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PROFESSIONAL RECOMMENDATION MEMORANDUM

Project Name: **Engineering Support Services and Recommendations for Roadside Safety Issues/Problems for Member States**

Sponsor: **Roadside Safety Pooled Fund**

Task 21-09: **Oregon 32-inch F shape Pin and Loop vs Portable Concrete Barrier (PCB) Tested**

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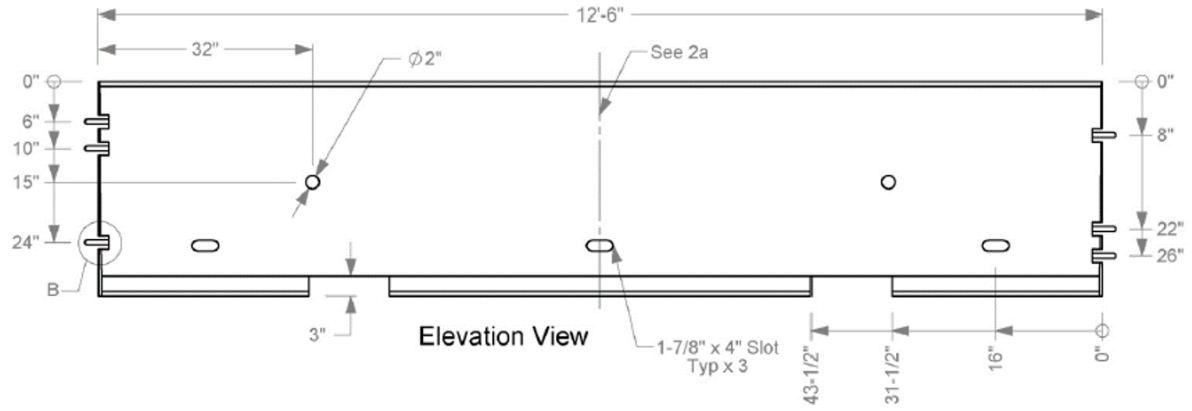
Overview/Problem Statement

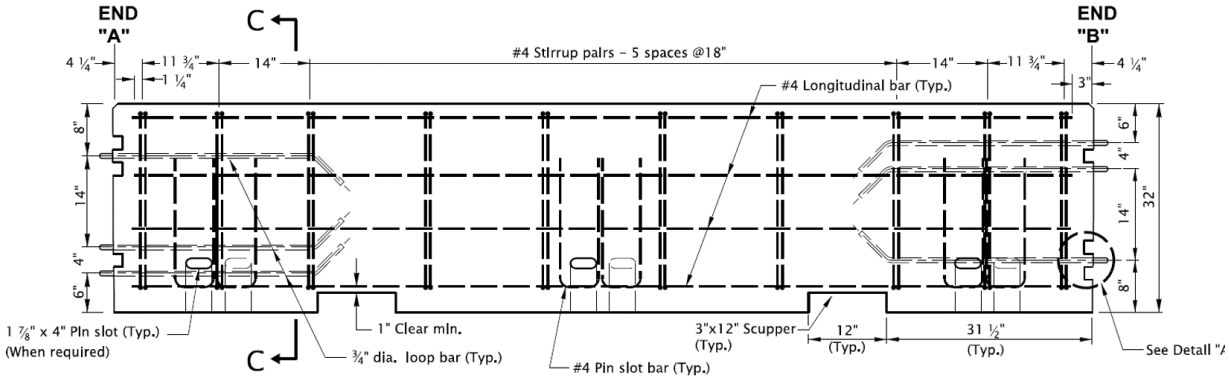
In this letter, two concrete barrier designs were compared and evaluated; 1) Oregon DOT's standard design and 2) F-shaped temporary concrete barrier design crash-tested by TTI (Sheikh et al. 2017; referred to as 'pooled fund barrier' herein). The main objective of this professional recommendation memorandum was to determine if the current Oregon DOT's 32-inch F-shaped concrete barriers (RD500 and RD501) meet the MASH TL-3 criteria. The major concerns brought by the sponsor and delivered to TTI researchers are mainly discussed in this letter.

