Midwest States Pooled Fund Program Consulting Quarterly Summary

Midwest Roadside Safety Facility

10-01-2014 to 12-31-2014

Ragged edges in the guardrail slot

Question
Date: 10-07-2014

This is a picture from our field review. You can see the spur on this brand new GR just installed. I initially thought it was a rare anomaly. However we noted other locations on new installations a significant distance from this project.

You were saying these ragged edges can cause a focus point for the stress and recommend they be filed smooth. This appears that the slot just was not punched clean. I assume this slot was produced by the manufacturer and I guess if the field crew had to correct them, the manufacturer would be hearing from his client the contractor.

Attachment: https://mwrsf-qa.unl.edu/attachments/decf7198cea676d73bc4561499281914.jpg

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Response
Date: 10-08-2014
During the early development of the MGS, we fabricated field slots on site by drilling two holes spaced apart and cutting out the area between with a jig saw. At times, there would be a few rough areas or stress risers where the cuts met up with the radii. During crash testing, we observed some tearing around the slot when the bolt head pulled through the rail slot. I recall that we later required the use of a small die grinder to pass around the slot to remove any leftover burrs and smooth the slot. From this experience, we realized that the fabrication of the slot should not include rough/sharp edges or burrs in order reduce concerns for tears initiating in this region. See page 32 of the attached TRR from 2007. It is preferred that we have clean, smooth slots in the rail and near the bolts.

Special Tempoary Barrier Design

Question

State: IA
Date: 10-15-2014

We have a bridge repair project with a unique temporary barrier need. The work involves replacing some finger joints on a river bridge. To do the work they need to have a 6 foot wide 1 foot tall work area at the bottom of the barrier. I have attached a PDF file that shows what they are proposing. The design has some concerns for me. I recommended that they use our H pile temporary barrier since it would be able to span over the work area. The designers felt that would not give then enough vertical clearance to get the finger joints in and out. The bridge is pretty narrow so they do not have the option of moving the barrier further over. They are also in a pretty big hurry to get this sorted out as their letting is in January. Would you be able to assist us with a design for this situation?
Attachment: https://mwrsf-qa.unl.edu/attachments/61cd6d6d26b92f9c121a53a250157e01.pdf

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Response

Date: 10-15-2014
I am trying to get the installation straight in my head.

1. It appears that you have temporary barriers on the far upstream and far downstream ends. Are these free-standing or anchored?
2. Next you have two types of “special barrier “ sections. Are these temporary barriers as well? Are they anchored or free-standing? What are the connections between the barrier sections.
3. On page 2, the special barrier sections appear to hang of the edge of the road surface? Is this correct or is the road surface only removed at the 6 ft opening?

Thanks

Response

Date: 10-15-2014

Please see my responses below. Thank you for you assistance.

Hi Brian,

I am trying to get the installation straight in my head.

1. It appears that you have temporary barriers on the far upstream and far downstream ends. Are these free-standing or anchored?

I understand they are not anchored to avoid holes in the bridge deck and they are not close to a drop off.

2. Next you have two types of “special barrier “ sections. Are these temporary barriers as well? Are they anchored or free-standing? What are the connections between the barrier sections.

As above, I think these are not anchored. They are temporary barriers. One section is right in advance of the spanned are and the other one is outside the spanned area. I assume they are similar to our standard F shape barriers. I can ask for connection details if you like.

3. On page 2, the special barrier sections appear to hang of the edge of the road surface? Is this correct or is the road surface only removed at the 6 ft opening?

he road surface is only missing for the 6 foot section through the finger joint and only for half of the roadway.

Thanks

Response
Date: 10-16-2014

Thanks for the responses.

I have reviewed the detail you sent. In general, I think that the proposed solution can be made to work. I have a some comments and thoughts.

