Midwest States Pooled Fund Program Consulting Quarterly Summary

Midwest Roadside Safety Facility

10-01-2007 to 12-31-2007

Vertical Adjustment of the Midwest Guardrail System

Question
State: IL
Date: 10-04-2007

We are looking at installing some new Midwest Guardrail System to replace corroded weathering steel guardrail. This is a very worthy safety improvement, and we want to get it accomplished as quickly as possible. However, the location is programmed for a resurfacing project to follow within a handful of years (3 to 5 probably). The resurfacing thickness will be 4.25 inches, and thus the height of the relatively new guardrail would be out of tolerance.

We are wondering if it would be acceptable to specify an additional bolt hole in the flange of the steel post such that the wood blockout could be raised by about 4" to match the new height of the overlay? This would raise the top of the blockout and rail by this amount above the top of the steel post. Also, we would be able to add some fill material around the posts, but it would be very difficult and expensive to compact this mechanically. Perhaps we could use a dense graded aggregate that would at least develop some cohesion with moisture and natural settling into place. Is this a reasonable method to allow for one vertical adjustment of the MGS? Would there be any other steps we could take to make this idea successful?

Response
Date: 10-05-2007

I have spoken with several of my colleagues regarding the MGS situation that you will likely encounter with the future overlay. For the standard MGS, we believe that the MGS will perform acceptably if you raise the rail height approximately 4 in. along with a similar increase in the asphalt overlay. As such, you could have an extra guardrail hole placed in the post's flange such that the rail and blockout could be raised at a later date. Note that with a longer load height above the ground line, the posts will yield at a lower magnitude of load and result is higher dynamic rail deflections.

There are additional issues to consider. Originally, the MGS R&D program was begun with 5-ft long foundation tubes. When the rail was raised, so was the slope of the anchor cable. This resulted in the foundation tubes to begin to be pulled upward and out of the ground during impacts. Further testing with 6-ft long tubes showed that this behavior was mitigated. Now, with another increase in rail height, it may be necessary to use even longer foundation tubes, such as 7 or 8-ft long tubes. Since we have used 8-ft tubes in other systems, you may want to use that length to ensure that pullout will not occur.

Finally, it has been noted that one could also use non-standard posts (slightly longer) such that the post would extend slightly above the blockout when first installed and also would use two holes in the posts. The extended post would be a reminder that this guardrail was intended for a future overlay.

In summary, we feel that your proposed MGS applications would be acceptable when incorporating the primary consideration noted above.

W-Thrie Transition Question

Question

Date: 08-21-2007

I'm just looking at the "W-beam to Stiff Bridge Transition (MWT-5)" and need confirmation if this is the detail we would apply for a transition to a safety shape or vertical concrete bridge rail, which I assume has also been successfully crash tested. If correct I'm assuming we would show the thrie beam terminal connector (RTE01b) being bolted to the nested 12 ga thrie beams at post 19 (which would actually be the concrete bridge rail similar to STB05).

If similar to STB05, I'm assuming we would also delete post 18. If not correct, I'm assuming we may need to use additional posts at 475mm centres similar to STB06.

One other question with the MWT-5 detail is the use of a half length of 12 ga thrie beam between posts 15 and 13, which also has the thicker asymmetric 10 ga thrie beam on one side and the nested 12 ga thrie beams on the other. This seems a little odd to use a thinner piece of steel (instead of a half length of 10 ga thrie beam) at this location when the intent is to stiffen the system as you approach the bridge rail. I have to ask this question as I'm sure I'll be asked this question by our installers once installations start. My preference would be to specify a half length of 10 ga thrie beam at this location, however if the 12 ga is what is recommended and crash tested, and there is uncertainty about 10 ga, we will specify the 12 ga.

Response

Date: 10-16-2007

We have no problem with you attaching the transition system to a concrete bridge rail as long as the bridge rail is 350 approved, is very stiff and rigid, and has the appropriate flare backs and/or tapers as have been 350 approved previously for approach guardrail transitions. Yes, you would want to attach the thrie beam terminal connector to the nested 12-gauge thrie beam at post 19. There would be no need to remove post 18. We have tested a few approach guardrail transitions to concrete barriers that have been 350 approved if you would like that information. One note...STB05 and STB06 are only 230 approved

At this time, we do not feel that we can recommend 10-gauge thrie beam in place of the 6-ft 3-in. long, single (non-nested) 12-gauge The new approach guardrail transition system has been configured with an additional 6-ft 3-in. long, single (non-nested) 12-gauge thrie beam rail, followed by the new asymmetrical, 10-gauge W-beam to thrie beam transition section. It is our current opinion that all of the prior nested thrie beam transition systems should be modified to include the additional 6-ft 3-in. thrie beam section as well as the asymmetrical transition section. In addition, the existing approach guardrail transition systems will require a longer transition length for which the support posts are installed and using a reduced post spacing. As part of another change, W6x12 steel posts were implemented in order to provide a more gradual change in lateral stiffness of the overall guardrail system

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Slopes Near End Terminals

Question

State: WI
Date: 10-19-2007

Earlier this week I had the opportunity to drive through various construction sites that were retrofitting energy absorbing terminals (See attached pictures). One question I had was about the slope just off of the gravel widening near the terminal. In this case the slope is approximately 1.5:1 and the terminal platform is approximately 2' higher than the grass slope. The grass slope is typically 4:1 or flatter. Figure 5.1b, of the Roadside Design Guide would indicate that this is acceptable (see page 2).
Given the instability of a vehicle during impact with the terminal, should this slope be permitted at the terminal?

