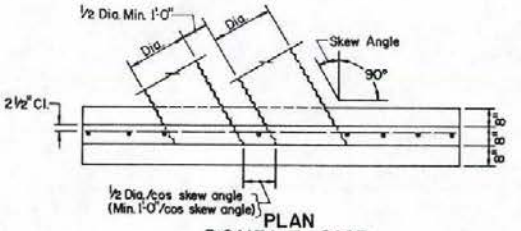
1- CONCRETE SHALL BE CLASS A OR AA.
2- REINFORCING STEEL SHALL BE DEFORMED BARS WITH MAXIMUM SPACING OF 18" SET 2½" CLEAR OF SURFACE OF CONCRETE EXCEPT AS NOTED. BAR ENDS SHALL BE KEPT 1½" CLEAR OF SURFACE OF CONCRETE. REINFORCING BARS MAY BE CUT AND BENT IN FIELD.
3- FOOTINGS SHOWN ARE OF MINIMUM DEPTH 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 5° INCREMENTS WHERE IT IS FEASIBLE.



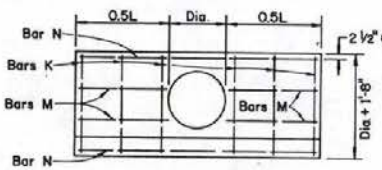
PLAN
SINGLE CMP



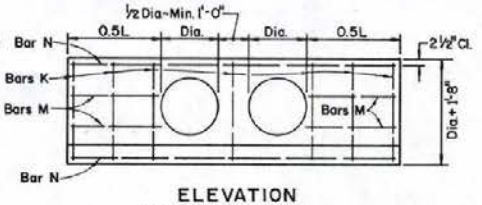
SECTION
(FOR ALL HEADWALLS)



PLAN
DOUBLE CMP

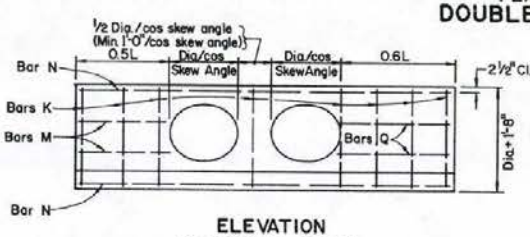


ELEVATION
SINGLE CMP

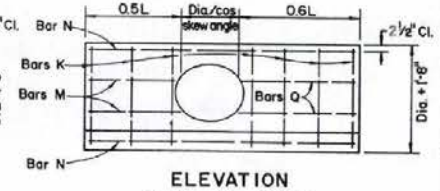


ELEVATION
DOUBLE CMP

0° SKEW



ELEVATION
DOUBLE CMP



ELEVATION
SINGLE CMP

15° TO 45° SKEW

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

CULVERT HEADWALLS
12" CMP TO 42" CMP

CHIEF ROAD DESIGN ENGINEER

R-2.4.1-(502)
ADOPTED: 8/69
REVISION

R20

CMP SIZE DIA.	CORR CMAP SXR	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"	59"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"	7.90	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	1095	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 DIA.	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'-9"	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'-9"	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'-7"	17#7'-10"

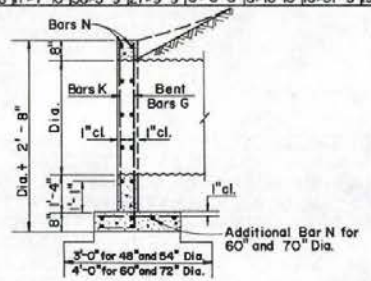
DOUBLE CMP

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'-9"	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#25'-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'-9"	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'-8"	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"

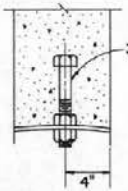
GENERAL NOTES

1. CONCRETE SHALL BE CLASS A OR AA.
2. REINFORCING STEEL SHALL BE DEFORMED BARS WITH MAXIMUM SPACING OF 18" SET 2 1/2" CLEAR OF SURFACE OF CONCRETE EXCEPT AS NOTED. BAR ENDS SHALL BE KEPT 1 1/2" 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 5° INCREMENTS WHERE IT IS FEASIBLE.
6. NO DIRECT PAYMENT FOR ANCHOR BOLTS.

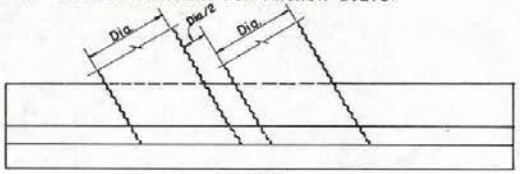


SECTION

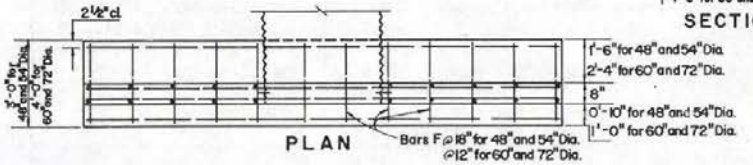


NOTE: Anchor bolts to be installed on inlet end only. (See Note no. 6)

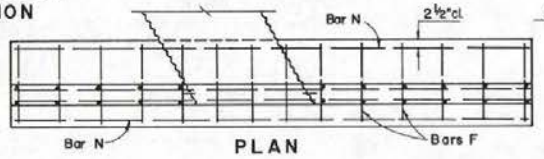
DETAIL A



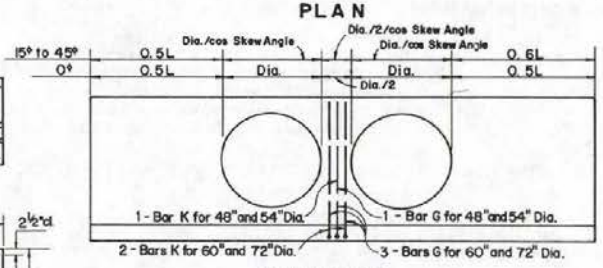
PLAN



PLAN

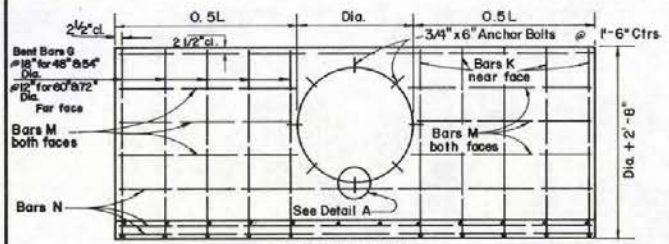


PLAN

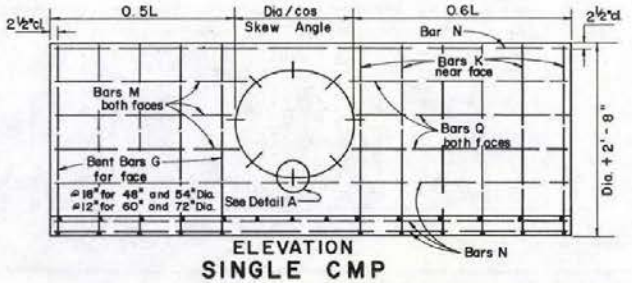


ELEVATION
DOUBLE CMP
0° TO 45° SKEW

NOTE: For details of other reinforcing bars see single culvert headwalls.



ELEVATION
SINGLE CMP
0° SKEW



ELEVATION
SINGLE CMP
15° TO 45° SKEW

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

CULVERT HEADWALLS
48" CMP TO 72" CMP

CHIEF ROAD DESIGN ENGINEER

R-2.4.2-(502)

ADOPTED: 8/99 REVISION

R21

QUANTITIES SHOWN BELOW ARE FOR TWO HEADWALLS

RCP SIZE DIA.	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 CONC 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'-10 1/4"	1'-2 1/4"	5'-0"	3'-3 1/2"
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'-10 1/2"	1'-2 1/2"	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'-10 3/4"	1'-2 3/4"	6'-6"	3'-10 1/2"
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	2.99	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'-11 1/2"	1'-3 1/2"	9'-0"	4'-9"
33"	5.94	3.50	125	3.82	132	3.87	134	3.98	137	4.62	153	4.98	160	5.17	164	5.56	172	0'-11 3/4"	1'-3 3/4"	9'-9"	5'-1/2"
36"	7.07	3.93	161	4.29	169	4.34	171	4.47	174	5.19	190	5.59	200	5.80	204	6.24	213	1'-0"	1'-4"	10'-6"	5'-4"

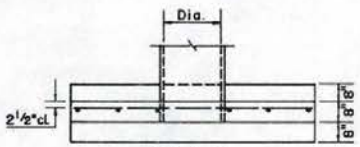
QUANTITIES SHOWN BELOW ARE FOR ONE HEADWALL

LENGTH OF REINFORCING BARS

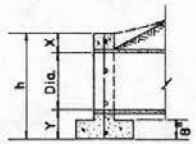
RCP SIZE DIA.	SINGLE 0°TO45° NO. 4	SINGLE 0° NO.5	SINGLE 15° NO. 5	SINGLE 30° NO.5	SINGLE 45° NO. 5	SINGLE OR DOUBLE 0° NO. 4	SINGLE OR DOUBLE 15° NO. 4	SINGLE OR DOUBLE 15° NO. 4	SINGLE OR DOUBLE 30° NO. 4	SINGLE OR DOUBLE 30° NO. 4	SINGLE OR DOUBLE 45° NO.4	SINGLE OR DOUBLE 45° NO.4	DOUBLE 0°TO45° NO. 4	DOUBLE 0° NO. 5	DOUBLE 15° NO.5	DOUBLE 30° NO.5	DOUBLE 45° 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#6'-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'-9"	2#10'-6"	2#11'-0"	2#12'-1"
21"	6#3'-8"	2#8'-0"	2#8'-9"	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'-4"	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'-9"	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"

GENERAL NOTES

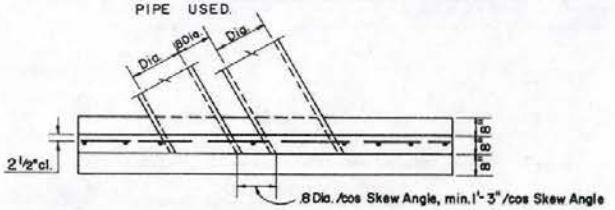
1. CONCRETE SHALL BE CLASS A OR AA.
2. REINFORCING STEEL SHALL BE DEFORMED BARS WITH MAXIMUM SPACING OF 18" SET 2 1/2" CLEAR OF SURFACE OF CONCRETE EXCEPT AS NOTED. BAR ENDS SHALL BE KEPT 1 1/2" CLEAR OF SURFACE OF CONCRETE. REINFORCING BARS MAY BE CUT AND BENT IN FIELD.
3. FOOTINGS SHOWN ARE OF MINIMUM 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 5° INCREMENTS 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.



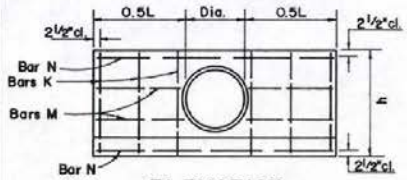
PLAN



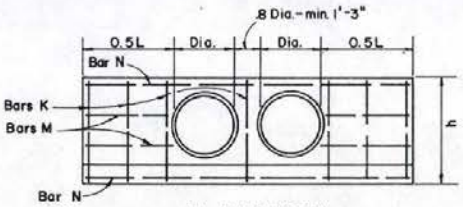
SECTION
(FOR ALL HEADWALLS)



PLAN

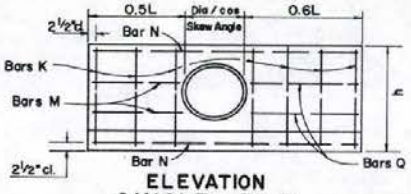


ELEVATION
SINGLE RCP

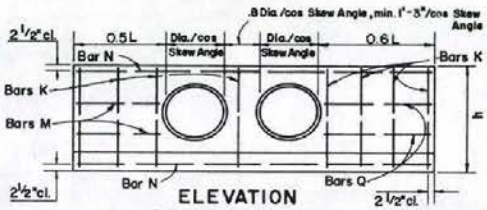


ELEVATION
DOUBLE RCP

0° SKEW



ELEVATION
SINGLE RCP



ELEVATION
DOUBLE RCP

15° TO 45° SKEW

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

CULVERT HEADWALLS
12" RCP TO 36" RCP

Forrest W. Lee
CHEIF ROAD DESIGN ENGR.

R - 2.51 - (502)
ADOPTED: 8/69
REVISION

R22

QUANTITIES SHOWN BELOW ARE FOR TWO HEADWALLS

RCP SIZE DIA.	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
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'-0¼"	2'-0¼"	12'-0"	6'-6½"
48"	12.57	7.41	688	8.10	745	8.21	781	8.46	792	9.88	829	10.65	889	11.07	935	11.96	1030	1'-1"	2'-1"	13'-9"	7'-2"
54"	15.90	9.81	990	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"
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"
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"

QUANTITIES SHOWN BELOW ARE FOR ONE HEADWALL

LENGTH OF REINFORCING BARS

SINGLE RCP

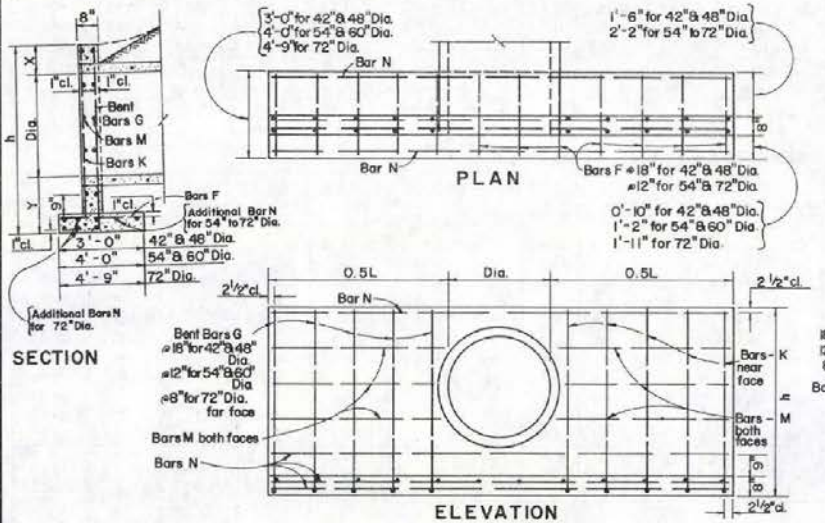
RCP SIZE DIA.	0°SKEW NO.5 F	0°SKEW NO.5 G	0°SKEW NO.4 M	0°SKEW NO.4 N	0°SKEW NO.4 K	15°SKEW NO.5 F	15°SKEW NO.5 G	15°SKEW NO.4 M	15°SKEW NO.4 Q	15°SKEW NO.4 N	15°SKEW NO.4 K	30°SKEW NO.5 F	30°SKEW NO.5 G	30°SKEW NO.4 M	30°SKEW NO.4 Q	30°SKEW NO.4 N	30°SKEW NO.4 K	45°SKEW NO.5 F	45°SKEW NO.5 G	45°SKEW 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"	9#15'-3"	10#5'-8"	13#2'-9"	11#7'-6"	6#5'-3"	6#6'-6"	9#16'-7"	11#5'-8"	13#2'-9"	11#7'-6"	6#5'-1"	6#6'-6"	9#17'-0"	11#5'-8"	14#2'-9"	12#7'-6"	6#4'-11"	6#6'-6"	9#7'-11"	12#5'-8"
48"	13#2'-9"	12#8'-1"	12#6'-3"	9#17'-6"	12#6'-3"	14#2'-9"	13#8'-1"	6#6'-1"	6#7'-5"	9#19'-0"	13#6'-3"	15#2'-9"	14#8'-1"	6#5'-11"	6#7'-5"	9#19'-6"	14#6'-3"	15#2'-9"	14#8'-1"	6#5'-9"	6#7'-5"	9#20'-6"	14#6'-3"
54"	21#3'-9"	16#9'-1"	16#7'-1"	10#19'-9"	12#6'-10"	23#3'-9"	18#9'-1"	8#6'-11"	8#8'-5"	10#21'-6"	13#6'-10"	23#3'-9"	18#9'-1"	8#6'-9"	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'-9"	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'-3"	8#9'-4"	10#25'-6"	16#7'-5"
72"	27#4'-6"	30#11'-7"	20#9'-11"	12#25'-0"	16#8'-7"	29#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'-0"	10#11'-3"	12#29'-0"	18#8'-7"	32#4'-6"	37#11'-7"	10#8'-10"	10#11'-3"	12#30'-6"	19#8'-7"

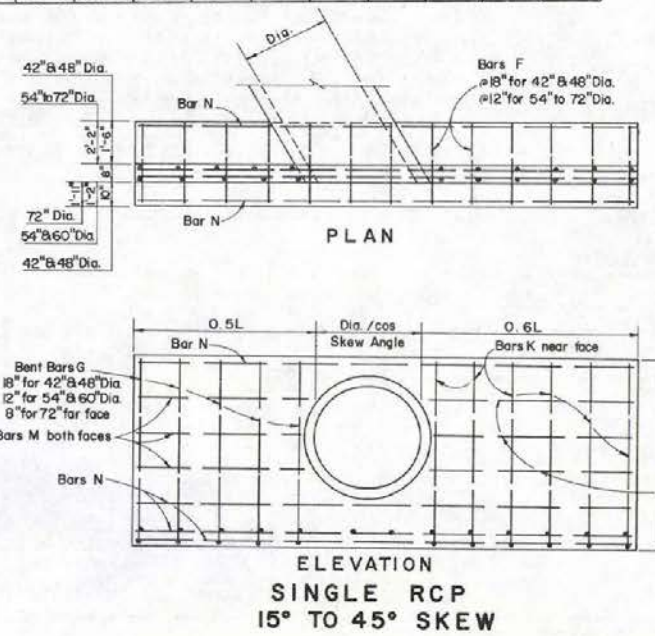
DOUBLE RCP

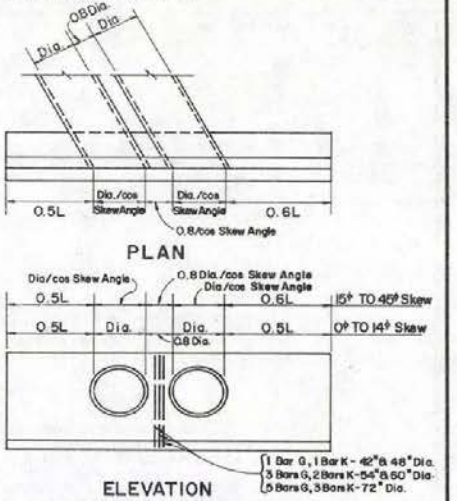
RCP SIZE DIA.	0°SKEW NO.5 F	0°SKEW NO.5 G	0°SKEW NO.4 M	0°SKEW NO.4 N	0°SKEW NO.4 K	15°SKEW NO.5 F	15°SKEW NO.5 G	15°SKEW NO.4 M	15°SKEW NO.4 Q	15°SKEW NO.4 N	15°SKEW NO.4 K	30°SKEW NO.5 F	30°SKEW NO.5 G	30°SKEW NO.4 M	30°SKEW NO.4 Q	30°SKEW NO.4 N	30°SKEW NO.4 K	45°SKEW NO.5 F	45°SKEW NO.5 G	45°SKEW 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"	9#21'-6"	11#5'-8"	17#2'-9"	12#7'-6"	6#5'-3"	6#6'-6"	9#23'-1"	12#5'-8"	18#2'-9"	13#7'-6"	6#5'-1"	6#6'-6"	9#24'-3"	13#5'-8"	20#2'-9"	15#7'-6"	6#4'-11"	6#6'-6"	9#26'-10"	15#5'-8"
48"	18#2'-9"	13#8'-1"	12#6'-3"	9#24'-9"	13#6'-3"	19#2'-9"	14#8'-1"	6#6'-1"	6#7'-5"	9#26'-6"	14#6'-3"	20#2'-9"	15#8'-1"	6#5'-11"	6#7'-5"	9#27'-10"	15#6'-3"	22#2'-9"	17#8'-1"	6#5'-9"	6#7'-5"	9#30'-9"	17#6'-3"
54"	29#3'-9"	19#9'-1"	16#7'-0"	10#27'-10"	14#6'-10"	31#3'-9"	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'-9"	26#9'-1"	8#6'-7"	8#8'-5"	10#34'-8"	18#6'-10"
60"	32#3'-9"	21#9'-8"	16#7'-9"	10#30'-9"	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'-6"	17#7'-5"	40#3'-9"	29#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"	19#8'-7"	40#4'-6"	39#11'-7"	10#9'-2"	10#11'-3"	12#39'-5"	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 2 1/2" CLEAR OF SURFACE OF CONCRETE EXCEPT AS NOTED. BAR ENDS SHALL BE KEPT 1 1/2" 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 5° INCREMENTS 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.







STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

CULVERT HEADWALLS
42" RCP TO 72" RCP

CHIEF ROAD DESIGN ENGINEER

R-2.5.2-(502)
ADOPTED: 6/69
REVISION

R-23

QUANTITIES SHOWN BELOW ARE FOR TWO HEADWALLS

CMAP SIZE S X R	CMP DIA.	CMAP AREA SQ. FT.	L	SINGLE CMAP								DOUBLE CMAP							
				0º SKEW		15º SKEW		30º SKEW		45º SKEW		0º SKEW		15º SKEW		30º SKEW		45º 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.
17" X 13"	15"	1.1	3'3"	0.87	35	0.94	37	0.97	38	1.03	39	1.30	48	1.38	51	1.46	53	1.64	57
21" X 15"	18"	1.6	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
24" X 18"	21"	2.3	4'9"	1.45	50	1.53	54	1.58	54	1.67	55	1.99	66	2.13	69	2.24	72	2.47	78
28" X 20"	24"	2.9	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
35" X 24"	30"	4.4	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
42" X 29"	36"	6.4	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
49" X 33"	42"	8.5	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
57" X 38"	48"	11.4	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
64" X 43"	54"	14.5	10'6"	4.27	156	4.63	164	4.75	166	5.01	172	5.82	199	6.24	208	6.55	214	7.21	228
71" X 47"	60"	17.5	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
77" X 52"	66"	21.2	12'6"	5.83	214	6.33	225	6.48	228	6.82	235	8.35	263	8.46	275	8.88	284	9.74	302
83" X 57"	72"	25.0	13'6"	6.61	246	7.18	254	7.35	260	7.72	267	9.44	294	9.57	308	10.00	319	10.98	339

GENERAL NOTES

1. CONCRETE SHALL BE CLASS A OR AA.
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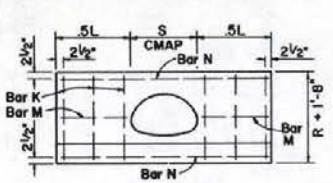
   11º TO 25º - USE QUANTITIES FOR 15º SKEW.
   26º TO 40º - USE QUANTITIES FOR 30º SKEW.
   41º TO 55º - USE QUANTITIES FOR 45º SKEW.
   OVER 55º - CALCULATE QUANTITIES REQUIRED.
   CULVERTS SHOULD BE INSTALLED ON 5º INCREMENTS WHERE IT IS FEASIBLE.

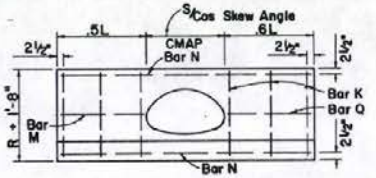
QUANTITIES SHOWN BELOW ARE FOR ONE HEADWALL

LENGTH OF REINFORCING BARS

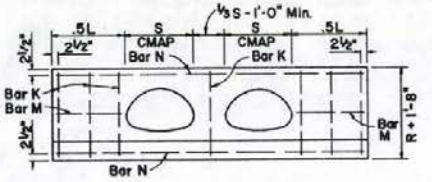
CMAP SIZE S X R	SINGLE CMAP					SINGLE OR DOUBLE CMAP							DOUBLE CMAP				
	0º - 45º	0º	15º	30º	45º	0º	15º		30º		45º		0º - 45º	0º	15º	30º	45º
	NO. 4	NO. 5	NO. 5	NO. 5	NO. 5	NO. 4	NO. 4	NO. 4	NO. 4	NO. 4	NO. 4	NO. 4	NO. 4	NO. 5	NO. 5	NO. 5	NO. 5
	K	N	N	N	N	M	M	Q	M	Q	M	Q	K	N	N	N	N
17" X 13"	4 @ 2'4"	2 @ 4'6"	2 @ 4'11"	2 @ 5'1"	2 @ 5'6"	2 @ 1'4"	1 @ 1'2"	1 @ 1'9"	1 @ 1'9"	1 @ 1'10"	1 @ 1'10"	1 @ 0'10"	1 @ 2'1"	5 @ 2'4"	2 @ 7'0"	2 @ 7'6"	2 @ 7'11"	2 @ 9'0"
21" X 15"	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"
24" X 18"	5 @ 2'9"	2 @ 6'6"	2 @ 7'1"	2 @ 7'2"	2 @ 7'9"	2 @ 2'1"	1 @ 2'1"	1 @ 2'7"	1 @ 2'1"	1 @ 2'7"	1 @ 2'1"	1 @ 2'7"	7 @ 2'9"	2 @ 9'6"	2 @ 10'1"	2 @ 10'6"	2 @ 11'6"
28" X 20"	6 @ 2'11"	2 @ 7'2"	2 @ 7'9"	2 @ 8'0"	2 @ 8'8"	2 @ 2'3"	1 @ 2'4"	1 @ 2'10"	1 @ 2'3"	1 @ 2'11"	1 @ 2'3"	1 @ 3'2"	7 @ 2'11"	2 @ 10'7"	2 @ 11'4"	2 @ 12'0"	2 @ 13'6"
35" X 24"	6 @ 3'3"	2 @ 8'9"	2 @ 9'6"	2 @ 9'10"	2 @ 10'7"	2 @ 2'9"	1 @ 2'7"	1 @ 3'6"	1 @ 2'6"	1 @ 3'7"	1 @ 2'6"	1 @ 3'10"	7 @ 3'3"	2 @ 12'9"	2 @ 13'7"	2 @ 14'5"	2 @ 16'3"
42" X 29"	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"
49" X 33"	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"
57" X 38"	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"
64" X 43"	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"
71" X 47"	10 @ 5'1"	2 @ 17'3"	2 @ 18'7"	2 @ 19'4"	2 @ 20'11"	6 @ 5'6"	3 @ 5'4"	3 @ 6'9"	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"
77" X 52"	10 @ 5'9"	2 @ 19'3"	2 @ 20'8"	2 @ 21'6"	2 @ 23'1"	6 @ 6'3"	3 @ 6'3"	3 @ 7'7"	3 @ 6'3"	3 @ 7'7"	3 @ 6'3"	3 @ 7'7"	12 @ 5'9"	2 @ 27'9"	2 @ 27'9"	2 @ 31'4"	2 @ 35'2"
83" X 57"	10 @ 6'2"	2 @ 20'8"	2 @ 22'3"	2 @ 23'2"	2 @ 24'11"	6 @ 6'9"	3 @ 6'9"	3 @ 8'2"	3 @ 6'9"	3 @ 8'2"	3 @ 6'9"	3 @ 8'2'	12 @ 6'2"	2 @ 29'11"	2 @ 31'11"	2 @ 33'9"	2 @ 38'0"



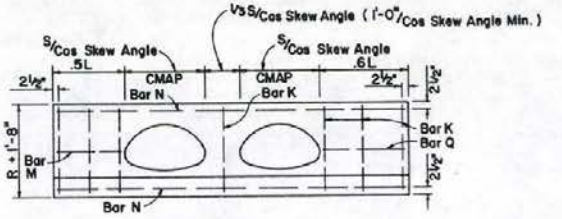
0º SKEW



15º to 45º SKEW

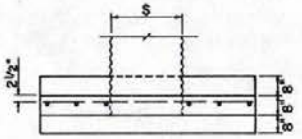


0º SKEW

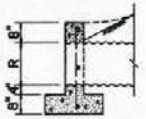


15º to 45º SKEW

ELEVATIONS

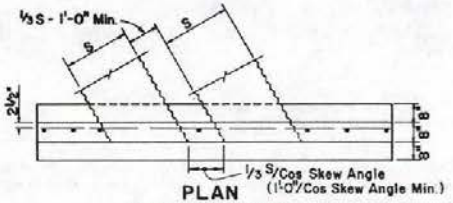


PLAN
SINGLE CMAP



SECTION
For all Headwalls

ELEVATIONS



PLAN
DOUBLE CMAP

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

CULVERT HEADWALLS

17" x 13" CMAP to 83" x 57" CMAP

Ronald W. Titt
CHIEF ROAD DESIGN ENGR.

R-2.6.1 (502)
ADOPTED: 8/69 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				
68"X43"	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"X48"	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'-2½"	2'-2½"	14'-3"	7'-5"
91"X58"	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.

LENGTH OF REINFORCING BARS

SINGLE OVAL RCP

OVAL RCP SIZE W&H	0° SKEW					15° SKEW					30° SKEW					45° SKEW				
	Nº 5		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
68"X43"	13@2'-9"	10@7'-10"	12@5'-8"	9@16'-2"	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"X48"	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"X58"	25@3'-9"	18@9'-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"X43"	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"X48"	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"X58"	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.

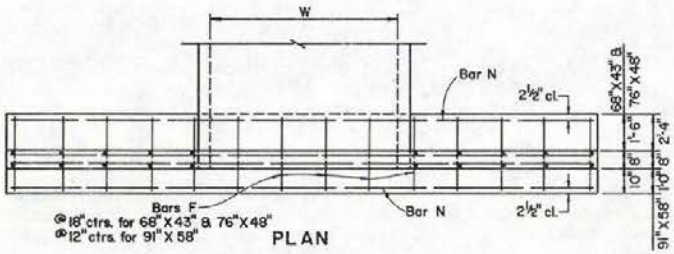
2 REINFORCING STEEL SHALL BE DEFORMED BARS MAXIMUM SPACING OF 18" SET 2½" CLEAR OF SURFACE OF CONCRETE EXCEPT AS NOTED. BAR ENDS SHALL BE KEPT 1½" CLEAR OF SURFACE OF CONCRETE. REINFORCING BARS MAY BE CUT AND BENT IN FIELD.

3 FOOTINGS SHOWN ARE OF MINIMUM DEPTH AND SHALL BE EXTENDED IF SOIL IS UNSUITABLE OR LIABLE TO SCOUR.

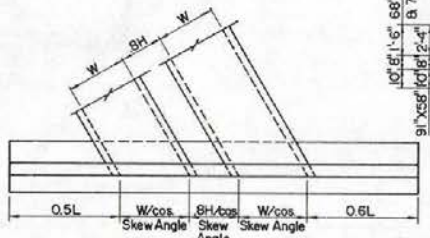
4 CULVERT PIPES TO BE SET ON A SKEW SHALL BE MITERED WHEN HEADWALLS ARE CONSTRUCTED. WHEN HEADWALLS ARE NOT CONSTRUCTED THE PIPES SHALL NOT BE MITERED EXCEPT IN OVERFLOW SECTION.

5 DIMENSIONS X, Y, L AND h TO REMAIN CONSTANT REGARDLESS OF MINOR VARIATIONS IN WALL THICKNESS DUE TO CLASS OF PIPE USED.

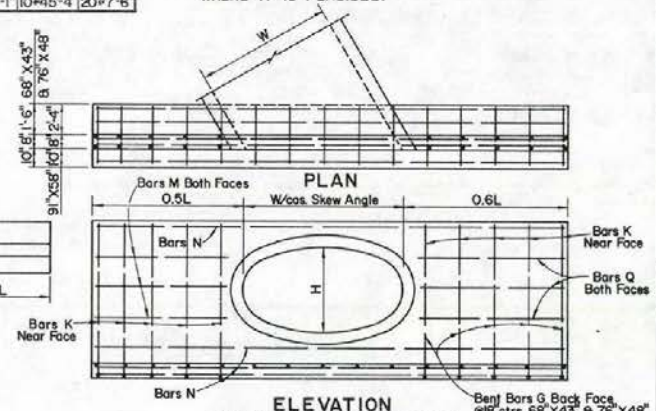
6 FOR ESTIMATING HEADWALL QUANTITIES ON SKEWED CULVERTS:
0° to 10°-USE QUANTITIES FOR 0° SKEW.
11° to 25°-USE QUANTITIES FOR 15° SKEW.
26° to 40°-USE QUANTITIES FOR 30° SKEW.
41° to 55°-USE QUANTITIES FOR 45° SKEW.
OVER 55°-CALCULATE QUANTITIES REQUIRED.
CULVERTS SHOULD BE INSTALLED ON 5° INCREMENTS WHERE IT IS FEASIBLE.



PLAN

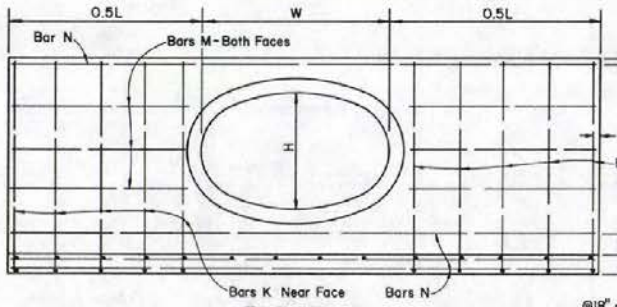


PLAN

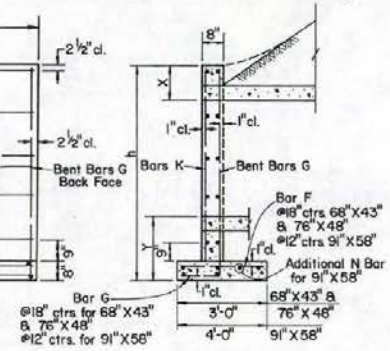


PLAN

ELEVATION
SINGLE OVAL RCP
15° TO 45° SKEW

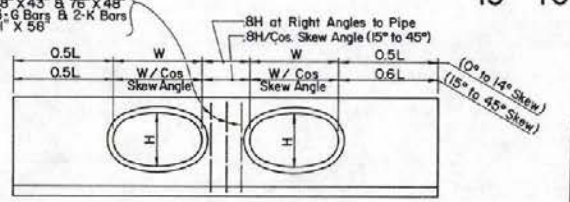


ELEVATION
SINGLE OVAL RCP
0° SKEW



SECTION

0° TO 45° SKEW
Add 1-G Bar & 1-K Bar for 68"X43" & 76"X48"
Add 3-G Bars & 2-K Bars for 91"X58"



ELEVATION
DOUBLE OVAL RCP
0° TO 45° SKEW

NOTE: FOR DETAILS OF OTHER REINFORCING BARS, SEE SINGLE CULVERT HEADWALLS

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

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

R-2.7.2 - (502)

Ronald D. Hill
CHIEF ROAD DESIGN ENGINEER

ADOPTED: 8/69

REVISION

R-26

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	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 OVAL 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
23"X14"	18"	1.82	1.37	57	1.49	60	1.52	61	1.60	63	1.94	74	2.08	77	2.18	80	2.40	86	10 3/4"	1'-2 3/4"	4'-9"	3'-3 1/2"
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	11 1/4"	1'-3 3/4"	6'-3"	3'-9 1/2"
34"X22"	27"	4.20	2.30	87	2.50	92	2.55	93	2.66	96	3.11	110	3.34	116	3.49	119	3.81	127	11 1/2"	1'-3 3/4"	7'-0"	4'-1"
38"X24"	30"	5.15	2.57	93	2.79	99	2.85	100	2.98	104	3.49	119	3.75	125	4.07	129	4.28	137	11 3/4"	1'-3 3/4"	7'-6"	4'-3 1/2"
42"X27"	33"	6.39	2.94	113	3.20	120	3.26	121	3.40	125	4.00	141	4.30	148	4.49	153	4.91	162	11 3/4"	1'-3 3/4"	8'-3"	4'-6 1/2"
45"X29"	36"	7.37	3.31	122	3.53	128	3.68	130	3.82	134	4.48	152	4.81	159	5.04	164	5.47	174	1'-0 1/2"	1'-4 1/2"	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	6.69	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	6.49	221	6.98	231	7.26	236	7.90	251	1'-1 1/2"	1'-5 1/2"	11'-6"	5'-9"

Quantities Shown Below Are For One Headwall.

OVAL RCP SIZE W & H	LENGTH OF REINFORCING BARS SINGLE OVAL RCP 0°-45°	0°	15°	30°	45°	SINGLE OR DOUBLE OVAL RCP 0°	15°		30°		45°		DOUBLE OVAL RCP 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
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"X19"	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'-1"	2 @ 14'-0"	2 @ 15'-8"	2 @ 17'-6"
38"X24"	6 @ 4'-1"	2 @ 10'-8"	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.

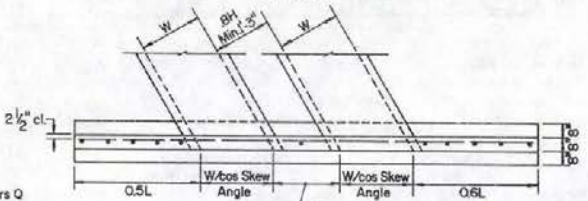
3 - FOOTINGS SHOWN ARE OF MINIMUM DEPTH AND SHALL BE EXTENDED IF SOIL IS UNSUITABLE OR LIABLE TO SCOUR.

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.

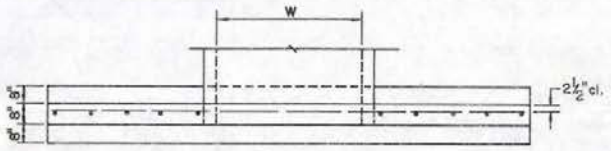
5 - DIMENSIONS X, Y, L AND h TO REMAIN CONSTANT REGARDLESS OF MINOR VARIATIONS IN WALL THICKNESS DUE TO CLASS OF PIPE USED.

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 5° INCREMENTS WHERE IT IS FEASIBLE.

PLAN



PLAN



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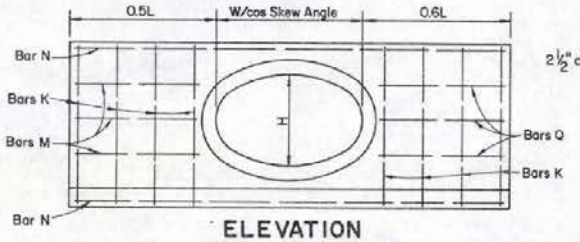
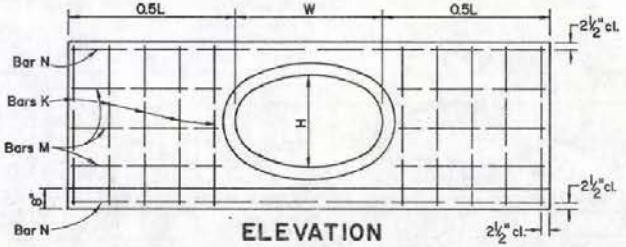
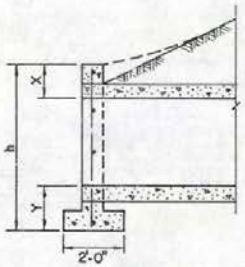


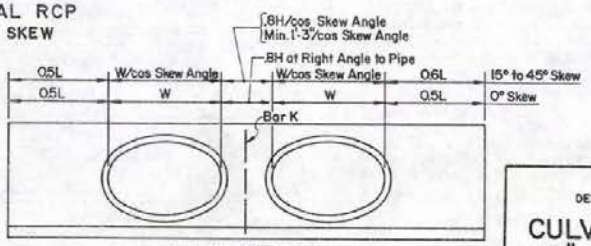
ELEVATION
SINGLE OVAL RCP
15° TO 45° SKEW



ELEVATION
SINGLE OVAL RCP
0° SKEW



SECTION
(FOR ALL HEADWALLS)



ELEVATION
SINGLE OVAL RCP
0° TO 45° SKEW

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

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

CULVERT HEADWALLS 23" x 14" OVAL RCP TO 60" x 38" OVAL RCP

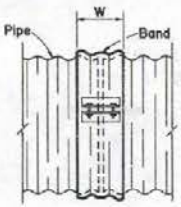
CHIEF ROAD DESIGN ENGINEER

R-2.7.1-(502)

ADOPTED: 8/69

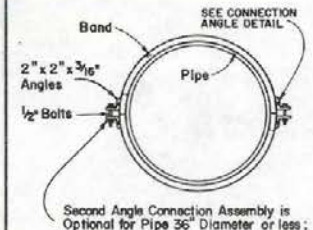
REVISION

R-25



SIDE VIEW

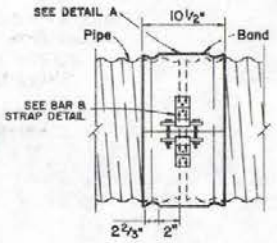
CONNECTION ANGLE DETAIL



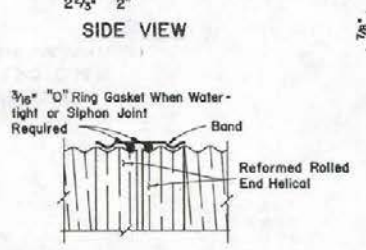
END VIEW

ANNULAR COUPLING BAND

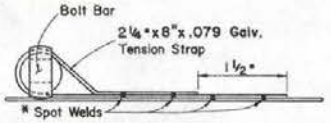
ANNULAR COUPLING BAND			
CORRUGATION	PIPE SIZE	W (IN MIN.)	1/2" BOLTS (NO. EACH CONNECTION)
2 2/3" X 1/2"	THRU 30"	7	2
2 2/3" X 1/2"	THRU 60"	12	3
2 2/3" X 1/2"	THRU 84"	24	5
3" X 1"	54" THRU 60"	14	3
3" X 1"	THRU 96"	26	5



SIDE VIEW

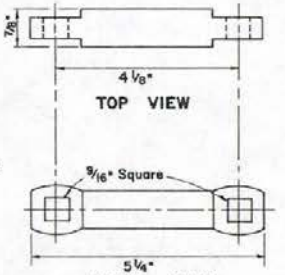


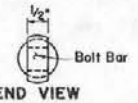
DETAIL A



STRAP DETAIL

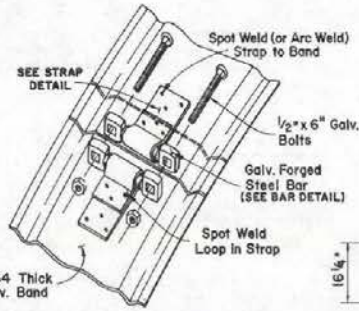
* SPOT WELDS SHALL DEVELOP FULL STRENGTH OF STRAP





END VIEW

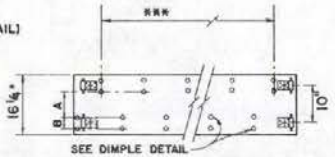
BAR DETAIL



BAR & STRAP DETAIL

ALTERNATIVE ANNULAR COUPLING BAND FOR HCMP THRU 84"

COUPLING BAND FOR HELICAL WELD SEAM ONLY

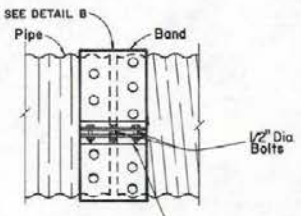


UNIVERSAL COUPLING BAND FOR USE ON 42" THRU 60" CMP INCLUSIVE

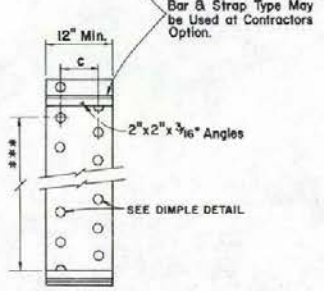
DIMENSION A: AS REQUIRED TO FIT HELIX ANGLE, 7" MIN.
DIMENSION B: AS REQUIRED TO FIT HELIX ANGLE, 2 2/3" MIN.

ONE PIECE BAND OPTIONAL ON 42" DIAMETER, TWO PIECE BAND REQUIRED ABOVE 42" DIAMETER.

*** 8 SPACES AS REQUIRED TO FIT HELIX ANGLE

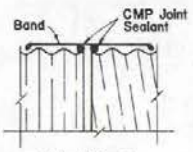


SIDE VIEW



BAND DETAIL

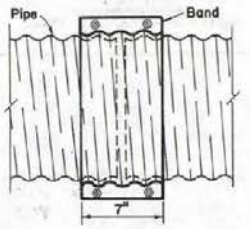
DIMENSION c: 7" MIN. BETWEEN DIMPLES, AS REQUIRED TO FIT THE HELIX ANGLE



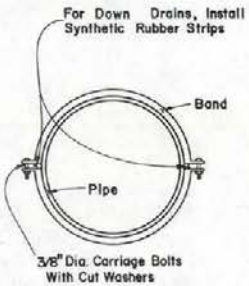
DETAIL B

NOTE: FOR HMCP DOWN DRAINS AND SLOTTED DRAINS.

**UNIVERSAL COUPLING BAND FOR USE ON CMP THRU 36" INCLUSIVE



TOP VIEW



END VIEW

**TWO PIECE INTEGRAL FLANGE DIE FORMED FOR USE ON 6", 8" & 10" HCMP

** TO BE USED ONLY FOR JOINING EXISTING HELICALLY CORRUGATED PIPES

DIMPLE DETAIL

GENERAL NOTES

1. ALL COUPLING BAND CONNECTING HARDWARE SHALL BE GALVANIZED.
2. FOR PIPE ARCHES USE SAME WIDTH BAND AS FOR ROUND PIPE OF EQUAL PERIPHERY.
3. FOR WATERTIGHT AND SIPHON JOINTS ON ALTERNATIVE ANNULAR COUPLING BAND PLACE MASTIC SEALANT STRIP 1/8" THICK X 1 1/2" WIDE X 5" LONG IN LAP BETWEEN BANDS.
4. 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 TRANSPORTATION

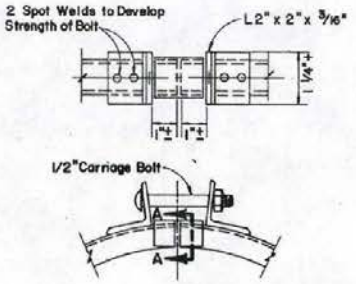
COUPLING BAND DETAILS CMP AND PIPE ARCHES

R-2.8.1- (604)
ADOPTED: 6/71

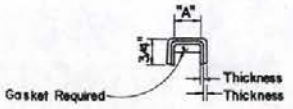
R-27

						BAR & STRAP				ANGLE				WEDGE & STRAP	
COUPLING TYPE	CORRUGATION	PIPE SIZE	W or A	THICKNESS PIPE WALL	THICKNESS BAND	THICKNESS STRAP	BOLTS	BAR DIA.	BAR YIELD STRENGTH P.S.I.	DIMENSIONS	BOLTS	RIVETS ANGLE TO BAND	SPOT WELDS ANGLE TO BAND	THICKNESS STRAP	THICKNESS WEDGE
TWO PIECE INTEGRAL FLANGE	1 1/2" x 1/4"	6" Thru 10"	7"	0.064-0.079	0.064						2 - 3/8"				
UNIVERSAL	2 2/3" x 1/2"	Thru 36"	12"	0.064-0.138	0.064									0.079	0.138
		Thru 36"	12"	0.064-0.138	0.064	0.079	1/2"	7/8"	32,000	2 x 2 x 3/16"	3 - 1/2"	3 - 3/8"	5 - 1/2"		
		42" Thru 60"	16 1/4"	0.064-0.168	0.064	Double 0.079	1/2"	7/8"	32,000						
ANNULAR	2 2/3" x 1/2"	Thru 36"	12"	0.064-0.138	0.064					2 x 2 x 3/16"	3 - 1/2"	3 - 3/8"	5 - 1/2"		
		42" Thru 60"	12"	0.064-0.079	0.064					2 x 2 x 3/16"	3 - 1/2"	3 - 3/8"	5 - 1/2"		
		42" Thru 60"	12"	0.064-0.168	0.064					2 x 2 x 5/16"	3 - 1/2"	5 - 3/8"			
		66" Thru 84"	24"	0.109-0.168	0.064					2 x 2 x 5/16"	5 - 1/2"	7 - 3/8"			
	3" x 1"	48" Thru 60"	14"	0.064-0.079	0.064					2 x 2 x 3/16"	3 - 1/2"	3 - 3/8"	5 - 1/2"		
		48" Thru 60"	14"	0.109	0.064					2 x 2 x 5/16"	3 - 1/2"	5 - 3/8"			
		66" Thru 120"	25"	0.064-0.109	0.064					2 x 2 x 5/16"	5 - 1/2"	9 - 3/8"			
CHANNEL	2 2/3" x 1/2"	Thru 24"	3/4"	0.064-0.079	0.079	0.079	1/2"	7/8"	32,000	2 x 2 x 5/16"	1 - 1/2"	See Note 8			
		30" Thru 42"	3/4"	0.064-0.079	0.079	0.079	1/2"	7/8"	32,000						
		30" Thru 42"	1"	0.109	0.109	0.079	1/2"	7/8"	32,000						
		48" Thru 54"	1"	0.064-0.079	0.109	0.079	1/2"	7/8"	32,000						

*SEE SHEET R-2.8.1. FOR 'W' DIMENSION.



CHANNEL COUPLING BAND
FOR USE ON FLANGED END C.M.P.
(CHANNEL COUPLING BAND SHALL BE TWO PIECE)



NOMINAL DIMENSIONS

THICKNESS	"A"	FOR USE WITH CMP
0.079"	3/4"	0.109" THICK or LIGHTER
0.109"	1"	0.138" THICK or HEAVIER

SECTION A-A

GENERAL NOTES

1. ALL COUPLING BAND CONNECTION HARDWARE SHALL BE GALVANIZED OR ELECTROPLATED IN ACCORDANCE WITH STANDARD SPECIFICATIONS.
2. FOR PIPE ARCHES USE SAME WIDTH BAND AS FOR ROUND PIPE OF EQUAL PERIPHERY.
3. TWO PIECE BAND REQUIRED FOR PIPE GREATER THAN 42" DIAMETER.
4. TENSION STRAP MAY BE CONNECTED TO BAND OR SHEET WITH EITHER SPOT WELDS OR FILLET WELDS THAT DEVELOP MINIMUM REQUIRED STRENGTH OF STRAP.
5. USE 1 1/4" GAGE LINE DIMENSION ON ATTACHED ANGLE LEG FOR RIVETS AND SPOT WELDS.
6. BAND THICKNESS SHALL NOT BE LESS THAN 3 STANDARD THICKNESSES LIGHTER THAN THE THICKNESS OF THE PIPE.
7. DIMENSIONS AND THICKNESS SHOWN ARE MINIMUM.
8. ANGLE 2" LONG WITH 0.064" x 2" STRAP.
9. FILLET WELDS OF EQUIVALENT STRENGTH MAY BE SUBSTITUTED FOR SPOT WELDS OR RIVETS.

SPIRAL C.M.P.
REFORMED TO ACCEPT UNIVERSAL, ANNULAR, CHANNEL COUPLERS

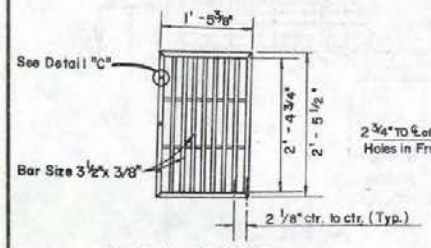
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

CMP COUPLING BAND DETAILS

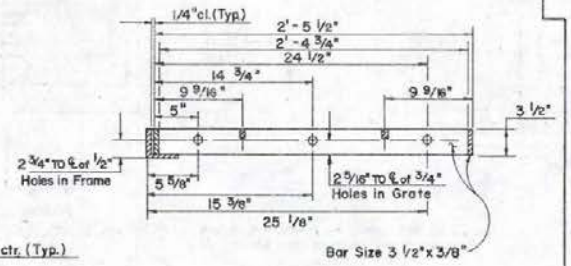
Michael A. Dell
CHIEF ROADWAY DESIGN ENGINEER

R-2.8.2 (604)
ADOPTED: 1/76
REVISION 1-10/84

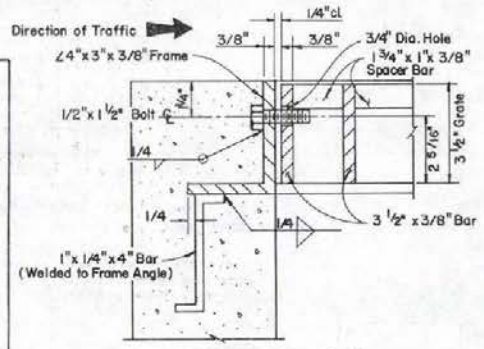
R-28



GRATE DETAIL



DETAIL "C"
GRATE HOLE DETAIL



DETAIL "D"
GRATE HOLD-DOWN BOLT
(INSTALL ONLY ON APPROACH SIDE OF GRATE & FRAME)

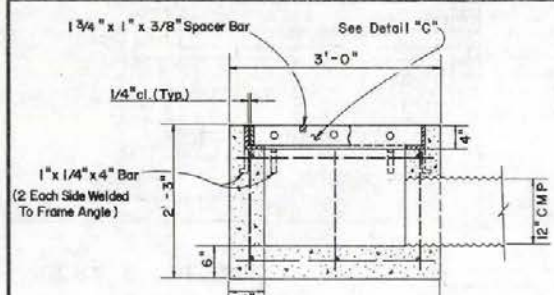
GENERAL NOTES

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 SURFACE BY ONE AND ONE-HALF INCHES.
3. ALL EXPOSED CONCRETE EDGES SHALL BE CHAMFERED ONE INCH.
4. GRATE AND FRAME ANGLE TO BE WELDED AT ALL CONTACT POINTS.

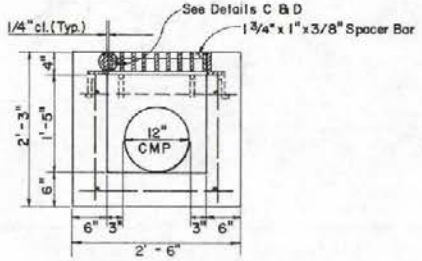
QUANTITIES *

CONCRETE	REINFORCING STEEL	STRUCTURAL STEEL
0.37 CU. YD.	25 LBS.	185 LBS.

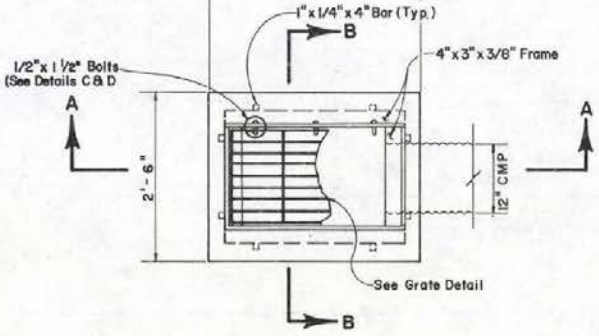
* FOR INFORMATION ONLY



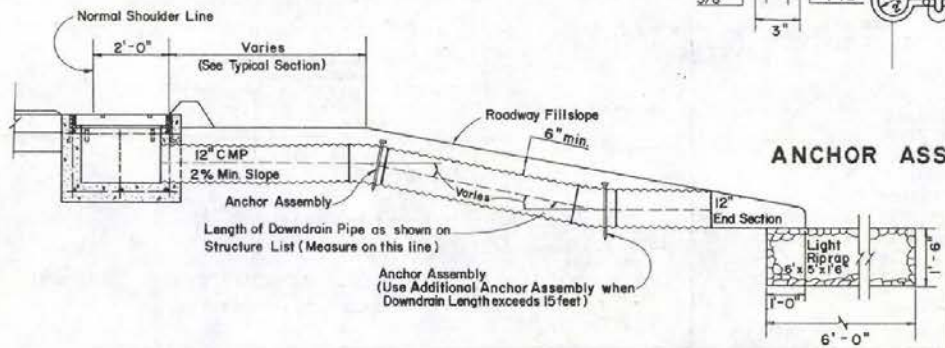
SECTION A-A



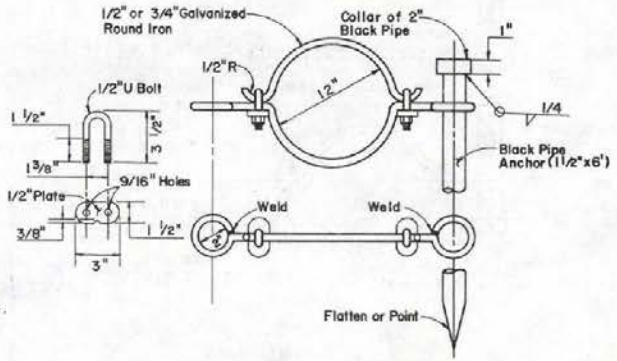
SECTION B-B



PLAN



TYPICAL INSTALLATION - ELEVATION



ANCHOR ASSEMBLY DETAIL

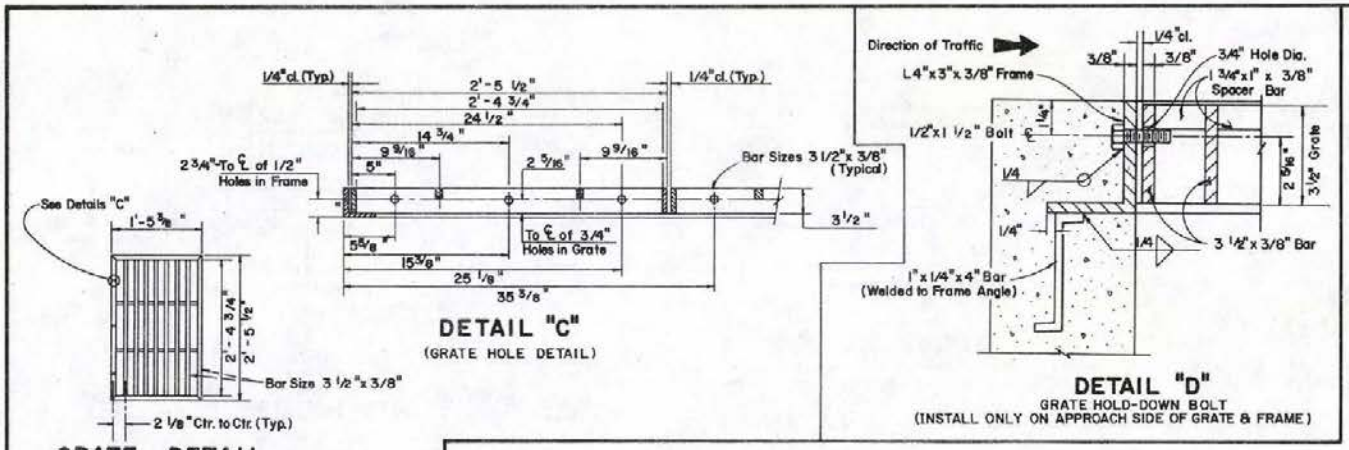
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

EMBANKMENT PROTECTOR (TYPE 5)

Howard W. Hale
CHIEF ROAD DESIGN ENGR.

R-3.1.2 (608)
ADOPTED: 5/79
REVISION 2-6/83

R29



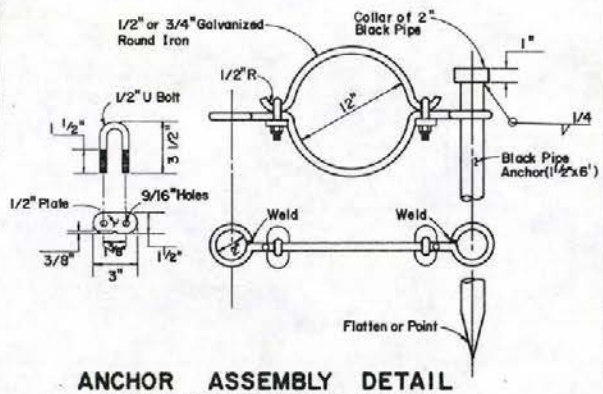
GRATE DETAIL

DETAIL "C"
(GRATE HOLE DETAIL)

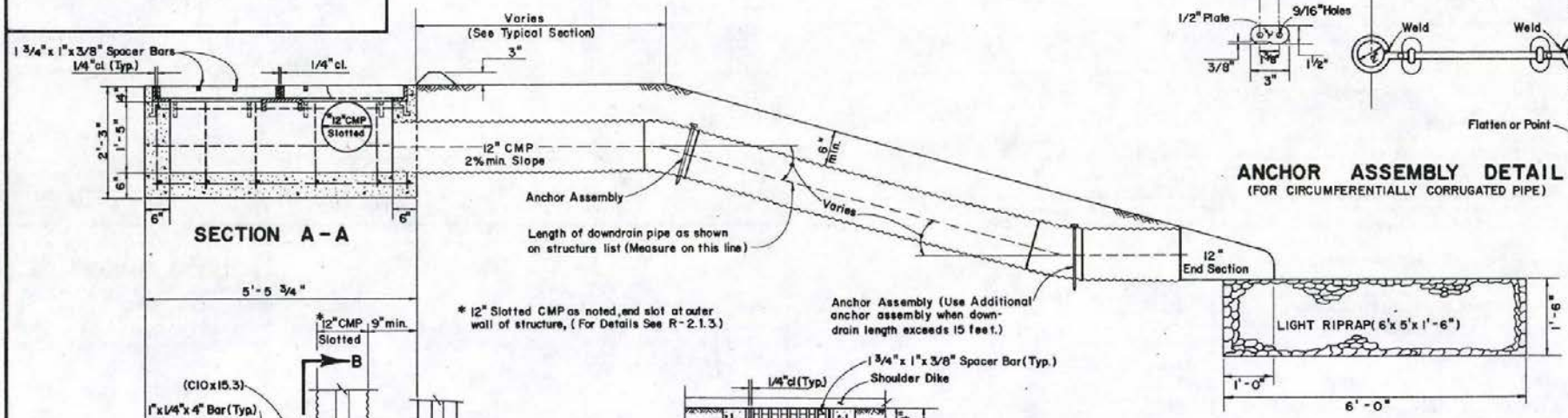
DETAIL "D"
GRATE HOLD-DOWN BOLT
(INSTALL ONLY ON APPROACH SIDE OF GRATE & FRAME)

GENERAL NOTES

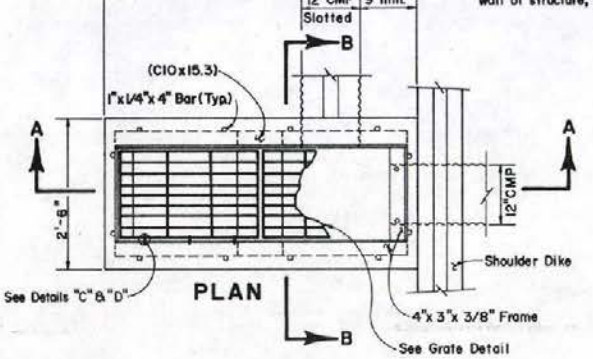
1. ALL CONCRETE SHALL BE CLASS A OR AA.
2. REINFORCING BARS SHALL BE NO. 4 BARS WITH MAXIMUM SPACING AT 18" CENTERS. BARS TO BE EMBEDDED A MINIMUM OF TWO INCHES AND BAR ENDS MUST CLEAR SURFACE BY ONE AND ONE-HALF INCH.
3. ALL EXPOSED CONCRETE EDGES SHALL BE CHAMFERED ONE INCH.
4. GRATE AND FRAME ANGLE TO BE WELDED AT ALL CONTACT POINTS.

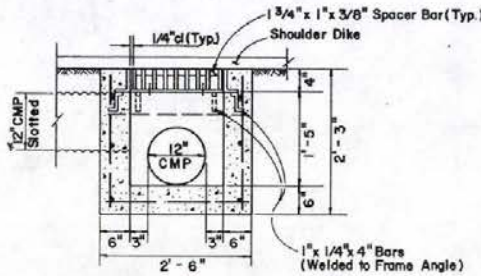


ANCHOR ASSEMBLY DETAIL
(FOR CIRCUMFERENTIALLY CORRUGATED PIPE)



* 12" Slotted CMP as noted, end slot at outer wall of structure, (For Details See R-2.1.3)





SECTION B-B

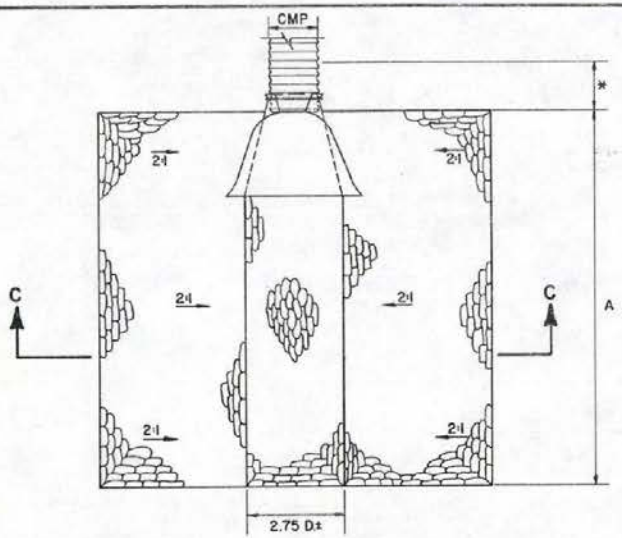
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

EMBANKMENT PROTECTOR (TYPE 5-2G)

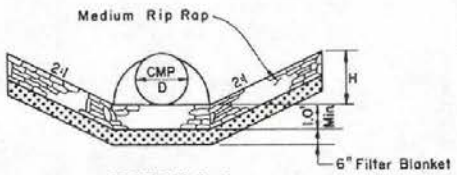
CHIEF ROAD DESIGN ENGR.

R-3.1.3 (608)
ADOPTED: 5/79
REVISION 2-8/83

R-30



PLAN



SECTION C-C

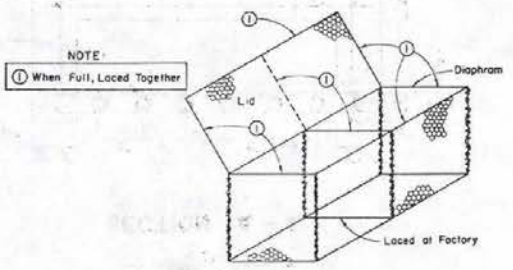
H= SEE STRUCTURE LIST.

CULVERT SIZE	A
18" to 36"	3D
42" to84"	4D

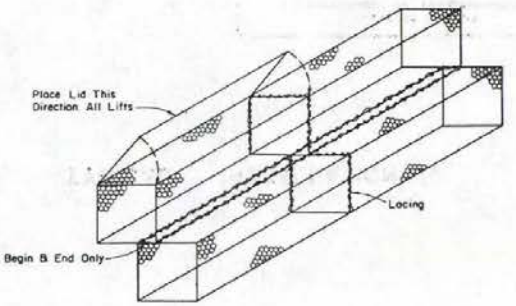
HYDRAULIC SECTION APPROVAL MUST BE OBTAINED PRIOR TO INCORPORATION INTO PLANS.

STANDARD RIPRAP BASIN

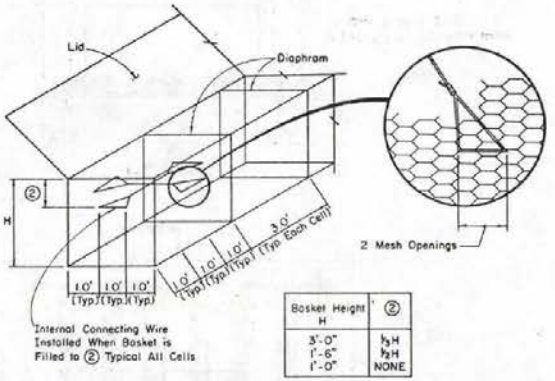
* When No End Section Is Used, Additional Rip Rap Shall Be As Required by Hydraulics Engineer.



LACING: SINGLE BASKET

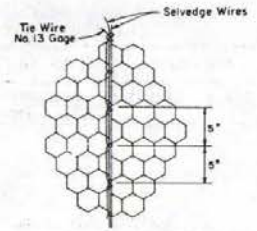


LACING: BASKET TO BASKET



Basket Height H	②
3'-0"	½H
1'-6"	½H
1'-0"	NONE

INTERNAL CONNECTING WIRE DETAIL FOR WIRE MESH GABIONS



WIRE MESH LACING DETAIL

GABIONS LACING DETAIL

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

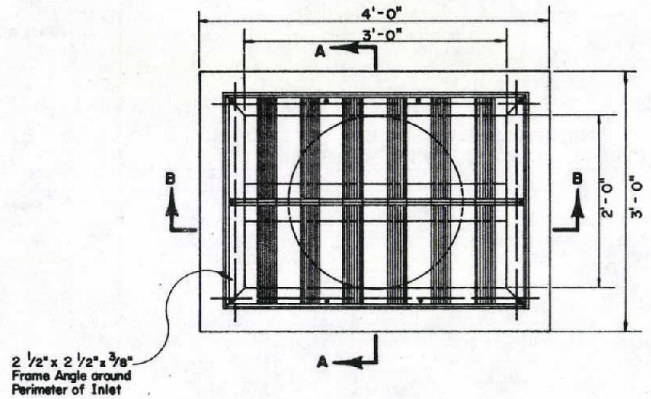
STANDARD RIPRAP BASIN & GABIONS LACING DETAIL

CHIEF ROAD DESIGN ENGR.

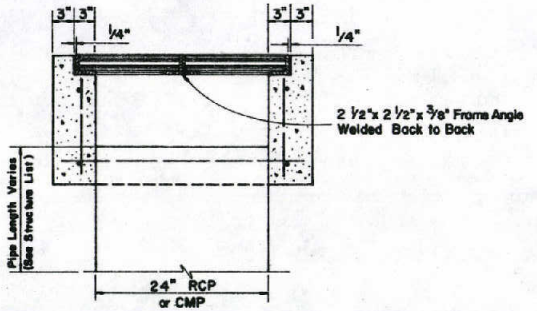
R-3.1.4. (610)

ADOPTED: 10/85

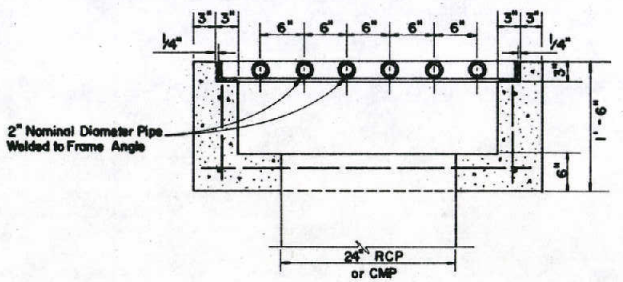
REVISION 1-11/86



PLAN



SECTION A - A



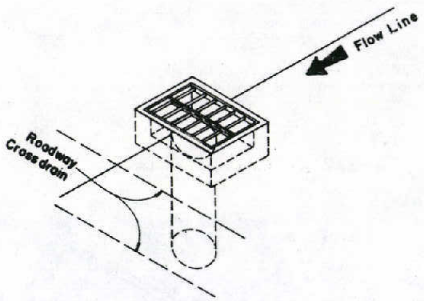
SECTION B - B

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 2 1/2" x 2 1/2" x 3/8" FRAME ANGLES.

QUANTITIES *		
CONCRETE	REINF. STEEL	STRUCT. STEEL
0.36 Cu. Yd.	23 lbs.	170 lbs.

* FOR INFORMATION ONLY



TYPICAL INSTALLATION

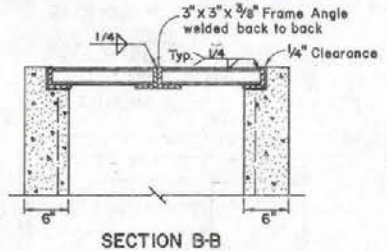
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

PIPE RISER INLET
(TYPE 3)

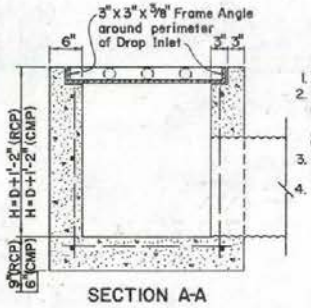
Horace W. Hee
CHIEF ROAD DESIGN ENGR.

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

R32



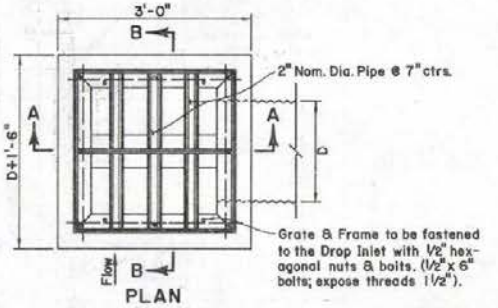
SECTION B-B



SECTION A-A

— GENERAL NOTES —

1. ALL CONCRETE SHALL BE CLASS A OR AA.
2. REINFORCING STEEL SHALL BE NO.4 BARS WITH MAXIMUM SPACING AT 18" CENTERS, WIRED TIGHTLY AT ALL INTERSECTIONS AND EMBEDDED 2" CLEAR OF ALL CONCRETE SURFACES.
3. ALL EXPOSED CONCRETE EDGES SHALL BE CHAMFERED ONE INCH.
4. STRUCTURAL STEEL WEIGHT INCLUDES THE 2" PIPE AND THE 3"x3"x3/8" FRAME ANGLES.

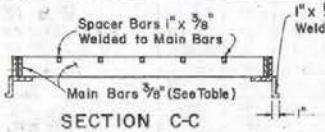


PLAN

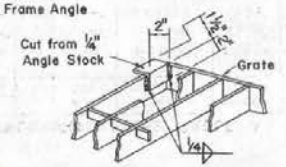
CMP SIZE	CONCRETE CU. YD.	REINF. LB.	STRUCT. STEEL LB.
18"	0.62	39	120
24"	0.77	44	132
30"	0.93	59	145
36"	1.11	64	138
42"	1.29	69	170

RCP SIZE	CONCRETE CU. YD.	REINF. LB	STRUCT. STEEL LB.
18"	0.68	40	120
24"	0.84	45	132
30"	0.99	60	145
36"	1.17	65	158
42"	1.35	70	170

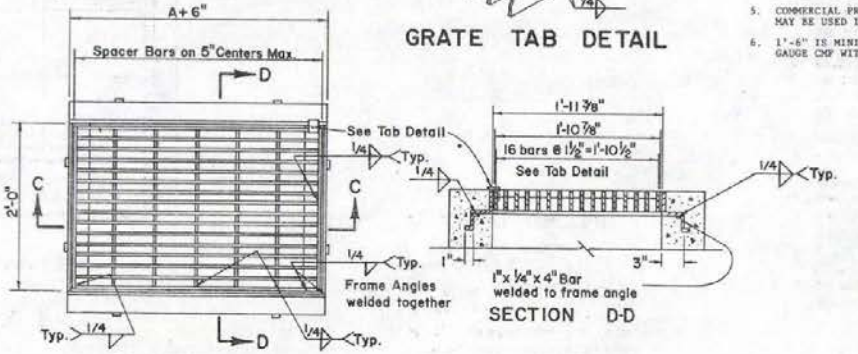
TYPE 2A DROP INLET



SECTION C-C



GRATE TAB DETAIL

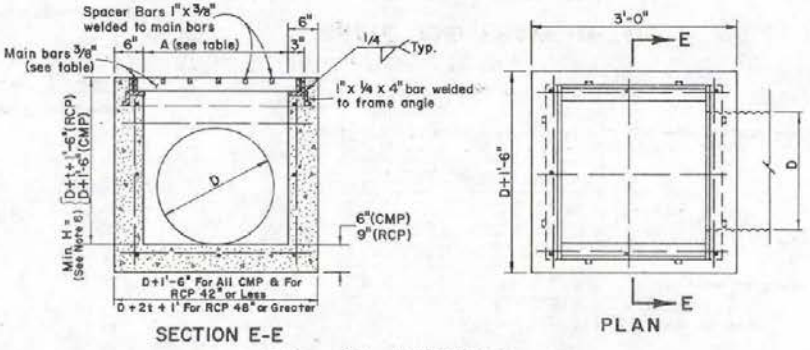


SECTION D-D

GRATE AND FRAME DETAIL

GENERAL NOTES

1. ALL CONCRETE SHALL BE CLASS A OR AA.
2. REINFORCING STEEL SHALL BE NO. 4 BARS WITH MAXIMUM SPACING AT 18" CENTERS, WIRED TIGHTLY AT ALL INTERSECTIONS AND EMBEDDED 2" CLEAR OF ALL CONCRETE SURFACES.
3. EXPOSED EDGES OF CONCRETE SHALL BE CHAMFERED 1".
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.
6. 1'-6" IS MINIMUM COVER FOR PIPE - ASSUMING CLASS III RCP OR 16 GAUGE CMP WITH CLASS C BEDDING.



SECTION E-E

PLAN

BILL OF MATERIALS

PIPE SIZE	A	RCP (Standard Wall Pipe) H (ft.)	RCP CONCRETE CU.YD.	RCP REINF LB.	CMP H (ft.)	CMP CONCRETE CU. YD.	CMP REINF LB.
18"	2'-0"	3.19	0.77	43	3.00	0.68	41
24"	2'-6"	3.68	0.94	48	3.50	0.83	46
30"	3'-0"	4.25	1.11	64	4.00	1.00	61
36"	3'-6"	4.76	1.30	69	4.50	1.18	66
42"	4'-0"	5.32	1.51	74	5.00	1.37	71

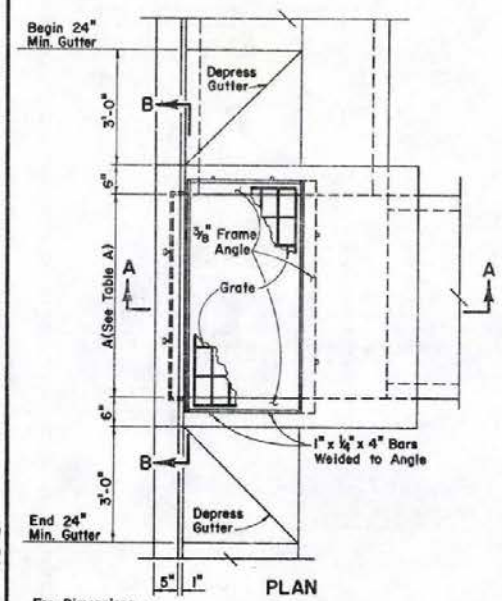
MAIN BARS INCHES	FRAME ANGLES INCHES	GRATE LB.	FRAME LB.	TOTAL LB.
2 1/2 x 3/8	3 x 3 x 3/8	138	67	205
3 x 3/8	3 1/2 x 3 1/2 x 3/8	199	82	281
3 1/2 x 3/8	4 x 3 x 3/8	266	96	362
4 1/2 x 3/8	5 x 3 x 3/8	387	120	507
4 1/2 x 3/8	5 x 3 x 3/8	434	129	563

TYPE 2 DROP INLET

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

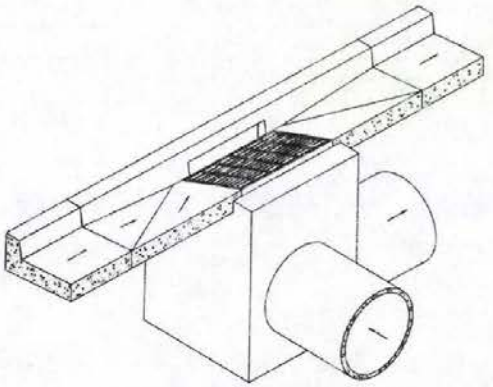
TYPE 2 AND 2A DROP INLET

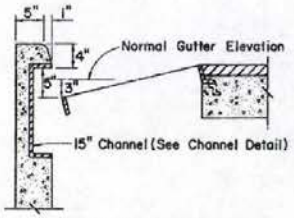
R33



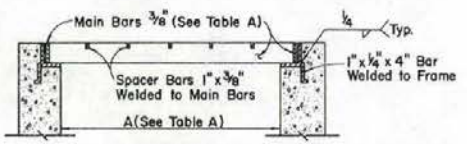
PLAN

TYPE 3 D.I.

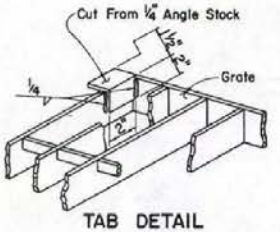




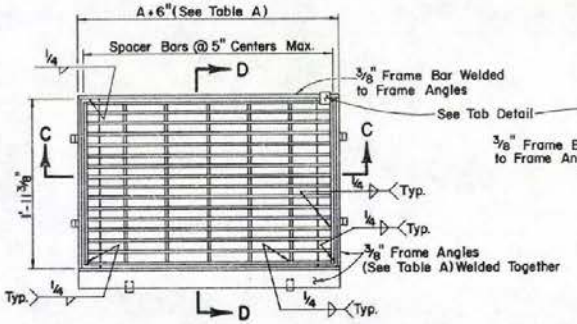
DETAIL F



SECTION C-C

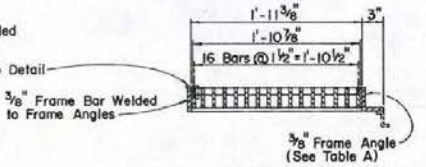


TAB DETAIL



PLAN

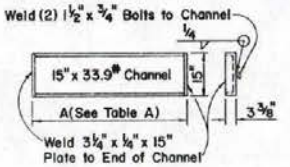
GRATE AND FRAME DETAIL



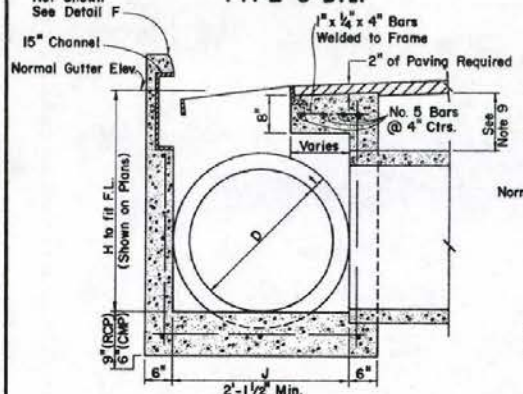
SECTION D-D

TABLE B

MAXIMUM H		
CMAP	J OR A	H
29" x 18" OR LESS	30" OR LESS	21'-0"
36" x 22"	36"	16'-0"
43" x 27"	42"	12'-0"
	48"	9'-0"
	54"	7'-0"
	60"	7'-0"
		(WITH #4 BARS @ 12" CENTERS)

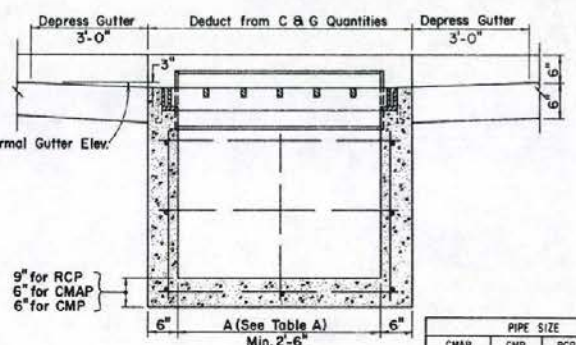


CHANNEL DETAIL



SECTION A-A

(FOR CMAP, CMP, RCP & LO-HED RCP)



SECTION B-B

(FOR CMAP, CMP, RCP & LO-HED RCP)

GENERAL NOTES

1. ALL CONCRETE SHALL BE CLASS A OR AA.
2. ALL REINFORCING STEEL SHALL BE TIGHTLY WIRED AND EMBEDDED 1 1/2" CLEAR OF CONCRETE SURFACE EXCEPT AS NOTED. ALL REINFORCING STEEL SHALL BE NO. 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 $\frac{J}{\cos \text{SKEW } \angle}$, REDESIGN FOR SKEWS AT A.
5. WHERE PIPE INTERSECTS DROP INLET ON 12° OR LARGER SKEW INCREASE S TO $\frac{S}{\cos \text{SKEW } \angle}$, REDESIGN FOR SKEWS AT A.
6. FOR VALUES OF "H" SEE STORM DRAIN SCHEDULE OR STRUCTURE LIST.
7. "H" IS THE DIFFERENCE IN ELEVATION BETWEEN THE OUT FLOW PIPE AND THE NORMAL GUTTER GRADE LINE AT THE CURB FACE.
8. PIPES(S) CAN BE PLACED IN ANY WALL.
9. 1'-6" IS MINIMUM COVER FOR PIPE - ASSUMING CLASS III RCP OR 16 GAGE CMP WITH CLASS C BEDDING.
10. FOR DROP INLET, CONFIGURATIONS WITH 2 PIPES - INFLOW PIPE INVERT ELEVATION SHALL BE ≥ 0.1' ABOVE OUTFLOW PIPE INVERT ELEVATION.

STRUCTURAL STEEL TABLE A

PIPE SIZE				A	MAIN BARS	FRAME ANGLES	FRAME BAR	GRATE LBS	FRAME LBS	CHANNEL & PLATES, LBS	TOTAL LBS
CMAP	CMP	RCP	LO-HED								
29" x 18" OR LESS	30" OR LESS	24" OR LESS	14" x 23" OR LESS	2'-6"	3" x 3/8"	3 1/2" x 3" x 3/8"	3 1/2" x 3/8"	199	68	93	360
36" x 22"	36"	30"	19" x 30"	3'-0"	3 1/2" x 3/8"	4" x 3" x 3/8"	4" x 3/8"	266	83	107	456
43" x 27"	42"	36"	22" x 34"	3'-6"	5" x 3/8"	5" x 3" x 3/8"	5" x 3/8"	387	105	126	618
	48"	42"	27" x 42"	4'-0"	5" x 3/8"	5" x 3" x 3/8"	5" x 3/8"	434	113	143	690
	54"		29" x 45"	4'-6"	4 1/2" x 3/8"	5" x 3" x 3/8"	5" x 3/8"	482	121	160	763

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

TYPE 3 DROP INLET

CHIEF ROAD DESIGN ENGR.

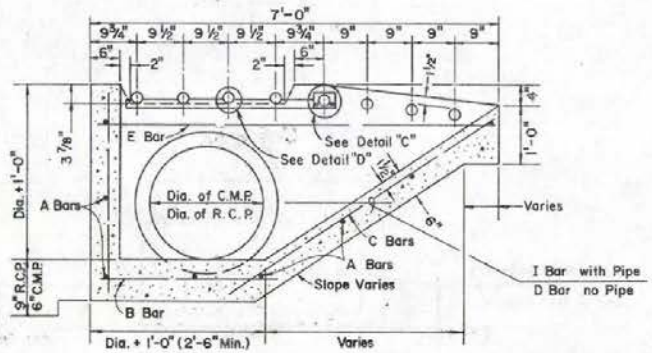
R-4.3.1(609)

ADOPTED 10/85 REVISION

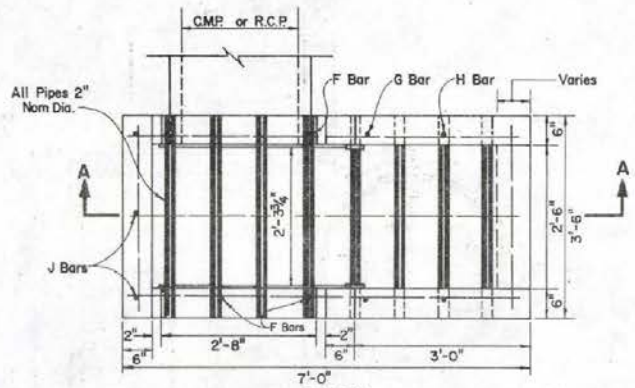
R-34

R35

TYPE 7 DROP INLET



SECTION A-A



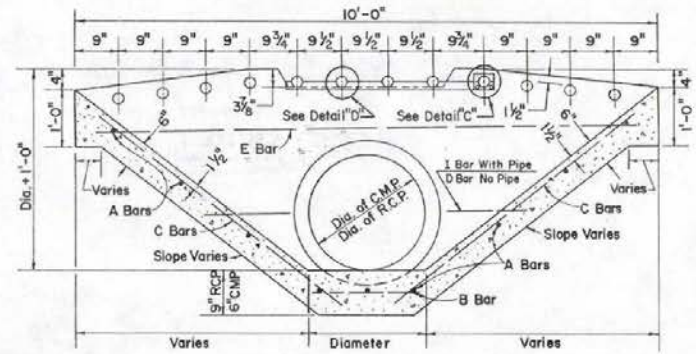
PLAN

TYPE 7 DROP INLET

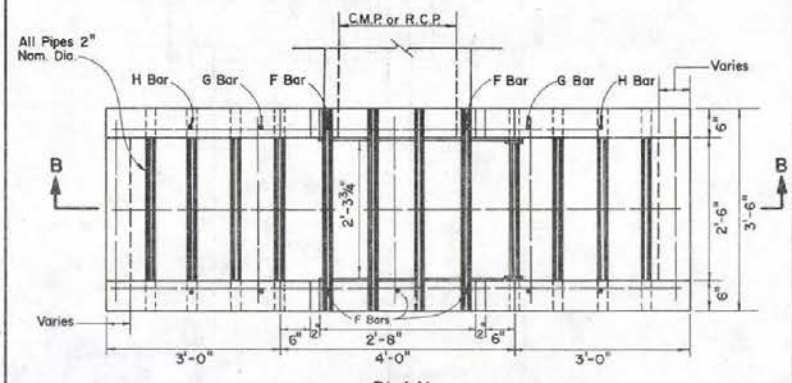
TABLE OF QUANTITIES

SIZE DIA.	A Bars	B Bars	C Bars	D Bars	E Bars	F Bars	G Bars	H Bars	I Bars	J Bars	CONC. CU. YD.	REINF. STEEL LB.	STR. STL. GRATE lb.
CMP													
18"	5 @ 3'-2"	3 @ 2'-3"	3 @ 4'-9"	1 @ 5'-0"	2 @ 6'-8"	3 @ 2'-3"	2 @ 1'-10"	2 @ 1'-2"	1 @ 2'-4"	3 @ 2'-8"	1.11	61	117
24"	6 @ 3'-2"	3 @ 2'-9"	3 @ 4'-9"	1 @ 5'-0"	2 @ 6'-8"	3 @ 2'-9"	2 @ 2'-0"	2 @ 1'-4"	1 @ 2'-3"	3 @ 3'-2"	1.23	63	117
30"	6 @ 3'-2"	3 @ 3'-4"	3 @ 4'-9"	1 @ 5'-4"	2 @ 6'-8"	3 @ 3'-3"	2 @ 2'-8"	2 @ 1'-9"	1 @ 1'-10"	3 @ 3'-8"	1.34	67	117
RCP													
18"	5 @ 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"	6 @ 3'-2"	3 @ 3'-4"	3 @ 5'-0"	1 @ 5'-0"	2 @ 6'-8"	3 @ 3'-0"	2 @ 2'-0"	2 @ 1'-4"	1 @ 2'-0"	3 @ 3'-5"	1.27	65	117
30"	6 @ 3'-2"	3 @ 3'-4"	3 @ 5'-0"	1 @ 5'-4"	2 @ 6'-8"	3 @ 3'-6"	2 @ 2'-8"	2 @ 1'-9"	1 @ 1'-8"	3 @ 3'-11"	1.41	68	117

TYPE 8 DROP INLET



SECTION B-B

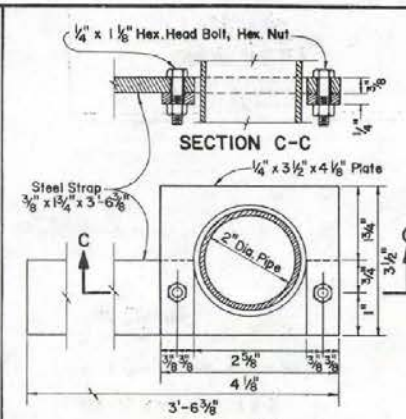


PLAN

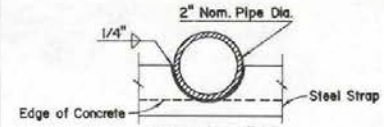
TYPE 8 DROP INLET

TABLE OF QUANTITIES

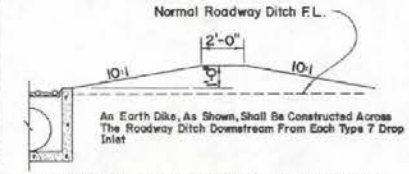
SIZE DIA.	A Bars	B Bars	C Bars	D Bars	E Bars	F Bars	G Bars	H Bars	I Bars	J Bars	CONC. CU. YD.	REINF. STEEL LB.	STR. STL. GRATE lb.
CMP													
18"	9 @ 3'-2"	3 @ 2'-0"	6 @ 4'-9"	1 @ 6'-6"	2 @ 9'-8"	5 @ 2'-3"	4 @ 1'-10"	4 @ 1'-2"	2 @ 2'-4"	Not Applicable	1.33	78	168
24"	9 @ 3'-2"	3 @ 2'-6"	6 @ 4'-9"	1 @ 6'-10"	2 @ 9'-8"	5 @ 2'-9"	4 @ 2'-0"	4 @ 1'-4"	2 @ 2'-3"		1.46	82	168
30"	9 @ 3'-2"	3 @ 3'-0"	6 @ 4'-9"	1 @ 7'-0"	2 @ 9'-8"	5 @ 3'-3"	4 @ 2'-8"	4 @ 1'-9"	2 @ 1'-10"		1.59	87	166
RCP													
18"	9 @ 3'-2"	3 @ 2'-0"	6 @ 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"	9 @ 3'-2"	3 @ 2'-6"	6 @ 5'-0"	1 @ 6'-10"	2 @ 9'-8"	5 @ 3'-3"	4 @ 2'-0"	4 @ 1'-4"	2 @ 2'-0"		1.48	84	168
30"	9 @ 3'-2"	3 @ 3'-0"	6 @ 5'-0"	1 @ 7'-0"	2 @ 9'-8"	5 @ 3'-6"	4 @ 2'-8"	4 @ 1'-9"	2 @ 1'-8"		1.63	89	168



DETAIL "C"



DETAIL "D"



SKETCH OF ROADWAY DITCH DIKE

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.

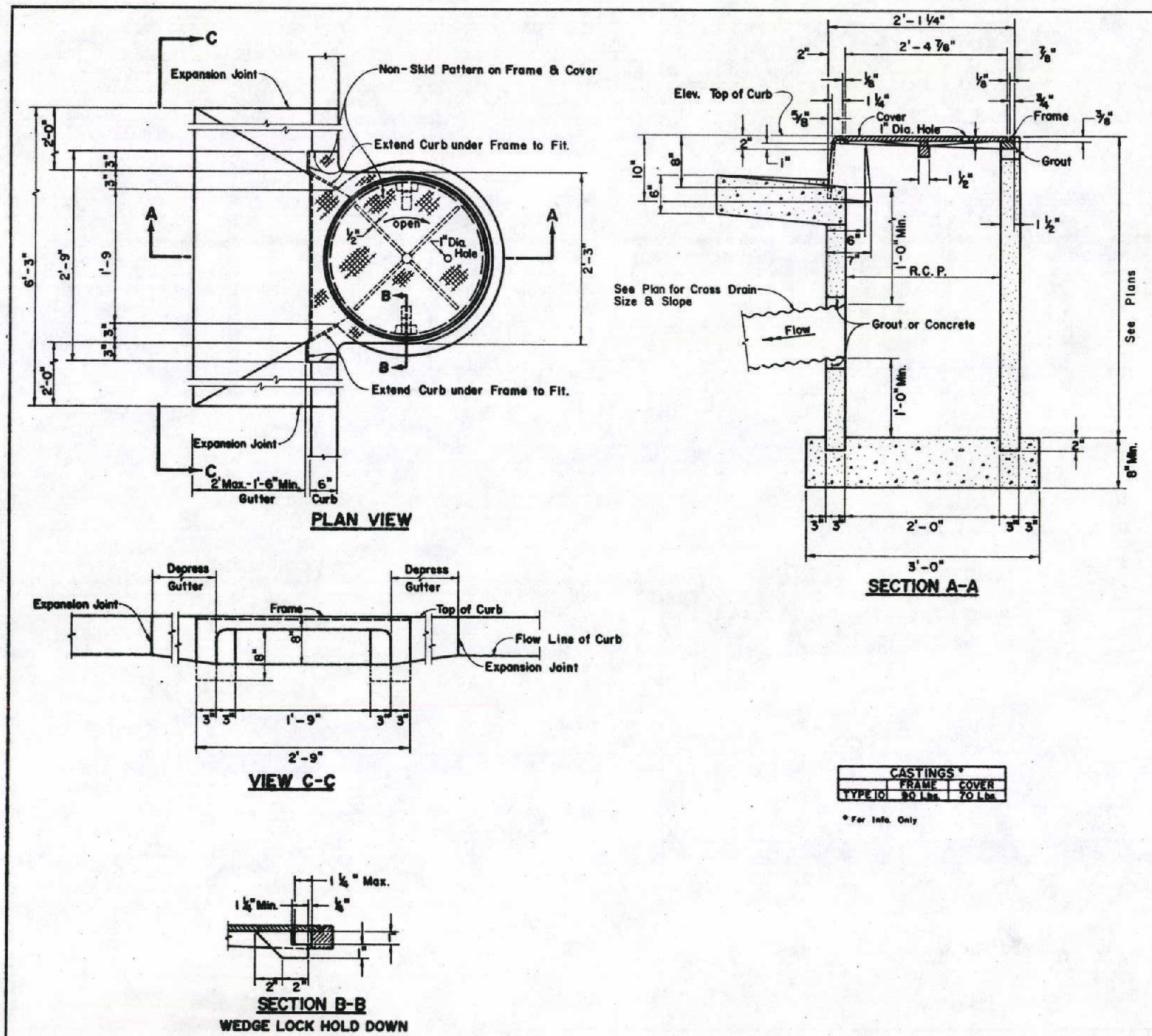
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

TYPE 7&8 DROP INLETS

CHIEF ROAD DESIGN ENGR.

R-4.6.1-(609)

ADOPTED 8/69 REV. 2-5/80



GENERAL NOTES

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

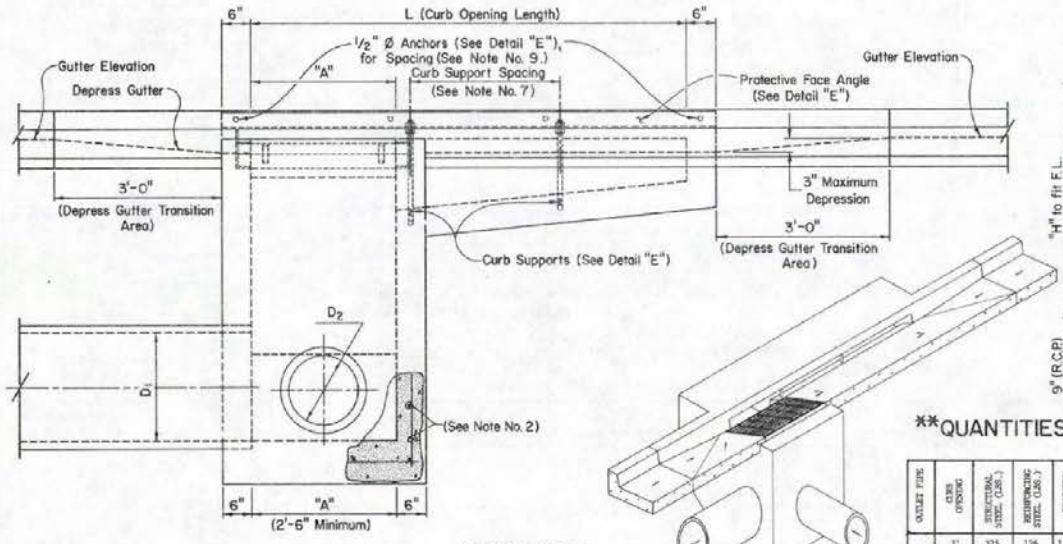
CASTINGS*	FRAME	COVER
TYPE 10	90 Lbs.	70 Lbs.

