

THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY

September 5, 2017

DESIGN BULLETIN No. 17-03

SUBJECT: Breakaway Light Poles Behind Midwest Guardrail System (MGS)

The following revisions to the Illinois Tollway Traffic Barrier Guidelines and Illinois Tollway Standard Drawings have been implemented on the standard offset of ground mounted light poles and the barrier clearance distance behind the Midwest Guardrail System.

The Illinois Tollway Traffic Barrier Guidelines have been revised as follows (attached):

- Page 55, Article 5.12 Barrier Limits Determination
 - Replace Figure 5.12
- Pages 82 and 83, Article 9.2 Barrier Clearance Distance
 - Replace Tables 9.2a and 9.2b with Tables 9.2a, 9.2b and 9.2c
- Pages 83 and 84, Article 9.3 Guardrail Post Spacing Transitions
 - Replace Figure 9.3a and Figure 9.3b

Illinois Tollway Standard C1 has been superseded by the following details (attached):

- Sheet 4 of 4, Galvanized Steel Plate Beam Guardrail
 - Replace Table 2 with Tables 2A and 2B
- No changes to Sheets 1, 2, and 3 of 4

Illinois Tollway Standard H1 has been superseded by the following details (attached):

- Sheets 7, 8 & 9 of 9, Light Standard Foundation
 - Revise offset of center of pole and foundation from edge of paved shoulder from 6'-0" to 7'-0".
- No changes to Sheets 1, 2, 3, 4, 5, and 6 of 9

Design Section Engineers (DSE) are hereby directed to incorporate this Design Bulletin into all contracts currently under design, currently being advertised and all future contracts. DSE's shall use these details instead of Standards C1 and H1. These details will be included in the next release of Illinois Tollway Standard Drawings. In the meantime, DSE's should request MicroStation files for their use. Exceptions to this directive shall be coordinated with the Project Manager and documented as a design deviation.



Paul D. Kovacs, P.E.
Chief Engineer Officer

9/5/17
Date

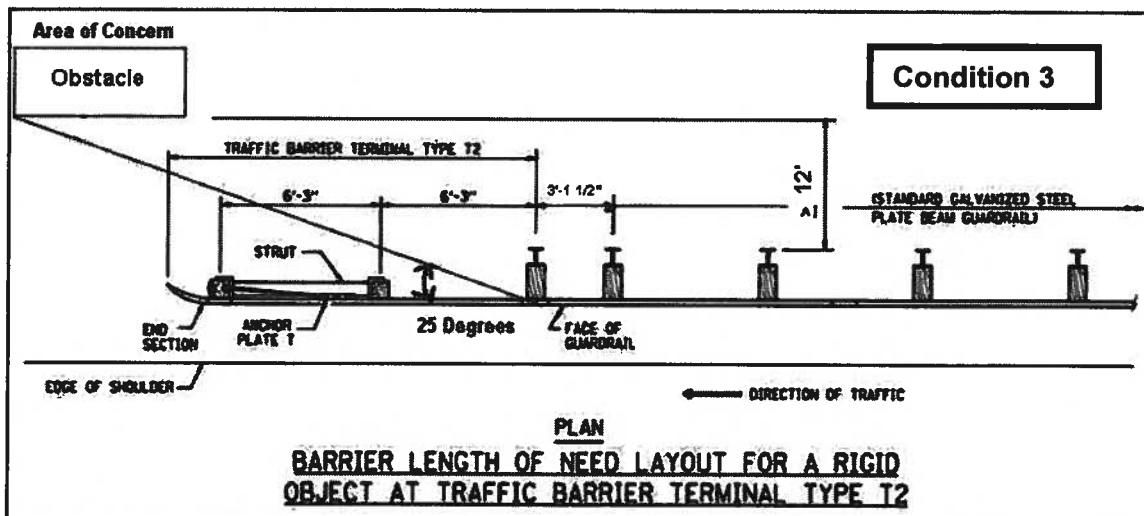
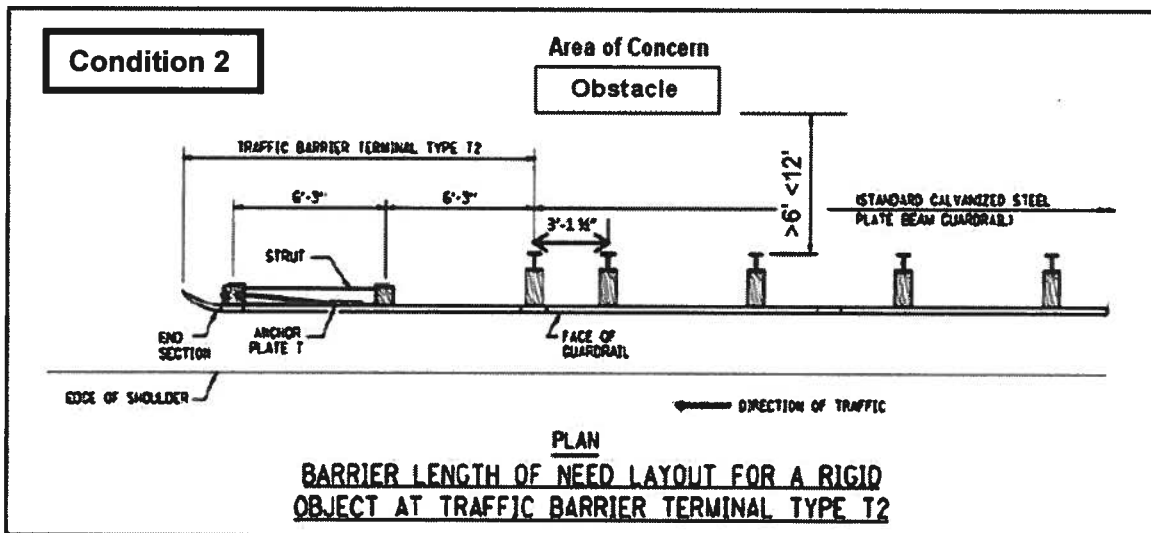
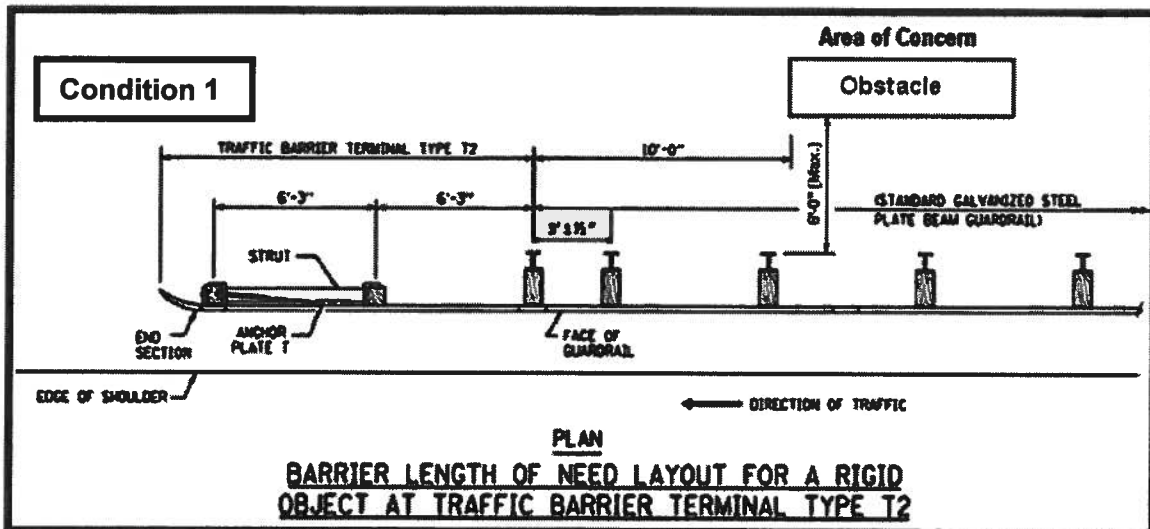


Figure 5.12 Overlapping of Terminal Type T2 with Obstacle

9.2 Barrier Clearance Distance

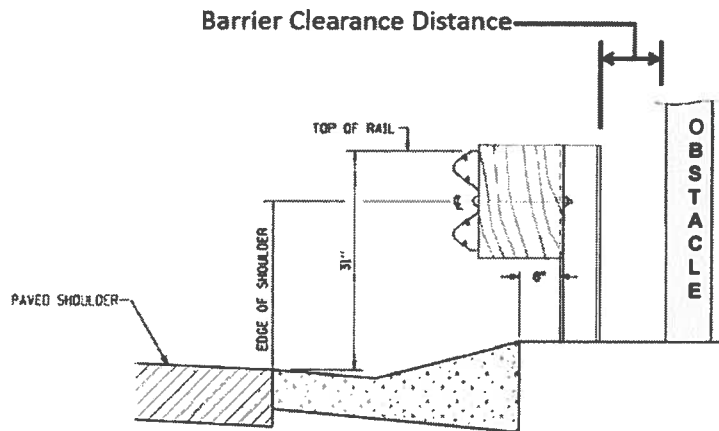


Figure 9.2 Barrier Clearance Distance

No rigid object (including light poles and sign supports on breakaway bases) shall be placed within the barrier clearance distance from the back of the barrier system as shown in Figure 9.2. The barrier clearance distance is a horizontal distance measured perpendicular from a line connecting the back of guardrail posts to the nearest point of the obstacle. Table 9.2a shows the minimum clearance distances for different post spacing of the MGS for new construction and reconstruction. Table 9.2b shows the clearance distances for rehabilitation projects. Table 9.2c shows the clearance distances for NCHRP 350 non-MGS systems.

