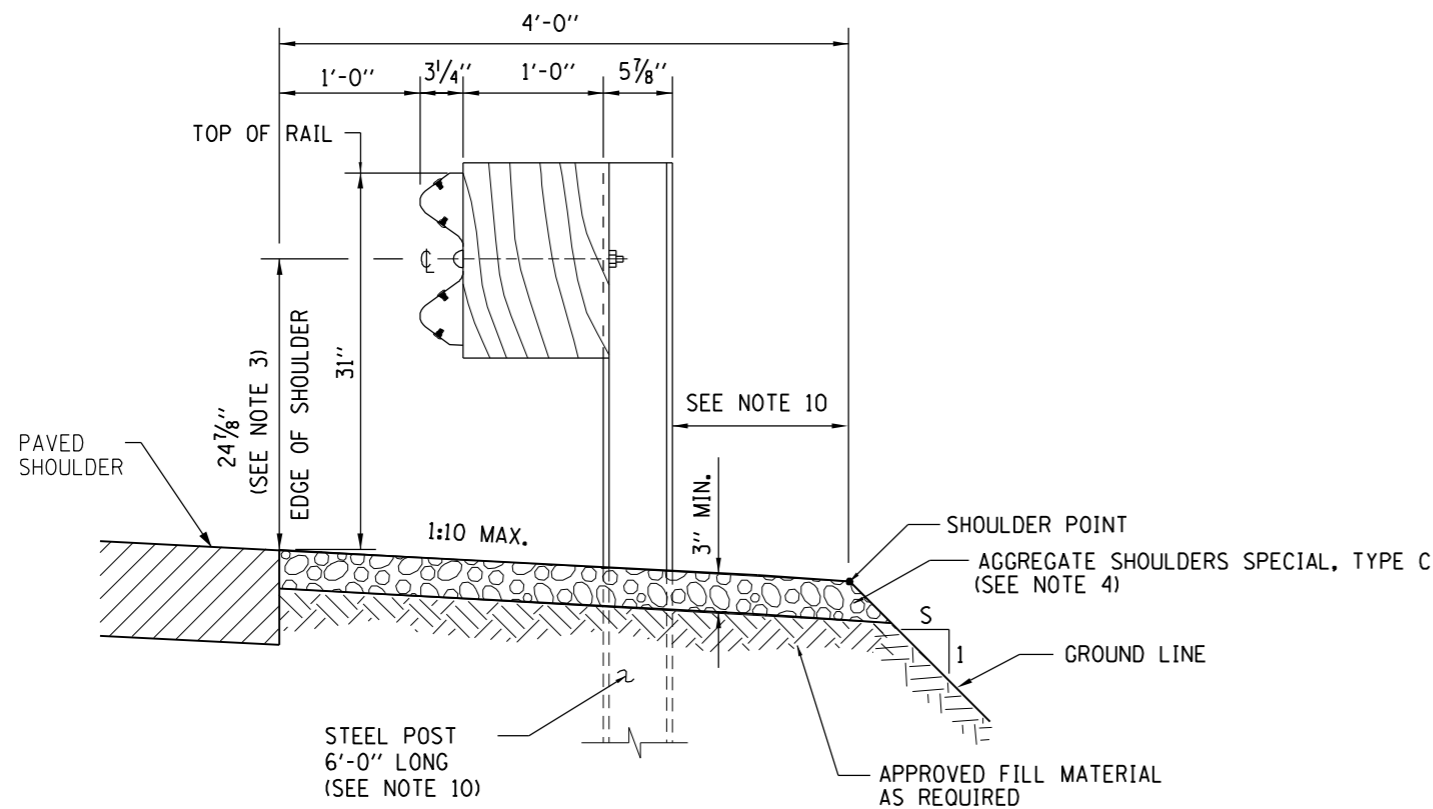


SECTION WITH GUTTER



SECTION WITHOUT GUTTER

NOTES:

- 1' OFFSET FROM EDGE OF PAVED SHOULDER TO FACE OF RAIL IS TYPICAL FOR ALL INSTALLATIONS 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 24 7/8" TYPICAL RAIL HEIGHT IS MEASURED FROM EXISTING SURFACE 1' IN FRONT OF RAIL, OR FROM EDGE OF SHOULDER/EDGE OF GUTTER WHEN EDGE IS MORE THAN 1' IN FRONT OF RAIL TO CENTER OF RAIL.
- AGGREGATE SHOULDERS SPECIAL, TYPE C SHALL COMPLY WITH THE REQUIREMENTS OF THE TOLLWAY RECURRING SPECIAL PROVISION. WHERE GUTTER IS PROPOSED WITH GUARDRAIL, A 3" MINIMUM THICKNESS OF AGGREGATE SHOULDERS SPECIAL, TYPE C SHALL BE PLACED BEHIND CURB. FOR GUARDRAIL WITHOUT CURB & GUTTER, AGGREGATE SHOULDER, OF THE SAME THICKNESS SHALL BE PLACED FROM THE EDGE OF PAVED SHOULDER SLOPING AWAY TO A 3" MIN. THICKNESS.
- AGGREGATE SHOULDERS SPECIAL, TYPE C SHALL EXTEND A MINIMUM OF 1' BEHIND POST OR GUARDRAIL, WHICHEVER IS FURTHER, EXCEPT AS DETAILED ELSEWHERE IN THE PLANS.
- PLASTIC BLOCK-OUTS SHALL NOT BE ALLOWED AS A SUBSTITUTE FOR WOOD BLOCK-OUTS ON NEW INSTALLATIONS.
- WHEN $S \leq 3$ AND 3'-0" MIN. AGGREGATE SHOULDER CANNOT BE MET, THE POST LENGTH SHALL BE 9'-0" AND THE MIN. AGGREGATE SHOULDER SHALL BE 1'-0" MEASURED DISTANCE BEHIND 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 $S \leq 3$, THE POST LENGTH SHALL BE 9'-0" AND 4' 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 HMA PAVEMENT. WHEN NECESSARY USE LEAVE-OUT DETAIL ON SHEET 4 OF 4 OF THIS SERIES.
- GUARDRAIL POSTS SHALL NOT BE ATTACHED TO ANY STRUCTURE.



