Midwest States Pooled Fund Program Consulting Quarterly Summary

Midwest Roadside Safety Facility

04-01-2017 to 07-01-2017

Transition Post Offset from Buttress

Question
State: IA
Date: 04-04-2017

We're looking to make some adjustments to our standard guardrail drawings, specifically where MGS transitions into a concrete barrier end section as we are having trouble aligning as-designed with actual field conditions. In comparing recent MGS approach tests (TRP-03-210-10 and TRP-03-291-14), it appears the space between the end of the concrete barrier and the first post (or between posts 19 and 18 in the reports) is 37.5". Our current transition design (BA-201) connects to one of the three typical end sections by BA-202 (Type A, B, or C). Type A is new construction, Type B is an older design with a slight flare, and Type C is either the flared end or a catch-all for those not fitting A or B.

My question to you is, what is the maximum spacing between the concrete barrier end section and the center of the first post before we would be concerned about a vehicle's ability to contact the leading edge of the end section? As it relates to BA-202, this would be the 11.5" dimension currently shown in the plan view at the top of page 1. Type A is less of a concern as we can adjust the bolt hole locations as part of construction, but for Types B and C, we're frequently at the mercy of what was there previously and are concerned that we're leaving too much of a gap. The designs in the two reports would suggest a dimension less than 37.5", as some of that would overlap the end section, but I was curious if recent testing for a generic end section provided a better value.

Attachment: https://mwrsf-qa.unl.edu/attachments/d0393bbf7476b6be47f03ea82c90396f.pdf

Attachment: https://mwrsf-qa.unl.edu/attachments/358ecc94c28c2fb45517cec958b9f0a6.pdf

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Response
Date: 04-04-2017

The gap between the concrete buttress and the first post of a transition system is dependent upon the specific transition system you are using. The Iowa transition was initially developed with the first post offset 11.5" from the buttress, as you noted in your email and have in your details. The thrie beam transition in which the upstream w-to-thrie beam transition (TRP-03-210-10 and TRP-03-291-14) was tested with utilizes larger posts at 37.5" spacing and a 37.5" offset. However, this offset/gap would not directly apply to the Iowa transition. So, the Iowa transition's nominal offset between the first post and the concrete buttress should remain at 11.5".

It's important to note that this distance is measured from the center of the first post to where the rail contacts the face of the buttress (i.e., it's the unsupported span length of the of the thrie beam). Changing the shape of the buttress will alter the unsupported span length if the taper, chamfer, of flair is increased without shifting the location of the first post. An increased unsupported span length may lead to increased deflections and vehicle snag on the buttress. Further, utilizing a different buttress shape from the as-tested system can have significant effects on the performance of the transition. We generally don't recommend altering the buttress on a transition without first doing some sort of evaluation on the new combination.

I understand that there will be situations where you have to attach to existing buttresses. In these situations, I would recommend that you try to keep the unsupported span length at 11.5", or minimize this distance as much as possible. I don't have good feeling on what the maximum allowable safe distance would be, but I would not be comfortable with increasing the distance to 37.5", or over 3 x's the nominal distance. We have previously conducted a study on retrofits for transitions to existing buttress where the first post could not be installed as intended. A couple of horizontal beams that attach to the backside of the buttress and support a blockout at the appropriate location were designed as part of this study. See report no. TRP-03-266-12 on the website for more details.

The current project to develop a standardized buttress aims to allow for singular buttress design for all thrie beam transitions. However, the nominal offset to the first post (unsupported span length) will remain the same. If you need a distance near 37.5", you may want to consider using a secondary transition system which incorporates larger posts at 37.5" spacing as these transitions often utilize a larger offset to the first post. If you are interested in another transition option, let me know and I can help identify potential systems (Nebraska uses one that may work for you).

Transverse deck steel development length

Question

State: MO
Date: 04-06-2017

I'd like to get the position of MwRSF on the criticality of meeting the development length requirement in the cantilever slab top mat transverse steel reinforcement beyond the face of a concrete barrier especially in light of recent changes to AASHTO's LRFD development length requirement increases.

