Midwest States Pooled Fund Program Consulting Quarterly Summary

Midwest Roadside Safety Facility

01-01-2011 to 04-01-2011

31" Guardrail End Treatments - Non-Proprietary

Question

Date: 01-07-2011

My colleague in our West Virginia office has been asked by WVDOT if there are any generic end terminals for the taller w-beam systems. Are any special modifications needed for Buried-in-Backslope terminals for 31-inch systems? Would a TL-2 MELT be OK at 31 inches? Thanks for any thoughts you might have on the issue.

Response

Date: 01-14-2011

Recently, Ed Demming of the CFLHD in the Denver area asked MwRSF to evaluate or estimate the height tolerances for some existing barrier systems covered in their standards plans. I recall that the Buried-in-Backslope Terminals were in that group and maybe the TL-2 MELT. When I get to that review, I will make sure to copy you on the results as I assume that this inquiry has potentially arisen from the same FHWA directive.

In any event, I am currently unaware of an existing, 31" tall generic guardrail end terminal.

Response

Date: 01-20-2011

Gentlemen, what guidance should we give the states when they ask for generic 31" end treatments? Are we asking them to go to 31" while not offering a crashworthy end treatment?

Hamilton Duncan, P.E., P.G.
Safety Engineer - FHWA West Virginia

Response

Date: 01-20-2011

There are many options available:

1) The state may specify that a crashworthy 31-inch end terminal be used. Proprietary designs will be provided.
2) The state may wait for MWRSF to offer guidance on existing generic terminals. The Division Office may allow them to wait.
3) The state may pay for development and crash testing of a 31-inch generic terminal.
4) The state may join a pooled-fund group and vote for generic 31-inch terminals to be developed and tested.
5) The state may use 27 ¾ inch high generic terminals and transition to 31-inch rail height.

Nick

Nicholas Artimovich, II
Highway Engineer, Office of Safety Design

Response

Date: 02-15-2011

Last month, I was copied on a discussion or inquiry regarding whether existing non-proprietary guardrail end terminals could possibly be adapted for use with 31-in. high, W-beam guardrail systems. The noted terminals included: (1) the buried-in-backslope terminal [FHWA acceptance letters CC-53 and CC-53A] and (2) the CST or cut slope terminal [no FHWA acceptance letter].

BURIED-IN-BACKSLOPE

Testing and Evaluation of W-Beam Guardrails Buried-In-Backslope – November 1996 – Arnold, Buth, and Menges
Testing and Evaluation of W-Beam Guardrails Buried-In-Backslope – January 1999 – Arnold, Buth, and Menges

Two TL-3 pickup truck crash tests were successfully performed on the guardrail terminal according to test designation no. 3-35 using the NCHRP Report No. 350 safety performance criteria. For these tests, the terminal attached to metric-height, W-beam guardrail located downstream of the terminal region. The first test occurred on a barrier system placed in combination with a 1:10 approach slope as well as a flat bottom ditch. The second test occurred on a barrier system placed in combination with a 1:10 approach slope, a V-ditch, and a drop inlet. Both barrier systems were anchored into an upstream 1:2 backslope using a reinforced concrete anchor block. A W-beam rubrail was utilized across the ditch sections.

Crash Test of the G4 W-Beam Guardrail with Terminal Buried-In-Backslope – March 1998 – Buth, Menges, and Arnold

One TL-3 pickup truck crash test was successfully performed on the guardrail terminal according to test designation no. 3-35 using the NCHRP Report No. 350 safety performance criteria. For this test, the terminal attached to metric-height, W-beam guardrail located downstream of the terminal region. The test occurred on a barrier system placed in combination with a 1:6 approach slope as well as a V-ditch. The barrier system was anchored into an upstream 1:4 backslope using a post end anchor system. Longer post lengths (i.e., 8 ft) were used throughout the ditch region. A W-beam rubrail was utilized across the ditch section as well.

NCHRP Report 350 Assessment of Existing Roadside Safety Hardware – November 2000 – Buth, Menges, and Schoeneman

The test results reported in the March 1998 document noted above were also contained herein.