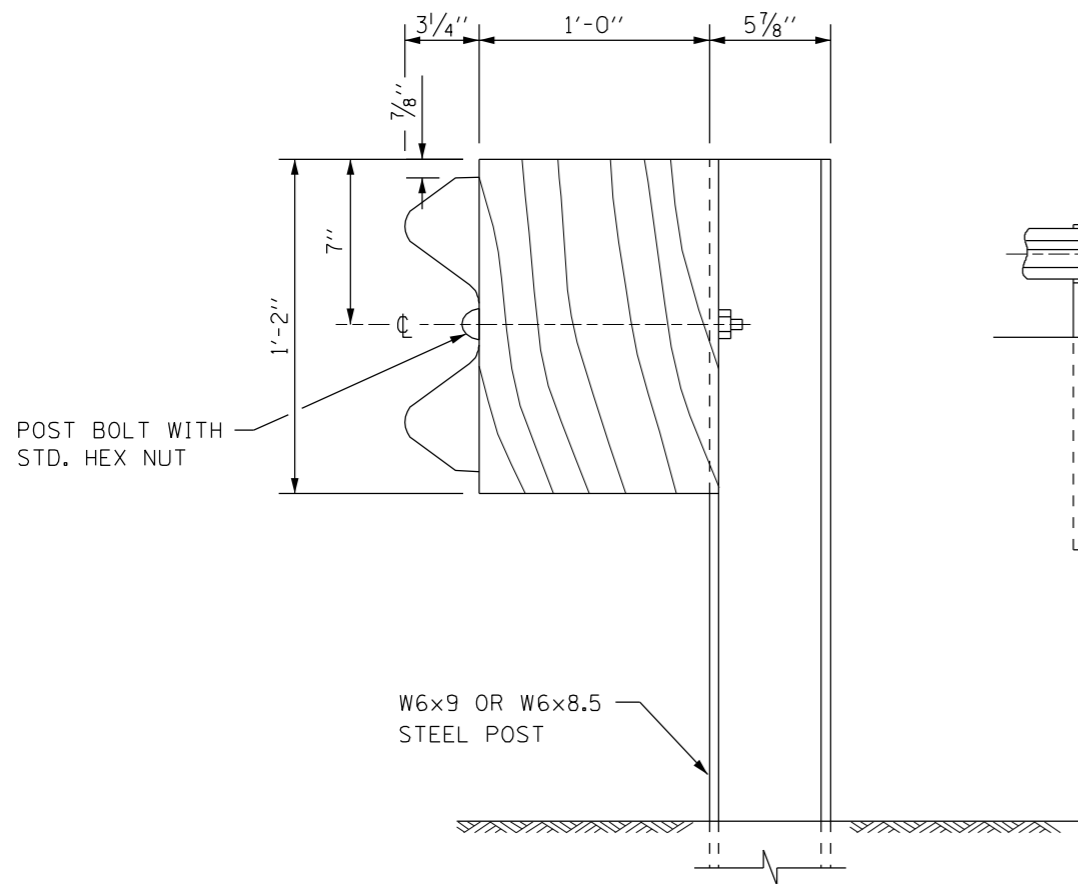
GUARDRAIL INSTALLATION DETAILS

APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 7-1-2009

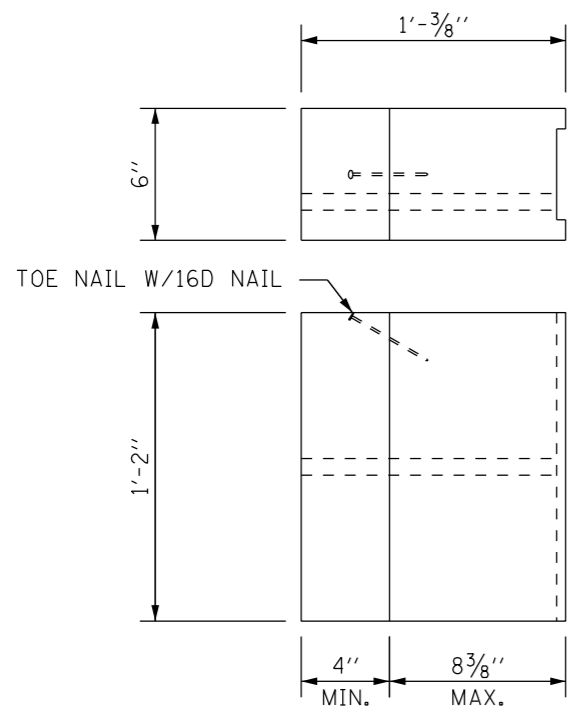
REVISIONS	
7-1-2009	REVISED DIMENSIONS, NOTES AND ADDED DETAILS
3-1-2010	REVISED AGGREGATE SHOULDER DIMENSIONS AND NOTES ADDED GUARDRAIL POST LEAVE-OUTS
1-1-2011	SHEET LAYOUT REVISIONS AND CLARIFICATIONS.

GALVANIZED STEEL PLATE
BEAM GUARDRAIL

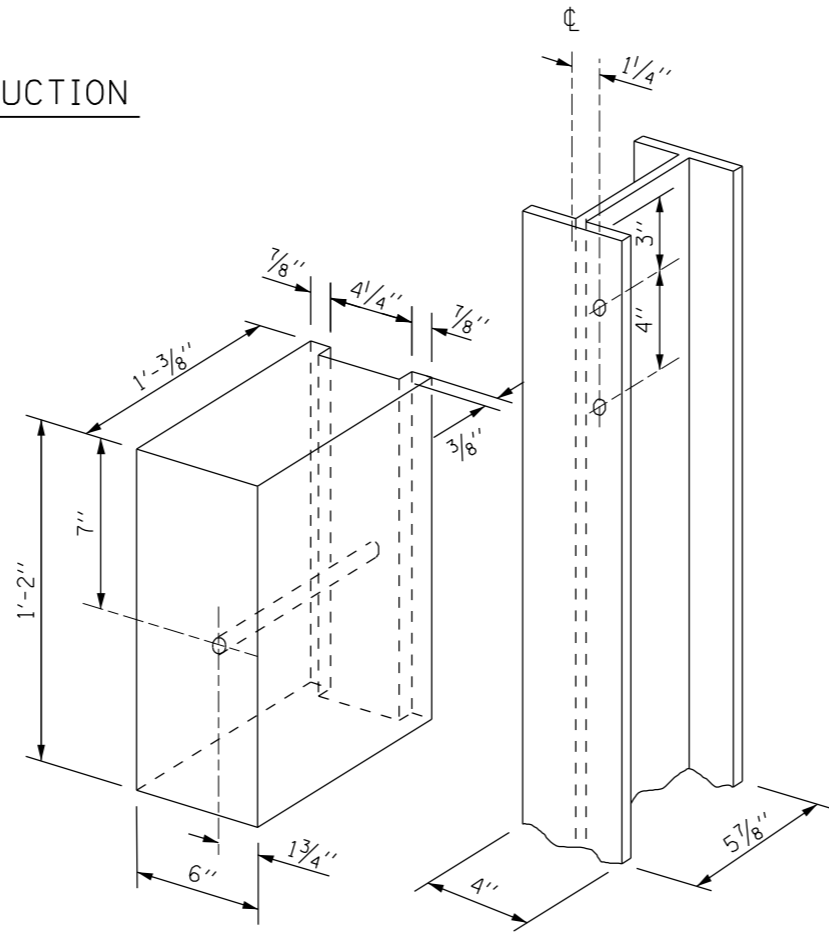
STANDARD C1-04



STEEL POST CONSTRUCTION

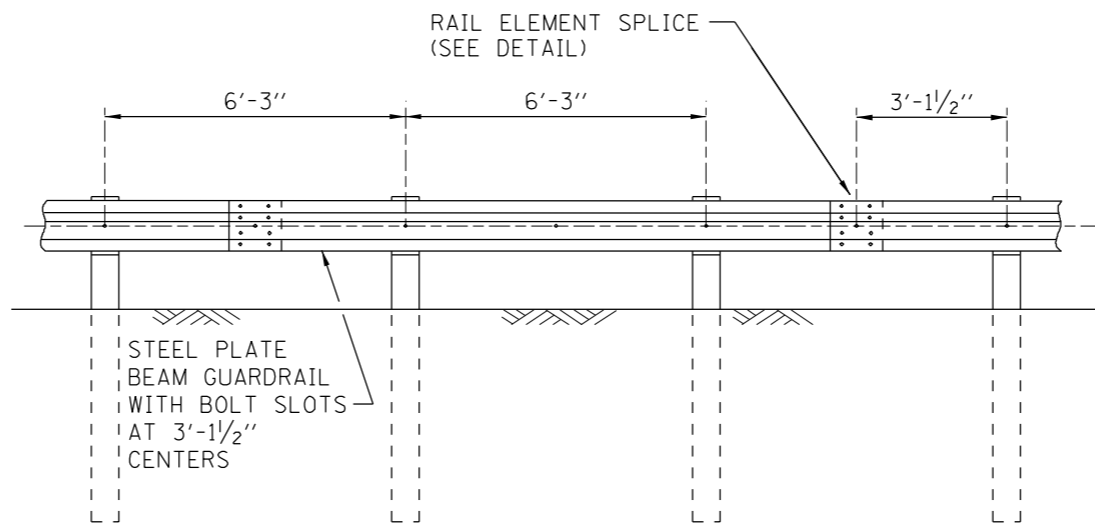


TWO-PIECE WOOD BLOCKOUT OPTION



NOTE:
ALL HOLES 3/4" DIA.

