U.S. Department
of Transportation
Federal Highway
Administration

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

November 3, 2005

In Reply Refer To: HSA-10/B-140

Mr. Steve L. Brown
President
Trinity Highway Safety Products Division
P.O. Box 568887
Dallas, Texas 75356-8887

Dear Mr. Brown:

In his September 19, 2005, letter to Mr. Richard Powers, Mr. Don Johnson requested the Federal Highway Administration (FHWA) acceptance of a new strong post W-beam guardrail design called the T-31. With the letter, he also sent copies of a Texas Transportation Institute (TTI) report dated September 2005, entitled "NCHRP Report 350 TL-3 Testing of the T-31 W-beam Guardrail", and videotapes of the two tests that were conducted. Both of these tests were run using the new test vehicles that are being proposed as replacements for the 820C and 2000P vehicles in the ongoing National Cooperative Highway Research Program (NCHRP) project to update to Report 350. Specifically, test 3-10 was conducted using a car weighing approximately 1100 kg impacting the barrier at a 25-degree angle and test 3-11 was conducted with a quad-cab pickup truck with a nominal weight of 2270 kg.

The T-31 guardrail uses standard 12-gauge W-beam panels mounted on modified W6 x 8.5 steel posts with a top-of-rail height of 31 inches. The modified posts, called SYLP (Steel Yielding Line Posts) posts are 6-feet long and set in the ground to a depth of 40 inches. Each post has four 13/16-inch diameter holes in the flanges at the ground line. The rail is attached to each post without an offset block using a 5/8-inch diameter x 1-3/4-inch long special bolt with a slotted countersunk head. A 6-inch long section of W-beam called a flange protector (backup plate) is used at each post. All splices in the W-beam rail elements fall midspan, between adjacent posts. Design details for the SYLP post and its unique connection bolt are shown on Enclosure 1.

As noted above, the T-31 was first tested using the heavier vehicles (and the increased impact angle for the small car) that are proposed for use in the Report 350 update that is currently nearing completion. However, after reviewing the results of the two tests you ran under the

proposed guidelines and realizing that it will be several years before any new guidelines become effective, my staff concluded that the current small car test could be more critical than the anticipated future test 3-10. Specifically, it was thought that a lighter small car impacting at the standard 20-degree angle would have contact with more of the T-31 support posts than occurred in your test with the heavier car at the 25-degree impact angle. Consequently, on October 19, 2005, the TTI conducted the standard car test and sent the summary results to Mr. Powers on October 26, 2005. Although the occupant impact velocities and ridedown accelerations were somewhat higher in the second test, all values remained under the NCHRP Report 350 *preferred* limits. There was less rail deflection with the shallower impact angle but more damage to the vehicle itself. Summary sheets for each of the three tests are shown as Enclosure 2.

Based on these test results, the T-31 barrier system as described above is classified as a test level 3 barrier and may be used on the National Highway System when such use is acceptable to the contracting authority. The T-31 guardrail may be considered crashworthy under both the existing Report 350 guidelines and under the new guidelines when they are formally adopted, assuming that the test matrix currently being proposed by the researchers remains unchanged.

Please note the following standard provisions that apply to the FHWA letters of acceptance:

- Any changes that may adversely influence the crashworthiness of this barrier will require a new acceptance letter.
- Should the FHWA discover that the qualification testing was flawed, that in-service performance reveals unacceptable safety problems, or that the device being marketed is significantly different from the version that was crash tested, it reserves the right to modify or revoke its acceptance.
- You will be expected to supply potential users with sufficient information on design and installation requirements to ensure proper performance.
- You will be expected to certify to potential users that the hardware furnished has essentially the same chemistry, mechanical properties, and geometry as that submitted for acceptance.
- To prevent misunderstanding by others, this correspondence, designated as acceptance letter B-140, shall not be reproduced except in full. This letter, and the test documentation upon which this letter is based, is public information. All such letters and documentation may be reviewed at our office upon request.
- Since the T-31 guardrail is a steel product, the provisions of Title 23, Code of Federal Regulations, Section 635.410 apply to its use on federally funded projects.
- The T-31 guardrail includes patented components and is considered a proprietary product. When proprietary devices are *specified by a highway agency* for use on federally-funded projects they: (a) must be supplied through competitive bidding with equally suitable unpatented items; (b) the highway agency must certify that they are essential for synchronization with existing highway facilities or that no equally suitable alternative exists or; (c) they must be used for research or for a distinctive type of construction on relatively short sections of road for experimental purposes. Our regulations concerning proprietary products are contained in Title 23, Code of Federal Regulations, Section 635.411.