Many crash tests with barrier on cantilever slab show that this length may not be critical since there is no slab damage.

What would a failure of slab look like with a development length failure?

It seems there are other load paths in play in case of “slipped" bar and surely the strength of slab in shear (like a blockout failure) and the barrier would come into play?

And would the size of the bar also be a factor, for example, when a crash test successfully shows that a No. 4 straight bar works, and we are using No 5 or No 6 bars that requires larger development lengths. Do the larger bars work as evidenced by the successful crash study?

Can I get your thoughts?

Attachment: https://mwrsf-qa.unl.edu/attachments/568aa270f68ea765cb04e40a01baadc3.jpg

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Response

Date: 04-06-2017

A lot of what you are saying has merit. Most of the bridge deck damage that we witness following a full-scale crash test of a continuous concrete bridge rail fits into one of 2 categories: 1) cracking and spalling of the outside edge of the deck behind/underneath the concrete bridge rail and 2) longitudinal bending cracks in the top surface of the deck located above the outermost girder. I do not recall witnessing cracking through the deck thickness directly in front of the bridge rail that would indicate that the transverse steel in the deck had exceeded their anchorage strength (developed strength in tension).

There are multiple load paths in play during an impact event that distribute the lateral loads. For example, the bending of the concrete rail itself takes much of the impact load and distributes it along the longitudinal length of the deck. The shear at the base of the rail that gets turned into a tensile load resisted by the transverse steel is only a portion of the impact load. Additionally, it should be recognized that many bridge rail reinforcement patterns utilize vertical steel bars (stirrups) which are anchored to the deck with 90 degree hooks and extend in toward the center of the deck. This reinforcement would also supply some resistance to the tensile failure that would occur from a lack of development length.

The size of the bars would not be factor if the same number of transverse steel bars were utilized. For example, let's say that a concrete rail and deck were tested with the transverse steel being #4 bars @ 12". But, due to an extended cantilever distance, the #4 bars needed to be increased to #5 or #6 bars to prevent bending failures over the outside girder. The lateral loads (tensile) that the #4 bars withstood during the test should not be a

problem for the larger bar sizes as they would only be stressed to a lesser degree, thus not needing a full development length. Important to note this only applies if the same number of bars (bar spacing) is used. Increasing the bar size and spacing may give the same design strengths, but the development length may come into effect as more load is now applied to each individual bar.

Hope this helps. Let me know if you have further questions.

Follow up question to Q/A #393

Question

State: IA
Date: 04-24-2017

We have been allowing the substitution of 6" x 8" posts when replacing older 8" x 8" post installations for a while now (Q/A #393 dated May 2009) but there have recently been discussions about whether the vacated hole needs to be filled and tamped before driving a 6" x 8" post in or whether a 6" x 8" post can be placed in the hole and only the remaining 2" gap be filled and tamped. Our concern is that standard soil strength would be difficult to achieve if only tamping 2", given the small space in which to work, but it has been requested and we wanted to get your thoughts.

Response

Date: 04-25-2017

We would concur that attempting to reinstall the 6x8 post in the excavated 8x8 hole and fill and compact the remaining 8"x2" space would be difficult to effectively achieve.

As such, we would prefer that the 8x8 hole be backfilled and tamped prior to installing the 6x8 post. This should provide for more consistent post installation and behavior.

Mow Strips

Question

State: VA
Date: 04-27-2017

1. Do you currently have a separate pay item(s) for w-beam to thrie beam stiffness transitions at bridges? Yes
2. Will you be using a separate pay item(s) for w-beam to thrie beam stiffness transitions at bridges after MASH implementation? Yes
3. If you answered yes to question 1 or 2 above, what are your separate pay items called? Do you use a separate pay item for approach and trailing ends?