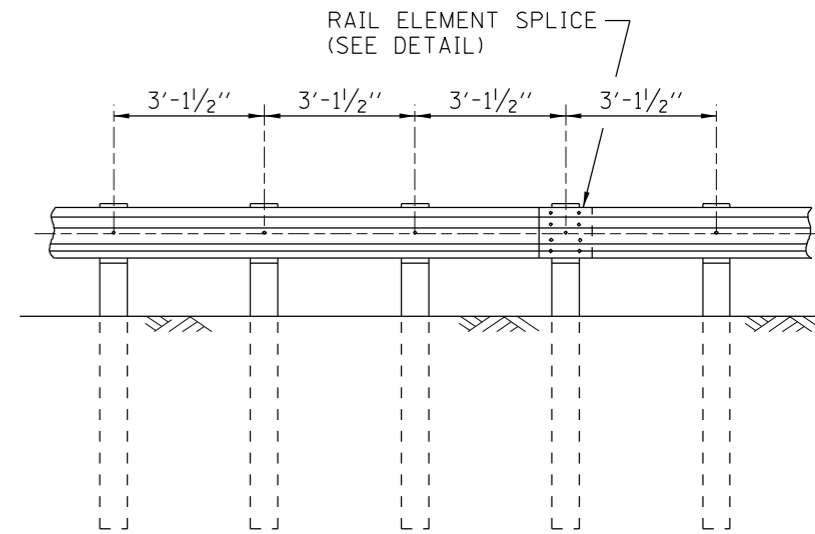
WOOD BLOCK-OUT AND STEEL POST DETAILS



ELEVATION

TYPE A

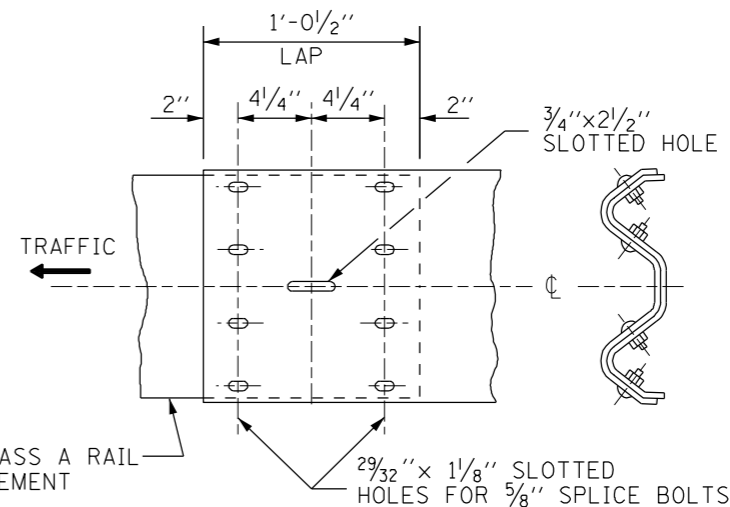
6'-3" TYPICAL POST SPACING



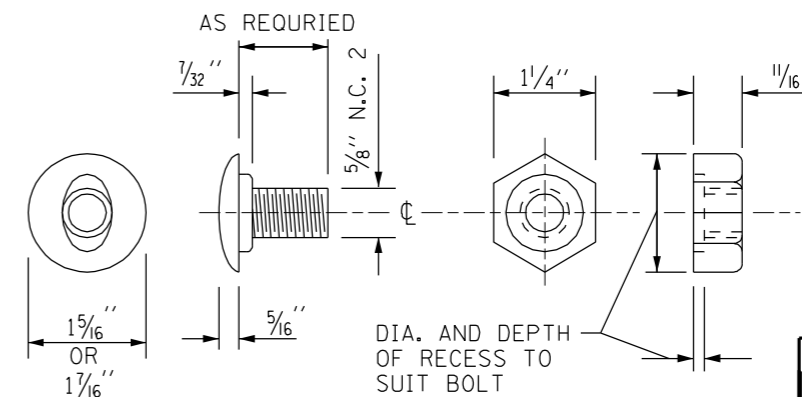
ELEVATION

TYPE B

3'-1 1/2" CLOSED POST SPACING



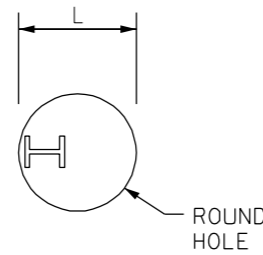
RAIL ELEMENT SPLICE



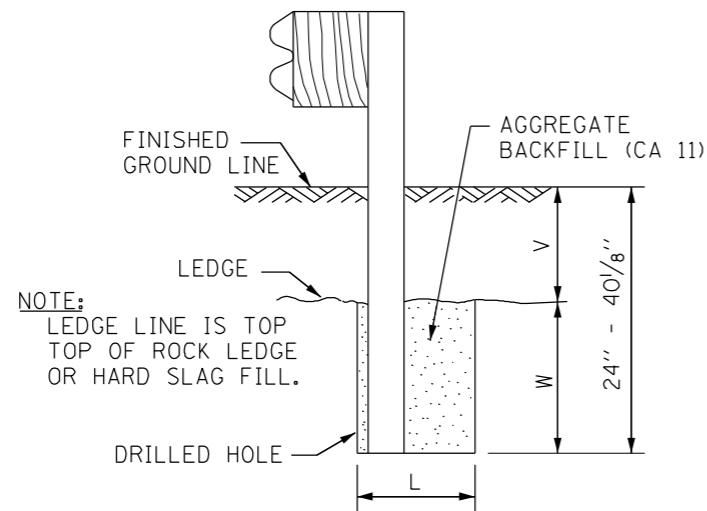
POST OR SPLICE BOLT & NUT

V	W	L	
		STEEL POST	WOOD POST
0 - 16 1/8"	24"	21"	23"
> 16 1/8" - 28 1/8"	12"	8"	10"
> 28 1/8" - 40 1/8"	12" - 0 (*)	8"	10"

* V+W=40 1/8"

