December 18, 2000

Refer to: HSA-1/B79

Gary L. Hoffman, P.E.
Chief Engineer for Highway Administration
Pennsylvania Department of Transportation
P.O. Box 2951
Harrisburg, PA 17105-2951

Dear Mr. Hoffman:

In your November 27 letter, you requested the Federal Highway Administration's (FHWA) acceptance of the Pennsylvania Department of Transportation's (PennDOT's) modified F-Shape temporary concrete barrier as a National Cooperative Highway Research Program (NCHRP) Report 350 longitudinal barrier at test level 3 (TL-3). To support this request, you included copies of a Texas Transportation Institute (TTI) test report dated November 2000, entitled " NCHRP Report 350 Test 3-11 on the PennDOT Portable Concrete Barrier" and videotapes of the test that was conducted.

The tested PennDOT temporary barrier is an 860-mm high modified F-shape portable barrier in segment lengths of 3.6 m. The use of a 127-mm vertical reveal in lieu of the standard 76-mm dimension increases the total barrier height to the 860 mm noted above and raises the slope break-point to 300 mm, just slightly lower than the 330-mm height in a New Jersey shape barrier. The base width is 610 mm and the barrier tapers to a 230-mm top width. Reinforcing consists of three longitudinal number 13 bars with five number 13 stirrups at each end on 50-mm centers. The connection between segments is a 300-mm long x 690-mm high x 13 mm thick steel plate that fits loosely into a vertical slot formed into the end of each segment. The segments are tightly butted together during installation. The first and last segments in a continuous run of barrier are both anchored with eight number 19 rebars driven into the pavement, four across each end and two on each side of these segments near the ends. A drawing of the PennDOT design is shown in Enclosure 1.

The summary results of the pickup truck test you conducted (NCHRP Report 350 test 3-11) are shown in Enclosure 2. Sixteen barrier segments were used in the test for a total installation length of 58.6 m. The test vehicle impacted the barrier at 100 km/h and at an angle of 24.2 degrees. The impact point was 1.2 m upstream from the connection between segments 7 and 8 or approximately 24.4 m from the upstream end of the test installation. Both ends of the test installation were anchored as described above to limit movement. Under these test and impact conditions, both the dynamic and permanent deflections of the barrier were reported to be 2555 mm. The pickup truck was contained and redirected, but the barrier separated at the first joint downstream from the impact point (between

segments 7 and 8). While this separation is not desirable, it is acceptable as long as the impacting vehicle is contained and redirected upright. However, the barrier deflection observed in the test would limit the use of this design to sites where a relatively large deflection can be accommodated or where additional measures can be taken to reduce the deflection to within acceptable limits.

Discussions with Mr. Paul Kokos of your staff confirmed that when your design is used as a permanent barrier, the lower 50 mm of the base will be set into the roadway surface thereby resulting in a barrier having the standard F-shape profile that can be expected to have little or no deflection under normal impacts. He also indicated that barrier segments constructed to the tested design will be clearly marked to differentiate them from your original design which used a smaller steel plate, contained less reinforcing, and more importantly, failed to contain the pickup truck when tested to NCHRP Report 350 criteria.

Based on the reported test results, we agree that the PennDOT modified portable concrete barrier meets the evaluation criteria for an NCHRP Report 350 test level 3 (TL-3) longitudinal barrier. When installed as tested, it may be used on the National Highway System (NHS) as a temporary barrier when such use is considered appropriate by a transportation agency, and as a permanent barrier when set two inches below grade. Because this design is the only accepted temporary concrete barrier that does not have a tensile connection between segments, its performance should continue to be monitored to verify satisfactory field service, particularly when it is used on the outside of curves.

