

CHAPTER 14: GUARDRAIL and BARRIERS

If you have any questions regarding guardrail, end treatments and/or pay items included in your plan, please contact the Project Design Services Unit or the Design Standards Engineer prior to completing your plan. It is much easier having a plan come in with the correct information than try to correct it later.

For information regarding Guardrail and Barriers check out the website at ...

[Roadside Safety Design webpage](#)

B8338 GUARDRAIL

REMOVING DESIGN SPECIAL

When removing design special, pay for it as 2104.503 REMOVE GUARDRAIL – PLATE BEAM by LIN FT and add the note: Includes Design Special.

Design Special can only be installed on the same structure it was salvaged from and only if it is up to present standards. This would be paid for as...

- 2104.503 SALVAGE GUARDRAIL – PLATE BEAM by LIN FT, and
- 2554.503 INSTALL TRAFFIC BARRIER DESIGN B8338 by LIN FT.
 - ❖ Note that it is a design special for both cases.

When placing a new design special use 2554.503 TRAFFIC BARRIER DESIGN SPECIAL by LIN FT. This includes the bridge connection 8318 so that does not need to be paid for separately. Make sure you reference the standard plate 8318 in the standard plate table.

GUARDRAIL END TREATMENTS

Guardrail must be in tension to work, this is true for both plate beam and cable. Therefore, it MUST have tension on both ends either by an anchorage assembly, design special, and/or end treatment. The designer needs to notice if both ends of the guardrail are addressed. So if there isn't an end treatment, is there an anchorage assembly or design special?

The following end treatments should be used on all projects using B8338 Guardrail, the plans must state as a note on either the estimate quantities table or the tab sheet:

- Tangent Terminal: Shall be SKT-350 or ET-PLUS
- Flared Terminal: Shall be either SRT-350 or FLEAT-350

If you are specifying just one option it will require a Public Interest Finding (PIF).

There are details available on the server for the following end treatments, which should be placed into the plans. These details are propriety end treatments and should not be modified or signed.

- Tangent Terminal - (SKT-350 or ET-PLUS)
- Flared Terminal - (SRT-350 and FLEAT-350)

Removing

When removing end treatments use the following items...

- 2104.502 REMOVE ENERGY ABSORBING TERMINAL by EACH, note what it is (e.g. ET-2000, SKT-350, etc.)
- 2104.502 REMOVE TWISTED END TREATMENT by EACH, note if it includes the removal of anchorage blocks.
- 2104.502 REMOVE ECCENTRIC LOADER BCT by EACH
- 2104.502 REMOVE SLOTTED RAIL TERMINAL by EACH
- 2104.502 REMOVE ANCHORAGE ASSEMBLY – PLATE BEAM by EACH
- 2104.502 REMOVE ANCHORAGE ASSEMBLY – CABLE by EACH

Salvaging & Install

Wood posts can NOT be replaced with steel posts on end treatments. If that is desired then it would have to be a new system not an install.

When removing or salvaging an existing guardrail end treatment then use the following items....

- 2104.502 SALVAGE ANCHORAGE ASSEMBLY – CABLE by EACH
- 2104.502 SALVAGE ANCHORAGE ASSEMBLY – PLATE BEAM by EACH
- 2104.502 SALVAGE ENERGY ABSORBING TERMINAL by EACH. This is used on existing treatments. Add a note to the SEQ or TAB stating what it is (e.g. 4=FLEAT 350 & 3=SKT 350).
- 2104.502 SALVAGE SLOTTED RAIL TERMINAL by EACH
- 2104.502 SALVAGE ECCENTRIC LOADER BCT by EACH, This can only be salvaged for parts, it cannot be re-installed.
- 2554.602 INSTALL ANCHOR ASSEMBLY – 3 CABLE by EACH
- 2554.602 INSTALL ANCHOR ASSEMBLY – PLATE BEAM by EACH
- 2554.602 INSTALL ENERGY ABSORBING TERMINAL by EACH. This is used on existing treatments. Add a note to the SEQ or TAB stating what it is (e.g. 4=FLEAT 350 & 3=SKT 350).
- 2554.602 INSTALL SLOTTED RAIL TERMINAL by EACH

If, however it is an instance where the contractor will be salvaging a guardrail end treatment and reusing it on the project as a result of staging cross traffic. Then use the following items...

- 2104.502 SALVAGE TANGENT TERMINAL by EACH *
- 2104.502 SALVAGE FLARED TERMINAL by EACH **
- 2554.602 INSTALL TANGENT TERMINAL by EACH *

- 2554.602 INSTALL FLARED TERMINAL by EACH **

*Note shall be SKT-350 or ET-PLUS

** Note shall be either SRT-350 or FLEAT-350.

- ❖ Include a detail in the plan for possible options.

When placing new end treatments then use the following items....

- 2554.502 ANCHORAGE ASSEMBLY – CABLE by EACH
- 2554.502 ANCHORAGE ASSEMBLY – PLATE BEAM by EACH
- 2554.502 END TREATMENT - TANGENT TERMINAL by EACH (Include details in plan and note that it shall be SKT-350 or ET-PLUS)
- 2554.502 END TREATMENT - FLARED TERMINAL by EACH (Include details in plan and note that it shall be either SRT-350 or FLEAT-350)

An EXCEPTION to this would be (FLARED TERMINAL ONLY with STEEL POSTS):

The SRT-350 with wood posts, is the only SRT terminal currently approved. The FLEAT-350 is the only approved flared treatment that has steel posts, and is energy absorbing. So, if the District wants to have an energy absorbing flared terminal with steel posts, then the following pay item should be used:

- 2554.502 END TREATMENT - ENERGY ABSORBING TERMINAL by EACH, add note to SEQ or tab: Shall be flared and have steel posts.

If this situation is used alone (no other end treatments) in your plan then Do NOT include the detail in plan for a flared terminal. If you are using this item along with the End Treatment – Flared Terminal pay item then the details for the flared terminals should be included in the plan.

REMOVING GUARDRAIL PLATE BEAM – POSTS ONLY

When there is a run of plate beam guardrail with wood posts and the rail is in good condition, the District may opt for salvaging the rail and replace the wood posts with steel posts, if this is the case use the following items...

- 2104.502 REMOVE ANCHORAGE ASSEMBLY – PLATE BEAM by EACH (providing there is one in place)
- 2104.503 SALVAGE GUARDRAIL by LIN FT , add note to SEQ or tab: Includes the removal of the wood posts.
- 2554.502 ANCHORAGE ASSEMBLY – PLATE BEAM by EACH (if required)
- 2554.603 INSTALL GUARDRAIL by LIN FT, add note to SEQ or tab: Includes the Furnish and Install of steel posts.

REMOVING GUARDRAIL PLATE BEAM – RAIL ONLY

When removing plate beam rail only (posts remain) and will not reuse the rail (this is used if the rail was hit or in poor condition and the District has decided that the posts are in good condition and would like to keep the post system), use the following items...