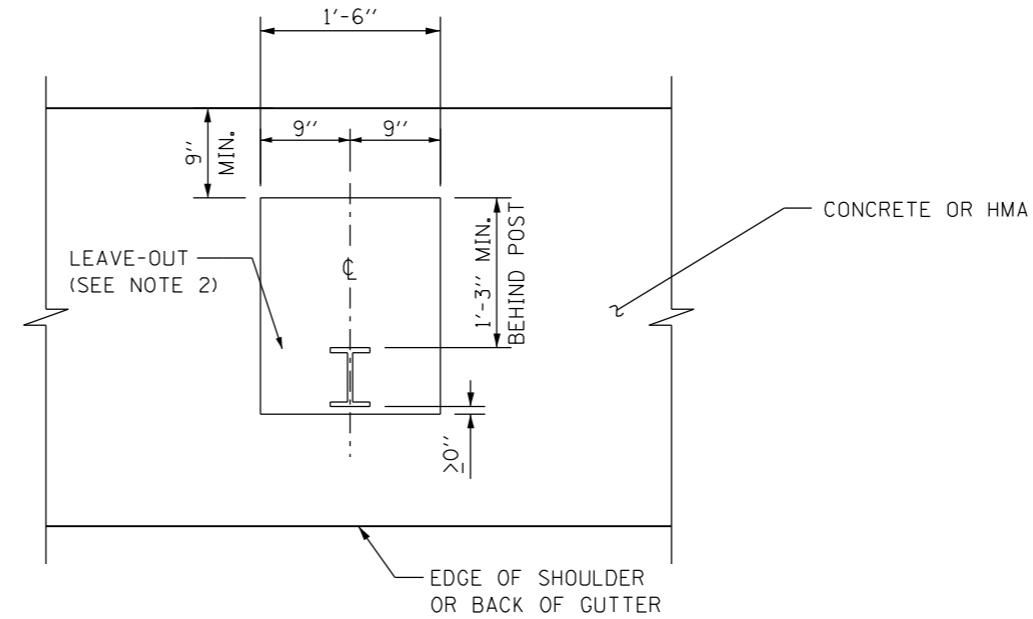


PLAN

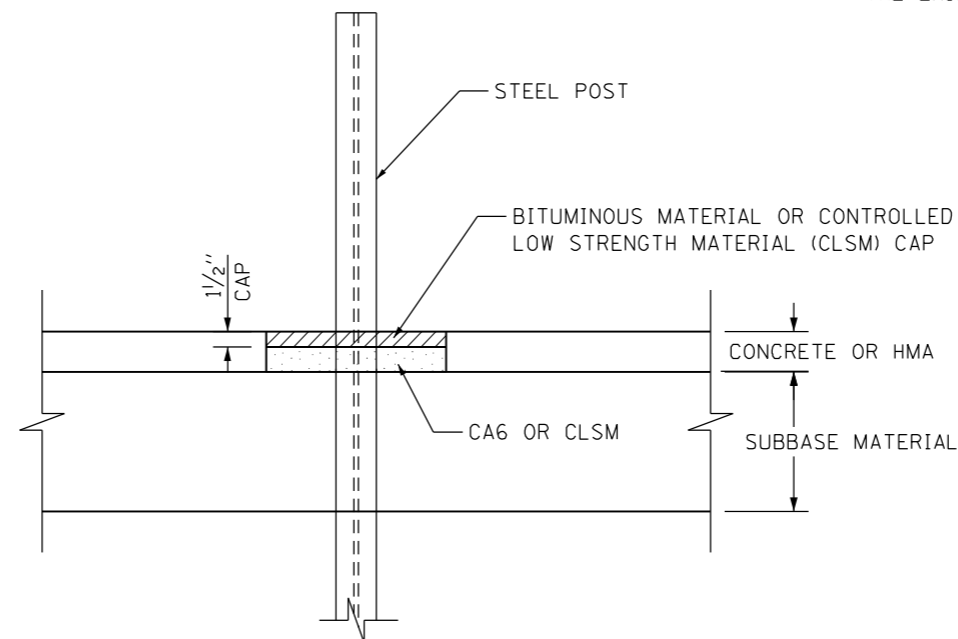


ELEVATION

FOOTING FOR POST WHEN IMPERVIOUS MATERIAL IS ENCOUNTERED



PLAN



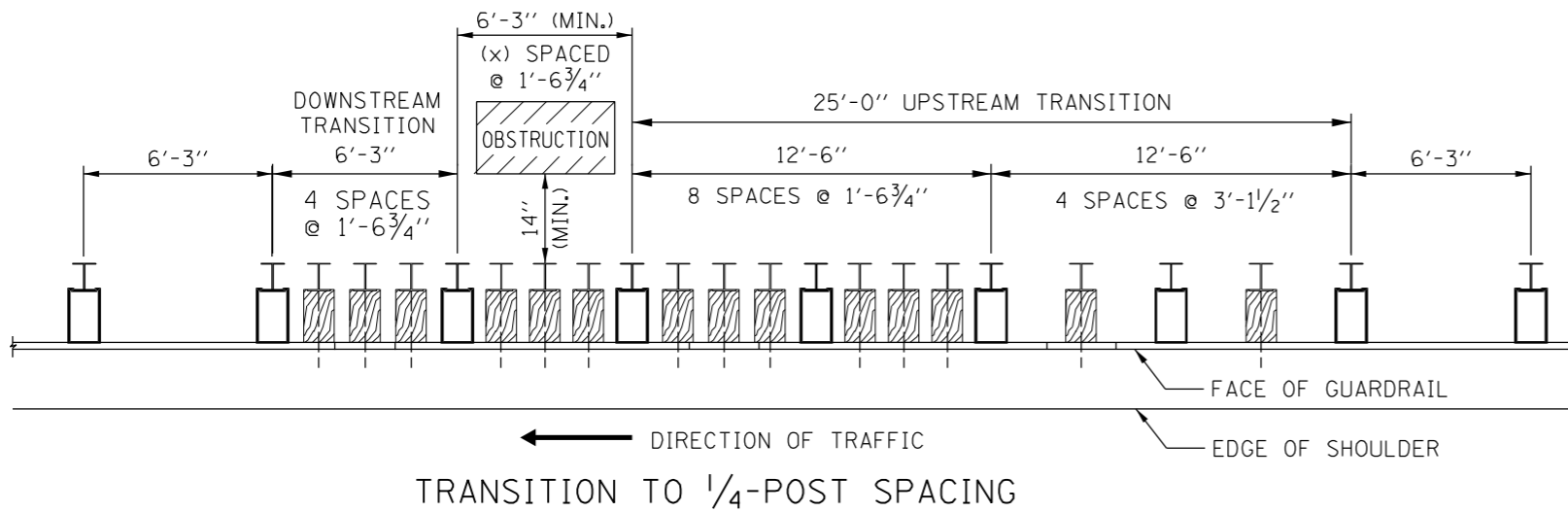
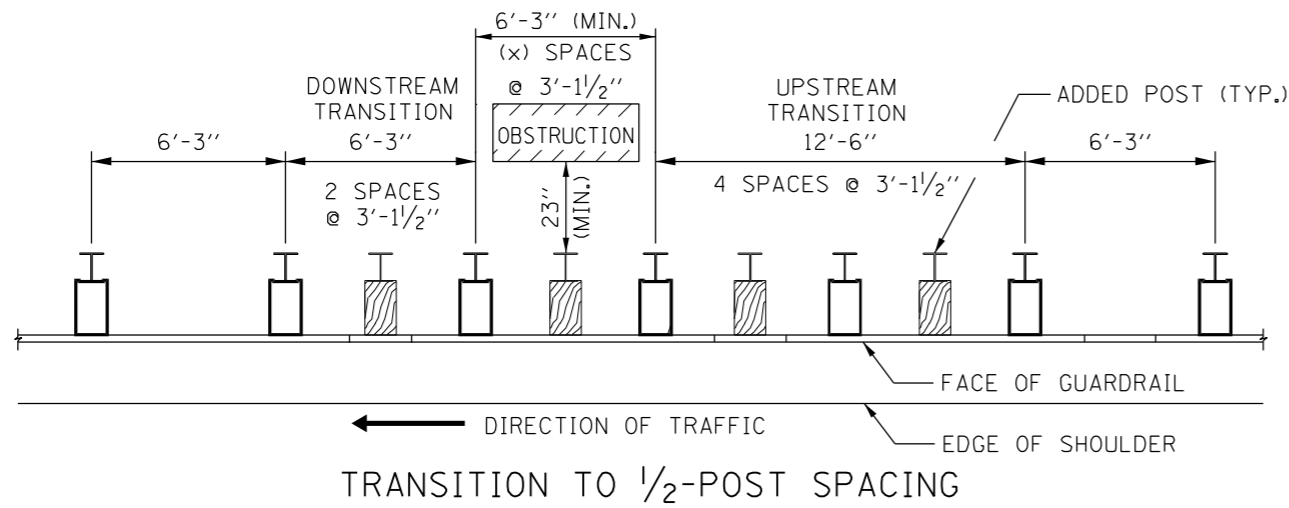
ELEVATION

LEAVE-OUTS

NOTES:

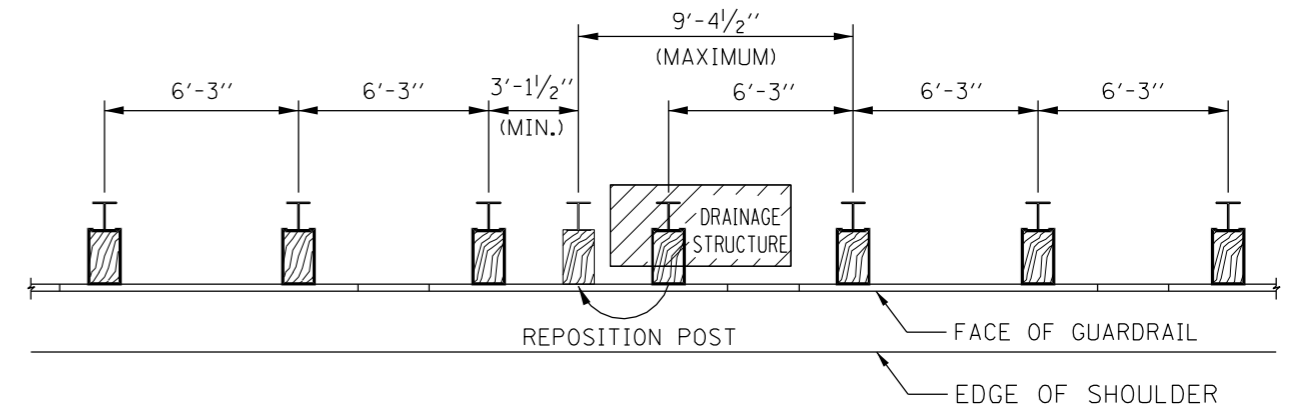
1. CAP SHALL BE INSTALLED TO MATCH THE EXISTING CROSS SLOPE.
2. THE LEAVE-OUT SHALL BE DEFINED AS THE AREA AROUND THE POST THAT IS EITHER OMITTED FROM THE NEW CONSTRUCTION OR REMOVED FROM THE EXISTING CONCRETE OR HMA.

GUARDRAIL CLEARANCE DISTANCE			
GUARDRAIL SYSTEM	POST SPACING	DESIRABLE GUARDRAIL CLEARANCE	MINIMUM GUARDRAIL CLEARANCE
TYPE A	6'-3"	42"	28"
TYPE B 1/2 POST SPACING	3'-1 1/2"	30"	23"
1/4 POST SPACING	1'-6 3/4"	24"	14"

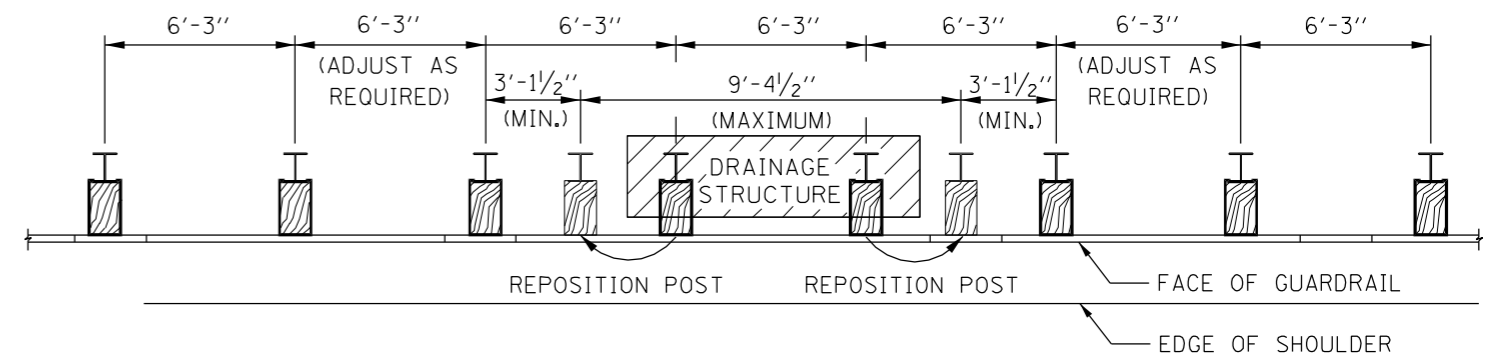


NOTES:

1. DESIRABLE GUARDRAIL CLEARANCE DISTANCES SHALL BE USED FOR ALL NEW INSTALLATIONS.
2. MINIMUM GUARDRAIL CLEARANCE DISTANCES ARE ONLY TO BE USED FOR EXISTING OBSTRUCTIONS.
3. WHEN LENGTH OF OBSTRUCTION IS 1'-3" OR LESS, THE DOWNSTREAM TRANSITION MAY BE OMITTED.