- This acceptance letter shall not be construed as authorization or consent by the FHWA to use, manufacture, or sell any patented device for which the applicant is not the patent holder. Patent issues, if any, are to be resolved by the applicant.

Sincerely yours,

/original signed by John R. Baxter/

John R. Baxter, P.E.
Director, Office of Safety Design
Office of Safety

2 Enclosures

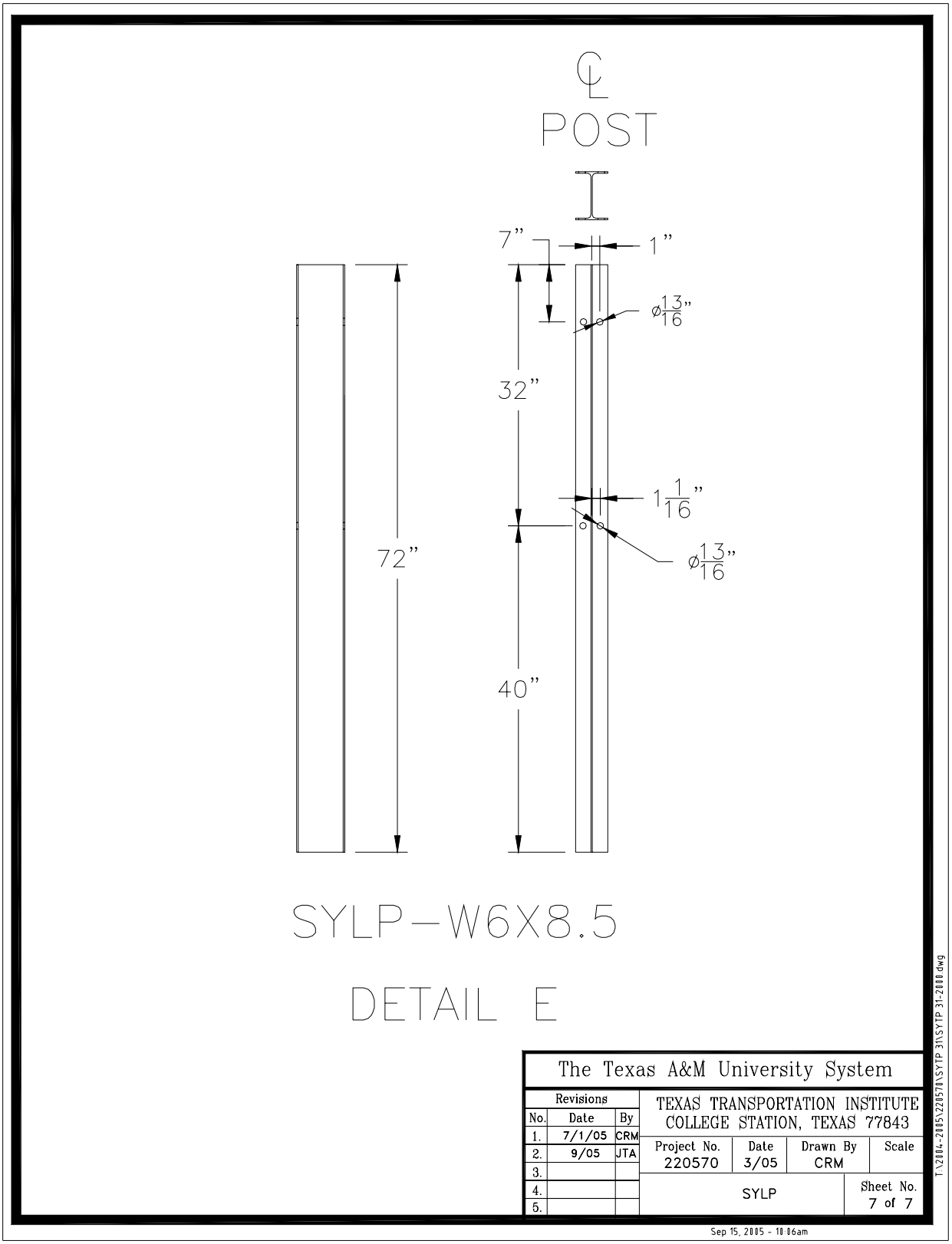
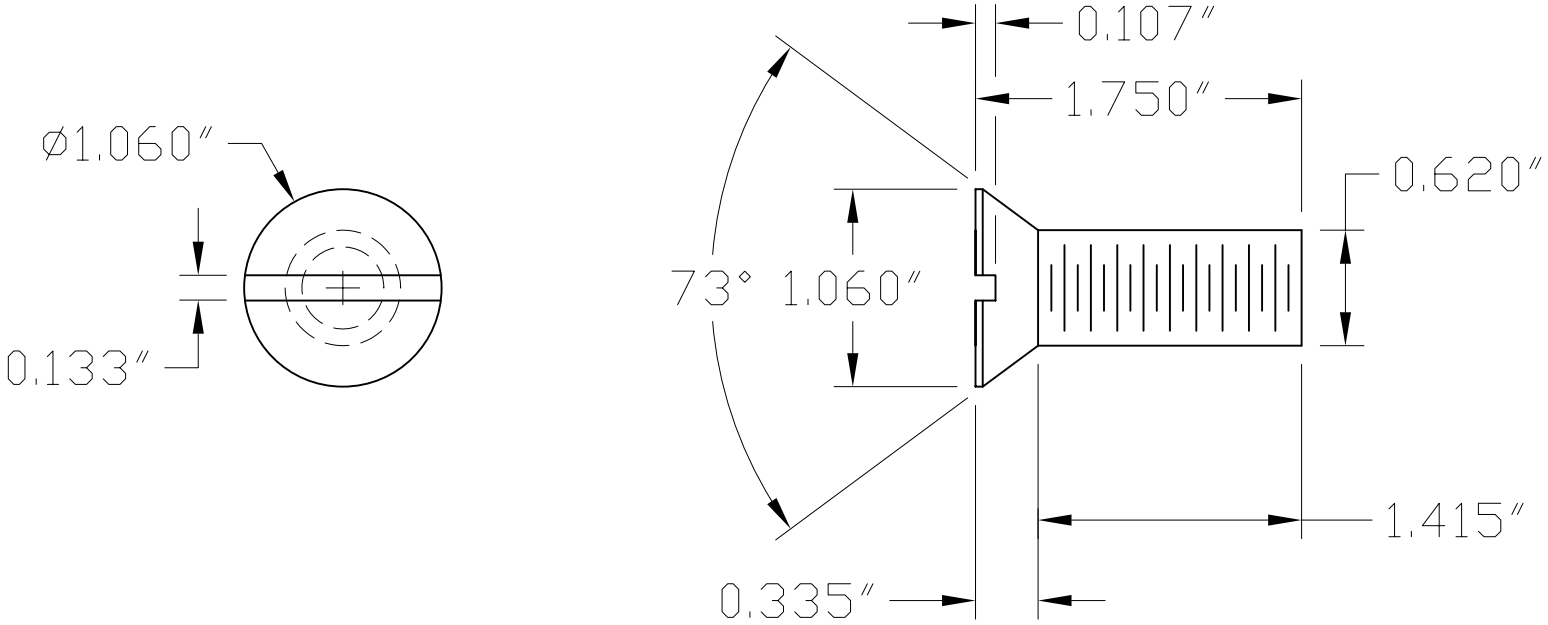