2505-4008300	STEEL BEAM G'RAIL
2505-4008410	STEEL BEAM G'RAIL BAR TRANS SECT, BA-201
2505-4021010	STEEL BEAM G'RAIL END ANCHOR, BOLTED

4. Are you now or in the future (due to MASH implementation) using a separate pay item(s) for stiffening the guide rail where a fixed object (IE: utility pole, pier, sign structure, etc) is less than 4 feet from face of rail element? If yes, what are your separate pay items called. We do not currently use a separate bid item for that. Locations are just noted in the plans.

Response

Date: 04-27-2017

Dave/ All,

1. … Pay item(s) … for w-beam/ thrie beam @ bridges? NDOR pays for a “Bridge Approach Section" (25') which includes the W-THRIE BEAM TRANSITION SECTION & nested thrie bean leading to the bridge rail – Standard plan 740.
2. … using a separate pay item(s w-beam/ thrie beam trans. @ bridges after MASH implementation? Yes:

3. (a) … what are your separate pay items called? “Bridge Approach Section" & “Special Bridge Approach Section" for thrie beam Plan 741.

   When not part of a “Bridge Approach Section" we use “W-THRIE BEAM TRANSITION SECTION“

   (b) … separate pay item for approach and trailing ends? Yes; Approach: End Treatments Type I (parallel) or II (taper 4' away) these are listed in the contract as to what is allowed, Trailing: “END ANCHORAGE ASSEMBLY" includes; 2 – posts, cable assembly, strut & yoke assembly, etc.

4. (a) … stiffening the guide rail when object is less than 4 feet from face ? we pay for extra posts; using 3'1.5" post spacing.

   (b) … separate pay items called. “Guardrail posts"

Average Unit Prices: http://www.roads.nebraska.gov/business-center/business-opp/hwy-bridge-lp/item-history/

Standard plans: http://www.roads.nebraska.gov/business-center/design-consultant/stand-spec-manual/

Standard plans 700 ‘s

Special plans: 7000 ‘s

Response
Date: 04-27-2017

We are working on our miscellaneous installation details for our new MGS standard. After discussions during our pooled fund meeting last week, it is apparent that the paving details under the rail are critical. We currently do not have a leave-out detail for our 27 ¾" w-beam guardrail.

How is your state handling this issue? It appears that some states are saw cutting or coring a leave-out and adding a low strength sealant after the post is installed to prevent weed growth. This seems to be a labor intensive process.

Other states specify a 2" thick asphalt mow strip without any leave-outs. Does anyone have any in-service data on this method?

Bob: Any thoughts?

Thanks

Response

Date: 04-27-2017

We have provided guidance on this topic in the past. We have typically referred to FHWA Memo B64b (see attached). The memo encapsulated previous research done at MwRSF, TTI, and CALTRANS regarding leave outs and fill materials.

I have attached the memo and the previous related research reports.

In addition, we did work on a weak post version of the MGS for installation in mow strips. This would be an alternative that would not require leave outs.

The link to a zip file with that research and the information above can be accessed at the link below.

https://unl.box.com/s/yn8spztfk6whv3qke2acenz5kyn37rw4

Thanks

Attachment: https://mwrsf-qa.unl.edu/attachments/72b43d259199d8837fc3dc96d57266b9.pdf

Attachment: https://mwrsf-qa.unl.edu/attachments/de6e936463620538976e753dcd31866c.pdf

Attachment: https://mwrsf-qa.unl.edu/attachments/36a504a20ff289c06d9c12d1d42c9e27.pdf

Attachment: https://mwrsf-qa.unl.edu/attachments/0c8f4d68fa22fbdc13ede6aa3f22c1d8.pdf

Attachment: https://mwrsf-qa.unl.edu/attachments/532d7efa772b80b7b4566c00798fe4fd.pdf

Attachment: https://mwrsf-qa.unl.edu/attachments/2f0c0893b5f967e705c3d4fd8f303a0f.pdf

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Response
Date: 04-28-2017

David,

See Illinois responses below in RED.