1. Horizontal holes in pooled fund barrier

There are two horizontal holes located at 32-inch away from each side end and 15-inch away from the top face in the pooled fund barrier. These holes are embedded for shipping and construction lifting purposes, and there is no structural perspective involved. Thus, TTI researchers believe these holes are not necessary although it is recommended for easier shipping and placement.



(a) Pooled fund barrier design

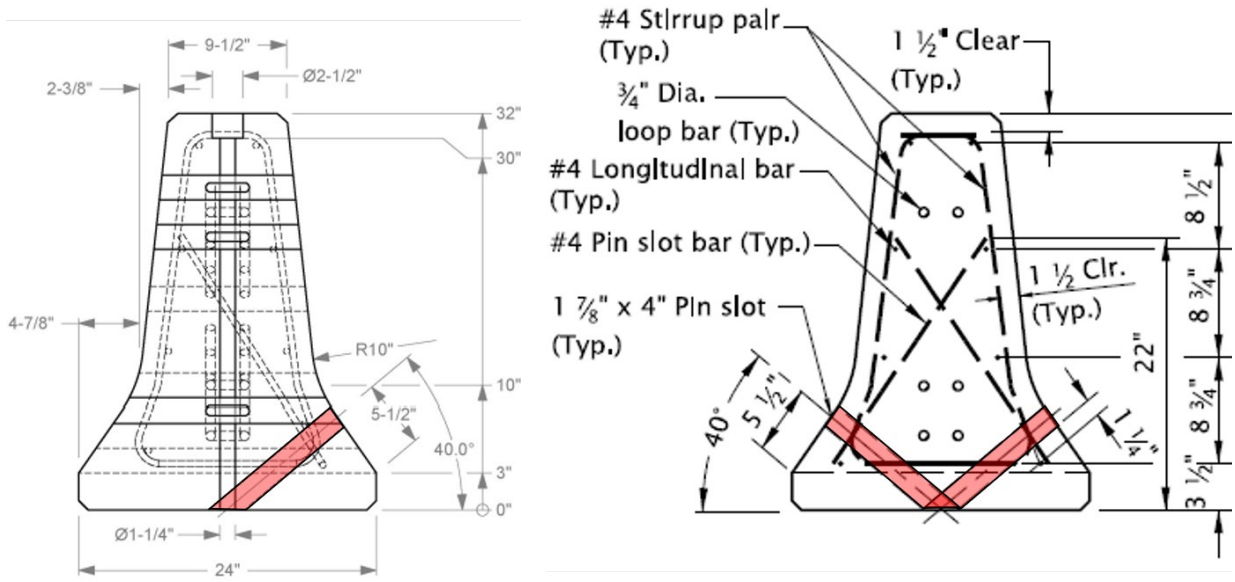


(b) Oregon standard barrier design

Figure 1. Comparison of Horizontal Holes

2. Slot on one side vs. slot on both sides

As shown in Figure 2, the pooled fund barrier design has one side slot in the barrier that can be pinned on the traffic side for temporary traffic control. The Oregon standard barrier design has two side slots in the barrier which can be pinned on both traffic and field sides to be suited for median barrier installations. Given that slots are located in the bottom part of the barrier which is expected to be under tension at the vehicle's impact moment, a reduced concrete area due to additional slots may not deteriorate the overall barrier's performance as long as the appropriate reinforcement is placed. Thus, the overall performance of the F-shaped barrier may not be affected by additional slots on the other side (field side).

