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.

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.

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 Midewest Roadside Safety Facility (statePooled Fund) to design and test a new “stand alone” end post in accordance with current crash test requirements (MASH).

DESIGN SPECIAL
When removing design special pay for it as

- 2104.501 REMOVE GUARD RAIL – 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

- 2104.521 SALVAGE GUARDRAIL – PLATE BEAM by LIN FT, and
- 2554.511 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 2554.501 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 – 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.

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 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?

MnDOT has requested and received a Public Interest Finding for the specification of w-beam guardrail Tangent terminals for use on State Trunk Highways.

The Public Interest Finding allows MnDOT to specify one of the following w-beam tangent terminals for exclusive use within a specific highway corridor, 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

We are operating under an old PIF for the flared terminals and this should be updated shortly.

If you are specifying just one option it will require a Public Interest Finding (PIF). The designer may also give three options for the Tangent terminal (SKT-350, ET-PLUS, X-LITE) and this would not require a 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…
- 2104.509 REMOVE ENERGY ABSORBING TERMINAL by EACH, note what it is (i.e. ET-2000, SKT-350, etc)
- 2104.509 REMOVE TWISTED END TREATMENT by EACH, note if it includes the removal of anchorage blocks.
- 2104.509 REMOVE ECCENTRIC LOADER BCT by EACH
- 2104.509 REMOVE SLOTTED RAIL TERMINAL by EACH
- 2104.509 REMOVE ANCHORAGE ASSEMBLY – PLATE BEAM by EACH
- 2104.509 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…
- 2104.523 SALVAGE ANCHORAGE ASSEMBLY – CABLE by EACH
- 2104.523 SALVAGE ANCHORAGE ASSEMBLY – PLATE BEAM by EACH
- 2104.523 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).
- 2104.523 SALVAGE SLOTTED RAIL TERMINAL by EACH
- 2104.523 SALVAGE ECCENTRIC LOADER BCT by EACH. This can only be salvaged for parts, it cannot be re-installed.
- 2104.523 SALVAGE ANCHORAGE ASSEMBLY – PL BEAM by EACH
- 2104.602 INSTALL ANCHOR ASSEMBLY – 3 CABLE by EACH
- 2104.602 INSTALL ANCHOR ASSEMBLY – PLATE BEAM by EACH
- 2104.602 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).
- 2104.602 INSTALL SLOTTED RAIL TERMINAL by EACH
- 2104.602 INSTALL ECCENTRIC LOADER BCT by EACH

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…
- 2104.523 SALVAGE TANGENT TERMINAL by EACH *
- 2104.523 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.

Furnish & Install
When placing new end treatments then use the following items….
 2554.521 ANCHORAGE ASSEMBLY – CABLE by EACH
 2554.521 ANCHORAGE ASSEMBLY – PLATE BEAM by EACH
 2554.523 END TREATMENT - TANGENT TERMINAL by EACH (Include details in plan and note that is shall be SKT-350 or ET-PLUS)
 2554.523 END TREATMENT - FLARED TERMINAL by EACH (Include details in plan and note that is shall be either SRT-350 or FLEAT-350)

An EXCEPTION to this would be (FLARED TERMINAL ONLY):
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:
 2554.523 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.

GUARDRAIL HEIGHTS
When revising existing profile grade elevations (such as overlay projects) consider guardrail heights (28” to 30”). Adjust guardrail height if necessary.

GUARDRAIL REPLACEMENT
The following information is meant to be tips for designers to better facilitate installation in the field.

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.

**GUARDRAIL TERMINALS AT 6 IN. CURB**

A potential problem is created when a guardrail end treatment is used where 6 in. curb is inplace. Since a flared terminal is placed with a 4 ft. flare, a considerable length of guardrail is more than 9 in. behind the face of the curb, thus causing a condition under which an errant vehicle could hit the curb and vault over the guardrail. When a tangent terminal is used, the extruder box is 9 ½ in. closer to the traffic lane than the guardrail. This means then even if the guardrail is set the maximum 9 in. behind the face of the curb, the extruder box will be partially in front of the face of the curb. This results in the possibility of the extruder box being hit by a passing vehicle or, more probable yet, a snow plow.

The problem mentioned above can be eliminated by the following action. When a flared terminal is placed behind 6 in. curb, the curb should be ground down 3 in. to a height of 3 in. beginning at a point 20 ft. in advance of the guardrail nose and continuing to Post No. 8, a total distance of 58 ft. When a tangent terminal is placed behind 6 in. curb, the extruder box should be placed a minimum of 9 in. behind the face of the curb. The first 50 ft. of guardrail needs to be in a straight line angled towards the curb and slightly kinked between Post Nos. 9 and 10. Beyond this point it would be parallel with the curb. The curb should be ground down 3 in. to a height of 3 in. beginning at a point 10 ft. in advance of the extruder box and continuing to Post No. 9, a total distance of 60 ft. .

As an alternate to grinding down the curb, it could be removed and replaced with D 424 curb and gutter. On overlay projects, no correction of the curb is necessary if the thickness of the overlay at the curb face is such that no more than 4 in. of curb remains exposed.