- 2104.502 REMOVE ANCHORAGE ASSEMBLY by EACH (providing there is one inplace)
- 2104.503 REMOVE GUARDRAIL by LIN FT
- 2554.502 ANCHORAGE ASSEMBLY – PLATE BEAM by EACH (if required)
- 2554.602 GUARDRAIL POST by EACH (if required)
- 2554.603 PLATE BEAM RAIL by LIN FT

REMOVING GUARDRAIL PLATE BEAM – COMPLETE SYSTEM

When removing plate beam guardrail (including posts and end treatment) and will not be reusing the guardrail but replace the existing system with new, use the following items:

- 2104.502 REMOVE ANCHORAGE ASSEMBLY – PLATE BEAM by EACH (providing there is one inplace)
- 2104.502 REMOVE specify end treatment (e.g. twisted end, energy absorbing, etc...) by EACH (see section on end treatments)
- 2104.503 REMOVE GUARDRAIL – PLATE BEAM by LIN FT
- 2554.502 ANCHORAGE ASSEMBLY – PLATE BEAM by EACH (if required)
- 2554.502 END TREATMENT – specify (see section on end treatments)
- 2554.503 TRAFFIC BARRIER DESIGN B8338 by LIN FT for steel posts
- 2554.503 TRAFFIC BARRIER DESIGN B8307 by LIN FT for wood posts

GUARDRAIL HEIGHTS

When revising existing profile grade elevations (such as overlay projects) consider guardrail heights (28” to 30”, never go below 27”). Adjust guardrail height if necessary.

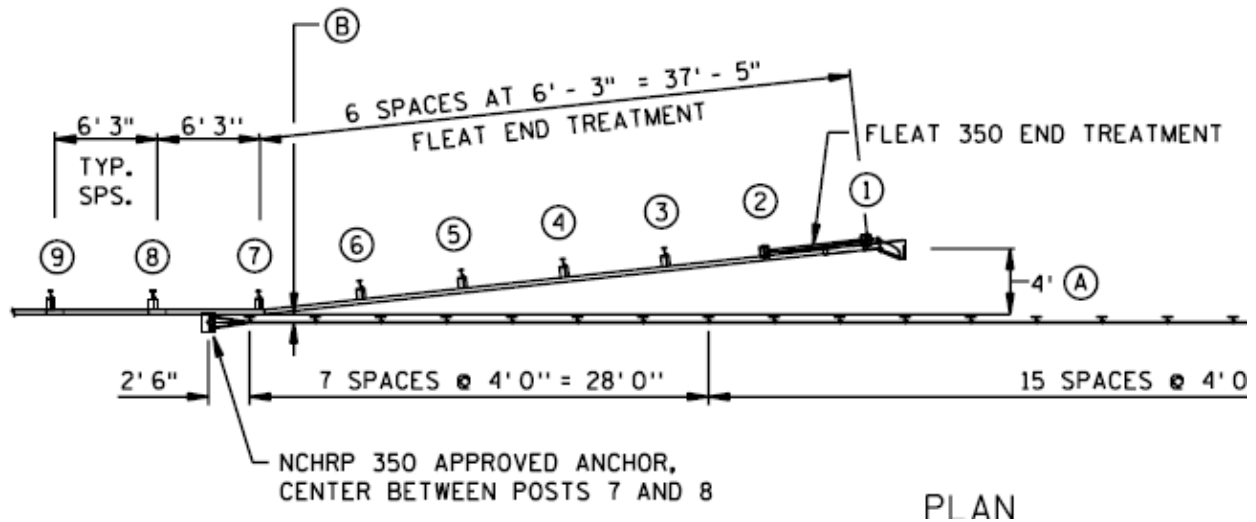
“J” RAIL DESIGN SPECIAL

There has been some confusion regarding the type of standard plan sheet to reference for the Design Special attachment. This is based on the height of the rail. If the rail is 1’9” to center of rail (2’3” to top of plate beam rail), then you can do the “F” design with no rub rail. Some of the older “J” rails are at this height. So even though it is a “J” rail it might require the “F” rail design special detail (Standard plan 5-297.603) in the plan.

If the rail is the higher height-2’2” to center of rail (2’8” to top of plate beam rail), then you’ve got a bigger gap between the curb and bottom of rail, you would need to use the Standard Plan 5-297.618. It all has to do with the amount of gap between the rail and curb and the potential for snagging.

PLATE BEAM GUARDRAIL BEHIND 3-CABLE GUARDRAIL (Low Tension Systems only)

When plate beam guardrail meets 3-cable guardrail the plate beam end is typically placed behind the 3-cable.



When this occurs the designer needs to...

- Use FLEAT-350 as the plate beam end treatment behind the cable.
- Include standard plate 8340 in the standard plate table
- Add the FLEAT-350 detail to the plan.
- Pay for it as 2554.502 END TREATMENT-FLARED TERMINAL by EACH
- ❖ add the note: Fleat-350 End Terminal is the only option permitted.

RUBRAIL

Rubrills are used when the distance between the top of curb or shoulder surface and bottom of plate beam rail is too great. Rubrills are included with the traffic barrier design special pay item as detailed out in the standard plans, they are not paid for separately.

BULLNOSE LENGTH

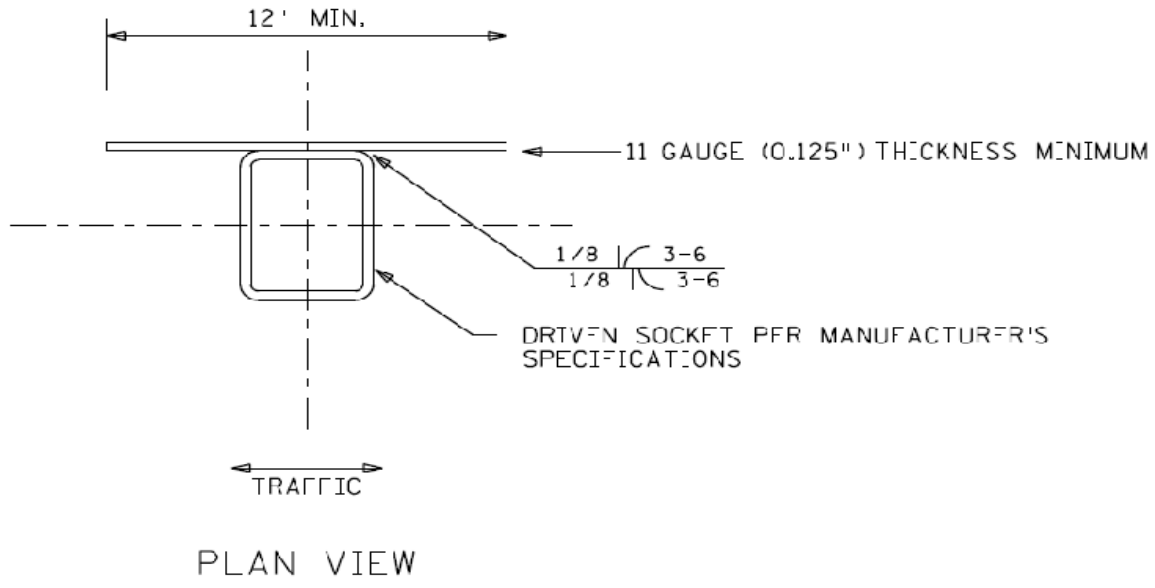
There has been confusion on how to calculate the length of the bullnose. Standard plan sheet 5-297.611 (1 of 3 and 3 of 3) shows the “pay limit”. For design purposes we typically use approximately 100 linear feet for each nose. In other words, the 100 linear feet includes both sides, 47’ + 47’ for 1 of 3 for narrow median and 48’ + 48’ for 3 of 3 for wide median and the bend of the bullnose as shown.

