Midwest States Pooled Fund Program Consulting Quarterly Summary

Midwest Roadside Safety Facility

01-01-2008 to 04-01-2008

Traversable Pipe Detail

Question
State: WI
Date: 01-04-2008

I was contacted yesterday by FHWA about a construction project that will be bid on in February. The FHWA had some concerns about some of the roadside safety devices being used on this project.
As I looked at the plan, I found out that the designer has developed a special detail to install steel bars to make a box culvert traversable (see attached details). I believe that the safety pipe runner s spacing is correct. The inside diameter of the safety pipe runners are slightly over sized.
My concerns are:

1. Does the Schedule 40 steel pipe have adequate structural strength to allow a vehicle to traverse the culvert?
2. Are the structural connections of the safety pipe runners adequate to allow a vehicle to traverse a culvert?
3. Does this detail have enough detail to be built?
4. Does MwSRF believe that this design is NCHRP 350 compliant?

I know that MwRSF tested a traversable safety runner design for a culvert.
Would it be possible to get a copy of the report (I probably have one buried somewhere in my files, but given the time frame for response, I do not know if I will have a chance to look at it).

Attachment: https://mwrsf-qa.unl.edu/attachments/f8dd207d0248c9e96173256b8488dd7f.jpg

Attachment: https://mwrsf-qa.unl.edu/attachments/dbf0738e3dcd4e520ef4a227b016ee85.jpg

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Response
Date: 01-04-2008
I am not sure I have enough details from what you sent to answer all of your questions completely, but I will start with answering what I can and then we can move forward from there.

To answer the questions below:

1. The Schedule 40 pipe listed on your plans is sufficient for allowing the vehicle to transverse the culvert. The table in your plans is developed from testing done at TTI in 1980 and was later adopted as an AASHTO guideline. Furthermore, we conducted a test of the culvert pipes with the largest spacing and size in the table on a 3:1 slope with the 2000P vehicle and the 820C vehicle and found that the specified pipes and spacing were adequate.
2. I cannot fully evaluate the structural connections for the pipes from your plans. The bolt grades are not listed and no details of the culvert wall reinforcement are listed. I don't fully understand the detail for section C-C. This appears to be a detail for additional crossbars on culverts with over 20' spans. The overall details have no guidance on the location and so it is hard to evaluate. Cross bars should not be necessary on culverts with spans of 20' or less. Do you expect to install culvert grates on culverts larger than this?
3. I would add the bolt grades and the details for the cross bar installation location if necessary. Your design appears to be identical to the Iowa DOT culvert detail. There detail is more complete in terms of specifying the cross bar details and such. You may want to look at their details for further guidance.
4. If the connections for the pipes to the headwall are structurally sufficient, this design should be NCHRP 350 compliant.

Guardrail Adjacent to Slope

Question

State: WI
Date: 01-24-2008

I received the following email from one of our designers (see below). I have included my initial response back to the designer in the attached word document. If MwRSF could provide additional guidance on this topic to me, it would be greatly appreciated.
-----Original Message-----
Hello-
The subject project is a 3R resurfacing project with 7 intersection realignments. The typical is 12' lanes with 6' shoulders (3' paved).
The project is at about a 60% level right now.
The question I have is regarding the use of longer beam guard posts and the use of "Beam Guard Retaining Walls". The PDF is a scan of the detail sheet and Misc Quant sheet from the 1988 As-Built, when the project was last resurfaced.
The current project is milling 1.5" of HMA and paving 4.25"-5.25", making the new vertical profile of STH 144 @ 2.75" to 3.75" higher than existing.
All of the existing beam guard is being replaced. With the additional shoulder gravel that will be required due to the profile change, I foresee problems with erosion at shoulders in the beam guard areas.
Either asphaltic curb and flumes will need to be installed under the beam guard to control the erosion, or the foreslopes will have to be paved. Do you have any recommendations on this?
Also, the existing foreslopes are very steep (and long), and many of the existing posts are installed down the foreslope a foot or more.
In other words, the face of beam guard was installed at or near the shoulder grade break. This is apparently why 8' or even 12' posts were specified in some locations on the 1988 As-Built - so the posts were embedded enough to develop full strength. The "Retaining Walls" were used to help prop up the shoulders near areas of culverts/box culverts/cattle passes where there was no room to build up the shoulders.
Due to the nature of this project, we would like to avoid having to fill in the slopes. A lot of earthwork would be required to fatten these slopes because they are so long. I have heard that other regions sometimes use similar details to solve these types of problems. Do you have any ideas for dealing with these problems, or any construction details that other regions use? If not, we may just use a modified version of the old detail that was used last time on this project.
Attached are some pictures of the areas in question. As you can see, many of the posts lean backwards due to the settling of the foreslopes over the years. However, I believe that the leaning posts were installed at the standard 6' length and not the 8' or 12' lengths.