Attachment: https://mwrsf-qa.unl.edu/attachments/76d84a55d3f4448f51b24b80d02b6b04.pdf

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Response

Date: 10-23-2007
The attached figure contains current FHWA guidelines for grading around terminals. The green area must be 3:1 or flatter. Our research would suggest that the orange region could be as steep as 3:1, even though FHWA gives a more conservative recommendation. We do not believe that 1.5:1 is acceptable under any circumstance.

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Establishing Best Practices for the Soil Support for Guardrail Posts on Slopes

Question

State: MN
Date: 10-24-2007

Since we do not have any standards in the above area outside the needed 2' of soil support behind the guardrail posts, I am trying to establish the best practices for Metro District for guardrail posts adjacent to various slopes. Sometimes due to the site limitations, we cannot provide the 2' of soil support behind the posts therefore, we need to establish a consistent approach to this issue for the District staff. Andy Halversen came up with the below draft guideline for use in standard soil:
For slopes 1:6 or flatter use 6' posts with 6'-3" post spacing
For slopes steeper than 1:6 to 1:3 use 7' posts with 6'-3" post spacing
For slopes steeper than 1:3 - with posts 1' from shoulder PI use 7' posts with 6'-3" post spacing
For slopes steeper than 1:3 - with posts at the shoulder PI use 7' posts with 3'-1.5" post spacing
Do you agree with the above?
How should we change the above if we have weak soil?
Your input is greatly appreciated.

Response

Date: 10-24-2007
We would recommend the following guidelines.
For standard W-beam guardrail:

1. Standard W-beam guardrail placed adjacent to any slope with 2' of level soil behind the posts is acceptable.
2. For w-beam guardrail placed 1'-2' adjacent to a 6:1 or flatter slope, standard 6' W6x9 posts at standard spacing are recommended.
3. For w-beam guardrail placed 1'-2' adjacent to a 3:1 to 6:1 slope, 7' W6x9 posts at standard spacing are recommended.
4. For w-beam guardrail placed less than 1' adjacent to a 3:1 or steeper slope, 7' W6x9 posts at half spacing are recommended.

For MGS guardrail:

1. Standard MGS guardrail placed adjacent to any slope with 2' of level soil behind the posts is acceptable.
2. For MGS guardrail placed 1'-2' adjacent to a 6:1 or flatter slope, standard 6' W6x9 posts at standard spacing are recommended.
3. For MGS guardrail placed 1'-2' adjacent to a 3:1 to 6:1 slope, 7' W6x9 posts at standard spacing are recommended.
4. For MGS guardrail placed less than 1' adjacent to a 3:1 or steeper slope, 9' W6x9 posts at standard spacing are recommended.

With regards to adjusting the installations for weak soil, we do not recommend adjusting guardrail installations for weak soil types.

Dynamic Impact Testing of W6x9 Steel Post on 2:1 Slope

Question

State: WI
Date: 11-02-2007

I was reviewing our standard drawings for beam guard and reading TRP-03-165-07 "Dynamic Impact Testing of w152x13.4 (W6x9) on 2:1 slopes". In that report, it is recommended that the W6x9 should be embedded 76 inches into the ground for the MGS system when the 2:1 is flush with the post.
This has generated two questions:
1. Should this embedment depth be used on non-MGS systems installed on 2:1?
2. Would this also apply to wood post installed on 2:1?
My first guess is that the embedment depth would be 76 inches for non-MGS systems, and for wood post installed on a 2:.

Response

Date: 11-02-2007
For non-MGS systems (i.e., standard metric height W-beam guardrail), the center of the W6x9 steel post is to be placed at the slope break point using 7-ft long posts spaced 3-ft 1 1/2-in. on centers. The MGS design utilized 9-ft long posts at the standard post spacing. In order to make the argument for wood posts, I believe that it would be important to perform a limited number of dynamic bogie tests using 7, 8, and 9-ft wood post lengths in a sloped soil pit.

MGS construction project issue

Question

State: IA
Date: 11-19-2007

We happened upon the following issue on one of our MGS construction projects last week (see photo). The existing guardrail posts are bolted into the "retaining wall" below the pavement (plans of the wall are attached). This was designed to allow for a narrow ditch section directly behind the edge of pavement, with drainage allowed through openings in the curb.
This situation exists for approximately 200 feet, and MGS is being installed continuously on both sides of this location. This is in an area of shallow bedrock, which the retaining wall is keyed into.
I am seeking your opinion on how to address this situation. Would you recommend bolting the MGS posts to the wall, as was done previously? Or would we be able to place the posts independent of the wall? Would thrie-beam be appropriate here, or would standard W-beam be sufficient?

