

Midwest States Pooled Fund Program Consulting Quarterly Summary

Midwest Roadside Safety Facility

04-01-2007 to 07-01-2007

Low Profile Bridge Rail

Question

State: IA

Date: 04-09-2007

Kimball Olson from the Office of Bridges & Structures at IaDOT, gave me your name. We are considering using the Low-Profile Bridge Rail (see attached PDF) on the 9th St. bridge in downtown Des Moines (over I-235). This would act as a pedestrian/traffic barrier. However, there are intersections right at the end of the bridge. This is preventing us from using the 108" End Section. I was wondering if this end section could be shortened to 2.1m (83") and still meet TL-2 requirements for 30 mph. I've also attached a PDF of the details we have on this barrier. Do you have any other detail sheets? It seems we're missing a few details.

Response

Date: 04-10-2007

The low-profile bridge rail was developed by MwRSF/UNL several years ago as part of the Pooled Fund Program. Details of this barrier system are contained in the report. Although it may seem that there are few details, it was not that complicated of a system. However, I will check to see whether we have any other details.

In your email, you mentioned that you desire to change the end slope and section length from 108 in. to 83 in. Actually, the report details show the end section length to be 180 in. As such, your proposed change is fairly drastic in terms of changing the end slope. In addition, our developed effort focused on the interior design and structural capacity. The geometry of the end section was adopted from the TTI low-profile barrier since they crash tested their end section. We did not crash test our end section but use their geometry to avoid the need to do so. If the end section is changed, I believe that you would be required to crash test the new proposed end section according to the NCHRP 350 requirements.

Second, I believe the adaptation of the low-profile bridge rail into urban situations still required research to address its use. I think Iowa submitted a problem statement last year that was written into a research proposal (attached) but unfunded in the Year 17 program. Originally, the low-profile bridge rail was developed for situation where farm implement equipment could pass over rural bridges. For urban applications, many issues come up, including how to deal with pedestrians, how long of end treatment or bridge rail is needed to shield the hazard, are there sidewalks near the end, etc. These issues were raised in another Pooled Fund report using our best engineering judgment and standard practices. I have a feeling that this material has not yet been widely reviewed nor implemented. However, I highly recommend that you review this report (TRP-03-127-03) when attempting to implement this bridge rail in the situation noted in your email. It certainly will show you what research remains needed in the future.

P.S. " I will look for additional CAD details in the near future. Also, Iowa DOT implemented this system several years ago on a curved on-ramp or off-ramp. I believe Will Stein (formerly at IA DOT) was the individual who used it. See attached files.



Wooden Posts for Guardrail

Question

State: NE

Date: 05-29-2007

Recall that the MwRSF conducted a study of the strength of guardrail posts sampled from field sites across the state. This study, funded by NDOR, involved removing and grading more than 600 guardrail posts. A stratified random sampling technique was used to select test specimens from this group of posts and approximately 100 posts were tested, either statically or dynamically. Based upon this research, we concluded that Grades 2, 2D, 1, 1D, and DS-65 were all adequate for use as guardrail posts. At the conclusion of this process, we recommended that, in the interest of assuring the quality guardrail posts, NDOR should require Grade 1 or better Southern Yellow Pine (SYP) posts (SYP is the most common type of wood used for guardrail posts East of the Rockies). Note that this recommendation is consistent with AASHTO guidelines and assures that practically all wood posts would be Grade 2 or better which we found to be the actual minimum strength.

At the time that the MwRSF made this recommendation, NDOR chose not to relax its specification, but instead maintained the pre-existing requirement that all wood posts be SYP DS-65 or better (this is a very high grade that is very costly). I suspect that the decision to retain the requirement for

DS-65 was, at least in-part, a reflection of NDOR dissatisfaction with the wood industry regarding its years long practice of supplying mill run quality SYP and certifying it as DS-65. Never-the-less, in response to the NDOR decision, the MwRSF did not include the recommendation for adopting Grade 1 SYP. Instead, as you can see the attached report remains silent on the issue of the standard for new wood purchases.

We stand by our original recommendation that NDOR adopt a wood post specification that requires Grade 1 or better SYP. We could even support adopting a requirement for Grade 2 or better SYP, provided this change came with a review and possible upgrading of wood post inspection procedures.

Response

Date: 05-29-2007

We have a couple of quick questions for you regarding minimum wooden post strengths/densities needed for guardrail. This subject area isn't my strong suit, but I have been asked to find out more info...so here are is a brief summary of the issue:

Currently NDOR specifies that, wooden posts must meet a minimum of 1600 psi. Suppliers are having extreme difficulty providing this grade of wooden posts, and they want to understand why we require a grade so much higher than AASHTO standards. Some folks assert that the 1600 psi post is necessary to retain expected performance, in crashes when the ground is frozen, others think that requiring this grade of post may be unnecessary, expensive and leads to the primary use of steel posts. Replacement posts are also currently required to meet this specification. What are your thoughts...is it necessary to require 1600 psi for the system to perform as designed? Do you know generally what some of the other MWRSF states require?

