WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
DESIGN DIRECTIVE

DD-665
CABLE BARRIER
March 23, 2017

Attached is the West Virginia Department of Transportation, Division of Highways' (WVDOH) policy for cable barrier on existing and proposed highways.

Attachment

CABLE BARRIER DESIGN POLICY

DESIGN CRITERIA:

Cable barrier design shall be in accordance with NCHRP Report 711, "Guidance for the Selection, Use, and Maintenance of Cable Barrier Systems", with reference to the currently adopted AASHTO Roadside Design Guide and A Policy on Geometric Design of Highways and Streets. The criteria below both clarifies and highlights WVDOH requirements.

LOCATION:

The WVDOH uses cable barrier to help reduce or lessen the severity of crossover crashes on divided highways. The State Highway Engineer shall make the final determination on locations to install cable barrier based on the following criteria.

- On roadways with higher than normal crossover accident rates.
- On divided highways with 40' or greater median widths (measured from edge of travel way to edge of travel way).
- Cost estimates with applicable alternates considered.
- Engineering judgment based on criteria in NCHRP Report 711.

DESIGN:

The Division's requirements for cable barrier are listed below:

- Be four strand high tension type
- Meet at a minimum, Test Level 3 per ~~NCHRP 350 or~~ MASH (latest edition) criteria @ 4:1 slopes and Test Level 4 @ 6:1 slopes (Note – all cable barrier shall conform to the latest edition of MASH beginning with projects let after December 31, 2018.)
- Have a maximum test deflection of 8'
- Have at a maximum 12' post spacing
- Have socketed posts set in concrete footings
- Have concrete mow strips with safety edge
- Have line post and end terminal foundations designed per site soil conditions
- Limited or known soil condition information is to be provided by the WVDOH. The contractor may obtain additional geotechnical information at their discretion. End terminal and line post foundations are to be designed by the cable barrier manufacturer.
- Specifications shall require "swedge (swaged)" connections. "Swedge (swaged)" connections are methods of securing wire rope with a permanently applied fitting or sleeve. Open wedge connections will not be allowed.

SLOPES:

Per NCHRP Report 711 cable barrier on slopes as steep as 4:1 is allowable, but not preferable. Better performance is achieved on slopes of 6:1 or flatter. Therefore, the WVDOH strongly prefers cable barrier be placed on slopes no steeper than 6:1. At a minimum, existing slopes should be spot checked in the field to verify they comply. Generally, medians where cable barrier would be installed are steeper than 6:1.

When cable barrier is the preferred installation, pay items for raising inlets and embankment to meet a 6:1 slope are necessary in the contracts, along with appropriate Temporary Pollution Control items and Seeding and Mulching items. The design and specifications need to include proper drainage and fill compaction. Saturated or poorly compacted material negatively affects the installation and performance of cable barrier post foundations.

Clear Zone

The roadside recovery area is commonly referred to as the clear zone and is defined as that area available for use by errant vehicles, starting at the edge of the traveled way and terminating at the closest obstruction. The primary purpose of a clear zone is the safety of the traveling public. The maximum width of any clear zone which the Division of Highways can control is limited by its right of way; however, moving all existing obstacles from the right of way may not be necessitated by the clear zone policy.

While it may be ideal to remove all obstacles, in many cases such removals may be impractical and ineffective. For example, it is less effective to move those obstacles near the outer limits of the clear zone than those near the traveled way. Moving a pole one foot so that it lies on the right of way line or off the right of way is not always prudent nor cost-effective and adds little to the safety intent of the zone. Once a decision is made to move an obstruction from the clear zone, it should be moved as far from the traveled way as practical.

Although the basic concept seems simple, there are a number of factors which make for the development and implementation of an effective clear zone difficult. One of the biggest factors influencing the establishment of a clear zone in West Virginia is terrain. Many of our roadways are constructed along hillsides with steep slopes, which may have natural obstacles (such as rock cliffs, streams, hillsides, etc.) within the desirable clear zone width. Development of a policy which requires a statewide uniform clear zone distance within such areas would be neither practical nor effective.

It will be the responsibility of the Engineering, Traffic (along with the District traffic Engineer), and Right of Way Divisions to work together, to establish a consistent clear zone for each project. The width of this zone should be based on the type of highway, operating speed and accident history of the highway section with consideration given to existing features within the highway right of way. Obstacles within the established zone shall either be removed, given adequate protection, or identified by proper warning devices. All obstacles outside the consistent clear zone should be evaluated on an individual basis to determine whether greater distances could be attainted for short distances.

The design speed is one of the primary controls for establishing a consistent clear zone, since it generally correlates with the severity of the accident and the distance an errant vehicle is likely to stray from the traveled way.

Design speeds can be divided into two classes:

40 MPH or Less: This design speed is typical for rural local service routes, collector routes, and urban roads and streets. Collisions with fixed objects at these speeds are less likely to be severe. In most cases within this class, it will be of little benefit to move obstructions unless there is a documented accident history.

Greater than 40 MPH: This design speed is found on many rural arterial and collector highways and is common on urban arterials. These highways are generally

characterized by the absence of parking or other impediments to smooth traffic flows. High speed operations characterize most rural arterials and a few urban arterials. In these situations, a collision with a fixed object will almost certainly result in major property damage and/or medical trauma. Given these operating speeds, the keys to establishing a consistent clear zone are the features of the roadside and the potential for accidents. When the Division of Highways determines that existing objects are likely to be involved in accidents and/or cause injuries to the highway user, corrective measures will be initiated to provide a safer environment via an appropriate clear zone. Decisions on each project should be made based on documented accident history and existing obstacles along the road or street.

While this policy has not set a defined clear zone width, it has established some very fundamental guidelines. These guidelines are to be used by those individuals responsible for determining how much clear zone can be reasonably obtained in any given highway section. This clear zone should never be less than the designated shoulder width. The ultimate goal is to provide the maximum usable clear zone available in any given section of highway.

EXISTING GUARDRAIL

See DD-662 Guardrail for more information on the treatment of existing guardrail and end treatments on 3R Projects.

ENCROACHMENTS AND UTILITIES (GUARDRAIL ONLY PROJECTS)

Projects for replacement guardrail to be placed at designated locations and which are not continuous shall have the non-work areas identified on the plans by the words "Project Omission." Encroachments existing within the non-work areas will not be shown on the Encroachment Report. All other Encroachments will be shown by Station and Offset on the straight line plan and listed in the Encroachment Report.

The designer will list utilities that are in conflict and/or may be involved in the limits of work. This determination shall be made by contacting the affected utilities. A "Plan Note" will be included in the plans stating that the Contractor will be responsible for contacting the utility companies before entering the area of potential conflict. The note shall include the names of utilities and the location by station or mile post as determined. The note shall also include the name and telephone number for the contact person for each utility company involved.

SIGNING, SIGNALS AND PAVEMENT MARKINGS

All traffic control signs, pavement markings and traffic signals will be in conformance with the "Manual on Uniform Traffic Control Devices." Traffic control during construction shall be maintained in accordance with a traffic control plan included in the plans. The traffic control plan shall be as specified in the latest edition of the Division's "Manual on Temporary Traffic Control for Streets and Highways".

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
DESIGN DIRECTIVE

DD-662
GUARDRAIL
April 8, 2013

Attached is the West Virginia Department of Transportation, Division of Highways' policy for the type, location, and termination of guardrail on highway projects. Designers shall incorporate these requirements in all contract plans.

Attachment

GUARDRAIL DESIGN POLICY

TYPE AND CLASS OF GUARDRAIL:

Type 1 Guardrail (Galvanized Steel Deep Beam) shall be specified on all new projects except Type 5 (Double-Faced Type 1) will be specified when double-faced guardrail is required.

The "Classes" of guardrail are as follows:

Class I: 6' 3" post spacing with blocks
Class II: 12' 6" post spacing with blocks
Class III: 12' 6" post spacing without blocks
Class IV: 3' 1-1/2" post spacing without blocks
Class V: 3' 1-1/2" post spacing with blocks

On National Highway System (NHS) projects, all guardrail specified shall be Class I.

For projects not on the NHS, the class shall be in accordance with the following table, unless otherwise directed.

DESIGN YEAR ADT	**Low Volume Road 399 or less**	**400 or Greater or Multi-Lane**	
DESIGN/OPERATING SPEED*	25 MPH	Less than 40 MPH	40 MPH or Greater
CLASS	III, IV**	II, V**	I, V**

*Design speed shall be used when specifying guardrail for a new highway. The higher of Operating speed or Speed Limit shall be used when specifying guardrail for an existing highway. The operating speed shall be obtained from the Traffic Engineering Division.

** 3' 1-1/2" post spacing provides lower guardrail deflection for locations with obstacles 4' or less behind the guardrail. A minimum 25' length of Class V should be used for obstacles. Other means of reducing deflection should also be considered.

APPROACH END TERMINALS:

Under ideal circumstances, all guardrail should be terminated outside the clear zone. In most cases, this cannot be accomplished requiring the installation of an approach end terminal.

The design of approach end terminals must be done on a case-by-case basis. When specifying an approach end terminal, the designer must insure that the location at which the approach end terminal is specified provides the proper width, run out area, and cross slopes to allow proper installation of the approach end terminal.

When Class I Guardrail must be terminated within the clear zone, an NCHRP 350 or MASH approved approach end terminal as discussed below shall be specified. When Class II or Class III Guardrail must be terminated in the clear zone, an approved approach end terminal need not be specified; however, the guardrail shall be flared away from traffic. The minimum width of flare should be 4'-0". This information will be shown on the plan sheet.

The clear zone can be defined as the area available for use by errant vehicles starting at the edge of the traveled way and terminating at the closest obstruction. The width of the clear zone must be established for each project based on the type of highway, operating speed, traffic volume and roadside geometry. Refer to DD-606, Non-NHS 3R Policy and Chapter 3 of the AASHTO "Roadside Design Guide" current approved edition, (RDG), for more information on determination of the clear zone.

PRIORITY #1 CST
#2 FET
#3 TET

NHS PROJECTS:

The standard approach end terminal is the Cut Slope Terminal (CST) as detailed on Standard Sheet GR4. If the use of a CST is not possible then the designer should use, in order of preference, a Flared End Terminal (FET) or Tangent End Terminal (TET) as detailed on Standard Sheets GR5 or GR6 respectively.

Both the CST and the FET require flared installation, as well as modifications to the normal shoulder slope in the area of the flare. The FET also requires grading behind the guardrail. In order to accommodate these installations, consideration must be given to drainage. When the treatments, especially the CST, are placed on the downstream end of a cut, an inlet and carrier pipe may be necessary to drain the cut ditch.

The TET, which does not require a flare, is currently available. Its use should be limited to cases where high traffic volumes and high speeds exist and the above treatments are impractical or not feasible.

The TET shall have a 4'-0" minimum offset from the inside edge of the extruder terminal to the outside edge of the traveled way. For narrow existing shoulders that have an offset of 5'-0" or less from the face of rail to the edge of the traveled way, the rail and terminal may be flared from the normal face of rail. The flared offset distance shall be 1'-0" at a taper rate of 25:1 or 50:1, which yields flare lengths of 25'-0" or 50'-0" respectively.

NON-NHS PROJECTS:

The NHS criteria will be used when Class I Guardrail is specified. As previously stated when Class II or Class III Guardrail is used, an approved approach end terminal need not be specified; however, the guardrail shall be flared away from traffic. The minimum width of flare should be 4'-0". This information will be shown on the plan sheet.

3R PROJECTS:

Guardrail design for resurfacing, restoration and rehabilitation projects shall conform to the criteria previously established for NHS projects or Non-NHS projects, whichever is applicable. The following information is intended to supplement these criteria.

Guardrail design for 3R projects presents unique challenges to the designer such as limited shoulder width and limited run out area at approach end terminals. The designer should not accept the location of the existing guardrail and end terminals as being correct and simply replace them with new material. The designer's goal should be improved safety.

The approach end terminals, as described above, shall be specified on 3R projects, if applicable, based on the class of guardrail being installed. On all NHS 3R projects, the approach end terminals in the project area shall be upgraded to a CST, FET, or TET as previously described. On all Non-NHS 3R projects requiring Class I Guardrail, NHS criteria will be used. This may require that additional work be specified such as site grading, which may require a quantity of borrow excavation, or raising the elevation of the adjacent ditch line. It may be necessary to extend the guardrail beyond the point of theoretical need in order to place the approach end terminal in a location where it can be installed in accordance with the appropriate Standard or Special Detail. The designer is encouraged to eliminate short gaps between runs of guardrail especially when the approach end terminal cannot be installed in accordance with the appropriate Standard or Special Detail. This decision would be influenced by the cost of the end terminals versus the cost of the guardrail.

In situations where the CST is the desired end terminal but it cannot be installed in accordance with Standard Detail Sheet GR4 due to excessive depth of the existing ditch, a Modified Cut Slope Terminal (MCST) should be specified. A Special Provision and a Special Detail, which can be obtained from the Engineering Division, will be required when the MCST is specified. The MCST shall not be used on new construction projects.

On Non-NHS 3R projects where the FET or the TET is the desired end terminal, but cannot be installed in accordance with Standard Detail Sheet due to lack of run out area behind the end terminal, the following guidance shall apply:

The area immediately behind and beyond the approach end terminal should be reasonably traversable and free from fixed-object hazards to the extent practicable. If a clear run out path is not attainable, this area should at least be similar in character to upstream unshielded roadside areas.

Ownership and storage location of any guardrail removed and stored (Item 607010) will be indicated in the plans by a General Note.

SPECIAL TRAILING END TERMINALS:

The Special Trailing End Terminal (STET) shall be specified when Class I Guardrail is specified and the guardrail is outside the clear zone of the opposing traffic. Generally, this will be on divided highways.

When the guardrail is not located outside the clear zone of the opposing traffic, it shall be designed as an approach end. The guidelines as mentioned in the Approach End Terminals Section are to be followed.

BRIDGE TRANSITIONS:

When the bridge shoulder width is less than the roadway shoulder width, a transition in the guardrail on the approach end and trailing end of the bridge is required. These transitions should occur on 15:1 straight tapers. There shall be a minimum of 12'-6" of standard guardrail between the bridge transition guardrail and the tapered guardrail.

BRIDGE TRANSITIONS – CONNECTIONS:

The Bridge Transition-Connection Detail, as shown on Standard Sheet GR11, is to be used on all new projects when transitioning approach end guardrail to a concrete shape. New bridges will have a vertical concrete face as detailed in the plans.

Existing bridges that do not have the proper vertical concrete endpost, as shown on Standard Detail Sheet GR11, will require the installation of the Modified Concrete Endpost. Special Detail Sheets for the Modified Concrete Endpost can be obtained from the Engineering Division.

Guardrail that must tie to new or existing bridges that have steel guardrail parapets rather than concrete parapets shall tie directly to the steel guardrail parapet.

The post spacing of the approach guardrail shall be equal to or less than the post spacing of the guardrail on the bridge. If the post spacing of the approach guardrail is greater than the post spacing of the bridge guardrail, the post spacing of the approach guardrail shall be decreased by one-half every twenty-five feet until the post spacing of the approach guardrail and the bridge guardrail are equal.

THEORETICAL POINT OF NEED, WARRANTS, AND LENGTH OF NEED:

The best available guide for guardrail theoretical point of need determination and warrants is the RDG. It shall be used on all projects.

An assumed encroachment angle for a vehicle leaving the highway will be used for length of need determination in lieu of the run out lengths as shown in the RDG. When a vehicle is approaching the obstacle, this angle will be 8 degrees for NHS projects and 15 degrees for Non NHS projects. When the trailing end is being considered, this angle will be 15 degrees for all projects. The use of these angles should be limited to tangent or near tangent sections of roadway. Scaling as demonstrated in Section 5.6.4 and Figure 5-48 of the RDG should be used in other cases. Results shall be documented in the project files.

The designer is cautioned to fully investigate each guardrail/end treatment installation to assure that the runout area is free of obstacles, including cut or fill slopes, and is traversable. The guardrail/end treatment installation may have to be lengthened to protect secondary obstacles behind the installation See Section 8.3.3.3 of the RDG for more information.

On new designs where Class I or Class II Guardrail is specified, the P.I. shall be offset 1'-0" from the back of the guardrail post. The post will be between the P.I. and the edge of pavement.

On new designs where the typical has not been set and Class III Guardrail is specified, the P.I. shall be offset 2'-0" from the face of the guardrail. The guardrail will be between the P.I. and the edge of pavement.

GUARDRAIL LOCATION - 3R PROJECTS:

On Interstate and APD 3R projects, the guardrail offset from edge of pavement shall be as originally constructed.

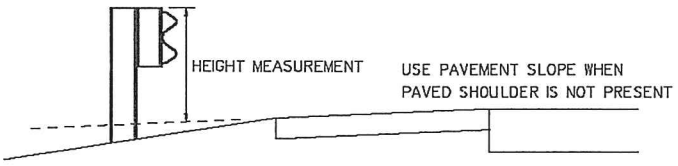
On all other 3R projects, the back of the guardrail post shall preferably be set at 1'-0" from the P.I. If this results in restricting the usable shoulder width, 8'-0" long posts shall be specified and the guardrail shall be placed at its prior location.

GUARDRAIL HEIGHT:

In accordance with the attached FHWA policy memo dated May 17, 2010 and the revised standard details regarding guardrail height, all new guardrail in projects let on or after July 9, 2013 shall be 2'-1" to center of the W-beam section (31" to top of rail), per the following guidelines:

- Existing guardrail and end treatments with no other deficiencies are acceptable at current height.
- New installations, replacement sections, or remove and reset sections that do not tie to existing guardrail shall be 31" height.
- New installations, replacement sections, or remove and reset sections that tie to existing guardrail will generally be "in kind" with regard to height. Guardrail height will taper as necessary to existing elements per standard details.
- After assessment of the guardrail system as a whole, in regard to various factors such as length of guardrail run, condition, length of need, end treatments, existing height, terrain, and materials, the designer may use engineering judgment to determine height. With a preference to 31" height, consideration to keep a consistent height in any project or area is appropriate.
- The Roadside Design Guide, currently adopted edition, shall be used to determine disposition of existing guardrail with regard to height for remove and reset sections on overlay and 3R projects. For these projects, guardrail having a top-of-rail height of 26 ½" or higher (AFTER the overlay is placed) may remain as is.
- The above guidelines generally apply to end treatments, with the following notes:

  Special Trailing End Terminal is acceptable at both 28-1/2" and 31" height.
  Approach Terminals – Use Approved Product List for each height. Separate lists will be maintained for both 28-1/2" and 31" height.
  Cut Slope Terminal – Transition guardrail down to 28-1/2" height before terminal.



GUARDRAIL HEIGHT DETERMINATION

U.S. Department of Transportation
Federal Highway Administration

Memorandum

SENT VIA ELECTRONIC MAIL

Subject: ACTION: Roadside Design: Steel Strong Post W-beam Guardrail

Date: May 17, 2010

From: David A. Nicol, P.E.
Director, Office of Safety Design

In Reply Refer To: HSSD

To: Division Administrators

This memorandum provides guidance to all State DOTs and FHWA Division Offices on the height of guardrail for new installations on the National Highway System (NHS). It details the minimum mounting heights of systems successfully crash tested per the NCHRP Report 350 "Recommended Procedures for the Safety Performance Evaluation of Highway Features" and the AASHTO Manual for Assessing Safety Hardware (MASH).

NCHRP Report 350 Accepted Systems:
Recent research on standard 27-inch guardrail shows that it does not meet NCHRP Report 350 Test Level 3 (TL-3) criteria. This requires a revision of current policy with regard to new G4(1S) guardrail installation height.

Transportation agencies should ensure the minimum height of newly-installed G4(1S) W-beam guardrail is at least 27¾ inches (minimum) to the top of the rail, including construction tolerance. A nominal installation height of 29 inches, plus or minus one inch, may be specified and is acceptable for use on the NHS. For your reference, a sampling of States that currently specify G4(1S) W-beam guardrail at 27¾ inches or higher is included in Appendix A. A summary of standard height guardrail testing is included as Appendix B.

MASH Accepted Systems:
Recent research on metric height G4(1S) guardrail (27¾ inches to the top) to meet AASHTO MASH TL-3 criteria has revealed performance issues that require the following recommendation with regard to modified G4(1S) guardrail installation height. Transportation agencies should consider adopting generic or proprietary 31-inch high guardrail designs (instead of the G4(1S) system) as standard for all new installations. The

installation height of 31 inches to the top of the rail is the nominal height and a construction tolerance of plus or minus one inch applies. These systems meet MASH test and evaluation criteria and have improved crash-test performance and increased capacity to safely contain and redirect higher center-of-gravity vehicles such as pickup trucks and SUVs. Existing crash testing of 27¾ inch high guardrail per MASH criteria can be found in Appendix B. Examples of 31-inch guardrail and end terminals are included in Appendix C. Experience in several States that have used the generic Midwest Guardrail System has shown that there is little or no increase in cost. Numerous guardrail terminals successfully tested under NCHRP Report 350 that are compatible with 31-inch high W-beam systems are also referenced in Appendix B.

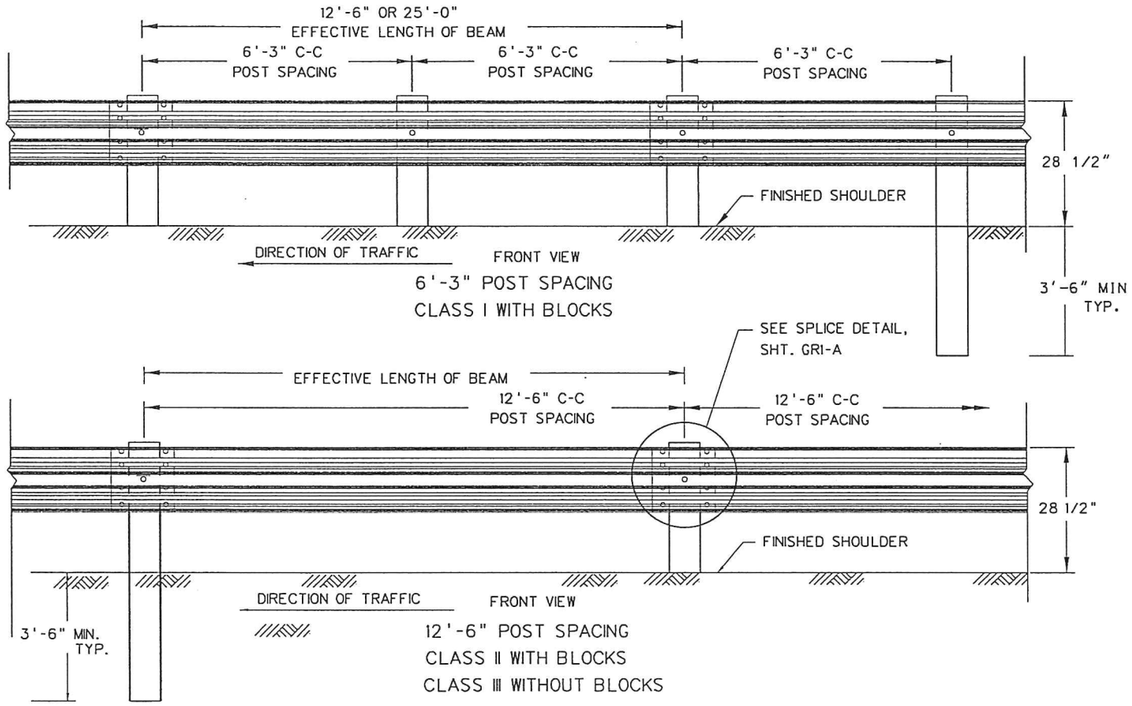
Action Needed
Division Offices should work closely with their State transportation agencies to implement the revised minimum installation height for G4(1S) guardrail of 27¾ inches, and also request that States consider adopting the 31-inch high guardrail designs.

In my November 20, 2009, memorandum, "Manual for Assessing Safety Hardware," I noted the AASHTO/FHWA Implementation Plan provided that all highway safety hardware accepted prior to the adoption of MASH using criteria contained in NCHRP Report 350 may remain in place and continue to be manufactured and installed. The G4(1S) strong steel post W-beam guardrail system installed at a minimum of 27¾ inches is consistent with this statement and may, indeed, be used on the NHS for the foreseeable future. However, we believe that States should consider adopting 31-inch guardrail as their standard because these systems exhibit superior performance at little or no additional cost.

Attached to this memorandum as Appendix D is a series of Frequently Asked Questions (FAQs) regarding guardrail, guardrail terminals, transitions, and bridge rails. A future memorandum, which will be coordinated with the AASHTO Technical Committee on Roadside Safety, will provide guidance on addressing the height of existing guardrail. If you have any questions or comments on this guidance, please contact Mr. Nicholas Artimovich at nick.artimovich@dot.gov or Mr. William Longstreet at will.longstreet@dot.gov, Office of Safety Design.

5 Attachments

cc: Mr. John R. Baxter, Associate Administrator for Federal Lands Highway
Mr. King W. Gee, Associate Administrator for Infrastructure
Mr. Jeffrey A. Lindley, Associate Administrator for Operation
Directors of Field Services
Federal Land Highway Division Engineers
Safetyfield



6'-3" POST SPACING
CLASS I WITH BLOCKS

12'-6" POST SPACING
CLASS II WITH BLOCKS
CLASS III WITHOUT BLOCKS

28-1/2" HEIGHT GUARDRAIL

Splice locations for 28 1/2" Guardrail shall be on the post.

GUARDRAIL HEIGHT

Transitions in guardrail height shall be accomplished at a rate of 1" vertical distance in 12.5' (one element) of horizontal distance. Height transitions shall end before end treatments or connections begin.

Height transitions between 28 1/2" and 31" require moving the splice on/off the post by placing one additional post at half the normal spacing.

Guardrail height shall be as indicated on plans.

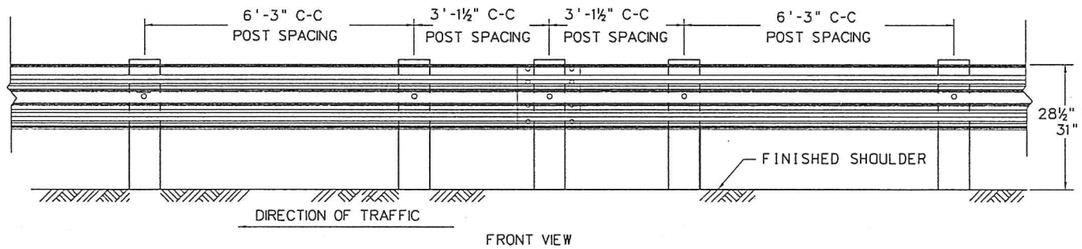
Construction tolerances for rail height is plus/minus 1".

The Standard Trailing End Treatment is acceptable for both 28½" and 31" guardrail height.

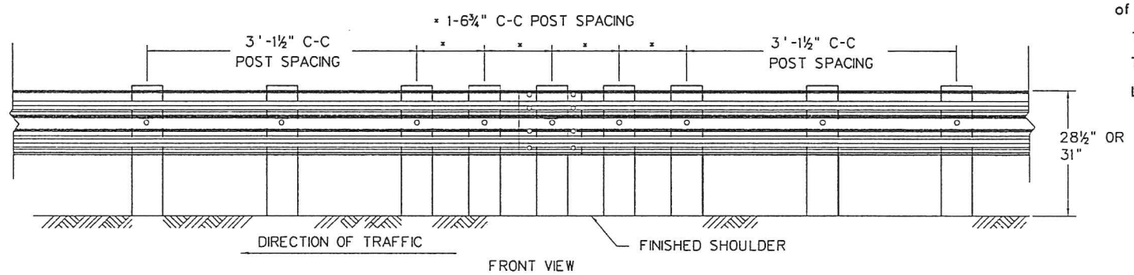
Approach Terminals-Separate approved product lists will be maintained for both 28 1/2" & 31" terminal height.

Guardrail that ties to Cut Slope Terminals (CST) must be transitioned per the standard details down to 28½" height (the height of the CST).

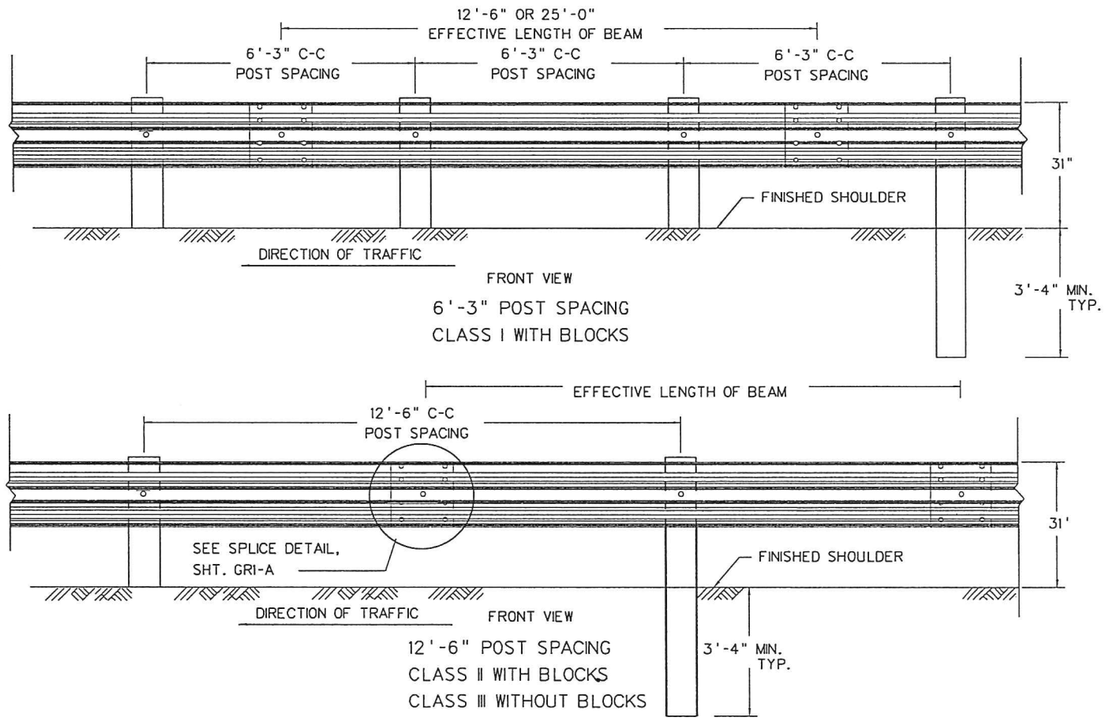
Thrie Beam transitions shall be per Standard GR-11 dated 11-13-12 for 28½" and dated 11-21-12 for 31".



3'-1½" POST SPACING
CLASS IV WITHOUT BLOCKS
CLASS V WITH BLOCKS



1'-6¾" POST SPACING



6'-3" POST SPACING
CLASS I WITH BLOCKS

12'-6" POST SPACING
CLASS II WITH BLOCKS
CLASS III WITHOUT BLOCKS

31" HEIGHT GUARDRAIL

Splice location for 31" Guardrail are generally off the post. However, for tight post spacings, splices on the posts are necessary and acceptable.

NOTES

Guardrail systems on NHS routes must meet NCHRP 350 or the most current AASHTO Manual for Assessing Safety Hardware (MASH) crash testing criteria and have an eligibility letter to be used on WVDOH projects.

Guardrail shall be secured to the blocks, post and other elements by 5/8" dia. bolts and nuts conforming to the details herein and to the requirements of 712.4 of the Standard Specifications. Nuts shall conform to ASTM A563, Grade A or better.

Approach and Trailing End Treatments shall be as shown or specified on the Plans or directed by the Engineer.

The pay quantity of guardrail will be the Linear Feet of guardrail measured along the face of the rail from center to center of end posts. Cost of the Terminal Section Buffer End shall be included in the cost of the Guardrail.

The approach slope to the face of all guardrail shall be 10:1 or flatter.

The Type, Class and Height of Guardrail shall be as shown in the Plans.

Lap Guardrail in Direction of Traffic.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

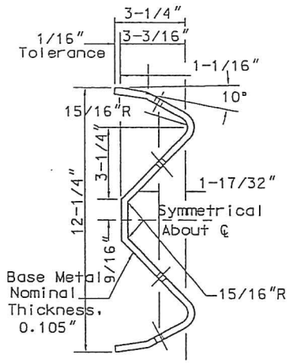
REVISED STANDARD DETAIL

PREPARED 7-1-99

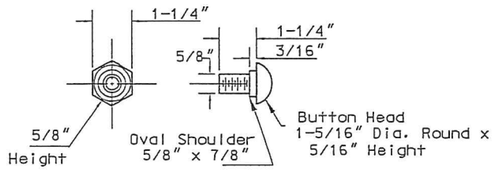
REVISION DATE
11-13-12

GUARDRAIL CLASS
GUARDRAIL HEIGHT

REPLACES SHEET GR1

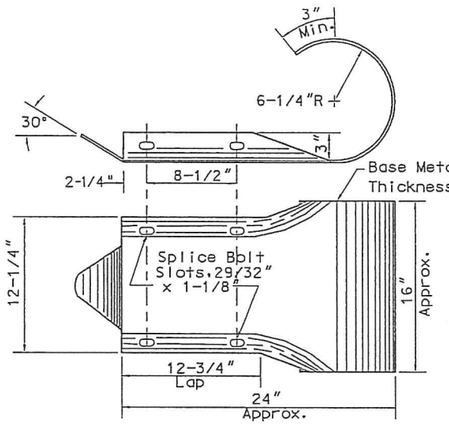


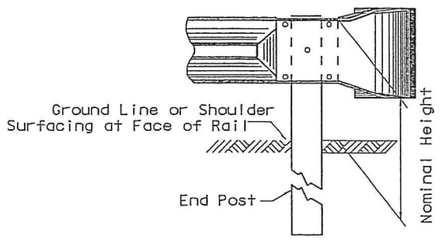
SECTION
RAIL ELEMENT



NUT SPLICE BOLT

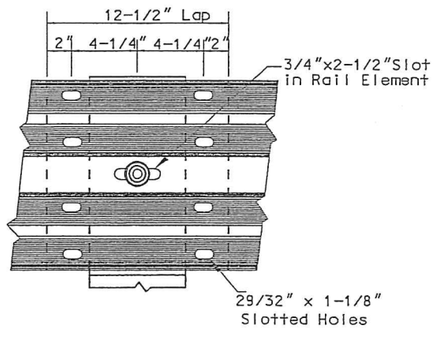
SLICE BOLT: Similar Except Length





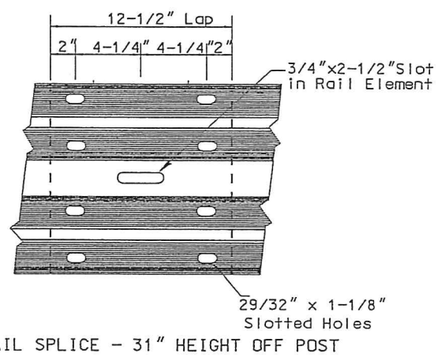
TERMINAL SECTION BUFFER END

(For Use Only on Unanchored Ends And on Special Trailing End Terminal)



RAIL SPLICE - 28 1/2" HEIGHT ON POST

Eight (8) Splice Bolts are to be used at all Rail Splices



RAIL SPLICE - 31" HEIGHT OFF POST

Eight (8) Splice Bolts are to be used at all Rail Splices

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

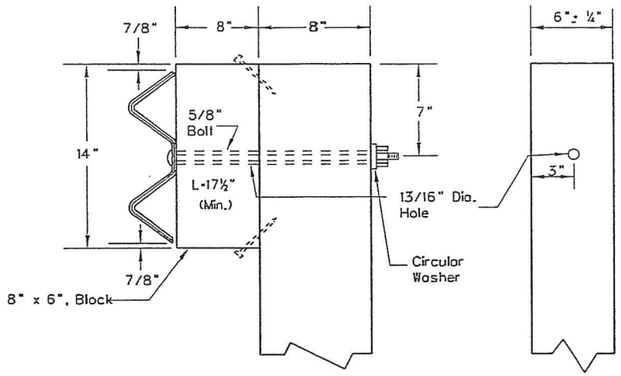
REVISED STANDARD DETAIL

GUARDRAIL ELEMENT
BUFFER END

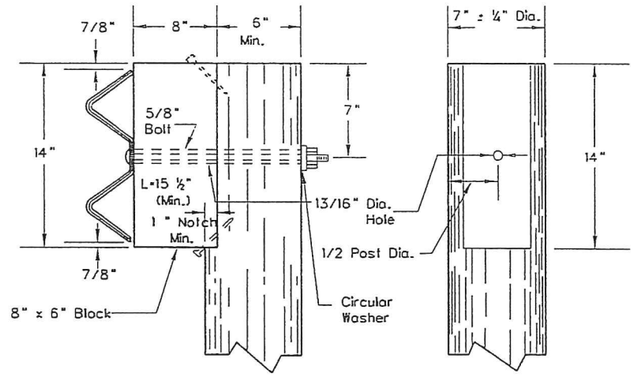
PREPARED 11-13-12

REVISION DATE

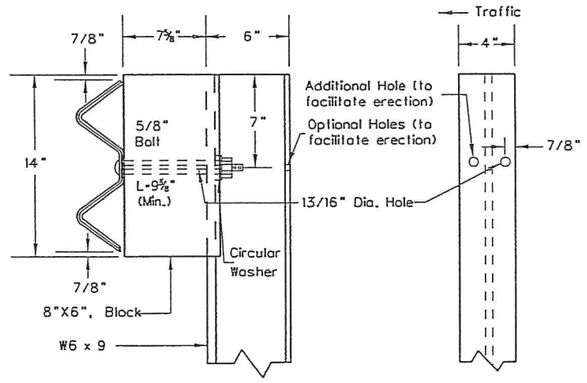
SHEET GR1-A



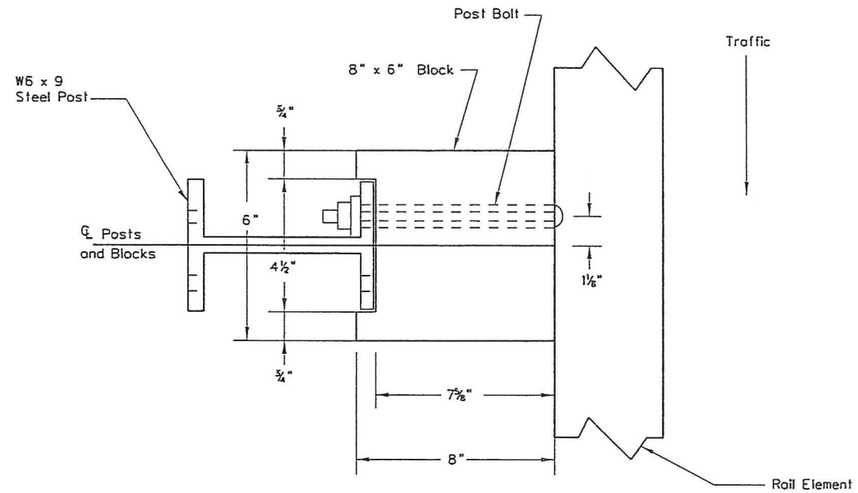
WOOD GUARDRAIL POST (RECTANGULAR)



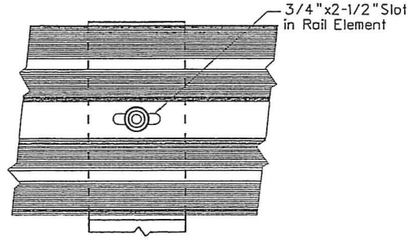
WOOD GUARDRAIL POST (ROUND)



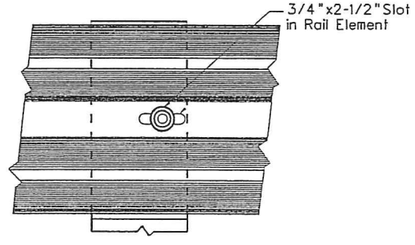
STEEL GUARDRAIL POST
(WOOD BLOCK)



PLAN



WOOD POST DETAIL



STEEL POST DETAIL

NOTES

GENERAL:

Guardrail systems on NHS routes must meet curreni NCHRP 350 or the most current AASHTO Manual for Assessing Safety Hardware (MASH) crosh testing criteria and hove an FHWA eligibility letter to be used on WVDOH projects.

Only FHWA approved guardrail systems utilizing wood or approved alternate block-outs shown on the Division's "Approved Source/Product Listing" shall be used. Steel "W" shapes shall not be used for block-outs. Only one type of block shall be used for block-outs throughout any project, unless otherwise specified.

" Blocks for block-outs" shall be used on all posts except when otherwise noted on plans. When blocks are not provided, the post details will be as shown herein, except the ⅝" bolt minimum length will be reduced as required, the 1" minimum notch for the wood guardrail post (round) will not be used, and nails for block stability will not be needed. For steel posts without blocks, details of the posts shall conform to the "Steel Guardrail Post (Wood Block)" details herein, with the additional holes (to facilitate erection) being optional.

The circular washers shall be made of steel and galvanized in accordance with the requirements of AASHTO M232.

WOOD POSTS:

Posts and blocks shall be the same type of wood.

Wood posts shall be pressure-treated after notching, in accordance with Section 710.5 of the specifications.

The 1" (minimum) notch dimension as shown for round wooden posts shall be located along the vertical centerline for the entire upper 14" of the post and shall apply regardless of whether the post is notched (as shown) or otherwise cut or sawed to form a vertical flat plane and then, at some location below the top 14", is angularly sliced out to the surface of the post.

Post length will be 6' -+ ½" unless otherwise noted.

STEEL POSTS:

Blocks shall be centered on their posts and the center of the block holes, for bolts connecting rails to blocks, shall be horizontally offset 1-1/8" from the center of the steel posts toward the post edge facing approaching traffic for both polimer and wood blocks, as shown for wood blocks on the Plan view of the Block Stop Detail. Post length will be 6' -+ ½" unless otherwise noted.