Midwest States Pooled Fund members,

NJDOT currently does not use a separate pay item for the W-beam to thrie beam transitions at bridges. The cost for these transitions are included in the price of the guide rail. Now that NJDOT will be switching to the 31" MGS after 12/31/2017, these transitions are significantly longer than the NCHRP 350 transitions and we are considering separate pay items.

Can you please answer the following questions on the practice in your state:

1. Do you currently have a separate pay item(s) for w-beam to thrie beam stiffness transitions at bridges? YES
2. Will you be using a separate pay item(s) for w-beam to thrie beam stiffness transitions at bridges after MASH implementation? YES
3. If you answered yes to question 1 or 2 above, what are your separate pay items called? Do you use a separate pay item for approach and trailing ends?

   Connection to a concrete parapet or other concrete structure is TRAFFIC BARRIER TERMINAL, TYPE 6. This is Highway Standard 631031.

   Connection to a steel bridge rail is called TRAFFIC BARRIER TERMINAL, TYPE 6A. This is Highway Standard 631032.

   Connection to a concrete structure and not using a curb is called TRAFFIC BARRIER TERMINAL, TYPE 6B. This is Highway Standard 631033.

   You can review these at our Highway Standards:http://www.idot.illinois.gov/doing-business/procurements/engineering-architectural-professional-services/Consultants-Resources/highway-standards-and-district-specific-standards

   You can find the coded pay items here: https://www.google.com/url?q=http://www.idot.illinois.gov/Assets/uploads/files/Doing-Business/Specialty-Lists/Highways/Design-%26-Environment/Coded-Pay-Items/January-16-2015-Letting/CodedPayItemsHwy20150116.pdf&sa=U&ved=0ahUKEwjPrcOY6f7SAhXh5oMKHQhxDuEQFggHMAE&client=uds-cse&usg=AFQjCNE8bvrnXfiy4U8l7oWNqlnH6-j74Q

4. Are you now or in the future (due to MASH implementation) using a separate pay item(s) for stiffening the guide rail where a fixed object (IE: utility pole, pier, sign structure, etc) is less than 4 feet from face of rail element? If yes, what are your separate pay items called.

Yes, guardrail with 6'-3" post spacing is STEEL PLATE BEAM GUARDRAIL, TYPE A. Guardrail with 3'-1 ½" post spacing is called STEEL PLATE BEAM GUARDRAIL, TYPE B. We do not have guardrail post spacing of 1' 6 ¾" depicted on a Standard, but it could be included as a plan detail with a unique pay item. Both Type A and Type B are shown on Highway Standard 630001 at the same link referenced above.

Response

Date: 04-28-2017

1. Yes, WisDOT has separate bid items.
2. Yes, WisDOT will use separate bid items.
3. 614.2500 MGS Thrie Beam Transition
4. Yes, we use separate bid items when there is a need for reduced working width. We use to not have separate bid items. Low and behold contractors and field staff were not stiffening the beam guards when they should have or not providing enough of it.

Bid items are:

614.2300 MGS Guardrail 3 (normal post spacing)

614.2310 MGS Guardrail 3 HS (Half postSpacing)

614.2320 MGS Guardrail 3 QS (Quarter postSpacing)

We tell designer they are responsible for providing appropriate working width. If they don't it is Errors and Omissions on their part.

We use a different bid items for a number of situations (e.g. areas with reduced grading, long spans…).

Steel Thrie Beam Bullnose

Question

State: WV
Date: 03-20-2017

We are developing plans to install a number of Thrie Beam Bullnoses on twin structures and a few questions have come up I hope You can help me with. Attached is the detail Midwest developed. Our only changes are some drafting and adding a note to clarify the gauge of the Thrie Beam.

(1) On the Steel Thrie Beam length a "STANDARD WOOD BLOCK", (8"X6"X14" blockout) is called for at Post Nos. 9-12 and beyond Post 12. We are developing a Special Detail (soon to be a Standard) for Modified Thrie Beam. We would like to use the tested Modified Thrie Beam for the run between Post 12 and the Thrie Beam Transition. Do You have any concerns using the tested Modified Thrie Beam for this instead of the "STANDARD WOOD BLOCK"?