Another TL-3 pickup truck crash test was successfully performed on the guardrail terminal according to test designation no. 3-35 using the NCHRP Report No. 350 safety performance criteria. For this test, the terminal attached to metric-height, W-beam guardrail located downstream of the terminal region. The test occurred on a barrier system placed in combination with a 1:4 approach slope as well as a V-ditch. The barrier system was anchored into an upstream 1:2 backslope using a post end anchor system. Longer post lengths (i.e., 8 ft) were used throughout the ditch region. A W-beam rubrail was utilized across the ditch section as well.

Discussion

Within the FHWA-TTI crash testing programs noted above, only test designation no. 3-35 was performed. No 2000P crash tests were performed closer to the upstream end but instead were run downstream from post no. 8. In addition, no small car crash tests were conducted along the terminal length placed with a V-ditch.

As such, it is difficult to form a complete opinion regarding the adaptation of the Buried-In-Backslope Terminal to 31-in. tall guardrail in the absence of tests that were not performed or impact locations which were not evaluated. Based on the results from the prior 2000P tests and using identical impact locations, it would seem reasonable that a slightly taller barrier would remain capable of redirecting the pickup truck (3-35). The upstream tension anchorage systems for the W-beam rail may require slight modifications to account for the raised rail height, reduced embedment, and decreased post-soil forces. In addition, some consideration may be necessary to evaluate whether the rubrail should remain at its current height or whether it is preferred to incorporate a similar height increase of 3.25 in. to mitigate any potential concerns for small car underride and/or post snag in ditch section. I suspect that a 3D plan of a modified terminal system and roadside geometry may help to alleviate any of these concerns.

Alternatively, the current Buried-In-Backslope design could be left alone. Instead, the metric-height W-beam guardrail located downstream and tangent to the roadway could be vertically transitioned in height to match up with 31-in. tall guardrail. The height transition could easily occur over a 50 ft segment length of barrier.

CST – CUT SLOPE TERMINAL

At this time, I am unable to find any crash testing programs corresponding to the CST system. From a WvDOT CAD detail, it is apparent that the CST system does not utilize a rubrail nor provides similar anchorage to that utilized in the systems described above. As such, there are concerns with the existing design that would not be mitigated by raising the rail height to match that of 31-in. tall guardrail. If by chance the CST design has demonstrated a satisfactory safety performance, then the tangent region downstream of the flared terminal section could also be adjusted using a height transition similar to that noted above.

If you have any questions regarding the information noted above, please feel free to contact me at your earliest convenience. Thanks!

P.S. – If new information does become available, it may be necessary to revise or restate my opinions noted above.

Response

Date: 03-31-2011

Thanks for your discussion of the buried in backslope. Until someone conducts crash testing on a 31-inch version we will recommend that the crash-tested version be installed, and then the height of rail be transitioned up to the LON height as you have noted.

I am copying Will Longstreet on this as he will be at the Pooled Fund meeting next month. I will suggest that he bring up the subject of generic terminals for 31 inch barriers (unless someone else beats him to it.)

Nick

Nicholas Artimovich, II
Highway Engineer, Office of Safety Technologies

Snow Gate Modifications â€" Additional questions

Question

State: KS
Date: 01-10-2011

Would you please provide your thoughts on the additional snow gate modifications proposed by our field staff? If the sleeve is not used, is there a minimum length of post?

Attachment: https://mwrsf-qa.unl.edu/attachments/40bc0ee785acc84f1e12acf6e51b4a85.pdf

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Response

Date: 01-12-2011
I have added some comments below in green.

1. I do not think the road closed sign needs to be hinged.

   (Since the "Road Closed" sign will not be facing the motorist when the gate is open, I agree with a non-hinged sign.)

   The hinge on the road closed sign is not an impact safety performance issue. As such we are okay if the sign is not hinged.
2. Gregg does not want us to drill holes in the gate tubing so I think we can use "U" bolts.