1. TTI recently designed and tested a median barrier gate that uses a tubular structure that is hinged to protect an opening in a permanent concrete median barrier. This system is somewhat related to what you are proposing, but it was for permanent barrier. The sizing and connection details may be useful.

    a. http://tti.tamu.edu/documents/9-1002-2.pdf

2. There are other gate systems such as the Armor Guard system that could be applied. However, it sounds like you need some clear area under the opening that these systems will not provide.

3. The tubes in your system are 8"x8"x5/8" tubes. These have slightly lower bending capacity than the TTI design which used 12"x12"x1/4" tubes. However, that is not believed to be an issue due to the shorter span length in your design.

4. The attachment of the tubes near the end of the concrete barrier appears to be done using a bent plate over the front of the tubes and some bolted brackets. It appears that this might be able to be simplified and made safer. The current bent plate bracket would have potential for vehicle snag on the vertical edge of the bracket. I have proposed a revised detail with at bent plate behind the tubes. The tubes would be welded to this plate and the plate could attach to the barrier at several locations. This would reduce vehicle snag and provide for a more positive attachment to the barrier.

5. There will likely need to be additional attachments from the tubes to the barrier than the two shown adjacent to the opening. In order to prevent the tubes from flexing or prying off of the face of the barrier we would recommend additional attachment of the tubes near the tapered ends. You may want to have an additional set of attachments near the start of the tube taper. It is best to be conservative in the attachment scheme given the system is not crash tested. You could use the an attachment similar to the one shown above. Alternatively, you could through bolt through the tubes and barrier in the tapered region as shown below.

6. The current configuration shown has tubes on only the impact side face of the barrier. While this does provide the redirective surface for the impacting vehicle, it is not optimal in terms of developing continuity across the barrier opening. For a system like this, you want to have the barrier act like a continuous unit across the gap. This means development of shear, tension and compression loads. Placement of the tubes on the front side only will handle the shear and compression, but may not be as effective in development of the tensile bending stresses between the barriers. The tubes you have are very strong, so their capacity along may be sufficient to develop continuity as long as they are very effectively anchored to the concrete barriers. However, it may be better to place tubes on the front and back side of the installation or a steel plate across the backside of the installation in order to create a stronger span that engages more effectively with the TCB on each end.

7. Another concern would be snag of the vehicle on the tow of the concrete barriers you have shown. Currently you are transitioning from the sloped face TCB to at partially vertical face for mounting the tubes. However, the barrier tow that remains can be a significant snag hazard that can cause rapid vehicle deceleration and instability. We would recommend removal of the barrier tow and conversion to a purely vertical shape with the tube offset front the barrier sufficiently to prevent snag on the end of the concrete barriers.

8. The steel tubes are currently tapered down at the ends to prevent snag. The taper shown is approx. 4:1. We would taper it more gently. An 8:1 or shallower taper is more appropriate.

9. A simpler option for the design may be a specialized concrete barrier segment in lieu of the steel tubes. You could place the vertical cutout needed at the base of the barrier and not have to deal with all of the attachment concerns with the steel. The concrete section would need to have flared back sections on the ends of the vertical opening to prevent snag on exposed concrete. We do this on open concrete bridge rail posts and approach guardrail transition parapets.

10. Depending on the type of connection used, the size and weight of the barrier segments, and the potential speeds and impact angles in this area, we would expect this type of system to deflect a significant distance when impacted. TL-3 displacements have been over 2 meters for MASH tests of F-shape TCB systems. Thus, you will need to consider the barrier displacement and worker exposure and positioning in the design. If sufficient displacement distance cannot be achieved, one would need to consider anchoring of the barrier system.

Take a look at these comments and let me know if you have questions or want to discuss things further.

Attachment: https://mwrsf-qa.unl.edu/attachments/269e1514e89d03366eef26a3e7228265.png

Attachment: https://mwrsf-qa.unl.edu/attachments/afd69e5cc45e2de755a9dd5512a9b3fc.jpg

Attachment: https://mwrsf-qa.unl.edu/attachments/ba5a6f8ce17effa4956004477644fff9.jpg

Attachment: https://mwrsf-qa.unl.edu/attachments/a6f2473298e1a37b31ea5f6777d13f18.jpg

Attachment: https://mwrsf-qa.unl.edu/attachments/0b7d6076e1f2971d41c044e83cdd2f46.jpg

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Response
Date: 10-17-2014

Thank you very much. You touched on all of the things that were giving be concern. I will pass this along to our consultant. If they have additional questions I will send you another note. The quick turnaround is greatly appreciated.