* For Info. Only

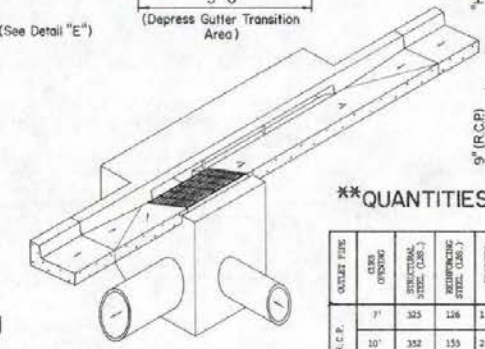
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

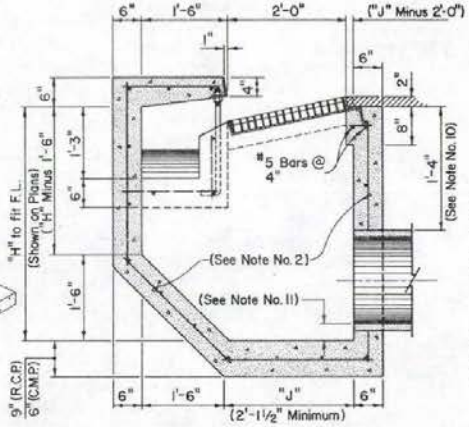
DROP INLET TYPE 10

CHIEF ROAD DESIGN ENGR. | R-4.6.1.2 | ADOPTED 11/71 | (608) | REVISION

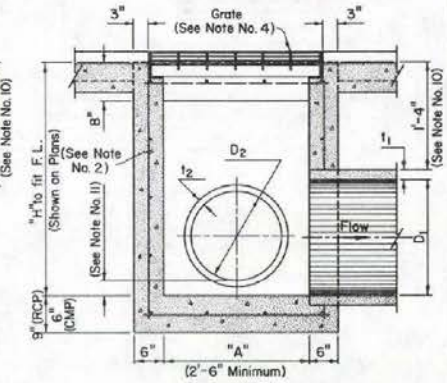


ELEVATION





SECTION "A"-"A"

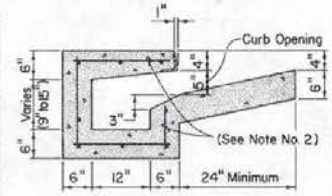


SECTION "B"-"B"

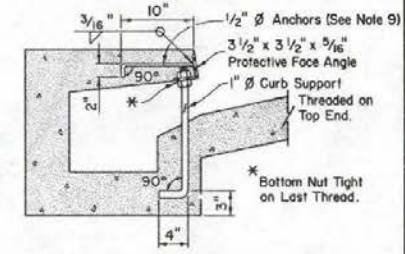
**QUANTITIES

OUTLET PIPE	CURB OPENING	STRUCTURAL STEEL (LBS.)	REINFORCING STEEL (LBS.)	CONCRETE (CU. YDS.)
18" R.C.P.	7'	325	126	1.64
	10'	352	153	2.01
	12'	367	176	2.26
24" R.C.P.	12'	367	179	2.36
	15'	394	209	2.72

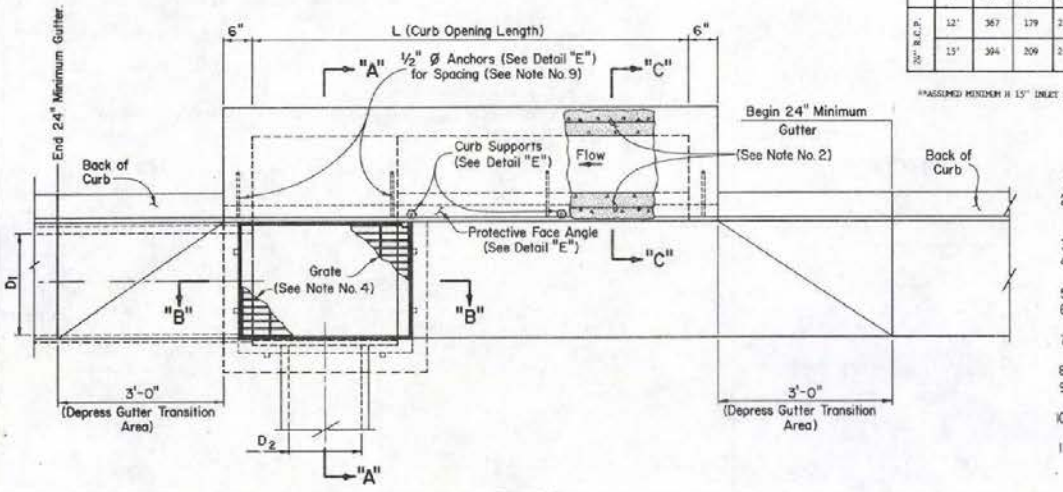
**ASSUMED MINIMUM IS 15" INLET PIPE



SECTION "C"-"C"



DETAIL "E"



PLAN

GENERAL NOTES

1. ALL CONCRETE SHALL BE CLASS AA OR A.
2. REINFORCING STEEL SHALL BE NO.4 BARS, EXCEPT AS NOTED, WITH MAXIMUM SPACE AT 12" CENTERS, WIRED TIGHTLY AT ALL INTERSECTIONS, AND EMBEDDED AT LEAST 1½" CLEAR OF CONCRETE SURFACE, EXCEPT AS NOTED.
3. EXPOSED EDGES OF CONCRETE SHALL BE CHAMFERED ONE INCH.
4. FOR GRATE AND FRAME DETAIL, SEE STANDARD PLANS SHEET R-4.3.1-(609). (TYPE 3 DROP INLET).
5. FOR VALUES OF "H" AND "L" SEE STORM DRAIN SCHEDULE.
6. "H" IS THE DIFFERENCE IN ELEVATION BETWEEN THE OUT PIPE FLOW LINE AND THE NORMAL GUTTER GRADE LINE AT THE CURB FACE.
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. ANGLE ANCHORS SHALL BE IMBEDDED MIDPOINT IN EACH ENDWALL AND EVENLY SPACED (MAXIMUMUM SPACING OF 5')
10. 1'-6" IS MINIMUM COVER FOR PIPE - ASSUMING CLASS III RCP OR 16 GAGE CMP WITH CLASS C BEDDING.
11. FOR DROP INLET CONFIGURATIONS WITH 2 PIPES - INFLOW PIPE INVERT ELEVATION SHALL BE ≥ 01' ABOVE OUTFLOW PIPE INVERT ELEVATIONS.

"A"

D_2 for CMP.

$D_2 + 6"$ for RCP 42" or Less.

$D_2 + 2t_2$ for RCP 48" or More.

"J"

D_1 for CMP

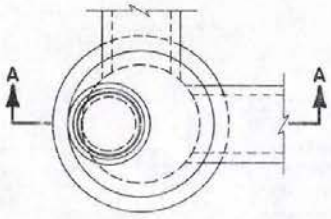
$D_1 + 6"$ for RCP 24" or Less.

$D_1 + 2t_1$ for RCP 30" or More.

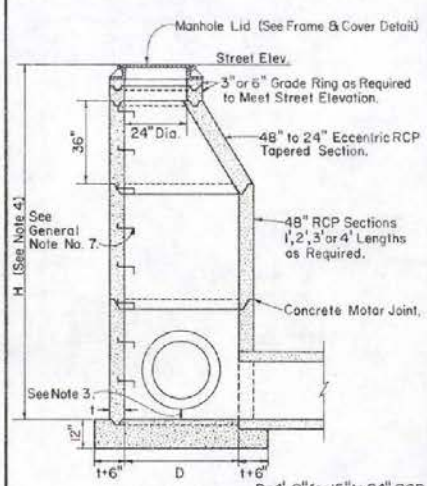
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

TYPE 11 DROP INLET

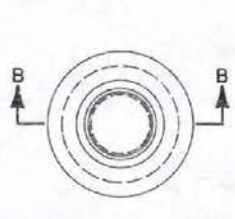
R-37



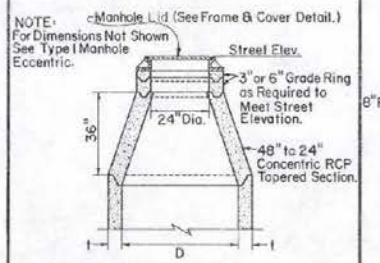
PLAN



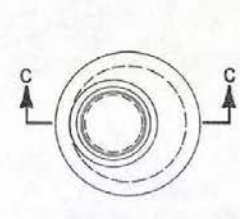
SECTION A-A
TYPE I MANHOLE
ECCENTRIC



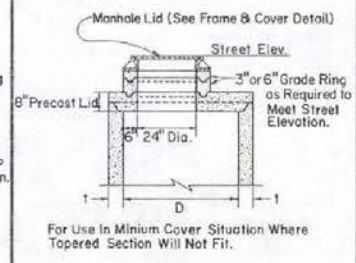
PLAN



SECTION B-B
TYPE I MANHOLE
CONCENTRIC

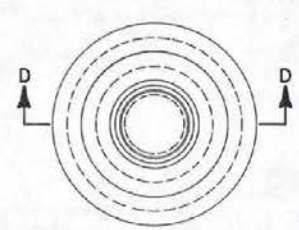


PLAN

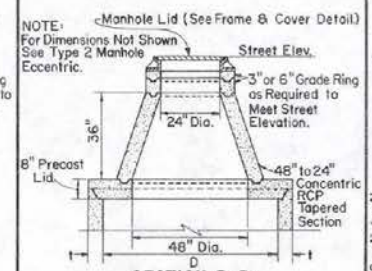


For Use In Minium Cover Situation Where Tapered Section Will Not Fit.

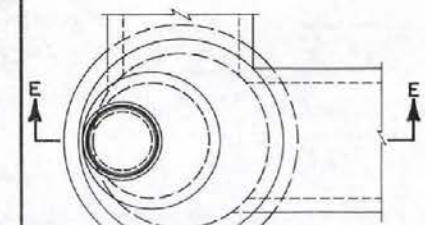
SECTION C-C
TYPE I & 2 MANHOLE
MODIFIED



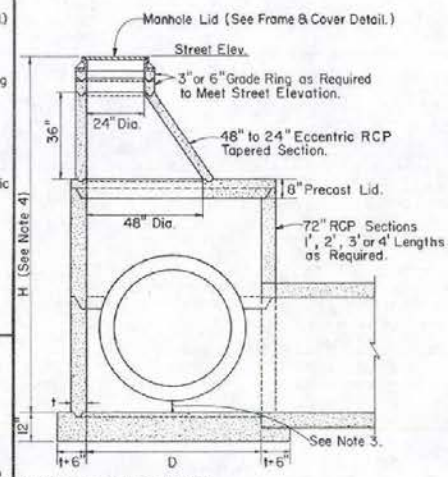
PLAN



SECTION D-D
TYPE 2 MANHOLE
CONCENTRIC



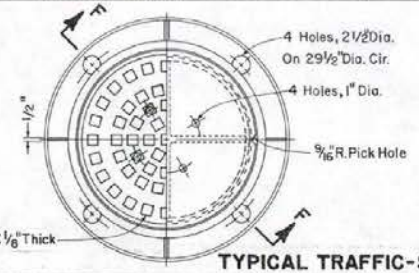
PLAN



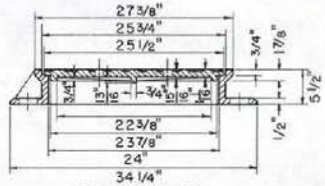
SECTION E-E
TYPE 2 MANHOLE
ECCENTRIC

—GENERAL NOTES—

1) FOR CAST IN PLACE CONCRETE BASE ALL REINFORCING STEEL TO BE NO. 4 BARS AT 18" CENTERS, TIGHTLY WOUND AT ALL INTERSECTIONS AND IMBEDDED IN CONCRETE AT LEAST 2" AND BAR ENDS MUST CLEAR CONCRETE SURFACES BY 1½".
2) ALL CONCRETE SHALL BE CLASS A. OR AA.
3) MANHOLE WITH MORE THAN ONE PIPE - INFLOW PIPE INVERT ELEVATIONS SHALL BE ≥ 0.1' ABOVE OUTFLOW PIPE ELEVATION.
4) FOR VALUES OF "H" SEE STORM DRAIN SCHEDULE OR STRUCTURE LIST. "H" IS THE DIFFERENCE IN ELEVATION BETWEEN THE OUTFLOW PIPE INVERT ELEVATION AND THE TOP OF MANHOLE ELEVATION AT STREET GRADE.
5) DO NOT PLACE PIPES IN TAPERED SECTION.
6) MANHOLE COVER SHALL BEAR N.D.O.T. IDENTIFICATION AND SYSTEM FUNCTION.
7) MANHOLE STEPS SHALL CONFORM TO ASTM STANDARD SPECIFICATION C-478 WITH MAXIMUM SPACING OF 16" AND 4" CLEAR DISTANCE FROM THE WALL OF RISER OR CONE SECTION. THE STEP MUST HAVE A 10" MINIMUM WIDTH.

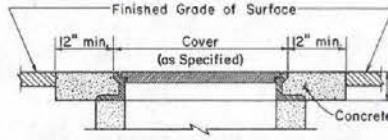


Approx. Weight: Frame 142 lb., Cover 122 lb. Min.
Material: Cast Iron.



SECTION F-F

TYPICAL TRAFFIC-STRENGTH MANHOLE FRAME & COVER



TYPICAL METHOD OF ADJUSTING MANHOLES & WATER VALVES
(ADJUSTED COLLARS MAY BE POURED SQUARE OR ROUND)

NOTE:
Commercial Prefabricated Adjustment Rings For Manholes May Be Used When Approved By The Engineer.

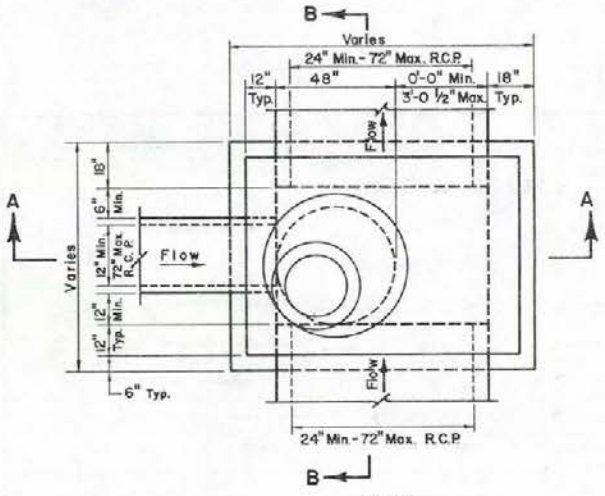
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

TYPE 1 & 2 & TYPE 1 & 2 MODIFIED MANHOLES

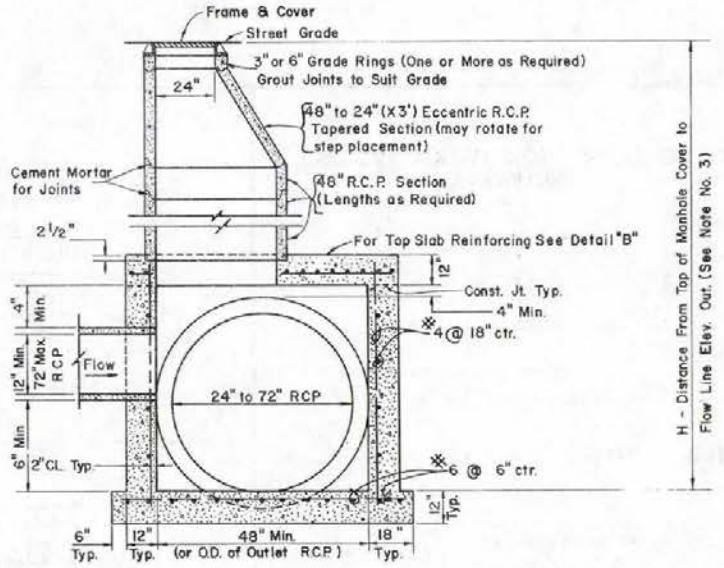
CHIEF ROAD DESIGN ENGR.

R-4.7.1 (609)
ADOPTED: 10/85
REVISION

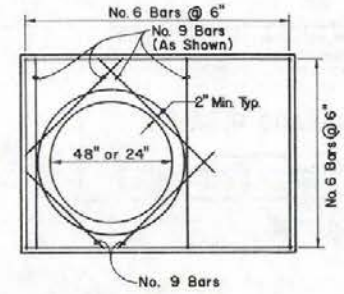
R-38



PLAN



SECTION A - A



DETAIL "B"
(TOP SLAB REINFORCING)

GENERAL NOTES

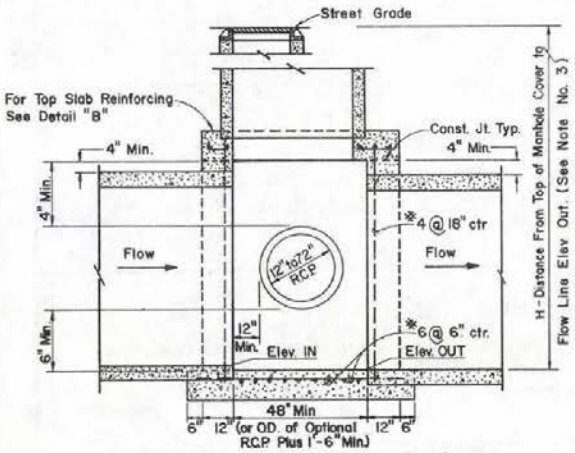
1) ALL CONCRETE SHALL BE CLASS A OR AA.

2) MANHOLES WITH MORE THAN ONE PIPE - THE INFLOW PIPES INVERT ELEVATIONS SHALL BE GREATER THAN OR EQUAL TO 0.1' ABOVE THE OUTFLOW PIPE INVERT ELEVATION.

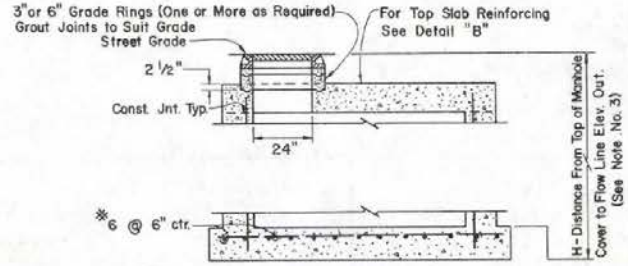
3) FOR VALUES OF "H" SEE STORM DRAIN SCHEDULE OR STRUCTURE LIST IN CONTRACT PLANS. "H" IS THE DIFFERENCE IN ELEVATION BETWEEN THE OUTFLOW PIPE INVERT ELEVATION AND THE TOP OF MANHOLE ELEVATION AT STREET GRADE.

4) MANHOLE STEPS SHALL CONFORM TO ASTM STANDARD SPECIFICATION C-478 WITH MAXIMUM SPACING OF 16" AND 4" CLEAR DISTANCE FROM THE MANHOLE WALL. THE STEP MUST BE A 10" MINIMUM WIDTH.

5) MANHOLE COVER SHALL BEAR N.D.O.T. IDENTIFICATION AND SYSTEM FUNCTION.

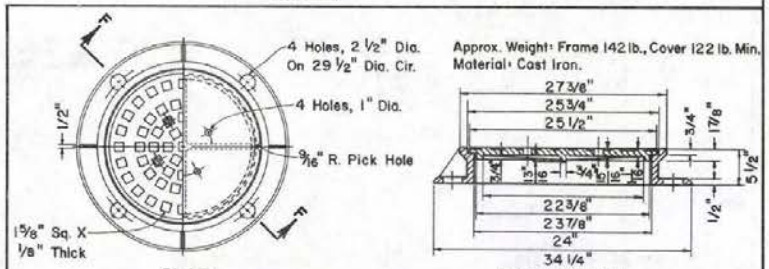


SECTION B-B



SECTION A-A
(FOR MINIMUM HEIGHT SITUATION)

Note: Hydraulic Engineer Will Look at Other Options for Extreme Minimum Cover Situation.



PLAN SECTION F-F

TYPICAL TRAFFIC-STRENGTH MANHOLE FRAME & COVER

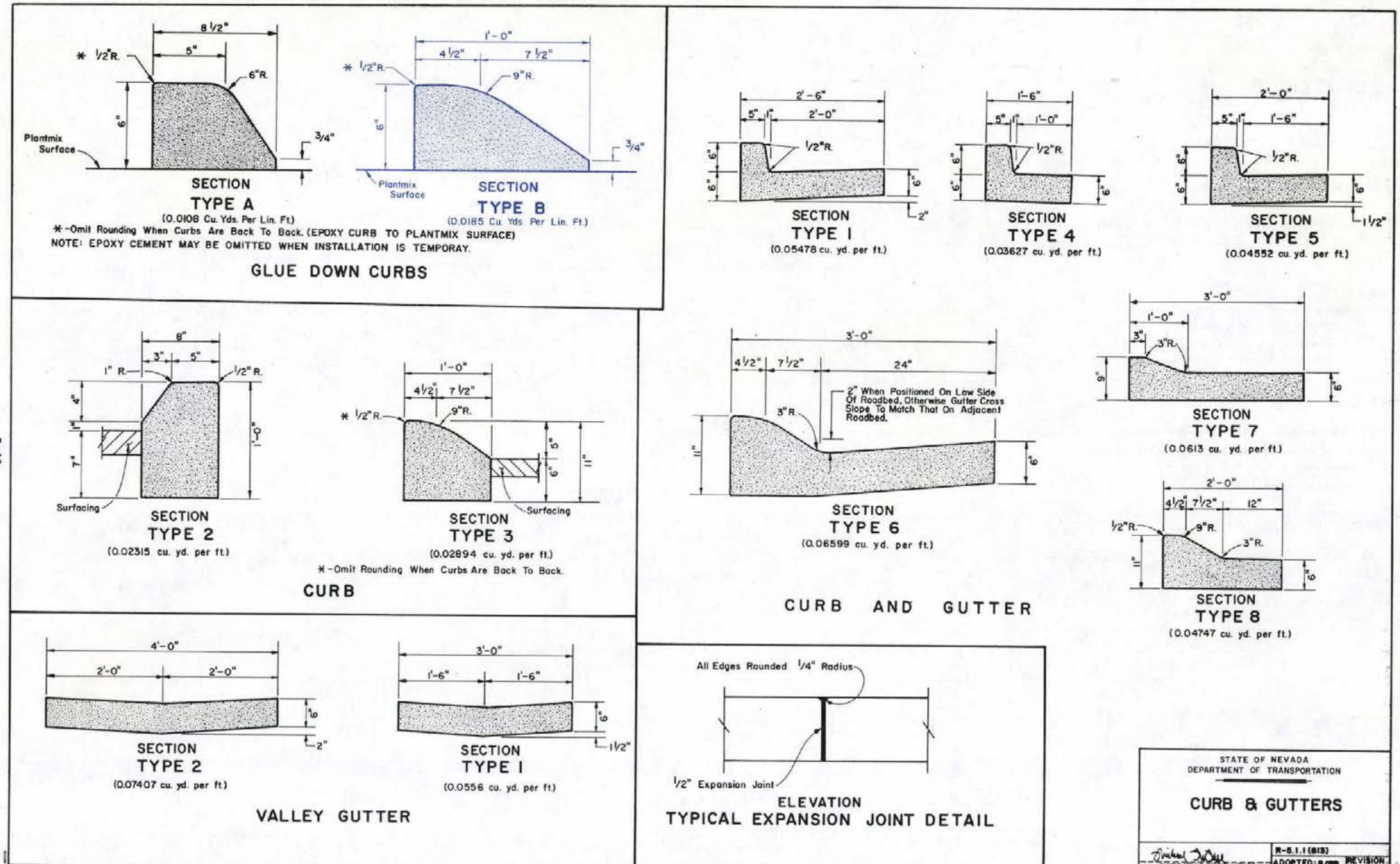
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

TYPE 4 MANHOLE

Richard B. Bell
CHIEF ROAD DESIGN ENGR.

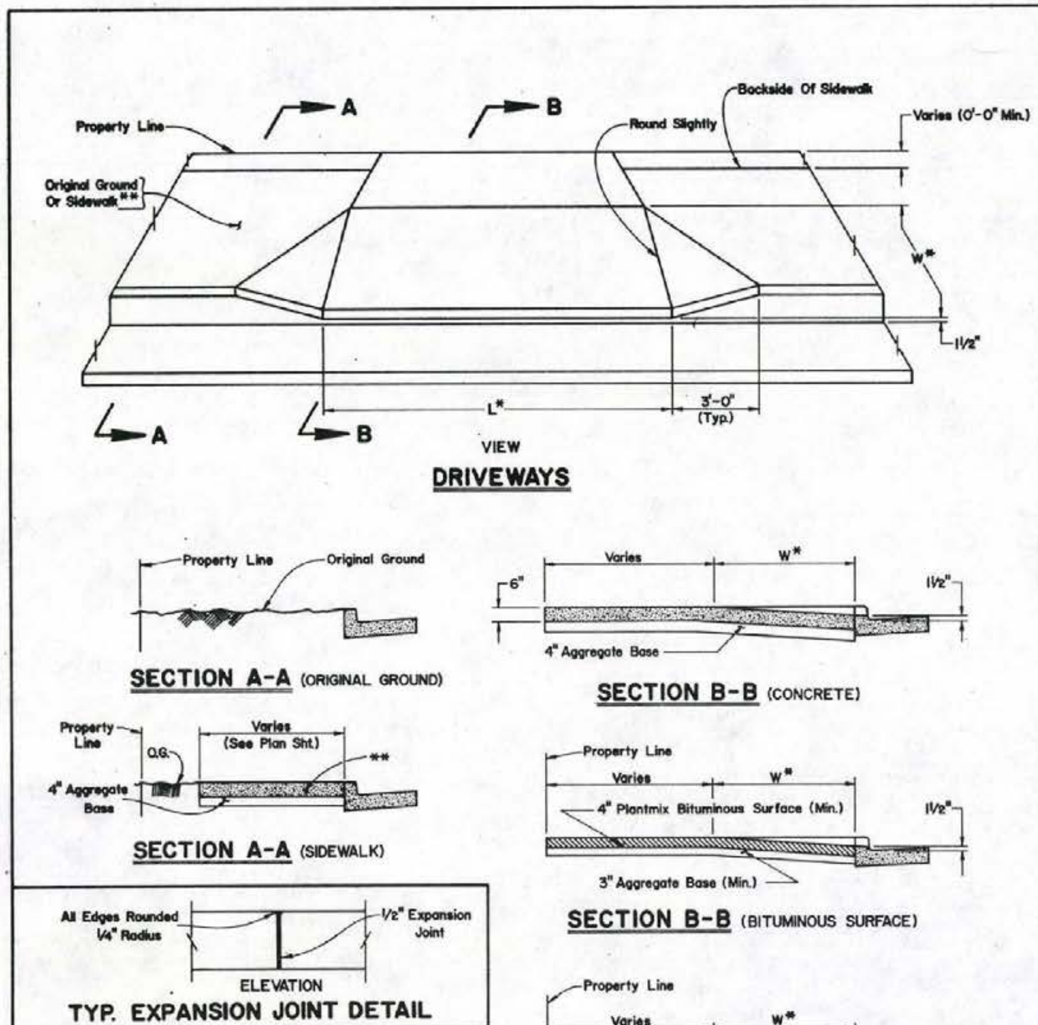
R-4.7.2 (609)
ADOPTED: 10/85 REVISION 1-11/88

R-39



8 1/2"
5"
* 1/2"R.
6"R.
6"
3/4"
Plantmix Surface
SECTION
TYPE A
(0.0108 Cu. Yds. Per Lin. Ft.)
1'-0"
4 1/2"
7 1/2"
* 1/2"R.
9"R.
6"
3/4"
Plantmix Surface
SECTION
TYPE B
(0.0185 Cu. Yds. Per Lin. Ft.)
*-Omit Rounding When Curbs Are Back To Back. (EPOXY CURB TO PLANTMIX SURFACE)
NOTE: EPOXY CEMENT MAY BE OMITTED WHEN INSTALLATION IS TEMPORAY.
GLUE DOWN CURBS
2'-6"
5"
1"
2'-0"
1/2"R.
6"
6"
6"
2"
SECTION
TYPE 1
(0.05478 cu. yd. per ft.)
1'-6"
5"
1"
1'-0"
1/2"R.
6"
6"
6"
SECTION
TYPE 4
(0.03627 cu. yd. per ft.)
2'-0"
5"
1"
1'-6"
1/2"R.
6"
6"
6"
1 1/2"
SECTION
TYPE 5
(0.04552 cu. yd. per ft.)
8"
3"
5"
1" R.
1/2" R.
4"
1"
7"
1'-0"
Surfacing
SECTION
TYPE 2
(0.02315 cu. yd. per ft.)
1'-0"
4 1/2"
7 1/2"
* 1/2"R.
9"R.
5"
6"
11"
Surfacing
SECTION
TYPE 3
(0.02894 cu. yd. per ft.)
*-Omit Rounding When Curbs Are Back To Back.
CURB
3'-0"
4 1/2"
7 1/2"
24"
3"R.
2" When Positioned On Low Side Of Roadbed, Otherwise Gutter Cross Slope To Match That On Adjacent Roadbed.
11"
6"
SECTION
TYPE 6
(0.06599 cu. yd. per ft.)
CURB AND GUTTER
3'-0"
1'-0"
3"
3"R.
9"
6"
SECTION
TYPE 7
(0.0613 cu. yd. per ft.)
2'-0"
4 1/2"
7 1/2"
12"
1/2"R.
9"R.
3"R.
11"
6"
SECTION
TYPE 8
(0.04747 cu. yd. per ft.)
4'-0"
2'-0"
2'-0"
6"
2"
SECTION
TYPE 2
(0.07407 cu. yd. per ft.)
3'-0"
1'-6"
1'-6"
6"
1 1/2"
SECTION
TYPE 1
(0.0556 cu. yd. per ft.)
VALLEY GUTTER
All Edges Rounded 1/4" Radius
1/2" Expansion Joint
ELEVATION
TYPICAL EXPANSION JOINT DETAIL
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION
CURB & GUTTERS
CHIEF ROAD DESIGN ENGR.
R-8.1.1 (813)
ADOPTED: 8/89
REVISION 4 1/88

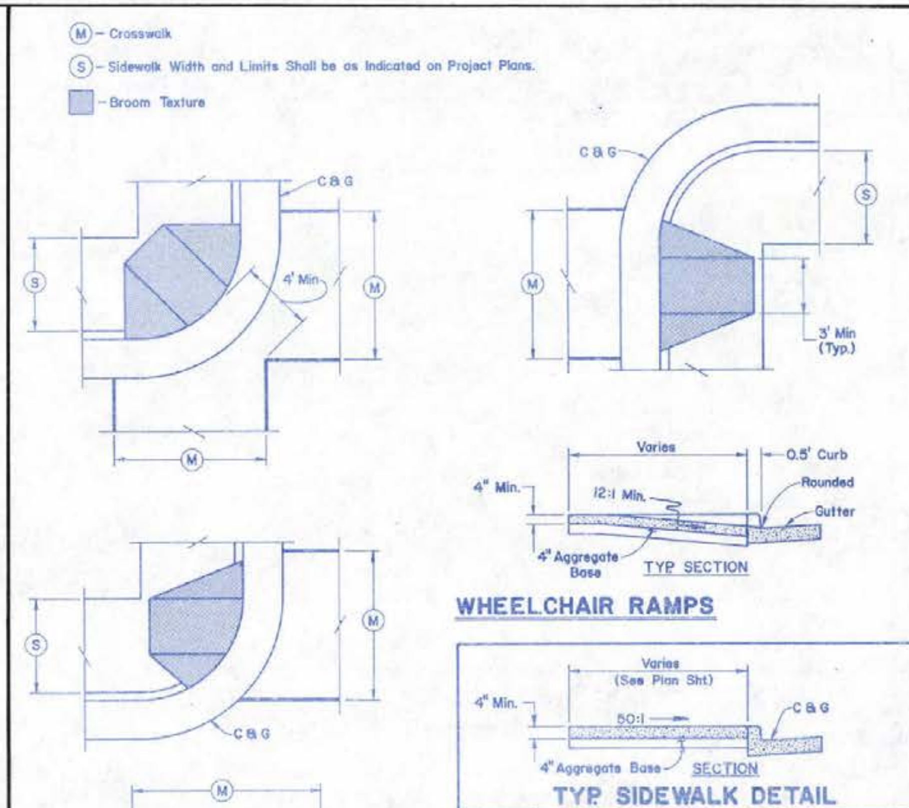
R-40

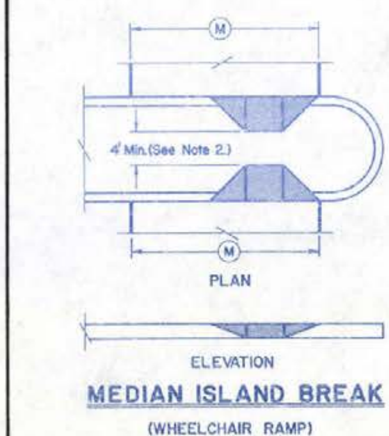


GENERAL NOTES

*SEE STRUCTURE LIST.

**SIDEWALK SHALL HAVE 4" MIN. THICKNESS AND LIMITS AS INDICATED ON PROJECT PLANS.





GENERAL NOTES

1. SIDE SLOPES FOR WHEELCHAIR RAMPS SHALL BE 12:1, EXCEPT WHEN A 4' MIN. WIDTH LANDING IS PROVIDED AT THE TOP OF THE RAMP, THEN THE SIDE SLOPES CAN BE 10:1.

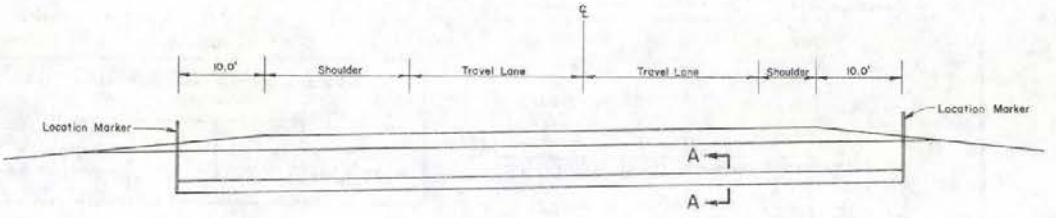
2. IF THE 4' PLATFORM AT THE TOP OF THE RAMP CANNOT BE ACHIEVED, CONSIDERATION SHOULD BE GIVEN TO MOVING THE ISLAND NOSE BEHIND THE CROSSWALK OR CUTTING A LEVEL PATH THROUGH THE ISLAND WITH A 3' MIN. WIDTH.

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

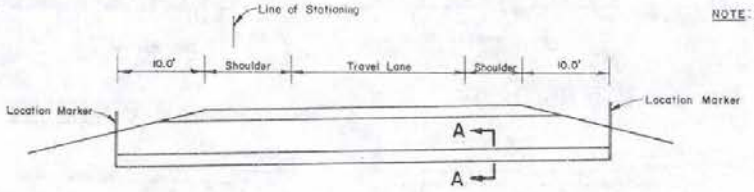
SIDEWALKS, DRIVEWAYS & WHEELCHAIR RAMPS

R-5.1.11 (9/3)
ADOPTED: 1/88

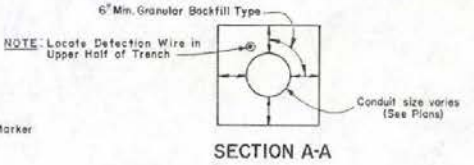
R-41



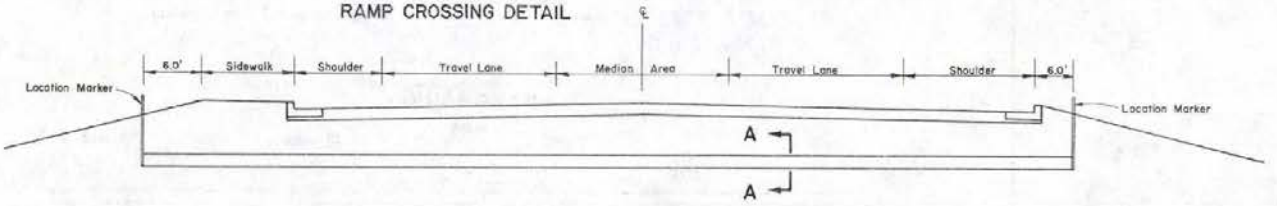
FREEWAY CROSSING DETAIL



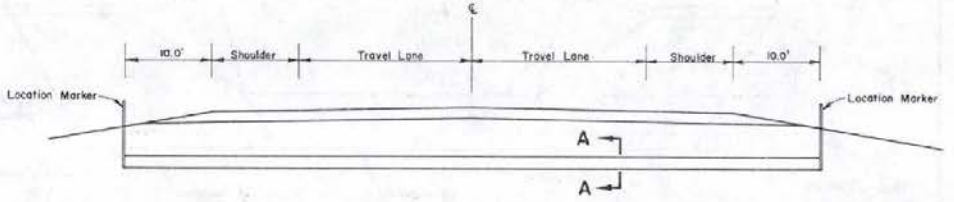
RAMP CROSSING DETAIL



SECTION A-A



CROSSROAD DETAIL



FRONTAGE ROAD DETAIL

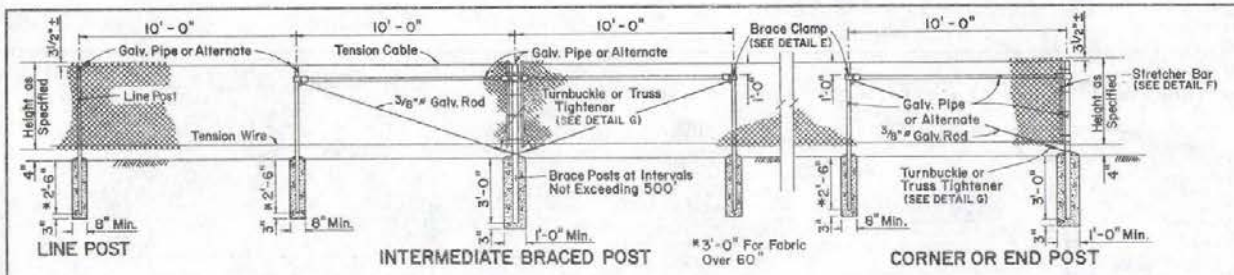
GENERAL NOTES

1. Minimum 3.0' Cover Over Top Of Conduit At Shoulder Line.
2. 12 Gauge Bare Copper Detection Wire To Lay In Trench Adjacent To Conduit And Attach To Location Marker At Each End.
3. Location Marker Shall Be 2" P.V.C. or 5.0' Steel Fence Posts.

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

CONDUIT INSTALLATION FOR FUTURE WATER LINES

	R-5.1.2	
CHIEF ROAD DESIGN ENGR.	ADOPTED: 5/73	REVISION: 2 11/82

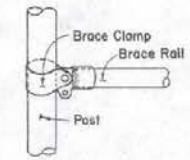


LINE POST

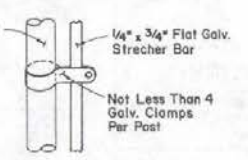
INTERMEDIATE BRACED POST

CORNER OR END POST

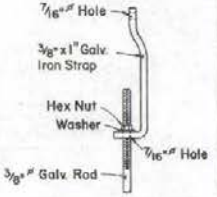
TYPICAL CHAIN LINK FENCE



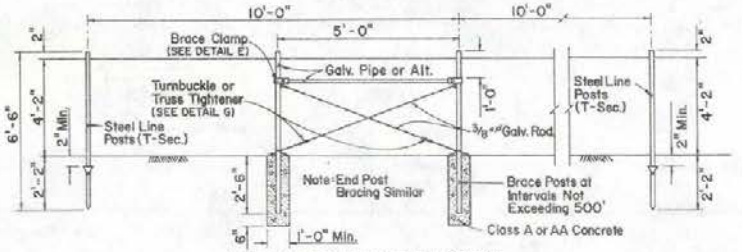
DETAIL E



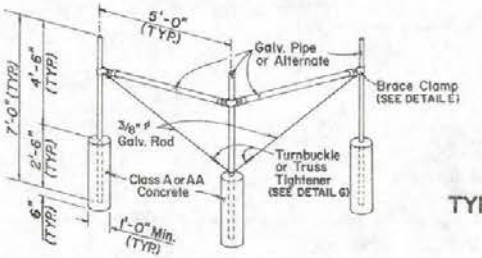
DETAIL F



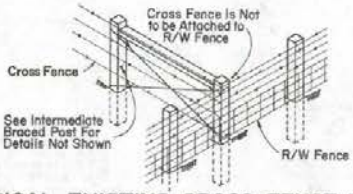
TRUSS TIGHTENER
DETAIL G



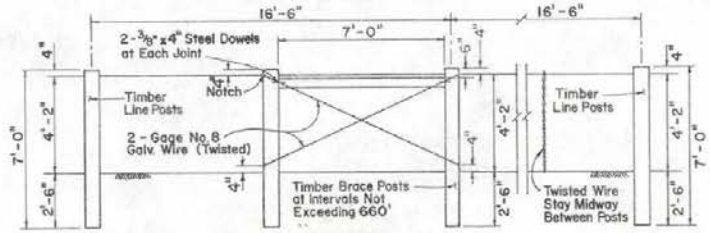
INTERMEDIATE BRACED POST
TYPE A FENCE



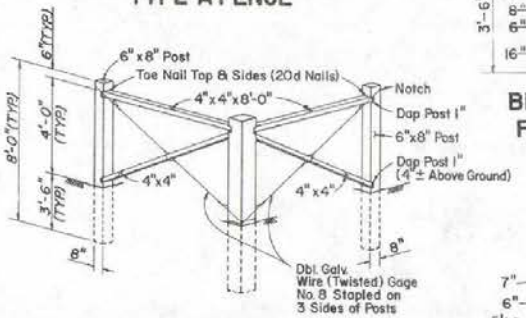
CORNER BRACE FOR
TYPE A FENCE



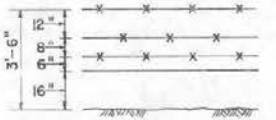
TYPICAL EXISTING CROSS FENCE TIE
TO R/W FENCE



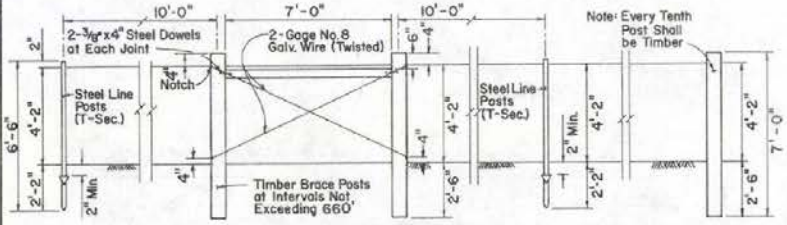
INTERMEDIATE BRACED POST
TYPE B FENCE



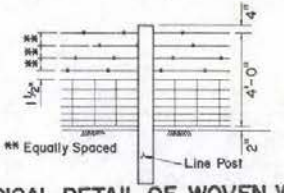
TIMBER CORNER BRACE



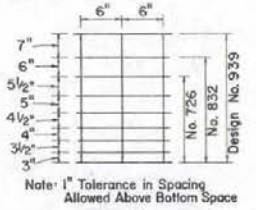
BLM, NDOW WIRE
FENCE DESIGN



INTERMEDIATE BRACED POST
TYPE C FENCE



TYPICAL DETAIL OF WOVEN WIRE
& BARBED WIRE FENCE APPLICABLE
TO TYPE A, B & C FENCING



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 (TUBULAR OR C-COLUMN).
3. BARBED WIRE SHALL BE SPACED AS FOLLOWS:

   4 WIRE: BOTTOM WIRE 15½" ABOVE GROUND, OTHER SPACING 11½
   5 WIRE: BOTTOM WIRE 16" 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-832-3S DESIGNATES METAL POSTS, 32" WOVEN (FARM) WIRE, AND 3 BARBED WIRES.

   TYPE 2-4S DESIGNATES WOOD POSTS, 4 BARBED WIRES.

   TYPE C-726-4S 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 SUITABLE 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.
   (F) FOR ALTERNATE POST AND BRACERAIL DETAILS SEE SHEETS NO. R-6.3.1 THROUGH R-6.3.3.

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

FENCE DETAILS

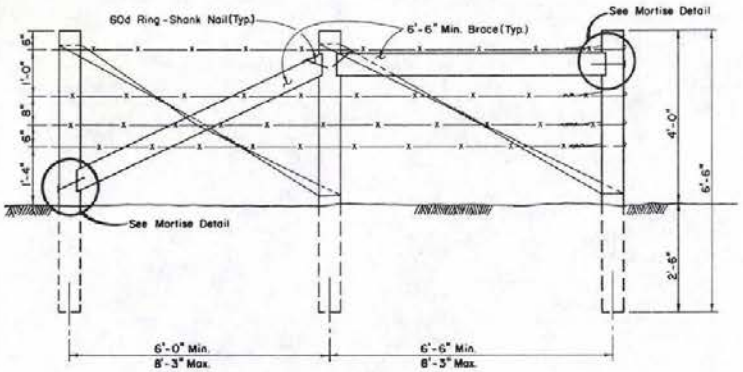
CHIEF ROAD DESIGN ENGR.

R-6.1.1-(724)

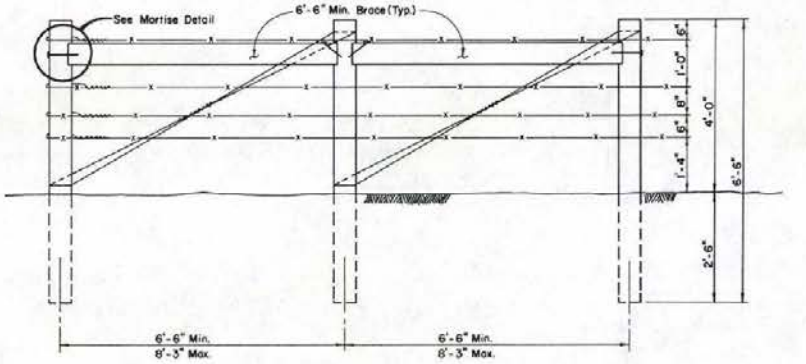
ADOPTED: 8/69

REVISION 6-10/85

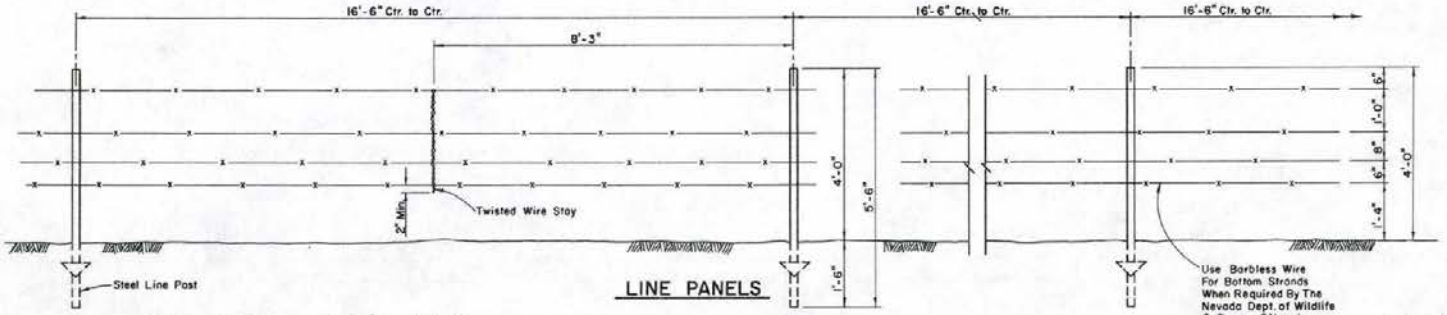
R-63



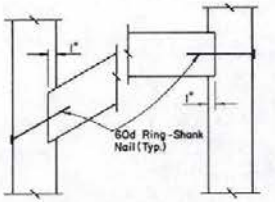
END PANEL-TYPE I
(SEE SPECIFICATIONS FOR TYPE TO BE USED)



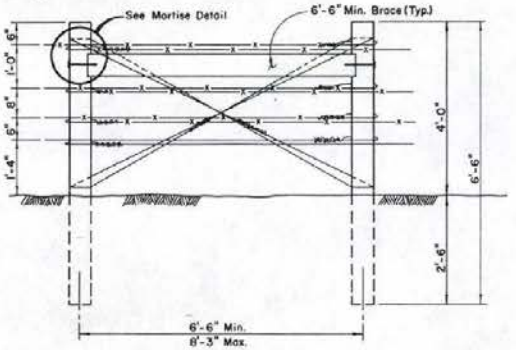
END PANEL-TYPE II
(SEE SPECIFICATIONS FOR TYPE TO BE USED)



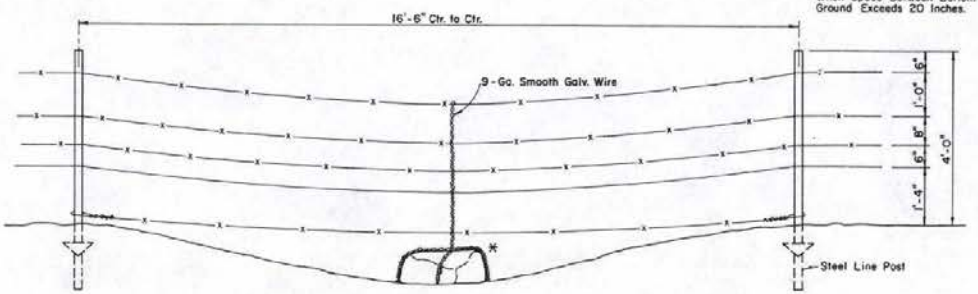
LINE PANELS



MORTISE DETAIL



STRESS PANEL



PANEL AT MINOR DEPRESSION

* Add Additional Strands of Barbed Wire And/or A Rock Deadman (Min. Weight 50 Lb.) When Space Between Bottom Wire And Ground Exceeds 20 Inches.

GENERAL NOTES

I. SEE SPECIFICATIONS FOR THE FOLLOWING:
   1. TYPE OF END PANEL TO BE USED.
   2. TYPE OF GATE(S) TO BE USED.
   3. TYPE OF CORNER PANEL(S) TO BE USED.
   4. TYPE OF POST(S) TO BE USED.

II. WIRES TO BE TIED OFF AT STRETCH POINTS, WRAP AND SPLICE TO SELF WITH AT LEAST 4 TURNS AT OPPOSITE END OF PANELS.

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

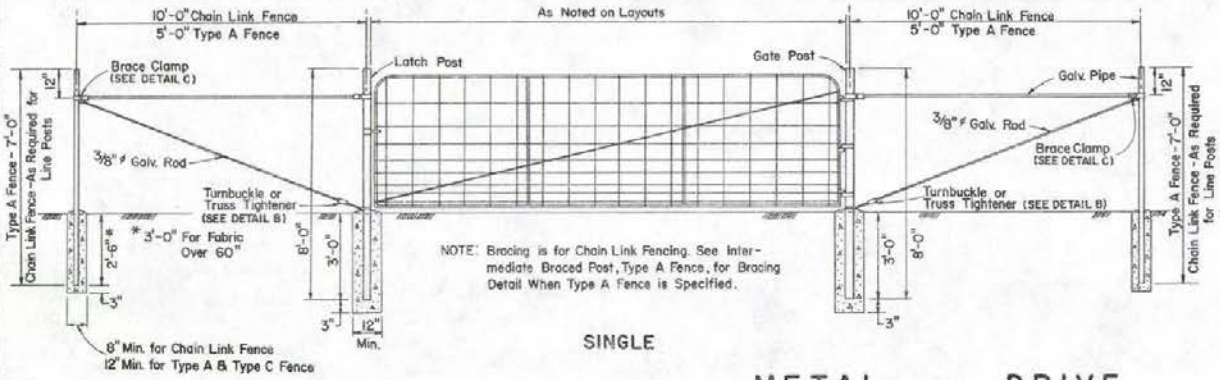
BARBED WIRE FENCE
NV(4-WIRE x 16'-6")

CHIEF ROAD DESIGN ENGR.

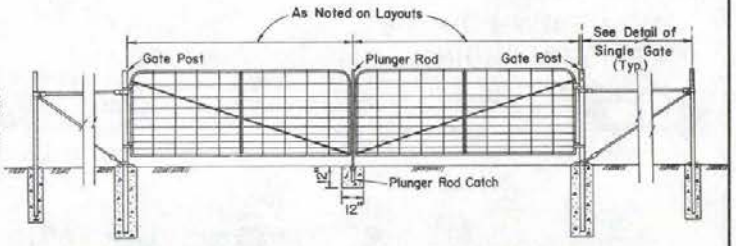
R - 6.1.2

ADOPTED: 10/85 REVISION 1-1-17 RS

R-44

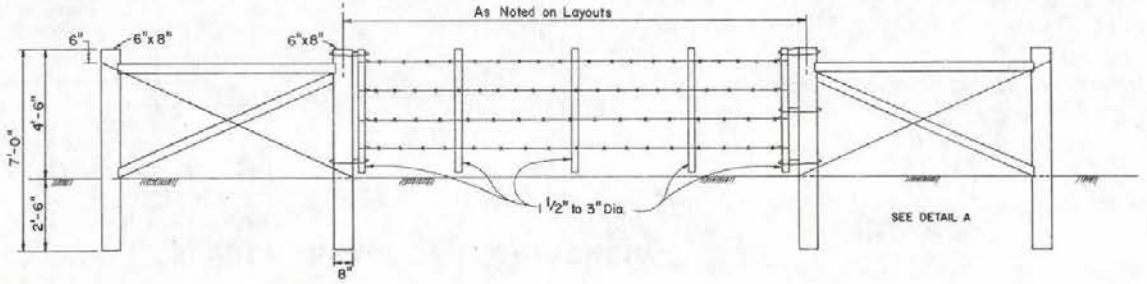


SINGLE

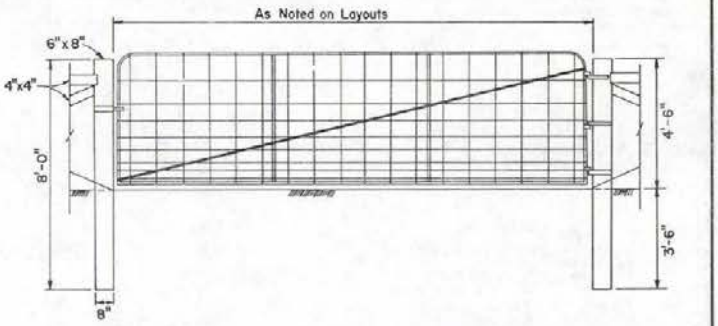


DOUBLE

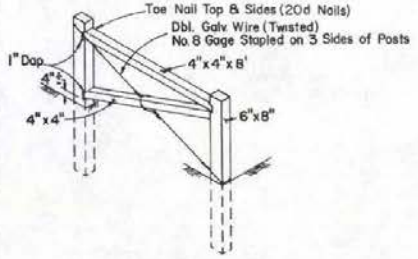
METAL DRIVE GATES



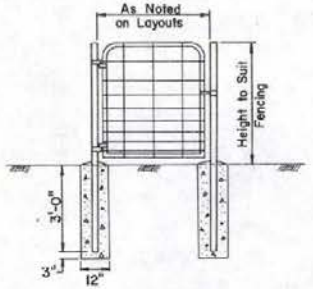
MISSOURI GATE



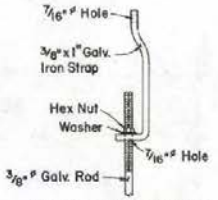
METAL DRIVE GATE IN TIMBER FENCE



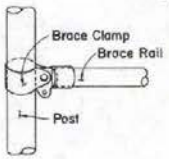
DETAIL A



WALK GATE



TRUSS TIGHTENER DETAIL B



DETAIL C

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.

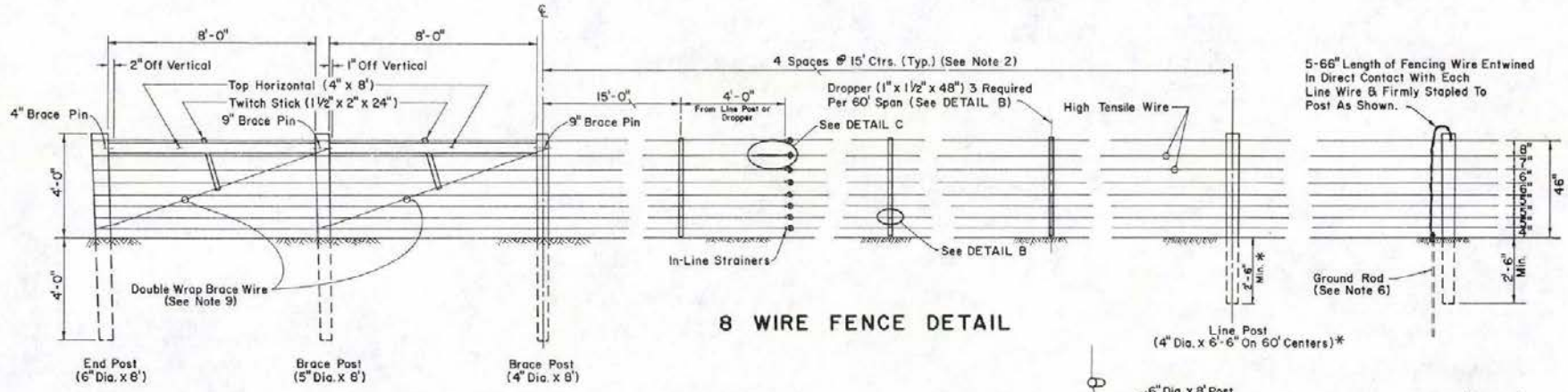
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

GATE AND FENCE DETAILS

CHIEF ROAD DESIGN ENGR.

R-6.1.3 - (616)
ADOPTED: 8/69
REVISION 3 - 11/82

R-46

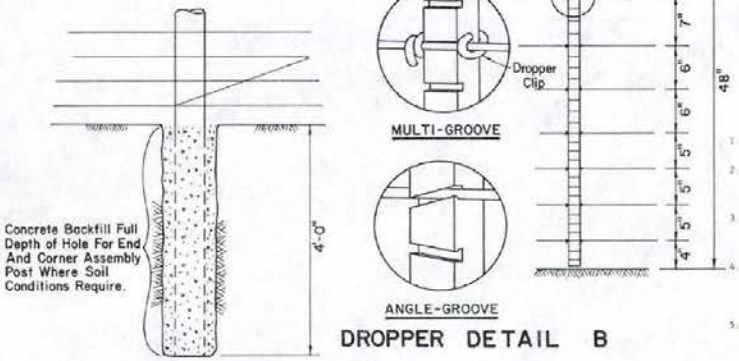


DOUBLE BRACE END ASSEMBLY

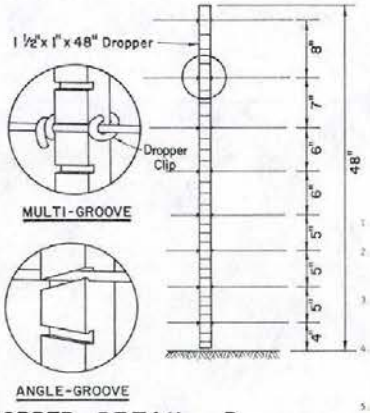
8 WIRE FENCE DETAIL

* Rise or Dip Post 4" Dia. x 8'. C-C Spacing As Needed Driven 48" (See Note 4)

Note: Form Gate 12' or Less May Be Installed On Post After Final Wire Tensioning.

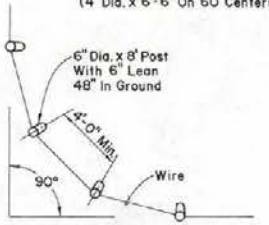


DETAIL A
(POST WITH CONCRETE BACKFILL)

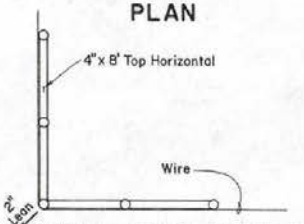


DROPPER DETAIL B

DETAIL C
(IN-LINE WIRE STRAINERS AND TENSION INDICATOR SPRING)



ALTERNATE FOUR POST CORNER ASSEMBLY PLAN



DOUBLE BRACE CORNER ASSEMBLY (FOR DETAILS-SEE ABOVE) PLAN

-CONSTRUCTION NOTES-

1. END POSTS AND LINE POSTS ARE RECOMMENDED TO BE MECHANICALLY DRIVEN INTO THE GROUND WHERE SOIL CONDITIONS PERMIT. TO BE DETERMINED BY THE ENGINEER.
2. MAXIMUM POST SPACING IS 60' ON LEVEL TERRAIN WITH DROPPERS ON 15' CENTERS. POST SPACING MAY BE DECREASED DUE TO TERRAIN CONDITIONS. DROPPER SPACING WILL REMAIN ON 15' MAX. CENTERS. MINIMUM LINE POST SPACING WILL BE ON 15' CENTERS WITHOUT DROPPERS. WITH 4" DIAMETER, SMALL END, LINE POSTS WHEN NEEDED.
3. PLACEMENT OF IN-LINE STRAINERS SHALL BE AS CLOSE TO THE CENTER OF THE FENCE RUN AS POSSIBLE. PLACEMENT OF TENSION INDICATOR SPRING SHALL BE ON THE SECOND WIRE FROM THE TOP. COMPRESSION OF THE INDICATOR SPRING BY 1-3/4" WILL INDICATE A TENSION OF APPROXIMATELY 250 LBS. (± 10 LBS.)
4. MAXIMUM LENGTH OF WIRE PER IN-LINE STRAINER ON LEVEL TERRAIN, STRAIGHT-3000', 1-90° CORNER-3000', 2-90° CORNERS-2000', 3-90° CORNERS-1500', 4-90° CORNERS-1000'. FOR UNEVEN TERRAIN REDUCE DISTANCES BY 500' FOR EACH MAJOR RISE AND DIP. DIP OR RISE POSTS SHALL BE A MINIMUM OF 4" DIAMETER SMALL END, 8' LONG, POSITIONED AT HIGH POINTS OF RIDGES AND LOW POINT OF GULLIES.
5. EXCEPT FOR FASTENING LINE WIRE WHICH HAS BEEN STRUNG AROUND THE OUTSIDES OF WOOD POST IN CORNERS AND CURVES, FENCE STAPLES SHOULD NOT BE DRIVEN VERTICALLY INTO WOOD POSTS. ROTATING STAPLES SLIGHTLY AWAY FROM SLASH CUT POINTS WILL PROVIDE IMPROVEMENT IN RESISTANCE TO PULLOUT.
6. GROUND RODS OF GALVANIZED STEEL (5/8" X 8') SHALL BE PLACED EVERY 150' IN DRY SOILS OR EVERY 300' IN MOIST SOILS. SPECIFIC ROD POSITIONING TO BE DETERMINED BY THE ENGINEER. FENCE UNDER POWER LINES SHALL BE GROUNDED AT 3 POINTS, ONE DIRECTLY UNDER POWER LINE AND ONE EACH SIDE 25' TO 50' AWAY.
7. IT IS RECOMMENDED FOR TYING OFF WIRES ON END POSTS TO USE TWO (2) NICROPRESS SLEEVES, CAT. NO. FW-2-3 MANUFACTURED BY THE NATIONAL TELEPHONE SUPPLY COMPANY OR ACCEPTABLE EQUAL.
8. IT IS RECOMMENDED FOR SPLICING WIRES TO USE THREE (3) NICROPRESS SLEEVES OR 1 RELIABLE WIRELINK NUMBER 5057V, MANUFACTURED BY RELIABLE ELECTRIC COMPANY OR ACCEPTABLE EQUAL.
9. PROPER TENSION ON THE BRACE WIRE IN THE END ASSEMBLY IS ACCOMPLISHED BY TWISTING THE BRACE WIRE A MINIMUM OF 6 TURNS TO A MAXIMUM OF 8 TURNS. THE TWITCH STICK SHOULD BE SECURELY FASTENED TO THE TOP HORIZONTAL BRACE POST.
10. LINE WIRES SHOULD BE STAPLED TO THE LINE POST ONLY AFTER TAKING UP PRELIMINARY TENSION (ABOUT 150 LBS.) ON EACH WIRE. STAPLES SHALL NOT BIND WIRE. AFTER STAPLING IS COMPLETED, TENSION EACH WIRE AN ADDITIONAL 100 LBS. FOR A TOTAL OF 250 LBS. INSTALL DROPPERS ONLY AFTER FINAL TENSION IS ON EACH WIRE. SEE CONSTRUCTION NOTE C ABOUT TENSION INDICATOR SPRING.
11. ADDITIONAL CONSTRUCTION NOTES MAY BE FOUND IN UNITED STATES STEEL CATALOG NO. 7111575 HOW TO BUILD FENCES WITH UNITED STATES STEEL MAX TEN 200 HIGH-TENSILE FENCE WIRE.

-SPECIFICATION NOTES-

A. ALL WOOD POSTS AND DROPPERS SHALL BE PRESSURE TREATED IN ACCORDANCE WITH AASHTO DESIGNATION OR EQUIVALENT STATE SPECIFICATION.

B. ALL FENCE WIRE, END AND CORNER BRACE ASSEMBLY WIRE SHALL CONSIST OF HIGH TENSILE FENCE WIRE 12½ GAUGE, WITH A MINIMUM OF 200,000 lbs/in TENSILE STRENGTH AND CONFORMS WITH THE REQUIREMENTS FOR CLASS 3 ZINC COATING OF ASTM SPECIFICATION A116.

C. BRACE PINS, DROPPER CLIPS, TENSION INDICATOR SPRINGS AND IN-LINE STRAINERS SHALL CONFORM WITH THE REQUIREMENTS FOR CLASS 3 ZINC COATING OF ASTM SPECIFICATION A116.

D. STAPLES ARE 1-3/4", 9 GAUGE WITH SLASH CUT POINTS AND SHALL CONFORM WITH THE REQUIREMENTS FOR CLASS 3 ZINC COATING OF ASTM SPECIFICATION A116.

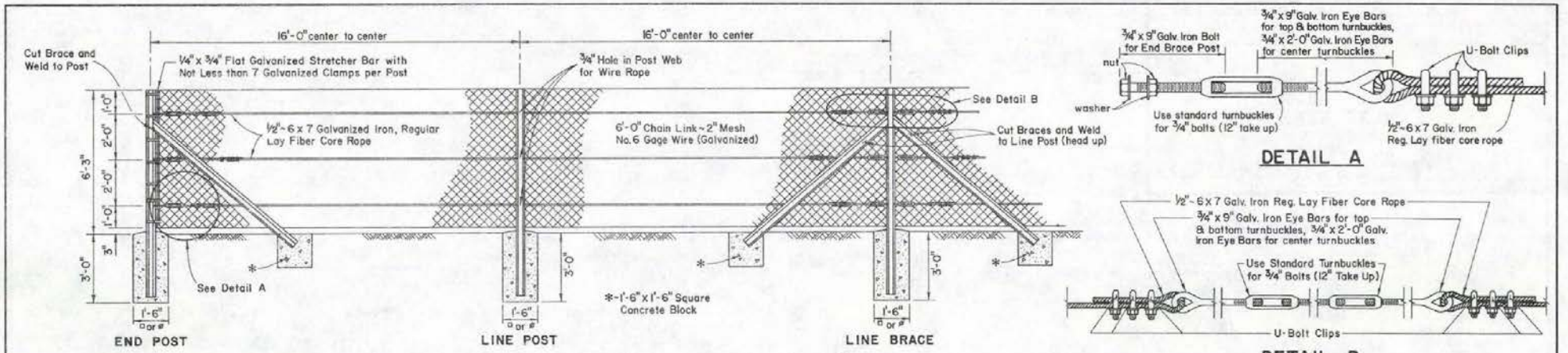
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

HIGH TENSILE 8-WIRE RANGE FENCE

CHIEF ROAD DESIGN ENGR

R-6.1.4 (616)
ADOPTED 11/82 REVISION

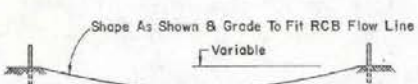
R-46



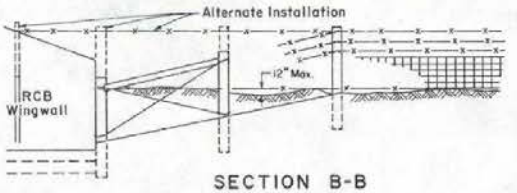
BENCH FENCE (630)

DETAIL A

DETAIL B



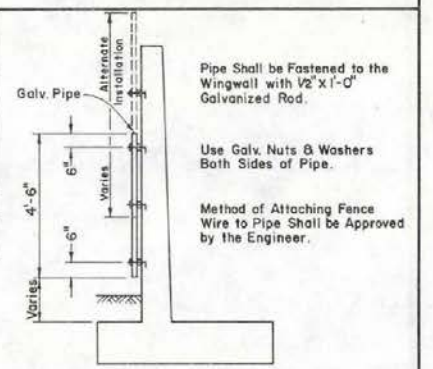
SECTION A-A



SECTION B-B

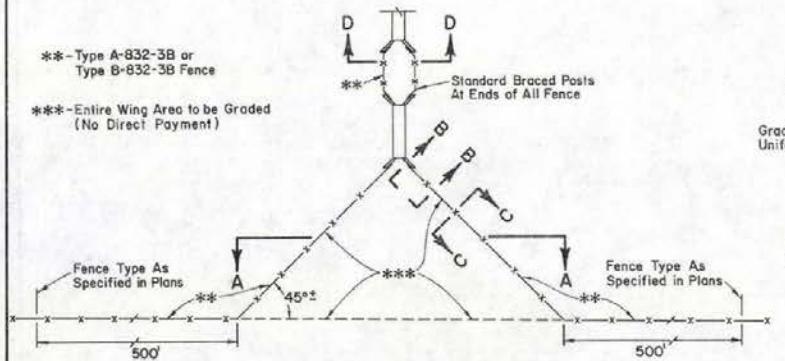
BENCH FENCE:

1. ALL POSTS AND BRACES SHALL BE 50 POUND CRANE RAIL OR 4"X4"X15 POUND WIDE FLANGE, 9' 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. 3 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. FEET.



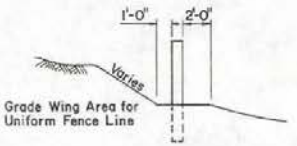
DETAIL C

METHOD OF ATTACHING FENCE TO RCB WINGWALL (OPTIONAL)

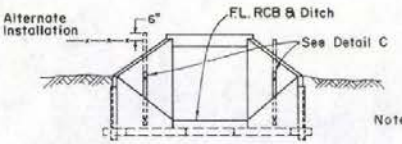


PLAN

CATTLE PASS FENCING (616)



SECTION C-C



SECTION D-D

Note: Fence Attachment and/or Alternate Installation to be Placed at the Direction of the Engineer. (1' Min. from Outer End of Wingwall).

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

BENCH FENCE AND CATTLE PASS FENCING

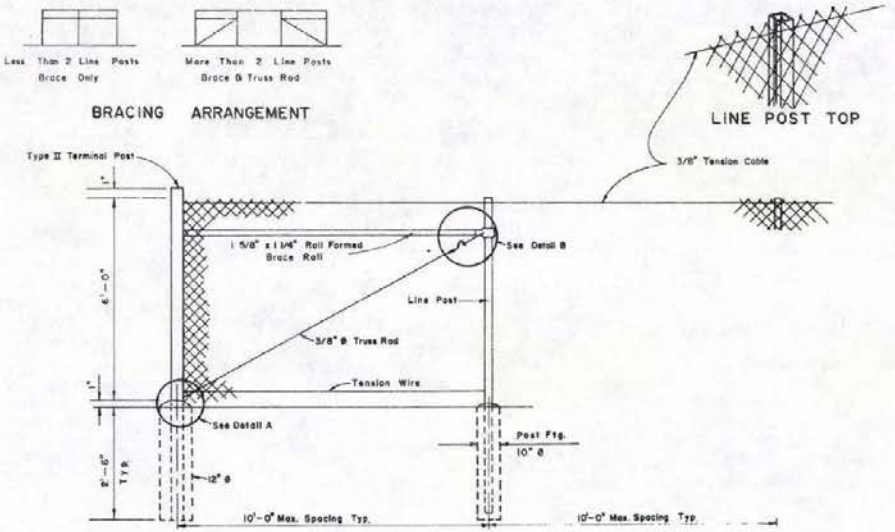
CHIEF ROAD DESIGN ENGR

R-6.2.1 (616-630)

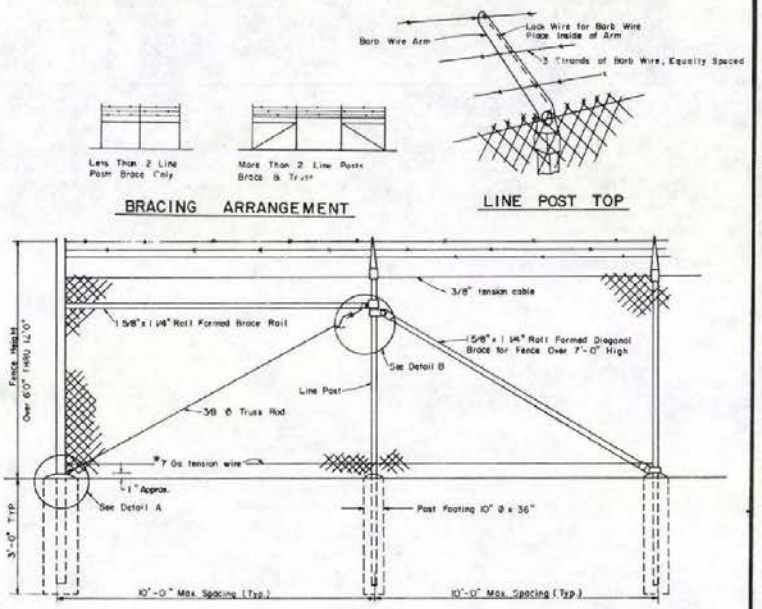
ADOPTED:

REVISION 2-11/82

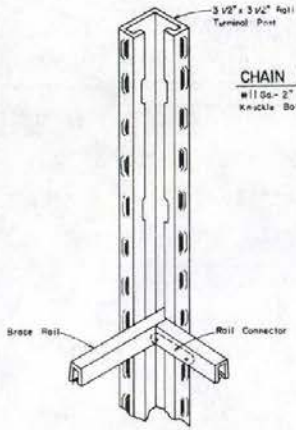
R-47



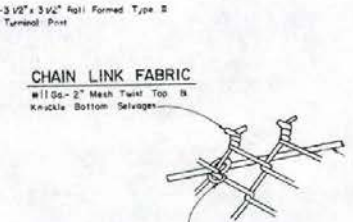
72 - INCH CHAIN LINK FENCE

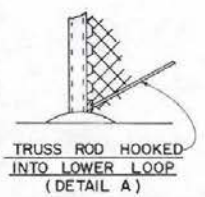


VARIABLE HEIGHT CHAIN LINK 3B FENCE

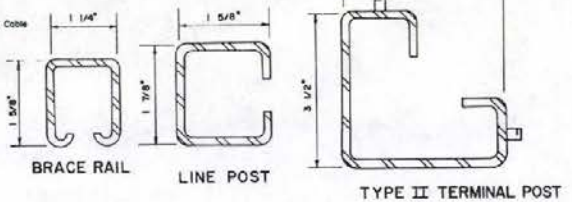


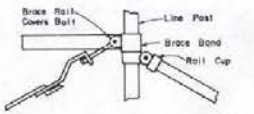
RAIL CONNECTION AT CORNER POSTS





TRUSS ROD HOOKED INTO LOWER LOOP
(DETAIL A)





BRACE & TRUSS CONNECTION AT LINE POST
(DETAIL B)

FABRIC BAND FOR LINE POST #11 GA.

GENERAL NOTES

1. FENCE POSTS AND MATERIALS SHALL CONFORM TO THE REQUIREMENTS OF STANDARD SPECIFICATIONS AND SUPPLEMENTS.
2. CHAIN LINK FENCING SHALL CONSIST OF GALVANIZED CHAIN LINK FABRIC ON STEEL POSTS (TUBULAR OR C-COLUMN).
3. (A) ALL POSTS SHALL BE SET IN CLASS A OR AA CONCRETE.
   (B) 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.
   (C) ALL FITTINGS SHALL BE HOT DIPPED GALVANIZED MALLEABLE, CAST IRON, OR PRESSED STEEL.
   (D) FABRIC SHALL BE FASTENED TO LINE POSTS WITH FABRIC BANDS SPACED APPROXIMATELY 14" APART, AND TO TOP TENSION CABLE AND BOTTOM TENSION WITH HOG RINGS OR TIE WIRES SPACED APPROXIMATELY 24" APART.
   (E) FOR TUBULAR POST AND BRACERAIL DETAILS, SEE SHEET NO. R-6.1.1.

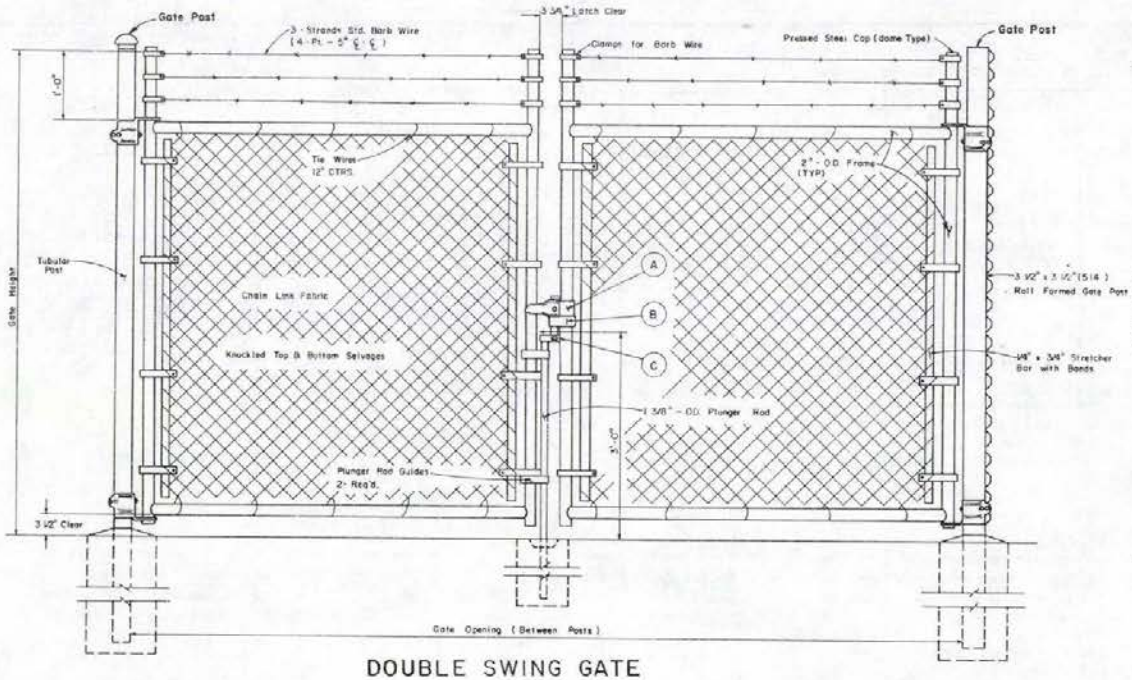
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

FENCE DETAILS
CHAIN LINK WITH C-TYPE POST

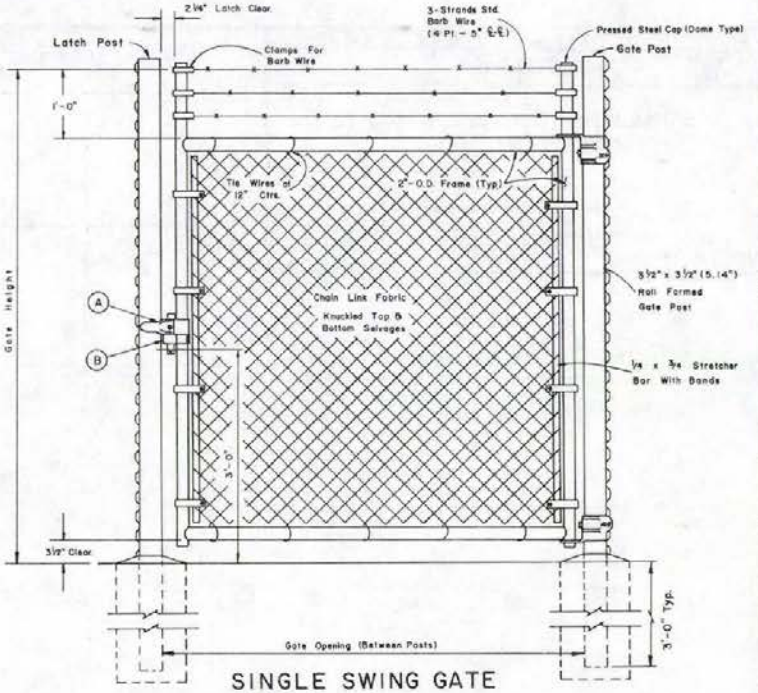
CHIEF ROAD DESIGN ENGR.

R-6.3.1	(616)
ADOPTED 3/79	REVISION 1-5/80

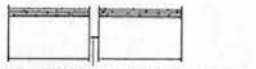
R-48



DOUBLE SWING GATE

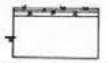


SINGLE SWING GATE

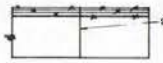


FRAME CONSTRUCTION GATES THRU 20'-0" OPENING

FRAME CONSTRUCTION GATES OVER 20'-0" OPENING

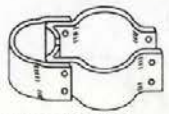


FRAME CONSTRUCTION GATES THRU 10'-0" OPENING



FRAME CONSTRUCTION GATES OVER 10'-0" OPENING

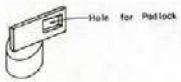
HINGE FOR ROLL FORM POST & 3"-O.D. POST



HINGE FOR 4"-O.D. & LARGER TUBULAR POSTS

(A) LOCK KEEPER

(B) LOCK KEEPER GUIDE



(C) PLUNGER ROD CAP

GATE POST

FENCE HEIGHT	GATE WIDTH	NOMINAL I.D.	WT/FT
6'-0" OR LESS	UP THRU 6'	2½"	5.79
	OVER 6' THRU 12'	4"	10.79
	OVER 12' THRU 18'	5"	14.62
	OVER 18' THRU 24' MAX	6"	18.97
OVER 6'-0"	UP THRU 6'	3"	7.58
	OVER 6' THRU 12'	5"	14.62
	OVER 12' THRU 18'	6"	18.97
	OVER 18' THRU 24' MAX	8"	28.55

NOTE: DIAMETERS AND WEIGHTS LISTED ABOVE ARE MINIMUMS. LARGER SIZES MAY BE USED ON APPROVAL OF THE ENGINEER.

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

FENCE DETAILS
SWING GATES FOR VARIABLE HEIGHT CHAIN LINK 3B FENCE

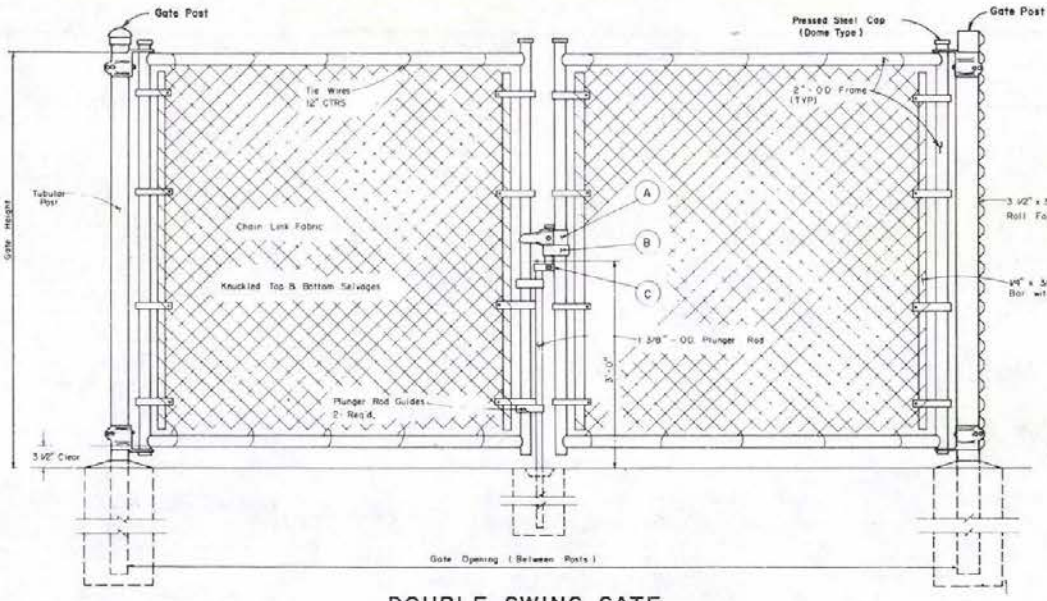
CHIEF ROAD DESIGN ENGR.

R-6.3.2 (616)

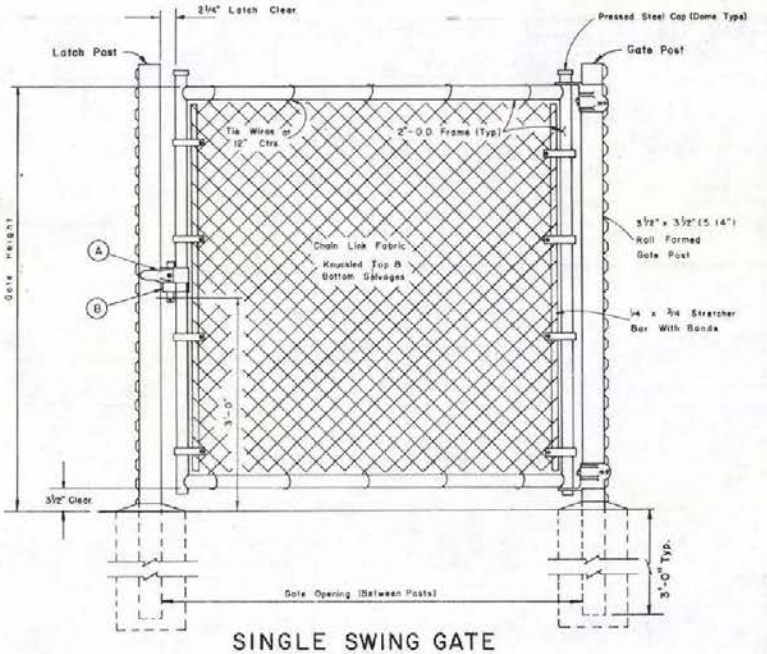
ADOPTED 8 3/79

REVISION 1-11/82

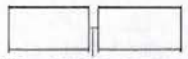
R-49



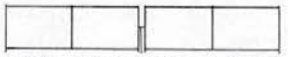
DOUBLE SWING GATE



SINGLE SWING GATE

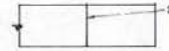


FRAME CONSTRUCTION GATES THRU 20'-0" OPENING



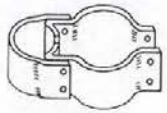
FRAME CONSTRUCTION GATES OVER 20'-0" OPENING

FRAME CONSTRUCTION GATES THRU 10'-0" OPENING

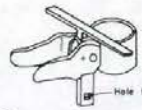


FRAME CONSTRUCTION GATES OVER 10'-0" OPENING

HINGE FOR ROLL FORM POST & 3"-O.D. POST

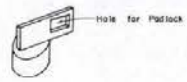


HINGE FOR 4"-O.D. & LARGER TUBULAR POSTS



(A) LOCK KEEPER

(B) LOCK KEEPER GUIDE



(C) PLUNGER ROD CAP

GATE POST

FENCE HEIGHT	GATE WIDTH	NOMINAL I.D.	WT/FT
6'-0" OR LESS	UP THRU 6'	2½"	5.79
	OVER 6' THRU 12'	4"	10.79
	OVER 12' THRU 18'	5"	14.62
	OVER 18' THRU 24' MAX	6"	18.97
OVER 6'-0"	UP THRU 6'	3"	7.58
	OVER 6' THRU 12'	5"	14.62
	OVER 12' THRU 18'	6"	18.97
	OVER 18' THRU 24' MAX	8"	28.55

NOTE: DIAMETERS AND WEIGHTS LISTED ABOVE ARE MINIMUMS. LARGER SIZES MAY BE USED ON APPROVAL OF THE ENGINEER.

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

FENCE DETAILS SWING GATES FOR 72-INCH CHAIN LINK FENCE

CHIEF ROAD DESIGN ENGR.

R-6.3.3 (616)

ADOPTED 8 3/79 REVISION 1-11/82

R-50

BILL OF MATERIALS

TIMBER

ITEM	NO. REQ'D	SIZE	LENGTH	FT. BM
WHEEL GUARDS	2	6"x6"	7'-2"	43.5
WING SLOPE	4	2"x6"	8'-0"	12.0
WING SLOPE	2	2"x6"	6'-4½"	13.8
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

GALVANIZED HARDWARE

ITEM	NO. REQ'D	SIZE	LENGTH	WT. LBS.
BOLTS	8	3/4"	12"	15
WASHERS	8	3/4"		1
WASHERS (LOCK)	4	3/4"		1/2
NAILS	50	10d		3
NAILS	72	20d		2-1/4
BOLTS	4	3/8"	1½"	1
TOTAL				22-3/4

STRUCTURAL STEEL

12' ROADBED

ITEM	NO. REQ'D	SIZE	LENGTH	WT. LBS.
I BEAMS	13	S4x7.7	13'-0"	1,301
I BEAMS	6	S8X18.4	7'-3"	805
SPACERS	72	2½"x5/16"	0'-6-13/16"	109
ANCHOR BOLTS	12	7/8"	1'-0"	13
END PLATES	2	8"x¼"	13'-0"	177
STEEL STRAPS	3	4"x¼"	7'-3"	74
TOTAL				2473

14' ROADBED

ITEM	NO. REQ'D	SIZE	LENGTH	WT. LBS.
I BEAMS	13	S4x7.7	13'-0"	1,301
I BEAMS	7	S8x18.4	7'-3"	934
SPACERS	84	2½"x5/16"	0'-6-13/16"	127
ANCHOR BOLTS	14	7/8"	1'-0"	16
END PLATES	2	8"x¼"	15'-0"	204
STEEL STRAPS	4	4"x¼"	7'-2"	99
TOTAL				2880

16' ROADBED

ITEM	NO. REQ'D	SIZE	LENGTH	WT. LBS.
I BEAMS	13	S4x7.7	13'-0"	1,702
I BEAMS	6	S8x18.4	7'-3"	1067
SPACERS	84	2½"x5/16"	0'-6-13/16"	127
ANCHOR BOLTS	14	7/8"	1'-0"	16
END PLATES	2	8"x¼"	17'-0"	231
STEEL STRAPS	4	4"x¼"	7'-2"	99
TOTAL				3240

20' ROADBED

ITEM	NO. REQ'D	SIZE	LENGTH	WT. LBS.
I BEAMS	13	S4x7.7	21'-0"	2,102
I BEAMS	9	S8x18.4	7'-3"	1201
SPACERS	108	2½"x5/16"	0'-6-13/16"	163
ANCHOR BOLTS	18	7/8"	1'-0"	18
END PLATES	2	8"x¼"	21'-0"	286
STEEL STRAPS	5	4"x¼"	7'-2"	123
TOTAL				3893

ALL ROADBED WIDTHS

ITEM	NO. REQ'D	SIZE	LENGTH	WT. LBS.
CORR. METAL PIPE	1	12"	**2'-0"	20

** PIPE LENGTH & DRAINAGE DITCH SHALL BE AS INDICATED ON THE PLANS.

SACKED SOCK AT END OF PIPE WILL NOT BE PERMITTED.

REINFORCING

12' ROADBED

	ITEM	NO. REQ'D	SIZE	LENGTH	WT. LBS.
*	HORIZONTAL BARS	12	NO. 4	12'-6"	100
	HORIZONTAL BARS	12	NO. 6	7'-0"	36
	HORIZONTAL BARS	18	NO. 4	16'-9"	201
	VERTICAL BARS	20	NO. 4	2'-9"	37
	U-BARS	26	NO. 6	12'-1"	471
	HORIZONTAL BARS	4	NO. 4	13'-2"	35
	TOTAL				900

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	16'-9"	225
	VERTICAL BARS	22	NO. 4	2'-9"	40
	U-BARS	29	NO. 6	12'-1"	526
	HORIZONTAL BARS	4	NO. 4	15'-2"	41
	TOTAL				1,009

16' ROADBED

	ITEM	NO. REQ'D	SIZE	LENGTH	WT. LBS.
*	HORIZONTAL BARS	12	NO. 4	16'-6"	132
	HORIZONTAL BARS	15	NO. 4	7'-0"	70
	HORIZONTAL BARS	18	NO. 4	20'-9"	249
	VERTICAL BARS	26	NO. 4	2'-9"	48
	U-BARS	32	NO. 6	12'-1"	580
	HORIZONTAL BARS	4	NO. 4	17'-2"	46
	TOTAL				1,125

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
	HORIZONTAL BARS	4	NO. 4	21'-2"	57
	TOTAL				1,359

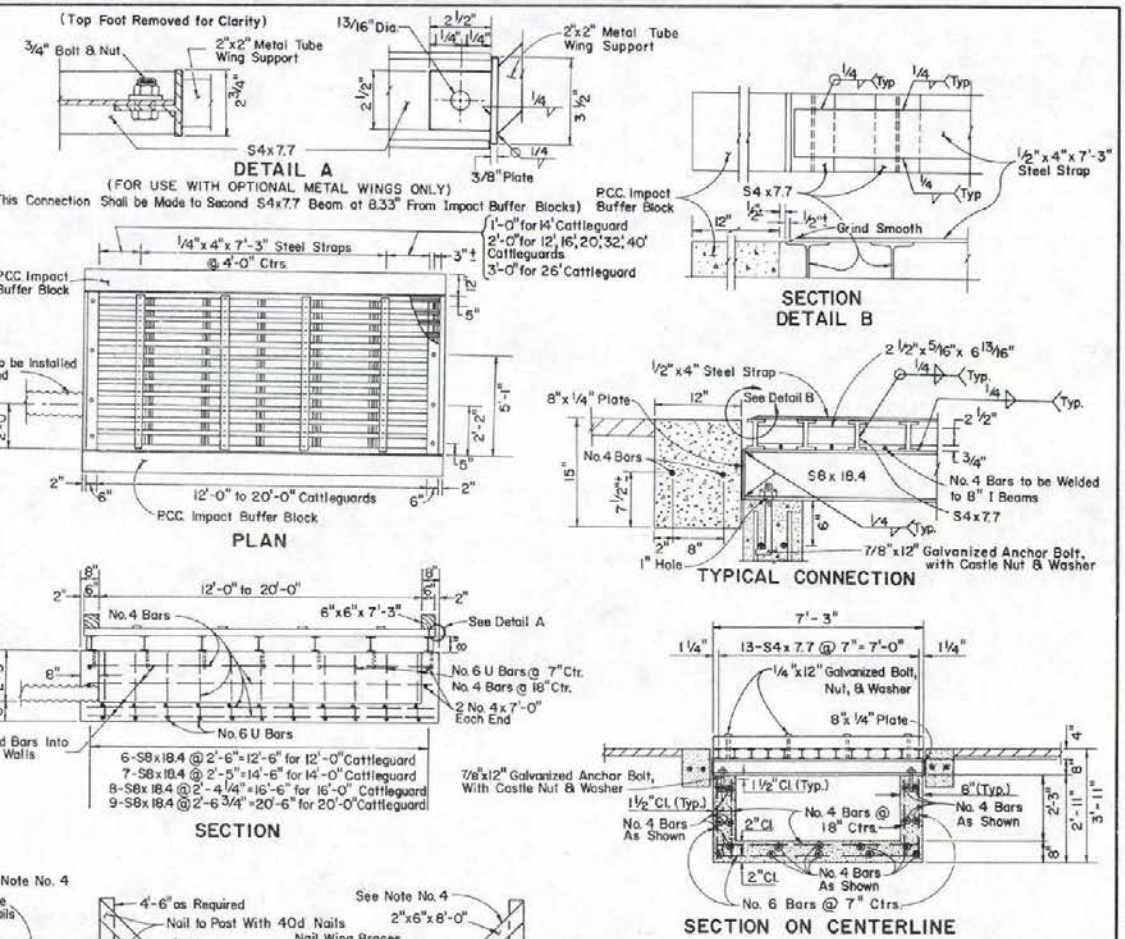
CONCRETE

12' ROADBED	6.23 CU.YD.
14' ROADBED	7.03 CU.YD.
16' ROADBED	7.79 CU.YD.
20' ROADBED	9.35 CU.YD.

* NO. 4 BARS WELDED TO 8" 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. METAL WINGS ARE OPTIONAL. FOR DETAILS, SEE DETAIL "A" THIS SHEET AND FOR ADDITIONAL DETAILS AND QUANTITIES, SEE R-7.13.
5. ALL TIMBER SHALL BE GIVEN TWO COATS OF APPROVED OUTSIDE WHITE PAINT.



NOTE: CATTLE GUARD WIDTHS SHALL INCLUDE A 2' SHY DISTANCE FROM THE EDGE OF TRAVEL WAY, EACH SIDE.

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

STEEL CATTLE GUARD

12' TO 20' ROADBED

CHIEF ROAD DESIGN ENGR.

R-7.1.1 - (617)

ADOPTED: 8/69 REVISION 6-1/80

R-51

TIMBER

ITEM	NO. REQ'D.	SIZE	LENGTH	fbm
WHEEL GUARDS	2	6" x 6"	7'-3"	43.5
WING SLOPE	4	2" x 6"	8'-0"	32.0
WING SLOPE	2	2" x 6"	6'-4 1/2"	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 2"	2'-0"	1.3

GALVANIZED HARDWARE

ITEM	NO. REQ'D.	SIZE	LENGTH	WT. LBS.
BOLTS	8	3/4"	12"	15
WASHERS	8	3/4"		6
NAILS	50	40d		3
NAILS	72	20d		2 1/4
TOTAL				26 1/4

CONCRETE

26' ROADBED	9.36 CU. YD.
32' ROADBED	11.23 CU. YD.
40' ROADBED	13.74 CU. YD.