CABLE GUARDRAIL

HIGH TENSION CABLE GUARDRAIL

Do NOT place the tension cable guardrail in the bottom of the ditch. Make sure the following note is added to the plan: Line posts shall be furnished and installed with a 10’ max spacing from center of post to center of post.

There has been some problems with the weld not being done properly in the plans and in the field. Make sure that the detail in the plan shows the weld as shown below.



The following information is part of the High Tension Cable Barrier (HTCB) standards package. All designers should read the HTCB Technical Memorandum No. 15-08-TS-04 before doing any HTCB final design. In addition, we suggest that you reference the following information related to HTCB in your plan as needed.

- Standard Plan 5-297.688
- Standard Plate for HTCB/Line Post Foundation/Concrete Design 8342
- Standard Plate for HTCB/Line Post Foundation/Steel Design 8343

Construction notes:

Consider the following or similar construction notes for use on HTCB projects, if not already covered elsewhere within your project:

All drainage inlets within 200 feet of any disturbed soil in the median shall be Provided with appropriate inlet protection prior to disturbance. Inlet protection Incidental unless otherwise specified in the contract.

All material removed and not reused on this project shall become the property of the contractor and be disposed of outside MnDOT Right of Way in accordance with Spec. 2106.

Salvage and installation of culvert marker posts are incidental.

Any required grading for HTCB shall be done before guardrail posts are set.

Roads shall be kept clean of sediment. Use a street sweeper with pick-up type, non-dust generating power broom as often as necessary to keep roads visibly clean within 24 hours of

activity that generates sediment tracking or before opening the affected lane to traffic, whichever comes first. All street sweeping work, including street sweeper, shall be incidental. Post foundations shall be flush with the ground line posts shall be placed plumb.

For all construction activities within designated noxious and invasive weed infested areas as shown in the plan, see special provisions.

Any required mowing for High Tension Cable Barrier (HTCB) construction is incidental.

SALVAGE AND INSTALL 3-CABLE GUARDRAIL

On the rare occasions when you want to salvage 3-cable guardrail (Low Tension Systems Only) and replace the wood posts. It should be paid for as...

- 2104.503 SALVAGE GUARDRAIL – CABLE by LIN FT, add note to SEQ or tab: Includes the removal of the wood posts.
- 2554.603 INSTALL 3-CABLE GUARDRAIL by LIN add note to SEQ or tab: Includes the Furnish and Install of steel posts.

CONCRETE END POST

The One-Line Bridge Rail End Post as shown on Standard Plan .609 & .619 has been modified to remove specific structural and reinforcing details regarding the end post. The primary intent of these standards is to show the guardrail transition and connection to flat faced structures.

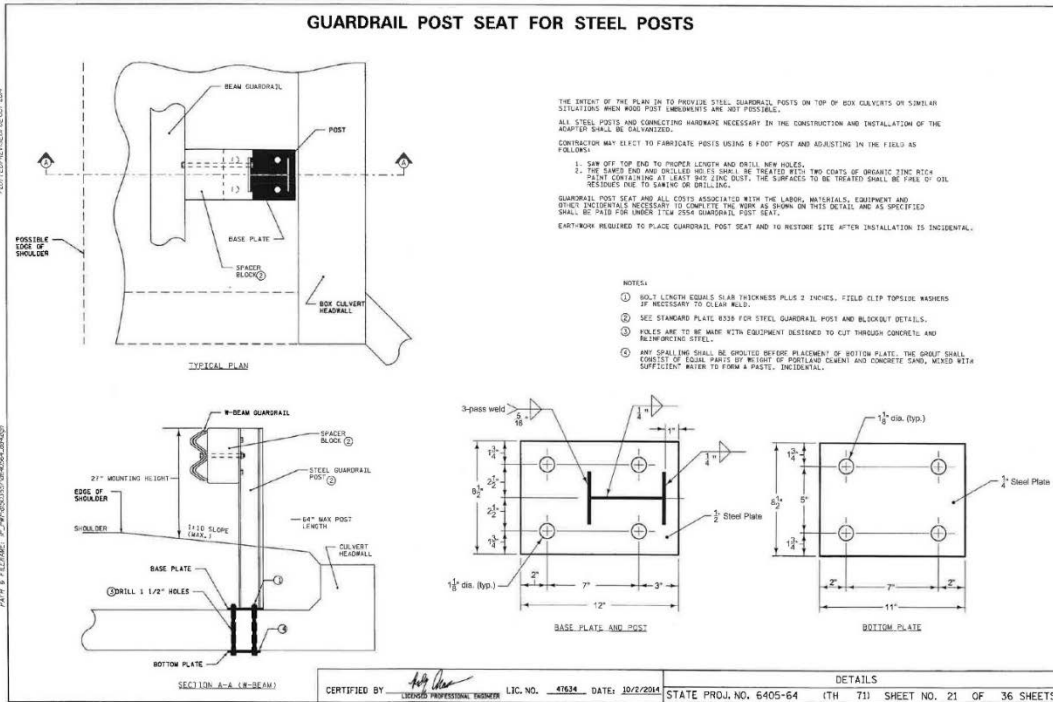
Designers will need to work with the Bridge Office to develop specific end post details and reinforcing on a “case-by-case” basis for all projects that require a new end post. The Office of Project Management and Technical Support is working with the Midwest Roadside Safety Facility (State Pooled Fund) to design and test a new “stand alone” end post in accordance with current crash test requirements (MASH).

GUARDRAIL – POST SEAT

This is used when the guardrail post cannot go as deep as typically required such as over culverts. This is paid for as 2554.602 GUARDRAIL POST SEAT by EACH

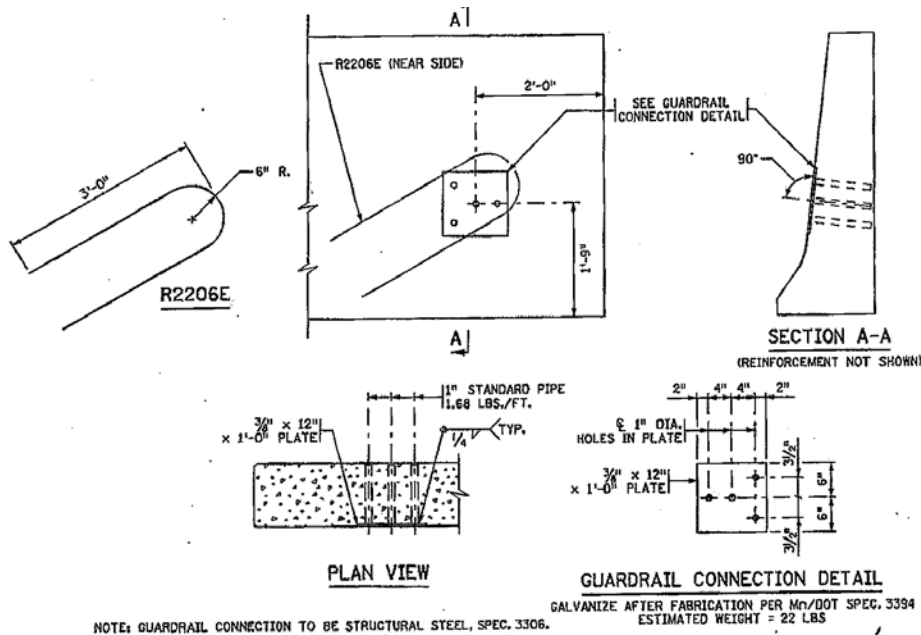
The designer needs to determine if they are using wood posts or steel posts. If they are using wood posts then Standard Plate 8316 needs to be referenced in the standard plate table. If they are using steel posts then they need to include a detail in the plan.