MGS Box Culvert Mounting

Question

State: NE
Date: 10-24-2014

Implementation of MGS mounted to culvert parapet.
I need to shorten the top mount.
The NDOR typical parapet is only 8" wide.
There should be more concrete behind this threaded rod from the top.
What should the strap length be?
Should the cover over the threaded rod be 2"? or centered in the parapet

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Response

Date: 12-09-2014
For the culverts in which the headwall is narrow (yours are 8"), I would not utilize the top-mounted, single-anchor design to attach the socket to the outside of the headwall. For that design, it's important to maintain the 7" anchor offset from the outside face to prevent concrete damage. Unfortunately, that will not leave you enough concrete cover on the inside of the anchor, 2 inches is recommended. We never designed the top mounted attachments for offsets less than 7".

However, you could utilize either the wrap-around design, or the side-mounted design (through bolt). See pages 36-41 of the report (TRP-03-277-14) for the design details of these attachment options. The only difference you would need to make is the length of the strap or bolts to reflect the correct headwall width.

Note, although only 2 of the 5 design concepts were included in the final drawing details, MwRSF has confidence that all five of the concepts provide adequate strength to support the system. Thus, any of the five concepts can be utilized to satisfy the installation needs of existing culverts.

Adaptations for w-beam attachment to culverts

Question

State: NE
Date: 10-27-2014

I need to shorten the top strap for the MGS mounted to culvert parapet.The NDOR typical parapet is only 8" wide.What is the correct offset behind the threaded rod anchor?Should the cover over the threaded rod be 2"? or centered in the parapet? What should the strap length be?

Attachment: https://mwrsf-qa.unl.edu/attachments/b37e3c954fd29e5135ca67a6504e6129.pdf

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Response

Date: 10-27-2014

For the culverts in which the headwall is narrow (yours are 8"), I would not utilize the top-mounted, single-anchor design to attach the socket to the outside of the headwall. For that design, it's important to maintain the 7" anchor offset from the outside face to prevent concrete damage. Unfortunately, that will not leave you enough concrete cover on the inside of the anchor, 2 inches is recommended. We never designed the top mounted attachments for offsets less than 7".

However, you could utilize either the wrap-around design, or the side-mounted design (through bolt). See pages 36-41 of the report (TRP-03-277-14) for the design details of these attachment options. The only difference you would need to make is the length of the strap or bolts to reflect the correct headwall width.

Note, although only 2 of the 5 design concepts were included in the final drawing details, MwRSF has confidence that all five of the concepts provide adequate strength to support the system. Thus, any of the five concepts can be utilized to satisfy the installation needs of existing culverts.

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hardened verses unhardened washers for beam guard

Question

State: WI
Date: 11-06-2014

We had project where the contractor supplied unhardened washer for bolting the rail to the post on normal MGS.

I was trying to determine if unhardened washers are acceptable. If they are what material spec should be used?

Response

Date: 11-07-2014

We do not require any washer under the nut where the guardrail bolt attaches to the post flange. In fact there are no washers at all on the standard steel post versions of the MGS that have been full-scale crash tested. That said, there would be no adverse affect of including a washer between the nut and the flange on the back of the post.

The wood post version of the MGS does use a washer under the nut on the back of the post. The washer used is the ASTM F844 washer typically specified with the A307 post bolt.