STRUCTURAL STEEL
26' ROADBED

ITEM	NO. REQ'D.	SIZE	LENGTH	WT. LBS.
I BEAMS	26	S4 x 7.7	13'-5 3/4"	2699
I BEAMS	12	S8x18.4	7'-3"	1331
SPACERS	144	2 1/2" x 5/16"	0'-6 13/16"	212
ANCHOR BOLTS	24	7/8"	1'-0"	23
END PLATES	4	7" x 1/4"	13'-6"	320
TOTAL				4590

32' ROADBED

ITEM	NO. REQ'D.	SIZE	LENGTH	WT. LBS.
I BEAMS	26	S4 x 7.7	16'-5 3/4"	3299
I BEAMS	14	S8x18.4	7'-3"	1553
SPACERS	160	2 1/2" x 5/16"	0'-6 13/16"	254
ANCHOR BOLTS	28	7/8"	1'-0"	27
END PLATES	4	7" x 1/4"	16'-6"	392
TOTAL				5525

MISCELLANEOUS

ITEM	LENGTH
12" C.M.P.	** 2' LENGTH

** Pipe Length & Drainage Ditch Shall be as Indicated on the Plans. Sacked Rock at End Pipe Will Not be Permitted.

40' ROADBED

ITEM	NO. REQ'D.	SIZE	LENGTH	WT. LBS.
I BEAMS	26	S4 x 7.7	20'-5 3/4"	4100
I BEAMS	18	S8x18.4	7'-3"	1997
SPACERS	216	2 1/2" x 5/16"	0'-6 13/16"	326
ANCHOR BOLTS	36	7/8"	1'-0"	35
END PLATES	4	7" x 1/4"	20'-6"	487
TOTAL				6945

REINFORCING
26' ROADBED

ITEM	NO. REQ'D.	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

*NO. 4 BARS WELDED TO 8" I BEAMS

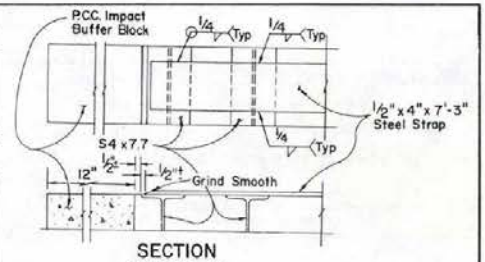
32' ROADBED

ITEM	NO. REQ'D.	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

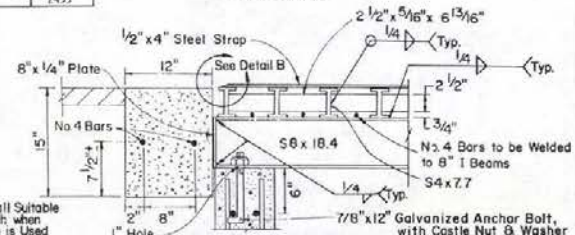
40' ROADBED

ITEM	NO. REQ'D.	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

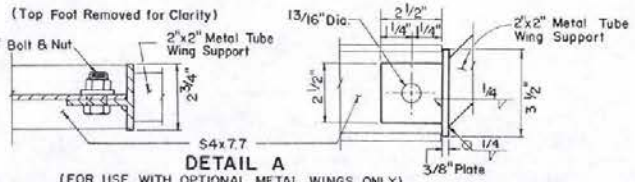
BILL OF MATERIALS



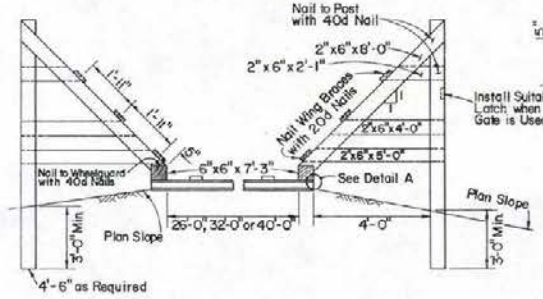
SECTION DETAIL B



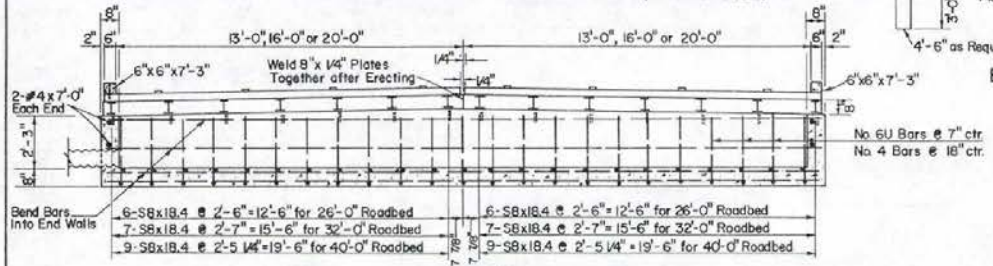
TYPICAL CONNECTION



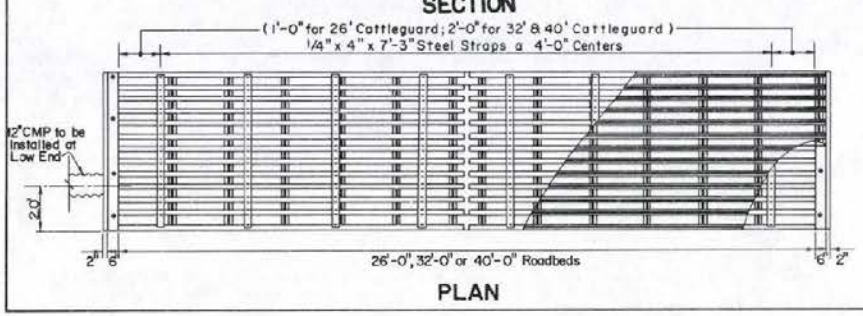
DETAIL A
(FOR USE WITH OPTIONAL METAL WINGS ONLY)
(This Connection Shall be Made to Second S4x7.7 Beam at 8.33" From Impact Buffer Blocks)



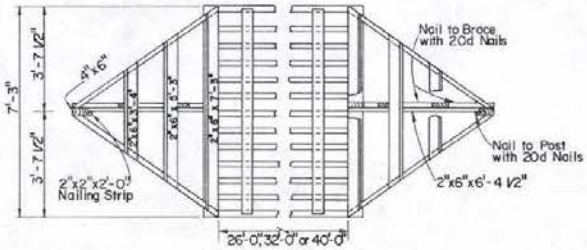
ELEVATION OF WINGS



SECTION

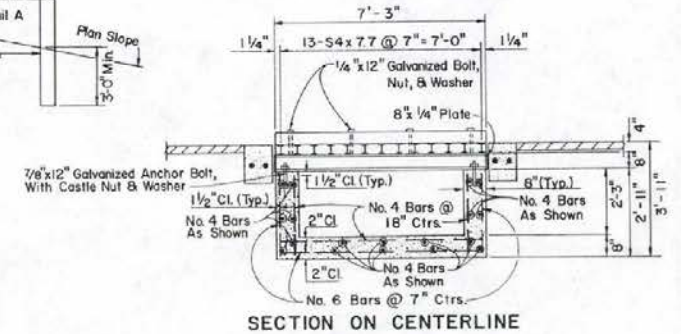


PLAN



PLAN OF WINGS

NOTE: CATTLE GUARD WIDTHS SHALL INCLUDE A 2' SHY DISTANCE FROM THE EDGE OF THE TRAVEL WAY, EACH SIDE



SECTION ON CENTERLINE

GENERAL NOTES

1. All Concrete to be Class A or AA
2. Standard Metal or Timber Gate 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.

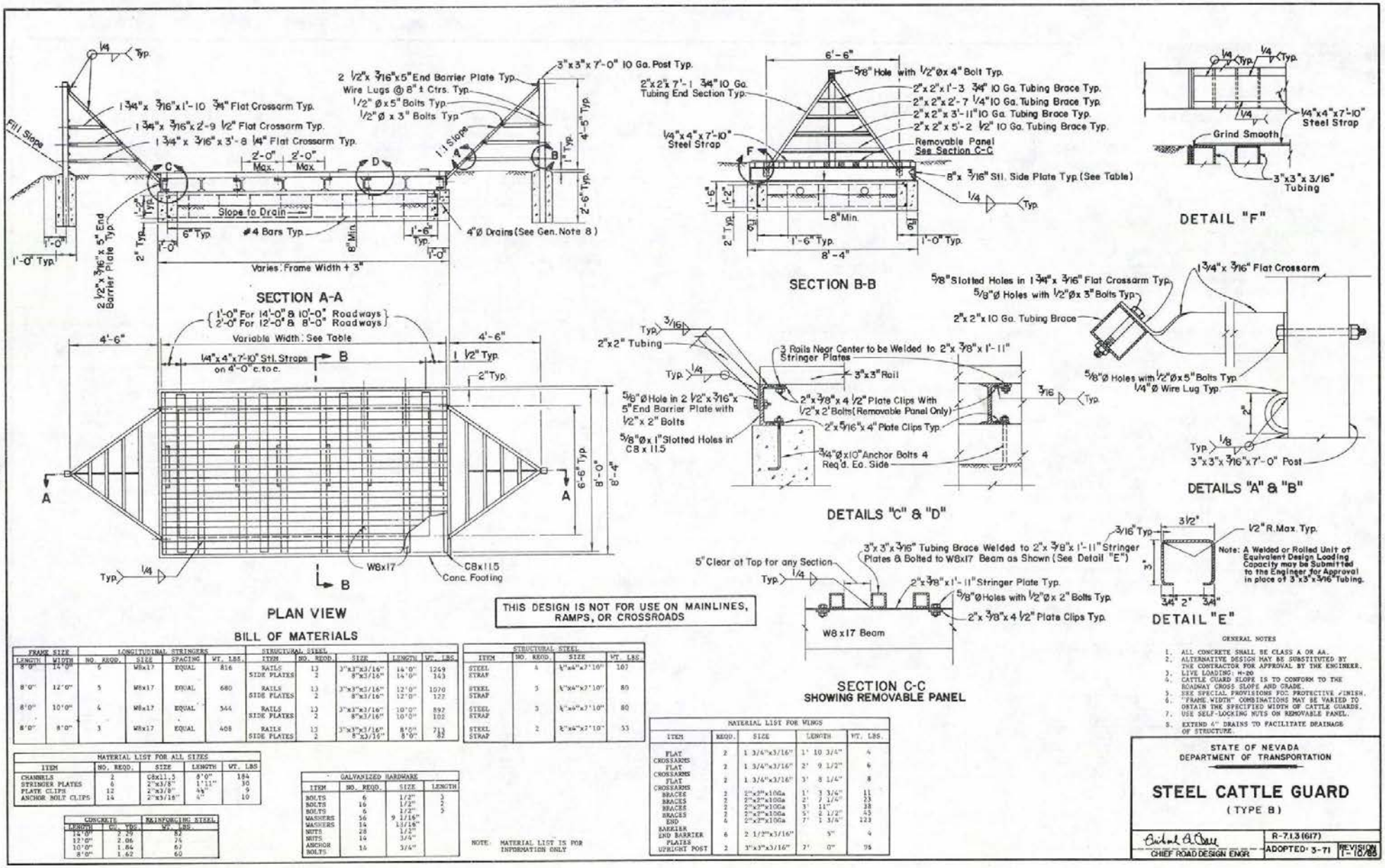
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

STEEL CATTLE GUARD
(26' To 40' ROADBED)

CHIEF ROAD DESIGN ENGR.

R-71.2-(617)
ADOPTED: 8/69
REVISED: 4-1/88

R-52



THIS DESIGN IS NOT FOR USE ON MAINLINES, RAMPS, OR CROSSROADS

BILL OF MATERIALS

FRAME SIZE		LONGITUDINAL STRINGERS				STRUCTURAL STEEL				
LENGTH	WIDTH	NO. REQD.	SIZE	SPACING	WT. LBS.	ITEM	NO. REQD.	SIZE	LENGTH	WT. LBS.
8'0"	14'0"	6	W8x17	EQUAL	816	RAILS	13	3"x3"x3/16"	14'0"	1269
						SIDE PLATES	2	8"x3/16"	14'0"	143
8'0"	12'0"	5	W8x17	EQUAL	680	RAILS	13	3"x3"x3/16"	12'0"	1070
						SIDE PLATES	2	8"x3/16"	12'0"	122
8'0"	10'0"	4	W8x17	EQUAL	544	RAILS	13	3"x3"x3/16"	10'0"	892
						SIDE PLATES	2	8"x3/16"	10'0"	102
8'0"	8'0"	3	W8x17	EQUAL	408	RAILS	13	3"x3"x3/16"	8'0"	713
						SIDE PLATES	2	8"x3/16"	8'0"	82

STRUCTURAL STEEL			
ITEM	NO. REQD.	SIZE	WT. LBS.
STEEL STRAP	4	¼"x4"x7'10"	107
STEEL STRAP	3	¼"x4"x7'10"	80
STEEL STRAP	3	¼"x6"x7'10"	80
STEEL STRAP	2	¼"x6"x7'10"	53

MATERIAL LIST FOR ALL SIZES				
ITEM	NO. REQD.	SIZE	LENGTH	WT. LBS
CHANNELS	2	C8x11.5	8'0"	184
STRINGER PLATES	6	2"x3/8"	1'11"	30
PLATE CLIPS	12	2"x3/8"	¾"	9
ANCHOR BOLT CLIPS	14	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

GALVANIZED HARDWARE			
ITEM	NO. REQD.	SIZE	LENGTH
BOLTS	6	1/2"	3
BOLTS	16	1/2"	2
BOLTS	6	1/2"	5
WASHERS	56	9 1/16"	
WASHERS	14	13/16"	
NUTS	28	1/2"	
NUTS	14	3/4"	
ANCHOR BOLTS	14	3/4"	

NOTE: MATERIAL LIST IS FOR INFORMATION ONLY

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' 8 1/4"	8
BRACES	2	2"x2"x10Ga	1' 3 3/4"	11
BRACES	2	2"x2"x10Ga	2' 7 1/4"	23
BRACES	2	2"x2"x10Ga	3' 11"	38
BRACES	2	2"x2"x10Ga	5' 2 1/2"	45
END BARRIER PLATES	6	2"x2"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

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: M-20
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.
7. USE SELF-LOCKING NUTS ON REMOVABLE PANEL.
8. EXTEND 4" DRAINS TO FACILITATE DRAINAGE OF STRUCTURE.

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

STEEL CATTLE GUARD
(TYPE B)

CHIEF ROAD DESIGN ENGR

R-7.1.3 (617)
ADOPTED: 3-71
REVISION 1-10/85

R-53

BILL OF MATERIALS

TIMBER

ITEM	Nº REQ'D.	SIZE	LENGTH	B.F.T.
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

GALVANIZED 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	40d		2½
		TOTAL		26¼

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

ITEM	Nº REQ'D.	SIZE	LENGTH	WT. LBS.
BEAMS	5	S7x15.3	7'-3"	554.6
STRUCTURAL TUBING	13	4"x2"x¼"	9'-11½"	1139.3
SPACER PLATES	60	2½"x⅜"	0'-5"	67.0
ANCHOR BOLTS	10	⅝"	0'-9"	9.0
STEEL STRAPS	3	4"x ¼"	7'-1"	72.3
END PLATES	2	7"x ¼"	9'-11½"	118.5
PIPE SLEEVES	8	2"	0'-6"	14.6
CONNECTION PLATES	As Req'd.	9"x4"x¼"		
CONNECTION BOLTS	As Req'd.	1"	15"	

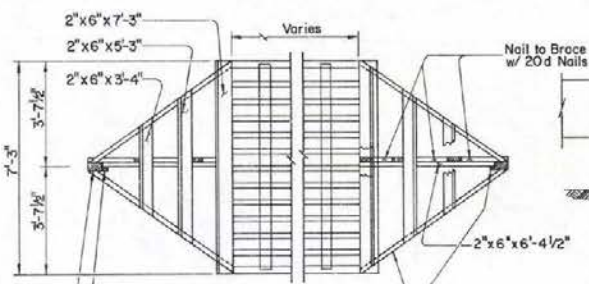
REINFORCING STEEL (1-10'-0" COMPONENT)

ITEM	Nº REQ'D.	SIZE	LENGTH	WT. LBS.
*HORIZONTAL BARS	12	Nº 4	9'-6"	76
HORIZONTAL BARS	18	Nº 4	9'-9"	117
HORIZONTAL BARS	18	Nº 4	7'-0"	84
VERTICAL BARS	44	Nº 4	1'-3"	37
LIFTING LUGS	4	Nº 4	2'-9"	7
U BARS	18	Nº 6	9'-6"	259
		TOTAL		580

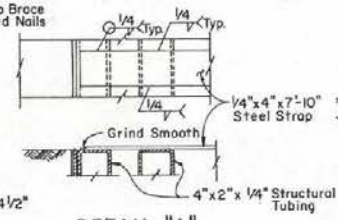
CONCRETE

1 - 10'-0" COMPONENT	1.94 cu. yd.

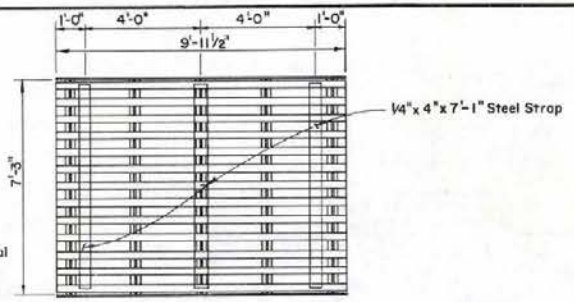
*-Nº 4 BARS WELDED TO I BEAMS.



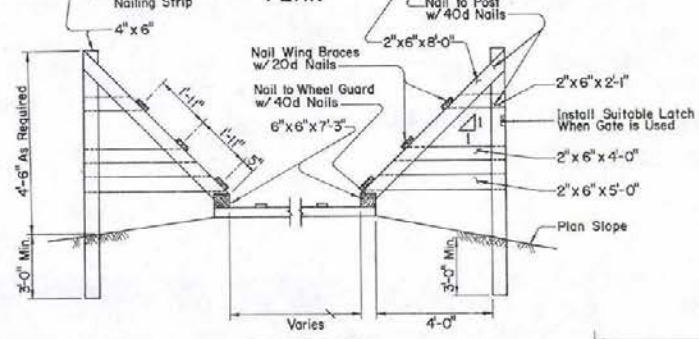
PLAN



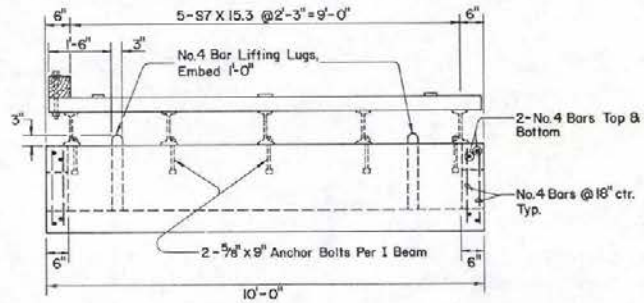
DETAIL "A"



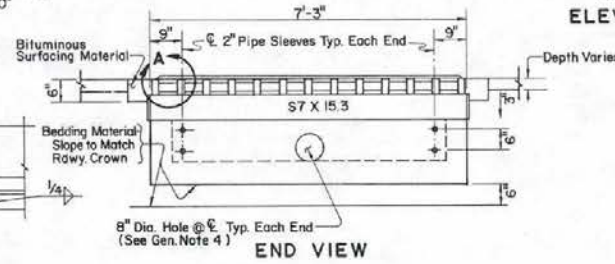
PLAN



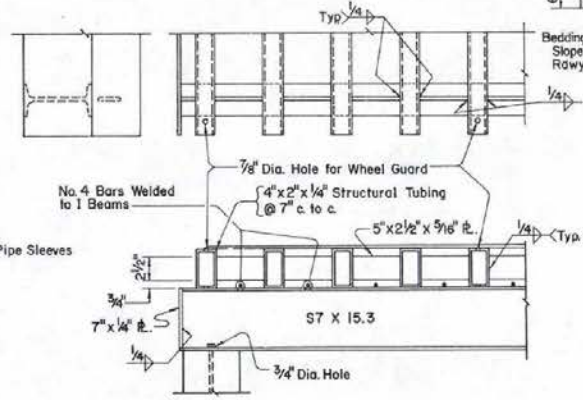
ELEVATION
TIMBER WINGS



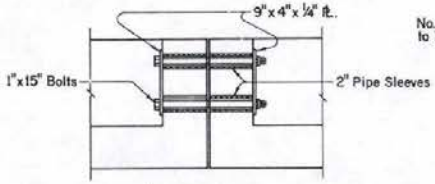
ELEVATION



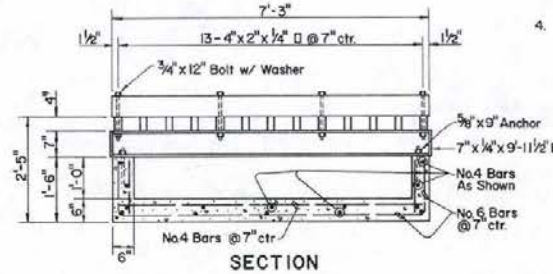
END VIEW



TYPICAL CONNECTION



CONNECTION DETAIL



SECTION

THIS DESIGN IS NOT FOR USE ON MAINLINES, RAMPS, OR CROSSROADS

GENERAL NOTES

1. All Concrete To Be Class DA.
2. All Connections To Be Welded.
3. When 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.
4. Extend Drain Pipes To Facilitate Drainage Of Structure.

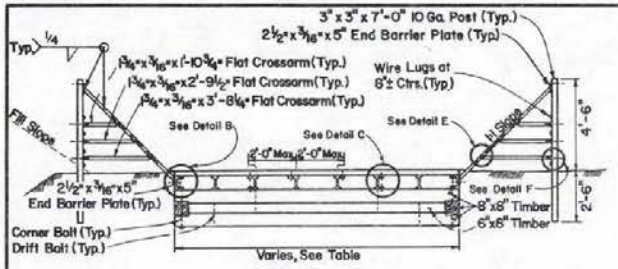
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

STEEL CATTLE GUARD (TYPE C)

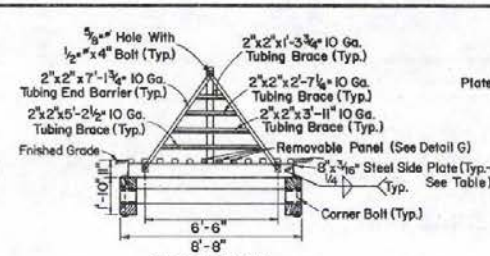
CHIEF ROAD DESIGN ENGR.

R-7.1.4 - (illegible)
ADOPTED · 10/79

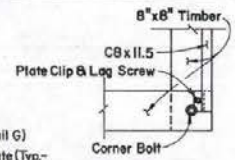
R-54



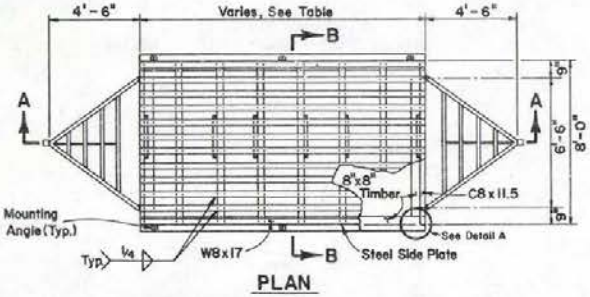
SECTION A-A



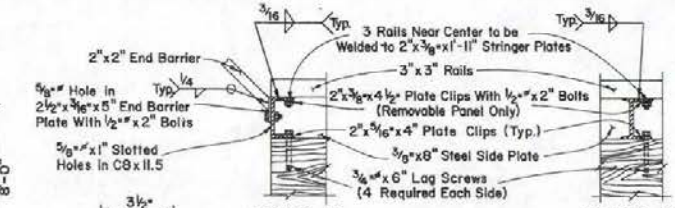
SECTION B-B



DETAIL A

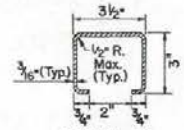


PLAN



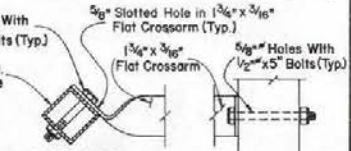
DETAIL B

DETAIL C

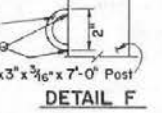


DETAIL D

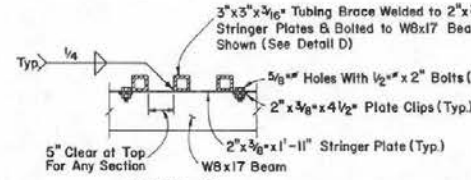
NOTE: A WELDED OR ROLLED UNIT OF EQUIVALENT DESIGN LOADING CAPACITY, MAY BE SUBMITTED TO THE ENGINEER FOR APPROVAL IN PLACE OF 3" X 3" X 3/16" TUBING.



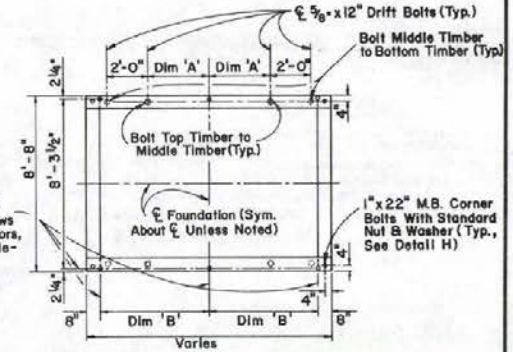
DETAIL E



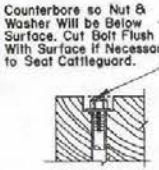
DETAIL F



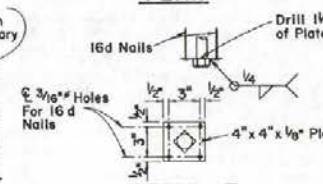
DETAIL G



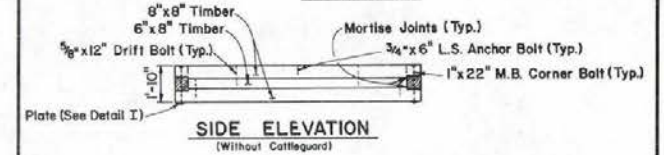
PLAN



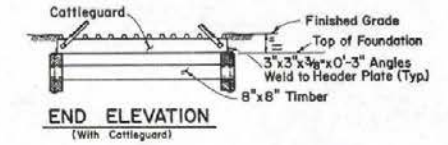
DETAIL H



DETAIL I



SIDE ELEVATION
(Without Cattleguard)



END ELEVATION
(With Cattleguard)

MATERIAL LIST FOR WINGS				
ITEM	REQD.	SIZE	LENGTH	WT. LBS.
FLAT CROSSARMS	2	1 3/4" X 3/16"	1' 10 3/4"	4
FLAT CROSSARMS	2	1 3/4" X 3/16"	2' 9 1/2"	6
FLAT CROSSARMS	2	1 3/4" X 3/16"	3' 3 1/4"	8
BRACES	2	2" X 2" X 10GA	1' 3 3/4"	11
BRACES	2	2" X 2" X 10GA	2' 7 1/4"	23
BRACES	2	2" X 2" X 10GA	3' 11"	38
BRACES	2	2" X 2" X 10GA	5' 2 1/2"	46
END BARRIER	4	2" X 2" X 10GA	7' 1 3/4"	125
END BARRIER PLATES	6	2 1/2" X 3/16"	5"	4
UPRIGHT POST	2	3" X 3" X 3/16"	7' 0"	96

NOTE: MATERIAL LIST IS FOR INFORMATION ONLY.

THIS DESIGN IS NOT FOR USE ON MAINLINES, RAMPS, OR CROSSROADS

GALVANIZED HARDWARE			
ITEM	NO. REQ'D.	SIZE	LENGTH
BOLTS	6	1/2"	3"
BOLTS	6	1/2"	5"
BOLTS	16	1/2"	2"
WASHERS	56	9/16"	
WASHERS	14	13/16"	
NUTS	28	1/2"	
NUTS	14	3/4"	
LAG SCREWS	14	3/4"	6"

BILL OF MATERIALS										
FRAME SIZE		LONGITUDINAL STRINGERS				STRUCTURAL STEEL				
LENGTH	WIDTH	NO.REQD.	SIZE	SPACING	WT. LBS.	ITEM	NO.REQD.	SIZE	LENGTH	WT. LBS.
8' 0"	14' 0"	6	W8x17	EQUAL	816	RAILS	13	3" x 3" x 3/16"	14' 0"	1249
						SIDE PLATES	2	8" x 3/16"	14' 0"	143
8' 0"	12' 0"	5	W8x17	EQUAL	680	RAILS	13	3" x 3" x 3/16"	12' 0"	1070
						SIDE PLATES	2	8" x 3/16"	12' 0"	122
8' 0"	10' 0"	4	W8x17	EQUAL	544	RAILS	13	3" x 3" x 3/16"	10' 0"	892
						SIDE PLATES	2	8" x 3/16"	10' 0"	102
8' 0"	8' 0"	3	W8x17	EQUAL	408	RAILS	13	3" x 3" x 3/16"	8' 0"	713
						SIDE PLATES	2	8" x 3/16"	8' 0"	82

MATERIAL LIST FOR ALL SIZES				
ITEM	NO. REQ'D.	SIZE	LENGTH	WT. LBS.
CHANNELS	2	C8x11.5	8' 0"	184
STRINGER PLATES	6	2" x 3/8"	1' 11"	30
PLATE CLIPS	12	2" x 3/8"	4-1/2"	9
ANCHOR BOLT CLIPS	14	2" x 5/16"	4"	10

GENERAL NOTES

1. ALTERNATE DESIGN MAY BE SUBSTITUTED BY THE CONTRACTOR FOR APPROVAL BY THE ENGINEER.
2. LIVE LOADING: H-20
3. CATTLE GUARD IS TO BE PLACED ON LEVEL GRADE ACROSS ROADWAY - ROADWAY CROSS SLOPE IS TO TRANSITION FROM NORMAL SECTION TO LEVEL SECTION 25' BACK ON LINE AND 25' AHEAD ON LINE FROM EDGE OF CATTLE GUARD.
4. "FRAME WIDTH" COMBINATIONS MAY BE VARIED TO OBTAIN THE SPECIFIED WIDTH OF CATTLE GUARDS.
5. USE SELF-LOCKING NUTS ON REMOVABLE PANEL.

GENERAL NOTES

1. USE SINGLE LAYER FOUNDATION UNIT FOR EACH CATTLE GUARD FRAME.
2. TIMBERS USED IN FOUNDATIONS SHALL BE TREATED.

FRAME SIZE		DIM.	DIM.
LENGTH	WIDTH	'A'	'B'
8'8"	14'0"	4'0"	6'4"
8'8"	12'0"	3'0"	5'4"
8'8"	10'0"	2'0"	4'4"
8'8"	8'0"	1'0"	3'4"

TIMBER FOUNDATION DETAILS

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

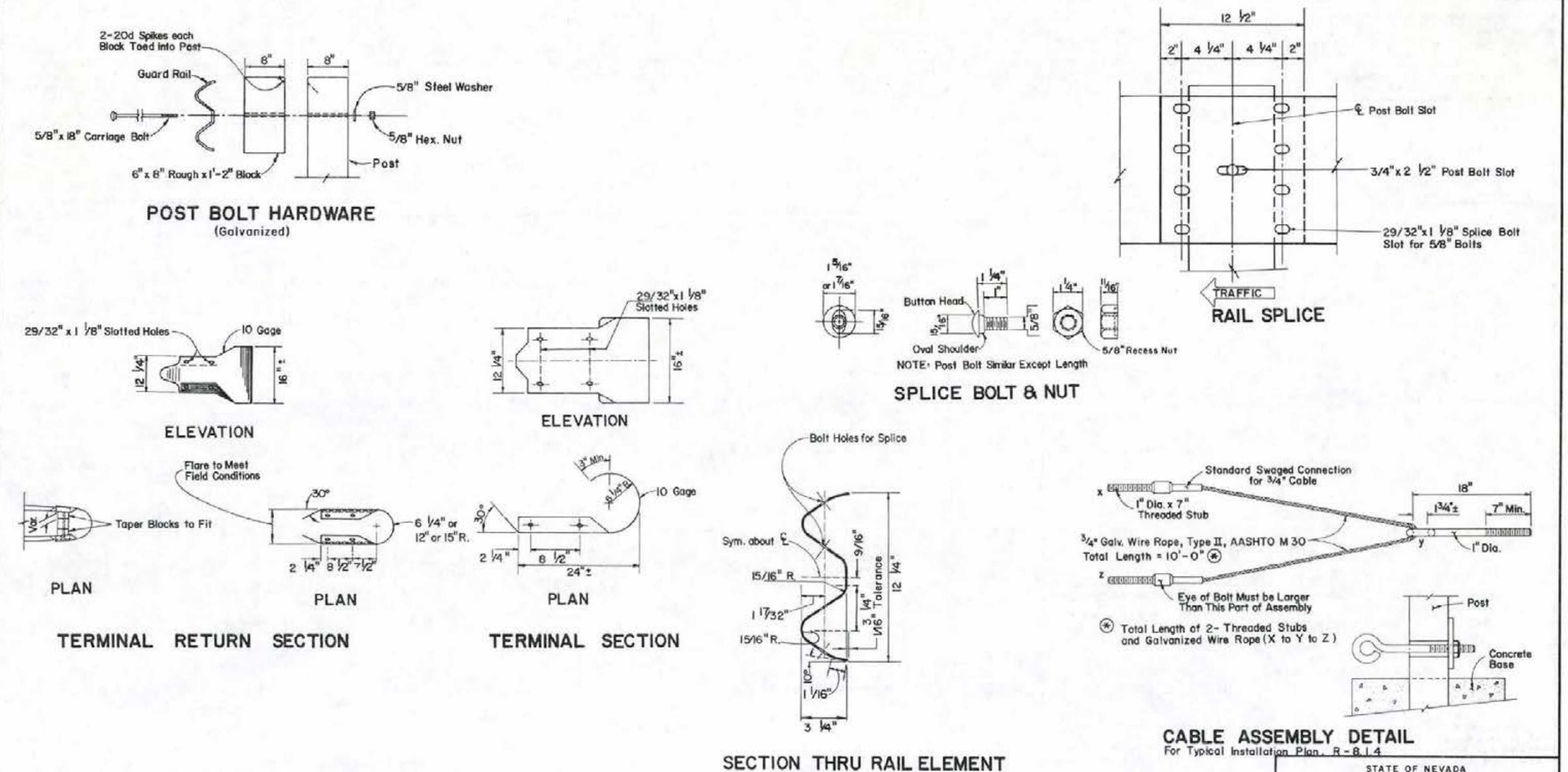
STEEL CATTLE GUARD TIMBER FOUNDATION

CHIEF ROAD DESIGN ENGR.

R-7.1.5 (617)
ADOPTED: 8 7/77 REVISION 1- 5/80

R-53

STEEL CATTLE GUARD DETAILS



GUIDEPOST PLACEMENT ALONG GUARDRAIL

SPACING SHALL BE AS SHOWN ON SHEET R-9.1.1 EXCEPT:

(a) 30 FEET ON TANGENTS AND ON CURVES OF 300 FEET RADIUS OR GREATER.

(b) ON CURVES OF LESSER RADII, THE PLACEMENT SHALL BE AS INDICATED ON TABLE 1, SHEET R-9.1.1.

(c) GUIDE POSTS SHALL BE OMITTED ON THE FLARED SECTIONS OF GUARDRAIL.

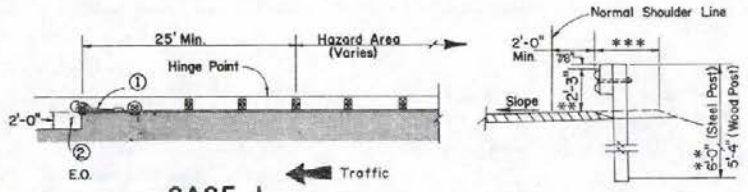
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

GALVANIZED GUARDRAIL ELEMENTS

CHIEF ROAD DESIGN ENGR.

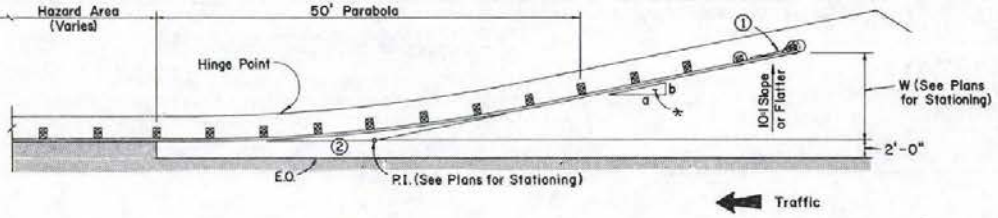
R-8.1.1-

ADOPTED:

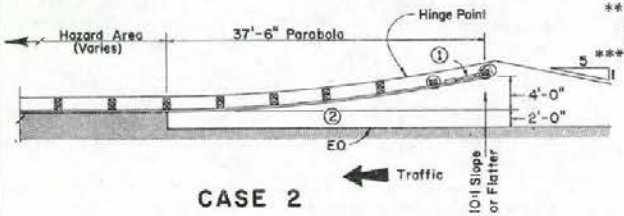


CASE 1

SUPERELEVATED INSTALLATION

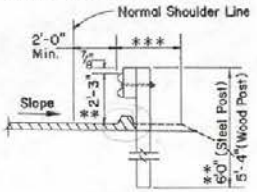


CASE 4
(FLARED APPROACH)



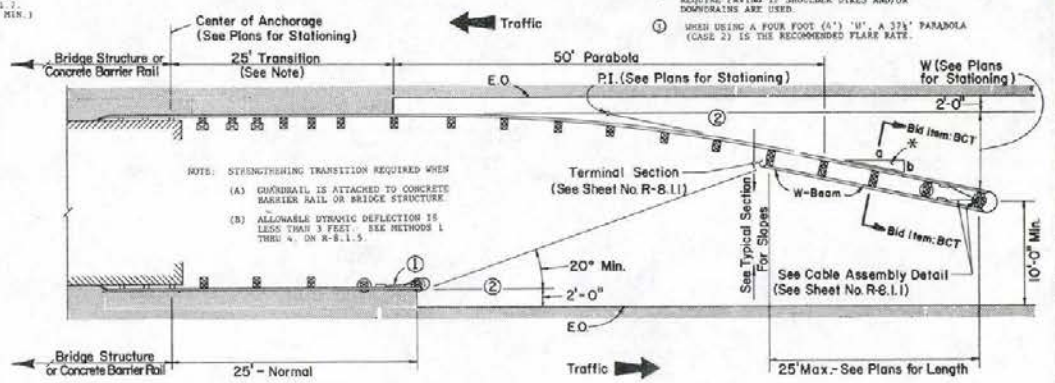
CASE 2

**GUARDRAIL HEIGHTS ON STAGE CONSTRUCTION PROJECTS SHALL BE GOVERNED BY FINAL SURFACING ELEVATION. THE SECTIONS SHOWN DEPICT W-BEAM INSTALLATIONS. IF TRIPLE CORRUGATION GUARDRAILS ARE SPECIFIED, USE POST AND BLOCK DIMENSIONS SHOWN ON SHEET R-8.1.7.
***SEE PROJECT TYPICAL SECTIONS FOR WIDENING (3' MIN.)



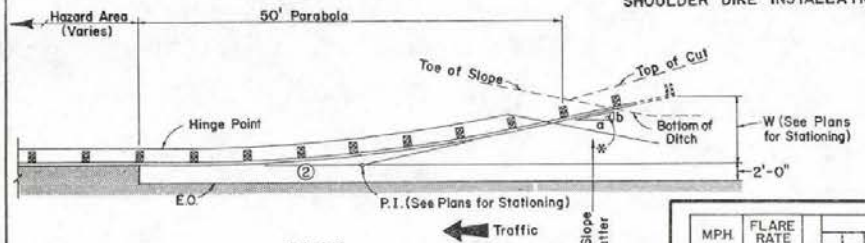
SHOULDER DIKE INSTALLATION

① FOR DETAILS OF BREAKAWAY CABLE TERMINAL, SEE STANDARD SHEET R-8.1.6.
② AREAS IN THE GUARDRAIL WIDTH TRANSITIONS MAY REQUIRE PAVING IF SHOULDER DIKES AND/OR DOWNDRAINS ARE USED.
③ WHEN USING A FOUR FOOT (4') 'W', A 37½' PARABOLA (CASE 2) IS THE RECOMMENDED FLARE RATE.

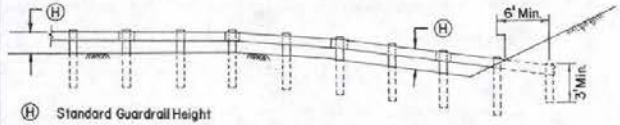


NOTE: STRENGTHENING TRANSITION REQUIRED WHEN
(A) GUARDRAIL IS ATTACHED TO CONCRETE BARRIER RAIL OR BRIDGE STRUCTURE.
(B) ALLOWABLE DYNAMIC DEFLECTION IS LESS THAN 3 FEET. SEE METHODS 1 THRU 4. ON R-8.1.5.

CASE 5



PLAN

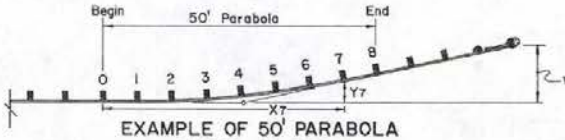


ELEVATION

CASE 3
(BURIAL IN BACKSLOPE)

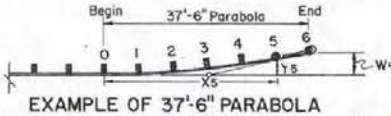
MPH.	FLARE RATE a:b		POST NUMBER 1	2	3	4	5	6	7	8
		X	6.25'	12.50'	18.75'	25.00'	31.25'	37.50'	43.75'	50.00'
70	15:1	Y	.03'	.10'	.23'	.42'	.65'	.94'	1.28'	1.67'
60	13:1	Y	.03'	.12'	.27'	.48'	.75'	1.08'	1.47'	1.92'
50	11:1	Y	.04'	.14'	.32'	.57'	.89'	1.28'	1.74'	2.27'
40	9:1	Y	.04'	.17'	.39'	.69'	1.09'	1.56'	2.13'	2.78'

NOTE: X AND Y DIMENSIONS ARE TO THE FACE OF THE GUARDRAIL.



EXAMPLE OF 50' PARABOLA
CASE 3, 4 & 5

	POST NUMBER 1	2	3	4	5	6
X	6.25'	12.50'	18.75'	25.00'	31.25'	37.50'
Y	.11'	.44'	1.00'	1.78'	2.78'	4.00'



EXAMPLE OF 37'-6" PARABOLA
CASE 2

* FLARE RATES

OPERATING SPEED	FLARE RATE
--	a:b
70	15:1 Min.
60	13:1
50	11:1
40	9:1

LEGEND
PAVED AREAS

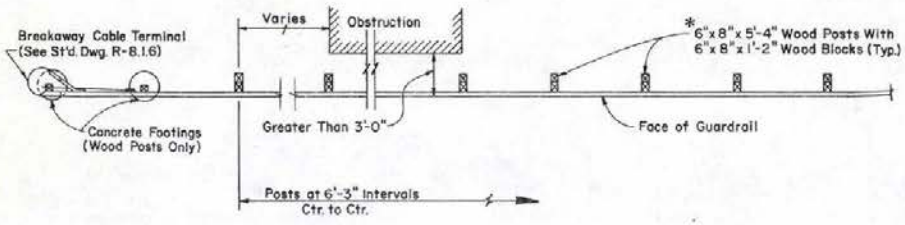
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

TYPICAL INSTALLATIONS GUARDRAIL FLARES

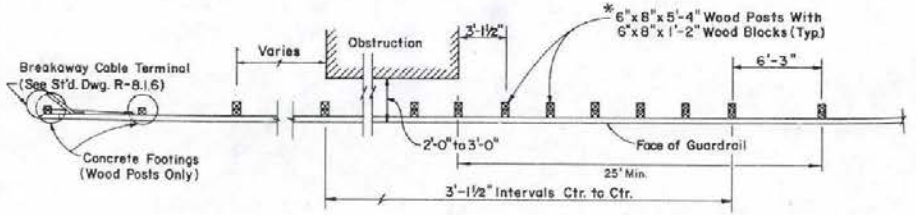
Kenneth L. Hill
CHIEF ROAD DESIGN ENGR.

R-8.1.4 (GR)
ADOPTED 7/82
REVISED

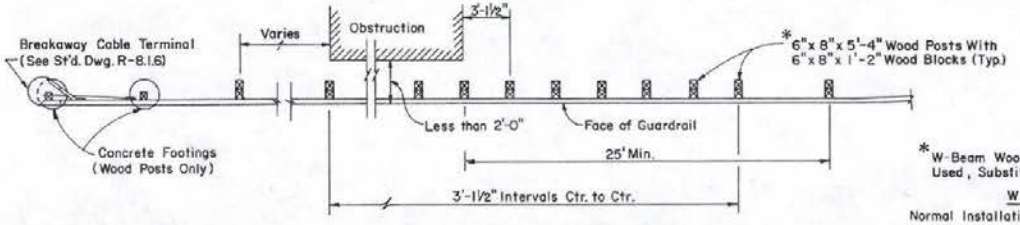
R-57



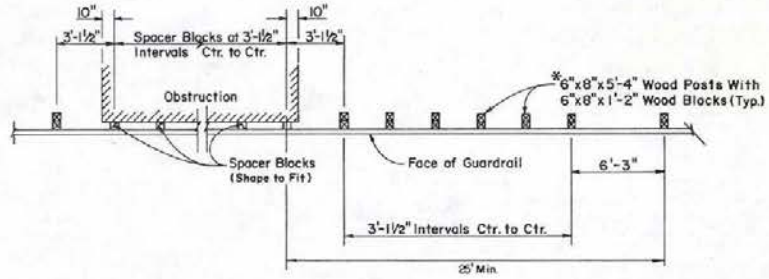
METHOD 1



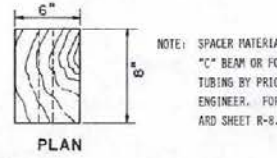
METHOD 2



METHOD 3

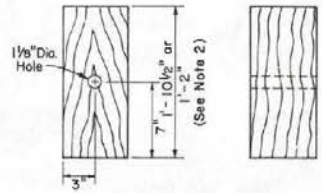


METHOD 4



PLAN

NOTE: SPACER MATERIAL MAY BE "I" BEAM, "C" BEAM OR FORMED STRUCTURAL TUBING BY PRIOR APPROVAL OF THE ENGINEER. FOR DETAILS SEE STANDARD SHEET R-8.2.2.



FRONT SIDE

NOTES:
1) When Slope Stability Compromises the Integrity of the Posts - The Posts Shall be Lengthened As Required.
2) Use of Triple Corrugated Guardrail Requires 1'-10½" Length Block.

SPACER BLOCK DETAIL

*W-Beam Wood Posts are Shown. When Triple Corrugation Guardrail is Used, Substitute Appropriate Posts and Blocks Listed Below.

W-BEAM GUARDRAIL			
Normal Installation	Acceptable Alternates		
Post : 6"x8"x5'-4" Wood	W6x8.5 (or 9.0) x 6'-0" Steel	or	4 3/8"x5 7/8"x 3/16"x 6'-0" C Steel
Block : 6"x8"x 1'-2" Wood	W6x8.5 (or 9.0) x 1'-2" Steel		4 3/8"x5 7/8"x 3/16"x 1'-2" C Steel
TRIPLE CORRUGATED GUARDRAIL			
Post : 6"x8"x6'-0" Wood	W6x8.5 (or 9.0) x 6'-8" Steel	or	4 3/8" x5 7/8"x 3/16"x 6'-8" C Steel
Block: 6"x8"x1'-10½" Wood	W6x8.5 (or 9.0) x 1'-9½" Steel		4 3/8" x5 7/8"x 3/16"x 1'-9½" C Steel

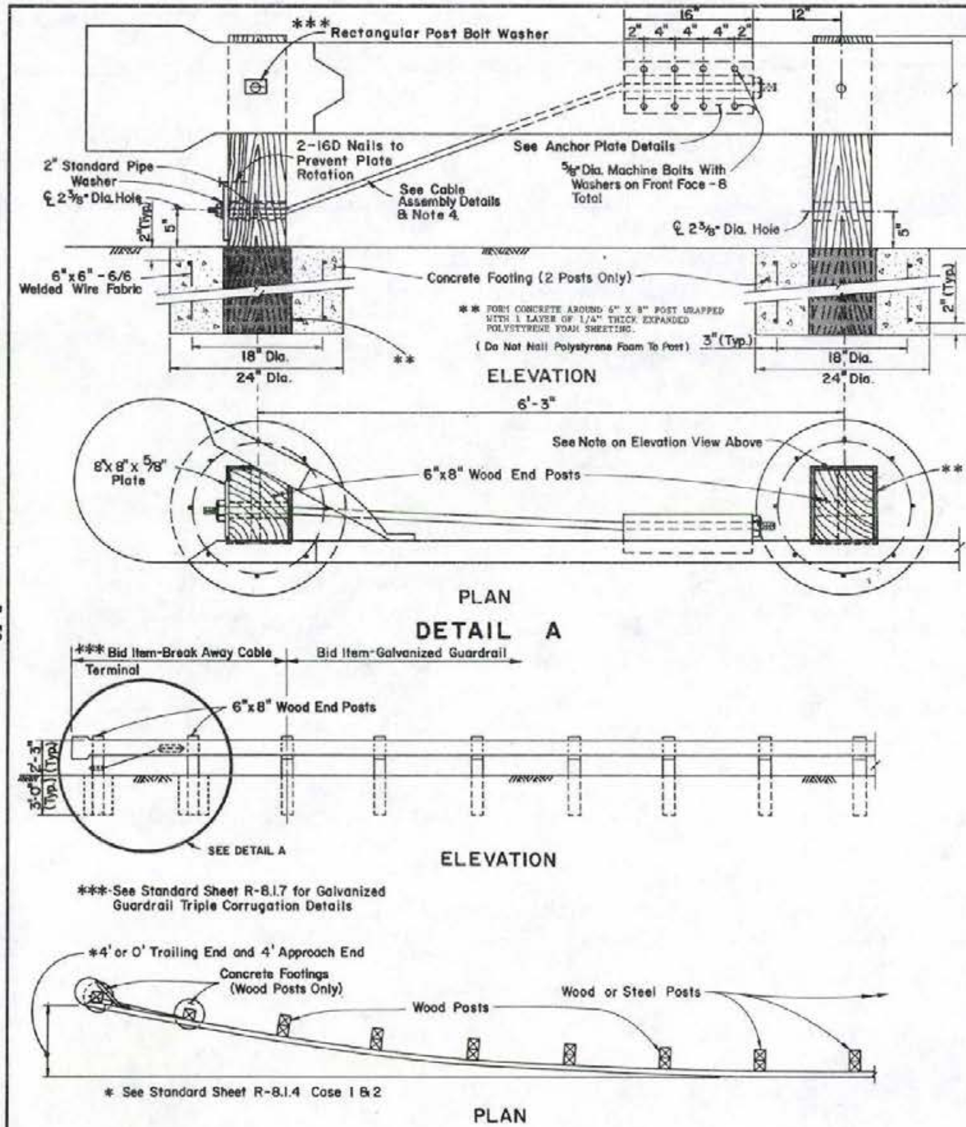
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

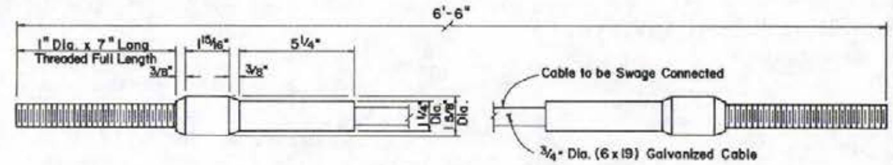
TYPICAL GUARDRAIL-TRANSITION INSTALLATIONS

CHIEF ROAD DESIGN ENGR.

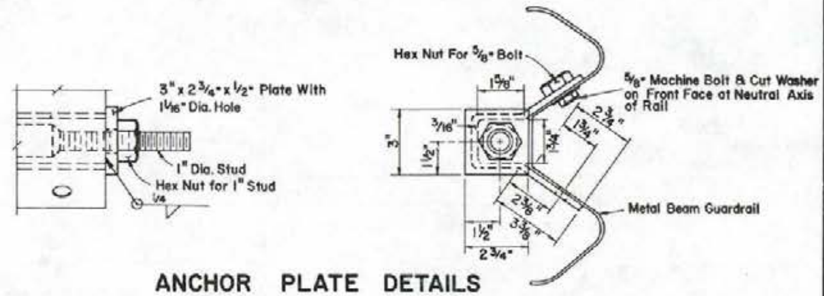
R-8.1.5 (6/81)
ADOPTED: 6/81
REVISED

R-58

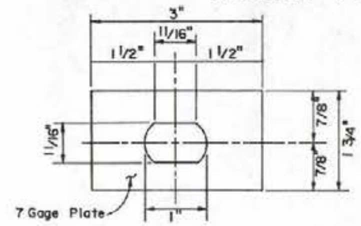




CABLE ASSEMBLY DETAILS

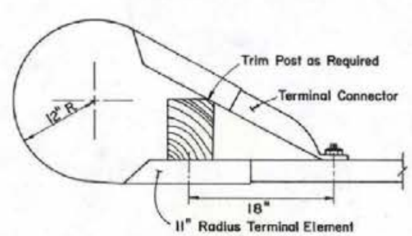


ANCHOR PLATE DETAILS



RECTANGULAR POST BOLT WASHER

(Galvanized)



END SECTION

— GENERAL NOTES —

1. Post Spacing Shall be 6'-3" Except as Otherwise Noted.
2. For Details Not Shown Refer to Standard Guardrail Sheets.
3. Terminal May be Omitted When End of Guardrail is Buried in Backslope. (See R-8.1.4, Case 3.)
4. Cable Assembly Should be Taut with No Obvious Slack in Cable.

*** 5. Rectangular Post Bolt Washer Shall be Installed on First Post Only.

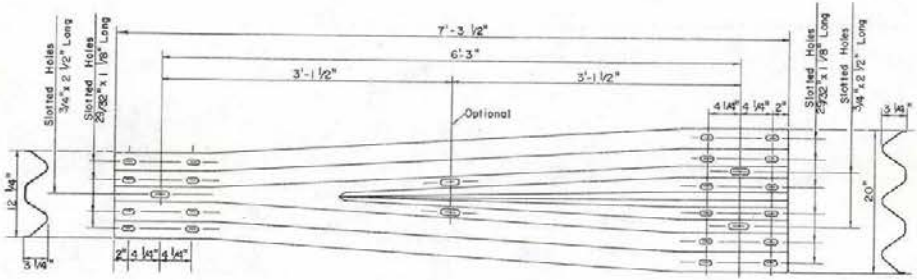
6. Steel Posts Shall Not be Substituted for Wood Posts and/or Blocks Where Required.
7. P.C.C. Shall be Type AA or Type A.

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

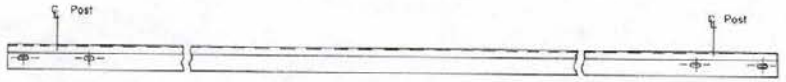
BREAKAWAY CABLE TERMINAL

CHIEF ROAD DESIGN ENGR.

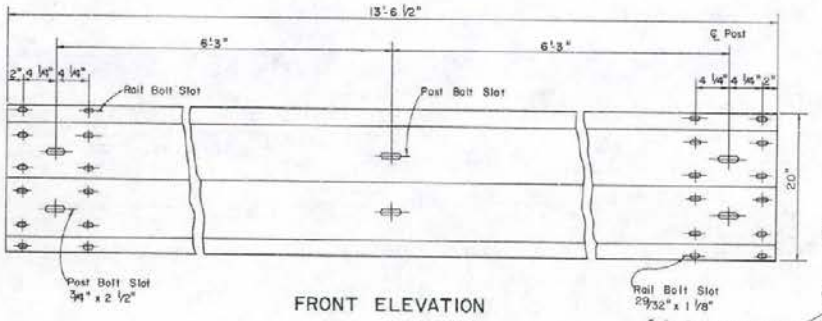
R-8.1.8



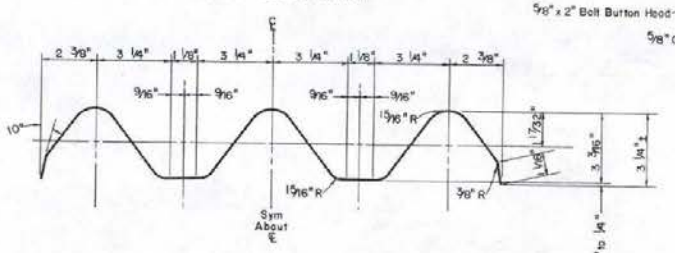
TRANSITION SECTION



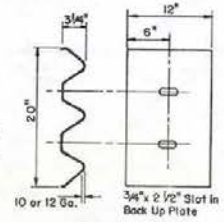
PLAN VIEW



FRONT ELEVATION

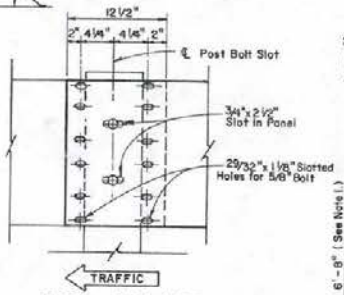


SECTION THROUGH RAIL ELEMENT

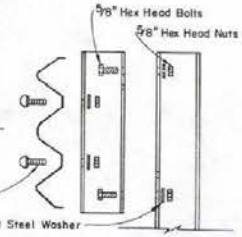


BACK UP PLATE

(FOR USE BETWEEN GUARDRAIL AND STEEL BLOCK AT POSTS BETWEEN RAIL SPLICES)



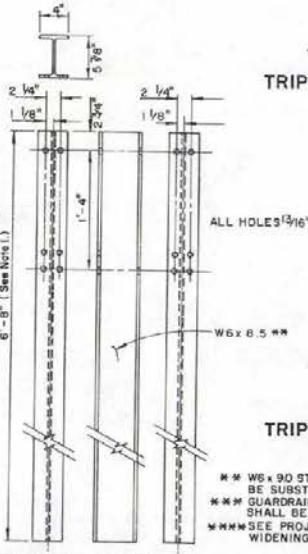
RAIL SPLICE



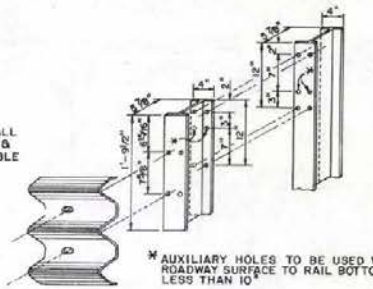
POST BOLT HARDWARE

(GALVANIZED)

NOTE 1.) WHEN SLOPE STABILITY COMPROMISES THE INTEGRITY OF THE POSTS, THE POSTS SHALL BE LENGTHENED AS SHOWN ON THE PLANS & SHALL BE CONSTANT FOR BREAKAWAY CABLE TERMINALS ALSO.

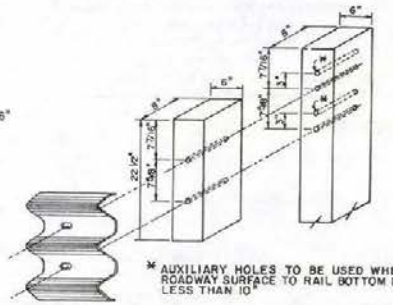


STEEL POST



* AUXILIARY HOLES TO BE USED WHEN ROADWAY SURFACE TO RAIL BOTTOM IS LESS THAN 10"

TRIPLE CORRUGATED RAIL – STEEL POST



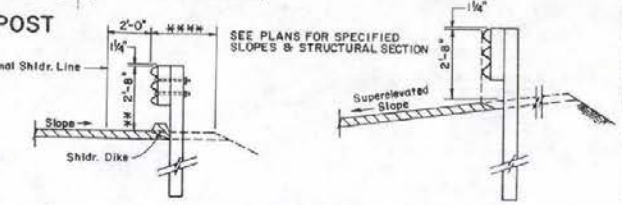
* AUXILIARY HOLES TO BE USED WHEN ROADWAY SURFACE TO RAIL BOTTOM IS LESS THAN 10"

TRIPLE CORRUGATED RAIL – WOOD POST

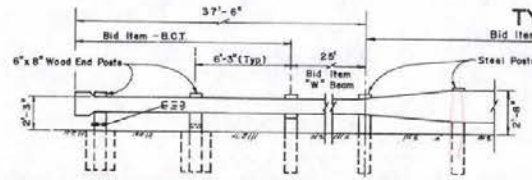
** W6 x 9.0 STEEL POST OR 6"x 8"x 6'-0" WOOD POST MAY BE SUBSTITUTED.

*** GUARDRAIL HEIGHTS ON STAGE CONSTRUCTION PROJECTS SHALL BE GOVERNED BY FINAL SURFACING ELEVATION.

**** SEE PROJECT TYPICAL SECTIONS FOR WIDENING (4' MIN.).



TYPICAL GUARDRAIL INSTALLATIONS



BREAKAWAY CABLE TERMINALS (TRIPLE CORRUGATION)

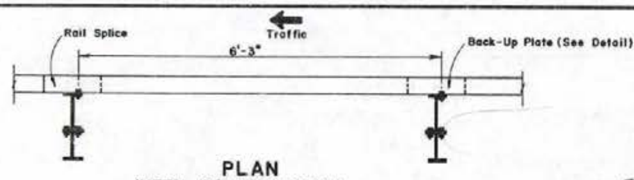
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

GALVANIZED GUARDRAIL (TRIPLE CORRUGATIONS)

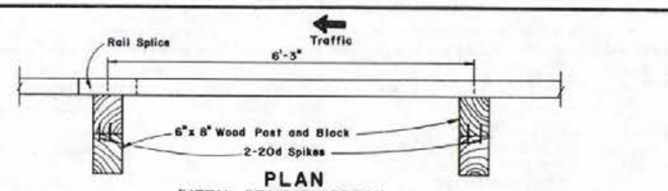
Richard A. Bare
CHIEF ROAD DESIGN ENGR.

R-8.1.7 (618)
ADOPTED 12/78
REVISION 3-11-86

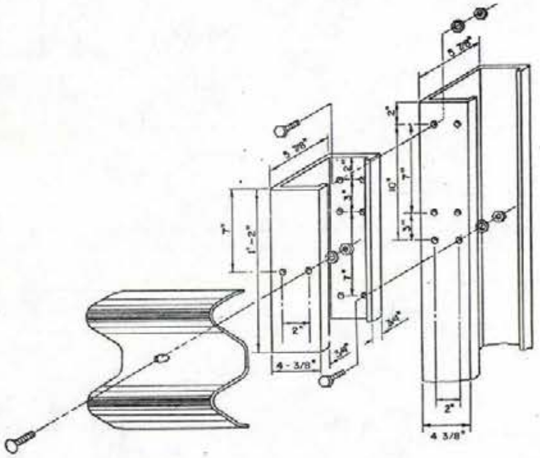
R-69



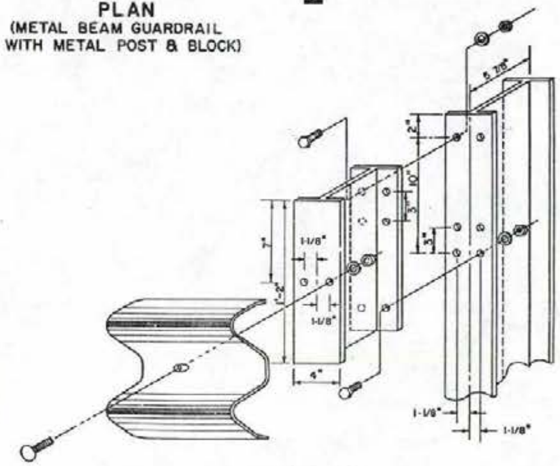
PLAN
(METAL BEAM GUARDRAIL WITH METAL POST & BLOCK)



PLAN
(METAL BEAM GUARDRAIL WITH WOOD POST & BLOCK)

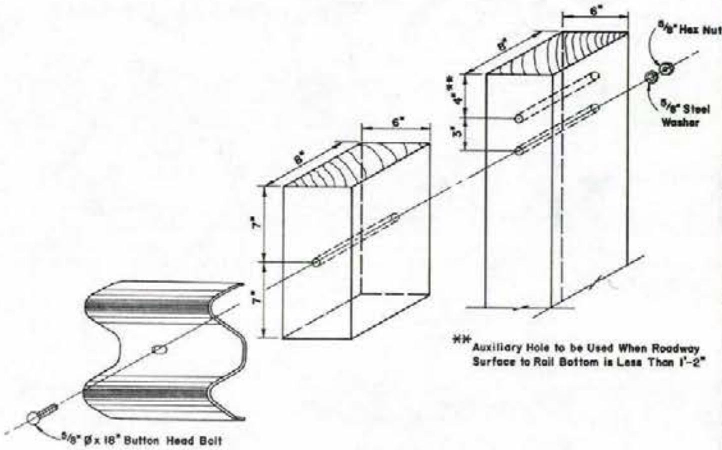


ALTERNATE BOLT PLACEMENT
"C" TYPE POST AND BLOCK

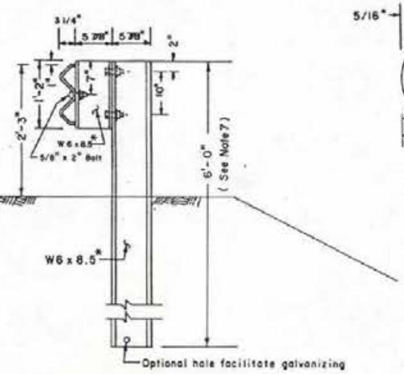


BOLT PLACEMENT DETAIL

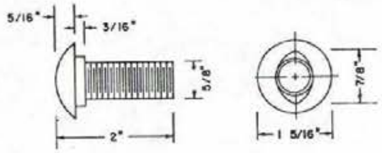
METAL BEAM GUARDRAIL WITH W6 x 8.5*
OR "C" TYPE ALTERNATE STEEL POSTS



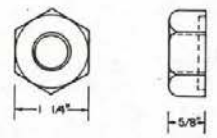
METAL BEAM GUARDRAIL WITH WOOD POSTS & BLOCKS



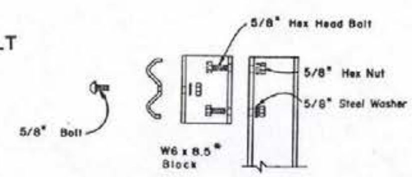
POST DETAIL



5/8" BUTTON HEAD BOLT

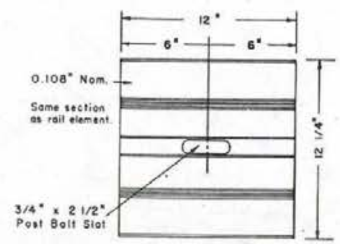


5/8" RECESSED NUT



POST BOLT HARDWARE
(GALVANIZED)

* See Note 6



BACK – UP PLATE
(For use between guard rail and steel block at posts between rail splices.)

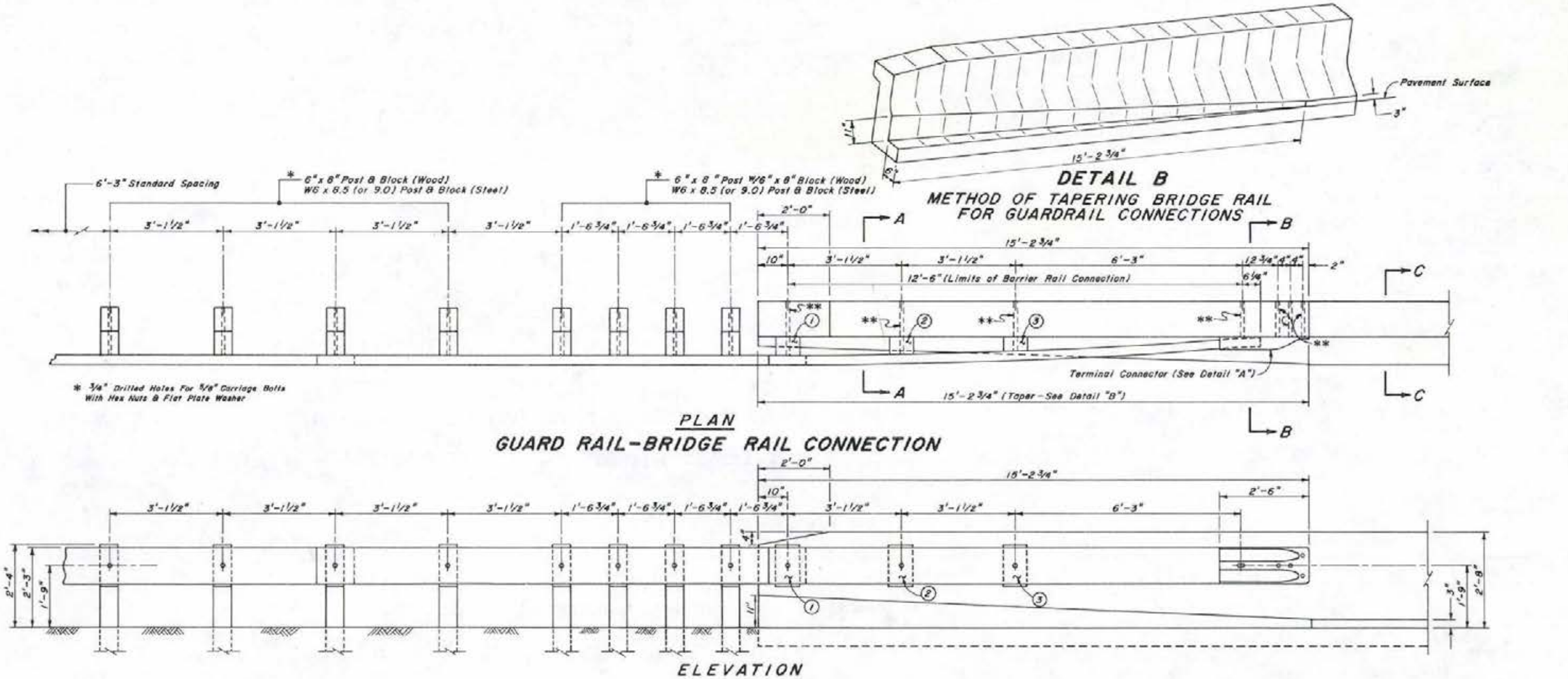
— GENERAL NOTES —

1. ALL HOLES 3/4" Ø
2. RAIL MOUNTS TO BLOCK WITH BOLT ON APPROACHING TRAFFIC SIDE OF BLOCK AND POST WEB.
3. BLOCK MOUNTS TO POST WITH 2 BOLTS STAGGERED. LOWER BOLT ON APPROACHING TRAFFIC SIDE OF BLOCK AND POST WEB. (FOR METAL BLOCKS ONLY).
4. EXCEPT FOR ALTERNATE BOLT PLACEMENT DETAIL, ALL VIEWS SHOW W6 X 8.5 DETAILS, FOR METAL POSTS AND BLOCKS.
5. ALL "C" TYPE POSTS AND BLOCKS MUST BE ASSEMBLED WITH THE OPEN ENDS IN THE SAME DIRECTION.
6. W6 X 9.0 STEEL POSTS AND BLOCKS MAY BE SUBSTITUTED.
7. WHEN SLOPE STABILITY COMPROMISES THE INTEGRITY OF THE POSTS, THE POST SHALL BE LENGTHENED AS SHOWN ON THE PLAN AND SHALL BE CONSTANT FOR BREAKAWAY CABLE TERMINAL ALSO.

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

GALVANIZED GUARDRAIL ("W"- BEAM)

CHIEF ROAD DESIGN ENGR.	R-8.2.2	(616)
	ADOPTED: 2/79	REVISION



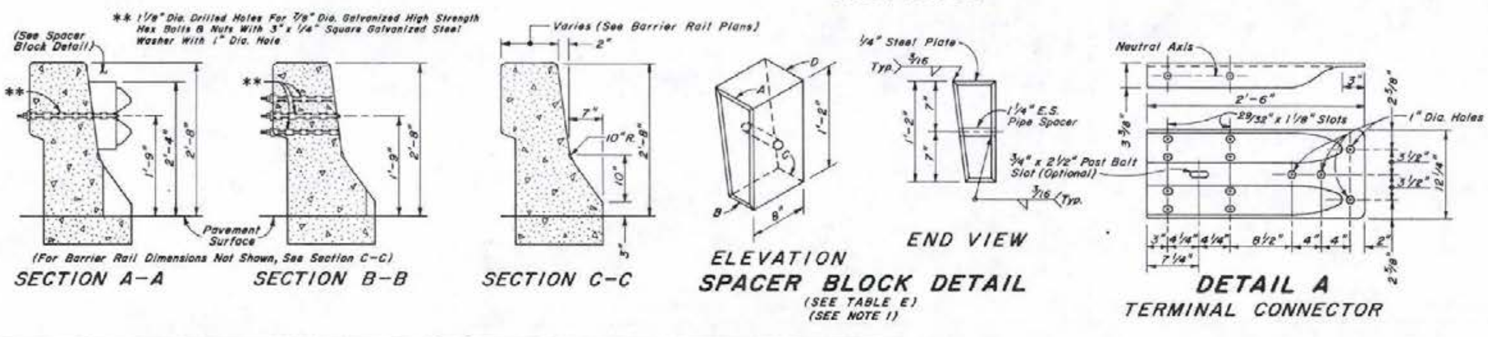


TABLE E				
SPACER BLOCK	A	B	C	D
①	6"	3 3/4"	3 3/4"	6"
②	5 5/8"	3 3/8"	3 1/8"	5 3/8"
③	4 1/8"	1 7/8"	1 5/8"	3 5/8"

NOTES

1. Wood Spacer Blocks (Of Proper Dimensions) May be Substituted For the Detailed Steel Blocks

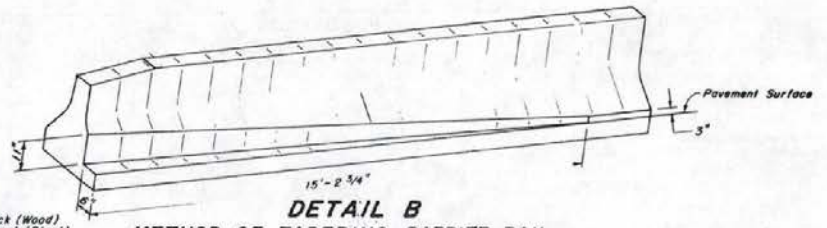
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

GUARD RAIL—BRIDGE RAIL CONNECTIONS ("W"-BEAM)

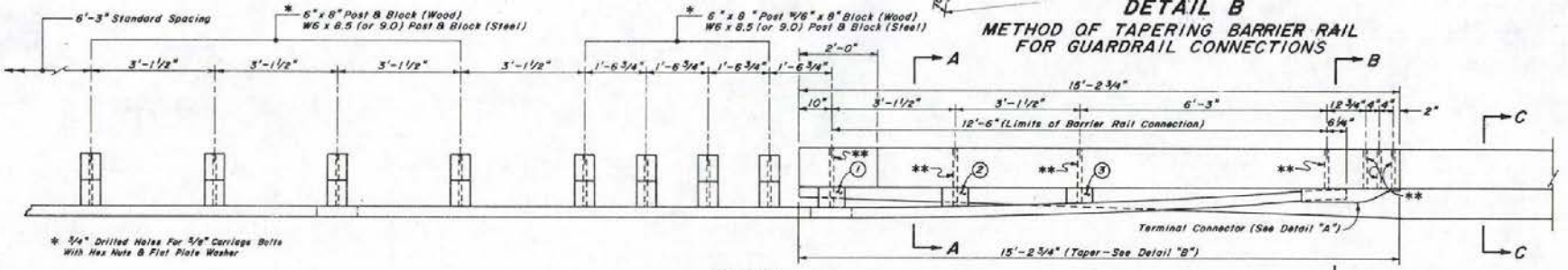
CHIEF ROAD DESIGN ENGR.

R-8.2.3 (616)

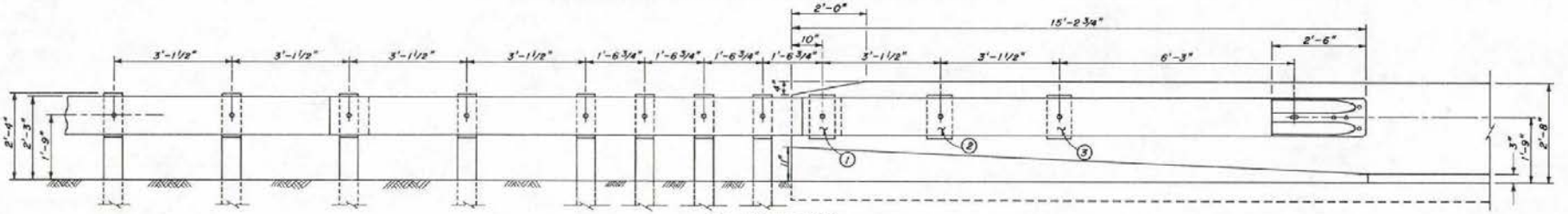
ADOPTED: 11-86 | REVISION



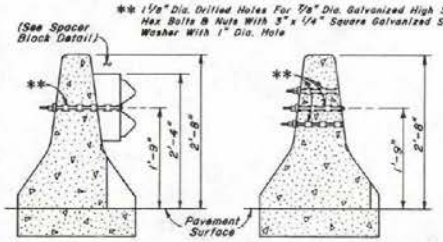
DETAIL B
METHOD OF TAPERING BARRIER RAIL FOR GUARDRAIL CONNECTIONS



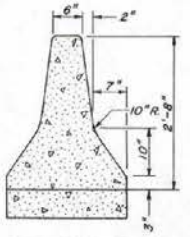
PLAN
GUARD RAIL-BARRIER RAIL CONNECTION



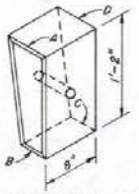
ELEVATION



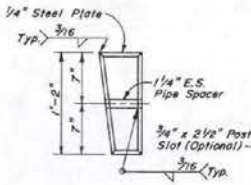
SECTION A-A SECTION B-B



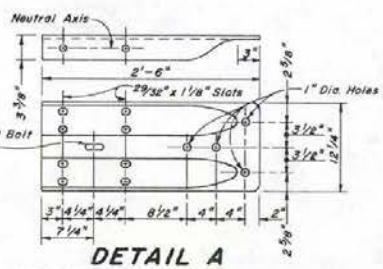
SECTION C-C



ELEVATION
SPACER BLOCK DETAIL
(SEE TABLE E)
(SEE NOTE 1)



END VIEW



DETAIL A
TERMINAL CONNECTOR

TABLE E				
SPACER BLOCK	A	B	C	D
1	6"	3 3/4"	3 3/4"	6"
2	5 5/8"	3 3/8"	3 1/8"	5 3/8"
3	4 1/8"	1 7/8"	1 3/8"	3 3/8"

NOTES
1. Wood Spacer Blocks (Of Proper Dimensions) May be Substituted For the Detailed Steel Blocks.

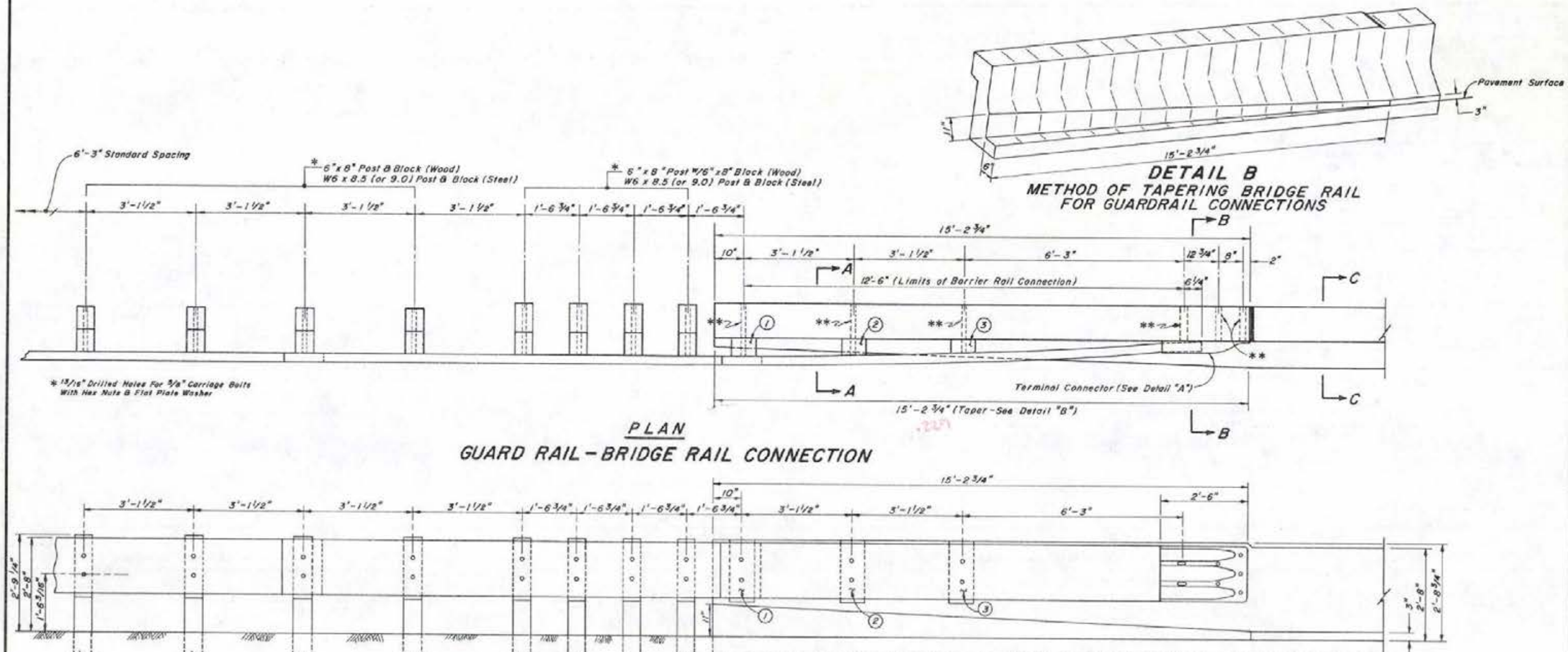
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

GUARD RAIL-BARRIER RAIL CONNECTIONS ("W"-BEAM)

CHIEF ROAD DESIGN ENGR.

R-9.2.3.1
ADOPTED: 11/86
REVISION

R-63



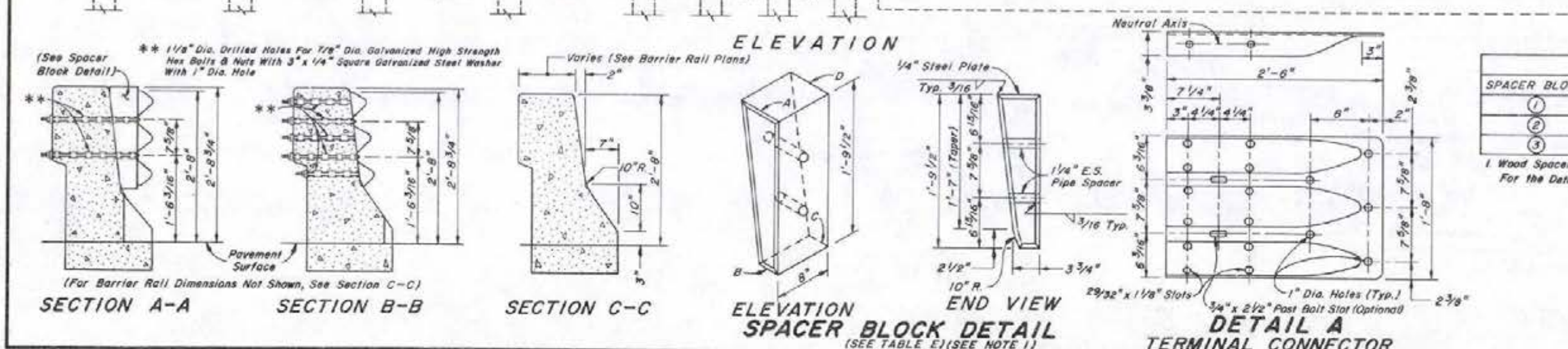


TABLE E				
SPACER BLOCK	A	B	C	D
①	6"	3"	3"	6"
②	5 5/8"	2 5/8"	2 3/8"	5 3/8"
③	4 1/8"	1 1/8"	5/8"	3 5/8"

1. Wood Spacer Blocks (Of the Proper Dimensions) May be Substituted For the Detailed Steel Blocks

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

GUARD RAIL - BRIDGE RAIL CONNECTIONS (TRIPLE CORRUGATION)

CHIEF ROAD DESIGN ENGR.

R-8.2.4.

ADOPTED: 11/86

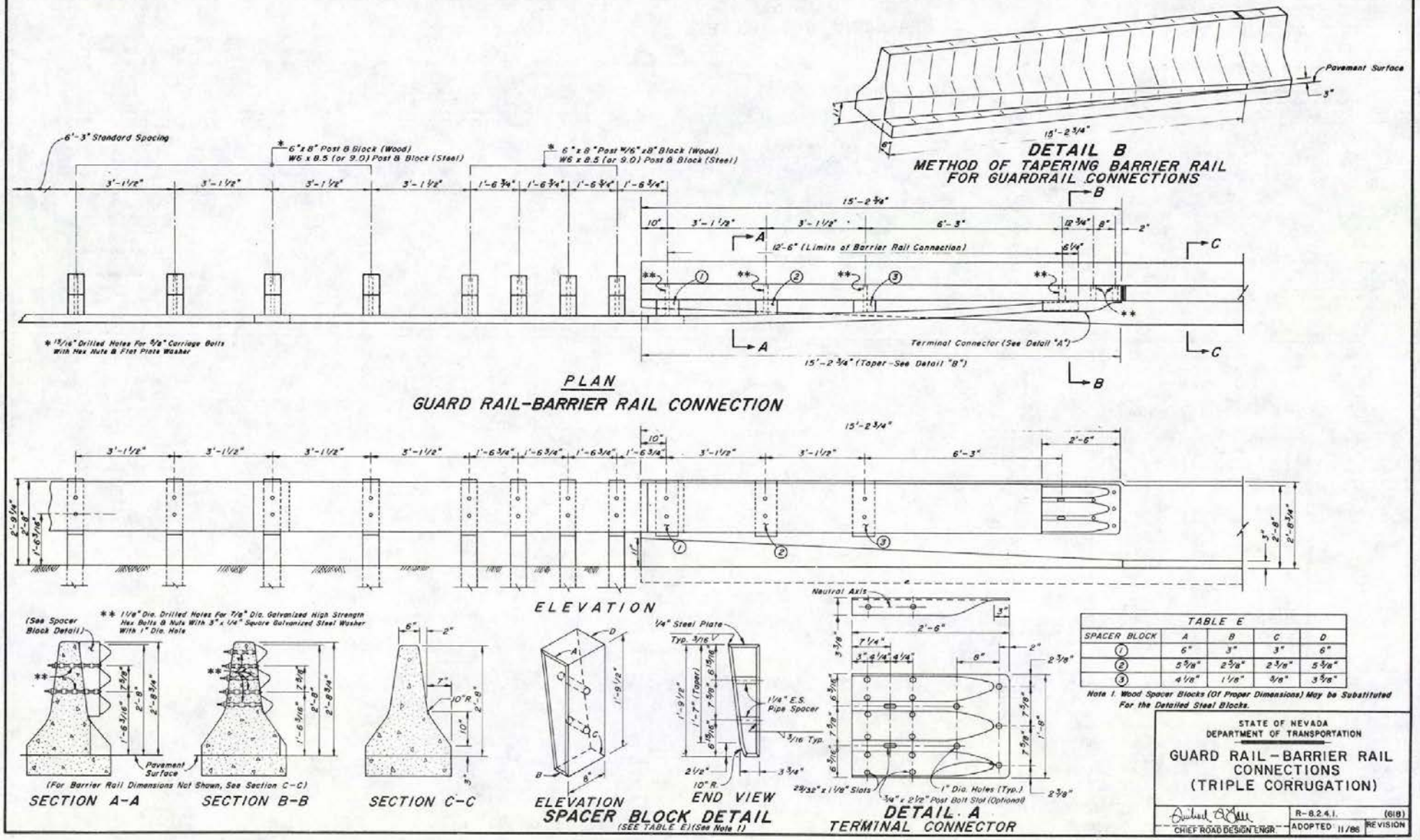


TABLE E				
SPACER BLOCK	A	B	C	D
1	6"	3"	3"	6"
2	5 5/8"	2 3/8"	2 3/8"	5 3/8"
3	4 1/8"	1 1/8"	5/8"	3 3/8"

Note 1. Wood Spacer Blocks (Of Proper Dimensions) May be Substituted For the Detailed Steel Blocks.

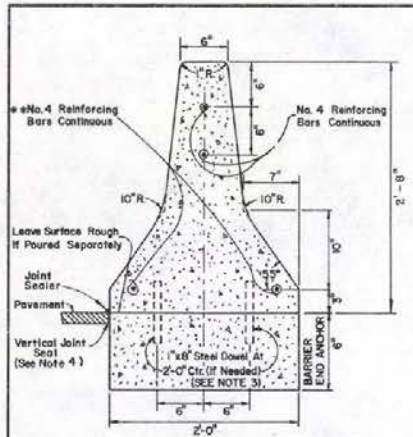
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

GUARD RAIL - BARRIER RAIL CONNECTIONS (TRIPLE CORRUGATION)

CHIEF ROAD DESIGN ENGR.

R-8.2.4.1. (618)
ADOPTED 11/86 REVISION

R-65



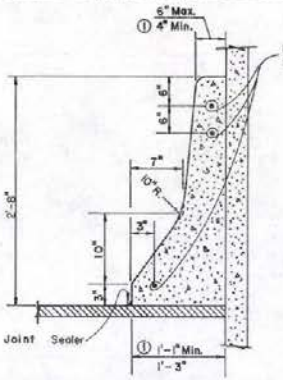
SECTION

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

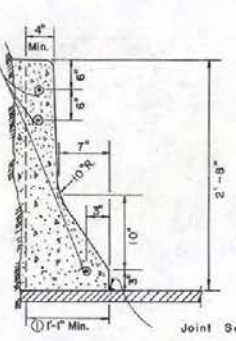
* # AT THE CONTRACTOR'S OPTION, 6" BASE MAY BE POURED MONOLITHICALLY FULL LENGTH UNDER TYPE BARRIER RAIL, IN WHICH CASE, THE TWO LOWER #4 BARS MAY BE ELIMINATED.
FOR VEHICULAR IMPACT ATTENUATOR OPTIONS SEE MANUFACTURER'S DESIGN MANUALS.



TYPE B

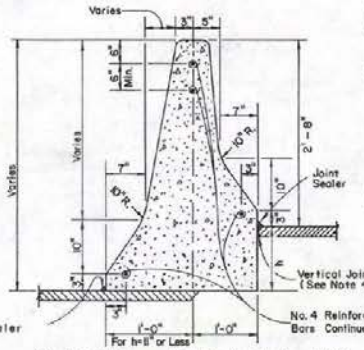
CONCRETE (INFORMATION ONLY)

4" MIN. 0.0598 CU. YD. PER LIN. FT.
6" MIN. 0.0768 CU. YD. PER LIN. FT.



① Dimension Used When Barrier is Placed Against Rock or Solid Object Such as A Retaining Wall.

TYPE C

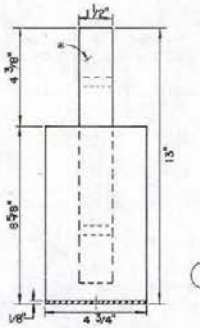


With Each 6" Increase in "h" Elevation, The Base Width Will Increase 2" Over The Normal 1'-0" Dim.

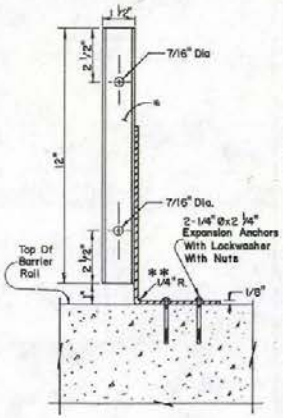
TYPE D

GENERAL NOTES

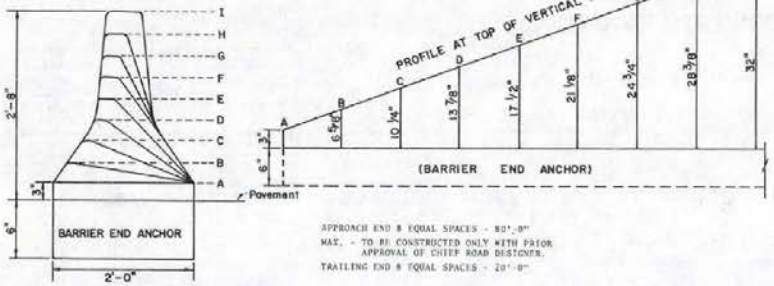
1. CONCRETE SHALL BE CLASS A OR AA.
2. TRANSVERSE JOINTS WITH 1" PREMOLDED EXPANSION JOINT FILLER OR 1" OPEN TRANSVERSE JOINTS SHALL BE PLACED AT STRUCTURES. JOINTS IN BARRIER RAIL OVER A STRUCTURE SHALL BE AT THE SAME LOCATION AND OF THE SAME DIMENSION AS THOSE IN THE STRUCTURE.
3. BITUMINOUS PAVING REQUIRED: PAVING SHALL BUTT AGAINST THE BARRIER RAIL END ANCHOR SECTION AND SHALL EXTEND FULL WIDTH UNDER THE NORMAL BARRIER RAIL SECTION PLUS 12" MINIMUM (SEE SECTION-K), 6-INCH DEEP BARRIER END ANCHORS SHALL BE CONSTRUCTED IN THE FIRST AND LAST 10 LINEAR FEET OF THE FULL HEIGHT BARRIER RAIL RUN. IF TRANSITIONS ARE USED, THE ANCHOR SHALL BE EXTENDED UNDER THE TRANSITION. CONCRETE PAVING REQUIRED: THE NORMAL BARRIER RAIL SECTION MAY BE PLACED ON THE CONCRETE PAVEMENT. DOWELS SHALL BE REQUIRED IN THE FIRST AND LAST 10 LINEAR FEET OF THE FULL HEIGHT BARRIER RAIL AND THROUGH TRANSITION SECTIONS. THE SURFACE OF THE CONCRETE SHALL BE CLEAN PRIOR TO PLACEMENT OF BARRIER RAIL. AT THE CONTRACTOR'S OPTION, CONCRETE PAVEMENT AND BARRIER RAIL MAY BE PLACED MONOLITHICALLY. IN WHICH CASE DOWELS MAY BE ELIMINATED.
4. VERTICAL JOINTS SHALL HAVE HOT RUBBERIZED ASPHALT SEALS FULL DEPTH OF THE JOINT.
5. JOINT SEALER SHALL BE HOT RUBBERIZED ASPHALT 1" THICK.



SECTION B-B



SECTION A-A



TRANSITION DETAIL

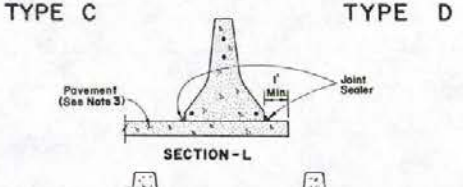
APPROACH END 8 EQUAL SPACES - 80'-0"
MAX. - TO BE CONSTRUCTED ONLY WITH PRIOR APPROVAL OF CHIEF ROAD DESIGNER.
TRAILING END 8 EQUAL SPACES - 20'-0"

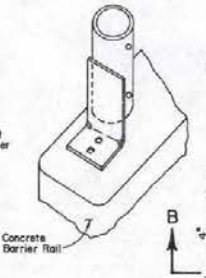
TRANSITION OF END OF BARRIER

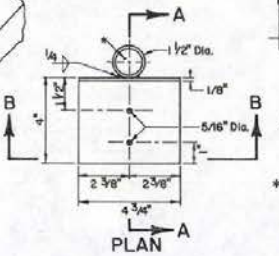
TO BE USED ONLY IF END IS FLARED

CONCRETE BARRIER RAIL
FLARE RATES

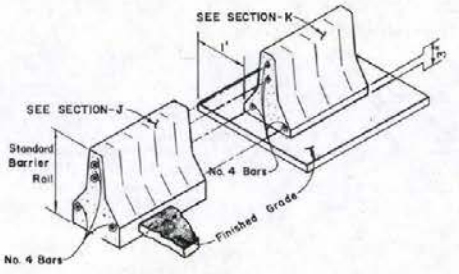
OPERATING SPEED	FLARE RATE
70	20:1 MAX.
60	17:1
50	14:1
40	11:1







* Where Snow Markers Are Not Needed, the Installation Shall Consist Only of the Delineator Portion. See Project Plans for the Specified Installation.
* * Cold Bending of this Corner shall not be permitted.



BARRIER END ANCHOR

(SEE NOTE 3)

SNOWPOLE MARKER OR DELINEATOR *

FOR PERMANENT BARRIERS ONLY
(FOR SPACING OF DELINEATORS, SEE SHEETS R-8.1.1 & R-9.1.1.)

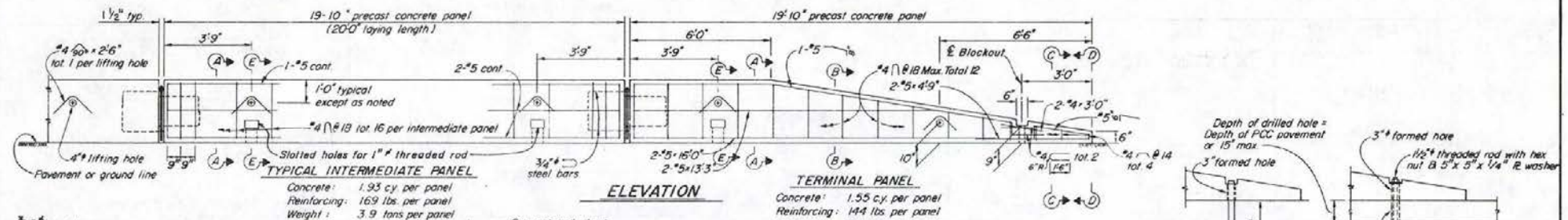
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

CONCRETE BARRIER RAIL

CHIEF ROAD DESIGN ENGR.

R-8.3.1 (502)
ADOPTED 11/70 REVISION 11-1/88

R-86



TYPICAL INTERMEDIATE PANEL

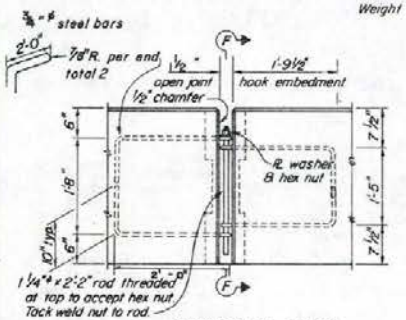
Concrete: 1.93 c.y. per panel
Reinforcing: 169 lbs. per panel
Weight: 3.9 tons per panel

ELEVATION

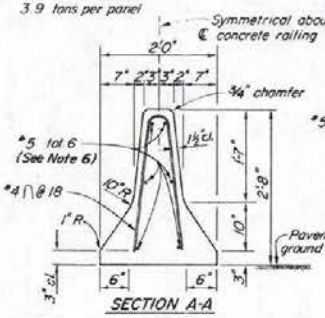
TERMINAL PANEL

Concrete: 1.55 c.y. per panel
Reinforcing: 144 lbs. per panel
Weight: 3.1 tons per panel

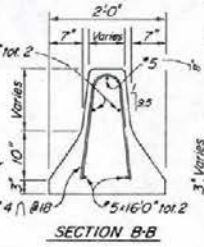
Note: #3 ∩ @ 18 and #4 ⌒ @ 14 may be replaced by welded wire fabric of equivalent cross-sectional area. For details not shown in Sections B-B, C-C, & D-D, see Section A-A



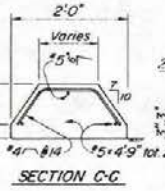
CONNECTION DETAIL



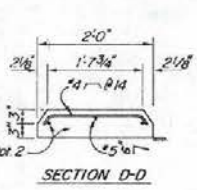
SECTION A-A



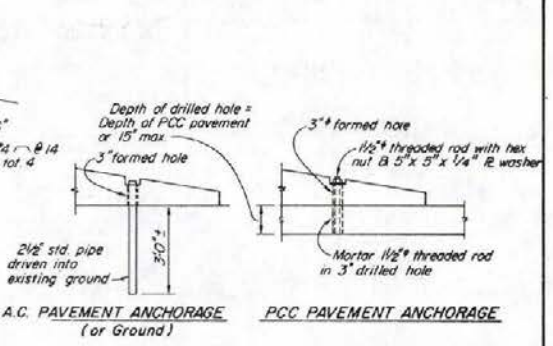
SECTION B-B



SECTION C-C



SECTION D-D

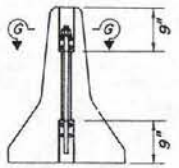


A.C. PAVEMENT ANCHORAGE (or Ground)

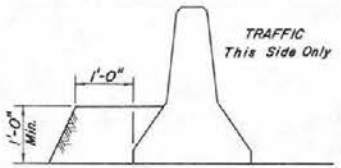
PCC PAVEMENT ANCHORAGE

NOTES:

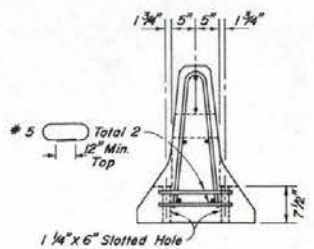
1. SEE PROJECT PLANS OR SPECIAL PROVISIONS FOR LAYOUT OF TEMPORARY RAILINGS.
2. OFFSET FOR TERMINAL SECTIONS AT APPROACH ENDS SHALL BE 6'0" MIN. FROM EDGE OF ROADWAY, OR AS DIRECTED BY THE ENGINEER.
3. WHERE BARRIERS ARE PLACED ON CURVES AND HAVE THAT ARE TOO SEVERE TO MAKE UP JOINTS BARRIERS ARE TO BE LAYED CONTINUOUSLY WITH EARTH FILL. SEE SECTION H-H.
4. BOLT UNITS TO DECK SLABS WHEN REQUIRED BY BRIDGE PLANS.
5. ATTACH UNITS TO PAVEMENT WHEN REQUIRED IN THE PLANS.
6. THE TWO #5 BARS SHALL BE EQUALLY SPACED FROM THE VERTEX OF THE STIRRUP BARS. ONE #5 BAR SHALL BE TIGHTLY WIRED TO THE STIRRUPS BARS AND THE SECOND #5 BAR SHALL BE TACK WELDED TO THE STIRRUP BARS. EACH PROCESS SHALL BE CONTINUOUS FOR EACH #5 BAR.