   (I am hesitant to approve "U" bolts since the NCHRP testing did not include "U" bolts. I will copy Scott King and Rod Lacy on this as they are our testing gurus.)

   I see no issue to using u-bolts attach the sign to the tubing as long as the capacity of the u-bolt is equal or greater than the bolts used in the original design.
3. I need someone's input on the 5' sleeve for the hold back post. Do we need this AND it we use an existing
   4x4 sign post with or without the sleeve is that OK?

   (My recommendation is to follow the design as tested.)

   With regards to the hold back post, the post is designed to fracture when impacted. As such, any alternative configuration would need to have a develop loads when impacted similar to the 4x4 post in the foundation tube used in the original design. Thus, we would not recommend a hold back post with greater strength than the one that was tested. If you would rather not use the foundation tube, then we would recommend that you embed the hold back post 5' such that is has similar resistance to rotation in the soil as the tested setup.
4. We want to put multiple locks on the snowgate, for multiple agencies. I think we could put the angle iron shelf on the post with both top and bottom using a threaded stub so a nut/wing nut can be run down to hold the gate tight in the wind " then a chain with multiple locks can be used somewhere else.

   (Sounds reasonable.) Nothing to add here.

MGS Curb Offset Clarification

Question

State: WI
Date: 01-12-2011

The crash test drawings for MGS with curb indicate that the face of rail should be 1 inch behind the back of curb (see attached). In some municipalities in our state like to use curb with a wider head. When wider curb heads are being used, is the 1" off of back of curb important or would it be better to have the face of rail 5" from the front face of the curb head? (See attached Curb Detail.jpg)

Attachment: https://mwrsf-qa.unl.edu/attachments/d0576021895ba3267295d1c9fe68883f.jpg

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Response

Date: 01-12-2011

The offset for the curb installation was set such that the front face of the guardrail was offset 6" from the vertical center of the curb.

The CAD in the report is confusing and is only valid for a curb setup with the width we used. The offset should be controlled by the center of the vertical face of the curb and the face of the guardrail.

NCHRP Report 665 Question

Question

State: AZ
Date: 01-20-2011

Can you please confirm a couple of items regarding Table 89 in NCHRP Report 665. We have been waiting for the AASHTO Roadside Safety Committee to adopt Dean's recommendations for some time now. Please confirm the following:

1. We use a design speed of 75mph for freeways that are signed for 75mph - according to the text we can use the 70mph design speed in Table 89 for 70mph and higher. We will label the Design Speed column as 70mph and higher.
2. We use 65 mph design speed for urban freeway design. Interpolate between the 60-70 mph values in the table.

Response

Date: 02-03-2011
I conversed with Dr.
Sicking about the use of interpolation with Table 89 of
NCHRP Report 665. He confirmed
that the use of the 70 mph design speed
runout lengths would be acceptable for use on roadways with speeds of 75 mph, and the 70 mph speed limit may be referred to as 70 mph and higher. He also
confirmed that interpolation between the 60-70 mph range for
runout length design on roads with speed limits of 65 mph would be acceptable.

Openings in Concrete Median Barrier

Question

State: IL
Date: 01-30-2011

The IL Tollway has openings in the concrete median barrier to allow emergency vehicles to make a U-turn. These openings vary from 100' to 130' measured between the ends of the concrete barrier wall. Each blunt end is protected by an impact attenuator which is either a GREAT or a Quadguard. During construction projects when vehicles are riding on the inside shoulder there is a desire to fill in this median opening. In the past, several methods have been used. One way was to remove the attenuators and place precast temporary barrier wall sections in the opening. To completely fill in the opening, one section of wall had to be cut to fit. Making the connection between the temporary barrier wall and permanent median barrier was difficult because of the different widths.