Question on our BA-100 Standard Road Plan

Question

State: IA
Date: 11-19-2014

We have a situation due to the recent cold weather that the epoxy holding the pins in the pavement froze, well below 20 deg. It is unclear what pullout strength these pins will provide. Do you know what pullout strength would be required by the design? My assumption was that the pin mainly functions as a sheer device but Chris Poole told me it does serve a pullout propose too. We are trying to decide what length we need to go to correct the situation. The RCE is going to talk to the manufacture to see if the epoxy will develop sufficient strength once it is warmed up. If that does not turn out favorably and the pullout strength is important to the design, what would recommend to for correcting the problem with the barrier in place? Thank you in advance.

http://www.iowadot.gov/design/SRP/IndividualStandards/eba100.pdf

Attachment: https://mwrsf-qa.unl.edu/attachments/a6a1e054d63a13c8ece2767908f6edc7.png

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Response

Date: 11-19-2014
We have looked briefly at the attached detail and have some thoughts.
1. What test level is this barrier designed for?

2. In looking at the design, the height, width, and reinforcement of the barrier suggest that the barrier would likely be sufficient to withstand TL-3 and TL-4 level impacts without counting on contributions from the epoxy adhesive anchors. If TL-5 is the target, we would need to perform additional calculations regarding the capacity.

3. If it turns out that the epoxy will not set following a warm up and additional capacity is required, the simplest solution for providing additional capacity would be to provide a 2" deep asphalt keyway on each side of the barrier. We have done similar setups in the past and they have worked acceptably.

Let me know if you need more information.

Response

Date: 11-19-2014
This is a TL-4 rail, so it sounds like we will be OK even if the epoxy does not make full strength. Thank you for getting back to me on this so quickly.

Extra Blockout on Steel Post Transitions to Bridges

Question

State: IL
Date: 11-25-2014

We have a question regarding the use of extra blockouts in a steel post transition to a bridge parapet. The subject location has an existing manhole with a conical top section that interferes with driving the second, third, and fourth posts from the end of the bridge parapet. These posts spaced at 1 ft 6 ¾ inches. A copy of our Highway Standard 630031 is attached, and depicts the particular bridge transition design. Also, several photos are attached that show the bridge rail transition, the curb alignment around the edge of the existing round inlet grating, the conflicting manhole, and the area immediately behind the curb. Please note that in photo "image009.jpg" the posts that are not driven, near the left side of the photo will be driven according to plan after some conflicting sleeper slab is removed at the joint of the bridge approach slab and the pavement.
It does appear feasible to add blockouts to produce a total offset from the back of the doubled thrie beam to the face of post of 24 inches (3 @ 8 inch blockouts or 2 @ 12 inch blockouts).

We have searched the consulting website for similar questions, but do not find one that is right on target for this issue. We do find the following:
June 15, 2011, ID = 205. Question about use of triple 8 inch steel blockouts in transition. This question is similar to our case, but is applicable to a w-beam section rather than the thrie beam application on our Highway Standard.
November 5, 2010, ID = 267. Question regarding use of extra blockouts in a run of guardrail (MGS.) This question is for guardrail, rather than bridge transition.
September 7, 2006, ID = 456. Question regarding use of extra blockouts in a w-beam transition to a bridge rail. The response acknowledges use of triple 8 inch blockouts with a thrie beam transition. However, this information is form 2006 and predates several changes to the bridge transition.

Our proposal is to use triple 8 inch blockouts or double 12 inch blockouts at posts 2, 3 ,and 4. Also, we have discussed ideas to compensate for possible increased deflection here:
- Adding a section or nested section of thrie beam rail across the backs of these three posts.
- Adding some form of diaphragm between the extended blockouts of posts 2, 3, and 4 (cross bracing, solid wood blocks, etc.)

Thanks for your help in advance.

Attachment: https://mwrsf-qa.unl.edu/attachments/b67ef7a3109803959388af95d60ea96e.zip

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Response

Date: 12-02-2014

In the past, we have considered the use of deeper blockouts in limited cases dependent on system in question. We have used 16" deep blockouts in certain systems, but we have not used 24" deep blockouts in system due to concerns that the additional blockout depth may begin to affect the way the guardrail post is loaded and may increase the potential for later-torsion buckling of the post rather than the desired post loading modes of strong axis bending and rotation of the post through the soil. As such, we have limited these extended blockouts to a single post in a run of guardrail in order to deal with obstacles or other issues.