Sincerely yours,

(original signed by Rudolph M. Umbs)
for
Frederick G. Wright
Program Manager, Safety

2 Enclosures

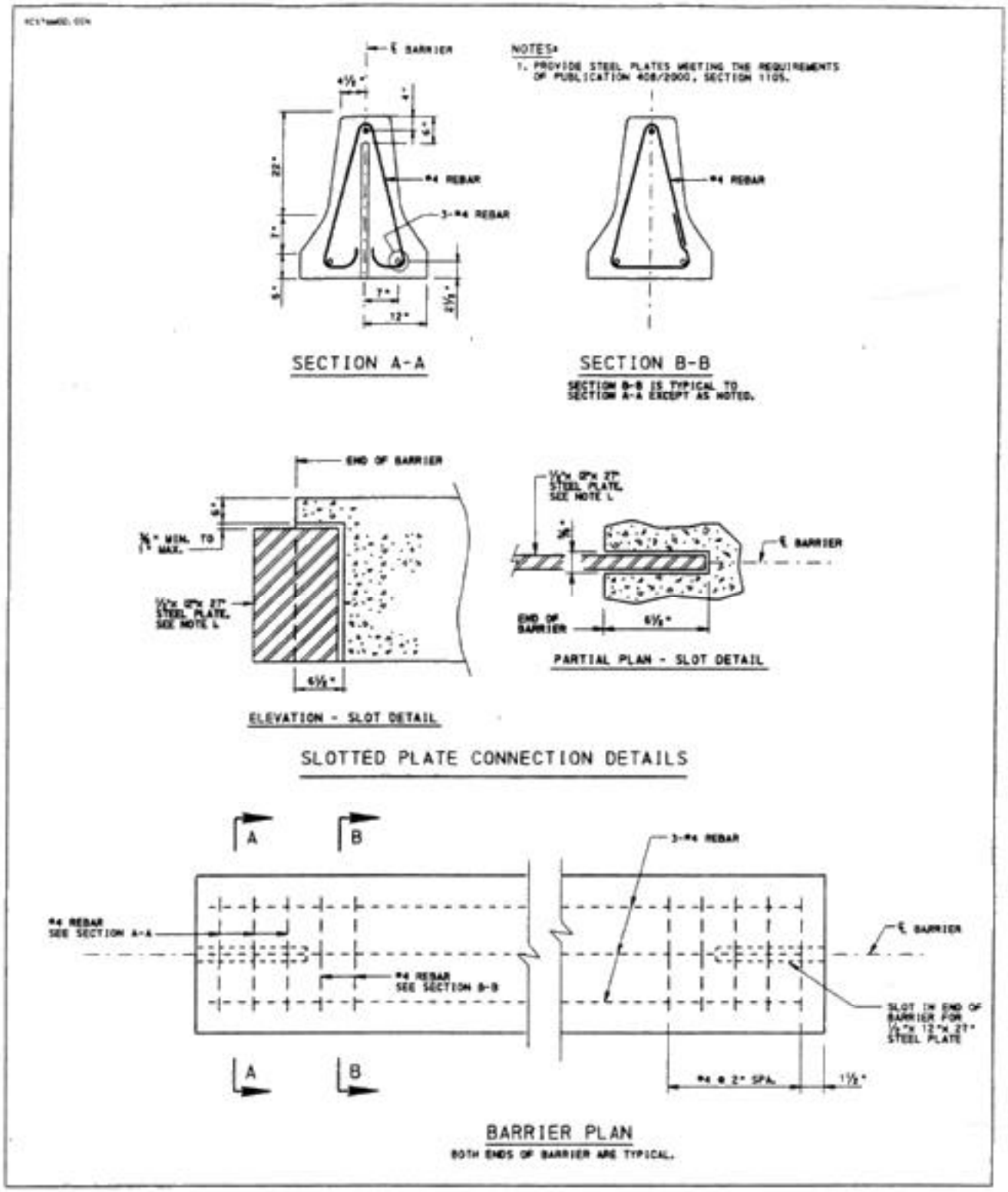
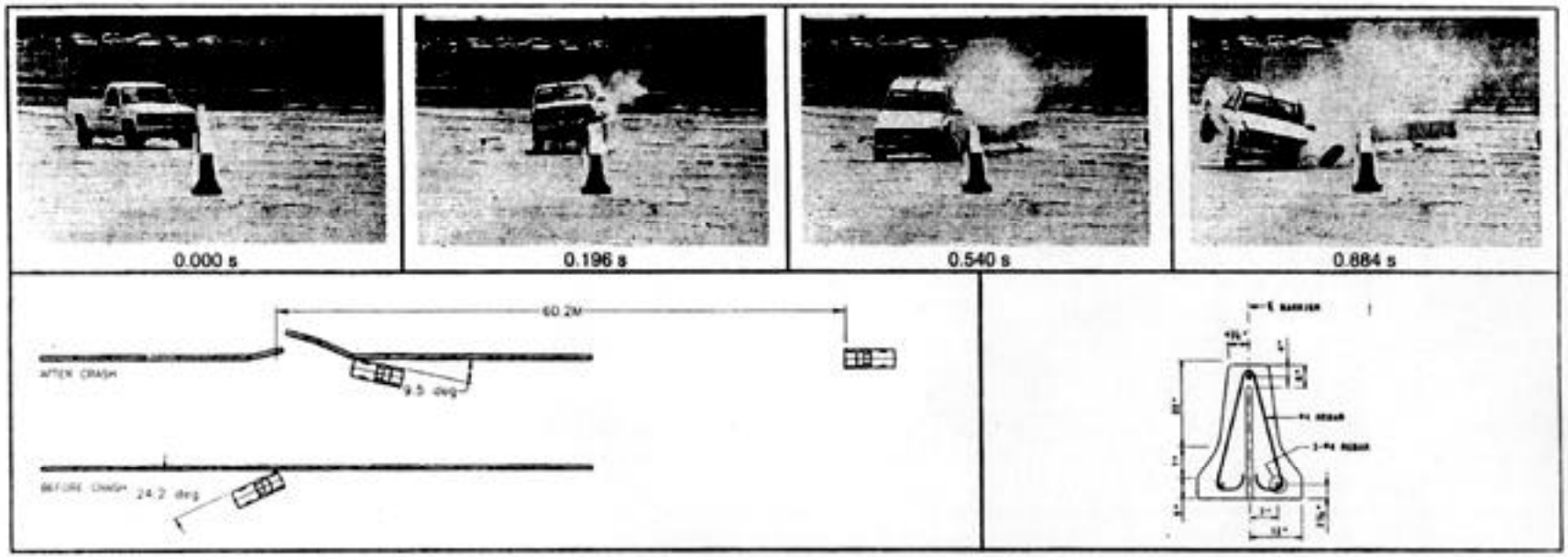