- The minimum clearance distance shall be met. However, it is desirable to provide more than the minimum clearance distance as long as it is economical to do so.
- Obstacles should be positioned to minimize the use of Type B and Type C post spacing.
- Temporary storage of material and equipment behind guardrail during construction shall be placed according to Article 11.4.1 in the *Illinois Tollway Roadway Traffic Control and Communications Manual*.

Table 9.2a: Barrier Clearance Distance (MGS) New Construction/Reconstruction		
Guardrail System	Post Spacing	Minimum Distance
MGS - 31" Type A	6'- 3"	39"
MGS - 31" Type B ½-Post Spacing	3'- 1½"	34"
MGS - 31" Type C ¼-Post Spacing	1'- 6¾"	26"

Table 9.2b: Barrier Clearance Distance (MGS) Rehabilitation				
Guardrail System	Post Spacing	Minimum Distance		
		Breakaway Light Poles ¹	All Other Obstacles ²	
			NCHRP 350	MASH
MGS - 31" Type A	6'- 3"	20"	28"	39"
MGS - 31" Type B ½-Post Spacing	3'- 1½"	N/A	23"	34"
MGS - 31" Type C ¼-Post Spacing	1'- 6¾"	N/A	14"	26"

1. Existing breakaway light poles behind new guardrail for rehabilitation projects may remain in place if the minimum barrier clearance distances shown are provided.
2. For all other obstacles in rehabilitation projects, minimum barrier clearance distance is dependent on the guardrail standard used for the project (NCHRP 350 or MASH).

Table 9.2c: Barrier Clearance Distance (Previous Standard) NCHRP 350 Non-MGS		
Guardrail System	Post Spacing	Minimum Distance
Retired Standard- 27½" Type A	6'- 3"	36"
Retired Standard- 27½" Type B ½-Post Spacing	3'- 1 ½"	24"

9.3 Guardrail Post Spacing Transitions

In locations where existing obstacles cannot be offset to obtain the minimum required barrier clearance distance, stiffer guardrail transitions shall be accomplished through reduced post spacing. Note that these post spacing transitions shall not be used on any terminals; they can only be used on standard guardrail. See Figure 9.3a for ½-post spacing and Figure 9.3b for ¼-post spacing. These transition details are shown on Illinois Tollway Standard Drawing C1.

In order to eliminate the potential for vehicle pocketing at the segment of ¼-post spacing an upstream guardrail transition region of ½-post spacing shall be added to the W-beam guardrail in order to provide a more gradual change in lateral barrier stiffness. Note that the ½-post spacing usually requires the addition of at least 4 posts and the ¼-post spacing usually requires a minimum of 14 additional posts.

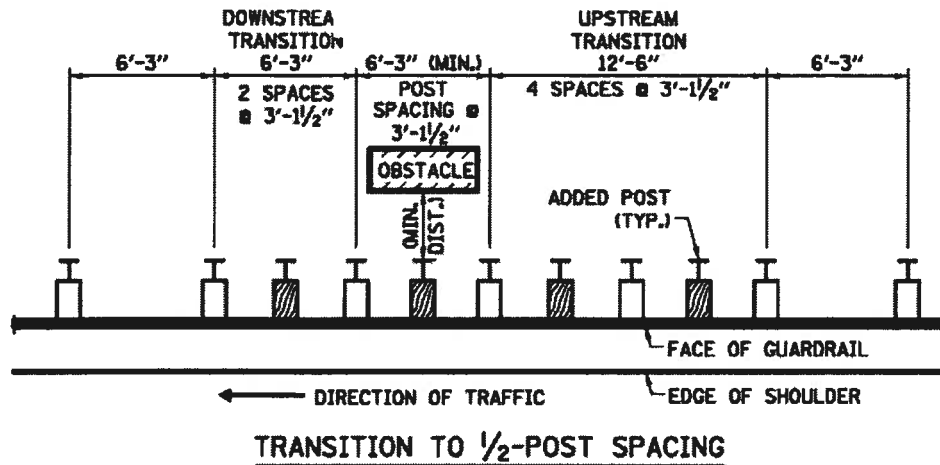
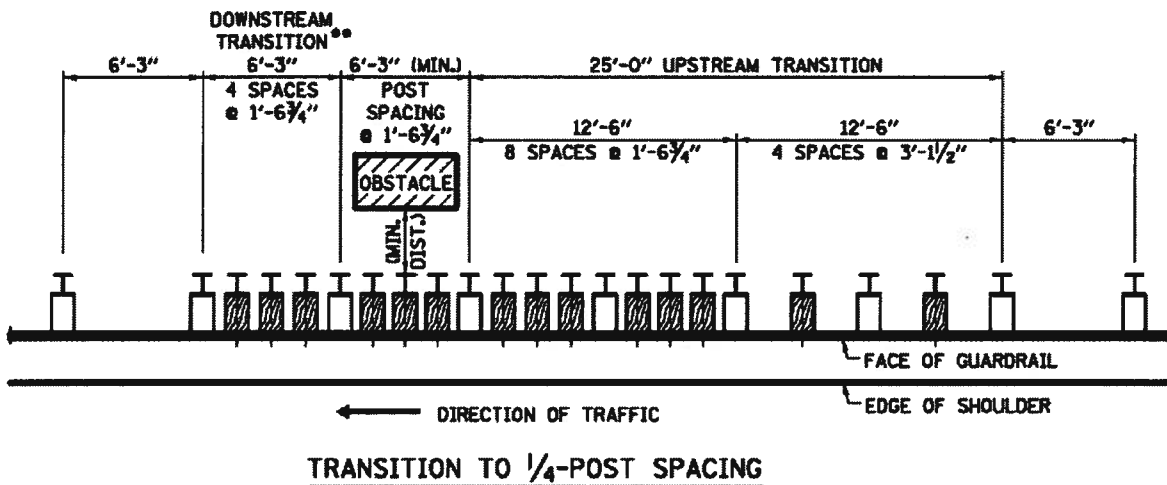


Figure 9.3a Guardrail Post Spacing Transition to 1/2-Post Spacing



** WHEN LENGTH OF OBSTACLES IS 1'-3" OR LESS, THE DOWNSTREAM TRANSITION SHALL BE OMITTED.

Figure 9.3b Guardrail Post Spacing Transition to 1/4-Post Spacing

For locations where the 1/4-post spacing minimum barrier clearance cannot be met, a single-face concrete barrier shall be installed or the obstacle relocated. Double nesting of the W-beam rail elements to stiffen the guardrail is not permitted.

Extended lengths of 1/4-post spacing guardrail are not economical and shall not exceed 100' without approval of the Chief Engineer.

Because these transitions are not typically paid separately, the locations shall be clearly shown on the design plans.

9.4 Drainage Structure Conflict

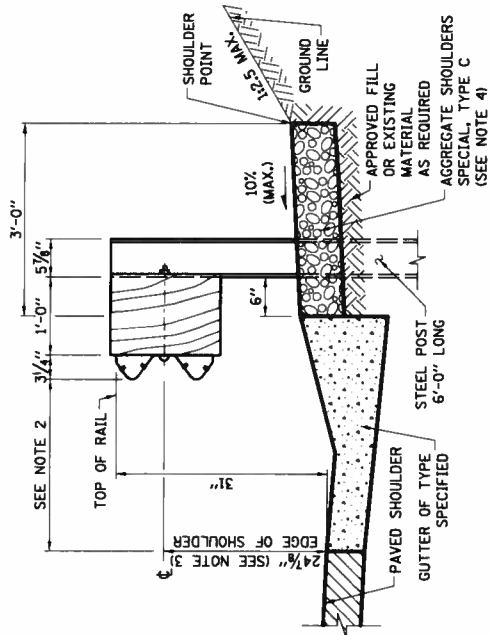
For locations where a guardrail post(s) conflicts with a drainage structure, it is permissible to move the posts apart to straddle the structure; however, the maximum allowable space between posts shall be 1.5 times the standard post spacing for that guardrail installation and the minimum allowable space shall be 0.5 times the standard post spacing. Adjacent posts shall be repositioned as required to meet minimum distance requirements. Posts should not be eliminated; all posts should be used. Also, additional block-outs shall **not** be added to provide a greater offset, in order for the post to avoid an obstacle. See Figure 9.4 and Illinois Tollway Standard Drawing C1.

For Guardrail Type A, which has standard 6'-3" post spacing, the maximum post spacing shall be 9'-4½" and the minimum shall be 3'-1½".

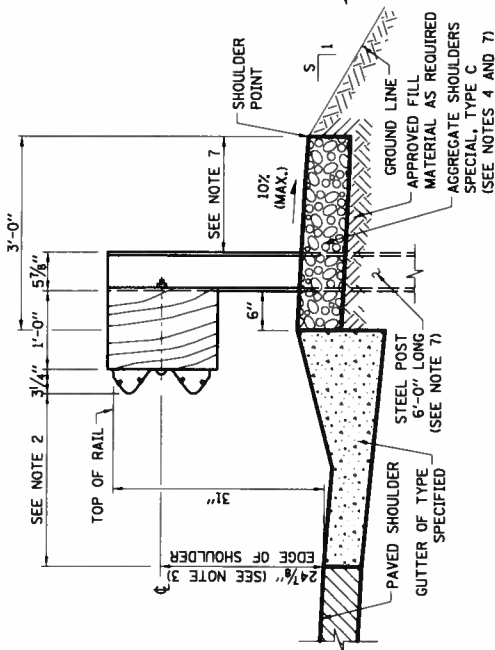
Note that it is not possible to span guardrail across a G-5 drainage structure, because the 9'-4½" maximum post spacing would be exceeded. The Designer should consider using single face reinforced concrete barrier instead.