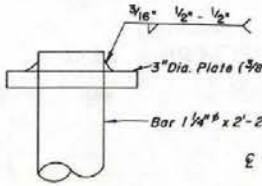
VIEW F-F



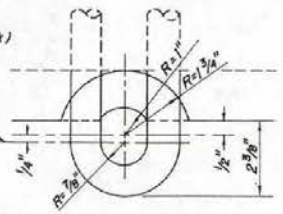
SECTION H-H



SECTION E-E

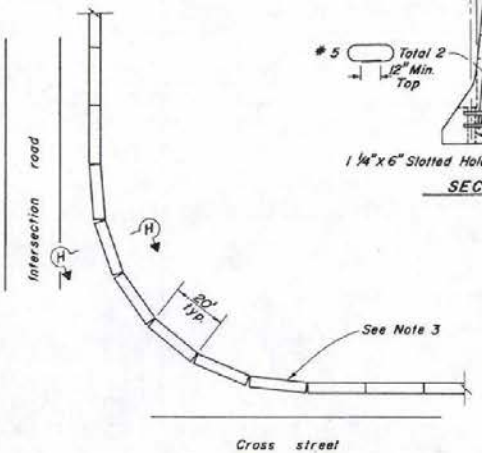


ALTERNATIVE HEAD DETAIL



SECTION G-G

PIN CONNECTION DETAIL



CURVED LAYOUT

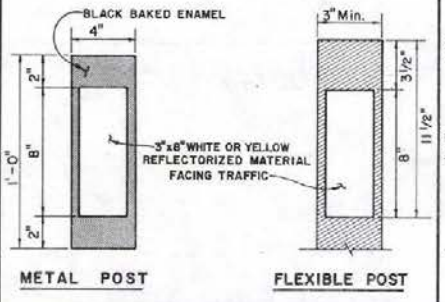
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

PORTABLE PRECAST CONCRETE BARRIER RAIL

Chief Road Design Engr.

R-8.3.3. (502,818)
ADOPTED: 1/76 REVISION: 6-11/84

R-67



TYPE 1 REFLECTORS
(ROADWAY)

MULTI-LANE DIVIDED HIGHWAY, RAMPS, NARROWING ROADWAYS: (FREEWAY STANDARDS)

UNLESS OTHERWISE NOTED ON PLANS, GUIDE POSTS SHALL BE SET AS FOLLOWS:

A) ON TANGENTS, GUIDE POSTS OF THE APPROPRIATE COLOR 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.

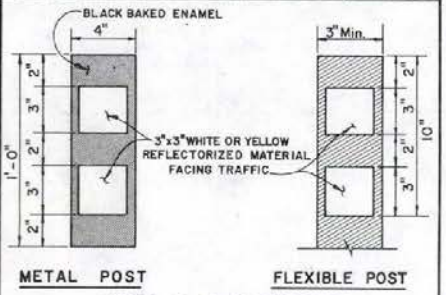
B) SEE TABLE 1 FOR SPACING ON CURVES.

C) NARROWING PAVEMENTS: GUIDE POSTS OF APPROPRIATE COLOR SHALL BE PLACED ADJACENT TO THE LANE FOR THE FULL LENGTH OF THE CONVERGENCE.

TWO LANE AND FOUR LANE UNDIVIDED HIGHWAYS: (SECONDARY AND PRIMARY)

A) WHITE REFLECTORIZED GUIDE POSTS SHALL BE INSTALLED ON THE RIGHT SIDE OF THE ROADWAY FACING TRAFFIC AT 600-FOOT INTERVALS ON TANGENTS AND ON CURVES HAVING A RADIUS GREATER THAN 10,000 FEET.

B) SEE TABLE 1 FOR SPACING ON CURVES.



TYPE 2 REFLECTORS
(RAMPS, APPROACHES)

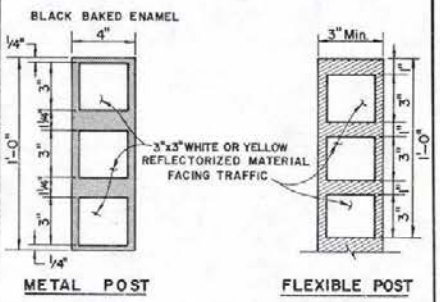
MULTI-LANE DIVIDED HIGHWAYS: (FREEWAY STANDARDS)

A) AT INTERCHANGES, GUIDE POSTS WITH APPROPRIATELY COLORED REFLECTORS SHALL BE INSTALLED AT A MAXIMUM SPACING OF 100' ALONG THE ACCELERATION OR DECELERATION LANES AND IN ACCORDANCE WITH TABLE 1 ON TURNING RAMPS.

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:

ALL APPROACHES SHALL BE DELINEATED WITH WHITE TYPE 2 GUIDE POSTS AT THE BEGINNING AND ENDING LIMITS OF THE APPROACHES. TYPE 4 AND 5 APPROACHES WILL HAVE AN ADDITIONAL GUIDE POST AT EACH TAPER SETBACK.



TYPE 3 REFLECTORS
(ISLANDS, CURBS, SHOULDER DIKES)

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.

TABLE 1

MAXIMUM SPACING FOR HIGHWAY DELINEATORS ON HORIZONTAL CURVES

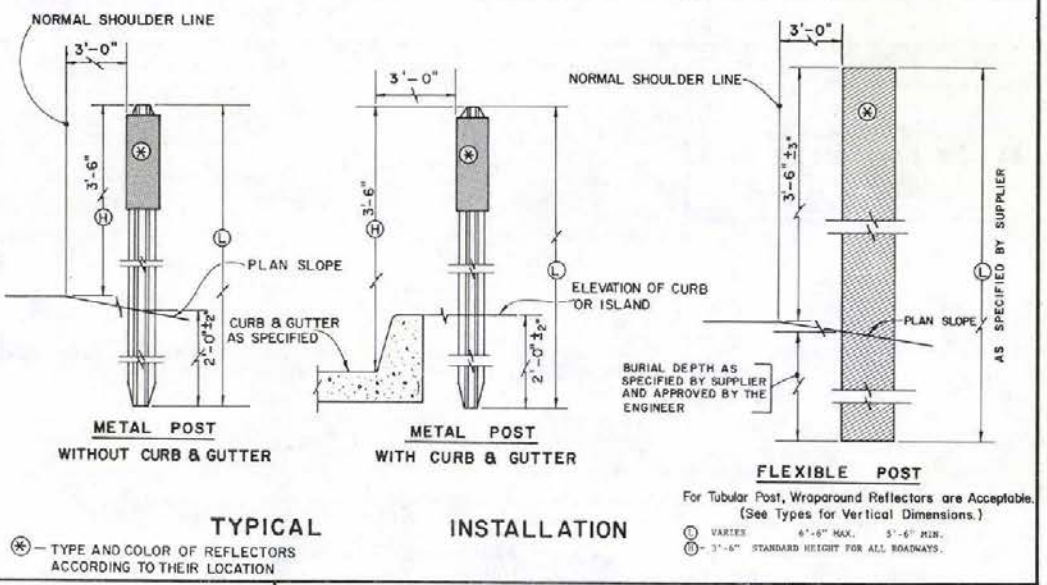
(DISTANCE IN FEET ROUNDED TO THE NEAREST 5 FEET)

RADIUS OF CURVE (IN FEET)	SPACING ON CURVE (IN FEET)	SPACING IN ADVANCE & BEYOND CURVE (IN FEET)		
		1ST	2ND	3RD
50	20	40	60	120
150	30	60	90	180
200	35	70	105	210
250	40	80	120	240
300	50	100	150	300
400	55	110	165	300
500	65	130	195	300
600	70	140	210	300
700	75	150	225	300
800	80	160	240	300
900	85	170	255	300
1,000	90	180	270	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 $S=3\sqrt{R-50}$. 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 300 FEET IS USED APPROACHING THE CURVE, THE DISTANCE SHOWN ABOVE SHOULD BE ADJUSTED ACCORDINGLY.

THE COLOR OF DELINEATORS SHALL BE WHITE ON THE RIGHT SHOULDER INSTALLATIONS AND YELLOW ON THE LEFT EDGE OF DIVIDED OR ONE-WAY ROADWAYS. THE COLORS SHALL BE DENOTED BY A LETTER CODE (EG. TYPE 1-Y FOR SINGLE DELINEATOR, YELLOW) IN THE SUMMARY OF GUIDE POST ONLY.

FOR PLACEMENT OF GUIDE POSTS ALONG GUARDRAIL SEE SHEET R-8.1.1



TYPICAL INSTALLATION

(*) — TYPE AND COLOR OF REFLECTORS ACCORDING TO THEIR LOCATION

PLACEMENT OF GUIDE POST ON CURVES

MULTI-LANE DIVIDED HIGHWAYS: (FREEWAY STANDARDS)

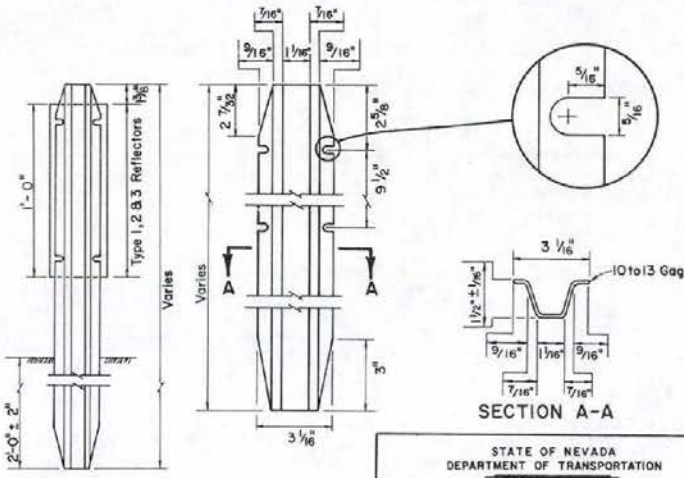
A) ON CURVES, THEY SHALL BE INSTALLED ALONG BOTH SIDES OF THE THROUGH ROADWAYS AT 400-FOOT SPACING ON THE OUTSIDE SHOULDER AND 800-FOOT SPACING ON THE MEDIAN SHOULDER FOR CURVES HAVING A RADIUS OF MORE THAN 10,000 FEET. FOR CURVES OF 10,000 FEET RADIUS OR LESS, THEY SHALL BE SPACED AS SHOWN IN TABLE 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, WHITE GUIDE POSTS SHALL BE INSTALLED ON THE RIGHT SIDE 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.



METAL POST DETAILS

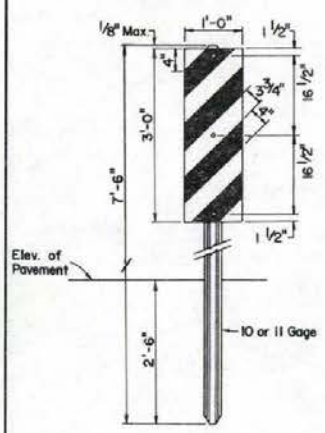
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

GUIDE POSTS

Andrael A. Gall
CHIEF ROAD DESIGN ENGR.

R-9.1.1-(619)
ADOPTED: 8/69
REVISION 5-10/85

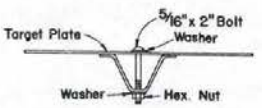
R-69



TYPE 3
BRIDGES, PIERS, ABUTMENTS

Front: Facing Traffic, Alternating Black With Reflectorized Yellow Stripes Sloping Down at A 45° Angle Toward Edge of Obstruction on Which Traffic Will Pass.

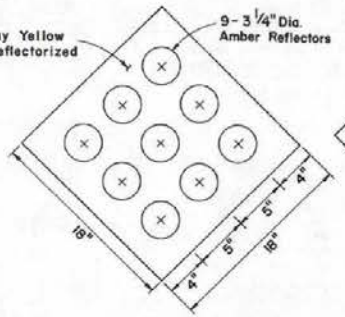
Back: Solid White



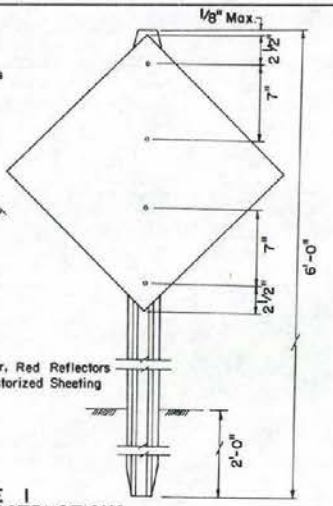
(Electroplated Bolts & Nuts & Protective Flat Non-Metallic Washers.)

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 When Guardrail or Barrier Rail Protects the Obstruction.

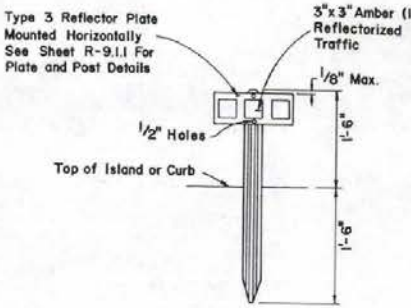
FOR POST DETAILS SEE SHEET R-9.1.1



When Used as "End Of Roadway" Marker, Red Reflectors On a Red Background or Red Type III Reflectorized Sheeting Shall be Used.

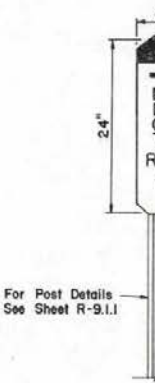


TYPE 1
MEDIAN OBSTRUCTIONS



TYPE 2
CURBS OR INLETS

OBJECT MARKERS

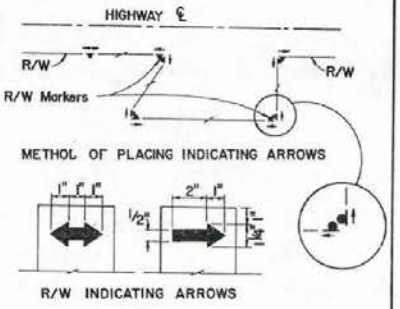


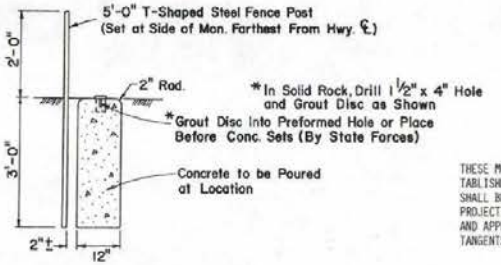
RIGHT OF WAY MARKERS SHALL BE ERECTED TO DEFINE THE RIGHT OF WAY LINES AND UNLESS OTHERWISE SPECIFIED, SHALL BE SET AT BEGINNING AND END OF EACH PROJECT, AT BEGINNING AND END OF EACH CURVE, AND AT ALL CORNERS OR IRREGULAR RIGHT OF WAY LINES, AND APPROXIMATELY ONE-HALF (½) MILE APART ON LONG TANGENTS.

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.

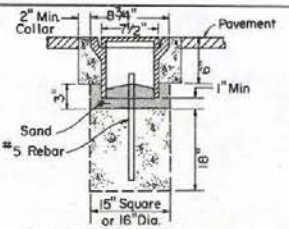
RIGHT OF WAY MARKERS



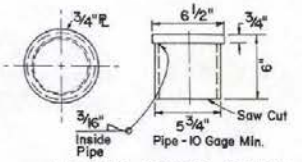


THESE MONUMENTS SHALL BE SET TO ASSIST IN RE-ESTABLISHMENT OF THE CENTERLINE FOR FUTURE USE AND SHALL BE SET AT THE BEGINNING AND END OF EACH PROJECT, AT THE BEGINNING AND END OF EACH CURVE, AND APPROXIMATELY ONE-HALF (½) MILE APART ON LONG TANGENTS.

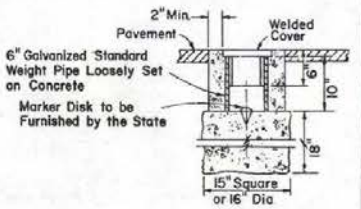
REFERENCE MONUMENT AND MARKER POST



SURVEY COVER & RING



WELDED COVER DETAIL



ALTERNATE PLACEMENT

SURVEY MONUMENTS

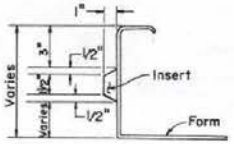
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

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

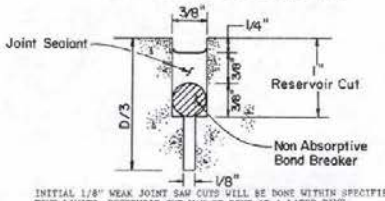
Ronald W. Lee
CHIEF ROAD DESIGN ENGR

R-9.2.1-(619 THRU 621)
ADOPTED: 6/89 REVISION 4-1/98

R-69

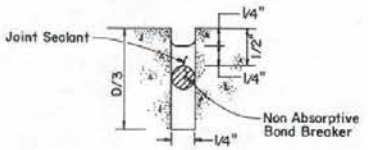


DETAIL OF METAL OR WOODEN INSERT TO BE PLACED ON FORM

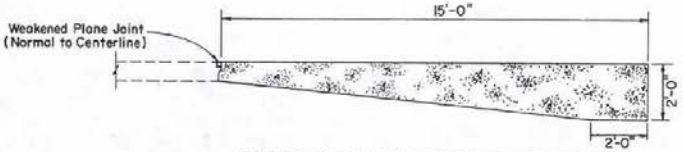


INITIAL 1/8" WEAK JOINT SAW CUTS WILL BE DONE WITHIN SPECIFIED TIME LIMITS. RESERVOIR CUT MAY BE DONE AT A LATER TIME.

TRANSVERSE WEAKENED PLANE JOINT
DOUBLE SAW CUT

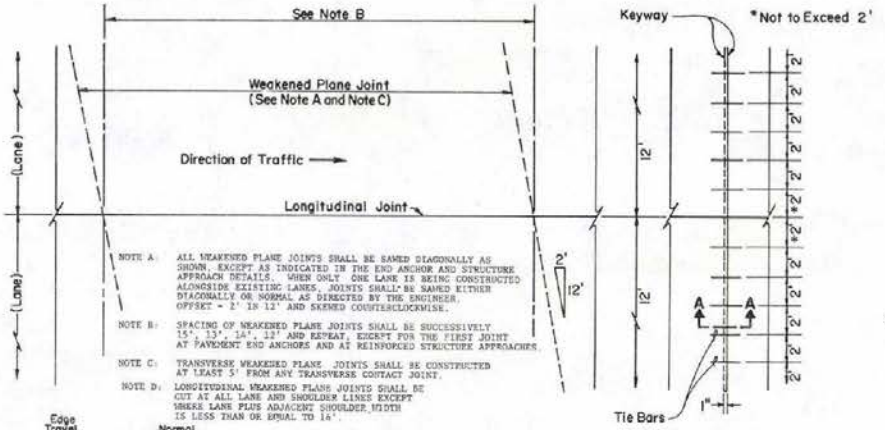


LONGITUDINAL WEAKENED PLANE JOINT
SINGLE SAW CUT

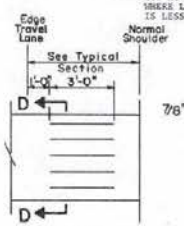


PAVEMENT END ANCHOR DETAIL

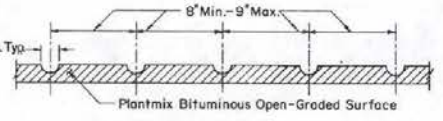
NOTE: PAVEMENT END ANCHORS SHALL BE CONSTRUCTED AS THE TERMINAL PANELS OF ALL PAVEMENT NOT ABUTTING EXISTING PAVEMENTS OR STRUCTURES, AND ELSEWHERE IF ORDERED BY THE ENGINEER.



PLAN



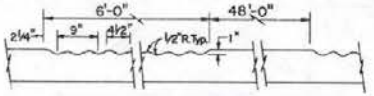
PLAN



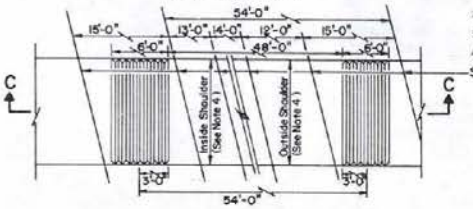
SECTION D-D

RUMBLE STRIP SHALL BE CONTINUOUS AS DESCRIBED ON PLANS TO BE USED ON ROADS WITH SHOULDERS 4' WIDE AND OVER.

RUMBLE STRIPS ON ASPHALT SHOULDERS

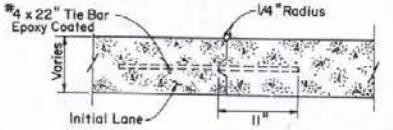


SECTION C-C



RUMBLE STRIPS ON CONCRETE SHOULDERS
(THIS DESIGN SHALL NOT BE USED IN URBAN AREAS)

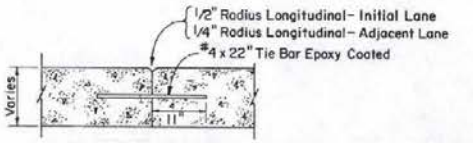
NOTE:
1. DO NOT SCORE THRU DECELERATION AND ACCELERATION AREAS OF RAMPS AND TAPERED APPROACHES. DO NOT SCORE ACROSS MINOR APPROACHES.
2. SHOULDER TRANSVERSE JOINTS SHALL BE THE SAME PATTERN AS MAIN ROADWAY.
3. 6" RUMBLE STRIPS SHALL BE SCORED BETWEEN THE 15' DIAGONALLY SAWED TRANSVERSE JOINTS.
4. SEE TYPICAL SECTION FOR WIDTH OF SHOULDER.



SECTION A-A
(TIE BAR)

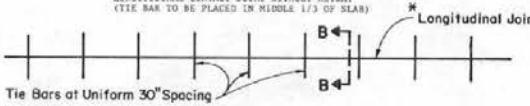
* TRANSVERSE CONTACT JOINT WITH KEYWAY AND TIE BARS

NOTE: TRANSVERSE CONTACT JOINTS WITH KEYWAY AND TIE BARS SHALL BE USED AT ALL CONSTRUCTION JOINTS, AND ELSEWHERE IF ORDERED BY THE ENGINEER. TIE BARS TO BE PLACED IN THE MIDDLE 1/3 OF THE SLAB THICKNESS.



SECTION B-B

LONGITUDINAL CONTACT JOINT WITHOUT KEYWAY (TIE BAR TO BE PLACED IN MIDDLE 1/3 OF SLAB)



PLAN

TIE BAR DETAIL

*ALL TRANSVERSE AND LONGITUDINAL CONTACT JOINTS SHALL BE SAWED AND JOINT SEALER USED PER RESPECTIVE WEAKENED PLANE JOINT DETAILS THIS SHEET.

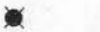
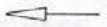
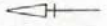
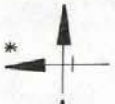
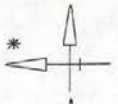
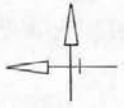
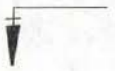
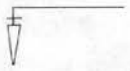
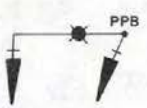
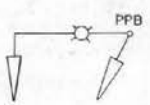
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

CONCRETE & ASPHALT PAVEMENT DETAILS

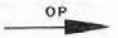
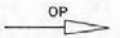
Richard A. Rhea
CHIEF ROAD DESIGN ENGR.

R-10.1.1 (409)
ADOPTED: 8/69
REVISION 10-1/88

R-70

NEW	EXISTING	DESCRIPTION
		Luminaire
		Electrolier
		Underpass Luminaire
		Traffic Signal Head, 3 Section, 12" Red, Yellow and Green Sections (Unless Indicated Otherwise)
		Traffic Signal Head with All Sections Louvered
		Traffic Signal Head with Back Plate
		Traffic Signal Head, Programmed Visability, 12" Green Arrow, 12" Solid Yellow and Red Sections, with Back Plate
		Traffic Signal Head with 12" Green, Yellow and Red Arrow Sections, with Back Plate
		Mast Arm Signal with Back Plate
		Combination Traffic Signal Standard with Luminaire and Signal Mast Arms and Attached Signal Heads, with Back Plate PPB = Pedestrian Push Button and Sign
		Pedestrian Signal (Walk-Don't Walk)
		Vehicle Detector - Inductive Loop Unless Otherwise Indicated (See Sheet T 30.1.4 for Information on Identification and Configuration)
		Quadrapole Detector Loop (See Sheet T-30.1.4)

NEW	EXISTING	DESCRIPTION
		Pull Box
		Controller Cabinet (Door Swing As Shown.)
		Service (120-240 V.A.C. Unless Otherwise Specified)
		Transformer Pad
		Power Source
		Conduit
		Conduit (Jacked)
		Pole Designation
		Conduit Run
		Junction Box
		Wood Power Pole
		Flashing Beacons "R" indicates Red Lens, "Y" indicates Yellow Lens.
		Special Junction Cabinet (For Interconnect Cable)
		M-5 (Cluster Type Head) (See Sheet T-30.1.2)

NEW	EXISTING	DESCRIPTION
		Traffic Signal Head With Opticom Detector Unit

T 1

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

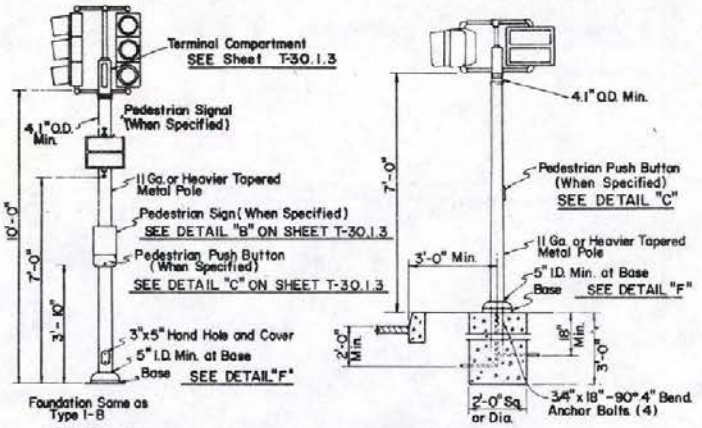
LIGHTING AND SIGNALS

TRAFFIC SIGNAL AND LIGHTING SYMBOLS

CHIEF TRAFFIC ENGINEER

T-30.1.1 (623)

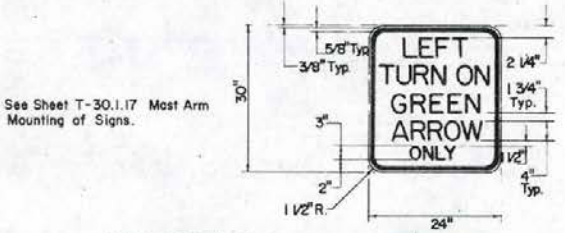
ADOPTED: 12/79 REVISION 2-11-86



TYPE 1-A

SIGNAL STANDARDS

TYPE 1-B

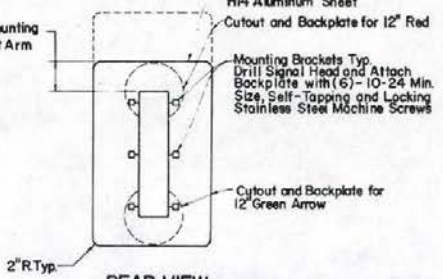


See Sheet T-30.1.17 Mast Arm Mounting of Signs.

NOTE: All Pedestrian Push Buttons Mounted on Poles Shall have a Mounted Height of 3'-10"

DETAIL-"D"

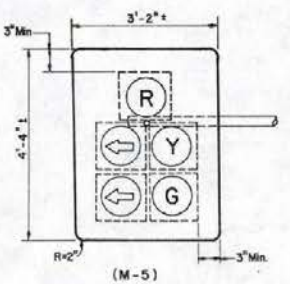
SIGN R10-5b(S)
BACKGROUND-WHITE (REFL.)
LEGEND, BORDER - BLACK (NON-REFL.)
(For Sign R10-5(S) See Sheet T-30.1.17)



REAR VIEW

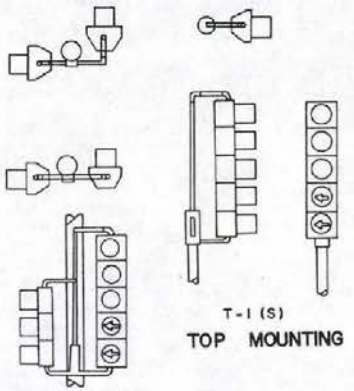
NOTE: No Background Light to Show Between Plate and Head. All Mast Arm Backplates Shall be Louvered

DETAIL-"G"



(M-5)

MAST ARM MOUNT

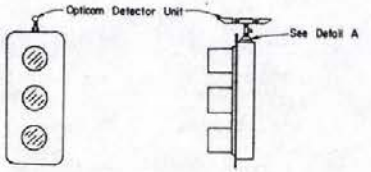


T-1 (S)

TOP MOUNTING

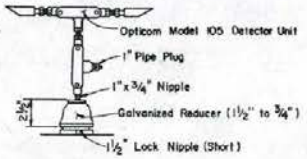
B-2a (S)

SIDE BRACKET MOUNTING



FRONT VIEW

SIDE VIEW

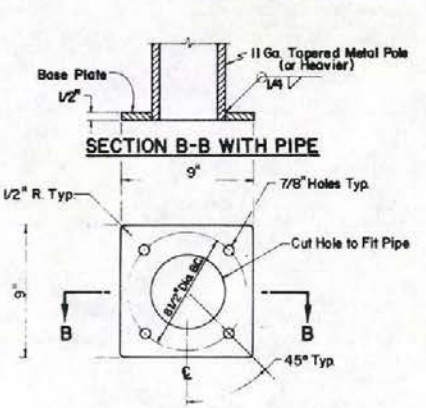


DETAIL A

MOUNTING DETAIL OPTICOM MODEL 105 DETECTOR

TYPICAL DIRECTIONAL LOUVER

TYPICAL ARROW LENS



DETAIL-"E"

DETAIL-"F"

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

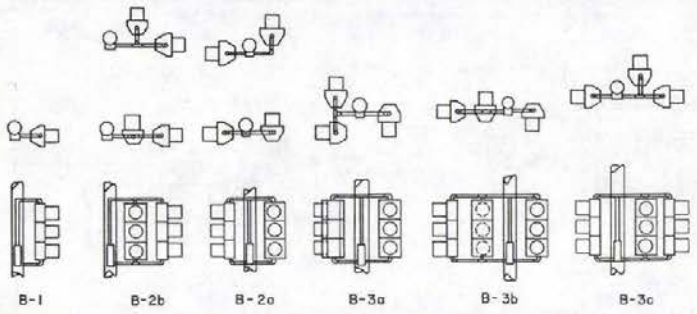
LIGHTING AND SIGNALS

CHIEF TRAFFIC ENGR

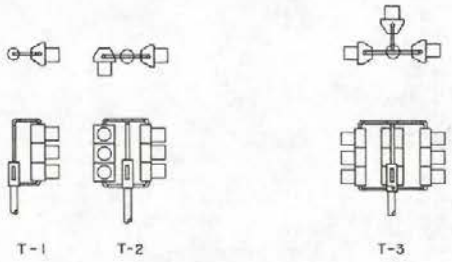
T-30.1.2 (6.23)
ADOPTED 2/71
REVISION T-5/82

R10-5 Sign, Backplate, Louver, Pole Type 1-A and 1-B Details

T 2

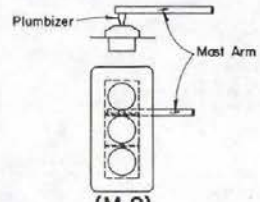


SIDE BRACKET MOUNTINGS



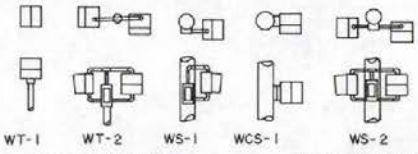
TOP MOUNTINGS

VEHICULAR SIGNALS AND MOUNTINGS

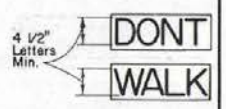


(M-2)

MAST ARM MOUNTINGS

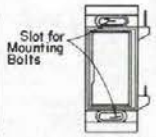


TOP MOUNTINGS SIDE MOUNTINGS

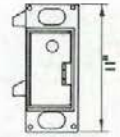


PEDESTRIAN SIGNAL-FACE MESSAGES

PEDESTRIAN SIGNAL – INTERNATIONAL SYMBOL
(To be Used Unless Othewise Specified)



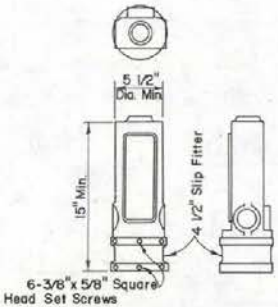
POLE PLATE



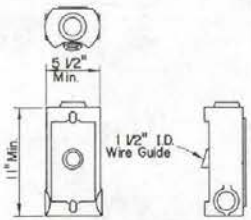
TERMINAL COMPARTMENT

CLAMSHELL MOUNTING HARDWARE(CS)
(To be Used Only When Specified)

PEDESTRIAN SIGNALS AND MOUNTINGS

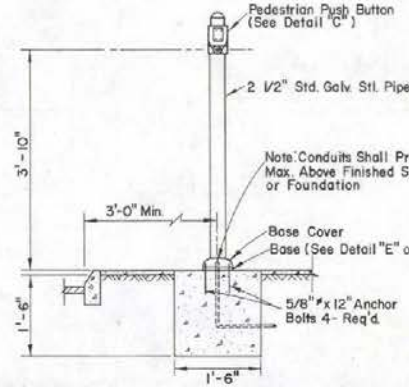


POST TOP MOUNTED

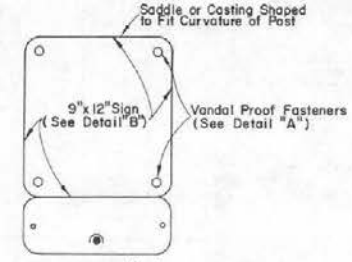


SIDE BRACKET MOUNTED

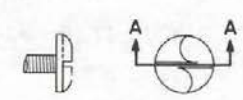
TERMINAL COMPARTMENTS



PEDESTRIAN PUSH BUTTON POST



DETAIL "C"



SECTION A-A

10/32"x1/2" Machine Screw (Stainless Steel)

DETAIL "A"

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"

NOTE: IN ADDITION TO THE VANDAL-PROOF FASTENER SHOWN ABOVE, THE "TORX" TYPE WILL BE ACCEPTABLE. THE DIMENSIONS SHALL BE SIMILAR.

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

LIGHTING AND SIGNALS

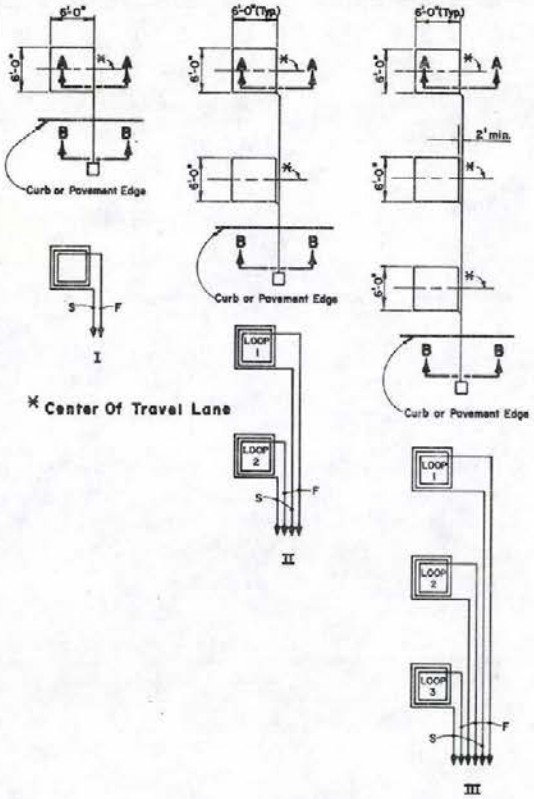
T-30.13 (623)

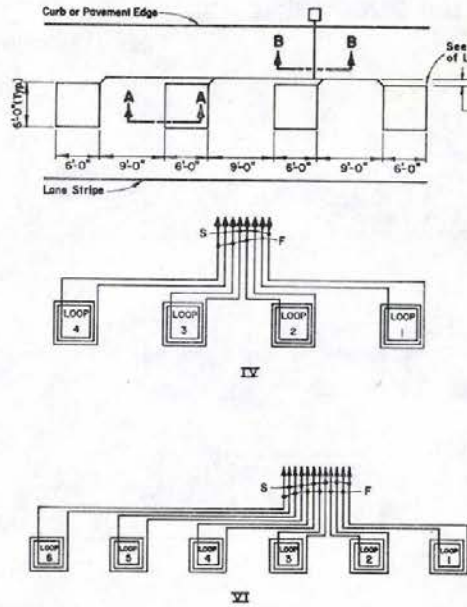
CHIEF TRAFFIC ENGR. ADOPTED: 1/83 REVISION 2-1/88

SIGNAL MOUNTING

PEDESTRIAN SIGNALS and PUSH BUTTON DETECTORS

T-3



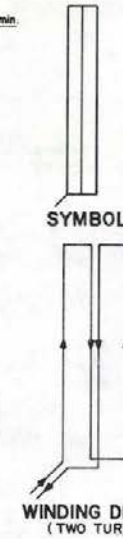


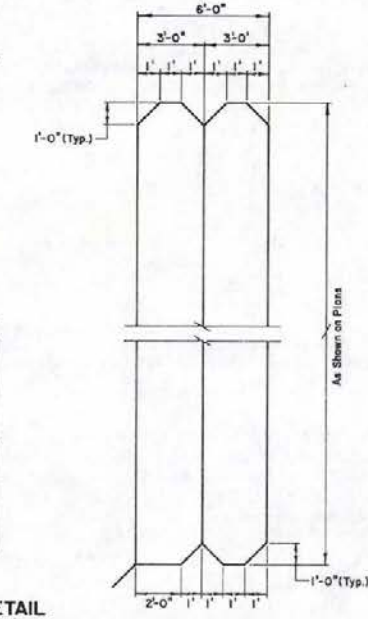
CONDUCTOR IDENTIFICATION IN PULL BOX SHALL INCLUDE THE FOLLOWING:

1. SENSOR NUMBER AND PHASE
2. LOOP NUMBER
3. START (S) OR FINISH (F)

CABLE IDENTIFICATION IN CONTROLLER CABINET SHALL INCLUDE THE FOLLOWING:

1. LOWER CASE LETTER AS SHOWN ON PLANS FOR DETECTOR AMPLIFIER ASSIGNMENT
2. PHASE DESIGNATION

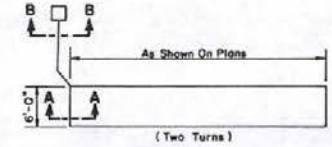




QUADRAPOLE LOOP DETECTOR

CONDUIT INSTALLATION

NOTE:
AT PULLBOX LOCATIONS WHERE THERE ARE NO CURB AND GUTTER, THE CONDUIT SHALL EXTEND FROM THE PULLBOX TO THE EDGE OF THE PAVEMENT.

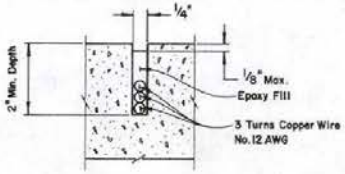


LOOP DETECTOR
6' x 20' AND LONGER

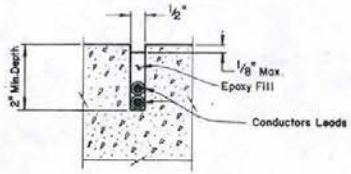
LOOP INSTALLATION PROCEDURE:

1. SAW SLOTS IN PAVEMENT FOR LOOP CONDUCTORS AS SHOWN IN DETAILS. BLOW OUT AND DRY THOROUGHLY WITH COMPRESSED AIR.
2. INSTALL TERMINATION PULL BOX.
3. INSTALL #12 AWG LOOP CONDUCTOR IN SLOTS USING A 3/16" TO 1/4" THICK WOOD PADDLE (SEE "LOOP WINDING PATTERNS"). ALLOW ADDITIONAL LENGTH FOR THE RUN TO TERMINATION PULL BOX PLUS 5 FEET OF SLACK IN PULL BOX. THIS ADDITIONAL LENGTH OF CONDUCTOR FOR EACH LOOP CIRCUIT SHALL BE TWISTED TOGETHER INTO A PAIR (AT LEAST 2 TURNS PER FOOT) BEFORE BEING RUN TO PULL BOX.
4. IDENTIFY LOOP CIRCUIT PAIRS. IDENTIFY START OF CONDUCTOR.
5. SPLICE LOOP CONDUCTORS TO LEAD-IN CABLE. ALL SPLICES SHALL BE SOLDERED USING ROSIN CORE SOLDER.
6. WHERE LOOP CONDUCTORS ARE NOT TO BE SPLICED TO A LEAD-IN CABLE, ENDS OF CONDUCTORS SHALL BE TAPED.
7. FILL SLOTS AS SHOWN IN DETAILS.
8. NO MORE THAN FOUR LOOP DETECTOR CONDUCTORS SHALL BE INSTALLED IN ONE SAWED SLOT. ALL LOOP CONDUCTORS IN SAME SLOT SHALL BE FOR SAME SIGNAL PHASE.
9. LEAD-IN CABLE SHALL NOT BE SPLICED BETWEEN THE TERMINATION PULL BOX AND THE CONTROLLER CABINET.
10. DISTANCE BETWEEN SIDE OF LOOP AND LEAD-IN SAW CUT SHALL BE 2'-0" MINIMUM. DISTANCE BETWEEN LEAD-IN SAW CUTS SHALL BE 6" MINIMUM.
11. WHEN LEAD-IN SAW CUTS ARE FOR SAMPLING DETECTORS OR FOR LEFT TURN LANE DETECTORS WHERE SAW CUTS CROSS OTHER TRAFFIC LANES, CONDUCTORS SHALL BE PAIRED FOR EACH LOOP CIRCUIT AND TWISTED TWO TURNS PER FOOT BETWEEN LOOP AND PULL BOX.

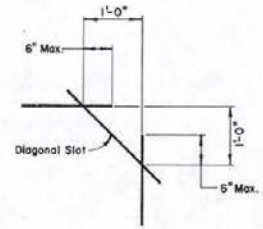
DETECTOR LAYOUTS, DIMENSIONS & WIRING PATTERNS



SECTION A-A



SECTION B-B



PLAN VIEW OF DIAGONAL SLOT AT CORNERS

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

LIGHTING AND SIGNALS

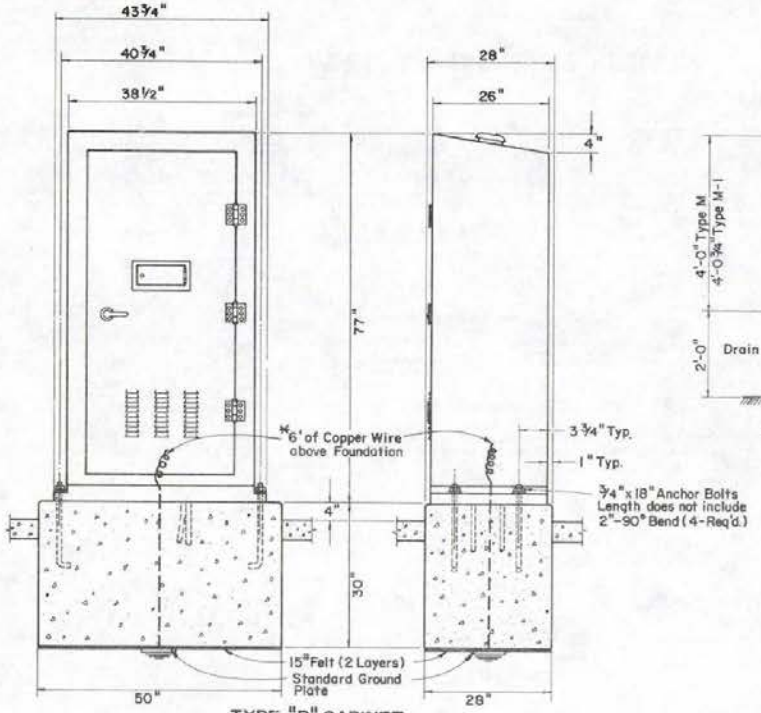
DETECTORS

CHIEF TRAFFIC ENGINEER

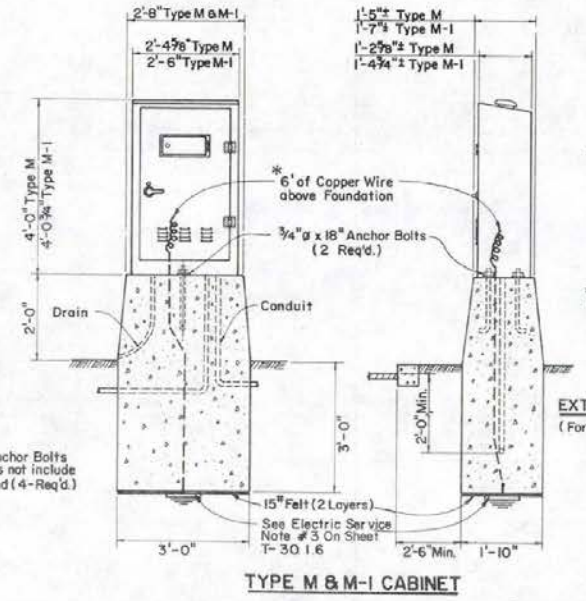
T-30.1.4 (625)

ADOPTED 12/79 REVISION 1-1-87

T-4

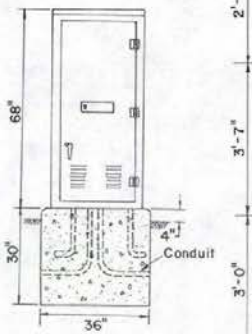


TYPE "R" CABINET

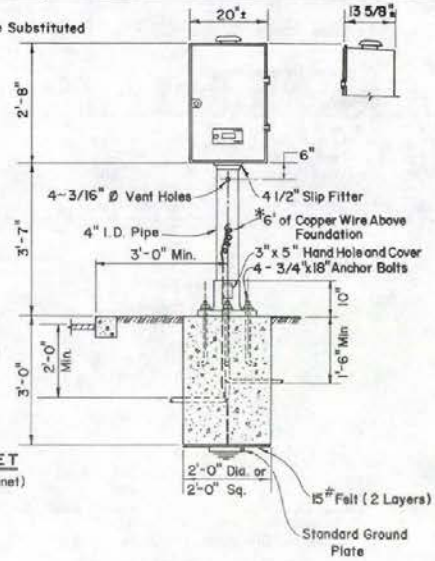


TYPE M & M-1 CABINET

* ½"x 8' Ground Rod May be Substituted in Lieu of Copper Wire



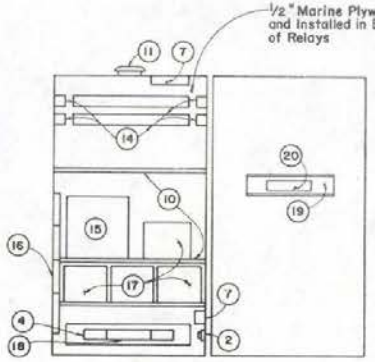
EXTENDED TYPE M CABINET
(For Details Not Shown See Type M Cabinet)



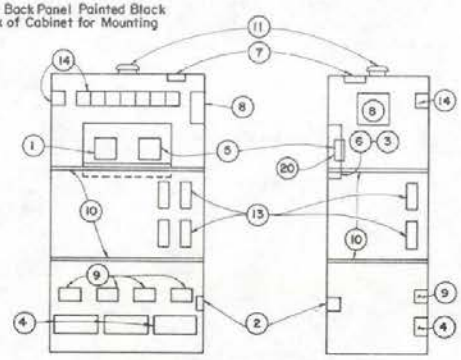
TYPE "G" CABINET

NOTES FOR TYPE M-1:

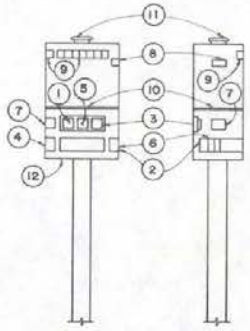
1. MATERIAL SHALL BE 14 GA. SHEET STEEL.
2. DOOR SHALL LOCK AT THREE POINTS.



TYPE "R" CABINET



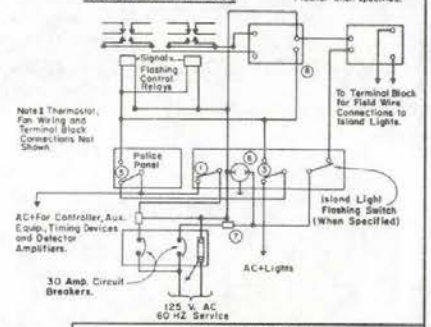
TYPE M & M-1 CABINET



TYPE "G" CABINET

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 FLAHSER (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



STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

LIGHTING AND SIGNALS

CONTROLLER CABINET DETAILS

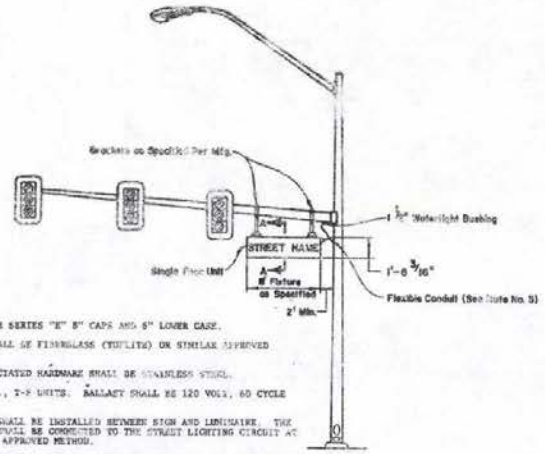
CHIEF TRAFFIC ENGR.

T-30.1.5 (6 2 3)

ADOPTED: 2/71

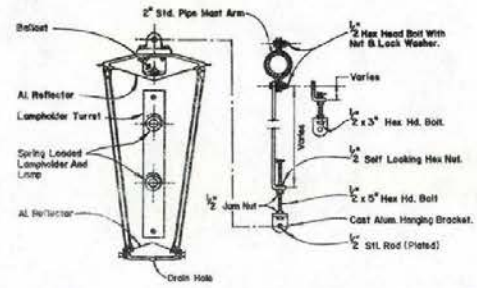
REVISION 4-1/83

T5

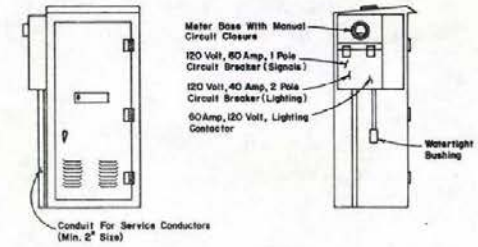


NOTES:

1. LEGEND ON SIGN SHALL BE SERIES "E" 8" CAPS AND 6" LOWER CASE.
2. SIGN PANEL MATERIAL SHALL BE FIBERGLASS (TUFLITE) OR SIMILAR APPROVED MATERIAL.
3. ALL FASTENERS AND ASSOCIATED HARDWARE SHALL BE STAINLESS STEEL.
4. LAMPS SHALL BE 360 M.A., T-8 UNITS. BALLAST SHALL BE 120 VOLT, 60 CYCLE 02 STARTING.
5. TWO NO. 12 CONDUCTORS SHALL BE INSTALLED BETWEEN SIGN AND LUMINAIRE. THE SIGN LIGHTING CIRCUIT SHALL BE CONNECTED TO THE STREET LIGHTING CIRCUIT AT THE P.E. CONTROL BY AN APPROVED METHOD.
6. SIGN CLAMPS SHALL BE SIZED TO FIT RESPECTIVE SIGNAL ARMS.



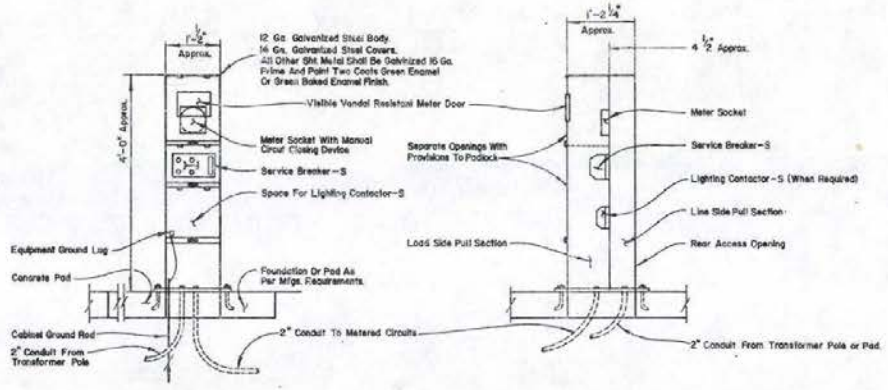
SECTION A-A



CONTROLLER CABINET SERVICE INSTALLATION

ELECTRIC SERVICE NOTES

1. MAIN BREAKER SHALL BE 100 AMP MINIMUM (120/240 V.A.C., 60 HZ. SINGLE PHASE, 3 WIRE). CIRCUIT BREAKERS SHALL BE AS SHOWN ABOVE UNLESS INDICATED OTHERWISE ON PLANS.
2. PANEL OPENINGS FOR BREAKERS OR SEPARATE ENCLOSURES SHALL HAVE HASPS AND LOCKS (MASTER 3900 OR 3943).
3. GROUNDING FOR SERVICE EQUIPMENT AND ALL CONTROLLER CABINETS SHALL BE AS FOLLOWS:
   a. GROUND WIRE MUST BE A MINIMUM SIZED NO. 8 FOR 100 AMP AND NO. 6 FOR 200 AMP AND BE CONTINUOUS TO THE SERVICE EQUIPMENT.
   b. MINIMUM GROUND PLATE DIMENSIONS: AREA = 2 SQUARE FEET (18" X 18" OR 20" DIAMETER ROUND). THICKNESS = 0.25 INCH STEEL, 0.06 INCH COPPER.
   c. GROUND ROD OF GALVANIZED STEEL OR PIPE OF AT LEAST 3/4" DIAMETER OR 1/2" DIAMETER COPPER IS ACCEPTABLE IN LIEU OF GROUND PLATE AS SHOWN.

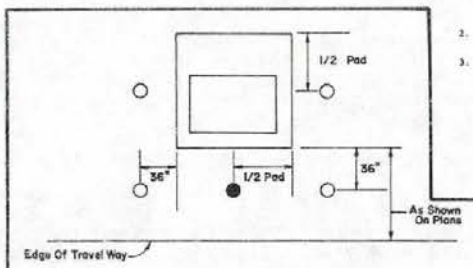


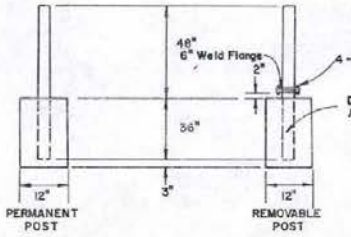
FRONT VIEW SIDE VIEW

UNDERGROUND SERVICE PEDESTAL

NOTES:

1. CONDUIT MUST EXTEND UP INTO CABINET A MINIMUM OF 2" ABOVE CONCRETE PAD.
2. SEE PLANS FOR LOAD RATING, PANEL DISTRIBUTION AND CIRCUIT BREAKERS REQUIRED.





NOTES

1. BARRIER POSTS ARE TO BE USED ONLY WHERE PAD MOUNTED TRANSFORMERS ARE INSTALLED IN AREAS SUBJECT TO DAMAGE BY VEHICULAR TRAFFIC. THE CONTRACTOR SHALL COORDINATE INSTALLATION WITH THE SERVING UTILITY COMPANY TO DETERMINE THE EXACT NUMBER OF POSTS REQUIRED.
2. FOOTINGS TO BE DRILLED HOLES, AS SHOWN, AND FILLED WITH CLASS "A" OR CLASS "AA" CONCRETE.
3. POST CONSTRUCTED OF 6" STANDARD PIPE (WELL CASTING) PRIMED AND PAINTED YELLOW, CONCRETE FILLED.

TRANSFORMER PAD BARRIER POST

STATE OF NEVADA DEPARTMENT OF TRANSPORTATION

LIGHTING AND SIGNALS

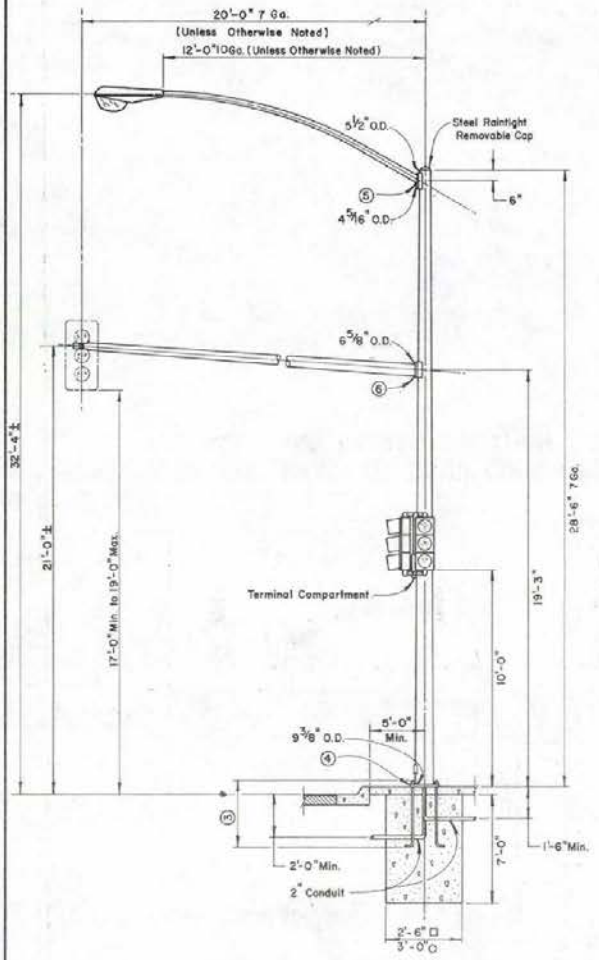
ELECTRICAL SERVICES AND INTERNALLY ILLUMINATED SIGN DETAILS

CHIEF TRAFFIC ENGR.

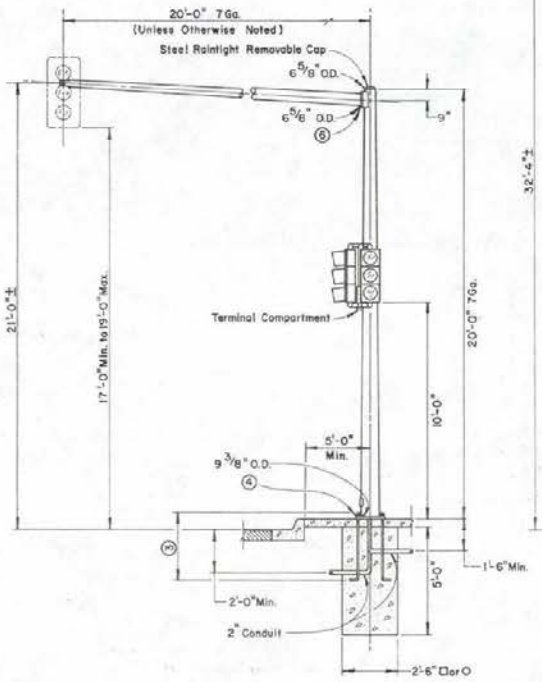
T-50.1.6

ADOPTED: 12/79

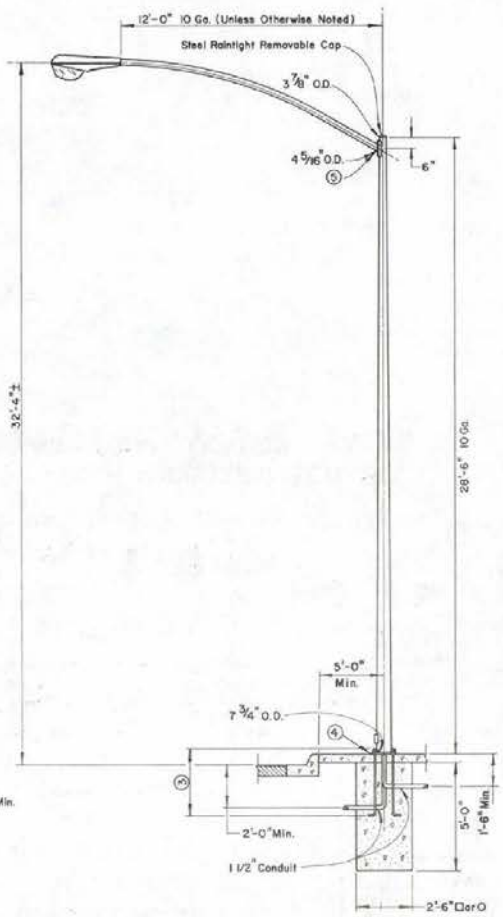
T6



POLE TYPE 6-A



POLE TYPE 5-A



POLE TYPE 7

GENERAL NOTES
FOR ALL POLE TYPES

GALVANIZING

1. POLES SHALL BE GALVANIZED AS PER ASTM A-123; HARDWARE SHALL BE GALVANIZED AS PER ASTM A-153.

STEEL SIGNAL AND LUMINAIRE ARMS

1. THE LAST 3" OF THE LUMINAIRE ARM SHALL BE STRAIGHT AND HORIZONTAL WITH LUMINAIRE ATTACHED.
2. CONNECTION BETWEEN ARMS AND POLES SHALL BE MADE BY MEANS OF A RAIN TIGHT SOCKET OR A DESIGN PERMITTING SIMPLE REMOVAL OF THE ARMS.

ANCHOR BOLTS

1. 4-ASTM A-307 ANCHOR BOLTS ARE REQUIRED FOR EACH POLE. PROVIDE A HEX NUT, LEVELING NUT AND 2 WASHERS FOR EACH BOLT.
2. 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 ARE REQUIRED ON ALL POLES EXCEPT WHERE SAFETY BASE IS SPECIFIED.
2. A REDUCED CAGE FOR SHAFT OF POLE WILL BE ACCEPTABLE ABOVE SIGNAL ARM ATTACHMENT SIMILAR TO POLE TYPE 20.

WELDS

1. LONGITUDINAL WELDS BY SUBMERGED ARC AND CIRCUMFERENTIAL BUTT WELDS SHALL HAVE PERMANENT BACK-UP RINGS. ALL EXPOSED BUTT WELDS SHALL BE GROUND FLUSH.
2. FOR WELD SIZES NOT SHOWN, USE MINIMUM SIZE WELD AS SPECIFIED BY THE LATEST WELDING CODE.
3. BREAK ALL SHARP EDGES FOR WIRE PROTECTION.

FOUNDATIONS

1. AT LOCATIONS BEHIND CURB, ALL SIGNAL AND LIGHTING POLES SHALL BE LOCATED AT THE BACK EDGE OF SIDEWALK OR AT THE R/W LINE, TO OBTAIN A MINIMUM SETBACK DISTANCE OF 5' BEHIND THE BACK EDGE OF CURB TO CENTER OF POLE. (SEE SHEET T-30.1.8 FOR TYPICAL LOCATIONS.)
2. AT LOCATIONS WITHOUT CURB, POLES SHALL BE PLACED A MINIMUM DISTANCE OF 4' FROM SHOULDER OR A MINIMUM OF 10' FROM TRAVEL WAY, WHICH EVER IS GREATER.
3. FOUNDATIONS SHALL BE IN CONFORMANCE WITH SHEETS T-30.1.7, T-30.1.10 AND T-30.1.17 OF THESE STANDARD PLANS.

SAFETY BASES

1. TYPE 7 AND TYPE 14 POLES SHALL REQUIRE SAFETY BASE ASSEMBLIES UNLESS MOUNTED ON STRUCTURE BEHIND BARRIER RAIL OR NOTED OTHERWISE ON THE PLANS.

(1) FOR FOUNDATION ISLAND, SEE DETAIL "B", SHEET T-30.1.10
(2) FOR SAFETY BASE, SEE SHEET T-30.1.9
(3) FOR ANCHOR BOLT LENGTHS AND DIMENSIONS, SEE SHEET T-30.1.10
(4) FOR BASE PLATE DETAIL, SEE DETAIL "A", SHEET T-30.1.10
(5) FOR LUMINAIRE ARM CONNECTION, SEE DETAIL "C", SHEET T-30.1.10
(6) FOR SIGNAL ARM CONNECTION, SEE DETAIL "D", SHEET T-30.1.10

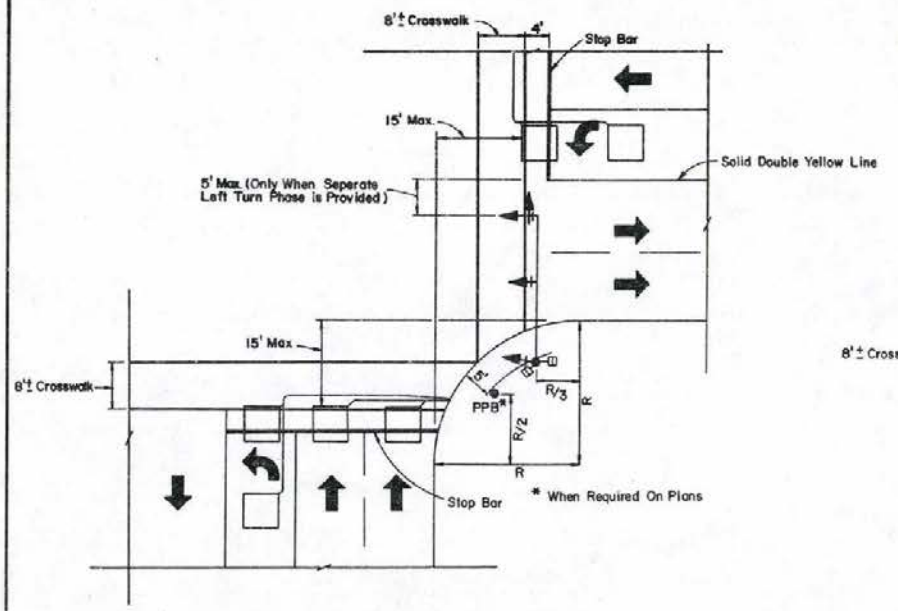
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

LIGHTING AND SIGNALS

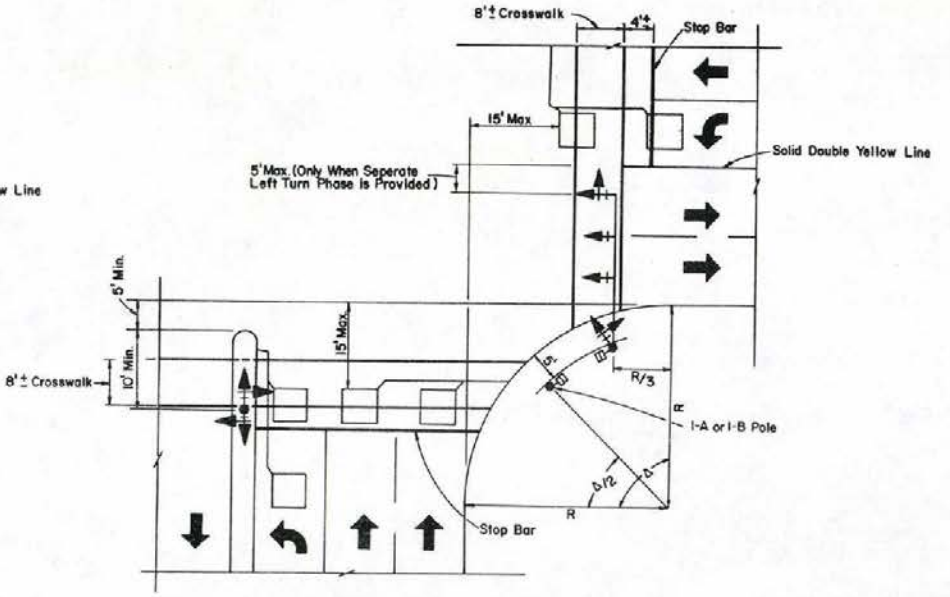
POLE TYPES 5-A-(S), 6-A-(L&S) & 7-(L)

CHIEF TRAFFIC ENGR.

T-30.1.7 (623)
ADOPTED: 2/71 REVISION 3-1/88



25' AND SMALLER RADII CURB RETURN AND MEDIAN LOCATION



30' AND LARGER RADII CURB RETURN AND MEDIAN LOCATION

T8

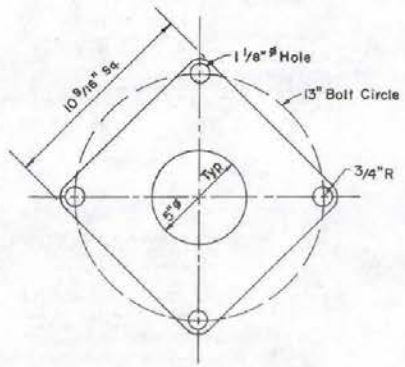
TYPICAL LOCATIONS FOR SIGNAL POLES AND LOOP DETECTORS

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

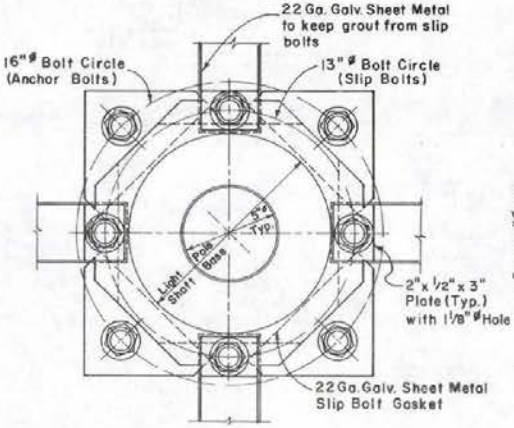
LIGHTING AND SIGNALS

CHIEF TRAFFIC ENGR.

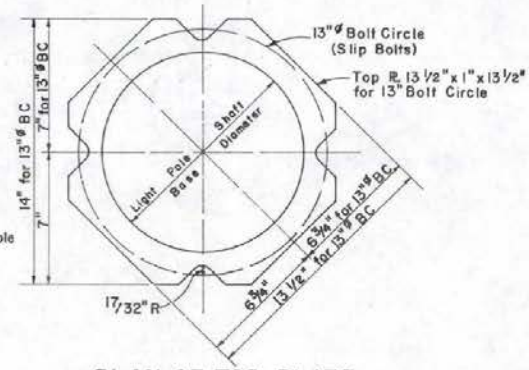
T-30.1.8 (623)
ADOPTED 3/82 REVISION



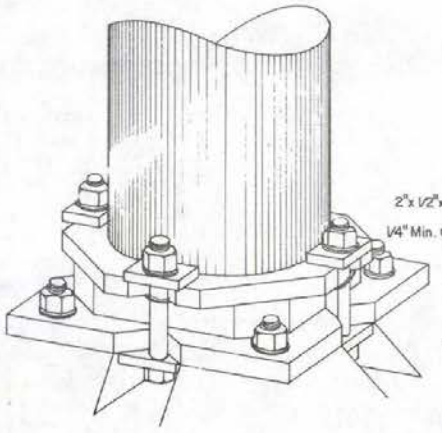
SLIP BOLT GASKET
(22 Gage Galvanized Sheet Metal)

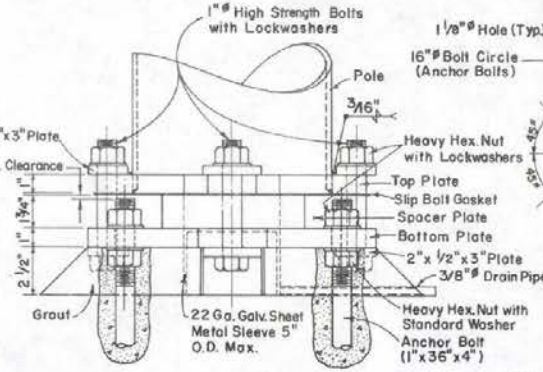


PLAN

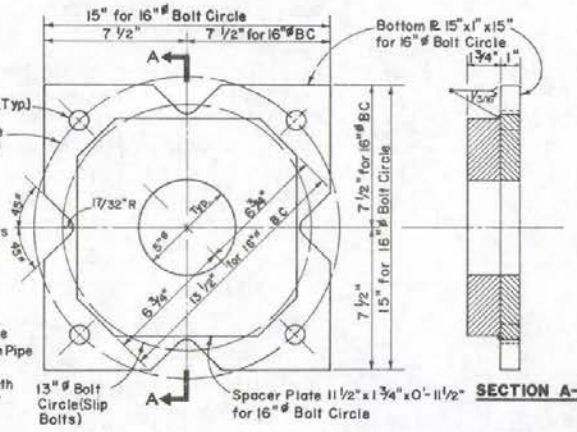


PLAN OF TOP PLATE





LIGHT POLE BASE



PLAN OF BOTTOM AND SPACER PLATE

SAFETY BASE NOTES FOR POLE TYPES 7 & 14

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"ø HIGH STRENGTH BOLTS. BOLTS SHALL BE INSTALLED IN THE SLOTS SO THAT THE BOLT SHANKS ARE IN CONTACT WITH THE PLATES.
4. ALL STEEL PLATE ASSEMBLIES SHALL BE HOT-DIP GALVANIZED AFTER FABRICATION.
5. ALL NUTS, BOLTS AND WASHERS SHALL BE ELECTRO-PLATED CADMIUM IN ACCORDANCE WITH ASTM A-165, TYPE TS.
6. ALL CONTACT AREAS OF PLATES SHALL BE FREE OF GALVANIZING BEADS OR RUNS.
7. SAFETY BASES SHALL BE UTILIZED ON ALL STEEL LIGHT POLES EXCEPT ON STRUCTURES OR UNLESS OTHERWISE NOTED ON THE PLANS.
8. SLIP BOLTS SHALL BE TORQUED TO 150 FOOT-POUNDS OR 1800 INCH-POUNDS.
9. GROUTING SHALL BE DONE AFTER LIGHT POLE HAS BEEN LOCATED IN FINAL POSITION.

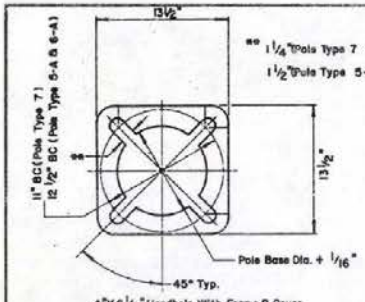
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

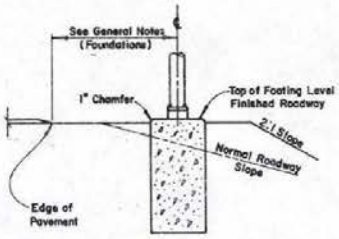
LIGHTING AND SIGNALS

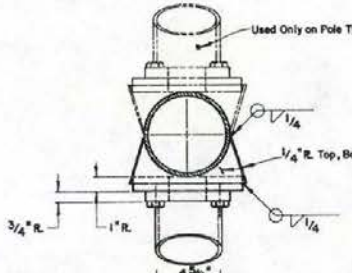
SAFETY BASE DETAILS FOR POLE TYPES 7 & 14

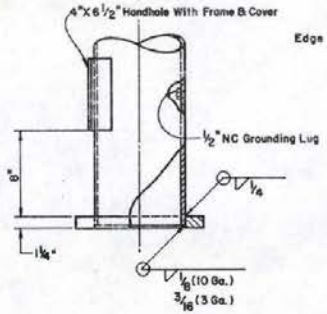
CHIEF TRAFFIC ENGR

T-30.1.9 (623)
ADOPTED: 2/71 REVISION 4-1/83







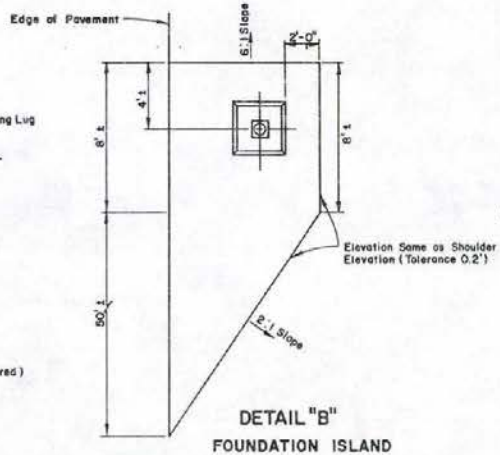


DETAIL "A"
BASE PLATE
(POLE TYPE 5-A, 6A & 7)

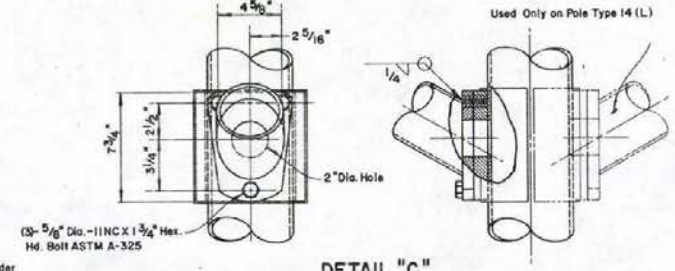
(Not Applicable When Safety Bases Are Required)

POLE TYPE	ANCHOR BOLT SIZE
5-A	1 1/4" x 44" x 4"
6-A	1 1/4" x 44" x 4"
*7	1" x 36" x 4"

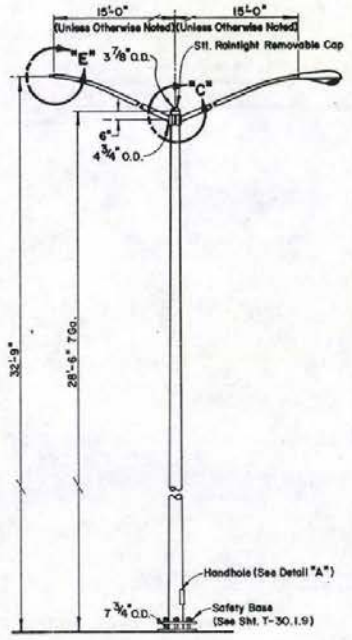
* Not Applicable When Mounted on Structures



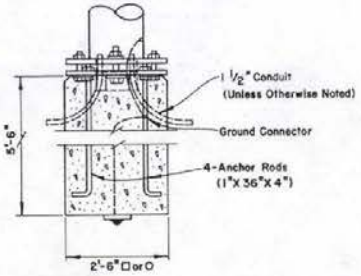
DETAIL "B"
FOUNDATION ISLAND



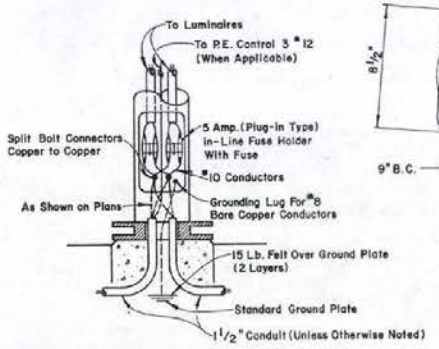
DETAIL "C"
LUMINAIRE ARM CONNECTION
(POLE TYPE 6-A, 7 & 14)



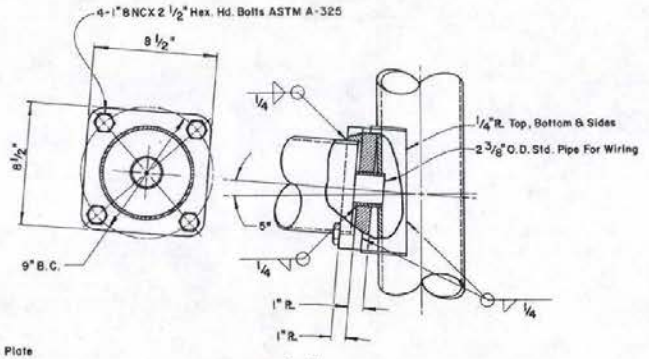
POLE TYPE 14



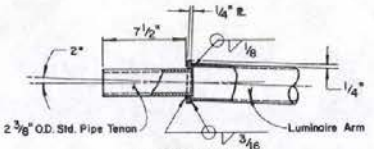
FOUNDATION DETAIL
FOR POLE TYPE 14



WIRING DIAGRAM FOR POLE TYPE 14



DETAIL "D"
SIGNAL ARM CONNECTION
(POLE TYPE 5-A & 6-A)

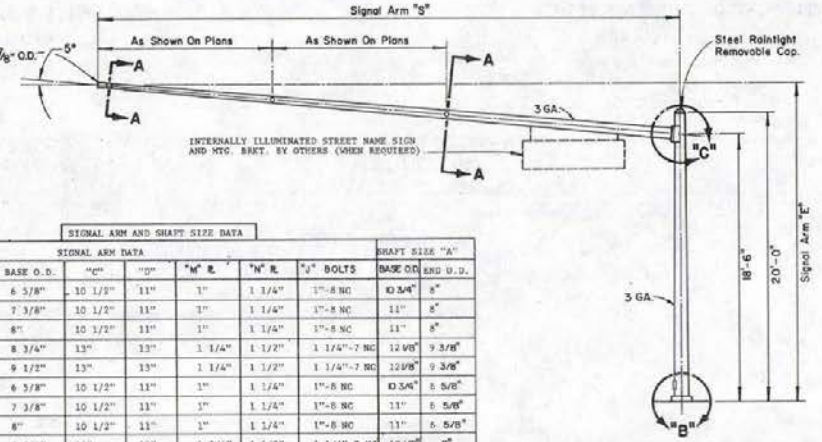


DETAIL "E"
LUMINAIRE TENON DETAIL

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

LIGHTING AND SIGNALS

POLE TYPE 14, 5-A, 6A, 7 & 14 MAST ARM MOUNTING AND TYPICAL FOUNDATION ISLAND DETAILS	CHIEF TRAFFIC ENGR.	T-30.1.10 686 ADOPTED: 12/79

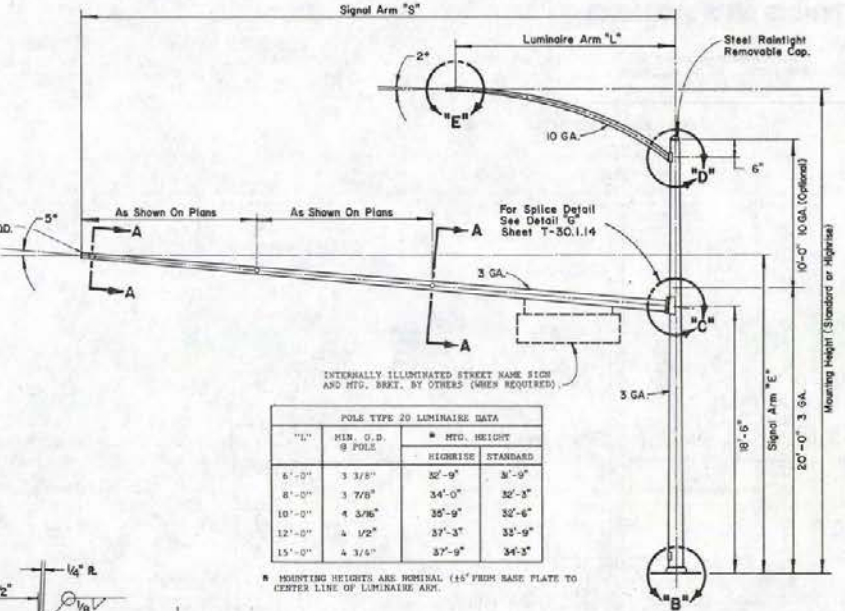


SIGNAL ARM AND SHAFT SIZE DATA

POLE TYPE	SIGNAL ARM DATA								SHAFT SIZE "A"	
	"S"	"E"	BASE O.D.	"C"	"D"	"M" R.	"N" R.	"J" BOLTS	BASE O.D.	END O.D.
10	20'-0"	20'-3"	6 5/8"	10 1/2"	11"	1"	1 1/4"	1"-8 NC	10 3/4"	8"
	25'-0"	20'-8"	7 3/8"	10 1/2"	11"	1"	1 1/4"	1"-8 NC	11"	8"
	30'-0"	21'-3"	8"	10 1/2"	11"	1"	1 1/4"	1"-8 NC	11"	8"
	35'-0"	21'-6"	8 3/4"	13"	13"	1 1/4"	1 1/2"	1 1/4"-7 NC	12 1/8"	9 3/8"
	40'-0"	22'-0"	9 1/2"	13"	13"	1 1/4"	1 1/2"	1 1/4"-7 NC	12 1/8"	9 3/8"
20	20'-0"	20'-3"	6 5/8"	10 1/2"	11"	1"	1 1/4"	1"-8 NC	10 3/4"	8 5/8"
	25'-0"	20'-8"	7 3/8"	10 1/2"	11"	1"	1 1/4"	1"-8 NC	11"	8 5/8"
	30'-0"	21'-2"	8"	10 1/2"	11"	1"	1 1/4"	1"-8 NC	11"	8 5/8"
	35'-0"	21'-6"	8 3/4"	13"	13"	1 1/4"	1 1/2"	1 1/4"-7 NC	12 1/8"	8"
	40'-0"	22'-0"	9 1/2"	13"	13"	1 1/4"	1 1/2"	1 1/4"-7 NC	12 1/8"	8"

POLE TYPE 10

FOR POLE FOUNDATIONS SEE SHEET T-30.1.17



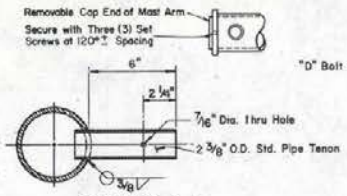
POLE TYPE 20 LUMINAIRE DATA

"L"	MIN. O.D. @ POLE	* MTG. HEIGHT	
		HIGHRISE	STANDARD
6'-0"	3 3/8"	32'-9"	31'-9"
8'-0"	3 7/8"	34'-0"	32'-3"
10'-0"	4 3/16"	35'-9"	32'-6"
12'-0"	4 1/2"	37'-3"	33'-9"
15'-0"	4 3/4"	37'-9"	34'-3"

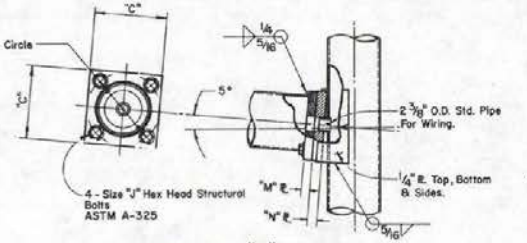
* MOUNTING HEIGHTS ARE NOMINAL (45' FROM BASE PLATE TO CENTER LINE OF LUMINAIRE ARM.

POLE TYPE 20

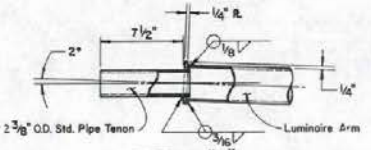
FOR POLE FOUNDATIONS SEE SHEET T-30.1.17



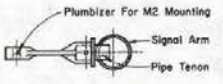
SECTION A-A
SIGNAL TENON ATTACHMENT



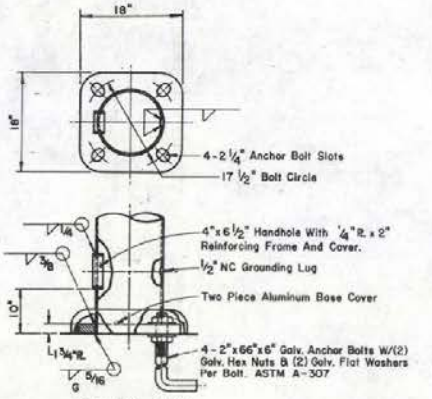
DETAIL "C"
SIGNAL ARM CONNECTION



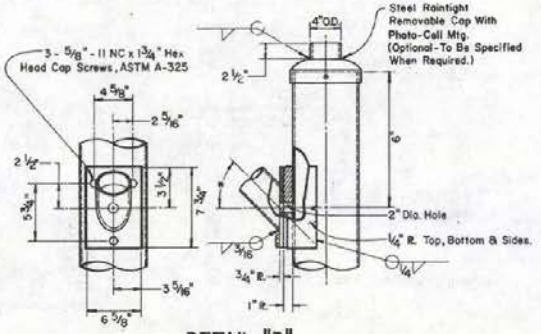
DETAIL "E"
LUMINAIRE TENON DETAIL



SPECIAL DETAIL
FOR MOUNTING SIGNAL HEAD



DETAIL "B"
POLE BASE



DETAIL "D"
LUMINAIRE ARM CONNECTION

* Highrise - 45°, Standard - 28°

For General Notes, (See Sheet No. T-30.1.7)

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

LIGHTING AND SIGNALS

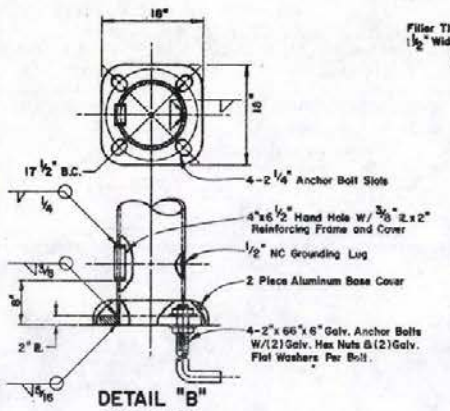
POLE TYPES 10 AND 20

CHIEF TRAFFIC ENGR.

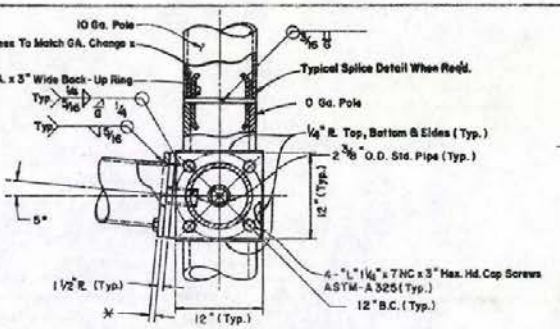
T-30.1.11 623

ADOPTED 12/79 REVISION 1-1/81

T11

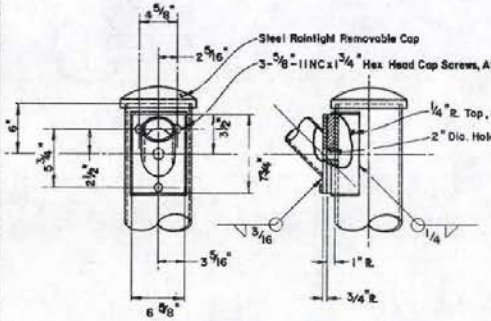


DETAIL "B"
POLE BASE

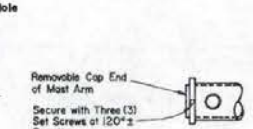


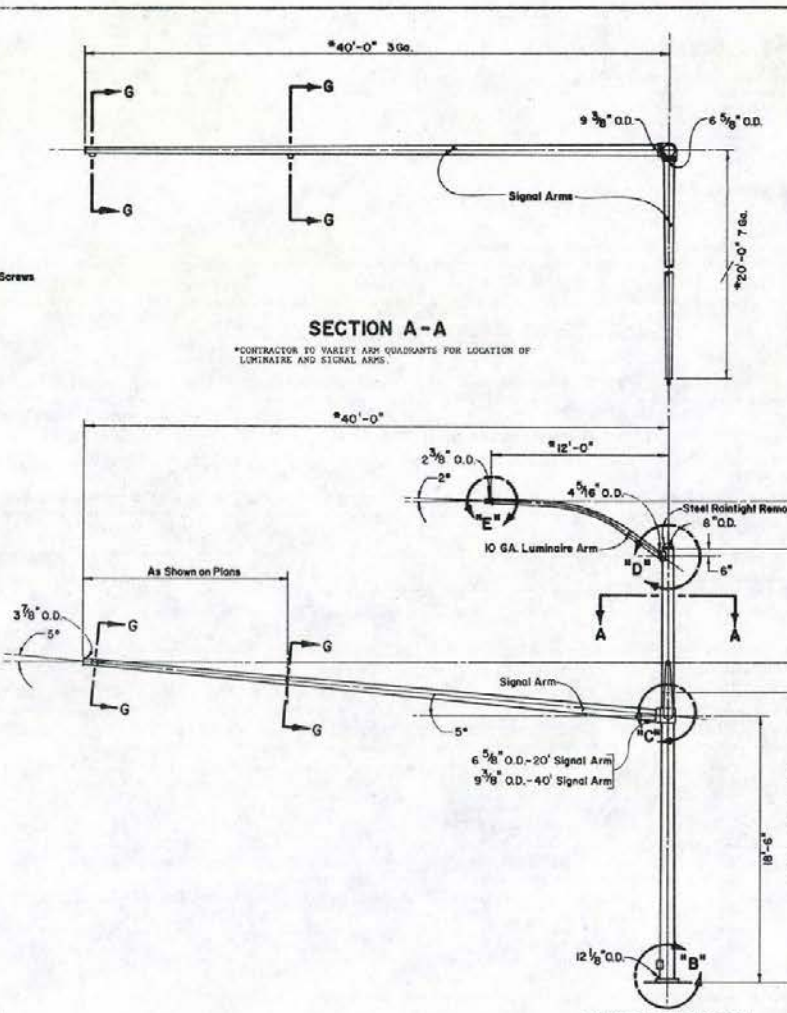
DETAIL "C"
SIGNAL ARM CONNECTION
*1" R. For 20' Signal Arm
1 1/4" R. For 40' Signal Arm

SECTION A-A
*CONTRACTOR TO VARIFY ARM QUADRANTS FOR LOCATION OF LUMINAIRE AND SIGNAL ARMS.

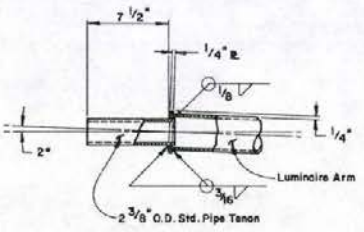


DETAIL "D"
LUMINAIRE ARM CONNECTION

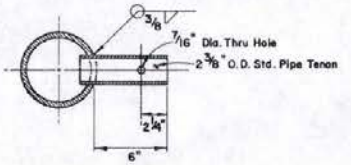




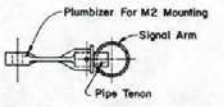
POLE TYPE 28



DETAIL "E"
LUMINAIRE TENON DETAIL



SECTION G-G
SIGNAL TENON ATTACHMENT



SPECIAL DETAIL
FOR MOUNTING SIGNAL HEAD

FOR POLE FOUNDATION SEE SHEET T-30. 1.17

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

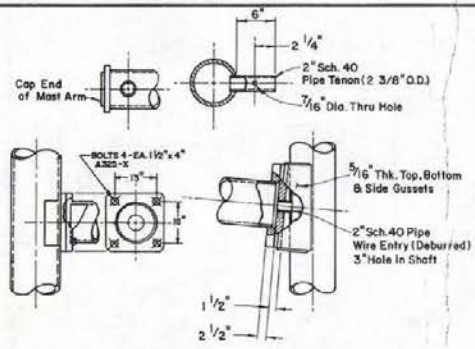
LIGHTING AND SIGNALS

POLE TYPE 28 AND MAST ARM MOUNTING DETAILS

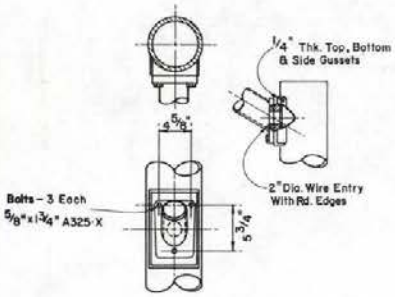
CHIEF TRAFFIC ENGR.

T-30.1.12 625
ADOPTED 12/79 REVISION 1-1/98

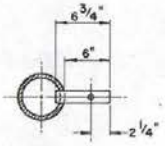
T12



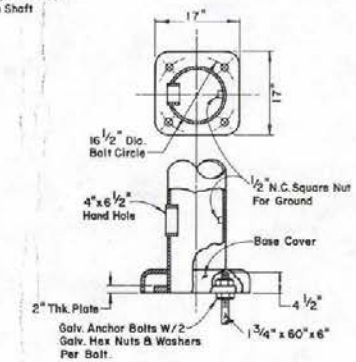
SIGNAL ARM ATTACHMENT



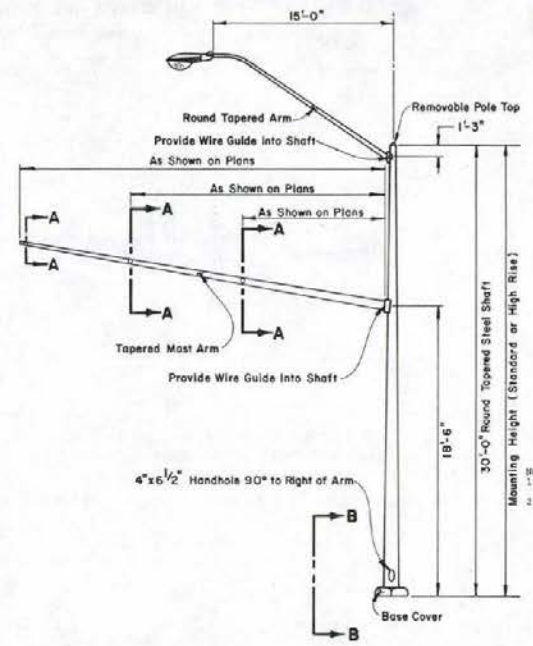
LUMINAIRE ARM ATTACHMENT



SECTION A-A



VIEW B-B

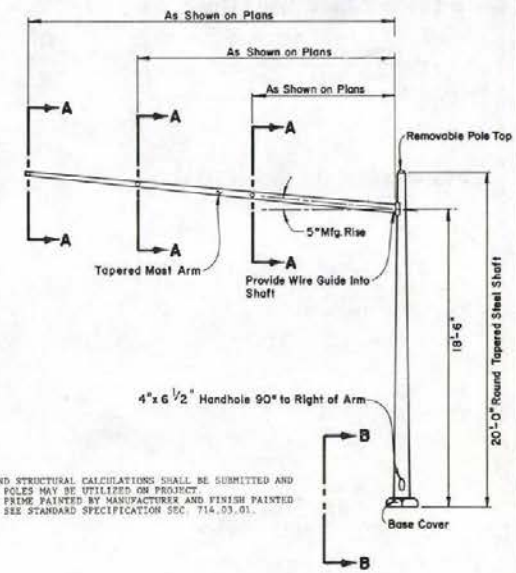


POLE TYPE 35

(FOR FOUNDATION SEE DETAIL "I", SHEET T-30.1.17)

POLE TYPE 35 LUMINAIRE DATA			
L	MIN. O.D. @ POLE	* MTG HEIGHT HIGHRISE	* MTG HEIGHT STANDARD
6'-0"	3 3/8"	32'-0"	31'-0"
8'-0"	3 7/8"	33'-3"	31'-6"
10'-0"	4 3/16"	35'-0"	31'-9"
12'-0"	4 1/2"	36'-6"	33'-0"
15'-0"	4 3/4"	37'-0"	33'-6"

*MOUNTING HEIGHTS ARE NOMINAL (±6" FROM BASE PLATE TO CENTER LINE OF LUMINAIRE ARM).



NOTES:
1. SHOP DRAWINGS AND STRUCTURAL CALCULATIONS SHALL BE SUBMITTED AND APPROVED BEFORE POLES MAY BE UTILIZED ON PROJECT.
2. ALL POLES TO BE PRIME PAINTED BY MANUFACTURER AND FINISH PAINTED BY CONTRACTOR. SEE STANDARD SPECIFICATION SEC. 714.03.01.

POLE TYPE 30

(USE SAME FOUNDATION AS POLE TYPE 35)

T13

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

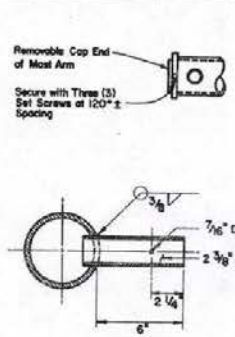
LIGHTING AND SIGNALS

POLE TYPES 35 AND 30

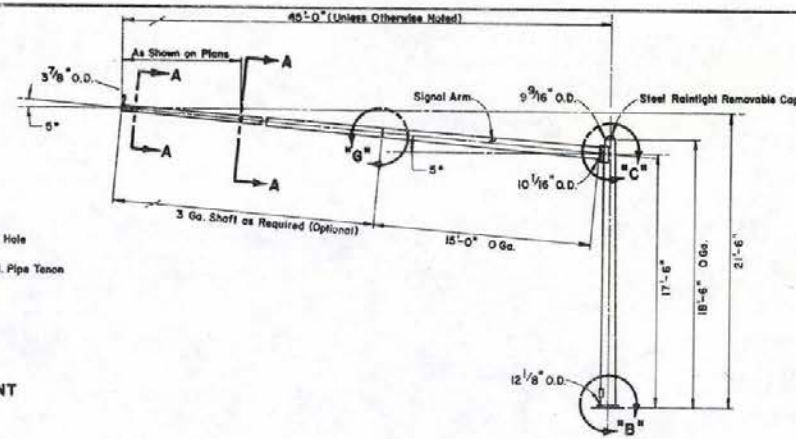
CHIEF TRAFFIC ENGR.