I am proposing to use the steel blockout with the clipped web as tested in the development of Modified Thrie Beam in lieu of the 14" deep blockout.

(2) Typically, when guardrail comes off the End Wall there is a very short length that is parallel to the roadway and a taper away from the shoulder begins. Is it acceptable to place a taper on the Thrie Beam Transition and length of "Steel Thrie Beam"? Also, where should the centerline of the bullnose be in relation to the centerline of the roadway.

Some of these proposed bullnose terminals are in a curve. These curves are not extreme curves since it is an arterial roadway, but still there are some alignment issues to deal with as shown below.

Was all the
testing performed in tangent sections?

Attachment: https://mwrsf-qa.unl.edu/attachments/d52c0430d662427af070a147abd08fbe.png

Attachment: https://mwrsf-qa.unl.edu/attachments/8b20de49e26ded33468afbbf4046dc21.png

Attachment: https://mwrsf-qa.unl.edu/attachments/28b8a81e4c4b95c8c04a53f1ec0d48de.png

Attachment: https://mwrsf-qa.unl.edu/attachments/4ecf9b267db28ed0acf5fa21f44e363b.pdf

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Response
Date: 04-27-2017

We are actually in the process of the MASH evaluation of the thrie beam bullnose for the Midwest Pooled Fund. I have some comments below in red.

I also noted that you have a note on your plans that “THE USE OF STEEL POSTS ON THE BULLNOSE IS NOT ALLOWED". We do have a version of the bullnose with breakaway steel posts if you are interested in seeing it. Let me know.

Thanks

We are developing plans to install a number of Thrie Beam Bullnoses on twin structures and a few questions have come up I hope You can help me with. Attached is the detail Midwest developed. Our only changes are some drafting and adding a note to clarify the gauge of the Thrie Beam.

(1) On the Steel Thrie Beam length a “STANDARD WOOD BLOCK", (8"X6"X14" blockout) is called for at Post Nos. 9-12 and beyond Post 12. We are developing a Special Detail (soon to be a Standard) for Modified Thrie Beam. We would like to use the tested Modified Thrie Beam for the run between Post 12 and the Thrie Beam Transition. Do You have any concerns using the tested Modified Thrie Beam

for this instead of the “STANDARD WOOD BLOCK"?

I am proposing to use the steel blockout with the clipped web as tested in the development of Modified Thrie Beam in lieu of the 14" deep blockout.

The modified thrie beam blockout could likely be used in that region. We typically have allowed standard thrie beam construction starting at post no. 9 in the system. We tested the system with shortened wood blockouts based on previous experience with thrie beam transitions that suggested that the shortened blockouts perform better than full length blockouts. Modified thrie beam blockouts have a similar shortened profile.

Modified thrie beam blockouts have only been evaluated to NCHRP 350. This is true of the bullnose as well. Thus, they can likely be used adjacent to the bullnose system. New Jersey and CALTRANS are currently looking for partners to evaluate the modified thrie beam system to MASH TL-3 if that is something West Virginia would be interested in.

One important note is that the modified thrie beam blockouts require the use of a backup plate to prevent the potential for stress concentrations and rail rupture when the W-beam folds around the blockout.

(2) Typically, when guardrail comes off the End Wall there is a very short length that is parallel to the roadway and a taper away from the shoulder begins. Is it acceptable to place a taper on the Thrie Beam Transition and length of “Steel Thrie Beam"? Also, where should the centerline of the bullnose be in relation to the centerline of the roadway.

We would not recommend flaring of the approach guardrail transition. These systems have never been evaluated tapered or flared and there are concerns that flaring them would increase the potential for pocketing and snag. We do believe you could flare the thrie beam guardrail once you were a minimum of 12-6" (one rail segment) past the end of the approach guardrail transition. This would mean 12-6" past any reduced posts spacing, non-standard posts, or nested or 10 gauge rail sections. The attached report has a schematic of such an installation.http://mwrsf.unl.edu/researchhub/files/Report120/TRP-03-95-00.pdf

We also developed wide designs for the bullnose. They are in the attached report but they do not have an FHWA eligibility letter.