NOTES:

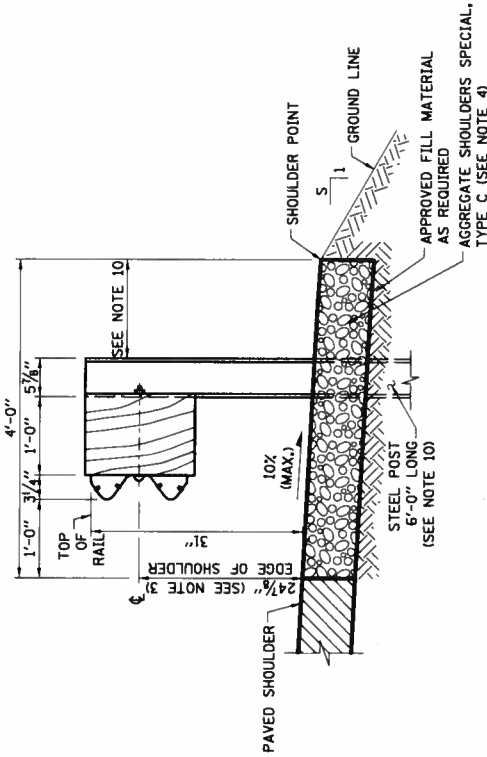
- 1'-0" OFFSET FROM EDGE OF PAVED SHOULDER TO FACE OF RAIL IS TYPICAL FOR ALL INSTALLATIONS WITHOUT GUTTER EXCEPT AS OTHERWISE DETAILED IN THE PLAN DRAWINGS.
- WHERE GUTTERS SUCH AS TYPE G-2, G-3 ARE REQUIRED IN FRONT OF THE GUARDRAIL, THE POSTS SHALL BE LOCATED 6" BEHIND THE GUTTER, OR AS OTHERWISE DETAILED IN THE PLANS. THE OFFSET FROM THE EDGE OF SHOULDER TO THE FACE OF THE GUARDRAIL SHALL BE AS SHOWN ON STANDARD B28.
- THE 2 1/4" TYPICAL RAIL HEIGHT IS MEASURED FROM EXISTING SURFACE 1'-0" IN FRONT OF RAIL, OR FROM EDGE OF SHOULDER/EDGE OF GUTTER WHEN EDGE IS MORE THAN 1'-0" IN FRONT OF RAIL TO CENTER OF RAIL.
- WHERE GUTTER IS PROPOSED WITH GUARDRAIL, A 6" MINIMUM THICKNESS OF AGGREGATE SHOULDERS SPECIAL, TYPE C SHALL BE PLACED BEHIND GUTTER. FOR GUARDRAIL WITHOUT GUTTER, AGGREGATE SHOULDER, TYPE C, OF THE SAME THICKNESS AS PAVED SHOULDER SHALL BE PLACED FROM THE EDGE OF PAVED SHOULDER SLOPING AWAY TO A 6" MIN. THICKNESS.
- GUARDRAIL POSTS SHALL NOT BE ATTACHED TO ANY STRUCTURE.
- PLASTIC BLOCK-OUTS SHALL NOT BE ALLOWED AS A SUBSTITUTE FOR WOOD BLOCK-OUTS ON NEW INSTALLATIONS.
- WHEN S IS GREATER THAN OR EQUAL TO 3 AND 3'-0" AGGREGATE SHOULDER WIDTH CANNOT BE MET, THE POST LENGTH SHALL BE 9'-0" AND THE AGGREGATE SHOULDER WIDTH SHALL BE 1'-0" MIN. BEHIND THE POST TO THE SHOULDER POINT.
- ALL SLOPES ARE EXPRESSED AS UNITS OF VERTICAL DISPLACEMENT TO UNITS OF HORIZONTAL DISPLACEMENTS (V:H).
- UNDER NO CIRCUMSTANCES SHALL AN EXISTING GUARDRAIL THAT WAS DESIGNED USING A PREVIOUS STANDARD, BE EXTENDED, ATTACHED TO OR MODIFIED IN ANYWAY FROM ITS ORIGINAL DESIGN. IF ANY MODIFICATION IS REQUIRED AND A PROPER BARRIER WARRANT HAS BEEN COMPLETED, THE ENTIRE BARRIER INSTALLATION SHALL BE COMPLETELY REMOVED, AND REPLACED WITH A NEW SYSTEM THAT CONFORMS TO THE CURRENT STANDARD.
- WHEN S IS GREATER THAN OR EQUAL TO 3, THE POST LENGTH SHALL BE 9'-0" AND 4'-0" AGGREGATE SHOULDER WIDTH MAINTAINED.
- THE GUARDRAIL SYSTEM HAS BEEN PERFORMANCE-TESTED FOR CRASHWORTHINESS UNDER PROCEDURES DEFINED IN THE NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM (NCHRP) REPORT 350. NO MODIFICATION TO THIS STANDARD DRAWING SHALL BE PERMITTED.
- GUARDRAIL POSTS SHALL NOT BE INSTALLED IN CONCRETE OR ASPHALT PAVEMENT. WHEN NECESSARY USE LEAVE-OUT DETAIL ON SHEET 3 OF 4 OF THIS SERIES.



CUT SECTION WITH GUTTER



FILL SECTION WITH GUTTER

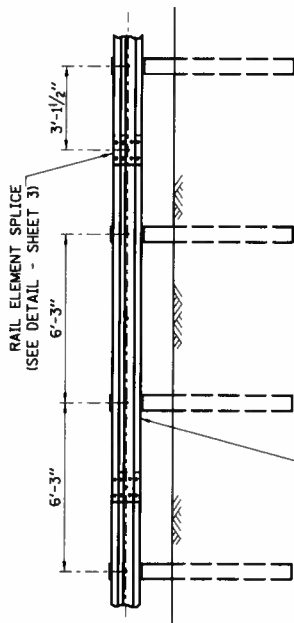


SECTION WITHOUT GUTTER

GUARDRAIL INSTALLATION DETAILS

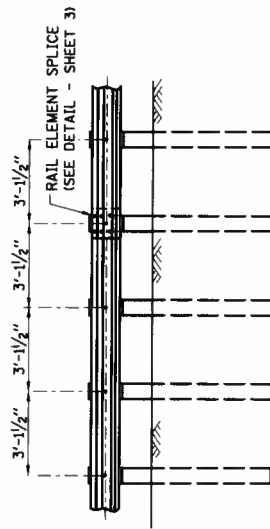
GALVANIZED STEEL PLATE
BEAM GUARDRAIL

SHEET 1 OF 4



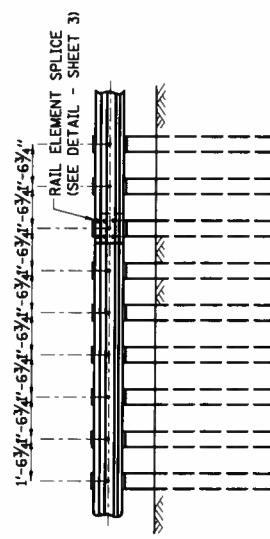
ELEVATION

TYPE A
6'-3" TYPICAL POST SPACING



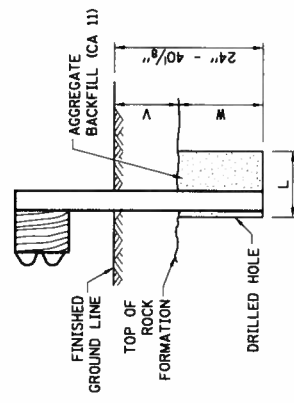
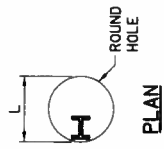
ELEVATION

TYPE B
3'-1/2" 1/2 POST SPACING



ELEVATION

TYPE C
1'-6 3/4" 1/4 POST SPACING



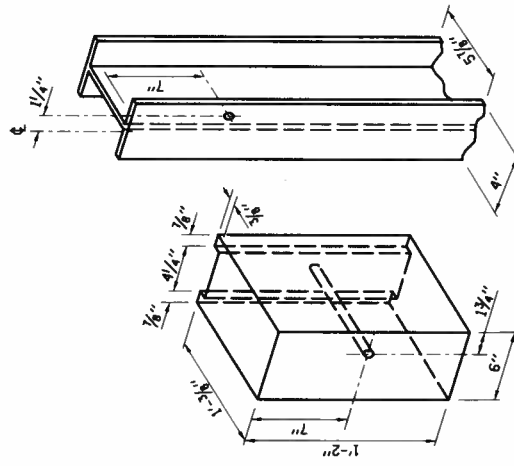
ELEVATION

FOOTING FOR POST WHEN ROCK FORMATION IS ENCOUNTERED

TABLE 1

V	W	L
0 - 16/8"	24"	21"
> 16/8" - 28/8"	12"	8"
> 28/8" - 40/8"	12" - 0 (*)	8"

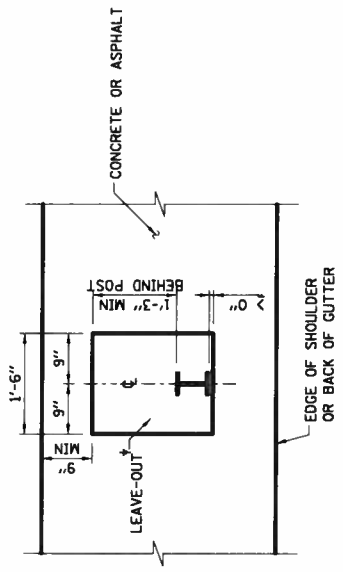
* V + W = 40/8"



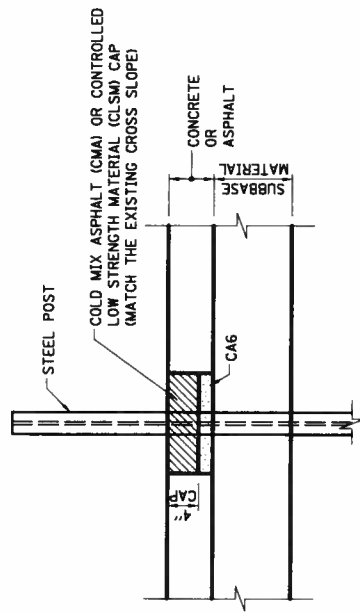
NOTES:
ALL HOLES 3/4" DIA.