As you noted in the message you sent, we have allowed deeper blockouts in approach guardrail transitions in the past. The concern for altering the post loading is less prevalent for the transition posts as they tend to be closer spaced and deflect less, which lowers the concern for buckling of the post.

Thus, we believe that it would be possible to use large blockouts for post nos. 2-4 shown in your detail without adversely affecting performance due to the special circumstance you are faced with. However, for general installations we would recommend using the tested configuration as the use of the deeper blockouts has not been formally investigated or tested.

We have conducted research for WisDOT in the past on a related issue of spanning obstacles in a transition and came up with some potential solutions. Take a look at the report below. There is an option in it for deeper blockout posts with a beam spanning the gap that may work for you as well.

http://mwrsf.unl.edu/researchhub/files/Report5/TRP-03-266-12.pdf

A couple of other items to note. First, I am not familiar with the curb section that you are using with the transition. I believe this transition was testing with a 4" wedge curb. As such, other 4" curbs may work with the transition as well, but higher curb sections may require further investigation for use in the transition. The exact dimensions are not listed on the detail.

The detail you have shown also appears to be longer than the transition sections we have tested to MASH with the MGS system. You may have a rational for using a longer transition section, but I wanted you to be aware that the transition may be able to be shortened.

http://mwrsf.unl.edu/researchhub/files/Report38/TRP-03-210-10.pdf

Thanks

TL-2 Combination Rails

Question

State: WI
Date: 12-05-2014

Do you know of any TL-2 combination railings that are crash tested?

We have a municipality that wants to place a TL-2 combination railing about 2' behind vertical curb on a 25 mph roadway.

I was asked to come up with some alternatives that are similar to what they propose and other alternatives (i.e. no barrier, move barrier face to curb face…).

Thanks,

Response

Date: 12-08-2014

I don't know of any test TL-2 combination bridge rails offhand.

We have done or have seen related research in the past that Illinois is currently using.

In 1998, the MwRSF developed and full-scale crash tested a combination traffic / bicycle bridge railing to TL-4 of NCHRP Report No. 350. The bicycle railing consisted of steel posts and rail segments mounted to a 32-in. tall New Jersey shaped concrete barrier. The barrier system utilized steel cables strung through the longitudinal rail elements to retain fractured railing segments during severe impact events. However, during crash testing, numerous spindles were broken free from the larger longitudinal tubes.

Another research effort was conducted regarding pedestrian railings for Missouri Department of Transportation. Two combination traffic/bicycle bridge railings with horizontal, tubular steel rails for use on a rigid, single-slope, concrete barrier were designed, constructed, and full-scale vehicle crash tested according to NCHRP Report No. 350. The first test consisted of a 2,015-kg (4,442-lb) 1998 GMC C2500 pickup truck impacting at an angle of 25.6 degrees and at a speed of 101.5 km/h (63.1 mph). The pickup snagged on the longitudinal rails during climb and eventually rolled, resulting in test failure. For the second test, modifications were made to the system in an attempt to reduce vehicle penetration and prevent rolling. The second test was also conducted with a 1998 GMC C2500 pickup truck. The pickup weighed 2,029 kg (4,473 lbs), and impacted the system at an angle of 25.6 degrees and at a speed of 102.7 km/h (63.8 mph). Once again, the pickup snagged as it climbed the barrier, resulting in vehicle roll and unsatisfactory results. The results indicated that the barrier system is not suitable for use on Federal-aid highways. However, it was noted that modifications could be made to the system in order to increase its chances of successfully meeting the requirements specified by NCHRP Report No. 350. One change was the use of an increased lateral offset for positioning the posts and rail farther away from the back side of the concrete barrier.

