



U.S. Department  
of Transportation

**Federal Highway  
Administration**

November 16, 1999

400 Seventh St., S.W.  
Washington, D.C. 20590

Refer to: HMHS-B60

Mr. Don H. Johnson  
Trinity Industries, Inc.  
2525 Stemmons Freeway  
Dallas, Texas 75207

Dear Mr. Johnson:

In your October 22 letter, you requested Federal Highway Administration (FHWA) acceptance of a modified w-beam rail element called O-Rail for use with strong-post w-beam guardrail on the National Highway System (NHS). To support this request you included copies of a Southwest Research Institute report dated October 1999 written by Mr. Joe B. Mayer, Jr. and entitled "FULL-SCALE CRASH EVALUATION OF A G4-1S TYPE GUARDRAIL SYSTEM USING THE O-RAIL ELEMENT AS THE RAIL SECTION," and copies of a videotape showing the test that was run.

We note that the O-Rail is shaped similar to a standard w-beam rail element, but uses flutes and edge curls "to redistribute material to critical stress locations". The tested design was fabricated from 15-gauge galvanized steel. The curled edges are crushed flat on one end of each beam so they will slide into the curl of the adjacent downstream beam at the spliced joint to minimize vertical flexure at the joint. The O-Rail dimensions are such that it can be spliced to standard w-beam rail elements with the w-beam either on top or underneath the O-Rail at the splice location. However, the O-Rail itself cannot be nested. Enclosure 1 shows a comparison the O-Rail cross section geometry to the standard w-beam section.

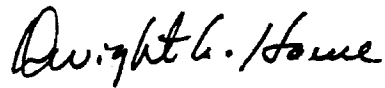
You ran NCHRP Report 350 test 3-11, a 25 degree impact with a 2000-kg pickup truck at 100 km/h, into a standard strong-post system with W150 x 13.5 (W6 x 8.5) posts and 150 mm x 150 mm x 350 mm (6 inch x 6 inch x 14 inch) routed wood blockouts. In lieu of standard w-beam, 3800-mm long sections of O-Rail were used. Enclosure 2 is a copy of the summary test results. We note that the permanent deflection of the O-Rail (1168 mm or approximately 48 inches) was slightly greater than comparable tests with standard strong post w-beam systems, but that the occupant impact velocities and maximum roll angle of the pickup truck were substantially lower than they were in tests with wood and steel post designs with standard 200-mm (8-inch) deep blockouts and with 150-mm (6-inch) deep blockouts.

We are willing to waive test 3-10 based on the results of your test 3-11 and on other tests that have been run on standard w-beam guardrail with the 820-kg car at 20 degrees.

Based on our review of the information you submitted, we conclude that the O-Rail may be used on the National Highway System as a direct substitute or replacement for standard w-beam on strong post systems when such use is requested by a transportation agency. Since you ran your test with the more-critical steel posts and 150-mm deep wood blockouts, our acceptance also includes its use with standard wood posts and with either 150-mm or 200-mm (6-inch or 8-inch) deep routed wood or recycled plastic blocks. Standard w-beam rail elements must continue to be used with all proprietary w-beam terminals and in all guardrail-to-bridge rail transitions unless they are re-tested using O-Rail.