Another method was to use precast barrier wall sections placed on a diagonal within the opening so that the barrier did not need to be cut and also so there was no blunt end to protect. One drawback to this method was that the temporary barrier wall extends onto each inside shoulder. The temporary barrier was not attached to the existing median barrier or to the attenuators.
As you can see, each of these options has problems. I know MwRSF has tested several connections between temporary barrier wall and permanent concrete barrier. Is there a TL-3 system that we can employ to safely fill in these median openings for the duration of the project?
The system should accommodate:

1. 32" F-shape temporary barrier wall, 22.5" wide at base
2. 32" Jersey shape or 42" F-shape permanent median barrier, 36" wide at base
3. Possible presence of slotted drain in the center of median opening running parallel to roadway.

Response

Date: 02-15-2012
We do have a system for transitioning between free-standing PCBs and rigid, concrete median barrier. I have attached a report detailing its design and testing.

Refer to MwRSF Report No. TRP-03-208-10. I believe that this system can be used in your situation.

You may note that it might be more desirable to simply anchor or pin all of the barriers in the installation rather than use the transition. However, we have seen in past testing that pins on the backside of a barrier may cause excess rotation and tipping of the barrier which in turn can produce vehicle instability. Thus, we currently do not recommend pinning on both sides of the PCB when placed in the median except for the transition section which we tested.

This issue of anchoring barriers in the median comes up a great deal and is something that we need to test in order to be confident that it is safe.

Attachment of Temporary Concrete Barrier to Bridge Rails

Question

State: NE
Date: 02-02-2011

What are the latest approved methods of attaching concrete protection barrier to Bridge rail?

Response

Date: 02-02-2011
MwRSF developed roadside and median transitions between free-standing F-shape TCB and rigid barrier. Both systems utilized a series of pinned TCBs with varied pin quantities over four segments and in combination with thrie beam guardrail. The median version also had a special steel sloped transition cap to fit between 32 and 42 in. barrier. Both designs have been reported, and Bob has submitted requests for seeking FHWA acceptance. I am not aware of any other systems which transition TCBs to concrete bridge rail. In the past, we have offered recommendations for running TCBs past the bridge rail, including length and lateral offset.

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54 Inch Barrier Length Necessary Before Pier

Question

State: FL
Date: 12-28-2010

Our team is currently designing a 54 inch barrier wall for abutting or intruding bridge piers. We plan on providing a transition length for the change from a 32 to a 54 inch high barrier. However, we would like to know if you could offer an opinion on the length of 54 inch barrier required before encountering the pier? I have attached a sketch to illustrate the location of the length desired by our team. We would sincerely appreciate any assistance that you could offer to us on this matter!

Response

Date: 02-03-2011
We have been able to discuss the FLDOT situation for shielding a bridge pier/abutment with a Test Level 5 (TL-5) highway barrier system. From your sketch, it is apparent that the FLDOT is seeking guidance regarding the recommended length of 54-in. tall, TL-5 barrier in advance of the tall hazard (i.e., critical pier/abutment).

To date, there is virtually no specific guidance for reasonably determining the length-of-need barrier protection for tractor-trailer impacts into bridge piers. Currently, AASHTO requires that 54-in. tall barriers be used to shield piers when placed close to the pier. Alternatively, 42-in. tall barriers have been recommended in situations when sufficient lateral clearance is provided between the barrier and pier. These recommendations have been made to prevent high-energy, tractor-trailer vehicles from impacting piers and causing catastrophic damage.

We understand that this AASHTO requirement can be quite costly to the DOTs, especially when considering the infrequent number of tractor-trailer impacts and high number of piers requiring shielding. As such, we have prepared our best guidance based on engineering judgment and experience with the understanding that a more refined recommendation would require further research.

In any event, we start with the assumption that the TL-5 impact condition involves a tractor-trailer vehicle striking a barrier at 50 mph. A TL-5 barrier would be used within the length-of-need to shield the pier and prevent a tractor-trailer vehicle from striking the pier. In your situation, the 54-in. tall barrier would be used per its limited lateral clearance. Upstream from the 54-in. tall barrier, a TL-3 rigid, reinforced concrete barrier with structurally-adequate anchorage would be connected to the TL-5 barrier and used to prevent errant passenger vehicles from encountering the pier/abutment structure.