I am not sure I follow what you mean by the position of the bullnose relative to the centerline?

Some of these proposed bullnose terminals are in a curve. These curves are not extreme curves since it is an arterial roadway, but still there are some alignment issues to deal with as shown below.

Was all the testing performed in tangent sections? Yes.

Attaching guardrail to flared bridge wingwalls

Question

State: MO
Date: 05-01-2017

I have a design group that is wanting to flare the end of a bridge rail (at the wing wall) and then attach the approach rail system on a 24:1 flare in an effort to open up sight distance for a nearby gravel approach. The bridge width is around 26 feet wide (11 foot lanes with 2 foot shoulders). This is a lower volume roadway, with something around 500 ADT I am told.

Can you comment on the use of the entire rail system on a flare using our current designs for bridge rail, barrier wall attachment, thrie beam stiffness transition, the transition to W-Beam, a small run of MGS rail and then the energy absorbing end terminal all being planned to be on a 24:1 flare from the bridge end?

I have concerns at the bend in the bridge rail that starts the flare on structure that it might create a critical point on the bridge. Are these concerns warranted? Also, is there reason for concern about pocketing or other crash concerns on the flared approach transition to the flared bridge rail?

Any comments you may have on the
topic or guidance to related research or other state design standards that
might have a flared approach rail system would be appreciated.

Attachment: https://mwrsf-qa.unl.edu/attachments/7777fd594a28dd9cf57e22bd918c0b99.pdf

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Response

Date: 05-02-2017

For installations where a bridge rail with limited space for approach guardrail and an end terminal on the upstream end of an installation, a flared approach guardrail transition may be desired to reduce runout length. Currently, guidance exists for flaring the Midwest Guardrail System (MGS) away from the roadway. However, no research or full-scale crash testing of flared approach guardrail transitions has been conducted under the NCHRP Report No. 350 or MASH evaluation criteria.

Approach guardrail transitions are sensitive systems, as the gradual increase in lateral stiffness along the transition length is critical to its safety performance. Improper designs or abrupt changes in lateral stiffness can result in guardrail pocketing, vehicle instabilities, and vehicle snag on the rigid bridge rail/parapet. Additionally, seemingly small changes to a crashworthy guardrail transition (e.g., the shape of the downstream parapet, the addition or removal of a curb below the guardrail, and/or the removal of a single post within the system) have led to failed crash tests and inadequate system designs. Due to the sensitivity of these systems and the limited knowledge about their performance in flared configurations, current guidelines are to place guardrail transitions tangent to the roadway.

Previous testing of flared guardrail systems and tangent transitions lead to several concerns related to flared transitions. Flaring of the transition would increase the effective impact angle, which would raise the potential for vehicle snag, pocketing, and vehicle instabilities. Increases to the loads imparted to the barrier would also be expected, which could lead to rail rupture.

MwRSF recently developed an upstream stiffness transition for use with previously-approved thrie-beam approach guardrail transitions and the MGS. As part of that research, the use of flared guardrail adjacent to the transition region was addressed. MwRSF recommended a minimum of 25 ft of tangent MGS to be used between the upstream end of the asymmetrical W-beam-to-thrie beam transition section and the start of the flared section (i.e., the bend between flare and tangent sections). No flaring of the actual transition was recommended without further research.

Full-scale crash testing of the MGS upstream stiffness transition with the 1100C vehicle indicated that wedging of the vehicle occurred under the asymmetrical W-to-thrie beam transition section, resulting in vehicle snag on the posts. While decelerations were below critical levels, there may be potential for increased occupant risk values as the flare rate increases for the critical small car impact. Finally, the use of flared transitions may increase the potential for vehicle instability due to the increased impact angle, increased vehicle snag, and the increased potential for pocketing. Therefore, a flared guardrail transition would need to be evaluated for impacts to the upstream W-to-thrie stiffness transition as well as near the downstream end attachment to a rigid buttress.