T-30.1.13 (623)

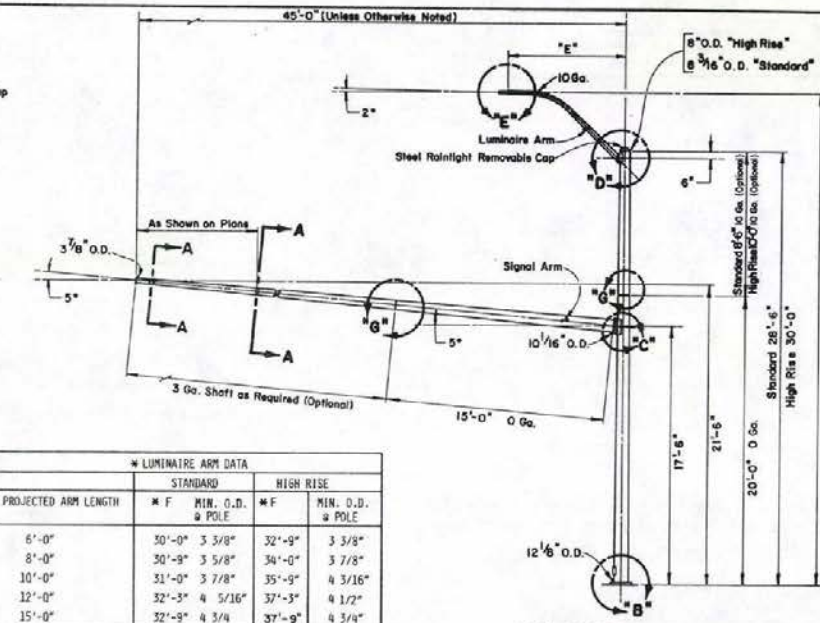
ADOPTED: 2/79 REVISION 3/11 - 86



SECTION A-A
SIGNAL TENON ATTACHMENT



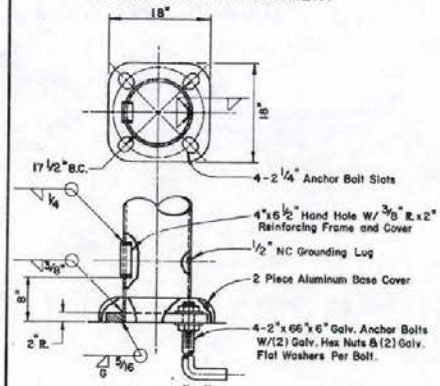
POLE TYPE 40
FOR FOUNDATION SEE DETAIL "I" SHEET T-30.1.17



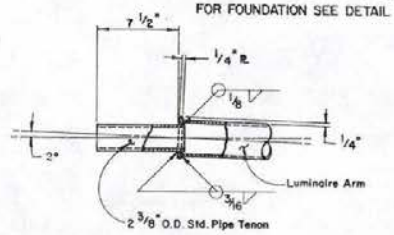
POLE TYPE 45
FOR FOUNDATION SEE DETAIL "I" SHEET T-30.1.17

* LUMINAIRE ARM DATA				
	STANDARD		HIGH RISE	
"E" PROJECTED ARM LENGTH	* F	MIN. O.D. @ POLE	* F	MIN. O.D. @ POLE
6'-0"	30'-0"	3 3/8"	32'-9"	3 3/8"
8'-0"	30'-9"	3 5/8"	34'-0"	3 7/8"
10'-0"	31'-0"	3 7/8"	35'-9"	4 3/16"
12'-0"	32'-3"	4 5/16"	37'-3"	4 1/2"
15'-0"	32'-9"	4 3/4	37'-9"	4 3/4"

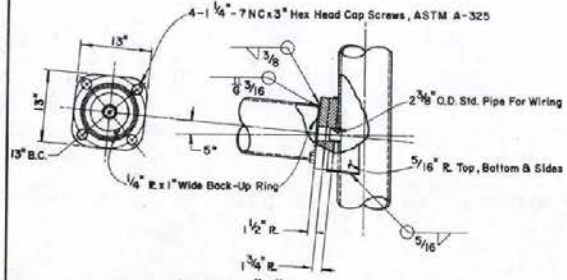
* MOUNTING HEIGHTS ARE NOMINAL (± 6" FROM BASE PLATE TO ℄ OF LUMINIARE ARM)



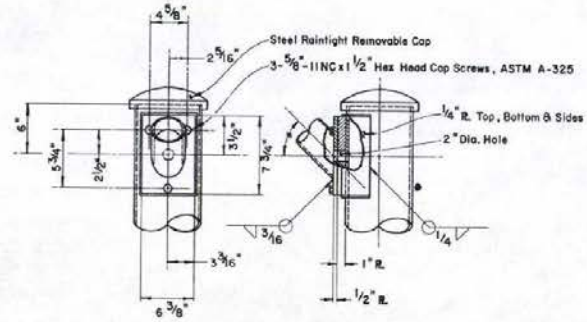
DETAIL "B"
POLE BASE



DETAIL "E"
LUMINAIRE TENON DETAIL

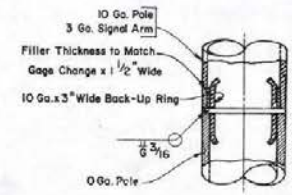


DETAIL "C"
SIGNAL ARM CONNECTION

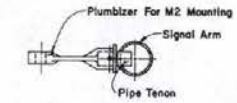


DETAIL "D"
LUMINAIRE ARM CONNECTION

*Standard – 28°
HighRise – 45°



DETAIL "G"
SPLICE DETAIL



SPECIAL DETAIL
FOR MOUNTING SIGNAL HEAD

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

LIGHTING AND SIGNALS

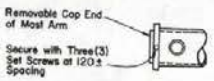
POLE TYPES 40 AND 45

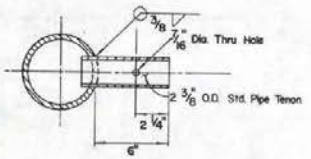
CHIEF TRAFFIC ENGR.

T-30.1.14 623

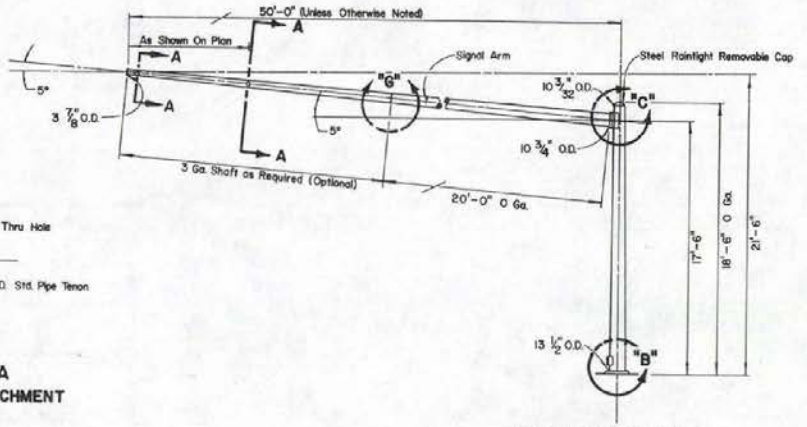
ADOPTED 12/79 REVISION 1-1/83

T14

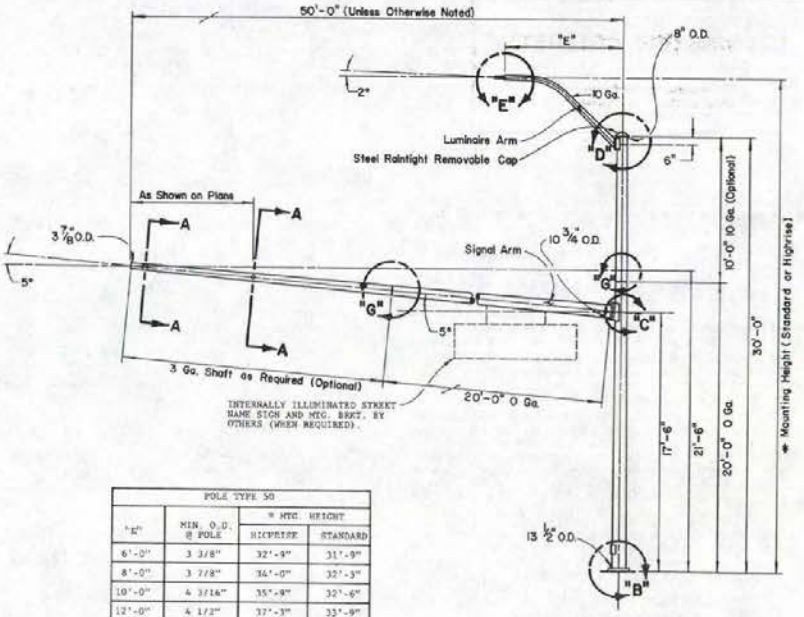




SECTION A-A
SIGNAL TENON ATTACHMENT



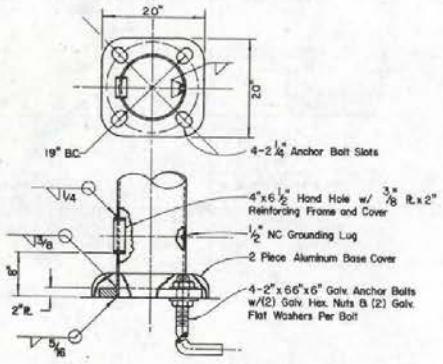
POLE TYPE 49
FOR POLE FOUNDATION SEE SHEET T-30.1.17



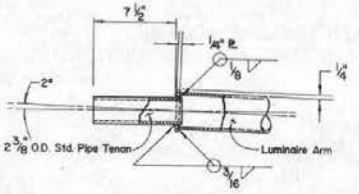
POLE TYPE 50			
"E"	MIN. O.D. @ POLE	* MTG. HEIGHT	
		HIGHRISE	STANDARD
6'-0"	3 3/8"	32'-9"	31'-9"
8'-0"	3 7/8"	34'-0"	32'-3"
10'-0"	4 3/16"	35'-9"	32'-6"
12'-0"	4 1/2"	37'-3"	33'-9"
15'-0"	4 3/4"	37'-9"	34'-3"

* MOUNTING HEIGHTS ARE NOMINAL (± 6" FROM BASE PLATE TO ℄ OF LUMINAIRE ARM).

POLE TYPE 50
FOR POLE FOUNDATION SEE SHEET T-30.1.17

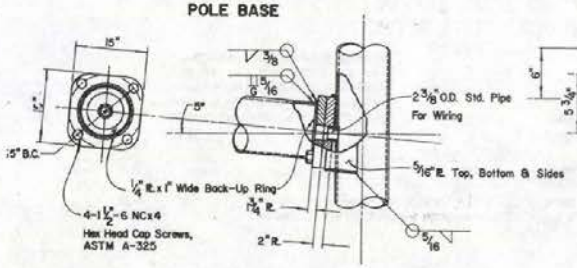


DETAIL "B"
POLE BASE

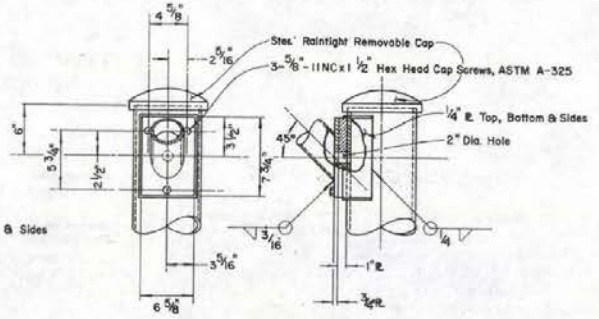


DETAIL "E"
LUMINAIRE TENON DETAIL

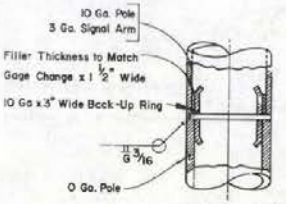
SPECIAL DETAIL
FOR MOUNTING SIGNAL HEAD



DETAIL "C"
SIGNAL ARM CONNECTION



DETAIL "D"
LUMINAIRE ARM CONNECTION



DETAIL "G"
SPLICE DETAIL

NOTE: USED ONLY WHEN REDUCED GAGE OPTION IS USED.

POLE TYPE 49 AND 50 AND MAST ARM MOUNTING DETAILS

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

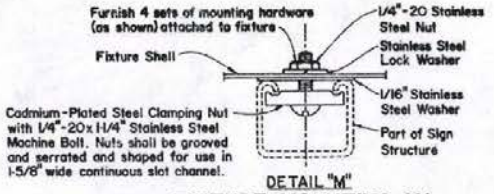
LIGHTING AND SIGNALS

T.D. Phillips
CHIEF TRAFFIC ENGR.

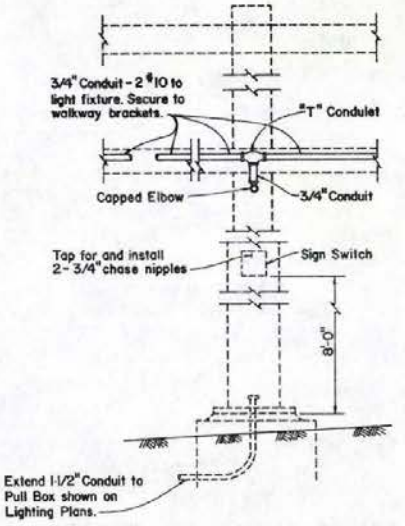
T-30.1.15 623
ADOPTED: 12/79 REVISION 1-1/83

T 15

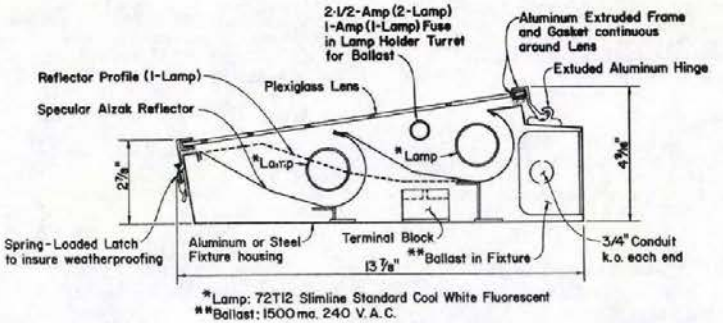
4-17-81



FIXTURE MOUNTING ON CONTINUOUS SLOT CHANNEL



DETAILS OF TYPICAL WIRING & SIGN SWITCH INSTALLATION



*Lamp: 72T12 Slimline Standard Cool White Fluorescent
**Ballast: 1500 ma. 240 V.A.C.

SECTION

LIGHTING FIXTURE (72" FLUORESCENT)

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)
11'-11" & Under	40-70 71-120	1	1 2	Match Center of Fixture With Center of Panel
12'-0" ↓ 17'-11"	40-70 71-120	2	2 4	36-72 Varies
18'-0" ↓ 23'-11"	40-70 71-120	3	3 6	36-72-72 Varies
24'-0" ↓ 31'-11"	40-70 71-120	4	4 8	36-72-72-72 Varies
32'-0" ↓ 37'-11"	40-70 71-120	5	5 10	36-72-72-72-72 Varies
38'-0" ↓ 43'-11"	40-70 71-120	6	6 12	36-72-72-72-72-72 Varies
44'-0"	40-70 71-120	7	7 14	36-72-72-72-72-72-72

FORMULA:

$$\frac{\text{Length of Panel (in inches)}}{\text{No. of Fixtures}} = \text{Ctr to Ctr (in inches) Between Fixtures}$$

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 3/4" 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-56.1.9 AND T-56.1.10).
7. SEE SIGN LAYOUT SHEETS FOR SIZE OF PANELS.
8. A SIGN SWITCH SHALL BE REQUIRED AS DESCRIBED IN SECTION 625.03.00 OF THE 1986 STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION.

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

LIGHTING AND SIGNALS

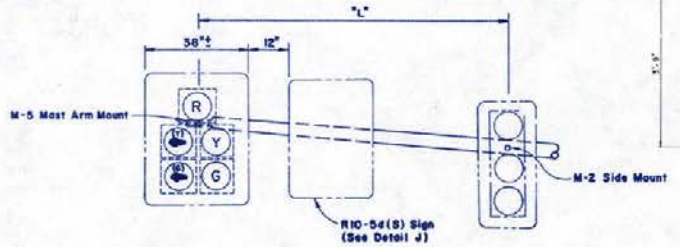
SIGN LIGHTING FIXTURES

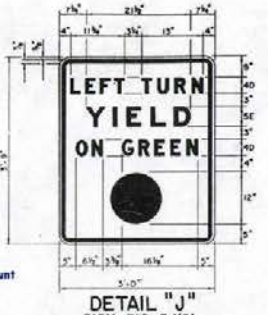
CHIEF TRAFFIC ENGR.

T-30.1.16-(623)

ADOPTED: 1/73 REVISION 5-1/88

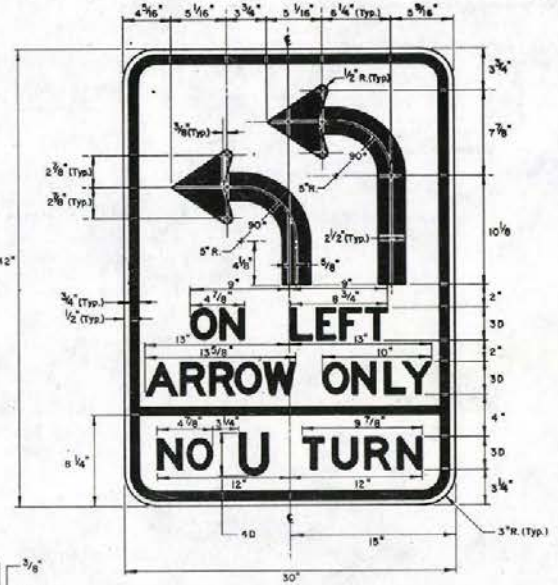
T16



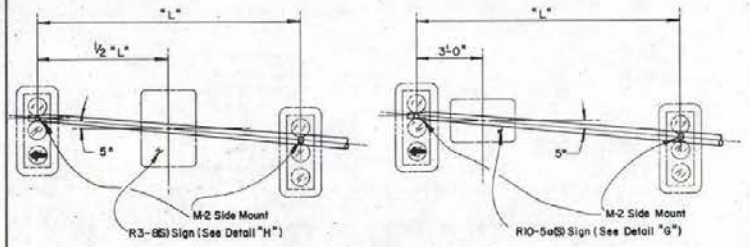


DETAIL "J"
SIGN R10-5d(S)

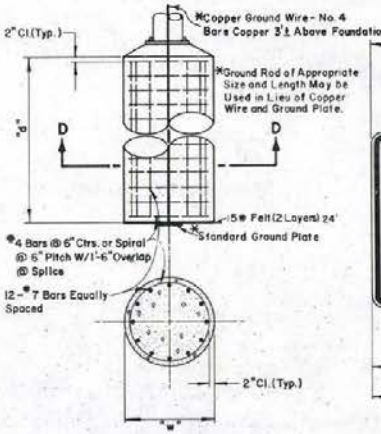
BACKGROUND - WHITE (REFL.)
BORDER & LEGEND - BLACK (NON-REFL)
CORNER RADIUS - 2"
CIRCULAR BALL - GREEN



DETAIL "H"
SIGN R3-8(S)
BACKGROUND-WHITE(REFL.)
LEGEND, BORDER-BLACK(NON-REFL.)



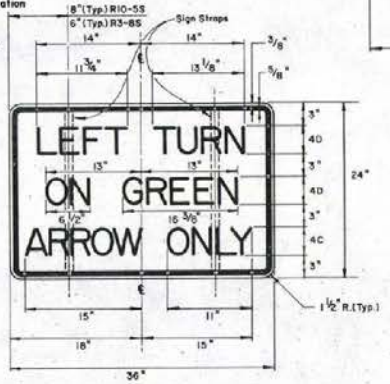
MAST ARM SIGNAL AND SIGN PLACEMENT
"L" = AS SHOWN ON PLANS



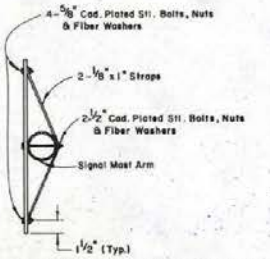
SECTION D-D
PILE FOUNDATION

POLE TYPE	SIGNAL ARM LENGTH	"d"	"w"
20	≤30'	8'-6"	30"
	>30'	10'-6"	36"
28, 35 AND 45	ALL	12'-0"	36"
50	ALL	13'-0"	36"

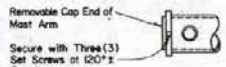
DETAIL "I"
* When Specified

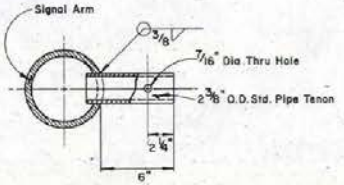


DETAIL "G"
SIGN R10-5a(S)
BACKGROUND-WHITE(REFL.)
LEGEND, BORDER-BLACK(NON-REFL.)
For Sign R10-5 See Sheet T-30.1.2



TYPICAL METHOD OF ATTACHMENT





M-2 SIDE MOUNT
SEE DETAIL FOR MOUNTING SIGNAL HEAD
ON SHEET T-30.1.15

GENERAL NOTES

1. ALL BOXES WILL HAVE 2-3/8" BRASS STUD BOLTS, NUTS AND WASHERS. COVER SHALL BE RECESSED FOR NUTS.
2. ALL BOXES AND EXTENSIONS SHALL BE PRECAST REINFORCED CONCRETE.
3. BOXES SHALL BE SEALED WITH MORTAR WHERE CONDUIT ENTERS BOX.
4. SIGN R10-5(S) SHALL BE USED WHEN A SINGLE LEFT TURN LANE IS REQUIRED AND SIGN R3-8(S) SHALL BE USED WHEN TWO LEFT TURN LANES ARE REQUIRED.

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

LIGHTING AND SIGNALS

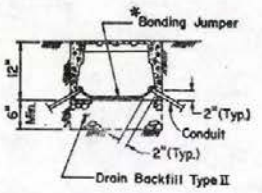
PILE FOUNDATIONS, TRAFFIC SIGNAL SIGNS

CHIEF TRAFFIC ENGR.

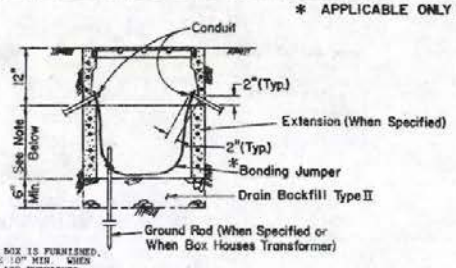
T-30.1.17 (623)
ADOPTED 12/79 REVISION 12-1/88

T17

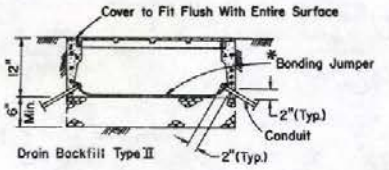
* APPLICABLE ONLY WHEN METAL CONDUIT IS USED



SECTION A-A



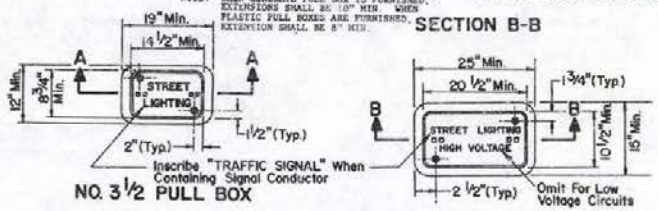
SECTION B-B



SECTION C-C

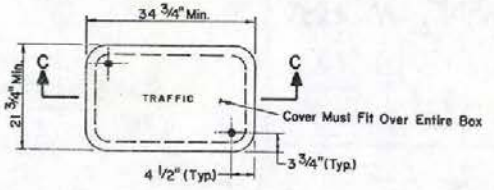
NOTES FOR PULL BOXES:

1. USE STEEL COVER WHEN BOX IS SUBJECT TO VEHICULAR TRAFFIC LOADS. HOWEVER, WHEN THE BOX IS LOCATED IN THE TRAVEL WAY, AN ELECTRICAL MANHOLE FRAME AND COVER SHALL BE INSTALLED.
2. WHEN THE PULL BOX IS INSTALLED IN A SIDEWALK AREA OR IN A STRUCTURE, THE DEPTH OF THE TOP OF THE PULL BOX SHALL BE ADJUSTED SO THAT THE TOP OF THE BOX IS FLUSH WITH THE TOP OF THE SIDEWALK.
3. IN AREAS WHERE THE POSSIBILITY OF MATERIAL ERODING FROM AROUND THE PULLBOX EXISTS, THE PULLBOX SHALL BE PLACED IN TYPE II DRAIN BACKFILL MATERIAL (2 FT ON EACH SIDE AND 1 FT DEPTH) AS DIRECTED BY THE ENGINEER.

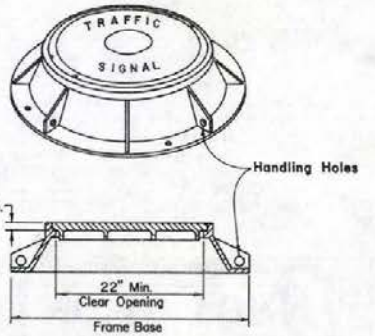


NO. 3 1/2 PULL BOX

NO.5 PULL BOX

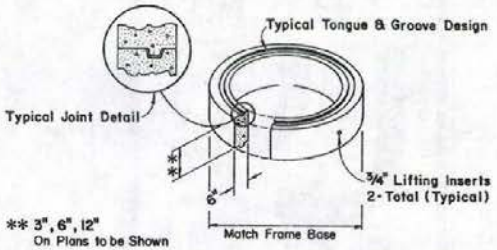


NO.7 PULL BOX

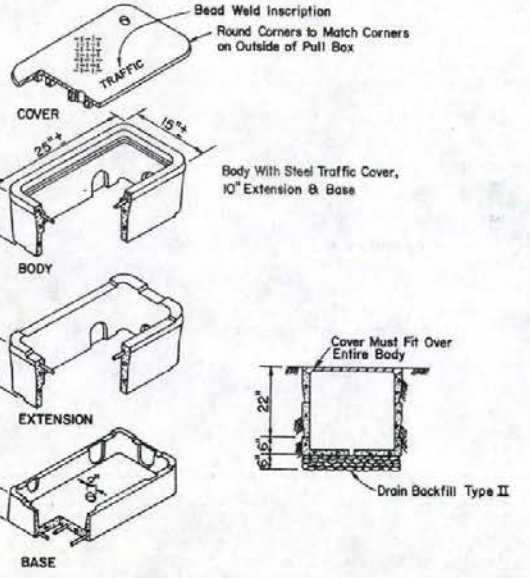


ELECTRICAL MAN HOLE FRAME & COVER

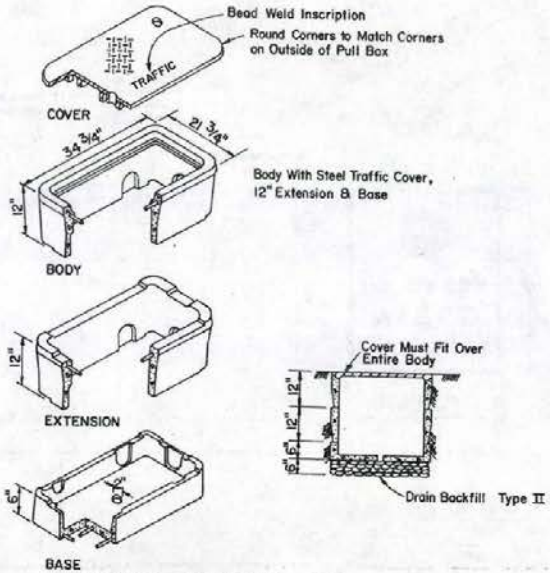
NOTES: 1. A COMPACTED BASE AND A CONCRETE FOOTING SUPPORT SHALL BE CONSTRUCTED PRIOR TO PLACEMENT OF THE CAST IRON FRAME AS DIRECTED BY THE ENGINEER.
2. ADJUSTMENTS TO ELEVATIONS SHALL BE MADE WITH COLLARS/RISERS AS REQUIRED.



COLLAR / RISER



SPECIAL NO.5 PULL BOX



SPECIAL NO.7 PULL BOX

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

LIGHTING AND SIGNALS

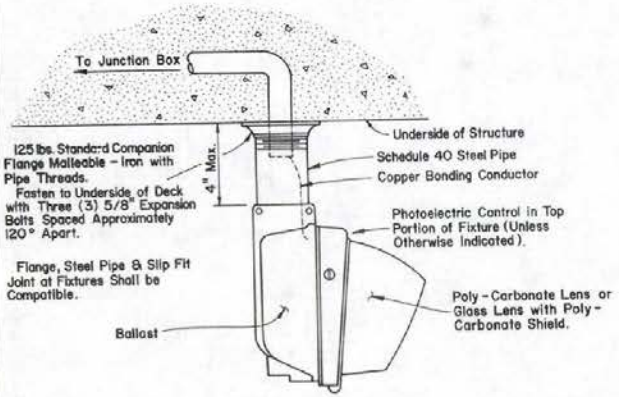
PULL BOXES & ELECTRICAL MANHOLE FRAME & COVER

CHIEF TRAFFIC ENGR.

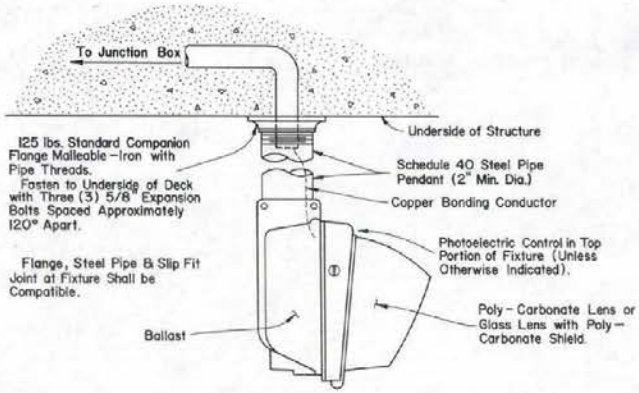
T 30.1.18 623

ADOPTED 1/83 REVISION

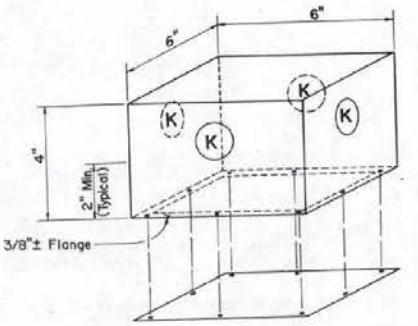
T18



TYPE "A" UNDERPASS LUMINAIRE

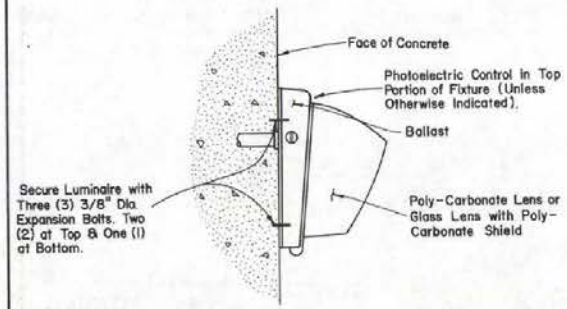


TYPE "C" UNDERPASS LUMINAIRE

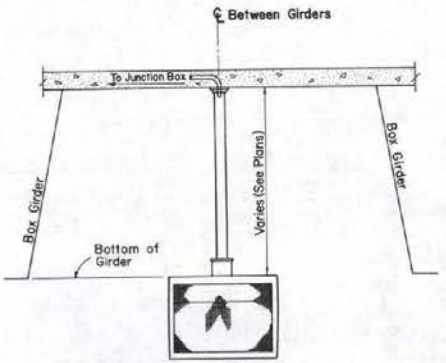


JUNCTION BOX DETAIL (J)

1. JUNCTION BOX AND COVER SHALL BE 16 GA. STEEL.
2. GALVANIZE ASSEMBLY AFTER FABRICATION.
3. BOX SHALL BE FLUSH WITH BOTTOM OF STRUCTURE.
4. FASTEN COVER BY DRILL AND TAP WITH EIGHT (8) #10-24 UNC BRASS SCREWS.
5. COVER SHALL BE ON BOX DURING POURING.
6. AN EQUIVALENT APPROVED MFG. BOX MAY BE USED IN LIEU OF DETAIL (J) JUNCTION BOX.
7. (K) KNOCK OUT FOR 1" CONDUIT. BOTTOM SHALL BE MIN OF 3½" ABOVE COVER TO CLEAR STRUCTURAL STEEL.

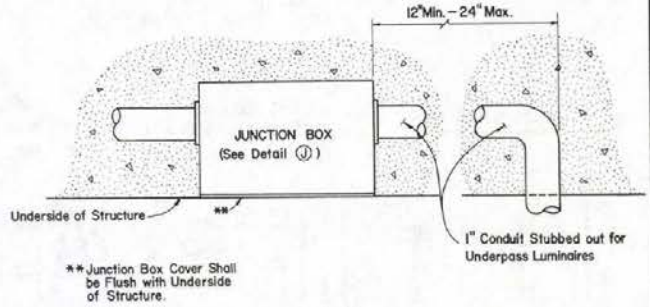


TYPE "B" UNDERPASS LUMINAIRE



DETAIL

PENDANT INSTALLATION (TYPE "C" UNDERPASS LUMINAIRE)



**Junction Box Cover Shall be Flush with Underside of Structure.

DETAIL "B"

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

LIGHTING & SIGNALS

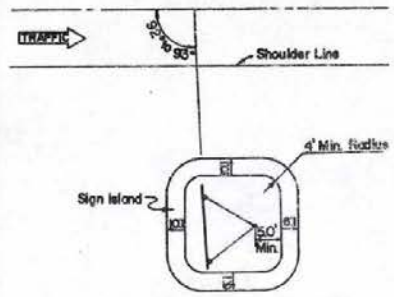
UNDERPASS LUMINAIRES & JUNCTION BOX

CHIEF TRAFFIC ENGR.

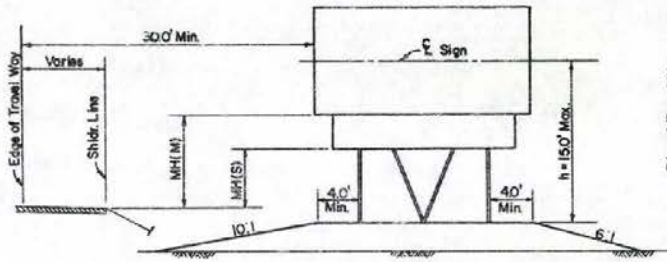
T-30.1.19 (623)

ADOPTED: 12/79 REVISION 1-1/88

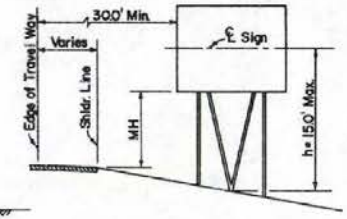
T19



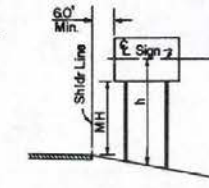
PLAN



LEVEL

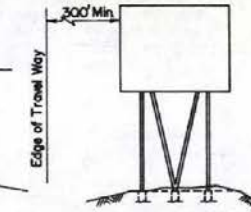


BRACED

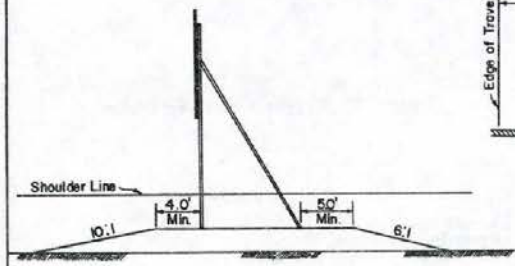


UNBRACED

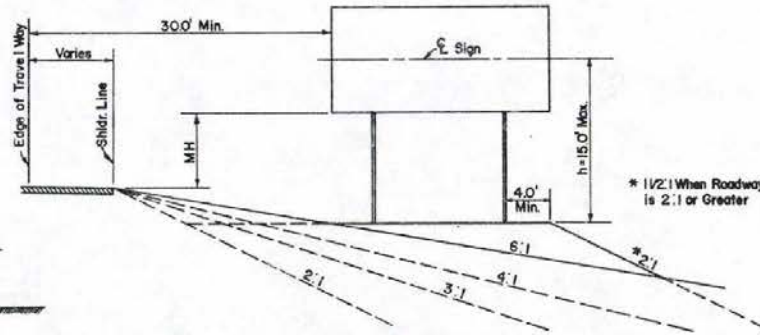
EMBANKMENT
(WITHOUT SIGN ISLAND)



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)

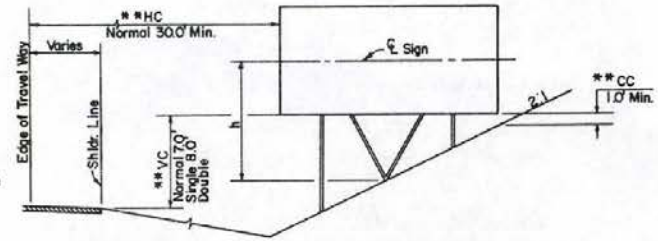


ELEVATION



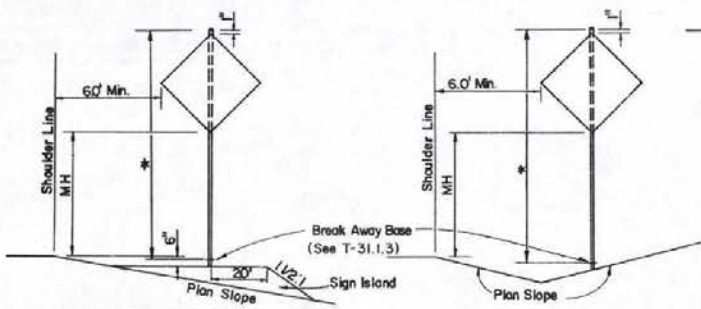
* 1 V2:1 When Roadway Slope is 2:1 or Greater

EMBANKMENT



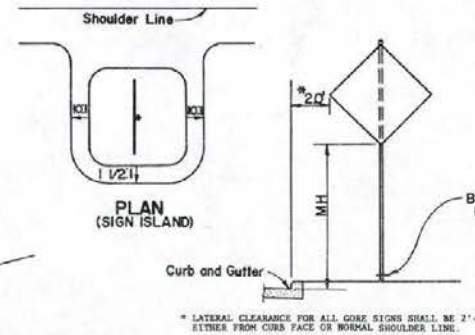
NOTE: If CC is Less than 1.0' Minimum
(1) Raise Sign Until CC=1.0' or VC=10.0' Max. for Single Sign VC=11.0' Max. for Double Sign, or h=15.0' Max.
(2) Maintain VC=10.0' or 11.0' and Move Sign Toward Shoulder Until CC=1.0', HC=16.0' Min., or h=15.0' Max.
(3) Special Consideration is Necessary if Given 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



* LATERAL CLEARANCE FOR ALL GORE SIGNS SHALL BE 2'-0" EITHER FROM CURB FACE OR NORMAL SHOULDER LINE.

GENERAL NOTES

1. SIGN ISLAND FOR TWO POST SIGNS REQUIRED ONLY WHEN h EXCEEDS 15.0'. ISLAND TO BE COMPACTED TO 95%
2. FOOTING AND SIGN DETAILS SHOWN ON SHEETS T-31.1.2, T-31.1.3, T-31.1.4.
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 6 FT. FROM THE EDGE OF THE SHOULDER, OR IF NONE, 12 FT. FROM THE EDGE OF THE TRAVELED WAY. IN URBAN AREAS A LESSER CLEARANCE MAY BE USED WHERE NECESSARY.

MINIMUM MOUNTING HEIGHTS (MH) FOR SIGNS

	*SINGLE GUIDE SIGNS	*DOUBLE GUIDE SIGNS	ROUTE MARKERS REGULATORY AND WARNING SIGNS
FREEWAYS AND EXPRESSWAYS	7'	8' (M) 5' (S)	6'
COMMERCIAL, RESIDENTIAL, CURB AND GUTTER	7'	7'	7'
RURAL ROADS AND INTERCHANGE RAMPS	5'	5'	5'
FREEWAY ENTRANCE AND DO NOT ENTER - WRONG WAY ASSEMBLIES			2'

(M) MAJOR SIGN (S) SECONDARY SIGN

NOTE: FOR MOUNTING HEIGHTS (MH) FOR CONSTRUCTION SIGNS AND TEMPORARY SIGNS, (SEE SHEET T-31.1.5).

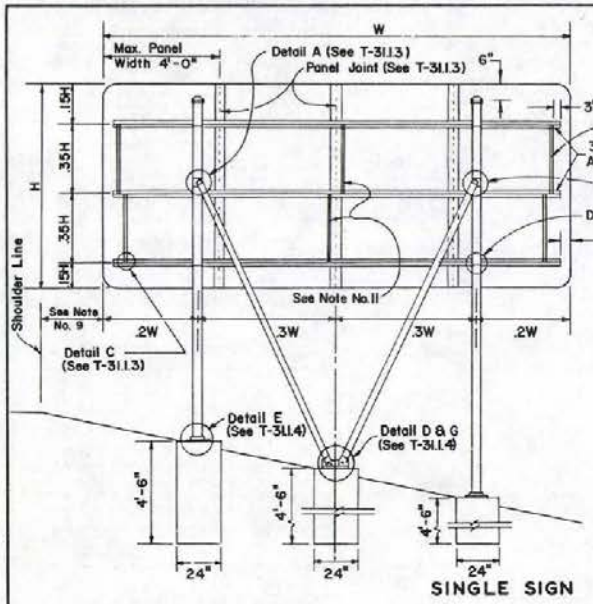
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

GROUND MOUNTED SIGN SUPPORTS (ROUND METAL POSTS)

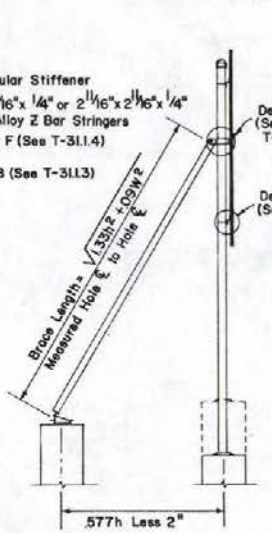
Russell Hill
CHIEF TRAFFIC ENGR.

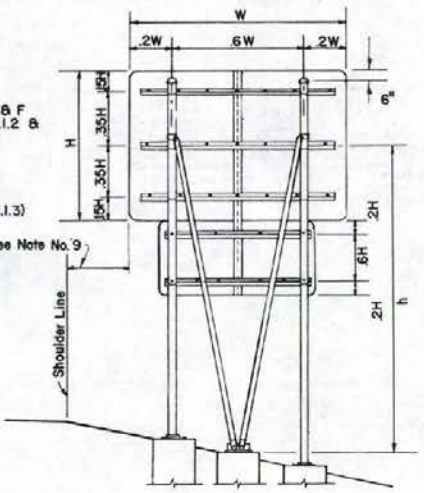
T-31.1.1 - (627)
ADOPTED: 6/99
REVISION 11 2/79

T-20

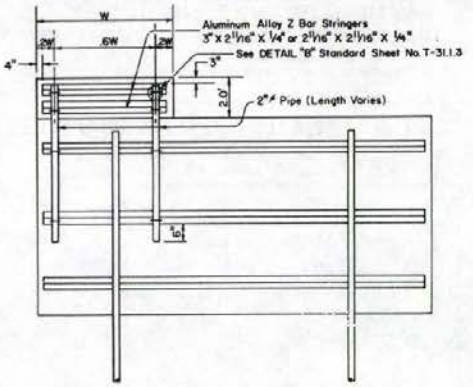


SINGLE SIGN



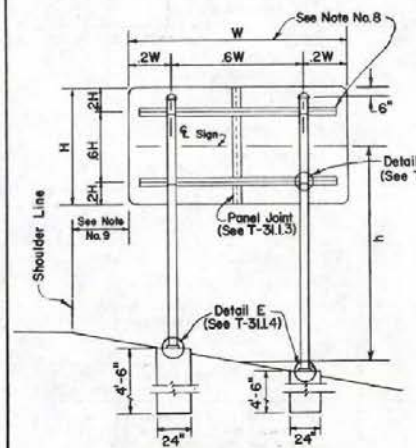


DOUBLE SIGN

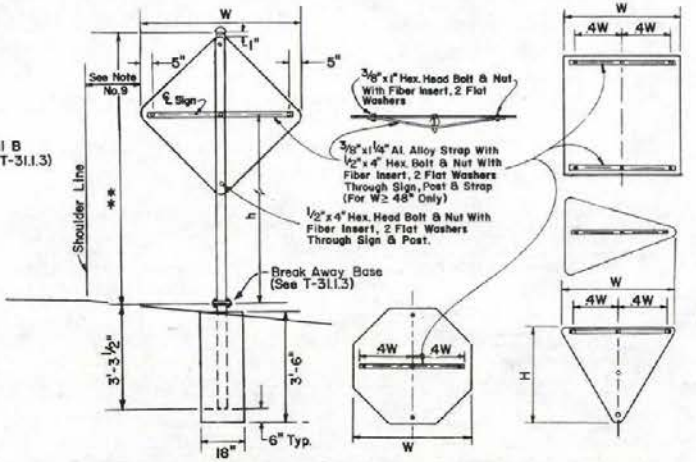


EXIT PANEL ATTACHMENT

DOUBLE SUPPORT WITH BRACES



DOUBLE SUPPORT



** Post Length as Show on Sign Summary Sheet

SINGLE SUPPORT

PIPE SIZE FOR BRACED PIPE SUPPORTS

SIGN AREA SQ. FT.	VERTICAL POST SIZE H 0' to 5'	5' to 6'	6' to 10'	10' to 12'	SIGN AREA SQ. FT.	BRACE SIZE h 0' to 8'	8' to 9'	9' to 11'	11' to 12'	12' to 15'
0' to 70'	2"	2"	2"	2"	0' to 70'	2"	2"	2"	3"	3"
70' to 140'	2"	2"	3"	3"	70' to 140'	2"	2"	2"	3"	3"
140' to 200'	3"	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.

GENERAL NOTES

1. SIZES AND TYPES OF SIGNS, POSTS AND BRACES ARE AS SHOWN ON SIGN SUMMARY SHEET.
2. FOR MATERIALS NOT DIRECTLY SPECIFIED SEE SPECIAL PROVISIONS.
3. FOOTINGS TO BE DRILLED HOLES, AS SHOWN, AND FILLED WITH CLASS A OR CLASS AA CONCRETE.
4. SIGN PANELS TO BE ALUMINUM SHEET CONSTRUCTION.
5. TUBULAR STIFFENERS REQUIRED ONLY WHEN 2W EXCEEDS 2'-0 ALUMINUM SHEET CONSTRUCTION.
6. SIGN ISLAND REQUIRED ONLY WHEN IN H EXCEEDS 15'-0" ISLAND TO BE COMPACTED TO 95% (SEE T-31.1.1).
7. FOR DOUBLE SIGN, DOUBLE SUPPORT WITH BRACES, AREA FOR TABLES IS TOTAL AREA OF TWO SIGNS. H' IS NOT CONSIDERED PART OF H.
8. "Z" BAR WILL BE USED ON ALL SIGNS REQUIRING TWO POSTS EXCEPT REGULATORY AND WARNING SIGNS. SPACING OF THE POSTS ON REGULATORY AND WARNING SIGNS REQUIRING TWO POSTS SHALL BE 2'-8".
9. SEE T-31.1.1 FOR SIGN PLACEMENT.
10. SEE T-31.1.4 FOR ANCHOR BOLT DETAILS.
11. TUBULAR STIFFENERS TO BE ADDED WHEN "W" EXCEEDS 10'-0".
12. REFER TO THE STANDARD HIGHWAY SIGN MANUAL FOR DRILL HOLE PLACEMENT.

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'	S 2"	S 2"	S 2"	S 2"	S 2"	S 2"
5' to 7.5'	S 2"	S 2"	S 2"	S 2"	S 3"	S 3"
7.5' to 10'	S 2"	S 2"	S 3"	S 3"	S 3"	S 3"
10' to 12.5'	S 2"	S 3"	S 3"	S 3"	S 3"	D 3"
12.5' to 15'	S 3"	S 3"	S 3"	D 3"	D 3"	D 3"
15' to 17.5'	S 3"	S 3"	S 3"	D 3"	D 3"	-
17.5' to 20'	S 3"	S 3"	D 3"	D 3"	D 3"	-
20' to 25'	S 3"	S 3"	D 3"	-	-	-
25' to 45'	S 3"	S 3"				

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

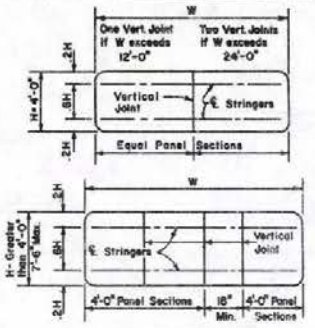
GROUND MOUNTED SIGN SUPPORTS (ROUND METAL POSTS)

T-31.1.2 (627)

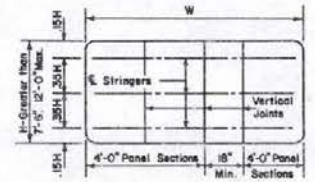
CHIEF TRAFFIC ENGR.

ADOPTED: 5/88

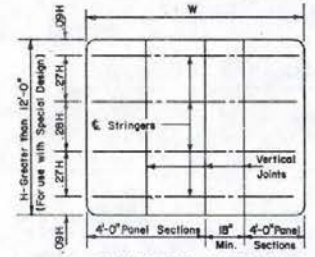
REVISION 11-5/81



2 STRINGER MOUNTING



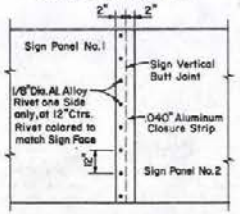
3 STRINGER MOUNTING



4 STRINGER MOUNTING

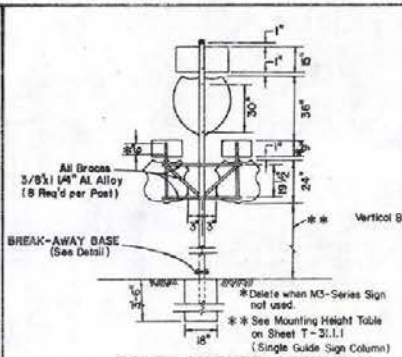
NOTE: To Obtain Desired Panel Width, Max. of 2 Panels may be Cut Less than 4'-0", (18" Min. each)

STRINGER AND PANEL ARRANGEMENT

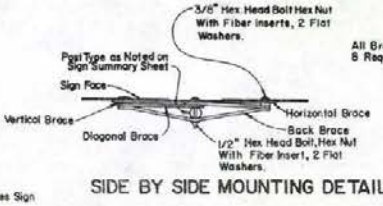


PANEL JOINT CLOSURE STRIP

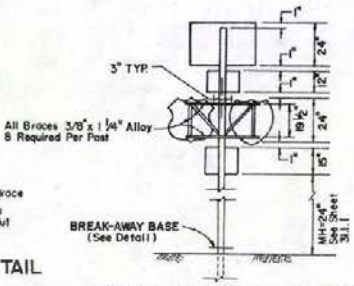
ALUMINUM SHEET CONSTRUCTION



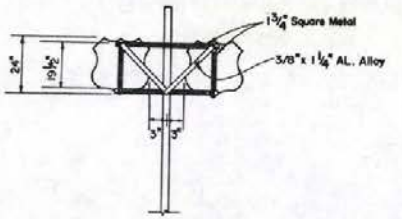
ROUTE MARKER ASSEMBLY

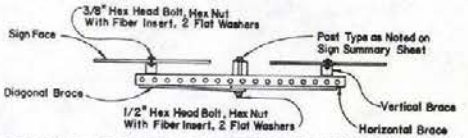


SIDE BY SIDE MOUNTING DETAIL

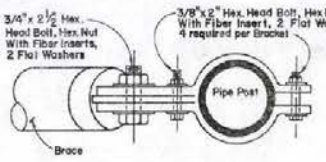


TYPICAL FREEWAY ENTRANCE

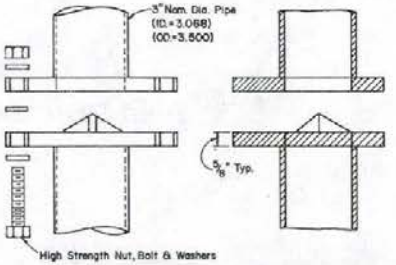




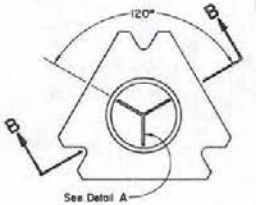
ALTERNATE SIDE BY SIDE SIGN MOUNTING DETAIL



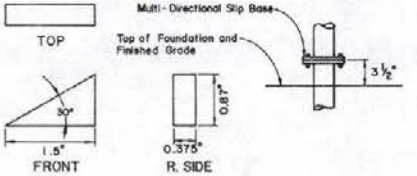
CLAMP ASSEMBLY DETAIL A



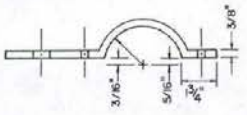
FRONT SECTION B-B

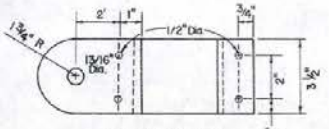


TOP VIEW

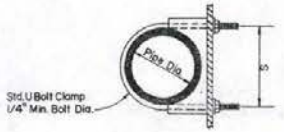


DETAIL A

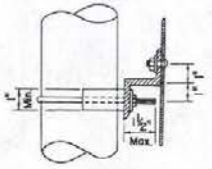




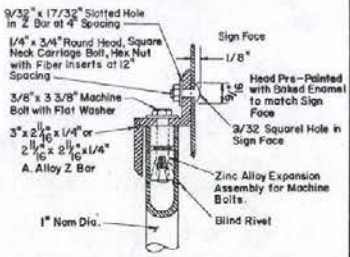
CLAMP PLATE



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

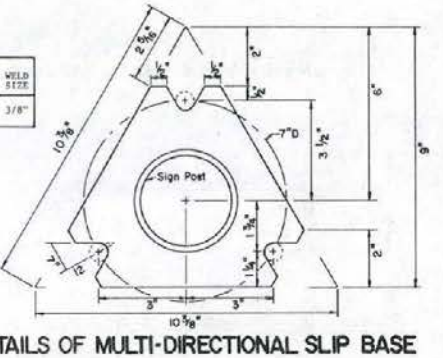


DETAIL B



DETAIL C

BOLT SIZE & TORQUE	WELD SIZE
3/8"Øx3½" T - 450	3/8"



DETAILS OF MULTI-DIRECTIONAL SLIP BASE

GENERAL NOTES

1. SEE STANDARD SHEETS T-31.1.1 THROUGH T-31.1.4 FOR DETAILS NOT SHOWN.

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

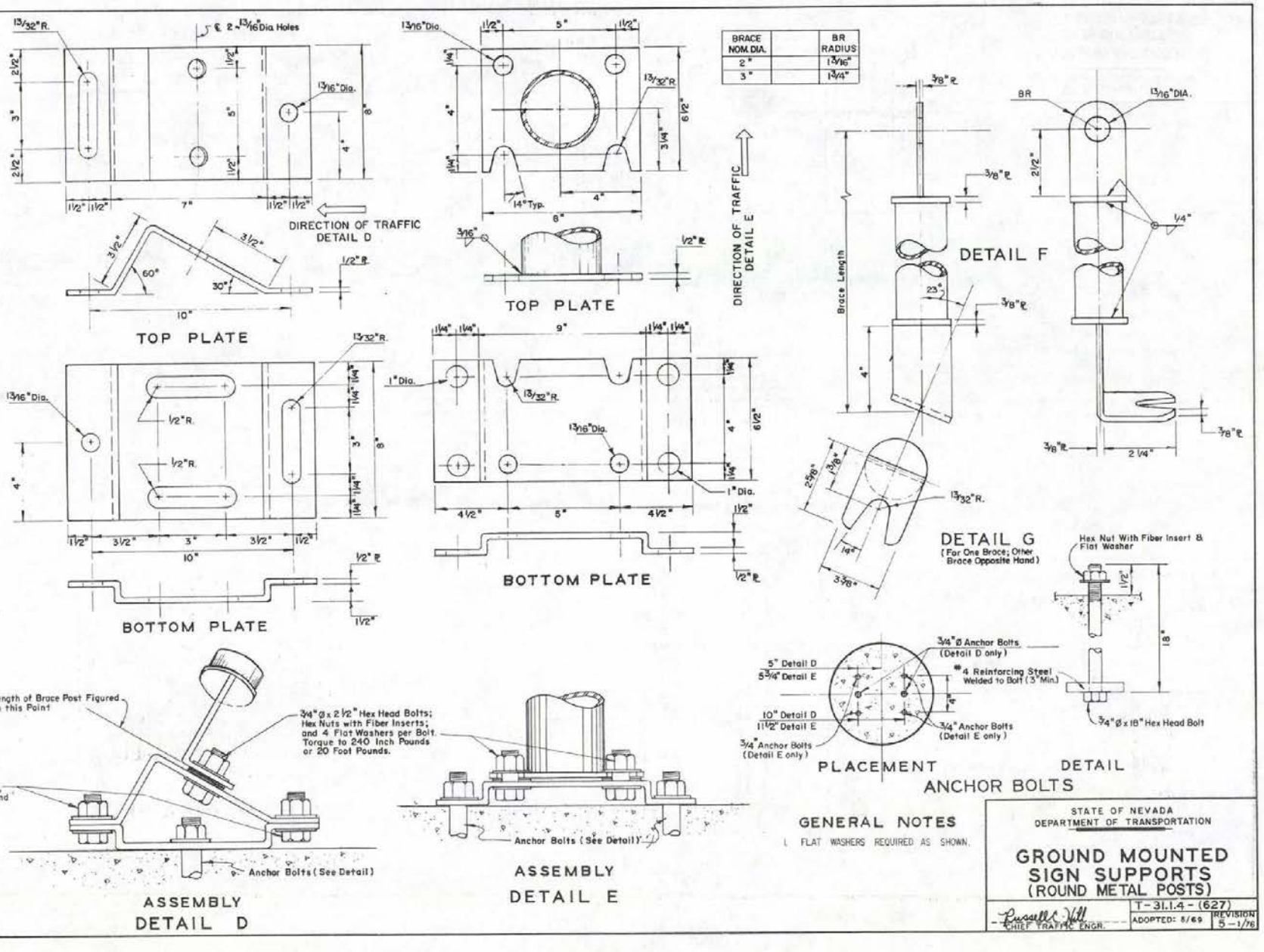
GROUND MOUNTED SIGN SUPPORTS (ROUND METAL POSTS)

CHIEF TRAFFIC ENGR.

T-31.1.3 (627)

ADOPTED: 8/82

REVISION



GENERAL NOTES

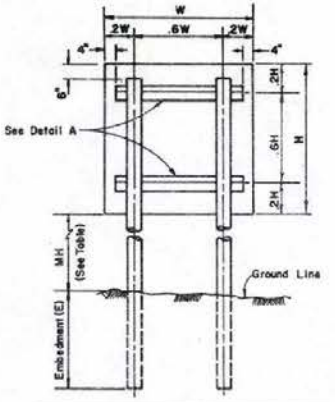
1. FLAT WASHERS REQUIRED AS SHOWN.

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

GROUND MOUNTED SIGN SUPPORTS (ROUND METAL POSTS)

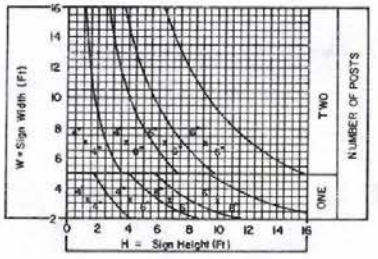
Russell C. Hill
CHIEF TRAFFIC ENGR.

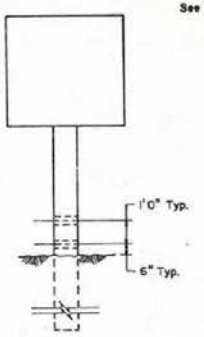
T-31.1.4-(627)
ADOPTED: 8/69
REVISION 5-1/76



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





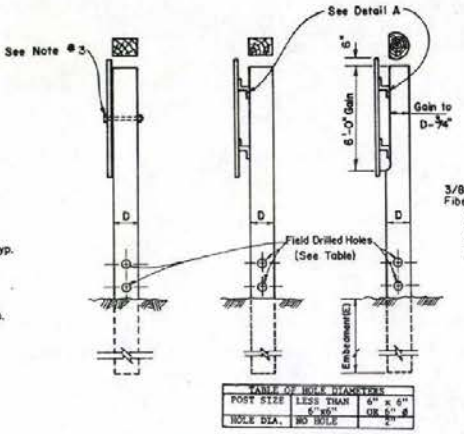
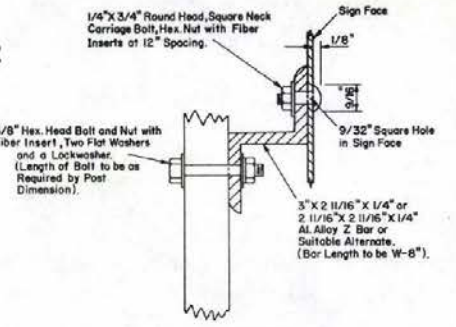
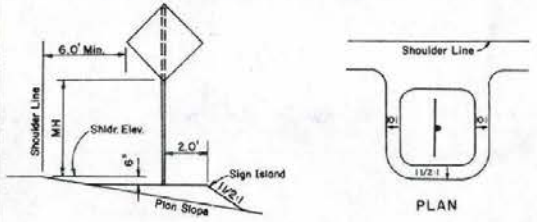


TABLE OF HOLE DIAMETERS		
POST SIZE	LESS THAN 6"x6"	6" x 6" OR 6" ø
HOLE DIA.	NO HOLE	2"

TIMBER POST SIGN SUPPORT



DETAIL A



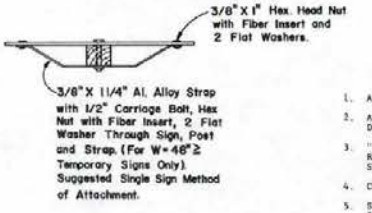
PLAN

SIGN ISLAND

MINIMUM MOUNTING HEIGHTS (MH) FOR SIGNS

	*SINGLE GUIDE SIGNS	*DOUBLE GUIDE SIGNS	ROUTE MARKERS, REGULATORY AND WARNING SIGNS
FREEWAYS AND EXPRESSWAYS	7'	8' (M) 5' (S)	6'
COMMERCIAL, RESIDENTIAL, CURB AND GUTTER	7'	7'	7'
RURAL ROADS AND INTERCHANGE RAMPS	5'	5'	5'
BARRICADE AND TRIPOD MOUNTING			1'

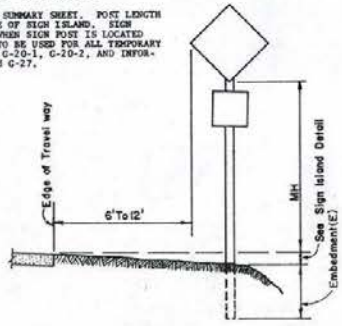
(M) MAJOR SIGN (S) SECONDARY SIGN



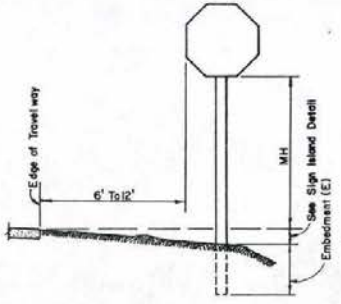
GENERAL NOTES

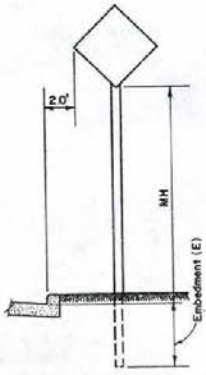
1. ALL BOLTS, NUTS AND WASHERS TO BE GALVANIZED.
2. ALL POSTS WITH CROSS SECTIONAL AREA LARGER THAN 24 SQUARE INCHES ARE TO BE DRILLED AS SHOWN.
3. "Z" BARS WILL BE USED ON ALL SIGNS REQUIRING TWO POSTS EXCEPT CONSTRUCTION REGULATORY AND WARNING SIGNS. SPACING OF THE POSTS ON REGULATORY AND WARNING SIGNS REQUIRING TWO POSTS SHALL BE 2'-8".
4. CONSTRUCTION SIGNS REQUIRING PORTABILITY MAY BE MOUNTED ON TRIPODS.
5. SIGN ISLAND FOR TWO POST SIGNS REQUIRED ONLY WHEN H EXCEEDS 15'-0". ISLAND TO BE COMPACTED TO 95%.

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.

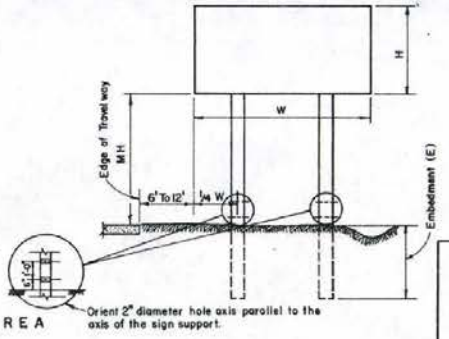


RURAL AREA





URBAN AREA



RURAL AND URBAN

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

TYPICAL SIGN ERECTION

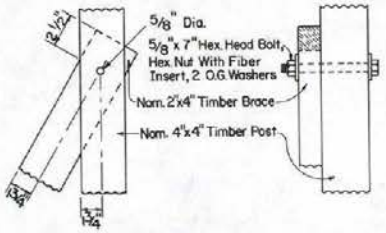
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

GROUND MOUNTED SIGN SUPPORTS (TIMBER POSTS)

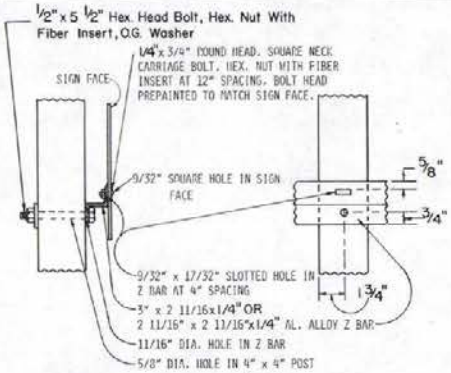
Russell C. Hill
CHIEF TRAFFIC ENGR.

T-31.1.5 (826)
ADOPTED: 8/73 REVISED: 6-

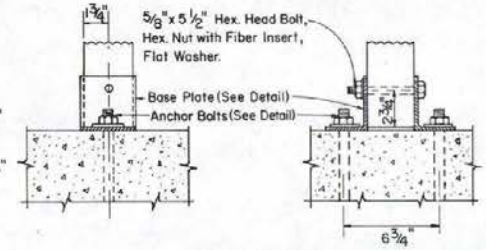
T-24



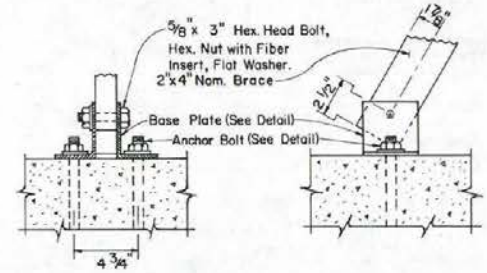
DETAIL "A"



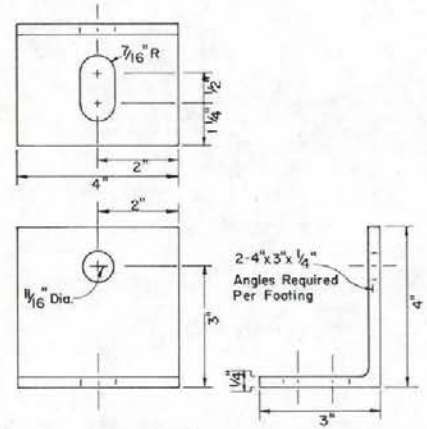
DETAIL "B"



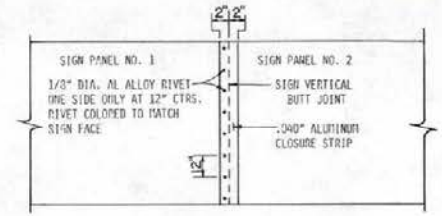
DETAIL "C"



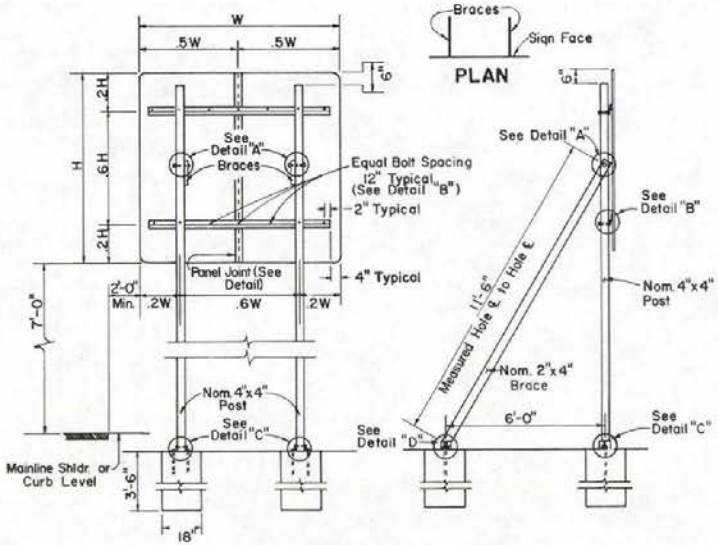
DETAIL "D"



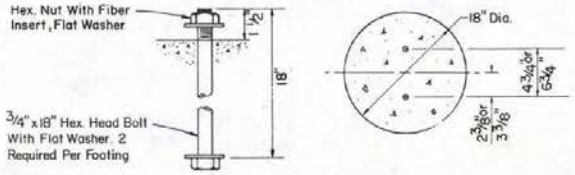
BASE PLATE DETAIL



PANEL JOINT CLOSURE STRIP



ELEVATION



ANCHOR BOLT DETAIL

GENERAL NOTES

1. ALL DRILLED HOLES IN TIMBER TO BE 5/8" DIAMETER UNLESS OTHERWISE NOTED.
2. BACK BRACE HOLE IN 4" x 4" POST TO BE DRILLED AND FITTED IN FIELD. ALL OTHER HOLES MAY BE SHOP DRILLED IN STANDARD POSITION.
3. FOOTINGS TO BE DRILLED HOLES - 18" DIAMETER, 3'6" DEEP, FILLED WITH CLASS A OR CLASS AA CONCRETE.

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

GROUND MOUNTED GORE SIGN (TIMBER SUPPORTS)

CHIEF TRAFFIC ENGR.

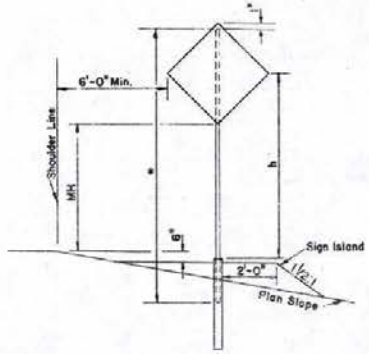
T 31.1.6 (627)

ADOPTED 10-68 | REVISION 1-1/83

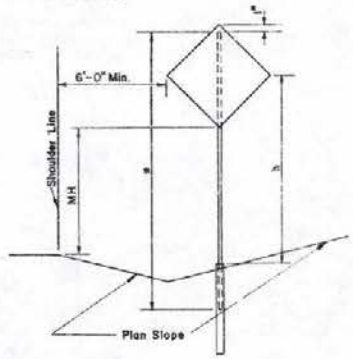
1-1/83

T-25

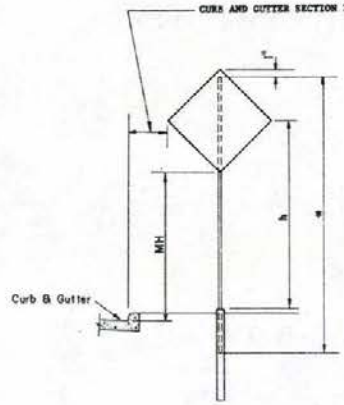
*POST LENGTH AS SHOWN ON SIGN SUMMARY SHEET. POST LENGTH CALCULATIONS ARE BASED ON USE OF SIGN ISLAND. SIGN ISLAND SHALL BE USED EXCEPT WHERE SIGNPOST IS LOCATED IN BACKSLOPE.



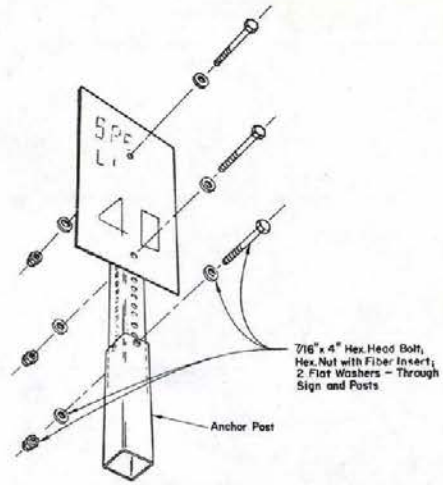
ELEVATION

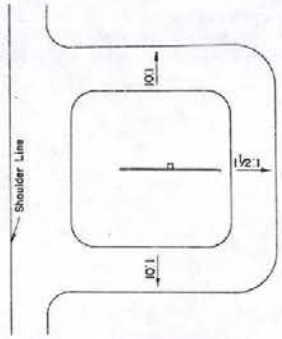


SIGN ON BACKSLOPE



SIGN ON GORE

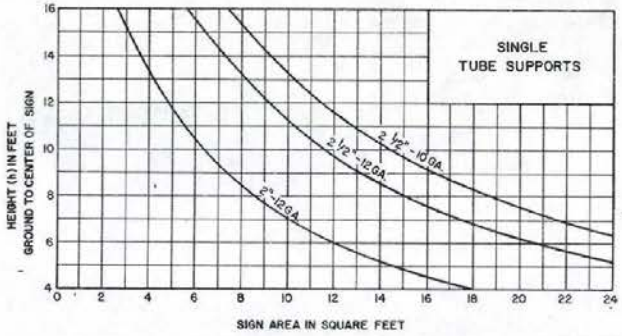


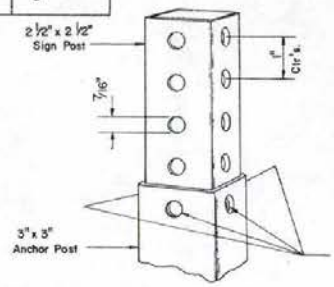


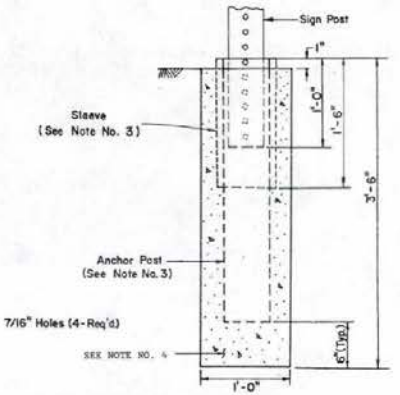
PLAN

SIGN ON SIGN ISLAND

MINIMUM MOUNTING HEIGHTS (MH) FOR SIGNS	
	ALL SIGNS
FREEWAYS AND EXPRESSWAYS	6'
COMERCIAL, RESIDENTIALS, CURB AND GUTTER	7'
RURAL ROADS AND INTERCHANGE RAMPS	5'
FREEWAY ENTRANCE AND DO NOT ENTER - WRONG WAY ASSEMBLIES	2'







POST SIZE	ANCHOR SIZE	SLEEVE SIZE
2"	2-1/4"	2-1/2"
2-1/2"	3"	NOT REQUIRED

GENERAL NOTES

1. SIGN ISLAND TO BE COMPACTED TO 95%
2. SIGNS SHOULD NOT BE CLOSER THAN 6 FT. FROM THE EDGE OF THE SHOULDER, OR IF NONE, 12 FT. FROM THE EDGE OF THE TRAVELED WAY. IN URBAN AREAS A LESSER CLEARANCE MAY BE USED WHERE NECESSARY.
3. ANCHOR POST AND SLEEVE TO BE INCLUDED IN COST OF POST LENGTH AS SHOWN ON THE SIGN SUMMARY SHEET.
4. THE ANCHOR AND SLEEVE (WHEN USED) SHALL BE DRIVEN INTO THE GROUND. IF THE CONTRACTOR CHOOSES TO DRILL A HOLE, IT SHALL BE AS SHOWN AND FILLED WITH CLASS A OR CLASS AA CONCRETE AT NO EXTRA COST TO THE STATE.

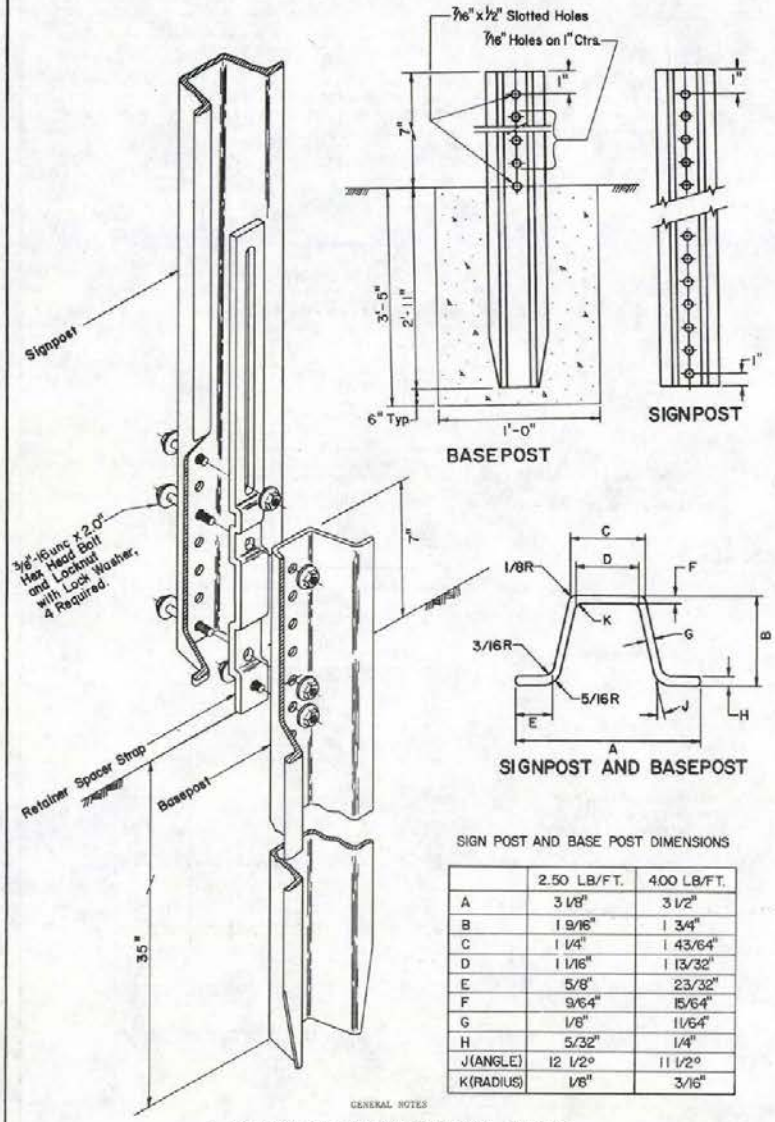
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

GROUND MOUNTED SIGN SUPPORTS (SQUARE METAL POSTS)

Russell C. Hill
CHIEF TRAFFIC ENG.

T-31.1.7(627)
ADOPTED: 1/76
REVISION 2-2/83

T-26



BASEPOST

SIGNPOST

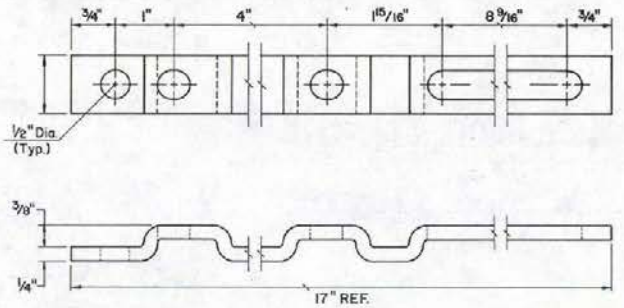
SIGNPOST AND BASEPOST

SIGN POST AND BASE POST DIMENSIONS

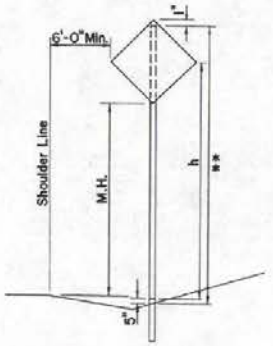
	2.50 LB/FT.	4.00 LB/FT.
A	3 1/8"	3 1/2"
B	1 9/16"	1 3/4"
C	1 1/4"	1 43/64"
D	1 1/16"	1 13/32"
E	5/8"	23/32"
F	9/64"	15/64"
G	1/8"	11/64"
H	5/32"	1/4"
J (ANGLE)	12 1/2°	11 1/2°
K (RADIUS)	1/8"	3/16"

GENERAL NOTES

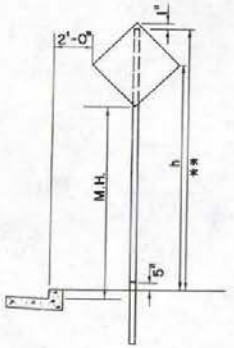
1. THE BASEPOST SHALL BE DRIVEN INTO THE GROUND. IF THE CONTRACTOR CHOOSES TO DRILL A HOLE, IT SHALL BE AS SHOWN AND FILLED WITH CLASS A OR CLASS AA CONCRETE AT NO EXTRA COST TO THE STATE.



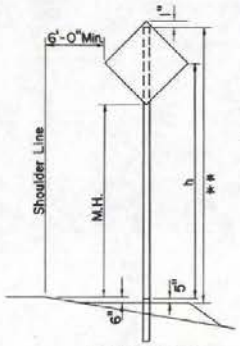
RETAINER - SPACER STRAP



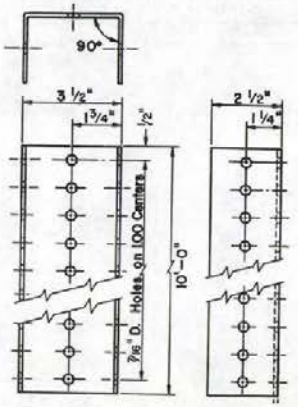
Sign on Backslope



Sign on Curb & Gutter



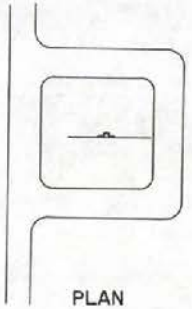
ELEVATION
Sign on Sign Island



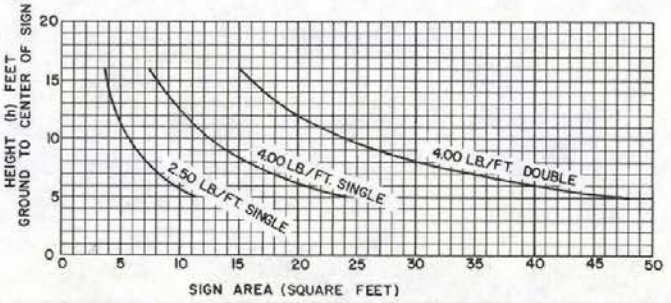
FORMED CHANNEL SIGN MOUNT

** 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.



PLAN



THE INFORMATION ON THIS SHEET DELETES AND SUPERCEDES THE 1983 STANDARD PLAN SHEET NO. T-31.1.8

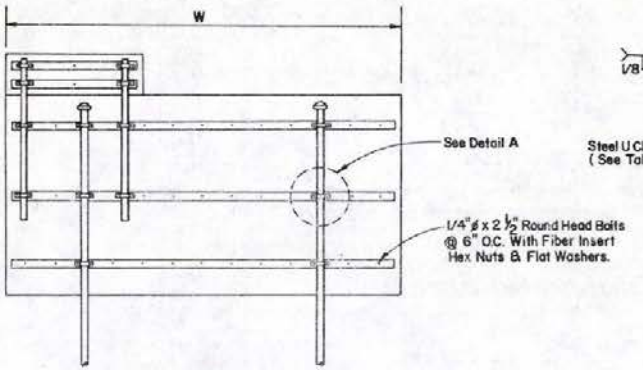
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

GROUND MOUNTED SIGN SUPPORTS FLANGED CHANNEL STEEL POSTS

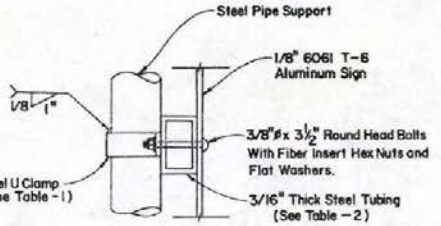
Ralph J. Taylor Jr.
CHIEF TRAFFIC ENGR.

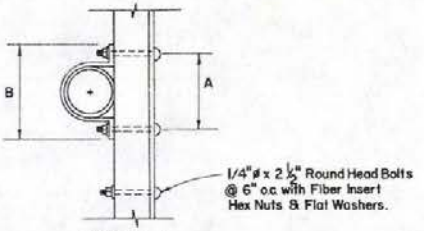
T31.1.8 (627)
ADOPTED: 3/79
REVISION 2-7/85

T-27

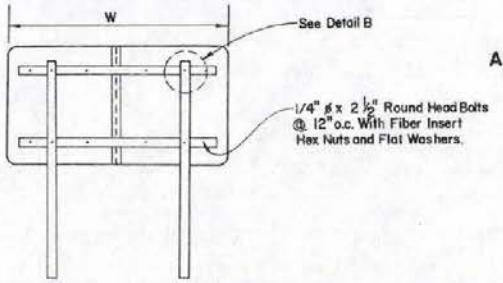


STEEL PIPE POST SUPPORTS

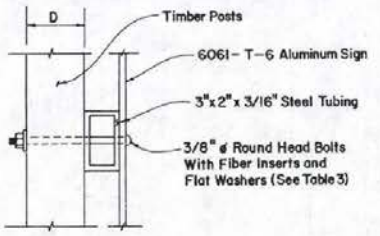




DETAIL A
ALTERNATE MOUNTING (STEEL POSTS)



WOOD POST SUPPORTS



DETAIL B
WOOD POST MOUNTING

GENERAL NOTES

1. FOR MOUNTING DETAILS NOT SHOWN, SEE SHEET NOS. T-31.1.1 THROUGH T-31.1.4 FOR ROUND METAL SUPPORTS AND SHEET NOS. T-31.1.5 AND T-31.1.6 FOR TIMBER SUPPORTS.

TABLE - 2 (Tubing Size)	
SIGN WIDTH	TUBING SIZE
24' or Less	3" x 2" x 3/16"
24' to 28'	4" x 2" x 3/16"

TABLE - 3		
POST SIZE	"D"	BOLT SIZE
4 x 4	3 1/2"	3/8" ø x 6 1/4"
4 x 6	5 1/2"	3/8" ø x 6 1/4"
6 x 6	5 1/2"	3/8" ø x 8 1/4"
6 x 8	7 1/2"	3/8" ø x 10 1/4"

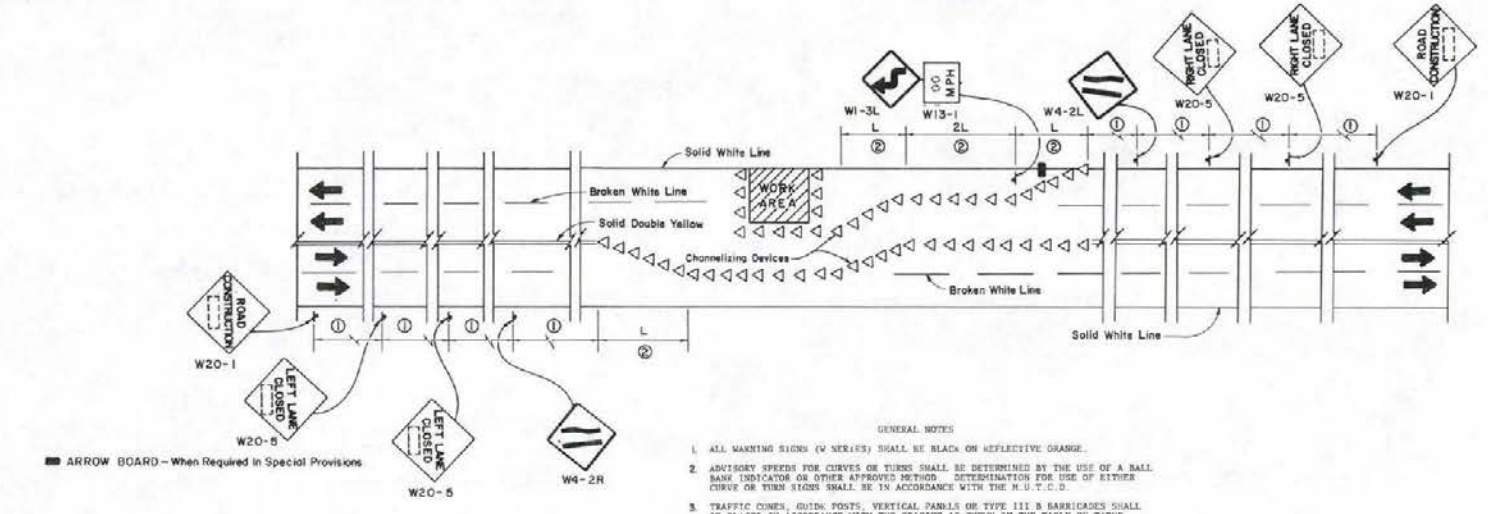
TABLE - 1 (Clamp Sizes)				
Pipe Diam.	O.D.	A	B	Clampstock
2" Nom.	2 3/8"	4 1/16"	5 11/16"	1/4" x 1 1/2"
3" Nom.	3 1/2"	5 3/16"	6 13/16"	1/4" x 1 1/2"

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

ALTERNATE MOUNTING DETAIL

CHIEF TRAFFIC ENGR.

T-31.1.9 (627)
ADOPTED: 8/82 REVISION



GENERAL NOTES

1. ALL WARNING SIGNS (W SERIES) SHALL BE BLACK ON REFLECTIVE ORANGE.
2. ADVISORY SPEEDS FOR CURVES OR TURNS SHALL BE DETERMINED BY THE USE OF A BALL BANK INDICATOR OR OTHER APPROVED METHOD. DETERMINATION FOR USE OF EITHER CURVE OR TURN SIGNS SHALL BE IN ACCORDANCE WITH THE M.U.T.C.D.
3. TRAFFIC CONES, GUIDE POSTS, VERTICAL PANELS OR TYPE III B BARRICADES SHALL BE PLACED IN ACCORDANCE WITH THE SPACING AS SHOWN IN THE TABLE OF TAPER LENGTHS AND CHANNELIZING DEVICE SPACING. THESE DEVICES SHOULD BE PLACED NO CLOSER THAN 2'-0" NOR MORE THAN 6'-0" OUTSIDE THE SOLID WHITE OR DOUBLE YELLOW LINES. TYPE OF DELINEATION DEVICE USED SHALL BE AS DIRECTED BY THE ENGINEER.
4. THE W6-3 SIGN SHALL BE INSTALLED AT ONE MILE INTERVALS WHEN THE LENGTHS OF CROSSOVER EXCEEDS ONE-HALF MILE.
5. END CONSTRUCTION SIGNS (G20-2) WHEN NECESSARY SHALL BE INSTALLED AT EACH END OF THE PROJECT IS ACCORDANCE WITH THE TABLE FOR SPACING OF ADVANCED WARNING SIGNS.

①

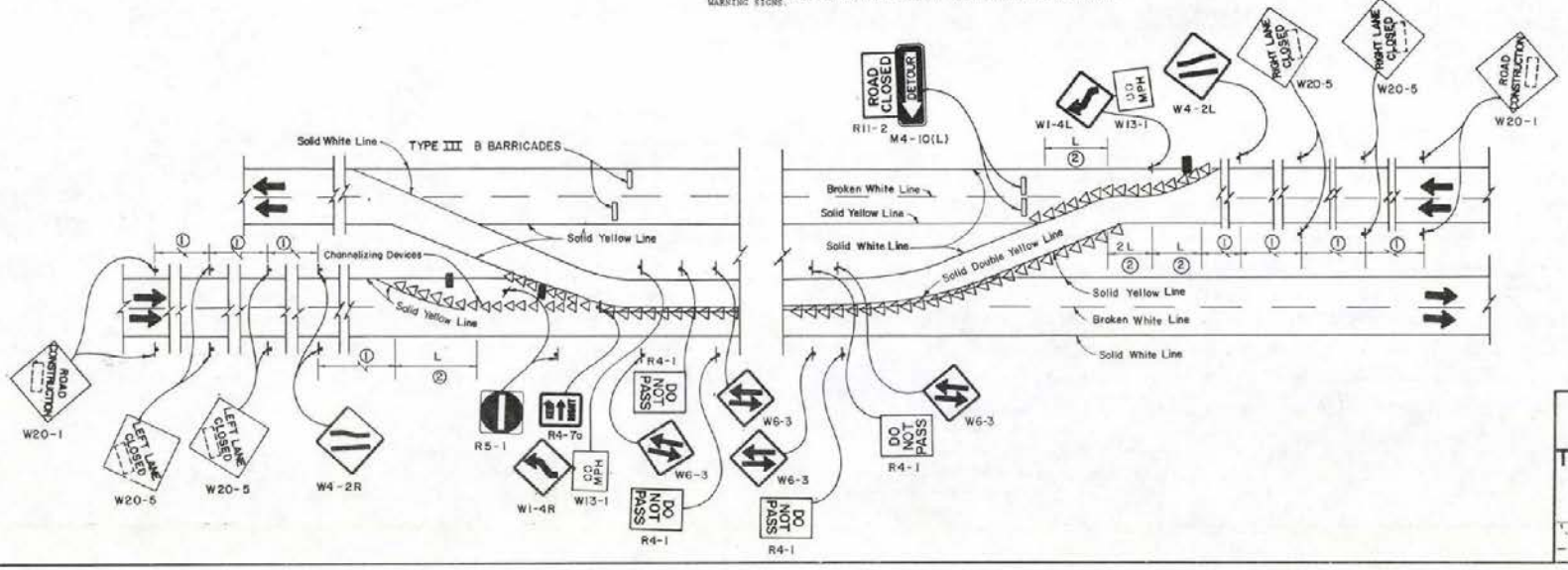
TABLE FOR SPACING OF ADVANCE WARNING SIGNS

SPEED	MINIMUM SPACING	
MILES PER HOUR 85th Percentile	BETWEEN SIGNS	FROM LAST SIGN TO TAPER
0-20	200	200
20-30	300	300
30-40	400	400
40-50	600	600
50-65	1000	1000

②

TABLE OF TAPER LENGTHS AND CHANNELIZING DEVICE SPACING

SPEED	MINIMUM TAPER LENGTH FOR LANE WIDTH			DEVICE
MILES PER HOUR 85th Percentile	10 FT.	11 FT.	12 FT.	SPACING IN FEET
20	70	75	80	20
25	105	115	125	25
30	150	165	180	30
35	205	225	245	35
40	265	295	320	40
45	450	495	540	45
50	500	550	600	50
55	550	605	660	55
60	600	660	720	60
65	650	715	780	65
70	700	770	840	70



BALL BANK INDICATOR TABLE

BELOW 20 MPH	14 DEGREES
25 TO 30 MPH	12 DEGREES
35 TO 65 MPH	10 DEGREES

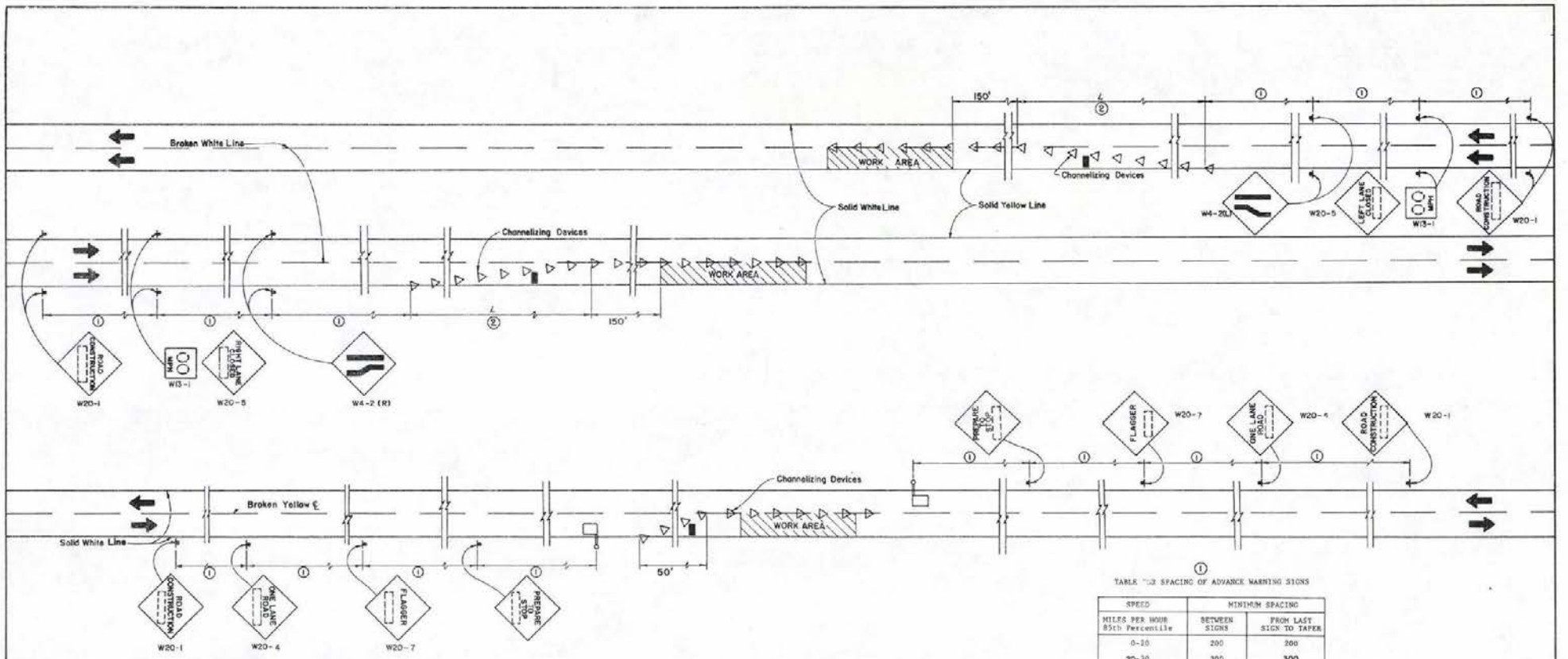
ADVISORY SPEED PLATED SHALL NOT BE POSTED FOR CURVES OVER 50 MPH.

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

TYPICAL ROAD CONSTRUCTION SIGNING

Russell "Bud" Hall
CHIEF TRAFFIC ENGR

T-35.1.1 (625)
ADOPTED 5/79
REVISION 1 1/88



■ – Arrow Board - When Required in Special Provisions

① TABLE FOR SPACING OF ADVANCE WARNING SIGNS

SPEED	MINIMUM SPACING	
MILES PER HOUR 85th Percentile	BETWEEN SIGNS	FROM LAST SIGN TO TAPER
0-20	200	200
20-30	300	300
30-40	400	400
40-50	600	600
50-65	1000	1000

② TABLE OF TAPER LENGTHS AND CHANNELIZING DEVICE SPACING

SPEED	MINIMUM TAPER LENGTH FOR LANE WIDTH			DEVICE SPACING IN
MILES PER HOUR 85th Percentile	10 FT.	11 FT.	12 FT.	FEET
20	70	75	80	20
25	105	115	125	25
30	150	165	180	30
35	205	225	245	35
40	265	295	320	40
45	450	495	540	45
50	500	550	600	50
55	550	605	660	55
60	600	660	720	60
65	650	715	780	65
70	700	770	840	70

GENERAL NOTES

1. ALL WARNINGS SIGNS (W SERIES) SHALL BE BLACK ON REFLECTIVE ORANGE.
2. TRAFFIC CONES, GUIDE POSTS, VERTICAL PANELS OF TYPE III B BARRICADES SHALL BE PLACED IN ACCORDANCE WITH THE SPACING AS SHOWN ON TABLE OR TAPER LENGTHS AND CHANNELIZING DEVICE SPACING. TYPE OF DELINEATION DEVICE USED SHALL BE AS DIRECTED BY THE ENGINEER
3. END CONSTRUCTION SIGN (C20-2) WHEN NECESSARY SHALL BE INSTALLED AT EACH END OF THE PROJECT IN ACCORDANCE WITH THE TABLE FOR SPACING OF ADVANCE WARNING SIGN.