WOOD BLOCK-OUT AND STEEL POST DETAILS

TWO-PIECE WOOD BLOCK-OUT OPTION



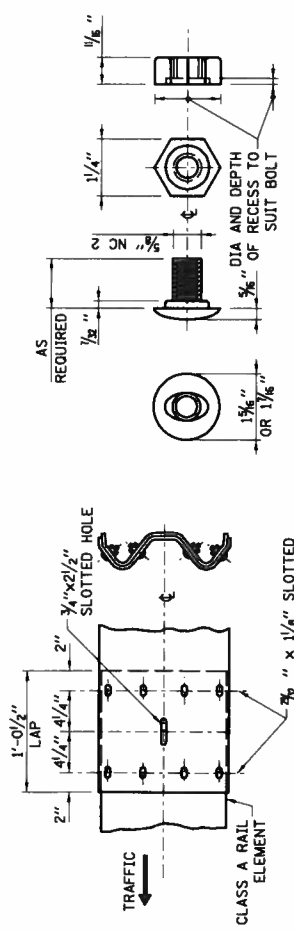
PLAN



ELEVATION

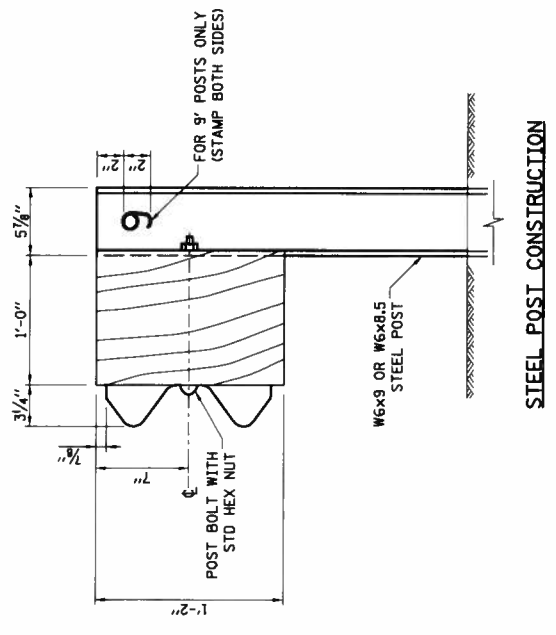
LEAVE-OUTS

† THE AREA AROUND THE POST THAT IS EITHER OMITTED FROM THE NEW CONSTRUCTION OR REMOVED FROM THE EXISTING CONCRETE OR ASPHALT.



POST OR SPLICED BOLT & NUT

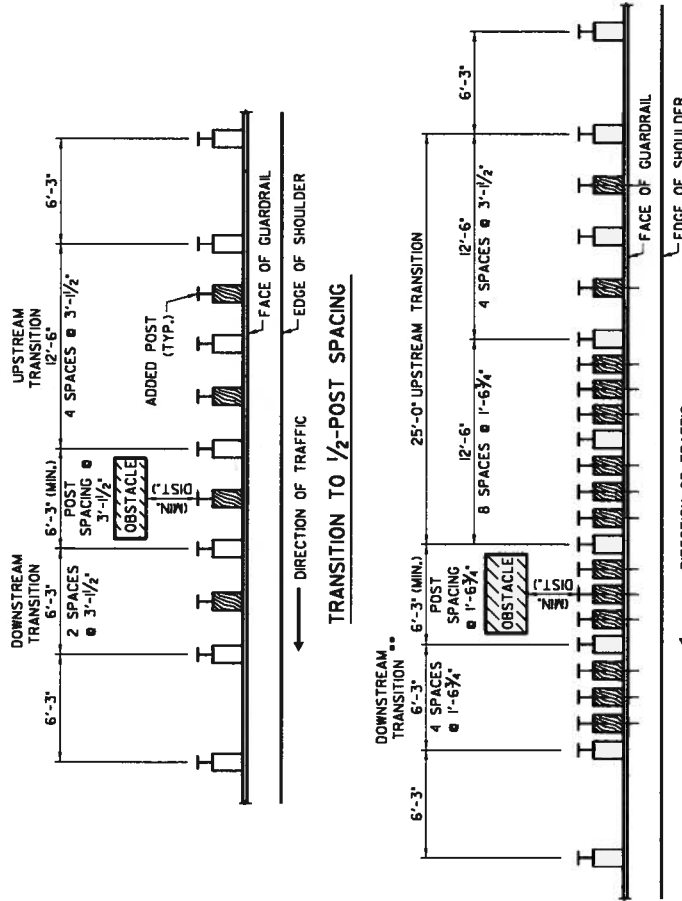
RAIL ELEMENT SPLICED



STEEL POST CONSTRUCTION

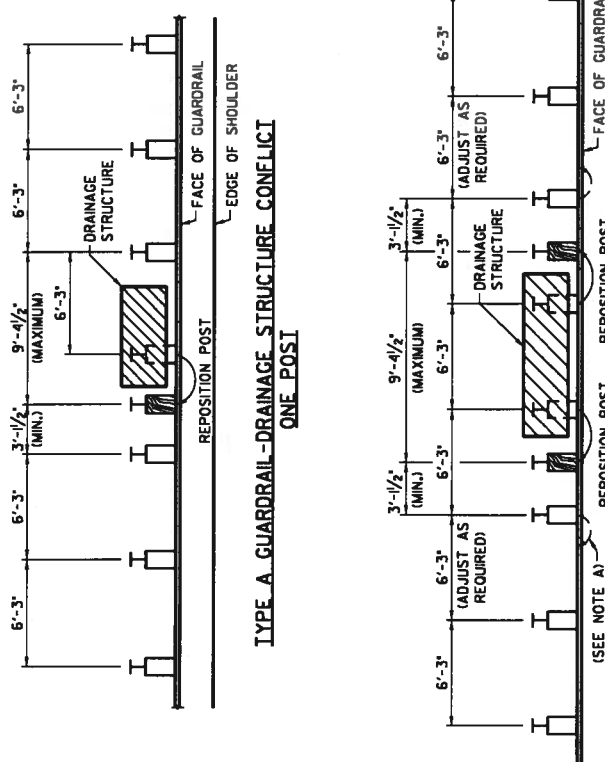
GUARDRAIL SYSTEM	POST SPACING	MINIMUM DISTANCE
TYPE A	6'-3"	39'
TYPE B	3'-1/2"	34'
1/2 POST SPACING		
TYPE C	1'-6 3/4"	26'
1/4 POST SPACING		

GUARDRAIL SYSTEM	POST SPACING	MINIMUM DISTANCE	
		BREAKAWAY LIGHT POLES	ALL OTHER OBSTACLES
TYPE A	6'-3"	20'	28'
TYPE B	3'-1/2"	N/A	23'
1/2 POST SPACING			
TYPE C	1'-6 3/4"	N/A	14'
1/4 POST SPACING			



POST SPACING TRANSITIONS

NOTE: NO MODIFICATIONS OF ANY KIND TO THE TRANSITION POST SPACING ARE ALLOWED.