WOOD BLOCKS:

The type (species) of wood for blocks is to be one of the types (species) permitted by specifications for wood posts. Wood blocks shall be pressure--treated in conformance with the requirements for wood posts. However, creosote oil is not permitted as a preservative in the pressure treatment of wood blocks to be erected on steel posts. 8" x 6" wood blocks shall be positioned so that the 6" x 14" faces of the blocks are the contact faces for the rail elements and the posts in order to achieve the blockout dimension shown. When wood block is used adjacent to a wood post, the block shall be nailed to the post with a galvanized steel 10d common nail. The nail is to be driven into the center of the top or bottom of the block.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

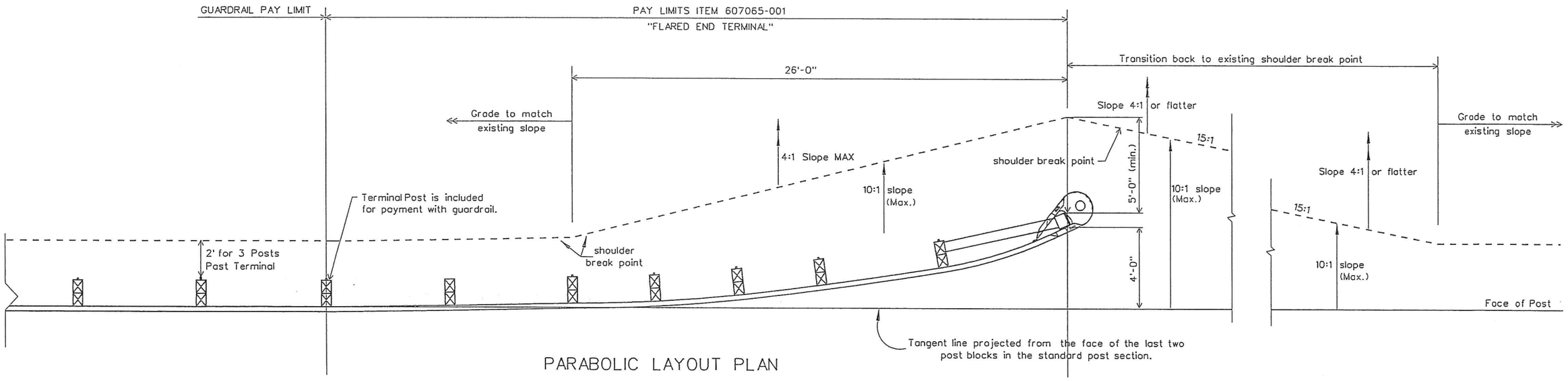
REVISED STANDARD DETAIL

PREPARED 7-1-99

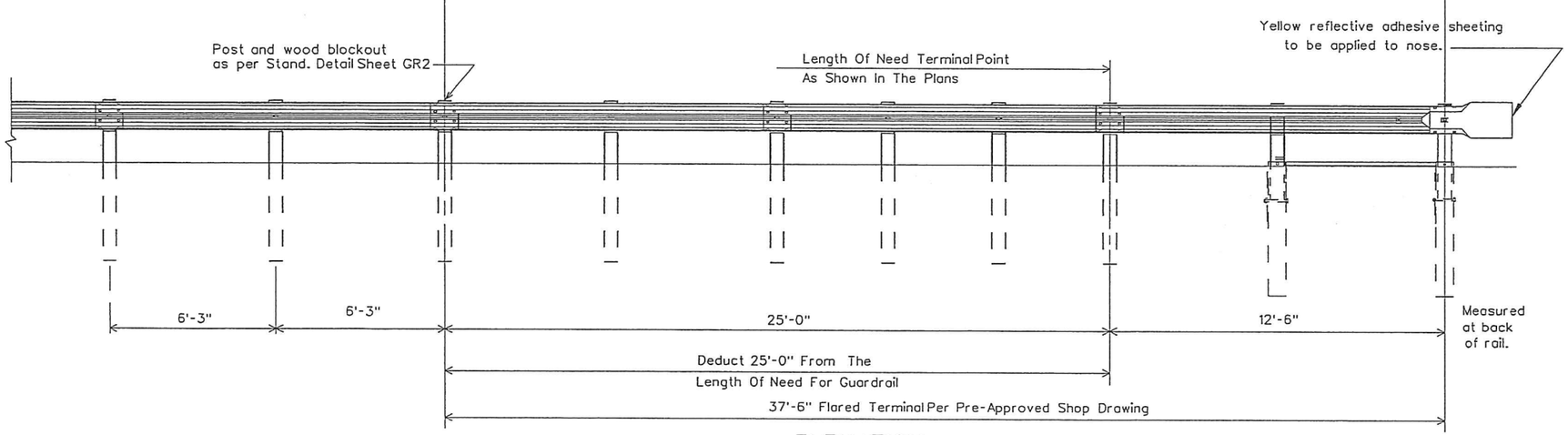
REVISION DATE
03-05-2010
06-16-2010
11-13-12

GUARDRAIL POSTS AND BLOCKS

REPLACES SHEET GR2



PARABOLIC LAYOUT PLAN



ELEVATION

NOTES

For details of Flared End Terminal see pre approved shop drawings.

All materials used shall meet the applicable requirements of Section 607 of the Standard Specifications Road and Bridges.

The post offset dimensions are given to the center of the traffic face of the blockouts: except at the first post, where the dimension is to the center of the traffic face of the post. Offset points are to be located by measurements at the back of rail equal to the nominal post spacings shown on pre-approved shop drawings. Posts are to be set approximately radial to the railing at each location.

When a wood block is used adjacent to a wood post, the block shall be nailed to the post with a galvanized steel 10d common nail. The nail is to be driven into the center of the top or bottom of the block.

The cost of furnishing and installing the Flared End Terminal, complete with all miscellaneous hardware and parts as detailed on the pre-approved shop drawings , is to be included in the unit price bid for "Flared End Terminal".

Yellow reflective sheeting shall cover the entire nose of those terminals with a flat impact head. Those terminals with a rounded impact head shall be covered with a 1'-0" X 3'-0" yellow reflective sheet.

As of 11-13-12 revision date, this detail is obsolete and no longer used for new construction.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

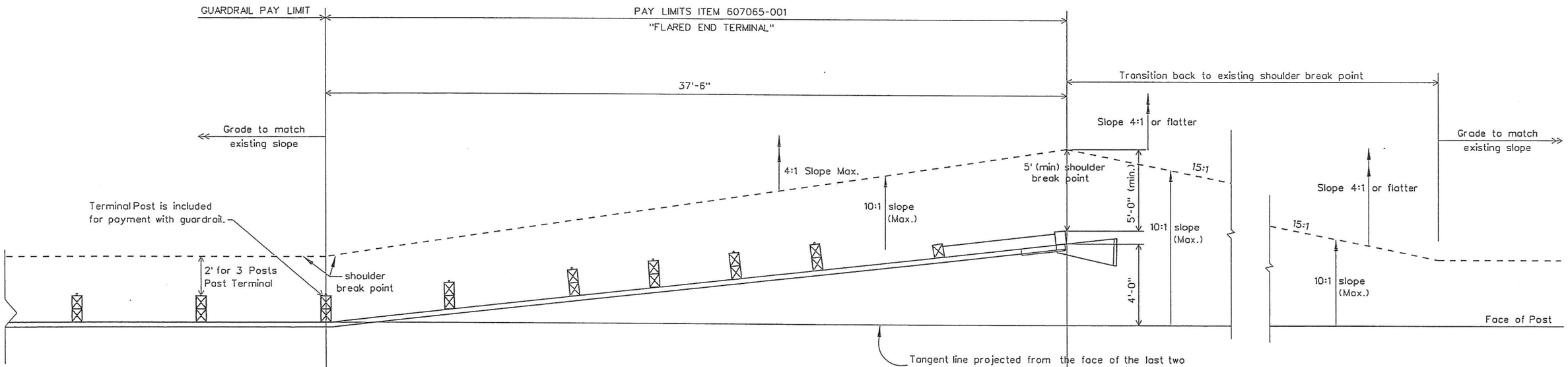
REVISED STANDARD DETAIL

PREPARED 7-1-99

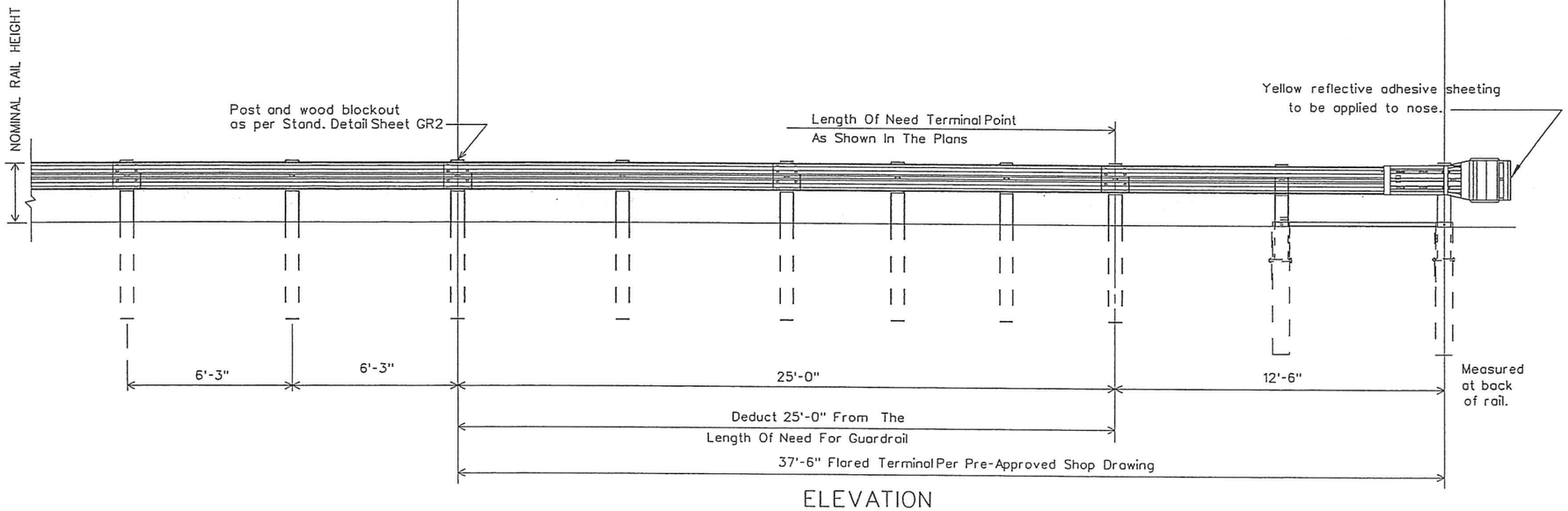
REVISION DATE
11-13-12

FLARED END TERMINAL
PARABOLIC LAYOUT
(SHEET 1 OF 2)

STANDARD SHEET GR5



STRAIGHT LAYOUT PLAN



ELEVATION

NOTES

Flared End Terminal shall meet NCHRP-350 and/or Mash testing for appropriate height.

Separate Approved Product Lists will be maintained for both 28 1/2" and 31" terminal heights.

For details of Flared End Terminal see pre approved shop drawings.

Post and splice locations are per manufacturer.

All materials used shall meet the applicable requirements of Section 607 of the Standard Specifications Road and Bridges.

The post offset dimensions are given to the center of the traffic face of the blockouts: except at the first post, where the dimension is to the center of the traffic face of the post. Offset points are to be located by measurements at the back of rail equal to the nominal post spacings shown on pre-approved shop drawings. Posts are to be set approximately radial to the railing at each location.

When a wood block is used adjacent to a wood post, the block shall be nailed to the post with a galvanized steel 10d common nail. The nail is to be driven into the center of the top or bottom of the block.

The cost of furnishing and installing the Flared End Terminal, complete with all miscellaneous hardware and parts as detailed on the pre-approved shop drawings , is to be included in the unit price bid for "Flared End Terminal".

Yellow reflective sheeting shall cover the entire nose of those terminals with a flat impact head. Those terminals with a rounded impact head shall be covered with a 1'-0" X 3'-0" yellow reflective sheet.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

REVISED STANDARD DETAIL

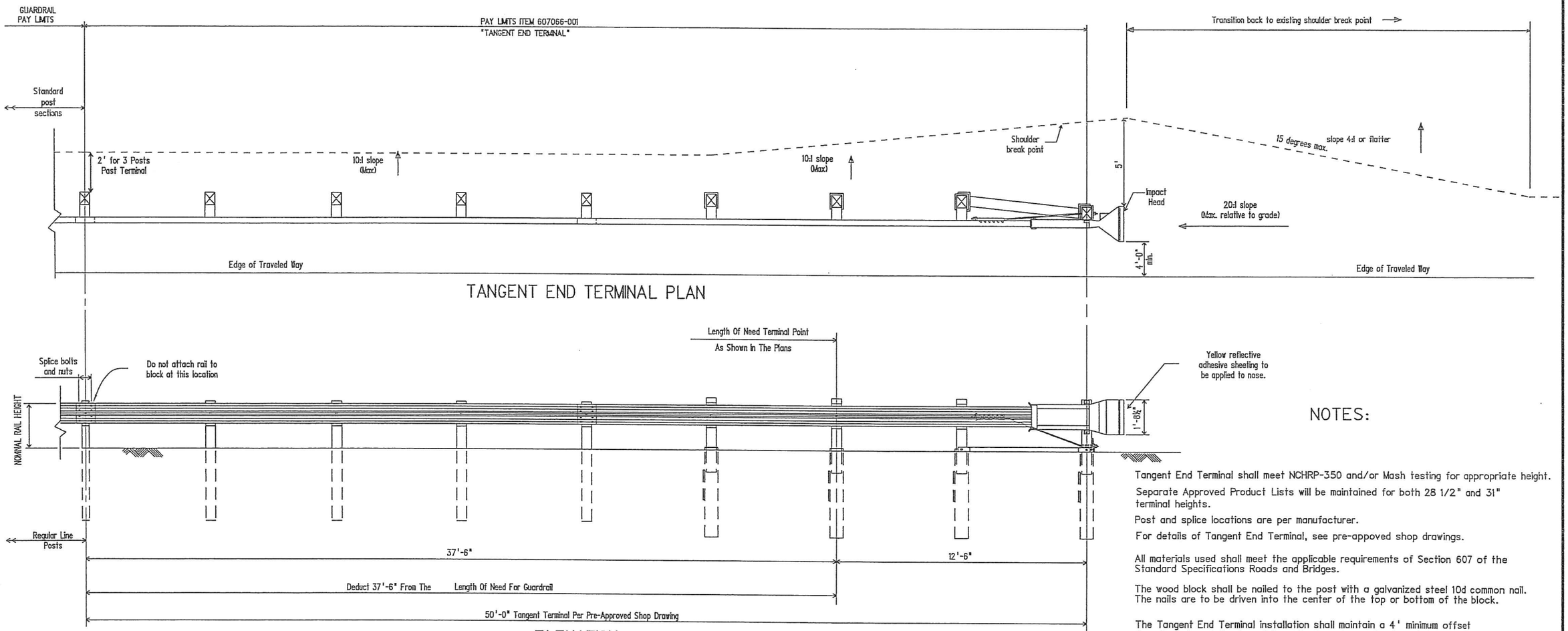
PREPARED 7-1-99

REVISION DATE
11-13-12

FLARED END TERMINAL STRAIGHT LAYOUT

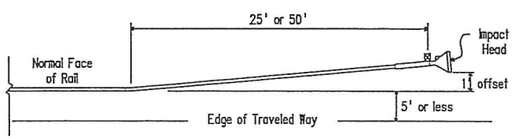
(SHEET 2 OF 2)

REPLACES SHEET GR5



TANGENT END TERMINAL PLAN

ELEVATION



FLARE DETAIL

NOTES:

Tangent End Terminal shall meet NCHRP-350 and/or Mash testing for appropriate height.

Separate Approved Product Lists will be maintained for both 28 1/2" and 31" terminal heights.

Post and splice locations are per manufacturer.

For details of Tangent End Terminal, see pre-appoved shop drawings.

All materials used shall meet the applicable requirements of Section 607 of the Standard Specifications Roads and Bridges.

The wood block shall be nailed to the post with a galvanized steel 10d common nail. The nails are to be driven into the center of the top or bottom of the block.

The Tangent End Terminal installation shall maintain a 4' minimum offset from the edge of the impact head to the edge of the traveled way. For narrow existing shoulders that have an offset of 5' or less from the face of the rail element to the edge of the traveled way, the rail and terminal may be flared from the normal face of rail. The flared offset distance shall be 1' at a taper rate of 25:1, for a total flare length of 25'; or a taper rate of 50:1, for a total flare length of 50' (see Flare Detail).

Rail element panel lengths shall be 25' only. Shorter lengths shall not be used.

The cost of furnishing and installing the Tangent End Terminal, complete with all miscellaneous hardware and parts as detailed on the pre-approved shop drawings, is to be included in the unit price bid for "Tangent End Terminal".

Yellow reflective sheeting shall cover the entire nose of those terminals with a flat impact head. Those terminals with a rounded impact head shall be covered with a 1'-0" X 3'-0" yellow reflective sheet.

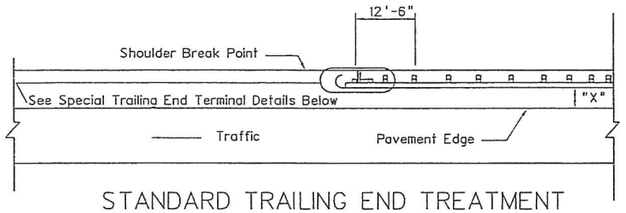
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

REVISED STANDARD DETAIL

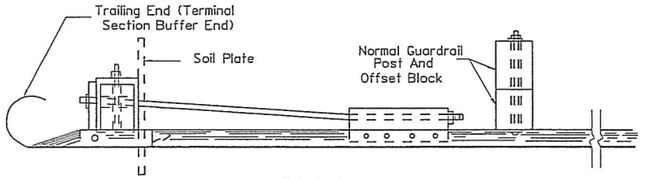
PREPARED 7-1-99
REVISION DATE
11-13-12

TANGENT END TERMINAL

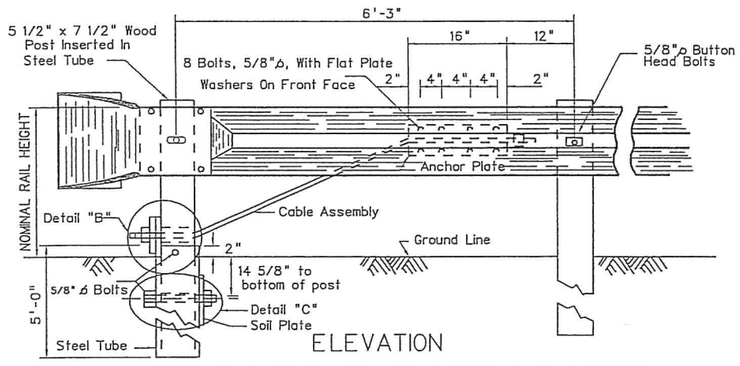
REPLACES SHEET GR6



STANDARD TRAILING END TREATMENT
(MULTI-LANE DIVIDED HIGHWAY)



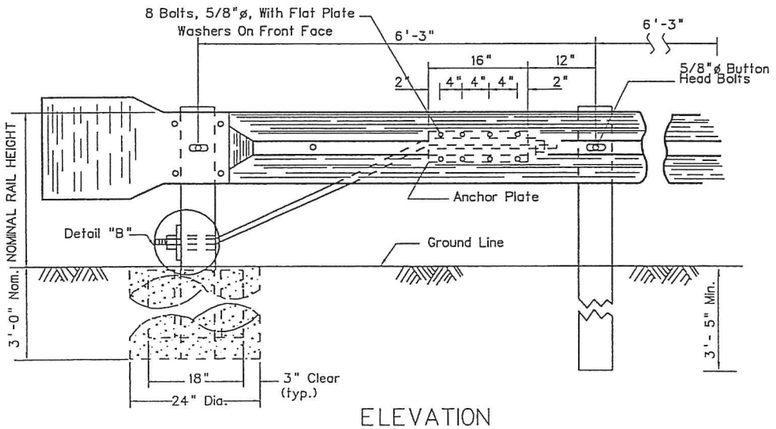
PLAN



ELEVATION

SPECIAL TRAILING END TERMINAL(STET)

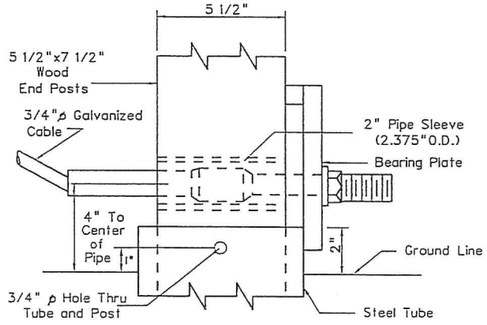
(TUBULAR STEEL END FOUNDATION)



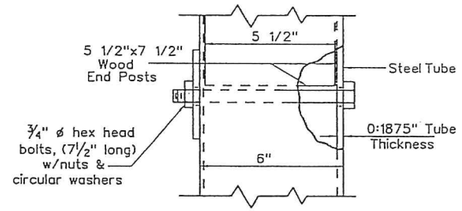
ELEVATION

SPECIAL TRAILING END TERMINAL(STET)

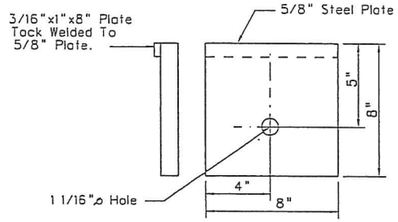
(CONCRETE FOOTER END FOUNDATION)



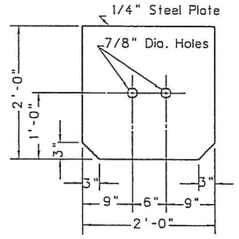
DETAIL "B"



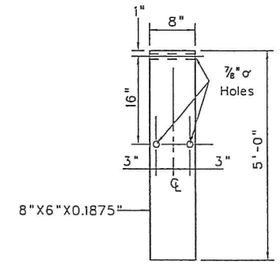
DETAIL "C"



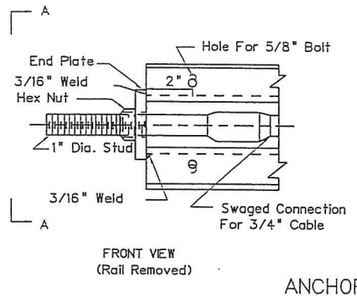
BEARING PLATE



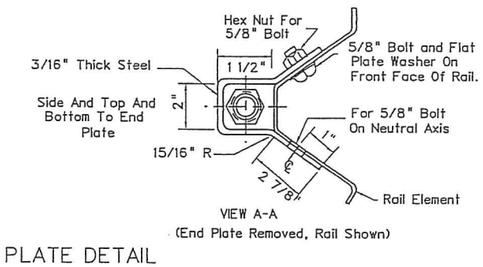
SOIL PLATE



STEEL TUBE

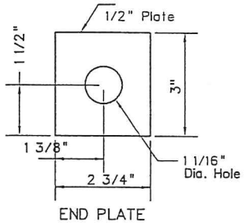


FRONT VIEW
(Rail Removed)

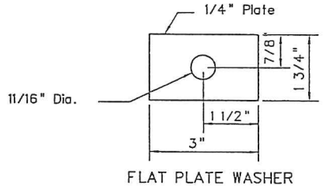


VIEW A-A
(End Plate Removed, Rail Shown)

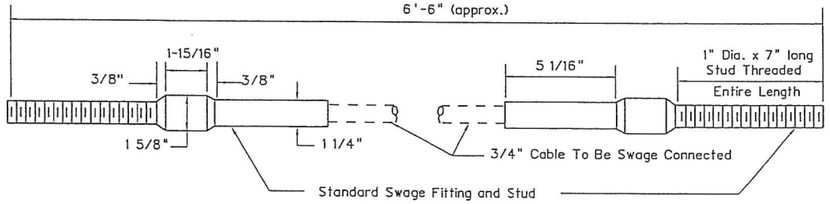
ANCHOR PLATE DETAIL



END PLATE



FLAT PLATE WASHER



CABLE ASSEMBLY

NOTES

Steel tubes shall meet the requirements of ASTM Specification A500, Grade B, and shall be galvanized after fabrication in accordance with the requirements of AASHTO Specification M111. Other terminal components; such as anchor plates, cable assemblies, hardware, plates, pipe sleeves, etc; shall conform to the detail and requirements of section 607 of the Specifications.

For each STET end treatment installation it shall be the Contractor's option whether to utilize the Tubular Steel End Foundation design detailed herein or Concrete Footer End Foundation design detailed , unless one type is specified in the plans. When the Concrete Footer End Foundation is used, the embedded portion of the Endpost is to be double wrapped with Composition Paper or single wrapped with sheet metal or other material acceptable to the Engineer before concrete placement to facilitate replacement of damaged posts.

The cost of furnishing and installing the Special Trailing End Terminal; including structural tubing, soil plates, and welded bearing plates for Tubular Steel End Foundations; concrete footers, welded wire fabric, all necessary excavation, composition paper and sheetmetal for Concrete Footer End Foundations; and all "terminal" hardware,cables, studs, plates, and pipe sleeves shall be included in the unit price bid for "Special Trailing End Terminal", per each. Normal guardrail components; i.e., posts, blocks, rail elemenis, hardware, etc; along with the special size and/or special length wood guardrail end post and the terminal section buffer end, shall be paid for as guardrail per linear foot.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

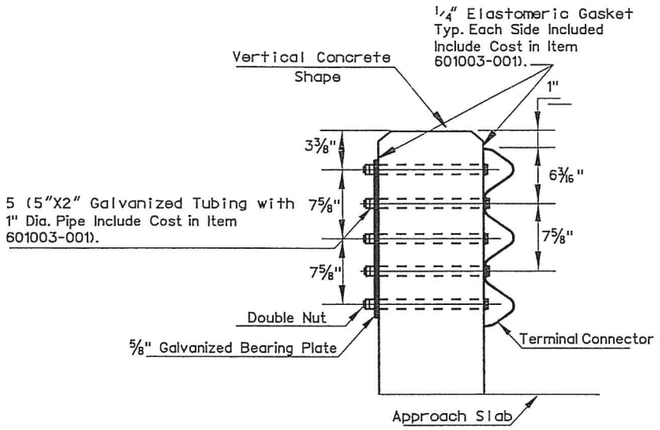
REVISED STANDARD DETAIL

PREPARED 7-1-99

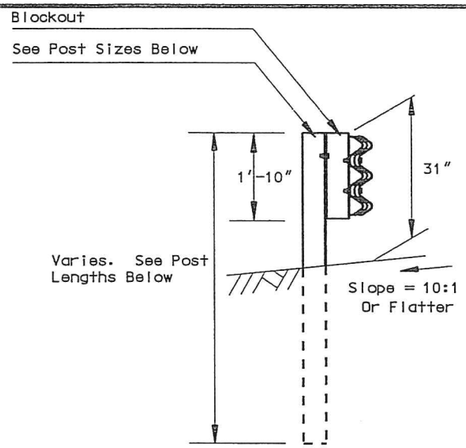
REVISION DATE
11-13-2012

SPECIAL TRAILING END TERMINAL

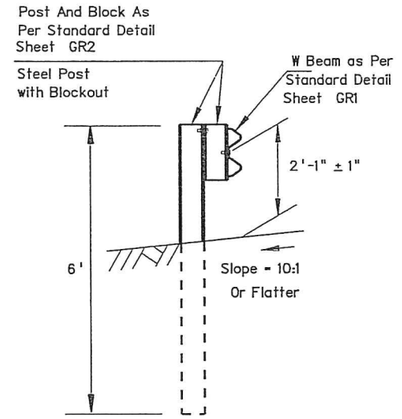
REPLACES SHEET GR7



SECTION A–A



SECTION B–B



SECTION C–C

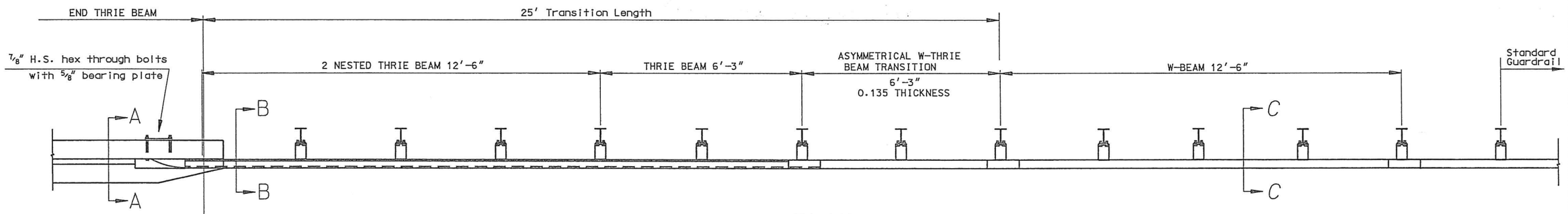
NOTES

This guardrail transition is appropriate for connection to a vertical concrete shape and should not be connected directly to a concrete safety shape. Concrete safety shape bridge rails or barriers shall be transitioned to a vertical shape at the guardrail connection in a manner detailed elsewhere in the Project Plans.

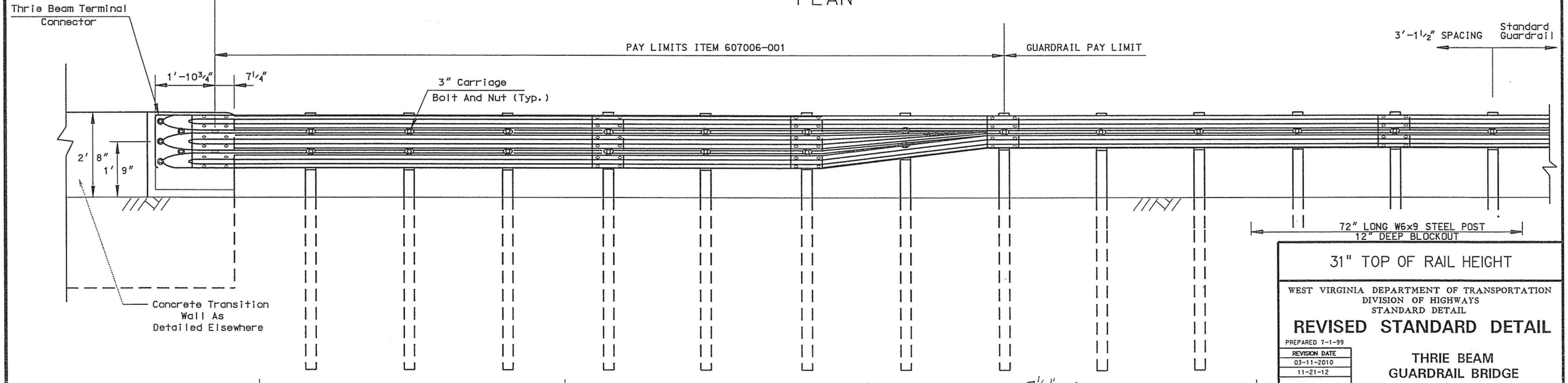
The two sections of 12'6" thrie beam require additional holes in order to mount the beam to the post nearest to the concrete wall.

See sheet 2 of 2 for details not shown on this sheet.

Guardrail systems must have met either the NCHRP 350 or the most current AASHTO Manual for Assessing Safety Hardware (MASH) crash testing criteria and have an FHWA eligibility letter to be used on WVDOH projects. Only FHWA approved guardrail systems utilizing wood or approved block-outs shown on the Division's "Approved Source/Product Listing" shall be used. Steel "W" Shapes shall not be used for block-outs. Only one type of block shall be used for blockout throughout any project, unless otherwise specified.



PLAN



ELEVATION

31" TOP OF RAIL HEIGHT

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

REVISED STANDARD DETAIL

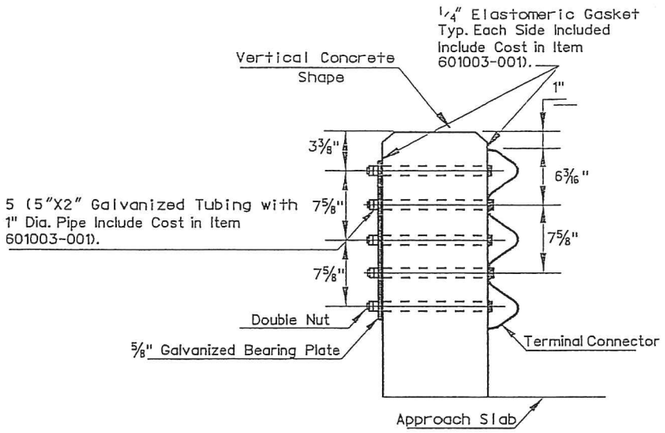
PREPARED 7-1-99

REVISION DATE
03-11-2010
11-21-12

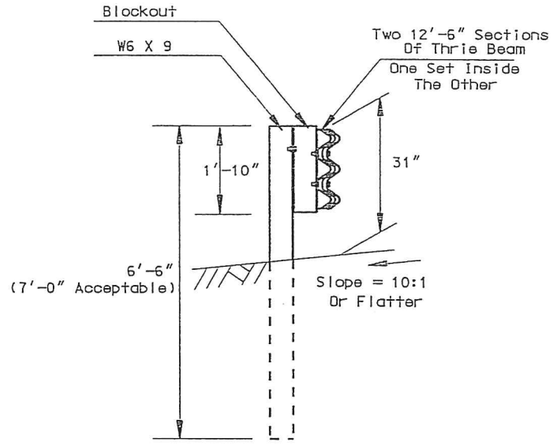
THRIE BEAM GUARDRAIL BRIDGE TRANSITION AND CONNECTION

REPLACES SHEET 1 OF 2
SHEET GR 11

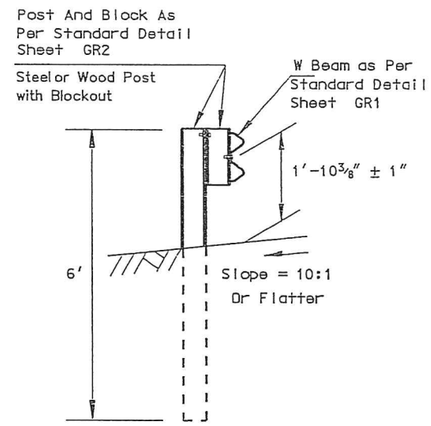
P3ANC92-STDSDR e



SECTION A–A



SECTION B–B



SECTION C–C

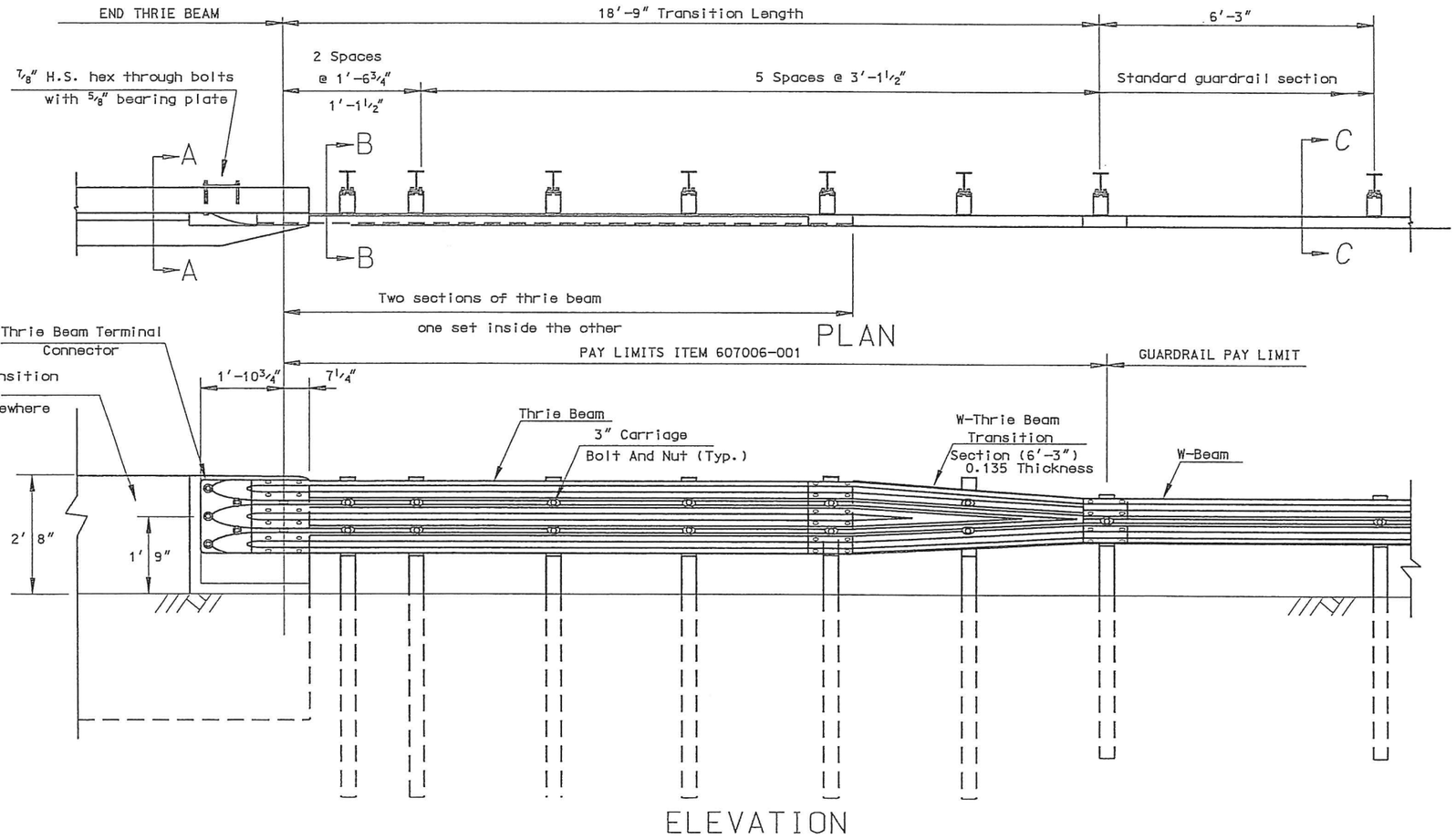
NOTES

This guardrail transition is appropriate for connection to a vertical concrete shape and should not be connected directly to a concrete safety shape. Concrete safety shape bridge rails or barriers shall be transitioned to a vertical shape at the guardrail connection in a manner detailed elsewhere in the Project Plans.

The two sections of 12'6" thrie beam require additional holes in order to mount the beam to the post nearest to the concrete wall.

See sheet 2 of 2 for details not shown on this sheet.

Guardrail systems must have met either the NCHRP 350 or the most current AASHTO Manual for Assessing Safety Hardware (MASH) crash testing criteria and have an FHWA eligibility letter to be used on WVDOH projects. Only FHWA approved guardrail systems utilizing wood or approved block-outs shown on the Division's "Approved Source/Product Listing" shall be used. Steel "W" Shapes shall not be used for block-outs. Only one type of block shall be used for blockout throughout any project, unless otherwise specified.