MwRSF is currently working on the development of a standardized end buttress for guardrail transitions that can connect any crashworthy, thrie-beam guardrail transition to various bridge rail shapes. The goal of the project was to develop a buttress that reduces snag potential and pocketing concerns by flaring the face of the buttress. Because of its increased safety performance, the standardized end buttress may allow for guardrail transitions to be safely flared by alleviating some snag and pocketing concerns near the rigid parapet associated with the increase in impact angle. However, the new buttress design would not alleviate snag and pocketing concerns near the upstream end of the transition.

The MGS has been tested under NCHRP Report No. 350 at flare rates up to 5:1, so thus use of 24:1 flares with the LON portion of the MGS would not be a concern. However, impacts near the end anchorage have not been evaluated at higher flare rates.

FHWA has allowed the installation of tangent, energy-absorbing terminals at flares of 25:1 over 50' minimum at TL-3. The flare you note here would slightly exceed that.

Thus, we cannot currently recommend flaring of the AGT and guardrail system directly off the bridge end for TL-3 applications based on the concerns above. These concerns may not be as substantial when considering a low-volume road application like you have with the potential for lower speeds and ADT's. In these applications, impact conditions may be less severe and the concerns noted above would be reduced.

Please let me know if you have further comments and/or questions.

Thanks

Temporary anchor application

Question

State: MN
Date: 05-01-2017

We have a contractor request to substitute an anchor bolt for our portable concrete barrier tie-down strap anchor.

See the attached PPCMB Anchor Plan.pdf, the detail is on the middle top of the sheet.

This anchor would be used in leu of the 3/4" drop in anchor outlined in the detail. The anchor is a 3/4" diameter anchor and would have a similar embedment in the detail 3-1/2" or greater.

Please take a look at the anchor properties and let us know
if you have any concerns with this be used in place of the standard tested
anchor.

Thanks

Mike,

Please find the attached submittal package for our Screw
Bolt+ anchor. This anchor would be used
in leu of the 3/4" drop in outlined in the detail that I had attached in
previous emails. The anchor is a
3/4" diameter anchor and would have a similar embedment in the detail
3-1/2" or greater. As I mentioned
in our conversation it's fully removable and outperforms the drop in anchor in
this application.

Our contractor has the project and is looking for a more
user friendly anchor for this application. As stated it has better performance
values in shear as well as tension.
Also, for the roadway it is fully removable after the barrier is no
longer in use. Please let me know if there
is anymore information needed to be able to use this anchor for the application.

http://www.powers.com/submittal_generator/generate_submittal.php

Attachment: https://mwrsf-qa.unl.edu/attachments/9945a10971fa8559ca2adb9b468c2aa5.pdf

Attachment: https://mwrsf-qa.unl.edu/attachments/b2852aa4937c48d6795d0c32a3af5ce6.pdf

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Response
Date: 05-02-2017

Hi Mike,

We looked at alternative anchors for the steel strap tie-down in some previous research for KDOT. I have attached a letter report that details that work.

During that work, we looked at several mechanical anchor alternatives like the one you sent. We found that those anchors compared well to the drop-in style anchors in terms of tensile capacity, but tended to have trouble developing the required shear loads. The difference in shear capacity was largely attributed to the larger diameter of the sleeve used for the drop-in and the higher grade steel used for the drop-in bolt.

Two potential mechanical anchor alternatives were identified.

1. Red Head Large Diameter Tapcon (LDT) 0.75-in. diameter x 4.5-in. long

2. Simpson Titen HD 0.75-in. diameter x 5.0-in. long

In the case of the Screw-Bolt+, we would need to ensure that the anchor could match a tensile capacity of 18.7 kips and a shear capacity of 25.6 kips that was found for the drop-in anchor used in the original crash testing of the system. We have used the approach that any replacement anchor must meet or exceed the capacity of the tested anchors in order to ensure similar performance. The shear capacities of the Screw-Bolt+ anchor are currently limited to 24.3 kips, so it would fall just beneath the tested anchorage. This anchor is very similar to the Wedge Bolt anchor used by Powers Fasteners, which did not meet the shear load criteria in the KDOT work. Thus, we could not recommend it at this time.