In 2013, the Illinois DOT began to develop a parapet-mounted bicycle railing system. Although Illinois DOT initially sought to utilize the barrier previously developed by MwRSF, concerns about the steel cables and vertical spindles led them to develop a new railing design based that combined the two combination traffic/bicycle rail systems described previously. The new design eliminated both the cables and the spindles while still satisfying AASHTO, FHWA, and Illinois specifications for bicycle and pedestrian railings. The steel rails were mounted and offset from the back of the parapet such that the rail faces were positioned 13-in. away from the front-top corner of the concrete parapet. Since this offset is greater than the Zone of Intrusion for TL-2 concrete barriers, MwRSF recommended its implementation as a TL-2 barrier without full-scale crash testing.

TTI has done several other TL-2 bridge rail tests, but I don't have all of the details for those. You may want to check the TF 13 bridge rail site and the 2006 FHWA bridge rail book (red).

http://www.aashtotf13.org/Bridge-Rail.php

http://guides.roadsafellc.com/bridgeRailGuide/index.php?action=view&railing=78

Let me know if you anything else.

Attachment: https://mwrsf-qa.unl.edu/attachments/374db1760e2d44b23077e6cf7c739f21.pdf

54 Inch Concrete Barrier

Question
State: WY
Date: 12-10-2014

We have a single slope barrier from Caltrans that is 56" tall. But I don't believe that it has the vertical reinforcement required for pier protection.

In most cases, we have convinced our structures department and FHWA to hardened new structures for the large truck impact loads. It is cheaper to do and less of a hazard to the driving public.

Response
Date: 12-10-2014

Does anyone
have any details for a 54 inch single slope barrier they would care to share
with me?

Response
Date: 12-10-2014

It's not quite a single slope barrier, but here are details for the (almost) vertical shape with head ejection criteria that we've used.

Attachment: https://mwrsf-qa.unl.edu/attachments/b8f0046bda78516614b3c49b61bda646.pdf

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Response
Date: 12-10-2014

I would like this information as well, as we are looking to create a 54" (TL-5) single slope bridge pier protection design for Ohio...

Florida has a 54" safety shape design.http://www.dot.state.fl.us/rddesign/DS/10/IDx/411.pdf

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Response
Date: 12-10-2014

I have attached a link to a previous question on this topic from the Q&A website (ID #360). The drawings are of a 54" F-shaped concrete barrier with a footing for both interior and exterior sections. It was designed

specifically for pier protection appilications (hence the footer). This could easily be converted to a single sloped shaped as long as the reinforcement remained the same (bar size, number of bars, and stirrup spacing) and the top with remained the same. I will caution against using this design as a vertical-faced barrier as the base would be narrow and may not provide enough over-turning moment strength.

http://mwrsf-qa.unl.edu/view.php?id=360

Response

Date: 12-10-2014

Our median barrier meets the criteria, but we were looking for a roadside version. Our structures folks also plan to reinforce new structures to avoid the need for such a barrier, but we do still have bridges that don't have redundant piers, so those will require the protection.

Response

Date: 12-10-2014

What is the intended purposed for the 54" barrier? Is it for pier protection or glare screen/barrier combination?

We are currently working on new standards for single slope barriers and bridge rails. We are using the Texas (10.8 - 11 degree) sloped barrier. The heights will be 36", 42" and either a 54" or a 56".

The purpose of the 54" or 56" height is for a permanent glare screen on top of a barrier, not pier protection. Our current f-shaped concrete median barrier is 56" and our bridge version is 54", so we are currently trying to reconcile the two.

Bottom line, we will have (54" or 56") single slope, bridge rail and median barrier designs to share soon, but they will not be designed for pier protection. We will likely be considering them all MASH TL-4 barriers.