28 1/2" TOP OF RAIL HEIGHT

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

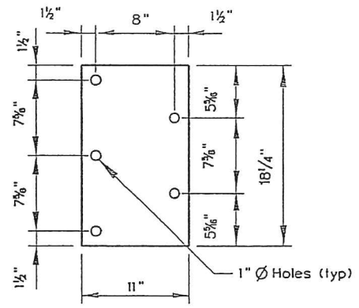
REVISED STANDARD DETAIL

PREPARED 7-1-99

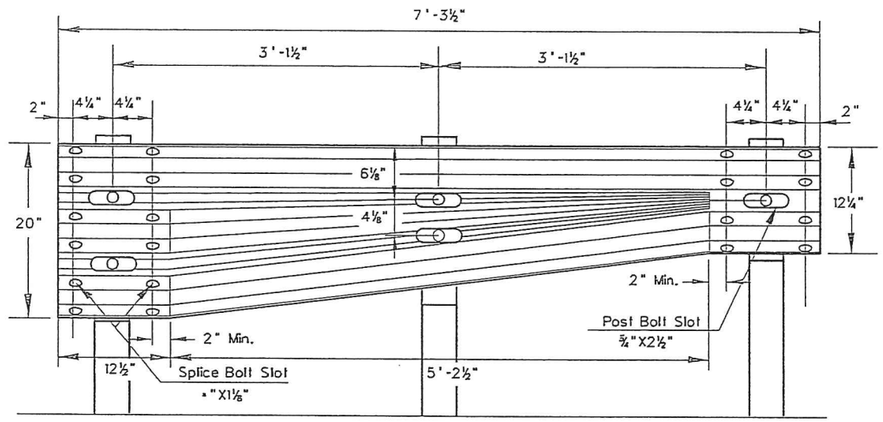
REVISION DATE
03-11-2010
11-13-12

THRIE BEAM
GUARDRAIL BRIDGE
TRANSITION AND
CONNECTION

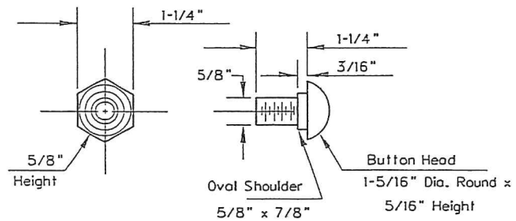
REPLACES SHEET 1 OF 2
SHEET GR 11



5/8" BEARING PLATE DETAIL

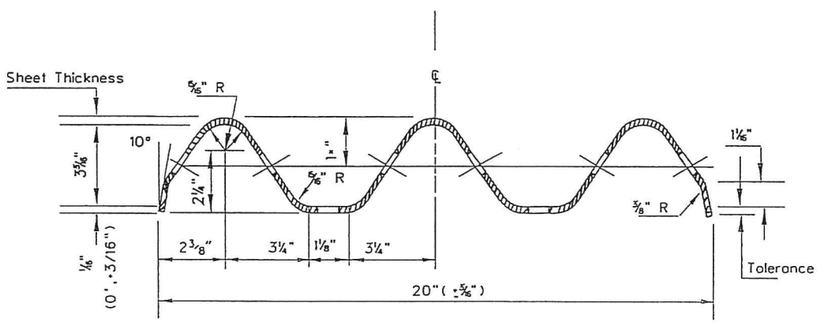


ASYMMETRICAL TRANSITION SECTION DETAIL
(W- THRIE BEAM)

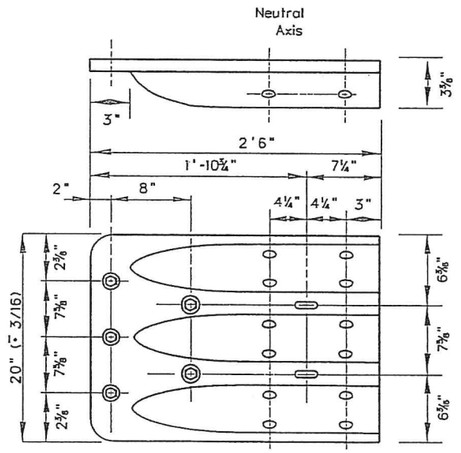


NUT SPLICE BOLT

NUT AND SPLICE BOLT DETAIL
(POST BOLT: Similar Except Length)



SECTION THRU THRIE BEAM RAIL ELEMENT



THRIE BEAM TERMINAL
CONNECTOR DETAIL

31" TOP OF RAIL HEIGHT

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

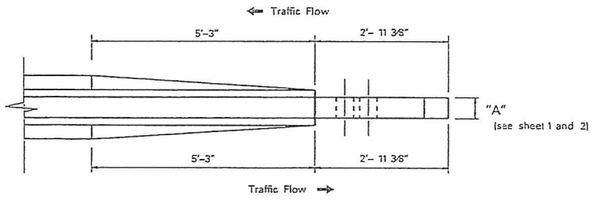
REVISED STANDARD DETAIL

PREPARED 7-1-99

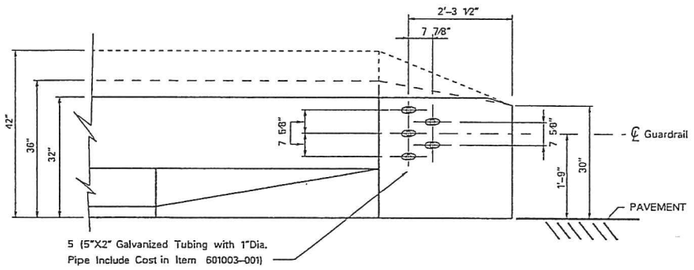
REVISION DATE
11-21-2012

THRIE BEAM
GUARDRAIL BRIDGE
TRANSITION AND
CONNECTION

REPLACES SHEET 2 OF 2
SHEET GR11

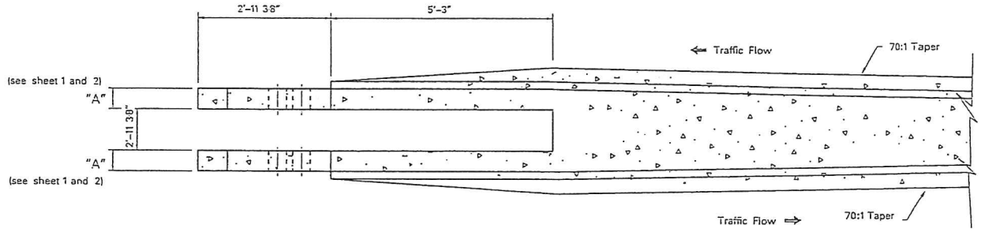


PLAN

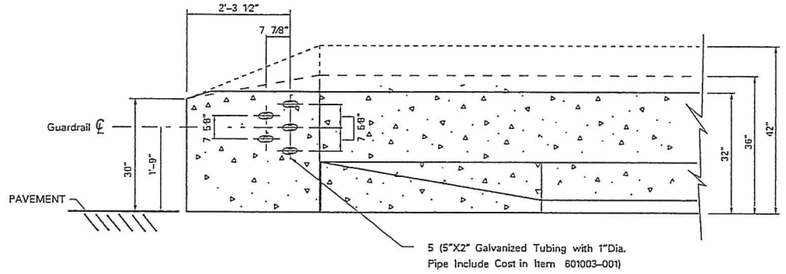


ELEVATION

DOUBLE FACE TRANSITION

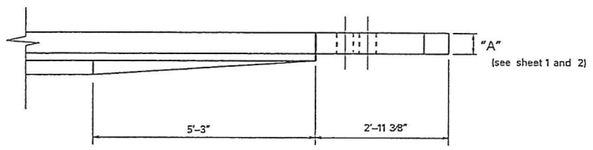


PLAN

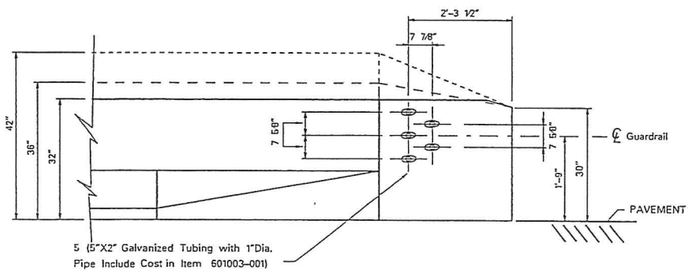


ELEVATION

DOUBLE MEDIAN TRANSITION

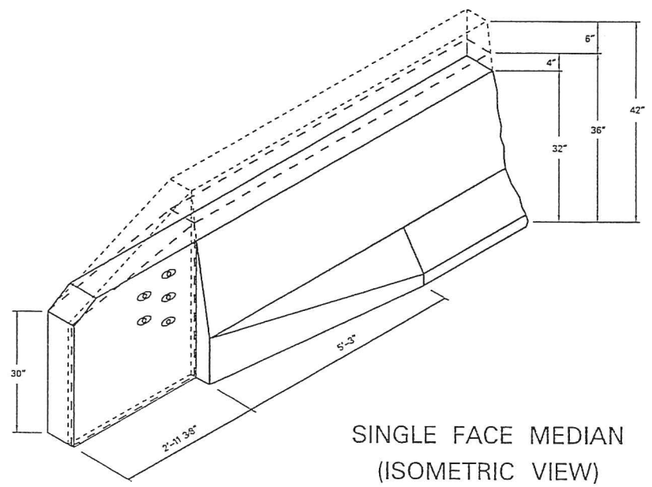


PLAN



ELEVATION

SINGLE FACE TRANSITION



SINGLE FACE MEDIAN
(ISOMETRIC VIEW)

NOTES

The contractor shall have the option to install either the N-J Shape or the F-Shape median unless otherwise specified on the Plans.

For additional dimensions, notes and details see Sheet 1 and 2.

For additional notes and details of the guardrail bolt pattern, see Standard Detail Sheet GR10.

Elongated bolt holes do not apply to existing end posts that are not being reconstructed.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

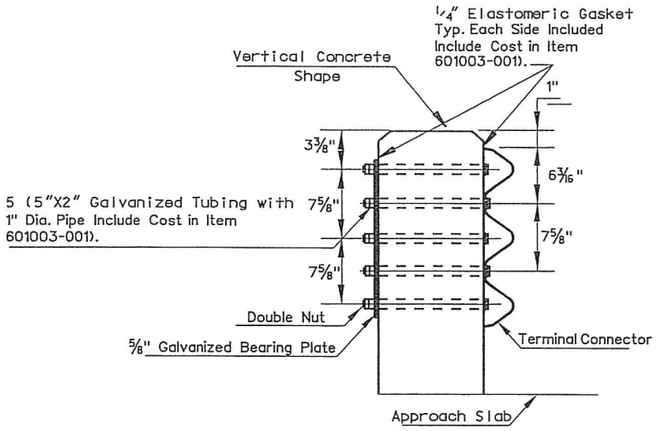
REVISED STANDARD DETAIL
TYPE V MEDIAN
GUARDRAIL ATTACHMENT
F-SHAPE OR N-J SHAPE

PREPARED 7-1-99

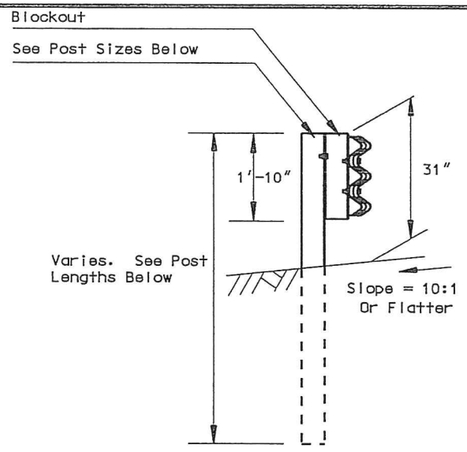
REVISION DATE
11-13-12

REPLACES (Sheet 3 of 4)

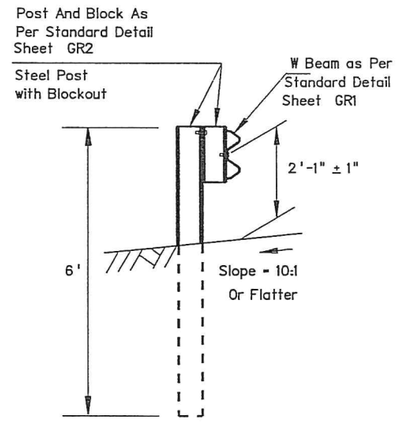
STANDARD SHEET GR12



SECTION A-A



SECTION B-B



SECTION C-C

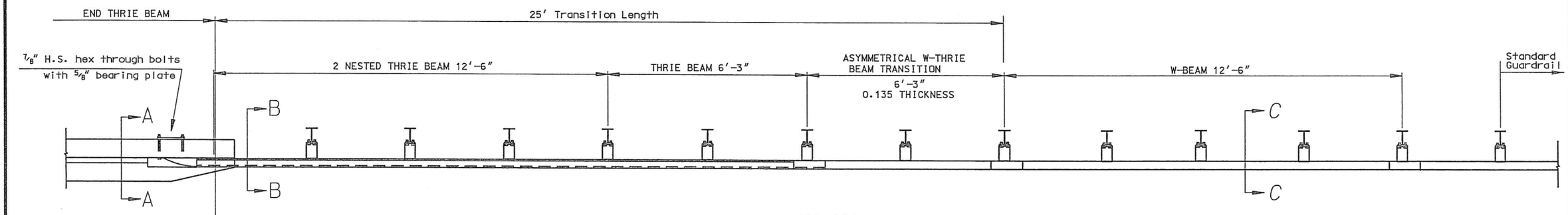
NOTES

This guardrail transition is appropriate for connection to a vertical concrete shape and should not be connected directly to a concrete safety shape. Concrete safety shape bridge rails or barriers shall be transitioned to a vertical shape at the guardrail connection in a manner detailed elsewhere in the Project Plans.

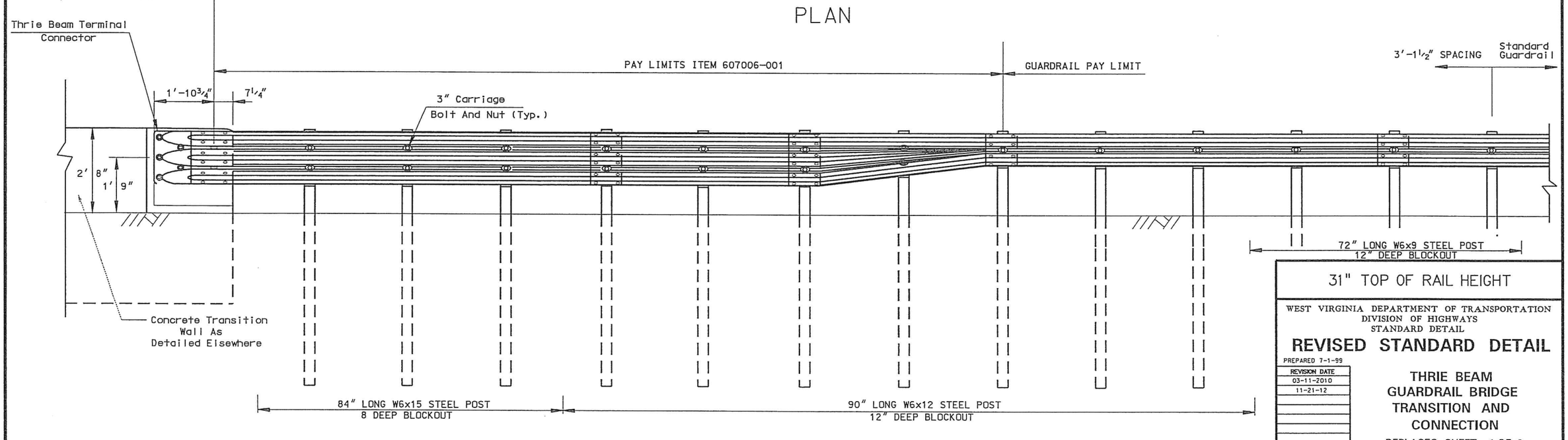
The two sections of 12'6" thrie beam require additional holes in order to mount the beam to the post nearest to the concrete wall.

See sheet 2 of 2 for details not shown on this sheet.

Guardrail systems must have met either the NCHRP 350 or the most current AASHTO Manual for Assessing Safety Hardware (MASH) crash testing criteria and have an FHWA eligibility letter to be used on WVDOH projects. Only FHWA approved guardrail systems utilizing wood or approved block-outs shown on the Division's "Approved Source/Product Listing" shall be used. Steel "W" Shapes shall not be used for block-outs. Only one type of block shall be used for blockout throughout any project, unless otherwise specified.



PLAN



ELEVATION

31" TOP OF RAIL HEIGHT

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

REVISED STANDARD DETAIL

PREPARED 7-1-99

REVISION DATE
03-11-2010
11-21-12

THRIE BEAM GUARDRAIL BRIDGE TRANSITION AND CONNECTION

REPLACES SHEET 1 OF 2
SHEET GR 11

P3AIC92-STDSOR e

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

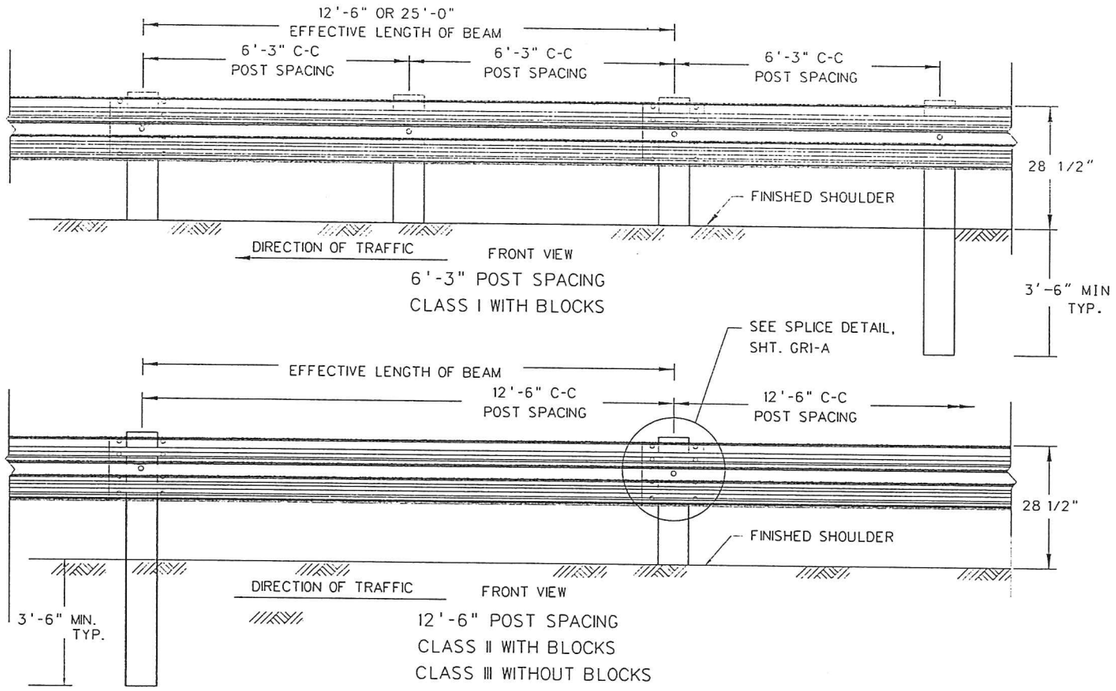
STANDARD DETAILS BOOK

VOLUME I

DRAINAGE, GUARDRAIL, PAVEMENT, FENCE, MARKERS AND MAILBOX

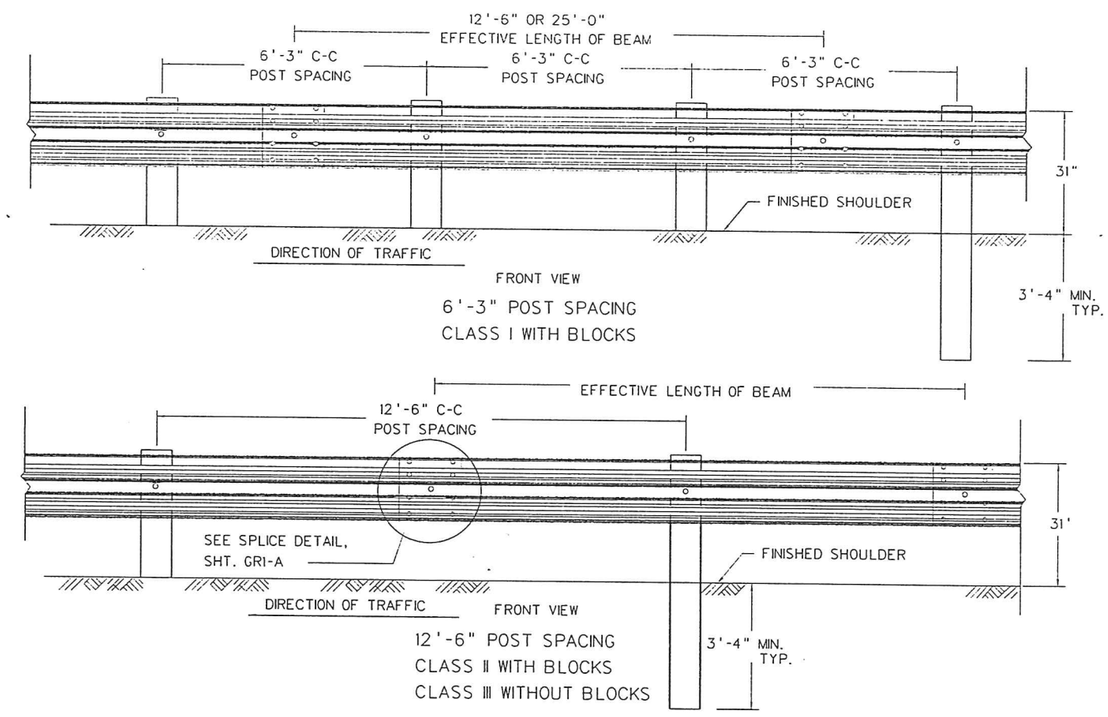
ISSUE DATE: MAY, 2016

TABLE OF CONTENTS



28-1/2" HEIGHT GUARDRAIL

Splice locations for 28 1/2" Guardrail shall be on the post.



31" HEIGHT GUARDRAIL

Splice location for 31" Guardrail are generally off the post. However, for tight post spacings, splices on the posts are necessary and acceptable.

GUARDRAIL HEIGHT

Transitions in guardrail height shall be accomplished at a rate of 1" vertical distance in 12.5' (one element) of horizontal distance. Height transitions shall end before end treatments or connections begin.

Height transitions between 28 1/2" and 31" require moving the splice on/off the post by placing one additional post at half the normal spacing.

Guardrail height shall be as indicated on plans.

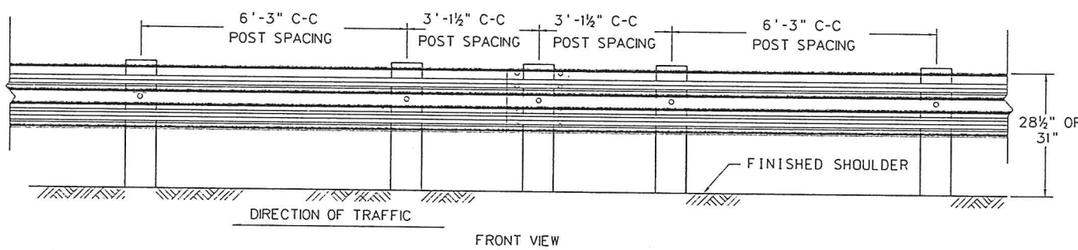
Construction tolerances for rail height is plus/minus 1".

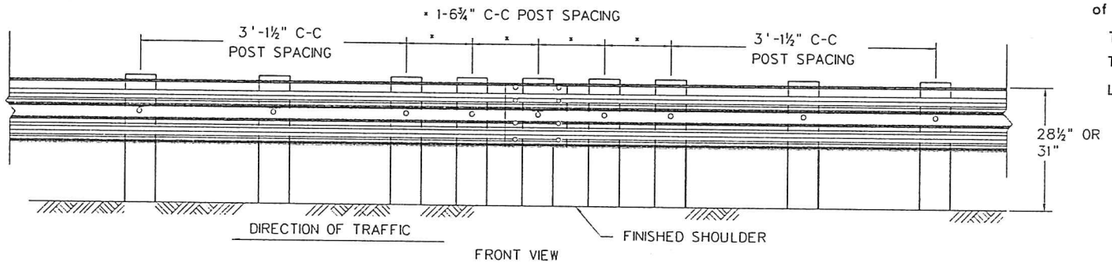
The Standard Trailing End Treatment is acceptable for both 28½" and 31" guardrail height.

Approach Terminals-Separate approved product lists will be maintained for both 28 1/2" & 31" terminal height.

Guardrail that ties to Cut Slope Terminals (CST) must be transitioned per the standard details down to 28½" height (the height of the CST).

Thrie Beam transitions shall be per Standard GR-11 dated 11-13-12 for 28½" and dated 11-21-12 for 31".





NOTES

Guardrail systems on NHS routes must meet NCHRP 350 or the most current AASHTO Manual for Assessing Safety Hardware (MASH) crash testing criteria and have an eligibility letter to be used on WVDOH projects.

Guardrail shall be secured to the blocks, post and other elements by 5/8" dia. bolts and nuts conforming to the details herein and to the requirements of 712.4 of the Standard Specifications. Nuts shall conform to ASTM A563, Grade A or better.

Approach and Trailing End Treatments shall be as shown or specified on the Plans or directed by the Engineer.

The pay quantity of guardrail will be the Linear Feet of guardrail measured along the face of the rail from center to center of end posts. Cost of the Terminal Section Buffer End shall be included in the cost of the Guardrail.

The approach slope to the face of all guardrail shall be 10:1 or flatter.

The Type, Class and Height of Guardrail shall be as shown in the Plans.

Lap Guardrail in Direction of Traffic.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

PREP:PED 7-1-99

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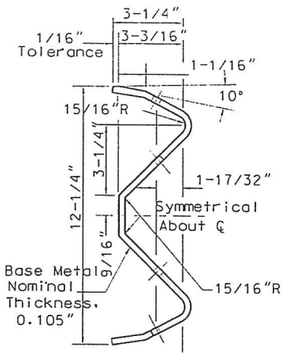
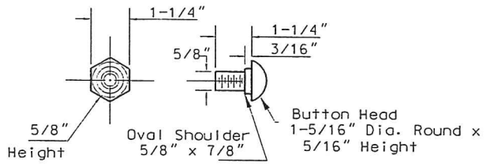
11-13-12

GUARDRAIL ELEMENTS
(SHEET 1 OF 2)

STANDARD SHEET GR1

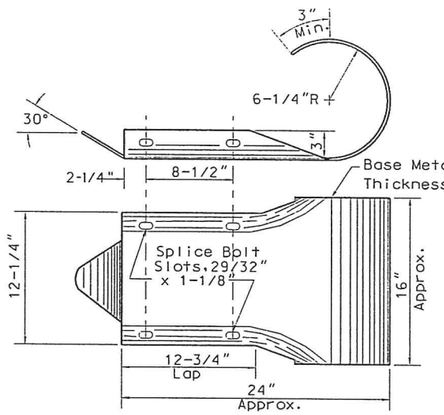


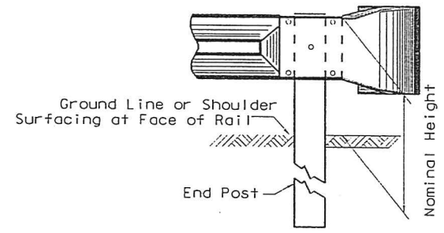
SECTION
RAIL ELEMENT



NUT SPLICE BOLT

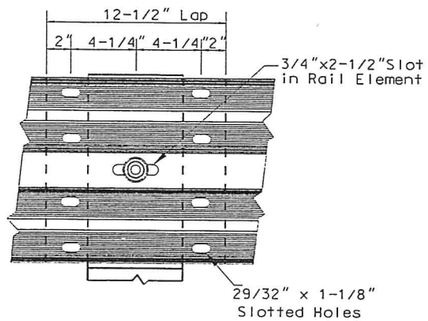
SLICE BOLT: Similar Except Length





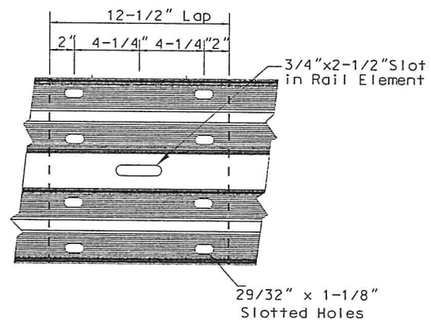
TERMINAL SECTION BUFFER END

(For Use Only on Unanchored Ends And on Special Trailing End Terminal)



RAIL SPLICE - 28 1/2" HEIGHT ON POST

Eight (8) Splice Bolts are to be used at all Rail Splices



RAIL SPLICE - 31" HEIGHT OFF POST

Eight (8) Splice Bolts are to be used at all Rail Splices

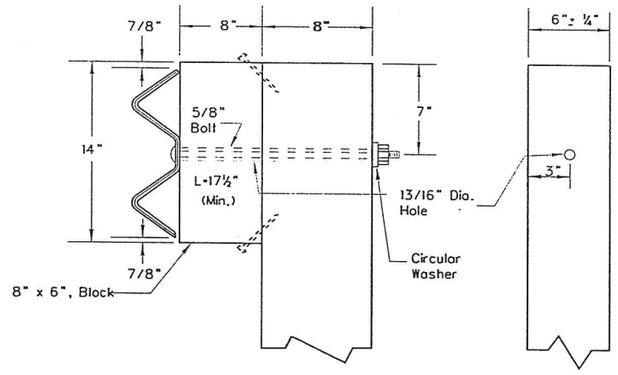
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

PREPARED 11-13-12

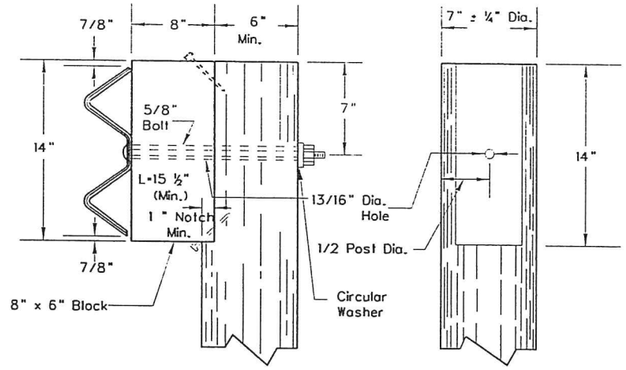
REVISION DATE

GUARDRAIL ELEMENTS
(SHEET 2 OF 2)

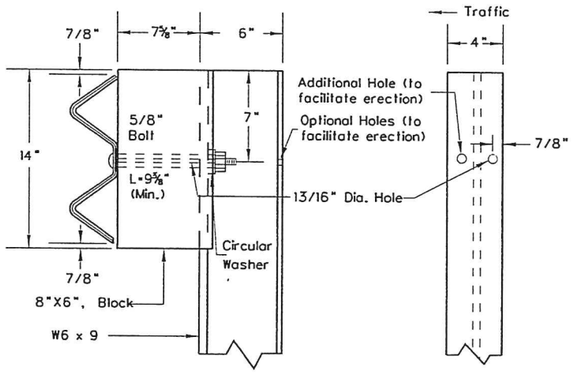
STANDARD SHEET GR1



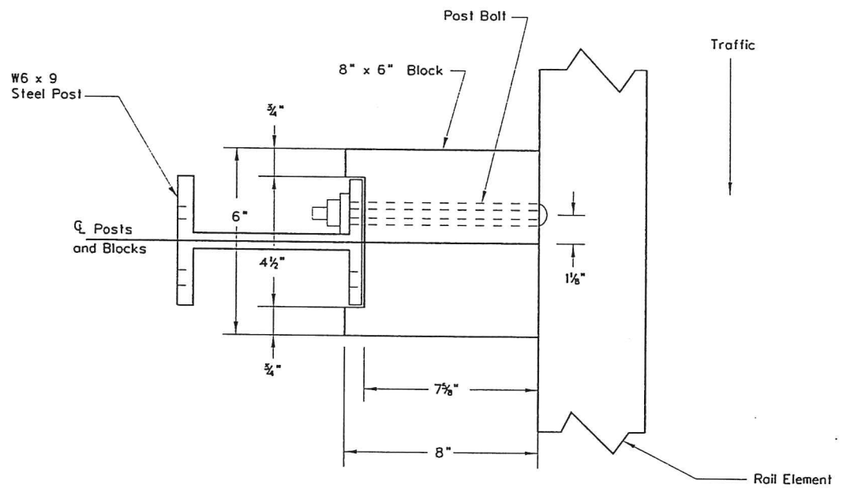
WOOD GUARDRAIL POST (RECTANGULAR)



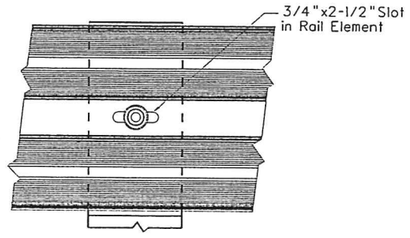
WOOD GUARDRAIL POST (ROUND)



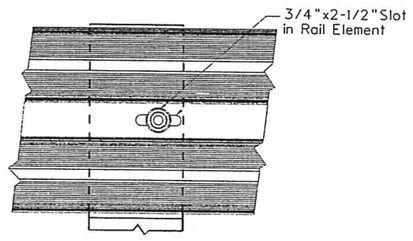
STEEL GUARDRAIL POST
(WOOD BLOCK)



PLAN



WOOD POST DETAIL



STEEL POST DETAIL

NOTES

GENERAL:

Guardrail systems on NHS routes must meet current NCHRP 350 or the most current AASHTO Manual for Assessing Safety Hardware (MASH) crash testing criteria and have an FHWA eligibility letter to be used on WVDOH projects.

Only FHWA approved guardrail systems utilizing wood or approved alternate block-outs shown on the Division's "Approved Source/Product Listing" shall be used. Steel "W" shapes shall not be used for block-outs. Only one type of block shall be used for block-outs throughout any project, unless otherwise specified.

" Blocks for block-outs" shall be used on all posts except when otherwise noted on plans. When blocks are not provided, the post details will be as shown herein, except the ⅝" bolt minimum length will be reduced as required, the 1" minimum notch for the wood guardrail post (round) will not be used, and nails for block stability will not be needed. For steel posts without blocks, details of the posts shall conform to the "Steel Guardrail Post (Wood Block)" details herein, with the additional holes (to facilitate erection) being optional.

The circular washers shall be made of steel and galvanized in accordance with the requirements of AASHTO M232.

WOOD POSTS:

Posts and blocks shall be the same type of wood.

Wood posts shall be pressure-treated after notching, in accordance with Section 710.5 of the specifications.

The 1" (minimum) notch dimension as shown for round wooden posts shall be located along the vertical centerline for the entire upper 14" of the post and shall apply regardless of whether the post is notched (as shown) or otherwise cut or sawed to form a vertical flat plane and then, at some location below the top 14", is angularly sliced out to the surface of the post.

Post length will be 6'-0 ½" unless otherwise noted.

STEEL POSTS:

Blocks shall be centered on their posts and the center of the block holes, for bolts connecting rails to blocks, shall be horizontally offset 1-1/8" from the center of the steel posts toward the post edge facing approaching traffic for both polimer and wood blocks, as shown for wood blocks on the Plan view of the Block Stop Detail. Post length will be 6'-0 ½" unless otherwise noted.

WOOD BLOCKS:

The type (species) of wood for blocks is to be one of the types (species) permitted by specifications for wood posts. Wood blocks shall be pressure-treated in conformance with the requirements for wood posts. However, creosote oil is not permitted as a preservative in the pressure treatment of wood blocks to be erected on steel posts. 8" x 6" wood blocks shall be positioned so that the 6" x 14" faces of the blocks are the contact faces for the rail elements and the posts in order to achieve the blockout dimension shown. When wood block is used adjacent to a wood post, the block shall be nailed to the post with a galvanized steel 10d common nail. The nail is to be driven into the center of the top or bottom of the block.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

PREPARED 7-1-99
REVISION DATE
03-05-2010
06-16-2010
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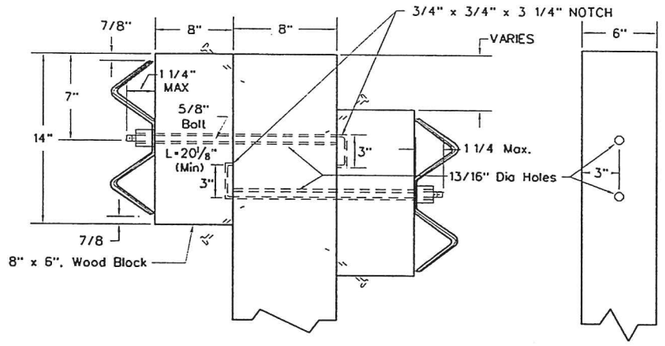
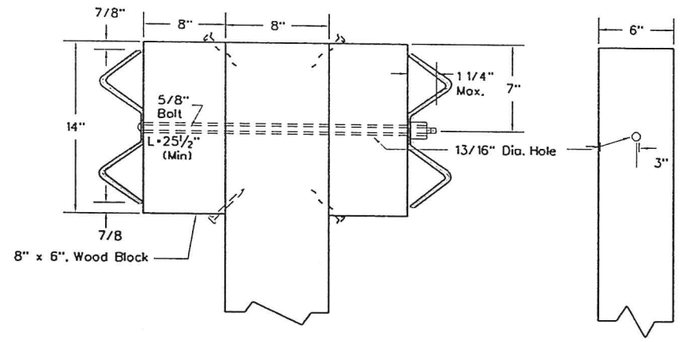
GUARDRAIL POSTS AND BLOCKS

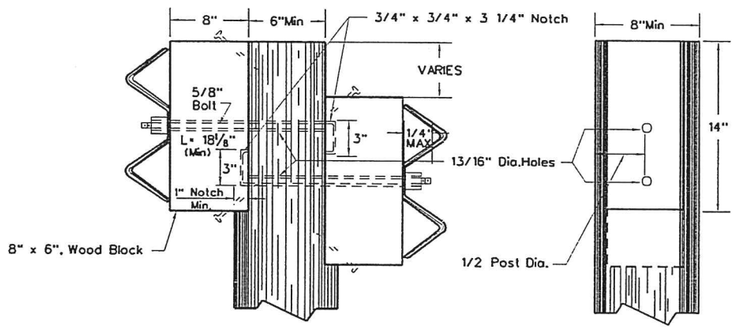
STANDARD SHEET GR2



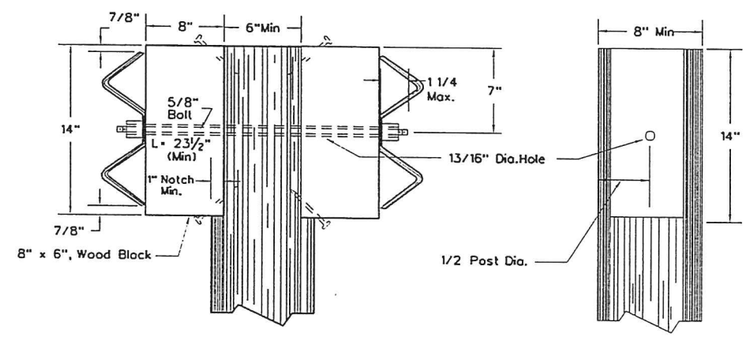
WOOD GUARDRAIL POST (RECTANGULAR)
(BEAMS AT DIFFERENT ELEVATIONS)



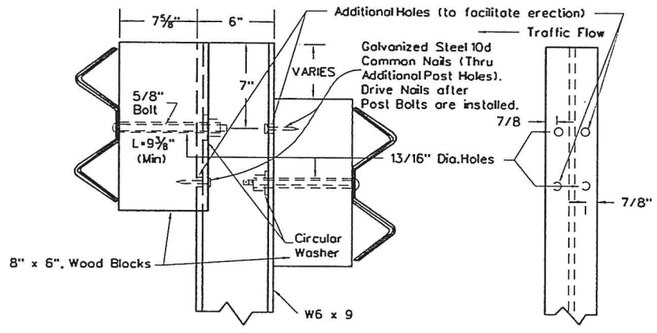
WOOD GUARDRAIL POST (RECTANGULAR)
(BEAMS AT SAME ELEVATION)



WOOD GUARDRAIL POST (ROUND)
(BEAMS AT DIFFERENT ELEVATIONS)



WOOD GUARDRAIL POST (ROUND)
(BEAMS AT SAME ELEVATION)



STEEL GUARDRAIL POST (WOOD BLOCK)
(BEAMS AT DIFFERENT ELEVATIONS)

NOTES

The blocks shall be bolted to the steel posts in the same manner when the beams are at the same elevation as they would when the beams are at different elevations.

The standard bolt shall be used for wood guardrail post when possible.

The applicable details and notes of Standard Sheet GR2 shall apply to this sheet.

The 1" (minimum) notch dimension as shown for round Wooden Posts shall be located along the vertical centerline for the entire upper 14" of the post and shall apply regardless of whether the Post is notched (as shown) or otherwise cut or sawed to form a vertical flat plane and then, at some location below the top 14", is angularly sliced out to the surface of the post.

When a wood block is used adjacent to a wood post, the block shall be nailed to the post with a galvanized steel 10d common nail. The nail is to be driven in the center of the top or bottom of the block.

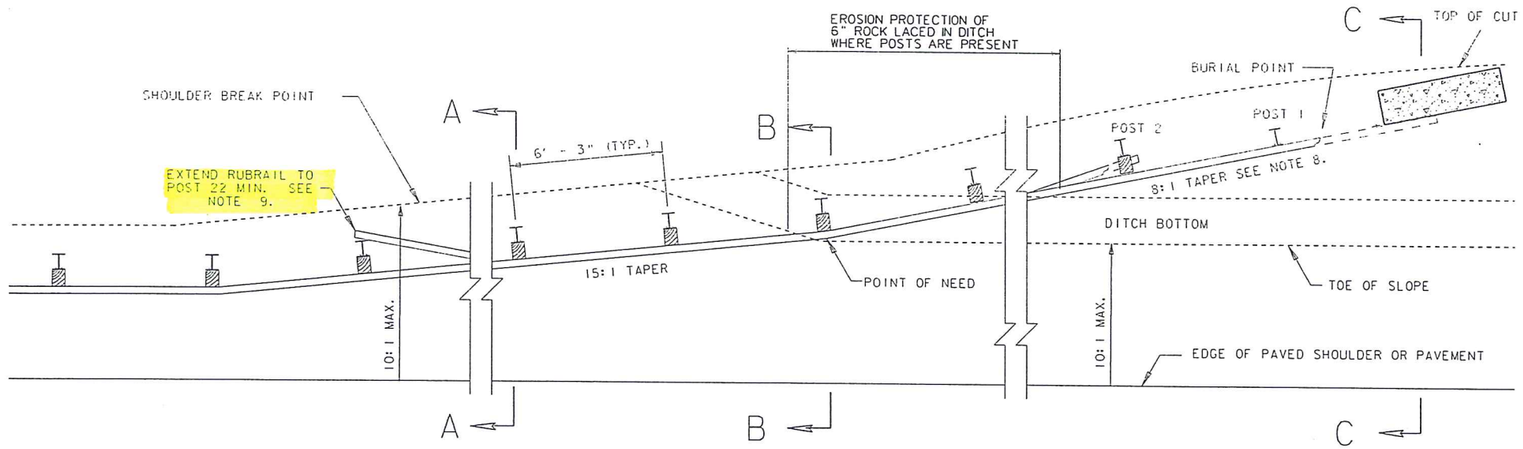
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

PREPARED 7-1-93

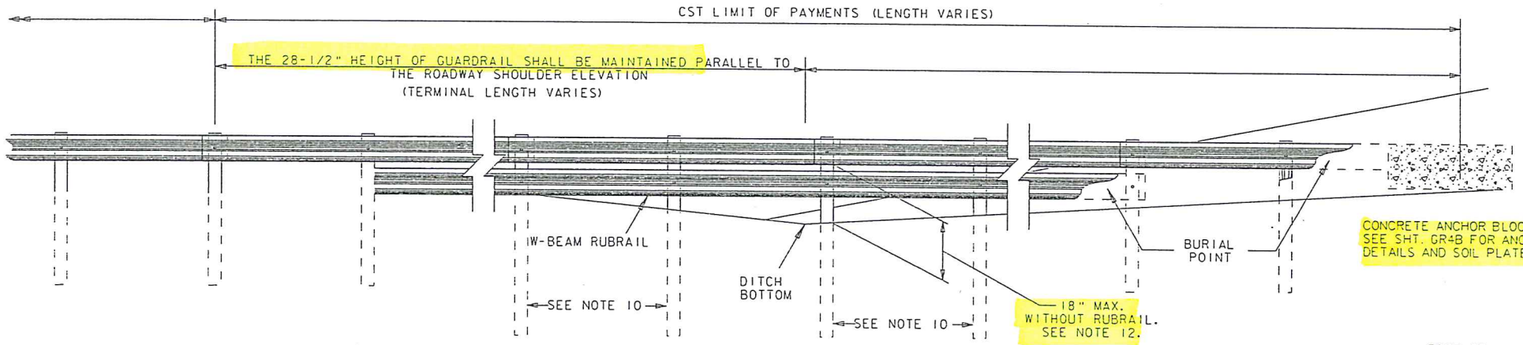
REVISION DATE

DOUBLE-FACED GUARDRAIL POSTS

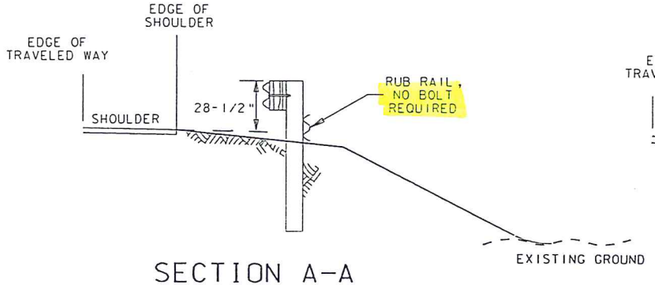
STANDARD SHEET GR3



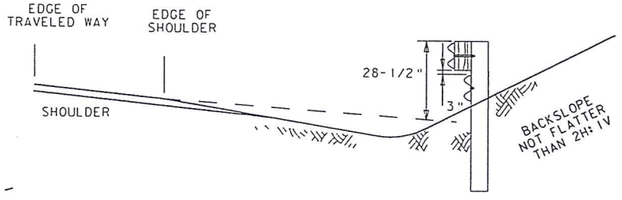
PLAN VIEW



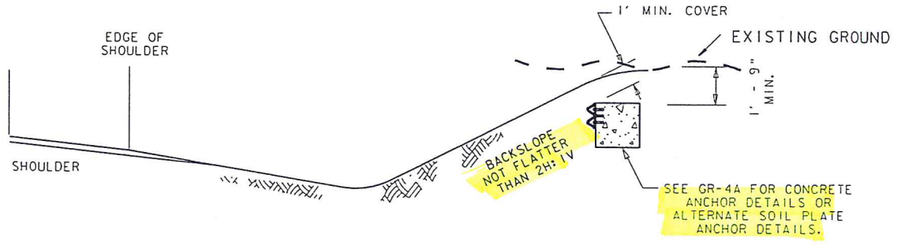
ELEVATION VIEW



SECTION A-A



SECTION B-B



SECTION C-C

NOTES

1. FOR FILL TO CUT GUARDRAIL TERMINALS (TRAILING END, TWO LANE HIGHWAYS, AND ALL APPROACH END) WHERE ANCHORED ENDS ARE SPECIFIED, THE DETAILS AND REQUIREMENT HEREIN SHALL BE APPLICABLE.