The TYPE 31 guardrail allows for a longer gap between posts (see Standard Plan 5-297.696) so a post seat may not be needed if using TYPE 31 guardrail.



GUARDRAIL ATTACHMENT TO BARRIER

When attaching guardrail to concrete sloped barrier you need to take into account the connection to the barrier. The detail below is an example of one such detail you would need to add to the plan....



GUARDRAIL REPLACEMENT

The following information is meant to be tips for designers to better facilitate installation in the field. Additional information can be found in Tech Memo 17-07-TS-02.

The designer should make a site visit for each installation. It might be a good idea to take pictures. The designer should be aware of the design requirements.

During the site visit, particular attention should be paid to the following:

- Existing geometrics, especially entrance slopes (was the original installation done properly?)
- Condition of material around the installation (is there considerable erosion?)
- Will the existing conditions allow installation without grading work?
- Make an estimate of grading materials required to make the installation proper. (a good field estimate will do, no cross sections are required)
- Closely review the affect grading will have on drainage
- Will grading require culvert extensions, etc.?
- Check for existence of utilities

Include pipe extensions, appurtenances, and treatments in estimate of quantities.

Break down grading quantities to individual pay items, rather than incidental, etc. (some of these applications can result in considerable quantities of grading material). This will ensure that bidders are actually including this in their bids. It will relieve our project people from paying premium prices for later contract adjustments.

IMPACT ATTENUATOR BARRELS

The Engineering Cost Data and Estimating Unit is responsible for determining reasonable prices for supplemental agreement to construction projects. They alerted us to the fact that our past practice has been to have a pay item for these barrel attenuators as an assembly, perhaps ten (10) barrels comprising an installation (assembly).

If a second or third installation was required on the project, with a different number of barrels, we could have 2 or 3 pay items. Also, if these installations are used for traffic control, the contract reads that the contractor would replace any units at his expense. This is difficult for a contractor to bid. Also we don't want to pay for a whole system (10 barrels) if only a couple barrels need replacing.

We will use impact attenuator barrels, (each). If additional barrels may be needed for replacement, include a quantity for this and sub note the item on the estimate sheet. The cost of each barrel has been coming out the same, regardless of the amount of sand/salt required. If a paved area is required, it should be allowed for separately. The attenuator should be shown in the plans per past practice, the number of barrels, spacing and weight of sand/salt shown.

IMPACT ATTENUATORS

In order to avoid external conflicts and maintain consistency within MnDOT, we will be changing how we call out temporary and permanent impact attenuators on our traffic control plans.

We will be specifying whether they are TL3s or TL2s (test levels) instead of posted speed limits.

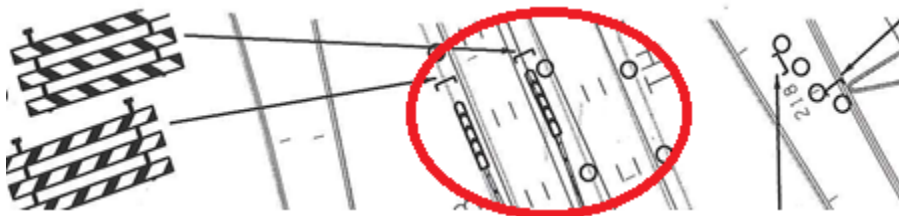
All Temporary Impact Attenuators that are to be placed on roads with the speeds of 50 mph or greater will now be TL3 and those that are 45 mph or less shall be TL2. These will be noted on our Pay Item Tabulation sheets like we have been doing. If the project requires both TL3 and TL2 attenuation, then they should be labeled on the plan sheets for clarification.

The plan should also contain a note stating if it is a temporary or permanent installation.

Examples: Same test level for all...

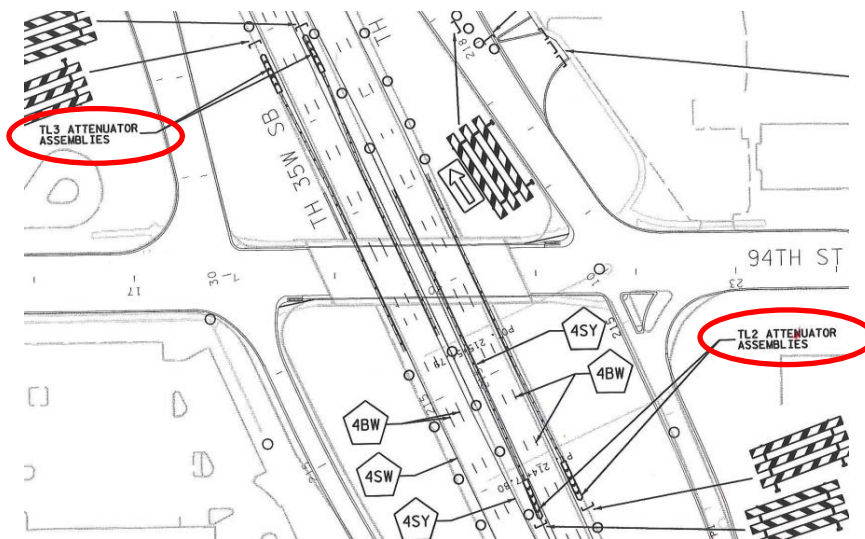
TRAFFIC TABULATION			TC
DESCRIPTION		UNIT	TOTAL
PORTABLE PRECAST CONCRETE BARRIER DESIGN 8337		LIN FT	400
PORTABLE PRECAST CONCRETE BARRIER DESIGN 8337-ANCHORED		LIN FT	792
IMPACT ATTENUATOR	①	ASSEMBLY	4
TRAFFIC CONTROL		LUMP SUM	1
MEDIAN BARRIER DELINEATOR	②	EACH	40
REMOVABLE PREFORM PAVEMENT MARKING TAPE	③	LIN FT	5798
REMOVABLE PREFROMED PLASTIC MASK (BLACK)		LIN FT	3470
① TL3, TEMPORARY			
② 20 WHITE, 20 YELLOW, ALL ONE WAY			
③ 3052 LIN FT OF 4" SOLID LINE WHITE, 2746 LIN FT OF 4" SOLID LINE YELLOW			

❖ No need to label attenuators as they are all the same.



Example: Different test levels and temporary situation...

TRAFFIC TABULATION			TC
DESCRIPTION		UNIT	TOTAL
PORTABLE PRECAST CONCRETE BARRIER DESIGN 8337		LIN FT	400
PORTABLE PRECAST CONCRETE BARRIER DESIGN 8337-ANCHORED		LIN FT	792
IMPACT ATTENUATOR	①	ASSEMBLY	4
TRAFFIC CONTROL		LUMP SUM	1
MEDIAN BARRIER DELINEATOR	②	EACH	40
REMOVABLE PREFORM PAVEMENT MARKING TAPE	③	LIN FT	5798
REMOVABLE PREFROMED PLASTIC MASK (BLACK)		LIN FT	3470
① 2-TL2 and 2-TL3, TEMPORARY			
② 20 WHITE, 20 YELLOW, ALL ONE WAY			
③ 3052 LIN FT OF 4" SOLID LINE WHITE, 2746 LIN FT OF 4" SOLID LINE YELLOW			



❖ Need to label all attenuators as to what level they are.