TL-3 barriers measuring 32 in. tall are not capable of containing and redirecting tractor-trailer vehicles impacting at the TL-5 condition. However, we believe that these TL-3 barriers would be capable of dissipating significant energy to slow down the heavy vehicle, thus greatly reducing the severity and potential for tractor-trailer impact events into bridge piers. In addition, these TL-3 barriers would likely scrub-off speed during the initial contact with the front and upper barrier faces, and then again after the heavy vehicle had rolled onto its side behind the barrier and continued to slide toward the pier structure. As such, it was our goal to greatly reduce the tractor-trailer vehicle's impact speed with the pier under situations involving TL-3 barrier override or penetration in advance of the TL-5 barrier and pier structure.

It is our hope that the severity of the vehicle crash into pier could be greatly reduced, such as that occurring with a speed reduction from 50 to 25/30 mph. For an initial speed of 50 mph, we would expect to scrub off at least 5 mph prior to landing on the back side of the barrier. With the vehicle on the barrier's back side and potentially on its side, a trailer-trailer vehicle would then be further slowed with friction losses through vehicle drag (i.e., sliding and/or soil plowing). Using a coefficient of friction of 0.5 and a reduced initial speed of 45 mph, we calculated the distance over which the vehicle's speed would be further slowed to 25 to 30 mph. From this simple analysis, the required distance ranged from 75 to 94 ft. As such, we selected a distance of 85 ft for the full-height, 54-in. tall TL-5 barrier found upstream from the pier. Adjacent to the barrier, a 14-ft 8-in. long sloped transition segment would be utilized to transition the concrete barrier from 54 to 32 in. using a 8:1 slope, thus resulting in a total upstream combined length of approximately 100 ft excluding the TL-3 barrier.

In summary, we have utilized engineering judgment and experience to configure the length of a TL-5 tall concrete barrier system for protecting bridge piers " 84 ft of full-height barrier and 15 ft of transition to sum to 100 ft. Please note that this length-of-need guidance is likely conservative and is not based on any economic analysis.

Response

Date: 02-03-2011

Attachment: https://mwrsf-qa.unl.edu/attachments/fdd8fdc36c55fd7cd16f96df2526fba1.pdf

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Alternative F-shape Barrier Connection Pin Detail

Question

State: MN
Date: 11-22-2010

Per our discussion last week, I am sending you a request for your consideration and approval of two Portable Concrete Barrier (PCB) Connecting Pin designs.
Minnesota uses an F shaped, 12.5' long, pin and loop, portable concrete barrier system. The design was developed by Midwest Roadside Safety Facility. The supporting FHWA acceptance letters are, B-41 for the original design, and B-122 for the current design. Our design matches the current design, as proposed for the Barrier and Hardware Guide (SWC09) through task force 13. See attached (SWC09 10-29-08.pdf).
The current connector pin is located at
http://aashtotf13.tamu.edu/Guide/Hardware/Components/FMW02.pdf
We have been told by our construction office that the current connector pin design is difficult to work with when installed. Especially when there is tension in the barrier system, thus having the effect of locking the pins into the loops. Construction personnel often use hammers to tap the pins loose, which in turn causes damage to the upper plate of the connecting pin design (FMW02).
Our two proposed options are a "T" shaped pin and a "Cane" shaped pin. See the attached drawing (pin_11_22_10.pdf). Both proposed designs provide the same 1.25" diameter and 25" long vertical pin design as FMW02. The proposed changes are to the top configurations of the bars only. The "T" shaped top is the preferred design, however the "Cane" shaped top is less expensive to make, and still provides the necessary durability in the field.
Also attached is our proposed standard 8337C plate (StandardPlateReviewForm_8337C_Draft.pdf). Our intention is to allow all three connecting pin types within our standards provided you approve. Our Proposed 8337C plate 3 of 3, will be revised to include all three options.