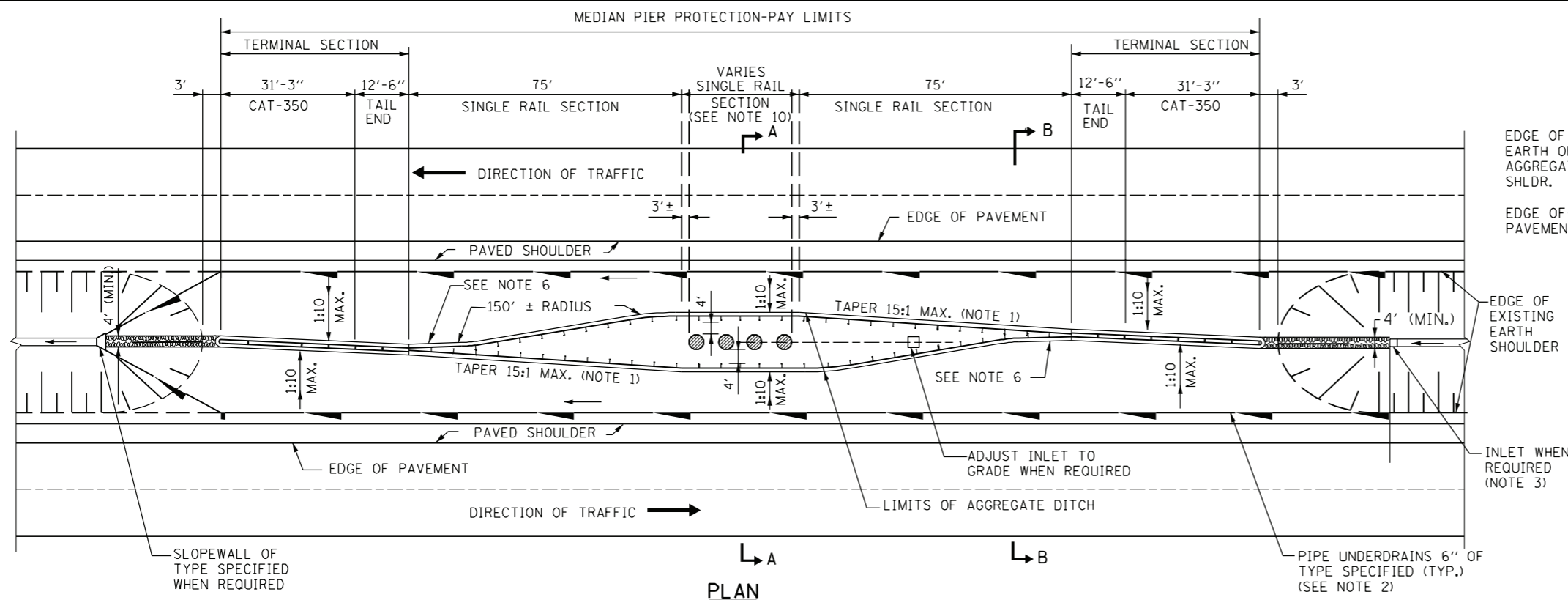
**TYPE A GUARDRAIL-DRAINAGE STRUCTURE CONFLICT
ONE POST**



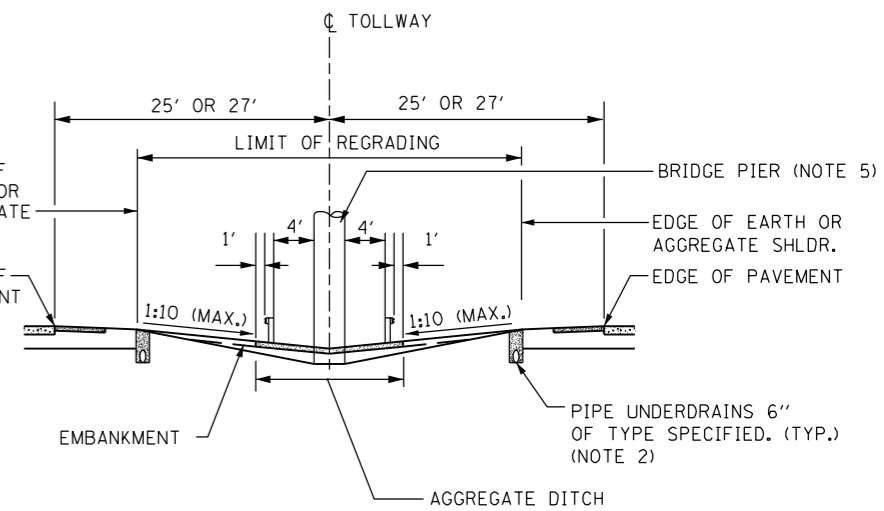
**TYPE A GUARDRAIL - DRAINAGE STRUCTURE CONFLICT
TWO POSTS**

NOTES:

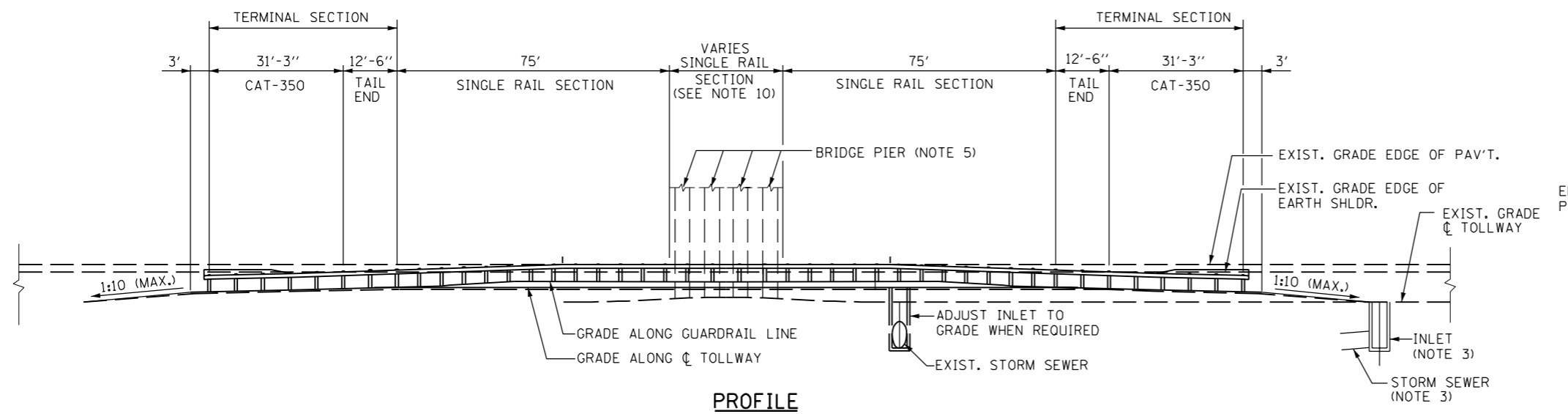
1. GUARDRAIL POSTS SHALL NOT BE ELIMINATED; ALL POSTS MUST BE USED.
2. GUARDRAIL POSTS SHALL NOT BE SET BACK TO AVOID CONFLICTS WITH A DRAINAGE STRUCTURE.



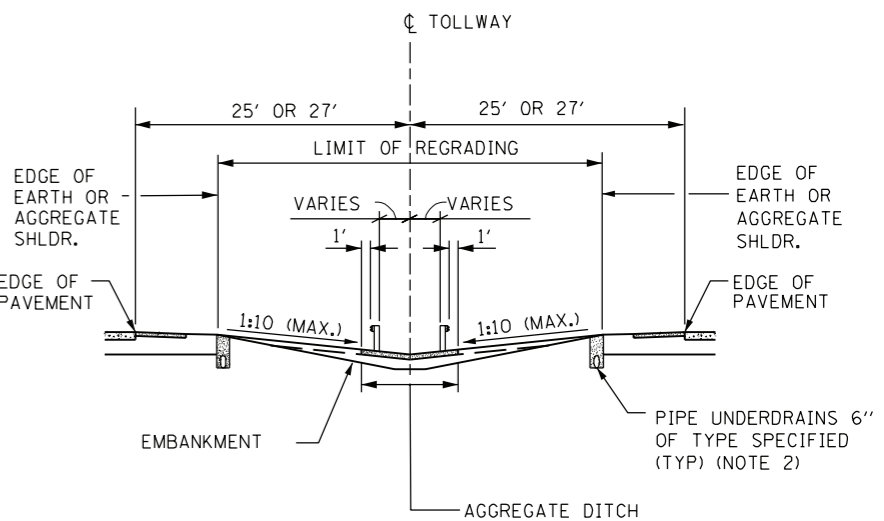
PLAN



SECTION A-A



PROFILE



SECTION B-B

NOTES:

1. FLATTER RATE OF TAPER MAY BE USED WHERE REQUIRED TO AVOID DAMAGE TO EXISTING STORM SEWERS.
2. PIPE UNDERDRAIN REQUIRED IN SAG VERTICAL CURVE OR WHEN FROST HEAVE IS EXPECTED.
3. AN INLET IS TO BE PROVIDED WHEN REQUIRED. THE INLET SHALL BE CONNECTED TO THE NEAREST DOWNSTREAM INLET OR CULVERT.
4. MAXIMUM CROSS SLOPE FROM THE EDGE OF THE EARTH SHOULDER TO THE FACE OF THE RAIL SHALL BE 1:10.
5. BRIDGE PIER OR OVERHEAD SIGN PIER.
6. SINGLE W6x8.5 STEEL POST WITH BLOCKOUTS MAY BE USED FOR THIS POST.
7. RAIL HEIGHT SHALL BE MEASURED FROM EXISTING SURFACE 1'-0" IN FRONT OF RAIL.
8. SLOPE RATIOS ARE EXPRESSED AS UNITS OF VERTICAL DISPLACEMENT TO UNITS OF HORIZONTAL DISPLACEMENT (v:h).
9. TRAFFIC BARRIER TERMINAL SHALL BE IN ACCORDANCE WITH THE MANUFACTURE'S DETAILS AND SPECIFICATIONS.
10. SEE PLAN FOR LIMITS.
11. THE GUARDRAIL SYSTEM HAS BEEN PERFORMANCE-TESTED FOR CRASHWORTHINESS UNDER PROCEDURES DEFINED IN THE NATIONAL COOPERATIVE RESEARCH PROGRAM (NCHRP) REPORT 350. NO MODIFICATION ANY KIND TO THIS STANDARD DRAWING SHALL BE PERMITTED.