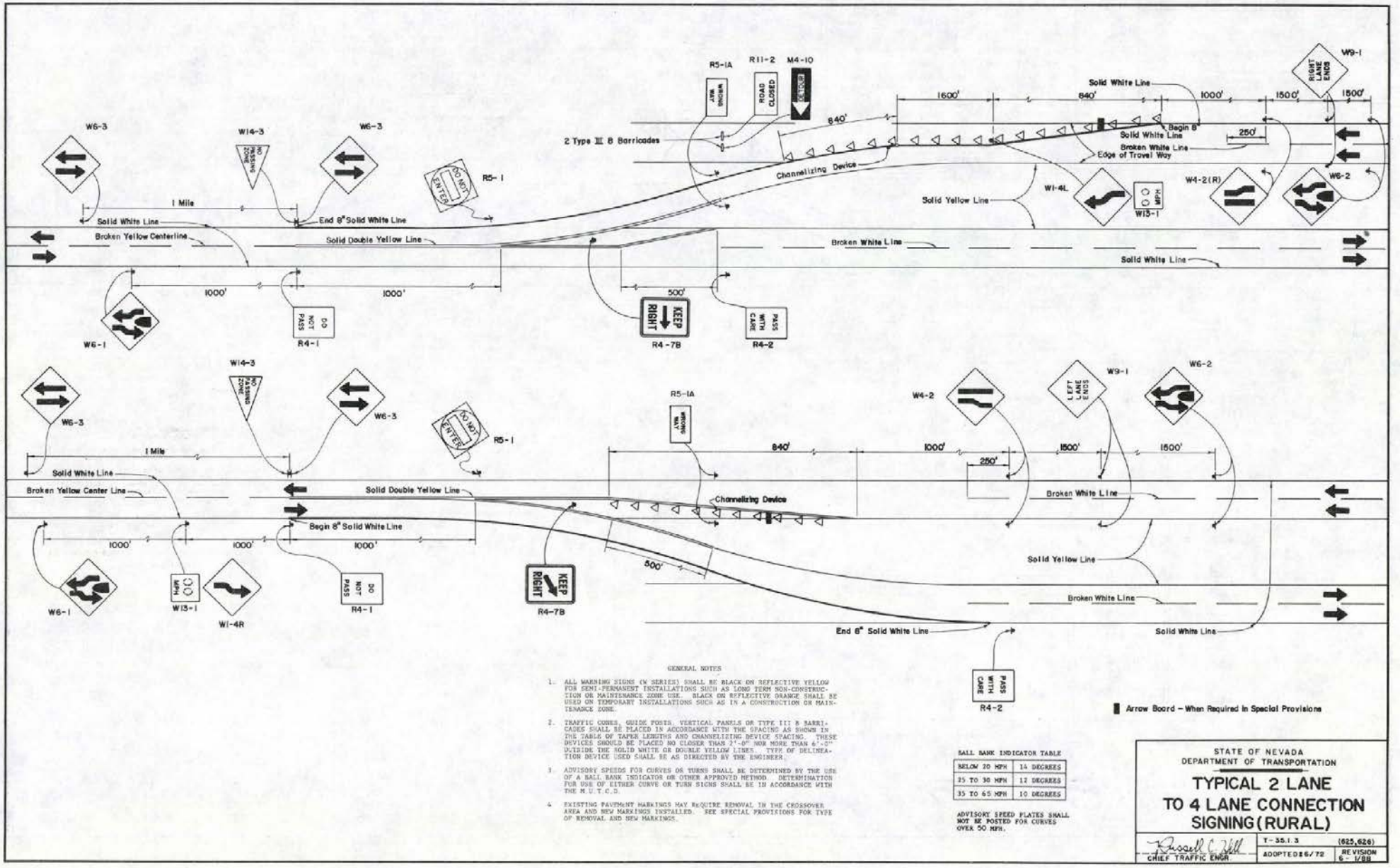
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

TYPICAL LANE CLOSURE SIGNING

Russell C. Hill
CHIEF TRAFFIC ENGR.

T-35.1.2 (625)
ADOPTED 8/72
REVISION 5- 1/88

T-30



GENERAL NOTES

1. ALL WARNING SIGNS (W SERIES) SHALL BE BLACK ON REFLECTIVE YELLOW FOR SEMI-PERMANENT INSTALLATIONS SUCH AS LONG TERM NON-CONSTRUCTION OR MAINTENANCE ZONE USE. BLACK ON REFLECTIVE ORANGE SHALL BE USED ON TEMPORARY INSTALLATIONS SUCH AS IN A CONSTRUCTION OR MAINTENANCE ZONE.

2. TRAFFIC CONES, GUIDE POSTS, VERTICAL PANELS OR TYPE III B BARRICADES SHALL BE PLACED IN ACCORDANCE WITH THE SPACING AS SHOWN IN THE TABLE OF TAPER LENGTHS AND CHANNELIZING DEVICE SPACING. THESE DEVICES SHOULD BE PLACED NO CLOSER THAN 2'-0" NOR MORE THAN 4'-0" OUTSIDE THE SOLID WHITE OR DOUBLE YELLOW LINES. TYPE OF DELINEATION DEVICE USED SHALL BE AS DIRECTED BY THE ENGINEER.

3. ADVISORY SPEEDS FOR CURVES OR TURNS SHALL BE DETERMINED BY THE USE OF A BALL BANK INDICATOR OR OTHER APPROVED METHOD. DETERMINATION FOR USE OF EITHER CURVE OR TURN SIGNS SHALL BE IN ACCORDANCE WITH THE M.U.T.C.D.

4. EXISTING PAVEMENT MARKINGS MAY REQUIRE REMOVAL IN THE CROSSOVER AREA AND NEW MARKINGS INSTALLED. SEE SPECIAL PROVISIONS FOR TYPE OF REMOVAL AND NEW MARKINGS.

BALL BANK INDICATOR TABLE

BELOW 20 MPH	14 DEGREES
25 TO 30 MPH	12 DEGREES
35 TO 65 MPH	10 DEGREES

ADVISORY SPEED PLATES SHALL NOT BE POSTED FOR CURVES OVER 50 MPH.

▮ Arrow Board – When Required in Special Provisions

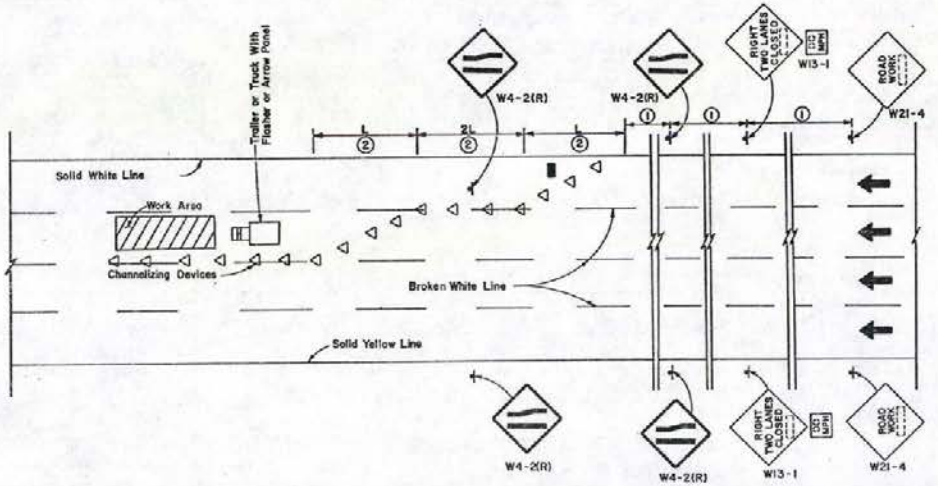
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

TYPICAL 2 LANE TO 4 LANE CONNECTION SIGNING (RURAL)

Russell C. Hill
CHIEF TRAFFIC ENGR

T-35.1.3	(625,626)
ADOPTED 6/72	REVISION 6-1/88

T-31



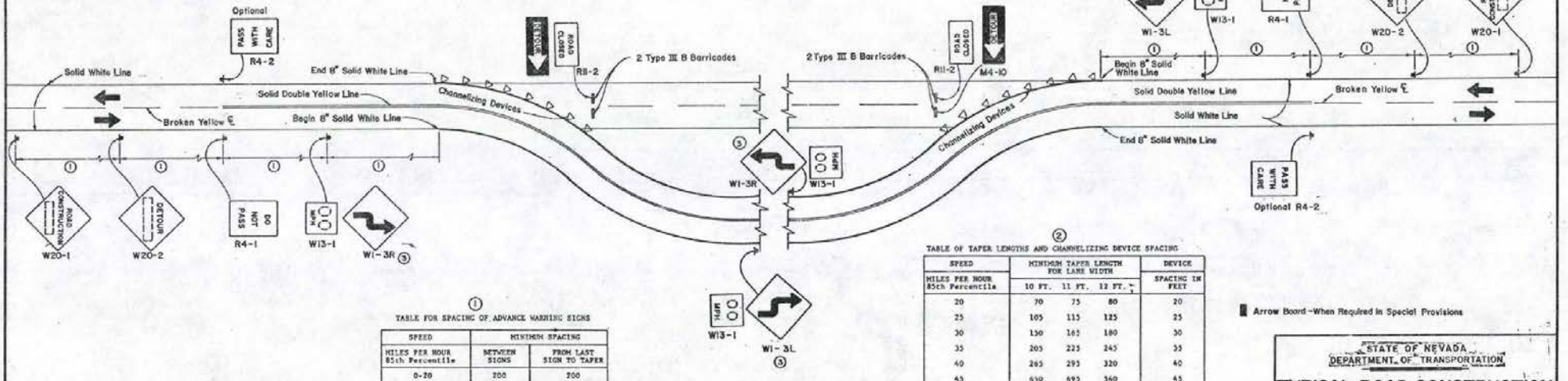
GENERAL NOTES

1. ALL WARNINGS SIGNS (W SERIES) SHALL BE BLACK ON REFLECTIVE ORANGE.
2. ADVISORY SPEEDS FOR CURVES OR TURNS SHALL BE DETERMINED BY THE USE OF A BALL BANK INDICATOR OR OTHER APPROVED METHOD. DETERMINATION FOR USE OF EITHER CURVE OR TURN SIGNS SHALL BE IN ACCORDANCE WITH THE M.U.T.C.D.
3. TRAFFIC CONES, GUIDE POSTS, VERTICAL PANELS OR TYPE III B BARRICADES SHALL BE PLACED IN ACCORDANCE WITH THE SPACING AS SHOWN IN THE TABLE OF TAPER LENGTHS AND CHANNELIZING DEVICE SPACING. THESE DEVICES SHOULD BE PLACED NO CLOSER THAN 2'-0" NOR MORE THAN 5'-0" OUTSIDE THE SOLID WHITE OR DOUBLE YELLOW LINES. TYPE OF DELINEATION DEVICE USED SHALL BE AS DIRECTED BY THE ENGINEER.
4. THE W6-3 SIGN SHALL BE INSTALLED AT ONE MILE INTERVALS WHEN THE LENGTH OF CROSSOVER EXCEEDS ONE-HALF MILE.
5. END CONSTRUCTION SIGNS (G20-2) WHEN NECESSARY SHALL BE INSTALLED AT EACH END OF THE PROJECT IN ACCORDANCE WITH THE TABLE FOR SPACING OF ADVANCED WARNING SIGNS.

BALL BANK INDICATOR TABLE

BELOW 20 MPH	14 DEGREES
25 TO 30 MPH	12 DEGREES
35 TO 65 MPH	10 DEGREES

ADVISORY SPEED PLATES SHALL NOT BE POSTED FOR CURVES OVER 50 MPH.



(1) TABLE FOR SPACING OF ADVANCE WARNING SIGNS

SPEED	MINIMUM SPACING	
MILES PER HOUR 85th Percentile	BETWEEN SIGNS	FROM LAST SIGN TO TAPER
0-20	200	200
20-30	300	300
30-40	400	400
40-50	600	600
50-65	1000	1000

(2) TABLE OF TAPER LENGTHS AND CHANNELIZING DEVICE SPACING

SPEED	MINIMUM TAPER LENGTH FOR LANE WIDTH			DEVICE
MILES PER HOUR 85th Percentile	10 FT.	11 FT.	12 FT.	SPACING IN FEET
20	70	75	80	20
25	105	115	125	25
30	150	165	180	30
35	205	225	245	35
40	265	295	320	40
45	450	495	540	45
50	500	550	600	50
55	550	605	660	55
60	600	660	720	60
65	650	715	780	65
70	700	770	840	70

(5) See General Note # 2

Arrow Board -When Required in Special Provisions

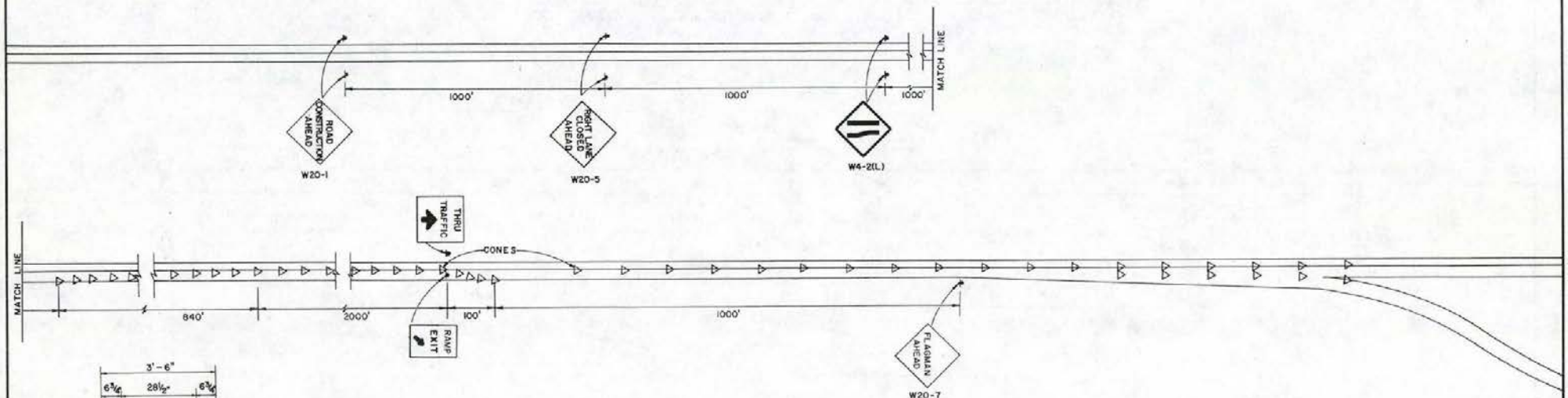
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

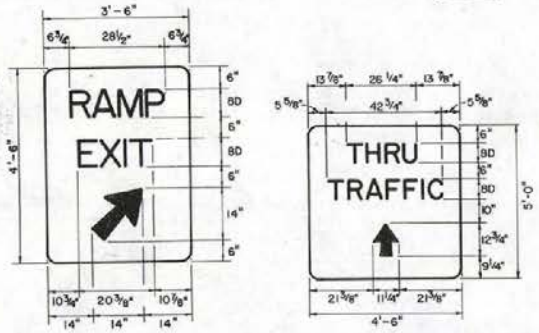
TYPICAL ROAD CONSTRUCTION SIGNING

Russell C. Hill
CHIEF TRAFFIC ENGR.

T-35.1.4 (625)
ADOPTED 6/72
REVISION 6-1/88

T-32





BACKGROUND . . . ORANGE
LEGEND, BORDER . BLACK
BORDER . . . . . 1"
CORNER RADIUS . 6"

BACKGROUND . . . ORANGE
LEGEND, BORDER . BLACK
BORDER . . . . . 1"
CORNER RADIUS . 6"

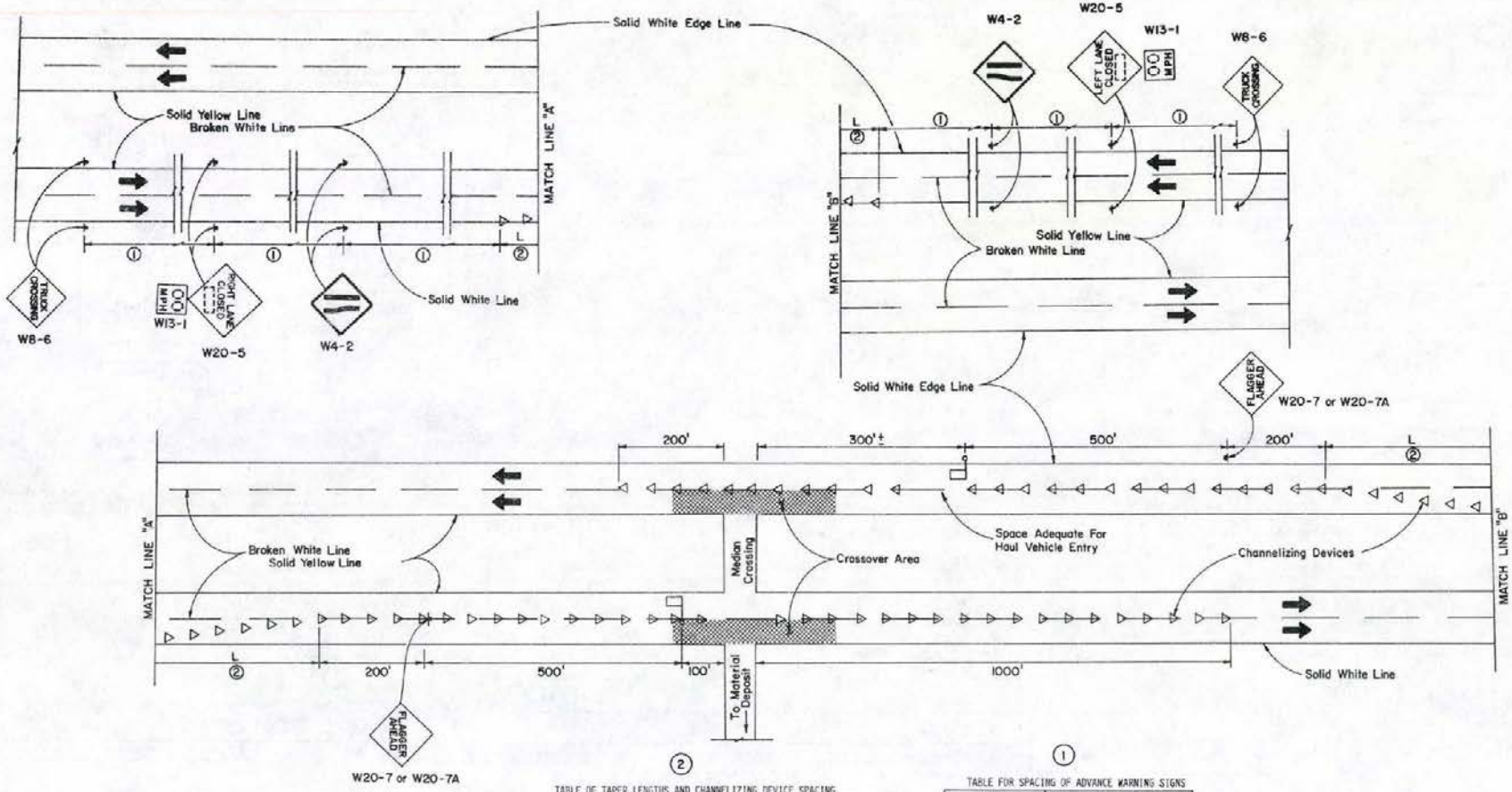
NOTE: TO BE USED FOR STORAGE OF VEHICLES ONLY WHEN TEMPORARY CLOSURES OF RAMP ARE ANTICIPATED.

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

TYPICAL TRAFFIC CONTROL FOR RAMP WORK

Russell "Bud" Hill
CHIEF TRAFFIC ENGR.

T-35.1.5 (625)
ADOPTED: 12/79
REVISION



T-34

(2)

TABLE OF TAPER LENGTHS AND CHANNELIZING DEVICE SPACING

SPEED	MINIMUM TAPER LENGTH FOR LANE WIDTH			DEVICE SPACING IN
MILES PER HOUR 85TH PERCENTILE	10 FT.	11 FT.	12 FT.	FEET
20	70	75	80	20
25	105	115	125	25
30	150	165	180	30
35	205	225	245	35
40	265	295	320	40
45	450	495	540	45
50	500	550	600	50
55	550	605	660	55
60	600	660	720	60
65	650	715	780	65
70	700	770	840	70

(1)

TABLE FOR SPACING OF ADVANCE WARNING SIGNS

SPEED	MINIMUM SPACING	
MILES PER HOUR 85TH PERCENTILE	BETWEEN SIGNS	FROM LAST SIGN TO TAPER
0 - 20	200	200
20 - 30	300	300
30 - 40	400	400
40 - 50	600	600
50 - 65	1000	1000

GENERAL NOTES

1. ALL WARNING SIGNS (W SERIES) SHALL BE BLACK ON REFLECTIVE ORANGE.
2. TRAFFIC CONES, DELINEATORS, VERTICAL PANELS OR TYPE III B BARRICADES SHALL BE PLACED IN ACCORDANCE WITH THE SPACING AS SHOWN ON TABLE OF TAPER LENGTHS AND CHANNELIZING DEVICE SPACING. TYPE OF DELINEATION DEVICE USED SHALL BE AS DIRECTED BY THE ENGINEER.
3. END CONSTRUCTION SIGN (G20-2) WHEN NECESSARY SHALL BE INSTALLED AT EACH END OF THE PROJECT IN ACCORDANCE WITH THE TABLE FOR SPACING OF ADVANCE WARNING SIGN.

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

TYPICAL TRAFFIC CONTROL FOR HAUL ROAD

CHIEF TRAFFIC ENGR.

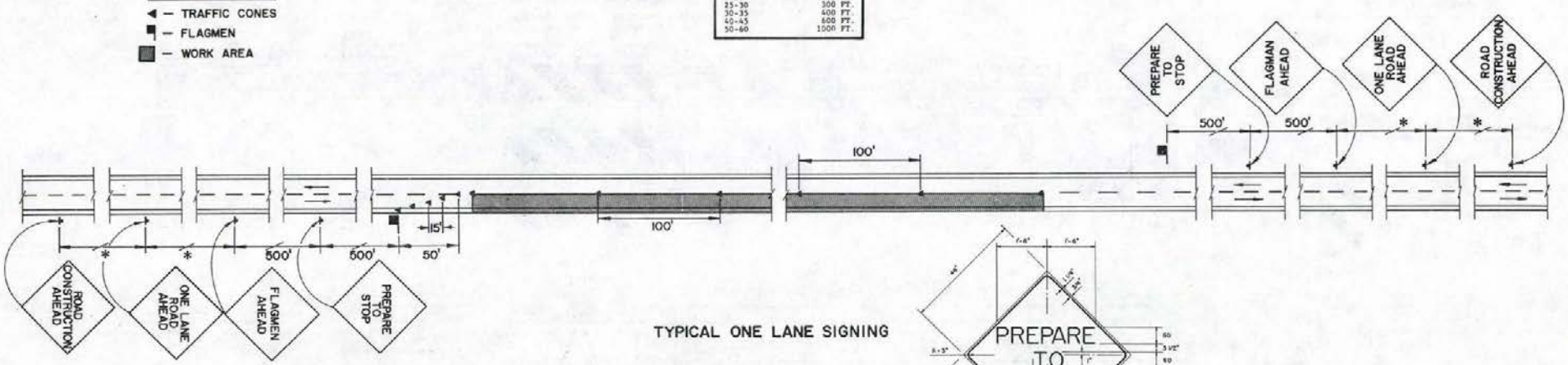
T-35.1.6 (625)

ADOPTED 8/82 REVISION 1-1/88

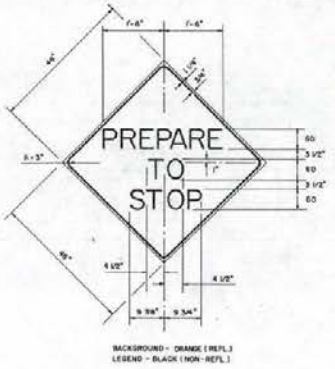
SPEED 85TH PERCENTILE MPH	WARNING DEVICE SPACING
0-20	200 FT.
25-30	300 FT.
30-35	400 FT.
40-45	600 FT.
50-60	1000 FT.

LEGEND

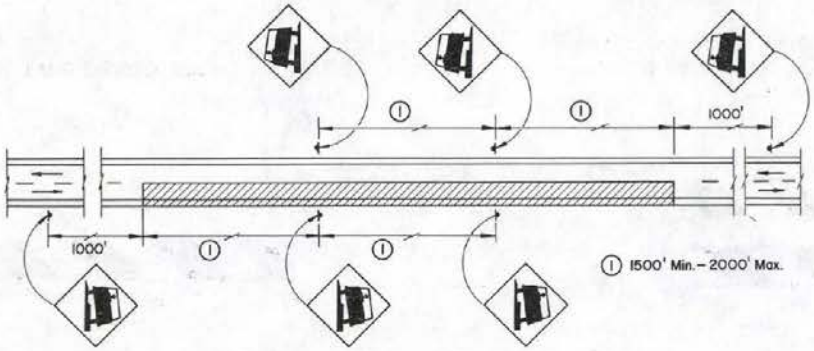
- ◀ — TRAFFIC CONES
- ■ — FLAGMEN
- ▩ — WORK AREA



TYPICAL ONE LANE SIGNING

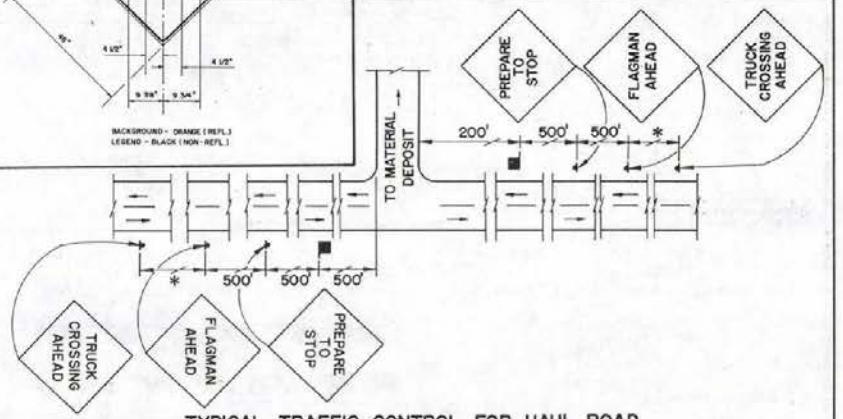


▨ — LIMITS OF PAVING OPERATION (DAILY RUN)



TYPICAL PLACEMENT OF DROP OFF SIGNS

(PLACED WHEN DROP OFF EXIST DURING NON-WORKING HOURS)



TYPICAL TRAFFIC CONTROL FOR HAUL ROAD
(2 LANE ROAD)

* See Table Above

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

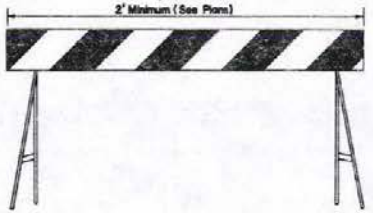
TYPICAL ONE LANE SIGNING
TYPICAL DROP OFF SIGNING
(2 LANE ROAD)
TYPICAL HAUL ROAD SIGNING
(2 LANE ROAD)

CHIEF TRAFFIC DESIGN ENGR.

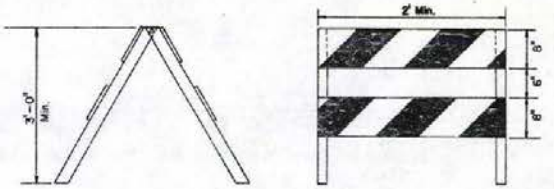
T-35.1.6.1 (625)

ADOPTED: 4/85 REVISION

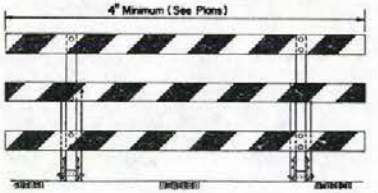
T-35

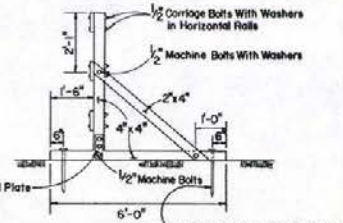


TYPE I BARRICADE

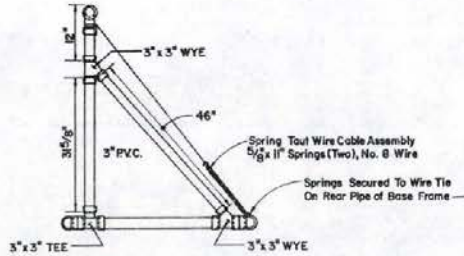


TYPE II BARRICADE
(FRAMEWORK TO BE PAINTED WHITE)

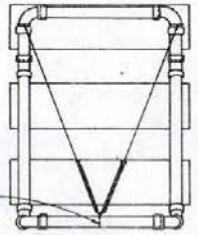




TYPE III A BARRICADE



SIDE VIEW

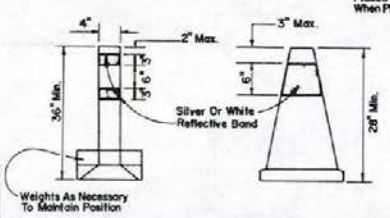


BACK VIEW

BARRICADE CHARACTERISTICS

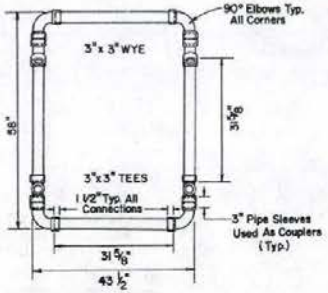
TYPE	I	II	III
WIDTH OF RAIL	8" MIN. -- 11" MAX.	8" MIN. -- 12" MAX.	8" MIN. -- 12" MAX.
LENGTH OF RAIL	2' MIN.	2' MIN.	4' MIN
WIDTH OF STRIPES	RAIL LENGTH 3' - 4" RAIL LENGTH 3" OR - 6"	RAIL LENGTH 3' - 4" RAIL LENGTH 3' OR - 6"	6"
HEIGHT	3' MIN.	3' MIN.	5' MIN.
NUMBER OF REFLECTORIZED RAIL FACES	2 (ONE EACH DIRECTION)	4 (TWO EACH DIRECTION)	3 IF FACING TRAFFIC IN ONE DIRECTION. 6 IF FACING TRAFFIC IN TWO DIRECTIONS

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

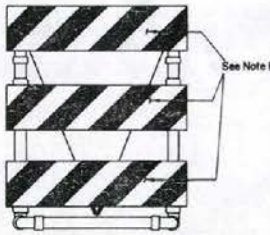


TRAFFIC CONES

1. CONES TO BE PREDOMINATELY ORANGE.
2. CONES TO BE USED DURING HOURS OF DARKNESS SHALL BE REFLECTORIZED AS SHOWN ABOVE.
3. CONES SHALL HAVE WEIGHTED BASES. HOWEVER, IF THE CONTRACTOR WISHES IN LIEU OF WEIGHTED BASES, HE MAY EPOXY OR NAIL THE CONES IN PLACE.



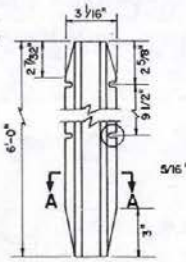
TOP VIEW OF BASE

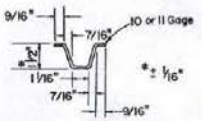


NOTE: 9"x48" Barricade Hazard Panels Orange and White Right or Left. (.025 Anodized Aluminum)
Panels Attached With 1" No.14 Pan Head Metal Screw.

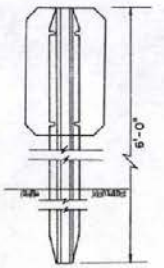
FRONT VIEW

TYPE III B BARRICADE
(Barricade to be Weighted Down With Sandbags)

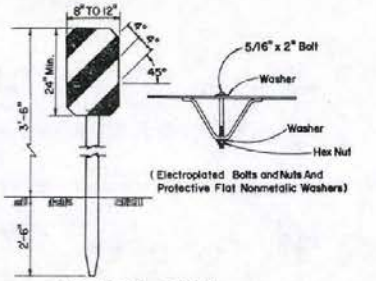




SECTION A-A



POST DETAILS



VERTICAL PANEL

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

BARRICADES

CHIEF TRAFFIC ENGR.

T-35.17 (625-626)
ADOPTED: 6/82 REVISION:

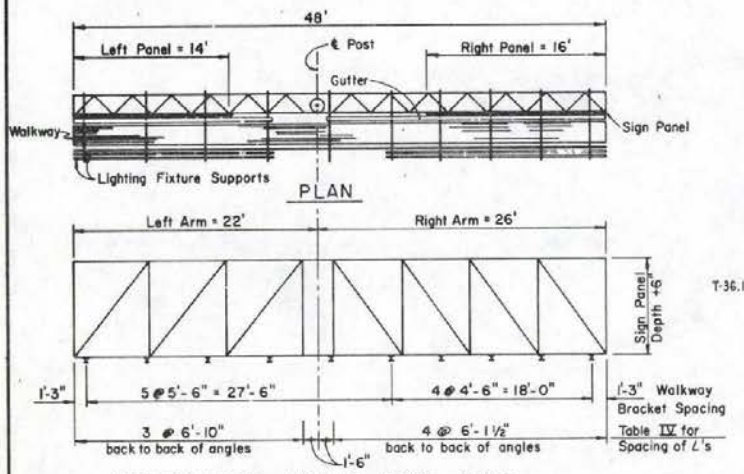
INSTRUCTIONS TO FABRICATOR

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 VIII.
T-36.1.3 - Post type 1-s thru VII-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.

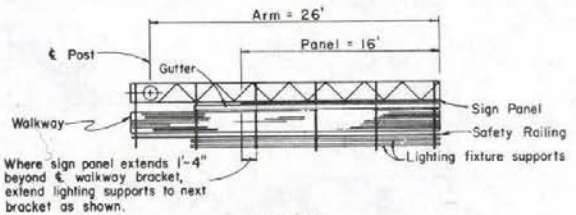
UNIT STRESSES:

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"

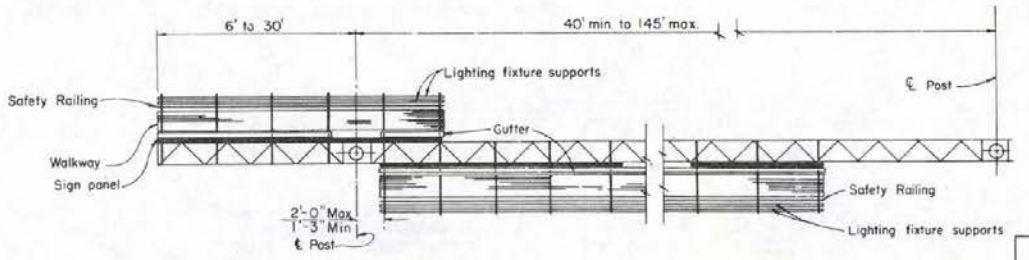
WELDING: All welding continuous unless otherwise noted on the plans. All welding to be done in accordance with the standard specifications for road and bridge construction.

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

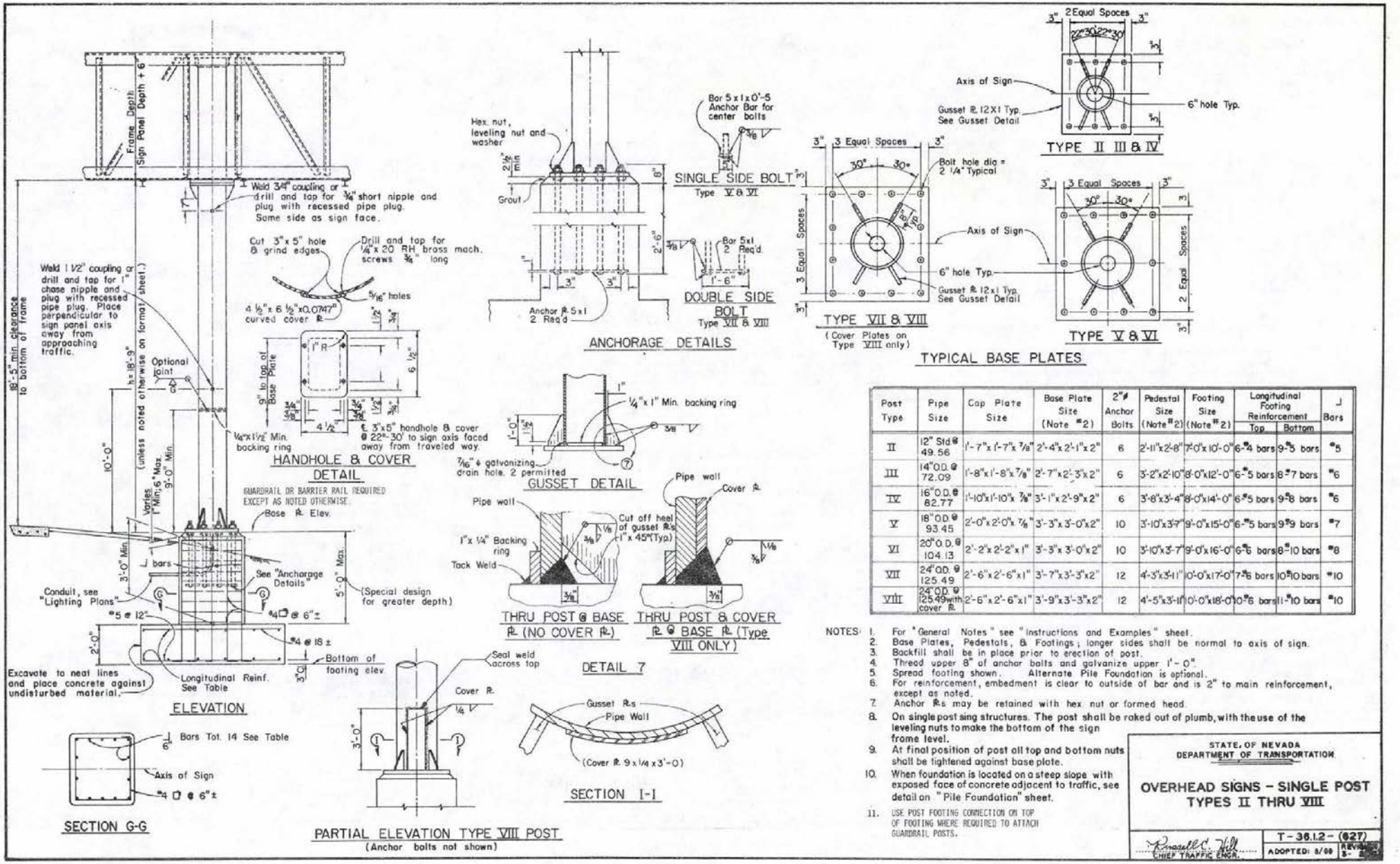
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

OVERHEAD SIGNS INSTRUCTIONS & EXAMPLES

Russell C. Hill
CHIEF TRAFFIC ENGR.

T-36.1.1 - (627)
ADOPTED: 8/69
REVISIONS 2-1/74

T-37



Post Type	Pipe Size	Cap Plate Size	Base Plate Size (Note #2)	2"ø 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"x 1'-7"x 7/8"	2'-4"x 2'-1"x 2"	6	2'-11"x 2'-8"	7'-0"x 10'-0"	6-#4 bars	9-#5 bars	#5
III	14"O.D. @ 72.09	1'-8"x 1'-8"x 7/8"	2'-7"x 2'-3"x 2"	6	3'-2"x 2'-10"	8'-0"x 12'-0"	6-#5 bars	8-#7 bars	#6
IV	16"O.D. @ 82.77	1'-10"x 1'-10"x 7/8"	3'-1"x 2'-9"x 2"	6	3'-8"x 3'-4"	8'-0"x 14'-0"	6-#5 bars	9-#8 bars	#6
V	18"O.D. @ 93.45	2'-0"x 2'-0"x 7/8"	3'-3"x 3'-0"x 2"	10	3'-10"x 3'-7"	9'-0"x 15'-0"	6-#5 bars	9-#9 bars	#7
VI	20"O.D. @ 104.13	2'-2"x 2'-2"x 1"	3'-3"x 3'-0"x 2"	10	3'-10"x 3'-7"	9'-0"x 16'-0"	6-#6 bars	8-#10 bars	#8
VII	24"O.D. @ 125.49	2'-6"x 2'-6"x 1"	3'-7"x 3'-3"x 2"	12	4'-3"x 3'-11"	10'-0"x 17'-0"	7-#6 bars	10-#10 bars	#10
VIII	24"O.D. @ 125.49 with cover PL	2'-6"x 2'-6"x 1"	3'-9"x 3'-3"x 2"	12	4'-5"x 3'-11"	10'-0"x 18'-0"	10-#6 bars	11-#10 bars	#10

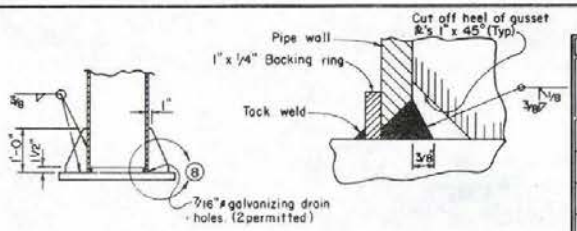
NOTES:
1. For "General Notes" see "Instructions and Examples" sheet.
2. Base Plates, Pedestals, & Footings; longer sides shall be normal to axis of sign.
3. Backfill shall be in place prior to erection of post.
4. Thread upper 8" of anchor bolts and galvanize upper 1'-0".
5. Spread footing shown. Alternate 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 PLs 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 frome 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.
11. USE POST FOOTING CONNECTION ON TOP OF FOOTING WHERE REQUIRED TO ATTACH GUARDRAIL POSTS.

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

OVERHEAD SIGNS - SINGLE POST TYPES II THRU VIII

Russell C. Hill
CHIEF TRAFFIC ENGR.

T-36.1.2 - (627)
ADOPTED: 6/00
REVISED: 8-



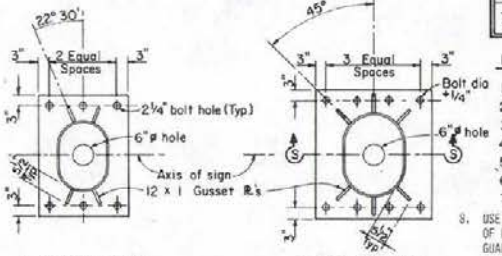
SECTION S-S

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"x2"	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"x2"	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"x2'-0"x2"	6-2"ø	3'-4"x2'-7"	7'-0"x13'-0"	7-#4 bars	7-#8 bars	#8
IV - S	16" O.D @ 82.77	6"	2'-11"x2'-7"x2"	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"x2'-9"x2"	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"x2'-9"x2"	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"x3'-3"x2"	8-2 1/4"ø	4'-5"x3'-11"	10'-0"x18'-0"	10-#6 bars	10-#11 bars	#11

Notes:

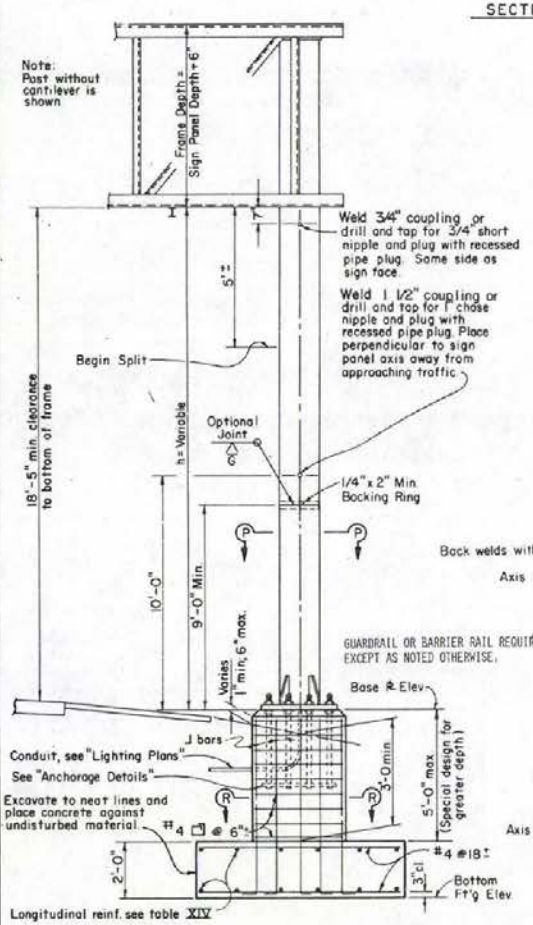
1 For reinforcement, embedment is clear to outside of bar and is 2" to main reinf except as noted.
2 For "General Notes" see "Instruction & Examples" sheet.
3 Base Plates, Pedestals, & Footings; longer sides shall be normal to axis of sign.
4 Backfill shall be in place prior to erection of post.
5 Thread upper 8" of anchor bolts and galvanize upper 1'-0"
6 Spread footing shown. Alternate Pile Foundation is optional.
7 Anchor ℄'s may be retained with hex nut or formed head.
8 USE POST FOOTING CONNECTION ON TOP OF FOOTING WHERE REQUIRED TO ATTACH GUARDRAIL POSTS.



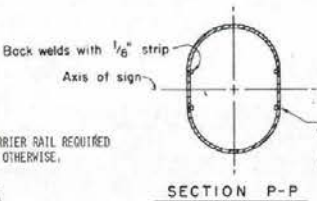
6 ANCHOR TYPE

8 ANCHOR TYPE

TYPICAL BASE PLATES

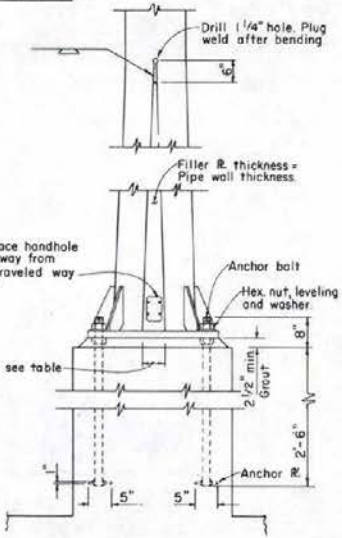


ELEVATION

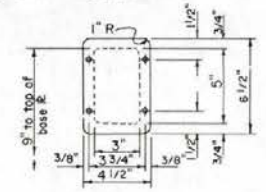


SECTION P-P

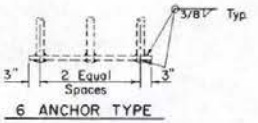
SECTION R-R



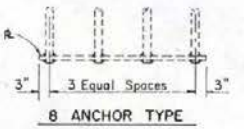
ANCHORAGE DETAILS



HANDHOLE & COVER DETAILS



6 ANCHOR TYPE



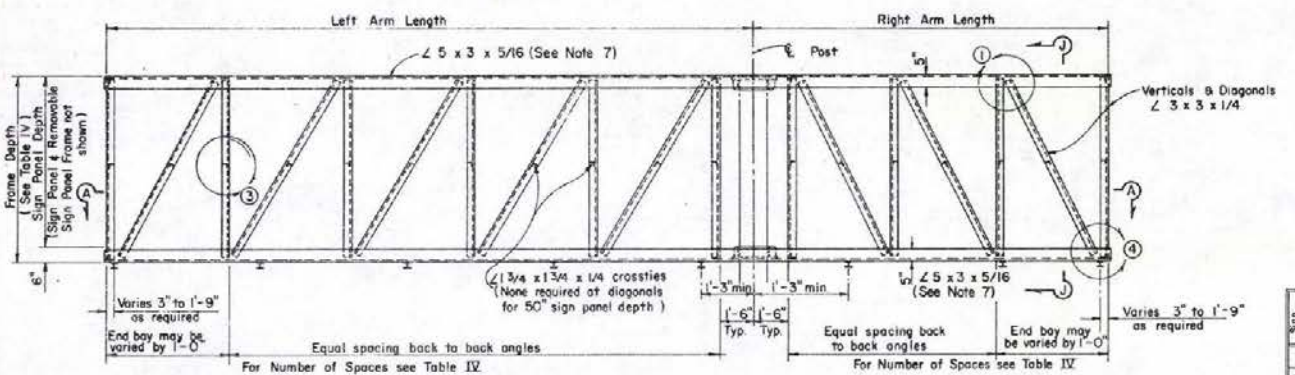
8 ANCHOR TYPE

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

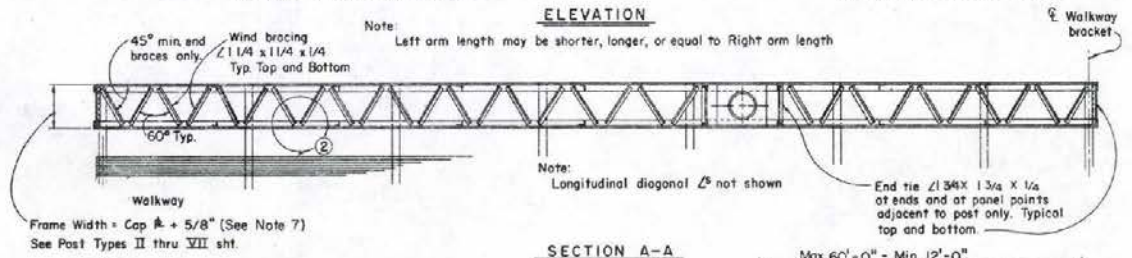
OVERHEAD SIGNS - TWO POST
TYPES I-S THRU VII-S

Russell C. Hill
CHIEF TRAFFIC ENGR.

T-36.1.3 - (627)
ADOPTED: 8/69
REVISION 3 - 2/78



ELEVATION

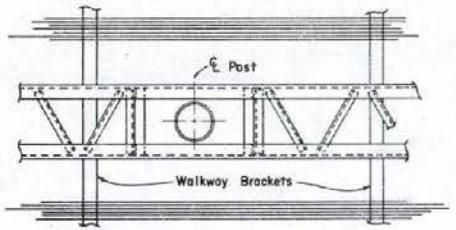


Note: Left arm length may be shorter, longer, or equal to Right arm length

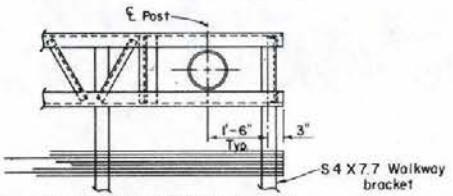
SECTION A-A

Sign Panel Depth	Frame Depth	Maximum Vertical ∠ Spacing	Arm Length	
60"	5'-6"	5'-0"	4'	No diagonals required
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'	

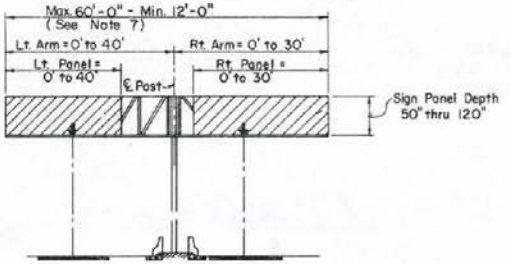
TABLE IV



PART PLAN OF DOUBLE FACED TYPE AT POST



PART PLAN OF CANTILEVER TYPE AT POST



▨ = Sign Panel

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 5x3x7/16 chord ∠'s.
   b. Frame width = Cap ℄ + 7/8".
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.

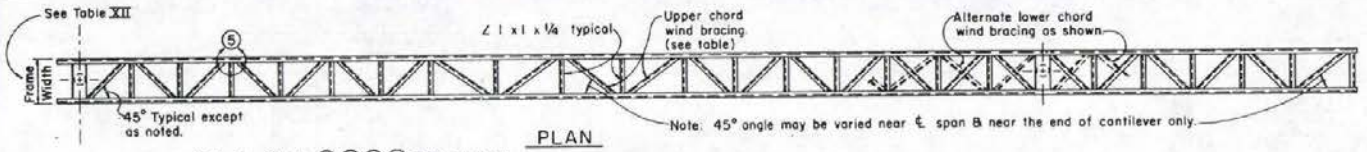
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

OVERHEAD SIGNS - SINGLE POST STRUCTURAL FRAME MEMBERS

Russell C. Hill
CHIEF TRAFFIC ENGR.

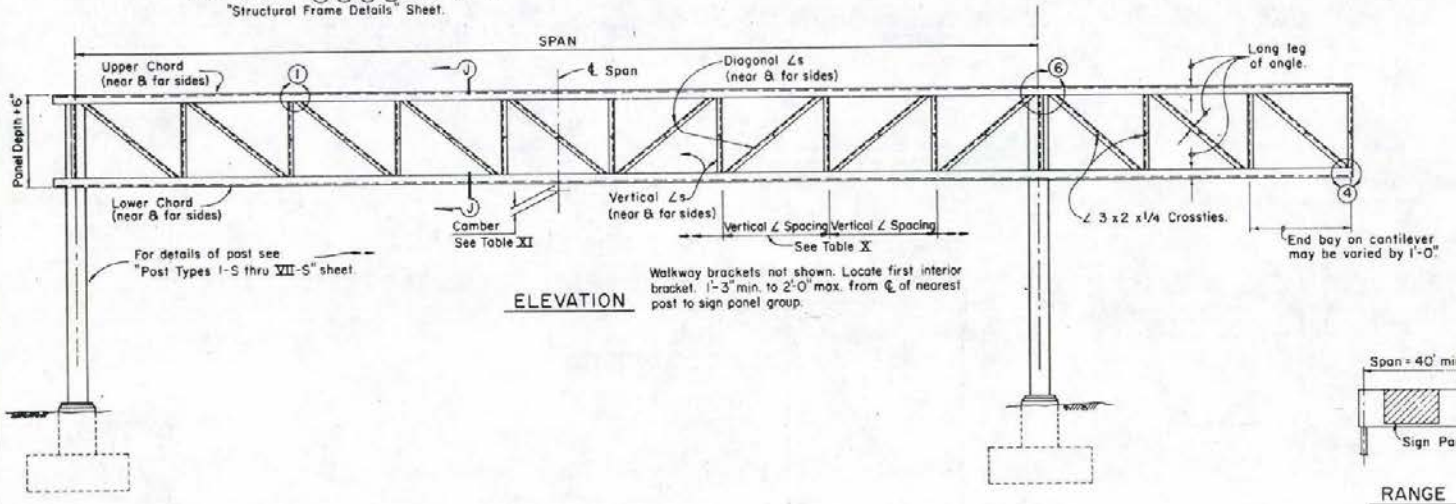
T-36.1.4 - (8/87)
ADOPTED: 8/88

T-40

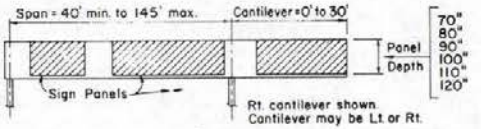


PLAN

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



ELEVATION



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

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

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.

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

TABLE XII

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

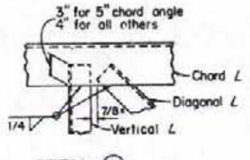
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

OVERHEAD SIGNS – TWO POST STRUCTURAL FRAME MEMBERS

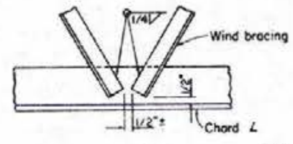
Russell C. Hill
CHIEF TRAFFIC ENGR.

T – 36.1.5 – (627)
ADOPTED: 8/80
REVISION

T-41



DETAIL (1)



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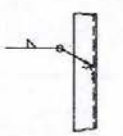

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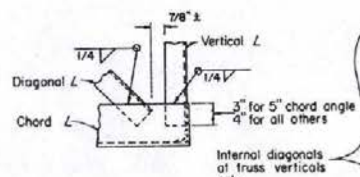

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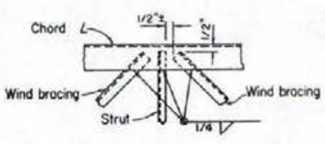

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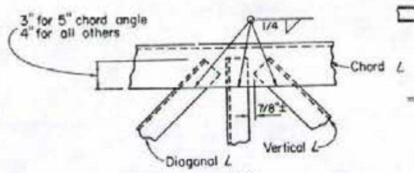

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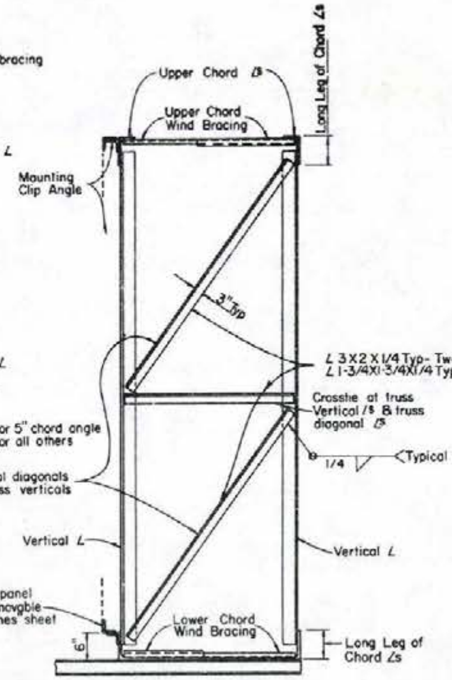
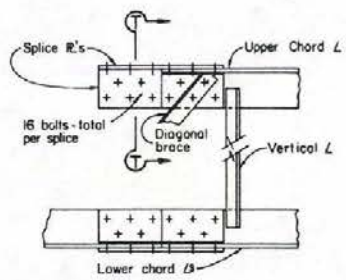
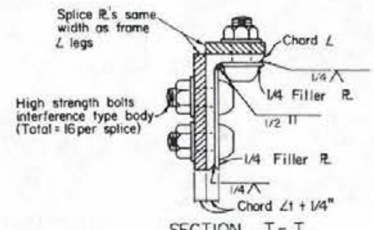


TYPICAL SECTION J-J

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



OPTIONAL
BOLTED CHORD SPLICE



SECTION T-T

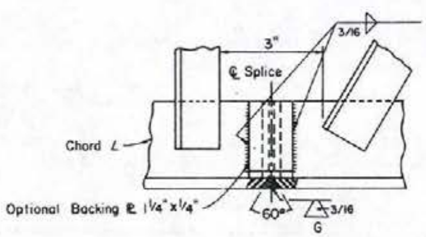
SPLICE NOTES

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.

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



WELDED CHORD SPLICE

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

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

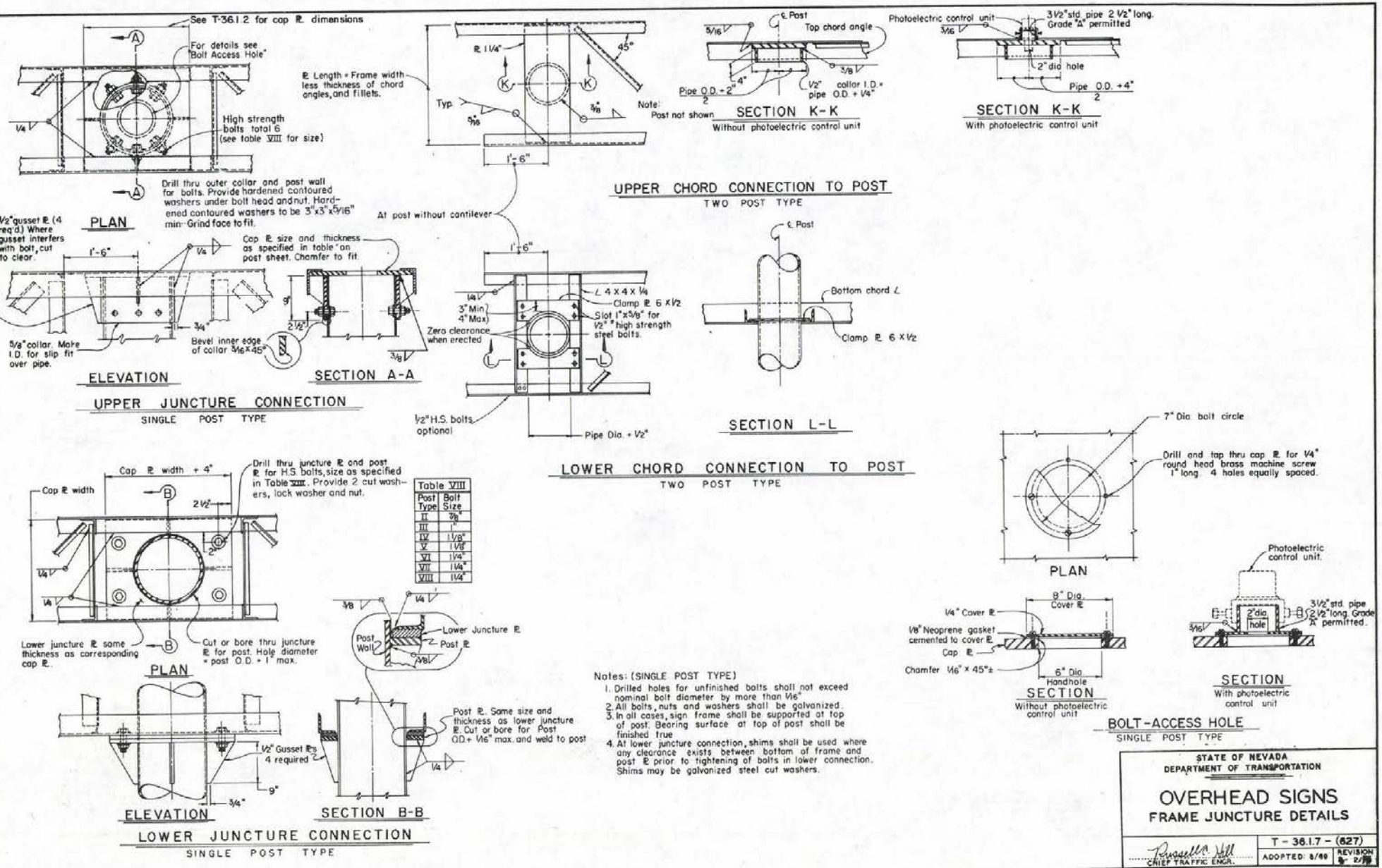
SINGLE POST SIGNS	
Chord L	Nominal Bolt Diam.
5X3 X5/16	3/4"
5X3X7/16	3/4"

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

OVERHEAD SIGNS
STRUCTURAL FRAME DETAILS

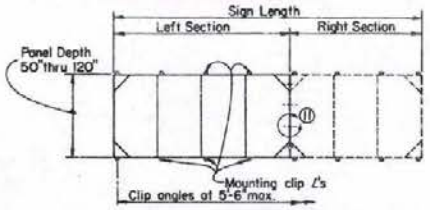
Russell C. Hill
CHIEF TRAFFIC ENGR.

T - 36.1.6 - (827)
ADOPTED: 8/69
REVISION 2 - 2/80


See T-36.1.2 for cap ℄ dimensions
For details see "Bolt Access Hole"
High strength bolts total 6 (see table VIII for size)
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.
PLAN
℄ Length = Frame width less thickness of chord angles, and fillets.
Typ.
Note: Post not shown
SECTION K-K
Without photoelectric control unit
℄ Post
Top chord angle
Photoelectric control unit
3½" std. pipe 2½" long. Grade "A" permitted
2" dia hole
Pipe O.D. +4"
2
SECTION K-K
With photoelectric control unit
UPPER CHORD CONNECTION TO POST
TWO POST TYPE
½"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
At post without cantilever
∠ 4 x 4 x ¼
Clamp ℄ 6 x ½
Slot 1"x3/8" for ½" " high strength steel bolts.
3" Min 4" Max
Zero clearance when erected
½" H.S. bolts optional
Pipe Dia. + ½"
UPPER JUNCTURE CONNECTION
SINGLE POST TYPE
Bottom chord ∠
Clamp ℄ 6 x ½
SECTION L-L
LOWER CHORD CONNECTION TO POST
TWO POST TYPE
Cap ℄ width + 4"
Cap ℄ width
Drill thru juncture ℄ and post ℄ for H.S. bolts, size as specified in Table VIII. Provide 2 cut washers, lock washer and nut.
Table VIII
Post Type | Bolt Size
II | 7/8"
III | 1"
IV | 1 1/8"
V | 1 1/8"
VI | 1¼"
VII | 1½"
VIII | 1½"
Lower juncture ℄ same thickness as corresponding cap ℄.
Cut or bore thru juncture ℄ for post. Hole diameter = post O.D. + 1" max.
PLAN
Lower Juncture ℄
Post Wall
Post ℄
Post ℄. Same size and thickness as lower juncture ℄. Cut or bore for Post O.D.+ 1/16" max. and weld to post
½" Gusset ℄s 4 required
ELEVATION
SECTION B-B
LOWER JUNCTURE CONNECTION
SINGLE POST TYPE
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 ¼" round head brass machine screw 1" long. 4 holes equally spaced.
PLAN
8" Dia. Cover ℄
¼" Cover ℄
⅛" 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
3½" std. pipe 2½" long. Grade A permitted.
SECTION
With photoelectric control unit
BOLT-ACCESS HOLE
SINGLE POST TYPE
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION
OVERHEAD SIGNS
FRAME JUNCTURE DETAILS
CHIEF TRAFFIC ENGR.
T - 36.1.7 - (627)
ADOPTED: 8/69
REVISION 2/

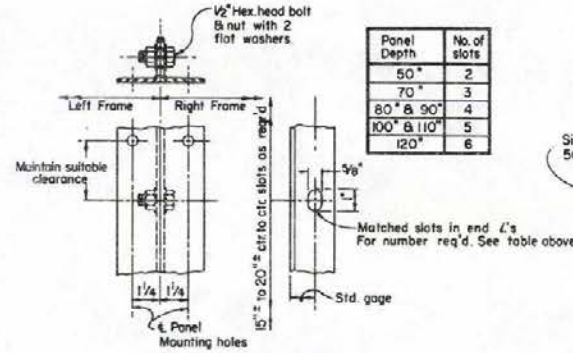
T-45

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.



REMOVABLE FRAME
GREATER THAN 20'-0"

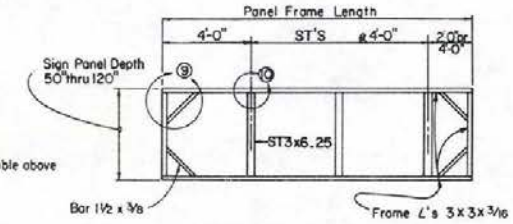
Sign Length	Left Section	Right Section
22'-0"	12'	10'
24'-0"	12'	12'
26'-0"	12'	14'
28'-0"	16'	12'
30'-0"	16'	14'
32'-0"	16'	16'
34'-0"	16'	18'
36'-0"	20'	16'
38'-0"	20'	18'
40'-0"	20'	20'



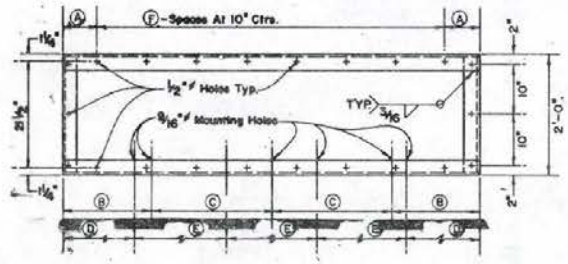
Panel Depth	No. of slots
50"	2
70"	3
80" & 90"	4
100" & 110"	5
120"	6

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")

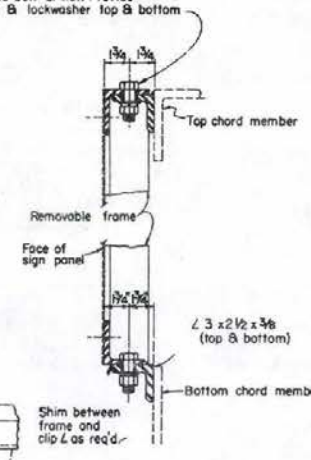


FRAME WIDTH	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓕ
5'-6"	0'-8"	0'-9"	2'-0"	—	—	5
7'-6"	0'-3"	1'-6"	—	—	—	7
8'-6"	0'-6"	—	—	1'-3"	2'-0"	9

NOTES:
1. Frame Ls Shall Be 3" X 3" X 3/16" ASTM-A36.
2. ⅜" Panel Mounting Holes Shall Be Drilled With Templates.
3. Holes For Mounting Sign May Be Slotted 1".
4. Mount Exit Frame At Right Edge Of Removable Frame So Front Faces Are Flush.

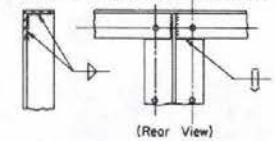
TYPICAL EXIT PANEL FRAMES

½" Hex. head bolt & nut. Provide flat washer & lockwasher top & bottom

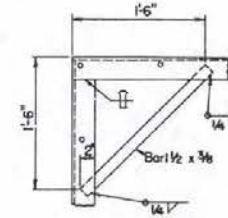


SECTION T-T

NOTES:
1. Frames shall be all-welded construction.
2. ½" Panel mounting holes shall be drilled by template. Sign panel may be considered a template.
3. Drilled and tapped holes (¼"-20 N.C.) may be used where interference due to welds or structural members is encountered.
4. ST3x6.25 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. ST3x6.25 may be crimped at ends to join frame angles. Fillet weld all around.
8. Panels shall be 2'-0" minimum and 4'-0" maximum.

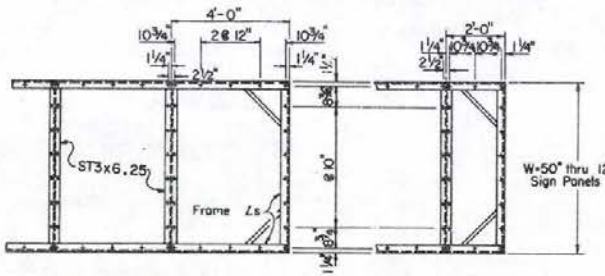


DETAIL (10)



DETAIL (9)

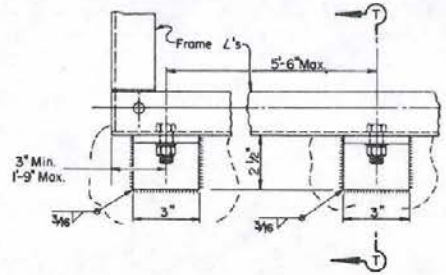
TYPICAL JOINT DETAILS



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

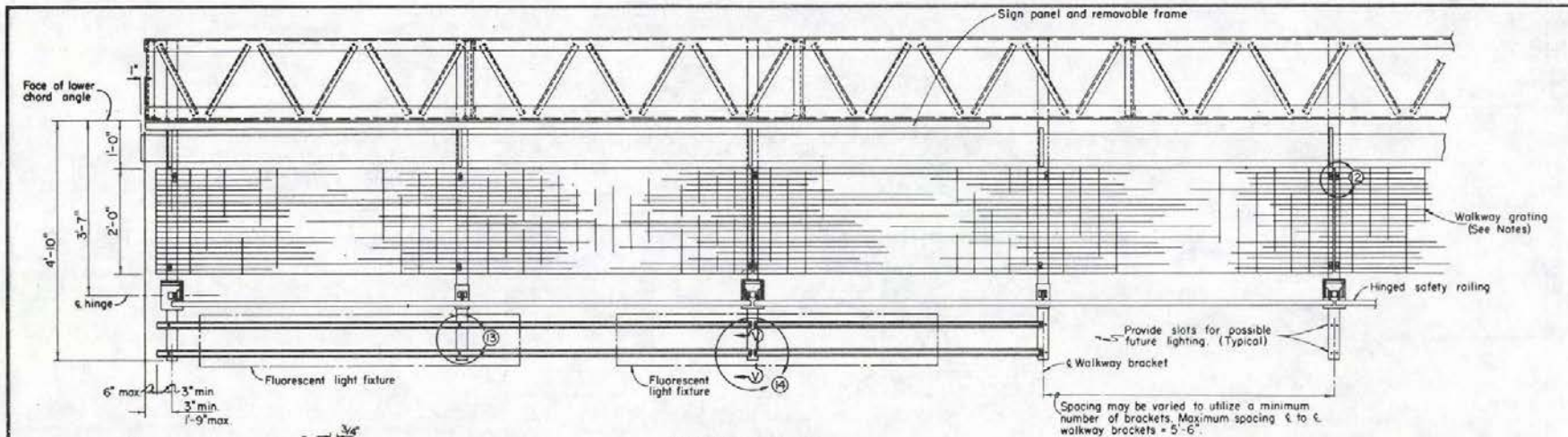
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

OVERHEAD SIGNS
REMOVABLE SIGN PANEL FRAMES

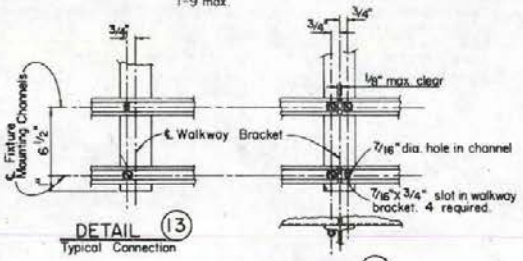
CHIEF TRAFFIC ENGR.

T - 36.1.8 - (627)
ADOPTED: 8/89 REVISION 2 - 8/79

T-44

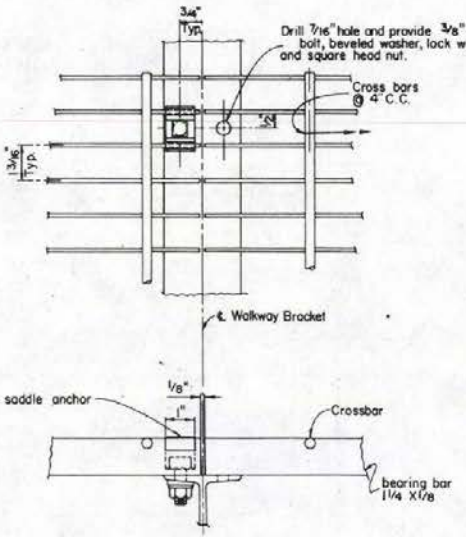


WALKWAY PLAN
Scale 1" = 1'-0"

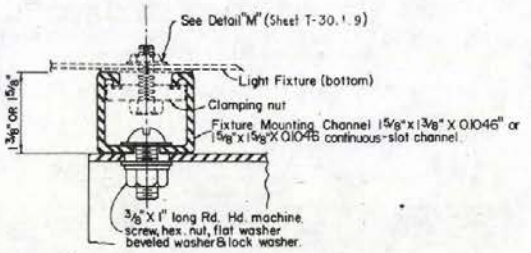


DETAIL (13)
Typical Connection

DETAIL (14)
Connection at Splice



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



SECTION V-V
Full Scale

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

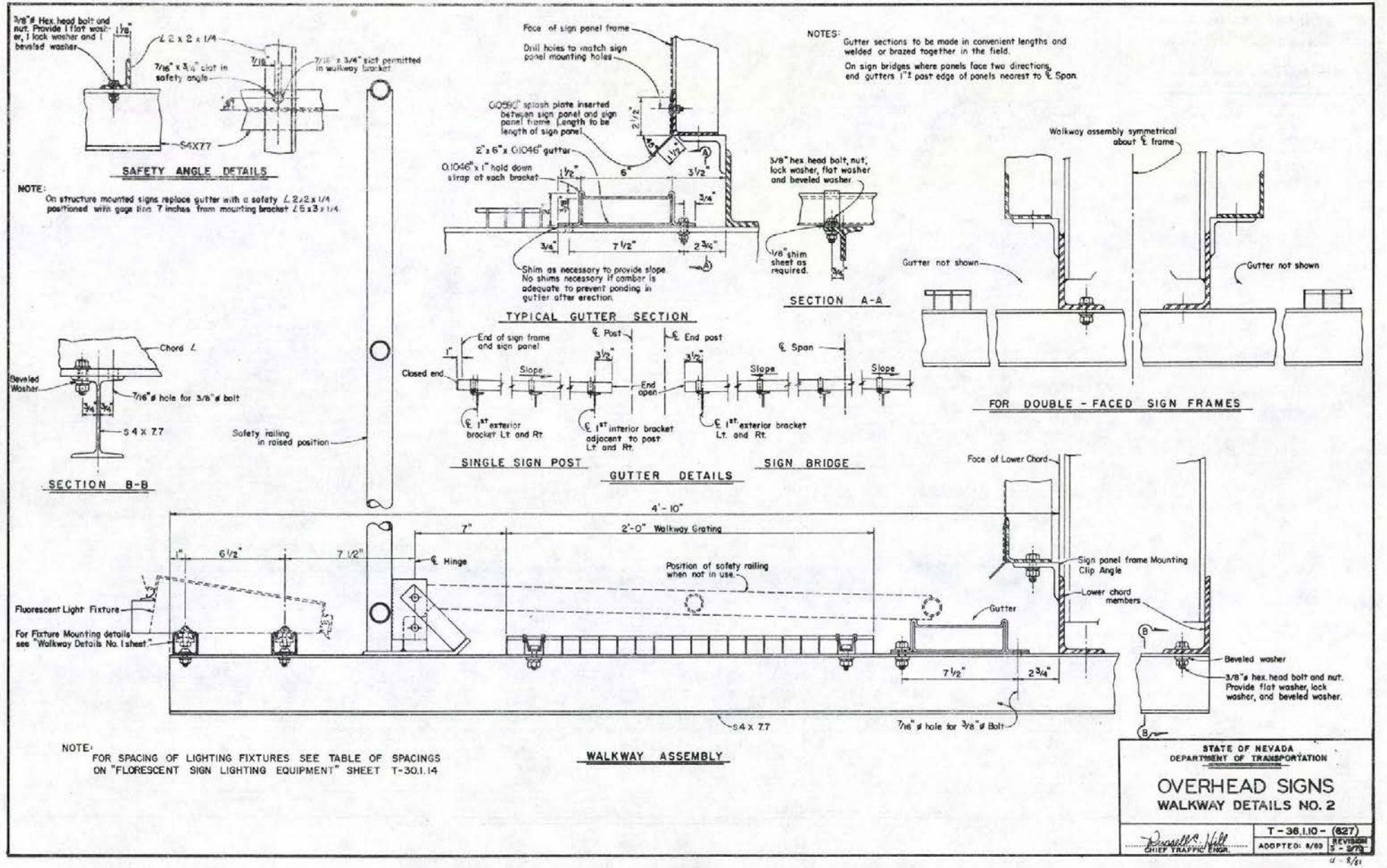
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

OVERHEAD SIGNS
WALKWAY DETAILS NO. 1

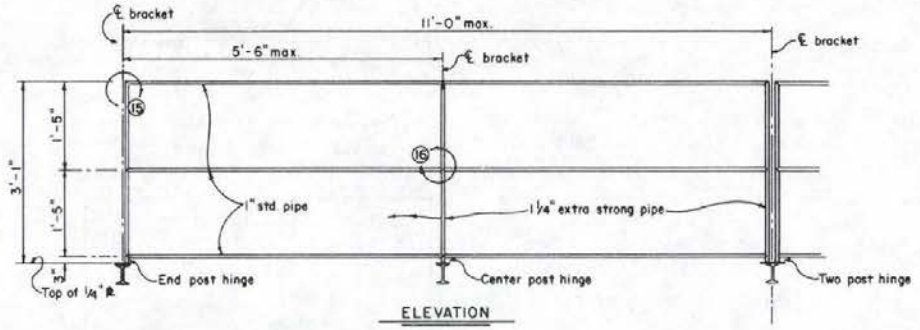
CHIEF TRAFFIC ENGR.

T-36.1.9-(627)
ADOPTED: 8/69
REVISION 3-2/79

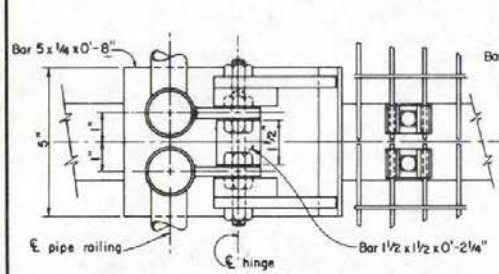
T-45


3/8"ø Hex. head bolt and nut. Provide 1 flat washer, 1 lock washer and 1 beveled washer
1 1/8"
L 2 x 2 x 1/4
7/16" x 3/4" slot in safety angle
7/16"
7/16" x 3/4" slot permitted in walkway bracket
S4X7.7
SAFETY ANGLE DETAILS
NOTE:
On structure mounted signs replace gutter with a safety L 2x2x1/4 positioned with gage line 7 inches from mounting bracket L 6 x 3 x 1/4.
Face of sign panel frame
Drill holes to match sign panel mounting holes
.0598" splash plate inserted between sign panel and sign panel frame. Length to be length of sign panel.
2" x 6" x .0104" gutter
.0104" x 1" hold down strap at each bracket
1 1/2"
6"
3 1/2"
2 1/2"
1 1/2"
3/4"
7 1/2"
2 3/4"
Shim as necessary to provide slope. No shims necessary if camber is adequate to prevent ponding in gutter after erection.
TYPICAL GUTTER SECTION
3/8" hex head bolt, nut, lock washer, flat washer and beveled washer
1/8" shim sheet as required.
3/4"
SECTION A-A
NOTES:
Gutter sections to be made in convenient lengths and welded or brazed together in the field.
On sign bridges where panels face two directions, end gutters 1" ± past edge of panels nearest to ℄ Span.
Walkway assembly symmetrical about ℄ frame
Gutter not shown
Gutter not shown
FOR DOUBLE - FACED SIGN FRAMES
Chord L
Beveled Washer
7/16"ø hole for 3/8"ø bolt
3/4
3/4
S 4 X 7.7
SECTION B-B
Safety railing in raised position
End of sign frame and sign panel
℄ Post
℄ End post
℄ Span
1"
Slope
3 1/2"
3 1/2"
Slope
Slope
Closed end
End open
℄ 1st exterior bracket Lt and Rt
℄ 1st interior bracket adjacent to post Lt and Rt
℄ 1st exterior bracket Lt. and Rt.
SINGLE SIGN POST
GUTTER DETAILS
SIGN BRIDGE
Face of Lower Chord
4'-10"
1"
6 1/2"
7 1/2"
7"
℄ Hinge
2'-0" Walkway Grating
Position of safety railing when not in use.
Sign panel frame Mounting Clip Angle
Lower chord members
Fluorescent Light Fixture
For Fixture Mounting details see "Walkway Details No. 1 sheet."
Gutter
7 1/2"
2 3/4"
Beveled washer
3/8"ø hex. head bolt and nut. Provide flat washer, lock washer, and beveled washer.
S4 x 7.7
7/16"ø hole for 3/8"ø Bolt
NOTE:
FOR SPACING OF LIGHTING FIXTURES SEE TABLE OF SPACINGS ON "FLORESCENT SIGN LIGHTING EQUIPMENT" SHEET T-30.1.14
WALKWAY ASSEMBLY
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION
OVERHEAD SIGNS
WALKWAY DETAILS NO. 2
Russell S. Hall
CHIEF TRAFFIC ENGR.
T-36.1.10 - (627)
ADOPTED: 8/89
REVISION
3 - 8/91
d - 8/91

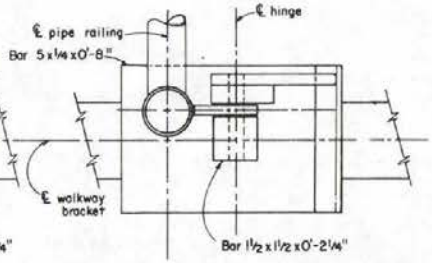
T-46



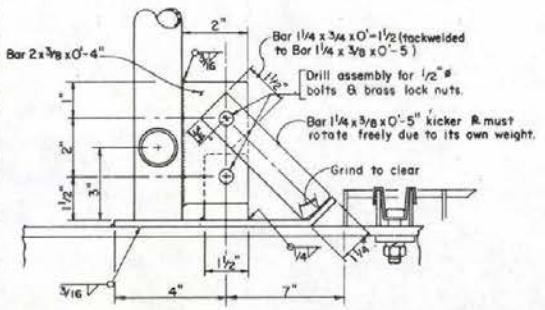
ELEVATION



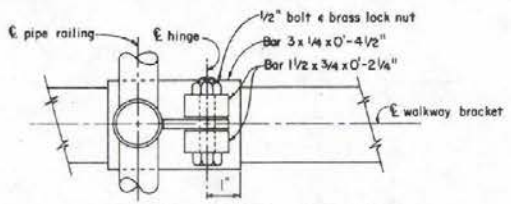
PLAN VIEW — TWO POST HINGE



PLAN VIEW — END POST HINGE



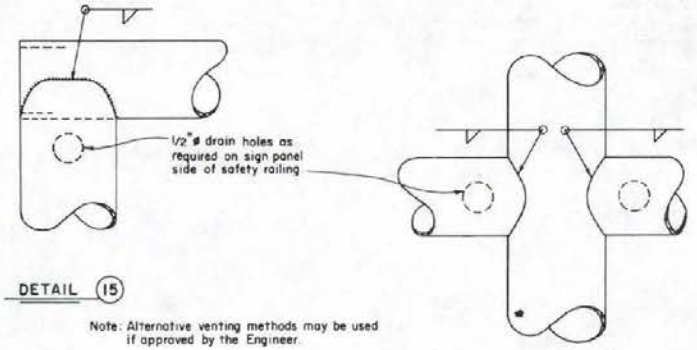
ELEVATION



PLAN VIEW — CENTER POST HINGE

Note:

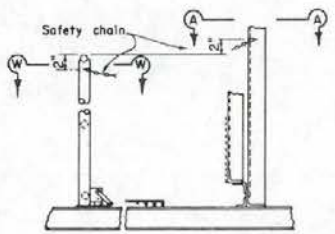
1. Special care shall be taken to insure that the completed hinge and latch assembly will hold the safety railing in a steady manner, free of wobble while in the raised position. Maximum allowable displacement from vertical at top of railing when latched shall be 1".
2. Details for bolting hinge base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



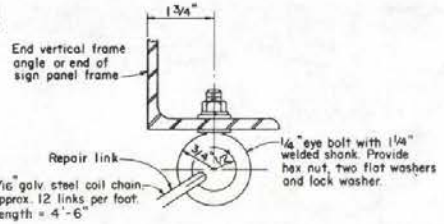
DETAIL (15)

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 TRANSPORTATION

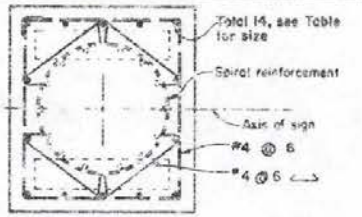
OVERHEAD SIGNS

WALKWAY SAFETY RAILING DETAILS

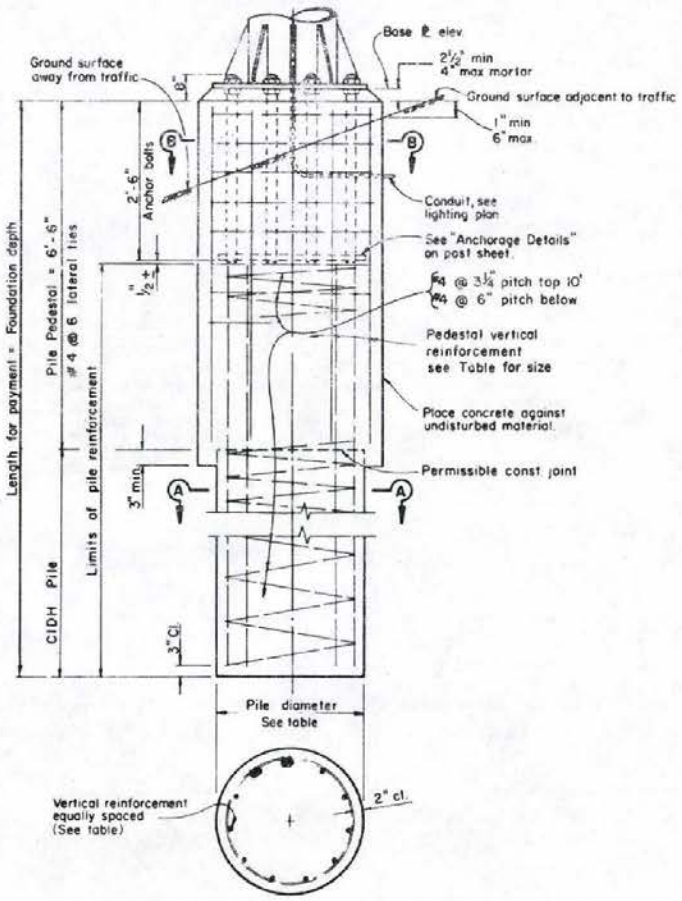
Russell C. Hill
CHIEF TRAFFIC ENGR.

T - 36.1.11 - (627)
ADOPTED: 8/69
REVISION 2 - 2/78

T-47



SECTION B-B



SECTION A-A

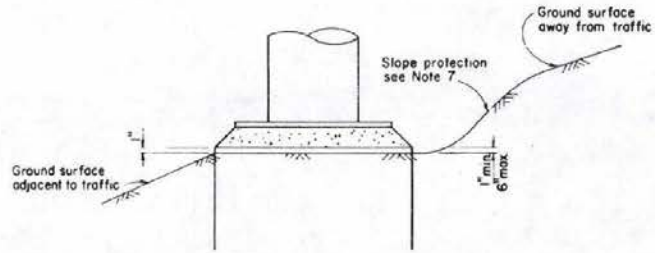
Post Type	Anchor Bolts	Pedestal Size	Reinforcing Steel Vertical	Pile Diameter	Foundation Depth**
I	6 - 2"	2'-11" x 2'-10"	14 - # 7	30"	14'
II	6 - 2"	3'-2" x 2'-10"	14 - # 8	30"	14'
IV	6 - 2"	3'-8" x 3'-4"	16 - # 8	36"	14'
V	10 - 2"	3'-10" x 3'-7"	16 - # 9	36"	17'
VI	10 - 2"	3'-10" x 3'-7"	16 - #10	36"	18'
VII	12 - 2"	4'-3" x 3'-11"	16 - #11	36"	21'
VIII	12 - 2"	4'-5" x 3'-11"	24* - #11	36"	22'
I-S	6 - 2"	2'-10" x 2'-10"	14 - # 7	30"	14'
II-S	8 - 2"	3'-1" x 2'-10"	14 - # 8	30"	16'
III-S	6 - 2"	3'-4" x 2'-10"	14 - #10	30"	18'
IV-S	8 - 2"	3'-6" x 3'-4"	16 - #10	36"	19'
V-S	8 - 2"	3'-9" x 3'-4"	16 - #11	36"	22'
VI-S	8 - 2"	4'-1" x 3'-4"	16 - #11	36"	23'
VII-S	8 - 2¼"	4'-5" x 3'-11"	24* - #11	36"	25'

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

* Bundled bars

NOTES

1. For anchor bolt layout see post sheet
2. For "Base ℄ Elev" see "Format" Sheet
3. Pedestal and pile shall be Class "A" or Class "AA" PCC
4. Pedestals & Base Plates, longer sides shall be normal to axis of sign
5. Prior to erection of the post, backfill which is equivalent to the surrounding material shall be in place
6. Pedestal shall be formed 6" min. below ground surface. Remainder to be placed against undisturbed material
7. Slope protection required when indicated on the Road Plans.

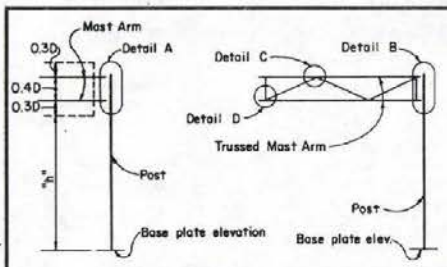


DETAIL C

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

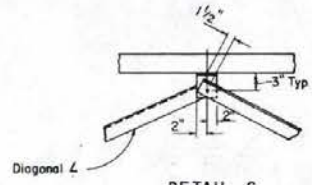
OVERHEAD SIGNS
ALTERNATE PILE FOUNDATION

T-48

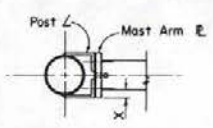


DOUBLE MAST ARM SERIES
TYPE C-1

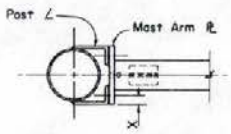
TRUSSED MAST ARM SERIES
TYPE C-2



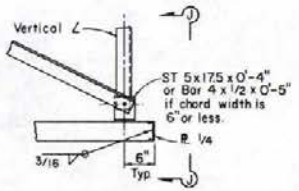
DETAIL C



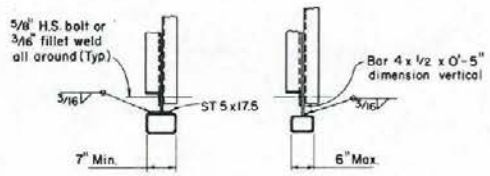
SECTION F-F



SECTION G-G

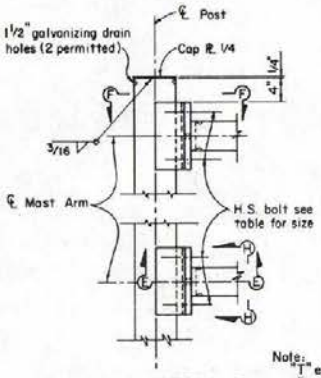


DETAIL D



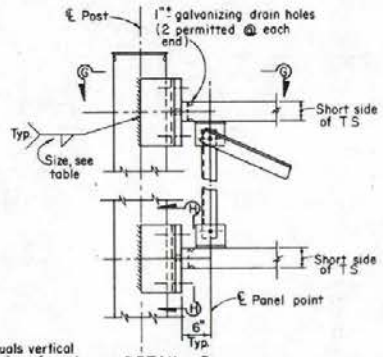
VIEW J-J

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

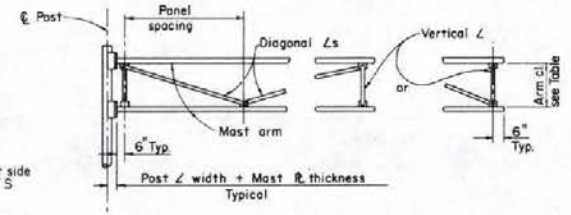


DETAIL A

Note: "T" equals vertical dimension of mast arm.



DETAIL B



SIGN DEPTH INCHES	ARM CLEARANCE	MAX. PANEL SPACING	VERTICAL ANGLE	DIAGONAL ANGLE
D = 40" - 70"	2'-0"	4'-4"	∠2 x 2 x 1/4	∠2 x 2 x 1/4
D = 80" - 100"	3'-0"	6'-6"	∠3½ x 2½ x 1/4*	∠3 1/2 x 2 1/2 x 1/4*

*Short leg outstanding

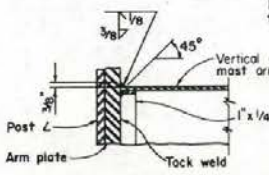
TRUSS FRAMING DATA

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

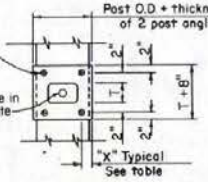
POST TO ARM FRAMING DATA

Note:
For post connection to base ℄ see T-36.1.16

For mast arm length and mast-arm-to sign panel connections see T-36.1.14



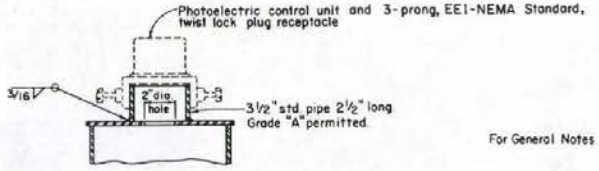
SECTION E-E



SECTION H-H

Note: "T" equals vertical dimension of mast arm.

Note: Bottom connection shown. Top similar.



PHOTOELECTRIC CONTROL UNIT

For General Notes see T-36.1.16

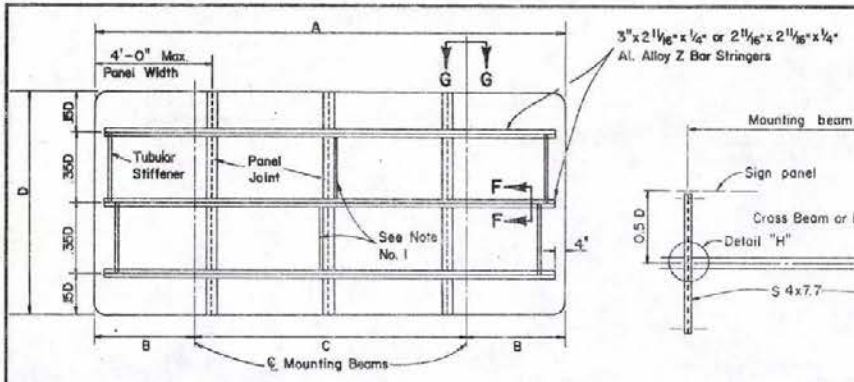
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

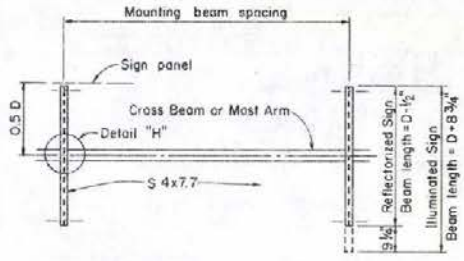
OVERHEAD SIGNS LIGHTWEIGHT TYPE C CONNECTION DETAILS

CHIEF TRAFFIC ENGR.