Response

Date: 12-10-2014

Thank you all for your valuable input. I may have a few questions as the day goes on, but want to answer Mike's question first. This barrier is intended for bridge pier protection. In general, our bridge designers are designing to the LRFD loading (600 Kips I think), but as Maria said, we have many existing structures which are not and some are in vulnerable locations. We have used 42 inch single slope barrier in the past with the

Texas slope design, but we are curious if we should switch to either the steeper Caltrans design (9% ??) or Iowa's more vertical face with head ejection criteria. I am not aware of head ejection being an issue with the Texas Design, at least for a 42 inch high barrier, but am curious if the Caltrans design is more at risk for head contact. Maybe **Scott** could weigh in on this. I am a little concerned about the Iowa design being more difficult to construct, and also if the second, flatter face may allow tankers to slide up over the barrier? Also, it may be harder to transition down to 31 or 32 inches to connect to a crash cushion or MGS barrier. Maybe **Scott and Chris** could weigh in on these issues.

Response
Date: 12-10-2014

I would agree that Iowa's vertical-faced barrier is probably more difficult to construct than a single-slope shape due to the multiple angles. For this same reason, it may be slightly more difficult to transition down to a shorter height barrier. Having said that, however, the contractor on our first installation was able to construct the barrier and the transitions in accordance with our plans, and the end result looks good. I can't really comment on the barrier's ability to redirect a tanker truck, as it's my understanding that 90 inches is the minimum height needed to redirect such a vehicle.

Response
Date: 12-10-2014

Head ejection with the Texas version of the single slope barrier is tough to estimate. Some tests have the vehicle ride a bit up the slope and cause the vehicle to roll away from the barrier. Other tests show the vehicle tires staying down and the vehicle rolling slightly toward the barrier. The risk of head slap is definitely less with the Texas single slope than it would be for more vertical shapes. The magnitude of this reduction… I don't have a good answer for.

Response
Date: 12-10-2014

Was vehicle stability good in all of the tests you saw as the vehicle comes off the barrier (Texas design)?

Response
Date: 12-10-2014

I don't recall any vehicle rollovers, only a couple of pickup tests that had >25 degree roll angles. Textured single slope barriers have caused vehicle instabilities for the CA single slope. I would assume the same results would occur for textured TX single slopes.

Response
Date: 03-05-2015

I am a little late on the response but we do not have the single slope barrier. Below is what our bridge staff uses.

Attachment: https://mwrsf-qa.unl.edu/attachments/240da23d56e5b3c6c15bdea36494be54.png

54â€• Concrete Barrier

Question

State: IA
Date: 11-30-2009

IADOT needs the following:

-54-in. tall, single-face, reinforced concrete parapet with foundation system for use in shielding bridge piers according to AASHTO 3.?.?
-reinforcement design for the interior and end locations of wall and foundation
-design based on WsDOT report and other more recent TL-5 barriers with reinforced footings/grade beams/slabs

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Response

Date: 11-30-2009
See the attached PDF file for a simplified drawing for a 54" tall, F-shape, TL-5 barrier. A few notes:

1. The only difference between the interior and ends sections for the barrier is the reduction of stirrup spacing from 9" to 6".
2. All longitudinal steel should be evenly spaced
3. 10 of 12 longitudinal steel bars in the interior footing can continue through the end section footing as well. The remaining two bars should be extended at least 2 feet into the end footing.
4. The end section shows the barrier positioned on the front of the footing, but it could be placed on the backside of the footing as well.
5. Other footing dimensions can be created to provide adequate strength, however the steel reinforcement may need to be reconfigured.

Attachment: https://mwrsf-qa.unl.edu/attachments/6b056c85523dc7c21fc7aa48f145d9f8.pdf

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Response

Date: 12-11-2014
here is a related 54" concrete barrier, near vertical shape with head ejection considerations
Attachment: https://mwrsf-qa.unl.edu/attachments/f9593b049273d48b9b9700edeeb06476.pdf

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2" lip on bridge rail

Question

State: NE
Date: 12-11-2014

Is there a good solution to updating the 2" concrete lip on bridge rail?

Could This be filled with grout? Or steel plates? Cardbored?