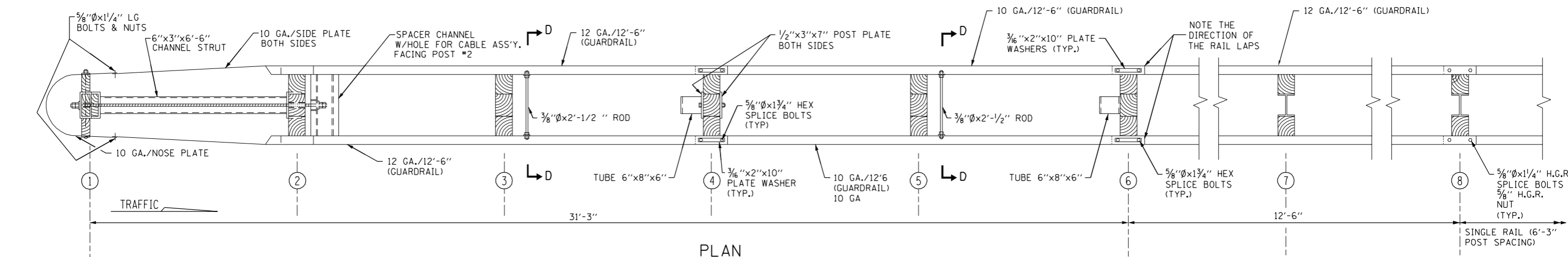


DATE	REVISIONS
7-1-2009	DITCH DIMENSION ON SECTION A-A MODIFIED GUARDRAIL BARRIER TERMINAL DIMENSIONS
	REVISED NOTES
3-1-2010	ADDED TERMINAL TAIL END SECTION
	REVISED NOTES

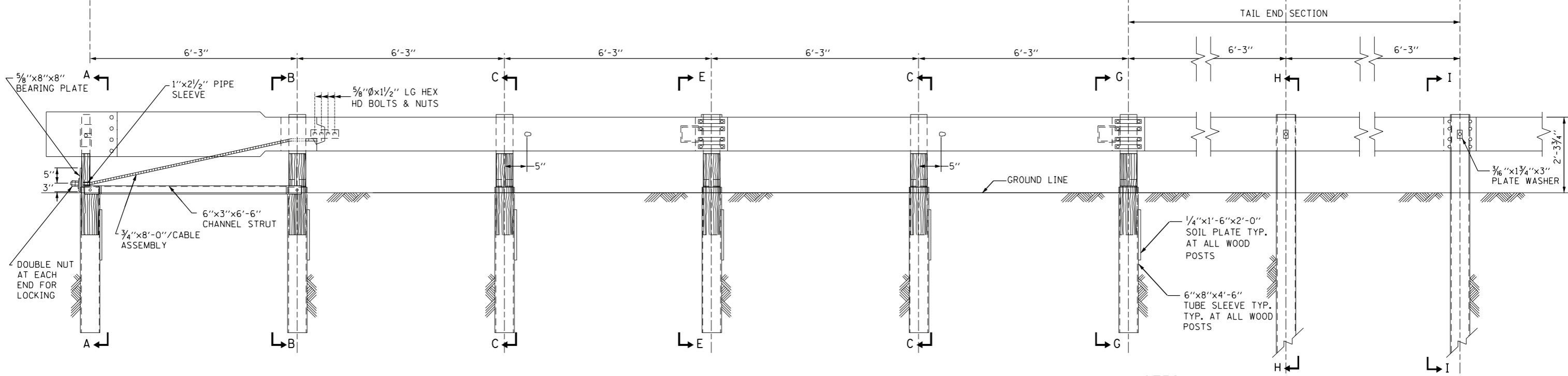
MEDIAN PIER PROTECTION

STANDARD C2-02

APPROVED: *Paul Kovacs* CHIEF ENGINEER DATE 7-1-2009.



PLAN

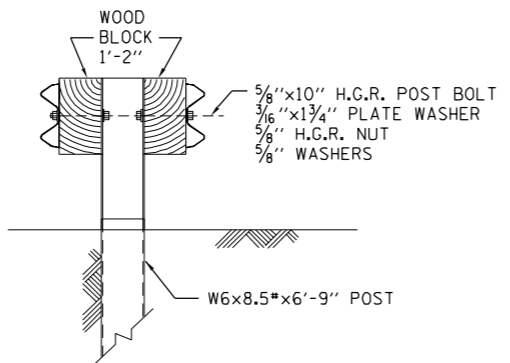


ELEVATION

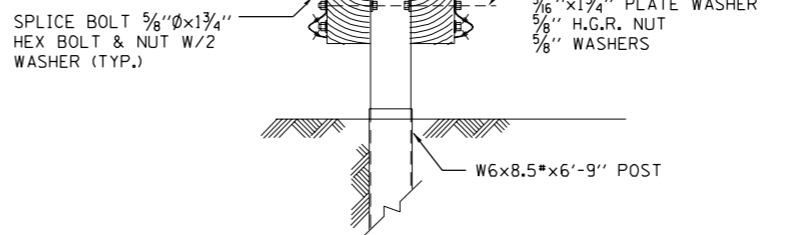
MEDIAN PIER PROTECTION-TERMINAL SECTION

NOTES:

1. RAIL ELEMENTS, BOLTS, NUTS AND WASHERS SHALL BE HOT DIP GALVANIZED IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS AND AASHTO M232 (ASTM A-153).
2. THE BOLTS, NUTS AND WASHERS SHALL CONFORM TO THE REQUIREMENTS OF ASTM A-307, GRADE A. HIGH STRENGTH BOLTS, NUTS AND WASHERS SHALL CONFORM TO AASHTO M164 (ASTM A-325).
3. POSTS, BLOCKS, PLATES AND MISCELLANEOUS ACCESSORIES SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M183 (ASTM A-36) AND SHALL BE GALVANIZED IN ACCORDANCE WITH AASHTO M111 (ASTM A-123).
4. THE WOOD TERMINAL POSTS SHALL BE TREATED AND CONFORM TO THE REQUIREMENTS OF THE STANDARD SPECIFICATIONS.
5. HOLLOW STRUCTURAL TUBING SHALL CONFORM TO ASTM-500, GRADE B OR A-501.
6. THE 3/16" STEEL PLATES SHALL BE GALVANIZED IN ACCORDANCE WITH THE REQUIREMENTS OF AASHTO M232 (ASTM A-153).



SECTION H-H ①



SECTION I-I ②

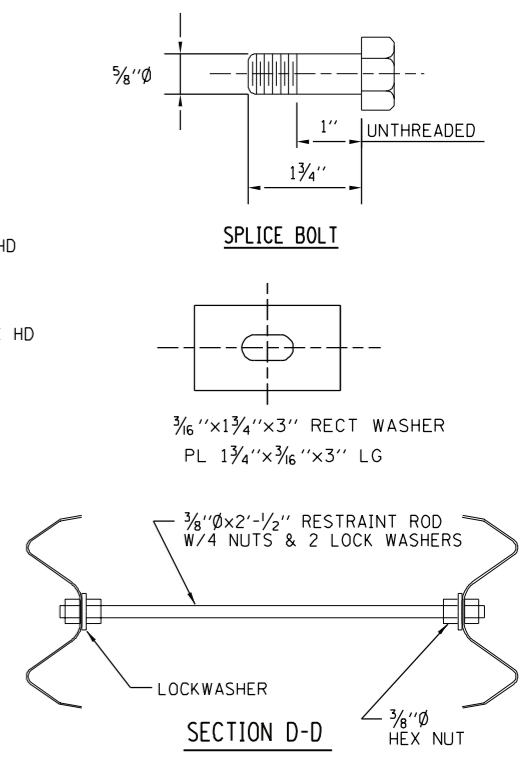
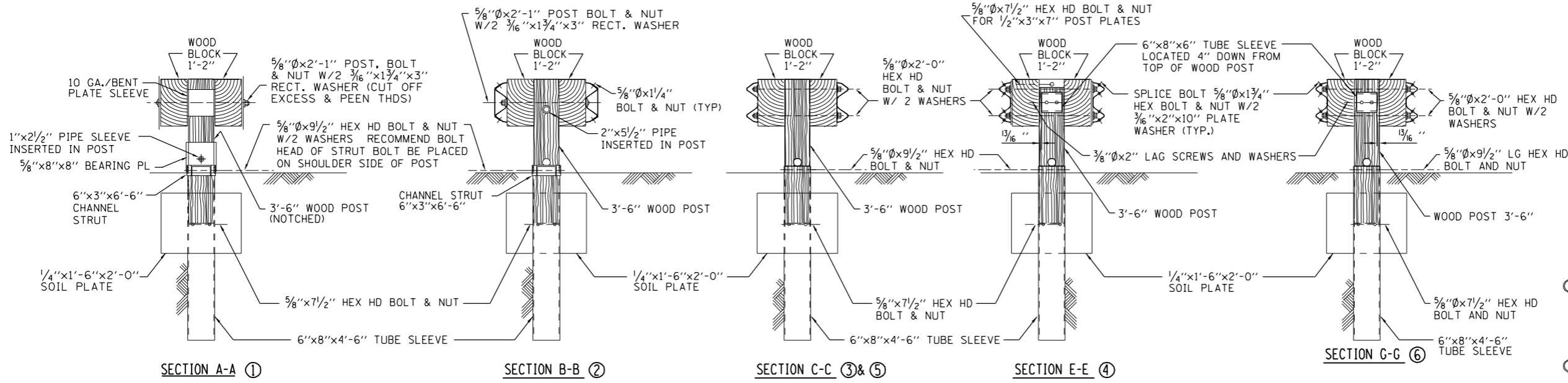
MEDIAN PIER PROTECTION-TERMINAL SECTION