Figure 7. Details of the SYLP for the T-31.

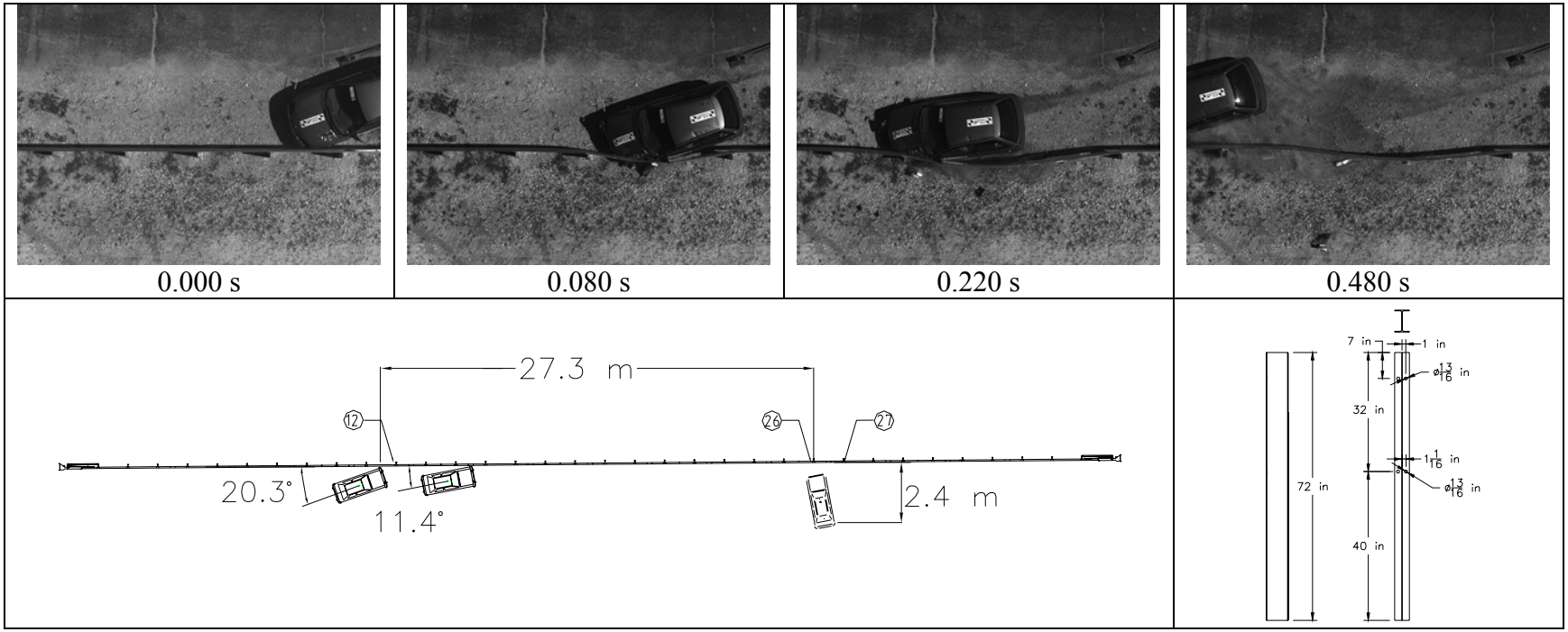


1.75” ANSI/ASME B18.5 GRADE 2, SLOTTED COUNTERSUNK BOLT
THREADS: UNIFIED COARSE, CLASS 2A,
11 THREADS PER INCH

The Texas A&M University System					
Revisions			TEXAS TRANSPORTATION INSTITUTE COLLEGE STATION, TEXAS 77843		
No.	Date	By			
1.			Project No. 220570	Date 10/05	Drawn By JWK	Scale
2.						
3.						
4.			T31 CONNECTION BOLT		Sheet No. 1 of 1
5.					