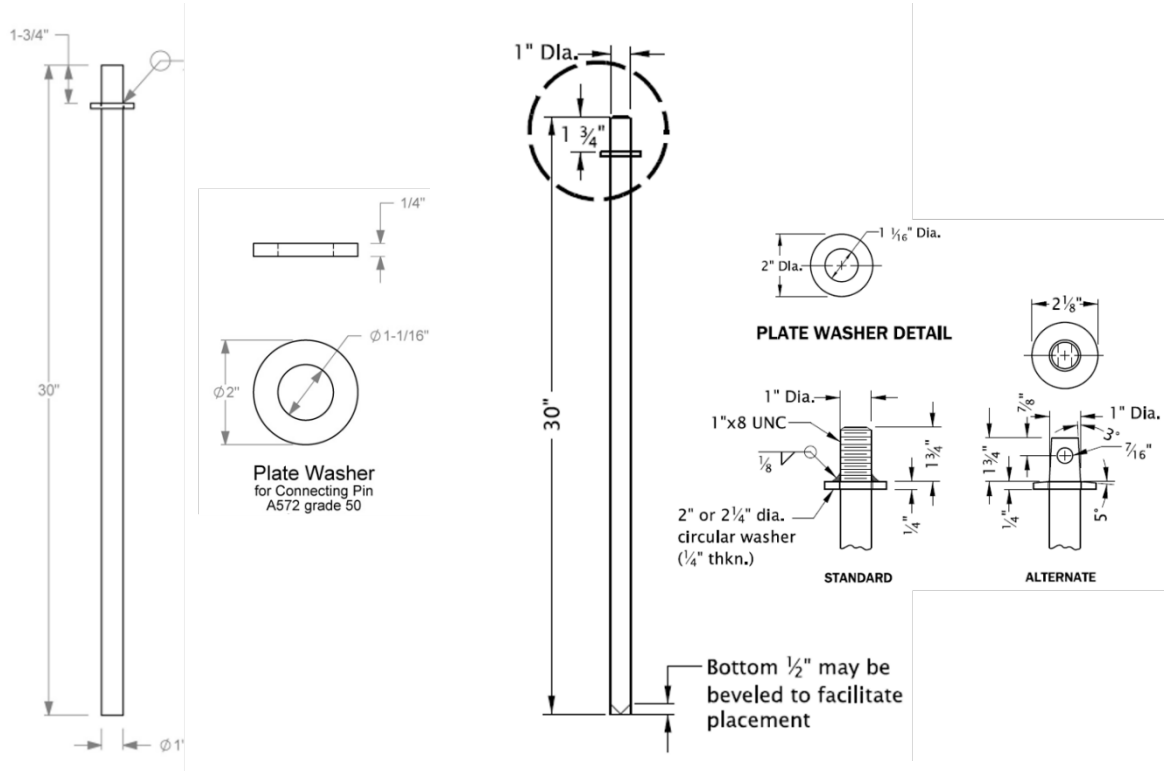


(a) Pooled fund barrier design (b) Oregon standard barrier design

Figure 2. Location of the slots on barriers

3. Slight difference in the washer and connecting pin

Figure 3 shows details of the connecting pin and washer from both designs. In a pin-and-loop type connection, the connection of adjacent precast barrier segments is established by a connecting pin (made of ASTM A 449 steel in the pooled fund barrier). The structural connection capacity is thus mainly based on the connecting pin and the loops. Considering that washer is a nonstructural part used to help the connecting pin hold its position, a slight difference in diameter (0.25 in. for standard washer and 0.125 in. for alternative washer) can be negligible. Also, whether the face of the top and bottom pin is 'squared off' or 'beveled' is not expected to make any difference as those are not in the shear critical location. TTI researchers recommend welding washers to the connecting pin.