When a tangent terminal is used with 4 in. curb or where there is no curb the configuration described above should also be used. However, in the latter case, the 9 in. minimum setback of the extruder box should be measured from a straight line extending forward from the face of the guardrail at Post No. 9.

**IMPACT ATTENUATOR BARRELS**

Engineering Cost Data and Estimating Unit is responsible for determining reasonable prices for supplemental agreement to construction projects 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 subnote 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 TL3’s or TL2’s (test level’s) 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…
Example: Different test levels and temporary situation...

<table>
<thead>
<tr>
<th>PAY ITEM TABULATION</th>
<th>TC</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAY ITEM</td>
<td>UNIT</td>
</tr>
<tr>
<td>PORTABLE PRECAST CONCRETE BARRIER DESIGN 8337</td>
<td>LIN FT</td>
</tr>
<tr>
<td>PORTABLE PRECAST CONCRETE BARRIER DESIGN 8337-ANCHORED</td>
<td>LIN FT</td>
</tr>
<tr>
<td>(1) IMPACT ATTENUATOR</td>
<td>ASSEMBLY</td>
</tr>
<tr>
<td>TRAFFIC CONTROL</td>
<td>LUMP SUM</td>
</tr>
<tr>
<td>(2) MEDIAN BARRIER DELINEATOR</td>
<td>EACH</td>
</tr>
<tr>
<td>PORTABLE CHANGEABLE MESSAGE SIGN</td>
<td>UNIT DAY</td>
</tr>
<tr>
<td>(3) REMOVABLE PREFORM PAVEMENT MARKING TAPE</td>
<td>LIN FT</td>
</tr>
<tr>
<td>REMOVABLE PREFORMED PLASTIC MASK (BLACK)</td>
<td>LIN FT</td>
</tr>
</tbody>
</table>

(1) 2-TL2, 2-TL3 ASSEMBLIES
(2) 20 WHITE, 20 YELLOW - ALL ONE WAY
(3) 3052' 4" SOLID LINE WHITE, 840' 4" BROKEN LINE WHITE, 1906' 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)...

<table>
<thead>
<tr>
<th>PAY ITEM TABULATION</th>
<th>TC</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAY ITEM</td>
<td>UNIT</td>
</tr>
<tr>
<td>(1) IMPACT ATTENUATOR</td>
<td>ASSEMBLY</td>
</tr>
<tr>
<td>(2) IMPACT ATTENUATOR NO 1</td>
<td>ASSEMBLY</td>
</tr>
<tr>
<td>(3) TRAFFIC CONTROL</td>
<td>LUMP SUM</td>
</tr>
<tr>
<td>MEDIAN BARRIER DELINEATOR</td>
<td>EACH</td>
</tr>
</tbody>
</table>

(1) TL-3, PERMANENT
(2) TL-2, PERMANENT
(3) 20 WHITE, 20 YELLOW - ALL ONE WAY
“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 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 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 2554.523 END TREATMENT-FLARED TERMINAL by EACH, add the note: Fleat-350 End Terminal is the only option permitted.

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

The Type III 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 III barrier will also be required along deep
drop-offs immediately adjacent to lanes used to carry traffic. Type III 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.

**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:

- 2104.501 REMOVE GUARD RAIL – PLATE BEAM by LIN FT
- 2104.509 REMOVE ANCHORAGE ASSEMBLY – PLATE BEAM by EACH (providing
  there is one inplace)
- 2104.509 REMOVE *specify end treatment* (i.e. twisted end, energy absorbing, etc…) by
  EACH (see section on end treatments)
- 2554.501 TRAFFIC BARRIER DESIGN B8338 by LIN FT for steel posts
- 2554.501 TRAFFIC BARRIER DESIGN B8307 by LIN FT for wood posts
- 2554.521 ANCHORAGE ASSEMBLY – PLATE BEAM by EACH (if required)
- 2554.521 END TREATMENT – *specify* (see section on end treatments)

**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:

- 2104.509 REMOVE ANCHORAGE ASSEMBLY – PLATE BEAM by EACH (providing
  there is one inplace)
- 2104.521 SALVAGE GUARD RAIL by LIN FT , add note to SEQ or tab: Includes the
  removal of the wood posts.
- 2104.521 ANCHORAGE ASSEMBLY – PLATE BEAM by EACH (if required)
- 2554.603 INSTALL GUARD RAIL by LIN FT, add note to SEQ or tab: Includes the
  Furnish and Install of steel posts

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

- 2104.521 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.
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:

- 2104.501 REMOVE GUARDRAIL by LIN FT
- 2104.509 REMOVE ANCHORAGE ASSEMBLY by EACH (providing there is one inplace)
- 2104.521 ANCHORAGE ASSEMBLY – PLATE BEAM by EACH (if required)
- 2554.602 GUARDRAIL POST by EACH (if required)
- 2554.603 PLATE BEAM RAIL by LIN FT

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

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.