Attachment: https://mwrsf-qa.unl.edu/attachments/0f4aede369cc02db5d6c5370dde44892.pdf

Attachment: https://mwrsf-qa.unl.edu/attachments/5a573c754ae3bb7cf93cf8cf463ddaa7.pdf

Attachment: https://mwrsf-qa.unl.edu/attachments/0ef802a7541df607a511c30c406f717f.pdf

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Response

Date: 11-23-2010
We have looked through your proposed pin designs and we have a couple of comments/concerns.

1. We believe that the T-handle design would work acceptably, but we are concerned with the weld between the main pin and the T-handle. The current pin design has a ¼" fillet weld on the top and bottom of the plate. This is a weld length of approximately 7 7/8" and a weld area of 1.39 in^2. The top of the pin can be loaded with significant vertical loads as the barriers rotate adjacent to one another, especially in a tie-down or anchored configuration. Thus, we are concerned that the T-handle pin does not have sufficient weld area to handle vertical loading similar to the tested pin and plate design. Our experience in welding round sections perpendicular to one another has found it very difficult to develop load capacity.

2. We also have concerns with the cane type pin. The concern here is that under high loads, the short extension on the cane pin could be pulled into the loops and compromise the joint. The bent end of the pin would be free to rotate when installed and could be in a position that allows it to be pulled into the loops when loaded, or large barrier and joint deflections could pull the relatively short bent end into the loops.
3. If the issue at hand is damage to the plates at the top of the pin, increasing the plate thickness should address that.

Response

Date: 11-24-2010

For furthered consideration is the attached proposed detail combining both request of MNDOT and MwRSF concerns on satisfying weld length & area requirements.

Attachment: https://mwrsf-qa.unl.edu/attachments/78a760ec0c07a06ba4a61085494e92bc.pdf

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Response

Date: 11-24-2010

We would like to pursue some type of "T" bar option. I would like to propose that you consider taking out the 2 ½ " of bar between the 4"x2.5"x0.5" plate and the top 6" horizontal bar. The 4"x2.5"x0.5" plate could be welded on both sides, but on the top of a 2' 1-1/2" bar, and then the 6" long horizontal "T" top could be welded to the plate, extending 1" beyond either side of it. The 6" top could be round or square stock.

There seems to be a discrepancy with the drawings. The AASHTO link and B-122 (2003) show only a one sided weld for the plate to the pin. B-41 (1997) shows welding on both sides of the plate. Do you know which one is correct since one gives twice the weld area as the other?

If only one side needs to be welded, the plate could be brought up to the T handle and welded on the bottom without worrying about welding the handle for retrofit use if the pin length is acceptable.

Minnesota uses an F shaped, 12.5' long, pin and loop, portable concrete barrier system. The design was developed by Midwest Roadside Safety Facility. The supporting FHWA acceptance letters are, B-41 for the original design, and B-122 for the current design. Our design matches the current design, as proposed for the Barrier and Hardware Guide (SWC09) through task force 13. See attached (SWC09 10-29-08.pdf).
Attachment: https://mwrsf-qa.unl.edu/attachments/2d7c20fdd8c05dc4974feb02594d380e.pdf

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Response

Date: 02-03-2011

I have given some additional thought to the T-top connection pin for the F-shape barrier. I have included some additional comments below.

1. First, I have reviewed the T-pin design that you have proposed which includes a 2.5"x4"x1/2" plate welded to the top of the 1.25" diameter connection pin. The T-pin is then welded to the top of this plate. I don't see any issues with this design. The F-shape barrier was originally tested to NCHRP 350 with a top plate mounted exactly as you propose. I have attached details. If the restraining plate at the top of the pin is attached with lower capacity welding than the original design that was tested, there concern that the top cap could disengage from the pin and allow the pin to exit the connection loops. This in turn would eliminate the integrity of the connection. However, because you are welding the top plate with the same weld used in the tested design, there should be no strength issues and attachment of the T-pin should be acceptable. Thus, I believe that your proposed design should function acceptably.
2. We also discussed the T-pin design that has currently been made by your barrier fabricators. This design consists of a 1.25" diameter T-pin welded directly to the top of the 1.25" diameter connection pin. Again, the concern here is that the T-pin may not be connected to the connection pin with sufficient weld to have similar capacity to the tested design and ensure that the T-pin does not disengage from the connection pin during an impact. We cannot determine exactly what the loads were on the top plate during testing of the original pin. Thus, we must require that any modification of the connection pin must have similar or greater capacity.