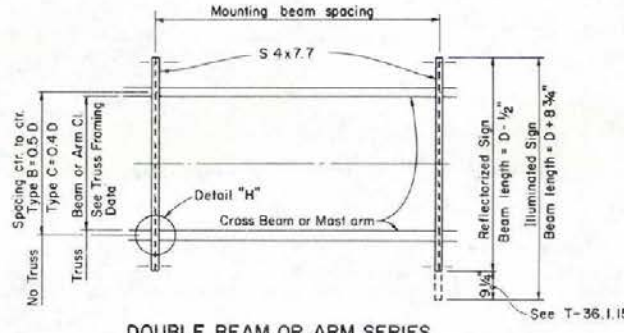
T-36.1.13 (627)
ADOPTED: 8/79 REVISION

T-49

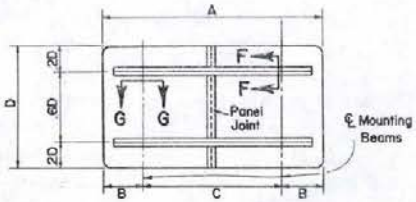


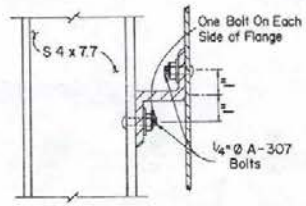


SINGLE BEAM OR ARM SERIES

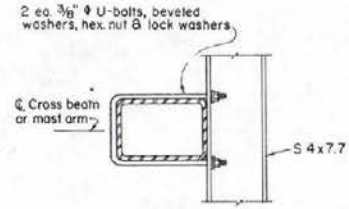


DOUBLE BEAM OR ARM SERIES





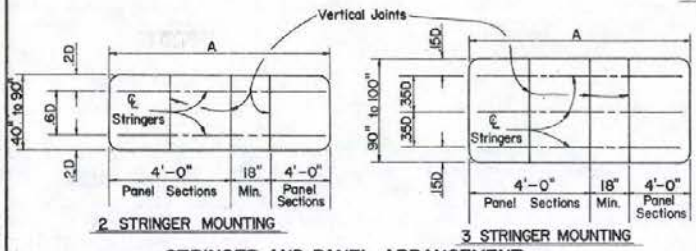
SECTION F-F



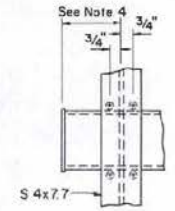
SECTION J-J

Sign Panel Length	Number Mounting Beams	Sign Panel Overhang	Mounting Beam Spacing
A		B	C
5'-0"	2	9"	3'-6"
6'-0"	2	12"	4'-0"
7'-0"	2	15"	4'-6"
8'-0"	2	18"	5'-0"
9'-0"	2	21"	5'-6"
10'-0"	2	24"	6'-0"
11'-0"	2	27"	6'-6"
12'-0"	2	30"	7'-0"
13'-0"	2	30"	8'-0"
14'-0"	2	30"	9'-0"
15'-0"	2	36"	9'-0"
16'-0"	2	36"	10'-0"
17'-0"	2	39"	10'-6"
18'-0"	2	42"	11'-0"

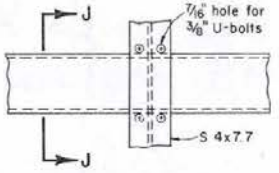
MOUNTING BEAM SPACING



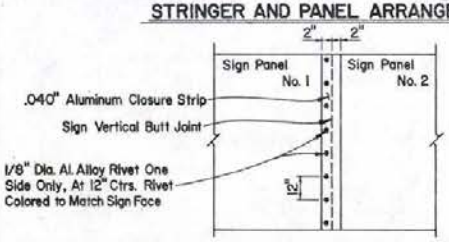
STRINGER AND PANEL ARRANGEMENT



END ARM DETAIL SINGLE POST SIGNS

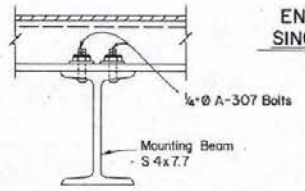


DETAIL H



PANEL JOINT CLOSURE STRIP

ALUMINUM SHEET CONSTRUCTION



SECTION G-G

NOTES

1. Tubular stiffeners to be added when "A" exceeds 10'-0"
2. Position sign panel so that mounting beams will clear truss connections and arm to post joints. Where interference cannot be avoided, 1/2" Ø holes to pass the 3/8" Ø U-bolts may be drilled through mast arm angles or truss connection members as necessary.
3. Torque aluminum sign panel mounting bolt to 100 in.-lbs.
4. 11" for Type C-1 and C-2. Others 4"
5. Flat washers required on all bolts, 1 or 2 as necessary
6. All nuts to have fiber inserts
7. To obtain desired panel width, max. of 2 panels may be cut less than 4'-0" (18" min. each)
8. Tubular stiffeners required only when panel overhang exceeds 2'-0"

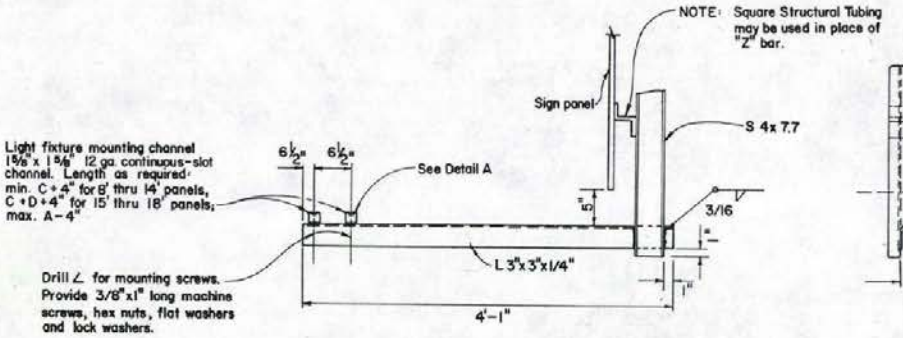
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

OVERHEAD SIGNS LIGHTWEIGHT SIGN PANEL MOUNTING DETAILS

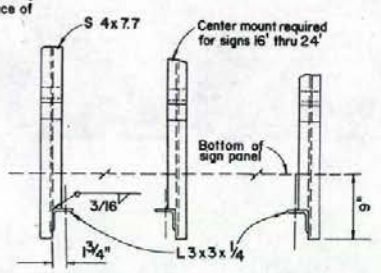
Russell "Bud" Hill
CHIEF TRAFFIC ENGINEER

T-36.1.14 (627)
ADOPTED: 8/79 REVISION

T-50

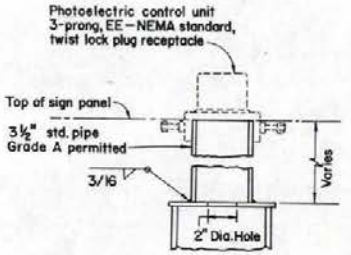


SIDE VIEW - SINGLE FACED SIGN TYPES A, B & C

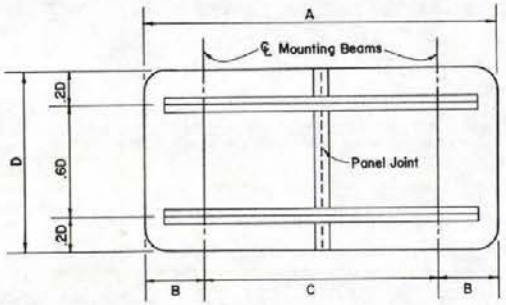


FRONT VIEW

LIGHT FIXTURE MOUNTING DETAIL
SIGNS GREATER THAN 5'-6" IN LENGTH

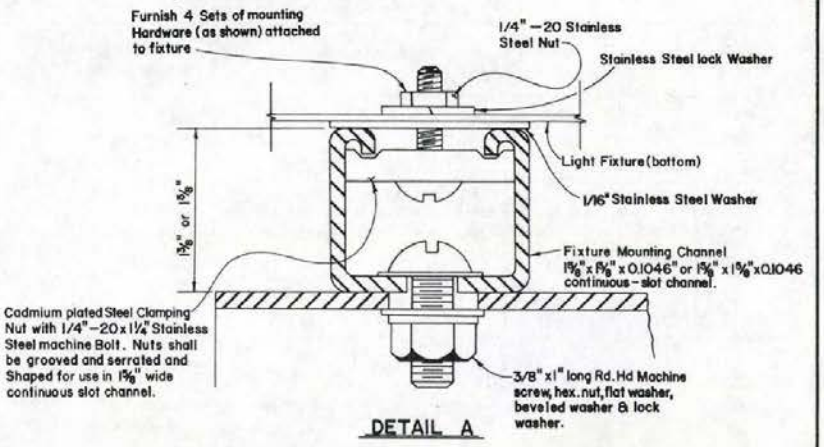


PHOTOELECTRIC CONTROL UNIT



Sign Panel Length A	Number Mounting Beams	Sign Panel Overhang B	Mounting Beam Spacing C
5'-0"	2	9"	3'-6"
6'-0"	2	12"	4'-0"
7'-0"	2	15"	4'-6"
8'-0"	2	18"	5'-0"
9'-0"	2	21"	5'-6"
10'-0"	2	24"	6'-0"
11'-0"	2	27"	6'-6"
12'-0"	2	30"	7'-0"
13'-0"	2	30"	8'-0"
14'-0"	2	30"	9'-0"
15'-0"	2	36"	9'-0"
16'-0"	2	36"	10'-0"
17'-0"	2	39"	10'-0"
18'-0"	2	42"	11'-0"

MOUNTING BEAM SPACING



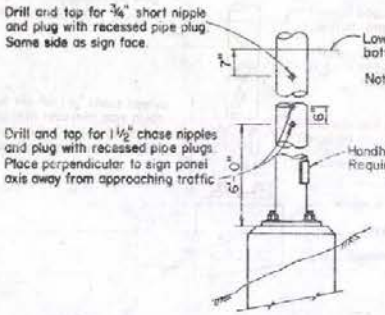
DETAIL A

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

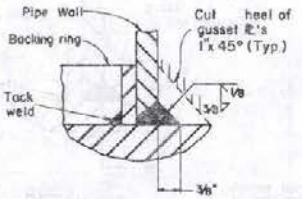
OVERHEAD SIGNS
LIGHTWEIGHT
LIGHT FIXTURE MOUNTING DETAILS

CHIEF TRAFFIC ENGR.	T-36.1.15(627)
	ADOPTED: 8/82 REVISION

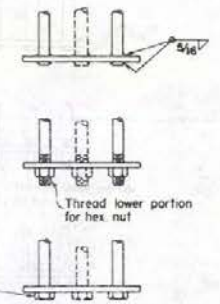
T-51



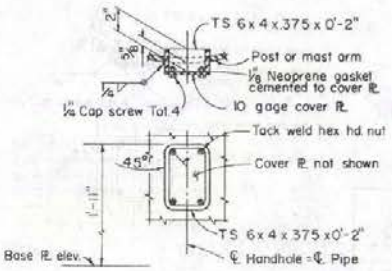
ELEVATION



DETAIL A



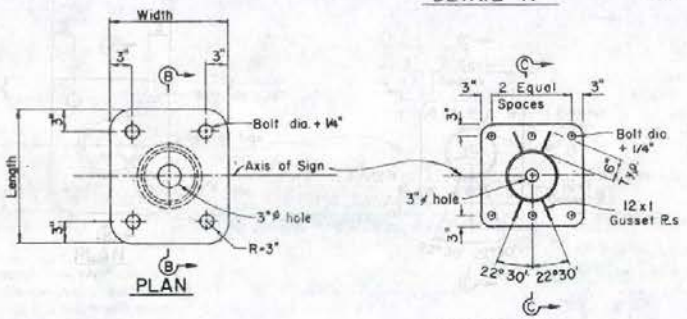
ALTERNATIVE BAR CONNECTIONS



HANDHOLE & COVER DETAILS

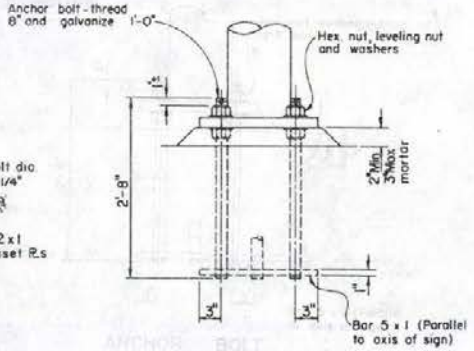
POST SIZE	BASE PLATE	ANCHOR BOLTS (Min.)
6 @ 18.97	1½" x 1'-2" x 1'-2"	4 - 1¼"
6 @ 28.57	1½" x 1'-2" x 1'-2"	4 - 1½"
8 @ 28.55	1½" x 1'-6" x 1'-6"	4 - 1¾"
8 @ 43.39	2" x 1'-6" x 1'-6"	4 - 2"
10 @ 54.74	2" x 1'-8" x 1'-8"	4 - 2¼"
12 @ 65.42	2" x 1'-8 x 1'-8"	4 - 2½"
14 @ 72.09	2" x 2'-4" x 2'-4"	6 - 2"
14 @ 89.30	2" x 2'-4" x 2'-4"	6 - 2¼"

NOTES:
1. Footings shall be placed with long dimensions normal to axis of sign.
2. On single post signs the post shall be raked out of plumb with the use of the leveling nuts to make the bottom of the sign frame level.
3. 2" ϕ anchor bolts may be substituted for 1¾" ϕ bolts.
   2½" ϕ anchor bolts may be substituted for 2¼" ϕ bolts.



PLAN

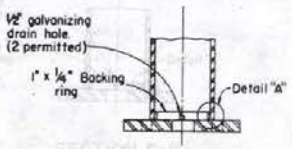
PLAN



ANCHOR BOLT

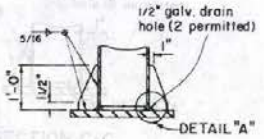
GENERAL NOTES

DESIGN:	A.A.S.H.T.O. SPECIFICATIONS FOR THE DESIGN AND CONSTRUCTION OF STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINARIES, AND TRAFFIC SIGNALS. DATED 1975. REVISED 1979.
CONSTRUCTION:	STANDARD SPECIFICATIONS. DIVISION OF HIGHWAYS DATED 1976 AND THE SPECIAL PROVISION.
WELDING:	ALL WELDING CONTINOUS UNLESS OTHERWISE NOTED ON THE PLANS. ALL WELDING TO BE DONE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS.



SECTION B-B

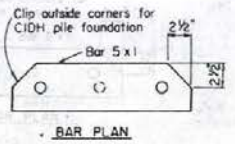
6" THRU 12" POSTS



SECTION C-C

14" POST

BASE PLATE DETAILS



BAR PLAN

ANCHORAGE DETAILS

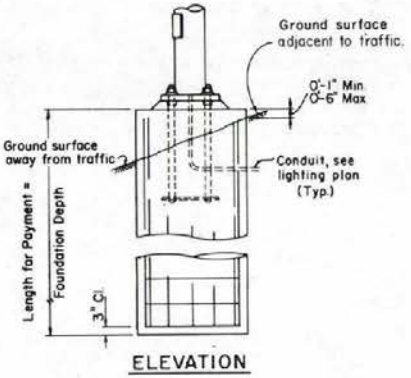
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

OVERHEAD SIGNS LIGHTWEIGHT POST DETAILS

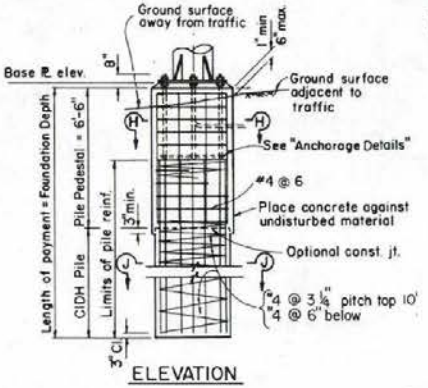
CHIEF TRAFFIC ENGR.	T-36.1.16 (627)	
	ADOPTED: 8/79	REVISION

T-52

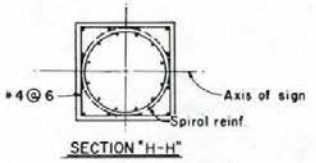
POST SIZE	PILE FOUNDATION				SPREAD FOOTING				
	Pedestal	Pile Dia.	Found. Depth	Reinf. Size	Pedestal	Footing	Reinf. Top	Reinf. Bot.	Reinf. L Bar
6 @ 18.97		24"	8'	#5	1'-10" x 1'-10"	4'-0" x 6'-0"	#4	#4	#5
6 @ 28.57		24"	9'	#5	1'-10" x 1'-10"	4'-0" x 7'-0"	#4	#4	#5
8 @ 28.55		30"	9'	#6	2'-2" x 2'-2"	5'-0" x 8'-0"	#4	#4	#5
8 @ 43.39		30"	11'	#7	2'-2" x 2'-2"	6'-0" x 9'-0"	#4	#5	#5
10 @ 54.74	2'-10" x 2'-10"	30"	13'	#8	2'-4" x 2'-4"	7'-0" x 10'-0"	#5	#7	#7
12 @ 65.42	2'-10" x 2'-10"	30"	15'	#10	2'-4" x 2'-4"	7'-0" x 12'-0"	#6	#8	#8
14 @ 72.09	3'-4" x 3'-4"	36"	15'	#10	2'-11" x 2'-11"	7'-0" x 13'-0"	#7	#9	#8
14 @ 89.30	3'-4" x 3'-4"	36"	16'	#10	2'-11" x 2'-11"	8'-0" x 14'-0"	#7	#9	#8



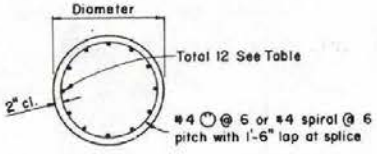
ELEVATION



ELEVATION

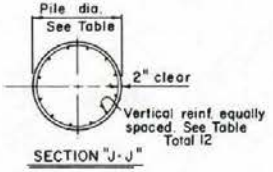


SECTION "H-H"



PLAN

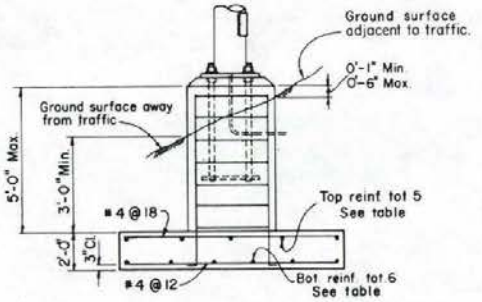
6" & 8" POSTS



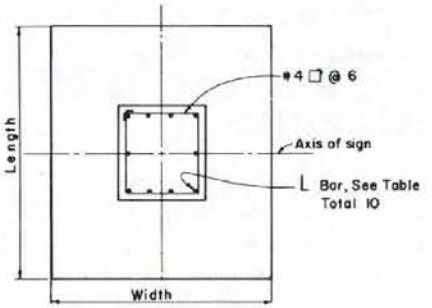
SECTION "J-J"

10" THRU 14" POSTS

PILE FOUNDATION



ELEVATION



PLAN

SPREAD FOOTING

NOTES:

1. Backfill shall be in place prior to erection of post.
2. Slope protection required when indicated on the plans.
3. Pile pedestal shall be formed 6" min. below ground surface. Remainder to be placed against undisturbed material.

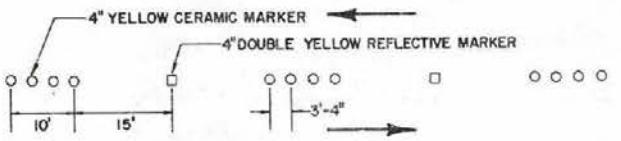
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

OVERHEAD SIGNS LIGHTWEIGHT FOUNDATION

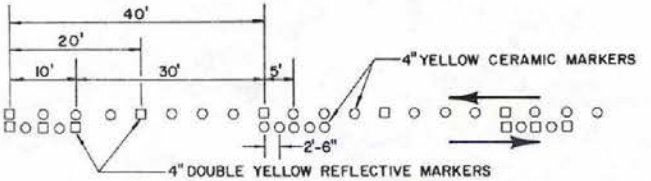
Russell "Bud" Hill
CHIEF TRAFFIC ENGR.

T-36.1.17 (627)
ADOPTED: 8/79 REVISION

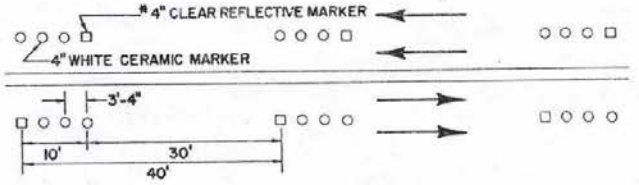
T-53



CENTER LANE TWO WAY TRAFFIC

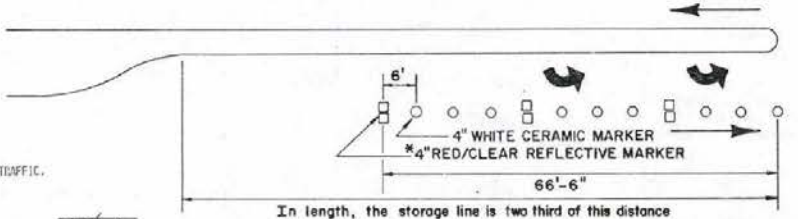


ONE WAY PASSING ZONE

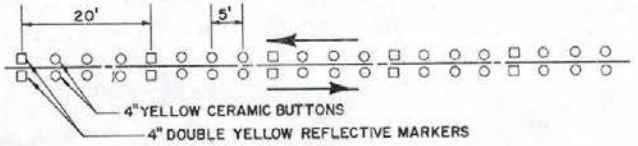


LANE LINE

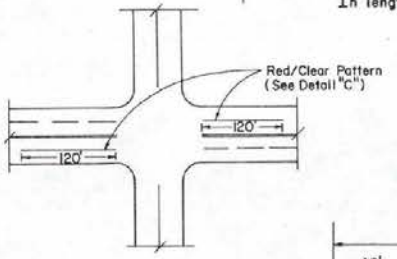
* CLEAR SIDE SHALL FACE ON-COMING TRAFFIC.

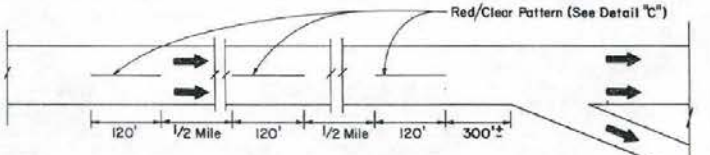


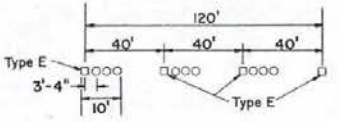
STORAGE LINE



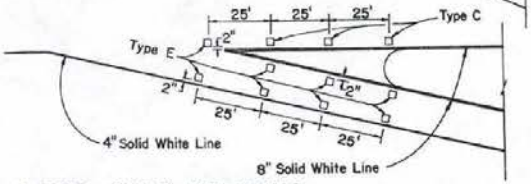
DOUBLE YELLOW CENTER LINE



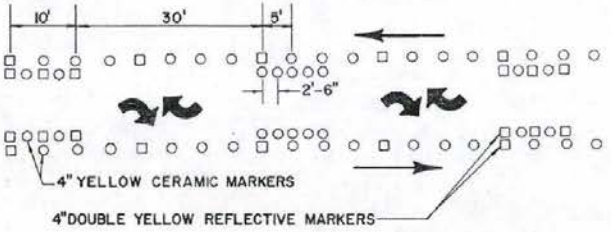




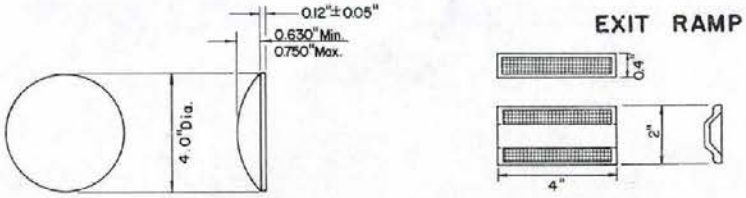
DETAIL "C"



EXIT RAMP GORE STRIPING



TWO WAY LEFT TURN LANE



NON-REFLECTIVE & REFLECTIVE MARKERS

TYPE A - NON - REFECTIVE YELLOW MARKER
TYPE B - NON - REFLECTIVE WHITE MARKER
TYPE C - CLEAR REFLECTIVE MARKER
TYPE D - TWO WAY YELLOW REFLECTIVE MARKER
TYPE E - RED/CLEAR REFLECTIVE MARKER

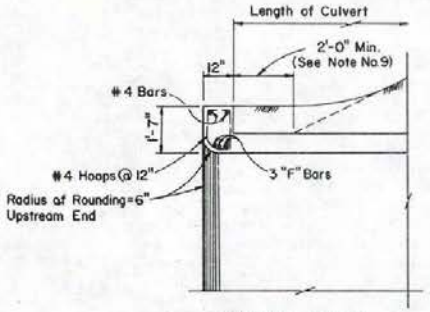
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

PAVEMENT MARKER

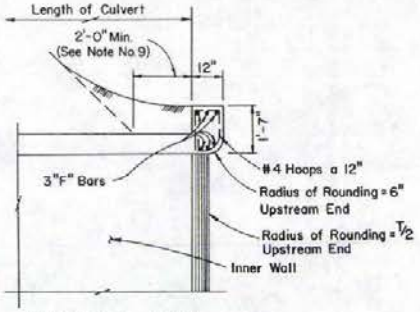
T-37.1.1 (635)

CHIEF TRAFFIC ENGR. | ADOPTED: 2/79 | REVISION 1-2/82

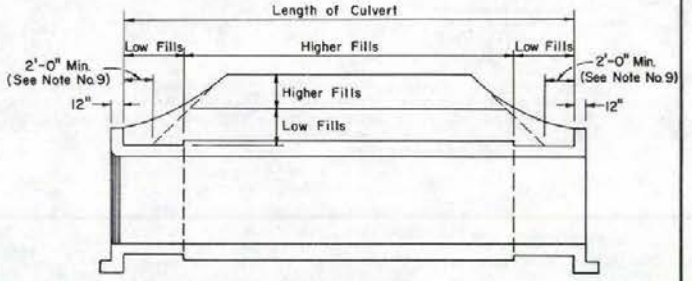
T-54



SINGLE SPAN

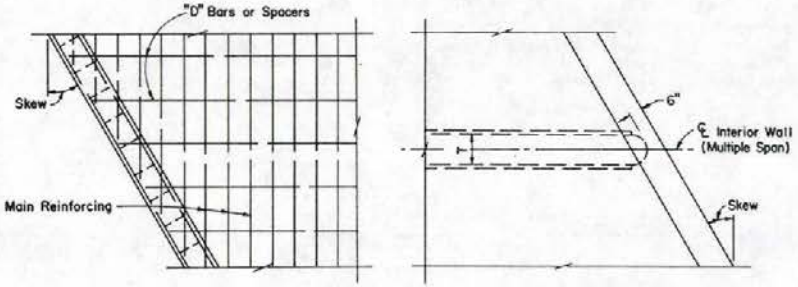


MULTIPLE SPAN

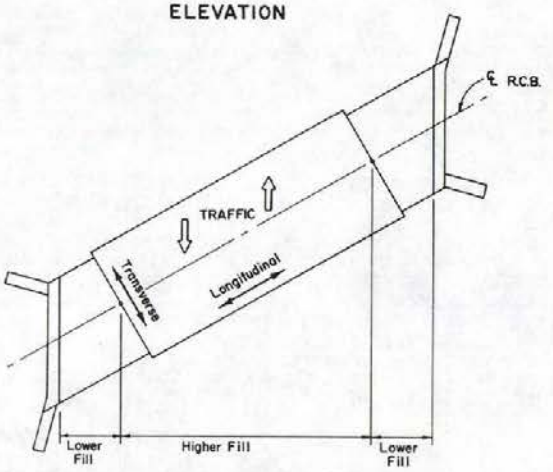


Low Fills = Lowest Table Value for Given Span
Higher Fills = Slab Increase as Shown in Table

ELEVATION

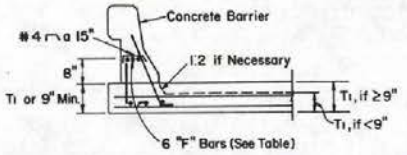


PLANS - SKEWED



PLAN - SKEWED

FILL HEIGHT TRANSITIONS



BARRIER SECTION

SKEWED PARAPETS								
SKEW ANGLE		SPAN	5	6	7	8	10	12	14
00-15°	"F" BARS	BAR NO.	4	5	5	6	7	8	8
16°-30°		BAR NO.	5	6	6	7	8	8	8
31°-45°		BAR NO.	6	6	6	7	8	8	8
0°-45°	#4 HOOPS		12" CTRS						

PARAPET DETAILS

COPING REINFORCING INCLUDED IN THE HEADWALL QUANTITIES

GENERAL NOTES

1) DESIGN SPECIFICATIONS: AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 1977," AND INTERIM SPECIFICATIONS THROUGH 1980, EXCEPT AS NOTED BELOW.
2) CONSTRUCTION SPECIFICATIONS: STATE OF NEVADA DEPARTMENT OF HIGHWAYS "STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION," CURRENT EDITION, AND SPECIAL PROVISIONS THERETO.
3) LOADING: LIVE LOAD: STANDARD HS20-44 OR ALTERNATE FHWA MILITARY LOADING. IMPACT FOR TOP SLAB IS 30% UP TO 3 FT. COVER, NO IMPACT ABOVE 3 FT. COVER. NO IMPACT FOR INVERT. NO SURCHARGE FOR WALLS.
EARTH LOAD: EQUIVALENT FLUID PRESSURE FOR TWO CONDITIONS.
1) 120 LBS./CU. FT. VERTICAL, 42 LBS./CU. FT. HORIZONTAL.
2) 140 LBS./CU. FT. VERTICAL, 140 LBS./CU. FT. HORIZONTAL.
LOAD FACTORS: 1.3D + 1.5E + 2.5 (L + I).
4) CONCRETE: THE CONCRETE SHALL HAVE A MINIMUM 28 DAY COMPRESSIVE STRENGTH OF 3,250 PSI. MAXIMUM ALLOWABLE SHEAR, Vc = 3.5 $\sqrt{f'c}$, PSI, TAKEN AT A DISTANCE "d" FROM THE SUPPORTING MEMBER.
5) REINFORCING STEEL: ALL REINFORCING STEEL TO BE ASTM A615 GRADE 60. MAIN REINFORCEMENT IS TO BE PLACED IN THE TRANSVERSE DIRECTION. STAGGER SPLICES NOT SHOWN. HOOKS MAY BE ROTATED OR TILTED, AS NECESSARY, FOR CLEARANCE. REINFORCEMENT SHALL HAVE A 2-½ INCH CLEARANCE ON BOTTOM OF BOTTOM SLAB AND 2 INCH CLEARANCE ON REMAINDER OF STRUCTURE AND ITS APPURTENANCES UNLESS OTHERWISE NOTED ON THE PLANS.
6) FOUNDATION PRESSURE: THE RCB CULVERTS ARE DESIGNED TO THE FOLLOWING SOIL BEARING PRESSURES:

COVER HEIGHTS	10 FT.	20 FT.
RCB HEIGHT	TONS/SQ.FT.	
6 FT.	1.0	1.6
8 FT.	1.1	1.7
10 FT.	1.2	1.8
12 FT.	1.3	1.9
14 FT.	1.4	2.0

7) SPECIAL DESIGN: CULVERTS WITH CONDITIONS, LOADINGS, OR SIZES DISSIMILAR TO THOSE GIVEN ON THESE RCB CULVERT SHEETS MAY REQUIRE A SPECIAL DESIGN.
8) DESIGNATION: BOX CULVERTS ARE SHOWN ON PLANS AS SPAN TIMES HEIGHT TIMES LENGTH (10' x 8' x 196' RCB).
9) ADDITIONAL LENGTH: LENGTH OF CULVERT SHALL BE INCREASED AS FOLLOWS: ADD 2.0 FT. TO EACH END WHEN COVER AT SHOULDER IS 0.0 TO 5.0 FEET. ADD AN ADDITIONAL 1.0 FT. TO EACH END FOR EACH SUCCEEDING 5.0 FT. OF COVER OR PORTION THEREOF.
10) HEADWALLS: ALL RCB CULVERTS SHALL HAVE TYPE I HEADWALLS UNLESS OTHERWISE NOTED ON THE PLANS.
11) QUANTITIES: QUANTITIES DO NOT INCLUDE "d" BARS, NOR SPLICES IN BARS, NOR TEMPERATURE BARS FOR EXPOSED TOP SLAB, NOR CONCRETE OR REINFORCEMENT FOR PARAPETS OR PAVING LEDGES.
12) THREE OR MORE CELLS: FOR CULVERTS WITH MORE THAN TWO CELLS, USE DIMENSIONS AND REINFORCEMENT FOR THE "DOUBLE BOX CULVERT" AND ADJUST THE QUANTITIES ACCORDINGLY.

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

R.C.B., CULVERTS, GENERAL NOTES

Hugh E. Briner
CHIEF BRIDGE ENGR

B-20.1.1(502)
ADOPTED 11/73
REVISION 2-3/82

I-8

SPAN '	5						6							
HEIGHT '	3		4		5		3		4		5		6	
MAXIMUM EARTH COVER '	10	20	10	20	10	20	10	20	10	20	10	20	10	20
CONC. ROOF T1 "	7½	7½	7½	7½	7½	7½	8	8	8	8	8	8	8	8
CONC. WALLS T2 "	6	6	6	7	6½	7½	6	6	6	7	6½	7½	7	8½
CONC. INVERT T3 "	6½	7	6½	7	6½	7	7	8	7	8	7	8	7	8
REINF. SPACING "	8½	5½	8½	5½	8½	5½	7½	5	7½	5	7½	5	7½	4½
REINF. "a" SIZE BAR #	7	6	7	6	7	6	7	6	7	6	7	6	7	6
REINF. "e" SIZE BAR #	4	4	5	5	6	6	4	4	5	5	6	6	7	6
QUAN. CONCRETE CF/LF	10.0	10.2	11.0	12.0	12.5	13.7	11.7	12.3	12.7	14.2	14.2	15.9	15.9	18.3
QUAN. REINFORCEMENT LBS/LF	58	68	67	81	82	105	70	81	82	96	97	120	124	148

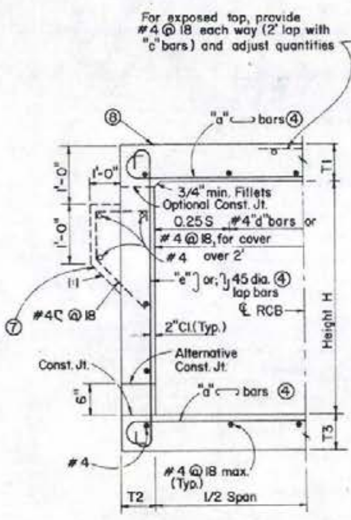
SPAN '	7										8											
HEIGHT '	3		4		5		6		7		3		4		5		6		7		8	
MAXIMUM EARTH COVER '	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20
CONC. ROOF T1 "	8	9	8	9	8	9	8½	9	8½	9	8½	9½	8½	9½	8½	9½	8½	10	8½	10	8½	10
CONC. WALLS T2 "	6	6	6	7	6½	7½	7	8½	8	9½	6	7	6	7	6½	7½	7	8½	8	9½	8½	10½
CONC. INVERT T3 "	8	9	8	9	8	9	8	9	8	9	8	9½	8	9½	8	10	8	10	8	10	8	10
REINF. SPACING "	6½	5	6½	4½	6½	5½	6½	5½	6½	5½	6	5	6	5	6	5	6	4½	6	5	6	4½
REINF. "a" SIZE BAR #	7	6	7	6	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
REINF. "e" SIZE BAR #	4	4	5	5	6	6	6	7	7	7	5	5	5	5	5	6	6	6	6	7	7	7
QUAN. CONCRETE CF/LF	13.7	14.9	14.6	16.8	16.1	18.5	18.1	21.0	20.7	23.8	15.4	18.0	16.4	19.0	17.9	21.1	19.5	24.1	22.1	26.9	24.1	30.1
QUAN. REINFORCEMENT LBS/LF	94	94	105	118	121	147	130	177	160	192	115	139	123	151	131	171	137	198	160	215	192	252

" d " BARS, FOR EARTH COVERS OF 2' AND LESS TO BE PLACED IN TOP SLAB ONLY							
SPAN	5'	6'	7'	8'	10'	12'	14'
NUMBER	6	7	8	9	10	12	16

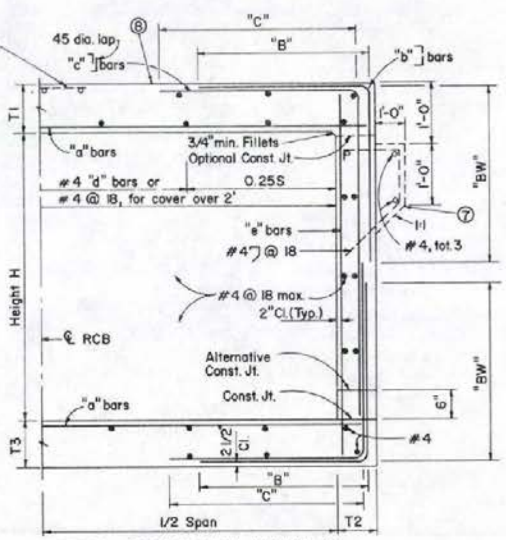
SPAN '	10															
HEIGHT '	3		4		5		6		7		8		9		10	
MAXIMUM EARTH COVER '	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20
CONC. ROOF T1 "	8	10½	8	10½	8	10½	8	10½	8	10½	8	10½	8	10½	8½	11
CONC. WALLS T2 "	8	8	8	8	8	8	8	9	8	9	8	10	8½	11½	9½	12½
CONC. INVERT T3 "	8	11	8	11	8	11	8	11	8	11	8	11	8	11	8½	11
REINFORCEMENT SPACING "	13	12	13	12	13	12	12	12	11	11	10	11	11	10	11	10
"a" ⑥ SIZE BAR #	6	7	6	7	6	7	6	7	6	7	6	7	6	6	6	6
"b" SIZE BAR #	6	7	6	7	6	7	6	7	6	7	6	7	6	6	7	7
"b" DIMENSION "B" ' "	2-10	2-11	2-10	2-11	2-11	2-11	2-11	3-0	2-11	3-9	2-11	3-9	2-11	3-9	2-11	3-9
"b" DIMENSION "BW" ' "	2-10	3-0	2-10	3-0	4-10	5-0	4-10	5-0	4-10	5-0	4-10	5-0	4-10	5-0	4-7	4-7
"c" SIZE BAR #	6	7	6	7	6	7	6	7	6	7	6	7	7	7	7	7
"c" DIMENSION "C" ' "	3-4	3-4	3-4	3-4	3-4	3-4	7-4	4-8	7-7	4-8	8-2	4-8	7-7	4-8	7-7	4-8
"e" ⑤ SIZE BAR #	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	5
QUAN. CONCRETE CF/LF	19.1	24.3	20.4	25.6	21.6	26.8	23.0	29.5	24.3	31.0	25.6	34.1	27.8	37.7	32.1	42.3
QUAN. REINFORCEMENT LBS/LF	161	230	169	237	191	267	233	285	260	325	300	339	314	327	360	373

SPAN '	12																	
HEIGHT '	4		5		6		7		8		9		10		11		12	
MAXIMUM EARTH COVER '	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20
CONC. ROOF T1 "	8½	12	8½	12	8½	12	8½	12	8½	12	8½	12	8½	12	9½	12	9½	12
CONC. WALLS T2 "	8	10	8	10	8	10	8½	10½	8½	10½	8½	11½	9	12½	10½	13½	11½	15
CONC. INVERT T3 "	8½	12½	8½	12½	8½	12½	9	12½	9	12½	9	12½	9	12½	9½	13	10	13
REINFORCEMENT SPACING "	9	10	9	10	9	10	9	10	9	10	8	10	8	10	10	9	9	8
"a" ⑥ SIZE BAR #	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6	6	6	6
"b" SIZE BAR #	6	7	6	7	6	7	6	7	6	7	6	7	6	7	7	7	6	7
"b" DIMENSION "B" ' "	3-1	3-2	3-1	3-2	3-1	3-2	3-9	3-9	3-9	3-9	3-7	3-9	3-7	4-4	3-7	4-4	4-4	4-4
"b" DIMENSION "BW" ' "	4-0	4-0	4-0	4-0	6-0	5-10	6-2	6-7	6-2	6-7	4-11	4-11	4-11	4-11	4-11	4-11	4-4	4-4
"c" SIZE BAR #	6	7	6	7	6	7	6	7	6	7	6	7	6	7	7	7	7	7
"c" DIMENSION "C" ' "	4-4	4-4	4-4	4-4	4-4	3-7	8-1	5-7	8-1	5-7	8-1	5-7	8-1	5-7	8-1	5-7	8-1	5-7
"e" ⑤ SIZE BAR #	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	5	5	5
QUAN. CONCRETE CF/LF	24.2	34.6	25.5	36.2	26.8	37.7	29.3	40.1	30.3	41.9	32.2	45.4	34.5	49.8	40.7	54.2	45.4	59.9
QUAN. REINFORCEMENT LBS/LF	271	331	278	339	295	362	353	409	365	420	402	413	415	424	440	471	468	534

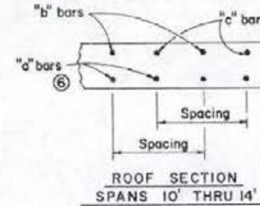
SPAN '	14															
HEIGHT '	7		8		9		10		11		12		13		14	
MAXIMUM EARTH COVER '	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20
CONC. ROOF T1 "	9½	14	9½	14	9½	14	9½	14	10	14	10	14	10½	14	11	14
CONC. WALLS T2 "	9½	11	9½	11½	9½	11½	10	12½	10½	14	11½	15	12½	16½	13½	17½
CONC. INVERT T3 "	10	14½	10	14½	10	14½	10	14½	10½	14½	10½	15	11	15	11½	15
REINFORCEMENT SPACING "	10	9	10	9	10	8	10	8	10	8	8	10	10	10	10	9
"a" ⑥ SIZE BAR #	7	7	7	7	7	7	7	7	7	7	6	7	6	7	6	7
"b" SIZE BAR #	6	7	7	7	7	7	7	7	7	7	6	8	7	8	7	8
"b" DIMENSION "B" ' "	2-9	4-2	3-4	4-4	3-4	4-6	3-4	4-6	3-6	4-6	3-6	4-6	3-6	4-6	4-9	6-0
"b" DIMENSION "BW" ' "	6-5	7-0	7-0	8-4	7-0	8-4	6-0	6-0	6-0	6-0	6-0	6-0	5-0	6-0	4-6	6-0
"c" SIZE BAR #	7	7	7	7	7	7	7	7	7	7	7	8	8	8	8	8
"c" DIMENSION "C" ' "	4-0	4-2	6-9	6-9	5-10	5-10	6-0	6-4	8-11	6-4	8-11	6-4	8-11	6-4	8-11	6-4
"e" ⑤ SIZE BAR #	4	4	4	4	4	4	4	4	4	4	4	5	6	6	6	6
QUAN. CONCRETE CF/LF	36.2	51.0	37.8	53.1	39.5	54.9	41.9	58.7	45.9	64.1	49.9	69.5	55.6	75.8	61.6	81.3
QUAN. REINFORCEMENT LBS/LF	374	471	449	522	446	587	449	580	492	596	537	605	564	634	604	759



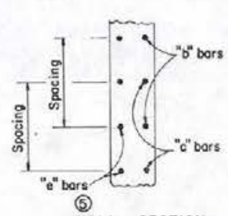
TYPICAL SECTION-SPANS 5' THRU 8'



TYPICAL SECTION-SPANS 10' THRU 14'



ROOF SECTION
SPANS 10' THRU 14'
Invert Similar



WALL SECTION
SPANS 10' THRU 14'

NOTES

① FOR BOXES WITH SPAN OR HEIGHT LESS THAN ANY OF THOSE SHOWN IN TABLE, USE NEXT GREATER SIZE BOX CONCRETE DIMENSIONS AND REINFORCEMENT. MAKE NECESSARY CHANGES IN BAR LENGTHS AND QUANTITIES.

② FOR BOXES WITH SPAN OR HEIGHT OR COVER GREATER THAN THOSE SHOWN IN TABLES, A SPECIAL DESIGN IS REQUIRED.

③ QUANTITIES ARE APPROXIMATE AND FOR DESIGN PURPOSES ONLY.

④ IT IS PERMISSABLE TO ELIMINATE THE 180° HOOKS ON EVERY OTHER BAR.

⑤ "e" BARS ARE AT HALF SPACING.

⑥ "a" BARS ARE AT HALF SPACING.

⑦ PROVIDE PAVING NOTCH WHEN TOP IS EXPOSED AND WHERE P.C.C. PAVEMENT OR APPROACH SLAB IS USED. ADJUST THE QUANTITIES.

⑧ WHEN TOP IS EXPOSED, THE TOP SLAB CONCRETE SHALL BE "EA", f'c=4500 psi, OR "A", f'c=4000 psi, AS DETERMINED BY THE ENGINEER. IF "EA" CONCRETE IS TO BE USED, THE TOP SLAB REINFORCING STEEL SHALL HAVE AN EPOXY COATING.

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

SINGLE RCB CULVERTS

CHIEF BR'DGE ENGR. | B-20 (2 of 2) | ADOPTED 11/70 | REVISION 3-3/82

SPAN				5					6						7							8										
HEIGHT				3	4	5			3	4	5	6			3	4	5	6	7			3	4	5	6	7			8			
MAXIMUM EARTH COVER				10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20
CONC	ROOF	T1	"	7	7½	7	7½	7	7½	7	9	7	9	7	9	7½	10	7½	10	7½	10	8	10	8	11	8	11	8	11	8	11	8	11
	EXTERIOR WALL	T2	"	6	6	6	7	6½	7½	6	6	6	7	6½	8	7	8½	6	6	6	7	6½	7½	7	9	8	9½	6	7½	6	7½	6½	8
	INVERT	T3	"	7	8	7	8	7	8	7	9	7	9	7	9	7½	10½	7½	10½	7½	10½	7½	10½	7½	10½	8	11½	8	11½	8	11½	8	11½
REINF	SPACING		"	11½	14	11½	14	11½	15	11½	12	11½	12	11½	12	11½	12	11	10½	11	10½	11	10½	11	10½	11	10½	9	10	9	10	9	10
	"g"	SIZE	BAR #	4	7	4	7	4	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	7	7	7	7	7	7	7	7	7	7
	"f"	SIZE	BAR #	5	5	5	5	5	5	5	5	5	5	5	5	5	5	6	5	6	5	6	5	6	5	6	5	5	5	5	5	5	5
	"a"	SIZE	BAR #	6	4	6	4	6	4	7	4	7	4	7	4	7	4	6	4	6	4	6	4	6	4	6	4	6	4	6	4	6	4
	"e" ⑤	SIZE	BAR #	4	5	5	6	5	7	4	5	4	6	5	6	6	7	4	5	5	5	5	6	6	7	6	7	4	5	4	5	5	6	6
QUAN	CONCRETE		CF/LF	17.8	19.3	19.3	21.6	21.3	23.8	20.1	24.6	21.6	27.0	23.6	29.7	25.8	32.2	23.7	30.8	25.2	33.3	27.2	35.5	29.4	38.1	32.4	41.8	27.8	38.5	28.2	40.1	31.2	42.4	33.4
	REINFORCEMENT		LBS/LF	122	121	134	137	145	162	166	162	192	179	206	190	227	212	207	197	220	208	227	228	252	262	260	276	270	224	283	257	302	266	340

SPAN				10											12													14													
HEIGHT				3	4	5		6		7		8		9		10		4		5		6		7		8		9		10		11		12		7		8		9	
MAXIMUM EARTH COVER				10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20
CONC	ROOF	T1	"	9	12½	9	12½	9	12½	9	12½	9	12½	9	12½	9½	12½	9½	12½	10	14½	10	14½	10	14½	10	14½	10	14½	10	14½	10	14½	10	14½	11½	16½	11½	16½	11½	16½
	EXTERIOR WALL	T2	"	8	8	8	8	8	8	8	8½	8	9½	8	10½	8½	11½	9½	12½	8	8½	8	8½	8	8½	8	9	8½	10½	9	11½	9½	12½	10	14	11	15	8½	9½	8½	10½
	INVERT	T3	"	9	12½	9	12½	9	12½	9	12½	9	12½	9	12½	9	12½	5	12½	10	15	10	15	10	15	10	15	10	15	10	15	10	15	10	15	11½	17	11½	17	11½	17
REINFORCEMENT	SPACING		"	11	7½	11	7½	11	7½	10½	7½	10	8	10	8	10½	8	10½	8	9	8	9	8	9	8	8	7½	8	7½	8½	7½	8½	8	8½	8	8½	8	8½	8	8½	8	8½
	"g"	SIZE	BAR #	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	8	8	8	8	8	8	8	8
	"f"	SIZE	BAR #	7	5	7	5	7	5	6	5	6	5	6	5	6	5	6	5	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	6	6	6	6	6	6	6	6
	"a"	SIZE	BAR #	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	4	4	4	4	4	4	5	6	5	6	5	6	5	6
	"b"	SIZE	BAR #	5	5	5	5	5	5	4	5	5	5	5	6	5	6	6	5	5	5	5	5	5	5	6	5	6	6	6	5	6	6	6	6	5	6	6	6	6	6	6	6
		DIMENSION	"B"	1-9	2-7	1-9	2-7	1-9	2-7	2-0	2-9	2-3	2-9	2-7	3-1	2-7	3-1	2-7	3-1	2-7	3-1	2-7	3-1	2-7	3-1	3-0	3-2	3-6	3-2	3-6	3-4	3-9	3-4	3-9	3-4	3-9	3-4	2-7	2-7	3-3	3-3	4-0	4-0
		DIMENSION	"BW"	3-6	3-10	3-6	3-10	4-0	4-11	4-0	4-11	4-0	4-11	4-0	4-11	4-0	4-11	4-0	4-11	4-1	3-2	4-1	3-2	4-1	3-2	4-1	3-4	4-1	3-4	4-1	3-7	3-9	3-7	3-9	3-7	3-7	3-7	5-0	3-9	5-0	4-6	5-0	5-0
	"c"	SIZE	BAR #	5	5	5	5	5	5	6	6	6	6	6	6	7	6	7	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	7	7	7	7	7
		DIMENSION	"C"	3-0	2-9	3-0	2-9	3-1	2-9	3-9	3-3	4-6	4-3	5-6	4-6	6-0	4-9	6-0	4-9	5-10	3-7	5-10	3-7	5-10	3-7	4-6	4-4	5-7	5-0	6-6	5-2	7-2	5-4	7-5	5-7	7-5	5-7	4-3	3-11	5-6	4-5	7-0	5-0
	"e" ⑤	SIZE	BAR #	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	5	4	4	4	4	4	4	4	4	4	4	4	4	5	5	5	5	4	4	4	4	4	4	5	5
QUAN	CONCRETE		CF/LF	39.0	51.8	41.0	53.8	42.7	55.6	44.7	58.2	46.7	61.8	48.7	65.6	52.5	70.0	56.3	74.5	51.3	72.4	53.3	73.4	55.0	76.3	57.0	79.1	59.8	83.8	62.7	88.1	65.9	92.7	69.1	98.8	73.7	104	71.8	98.7	73.9	104	76.9	108
	REINFORCEMENT		LBS/LF	339	415	349	428	370	454	381	494	418	498	460	510	486	550	518	568	505	567	514	577	543	604	563	646	600	663	614	688	627	691	701	749	735	764	662	710	715	783	756	820

NOTES

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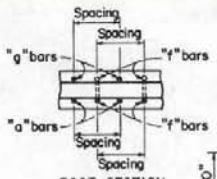
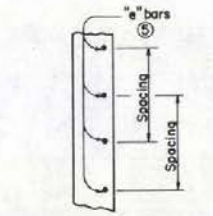
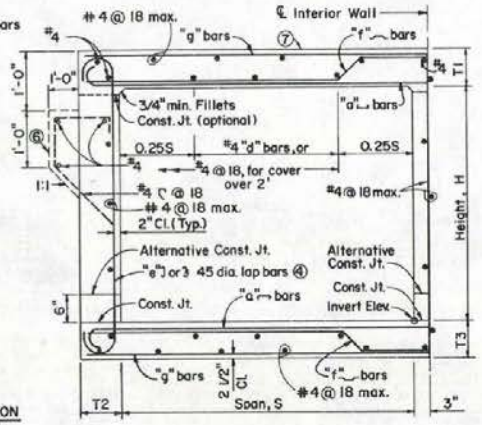


ROOF SECTION
SPANS 5' THRU 8'
INVERT SIMILAR

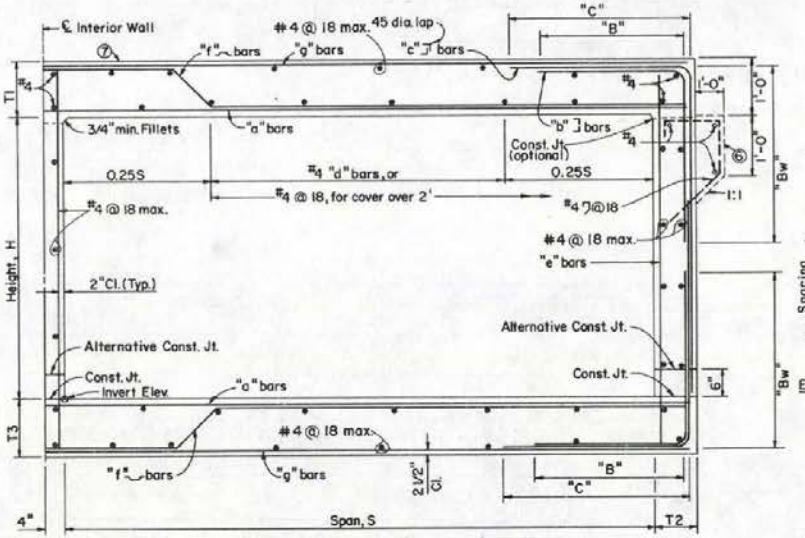


EXTERIOR WALL SECTION
SPANS 5' THRU 8'

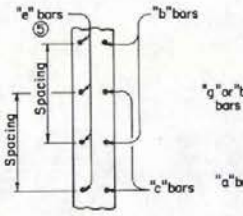
"d" BARS, FOR EARTH COVERS TO BE PLACED IN TOP SLAB ONLY.	2' AND LESS						
SPAN	5'	6'	7'	8'	10'	12'	14'
NUMBER/CELL	5	6	8	10	11	15	15



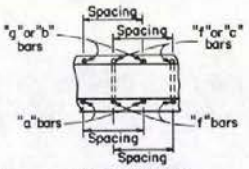
TYPICAL SECTION - 5' THRU 8' SPANS



TYPICAL SECTION - 10' THRU 14' SPANS



EXTERIOR WALL SECTION
SPANS 10' THRU 14'



ROOF SECTION
SPANS 10' THRU 14'
INVERT SIMILAR

NOTE: This plan sheet may be used for Multiple Cell Culverts by making necessary adjustments.

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

DOUBLE RCB CULVERTS

CHIEF BRIDGE ENGR.

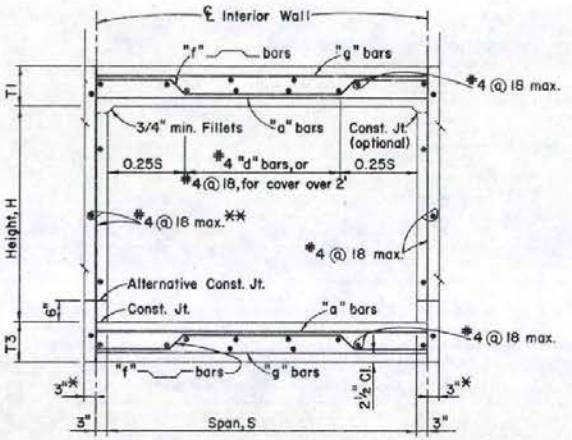
B-20.1.3(602)
ADOPTED
REVISION 9-3/82

B-3

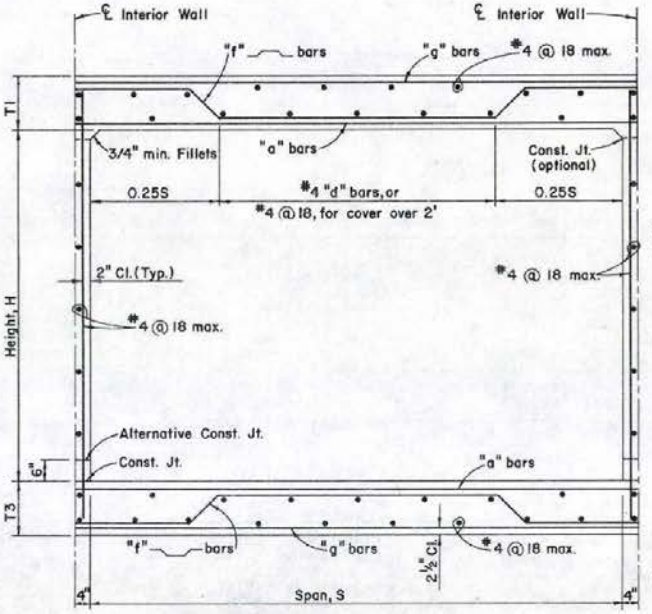
SPAN		5					6								7										8											
HEIGHT		3		4		5	3		4		5		6		3		4		5		6		7		3		4		5		6		7		8	
MAX. EARTH COVER		10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20
QUAN.	CONCRETE CF/LF	7.9	8.6	8.4	9.1	8.9	9.6	9.1	11.3	9.6	11.8	10.1	12.3	10.6	12.8	10.9	14.3	11.4	14.8	11.9	15.3	12.4	15.8	13.2	16.3	12.8	17.4	13.3	17.9	13.8	18.4	14.3	18.9	14.8	19.4	15.3	19.9
	REINF LBS/LF	56	54	58	57	60	56	81	68	83	70	86	73	88	75	102	94	104	96	107	98	109	100	110	101	133	106	135	108	137	111	139	113	140	114	142	116

SPAN		10										12												14											
HEIGHT		3		4		5		6		7		8		9		10		4		5		6		7		8		9		10		11		12		7	
MAX. EARTH COVER		10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20	10	20
QUAN.	CONCRETE CF/LF	18.0	24.2	18.7	24.9	19.3	25.6	20.0	26.2	20.7	26.9	21.3	27.6	22.5	28.2	23.1	28.9	23.8	33.8	24.4	34.5	25.1	35.1	25.8	35.8	26.4	36.5	27.1	37.1	27.8	37.8	28.4	38.5	29.1	39.1
	REINF LBS/LF	141	160	142	161	144	163	139	165	145	158	147	160	144	162	145	156	196	219	198	221	201	223	201	224	203	216	205	218	196	219	199	210	201	212

SPAN		14													
HEIGHT		8		9		10		11		12		13		14	
MAX. EARTH COVER		10	20	10	20	10	20	10	20	10	20	10	20	10	20
QUAN.	CONCRETE CF/LF	32.8	45.6	33.4	46.3	34.1	46.9	34.8	47.6	35.4	48.3	36.1	48.9	36.8	49.6	37.4	50.3
	REINF LBS/LF	246	261	249	264	251	266	252	267	254	269	256	271	246	272	248	274



TYPICAL SECTION - 5' THRU 8' SPANS



TYPICAL SECTION - 10' THRU 14' SPANS

* - Concrete For This Portion Is Included In Quantities Of Adjoining Cells.
** - Reinforcing Steel Included In Previous Cells Quantities.

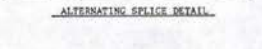
NOTES

(1) NOTES ON ①②③ & ⑦ OF SHEET B-20.1.3(502) SHALL APPLY.

(2) WHEN THE ADDITION OF CELLS CAUSES THE LENGTHS OF THE "a", "f", AND "g" BARS TO EXCEED 60 FEET, THE BARS WILL REQUIRE SPLICING. SPLICES FOR THE "a" BARS SHALL BE CENTERED ABOUT THE CENTER LINE OF THE INTERIOR WALLS. SPLICES FOR THE "g" BARS SHALL BE CENTERED ABOUT THE CENTER OF THE CELLS. SPLICES FOR THE "f" BARS SHALL BE DONE AT THE 45 DEGREE LEG AND CONFORM TO THE SPLICE DETAIL SHOWN. SPLICE LOCATIONS SHALL BE ALTERNATED FROM BAR TO BAR. SEE DETAIL SHOWN. SPLICE LENGTHS FOR THE "a" AND "g" BARS SHALL BE AS FOLLOWS:

#4 BARS = 16 INCHES
#6 BARS = 24 INCHES
#7 BARS = 31 INCHES
#8 BARS = 40 INCHES

"f" BAR SPLICE DETAIL



ALTERNATING SPLICE DETAIL

(3) FOR DIMENSIONS, BAR SIZES, BAR SPACING, AND ROOF SECTION SPACING DETAIL, SEE SHEET B-20.1.3(502). FOR GENERAL NOTES, SEE SHEET B-20.1.1(502).

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

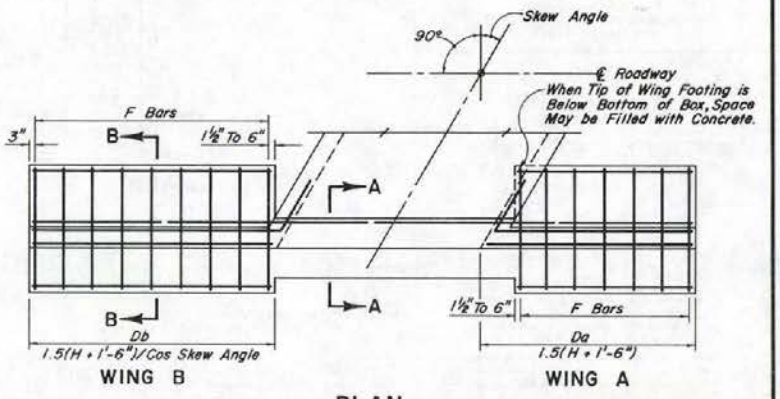
ADDITIONAL CELLS TO BE USED WITH DOUBLE RCB CULVERTS TO PROVIDE FOR MULTIPLE CELL CULVERTS

CHIEF BRIDGE ENGR.

B-20.1.3.1 (502)
ADOPTED 8/84 REVISION

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

SPAN	HEIGHT	SINGLE BOX								DOUBLE BOX								TRIPLE BOX								HEIGHT	SPAN
		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	9.4	871	9.4	888	10.2	947	11.5	1073	11.4	991	11.6	1013	12.4	1085	14.3	1243									3	
	4	12.8	1141	12.8	1163	13.5	1237	15.6	1399	14.8	1261	15.0	1287	15.9	1376	18.6	1568	16.8	1367	17.0	1397	18.5	1498	21.4	1718	4	5
	5	16.4	1676	16.6	1707	17.5	1813	19.8	2044	18.6	1795	18.6	1831	19.9	1952	22.8	2214	20.6	1901	20.8	1941	22.3	2074	25.6	2364	5	
6	3	9.8	886	9.8	903	10.6	963	12.1	1094	12.2	1094	12.2	1119	13.2	1204	15.3	1389									3	
	4	13.2	1155	13.2	1178	14.1	1254	16.2	1419	15.4	1364	15.6	1393	16.7	1495	19.4	1714	17.8	1536	18.0	1572	19.5	1693	22.8	1957	4	
	5	16.8	1690	17.8	1722	18.9	1830	20.5	2064	20.0	1898	20.4	1937	21.7	2071	24.8	2360	22.4	2070	22.8	2116	24.5	2269	28.2	2603	5	6
	6	25.8	2598	26.1	2646	27.6	2808	31.1	3160	27.8	2806	28.5	2861	30.2	3049	34.5	3456	30.4	2978	31.1	3040	33.0	3247	38.3	3699	6	
	7	32.0	3666	32.3	3733	34.2	3960	38.6	4453																	7	
7	3	10.2	900	10.2	918	11.0	980	12.5	1114																	3	
	4	13.6	1170	13.6	1193	14.5	1270	16.6	1439																	4	
	5	17.2	1704	17.3	1736	19.3	1846	20.9	2085																	5	7
	6	26.2	2612	26.3	2660	28.0	2824	31.7	3181																	6	
	7	32.2	3682	32.7	3750	34.6	3978	39.0	4485																	7	
8	3	10.6	914	10.6	933	11.4	996	13.1	1134	13.8	1296	14.0	1326	15.2	1437	17.1	1675									3	
	4	14.0	1184	14.0	1207	14.9	1287	17.0	1460	17.0	1566	17.2	1602	18.5	1728	21.6	2000	20.2	1830	20.4	1876	24.1	2033	26.0	2373	4	
	5	17.6	1718	17.7	1751	18.8	1863	21.3	2105	20.8	2100	20.9	2146	22.6	2304	25.9	2646	24.8	2364	25.1	2420	27.0	2609	31.5	3019	5	8
	6	26.4	2626	26.7	2675	28.4	2841	32.1	3201	29.2	3008	29.9	3070	31.8	3282	36.3	3742	32.4	3272	33.1	3344	35.4	3587	40.9	4115	6	
	7	32.8	3697	33.0	3765	34.9	3935	39.3	4496	35.8	4067	36.2	4147	38.5	4422	43.7	5019	39.0	4331	39.6	4421	42.3	4727	48.3	5392	7	
	8	40.4	4979	40.8	5070	43.3	5377	48.8	6046	43.8	5332	44.2	5434	47.1	5785	53.3	6546	47.0	5596	47.6	5708	50.9	6190	57.9	6919	8	
10	3	11.4	943	11.4	962	12.5	1029	14.3	1174	14.8	1604	15.0	1648	16.3	1793	18.9	2110									3	
	4	14.6	1212	14.7	1237	15.8	1320	18.1	1500	18.2	1874	18.3	1922	19.8	2084	24.1	2435									4	
	5	18.4	1747	18.5	1781	19.8	1895	22.5	2145	20.4	2408	22.0	2466	23.9	2660	26.8	3081	25.6	2836	25.9	2909	28.2	3154	32.9	3686	5	
	6	27.0	2655	27.2	2705	28.9	2874	32.8	3241	30.4	3316	31.2	3390	33.1	3638	38.0	4117	34.1	3744	35.0	3833	37.5	4132	43.4	4782	6	10
	7	33.4	3729	33.8	3799	36.1	4033	40.9	4542	37.2	4375	37.6	4467	40.1	4778	45.7	5454	41.0	4803	41.6	4910	44.5	5272	51.1	6059	7	
	8	41.2	5015	41.5	5107	44.0	5419	48.6	6097	44.4	5640	44.7	5724	47.8	6141	54.2	6981	48.4	6068	48.9	6197	52.2	6635	59.8	7586	8	
	9	49.8	5687	50.2	5791	53.1	6144	59.6	6909																	9	
	10	61.0	8535	61.4	8690	65.2	9216	73.2	10,358	65.2	9109	65.8	9285	70.2	9878	79.2	11,169	69.6	9537	70.4	9728	75.2	10,372	85.4	11,774	10	
12	4	15.4	1241	15.5	1266	16.6	1356	19.1	1540	19.6	2290	19.9	2352	21.4	2564	24.9	3023									4	
	5	18.8	1775	18.9	1810	20.2	1929	22.9	2185	23.0	2824	23.1	2896	25.0	3140	28.9	3669									5	
	6	28.0	2683	28.2	2734	29.9	2908	33.9	3281	32.2	3732	33.6	3820	35.1	4118	40.1	4766	36.8	4381	37.4	4492	40.3	4867	46.7	5683	6	
	7	34.2	3761	33.8	3831	36.5	4069	41.3	4586	38.4	4791	39.0	4897	41.6	5258	47.5	6042	43.0	5440	43.8	5569	47.0	6007	54.1	6960	7	12
	8	42.0	5050	42.1	5143	44.8	5459	50.6	6147	46.6	6056	46.9	6140	50.2	6621	56.0	7569	51.2	6705	51.7	6856	55.6	7370	63.6	8487	8	
	9	50.4	5722	50.8	5828	53.8	6187	60.6	6959	55.2	6728	55.8	6869	59.4	7346	67.4	8381	60.0	7377	60.8	7541	65.0	8095	74.2	9299	9	
	10	61.8	8580	62.3	8736	65.9	9267	74.3	10,421	66.6	9525	67.1	9715	71.7	10,358	81.1	11,757	71.4	10,174	72.3	10,387	77.5	11,107	88.1	12,675	10	
	12	88.0	12,939	88.8	13,172	94.0	13,963	105.7	15,682	93.2	13,884	94.2	14,150	99.8	15,054	113.1	17,018	98.0	14,533	99.2	14,822	105.6	15,803	119.4	17,936	12	



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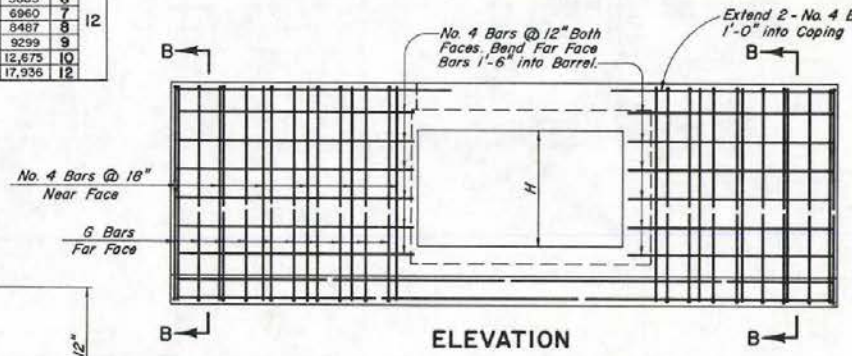
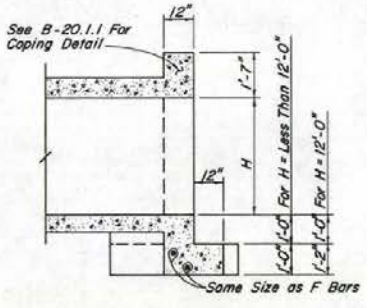
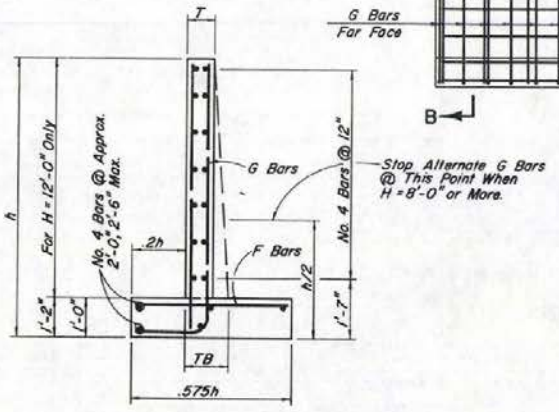


ELEVATION

H - FEET	T - INCHES	TB - INCHES	G BARS		F BARS	
			SIZE NO.	SPACE IN.	SIZE NO.	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 TRANSPORTATION

RCB CULVERTS TYPE II HEADWALLS

Chief Bridge Engr.

B-20.1.4-(502)

ADOPTED 11/70 REVISION

B-6

TYPE I HEADWALL DIMENSIONS AND REINFORCING STEEL

0° SKEW

H = Height In Feet	h = All Wings Except B For 45° Skew	AA & BB	CC & DD	C & D	E & K	F & L	G & M	J & N	Wings A & B G Bars Size	Wings A & B G Bars Spacing	Wings A & B F Bars Size	Wings A & B 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	6-6	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

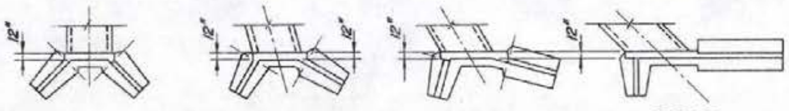
H	AA	BB	CC	DD	C	D	E & K	F	G	J & N	L	M	Wing A G Bars Size	Wing A G Bars Spacing	Wing A F Bars Size	Wing A F Bars Spacing	Wing B G Bars Size	Wing B G Bars Spacing	Wing B F Bars Size	Wing B F Bars Spacing
3	3-7	4-6	4-11	5-7	8	8	1-4	1-0	2-6	3-4	1-2	2-10	4	12	4	12	4	12	4	12
4	4-6	5-11	5-4	6-2	8	8	1-6	1-1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

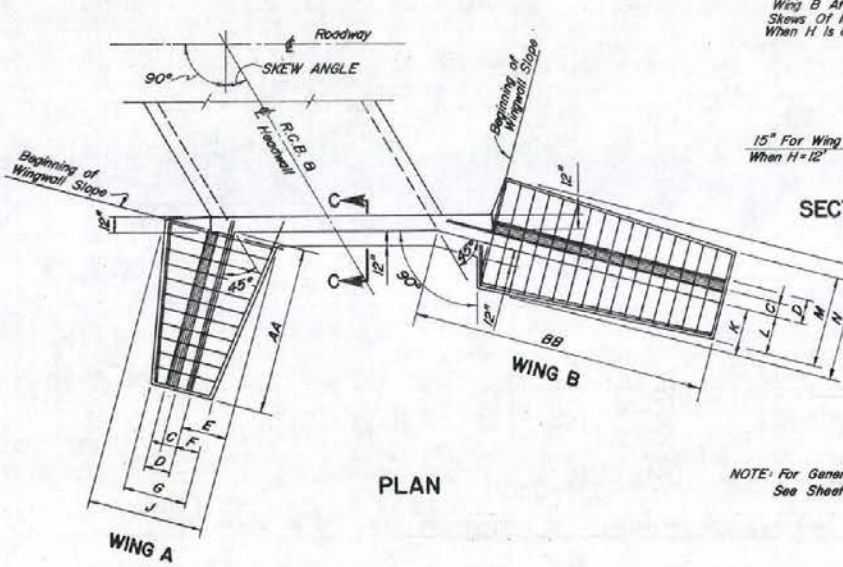
H	AA	BB	CC	DD	C	D	E & K	F	G	J & N	L	M	Wing A G Bars Size	Wing A G Bars Spacing	Wing A F Bars Size	Wing A F Bars Spacing	Wing B G Bars Size	Wing B G Bars Spacing	Wing B F Bars Size	Wing B F Bars Spacing
3	3-4	5-10	4-8	6-2	8	8	1-4	0-11	2-4	3-4	1-3	3-4	4	12	4	12	4	12	4	12
4	4-3	7-5	5-2	6-11	8	8	1-6	1-0	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	6-1	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 = Height In Feet
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

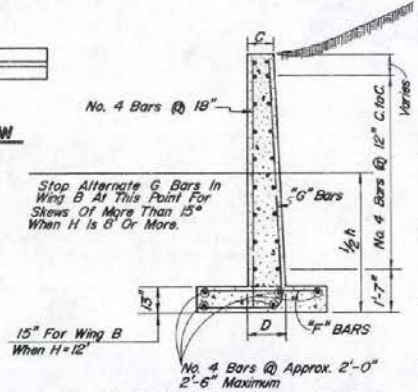


0° Skew   15° Skew   30° Skew   45° Skew

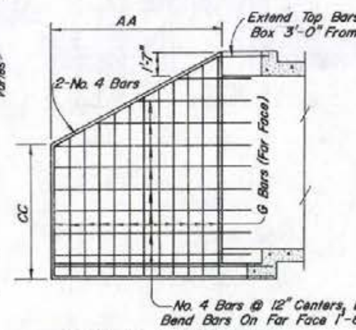


PLAN

NOTE: For General Notes See Sheet B-20.1.1

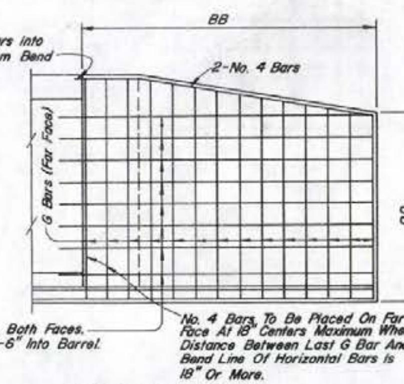


SECTION OF WINGS A AND B

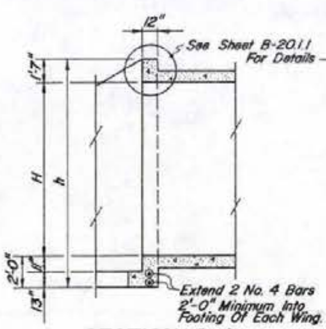


SECTION WING A

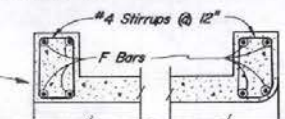
NOTE: For Boxes With 0° Skew Both Wings Are As Shown For Wing A.



SECTION WING B



SECTION C-C



OUTLET   INLET

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

RCB CULVERTS
TYPE I HEADWALLS

CHIEF BRIDGE ENGR. | B-20.1.5-(502) | ADOPTED: 11/70 | REVISION

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

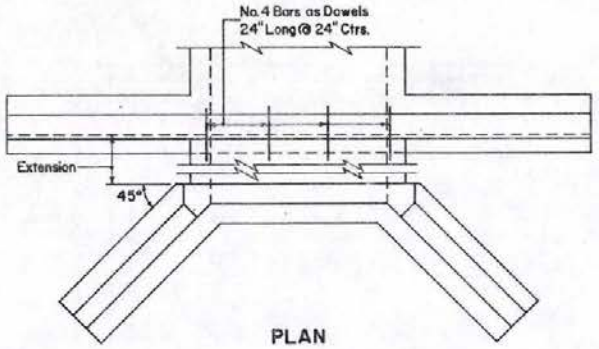
SPAN	HEIGHT	SINGLE BOX								DOUBLE BOX								TRIPLE BOX							
		0°SKEW		15°SKEW		30°SKEW		45°SKEW		0°SKEW		15°SKEW		30°SKEW		45°SKEW		0°SKEW		15°SKEW		30°SKEW		45°SKEW	
		CONC.	REINF.	CONC.	REINF.	CONC.	REINF.	CONC.	REINF.	CONC.	REINF.	CONC.	REINF.	CONC.	REINF.	CONC.	REINF.	CONC.	REINF.	CONC.	REINF.	CONC.	REINF.	CONC.	REINF.
5	3	5.6	393	6.4	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	9.6	774	11.6	946	9.7	726	10.1	767	12.0	912	14.6	1119	11.8	842	12.3	886	14.4	1045	17.6	1280
	5	9.6	705	10.2	782	11.8	942	15.0	1238	11.7	825	12.4	908	14.3	1085	18.0	1414	13.9	944	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	673	10.0	807	12.1	985	10.3	821	10.8	869	12.7	1032	15.5	1270	12.6	1004	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	1566	14.7	1103	15.5	1199	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	16.0	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	1432	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	817	10.7	1064	11.8	1109	14.5	1268								
	4	8.6	693	9.1	731	10.8	872	13.1	1065	11.8	1045	12.3	1078	14.3	1238	17.3	1475	14.9	1320	15.5	1365	17.8	1558	21.4	1858
	5	10.6	782	11.3	864	13.0	1038	16.4	1360	13.8	1137	14.5	1216	16.6	1405	20.6	1773	17.0	1414	17.8	1501	20.2	1720	25.0	2159
	6	13.1	1039	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	1464	16.7	1673	20.6	2242	27.5	3219	19.2	1824	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	2850	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	1734								
	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	1441	15.2	1434	16.1	1531	18.4	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	1661	22.3	2365	17.8	1697	18.1	1775	21.7	2187	28.0	3165	21.8	2141	22.2	2219	26.3	2666	33.6	3786
	7	16.6	1528	17.4	1745	21.4	2329	28.4	3334	20.7	2135	21.6	2359	26.1	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	4860	26.8	3037	29.4	3399	34.4	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	804	10.5	848	12.4	1001	15.1	1224	14.6	1732	15.2	1806	17.6	2090	21.5	2549								
	5	12.0	884	12.7	975	14.6	1165	18.4	1522	16.6	1815	17.5	1941	20.0	2247	24.9	2849								
	6	14.5	1148	14.7	1296	17.9	1738	23.3	2469	19.2	2086	19.6	2244	23.3	2817	29.9	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	3449	22.1	2531	23.0	2775	27.7	3497	36.1	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	2884	26.7	3396	31.3	4048	41.8	5506	27.8	3554	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	6984
	10	30.2	3429	32.3	3680	39.4	4488	52.7	6003	35.0	4373	37.4	4646	45.1	5580	59.6	7344	39.9	5049	42.4	5341	50.7	6353	66.5	8289
	12	42.8	5137	47.2	5372	56.4	6075	80.1	8124	47.8	6087	52.3	6340	62.2	7141	87.2	9470	52.7	6768	57.5	7045	67.9	7930	94.2	10,420

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

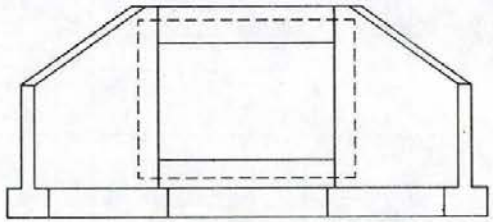
ESTIMATE OF QUANTITIES
TYPE I HEADWALLS

CHIEF BRIDGE ENGR.

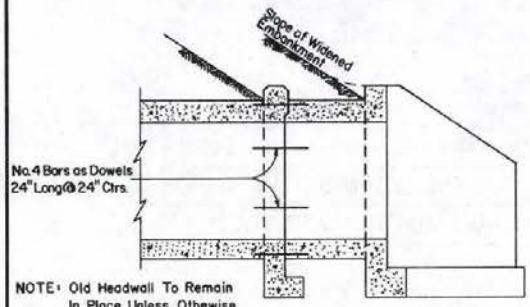
B-20.1.6-(502)
ADOPTED: 11/70 REVISION



PLAN



ELEVATION

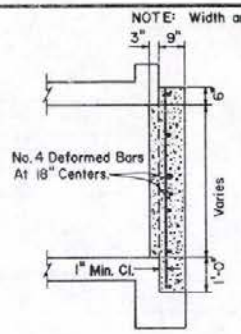


NOTE: Old Headwall To Remain In Place Unless Othewise Noted.

PART LONGITUDINAL SECTION

R C B CULVERT EXTENSION

NOTE: Width and Height Varies.



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 MOTAR.

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

METHOD OF EXTENDING RCB CULVERTS

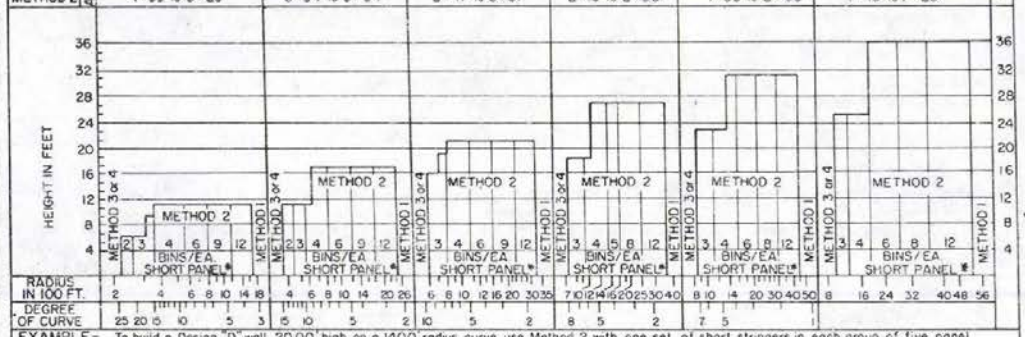
CHIEF BRIDGE ENGR

B-20.1.7-(502)
ADOPTED 11/70 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'
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	4 3 1

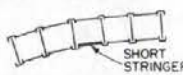


EXAMPLE- To build a Design "D" wall 20.00' high on a 1400' radius curve, use Method 2 with one set of short stringers in each group of five panel sections.

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.

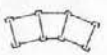


Use short panel sections (9'-6" face or rear) in addition to play in bolt holes. Curvature chart indicates number * of bins in each group, including a modified bin, necessary to build a curved wall at a required height and radius.

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.

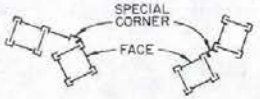
NOTE - Use Chart X and Table Y shown on Construction Details B-21.1.2 to determine base width to height ratio for the various surcharges on both vertical and battered walls.

METHOD 3



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

METHOD 4



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

UNITS REQUIRED PER SHORT PANEL SECTION

WALL HEIGHT	SHORT STRINGERS IN FRONT OF WALL										SHORT STRINGERS IN REAR OF WALL									
	16 Ga		14 Ga		12 Ga		10 Ga		Sh't		16 Ga		14 Ga		12 Ga		10 Ga		St'd	
	St'd	Short	St'd	Short	St'd	Short	St'd	Short	Str		St'd	Short	St'd	Short	St'd	Short	St'd	Short	Str	
FEET	9.5'	9.0'	9.5'	9.0'	9.5'	9.0'	9.5'	9.0'	St'r		9.5'	9.0'	9.5'	9.0'	9.5'	9.0'	9.5'	9.0'	St'r	
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	1	3					1		6	6	3	1					1	
13.33	6	6	2	3		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	1	4			1		6	6	3	4	4	1			1	
18.67	6	6	4	3	2	5			1		6	6	3	4	5	2			1	
20.00	6	6	4	3	3	5		1	1		6	6	3	4	5	3	1		1	
21.33	6	6	4	3	4	5		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	1	3	1		6	6	3	4	5	7	3	1	1	
28.00	6	6	4	3	7	5	2	3	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				Total Col. Length in Feet	Column Splice	Column Cap	SPACERS Gage & Length								BOT SPACER Gage & Length							
		1st Lift	2nd Lift	3rd Lift	Total Height	1st Lift	2nd Lift	3rd Lift	Total Height				16	16	14	12	12				16	16	14	12	12			
FEET	16"x22"												52	74	96	118	140	62			52	74	96	118	140	62		
4.00	2	4.00			4.00	1.33			1.33	5.33		1																
5.33	2	5.33			5.33	2.67			2.67	8.00		1	1															
6.67	2	6.67			6.67	4.00			4.00	10.67		1	2															
8.00	2	8.00			8.00	5.33			5.33	13.33		1	3															
9.33	2	9.33			9.33	6.67			6.67	16.00		1	4															
10.67	2	10.67			10.67	8.00			8.00	18.67		1	5	5														
12.00	2	12.00			12.00	9.33			9.33	21.33		1		6								1						
13.33	2	8.00	5.33		13.33	10.67			10.67	24.00	1	1		7								1						
14.67	2	8.00	6.67		14.67	12.00			12.00	26.67	1	1		8	8							1	1					
16.00	2	8.00	8.00		16.00	8.00	5.33		13.33	29.33	2	1		9	9							1	1					
17.33	2	12.00	5.33		17.33	8.00	6.67		14.67	32.00	2	1		10	10							1	1					
18.67	2	12.00	6.67		18.67	8.00	8.00		16.00	34.67	2	1			11	11						1	1					
20.00	2	12.00	8.00		20.00	12.00	5.33		17.33	37.33	2	1			12	12						1	1					
21.33	2	12.00	9.33		21.33	12.00	6.67		18.67	40.00	2	1			13	13						1	1					
22.67	2	12.00	10.67		22.67	12.00	8.00		20.67	42.67	2	1				14	14					1	1					
24.00	2	12.00	12.00		24.00	12.00	9.33		21.33	45.33	2	1				15	15					1	1					
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					
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					
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					
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					
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					
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				
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				
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				
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				

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

UNITS REQUIRED PER PANEL SECTION

WALL HEIGHT	STRINGERS					St'r	WALL HEIGHT
	16 Ga	14 Ga	12 Ga	10 Ga	8 Ga	St'r	
FEET	9.5'	9.5'	9.5'	9.5'	9.5'	9.5'	FEET
4.00	3					1	4.00
5.33	4					1	5.33
6.67	5					1	6.67
8.00	6					1	8.00
9.33	6	1				1	9.33
10.67	6	2				1	10.67
12.00	6	3				1	12.00
13.33	6	3	1			1	13.33
14.67	6	3	2			1	14.67
16.00	6	3	3			1	16.00
17.33	6	3	4			1	17.33
18.67	6	3	5			1	18.67
20.00	6	3	5	1		1	20.00
21.33	6	3	5	2		1	21.33
22.67	6	3	5	3		1	22.67
24.00	6	3	5	3	1	1	24.00
25.33	6	3	5	3	2	1	25.33
26.67	6	3	5	3	3	1	26.67
28.00	6	3	5	3	4	1	28.00
29.33	6	3	5	3	5	1	29.33
30.67	6	3	5	3	6	1	30.67
32.00	6	3	5	3	7	1	32.00
33.33	6	3	5	3	8	1	33.33
34.67	6	3	5	3	9	1	34.67
36.00	6	3	5	3	10	1	36.00

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

UNITS REQUIRED PER PANEL SECTION

WALL HEIGHT	STRINGERS				St'r	WALL HEIGHT
	16 Ga	14 Ga	12 Ga	10 Ga	St'r	
FEET	9.5'	9.5'	9.5'	9.5'	9.5'	FEET
4.00	1				1	4.00
5.33	2				1	5.33
6.67	3				1	6.67
8.00	4				1	8.00
9.33	5				1	9.33
10.67	6				1	10.67
12.00	6	1			1	12.00
13.33	6	2			1	13.33
14.67	6	3			1	14.67
16.00	6	4			1	16.00
17.33	6	4	1		1	17.33
18.67	6	4	2		1	18.67
20.00	6	4	3		1	20.00
21.33	6	4	4		1	21.33
22.67	6	4	5		1	22.67
24.00	6	4	6		1	24.00
25.33	6	4	7		1	25.33
26.67	6	4	7	1	1	26.67
28.00	6	4	7	2	1	28.00
29.33	6	4	7	3	1	29.33
30.67	6	4	7	4	1	30.67
32.00	6	4	7	5	1	32.00
33.33	6	4	7	6	1	33.33
34.67	6	4	7	7	1	34.67
36.00	6	4	7	8	1	36.00

NOTE - For Construction Details See B-21.1.2

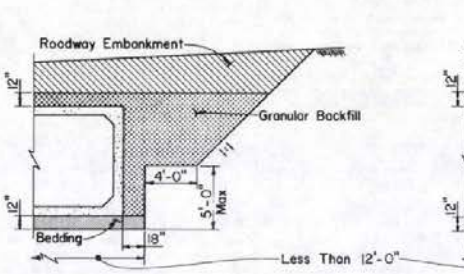
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

DESIGN DATA FOR METAL RETAINING WALL

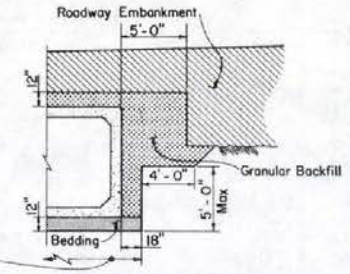
W. Alan Odell
CHIEF BRIDGE ENGR.

B-21.1.1 -(612)
ADOPTED: 11/78
REVISION 1-11/78

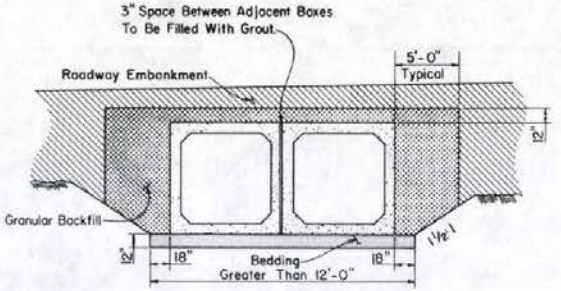
01-8



CULVERT IN EXCAVATION



CULVERT IN EMBANKMENT



CULVERT IN EXCAVATION OR EMBANKMENT
(SHOWING A DOUBLE CULVERT INSTALLATION)

Roadway Embankment
Granular Backfill
Bedding

EXCAVATION AND BACKFILL

(Backfill Shown. Excavation As Shown On Sheet R-1.1.4 With The Addition Of The Area For Bedding.)

GENERAL NOTES

1) DESIGN SPECIFICATIONS: AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 1983," AND AASHTO SPECIFICATIONS M259 OR M273 AS INDICATED BY THE FOLLOWING:

CONDITION	MIN. COVER *	AASHTO	EQUIV. ASTM
2 FT OR MORE COVER	2 FT.	M259, TABLE 2	C789, TABLE 2
LESS THAN 2 FT COVER	0 FT.	M273, TABLE 2	C850, TABLE 2

THE ABOVE SHOWS CONCRETE DIMENSIONS, REINFORCING PLACEMENT, EARTH COVER, AND OTHER DETAILS NEEDED TO MANUFACTURE THE BOX CULVERTS.

2) CONSTRUCTION SPECIFICATIONS: CURRENT EDITION STATE OF NEVADA DEPARTMENT OF TRANSPORTATION "STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION," AND SPECIAL PROVISIONS THERETO.

3) LIVE LOAD: STANDARD HS20-44 OR FHWA ALTERNATIVE MILITARY LOADING.

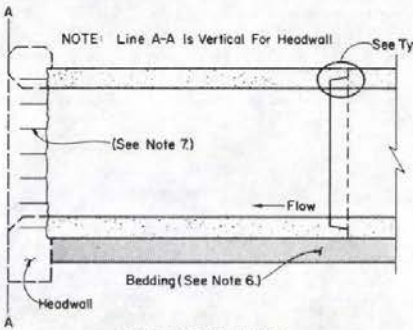
4) CONCRETE: THE CONCRETE SHALL BE CLASS AA MODIFIED OR CLASS DA MODIFIED WITH A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 5000 P.S.I. FOR AN APPROVED "DRY CAST" MANUFACTURING PROCESS, THE ENTRAINED AIR AND AND MINIMUM SLUMP REQUIREMENTS MAY BE DISREGARDED.

5) REINFORCING STEEL: ALL REINFORCING BARS TO BE ASTM 615 GRADE 60. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185, SMOOTH WIRE, OR ASTM A497, DEFORMED WIRE.

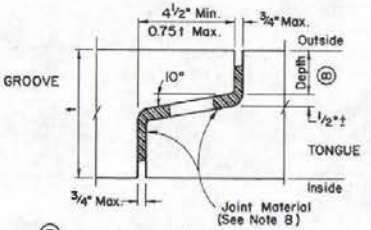
6) BEDDING: BEDDING MATERIAL SHALL BE EITHER 12 INCHES OF GRANULAR BACKFILL OR 6 INCHES OF TYPE 2 CLASS B AGGREGATE. CHOICE OF BEDDING WILL BE AT THE CONTRACTOR'S OPTION. EXCAVATION FOR BEDDING SHALL BE PAID FOR AS 12 INCHES OF STRUCTURE EXCAVATION AND BEDDING MATERIAL SHALL BE PAID FOR AS 12 INCHES OF GRANULAR BACKFILL REGARDLESS OF WHICH OPTION THE CONTRACTOR USES. BEDDING SHALL NOT BE REQUIRED WHERE EXISTING MATERIAL CAN BE GRADED AND COMPACTED TO MEET THE REQUIREMENTS OF SECTION 207.03.01 OF THE STANDARD SPECIFICATIONS. WHERE BEDDING IS NOT REQUIRED, STRUCTURE EXCAVATION SHALL BE PAID FOR TO THE GRADE LINE OF THE BOXES ONLY.

7) HEADWALLS: HEADWALL DETAILS SHALL BE AS SHOWN IN THE STANDARD PLANS. EXPOSED REINFORCING TO TIE CAST-IN-PLACE HEADWALL TO PRECAST BOX SHALL CONSIST OF EITHER #4 BARS AT 12" SPA. OR EXPOSURE OF THE DOUBLE CAGE OF WELDED WIRE FABRIC. THE #4 BARS SHALL BE CAST A MIN. OF 18" INTO THE PRECAST BOX SEGMENT. BOTH THE #4 BAR OR WELDED WIRE FABRIC SHALL EXTEND A MIN. OF 12" INTO THE CAST-IN-PLACE HEADWALL.

8) JOINT MATERIAL: JOINT MATERIAL SHALL BE A PREFORMED JOINT MATERIAL MEETING AASHTO SPECIFICATIONS M198, TYPE B. THE MATERIAL SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS. A DOUBLE APPLICATION OF JOINT MATERIAL SHALL BE USED. ONE APPLICATION SHALL BE APPLIED TO THE TONGUE AND THE OTHER TO THE GROOVE. THE MIN. SIZE OF JOINT MATERIAL SHALL BE 1¼". ANY JOINT MATERIAL EXTRUDING FROM THE INTERIOR OF THE JOINT SHALL BE REMOVED FLUSH WITH THE BOX WALL.

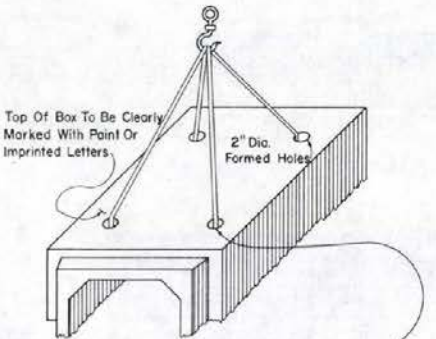


CULVERT END



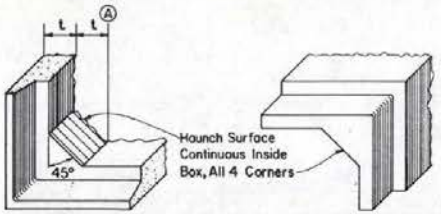
(B) For Spans Thru 8', Dmin. = 2"
For Spans Over 8', Dmin. = 3¼"

TYPICAL JOINT DETAIL



Lifting Holes (Located by Mfr.) Cylindrical Hole Shall Be Filled With an Approved Epoxy Non-Shrink Grout. Holes With An Approved Conical Shape for the Bottom 3" May be Filled With a Concrete Grout Composed of One Part by Volume of Cement to Two Parts by Volume of Sand with Only Enough Water to Permit Placing & Tamping. An Approved Custom Plug May be Used. (An Optional Method of Lifting May be Used As Approved by the Engineer.)

LIFTING



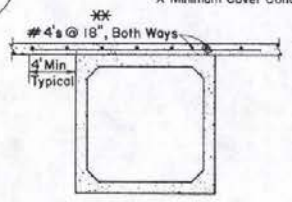
Ⓐ - t Min. Shall Equal the Wall Thickness
t Max. Shall be 8" for Spans Thru 8' &
12" for Spans Over 8'.

CORNERS

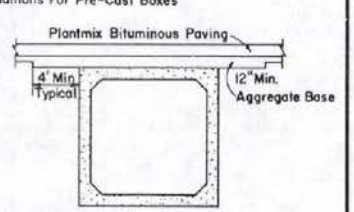
*** Length of Culvert Shall Be Increased As Follows: Add 2.0' To Each End When Cover At Shoulder Is 0.0' To 5.0' Add An Additional 1.0' To Each End For Each Succeeding 5.0' On Cover Or Portion Thereof.

TYPICAL CULVERT INSTALLATION

* Minimum Cover Conditions For Pre-Cast Boxes



CONCRETE PAVING



BITUMINOUS PAVING

** Reinforcing Steel Shall Extend Full Width Of Concrete Pavement. The Reinforcement Shall Have A Minimum Clearance Of 3" On The Bottom. In Areas Of The State Where Road Salts Are Used, The Reinforcing Shall Be Epoxy Coated. Reinforcing Is To Be Placed Parallel To The Centerline Of Road For Longitudinal Reinforcement And Parallel To The Precast Box For Tansverse Reinforcement.

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

PRECAST CONCRETE BOX CULVERT

Designer To Investigate The Availability Of The Required Box Size.

CHIEF BRIDGE ENGR.

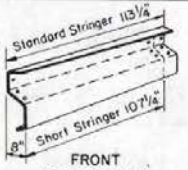
B-2018-(502)

ADOPTED: 4/85 REVISION

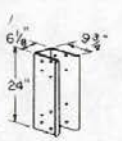
B-9

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

① Curve number. TABLE Y

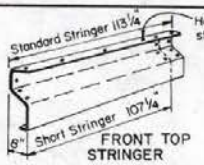


FRONT INTERMEDIATE STRINGER

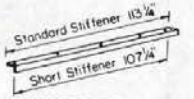


COLUMN SPLICE PLATE 10 GA.

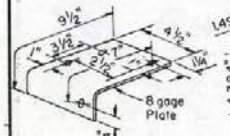
COLUMN CAP-12 GA.



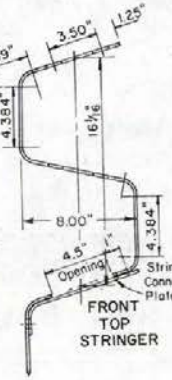
FRONT TOP STRINGER



STRINGER STIFFENER-8 GA.



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



FRONT TOP STRINGER

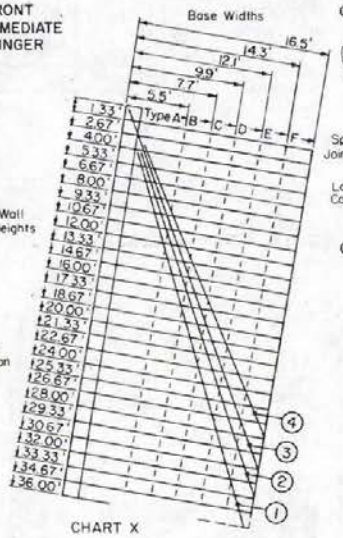
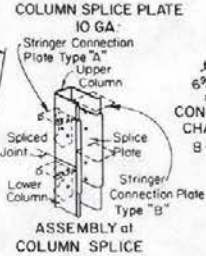
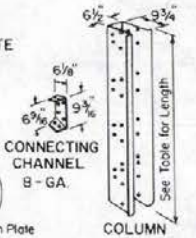


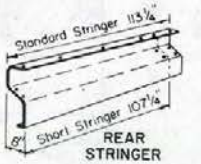
CHART X



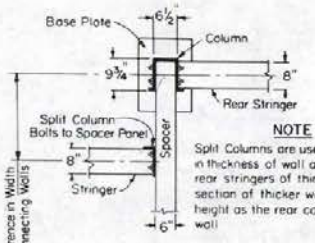
ASSEMBLY at COLUMN SPLICE



CONNECTING CHANNEL 8-GA.
COLUMN 8-GA.



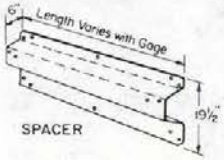
REAR STRINGER



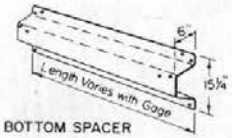
DETAIL SPLIT COLUMN ATTACHMENT

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.

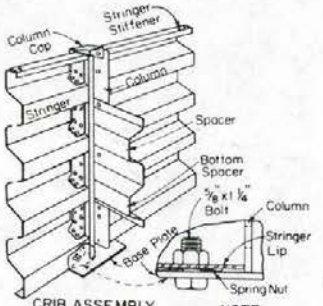


SPACER



BOTTOM SPACER

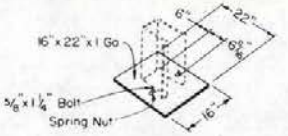
NOTE - See Table on Sheet 1 for Gage and Length



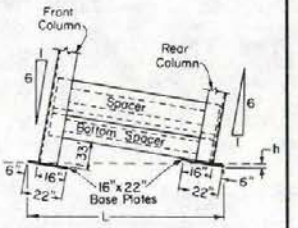
CRIB ASSEMBLY FRONT COLUMN
Rear Column Similar

NOTE

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



BASE PLATE ARRANGEMENT



DETAIL - BASE PLATE PLACEMENT

WALL WIDTH TYPE	h	L
"A"	* 3"	6'-7⅝"
"B"	1⅜"	8'-9⅝"
"C"	5⅝"	10'-11⅜"
"D"	10⅜"	13'-2⅛"
"E"	14⅝"	15'-4⅜"
"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"

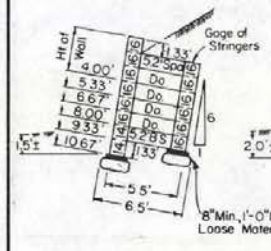
GENERAL NOTES

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

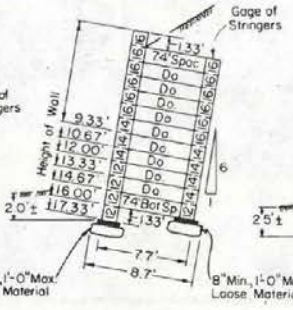
For Design Data see 8-21.1.1

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.

