

Midwest States Pooled Fund Program Consulting Quarterly Summary

Midwest Roadside Safety Facility

04-01-2011 to 07-01-2011

Downstream Anchorage for One Way Roadway

Question

State: WI

Date: 04-05-2011

I have answers for your questions regarding the end anchorages for the MGS.

1. The post bolt, nut, and washer hardware specification is according to the Hardware Guide. Note that the specifications and the diameter are consistent for all post bolts, but the length of the bolt varies depending on the blockout and type of post used. For the BCT posts in the end anchorage, the specs should be:
 - a. 5/8" diameter x 10" long ASTM A307 guardrail bolt galvanized according to ASTM 153 (AASHTO M232 Class C) or ASTM B695 (AASHTO M298 Class 50)
 - b. 5/8" diameter A563 DH heavy hex nut galvanized according to ASTM 153 (AASHTO M232 Class C) or ASTM B695 (AASHTO M298 Class 50)
 - c. 5/8" diameter F436 flat washer galvanized according to ASTM 153 (AASHTO M232 Class C) or ASTM B695 (AASHTO M298 Class 50)
2. As a side comment, your details should show a 6" long, 2" Schedule 40 pipe sleeve in the BCT hole.
3. The post bolt hole in the BCT post should be 7 1/8" down from the top of the post. The detail you have shows a second hole at 10 3/8". This hole is for use with standard W-beam mounted at 27 3/4".
4. Another side comment, page 2 of your detail shows two different cable end fittings. We would prefer that you use the one shown on the bottom as it is what we test with. The end fitting should also be Grade 5 material in order to have sufficient ductility. Some people have ordered Grade 8 cable end fittings, but these are too brittle and can fracture under loading.
5. The cable anchor bracket is a standard part from the Hardware Guide (FPA01). I have attached the details from the hardware guide with the remaining dimensions.
- 6.

One last item to discuss was your desire to adapt the end anchorage to use white pine posts. Ron and I discussed this and we believe that it is possible, but it will require some further investigation. From the CRT work that Scott did in the white pine report, we could expect that the white pine BCT post would increase in size by around 2". This in turn would increase the size of the foundation tube and the angle of the cable to the guardrail. The larger foundation tube would increase the soil resistance of the tube, and it might need to be made shorter in order to prevent excessive loading of the anchorage. We think that this kind of change can be accomplished, but we would recommend component testing of the anchorage prior to recommending its use. The component test required would be a simple jerk test on the redesigned anchorage to verify its force vs. deflection properties.

Attachment: <https://mwrsf-qa.unl.edu/attachments/8372ba093bf8b38818e8207fe11ae5b9.pdf>

Response

Date: 04-05-2011

Here is a PDF with some question about the type 2 end treatment.

Attachment: <https://mwrsf-qa.unl.edu/attachments/8372ba093bf8b38818e8207fe11ae5b9.pdf>

MGS behind 6" curb

Question

State: IA

Date: 04-05-2011

What is your current recommendation regarding the maximum offset of the MGS behind a 6" AASHTO Type B curb for TL-3 conditions?

I am specifically interested in the case where the top of rail height is 31 inches relative to the gutter elevation.

Response

Date: 04-05-2011

I am enclosing a copy of a presentation that I gave a few years ago at a TRB AFB20 summer workshop. This presentation was given prior to conducting the failed TL-3 test at the 8 ft offset location. At that time, we had critical lateral locations where we believed one would need to transition from 31" to 37" MGS relative to the road. However, testing would be needed to evaluate these limits.

Originally, the research study was geared toward a performance limits study where we would increment through critical test conditions and locations. However, the project was refocused by the sponsors in the middle of the study where the performance limits portion was replaced with testing at practical locations and then later a lower test level following a failed TL-3 test. As such, we later obtained a successful TL-2 test at the 6-ft lateral offset but still were unable to explore all of the critical locations.

We really are unable to provide much guidance beyond our original MGS testing with the 6" offset at TL-3 and extrapolate some guidance at TL-2 due to the 2270P test. No small car testing was performed with combination curbs and barriers.

Attachment: <https://mwrsf-qa.unl.edu/attachments/5f5b5e1b008ff7e01d29749dbe768ebd.ppt>

CRT Posts Adjacent to Slopes for MGS Long Span

Question

State: WA

Date: 04-14-2011

I found your e-mail on the "**Midwest Guardrail System for Long Span Culvert Applications**" and was hoping you could offer some quick advice.

I'm using the Washington State Design Manual which provides the following installation cases (See Attached Figure 1.jpg).

I'm spanning 25' and need to install 3 CRT posts on each side of the culvert.

What are your thoughts on using 11' long CRT posts on each side as shown in CASE 6 above? I'm trying to stay within my R/W and not have to spend money on a retaining wall.