2. PRIOR TO PLACING GUARDRAIL, A FINAL CHECK OF EXISTING CONDITIONS WILL BE MADE BY THE ENGINEER AND ANY ADJUSTMENT NECESSARY TO INSURE THE PROPER LOCATION AND FUNCTIONING OF THE GUARDRAIL FOR THE PURPOSE FOR WHICH IT IS INTENDED WILL BE MADE ACCORDINGLY.

3. POSTS, BLOCKS AND RAIL ELEMENTS SHALL BE THE SAME TYPES USED IN THE NORMAL GUARDRAIL INSTALLATION, UNLESS OTHERWISE NOTED. GUARDRAIL BLOCKS SHALL NOT BE USED ON ANY POSTS COMPLETELY UNDERGROUND.

4. THE FINAL DECISION AS TO THE TYPE OF CUT SLOPE TERMINAL INSTALLATION (TYPE A OR B) AT EACH LOCATION WILL ABE BASED ONTHE ACTUAL MATERIALS ENCOUNTERED DURING CONSTRUCTION.

5. CUT SLOPE TERMINAL INSTALLATION CAN INTERFERE WITH NORMAL DRAINAGE THROUGH A CUT SECTION. WHEN THIS OCCURS, DETAILS FOR MAINTAINING POSITIVE DRAINAGE WILL BE SHOWN ON THE PROJECT PLANS.

6. WHEN INSTALING CST TYING INTO 31" TOP OF RAIL HEIGHT GUARDRAIL, THE CST SHALL BE INSTALLED AT 28-1/2" HEIGHT.
TAPER 31" GUARDRAIL DOWN VERTICALLY PRIOR TO CST INSTALLATION.

7. THE CST GUARDRAIL TERMINAL SHOULD BE USED ONLY WITH 2:1 OR STEEPER BACK SLOPE.

8. THE FLARE RATE OF THE GUARDRAIL MAY BE STEEPENED TO 8:1 AFTER CROSSING THE DITCH BOTTOM TO SHORTEN THE LENGTH OF THE TERMINAL.

9. RUBRAIL TO EXTEND FROM POST 2, THROUGH ENTIRETY OF DITCH, TO POST 22 AT A MINIMUM.

10. FOR THE RUB RAIL SECTION USE 8' LONG POSTS.

11. SEE GR-4A AND GR-4B FOR DETAILS OF TYPE A AND TYPE B TERMINALS.

12. MAXIMUM CLEARANCE FROM BOTTOM OF W-BEAM TO GROUND LINE WITHOUT W-BEAM RUBRAIL IS 18".

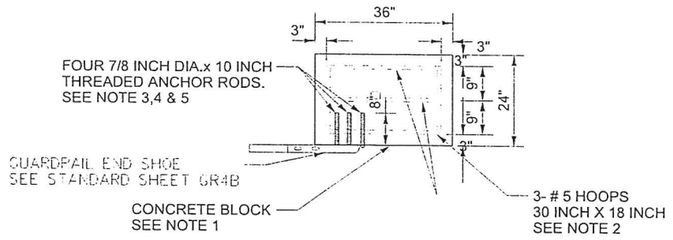
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

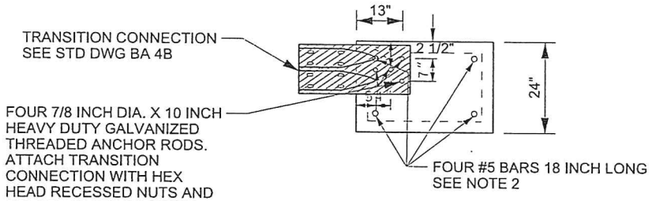
PREPARED 7-1-99

REVISION DATE
4/22/15

CUT SLOPE TERMINAL

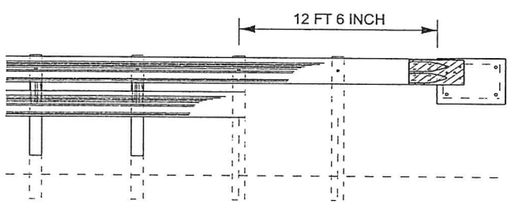
STANDARD SHEET GR4





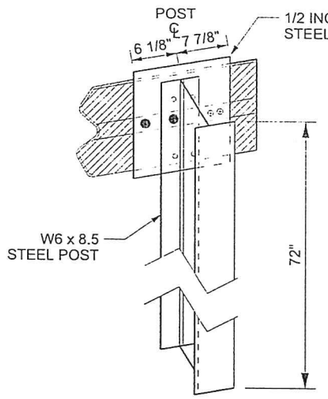
NOTES:

1. USE CLASS B CONCRETE.
2. USE EPOXY COATED REINFORCING STEEL, PER SECTION 602 OF THE SPECIFICATIONS.
3. USE GALVANIZED THREADED ROD.
4. THREADED RODS CAN BE CAST INTO CONCRETE BLOCK OR HOLES CAN BE DRILLED INTO BLOCK AND RODS ANCHORED WITH EPOXY.
5. DRILL HOLES A MINIMUM 9 INCH DEEP. CLEAN DRILLED HOLES PRIOR TO INSERTING THREADED ROD.

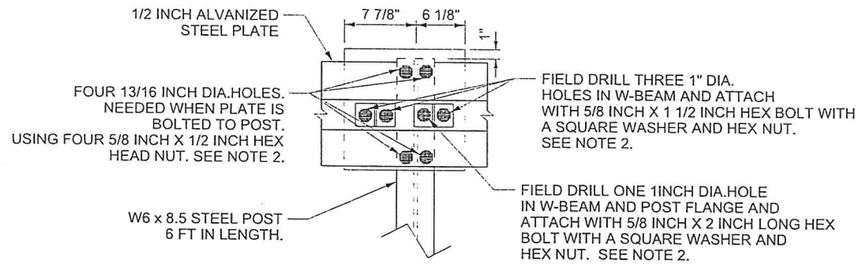


RUBRAIL ELEMENT

OPTION I
CONCRETE BLOCK

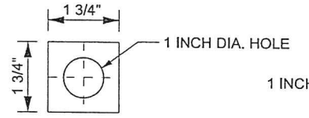


REAR VIEW

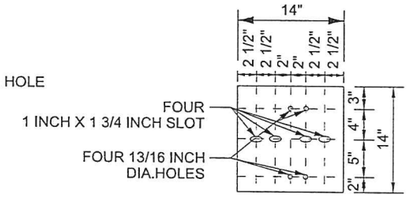


FRONT VIEW

ANCHOR POST/PLATE ATTACHMENT
FOR SINGLE RAIL ELEMENT



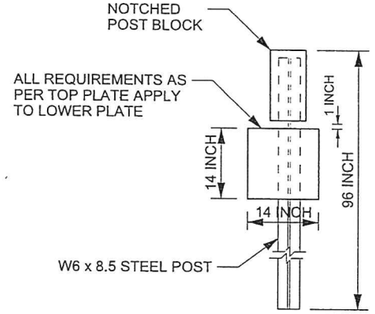
SQUARE WASHER
(3/16 INCH THICK,GALVANIZED)



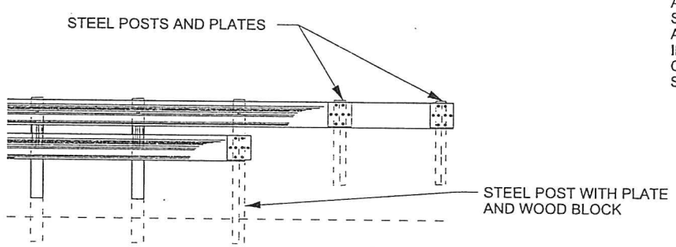
1/2 INCH STEEL PLATE
(GALVANIZED)

NOTES:

1. USE 1/2 INCH STEEL PLATE MEETING REQUIREMENTS OF ASTM A 36.
2. GALVANIZING REQUIRED FOR PLATE AND HARDWARE.
3. USE ZINC RICH PAINT TO COAT FIELD DRILLED HOLES.



ANCHOR POST/PLATE ATTACHMENT
FOR RUB RAIL ELEMENT



RUBRAIL ELEMENT

OPTION II
STEEL POSTS AND PLATES

GENERAL NOTES:

TYPE A (SOFT SHALE OR SOIL) CUT SLOPE TERMINAL GUARDRAIL SHALL BE THAT GUARDRAIL WHICH IS TO EXTEND A MINIMUM OF TWO 6'-3" SPANS INTO THE CUT SLOPE, FROM THE FIRST POST BEYOND THE TOE OF THE CUT SLOPE AND IS TO TERMINATE A MINIMUM OF 1'-0" BELOW THE GROUND ELEVATION OF THE BACK SLOPE, EXCEPT IN AREAS OF HEAVY ROCK OUTCROPPING WHERE THE MINIMUM DEPTH MAY BE 6 INCHES.

A TRENCH NO GREATER THAN 18" IN WIDTH SHALL BE EXCAVATED INTO THE CUT SLOPE TO ACCOMMODATE THE TYPE A TERMINAL INSTALLATION. THE CONTRACTOR SHALL ARRANGE HIS WORK SEQUENCE SUCH THAT EACH TYPE A CUT SLOPE TERMINAL INSTALLATION BE EXCAVATED, POSTS DRIVEN, RAIL ELEMENTS AND GUARDRAIL COMPONENTS ASSEMBLED, TRENCH BACKFILLED, AND DISTURBED SLOPE SHAPED SEEDED AND MULCHED ALL IN A CONTINUOUS OPERATION.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

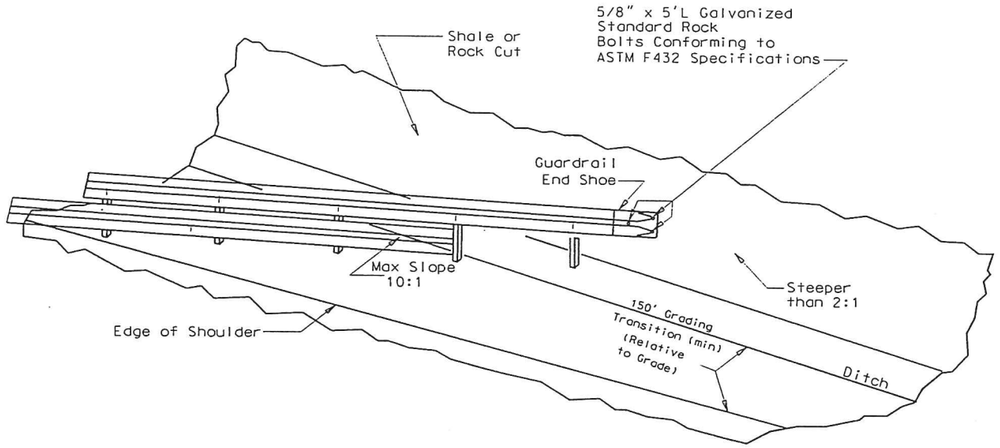
PREPARED 4/22/15

REVISION DATE

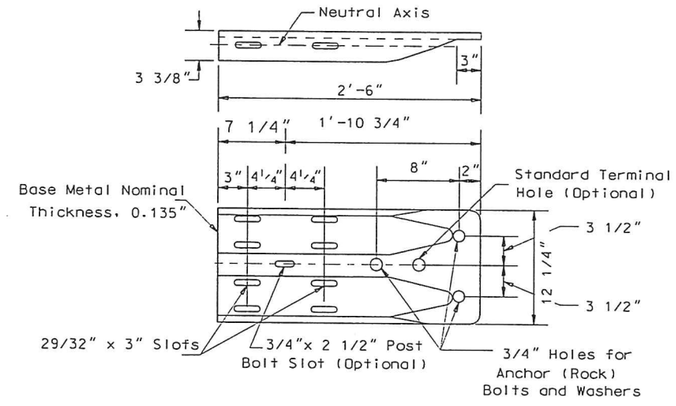
CUT SLOPE TERMINAL
TYPE A INSTALLATION
SOFT SHALE OR SOIL

STANDARD SHEET GR4A

Type B (Shale or Rock) Cut Slope Terminal installation shall consist of anchoring the guardrail against the face of the cut slope utilizing guardrail end shoes and rock bolts, as detailed herein.



TYPE B (SHALE OR ROCK) CUT SLOPE TERMINAL INSTALLATION



GUARDRAIL END SHOE DETAIL

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

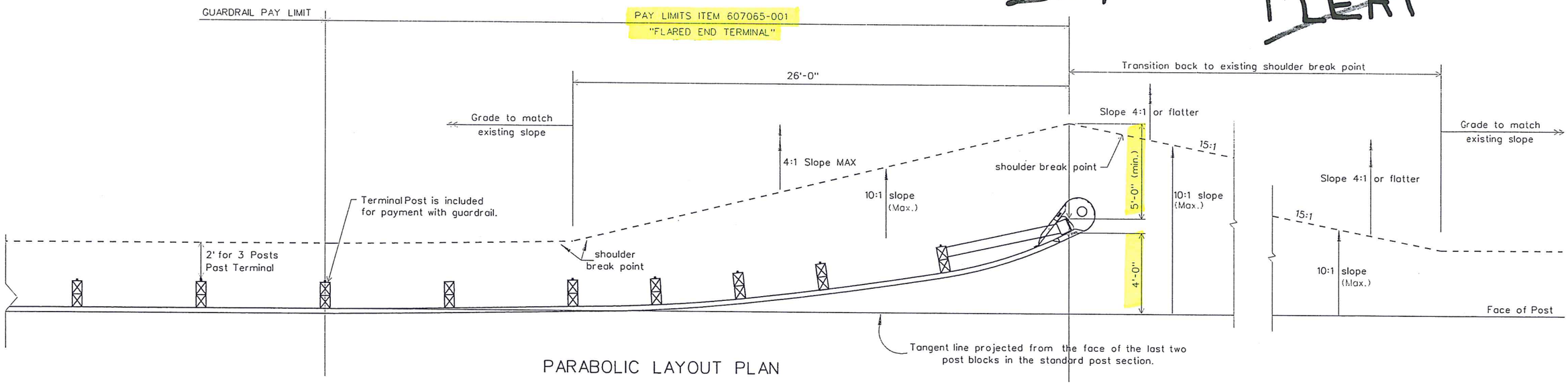
PREPARED 4/22/15

REVISION DATE

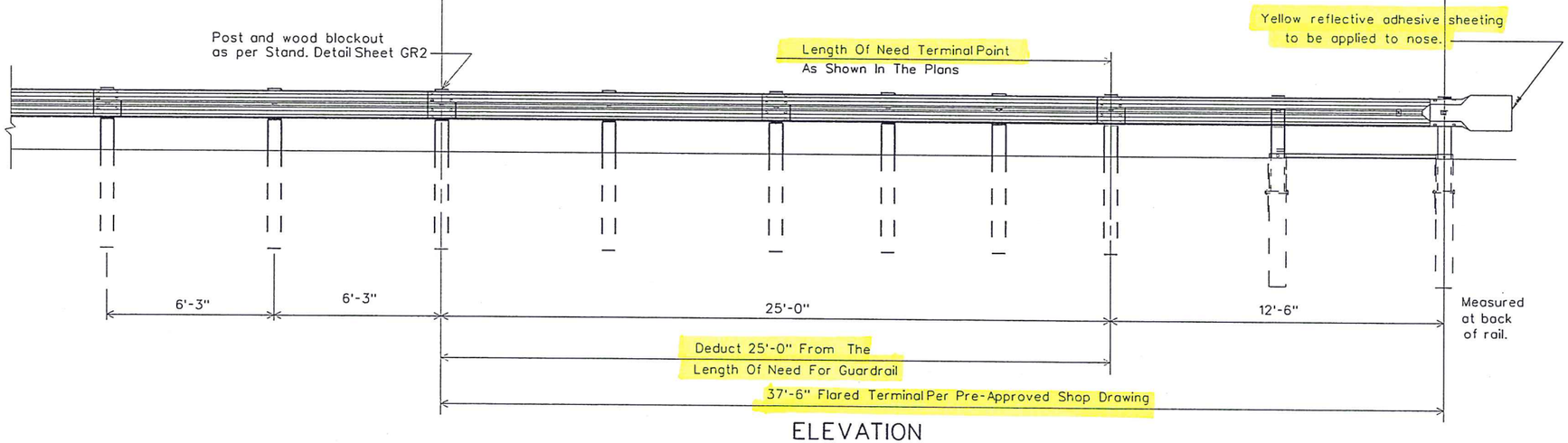
CUT SLOPE TERMINAL TYPE B INSTALLATION SHALE OR ROCK

STANDARD SHEET GR4B

SET FLEAT



PARABOLIC LAYOUT PLAN



ELEVATION

NOTES

For details of Flared End Terminal see pre approved shop drawings.

All materials used shall meet the applicable requirements of Section 607 of the Standard Specifications Road and Bridges.

The post offset dimensions are given to the center of the traffic face of the blockouts: except at the first post, where the dimension is to the center of the traffic face of the post. Offset points are to be located by measurements at the back of rail equal to the nominal post spacings shown on pre-approved shop drawings. Posts are to be set approximately radial to the railing at each location.

When a wood block is used adjacent to a wood post, the block shall be nailed to the post with a galvanized steel 10d common nail. The nail is to be driven into the center of the top or bottom of the block.

The cost of furnishing and installing the Flared End Terminal, complete with all miscellaneous hardware and parts as detailed on the pre-approved shop drawings , is to be included in the unit price bid for "Flared End Terminal".

Yellow reflective sheeting shall cover the entire nose of those terminals with a flat impact head. Those terminals with a rounded impact head shall be covered with a 1'-0" X 3'-0" yellow reflective sheet.

As of 11-13-12 revision date, this detail is obsolete and no longer used for new construction.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

PREPARED 7-1-99

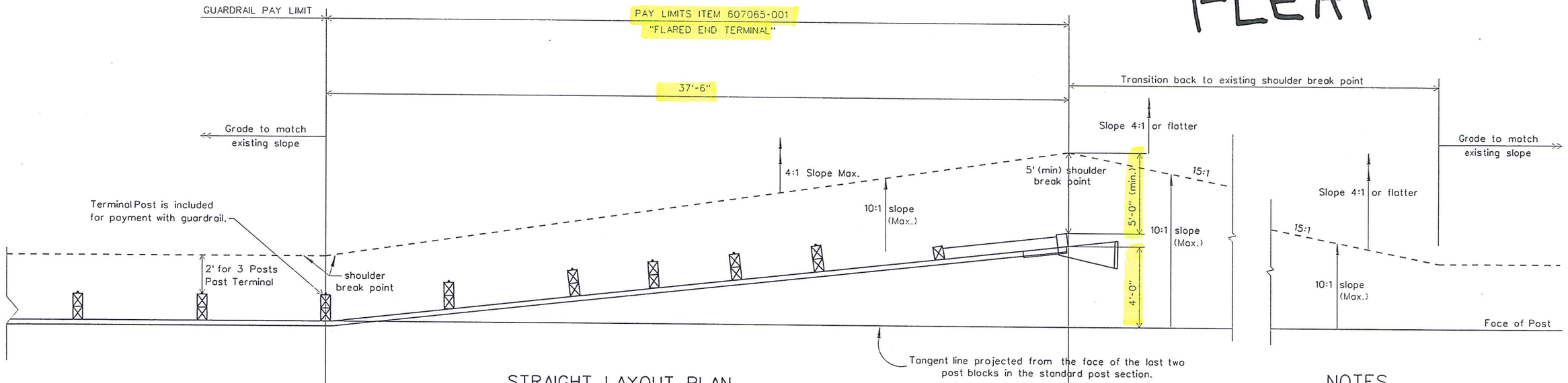
REVISION DATE
11-13-12

FLARED END TERMINAL PARABOLIC LAYOUT

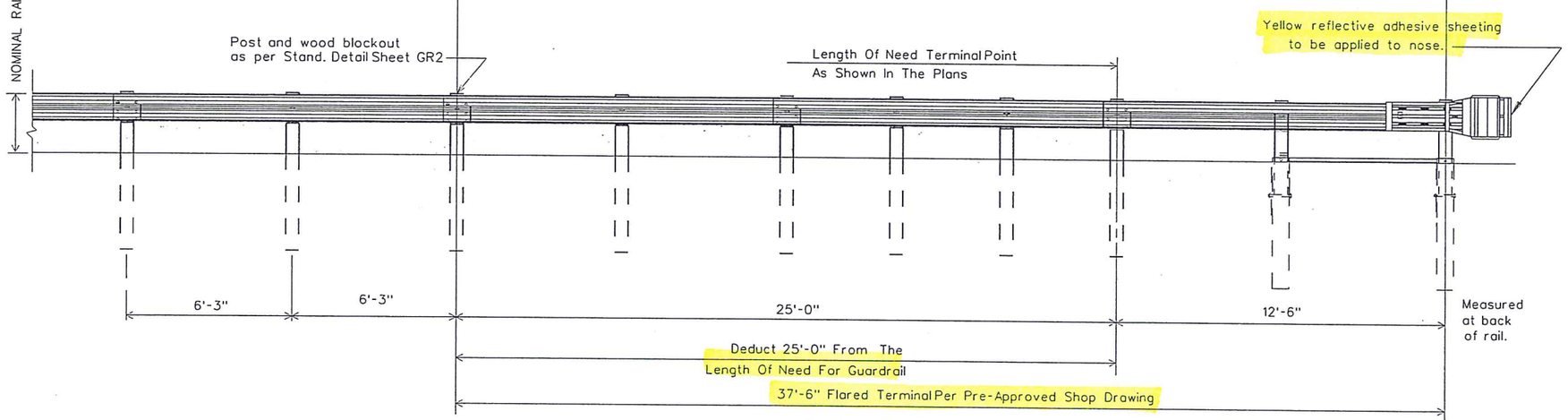
(SHEET 1 OF 2)

STANDARD SHEET GR5

FLEAT



STRAIGHT LAYOUT PLAN



ELEVATION

NOTES

Flared End Terminal shall meet NCHRP-350 and/or Mash testing for appropriate height.

Separate Approved Product Lists will be maintained for both 28 1/2" and 31" terminal heights.

For details of Flared End Terminal see pre approved shop drawings.

Post and splice locations are per manufacturer.

All materials used shall meet the applicable requirements of Section 607 of the Standard Specifications Road and Bridges.

The post offset dimensions are given to the center of the traffic face of the blockouts: except at the first post, where the dimension is to the center of the traffic face of the post. Offset points are to be located by measurements at the back of rail equal to the nominal post spacings shown on pre-approved shop drawings. Posts are to be set approximately radial to the railing at each location.

When a wood block is used adjacent to a wood post, the block shall be nailed to the post with a galvanized steel 10d common nail. The nail is to be driven into the center of the top or bottom of the block.

The cost of furnishing and installing the Flared End Terminal, complete with all miscellaneous hardware and parts as detailed on the pre-approved shop drawings , is to be included in the unit price bid for "Flared End Terminal".

Yellow reflective sheeting shall cover the entire nose of those terminals with a flat impact head. Those terminals with a rounded impact head shall be covered with a 1'-0" X 3'-0" yellow reflective sheet.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

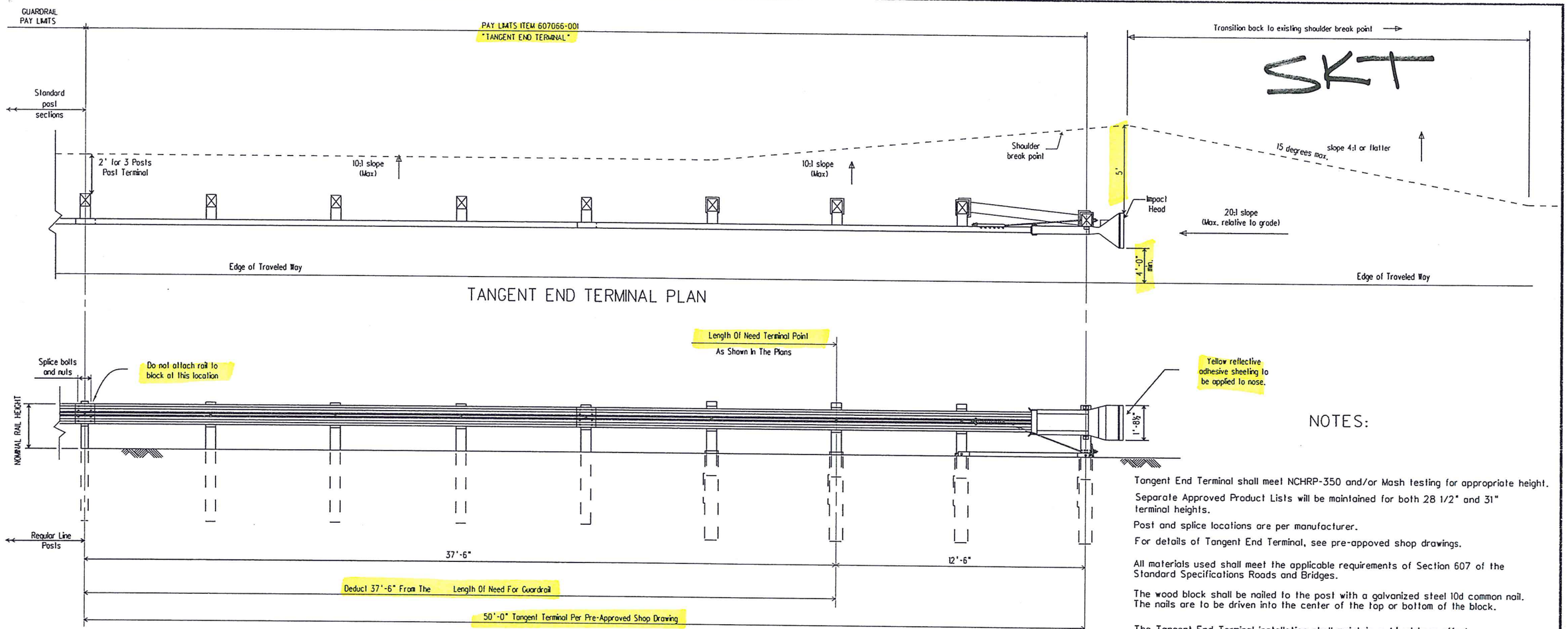
PREPARED 7-1-99

REVISION DATE
11-13-12

FLARED END TERMINAL STRAIGHT LAYOUT

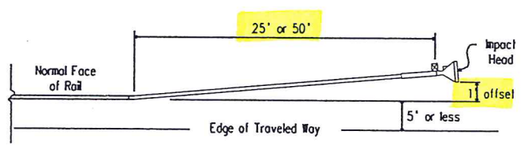
(SHEET 2 OF 2)

STANDARD SHEET GR5



TANGENT END TERMINAL PLAN

ELEVATION



FLARE DETAIL

NOTES:

Tangent End Terminal shall meet NCHRP-350 and/or Mash testing for appropriate height.

Separate Approved Product Lists will be maintained for both 28 1/2" and 31" terminal heights.

Post and splice locations are per manufacturer.

For details of Tangent End Terminal, see pre-appoved shop drawings.

All materials used shall meet the applicable requirements of Section 607 of the Standard Specifications Roads and Bridges.

The wood block shall be nailed to the post with a galvanized steel 10d common nail. The nails are to be driven into the center of the top or bottom of the block.

The Tangent End Terminal installation shall maintain a 4' minimum offset from the edge of the impact head to the edge of the traveled way. For narrow existing shoulders that have an offset of 5' or less from the face of the rail element to the edge of the traveled way, the rail and terminal may be flared from the normal face of rail. The flared offset distance shall be 1' at a taper rate of 25:1, for a total flare length of 25'; or a taper rate of 50:1, for a total flare length of 50' (see Flare Detail).

Rail element panel lengths shall be 25' only. Shorter lengths shall not be used.

The cost of furnishing and installing the Tangent End Terminal, complete with all miscellaneous hardware and parts as detailed on the pre-approved shop drawings, is to be included in the unit price bid for "Tangent End Terminal".

Yellow reflective sheeting shall cover the entire nose of those terminals with a flat impact head. Those terminals with a rounded impact head shall be covered with a 1'-0" X 3'-0" yellow reflective sheet.

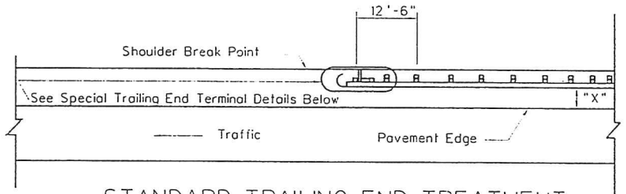
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

PREPARED 7-1-99

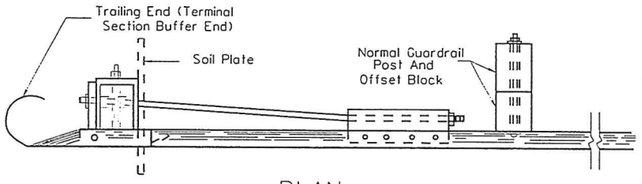
REVISION DATE
11-13-12

TANGENT END TERMINAL

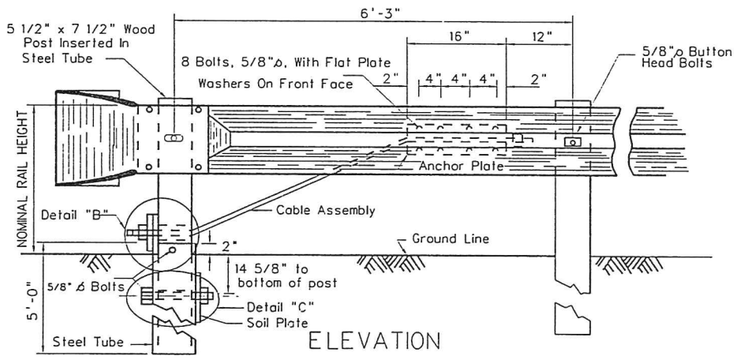
STANDARD SHEET GR6



STANDARD TRAILING END TREATMENT
(MULTI-LANE DIVIDED HIGHWAY)



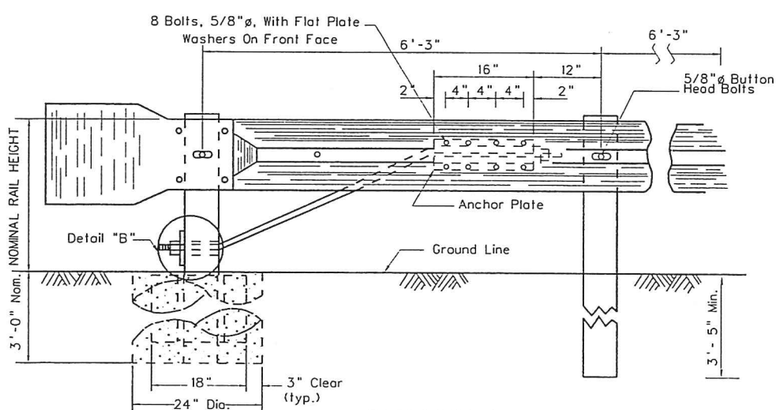
PLAN



ELEVATION

SPECIAL TRAILING END TERMINAL(STET)

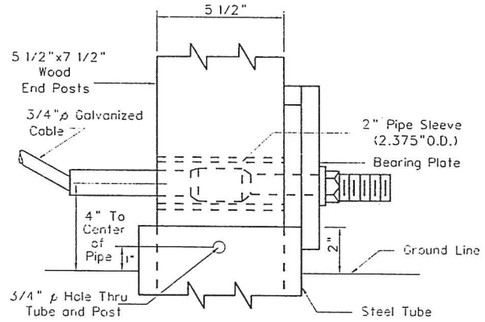
(TUBULAR STEEL END FOUNDATION)



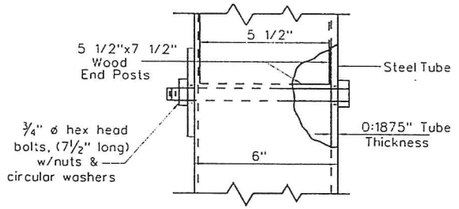
ELEVATION

SPECIAL TRAILING END TERMINAL(STET)

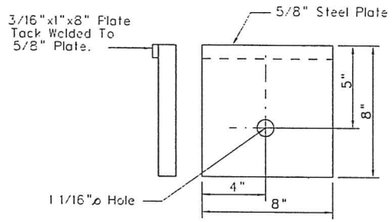
(CONCRETE FOOTER END FOUNDATION)



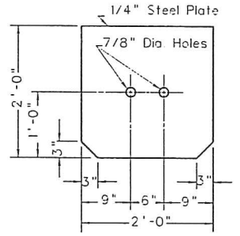
DETAIL "B"



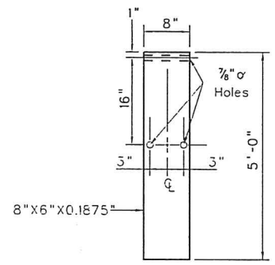
DETAIL "C"



BEARING PLATE

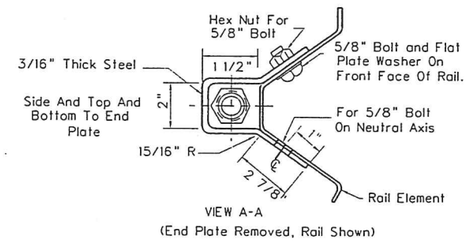


SOIL PLATE



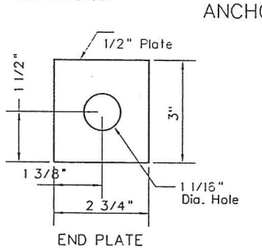
STEEL TUBE

FRONT VIEW
(Rail Removed)

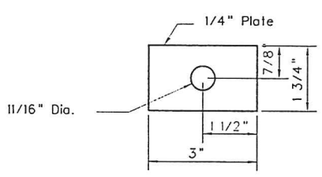


VIEW A-A
(End Plate Removed, Rail Shown)

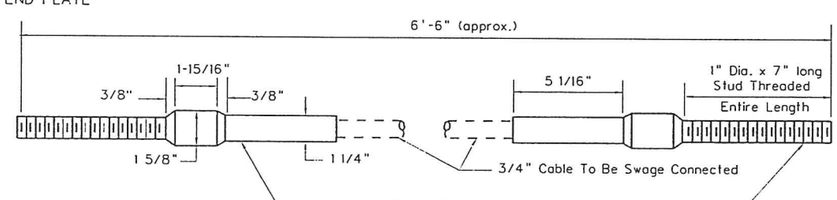
ANCHOR PLATE DETAIL



END PLATE



FLAT PLATE WASHER



CABLE ASSEMBLY

NOTES

Steel tubes shall meet the requirements of ASTM Specification A500, Grade B, and shall be galvanized after fabrication in accordance with the requirements of AASHTO Specification M111. Other terminal components; such as anchor plates, cable assemblies, hardware, plates, pipe sleeves, etc; shall conform to the detail and requirements of section 607 of the Specifications.

For each STET end treatment installation it shall be the Contractor's option whether to utilize the Tubular Steel End Foundation design detailed herein or Concrete Footer End Foundation design detailed , unless one type is specified in the plans. When the Concrete Footer End Foundation is used, the embedded portion of the Endpost is to be double wrapped with Composition Paper or single wrapped with sheet metal or other material acceptable to the Engineer before concrete placement to facilitate replacement of damaged posts.

The cost of furnishing and installing the Special Trailing End Terminal; including structural tubing, soil plates, and welded bearing plates for Tubular Steel End Foundations; concrete footers, welded wire fabric, all necessary excavation, composition paper and sheetmetal for Concrete Footer End Foundations; and all "terminal" hardware,cables, studs, plates, and pipe sleeves shall be included in the unit price bid for "Special Trailing End Terminal", per each. Normal guardrail components; i.e., posts, blocks, rail elements, hardware, etc; along with the special size and/or special length wood guardrail end post and the terminal section buffer end, shall be paid for as guardrail per linear foot.

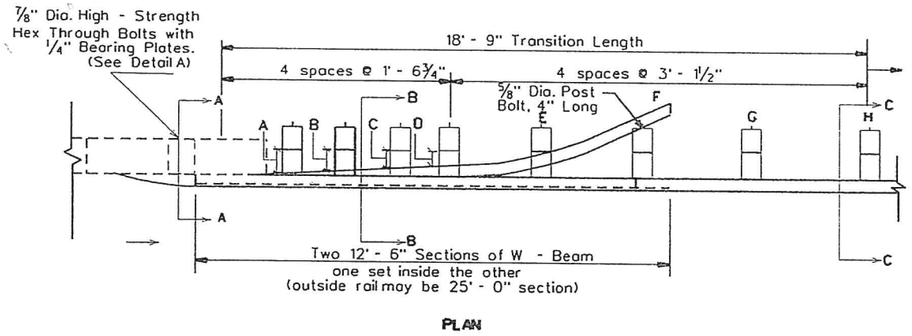
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

PREPARED 7-1-99

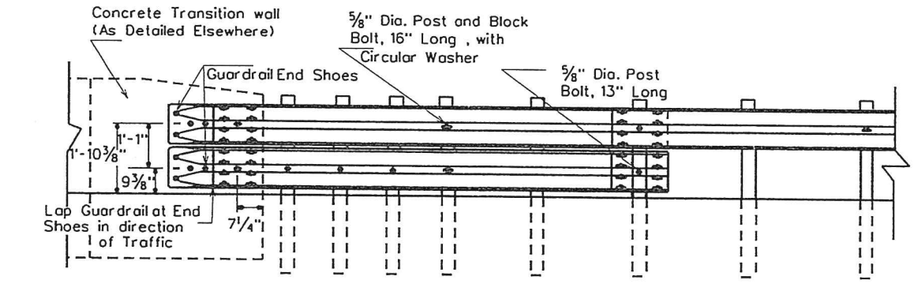
REVISION DATE
11-13-2012

SPECIAL TRAILING END TERMINAL

STANDARD SHEET GR7

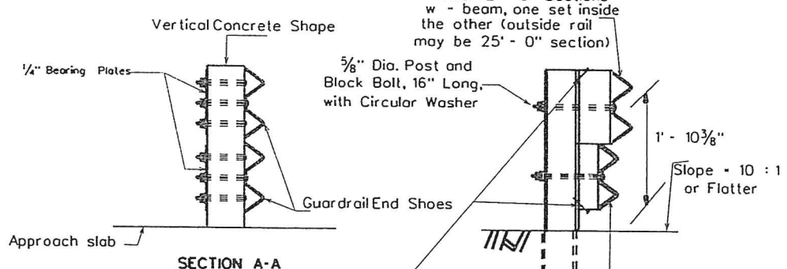


PLAN



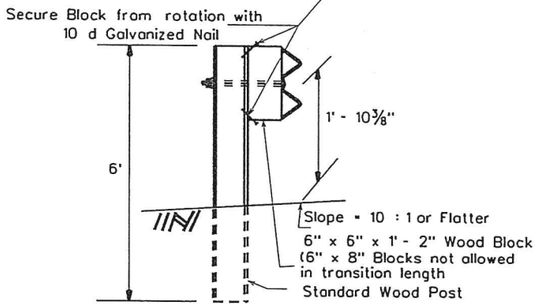
ELEVATION

Guardrail - Bridge Transition and Connection (Wood Post Design)



SECTION A-A

SECTION B-B



SECTION C-C

Bottom Beam Wood Blocks (1' - 2" x 6")

POST	THICKNESS
A	5"
B	4"
C	3"
D	2"

Table applies to both transition designs.

NOTES

These guardrail transitions are appropriate for connection to a vertical concrete shape and should not be connected directly to a concrete saftey shape. Concrete saftey shape bridge rails or barriers shall be transitioned to a vertical shape at the guardrail connection in a manner detailed elsewhere in the Project Plans.

Although these details may appear to apply strictly to guardrail-to-bridge transitions and connections, they actually can apply to guardrail transitions and connections to concrete barriers, concrete rigid walls or other structures as specified and detailed on the Project Plans.