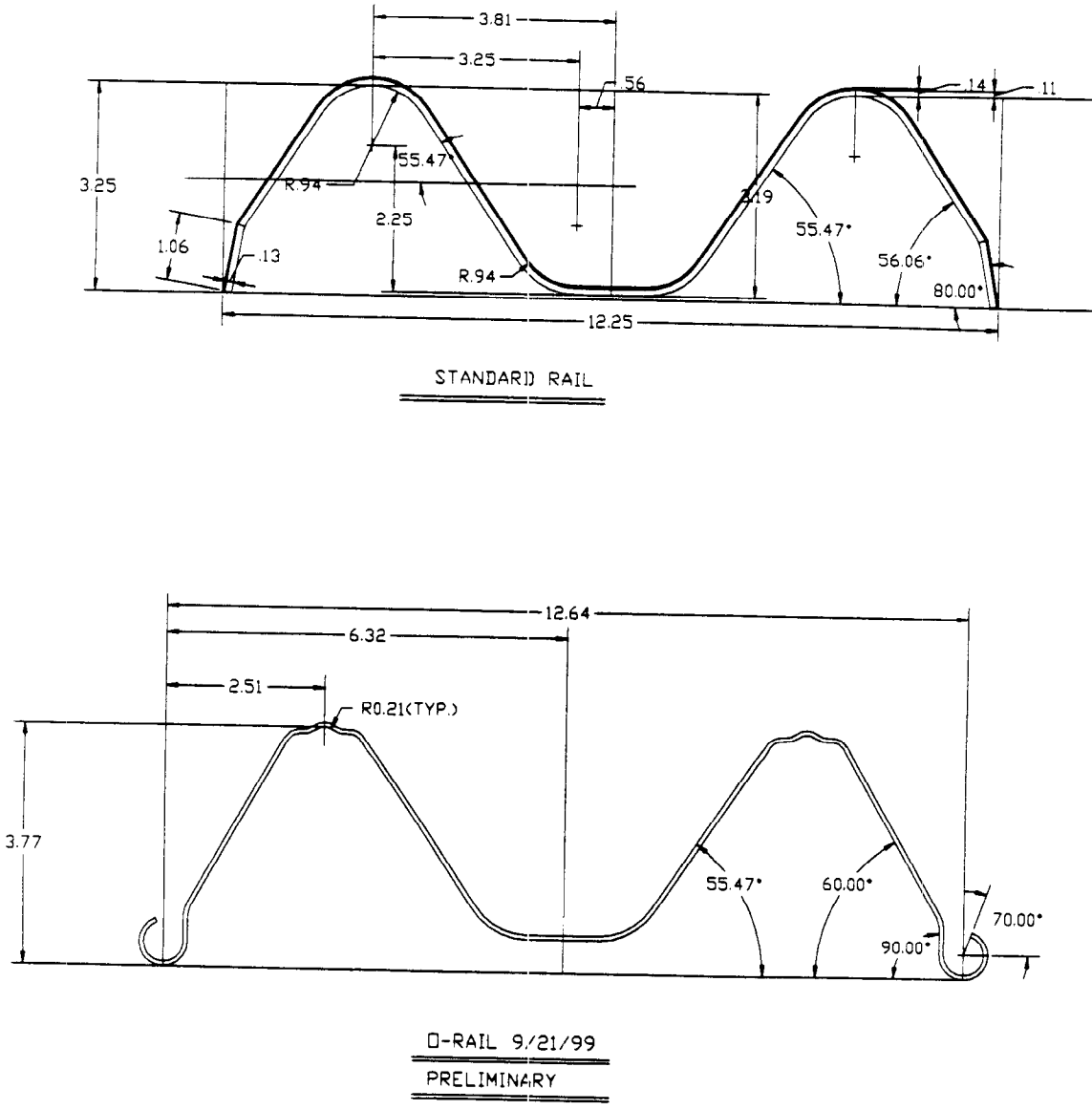
Since O-Rail is a proprietary product, its use on Federal-aid projects, except exempt, non-NHS projects, is subject to the conditions listed in Title 23, Code of Federal Regulations, Section 635.411, a copy of which is enclosed (Enclosure 3) for your ready reference. Please call Mr. Richard Powers of my staff if you have any questions relating to this acceptance letter.

Sincerely yours,

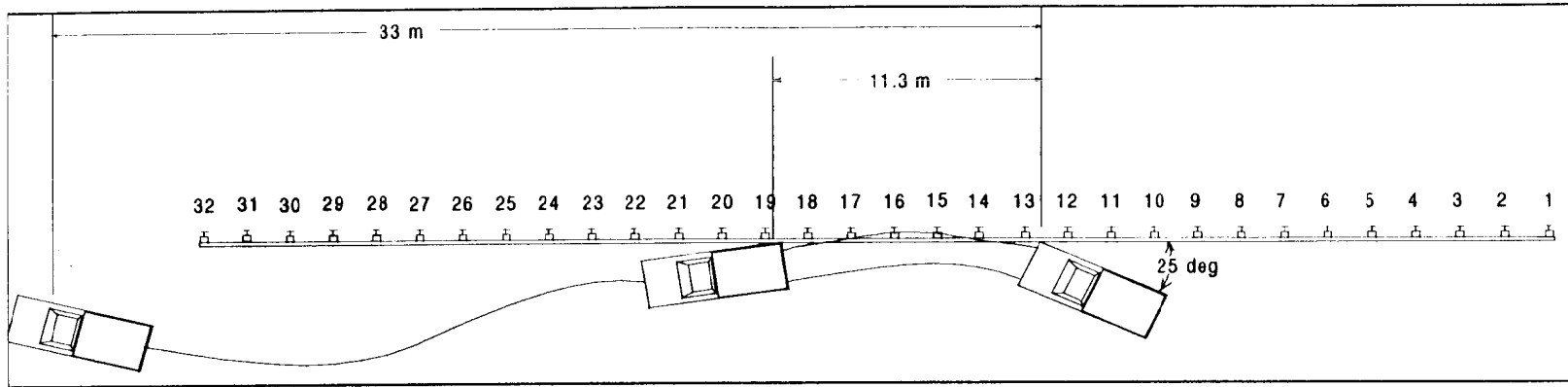
A handwritten signature in cursive script that reads "Dwight A. Horne".

