Midwest States Pooled Fund Program Consulting Quarterly Summary

Midwest Roadside Safety Facility

07-01-2004 to 10-01-2004

Temporary Barrier Transitions

Question
State: OH
Date: 07-27-2004

One of the issues I know ODOT is behind the curve on is PCB connected to permanent longitudinal barrier in construction zones. I have an opportunity now to solve a current problem for a designer, and then to set an ODOT standard for the future.

This designer is proposing using the attached design in two MOT phases. Phase 1 involves a PCB flared through a removed section of guardrail with a w-beam attached. Phase 2 shows a PCB flush against a permanents concrete barrier. We need to have a connection that could meet 350.

My proposed solution to Phase 1 would be to anchor the PCB in the last two sections (12.5' x 2 =25'), and to use a nested w-beam section connect the old and the new. I would not see much a snagging issue. But maybe a steel wedge should be used at mid-span of the rail element and fastened to the PCB. Your thoughts would be appreciated.

For Phase 2, I have seen other designers use an impact attenuator at the end of the PCB and flush with the existing barrier. That would work, I assume. But I wonder if you have other ideas?

We use NJ PCB and Single Slope for permanent. but this project will tie into existing NJ barrier.

I could poll the states, but I think their designs are probably just jury-rigged designs like ours.
Attachment: http://mwrsf-qa.unl.edu/attachments/ba2bdc1bd6e4581096866a09eb6b1d97.png

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Response
Date: 07-27-2004
A couple of quick responses to you temporary barrier transitions questions.

I see several problems when looking at your Phase 1 option. Transitioning from the PCB to the guardrail would prove difficult on many levels. First, there is not enough of a transition in the relative stiffness between the two systems. Your anchored PCB's would essentially be rigid, while your guardrail would be much more flexible. Thus, eventhough the potential for snagging in not great, there is still a significant potential for vehicle instability. In order to make that concept function, significant work would need to be done to transition between the stiffness of the flexible rail and the stiff PCB's. You nested W-beam section is a start, but I don't believe it is sufficient to insure vehicle stability. The second issue with the Phase 1 transition is the anchorage of the guardrail. I have not looked into it sufficiently yet, but I am not sure you can get the necessary anchorage out of the PCB's.

Your Phase 2 option is closer to what we would recommend, but it would need to be modified as well. In order to alleviate snag concerns and stability problems, the guardrail section would need to approach the temporary barriers at a 15:1 flare at most. The would likely mean using a longer transition section of guardrail than you have drawn. In addition, a rubrail of some for would need to be installed below the regular rail, and special spacer blocks would have to be installed on at least 3'-1 1/2" spacing.

I have attached a pdf of a presentation that we recently gave in Minnesota regarding this issue. It shows our current recommendation for attaching temporary barriers to rigid barriers. It consists of using tie-downs on the temporary barriers as the approach the rigid rail. Then a 10 gage thrie beam section with end shoes is used to bridge across the PCB and rigid barrier connection. For now, this is our best alternative. We are currently working on a project with the Florida DOT to further research this issue.

Let me know if you have further questions/concerns. Thanks for the questions.

Attachment: http://mwrsf-qa.unl.edu/attachments/f75ef84be7d9cbcccd9175f7a41ac098.pdf

Temporary Barrier Deflection and Tie-Down Options

Question

State: WI
Date: 08-13-2004

We have a note on our current standard detail that requires the TCB to be anchored when the clear space behind the barrier is 2'-0" but no anchoring is required if that space exceeds two feet. In addition to the 2'-0" clear space, we also require that the drop-off exceed 2'-0" deep The decision for the 2' clear space and 2' drop-off was based on the fact that most locations where anchoring would be required are generally old bridge decks in 1st stage of construction. There is usually minimal space on these bridges. On some bridges we can't even get the 2 feet. The second reason was travel speed is usually reduced at these locations.

I have consulted a few other states and found a good number of them don't even anchor the TCB and those that require anchoring, have no definite minimum distance requirement. North Carolina requires anchoring whenever the clear space is less than 6 feet and the drop-off is deeper than 3 feet on bridge decks. We don't have that kind of space in Wisconsin, especially on the low volume local and state highways. Incorporating speed introduces other complication so we dropped the idea.

What in your judgement would be the appropriate clear space given the facts I mentioned above.