Attachment: https://mwrsf-qa.unl.edu/attachments/e347a73b686e39d724bd555b95800c70.JPG

Attachment: https://mwrsf-qa.unl.edu/attachments/7ce4ac9909edcc9272dac8aa51f44b20.JPG

Response

Date: 01-24-2008

For fill slopes as steep as 2:1, MwRSF researchers have developed two strong-post W-beam guardrail systems for use at the slope break point. The first system utilized metric height W-beam rail (27-3/4" or 706 mm) with 7-ft long, W6x9 steel posts spaced on 3-ft 1-1/2-in. centers. The second system utilized the MGS with a 31-in. top height along with 9-ft long, W6x9 steel posts spaced 6-ft 3-in. on centers. For 2:1 slopes, both guardrail systems can be used. Additional discussion on this topic has been provided in the MGS Implementation discussions that I led last fall. I believe that we also provided recommendations for slopes less than 2:1. I will see if I can provide that here as well.

MwRSF: Recently, the Mn DOT requested guidance for placement of standard and MGS guardrail adjacent to slopes of various configurations. In response to this request and using available crash test data as well as engineering judgment, Dr. Dean Sicking and Mr. Bob Bielenberg prepared the preliminary guidance, subject to refinement in the future. It is as follows:

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.

In the photographs and design details that you provided, discrete W-beam rail segments were shown bolted to the face of guardrail posts both above and below grade and for retaining soil. We do not believe that this practice should be used. In addition, when asphalt overlays are placed in advance of the guardrail without placing new fill behind the posts, the post-soil behavior is altered. An even greater concern is whether the long, wood posts can rotate at the appropriate load without fracturing. In the past, we have developed recommendations for such cases for the Missouri DOT and with using steel posts. This recommendation was based on the best available data and engineering judgment - no testing. I can find that recommendation if you desire it.

In several of your photographs, the guardrail posts are tipped backward. If subsequent work were to occur in these areas, it would be suggested that the guardrail systems be adapted to meet those noted above and that the posts be placed vertical to reduce any tendencies for vehicle climb and override.

Other photographs also reveal the use of buried, turned down end terminals that are not in a back-slope. If modifications are to occur to these guardrail systems, you will need to review the WsDOT policies for replacing these terminals when certain 3R or roadway surfacing activities are scheduled. I assume that WsDOT has a policy on when guardrail terminal upgrades are to occur. Once again, it is highly recommended that you review this policy before doing any work around these terminals to ensure that you follow your long-range implementation plan for certain roadway classifications.

Transition From Free Standing to Rigid Concrete Barrier

Question

State: IL
Date: 02-04-2008

I have report TRP-03-180-06, "Development of Tie-Down and Transition Systems for Temporary Concrete Barrier on Asphalt Road Surfaces." From this, we do need to make some updates to our TCB design, and also consider new Standard(s) to implement transitions.
However, I have an immediate question from one of our districts regarding a transition to an existing bridge parapet. In this case the parapet end is curved away from traffic, making connection of the TCB problematic. There is no ready way to adapt to a pinned connection, and also spanning the back side of the joint with the thrie beam is not possible without removing part of the parapet end.
There seem to be a couple possibilities " remove and recast the end of the parapet to work with the TCB, or perhaps fabricate a triangular steel shape to bolt to the face of the parapet and provide a connection point and also fill over the curved portion. This latter idea still leaves the question of how to span the back of the joint.
Do you have any comments on either of these ideas, or other likely approaches?