These details are not required for transitioning guardrail to a bridge when the guardrail is located on the trailing end of a divided highway bridge. Normal guardrail details shall apply.

Installation shall be performed in such a manner as to maintain the rail elements (top w-beams) parallel to the roadway centerline throughout the length of the 18'- 9" transition for both designs.

Posts A,B,C,and D require an additional hole to attach bottom blocks and bottom beams. For wood post design the bottom beam wood blocks shall be center drilled and attached with 5/8" diameter post bolts. For steel post design the bottom beam wood blocks shall be offset drilled to sit squarelly on the post flange and attached with 5/8" diameter bolts.

For both transitions, the sixth post from the vertical concrete wall shall require an additional hole on the back face of the post to attach the bottom w-beam with 5/8" diameter bolts.

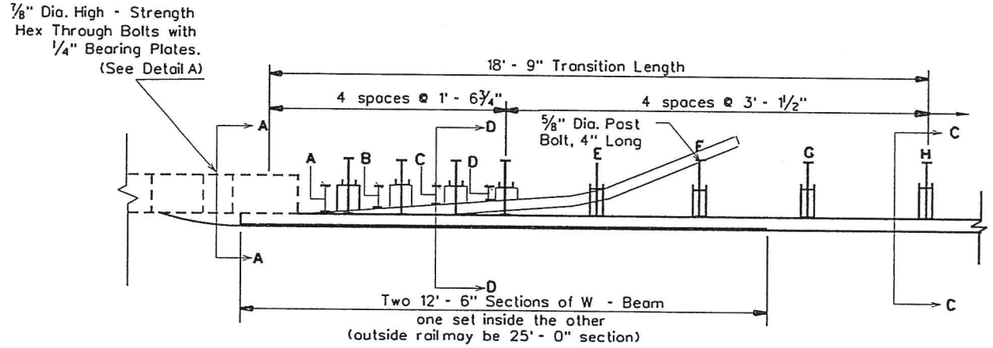
The rubrail (bottom w-beam) may be shop bent for approximately the last three feet to facilitate installation.

A,B,C,E,and G posts and blocks shall not be bolted to the top rail elements; however, posts and blocks shall be bolted and carefully erected to provide firm contact of the blocks against the top rails at these posts.

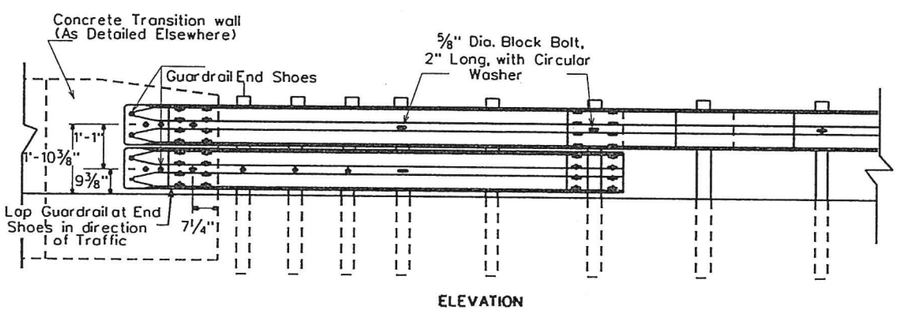
All bolt holes in all rail sections shall be shop fabricated.

These details are for transitioning 6' 3" post spacing guardrail to a vertical concrete shape. When transitioning 12' 6" post spacing guardrail to a vertical concrete shape, the 25' of rail prior to this 18' 9" transition shall have 6' 3" post spacing.

There is no separate pay item for this connection and all components as detailed herein shall be included in the contract price for guardrail.

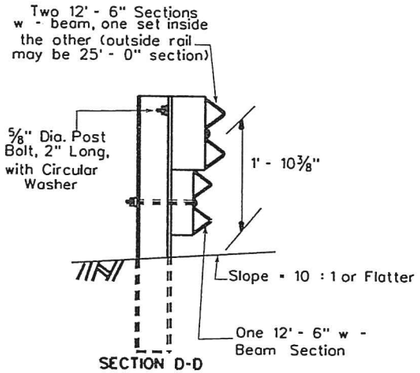


PLAN

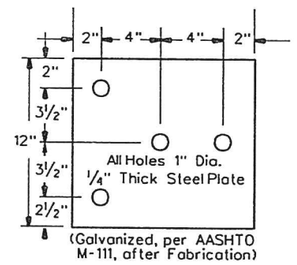


ELEVATION

Guardrail - Bridge Transition and Connection (Steel Post Design)

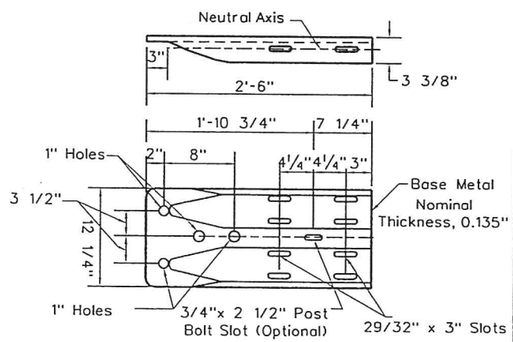


SECTION D-D



(Galvanized, per AASHTO M-111, after Fabrication)

DETAIL A



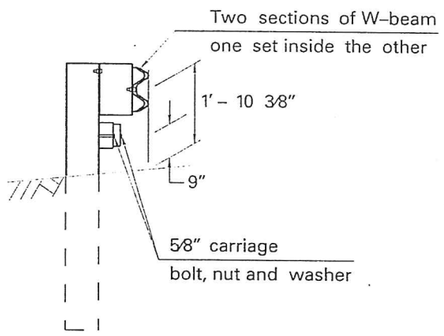
GUARDRAIL END SHOE DETAIL

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

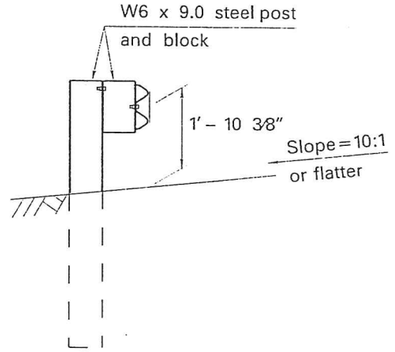
PREPARED 7-1-99
REVISION DATE

GUARDRAIL BRIDGE TRANSITIONS AND CONNECTIONS

STANDARD SHEET GR9



SECTION A–A



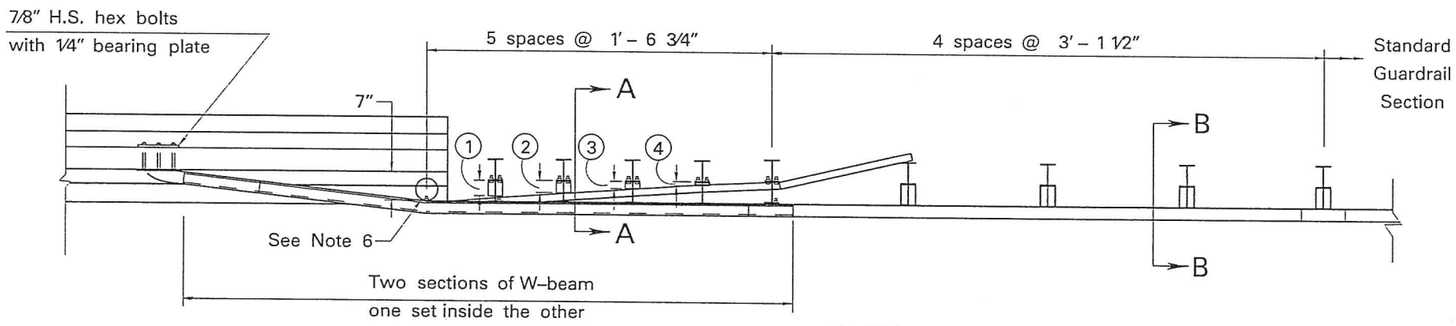
SECTION B–B

RUBRAIL
WOOD BLOCKS
7″ X 4″

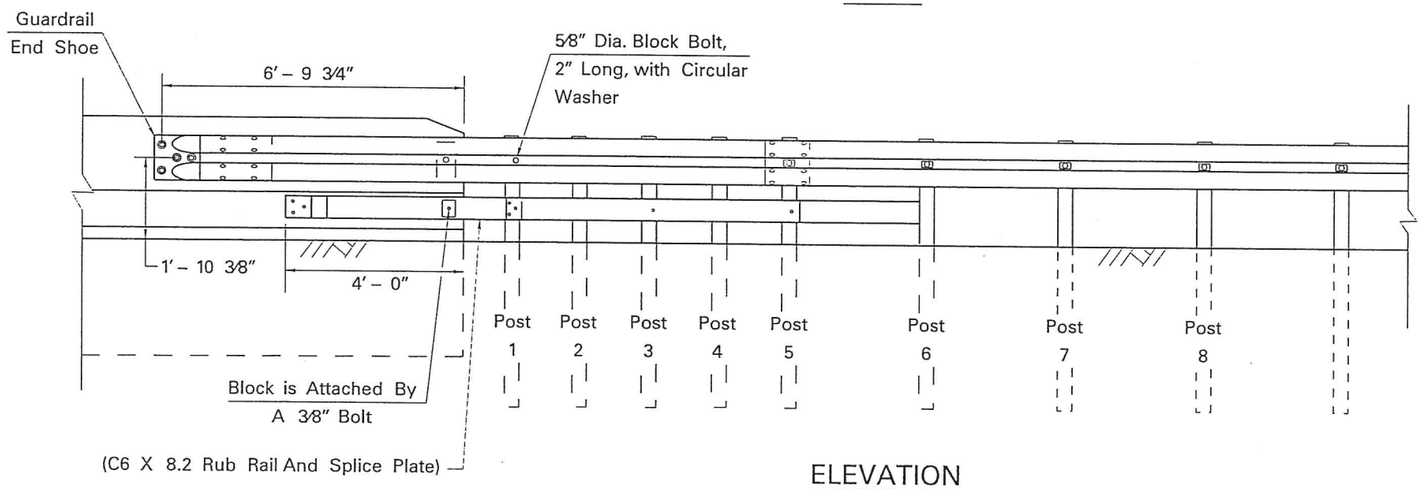
POST	THICKNESS
1	4 1⁄2″
2	3 1⁄2″
3	2″
4	1″

NOTES

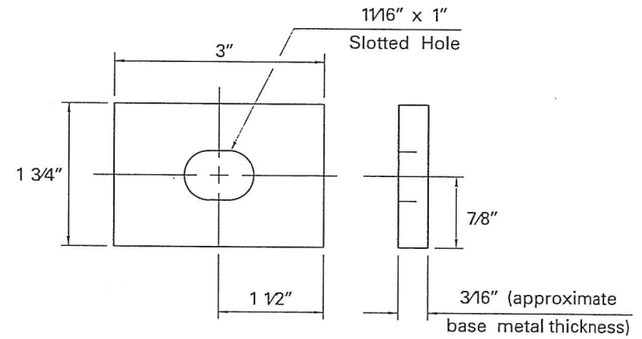
1. This guardrail transition is appropriate for connection to a concrete safety shape.
2. Bridge rail ends and bridge parapets must be of adequate strength to accept full impact loading.
3. Posts 1–6 require an additional hole to attach lower blocks and⁄or rubrail.
4. Rubrail wood blocks located on posts 1 through 4 are offset drilled and secured with 5⁄8″ carriage bolts to posts 2 and 4. : rubrail and posts of posts 1, 3 and 5.
5. W–beam is not bolted to posts at posts 2 through 4 and posts 6 and 8.
6. Steel spacer tube, schedule 40 galvanized pipe, 6″ (I.D.) x 9″, and attached by a 5⁄8″ carriage bolt and rectangular plate washer.
7. See sheet 3 of 3 for detail. Block is attached by 3⁄8″ X 3″ bolt.
8. There is no separate pay item for this connection and all components as detailed herein shall be included in the contract price for guardrail.



PLAN



ELEVATION



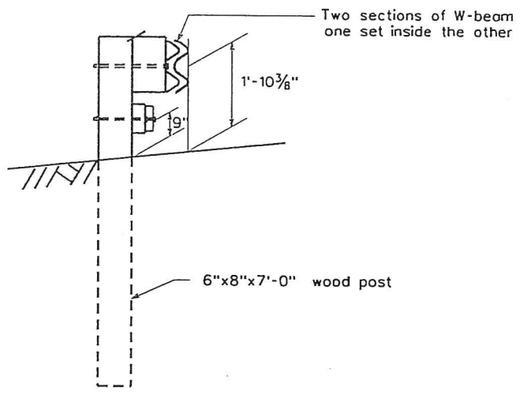
RECTANGULAR PLATE WASHER DETAIL

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

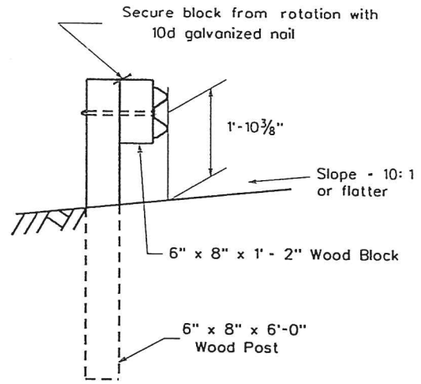
PREPARED 7-1-99
REVISION DATE

W–BEAM TRANSITION TO SAFETY SHAPE WOOD POST WITH RUBRAIL

SHEET 1 OF 3
STANDARD SHEET GR10



SECTION A-A



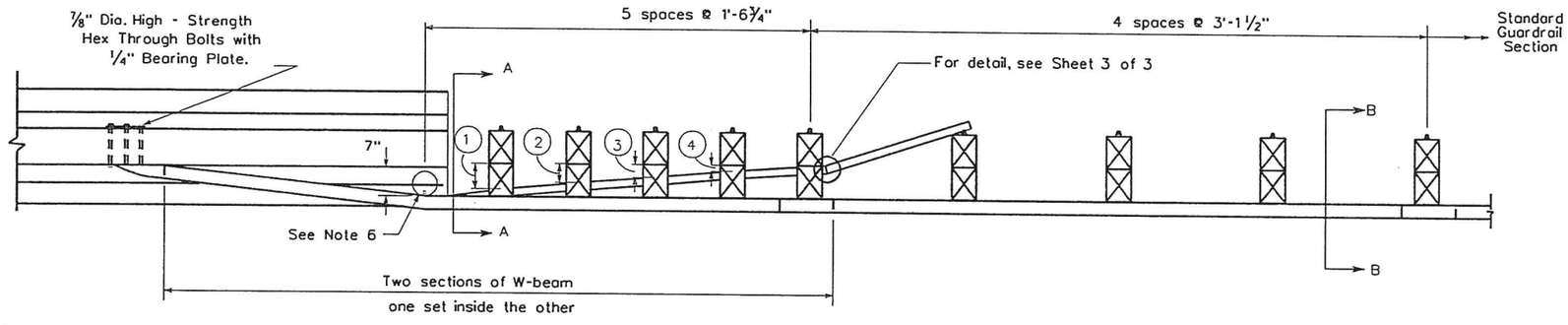
SECTION B-B

Rubrail
Wood Blocks 7" x 6"

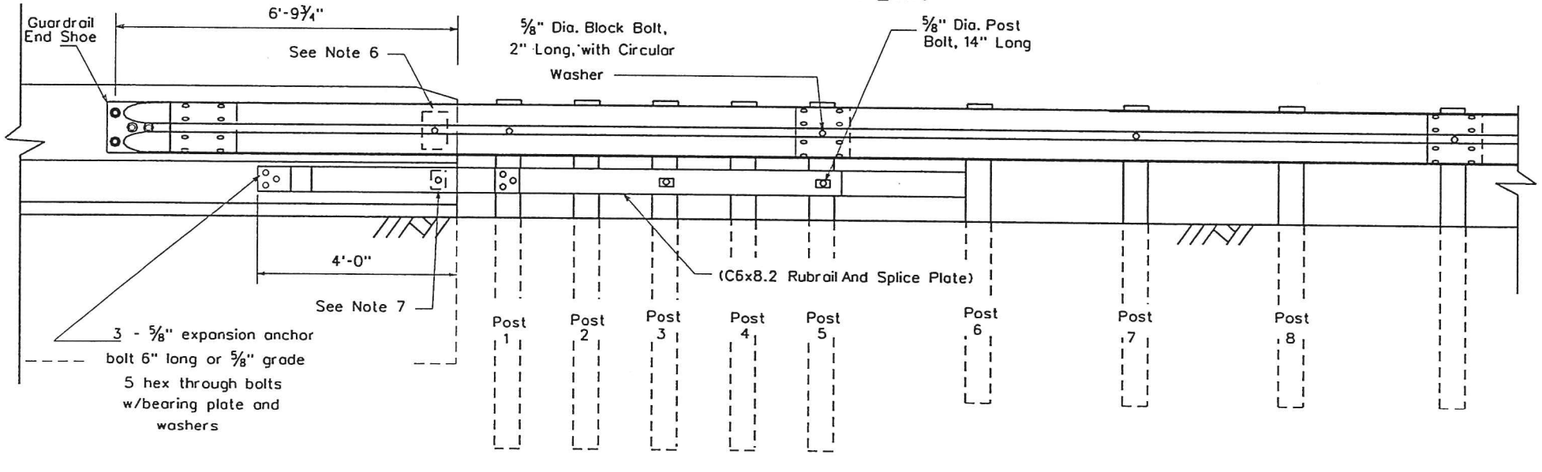
POST	THICKNESS
1	6 1/4"
2	4 5/8"
3	3 1/8"
4	1 1/2"

NOTES

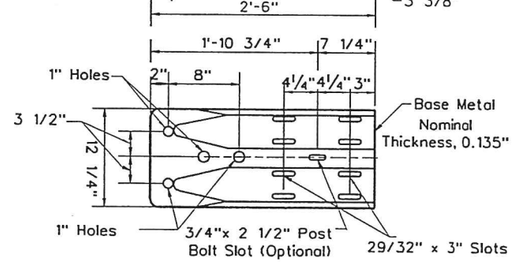
1. This guardrail transition is appropriate for connection to a concrete safety shape.
2. Bridge rail ends and bridge parapets must be of adequate strength to accept full impact loading.
3. Rubrail wood bocks, located on posts 1 through 4 are center drilled and secured with 7/8" carriage bolts.
4. Posts 1 through 5 require an additional hole to attach lower blocks and/or lower rubrail.
5. W-beam is not bolted to posts and blocks at posts 2, 3, 4, 6, and 8. Blocks are bolted directly to posts.
6. Steel spacer tube, schedule 40 galvanized pipe, 6" (I.D.) x 9", attached by a 5/8" carriage bolt, and rectangular plate washer.
7. See Sheet 3 of 3 for detail. Block is attached by a 3/8" x 3" bolt.
8. There is no separate pay item for this connection and all components as detailed herein shall be included in the contract price for guardrail.



PLAN



ELEVATION



GUARDRAIL END SHOE DETAIL

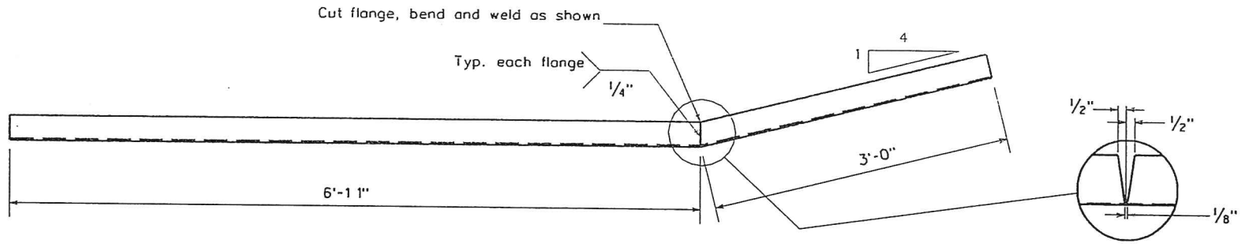
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

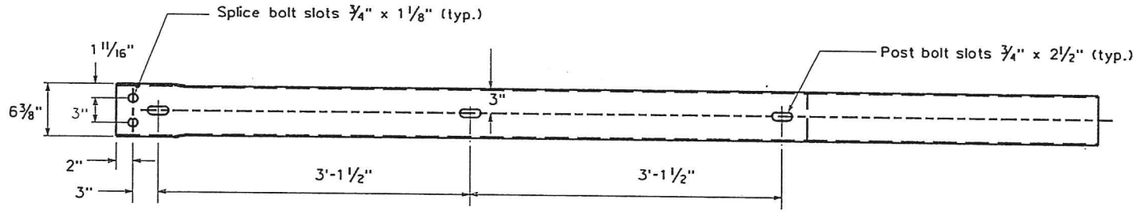
PREPARED 7-1-99
REVISION DATE

W-BEAM TRANSITION TO SAFETY SHAPE WOOD POST WITH RUBRAIL

SHEET 2 OF 3

STANDARD SHEET GR10

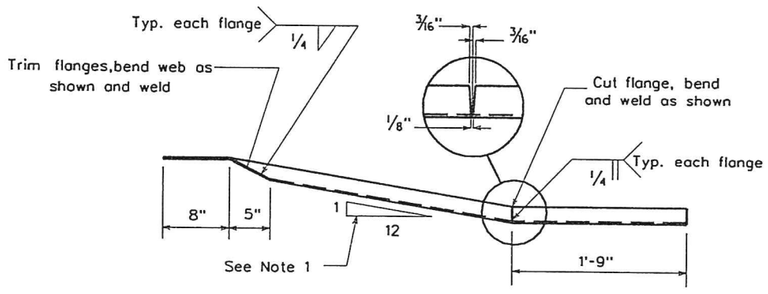


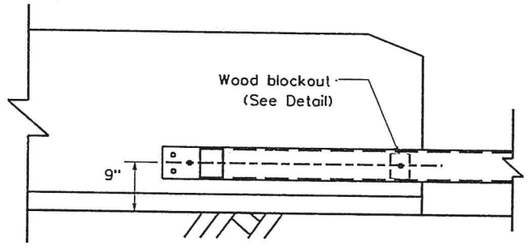


BENT PLATE RUBRAIL DETAIL

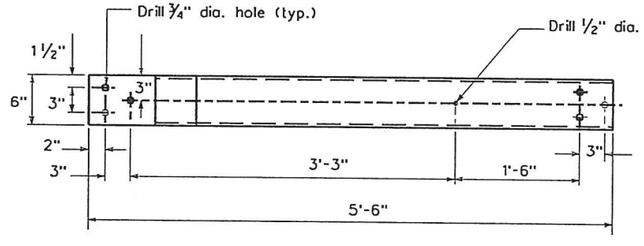
NOTES

1. Rubrail end must be attached flush with sloped toe of safety shape. Installation can be greatly simplified by fabricating or shop twisting the rubrail end to be consistent with the the slope of safety shape. Rubrail ends twisted both clockwise and counterclockwise may be required in most situations.
2. The rubrail end attachment to the concrete safety shape requires three closely drilled holes. appropriate epoxy bolt anchors should be used to reduce the risk of splitting the concrete.
3. There is no separate pay item for this connection and all components as detailed herein shall be included in the contract price for guardrail.

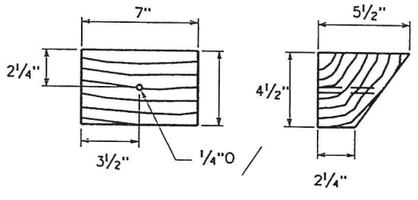




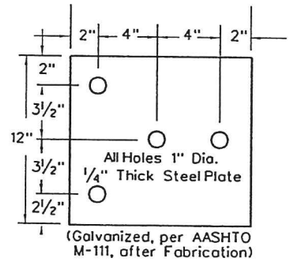
RUBRAIL ATTACHMENT
TO SAFETY SHAPE



C6X8.2 RUBRAIL
DETAIL



WOOD BLOCKOUT FOR RUBRAIL
DETAIL



BEARING PLATE
DETAIL

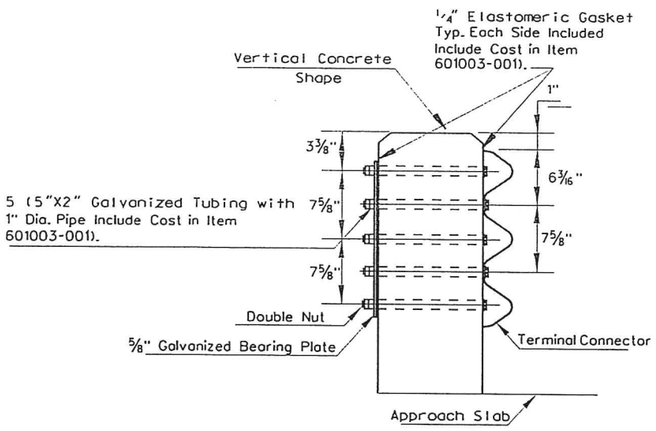
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

PREPARED 7-1-99
REVISION DATE

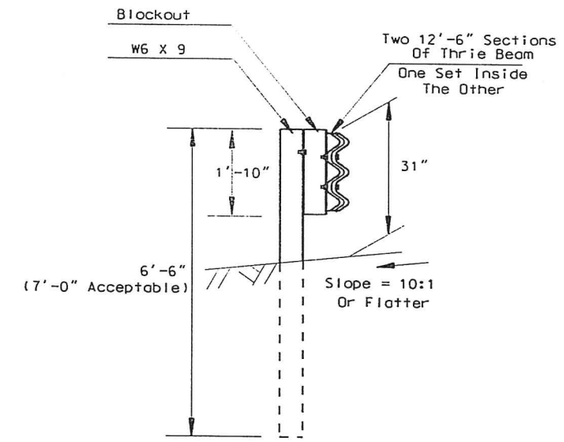
W-BEAM TRANSITION TO SAFETY SHAPE RUBRAIL DETAILS

SHEET 3 OF 3

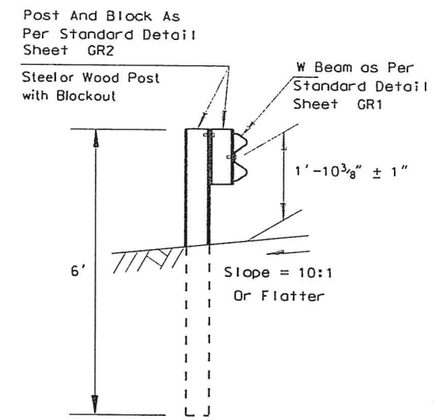
STANDARD SHEET GR10



SECTION A-A



SECTION B-B



SECTION C-C

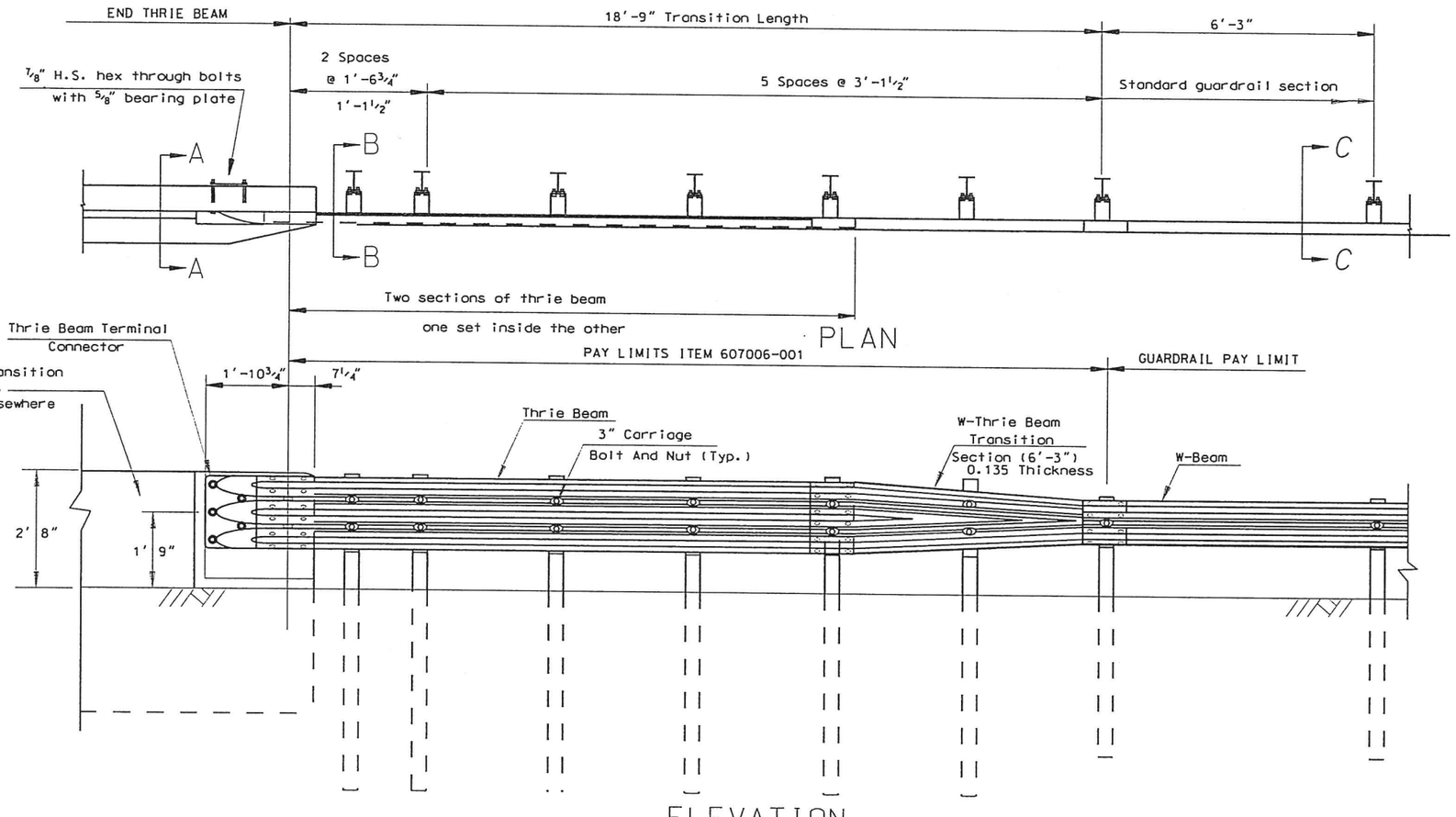
NOTES

This guardrail transition is appropriate for connection to a vertical concrete shape and should not be connected directly to a concrete safety shape. Concrete safety shape bridge rails or barriers shall be transitioned to a vertical shape at the guardrail connection in a manner detailed elsewhere in the Project Plans.

The two sections of 12'6" thrie beam require additional holes in order to mount the beam to the post nearest to the concrete wall.

See Sheet GR 11-C for details not shown on this sheet.

Guardrail systems must have met either the NCHRP 350 or the most current AASHTO Manual for Assessing Safety Hardware (MASH) crash testing criteria and have an FHWA eligibility letter to be used on WVDOH projects. Only FHWA approved guardrail systems utilizing wood or approved block-outs shown on the Division's "Approved Source/Product Listing" shall be used. Steel "W" Shapes shall not be used for block-outs. Only one type of block shall be used for blockout throughout any project, unless otherwise specified.



28½" TOP OF RAIL HEIGHT

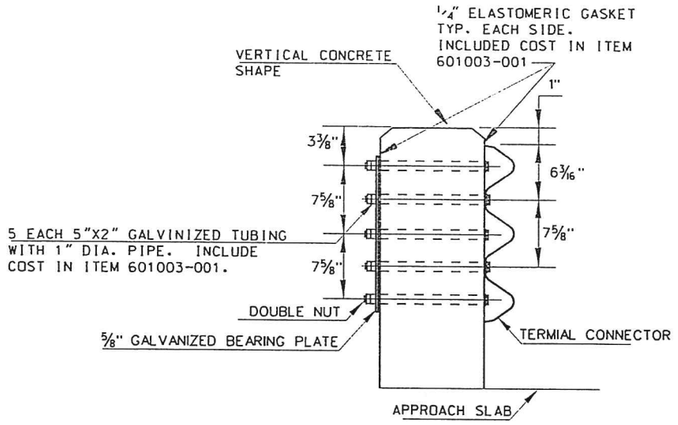
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

PREPARED 7-1-99

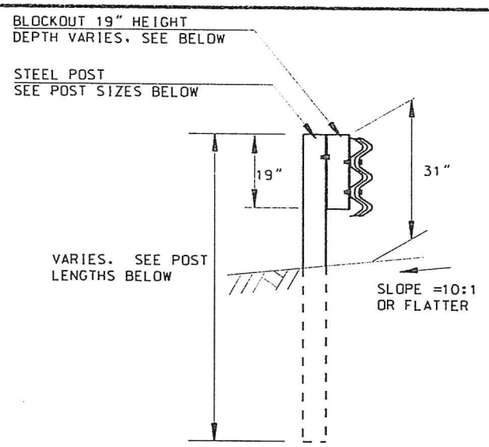
REVISION DATE
03-11-2010
11-13-12

THRIE BEAM GUARDRAIL BRIDGE TRANSITION AND CONNECTION

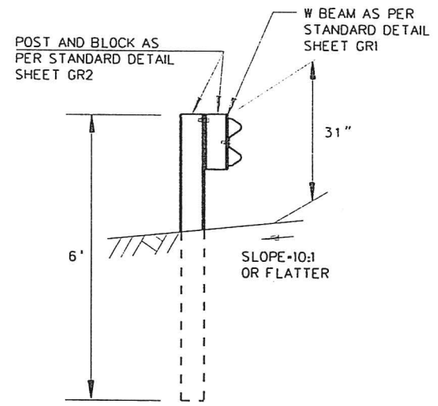
STANDARD SHEET GR 11-A



SECTION A-A



SECTION B-B



SECTION C-C

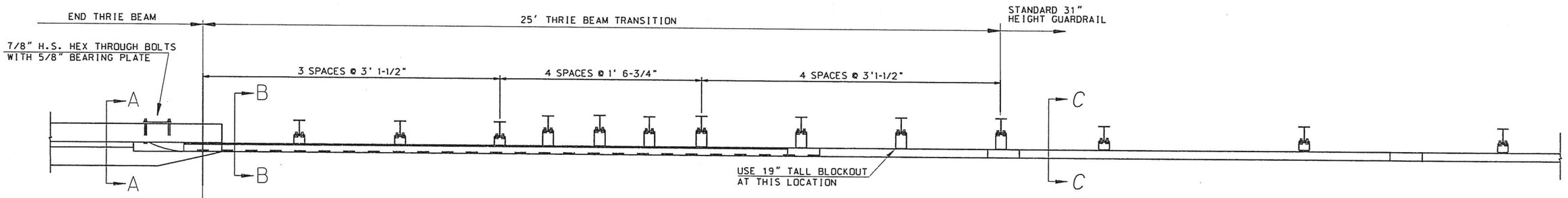
NOTES

THIS GUARDRAIL TRANSITION IS APPROPRIATE FOR CONNECTION TO A VERTICAL CONCRETE SHAPE AND SHOULD NTO BE CONNECTED DIRECTLY TO A CONCRETE SAFETY SHAPE. CONCRETE SAFETY SHAPE BRIGE RAILS OR BARRIERS SHALL BE TRANSITIONED TO A VERTICAL SHAPE AT THE GUARDRAIL CONNECTION OIN A MANNER DETAILED ELSEWHERE IN THE PROJECT PLANS.

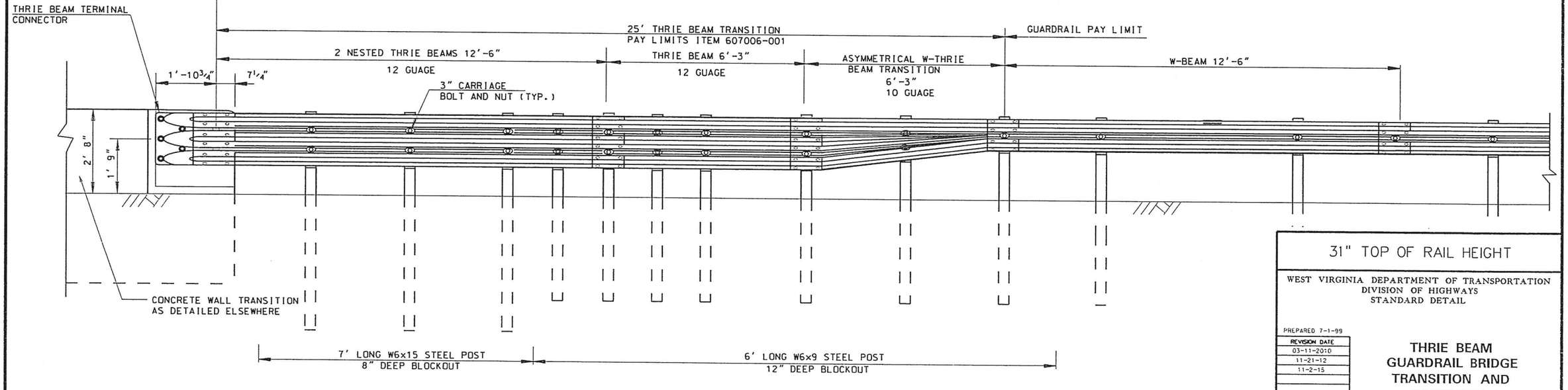
THE TWO SECTIONS OF 12' 6" THRIE BEAM REQUIRE ADDITIONAL SLOTTED HOLES IN ORDER TO MOUNT THE BEAM TO THE POST NEAREST TO THE CONCRETE WALL.

ONLY BLOCK-OUTS SHOWN ON THE DIVISION'S "APPROVED SOURCE/PRODUCT LISTING" SHALL BE USED. STEEL "W" SHAPES SHALL NOT BE USED FOR BLOCK-OUTS. ONLY ONE TYPE OF BLOCK SHALL BE USED THROUGHOUT ANY PROJECT, UNLESS OTHERWISE SPECIFIED.

SEE SHEET GR 11-C FOR DETAILS NOT SHOWN ON THIS SHEET.