TYPE A GUARDRAIL - DRAINAGE STRUCTURE CONFLICTS
ONE POST

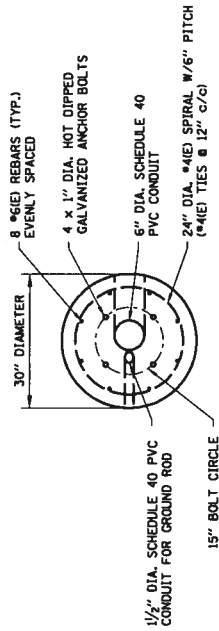
TYPE A GUARDRAIL - DRAINAGE STRUCTURE CONFLICTS
TWO POSTS

DRAINAGE STRUCTURE CONFLICTS

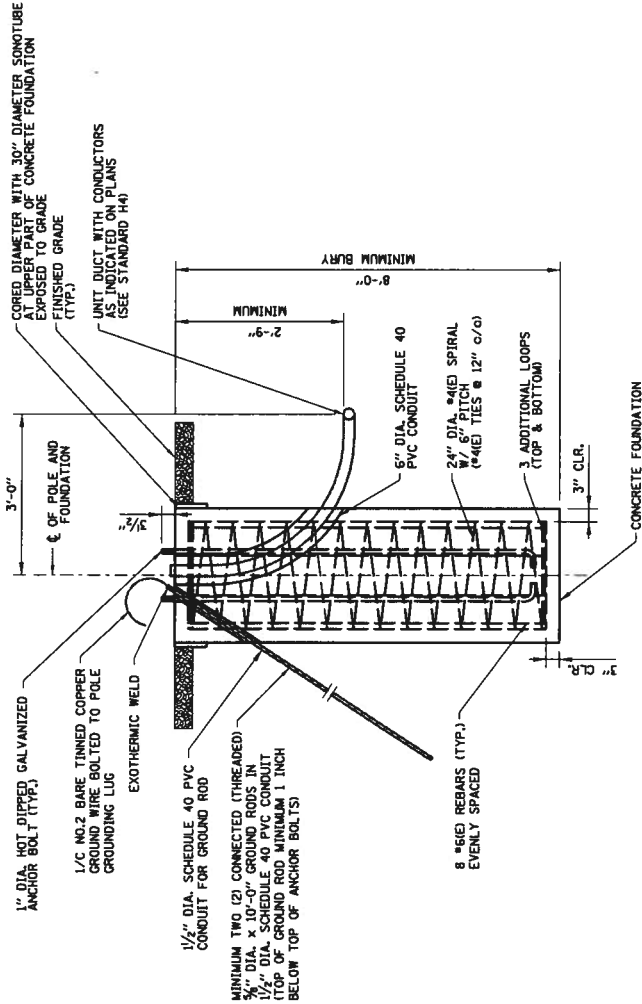
- NOTES:
- A. GUARDRAIL POSTS SHALL NOT BE ELIMINATED; ALL POSTS MUST BE USED. POSTS ADJACENT TO REPOSITIONED POSTS MAY NEED TO BE MOVED TO KEEP 3'-1/2" MINIMUM SPACING.
 - B. GUARDRAIL POSTS SHALL NOT BE SET BACK TO AVOID CONFLICTS WITH A DRAINAGE STRUCTURE.
 - C. THIS DETAIL ALSO APPLIES TO OTHER UNDERGROUND CONFLICTS.

NOTES:

1. AT LOCATIONS NOT SHIELDED BY GUARDRAIL, THE LIGHT POLE FOUNDATION SHALL BE FLUSH WITH SURROUNDING GRADED ON ALL SIDES. THE SURROUNDING AREA SHALL BE A LEVEL, GRADED AREA CONSTRUCTED OF AGGREGATE SHOULDERS WITH FILTER FABRIC, TYPE B, 4".
2. PROVIDE SEEDING, POTASSIUM FERTILIZER NUTRIENT, AND EROSION CONTROL BLANKET AS REQUIRED.
3. THE TOP OF FOUNDATION SHALL BE AT THE SAME ELEVATION AS THE ADJACENT TOP OF CUTTER OR WHEN ADJACENT TO AGGREGATE SHOULDER, AT THE SAME ELEVATION AS THE OUTSIDE EDGE OF THE AGGREGATE SHOULDER SLOPED A MAXIMUM 6% AWAY FROM THE PAVED SHOULDER.
4. ALL SLOPES ARE EXPRESSED AS UNITS OF VERTICAL DISPLACEMENT TO UNITS OF HORIZONTAL DISPLACEMENT (V/H).
5. ALL GROUND MOUNTED LIGHT POLES SHALL BE PROVIDED WITH AN ACCEPTED FHMA BREAKAWAY BASE OR DEVICE PER THE ILLINOIS TOLLWAY SUPPLEMENTAL SPECIFICATIONS SECTION 1070.
6. FOR DETAILS OF FUSE HOLDER, POLE BASE WIRING AND CONDUCTOR SPLICE SEE STANDARD H2.
7. ALL REINFORCEMENT BARS SHALL BE EPOXY COATED.
8. ALL EQUIPMENT SHALL BE GROUNDED AND BONDED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE AND THE NATIONAL ELECTRICAL SAFETY CODE.
9. FOR ALL MEDIAN BARRIER FOUNDATIONS, THE ANCHOR BOLTS SHALL BE CENTERED AROUND THE MEDIAN BARRIER WALL CENTERLINE.



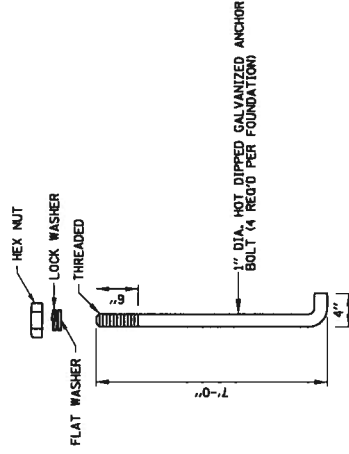
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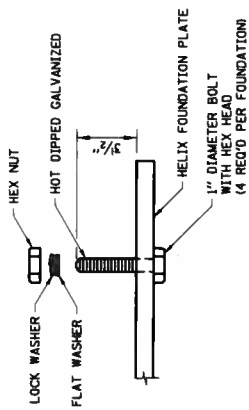


ELEVATION

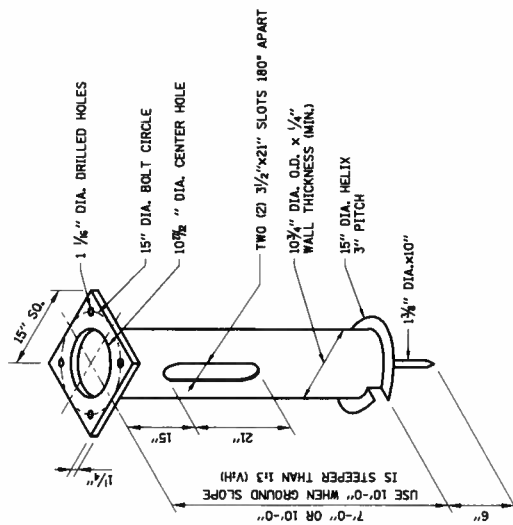
**LIGHT STANDARD FOUNDATION DETAILS - CONCRETE
(GROUND MOUNTED UNITS)**

ANCHOR BOLT DETAIL

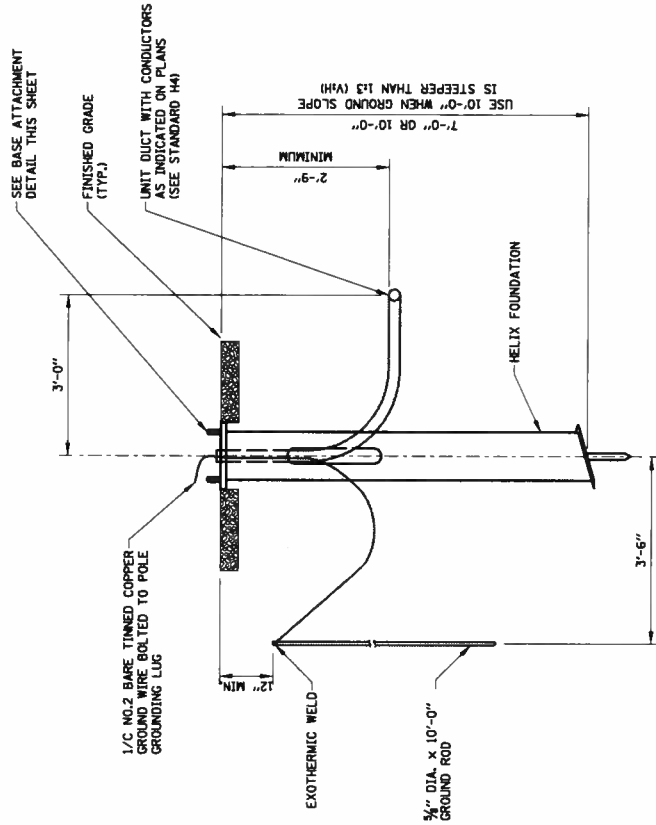




BASE ATTACHMENT DETAIL



ISOMETRIC



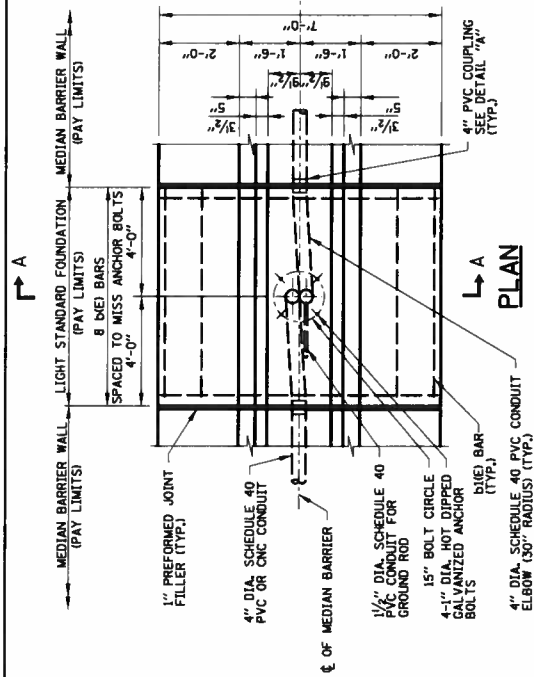
ELEVATION

**LIGHT STANDARD FOUNDATION DETAILS - HELIX
 (GROUND MOUNTED UNITS)**

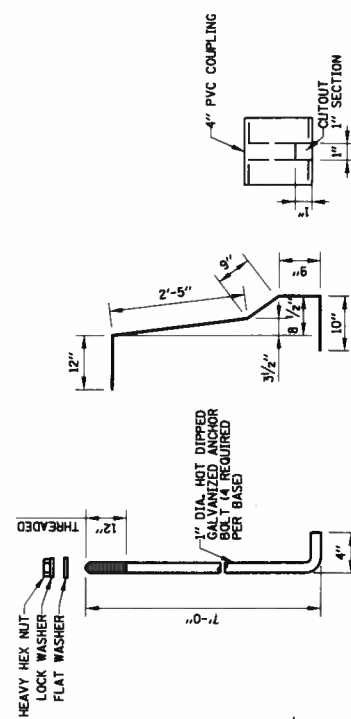
NOTES:
 SEE SHEET 1 OF THIS SERIES FOR NOTES.