   I do not believe that it is possible to get sufficient weld area (and corresponding weld capacity) in the fabricators design to match the tested pin. The strength and capacity of a given weld is determined by the throat area of the weld. Weld throat area can be determined by the formula At= .707hl. In this formula, At is the throat area, h is the height of the weld, and l is the weld length. The tested pin cap was attached to the connection pin with a throat area of 1.39 in^2. Thus, we would require that the attachment of the T-pin to the connection pin have similar throat area and weld capacity.
3. It may be possible to retrofit the existing T-pins that have been fabricated. I have attached a detail for a proposed retrofit. This retrofit would attach the tested pin plate to the pin using the standard ¼" fillet weld on the bottom. The plate could be slid up the pin from the bottom. Then the plate would be welded to the T-pin on top with a flare bevel weld along the length of the plate. This would require checking to make sure the retrofitted pin still extended into the barrier loops (had the same effective length) as the tested design. Let me know what you think.

With respect to the weld details, there are different weld details floating around out there. There are currently three details.

1. The original pin cap was welded with the cap flush with the top of the 24.5" long pin. The cap was welded to the pin with a ¼" fillet weld on the bottom of the cap and the top of the cap was welded to the pin with a flare bevel weld. This pin design was used when the free-standing barrier was originally tested to NCHRP Report 350.
2. The pin cap weld configuration was used when the steel strap tie-down was developed for the F-shape PCB. At that time, we used a 27 ¾" pin that mounted the cap plate 1" below the top of the pin. This cap was attached with ¼" fillet welds on both the top and bottom of the plate.

3. The remaining F-shape PCB testing was conducted with a 28" long pin with the pin cap mounted 2.5" below the top of the pin. The pin cap for this design was welded with a ¼" fillet weld on the top of the pin cap only. This pin was a design originally submitted directly to us by KsDOT when we switched from the two loop to three loop connection design. It was used in both the MASH testing and the other tie-down and transition testing conducted at MwRSF.

Based on the different configurations above, we have typically recommended that the second configuration with top and bottom fillet welds be used. However, the single fillet weld design has passed the free-standing barrier MASH test, and it was used in all of the tie-down and transition designs excluding the steel strap tie-down. Thus, it would be okay to use the third pin configuration as long as you did not plan to use the steel strap tie-down. The steel strap tie-down would still require the second pin design.

My previous weld areas were calculated based on the second pin design. If you went with the third option, then your revised T-pin design would require ½ the weld area. This would be a throat area of 0.694 in^2. I don't believe that you can get that much weld area with the welding of the T handle directly to the pin. Thus, some form of retrofit would still be needed. However, the retrofit I proposed could be simplified by only using the fillet weld on the underside of the pin cap and then welding the T-handle to the top of the pin cap plate. No filler weld needed on the top of the pin cap to attach it to the pin.
Attachment: https://mwrsf-qa.unl.edu/attachments/190dd679cd20782f77a221933fd62236.PDF

Response

Date: 02-14-2011
We have put together a design which is similar to what Bob had suggested below. Please see the attached PDF.

We are proposing that the plate be attached with the ¼" fillet weld on the underside of the pin plate. We are not proposing any additional welding on the top side of the plate. The proposed modified pin design does state that this design is not to be used with the steel strap tie down.

Attachment: https://mwrsf-qa.unl.edu/attachments/43fabd9e455d343cc84e8a8a78072db8.PDF

Response

Date: 02-14-2011
The detail looks consistent with our discussions, and I have no issues using this pin.

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;

<u>Illinois</u>
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

<u>Nebraska</u>
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.