PLAN



ELEVATION

31" TOP OF RAIL HEIGHT

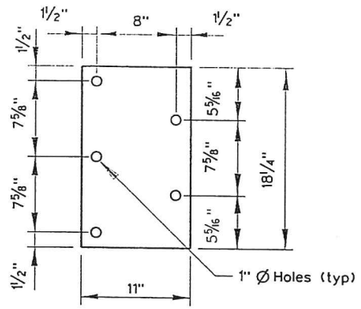
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

PREPARED 7-1-99

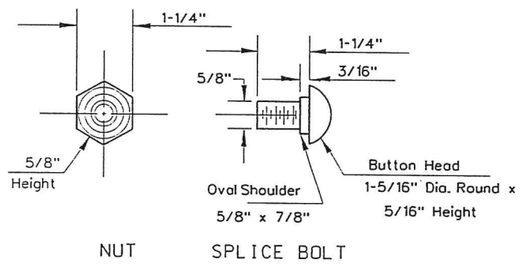
REVISION DATE
03-11-2010
11-21-12
11-2-15

THRIE BEAM GUARDRAIL BRIDGE TRANSITION AND CONNECTION

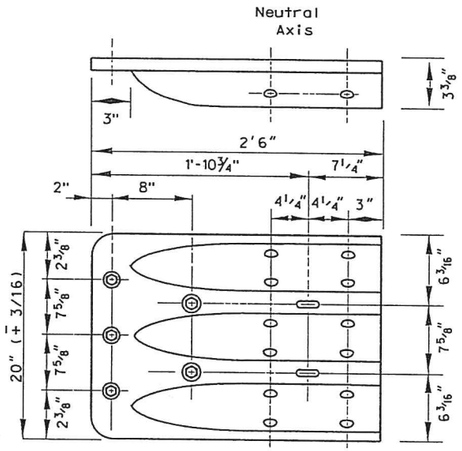
SHEET GR 11-B



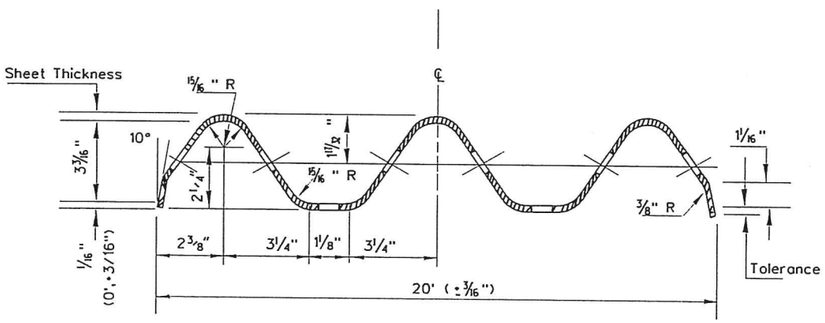
5/8" BEARING PLATE DETAIL



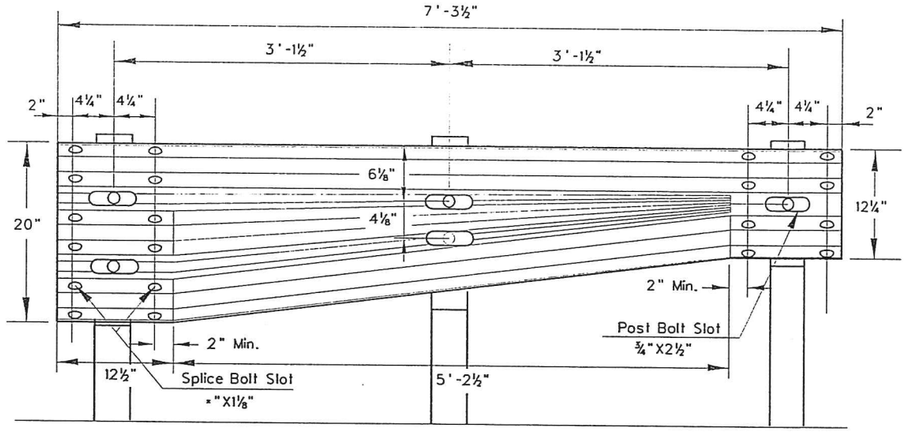
NUT AND SPLICE BOLT DETAIL
(POST BOLT: Similar Except Length)



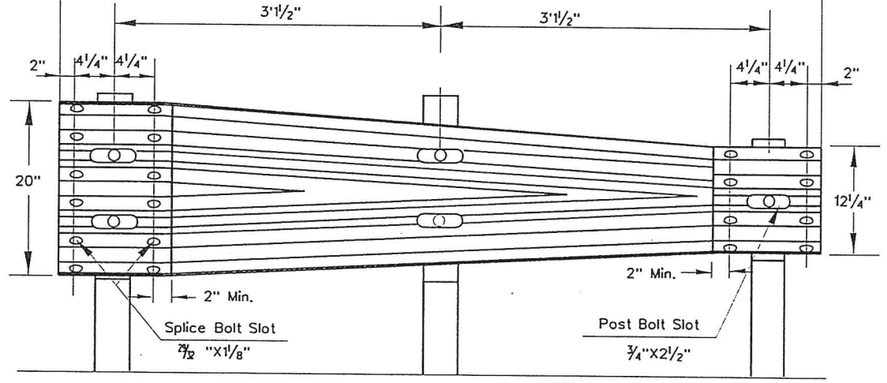
THRIE BEAM TERMINAL
CONNECTOR DETAIL



SECTION THRU THRIE BEAM RAIL ELEMENT



ASYMMETRICAL TRANSITION SECTION DETAIL
(THRIE BEAM TO 31" HEIGHT W-BEAM)



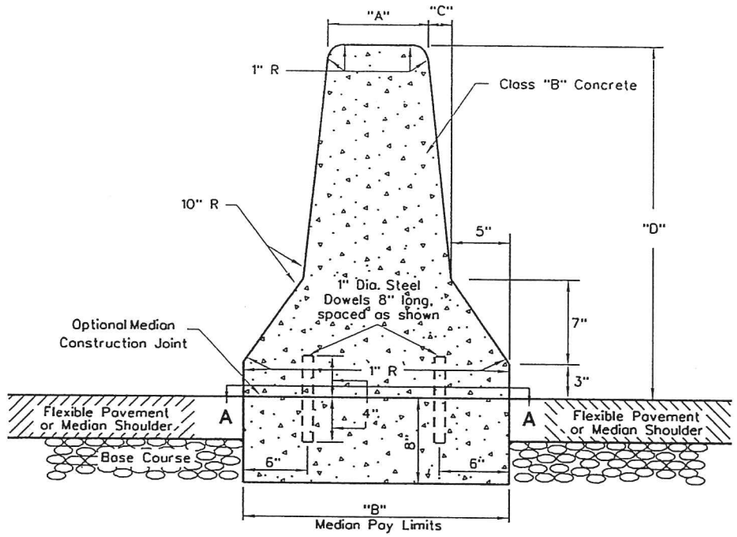
TRANSITION SECTION DETAIL
(THRIE BEAM TO 28-1/2" W-BEAM)

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

PREPARED 7-1-99
REVISION DATE

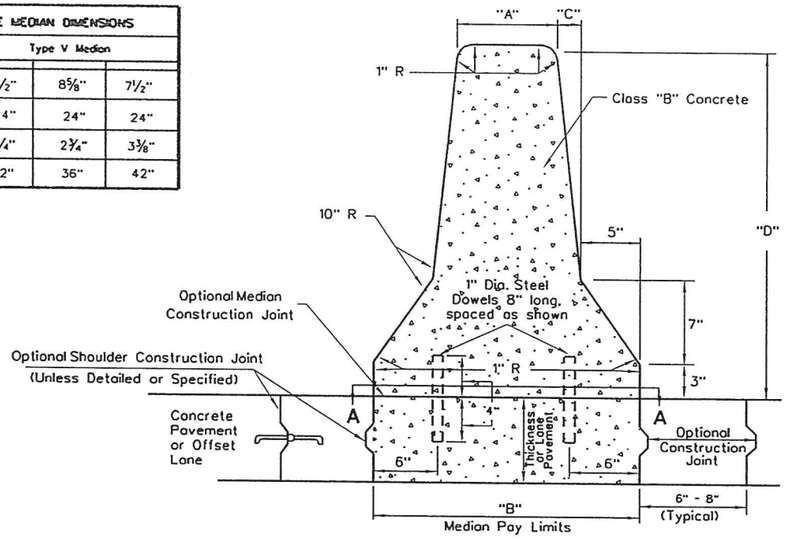
THRIE BEAM GUARDRAIL BRIDGE TRANSITION AND CONNECTION

STANDARD SHEET GR11-C



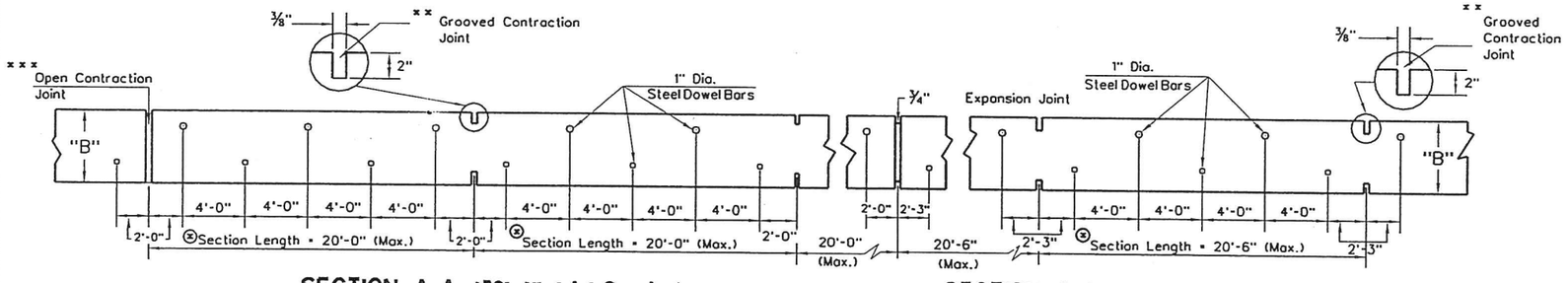
(Adjacent to Bituminous Paving)

F-SHAPE MEDIAN DIMENSIONS			
Designation	Type V Median		
"A"	9½"	8⅝"	7½"
"B"	24"	24"	24"
"C"	2¼"	2¾"	3⅜"
"D"	32"	36"	42"



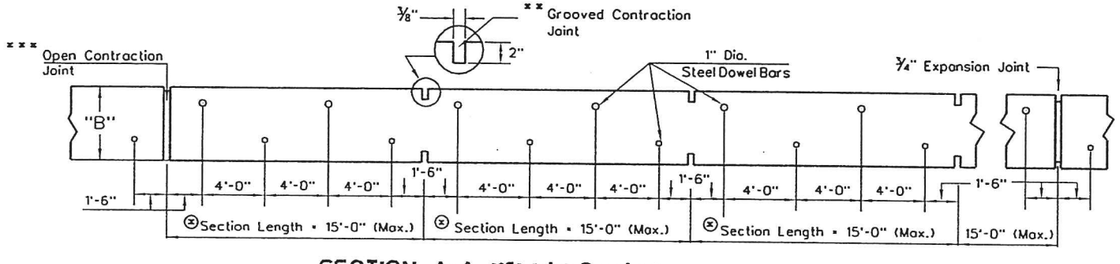
(Adjacent to Concrete Paving)

F-SHAPE



SECTION A-A (39'-4" Joint Spacing)

SECTION A-A (60'-8" Joint Spacing)



SECTION A-A (15' Joint Spacing)

NOTES

The median and footer can be poured monolithically. When the median is poured on existing concrete pavement, the median shall be secured with dowel bars drilled and grouted in the existing concrete pavement, as shown.
When the median and footer are to be poured separately, a median construction joint shall be used.

Where the median is placed over existing pavement contraction joints, median sections shall be separated by open joints having the same width as the pavement joints for the full median height. At all other median contraction joints, a ⅜" wide and 2" deep groove shall be sawed or formed across the top and along the sides for the entire height (including footer depth) of the median, or a full depth butt joint shall be formed at approximately 15' - 20' intervals along the length of the median. In addition these grooved or butt joints shall transversely align within a plus or minus one-foot tolerance with the contraction joints in abutting concrete pavement.

Expansion joints shall be placed in the median at structures when so indicated, opposite expansion joints in abutting concrete pavement, over existing expansion joints in underlying concrete pavement, and at other locations as shown on the Plans or directed by the Engineer. At expansion joints, median sections shall be ¾" apart and the opening filled for the entire depth of the median with ¾" preformed joint filler which complies with the requirements of section 610 of the Standard Specifications Roadways and Bridges. The filler shall be recessed ¼" in from the sides and the top of the median and the completed joint shall recieve no further treatment; e.g., sealing with a waterproof sealer is prohibited. The median shall be adequately terminated at each end of median installations as shown or specified elsewhere in the Plans.

Drainage openings shall be provided in the medians where indicated on the Plans or directed by the Engineer.

Unless otherwise specified, bi-directional delineators meeting the requirements of Section 661 of the Standard Specifications Roads and Bridges and mounted on suitable supports, shall be secured to, and spaced along the length of the median as shown and specified on Standard Sheet TE 11-5 of the Standard Details Book, Volume II. The cost of concrete, steel dowel bars, preformed joint filler, delineators and delineator mountings shall be included in the cost of the median.

Type of surface adjacent to the median, whether normal width or widened pavement, offset lane, median shoulder, etc., shall be specified in the Plans and shall not be included in the cost of the median but shall be paid for separately.

The contractor shall have the option to install either the N-J Shape or the F-Shape median unless otherwise specified in the Plans.

For additional dimensions, notes and details see sheet 2 and 3.

⊗ center-to-center of Contraction Joints, except where Expansion Joints are Specified.

×× formed full-depth butt joint.

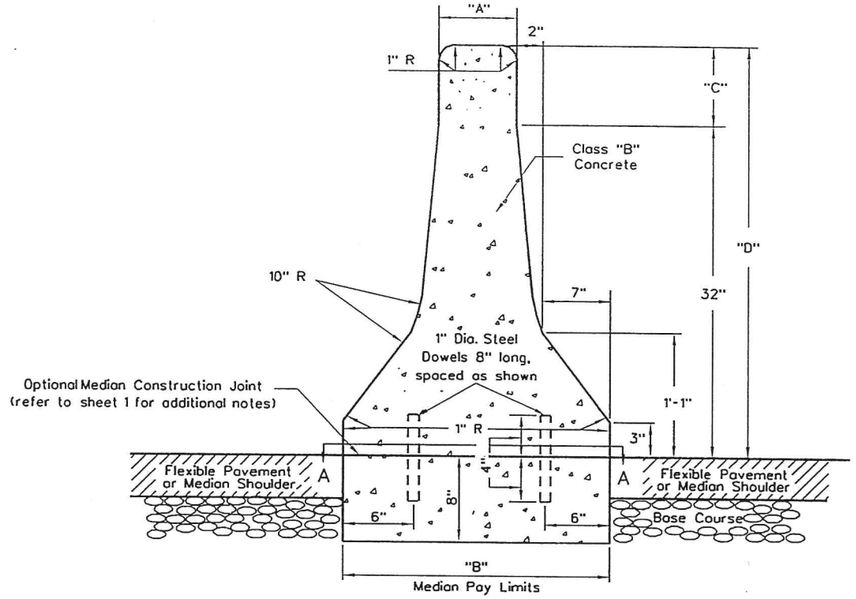
××× open (separated) joint over existing ridged pavement contraction joint. Median joint width equal to pavement joint width.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

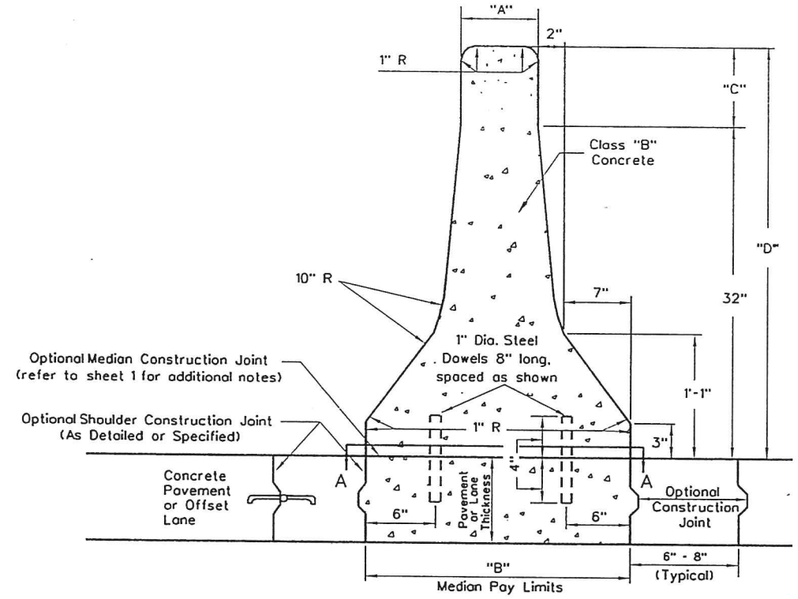
PREPARED 7-1-99
REVISION DATE

TYPE V MEDIAN
F-SHAPE
(Sheet 1 of 4)

STANDARD SHEET GR12



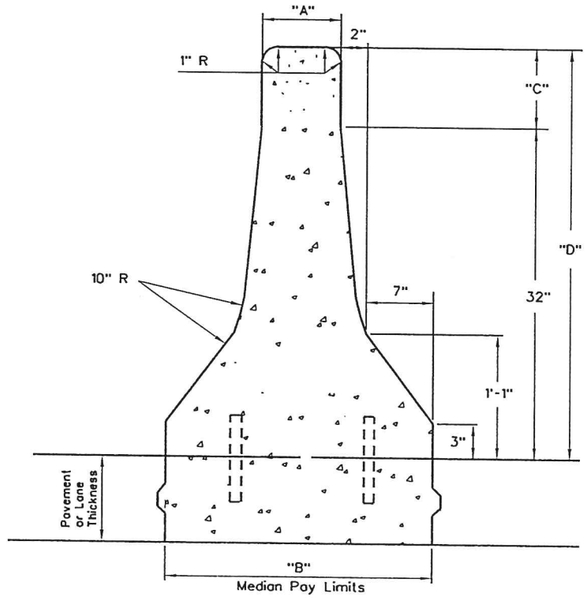
(Adjacent to Bituminous Paving)



(Adjacent to Concrete Paving)

N-J SHAPE

N-J SHAPE MEDIAN DIMENSIONS			
Designation	Type V Median		
"A"	6"	6"	6"
"B"	24"	24"	24"
"C"	-0-	4"	10"
"D"	32"	36"	42"



Raised Median

NOTES

Height of the median, dimension "D", shall be included in the Plans.

Additional height of median, dimension "C" shall be vertical.

The contractor shall have the option to install either the N-J Shape or the F-Shape median unless otherwise specified in the Plans.

For additional dimensions, notes and details, see Sheet 1 and 3.

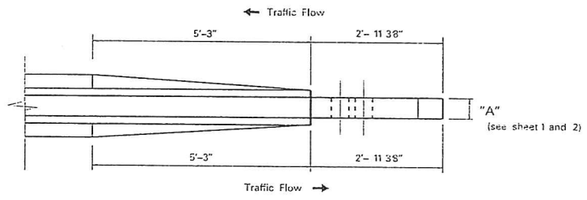
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

PREPARED 7-1-99
REVISION DATE

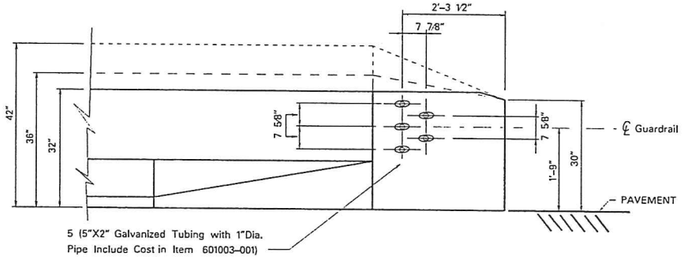
TYPE V MEDIAN
N-J SHAPE

(Sheet 2 of 4)

STANDARD SHEET GR12

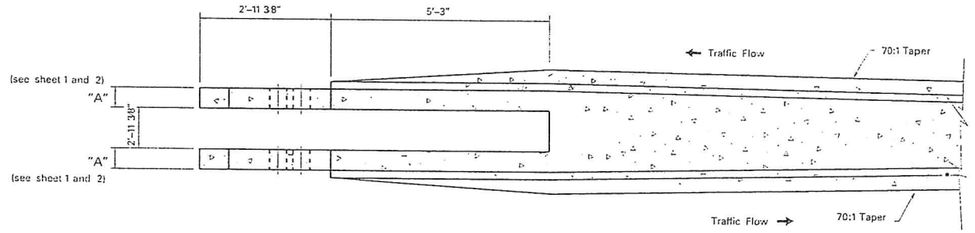


PLAN

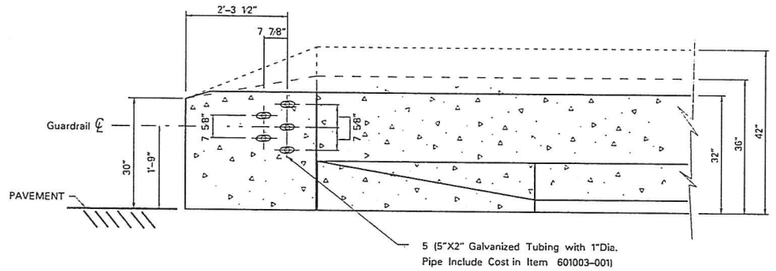


ELEVATION

DOUBLE FACE TRANSITION

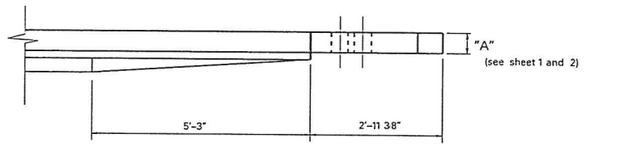


PLAN

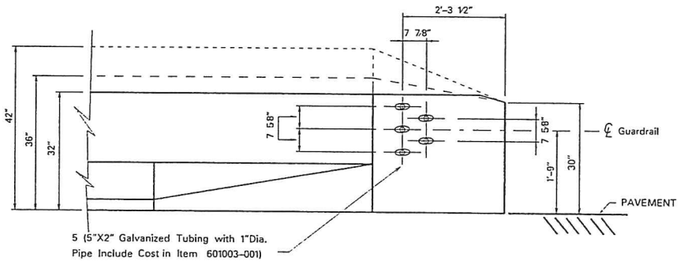


ELEVATION

DOUBLE MEDIAN TRANSITION

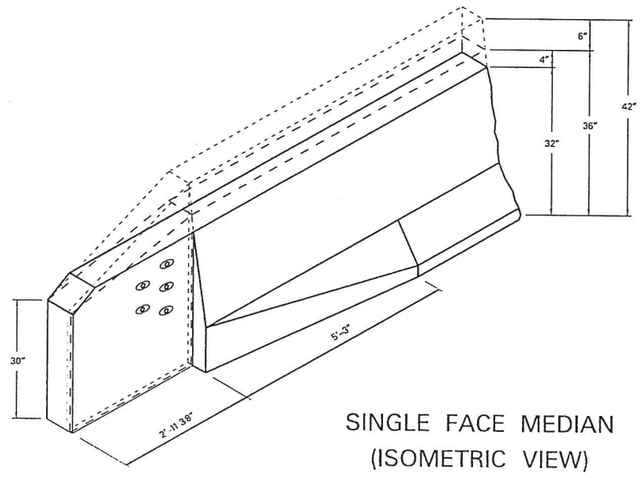


PLAN



ELEVATION

SINGLE FACE TRANSITION



SINGLE FACE MEDIAN
(ISOMETRIC VIEW)

NOTES

The contractor shall have the option to install either the N-J Shape or the F-Shape median unless otherwise specified on the Plans.

For additional dimensions, notes and details see Sheet 1 and 2.

For additional notes and details of the guardrail bolt pattern, see Standard Detail Sheet GR10.

Elongated bolt holes do not apply to existing end posts that are not being reconstructed.

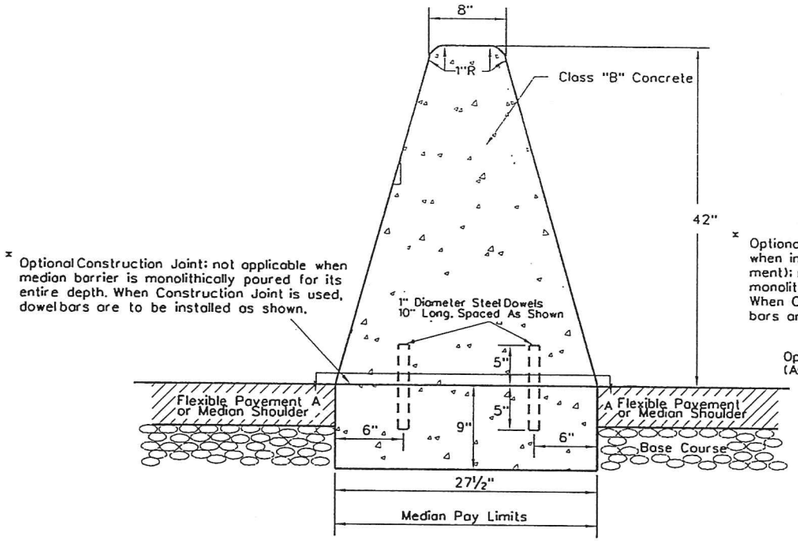
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

PREPARED 7-1-99
REVISION DATE
11-15-12

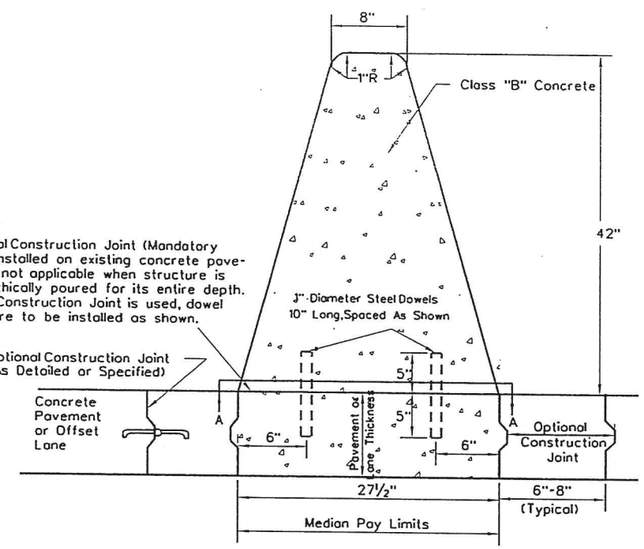
TYPE V MEDIAN GUARDRAIL ATTACHMENT F-SHAPE OR N-J SHAPE

(Sheet 3 of 4)

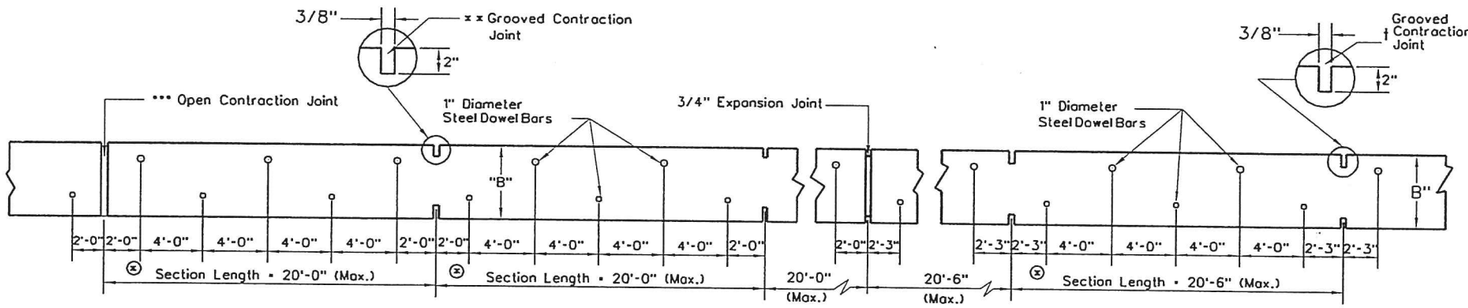
STANDARD SHEET GR12



TYPE VII MEDIAN
SINGLE SLOPE CONCRETE BARRIER
(Adjacent to Bituminous Paving)

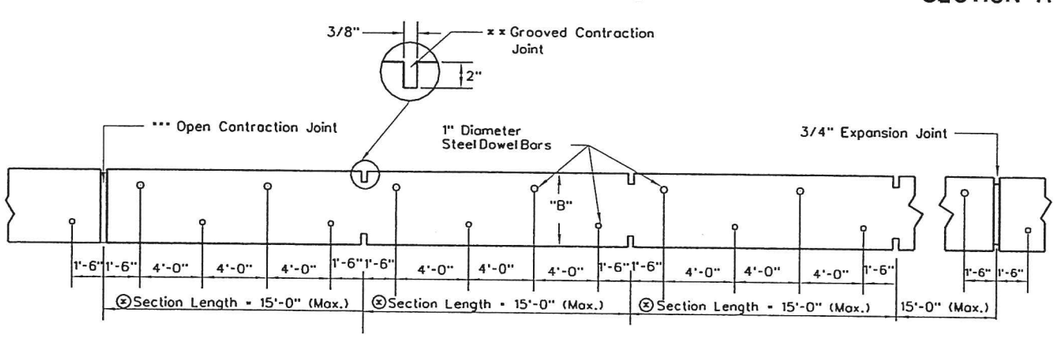


TYPE VII MEDIAN
SINGLE SLOPE CONCRETE BARRIER
(Adjacent to Concrete Paving)



SECTION A-A (40' Joint Spacing)

SECTION A-A (61'-6" Joint Spacing)



SECTION A-A (15' Joint Spacing)

⊗ Center to Center of Contraction Joints, except where Expansion Joints are Specified.

† or a formed full-depth butt joint. Also, 1/4" open (separated) joint over existing pavement contraction joint.

x x or a formed full-depth butt joint.

x x x open (separated) joint over existing rigid pavement contraction joint, with median joint width equal to pavement joint width.

NOTES

Cast-in-place concrete barrier medians shall be constructed in sections as shown herein and shall be constructed in accordance with the applicable provisions of Section 610 of the Specifications.

At barrier median contraction joints over existing pavement contraction joints, median sections shall be separated by open joints, having the same width as the pavement joints, for the full exposed depth of the median. At all other barrier median contraction joints, a groove, 3/8" wide and 2" deep, shall be sawed or formed across the top and along the sides for the entire depth of the median or a full depth butt joint shall be formed, at approximately 15'-20'. intervals along the length of the median. In addition, these grooved or butt joints shall transversely align, within a plus or minus one-foot tolerance, with the contraction joints in abutting concrete pavement.

Expansion joints shall be placed in the barrier median at structures when so indicated, opposite expansion joints in abutting concrete pavement, over existing expansion joints in underlying concrete pavement, and at other locations as shown on the Plans or directed by the Engineer. At expansion joints, barrier median sections shall be 3/4" apart and the opening filled, for the entire depth of the median, with 3/4" preformed joint filler which complies with the requirements of section 610 of the Specifications. The filler shall be recessed 1/4" in from the sides and the top of the median and the completed joint shall receive no further treatment; e.g., sealing with a waterproof sealer is prohibited.

The finished surface of the barrier median shall be smooth, dense, unpitted and free from air bubble pockets, depressions, and honeycomb. If deemed necessary by the Engineer, the above mentioned finished surface will be obtained by the use of water and a wood block or Carborundum brick.

At each end of barrier median installations, the median shall be adequately terminated as shown or specified elsewhere in the Project Plans.

Drainage openings shall be provided in the barrier medians where indicated on the Plans or directed by the Engineer.

Unless otherwise specified, bi-directional delineators, meeting the requirements of 661 of the Specifications and mounted on suitable supports, shall be secured to, and spaced along the length of, the barrier median as shown and specified on Standard Sheet TE 11-5 of the Standard Details Book, Volume II.

The cost of median concrete, steel dowel bars, preformed joint filler, delineators and delineator mountings shall be included in the cost of the median.

Type of surface adjacent to the barrier median, whether normal width or widened pavement, offset lane, median shoulder, etc., shall be specified in the Plans and shall not be included in the cost of barrier median but shall be paid for separately.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

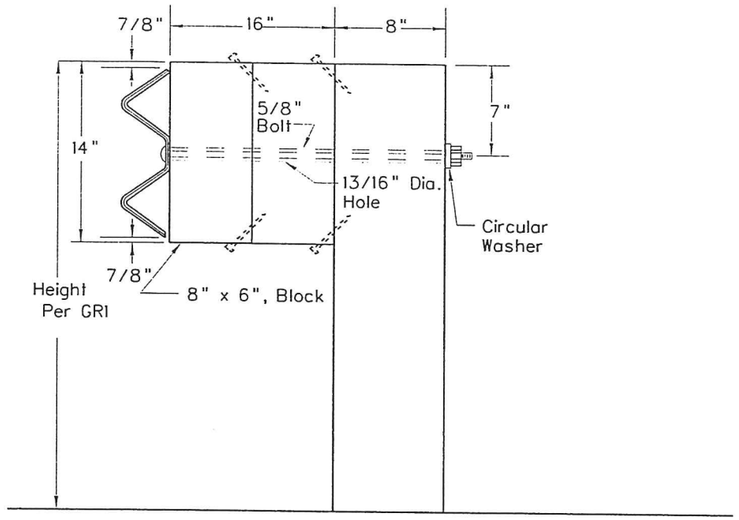
PREPARED 7-1-99

REVISION DATE

TYPE VII MEDIAN

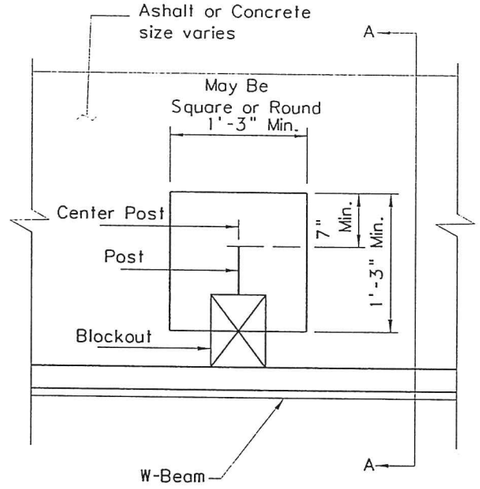
(Sheet 4 of 4)

STANDARD SHEET GR12

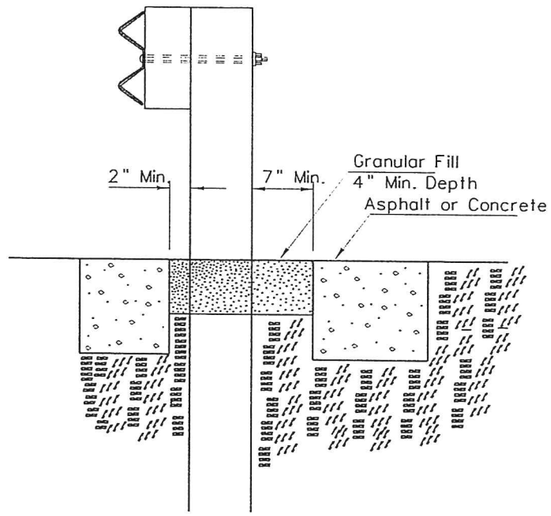


DETAIL FOR 16" BLOCKOUT DEPTH

It is acceptable to use blockouts up to 16"deep to increase the post offset to avoid underground obstacles.There is no limit to the number of posts that can have additional blockouts up to 16" deep.



Steel Post Detail

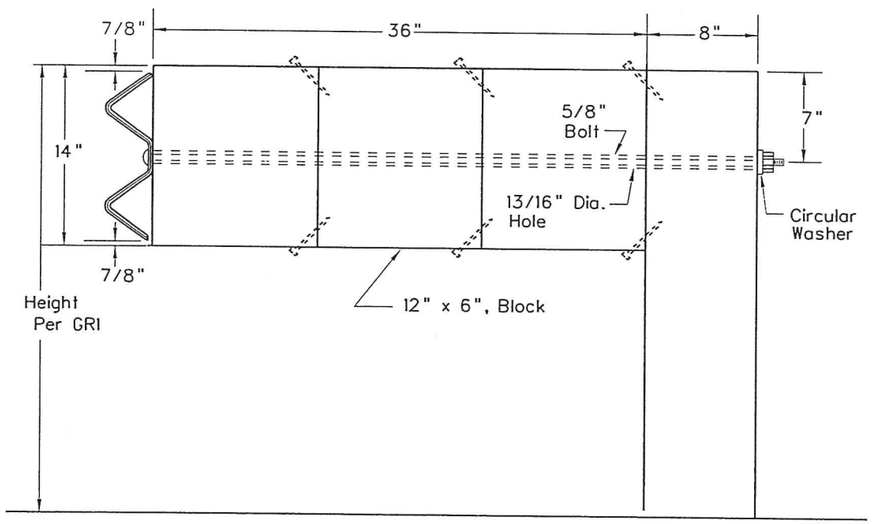


Section A-A

PAVING AROUND POSTS

Notes:

Unless otherwise noted no separate measurement or payment shall be made when details on this sheet are used. The cost associated with using these details shall be included in the appropriate guardrail pay item.



DETAIL FOR 36" BLOCKOUT DEPTH

Under special circumstances, such as avoiding obstacles that are not relocated, it is acceptable to install additional blockouts to obtain up to 36" depth for one or two consecutive posts in a section of guardrail.

Do not use 16"or 36" blockouts if it causes the post to be driven beyond shoulder hinge point or causes a fixed object to be within the deflection distance of the barrier.

Reduce post spacing to 3'-1 ½".

Reduce post spacing to 1'-6 ¾".

Double nest rail element.

Any one stiffening method shall not exceed 25' in length.

Any combination of stiffening methods shall not exceed 50'in length.

METHODS OF REDUCING W-BEAM DEFLECTION

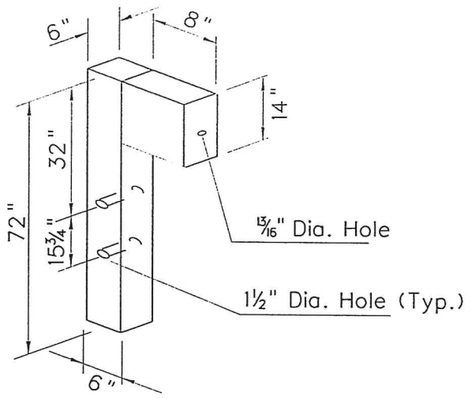
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

PREPARED 3-1-12

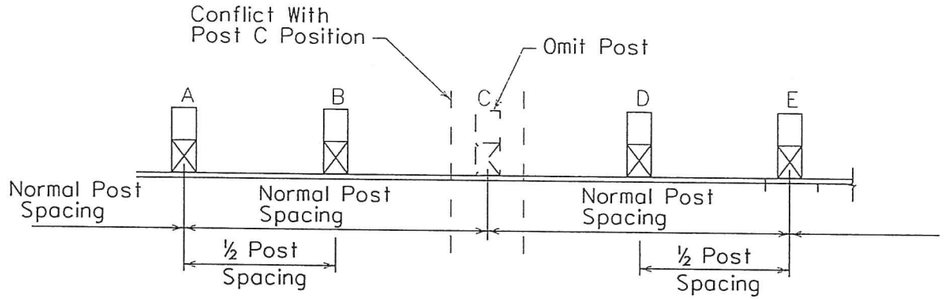
REVISION DATE

GUARDRAIL MODIFICATIONS

STANDARD SHEET GR15



CRT WOODEN POST DETAIL

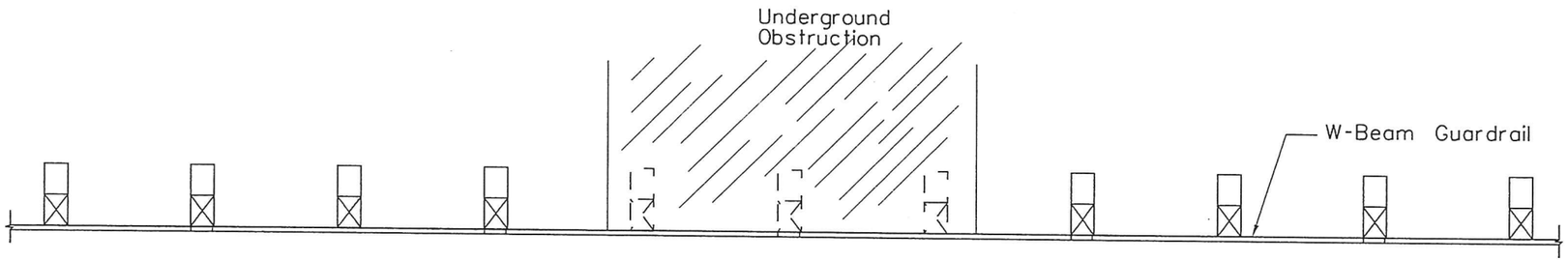


POST DRIVING FOR CONTINUOUS TRANSVERSE UNDERGROUND OBSTRUCTION

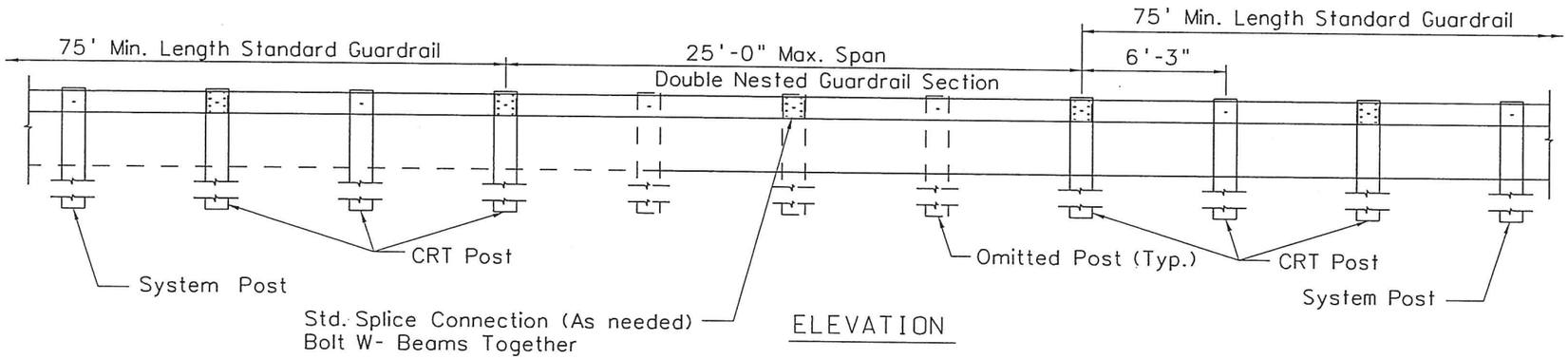
Notes:
Unless otherwise noted no separate measurement or payment shall be made when details are used. The cost associated with these details shall be included in the appropriate guardrail pay item.

Details on this sheet to be used with Class I Guardrail only.

Methods of obstacle avoidance shown in Guardrail Modifications Sheet GR15 are preferred, if applicable.