LIGHT STANDARD FOUNDATION

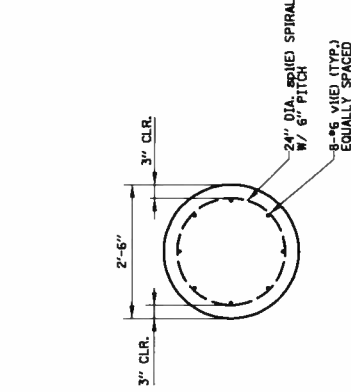
SHEET 2 OF 9



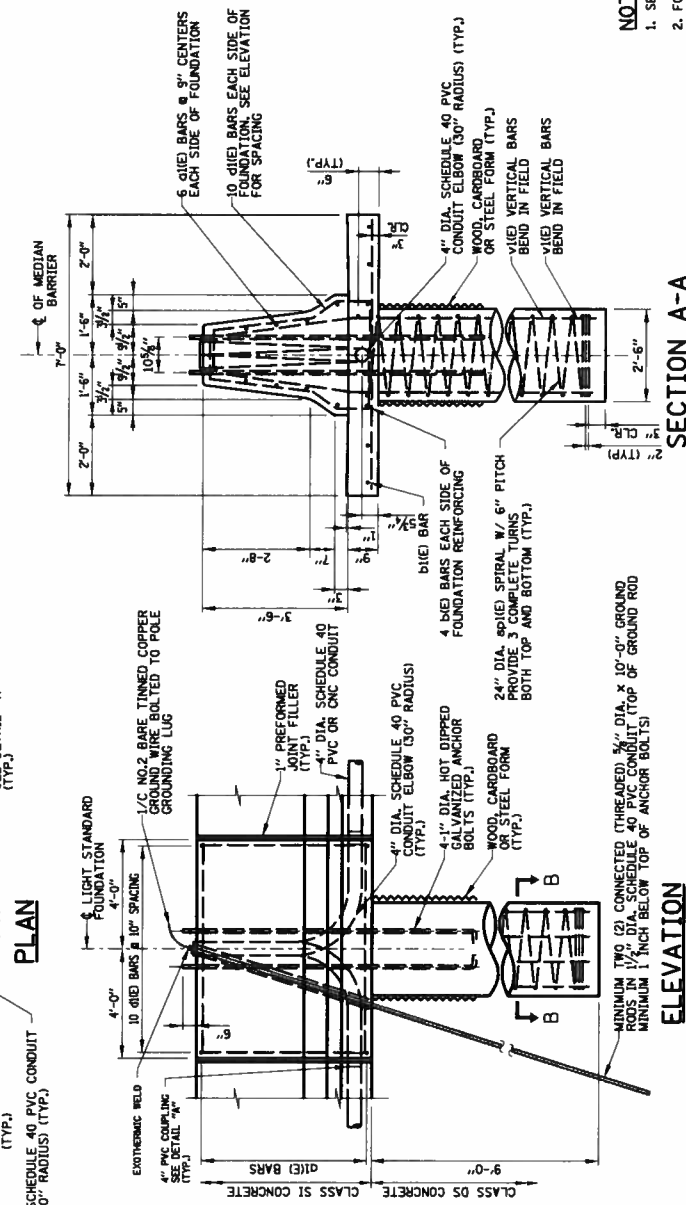
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ANCHOR BOLT DETAIL



SECTION B-B



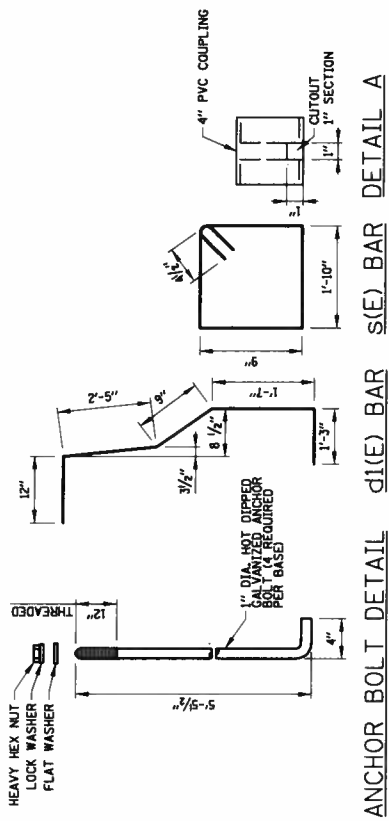
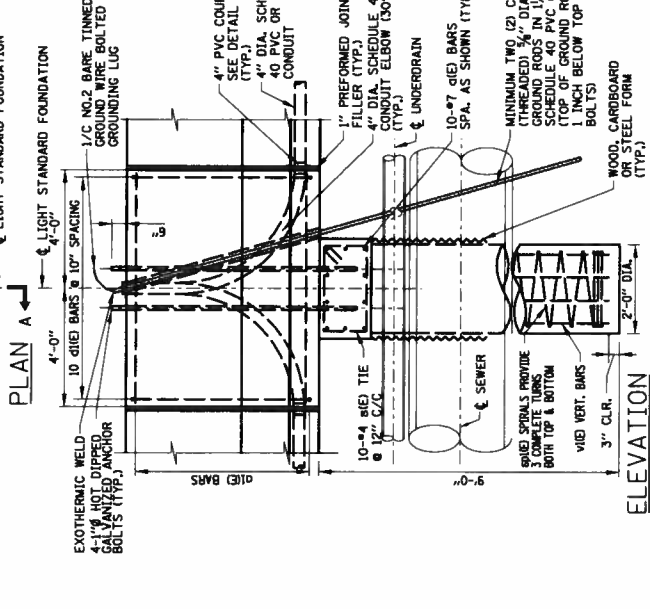
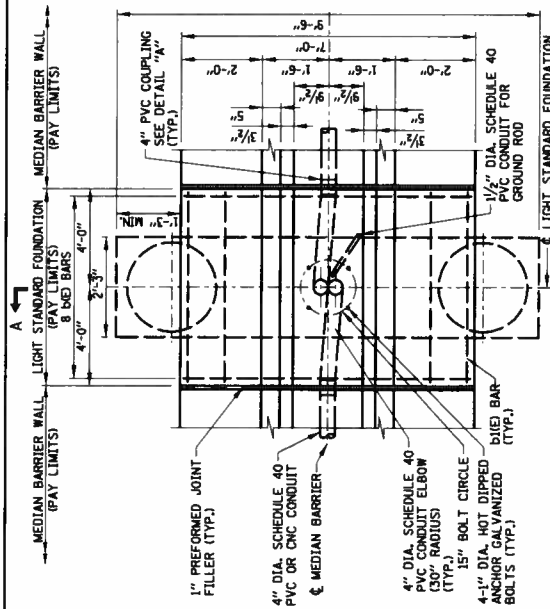
SECTION A-A

- NOTES:**
1. SEE SHEET 1 OF THIS SERIES FOR NOTES.
 2. FOR SLIP FORM, SEE SHEET 6 OF THIS SERIES.

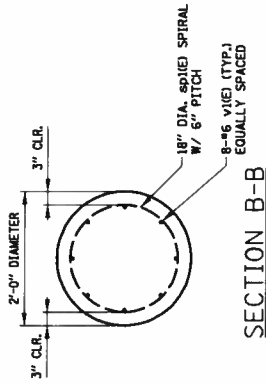
REINFORCEMENT BARS SCHEDULE			
BAR NO.	SIZE	LENGTH	WT. SHAPE
d1(E)	12	7'-6"	60
d1(E)	8	6'-6"	35
d1(E)	4	7'-8"	21
d1(E)	20	4	5'-9"
d1(E)	1	4	6
v1(E)	8	11'-9"	142