Example: Different test levels and permanent situation, you need to label as different attenuators both on the table and in the plan view (see example above)...

TRAFFIC TABULATION			TC
DESCRIPTION		UNIT	TOTAL
PORTABLE PRECAST CONCRETE BARRIER DESIGN 8337		LIN FT	400
IMPACT ATTENUATOR	①	ASSEMBLY	2
IMPACT ATTENUATOR NO 1	②	ASSEMBLY	2
TRAFFIC CONTROL		LUMP SUM	1
MEDIAN BARRIER DELINEATOR	③	EACH	40
① TL-3 PERMANENT			
② TL-2 PERMANENT			
③ 20 WHITE, 20 YELLOW, ALL ONE WAY			

PORTABLE PRECAST CONCRETE BARRIER

PPCB, (Type F), Standard Plate No. 8337 is for temporary usage only. It is not designed to be used for a permanent barrier.

The Type F PPCB is required on many bridge construction sites and their immediate approaches (normally, (120 ft.) adjacent to the bridge end) when the PPCB is designated as the means of protecting the construction site. The Type F barrier will also be required along deep drop-offs immediately adjacent to lanes used to carry traffic. See the MnMUTCD Table 6F-5 for more information. Type F PPCB is required for major maintenance work on bridges, which will take a considerable length of time and if a positive barrier is needed.

Adequate flare (desirably about 1:10) or end protection, such as a crash cushion, to prevent impact with exposed barrier ends must continue to be provided.

LONG POST LENGTH

Whenever the project requires the longer guardrail post lengths they need to be called out in the tabulation. The guardrail tabulation needs to note the length of guardrail that requires long posts.

SHORT RADIUS GUARDRAIL

Whenever the guardrail includes a short radius around an entrance, driveway, or side road it will require a special short radius detail. Only wood posts may be used for this installation, NO STEEL POSTS and NO TYPE 31.

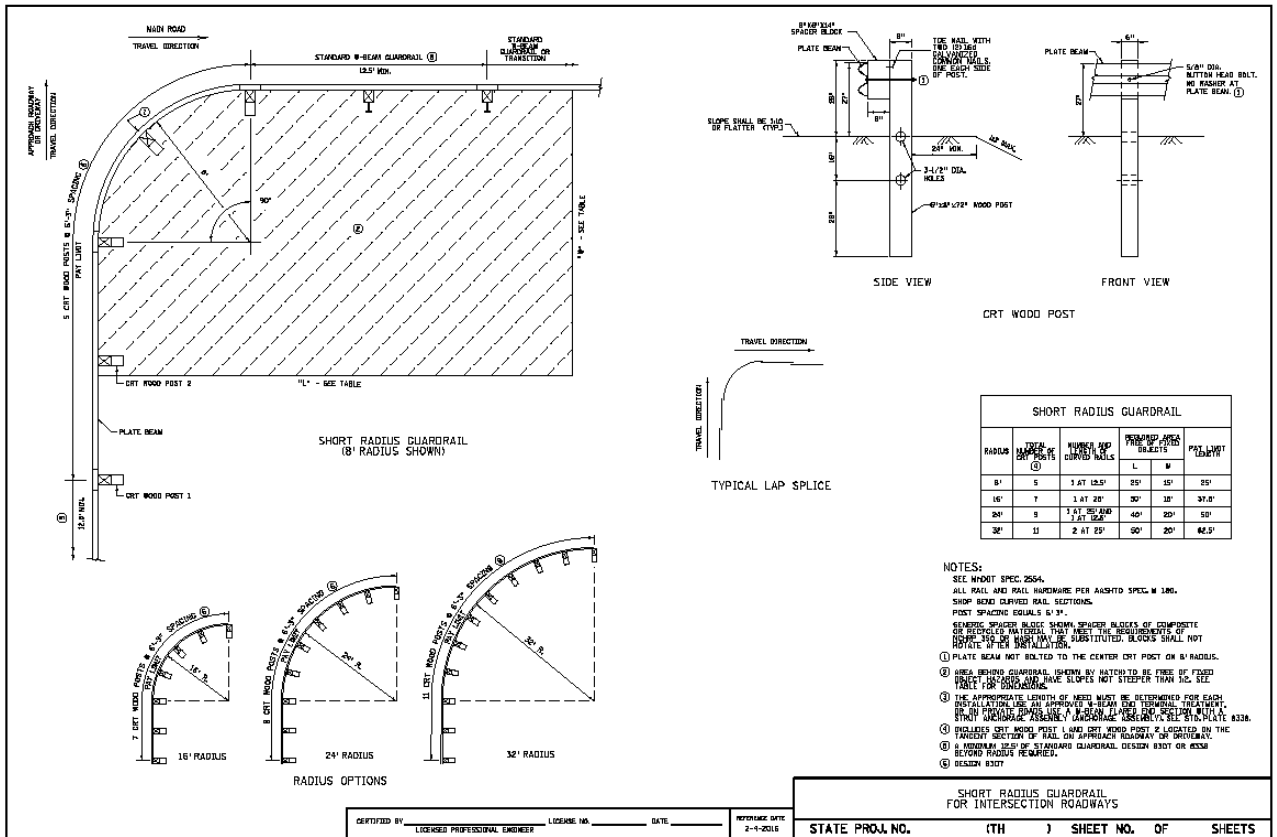
For TYPE 31 connection see article in this chapter under “TYPE 31 GUARDRAIL...CONNECTING TO SHORT RADIUS” for more information.

The detail is considered an unapproved standard detail and shows the use of wood posts. This would require the use of item 2554.503 TRAFFIC BARRIER DESIGN A8307 or 2554.503 TRAFFIC BARRIER DESIGN B8307 by the LIN FT.

It can be found internally at....

[Design Details](#)

For those outside of MnDOT please contact your project manager to get a copy.

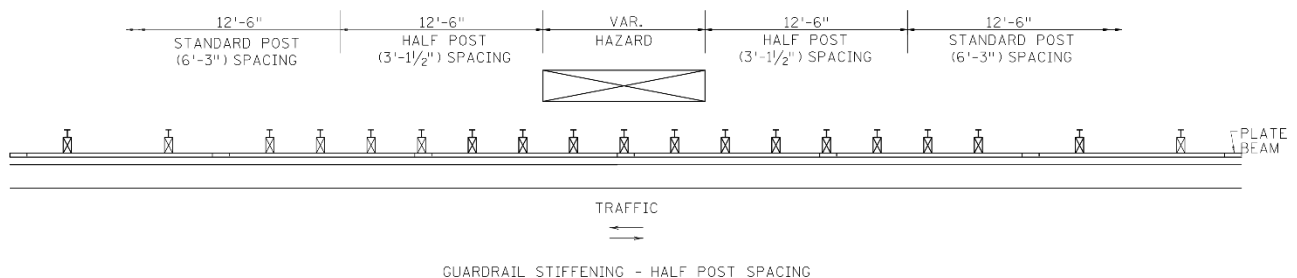


STIFFENED GUARDRAIL

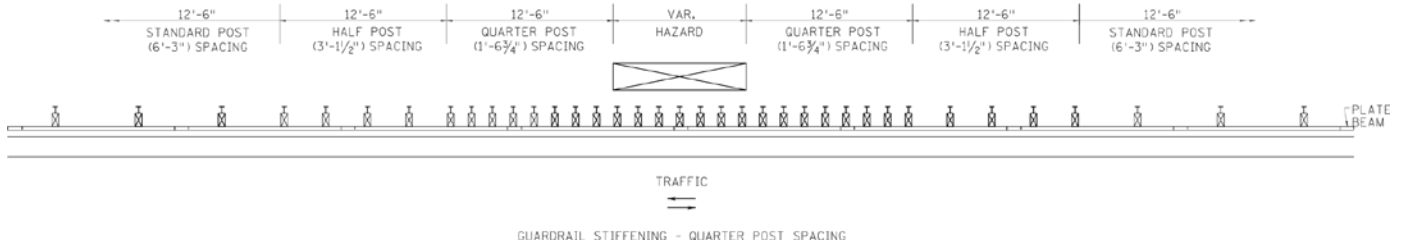
When nested rail and/or half or quarter post spacing is required use the standard pay item for guardrail and add a note to the SEQ or tab: Item includes additional posts and/or nested rail from Station XX+XXX to Station XX+XXX.