This is considered an unapproved standard detail and shows the use of wood posts. This would require the use of item 2554.501 TRAFFIC BARRIER DESIGN A8307 or 2554.501 TRAFFIC BARRIER DESIGN B8307 by the LIN FT.

It can be found internally at…
http://ihub/designsupport/standards/design.html

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”).

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 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 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.

Tangent terminal
The preferred MnDOT terminal is the tangent terminal. MnDOT now has two design details and associated approvals on the APL web page. MnDOT has a state wide PIF (also available on the APL web page) for the Tangent Terminals so both need to be listed in the plan. If you only choose one of the terminals it will require a project specific PIF.
Flared terminal
MnDOT only has one flared terminal for the TYPE 31 at this time. Each project will need a project specific PIF if using this terminal.

- 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.

Projectwise Design Detail Locations
Tangent terminal design details:
 SoftStop_dd.dgn
 MSKT_dd.dgn
Flared terminal design details:
 SRT_M10_dd.dgn

Connecting to barriers other than single slope
The Approach Guardrail Transition Type 31 (Standard Plan .694) is currently only available for connection to the new single slope barrier (Standard Plan .681).

- 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 either 8338 guardrail (Standard Plate 8338) and an NCHRP 350 end terminal, or the 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 either 8338 guardrail (Standard Plate 8338) and an NCHRP 350 end terminal, or the 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 project’s 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 other barrier systems
When connecting the bullnose to the TYPE 31 guardrail use the thrice beam bullnose transition to Traffic Barrier Type 31 design detail (BULLNOSE TO TYPE 31). The 6’3” transition section (between posts 10 and 11) are paid for as TYPE 31 guardrail. The plan will also need to include the Standard Plan sheet 5-297.695.

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).
Proposed solution for tangent terminals of different lengths (Stationing of guardrail length).
There has been confusion on how to show this in the plan as the two end treatments 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).

<table>
<thead>
<tr>
<th>Estimated Design Deflection Table for Type 31 Guardrail</th>
<th>Minimum working width</th>
</tr>
</thead>
<tbody>
<tr>
<td>6’-3” post spacing, 9’ long posts, 1:2 back slope at post</td>
<td>5’-5”</td>
</tr>
<tr>
<td>6’-3” post spacing</td>
<td>5’</td>
</tr>
<tr>
<td>Modified 3’- 1.5” post spacing</td>
<td>3’-7”</td>
</tr>
<tr>
<td>Modified 1’- 6.75” post spacing</td>
<td>3’</td>
</tr>
</tbody>
</table>

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)
Pay Items for Type 31 Guardrail

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>2104.501</td>
<td>REMOVE GUARDRAIL – TYPE 31</td>
<td>LIN FT</td>
</tr>
<tr>
<td>2104.509</td>
<td>REMOVE ANCHORAGE ASSEMBLY – TYPE 31</td>
<td>EACH</td>
</tr>
<tr>
<td>2104.521</td>
<td>SALVAGE GUARDRAIL – TYPE 31</td>
<td>LIN FT</td>
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<td>SALVAGE ANCHORAGE ASSEMBLY – TYPE 31</td>
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<td>INSTALL ANCHORAGE ASSEMBLY – TYPE 31</td>
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**Type 31 Standard Plans with notes**
Guardrail Installations At Medians and End Treatments – Standard Plan 5-297.601
Concrete Median Barrier Single Slope - Standard Plan 5-297.681
- 36” – Minimum height to meet new crash standards
- 42” – Use this if a built in height for a future mill and overlay is desired (Note to coordinate with bridge off is the project has a bridge, or a retaining wall with barriers).
- 54” – Glare screen option.
Traffic Barrier Type 31 - Standard Plan 5-297.690
- 31” height
- 12” block out
- Splices between posts
- Same 6’ length post just not pounded so far in the ground
- 9’ posts if on adjacent to 1:2 backslope

Traffic Barrier Type 31 End Anchorage - Standard Plan 5-297.692
- Guardrail extends beyond the last post by 3’-8”
- End anchorage utilizes BCT timber posts.

Approach Guardrail Transition (AGT) Type 31 - Standard Plan 5-297.694
- 25’ thrie beam guardrail, 12’6+6’3” thrie beam + 6’3” transition to w-beam
- New thrie beam connection to bridge rail - see Standard Plate 8350 and 8352 (8318 does not work with Type 31)
- New transition post spacing
- Increased distance between end post and first transition post

Steel Plate Beam Guardrail Details - Standard Plan 5-297.695
- Transition from thrie beam to plate beam guardrail.

Traffic Barrier Type 31 Long span - Standard Plan 5-297.696
- Details for one missing post, and 2-3 missing posts
- When 2-3 post are missing, use 3 CRT wood posts on both sides of span.
- Minimum distance of regular guardrail run on both sides of the missing post
- Increases working width to 8’

Post set in concrete - Standard Plan 5-297.601 (page 2 of 3)
- Will be updated for Type 31. The current guidance of 7” minimum behind the post and an 18” wide cutout will still be required. The post options will remain the same. The blockout depth will be updated to include the 12” option.

**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 (Pending, check with Design Standards for a detail if needed)
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.