• SEE SECTION A-A

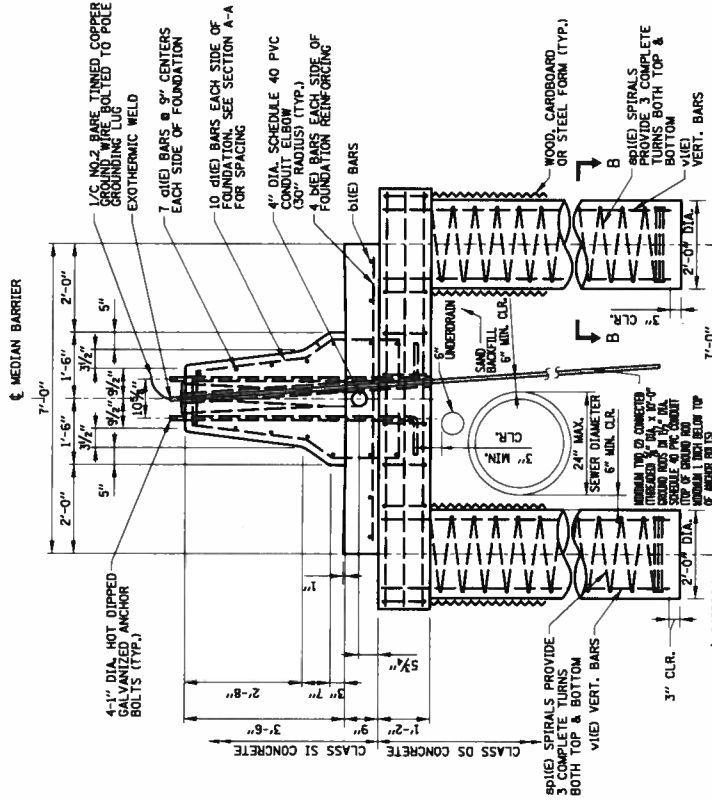
LIGHT STANDARD FOUNDATION DETAILS - MEDIAN BARRIER
(TYPE 1 CENTERED CAISSON, 42" BARRIER)



ANCHOR BOLT DETAIL d1(E) BAR S(E) BAR DETAIL A



SECTION B-B



SECTION A-A

BAR	NO.	SIZE	LENGTH	WT. LBS.	SHAPE
d1(E)	10	#7	9'-0"	184	—
d1(E)	14	#4	7'-6"	70	—
d1(E)	8	#4	6'-6"	35	—
d1(E)	4	#4	7'-8"	21	—
d1(E)	20	#4	6'-7"	88	—
d1(E)	10	#4	5'-11"	40	—
d1(E)	2	#4	#	#	—
v1(E)	16	#6	9'-9"	235	—

* SEE ELEVATION

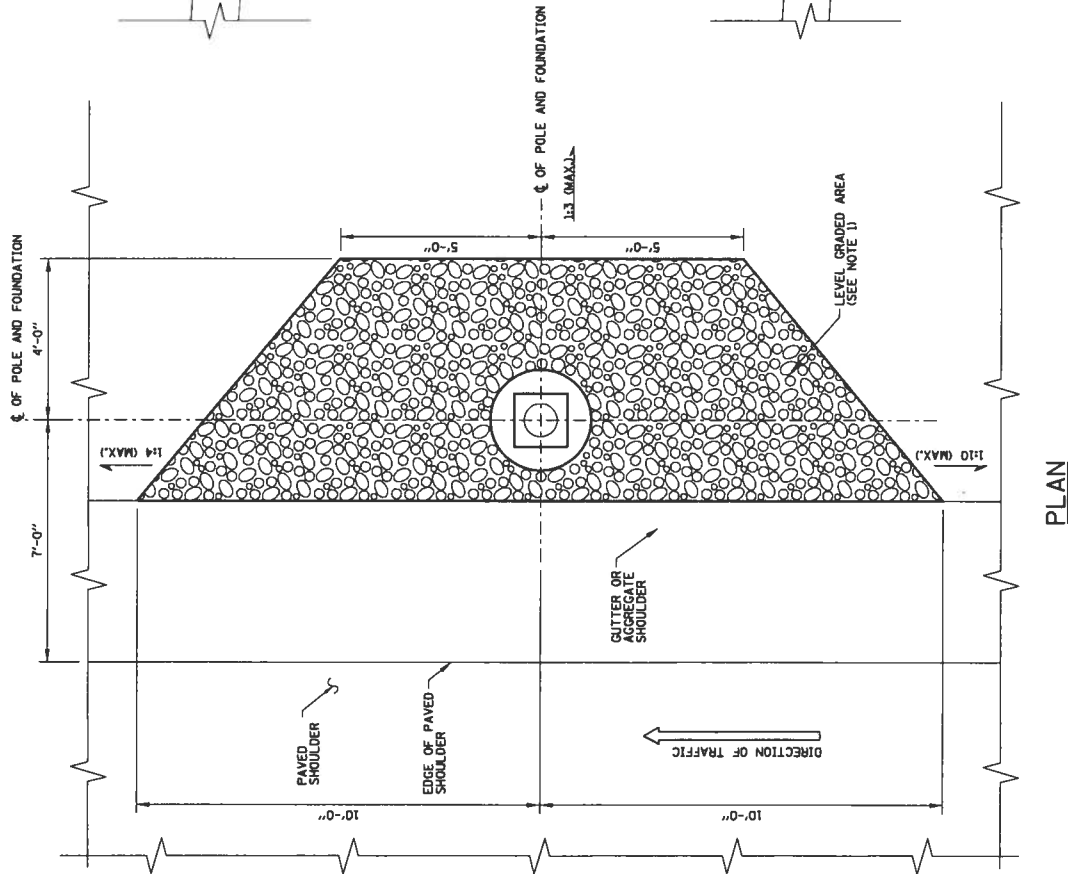
NOTES:

1. SEE SHEET 1 OF THIS SERIES FOR NOTES.
2. FOR SLIP FORM, SEE SHEET 6 OF THIS SERIES.

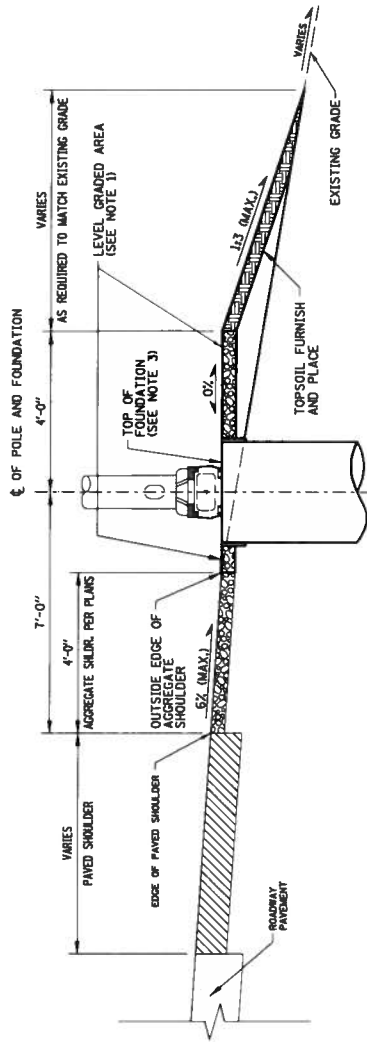
LIGHT STANDARD FOUNDATION DETAILS - MEDIAN BARRIER (TYPE 3 STRADDLED CAISSON, 42" BARRIER)