When stiffening guardrail, use the following guidance when location the additional posts (Nesting is not an option for TYPE 31 guardrail).

- Half post spacing (posts every 3'-1.5")
- Begin half post spacing 12.5' before hazard
- End half post spacing – 12.5' past hazard

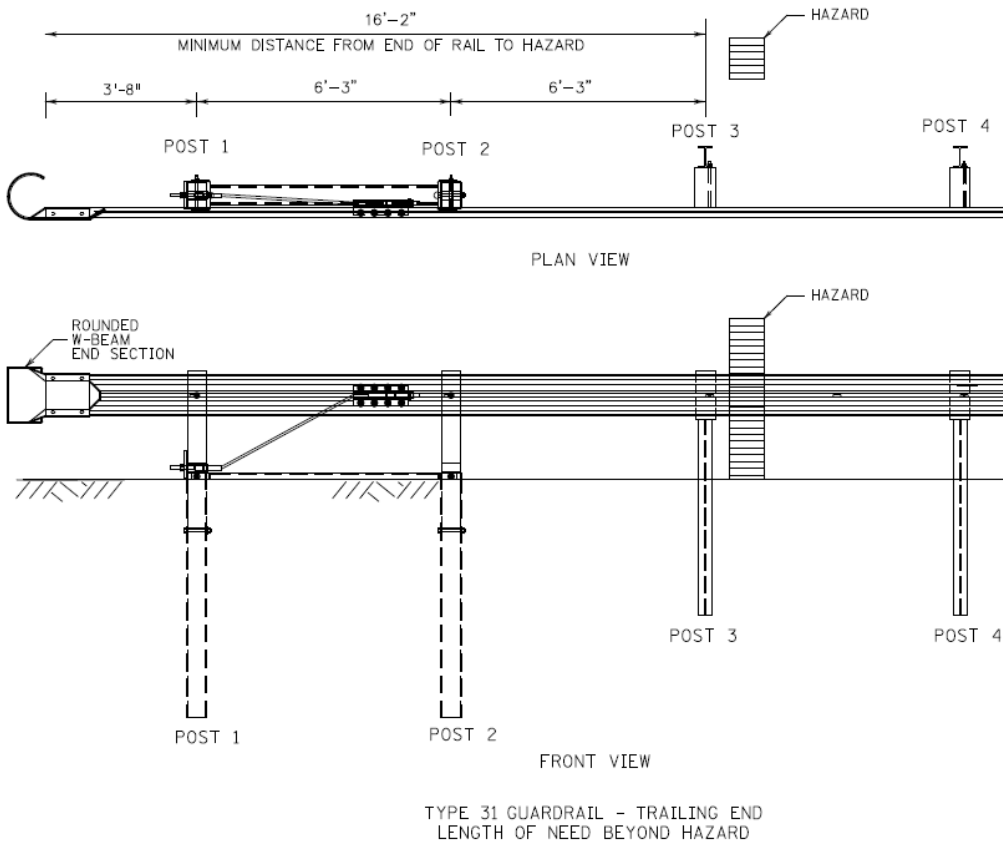


Quarter spacing (posts every 1'- 6.75")
 Start half post spacing 25' before hazard
 Start quarter post spacing 12.5' before hazard
 End quarter post spacing 12.5' past hazard
 End half post spacing 25' past hazard



Ending Guardrail - How far to take the guardrail beyond the hazard when shielding is not required in the opposite traffic direction? There is currently no statewide consensus on this. The guidance is different for 8338 vs. Type 31. For the interim we would recommend that 12'-6" be used as a minimum for type 8338, and that 16'-2" be used for Type 31 (12'-6" + 3'-8").

This will take you to the end of the guardrail but not the rounded end of the anchorage as shown below...



T-BARRIER BRIDGE CONN DES 8318

The T-Barrier Bridge Connection is used when connecting guardrail to a bridge rail or concrete structure. It is included in the pay item for Traffic Barrier Design Special or AGT and should not be paid for separately in those cases.

If there is guardrail on the downstream end of a bridge and it is not a design special attachment then the pay item 2554.602 T-BARRIER BRIDGE CONN DES 8318 by EACH should be included in the tab and SEQ.

In both cases the standard plate table should reference 8318.

TYPE 31 VS B8338 GUARDRAIL

With the new Tech Memo #17-07-TS--2 there has been some confusion on when you have to use the TYPE 31 guardrail and when you can still use the B8338 when working on the existing guardrail.

If it is a preservation project and no bridge work is being done and the existing guardrail is in good condition (per tech memo) then the B8338 guardrail may remain as is.

If the preservation project extends the life of the surface more than 10 years, or increases the height of the surface such that the existing guardrail height will be less than 27" the guardrail should be upgraded to meet the current MASH standard.

If there is a proposed project that will replace the existing guardrail within 10 years then the B8338 guardrail may be used in the interim as long as it was up to standards.

TYPE 31 GUARDRAIL

There has been much confusion regarding the design/use of the TYPE 31 guardrail. Hopefully the following will help to alleviate some of that confusion.

REMOVE APPROACH GUARDRAIL TRANSITION (AGT)

When removing AGT pay for it as...

- 2104.503 REMOVE GUARDRAIL – PLATE BEAM by LIN FT and add the note:
Includes AGT.

GUARDRAIL END TREATMENTS

Guardrail must be in tension to work, this is true for both plate beam and cable. Therefore, it MUST have tension on both ends either by an anchorage assembly, design special, and/or end treatment. The designer needs to notice if both ends of the guardrail are addressed. So if there isn't an end treatment, is there an anchorage assembly or design special?

TYPE 31 End Terminals

- Tangent Terminals...The preferred MnDOT terminal is the tangent terminal. MnDOT now has two design details and associated approvals on the APL web page and both need to be listed in the plan. If you only choose one of the terminals it will require a project specific PIF. These terminals are MASH tested terminals.
- Flared terminal...MnDOT does not have an approved flared terminal for TYPE 31. If a flared terminal is preferred, the FLEAT-MGS and SRT-350 31 are NCHRP 350 approved end terminals for TYPE 31 guardrail.
- There are details available on the server for the following end treatments, which should be placed into the plans. These details are propriety end treatments and should not be modified or signed. These details are located in Projectwise Design Detail Locations. If outside of MnDOT you will need to contact the MnDOT project manager to obtain the details.
 - ❖ Tangent terminal design details:
 - ✦ [SoftStop_dd.dgn](#)
 - ✦ [MSKT_dd.dgn](#)
- A District can still proceed with a project specific PIF for the flared terminal if desired.
- The Standard Plan 5-297.601 should be used for both the MSKT and SOFTSTOP.
- The plans must state as a note on either the estimate quantities table or the tab sheet:
 - ❖ Tangent Terminal: Shall be MSKT or SOFTSTOP

Removing

When removing end treatments they may be the old B8338 guardrail end treatments. If that is the case see the article in this chapter under B8338 GUARDRAIL section on “Guardrail End Treatments...Removing”. If the new TYPE 31 then use the following items...