PLAN



ELEVATION

OMITTING MUTIPLE POSTS FOR UNDERGROUND OBSTRUCTION

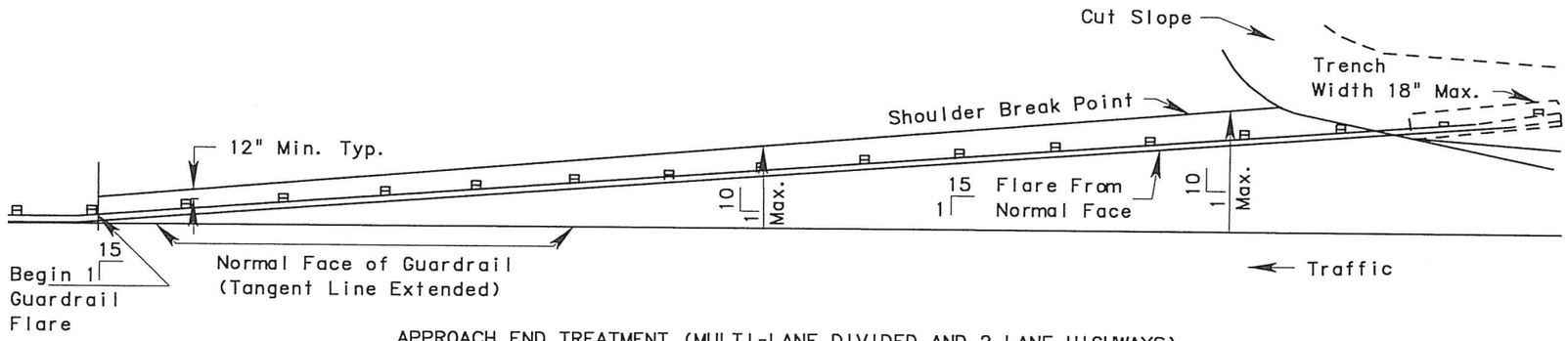
Only those posts coflicting with the obstacle shall be eliminated.
A maximum of three posts may be eliminated within 25' span of W-Beam guardrail.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

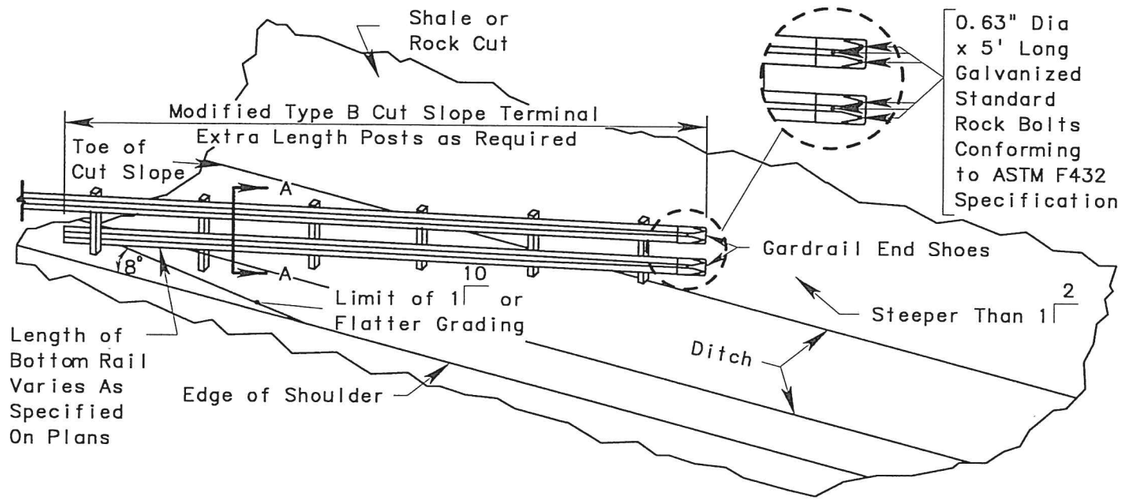
PREPARED 3-1-12
REVISION DATE

GUARDRAIL MODIFICATION FOR UNDERGROUND OBSTRUCTIONS

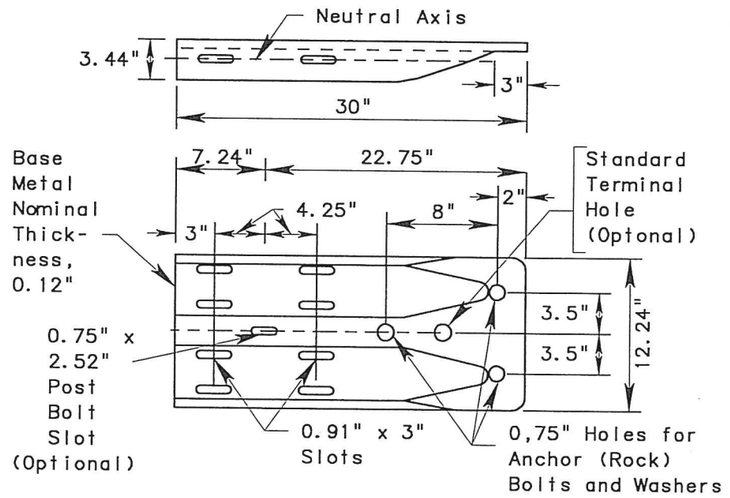
STANDARD SHEET GR16



APPROACH END TREATMENT (MULTI-LANE DIVIDED AND 2-LANE HIGHWAYS)



MODIFIED TYPE B (SHALE OR ROCK) CUT SLOPE TERMINAL INSTALLATION

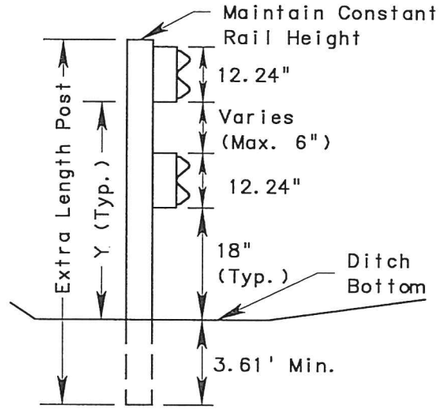


GUARDRAIL END SHOE DETAIL

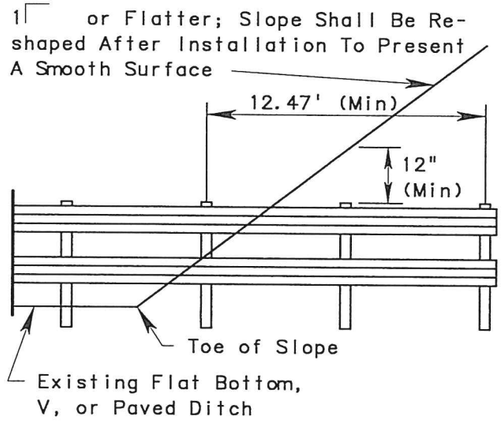
THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

MODIFIED CUT SLOPE TERMINAL (1 OF 2)

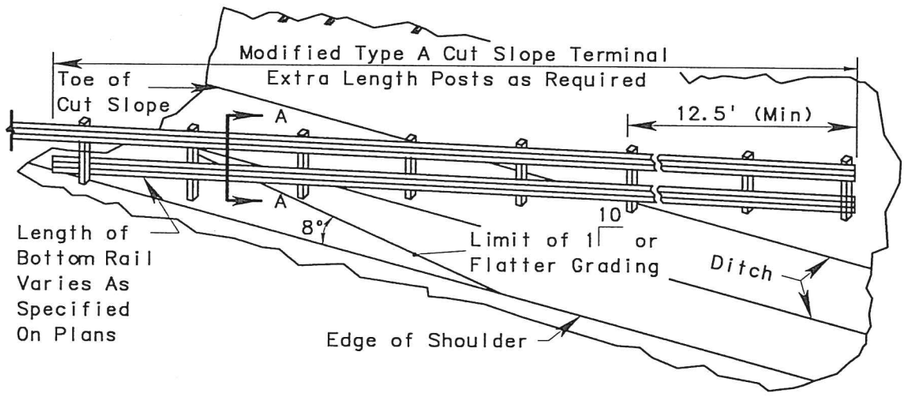
Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	County
W. V.				



Discontinue Bottom Rail When Y ≤ 18"
Section A - A



END VIEW (TYPE A CUT SLOPE TERMINAL)



MODIFIED TYPE A (SOFT SHALE OR SOIL) CUT SLOPE TERMINAL INSTALLATION

NOTES

THIS DETAIL IS APPLICABLE WHERE A CUT SLOPE TERMINAL IS DESIRED, BUT ADDITIONAL GRADING OR PLACEMENT OF MATERIAL INTO THE ROADWAY DITCH IS NOT DESIRED. THE TOP OF THE GUARDRAIL RELATIVE TO THE ELEVATION OF THE EDGE OF PAVEMENT MUST REMAIN CONSTANT.

MODIFIED TYPE A (SOFT SHALE OR SOIL) CUT SLOPE TERMINAL GUARDRAIL SHALL BE THAT GUARDRAIL WHICH (1) IS TO EXTEND A MINIMUM OF TWO 75" SPANS INTO THE CUT SLOPE, FROM THE FIRST POST BEYOND THE TOE OF THE CUT SLOPE, AS DETAILED HEREIN, AND (2) IS TO TERMINATE A MINIMUM OF 12" BELOW THE GROUND ELEVATION OF THE BACK SLOPE, AS DETAILED HEREIN, EXCEPT IN AREAS OF HEAVY ROCK OUTCROPPING WHERE THE MINIMUM DEPTH MAY BE 6".

MODIFIED TYPE B (SHALE OR ROCK) CUT SLOPE TERMINAL INSTALLATION SHALL CONSIST OF ANCHORING THE GUARDRAIL AGAINST THE FACE OF THE CUT SLOPE UTILIZING GUARDRAIL END SHOES AND ROCK BOLTS, AS DETAILED HEREIN.

POSTS, BLOCKS, AND RAIL ELEMENTS SHALL BE THE SAME TYPES USED IN THE NORMAL GUARDRAIL INSTALLATION, EXCEPT FOR THE ADDITIONAL LENGTH POSTS WHOSE LENGTH WILL BE DETERMINED IN THE FIELD. THESE POSTS ARE TO BE MODIFIED TO ACCEPT THE ADDITIONAL GUARDRAIL SECTION. UNDERGROUND POSTS MAY BE W6" x 8.5" IN LENGTH, IN AREAS OF HEAVY ROCK OUTCROPPING. GUARDRAIL BLOCKS SHALL NOT BE USED ON ANY POSTS COMPLETLY UNDERGROUND.

A TRENCH NO GREATER THAN 17.22" IN WIDTH SHALL BE EXCAVATED INTO THE CUT SLOPE TO ACCOMMODATE THE MODIFIED TYPE A TERMINAL INSTALLATION. THE CONTRACTOR SHALL SO ARRANGE HIS WORK SEQUENCE TO PROVIDE THAT EACH MODIFIED TYPE A CUT SLOPE TERMINAL INSTALLATION SHALL BE EXCAVATED, POSTS DRIVEN, RAIL ELEMENTS AND GUARDRAIL COMPONENTS ASSEMBLED, THE TRENCH BACKFILLED, AND DISTURBED SLOPE SHAPED, SEEDED AND MULCHED, ALL IN ONE CONTINUOUS OPERATION.

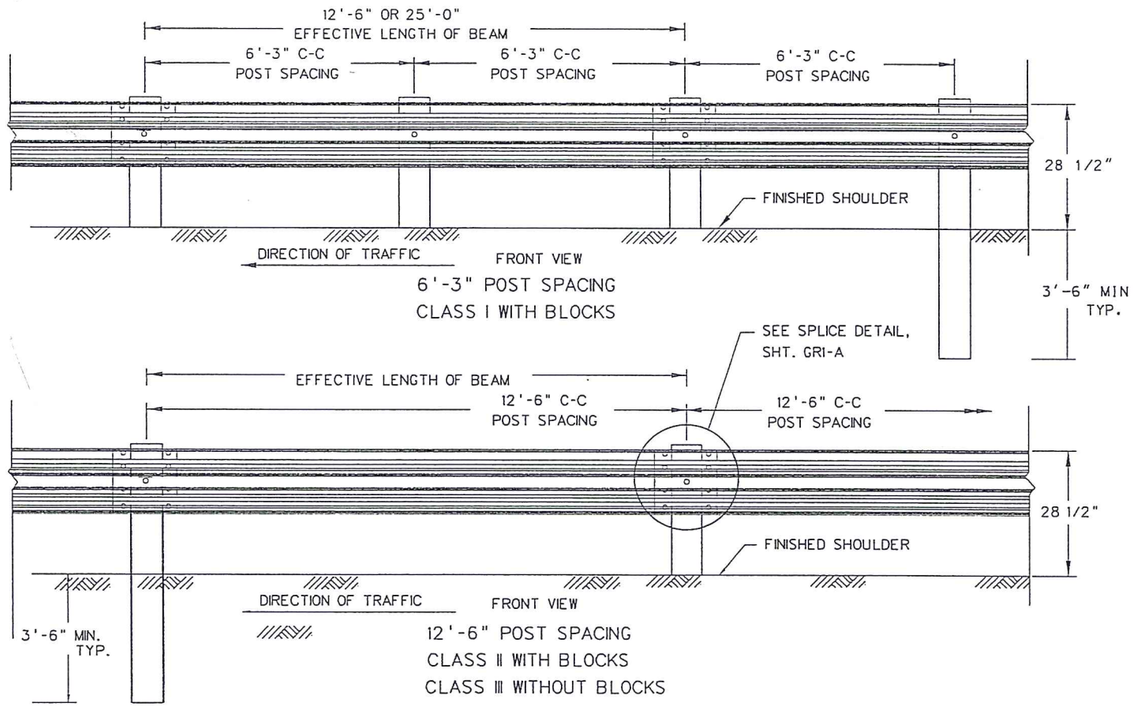
THE COST OF FURNISHING AND INSTALLING MODIFIED CUT SLOPE TERMINAL (A OR B) SHALL INCLUDE EXCAVATING, BACKFILLING, RESHAPING, SEEDING AND MULCHING THE TRENCH, ADDITIONAL LENGTH GUARDRAIL POSTS AS REQUIRED, DRILLING HOLES INTO THE CUT SLOPE, FURNISHING AND INSTALLING ROCK BOLTS, END SHOES AND HARDWARE FOR BOTH THE UPPER AND LOWER GUARDRAIL SHALL BE INCLUDED IN THE UNIT PRICE BID FOR ITEM 607025-001, "CUT SLOPE TERMINAL, TYPE A OR B MODIFIED" PER EACH.

NORMAL GUARDRAIL COMPONENTS: I.E. POSTS, BLOCKS, RAIL ELEMENTS, HARDWARE, ECT. SHALL BE PAID FOR AS GUARDRAIL PER FOOT.

THE WEST VIRGINIA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

MODIFIED CUT SLOPE TERMINAL (2 OF 2)

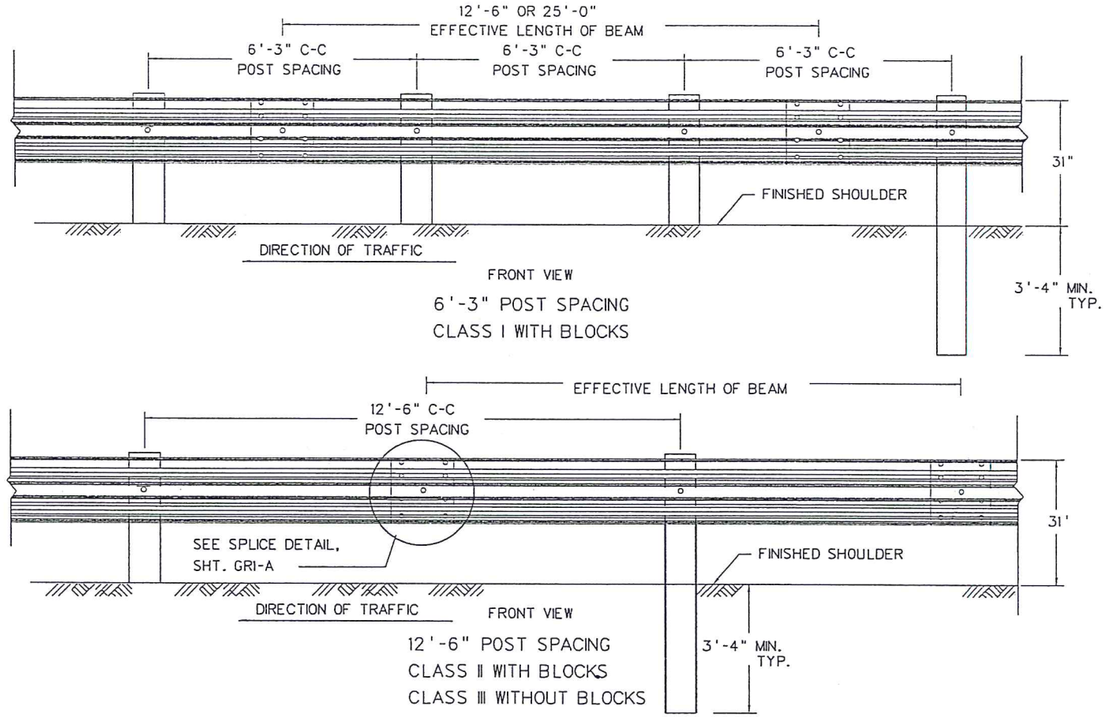
Public Roads Div.	State Dist. No.	State Project No.	Federal Project No.	County
W. V.				



6'-3" POST SPACING
CLASS I WITH BLOCKS

12'-6" POST SPACING
CLASS II WITH BLOCKS
CLASS III WITHOUT BLOCKS

28-1/2" HEIGHT GUARDRAIL



6'-3" POST SPACING
CLASS I WITH BLOCKS

12'-6" POST SPACING
CLASS II WITH BLOCKS
CLASS III WITHOUT BLOCKS

31" HEIGHT GUARDRAIL

Splice locations for 28 1/2" Guardrail shall be on the post.

Splice location for 31" Guardrail are generally off the post. However, for tight post spacings, splices on the posts are necessary and acceptable.

GUARDRAIL HEIGHT

Transitions in guardrail height shall be accomplished at a rate of 1" vertical distance in 12.5' (one element) of horizontal distance. Height transitions shall end before end treatments or connections begin.

Height transitions between 28 1/2" and 31" require moving the splice on/off the post by placing one additional post at half the normal spacing.

Guardrail height shall be as indicated on plans.

Construction tolerances for rail height is plus/minus 1".

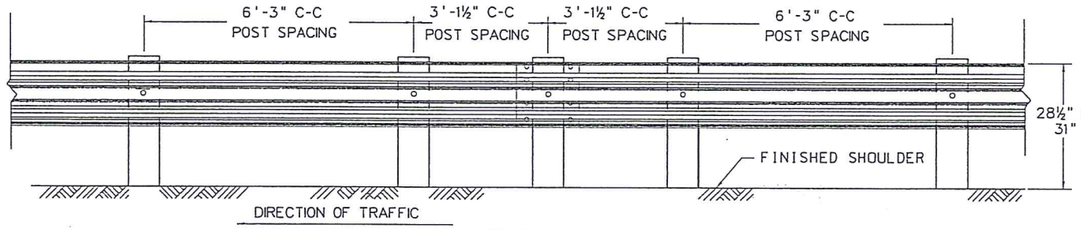
The Standard Trailing End Treatment is acceptable for both 28½" and 31" guardrail height.

Approach Terminals-Separate approved product lists will be maintained for both 28 1/2" & 31" terminal height.

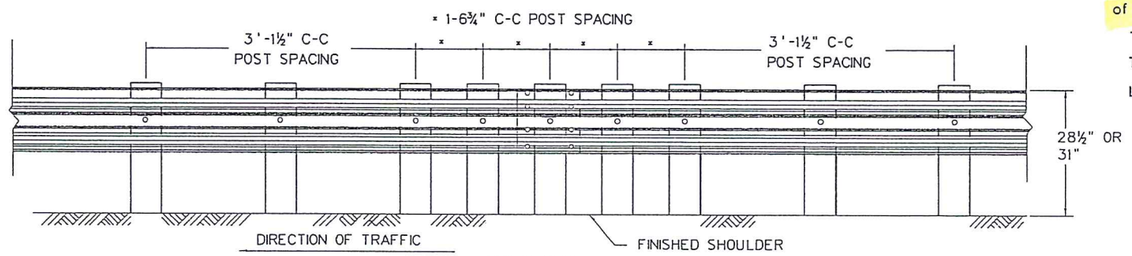
Guardrail that ties to Cut Slope Terminals (CST) must be transitioned per the standard details down to 28½" height (the height of the CST).

Thrie Beam transitions shall be per Standard GR-11 dated 11-13-12 for 28½" and dated 11-21-12 for 31".

WV DOH
JAN 2013



3'-1½" POST SPACING
CLASS IV WITHOUT BLOCKS
CLASS V WITH BLOCKS



1'-6¾" POST SPACING

Guardrail systems on NHS routes must meet NCHRP 350 or the most current AASHTO Manual for Assessing Safety Hardware (MASH) crash testing criteria and have an eligibility letter to be used on WVDOH projects.

Guardrail shall be secured to the blocks, post and other elements by 5/8" dia. bolts and nuts conforming to the details herein and to the requirements of 712.4 of the Standard Specifications. Nuts shall conform to ASTM A563, Grade A or better.

Approach and Trailing End Treatments shall be as shown or specified on the Plans or directed by the Engineer.

The pay quantity of guardrail will be the Linear Feet of guardrail measured along the face of the rail from center to center of end posts. Cost of the Terminal Section Buffer End shall be included in the cost of the Guardrail.

The approach slope to the face of all guardrail shall be 10:1 or flatter.

The Type, Class and Height of Guardrail shall be as shown in the Plans.

Lap Guardrail in Direction of Traffic.

NOTES

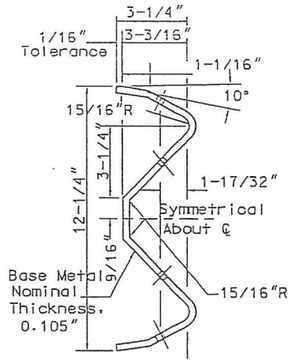
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

REVISED STANDARD DETAIL

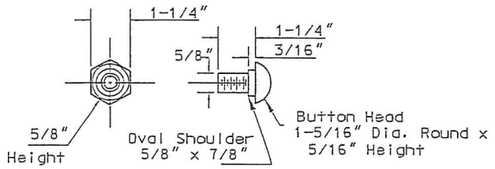
PREPARED 7-1-99
REVISION DATE
11-13-12

GUARDRAIL CLASS
GUARDRAIL HEIGHT

REPLACES SHEET GR1

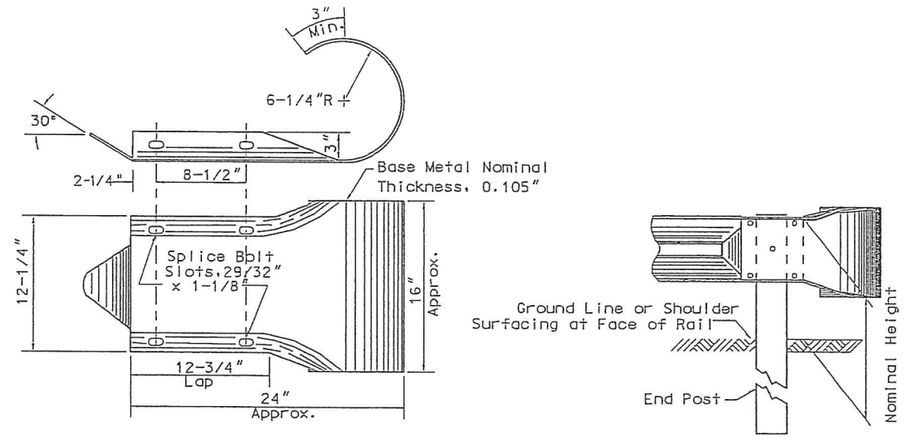


SECTION
RAIL ELEMENT



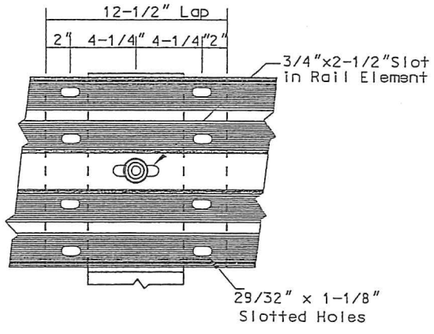
NUT SPLICE BOLT

SLICE BOLT: Similar Except Length



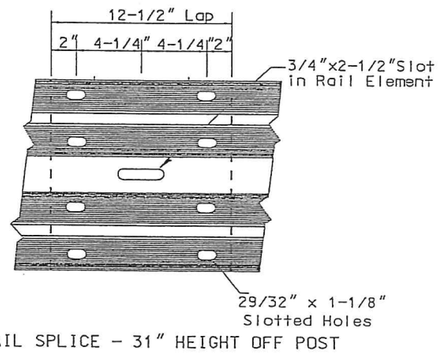
TERMINAL SECTION BUFFER END

(For Use Only on Unanchored Ends And on Special Trailing End Terminal)



RAIL SPLICE - 28 1/2" HEIGHT ON POST

Eight (8) Splice Bolts are to be used at all Rail Splices



RAIL SPLICE - 31" HEIGHT OFF POST

Eight (8) Splice Bolts are to be used at all Rail Splices

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

REVISED STANDARD DETAIL

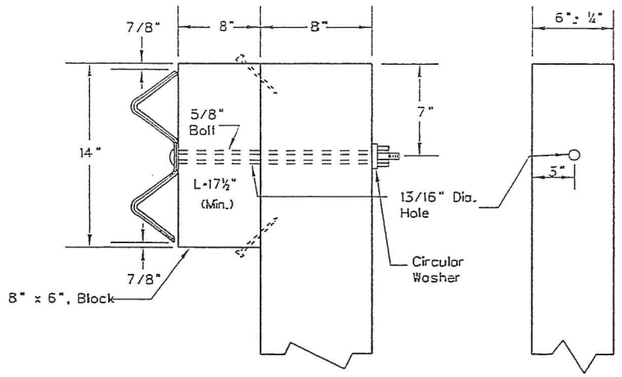
GUARDRAIL ELEMENT

BUFFER END

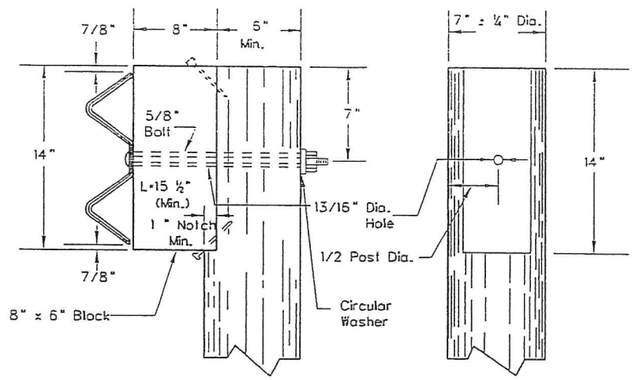
PREPARED 11-13-12

REVISION DATE

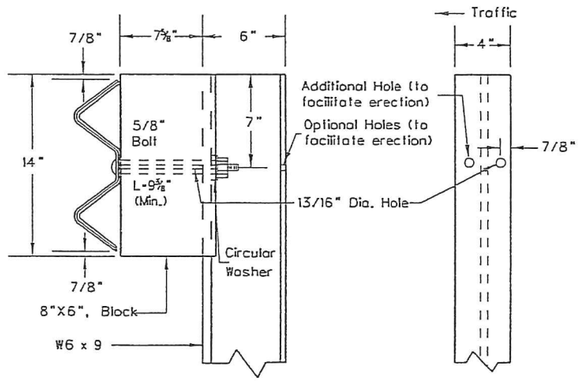
SHEET GR1-A



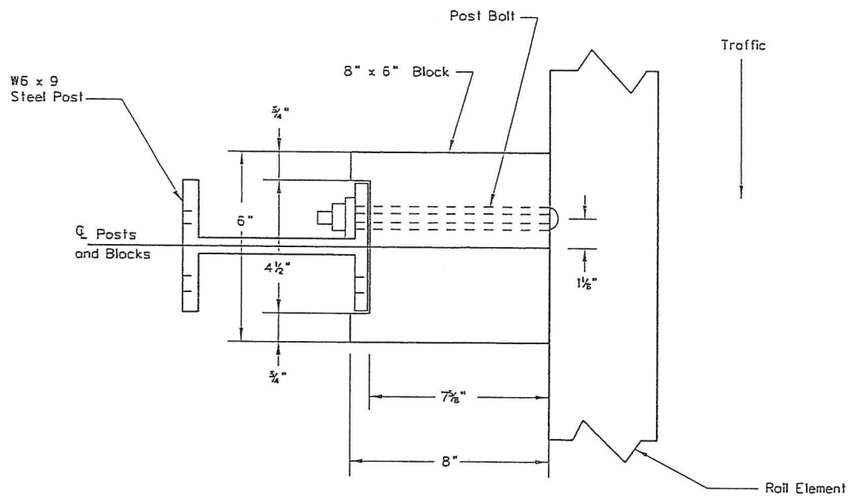
WOOD GUARDRAIL POST (RECTANGULAR)



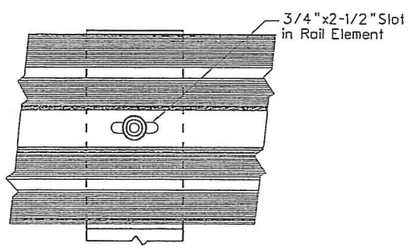
WOOD GUARDRAIL POST (ROUND)



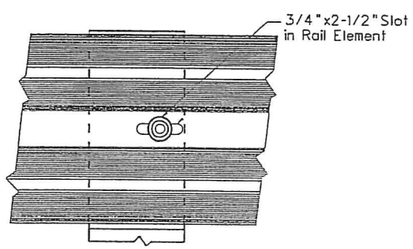
STEEL GUARDRAIL POST
(WOOD BLOCK)



PLAN



WOOD POST DETAIL



STEEL POST DETAIL

NOTES

GENERAL:

Guardrail systems on NHS routes must meet current NCHRP 350 or the most current AASHTO Manual for Assessing Safety Hardware (MASH) crash testing criteria and have an FHWA eligibility letter to be used on WVDOH projects.

Only FHWA approved guardrail systems utilizing wood or approved alternate block-outs shown on the Division's "Approved Source/Product Listing" shall be used. Steel "W" shapes shall not be used for block-outs. Only one type of block shall be used for block-outs throughout any project, unless otherwise specified.

" Blocks for block-outs" shall be used on all posts except when otherwise noted on plans. When blocks are not provided, the post details will be as shown herein, except the ⅝" bolt minimum length will be reduced as required, the 1" minimum notch for the wood guardrail post (round) will not be used, and nails for block stability will not be needed. For steel posts without blocks, details of the posts shall conform to the "Steel Guardrail Post (Wood Block)" details herein, with the additional holes (to facilitate erection) being optional.

The circular washers shall be made of steel and galvanized in accordance with the requirements of AASHTO M232.

WOOD POSTS:

Posts and blocks shall be the same type of wood.

Wood posts shall be pressure-treated after notching, in accordance with Section 710.5 of the specifications.

The 1" (minimum) notch dimension as shown for round wooden posts shall be located along the vertical centerline for the entire upper 14" of the post and shall apply regardless of whether the post is notched (as shown) or otherwise cut or sawed to form a vertical flat plane and then, at some location below the top 14", is angularly sliced out to the surface of the post.

Post length will be 6'-± ½" unless otherwise noted.

STEEL POSTS:

Blocks shall be centered on their posts and the center of the block holes, for bolts connecting rails to blocks, shall be horizontally offset 1-1/8" from the center of the steel posts toward the post edge facing approaching traffic for both polimer and wood blocks, as shown for wood blocks on the Plan view of the Block Stop Detail. Post length will be 6'-± ½" unless otherwise noted.

WOOD BLOCKS:

The type (species) of wood for blocks is to be one of the types (species) permitted by specifications for wood posts. Wood blocks shall be pressure--treated in conformance with the requirements for wood posts. However, creosote oil is not permitted as a preservative in the pressure treatment of wood blocks to be erected on steel posts. 8" x 6" wood blocks shall be positioned so that the 6" x 14" faces of the blocks are the contact faces for the rail elements and the posts in order to achieve the blockout dimension shown. When wood block is used adjacent to a wood post, the block shall be nailed to the post with a galvanized steel 10d common nail. The nail is to be driven into the center of the top or bottom of the block.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

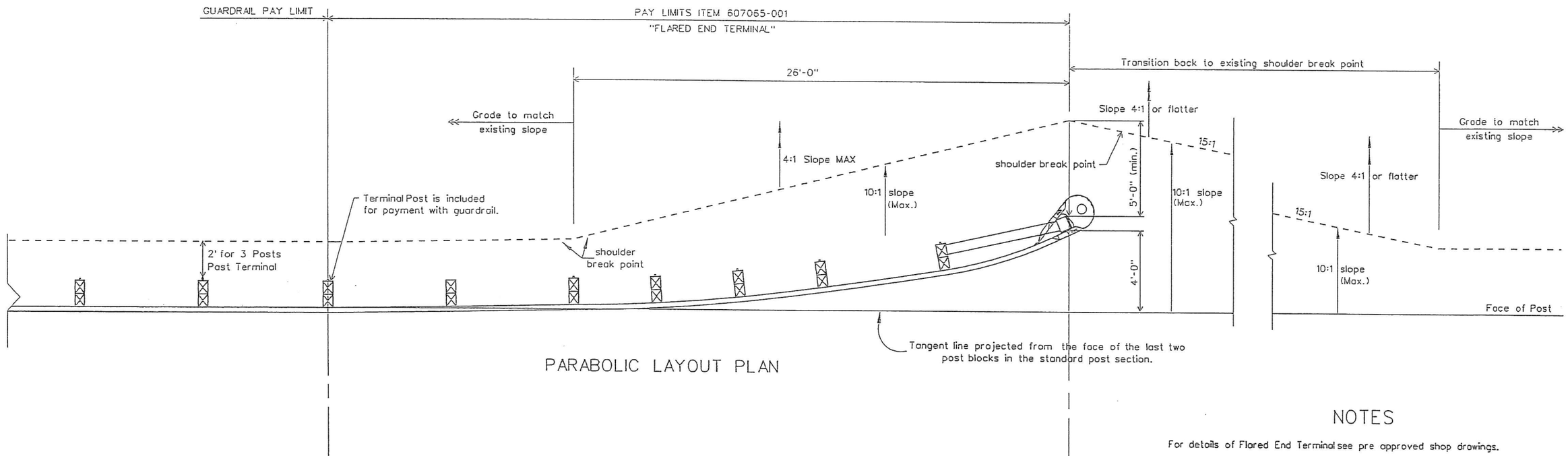
REVISED STANDARD DETAIL

PREPARED 7-1-99

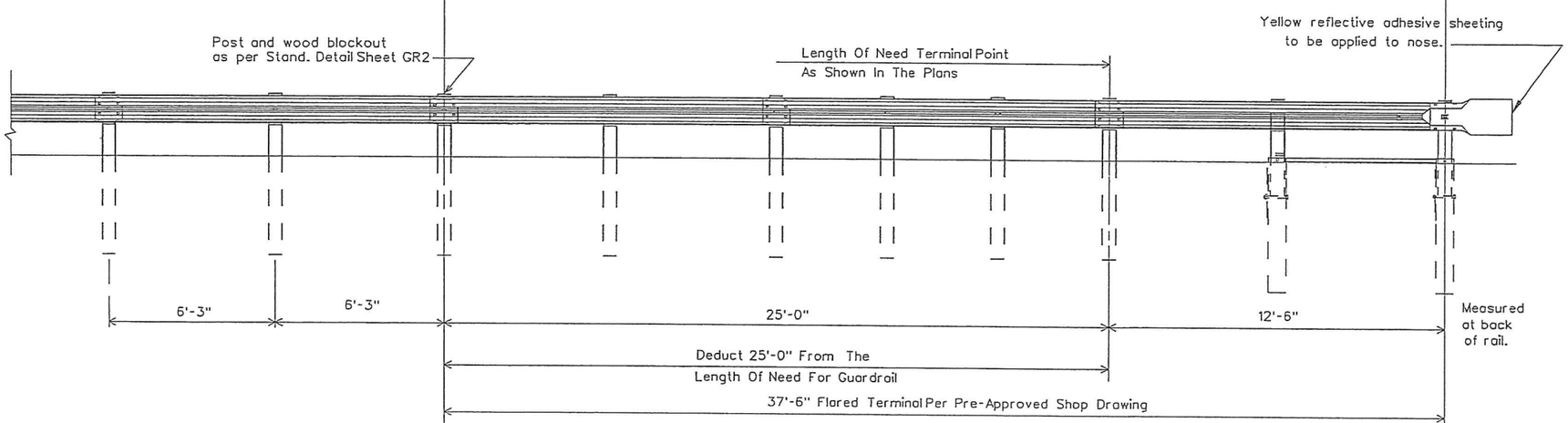
REVISION DATE
03-05-2010
06-16-2010
11-13-12

GUARDRAIL POSTS AND BLOCKS

REPLACES SHEET GR2



PARABOLIC LAYOUT PLAN



ELEVATION

NOTES

For details of Flared End Terminal see pre approved shop drawings.

All materials used shall meet the applicable requirements of Section 607 of the Standard Specifications Road and Bridges.

The post offset dimensions are given to the center of the traffic face of the blockouts; except at the first post, where the dimension is to the center of the traffic face of the post. Offset points are to be located by measurements at the back of rail equal to the nominal post spacings shown on pre-approved shop drawings. Posts are to be set approximately radial to the railing at each location.

When a wood block is used adjacent to a wood post, the block shall be nailed to the post with a galvanized steel 10d common nail. The nail is to be driven into the center of the top or bottom of the block.

The cost of furnishing and installing the Flared End Terminal, complete with all miscellaneous hardware and parts as detailed on the pre-approved shop drawings , is to be included in the unit price bid for "Flared End Terminal".

Yellow reflective sheeting shall cover the entire nose of those terminals with a flat impact head. Those terminals with a rounded impact head shall be covered with a 1'-0" X 3'-0" yellow reflective sheet.

As of 11-13-12 revision date, this detail is obsolete and no longer used for new construction.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

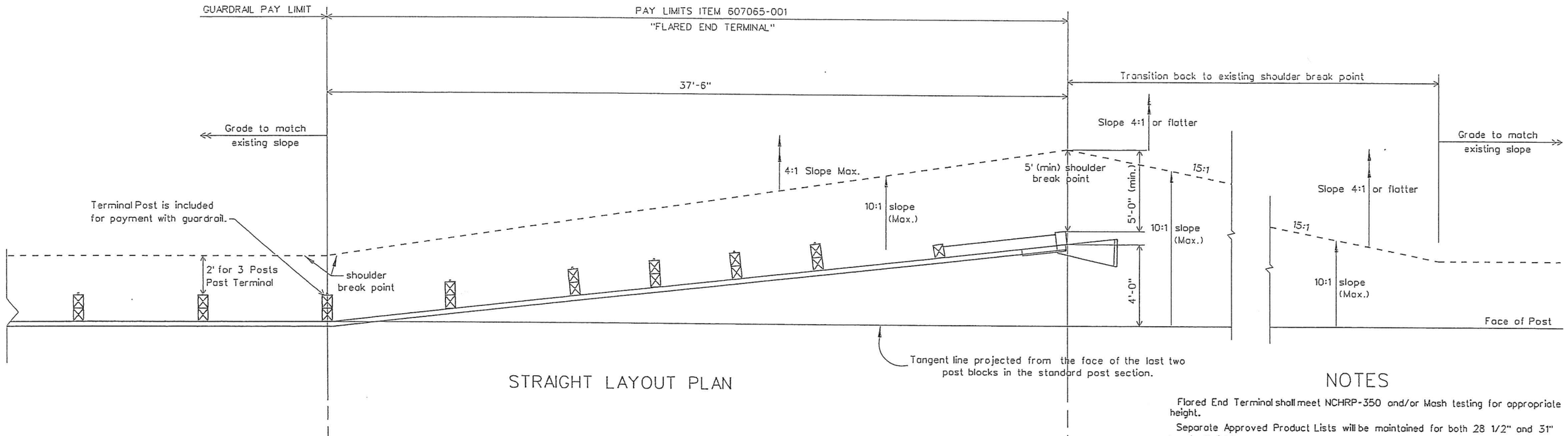
REVISED STANDARD DETAIL

PREPARED 7-1-99

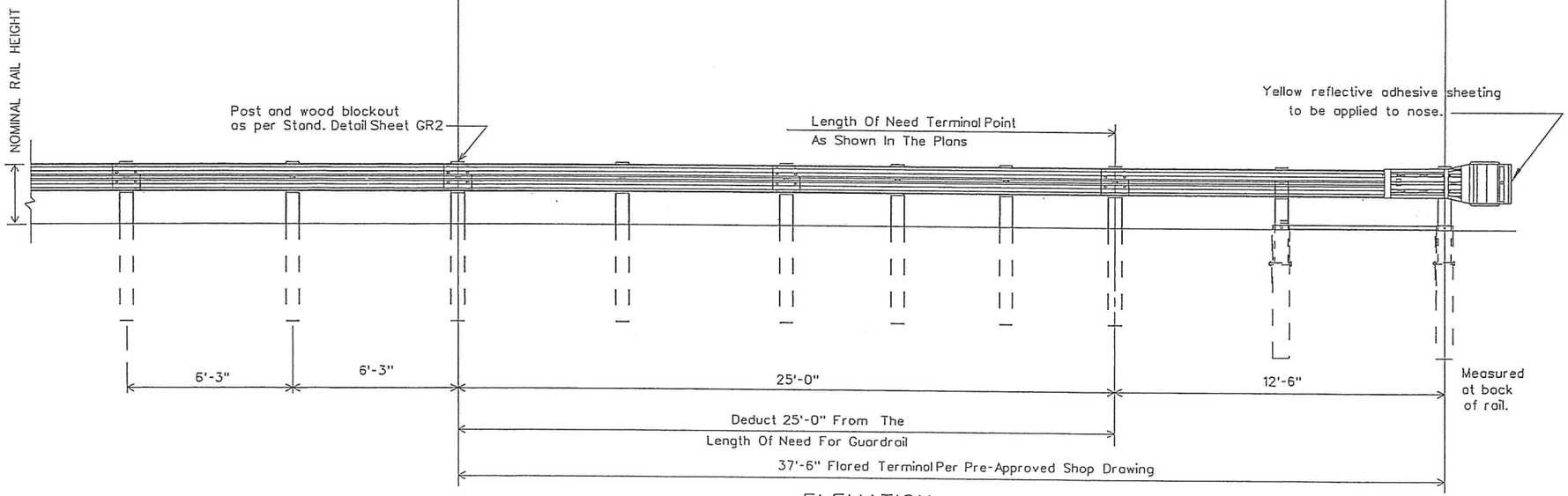
REVISION DATE
11-13-12

FLARED END TERMINAL
PARABOLIC LAYOUT
(SHEET 1 OF 2)

STANDARD SHEET GR5



STRAIGHT LAYOUT PLAN



ELEVATION

NOTES

Flared End Terminal shall meet NCHRP-350 and/or Mash testing for appropriate height.

Separate Approved Product Lists will be maintained for both 28 1/2" and 31" terminal heights.

For details of Flared End Terminal see pre approved shop drawings.

Post and splice locations are per manufacturer.

All materials used shall meet the applicable requirements of Section 607 of the Standard Specifications Road and Bridges.

The post offset dimensions are given to the center of the traffic face of the blockouts: except at the first post, where the dimension is to the center of the traffic face of the post. Offset points are to be located by measurements at the back of rail equal to the nominal post spacings shown on pre-approved shop drawings. Posts are to be set approximately radial to the railing at each location.

When a wood block is used adjacent to a wood post, the block shall be nailed to the post with a galvanized steel 10d common nail. The nail is to be driven into the center of the top or bottom of the block.

The cost of furnishing and installing the Flared End Terminal, complete with all miscellaneous hardware and parts as detailed on the pre-approved shop drawings , is to be included in the unit price bid for "Flared End Terminal".