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Response

Date: 11-20-2007
At this time, I cannot recommend attaching the MGS to the headwall as our MGS bridge rail project has not been completed. Actually, we are only beginning the Phase I part of that effort in the Year 18 program.
As an alternative you could attach the MGS using an adaptation of the guardrail culvert system that was previously developed for culvert slabs. We discussed this system in the first three topics of the MGS implementation discussions that occurred before I left on medical leave. Did you or Deanna receive those emails? I am not sure as many of the Pooled Fund State members have not commented on the noted topics.
If that option is not possible, then I suggest using a thrie beam bridge railing detail that already has been crash tested. Also, one would then use the asymmetrical w-beam to thrie beam transition section in conjunction with approved transition designs. MwRSF is currently revises details for the transition to exisitng transitions as well.

Guardrail Adjacent to Culvert Repair

Question

State: KS
Date: 12-07-2007

This is a question regarding the repair of a guardrail on US-56. The existing guardrail is protecting a triple 20'x20' box culvert. The guardrail is non-blocked out on concrete posts. The maintenance repair options we have will result in narrowing of the shoulder or extension of the box culvert to accommodate a low-fill guard rail attachment. Both of these options are not likely for a maintenance activity. Do you know of any designs that allow guardrail posts to be bolted to the outside edge of the culvert headwall? I could not find any details. However a colleague said that he found a little info from West Virginia DOT. The sheet is called "Guardrail Installation on Box Culverts and Bridges" I have not had a chance to look at this yet.
Let me know what you find out.

Currently we are considering to replace in kind as a maintenance activity based on approved agreement that we have with the FHWA regarding guardrail maintenance.

Let me know what your thoughts are.

Response

Date: 12-10-2007
1. It appears that there is some room between the edge of the roadway and the culvert edge. As such, it would appear that you could install the guardrail attached to the top of the culvert previously designed by MwRSF through the pooled fund. However, if you cannot move the guardrail in, then that may not be a viable option.
2. No 350 approved or tested design exist that we know of consisting of posts mounted to the side or edge of the culvert. I looked at the West Virginia designs, but I have never seen testing of those designs.
3. Another option would be to install a steel bridge rail on the culvert. There are several steel bridge rail options with side mounted posts. The two issues with this option are ensuring that the culvert structure has sufficient capacity for mounting the bridge posts, and the steel bridge rail would require an approach transition.
4. This problem would be a good extension of the current pooled fund project to develop an MGS bridge railing that was funded last year. If the MGS bridge railing development is successful, it would be fairly straightforward to develop the technology to culvert applications as a second phase of the project.
I hope this addresses some of your questions. Let me know if you need more information or if I forgot to address something.

TL-2 Concrete Barrier with No Reinforcement

Question

State: OH
Date: 12-12-2007

Ohio has issued an arbitrary five year phase out period for our older portable concrete barrier (not compliant to 350) ending as of January 1st, 2008. After that date, all of our unreinforced pin and loop barrier has to be off of projects.

With the approaching date, all sorts of contractor questions have arisen, leading ODOT to review all remaining unreinforced barrier use and deciding on a case-by-case basis if the units really do have to be removed from pending projects. One final question is if our unreinforced barrier can be used for another year in a TL-2 urban situation.

I know there is no FHWA mandate to remove the barrier, and it is ODOT's own arbitrary deadline, but do you believe unreinforced barrier would meet TL-2 criteria?

Our 350 crash tested barrier has FHWA Acceptance letter B-93 (design is attached as rm42.pdf) and differs from the previous barrier design (attached as unreinforced 32 inch pcb.pdf) in only the internal rebar cage in lieu of the previous design's wire mesh. The pin and loop connection remained unchanged.

I would be of the opinion that if the rebar cage reinforced barrier meets 350 TL-3, then the same design with the wire mesh would be crashworthy to TL-2. What do you think? Your answer will influence our decision to on whether or not to keep this particular barrier run in place for another year.
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Attachment: https://mwrsf-qa.unl.edu/attachments/033f2f305149d2c320d3cadaceabe01d.pdf

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Response

Date: 12-12-2007
We have looked at the unreinforced barrier section that you sent. It appears that that design does have some reinforcement in the form of a wire mesh in the center of the barrier. The connection design of the barrier seems adequate. Because the design does have some minimal reinforcement, adequate connections, and the fact that the anticipated loads for a TL-2 urban installation will be much lower than the TL-3 impact loads, we believe that this barrier, as shown on the detail you submitted, should be adequate for use in TL-2 urban installations.
One addition note on the detail is the tapered end section details. The TL-2 tested tapered end-section has been tested and required a 20' length. Thus, it appears the end section on your detail does not have sufficient length. We would recommend that you use an extended tapered end section if possible.