Attachment: <https://mwrsf-qa.unl.edu/attachments/04e0e40b8c67901b713ea33d4dee2888.jpg>

Response

Date: 04-15-2011

MwRSF has successfully developed and crash tested two W-beam guardrail systems to span across long concrete box culverts, such as those measuring up to 25 ft in length. For the first system, the metric-height W-beam guardrail was configured with a 27-3/4-in. top mounting height, while the Midwest Guardrail System (MGS) was utilized for the second configuration with a 31-in. top mounting height. For both designs, three 6-in. x 8-in. by 6-ft long wood CRT posts were placed adjacent to the long span using the 6-ft 3-in. post spacing. Beyond the CRT wood posts, the guardrail system was transitioned into a steel post, wood block, semi-rigid barrier system which also used 6-ft long posts and a 6-ft 3-in. post spacing. For both crash-tested systems, a region of level, or relatively flat, soil fill was provided behind the CRT wood posts.

We recommend providing 2 ft of level, or mostly level, soil grading behind the wood CRT posts. However, we understand that this can be difficult. As such, your inquired as to whether the wood CRT posts could be lengthened to account for the reduction in soil resistance resulting from an increased soil grade behind these six posts, especially when placed at the slope break point of a 2:1 fill slope.

Recently, MwRSF performed limited research to determine an acceptable MGS post length for a 6-in. x 8-in. solid wood post installed at the slope break point of a 2:1 fill slope. MwRSF determined that 7.5-ft long wood posts are an acceptable alternative when considering the 31-in. tall MGS placed at the slope break point of a 2:1 fill slope using 6-ft 3-in. post spacing.

The MGS Long Span system utilizes six CRT wood posts. A CRT post's moment capacity about its strong axis of bending is approximately 81 percent of that provided by the standard wood post. In the absence of dynamic component test results, it is believed that the six CRT wood posts could also be fabricated with the 7.5-ft length when used in the MGS Long Span system. If the steep fill slopes continue beyond the location of the CRT posts, then the guardrail would transition to the MGS for 2:1 Fill Slopes using either 6-in. x 8-in. by 7.5-ft long wood posts or W6x9 by 9-ft long steel posts.

Thus, for the cases you sent, we believe Case 2 is acceptable and that Case 1 and Case 3 would be acceptable if 7.5 long CRT posts were used. We cannot recommend the use of extended length CRT posts on steep slopes as you have shown in Cases 4-6. Determination of proper CRT post lengths for this type of installation would require additional analysis and testing in order to ensure proper function of the CRT's in the long span system.

MnDOT Questions Regarding Bridge Barriers

Question

State: MN

Date: 02-16-2011

We've had several meetings within Mn/DOT to discuss various options and criteria regarding traffic barriers on bridges and barrier/guardrail transitions and would like to have a conference call w/ either or both of you to get your opinions and insights on these issues (see specific details below). We're proposing a 2 hour telephone or video conference call the week of March 7th or 14th.

Could you please respond by indicating 2-3 times/dates that work for you? Do you have video conference capabilities?

Specific issues we'd like to discuss are outline below;

1). Our past/present policy is to place traffic barriers on bridges "plumb" or "level", regardless of the adjacent shoulder slope. (See Figure 1.jpg);

Any comment on this? Do you know if other states use a similar detail?

2). Our current policy on when to use a TL-5 barrier (42" high) on a bridge (in lieu of a TL-4, 32" high) includes the following criteria; Degree of curvature > 5 degrees (radius of 1145 ft) and speed > 40 mph. An incomplete survey of nearby states indicates they use the following TL-5 criteria;

Illinois

- a). Structures with a future DHV (one way) x % trucks greater than 250
- b). Structures located in areas with high incidences of truck rollover accidents.
- c). Structures with a radius of 1000 ft. or less with truck traffic

Nebraska

All interstate structures, expressways, and over railroads.

They use a 34" (2" taller than Mn/DOT) TL-4 barrier on all other "on system" bridges.

Iowa

"Most interstate projects due to higher truck traffic"

Michigan/North Dakota/South Dakota

No set policy for use of TL-5 barrier.

Any guidance, criteria, or opinions on when to use TL-5 barriers on bridges?

3). At the end of a concrete barrier, where it transitions to a guardrail connection, Mn/DOT details a slight slope (5V:12H) to the top of the barrier (see top sketch below).

This guardrail connection/transition has been crash tested and approved for TL-3. What is the appropriate slope or taper length that should be used when transitioning from a 42" (or taller, glare screen barrier that is 4'6" tall, 6V:12H taper) barrier to a guardrail connection? (See Figure 2.jpg and Figure 3.jpg)

4). Based on recent test results regarding the New Jersey shape and the new MASH criteria do you have any recommendations or considerations for what shape and height of barrier should be used on new bridges going forward? We're considering single slope, vertical face, etc, and looking for advice. Which states (if any) do feel are headed in the right direction and may have standards that we can review and compare? FYI, our version of a vertical face bridge barrier is shown in Figure 4.jpg.