Response

Date: 08-16-2004
I believe that you recommendations for anchoring of temporary concrete barrier are acceptable assuming you are refering to the F-shape temporary barrier design developed here at MwRSF. As stated in the report I gave you previously, the F-shape PCB can be safely used unanchored with 2' of clear space behind the barrier based on the 85th percentile impact. For distances less than this or installations with a sharp drop at the end of the clear space, an anchored PCB is more appropriate. This is basically agrees with what you have told me about the Wisconsin standard. Therefore, I would recommend that you stick with your currently guidelines for now.
The difference between our recomendation for the F-shape barrier as opposed to what some other states may recommend is likely due to the use of differenent PCB systems. Different PCB designs have vastly different deflections based on the type of section, the length of the section, and the connection between the barriers. North Carolina uses a 10' long NJ shape barrier with little reinforcement and a relatively weak connection when compared to the F-shape developed here. It will experience higher deflections than the F-shape and thus they have likely used more forgiving clear areas behind the barriers.
Hope this help you out. Let me know if you have more questions.

F-shape Temporary Barrier Steel Strap Tie-down Anchors

Question

State: KS
Date: 08-16-2004

Ron, attached is a PDF for the Type II Guard Fence End Terminal Standard Drawing that we use on divided roadways when the end terminal is outside the clear zone.
Will our Type II end terminal anchorage system provide the required strength to develop the capacity of the rail? My concern is that this may be an item not studied to date based on 350 since the end terminals, temporary barrier, etc have been the main focus so far.

Attachment: http://mwrsf-qa.unl.edu/attachments/6d696eb48b7bbd1bb907e0c8ab18e7c0.png

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Response

Date: 08-16-2004
Bob and I briefly reviewed your detail and made a comparison to a new single, cable anchor post developed for Road Systems, Inc. and for use with the taller MGS in combination with FLEAT and SKT end treatments. In the comparison, the Ks DOT detail uses a shorter tubular post but a larger soil plate area. On the contrary, the Road Systems detail uses a longer wide flange anchor post instead of a tubular foundation member and in combination with a smaller soil plate area than currently used byKansas.
In the absence of any testing and evaluation of your system, we may be more comfortable withKansas increasing the length of the single anchor tube by 12 in. Please note that it may be possible that your existing system would meet the NCHRP 350 requirements for longitudinal, strong-post W-beam guardrail systems. However, we cannot make that final determination without full-scale vehicle crash testing. Therefore, in the interim and absence of testing, we recommend that you increase the tube length by 1 ft if you wish to continue the use of a single anchor tube in lieu of the two tube system adjoined with a channel strut.
If you have any questions regarding this information, please feel free to contact me at your convenience. Thanks again.

Temporary Barrier Deflection Limits for Reduced Speeds

Question

State: MO
Date: 08-26-2004

What is your opinion of reducing the deflection spacing behind a temporary barrier, if the speed limit is marked at lower speeds than the test speed of 62 mph? Right now we are following the criteria from your group in the deflection recommendation report of 45 inches unless used on road ways with 10 foot lanes or greater and then we reduce the defleciton to 24 inches.

Response

Date: 08-31-2004

The original Iowa temporary concrete barrier was crash tested to the TL-3 criteria of NCHRP Report No. 350. In that test, dynamic barrier deflections of approximately 45 in. were observed. Later, MwRSF published a report which stated that when the barrier is positioned near a bridge deck edge using the freestanding configuration, the clear distance between the deck edge and the back-side barrier base should be 45.3 in. However, for all other applications, the design deflection limit should be set at 600 mm or 24 in. This distance coresponds to the distance that the Iowa temporary barrier could be expected to deflect under the 85th percentile impact for passenger cars and light trucks. The 85th percentile impact condition was determined to be a 3/4-ton pickup truck impacting at a speed of 58 km/hr (36 mph) and 27.1 degrees.

End Treatment Gaps

Question

State: MO
Date: 08-26-2004

MoDOT has a situation where the roadway guardrail and the ramp guardrail come close together at the nose of the gore. Have you any experience or knowledge of what is the required or recommended gap between the two end treatment (ex. ET 2000) to work properly?

Response

Date: 08-31-2004

Two different approaches are available for treating the situation described above. First, one could install end treatments that bring both guardrails into a single terminal system, such as used in the FLEAT-MT and CAT. Second, one could use any of the energy-asborbing guardrail end terminals on each guardrail end but with ending the back-side system approximately 50 ft downstream of the first system. If option two is used, all guardrail posts exposed on the back side of the first terminal must be treated with breakaway guardrail posts in order to avoid excessive wheel snag concerns and the potential for vehicle rollovers.