- 2104.502 REMOVE ENERGY ABSORBING TERMINAL by EACH, note what it is (e.g. SOFTSTOP, MSKT, etc.)
- 2104.502 REMOVE ANCHORAGE ASSEMBLY – TYPE 31 by EACH

Salvaging & Install

Wood posts can NOT be replaced with steel posts on end treatments. If that is desired then it would have to be a new system not an install.

When removing or salvaging an existing guardrail end treatment then use the following items....

- 2104.502 SALVAGE ANCHORAGE ASSEMBLY – TYPE 31 by EACH
- 2104.502 SALVAGE ENERGY ABSORBING TERMINAL by EACH. This is used on existing treatments. Add a note to the SEQ or TAB stating what it is (e.g. 4=SOFTSTOP & 3=MSKT).
- 2554.602 INSTALL ENERGY ABSORBING TERMINAL by EACH. This is used on existing treatments. Add a note to the SEQ or TAB stating what it is (e.g. 4=SOFTSTOP & 3=MSKT).

If, however it is an instance where the contractor will be salvaging a guardrail end treatment as a result of staging cross traffic. Then use the following items...

- 2104.502 SALVAGE TANGENT TERMINAL by EACH
- 2554.602 INSTALL TANGENT TERMINAL by EACH
 - ❖ Note shall be SOFTSTOP or MSKT
 - ❖ Include a detail in the plan for possible options.
 - ❖ These salvaged terminals CANNOT become the property of MnDOT.

Furnish & Install

When placing new end treatments then use the following items....

- 2554.502 ANCHORAGE ASSEMBLY – TYPE 31 by EACH
- 2554.502 END TREATMENT - TANGENT TERMINAL by EACH (Include details in plan and note that is shall be SOFTSTOP or MSKT)

CONNECTING TO BARRIERS OTHER THAN SINGLE SLOPE

The Approach Guardrail Transition Type 31 (Standard Plan 5-297.694) is currently only available for connection to single slope barrier (Standard Plan 5-297.681) and vertical end post (Standard Plan 5-297.693).

Note: The Approach Guardrail Transition (AGT) is a new name for what has been historically called a Design Special by MnDOT. The new name better represents the system's purpose and also brings MnDOT nomenclature in line with other States.

The decision for an AGT upgrade is dependent on the scope of the preservation project and on the future plans for any bridge or barrier work planned for in the STIP within the project limits. The overall goal is to upgrade the AGTs within the project limits to the current Design Special or AGT Type 31 Standards, unless there is a bridge or barrier project in the near future (as identified in the STIP) which will accomplish that goal. The options are as follows for roadway preservation projects:

Option 1: Preservation Project with Concurrent Bridge or Concrete Barrier Work:

When a roadway preservation project, includes bridge or concrete barrier work but does not change the shape of the bridge barrier, and a new AGT Type 31 cannot be constructed, then the following options may be considered:

If the project requires a new AGT (Design Special) and it has to connect to an F-shape barrier, then use ...

- The design special (Standard Plan .603) followed with
 - ❖ B8338 guardrail (Standard Plate 8338) and an NCHRP 350 end terminal, or
 - ❖ 25' long, Type 31 to 28" Height Transition guardrail in front of the AGT (design detail TYPE31TRANSITION28) with a Type 31 (MASH) end terminal.

✦ If using the Type 31 to 28" Height Transition, it should be paid for as Type 31

guardrail, and noted in the Plan.

If the project requires a new transition (design special) and it has to connect to an J-shape barrier, then use...

- The design special (Standard Plan .618) followed with
 - ❖ B8338 guardrail (Standard Plate 8338) and an NCHRP 350 end terminal, or
 - ❖ 25' long, Type 31 to 28" Height Transition guardrail in front of the AGT (design detail TYPE31TRANSITION28) with a Type 31 (MASH) end terminal.
 - ✦ If using the Type 31 to 28" Height Transition, it should be paid for as Type 31 guardrail, and noted in the Plan.

In either of these cases, consult with the Bridge Office as early as possible to coordinate bridge barrier repair or replacement work that may be driven by the guardrail connection.

Additionally, bridge and roadway designers will need to coordinate for guardrail connections to any other bridge barrier type.

Option 2: Preservation Project with Non-Concurrent Bridge or Concrete Barrier Work:

When a roadway preservation project includes an existing bridge or concrete connection within the projects limit, but does not include bridge or concrete barrier work, then the following guidance will apply:

If there is a separate bridge (or barrier) project programmed in the near future (as identified in the STIP) concerning the connection (AGT) point in question, then the guardrail can be reconnected to the end post or bridge rail with the original design standard in place at the time of its construction. This option can be used if the connection system is fully inspected and that it's found to be in an acceptable condition.

If there is not a bridge (or barrier) project programmed in the STIP, or if the system elements are in disrepair, then the Bridge Office will need to be consulted early on in the project scoping process to investigate alternative design variations.