Yellow reflective sheeting shall cover the entire nose of those terminals with a flat impact head. Those terminals with a rounded impact head shall be covered with a 1'-0" X 3'-0" yellow reflective sheet.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

REVISED STANDARD DETAIL

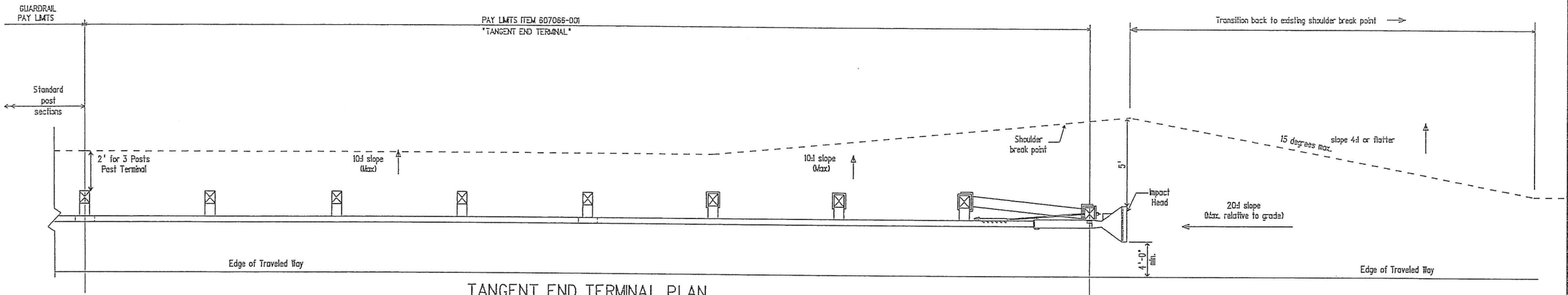
PREPARED 7-1-99

REVISION DATE
11-13-12

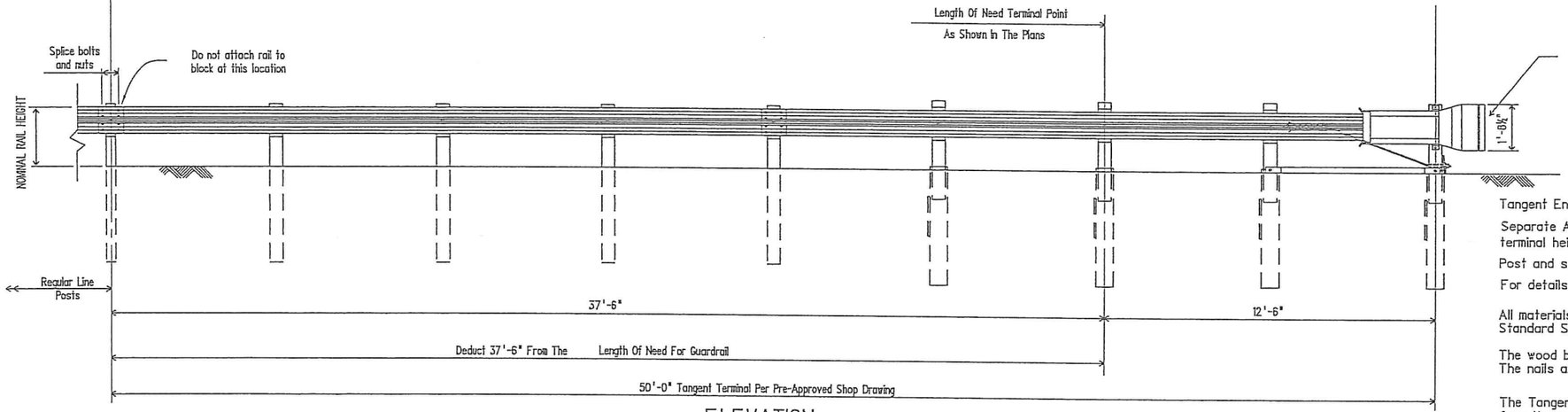
FLARED END TERMINAL STRAIGHT LAYOUT

(SHEET 2 OF 2)

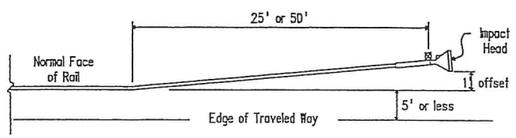
REPLACES SHEET GR5



TANGENT END TERMINAL PLAN



ELEVATION



FLARE DETAIL

NOTES:

Tangent End Terminal shall meet NCHRP-350 and/or Mash testing for appropriate height.

Separate Approved Product Lists will be maintained for both 28 1/2" and 31" terminal heights.

Post and splice locations are per manufacturer.

For details of Tangent End Terminal, see pre-appoved shop drawings.

All materials used shall meet the applicable requirements of Section 607 of the Standard Specifications Roads and Bridges.

The wood block shall be nailed to the post with a galvanized steel 10d common nail. The nails are to be driven into the center of the top or bottom of the block.

The Tangent End Terminal installation shall maintain a 4' minimum offset from the edge of the impact head to the edge of the traveled way. For narrow existing shoulders that have an offset of 5' or less from the face of the rail element to the edge of the traveled way, the rail and terminal may be flared from the normal face of rail. The flared offset distance shall be 1' at a taper rate of 25:1, for a total flare length of 25'; or a taper rate of 50:1, for a total flare length of 50' (see Flare Detail).

Rail element panel lengths shall be 25' only. Shorter lengths shall not be used.

The cost of furnishing and installing the Tangent End Terminal, complete with all miscellaneous hardware and parts as detailed on the pre-approved shop drawings, is to be included in the unit price bid for "Tangent End Terminal".

Yellow reflective sheeting shall cover the entire nose of those terminals with a flat impact head. Those terminals with a rounded impact head shall be covered with a 1'-0" X 3'-0" yellow reflective sheet.

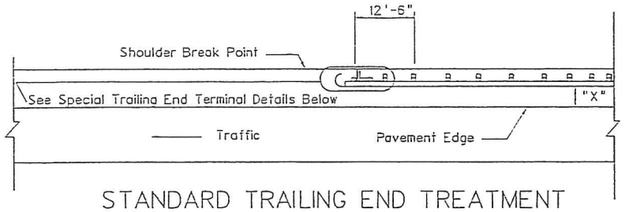
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

REVISED STANDARD DETAIL

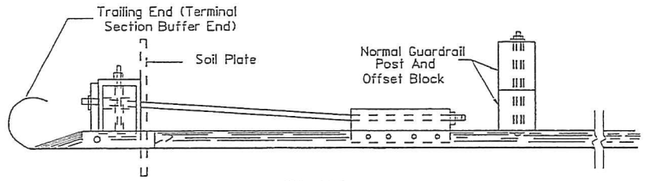
PREPARED 7-1-99
REVISION DATE
11-13-12

TANGENT END TERMINAL

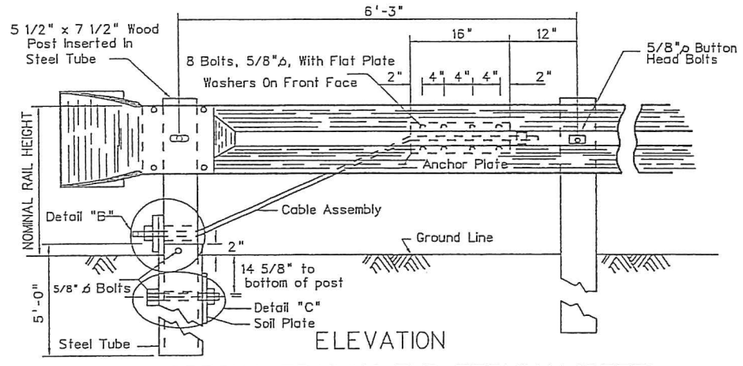
REPLACES SHEET GR6



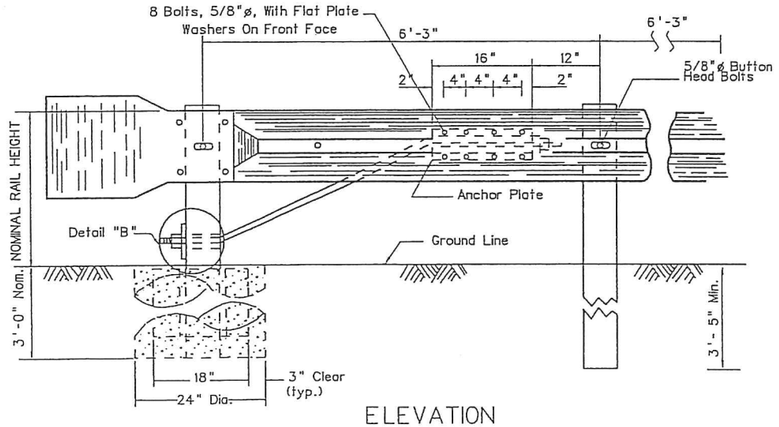
STANDARD TRAILING END TREATMENT
(MULTI-LANE DIVIDED HIGHWAY)



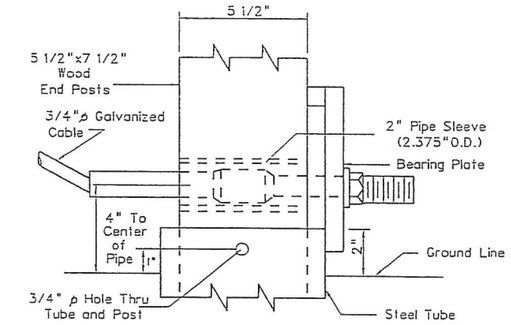
PLAN



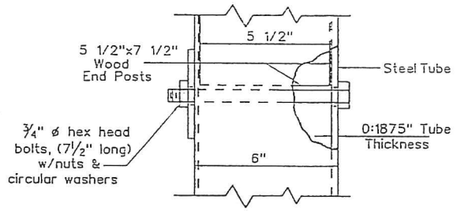
ELEVATION
SPECIAL TRAILING END TERMINAL(STET)
(TUBULAR STEEL END FOUNDATION)



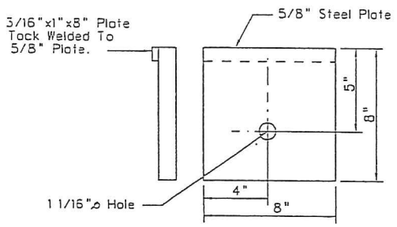
ELEVATION
SPECIAL TRAILING END TERMINAL(STET)
(CONCRETE FOOTER END FOUNDATION)



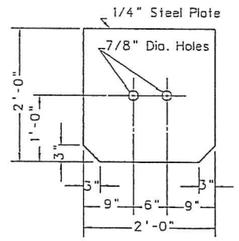
DETAIL "B"



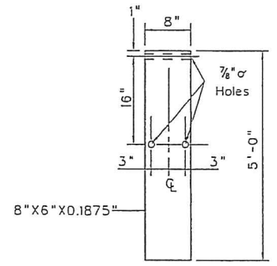
DETAIL "C"



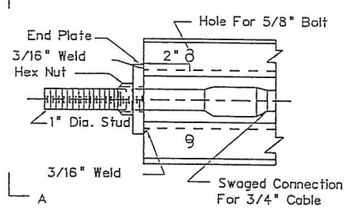
BEARING PLATE



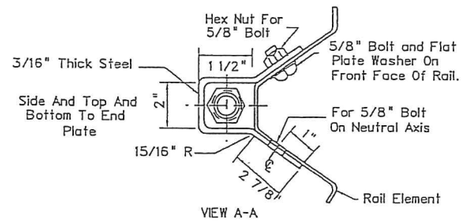
SOIL PLATE



STEEL TUBE

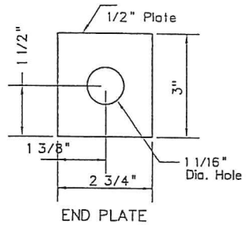


FRONT VEW
(Rail Removed)

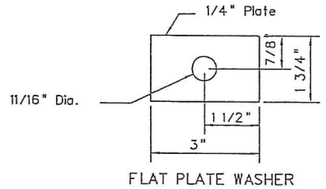


VIEW A-A
(End Plate Removed, Rail Shown)

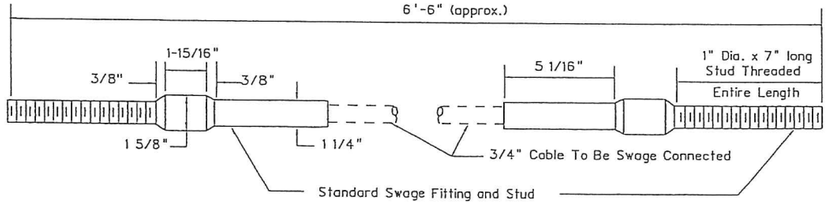
ANCHOR PLATE DETAIL



END PLATE



FLAT PLATE WASHER



CABLE ASSEMBLY

NOTES

Steel tubes shall meet the requirements of ASTM Specification A500, Grade B, and shall be galvanized after fabrication in accordance with the requirements of AASHTO Specification M111. Other terminal components; such as anchor plates, cable assemblies, hardware, plates, pipe sleeves, etc; shall conform to the detail and requirements of section 607 of the Specifications.

For each STET end treatment installation it shall be the Contractor's option whether to utilize the Tubular Steel End Foundation design detailed herein or Concrete Footer End Foundation design detailed , unless one type is specified in the plans. When the Concrete Footer End Foundation is used, the embedded portion of the Endpost is to be double wrapped with Composition Paper or single wrapped with sheet metal or other material acceptable to the Engineer before concrete placement to facilitate replacement of damaged posts.

The cost of furnishing and installing the Special Trailing End Terminal; including structural tubing, soil plates, and welded bearing plates for Tubular Steel End Foundations; concrete footers, welded wire fabric, all necessary excavation, composition paper and sheetmetal for Concrete Footer End Foundations; and all "terminal" hardware,cables, studs, plates, and pipe sleeves shall be included in the unit price bid for "Special Trailing End Terminal", per each. Normal guardrail components; i.e., posts, blocks, rail elements, hardware, etc; along with the special size and/or special length wood guardrail end post and the terminal section buffer end, shall be paid for as guardrail per linear foot.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

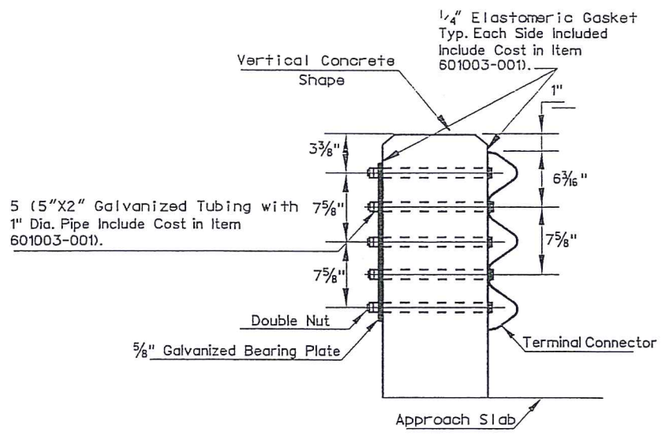
REVISED STANDARD DETAIL

PREPARED 7-1-99

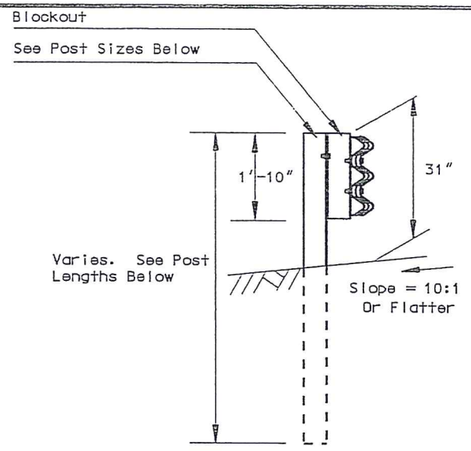
REVISION DATE
11-13-2012

SPECIAL TRAILING END TERMINAL

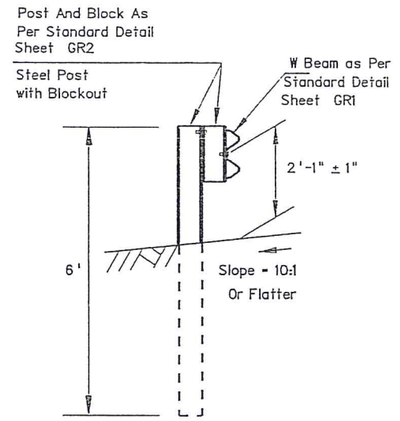
REPLACES SHEET GR7



SECTION A–A



SECTION B–B



SECTION C–C

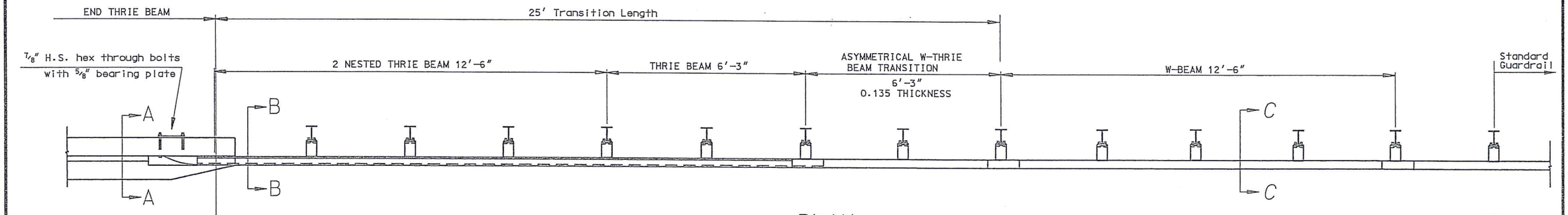
NOTES

This guardrail transition is appropriate for connection to a vertical concrete shape and should not be connected directly to a concrete safety shape. Concrete safety shape bridge rails or barriers shall be transitioned to a vertical shape at the guardrail connection in a manner detailed elsewhere in the Project Plans.

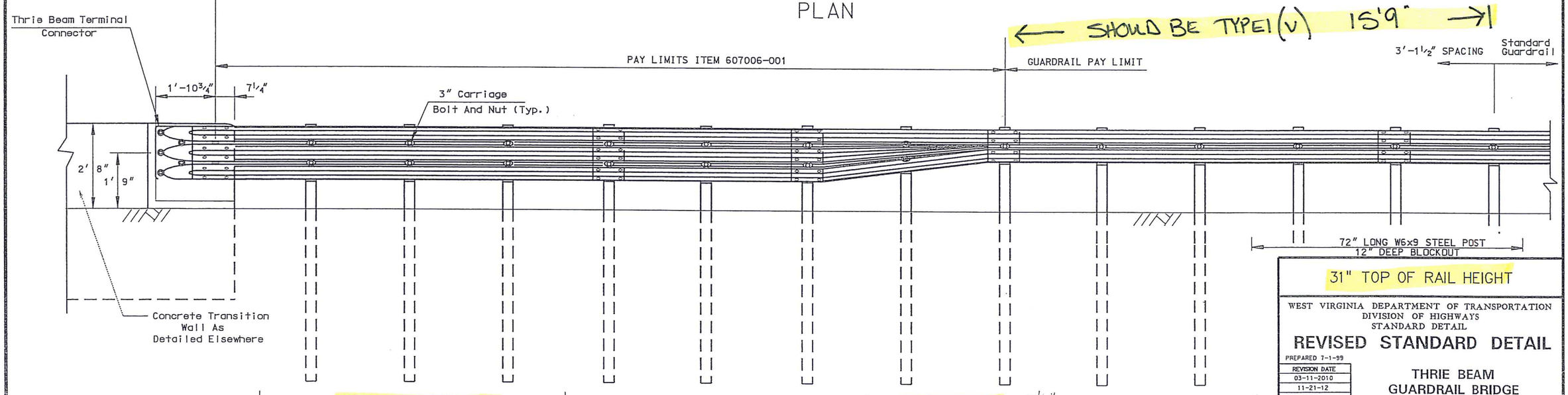
The two sections of 12'6" thrie beam require additional holes in order to mount the beam to the post nearest to the concrete wall.

See sheet 2 of 2 for details not shown on this sheet.

Guardrail systems must have met either the NCHRP 350 or the most current AASHTO Manual for Assessing Safety Hardware (MASH) crash testing criteria and have an FHWA eligibility letter to be used on WVDOH projects. Only FHWA approved guardrail systems utilizing wood or approved block-outs shown on the Division's "Approved Source/Product Listing" shall be used. Steel "W" Shapes shall not be used for block-outs. Only one type of block shall be used for blockout throughout any project, unless otherwise specified.



PLAN



← SHOULD BE TYPE I (V) 15'9" →

3-7'

7'6"- TEA

ELEVATION

31" TOP OF RAIL HEIGHT

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

REVISED STANDARD DETAIL

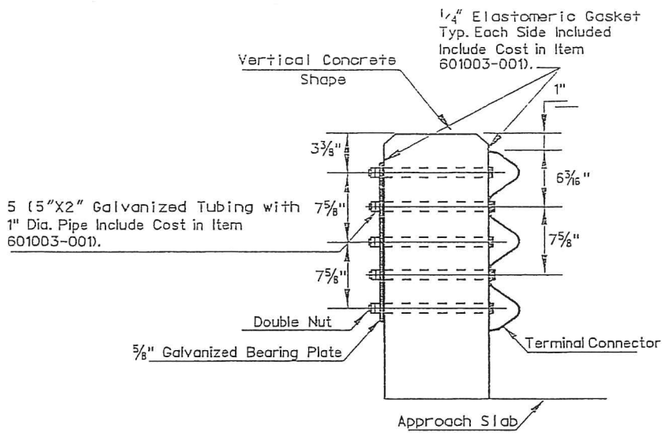
PREPARED 7-1-99

REVISION DATE
03-11-2010
11-21-12

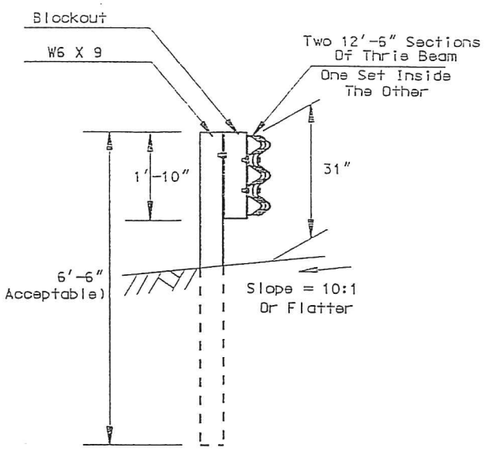
THRIE BEAM GUARDRAIL BRIDGE TRANSITION AND CONNECTION

REPLACES SHEET 1 OF 2
SHEET GR 11

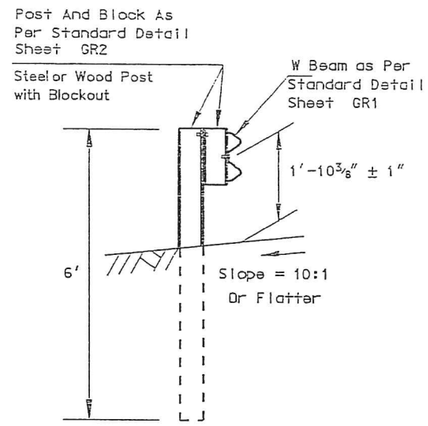
P:\ANDY2-STD\SOR e



SECTION A-A



SECTION B-B



SECTION C-C

NOTES

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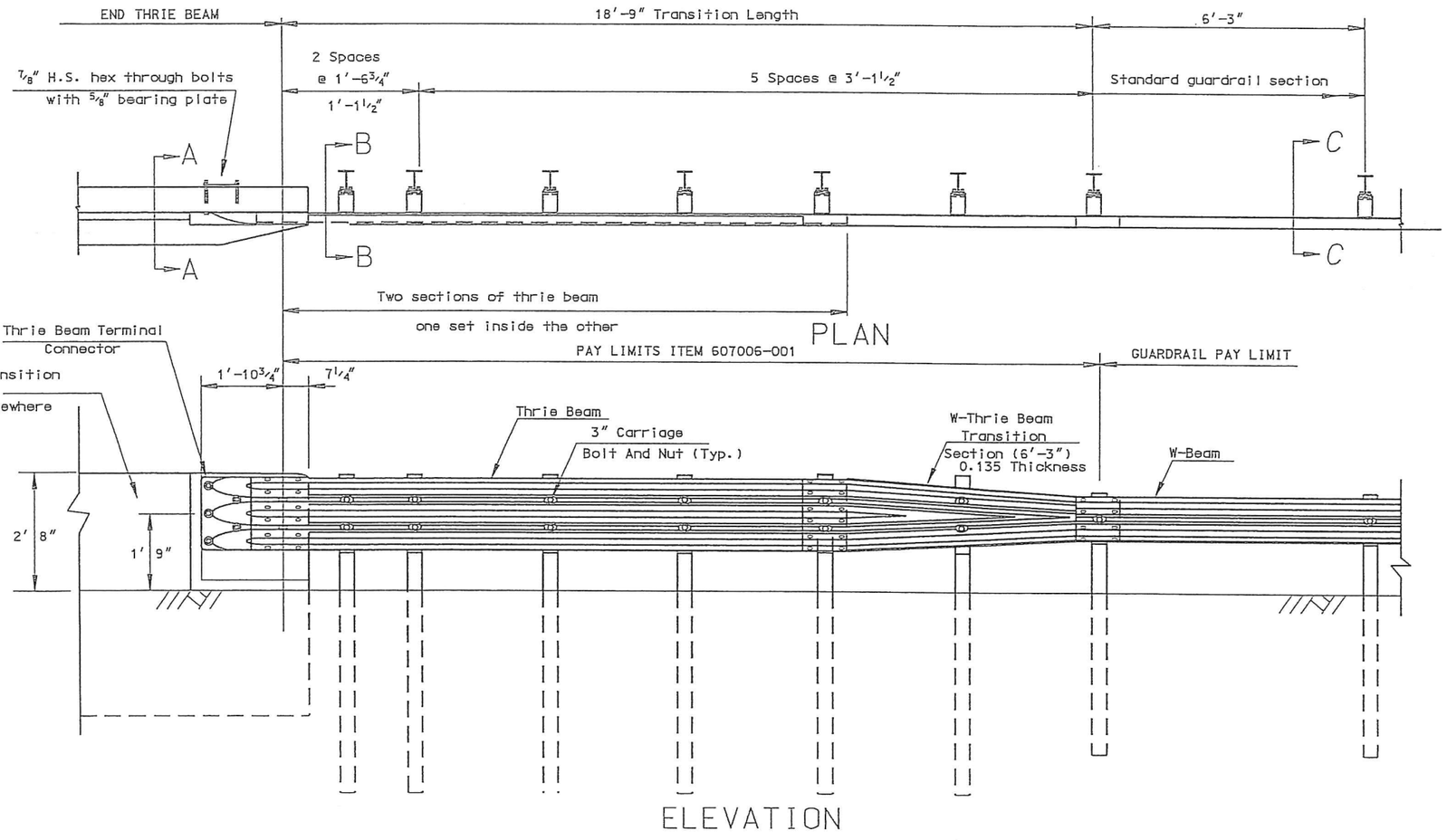


28½" TOP OF RAIL HEIGHT

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

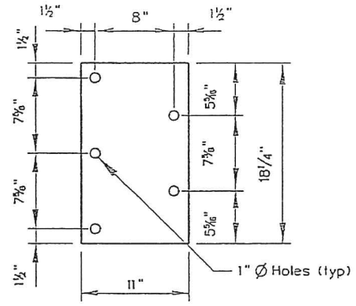
REVISED STANDARD DETAIL

PREPARED 7-1-99

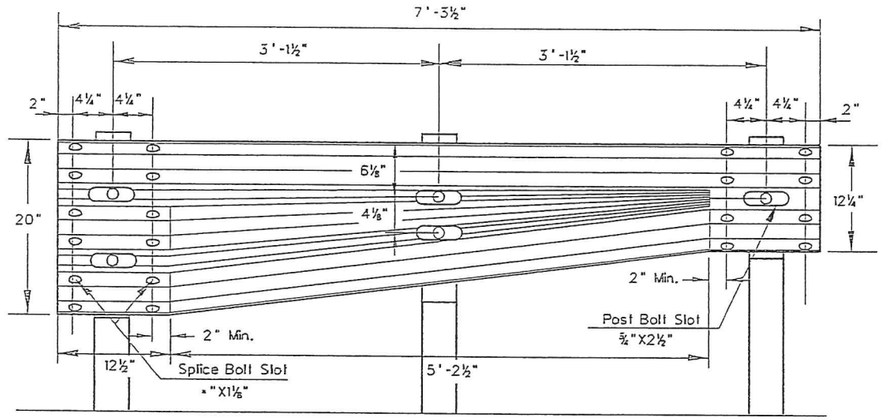
REVISION DATE
03-11-2010
11-13-12

THRIE BEAM GUARDRAIL BRIDGE TRANSITION AND CONNECTION

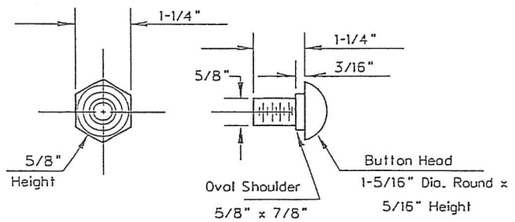
REPLACES SHEET 1 OF 2
SHEET GR 11



5/8" BEARING PLATE DETAIL

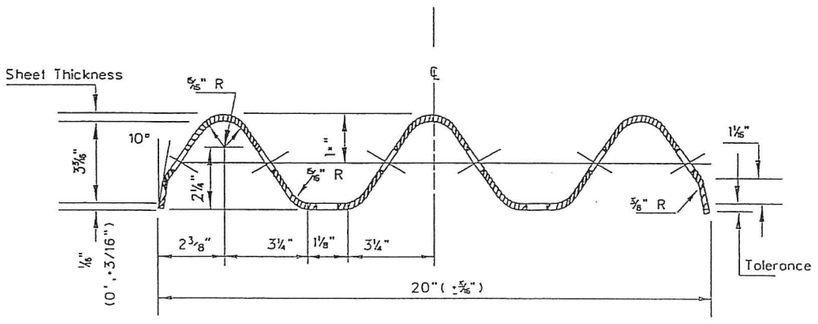


ASYMMETRICAL TRANSITION SECTION DETAIL
(W- THRIE BEAM)

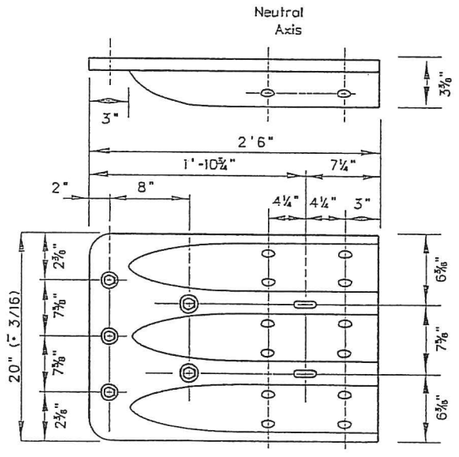


NUT SPLICE BOLT

NUT AND SPLICE BOLT DETAIL
(POST BOLT: Similar Except Length)



SECTION THRU THRIE BEAM RAIL ELEMENT



THRIE BEAM TERMINAL
CONNECTOR DETAIL

31" TOP OF RAIL HEIGHT

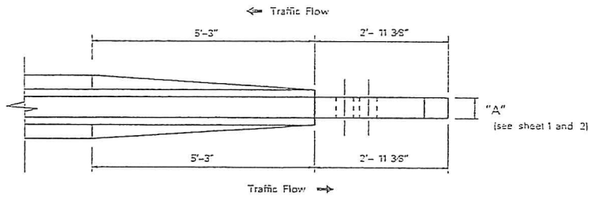
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

REVISED STANDARD DETAIL

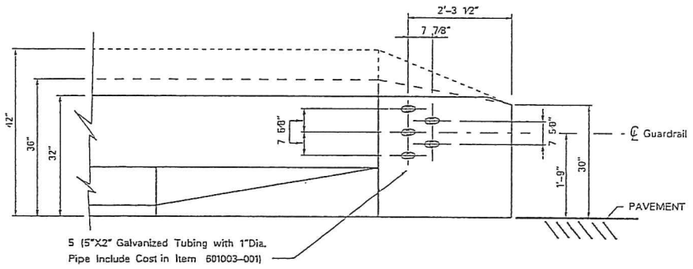
PREPARED 7-1-99
REVISION DATE
11-21-2012

THRIE BEAM
GUARDRAIL BRIDGE
TRANSITION AND
CONNECTION

REPLACES SHEET 2 OF 2
SHEET GR11

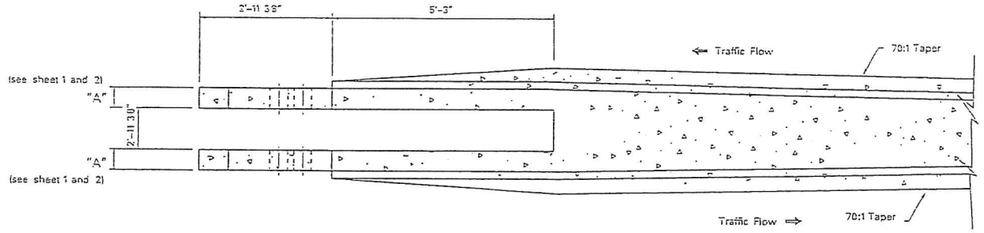


PLAN

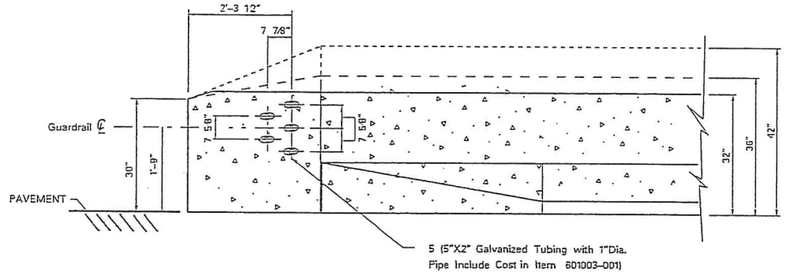


ELEVATION

DOUBLE FACE TRANSITION

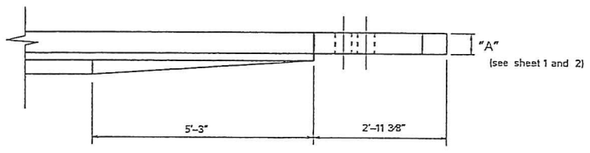


PLAN

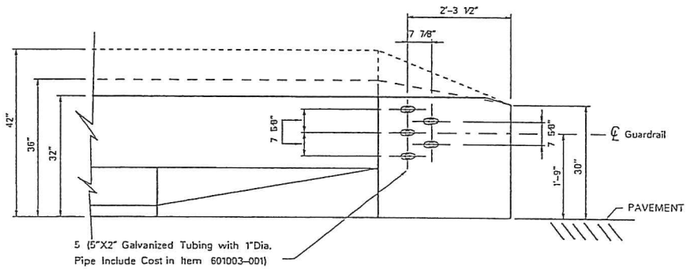


ELEVATION

DOUBLE MEDIAN TRANSITION

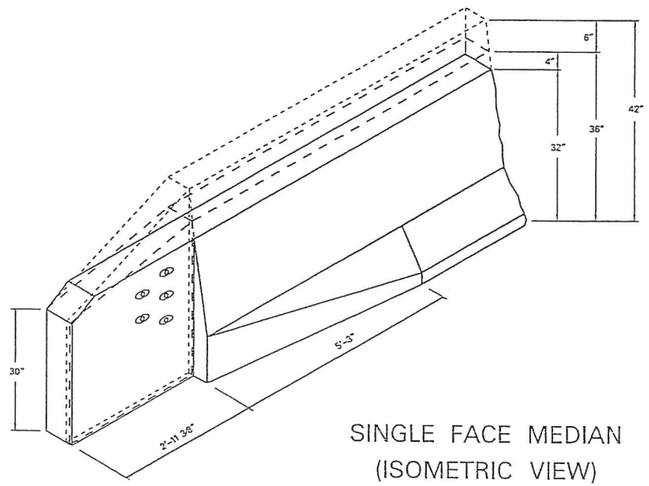


PLAN



ELEVATION

SINGLE FACE TRANSITION



SINGLE FACE MEDIAN
(ISOMETRIC VIEW)

NOTES

The contractor shall have the option to install either the N-J Shape or the F-Shape median unless otherwise specified on the Plans.

For additional dimensions, notes and details see Sheet 1 and 2.

For additional notes and details of the guardrail bolt pattern, see Standard Detail Sheet GR10.

Elongated bolt holes do not apply to existing end posts that are not being reconstructed.

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

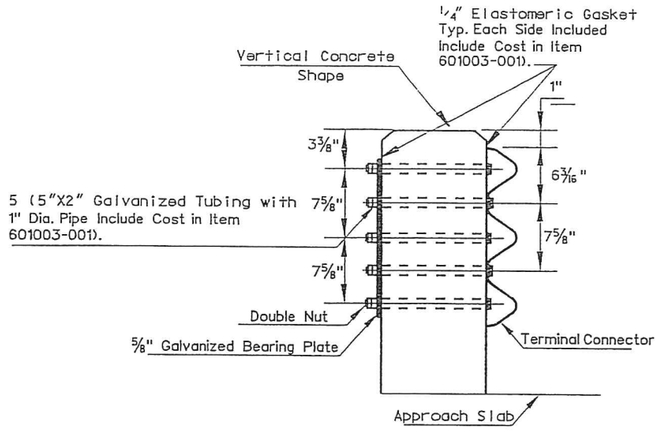
REVISED STANDARD DETAIL

TYPE V MEDIAN GUARDRAIL ATTACHMENT F-SHAPE OR N-J SHAPE

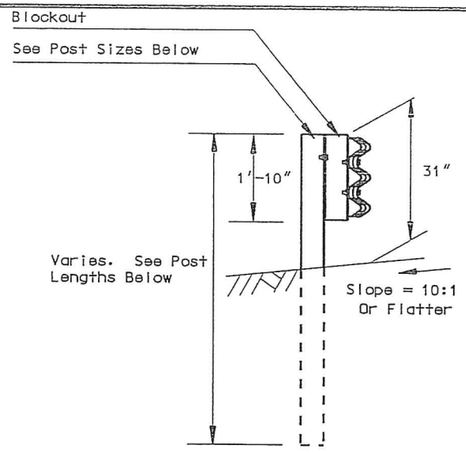
PREPARED 7-1-99
REVISION DATE
11-13-12

REPLACES (Sheet 3 of 4)

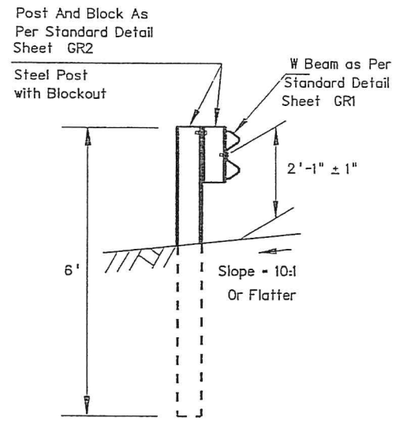
STANDARD SHEET GR12



SECTION A-A



SECTION B-B



SECTION C-C

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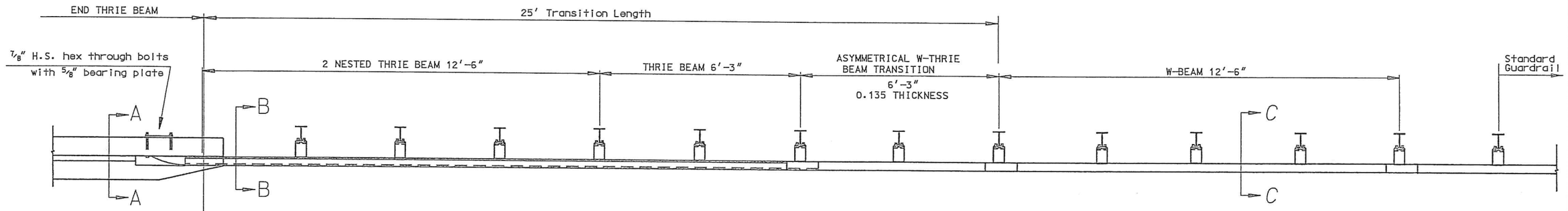
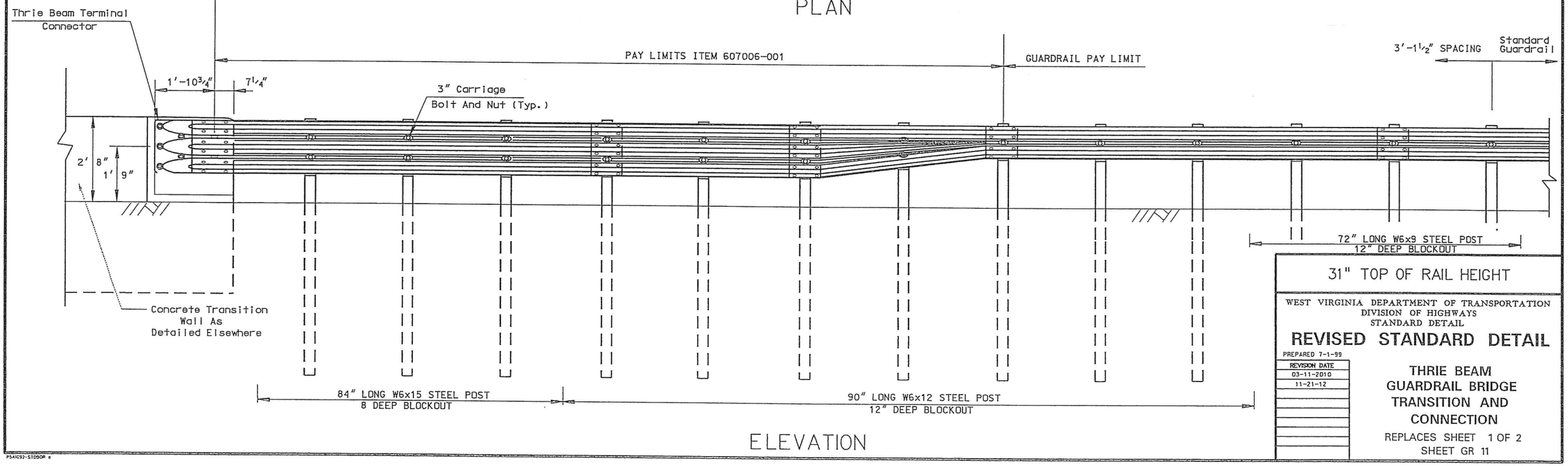


PLAN



ELEVATION

31" TOP OF RAIL HEIGHT

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STANDARD DETAIL

REVISED STANDARD DETAIL

PREPARED 7-1-99

REVISION DATE
03-11-2010
11-21-12

THRIE BEAM GUARDRAIL BRIDGE TRANSITION AND CONNECTION

REPLACES SHEET 1 OF 2
SHEET GR 11

P3A1C32-STDSOR e