Attachment: https://mwrsf-qa.unl.edu/attachments/7d0ee28e522b4f7def0d2f5c9b204503.jpg

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Response

Date: 12-15-2014

When one raises the thrie beam end shoe off of the concrete surface and depending on the method, the threaded bolts could be loaded to a higher stress level due to combined bending and shear. I believe we have in the past used a higher grade of steel when using fabricated steel offset plates on sloped parapets. An offset late could be used but one would want to consider higher grade bolts and hardware that reduces bolt bending and maintains more shear loading. A concrete fill region could be used but may be difficult to cast/bond to old concrete. Reinforcement should be used in this scenario to help anchor the new concrete surfacing. I am not sure how successful this option would be for long-term durability and impact loading that may shatter off concrete patch. The cardboard option is not acceptable.

For new construction, I would eliminate the recessed region.

Review of Standard drawings: 7470 - Guardrail Attached to Culvert

Question

State: NE
Date: 12-19-2014

We have developed a new standard for guardrail attached to culvert based on recent MwRSF research. Can you please review the details and provide comments.
Attachment: https://mwrsf-qa.unl.edu/attachments/dd6aefdf4b4d86c4724ceadf335f9a10.pdf

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Response

Date: 12-22-2014

I have reviewed the attached drawings and have the following comments/edits,

Sheet 1:

- The spacing between the first S3x5.7 post (in socket on culvert) and the adjacent W6x9 post (standard line post in soil) can be either 37.7" or 75". The wider spacing may allow installations to avoid conflicts with W6x9 posts and concrete structures such as wing walls.

- The cross section view shows a standard line post and blockout configuration, but is labeled as an S3x5.7 post. The line posts (in soil) should remain the standard W6x9 posts. The S3x5.7 posts are placed in sockets which are attached to the culvert, and do not utilize blockouts.

- The notes section call out guardrail bolts for standard line posts. The rail attachment bolts for the bridge rail (and this culvert attachment) are 5/16" dia. A307 bolts. Further a 1.75" square washer (1/8" thick) is utilized between the bolt head and the face of the rail.

- The weak-post bridge rail should have backup plates between the posts and the rail. The original bridge rail was tested with 6" backup plates (6" long sections of W-beam). However, as discussed during the Dec. 17th pooled fund meeting, MwRSF will be recommending utilizing 12" long backup plates for all weak-post guardrail variations due to the consistent occurrence of rail tears forming during crash testing at both TTI and MwRSF. Oversized holes/slots will need to be cut into these 12" backup plates to fit over the splice bolts for the post locations that coincide with rail splices.

- Note section should also indicate that any of the 4 designs on sheets 3-6 are acceptable for use. All utilize the same post, just the attachment to the culvert is different.

- A note should be added to specify an epoxy with a minimum bond strength of 1,300 psi.

Sheet 2:

- The post length should be 44", not variable
- The post details on the right again show a standard line post to guardrail attachment (12" blockout and 5/8" bolt). This detail needs to be replaced with the 5/16" bolt, square washer, and 12" backup plate as discussed above.

Sheet 4:

- May want to add total length dimension of 9" (top to bottom) for top mounting plate.

Sheet 5:

- The 5-13/16" dimension should be from the bottom of the top plate to the center of the hole. The dimension as drawn (bottom of top plate to absolute bottom of plate) should be 7-5/16"

Sheet 6:

- The welds on the top plate gussets (shown on “top view") should be ¼" fillets. 3/8" welds are too large for ¼" thick plate.

Low Tension Cable - Post no 2/ Slip Base

Question

State: NE
Date: 12-22-2014

I suggest a change to the bolts on post no 2 on the low-tension cable system.

Could we install the bolts with the nuts on the top side of the “slip Base" plates?

This would help with replacement when damaged.

Attachment: https://mwrsf-qa.unl.edu/attachments/5b149816c81a3d387134a1a3e6e7d2e6.jpg

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Response

Date: 12-22-2014

I do not see a difference with the bolts oriented 180 degrees from the current configuration as this change should not affect their ability to slip out of the base.