Dwight A. Horne  
Director, Office of Highway Safety Infrastructure

3 Enclosures



**Figure 1. Comparison of O-Rail Section to Standard W-Beam Section, Test O-R 102**



General Information		Test Vehicle (continued)		Ridedown Accelerations (g's)	
Test Agency	Southwest Research Institute	Mass (kg) Dummy(s)	75.0	Y-direction	8.6
Test Number	O-R 102	Mass (kg) Gross Static	2110.0	<b>Test Article Deflection (mm)</b>	
Test Date	10-Aug-99	<b>Impact Conditions</b>		Dynamic	1168
<b>Test Article</b>	Prototype W-Beam	Speed (km/h)	100.2	Permanent	826
Type	G4-1S (Prototype)	Angle (deg)	25.3	<b>Vehicle Damage</b>	
Installation Length (m)	61	<b>Exit Conditions</b>		Exterior	
Barrier	W-beam	Speed (km/h)	55.1	VDS	01FQ-3
<b>Soil Type and Condition</b>	S1-Dry	Angle (deg)	7.1	DCDC	01FNEN
<b>Test Vehicle</b>		<b>Occupant Risk Values</b>		Interior	-
Type	Standard Pickup	Impact Velocity (m/s)		OCDI	RF000000
Designation	2000P	X-direction	3.5	<b>Post-Impact Vehicular Behavior</b>	
Model	1993 GMC Sierra 2500	Y-direction	3.7	Maximum Roll Angle (deg)	9.4
Mass (kg) Curb	2035	<b>Ridedown Accelerations (g's)</b>		Maximum Pitch Angle (deg)	15.3
Mass (kg) Test Inertial	2035	X-direction	6.8	Maximum Yaw Angle (deg)	Not Available

Figure 4. Summary of Results, Test O-R 102

**Sec. 635.411 Material or product selection.**

(a) Federal funds shall not participate, directly or indirectly, in payment for any premium or royalty on any patented or proprietary material, specification, or process specifically set forth in the plans and specifications for a project, unless:

(1) Such patented or proprietary item is purchased or obtained through competitive bidding with equally suitable unpatented items; or

(2) The State highway agency certifies either that such patented or proprietary item is essential for synchronization with existing highway facilities, or that no equally suitable alternate exists; or

(3) Such patented or proprietary item is used for research or for a distinctive type of construction on relatively short sections of road for experimental purposes.

(b) When there is available for purchase more than one nonpatented, nonproprietary material, semifinished or finished article or product that will fulfill the requirements for an item of work of a project and these available materials or products are judged to be of satisfactory quality and equally acceptable on the basis of engineering analysis and the anticipated prices for the related item(s) of work are estimated to be approximately the same, the PS&E for the project shall either contain or include by reference the specifications for each such material or product that is considered acceptable for incorporation in the work. If the State highway agency wishes to substitute some other acceptable material or product for the material or product designated by the successful bidder or bid as the lowest alternate, and such substitution results in an increase in costs, there will not be Federal-aid participation in any increase in costs.

(c) A State highway agency may require a specific material or product when there are other acceptable materials and products, when such specific choice is approved by the Division Administrator as being in the public interest. When the Division Administrator's approval is not obtained, the item will be nonparticipating unless bidding procedures are used that establish the unit price of each acceptable alternative. In this case Federal-aid participation will be based on the lowest price so established.

(d) Appendix A sets forth the FHWA requirements regarding (1) the specification of alternative types of culvert pipes, and (2) the number and types of such alternatives which must be set forth in the specifications for various types of drainage installations.

(e) Reference in specifications and on plans to single trade name materials will not be approved on Federal-aid contracts.