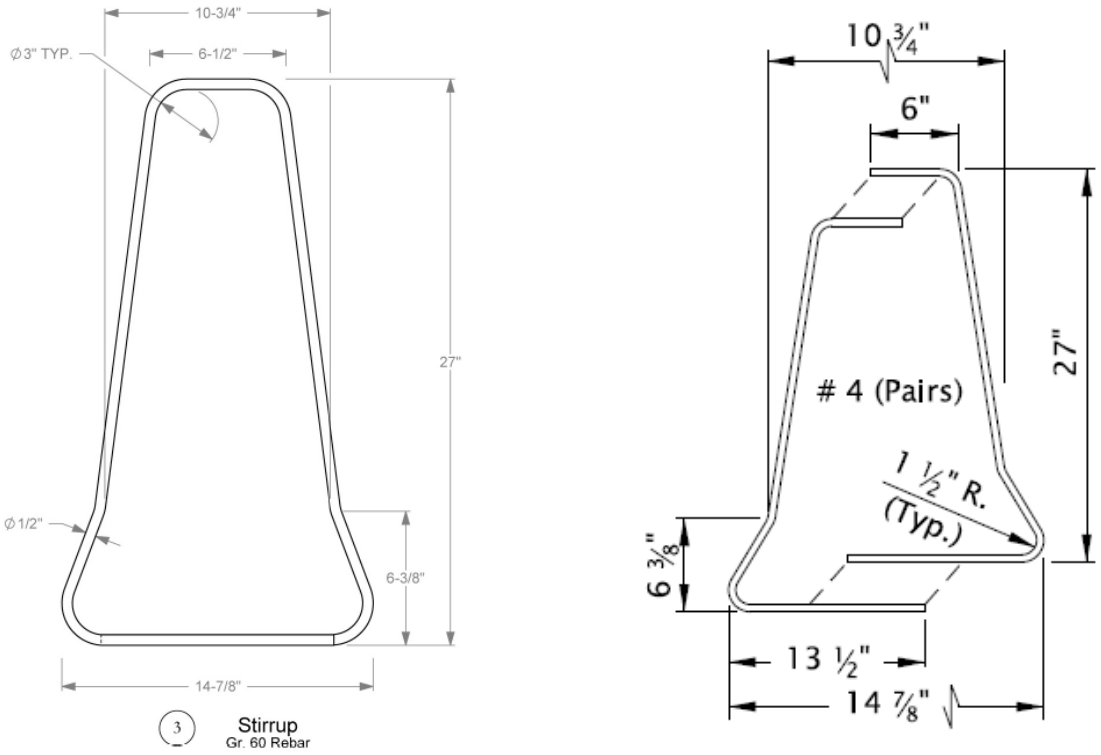


(a) Pooled fund barrier design (b) Oregon standard barrier design

Figure 3. Washer and Connecting pin

4. Use of spliced stirrup for Oregon DOT's standard drawings

Figure 4 shows stirrup placed on both designs. As shown in the figure, closed stirrup fabricated as a single piece is used in the pooled fund barrier design while spliced stirrup is used in the Oregon standard drawing for better constructability. TTI researchers believe the splice stirrup is acceptable as long as properly anchored and spliced with an adequate length of laps in accordance with AASHTO Article 5.10.8. Also, the top and bottom splice used in the Oregon standard drawing is a preferable splice detailing as the splice is located away from the direction of action of shear forces (Birely et al. 2018).



(a) Pooled fund barrier design (b) Oregon standard barrier design

Figure 4. Comparison of Stirrup Detailing

Summary of professional opinion on the Oregon 32 in. F-shaped barrier design

Based on the professional opinion aforementioned, it is concluded that the differences between the current Oregon DOT's standard design and F-shaped temporary concrete barrier design crash-tested by TTI may not affect the structural performance of the barrier and are negligible. Therefore, the Oregon 32 in. F-shaped barrier design is considered to be acceptable for the MASH TL-3 criteria.

References

Sheikh, N., Menges, W., and Kuhn, D., (2017). "MASH TL-3 Testing and Evaluation of Free-Standing Portable Concrete Barrier." Report No. 607911-1&2. Texas A&M Transportation Institute, College Station, TX.

Birely, A. C., Mander, J. B., Lee, J. D., McKee, C. D., Yole, K. J., and Barooah, U. R. (2018). "Precast, Prestressed Concrete Bent Caps: Volume 1 Preliminary Design Considerations and Experimental Test Program." Report No. FHWA/TX-18/0-6863-1, Texas A&M Transportation Institute, College Station, TX.