APPROVED: *Paul Kovacs* CHIEF ENGINEER DATE 7-1-2009.

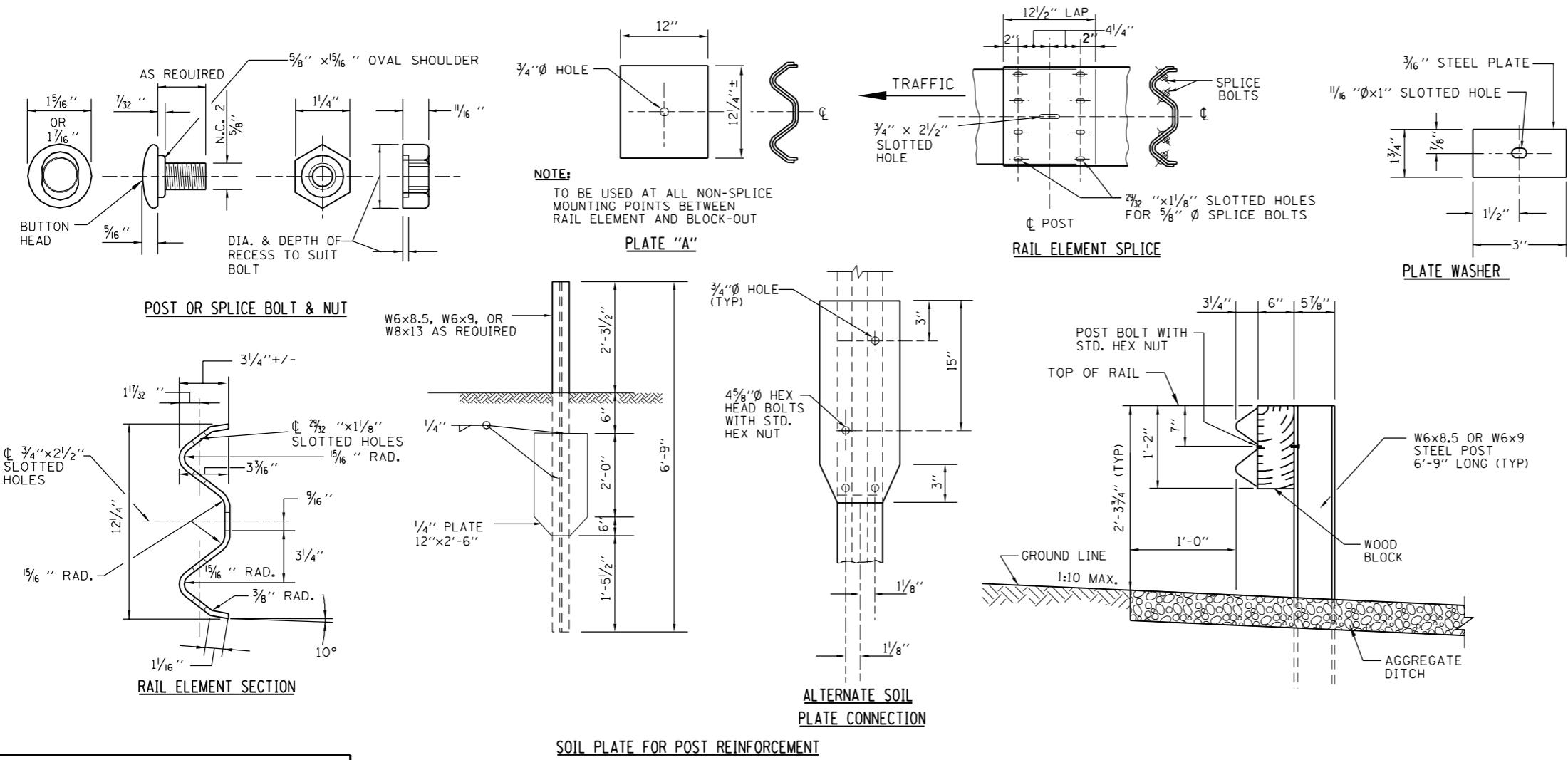


MEDIAN PIER PROTECTION

STANDARD C2-02



MEDIAN PIER PROTECTION-TERMINAL SECTION



- NOTES:**
- ALL HOLES IN POSTS AND BLOCK-OUTS SHALL BE 3/4" Ø UNLESS OTHERWISE NOTED.
 - IN THE EVENT OF AN OBSTRUCTION PREVENTING POST INSTALLATION, UP TO TWO (2) CONSECUTIVE POSTS MAY BE OMITTED IF 2-PLY GUARDRAIL PANELS ARE USED FROM THIS LENGTH.
 - RAIL ELEMENT SHALL BE FURNISHED IN NOMINAL LENGTHS OF 12'-6". AN ALTERNATE 25'-0" NOMINAL LENGTH MAY BE FURNISHED AT THE OPTION OF THE CONTRACTOR.
 - ALL RAIL ELEMENTS AND ACCESSORIES SHALL CONFORM TO STANDARD SPECIFICATIONS UNLESS OTHERWISE NOTED.
 - THE CONTRACTOR SHALL LOAD TEST 10 PERCENT OF ALL EXPANSION ANCHOR BOLTS IN INSTALLATION IN THE PRESENCE OF THE ENGINEER. THE EQUIPMENT AND METHOD USED SHALL MEET THE APPROVAL OF THE ENGINEER. THE MINIMUM TEST LOAD SHALL BE 8,000 POUNDS FOR 5/8" Ø BOLTS IN DIRECT OF PULL FOR EACH ANCHOR THAT FAILS THE TEST REQUIREMENTS, TWO MORE ANCHOR BOLTS, PICKED BY THE ENGINEER SHALL BE TESTED. EACH ANCHOR BOLT THAT FAILS TO MEET THE TEST REQUIREMENTS SHALL BE RESET OR REMOVED AND THE HOLE DRILLED DEEPER. ALL RESET ANCHOR BOLTS SHALL MEET THE MINIMUM TEST REQUIREMENTS.
 - THE MAXIMUM POST SPACING SHALL BE 6'-3".



MEDIAN PIER PROTECTION

STANDARD C2-02

APPROVED: *Paul Kovacs* CHIEF ENGINEER DATE 7-1-2009.

MEDIAN PIER PROTECTION-SINGLE RAIL SECTION