MGS Long Span with a Flared End Terminal

Question

State: IA

Date: 06-18-2007

With regards to the MGS Long Span, the TRB paper recommends installing tangent guardrail for 62.5' from the unsupported rail or 50' from the last CRT prior to flaring the guardrail. In addition, the overall system length is recommended to be 175' which makes for a minimum of 75' of guardrail from the end of the unsupported span or 62.5' from the last CRT.

If we want to install a FLEAT terminal on the system, following the flare guidelines forces the system length to be greater than 175'. Is this necessary?

Response

Date: 06-18-2007

The FLEAT has been tested in the flared region, so we know that the system works when impacted under NCHRP 350 conditions in the flared region. Our recommendation in the report was based on general flares for tangent end terminals that we had no real test data for. Because the FLEAT has been tested to 350 in the flared region, we believe that you can count it as part of the "tangent" length. The same would not be true for tangent terminals installed on flares.

That said, the second factor for this question deals with the overall system length needed for anchorage that you had touched on before. We cannot recommend system lengths less than 175' at this time. Thus you must have 75' outside the unsupported span or 62.5' outside of the CRT post for anchorage purposes. This is 12.5' longer than our flare recommendation. However, as mentioned above, the FLEAT is special as it was designed and tested as a flared system, and thus, we don't believe that the flare starting distance applies to the FLEAT. The anchorage length limit still applies however. Thus, the setup for an MGS long span installation with the FLEAT would require 37.5' of tangent rail adjacent to the unsupported span or 25' of tangent rail adjacent to the end of the CRT posts and then the 37.5' FLEAT terminal. This would yield the anchorage length required, but would waive the flare recommendation due to the use of the FLEAT.

Use of standard tangent terminals installed on recommended flares would require that the flare criteria be met, because these systems have not been tested on a flare. Also, these recommendations only apply with respect to the MGS long span and not the old version with nested guardrail. The old version with nested rail would require that both the flare and anchorage requirements be met due to the use of the nested guardrail, even for the FLEAT.

Temporary Barrier Tie-Downs

Question

State: IA

Date: 06-25-2007

My first, broad question is this: Do we have any recommended method for tying down temporary barrier to a concrete pavement/bridge deck that has been overlaid with asphalt? I've read some reports where tying down through an asphalt overlay is not recommended. But I haven't come across any reports that say such practice is allowed.

As a follow-up, do you believe that the asphalt pin tie-down could be used on a concrete pavement that has been overlaid with asphalt, if the pavement was first drilled (say with a 1.625" bit) down to the subbase to allow for pin penetration?

Finally, is it possible to constrain the barrier through the vertical bolt holes with drop-in anchors or screw-in anchors?

Response

Date: 07-02-2007

I have some short answers for your questions.

1. We have not tested any systems for tying down temporary barrier to a concrete pavement/bridge deck that has been overlaid with asphalt. The strap tie-down and the bolted tie-down will not work in this situation due to bending loads on the anchor bolts.
2. We do believe that the asphalt pin tie-down could be used with concrete pavement with an asphalt overlay. This would be stiffer than what we originally tested, but we think it is the best option at this time. The pins should not fracture, but would tend to bend and pull up. We do believe that they will constrain the barriers. Kansas DOT has asked about this previously and we have allowed it.
3. We do not believe that you can constrain the barrier through the vertical holes with drop-in anchors or screw-in anchors. Use of these types of anchors would result in the anchor having approximately 4" exposed inside the vertical hole. This would limit the anchorage depth for the screw-in anchors and would create large bending loads in both types of anchors that will cause them to fail and thus result in a loss of anchorage. The drop-in anchors or screw-in anchors also do not have the capacity of the larger threaded rods used in the bolt through design.

Response

Date: 07-11-2007

Do you have any recommendations on what size of drill bit should be used to pre-drill the concrete for the asphalt pin?

As a follow-up to my previous question " would it be feasible to use the asphalt pin tie-down directly on top of full-depth PCC pavement (no asphalt overlay)?

Response

Date: 07-24-2007

With regards to your first question about the size of the drill bit used for the asphalt pin, I would recommend that it be only 1/16" to 1/8" larger than the pin diameter. This would be a maximum bit size of 1.625". The hole in the pavement needs to be kept as small as

possible to make the pin engage as soon as possible during the impact. For installation, it may be easier to set the barriers down and then drill through the existing holes in the barrier as guides to make sure the pins will fit.

Your second question asked if it would be feasible to use the asphalt pin tie-down directly on top of full-depth PCC pavement. We think that this might be acceptable if it was just being used on a roadside installation, but we would rather see you use the bolted tie-down option we developed for concrete. This option has been tested and we know how it will perform. We think that the asphalt pins may work as well, but they will not provide as effective restraint as the bolted tie-down. We would definitely recommend using on the bolted tie-down on a bridge installation.