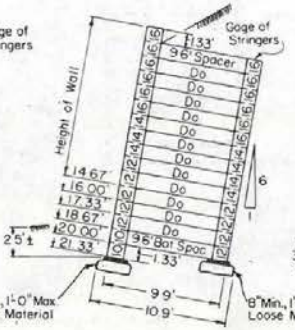
Example - Wall on 1:6 batter, with live load, wall height 18 ft. These conditions are found as (2) in table. In chart, line (2) intercepts the 18-ft. height line about midway of Type "C" which has a base width of 9.9 feet.



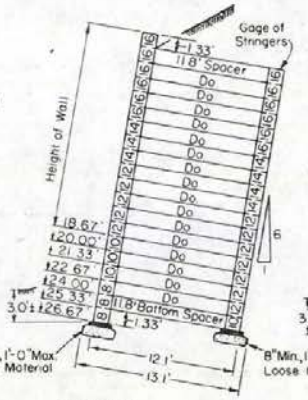
TYPE "A"



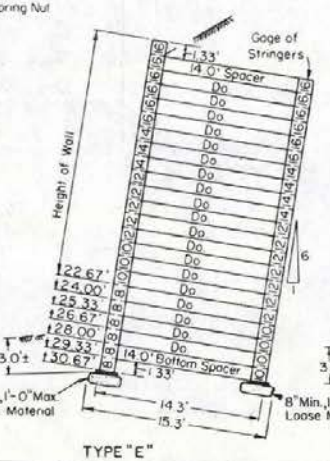
TYPE "B"



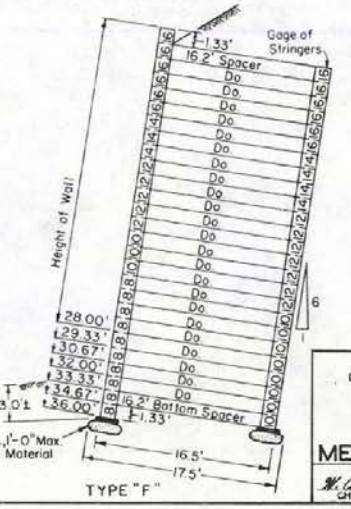
TYPE "C"



TYPE "D"



TYPE "E"



TYPE "F"

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

CONSTRUCTION DETAILS FOR METAL RETAINING WALL

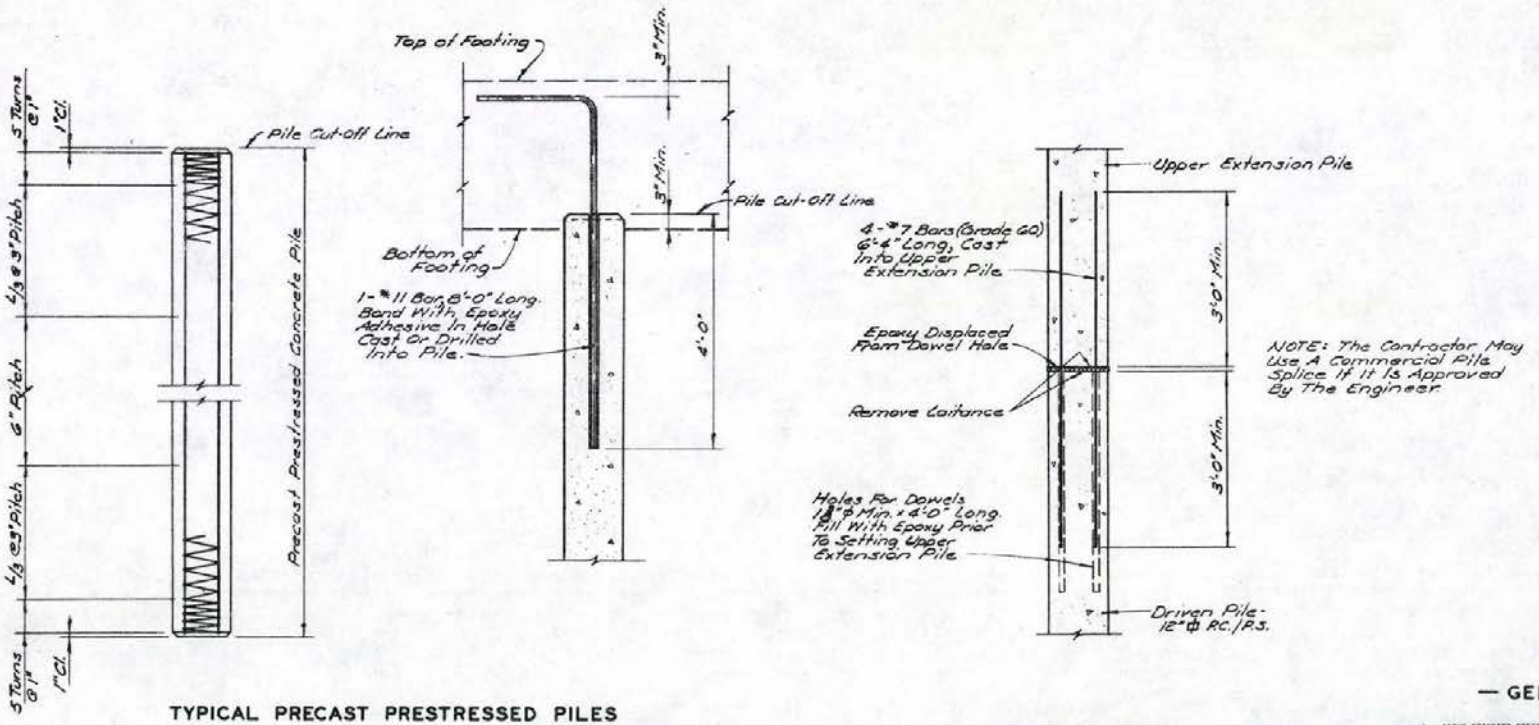
W. Allan Cobb
CHIEF BRIDGE ENGR.

B-21.1.2-(6)12

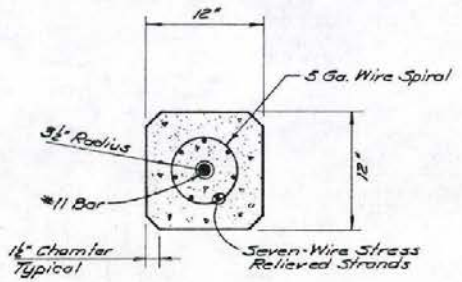
ADOPTED 8/09

REVISION

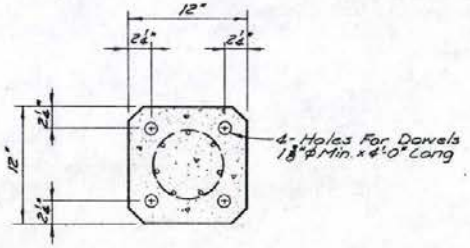
II-8



TYPICAL PRECAST PRESTRESSED PILES



SECTION



PILE SPLICE DETAILS

— GENERAL NOTES —

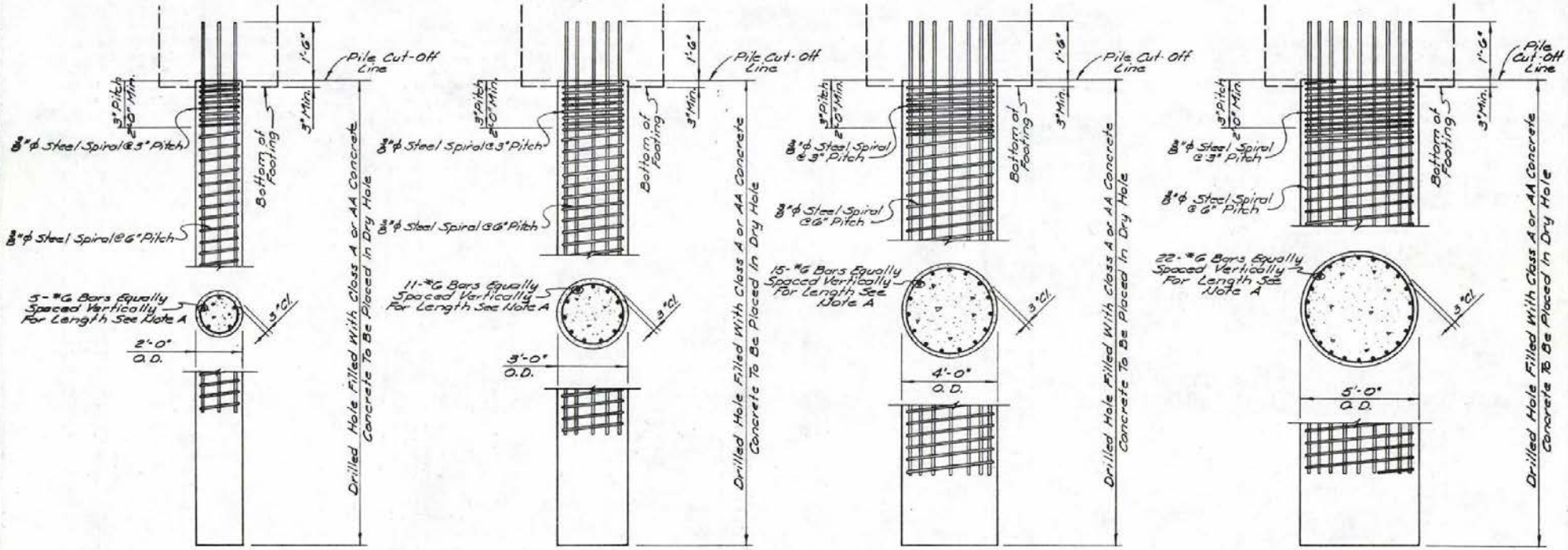
1. AASHO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES 1969 EDITION, INTERIM SPECIFICATIONS AASHO 1971 - PRESTRESSED CONCRETE.
2. THE UNIT PRESTRESS AFTER LOSSES SHALL BE NOT LESS THAN 700 p.s.i.
3. CONCRETE STRENGTH: f'_{ci} = 4,000 p.s.i.
   f'_c = 6,000 p.s.i.
4. PRESTRESSING REINFORCEMENT: SEVEN-WIRE 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 8 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 TRANSPORTATION

PRECAST PRESTRESSED CONCRETE PILE DETAILS

Hugh E. Briner
CHIEF BRIDGE ENGR.

B-23.1.1-(508)
ADOPTED: 11/78
REVISION 1-11/78



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 WHEN HOLES ARE DRILLED THROUGH EMBANKMENT CONSTRUCTED BY CONTRACTOR.
2) TO THE ELEVATION SHOWN ON THE PLANS OR SPECIFIED IN THE SPECIAL PROVISIONS.

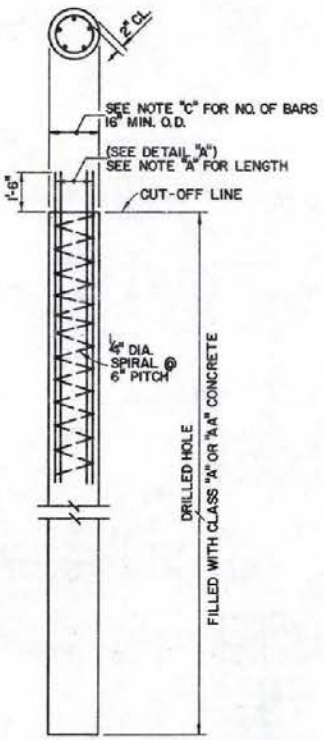
NOTE B: ALL BARS EXTENDED INTO SLAB OR FOOTING SHALL BE HOOKED AS REQUIRED TO PROVIDE 2" MINIMUM CLEARANCE.

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

CAST-IN-DRILLED HOLE CONCRETE PILE DETAILS

Hugh E. Brinton
CHIEF BRIDGE ENGR.

B-23.1.2-(508)'
ADOPTED: 11/78
REVISION 1-11/98



TO BE USED AS AN OPTION ONLY IF SPECIFIED ON THE PLANS.

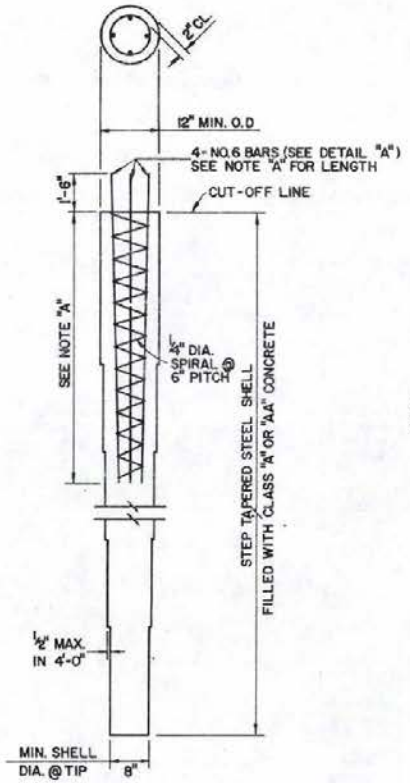
NOTE "A" - THE BARS SHALL EXTEND A MINIMUM OF 12'-0" BELOW THE LOWEST OF THE FOLLOWING:
1. BOTTOM OF FOOTING.
2. TOP OF FINAL GROUND SURFACE.
3. TOP OF ORIGINAL GROUND SURFACE WHEN PILES ARE DRILLED THROUGH FILL.

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 NO. OF BARS SHALL BE FIVE (5).

CAST-IN-DRILLED HOLE CONCRETE PILE

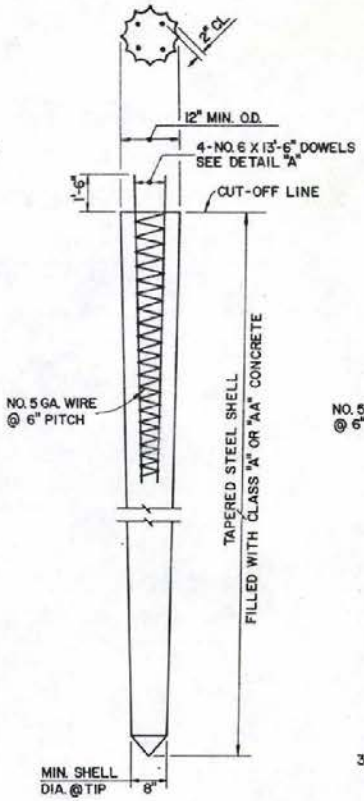


NOTE "A" - THE NO.6 BARS SHALL EXTEND A MIN. 12'-0" BELOW THE LOWEST OF THE FOLLOWING:
1. BOTTOM OF FOOTING.
2. TOP OF FINAL GROUND SURFACE.
3. TOP OF ORIGINAL GROUND SURFACE WHEN PILES ARE DRIVEN THROUGH FILL.

NOTE "B" - 10" MIN. DIA. PIPE EXTENSION MAY BE USED WHEN STEP TAPER IS 30' OR MORE IN LENGTH. MIN. LENGTH OF EXTENSION IS 15'-0". MIN. THICKNESS OF PIPE EXTENSION IS 0.1793".

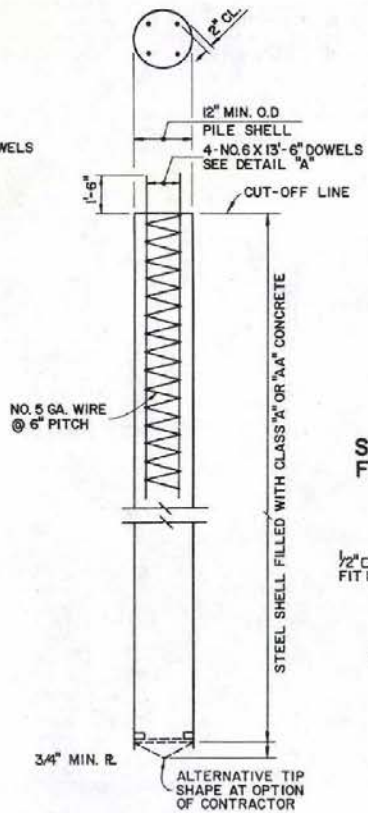
NOTE "C" - CONTRACTOR TO BE RESPONSIBLE FOR FURNISHING SHELLS OF SUFFICIENT STRENGTH TO DRIVE WITHOUT DISTORTION.

CAST-IN-PLACE CONCRETE PILE ALTERNATE "A"



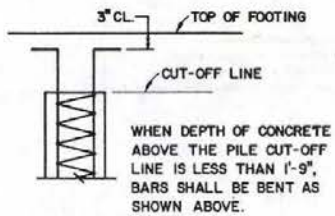
CONTRACTOR TO BE RESPONSIBLE FOR FURNISHING SHELLS OF SUFFICIENT THICKNESS TO DRIVE WITHOUT DISTORTION.

CAST-IN-PLACE CONCRETE PILE ALTERNATE "B"

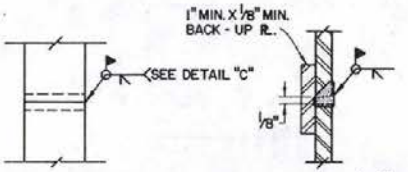


MIN. SHELL THICKNESS IS 1/4"
CONTRACTOR TO BE RESPONSIBLE FOR FURNISHING SHELLS OF SUFFICIENT THICKNESS TO DRIVE WITHOUT DISTORTION.

CAST-IN-PLACE CONCRETE PILE

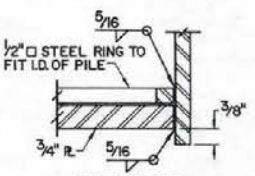


DETAIL "A"

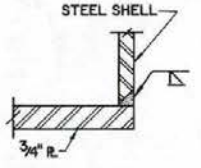


STEEL SHELL FIELD SPLICE

DETAIL "C"



PILE TIP DETAIL



ALTERNATE PILE TIP DETAIL

GENERAL NOTES

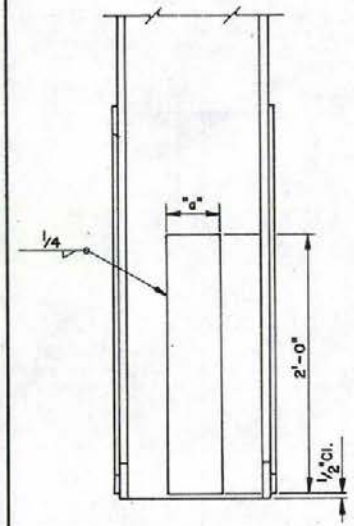
1. ALL REINFORCING SHOWN SHALL BE INCLUDED IN THE CONTRACT PRICE FOR "FURNISHING STEEL SHELL FOR PILES."
2. IF LOAD TESTS ARE REQUIRED THE CONTRACTOR SHALL SUBMIT FOR APPROVAL DETAILED PLANS OF HIS PROPOSED TESTING METHOD.

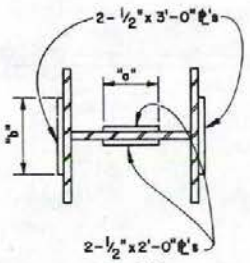
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

CONCRETE PILE DETAILS

CHIEF BRIDGE ENGINEER

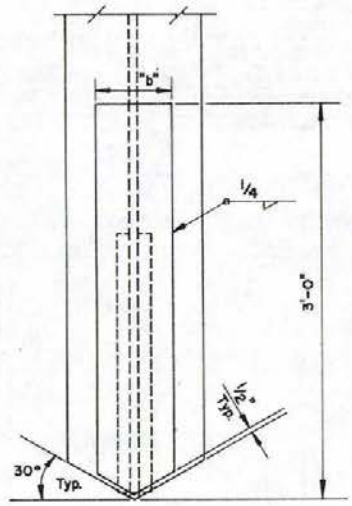
B-23.1.3 (508)
ADOPTED: 3/85
REVISION: 2-3/85



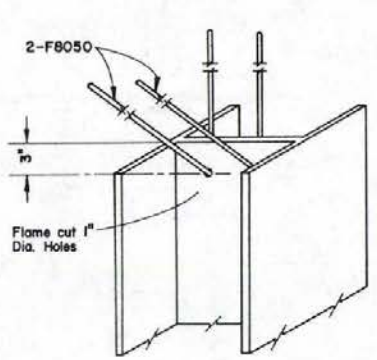


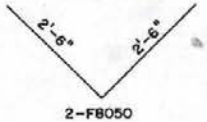
PLAN

HP SIZE	"a"	"b"
8"	4"	5"
10"	5"	7"
12"	7"	9"
13"	8"	10"
14"	8"	11"

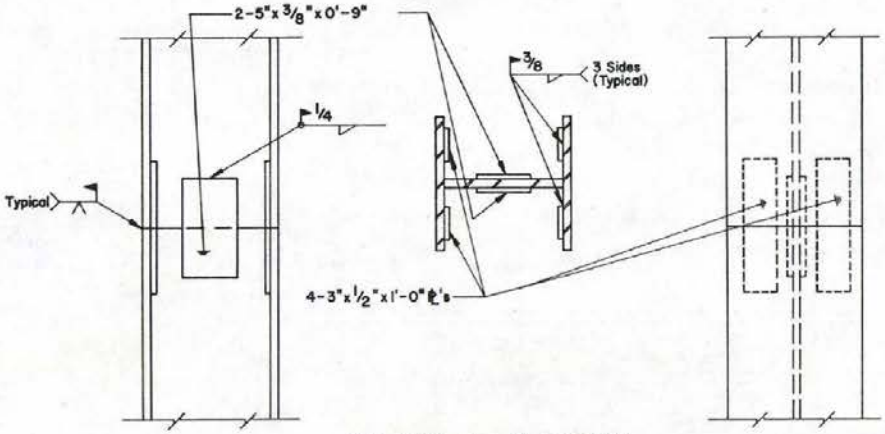


TYPICAL HP PILE POINT REINFORCEMENT DETAIL





HP PILE ANCHORAGE DETAIL



HP PILE SPLICE DETAIL

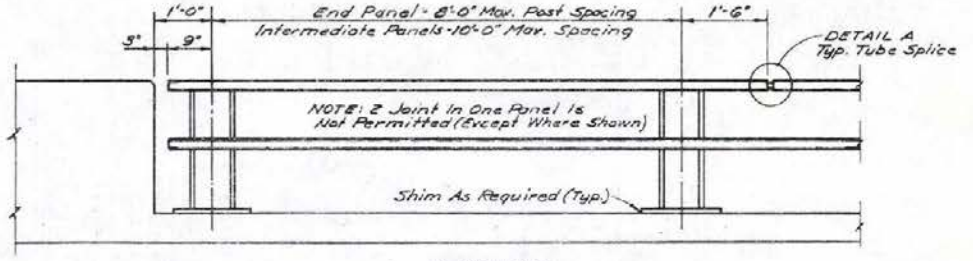
NOTE: 1. Weld Splice ℄'s To Upper Pile Section. Set In Place & Tap Several Times With Pile Hammer Before Completion Of Welding. Piles Must Be Stopped At Least 3'-0" Above Ground, Prior To Splicing.

2. Contractor May Submit Other Pile Splice Detail And Other Pile Point Reinforcement For Approval.

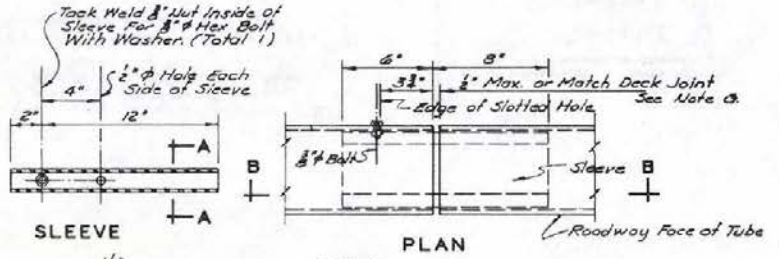
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

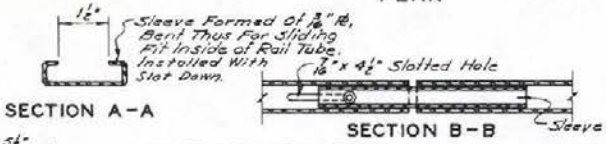
"HP" PILE DETAILS

CHIEF BRIDGE ENGR.	8-23.1.4-(508)
	ADOPTED: 4/85 REVISION



ELEVATION





TUBE SPLICE DETAIL A

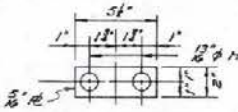
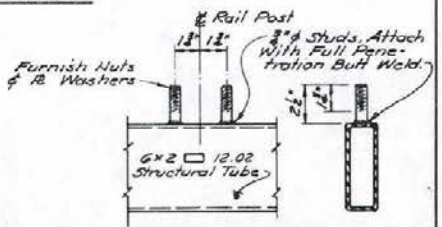
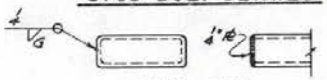


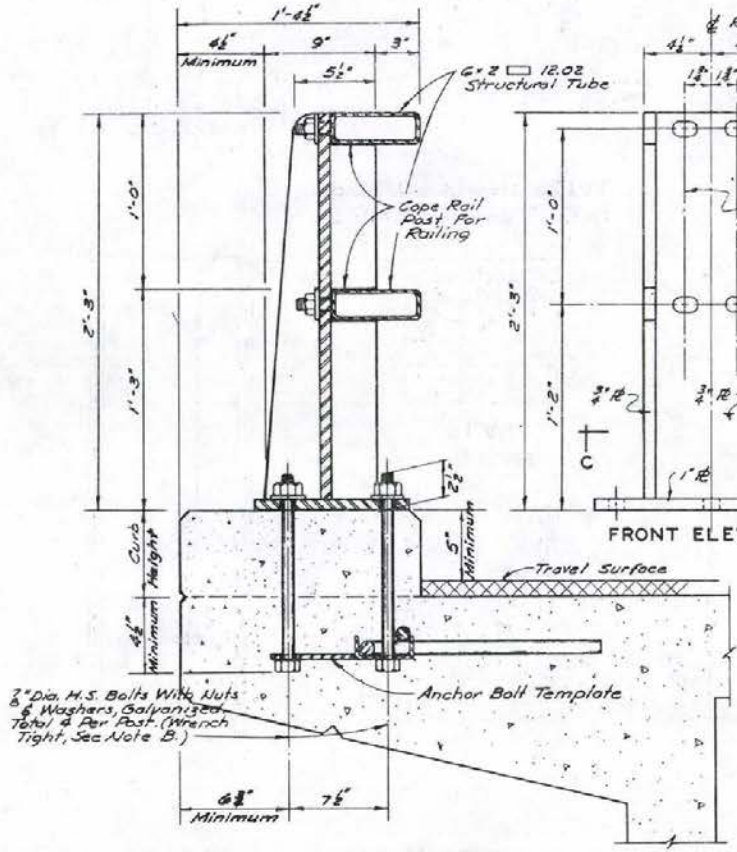
PLATE WASHER



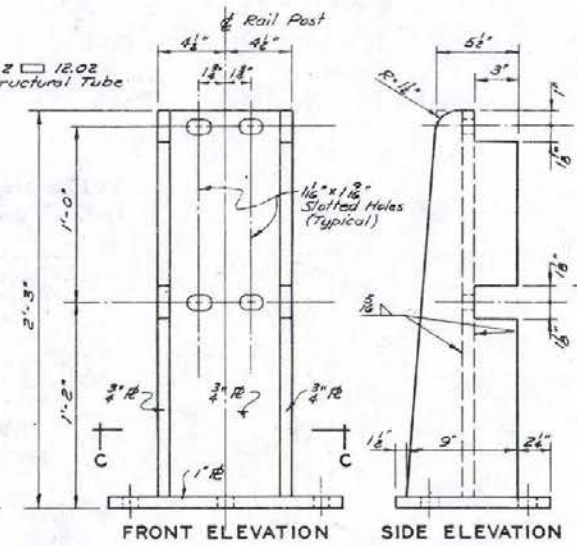
STUD BOLT DETAILS



RAIL CAP

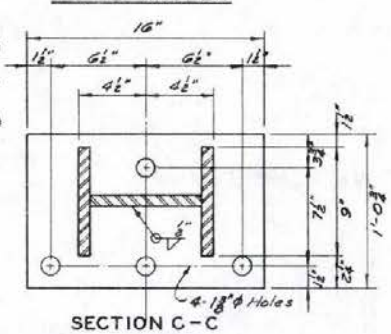


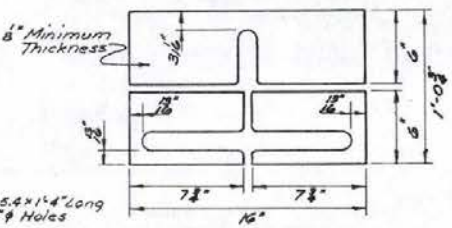
RAIL SECTION



FRONT ELEVATION SIDE ELEVATION

RAIL POST DETAILS



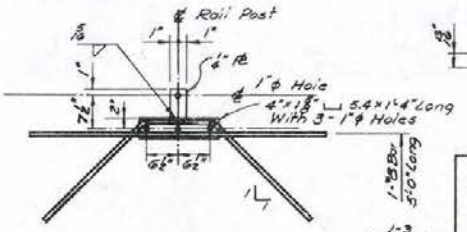


SHIM DETAIL

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 TUBES AT DECK EXPANSION JOINTS 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. I(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 TRANSPORTATION

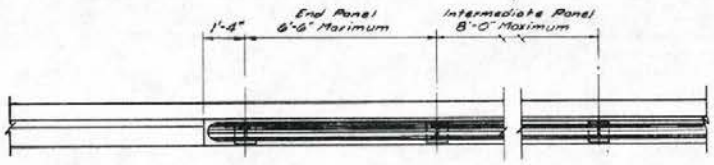
BRIDGE RAIL
TYPE "AC"

CHIEF BRIDGE ENGR.

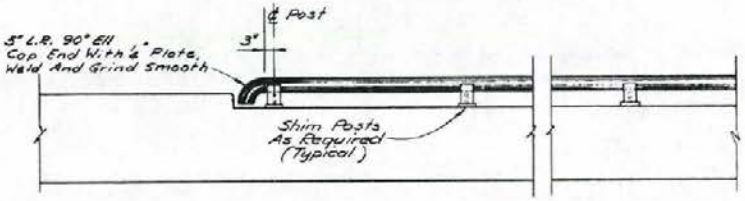
B-25.1.1-(508)

ADOPTED: 11/78

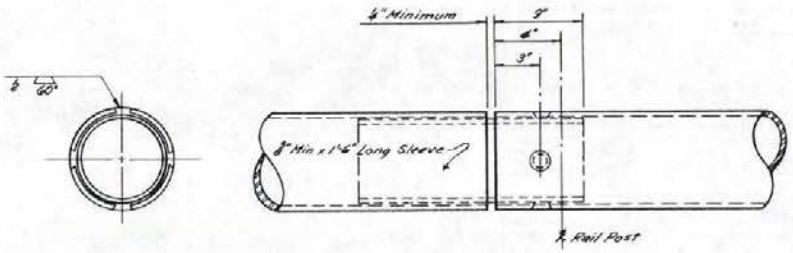
REVISION 1-11/78



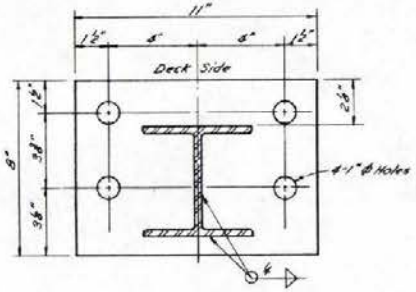
PART PLAN



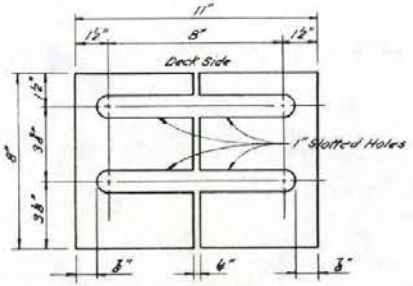
PART ELEVATION



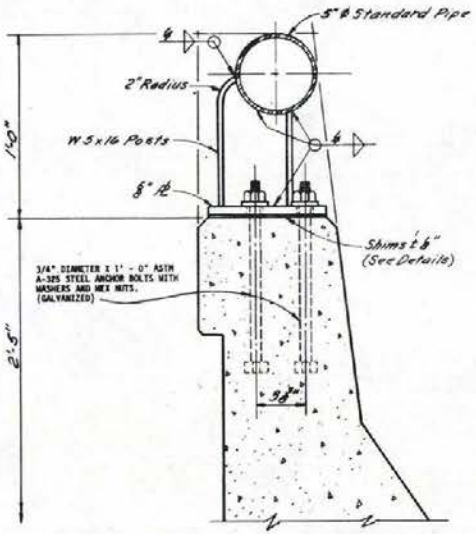
SLIP JOINT DETAIL

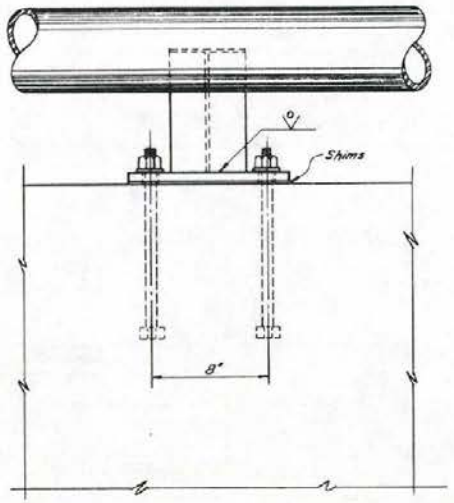


ANCHOR PLATE DETAIL



SHIM DETAIL





RAILING DETAIL

-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 1/4" 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.

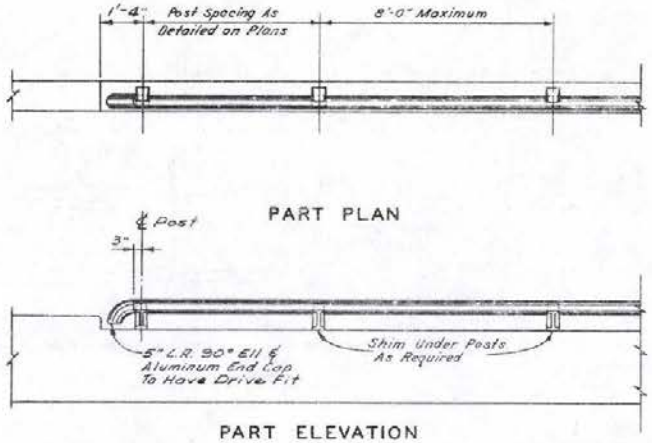
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

STEEL BRIDGE RAIL TYPE "H"

Hugh E. Brinden
CHIEF BRIDGE ENGR.

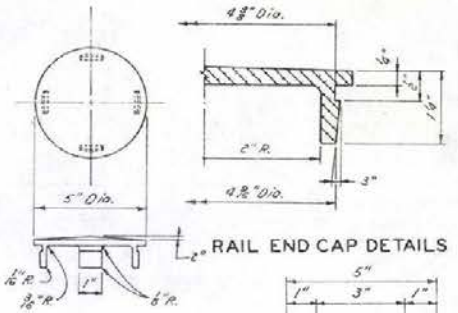
B-25.1.2-(506)
ADOPTED: 11/78
REVISION

B-17

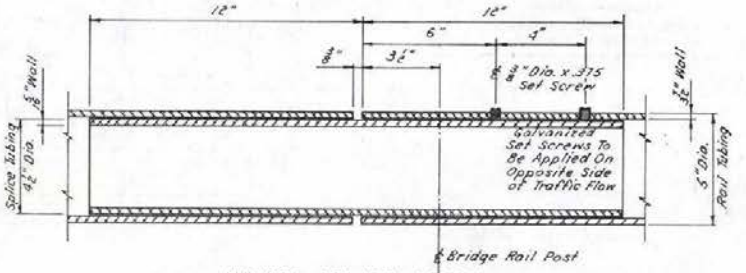


PART PLAN

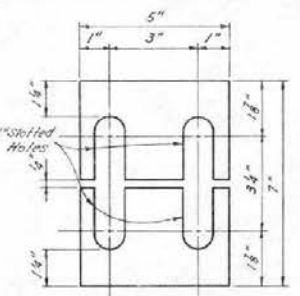
PART ELEVATION



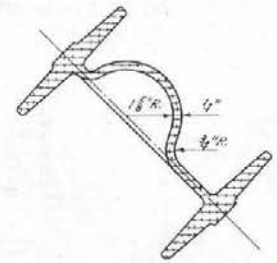
RAIL END CAP DETAILS



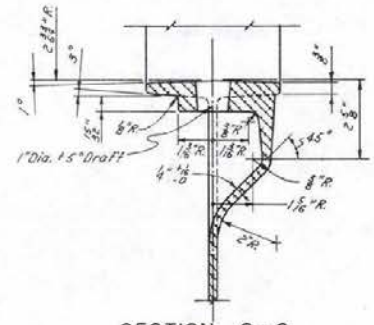
INSIDE SPLICE DETAIL



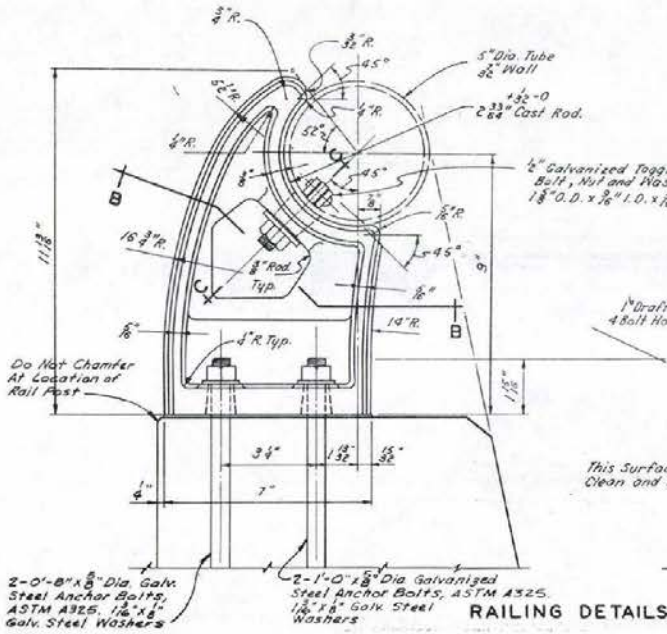
SHIM DETAIL



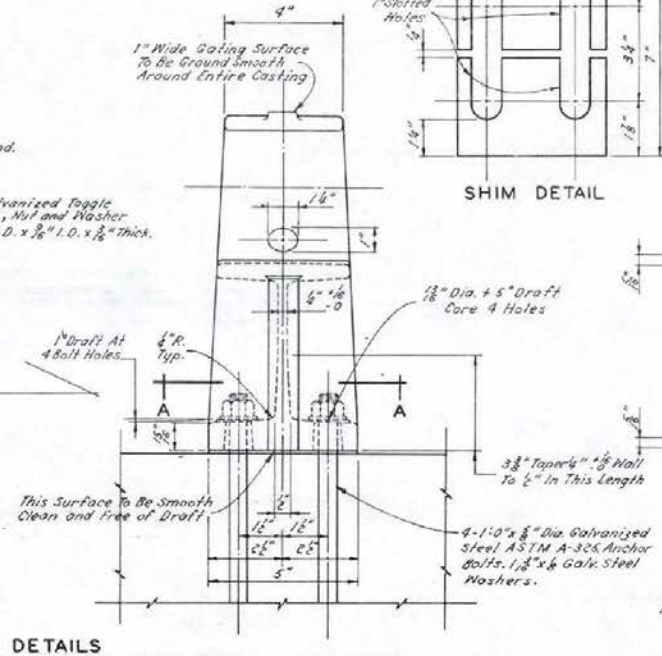
SECTION B-B

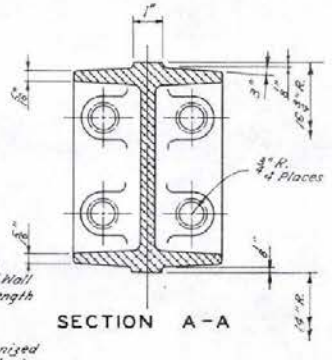


SECTION C-C



RAILING DETAILS





SECTION A-A

NOTE:
Unless Otherwise Specified
All Draft to be 3°

All Unmarked Radii To Be ½" R.

GENERAL NOTES

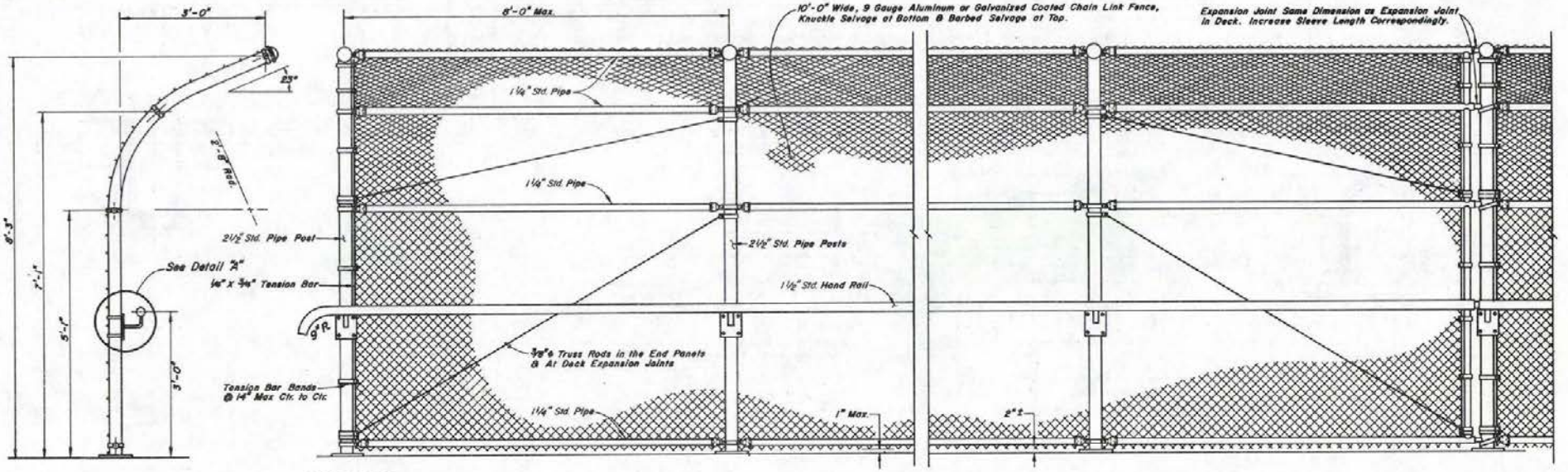
1. Railing To Conform To Vertical and Horizonal Alignment.
2. Joint To Be Placed 25'-0" Center To Center, MAX.
3. Slip Joint To Be Placed in Panels To Match Expansion Joints in Deck. The ⅜" For Movement Will Be Changed To Match Allowances for Movement in The Deck and Curb.
4. Design Weight: 6¼ Lbs. Per Foot.

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

ALUMINUM BRIDGE RAIL TYPE "H"

Hugh C. Grimes
CHIEF BRIDGE ENGR.

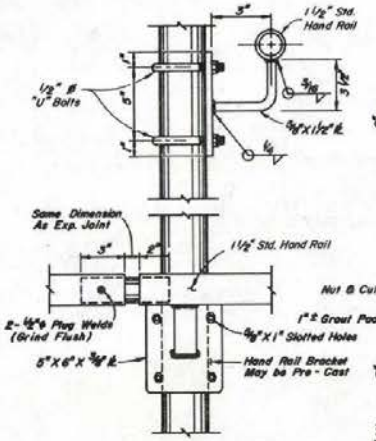
B-25.1.3-(506)
ADOPTED: 11/78
REVISION



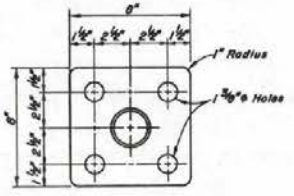
END POST

TYPICAL INTERIOR PANEL

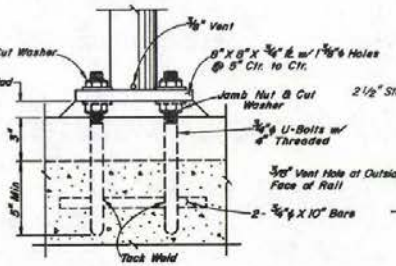
AT EXPANSION JOINT



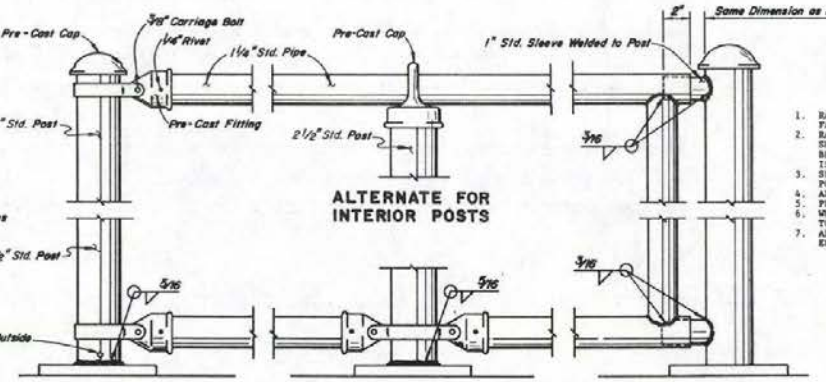
DETAIL "A"



BASE PLATE



ANCHORAGE DETAILS



TYPICAL CONNECTION DETAILS

GENERAL NOTES

1. RAILING ASSEMBLY EXCEPT CHAIN LINK FABRIC, TO BE GALVANIZED AFTER FABRICATION.
2. RAILING SHALL CONFORM TO HORIZONTAL AND VERTICAL ALIGNMENTS. 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 CENTERLINE POSTS.
4. ALL EXPOSED CORNERS TO BE SMOOTH.
5. PEEN ALL 3/8" BOLTS.
6. WHEN FENCE IS ON SLOPE THE 10'-0" FABRIC SHALL BE PLACED PARALLEL TO THE SLOPE.
7. ALTERNATIVE DETAILS MAY BE SUBMITTED BY THE CONTRACTOR FOR THE ENGINEERS APPROVAL.

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

PEDESTRIAN RAIL
TYPE "M"

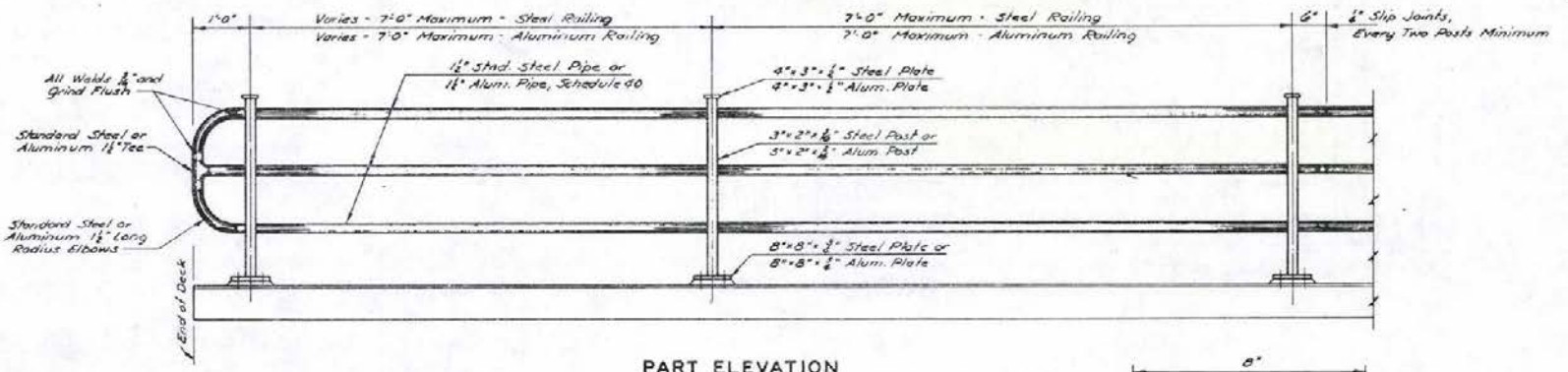
CHIEF BRIDGE ENGR.

B-25.1.4-(506)

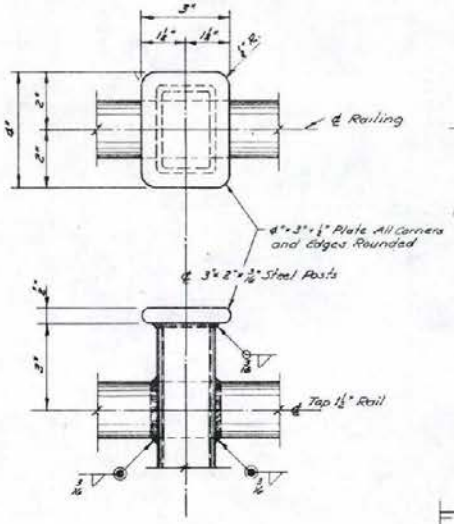
ADOPTED: 6/85 REVISION

B-19

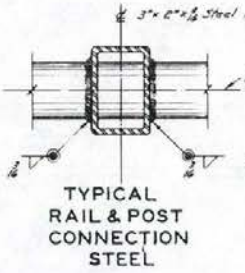
1. All Steel Railing Assembly Shall Be Galvanized After Fabrication.
2. All Exposed Surfaces of Steel Railing Assembly Shall Be Painted White.



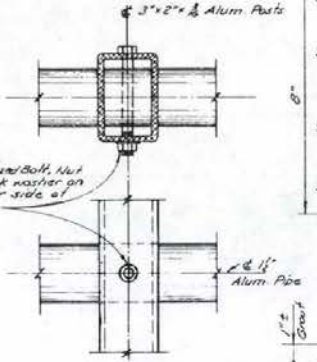
PART ELEVATION



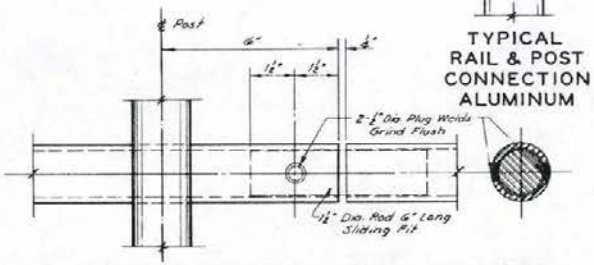
TOP POST PLATE DETAILS



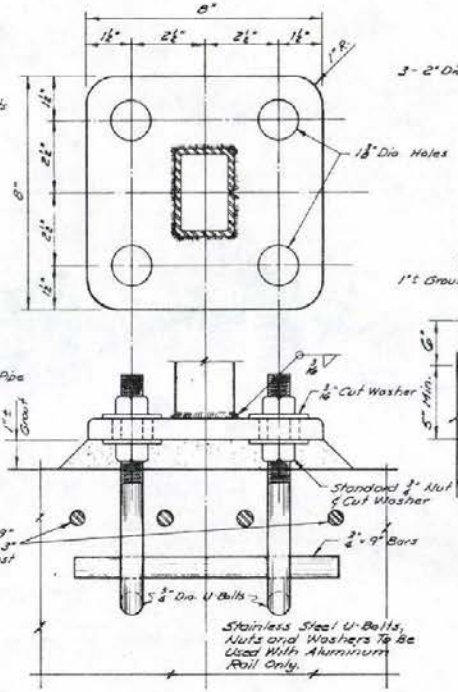
TYPICAL RAIL & POST CONNECTION STEEL



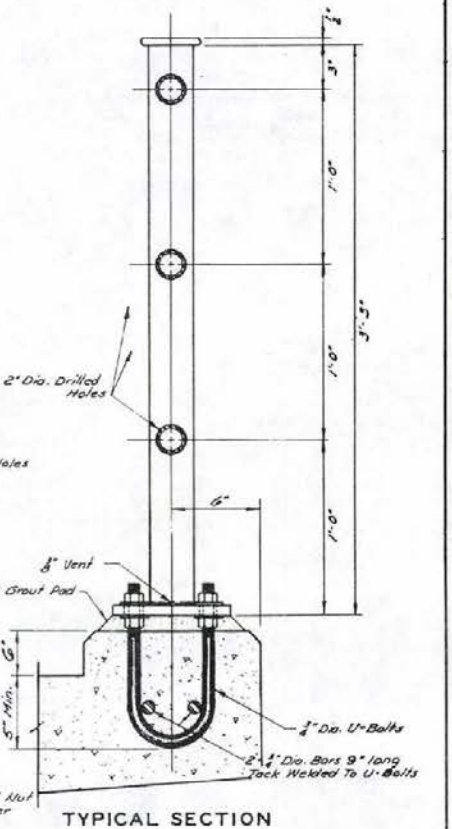
TYPICAL RAIL & POST CONNECTION ALUMINUM



SLIP JOINT DETAILS



BOTTOM PLATE DETAILS



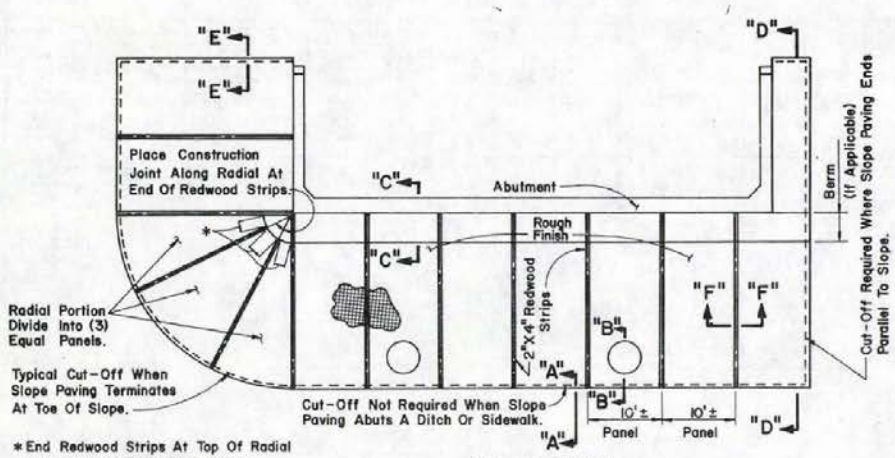
TYPICAL SECTION

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

PEDESTRIAN RAIL TYPE "R"

CHIEF BRIDGE ENGR.	B-25.1.5-(506)
	ADOPTED: 11/78
	REVISION 1-11/78

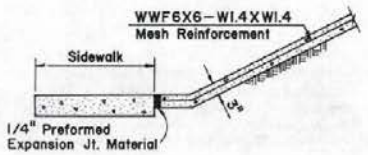
B-20



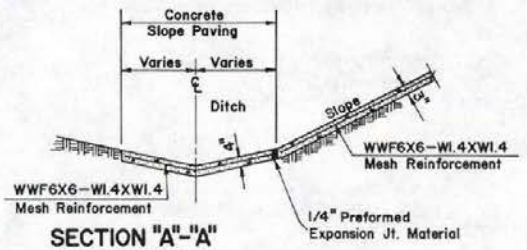
*End Redwood Strips At Top Of Radial Section When Their Intermediate Distance From Each Other Reaches Three (3') Feet.

PLAN VIEW

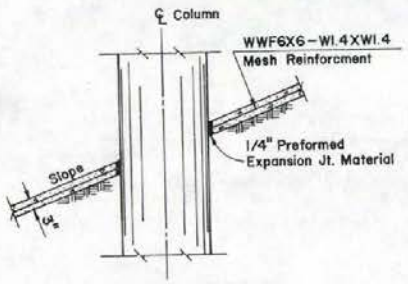
NOTE: 1. SLOPE PAVING IS TO BE DIVIDED INTO EQUALLY SPACED PANELS. THE WIDTH OF EACH PANEL IS TO BE AS NEARLY 10' AS SITE DIMENSIONS WILL PERMIT. 2. THESE DETAILS WILL NOT APPLY IN TOTAL TO ANY ONE SITE, BUT ARE INTENDED TO BE GENERAL ENOUGH TO COVER ALL POSSIBILITIES. TO OBTAIN LIMITS OF SLOPE PAVING FOR A SPECIFIC SITE, CONSULT THE PLAN SHEETS.



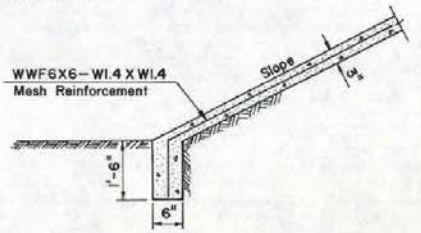
SECTION "A"-"A" (WITH SIDEWALK)



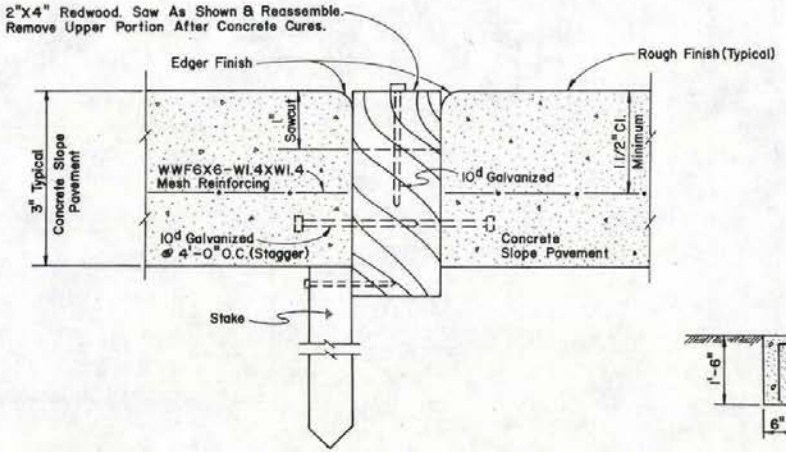
SECTION "A"-"A" (WITH DITCH)



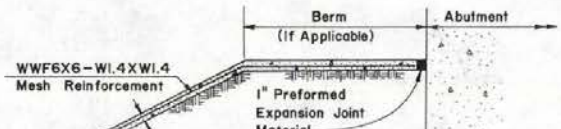
SECTION "B"-"B" (AT PIER)



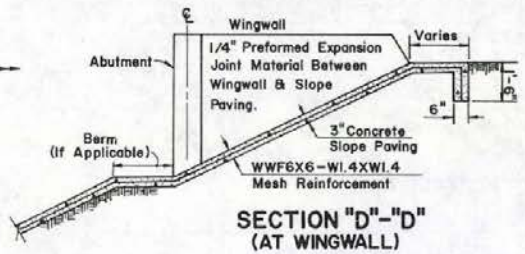
SECTION "A"-"A" (TOE OF SLOPE)



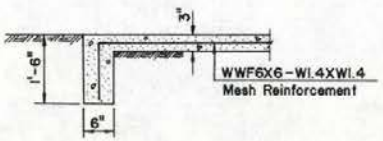
SECTION "F"-"F"



SECTION "C"-"C" (AT ABUTMENT)



SECTION "D"-"D" (AT WINGWALL)



SECTION "E"-"E" (EDGE OF SLOPE)

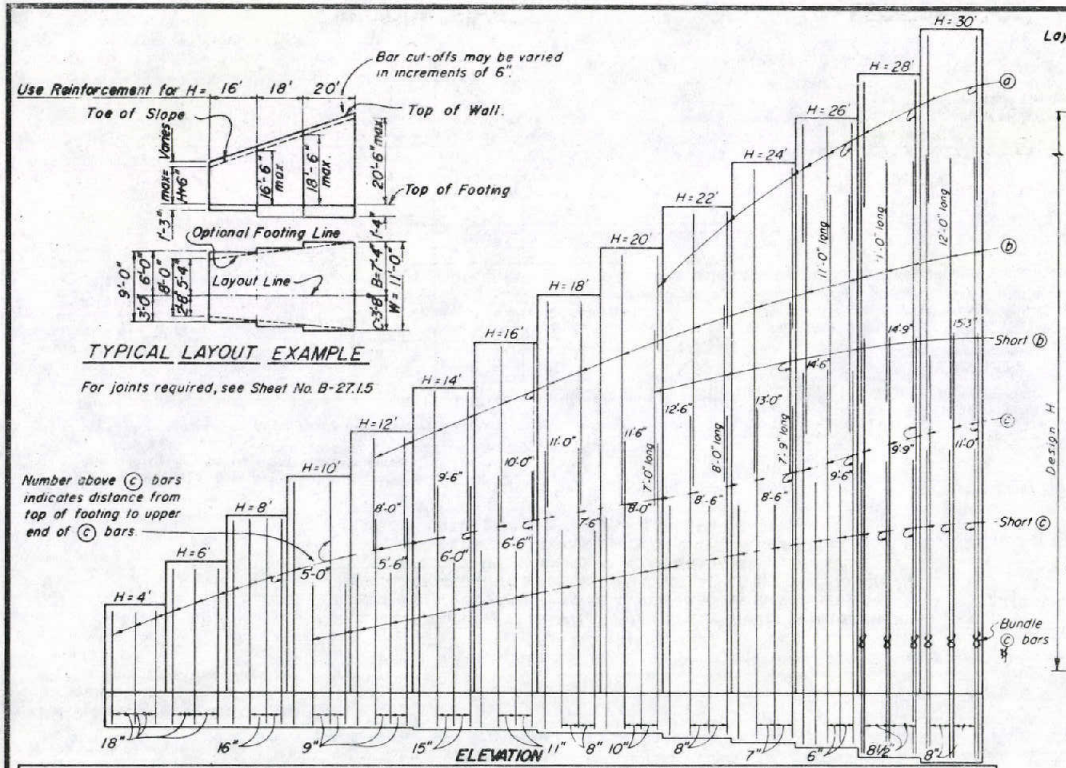
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

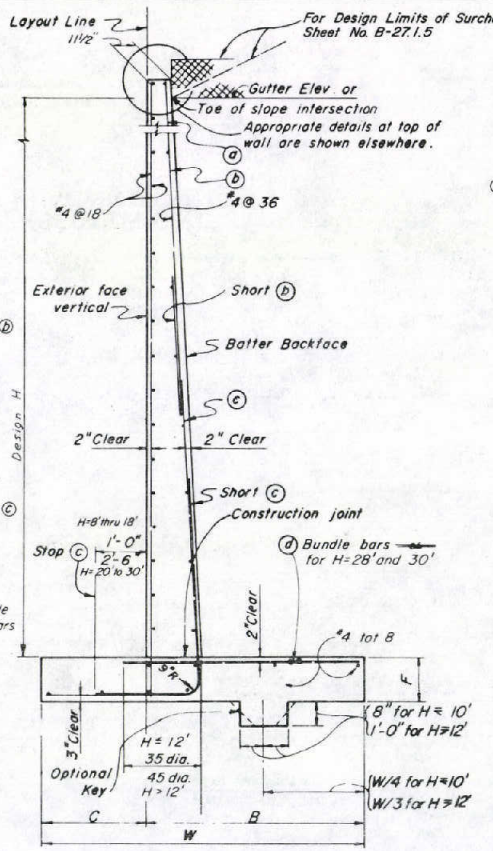
CONCRETE SLOPE PAVING DETAILS

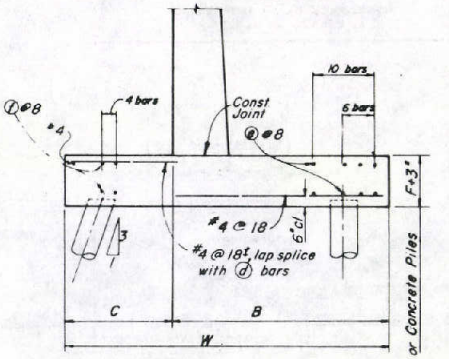
CHIEF BRIDGE DESIGN ENGR.

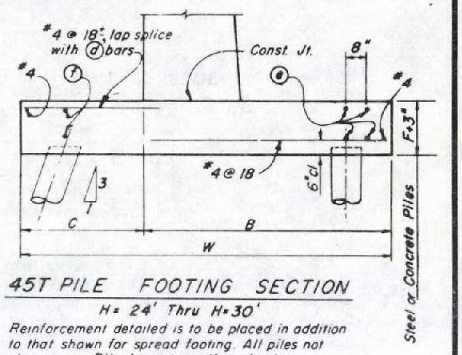
B-26.11-(611)

ADOPTED 11-78 REVISION 2-3-88









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

TABLE OF REINFORCING STEEL DIMENSIONS AND DATA

Design H		4'	6'	8'	10'	12'	14'	16'	18'	20'	22'	24'	26'	28'	30'
W		3'-2"	4'-2"	5'-2"	6'-2"	7'-2"	8'-0"	9'-0"	10'-0"	11'-0"	12'-0"	13'-3"	14'-3"	15'-3"	16'-9"
C		1'-0"	1'-4"	1'-8"	2'-0"	2'-4"	2'-8"	3'-0"	3'-4"	3'-8"	4'-0"	4'-5"	4'-9"	5'-1"	5'-5"
B		2'-2"	2'-10"	3'-6"	4'-2"	4'-10"	5'-4"	6'-0"	6'-8"	7'-4"	8'-0"	8'-10"	9'-6"	10'-2"	11'-4"
F Spread Ftg.		1'-2"	1'-2"	1'-2"	1'-2"	1'-2"	1'-3"	1'-3"	1'-4"	1'-4"	1'-5"	1'-8"	1'-11"	2'-2"	2'-4"
Batter		1/2:12	1/2:12	1/2:12	1/2:12	1/2:12	1/2:12	1/2:12	1/2:12	1/2:12	1/2:12	5/8:12	3/4:12	3/4:12	7/8:12
(a)	bars					#4@18	#6@30	#6@22	#6@16	#8@20	#8@16	#8@14	#8@12	#8@8½	#8@8
(b)	bars									#5@20	#5@32	#5@28	#5@12	#6@17	#6@16
(c)	bars	#5@18	#5@18	#5@16	#5@9	#6@9	#9@15	#9@11	#9@8	#10@10	#11@8	#11@7	#11@6	#10@8½	#10@8
(d)	bars	#5@18	#5@18	#4@16	#4@9	#5@9	#8@15	#8@11	#9@8	#10@10	#10@8	#10@7	#10@6	#9@8½	#9@8
Total (e)	bars	6-#6	6-#6	6-#6	10-#7	10-#7	10-#7	10-#7	6-#7	6-#7	6-#7	4-#7	4-#7	4-#7	4-#7
Total (f)	bars				4-#7	4-#7	4-#7	4-#7	4-#7	4-#7	4-#7	2-#7	2-#7	2-#7	2-#7
2' Level surcharge	Toe Pr k/sf	1.6	1.9	2.2	2.5	2.8	3.3	3.5	4.0	4.3	4.6	4.9	5.3	5.7	6.2
2:1 unlimited slope	Toe Pr k/sf	1.1	1.5	2.0	2.3	2.7	3.3	3.6	4.2	4.7	5.5	5.9	6.5	7.1	7.5
1/2:1 limited slope	Toe Pr k/sf	1.3	1.7	2.1	2.5	2.9	3.4	3.8	4.3	4.8	5.4	5.8	6.5	7.2	7.5
Spread Footing	Steel lbs/ft	18	22	28	37	51	80	105	153	192	248	307	409	449	507
	Conc cf/ft	8.9	12.5	16.3	20.2	25.4	30.1	34.6	40.1	45.0	52.1	63.3	77.0	88.1	104.8
Pile ftg.	Steel lbs/ft	30	34	41	70	84	113	140	178	217	273	326	429	469	528
	Conc cf/ft	10.2	12.7	16.7	20.8	25.2	30.1	34.8	40.6	45.7	53.1	64.7	78.6	89.9	107.0

NOTES:

For details not shown and drainage notes see sheet No. B-27.1.5

Quantities do not include the wall portion above "Gutter Elevation" and are for design purposes only.

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

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

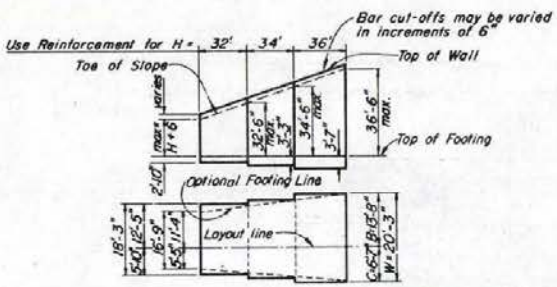
RETAINING WALL TYPE 1
H=4' TO 30'

CHIEF BRIDGE ENGR.

B-27.1.1 - (502)

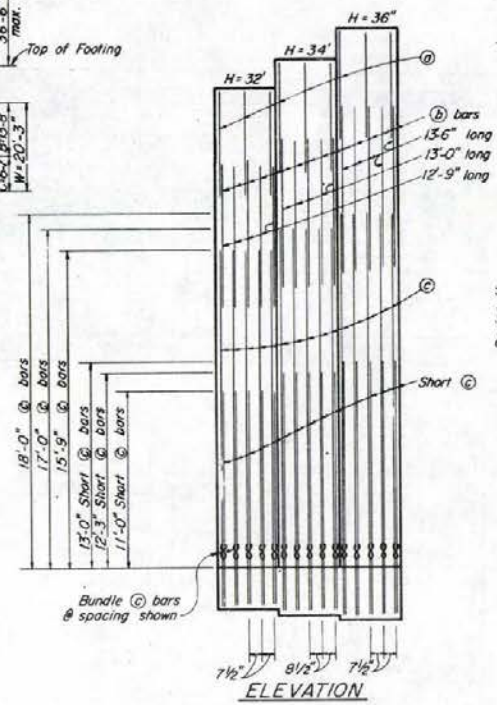
ADOPTED: 1-1-83

REVISIONS

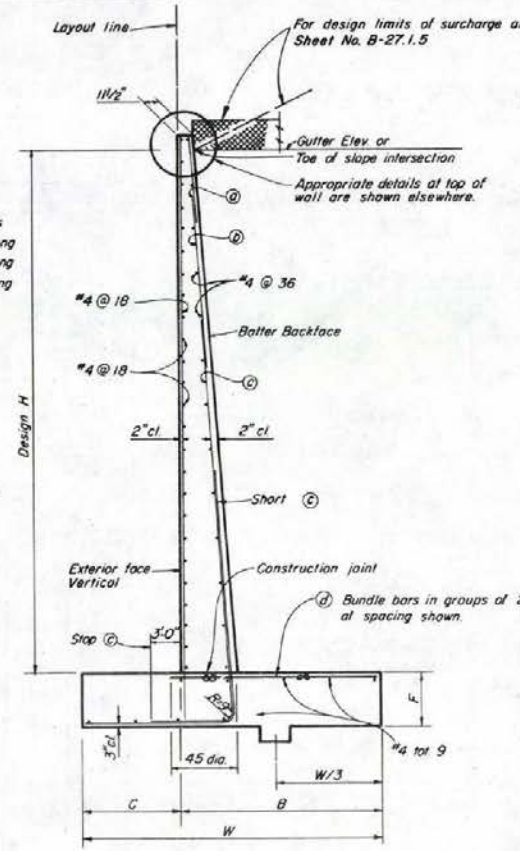


TYPICAL LAYOUT EXAMPLE

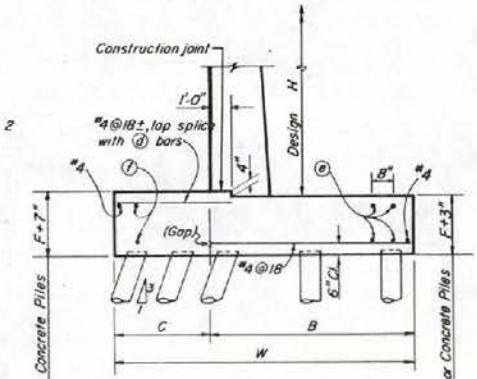
For joints required, see Sheet No. B-27.1.5



ELEVATION



SPREAD FOOTING SECTION



45T PILE FOOTING SECTION

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

TABLE OF REINFORCING STEEL DIMENSIONS AND DATA

Design H		32'	34'	36'
W		18'-3"	19'-3"	20'-3"
C		5'-10"	6'-3"	6'-7"
B		12'-5"	13'-0"	13'-8"
F Spread Ftg.		2'-10"	3'-3"	3'-7"
Batter		1:12	1:12	1:12
ⓐ	bars	#6 @ 15	#7 @ 17	#7 @ 15
ⓑ	bars	#8 @ 7½	#9 @ 8½	#9 @ 7½
ⓒ	bars	#10 @ 7½ ¥	#11 @ 8½ ¥	#11 @ 7½ ¥
ⓓ	bars	#9 @ 7½ ¥	#10 @ 8½ ¥	#9 @ 7½ ¥
Total ⓐ	bars	4-#7	4-#7	4-#7
Total ⓕ	bars	2-#7	2-#7	2-#7
2' level surcharge	H Comp. k	24.3	27.7	31.0
	V Comp. k	59.2	66.5	74.4
	Toe Pr. k/sf	6.3	6.8	7.3
2:1 unlimited slope	H Comp. k	36.6	41.7	46.9
	V Comp. k	81.5	91.7	102.6
	Toe Pr. k/sf	7.7	8.4	9.1
1½:1 limited slope	H Comp. k	29.3	32.8	36.3
	V Comp. k	66.6	74.5	82.9
	Toe Pr. k/sf	7.9	8.4	8.9
Spread Footing	Steel lbs/ft.	563.2	665.7	751.0
	Conc. c.f./ft.	129.4	147.8	165.7
Pile Footing	Steel lbs/ft.	590.3	694.3	779.0
	Conc. c.f./ft.	134.2	153.0	171.3

¥ Denotes a bundle of 2 bars.

NOTES:

For details not shown and drainage notes see Sheet B-27.1.5

Quantities do not include the wall portion above "Gutter Elevation" and are for design purposes only.

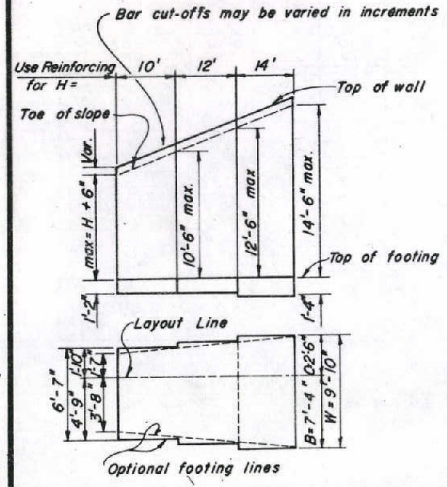
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

# RETAINING WALL TYPE 1
H=32' TO 36'

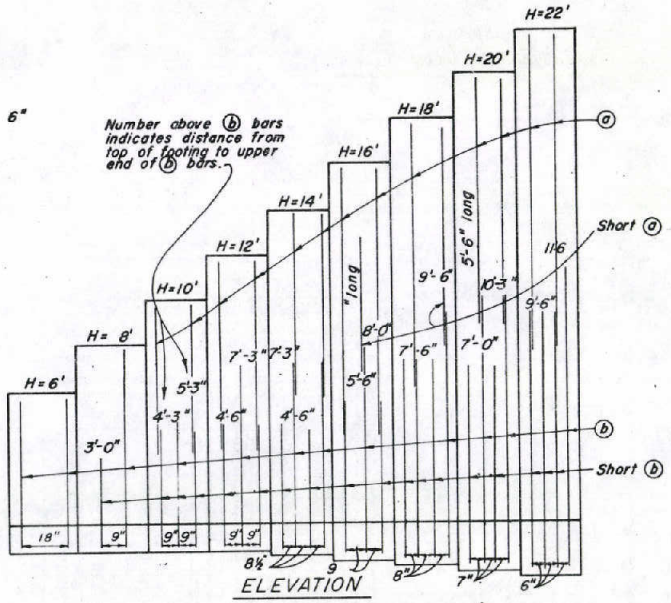
CHIEF BRIDGE ENGR.

B-27.1.2-(502)
ADOPTED: 1-1-83 REVISION

B-23



TYPICAL LAYOUT EXAMPLE



ELEVATION

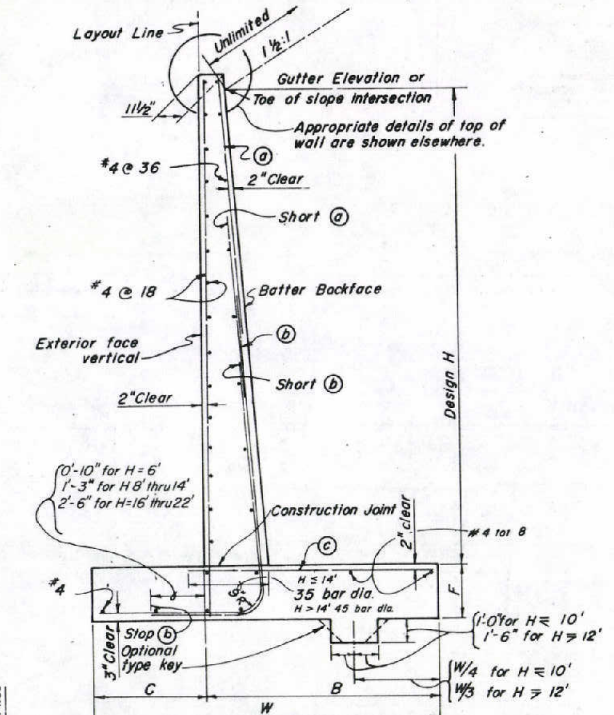
For joints required, see Sheet No. B-27.1.5

TABLE OF REINFORCING STEEL DIMENSIONS AND DATA										
Design H		6'	8'	10'	12'	14'	16'	18'	20'	22'
W		3'-10"	5'-3"	6'-7"	8'-1"	9'-10"	11'-4"	13'-0"	14'-10"	17'-6"
C		1'-4"	1'-7"	1'-10"	2'-1"	2'-6"	2'-10"	3'-1"	3'-8"	4'-4"
B		2'-6"	3'-8"	4'-9"	6'-0"	7'-4"	8'-6"	9'-11"	11'-2"	13'-2"
F		1'-2"	1'-2"	1'-2"	1'-2"	1'-4"	1'-7"	1'-10"	2'-1"	2'-4"
Batter		½ : 12	½ : 12	½ : 12	½ : 12	½ : 12	½ : 12	½ : 12	⅝ : 12	⅞ : 12
ⓐ bars				#5@18	#5@18	#6@17	#6@9	#8@16	#8@14	#8@12
ⓑ bars		#5@18"	#5@9	#6@9	#8@9	#9@8½	#11@9	#11@8	#11@7	#11@6
ⓒ bars		#5@18"	#5@18	#6@18	#6@9	#6@8½	#8@9	#8@8	#8@7	#8@6
Tot. ⓔ bars		6-#6	6-#6	10-#7	10-#7	10-#7	10-#7	8-#7	8-#7	8-#7
Tot. ⓕ bars				6-#7	6-#7	6-#7	6-#7	4-#7	4-#7	4-#7
Toe Press		2540	3170	3880	4470	4950	5720	6540	6970	6990
Spread footing	Conc. cf./ft.	13.2	17.5	21.8	29.0	35.7	43.7	54.9	68.2	85.7
	Steel lbs/ft.	21	2730	44	69	89	139	184	241	325
Pile Footing	Conc. cf./ft.	12.2	16.8	21.4	26.5	33.6	42.1	53.7	67.5	85.5
	Steel lbs/ft.	32	42	80	106	126	176	214	272	357

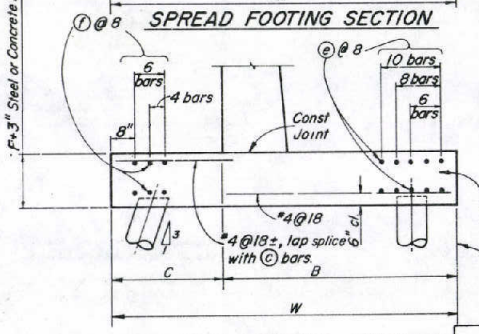
NOTES:

For Design and Drainage notes and other details see Sheet No. B-27.1.5

Quantities do not include the wall portion above "Gutter Elevation" and are for design purposes only.



SPREAD FOOTING SECTION



45T PILE FOOTING SECTION

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

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

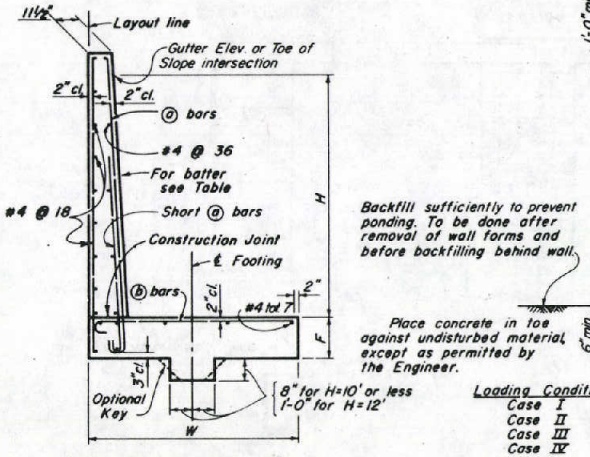
RETAINING WALL TYPE 2
H = 6' TO 22'

B-27.1.3-(502)

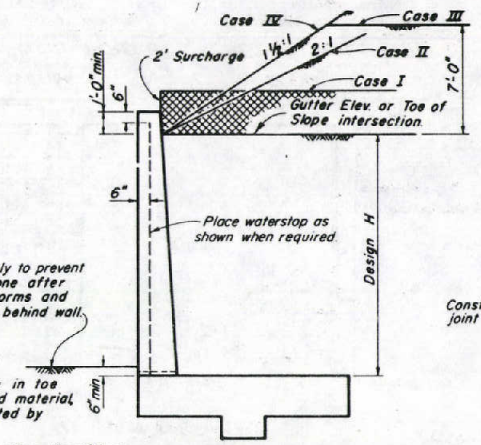
CHIEF BRIDGE ENGR.

ADOPTED: 1/83 REVISION

B-24



SPREAD FOOTING SECTION



Loading Conditions:

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

DESIGN

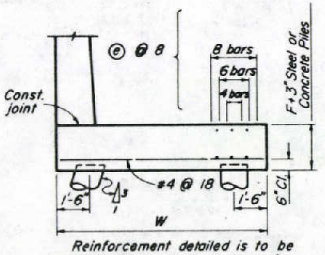
For drainage notes and other details, see Sheet No 27.1.5

MAX. PILE SPACING FOR 45 TON PILES

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

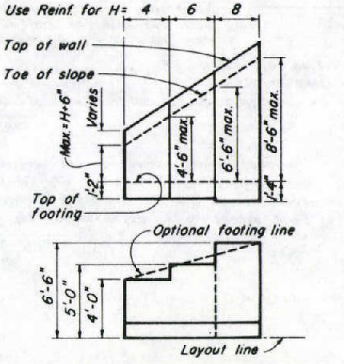
For actual spacing, see Wall Layout.

Pile layout does not apply to Case IV conditions.



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

45T PILE FOOTING SECTION

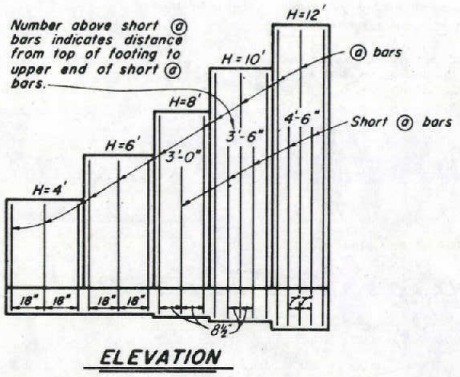


TYPICAL LAYOUT EXAMPLE

For joints required, see Sheet No 27.1.5

TABLE OF REINFORCING STEEL DIMENSIONS AND DATA

Design H ft.		ⓔ 4'	6'	8'	10'	12'
W		4'-0"	5'-0"	6'-6"	8'-0"	9'-6"
F Spread Ftg.		1'-2"	1'-2"	1'-4"	1'-6"	1'-10"
Batter		None	None	None	1/6 : 12	1/4 : 12
	ⓐ bars	#4 @ 18	#5 @ 18	#5 @ 17	#6 @ 17	#6 @ 14
Short	ⓐ bars	None	None	#5 @ 17	#6 @ 17	#6 @ 14
	ⓑ bars	#4 @ 18	#5 @ 18	#5 @ 17	#6 @ 8½	#6 @ 7
Total	ⓔ bars	6 - #7	6 - #7	8 - #7	6 - #7	4 - #7
Toe Pressure	Case I k/sf	1.6	2.2	2.5	3.0	3.5
	Case II k/sf	1.5	2.1	2.7	3.4	4.1
	Case III k/sf	1.6	2.3	2.9	3.8	4.4
	Case IV k/sf	2.0	3.2	4.2	5.3	6.5
Spread Ftg.	Steel lb/ft	16	22	35	55	73
	Conc. c.f./ft	9.4	12.5	17.2	24.4	36.1
Pile Footing	Steel lb/ft	31	36	54	70	85
	Conc. c.f./ft	10.9	12.9	17.9	25.5	36.5



ELEVATION

NOTES

Design Conditions:

Design H may be exceeded by 6" before going to the next size.

Special footing design is required where foundation material is incapable of supporting toe pressure loads listed in table.

Design Data:

f_c = 1300 psi f'_c = 3250 psi f_s = 24,000 psi n = 10 earth = 120 pcf Case I - Wall design for equivalent fluid pressure = 27 and 36 pcf. Case II, III, IV - Wall design is based on Rankine's formula with ϕ = 33°-42'.

Quantities:

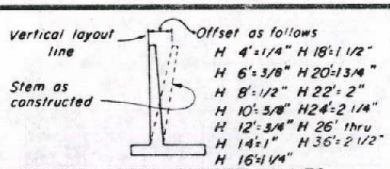
Quantities do not include the wall portion above "Gutter Elevation" and are for design purposes only.

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

RETAINING WALL TYPE 3
H = 4' TO 12'

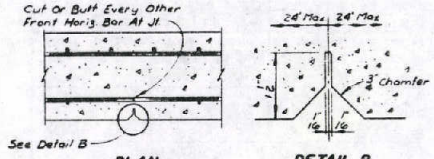
CHIEF BRIDGE ENGR.

8-27.1.4-(502)
ADOPTED: 1/83 REVISION



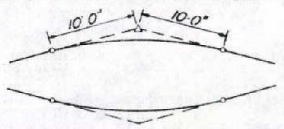
APPROX. WALL OFFSET VALUES

Values for offsetting forms to be determined by the Engineer



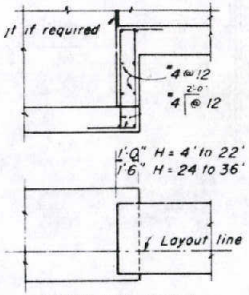
PLAN

DETAIL B

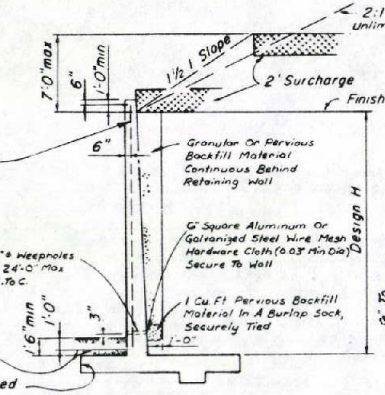


20' VC AT TOP OF WALL SLOPE CHANGE

WHERE SHOWN ON THE PLANS



FOOTING STEP



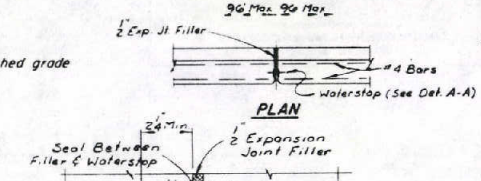
Place waterstop as shown when required

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

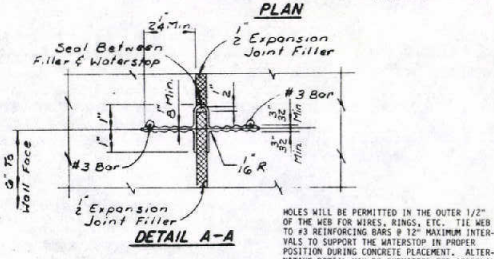
Place concrete in toe against undisturbed material, except as permitted by the Engineer.

DESIGN AND DRAINAGE

Surcharge limits shown apply to Retaining wall Type 1.



PLAN

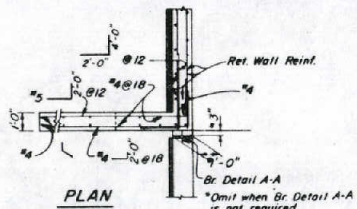


DETAIL A-A

HOLES WILL BE PERMITTED IN THE OUTER 1/2" OF THE WEB FOR WIRES, RINGS, ETC., TIE WEB TO #3 REINFORCING BARS @ 12" MAXIMUM INTERVALS TO SUPPORT THE WATERSTOP IN PROPER POSITION DURING CONCRETE PLACEMENT. ALTERNATIVE DETAIL MAY BE SUBMITTED FOR APPROVAL OF THE ENGINEER.

WATERSTOP TO HAVE 5 OR MORE PAIRS OF RAISED RIBS TO PROVIDE 0.1 SQUARE INCH MINIMUM RIB CROSS-SECTION AREA ON EACH HALF OF THE WATERSTOP. HEIGHT OF RIBS TO BE 3/32" MINIMUM.

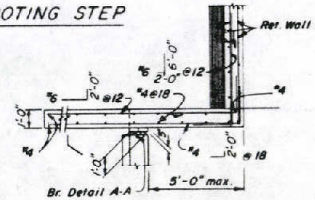
CONTRACTION JOINT



PLAN

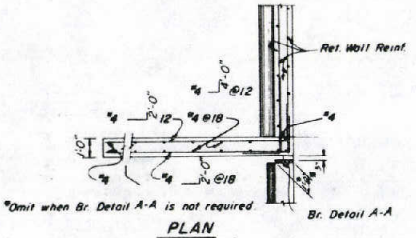
(For Return Wall Type "A")

*Omit when Br. Detail A-A is not required.



PLAN

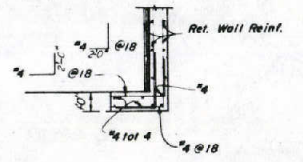
(For Return Wall Type "B")



*Omit when Br. Detail A-A is not required.

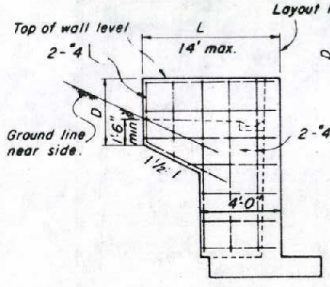
PLAN

(For Return Wall Type "C")



PLAN

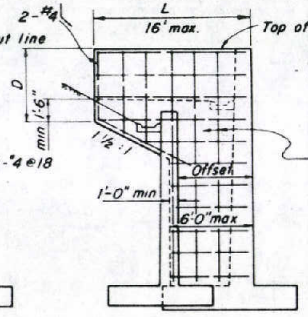
(For Return Wall Type "D")



ELEVATION

RETURN WALL TYPE 'A'

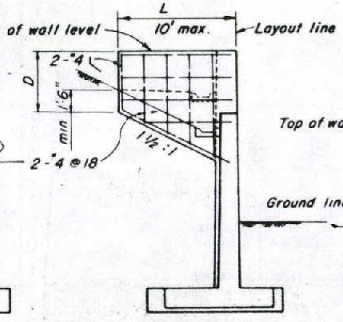
Use where H = 8' or less



ELEVATION

RETURN WALL TYPE 'B'

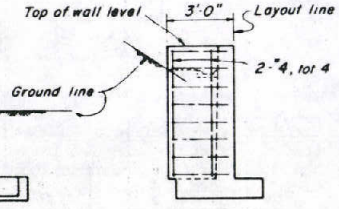
Use where H = 10' or more on offset walls



ELEVATION

RETURN WALL TYPE 'C'

Use where H = 10' or more on straight walls



ELEVATION

RETURN WALL TYPE 'D'

Use where H = 6' or less

NOTES:

Design Conditions:

Design H may be exceeded by 6" before going to the next size.
Special footing design is required where foundation material is incapable of supporting toe pressure loads listed in table
Return wall not required unless shown elsewhere

Design Data:

f'_c = 1300 psi f_c = 3250 psi f_s = 24,000 psi n = 10 earth = 120 pcf
2' Surcharge
Equivalent fluid pressure = 36 pcf max for determination of toe pressure.
27 pcf min. for determination of heel pressure.

Earth pressures for 2:1 unlimited slope, 1½:1 slope, and 1½:1 unlimited slope, determined from Rankine's formula with $\phi = 33°\text{-}42'$.

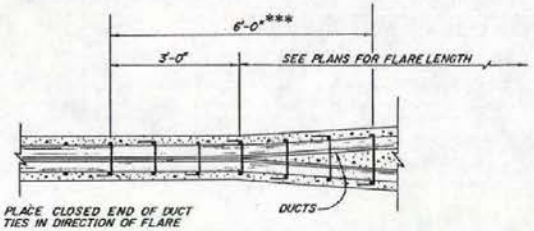
STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

RETAINING WALL DETAILS TYPES 1 2 & 3

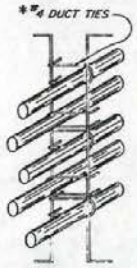
CHIEF BRIDGE ENGR.	B-27.1.5-(502)
	ADOPTED 8 1/83 REVISION

B-26

*** ℄ @ 12" MAX. W/ #4 ⊂ TIE ON EACH DUCT



PLAN



STIRRUP REINFORCEMENT AT FLARE OF GIRDER STEM

DISTRIBUTION OF PRESTRESSING FORCE:

UNLESS OTHERWISE NOTED THE PRESTRESSING FORCE, P JACK OR Pf, SHALL BE DISTRIBUTED WITH AN APPROXIMATELY EQUAL AMOUNT IN EACH GIRDER AND SHALL BE PLACED SYMMETRICALLY ABOUT THE CENTERLINE OF THE STRUCTURE. IN SLABS, THE PRESTRESSING FORCE SHALL BE UNIFORMLY DISTRIBUTED ACROSS THE SLAB.

STRESSING SEQUENCE:

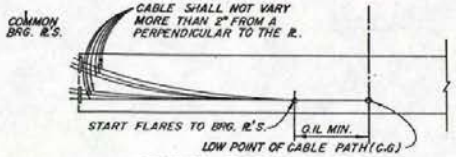
NO MORE THAN 1/2 OF THE PRESTRESSING FORCE IN ANY GIRDER MAY BE STRESSED BEFORE AN EQUAL FORCE IS STRESSED IN THE ADJACENT GIRDERS. AT NO TIME DURING THE STRESSING OPERATIONS WILL MORE THAN 1/6 OF THE TOTAL PRESTRESSING FORCE BE APPLIED ECCENTRICALLY ABOUT THE CENTERLINE OF THE STRUCTURE.

GIRDER STEM SHALL BE FLARED NEAR ANCHORAGE TO PROVIDE A MINIMUM OF 1-1/2" CONCRETE COVERING THE REBAR. FLARE MAY BE ON ONE SIDE OF GIRDER ONLY.

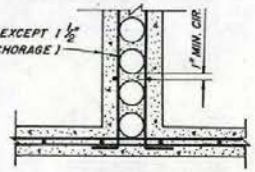
BAR REINFORCEMENT INTERFERING WITH THE PRESTRESSING TENDON ALIGNMENT SHALL BE ADJUSTED AS APPROVED BY THE ENGINEER.

* #BARS MARKED THUSLY ARE TO BE INCLUDED IN THE COST OF PRESTRESSING CAST-IN-PLACE CONCRETE.

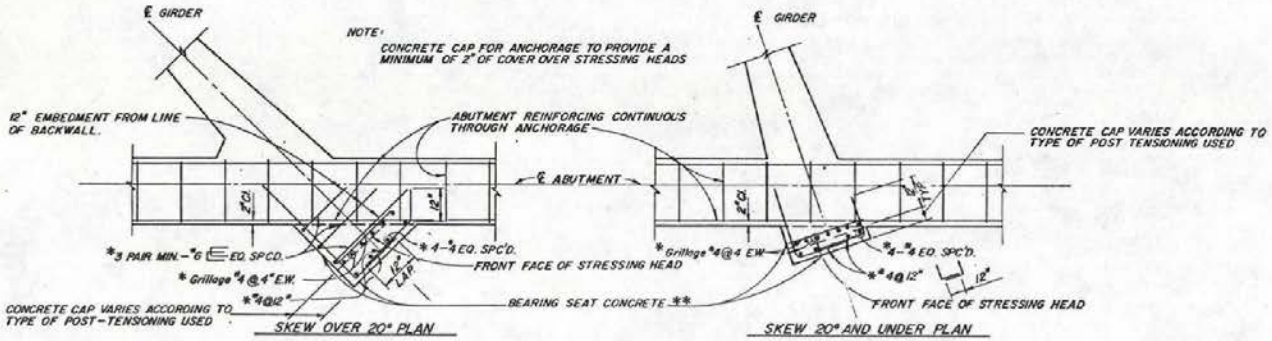
** CONCRETE USED IN THE BEARING SEATS IS TO BE INCLUDED IN THE COST OF PRESTRESSING CAST-IN-PLACE CONCRETE.



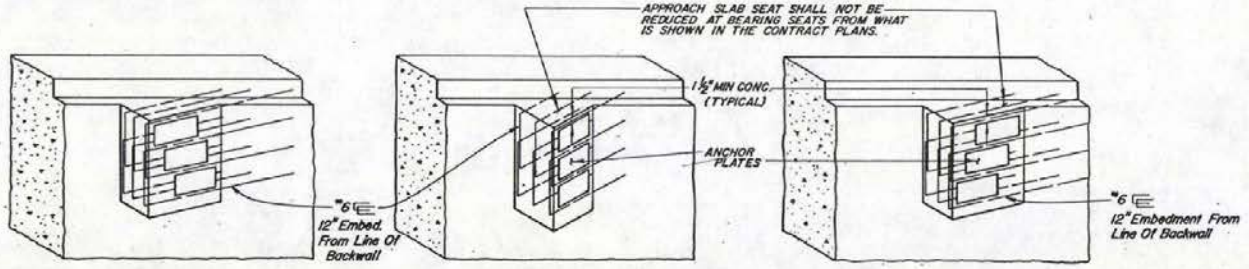
COMMON BEARING PLATE PRESTRESSING PATH



DUCTS OVER 4 1/2" O.D.



BEARING SEAT FOR PRESTRESSED ANCHORAGE AT DIAPHRAGM TYPE ABUTMENTS



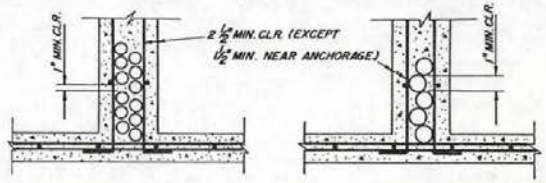
EXT. SLOPING GIRDER

VERTICAL GIRDER

EXT. SLOPING GIRDER

NOTE: DETAILS MAY BE MODIFIED TO SUIT SPECIFIC ANCHORAGE

TYPICAL BEARING SEAT ILLUSTRATIONS



DUCTS 3" O.D. & LESS

DUCTS OVER 3" O.D. TO 4 1/2" O.D.

CLEARANCE REQUIREMENTS FOR DUCTS

1. DUCT PATTERNS SHOWN ARE FOR A 12" WIDE GIRDER STEM; FOR OTHER WIDTHS THE MINIMUM CLEARANCES MUST BE MAINTAINED.
2. VERTICAL DIMENSIONS AT TENTH POINTS TO BE SHOWN IN ORDER TO FACILITATE THE PLACING OF THE DUCTS ACCURATELY.
3. APPROVAL OF THE ENGINEER IS REQUIRED FOR DEVIATIONS.

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

CAST-IN-PLACE PRESTRESSED GIRDER DETAILS

CHIEF BRIDGE ENGINEER

B-26.1.1-(503)

ADOPTED: 3/85 REVISION 12-5-97