T:\2004-2005\220570\T31 Connection Bolt.dwg

Oct 04, 2005 - 11:49am

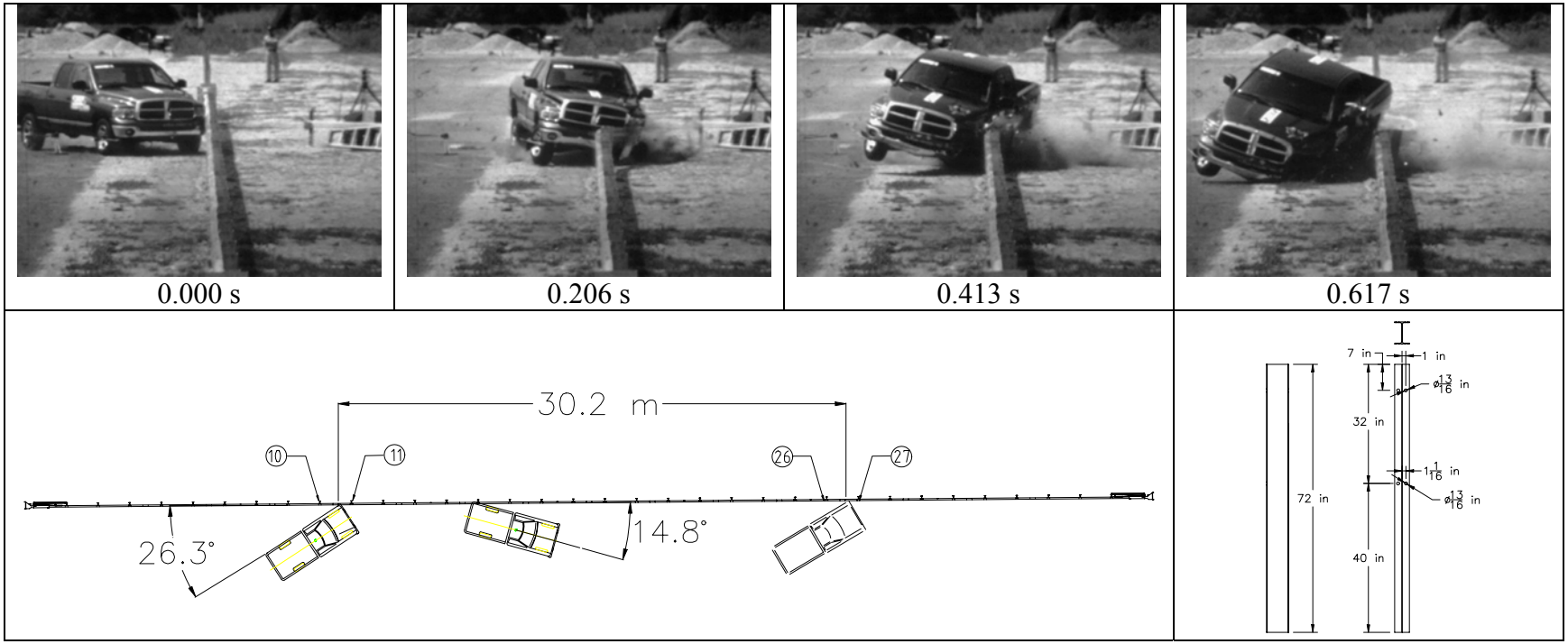


General Information	
Test Agency	Texas Transportation Institute
Test No.	220570-4
Date	10-19-2005
Test Article	
Type	Guardrail
Name	T-31
Installation Length (m)	68.6
Material or Key Elements	W-Beam Guardrail on Steel Yielding Line Posts with Splices at Mid-Span
Soil Type and Condition	Standard Soil, Dry
Test Vehicle	
Type	Production
Designation	820C
Model	1997 Geo Metro
Mass (kg)	
Curb	805
Test Inertial	825
Dummy	75
Gross Static	900

Impact Conditions	
Speed (km/h)	102.1
Angle (deg)	20.3
Exit Conditions	
Speed (km/h)	58.0
Angle (deg)	-11.4
Occupant Risk Values	
Impact Velocity (m/s)	
Longitudinal	6.4
Lateral	5.8
THIV (km/h)	29.8
Ridedown Accelerations (g's)	
Longitudinal	-12.9
Lateral	7.6
PHD (g's)	14.8
ASI	1.05
Max. 0.050-s Average (g's)	
Longitudinal	-10.2
Lateral	6.8
Vertical	2.4

Test Article Deflections (m)	
Dynamic	0.49
Permanent	0.31
Working Width	1.34
Vehicle Damage	
Exterior	
VDS	11LFQ5
CDC	11LFEW3
Max. Exterior Vehicle Crush (mm)	390
Interior	
OCDI	LF0013000
Max. Occupant Compartment Deformation (mm)	85
Post-Impact Behavior	
(during 1.0 sec after impact)	
Max. Yaw Angle (deg)	-35
Max. Pitch Angle (deg)	-3
Max. Roll Angle (deg)	-7

Figure 15. Summary of results for *NCHRP Report 350* test 3-10 on T-31 W-beam guardrail.