LIGHT STANDARD FOUNDATION

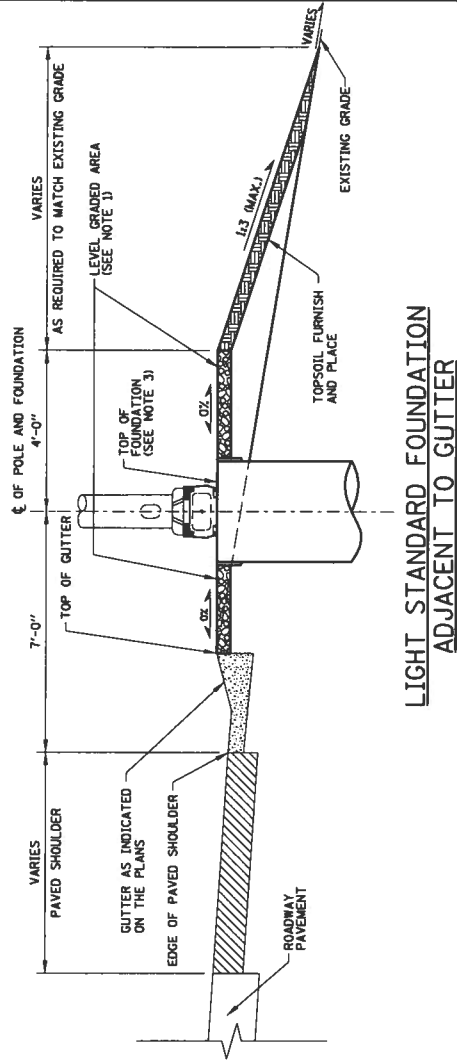
SHEET 5 OF 9



PLAN



LIGHT STANDARD FOUNDATION
ADJACENT TO AGGREGATE SHOULDER



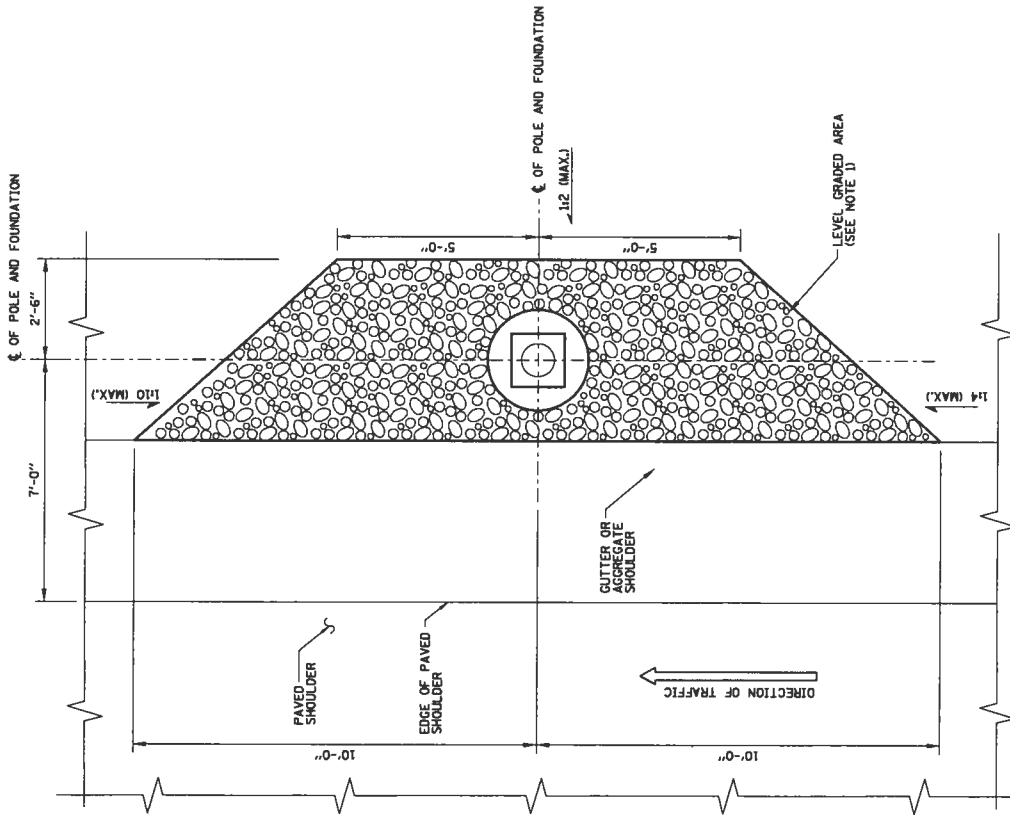
LIGHT STANDARD FOUNDATION
ADJACENT TO GUTTER

LIGHT STANDARD FOUNDATION DETAILS - GRADING W/ FORESLOPE
(GROUND MOUNTED UNITS)

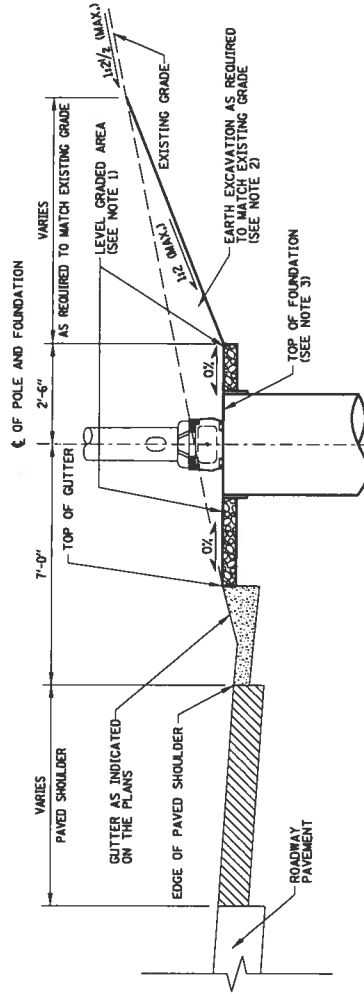
NOTE:
SEE SHEET 1 OF THIS SERIES FOR NOTES.

LIGHT STANDARD
FOUNDATION

SHEET 7 OF 9



PLAN



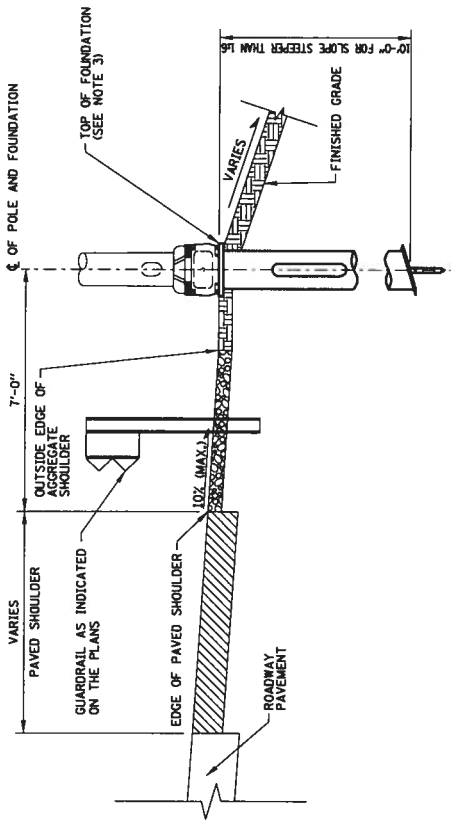
LIGHT STANDARD FOUNDATION
ADJACENT TO GUTTER

LIGHT STANDARD FOUNDATION DETAILS - GRADING W/ BACKSLOPE
(GROUND MOUNTED UNITS)

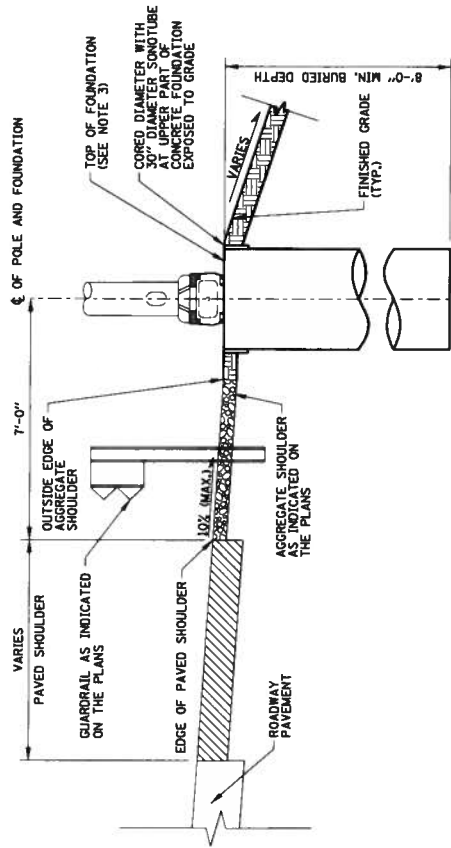
NOTE:
SEE SHEET 1 OF THIS SERIES FOR NOTES.

LIGHT STANDARD
FOUNDATION

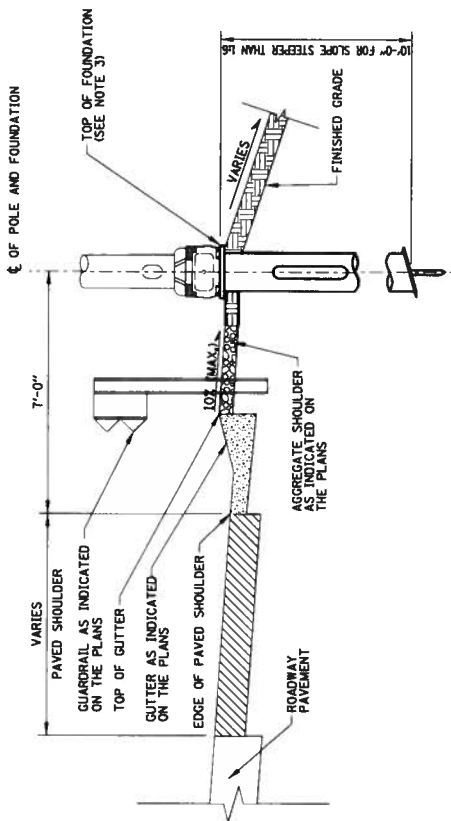
SHEET 8 OF 9



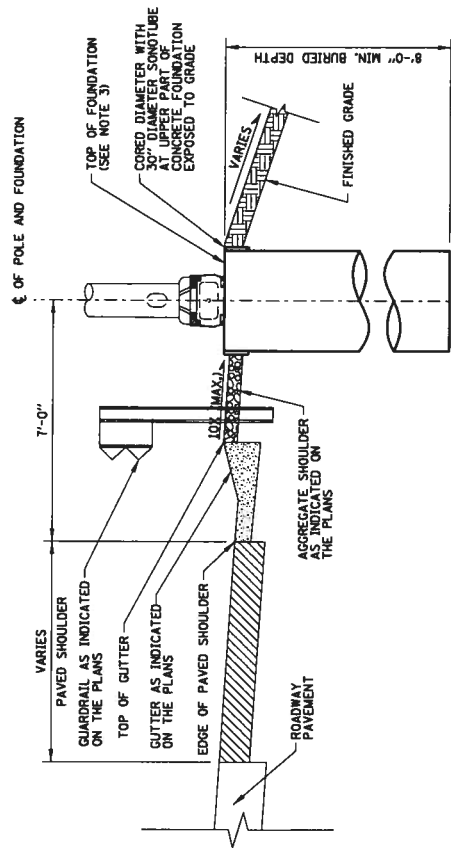
**LIGHT STANDARD FOUNDATION - HELIX
ADJACENT TO AGGREGATE SHOULDER**



**LIGHT STANDARD FOUNDATION - CONCRETE
ADJACENT TO AGGREGATE SHOULDER**



**LIGHT STANDARD FOUNDATION - HELIX
ADJACENT TO GUTTER**



**LIGHT STANDARD FOUNDATION - CONCRETE
ADJACENT TO GUTTER**

**LIGHT STANDARD FOUNDATION DETAILS - ADJACENT TO GUARDRAIL
(GROUND MOUNTED UNITS)**

NOTE:
SEE SHEET 1 OF THIS SERIES FOR NOTES.