Figure 1. Details of the PennDOT portable concrete barrier.



General Information
- Test Agency ..... Texas Transportation Institute
- Test No. 473750-5
- Date 09/13/00

Test Article
- Type ..... Portable Concrete Barrier
- Name ..... PennDOT Portable Concrete Barriers
- Installation Length (m) 58.56
- Material or Key Elements ... 16 each 3.66-m-long Jersey Shape Concrete Barriers
- **Soil Type and Condition** .... Concrete Pavement, Dry

Test Vehicle
- Type ..... Production
- Designation 2000P
- Model ..... 1996 Chevrolet 2500 Pickup Truck
- Mass (kg)
  - Curb 2120
  - Test Inertial 2000
  - Dummy ..... No Dummy
  - Gross Static 2000

Impact Conditions
- Speed (km/h) 100.0
- Angle (deg) 24.2

Exit Conditions
- Speed (km/h) 85.8
- Angle (deg) 9.5

Occupant Risk Values
- Impact Velocity (m/s)
  - x-direction 3.6
  - y-direction 6.3
- THIV (km/h) 25.4
- Ridedown Accelerations (g's)
  - x-direction 4.6
  - y-direction 9.5
- PHD (g's) 10.3
- ASI 1.31
- Max. 0.050-s Average (g's)
  - x-direction ..... -5.8
  - y-direction 10.5
  - z-direction ..... -5.2

Test Article Deflections (m)
- Dynamic 2.55
- Permanent 2.55
- Working Width 3.00

Vehicle Damage
- Exterior
  - VDS 11LFQ
  - CDC ..... 11FYEK3 & 11LDEW4
- Maximum Exterior Vehicle Crush (mm) 320
- Interior
  - OCDI LS0000000
- Max. Occ. Compart. Deformation (mm) 30

Post-Impact Behavior (during 1.0 s after impact)
- Max. Yaw Angle (deg) ..... -38
- Max. Pitch Angle (deg) ..... -16
- Max. Roll Angle (deg) ..... -19

Figure 10. Summary of results for test 473750-5, *NCHRP Report 350* test 3-11.