However, either of the alternative anchorages noted in the attached study are acceptable.

Let me know if you have any further questions.

Thanks

Attachment: https://mwrsf-qa.unl.edu/attachments/96084b4dc6b4e0ba5b9d30abd291ce22.pdf

Chain link fence on top of barrier

Question

State: IA
Date: 05-17-2017

Good afternoon!

We have been approached by our Rail office to review available designs for putting chain link fence on top of barriers to prevent materials from falling onto the tracks below. Since the fence is adjacent to vehicular traffic, as opposed to pedestrian traffic, there is some concern on my part regarding what testing needs to be done to support this application for MASH.

In 1997, FHWA published*Crash Testing and Evaluation of Retrofit Bridge Railings and Transition – FHWA-RD-96-032* (attached) that discussed a PL-2 testing of a 32" New Jersey shaped fence/barrier combination rail. Reviewing the PL-2 testing criteria suggests it would be equivalent to a point somewhere between TL-2 and TL-3. Iowa has used this design in urban areas where a TL-2 speed is present but there is a growing need to have something available at TL-3 speeds.

A recent search for available designs yielded the following:

color:#595959"> Iowa - attached is an Iowa example from a recent project

color:#595959"> Nebraska -http://www.roads.nebraska.gov/media/2912/bopp-manual.pdf
(pdf page 437)

color:#595959"> Minnesota -http://www.dot.state.mn.us/bridge/pdf/lrfdmanual/section13.pdf
(pdf page 6 lists as TL-2 for Design 5-397.212)

http://www.dot.state.mn.us/bridge/pdf/cadd/files/bdetailspart2/pdf/fig7119e.pdf
for drawing

I'm curious to
get your take on the following:

color:#595959"> What test level a PL-2 may be considered
equivalent to for NCHRP 350 and/or MASH.

color:#595959"> How high the concrete barrier would need
to be in order to not need the chain link attachment tested for TL-3 conditions
because we would not expect the TL-3 vehicle to interact with the fence (44
inches, 54 inches,?)

color:#595959"> What MASH tests would need to be
considered to verify the combination barrier met TL-3 conditions, as well as
estimated project costs and timeframe. This presumes building the resulting
barrier from question 2 is undesirable or infeasible given design or
construction constraints.

Thank you!

Attachment: https://mwrsf-qa.unl.edu/attachments/242bcb20017a1e79c1a971aa9ef0ae82.pdf

Attachment: https://mwrsf-qa.unl.edu/attachments/c734b633da9ffbe55efddbf70752e329.pdf

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Response

Date: 05-19-2017

There are concerns with mounting fence structure on concrete barriers. First, the vehicle may interact with the fence structure causing snag. This may pull the fence down on the vehicle or cause deceleration or instability of the vehicle that is undesirable. it is essentially a zone of intrusion issue with the vehicle interacting with the fence.

We looked at this several years ago in a Pooled Fund proposal for Illinois, but the project was never funded. We also commented on a fence for 32" barrier for Illinois based on a FLDOT design tested at TTI under PL-2 as you mentioned in your email. See link - http://mwrsf-qa.unl.edu/view.php?id=174

As to your questions:

1. What test level a PL-2 may be considered equivalent to for NCHRP 350 and/or MASH.

    a. AASHTO PL-2 is a lower speed and angle than the NCHRP 350 TL-3 testing requirements. Thus, we would consider PL-2 somewhere between TL-2 and TL-3. With the increased speed and angle, we would expect that the ZOI and potential for interaction with fence structures would increase with the angle having the largest effect. While arguments have been made in the past regarding PL-2 barriers equivalency with TL-3 based on test results and comparisons of barrier capacity and geometry, that argument may be more difficult here due to the concerns for increased interaction with the attached fence.