CONNECTING TO BULLNOSE

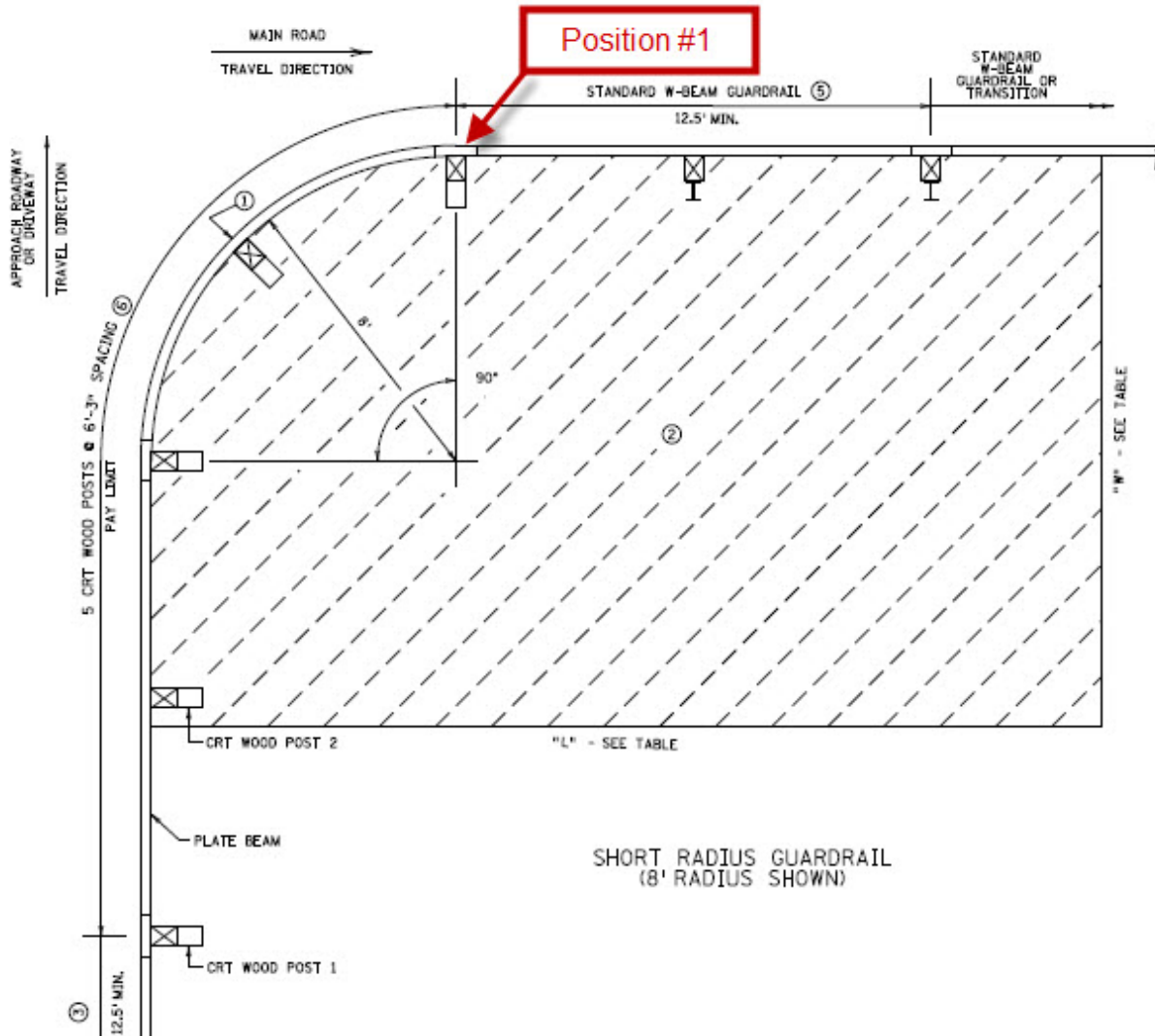
When connecting the bullnose to the TYPE 31 guardrail use the thrie beam bullnose transition to Traffic Barrier Type 31 design detail (BULLNOSE_TO_TYPE_31), and change note ① to read, "SEE STANDARD PLATE 8356." The 6'3" transition section (between posts 10 and 11) is paid for as bullnose.

The plan will also need to include the Standard Plan sheet 5-297.601, 5-297.611, 5-297.614 (cross out the top right detail and reference the Standard plate 8356), also include Standard Plate 8356 in the Standard Plates tabulation.

Standard Plan 5-297.611 will need to be modified as follows until the new updated one is issued. Modify note 10 on standard plan 5-297.611 sheet 1 of 3 to read, "SEE STANDARD PLATE 8356".

CONNECTING TO SHORT RADIUS

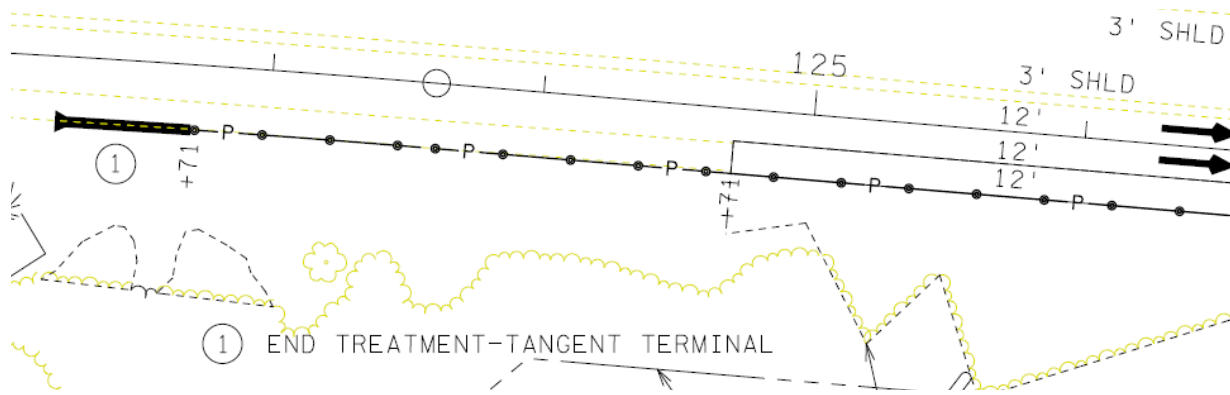
Designers can only attach Type 31 to the short radius after the vertical transition at position #1, as indicated on the drawing below (where the curved section ends, on the main roadway side of the short radius detail).



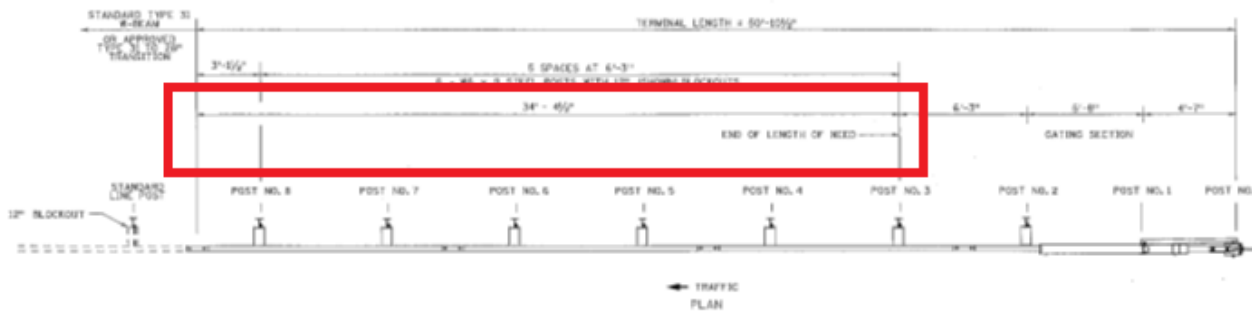
TYPE 31 END TREATMENT SHOWN IN PLAN VIEW

There has been confusion on how to show this in the plan as the two end treatments (SOFTSTOP & MSKT) are of different lengths. In the past we would show the stationing to the end of the end treatment but that is not the case for the Type 31 guardrail with tangent terminals.

In the plan view show a + station where the Type 31 guardrail ends and the end treatment begins. This may not necessarily be the length of need as a portion of the length of need is covered in the end treatment pay item (approximately 34' - 4.5"). It is desirable to show the end treatment with a different icon. For example below the TYPE 31 ends at 122+71 which is where the end treatment begins.



The end treatment will include approximately 34'-4.5" of the length of need (see example below).



TYPE 31 GUARDRAIL WORKING WIDTH

For Type 31 guardrail use the following table to replace the deflection table on Standard Plan 5-296.601 (1 of 3) if deflection is a concern. Modification to the standard plan sheet will be needed to reflect working width versus deflections.

Estimated Working Width Table for TYPE 31 Guardrail	Minimum working width
6'-3" post spacing, 9' long posts, 1:2 back slope at post	5'-5"
6'-3" post spacing	5'
Modified 3'- 1.5" post spacing	3'-7"
Modified 1'- 6.75" post spacing	3'

Working width is used to determine the lateral distance from the face of the guardrail to the hazard. Working width is defined in MASH as the distance between the traffic face of the test article before impact and the maximum lateral position of any major part of the system or vehicle after the impact (see detail)