General Information

Test Agency	Texas Transportation Institute
Test No.	220570-2
Date	08-02-2005

Test Article

Type	Guardrail
Name	T-31
Installation Length (m)	68.58
Material or Key Elements	W-Beam Guardrail on Steel Yielding Line Posts with Splices at Mid-Span
Soil Type and Condition	Standard Soil, Dry

Test Vehicle

Type	Production
Designation	2270P
Model	2002 Dodge Ram 1500
Mass (kg)	
Curb	2207
Test Inertial	2299
Dummy	No dummy
Gross Static	2299

Impact Conditions

Speed (km/h)	97.6
Angle (deg)	26.8

Exit Conditions

Speed (km/h)	63.8
Angle (deg)	14.8

Occupant Risk Values

Impact Velocity (m/s)	
Longitudinal	5.0
Lateral	5.1
THIV (km/h)	23.9
Ridedown Accelerations (g's)	
Longitudinal	-6.1
Lateral	7.4
PHD (g's)	7.5
ASI	0.70
Max. 0.050-s Average (g's)	
Longitudinal	-5.0
Lateral	5.5
Vertical	1.8

Test Article Deflections (m)

Dynamic	1.04
Permanent	0.73
Working Width	1.12

Vehicle Damage

Exterior	
VDS	11LFQ5
CDC	11LFEW4
Max. Exterior Vehicle Crush (mm)	410
Interior	
OCDI	FS0000000
Max. Occupant Compartment Deformation (mm)	0

Post-Impact Behavior

(during 1.0 sec after impact)

Max. Yaw Angle (deg)	42
Max. Pitch Angle (deg)	-14
Max. Roll Angle (deg)	-22

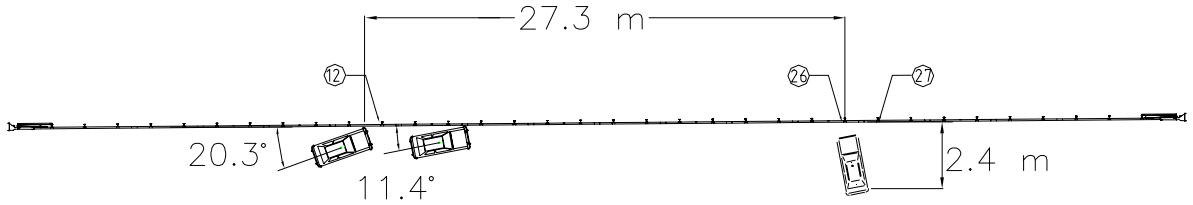
Figure 22. Summary of results for *NCHRP Report 350* test 3-11 on the T-31.

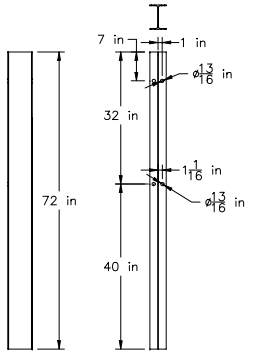
0.000 s

0.080 s

0.220 s

0.480 s





General Information

Test Agency	Texas Transportation Institute
Test No.	220570-4
Date	10-19-2005

Test Article

Type	Guardrail
Name	T-31
Installation Length (m)	68.6
Material or Key Elements	W-Beam Guardrail on Steel Yielding Line Posts with Splices at Mid-Span
Soil Type and Condition	Standard Soil, Dry

Test Vehicle

Type	Production
Designation	820C
Model	1997 Geo Metro
Mass (kg)	
Curb	805
Test Inertial	825
Dummy	75
Gross Static	900

Impact Conditions

Speed (km/h)	102.1
Angle (deg)	20.3

Exit Conditions

Speed (km/h)	51.8
Angle (deg)	-11.4

Occupant Risk Values

Impact Velocity (m/s)	
Longitudinal	6.4
Lateral	5.8
THIV (km/h)	29.8
Ridedown Accelerations (g's)	
Longitudinal	-12.9
Lateral	7.6
PHD (g's)	14.8
ASI	1.05
Max. 0.050-s Average (g's)	
Longitudinal	-10.2
Lateral	6.8
Vertical	2.4

Test Article Deflections (m)

Dynamic	0.42
Permanent	0.31
Working Width	0.50

Vehicle Damage

Exterior	
VDS	11LFQ5
CDC	11LFEW3
Max. Exterior Vehicle Crush (mm)	390
Interior	
OCDI	LF0013000
Max. Occupant Compartment Deformation (mm)	85

Post-Impact Behavior

(during 1.0 sec after impact)	
Max. Yaw Angle (deg)	-35
Max. Pitch Angle (deg)	-3
Max. Roll Angle (deg)	-7

Summary of results for *NCHRP Report 350* test 3-10 on the T-31 Guardrail.