August 30, 2002

HSA-10/B96

Mr. Rick Mauer
National sales Manager
Marion Steel Company
Post Office Box 837
Greenland, New Hampshire 03840-0837

Dear Mr. Mauer:

Your January 8 letter to Mr. Lawrence A. Staron, former Chief of the Federal Highway Administration's Federal-Aid and Design Division, was forwarded to me for a response. Because you requested acceptance of a modified cable barrier design that used a new anchoring system, you subsequently asked Mr. Richard Powers of my staff to withhold action on the barrier proper until the new terminal design was accepted. An interim review of the test report also revealed some discrepancies between the report text and figures. A revised report, dated February 2002 and entitled "NCHRP Report 350 Test 3-11 of the Wire Rope Barrier with Marion Steel 6 Kg/M U-Channel Posts" was sent to Mr. Powers by Dr. Dean Alberson, Texas Transportation Institute Research Engineer on March 4. The proprietary cable anchor was finally accepted on August 29, following additional tests and significant design modifications. However, the terminal changes would have no effect on the performance of the length of need section of barrier that you tested.

Your tested installation was a 3-strand cable guardrail installed as a median barrier with the upper and lower cables on the field side of the posts and the middle cable on the impact side. The cables were 19-mm diameter 3 x 7 wire rope and their heights above the ground were approximately 520 mm, 650 mm, and 775 mm. The length-of-need posts were standard 1664-mm long 6 kg/m U-channel posts installed on 2-meter centers with trapezoidal soil plates just below the ground line. The cables were attached to the line posts with proprietary 6.4-mm diameter locking hook bolts. The test installation was anchored at both ends with TTI's proprietary Cable Guardrail Terminal and each cable was tensioned to 25 kN (5600 lbs.) for the ambient temperature of 21 degrees C. Design details can be seen in Enclosure 1, but note that changes have been made to the terminal itself and its final design is somewhat different from that shown on Enclosure 1A.

NCHRP Report 350 Test No. 3-11 was run on the 101.4 meter test installation, with the pickup truck impacting approximately 20 m from the upstream anchor at 25.3 degrees and 100.7 km/h. The dynamic deflection of the cable barrier was 1.99 m with the 2.0 m post spacing. By comparison, the dynamic deflection of the standard 3-cable median barrier in test 3-11 was 3.4 m. The reduced deflection seen in your test can be attributed to the combination of higher cable tension, the reduced post

spacing, and the use of locking hook bolts to develop the full strength of each post before the cables disengage. Summary test results are shown in Enclosure 2.

Test 3-10, an 820-kg car impacting at 20 degrees, was not run. However, based on earlier tests of Washington State's cable median barrier that has cables at the same heights (but with significantly less tension) and posts on 5.0 m centers, I am willing to waive test 3-10.

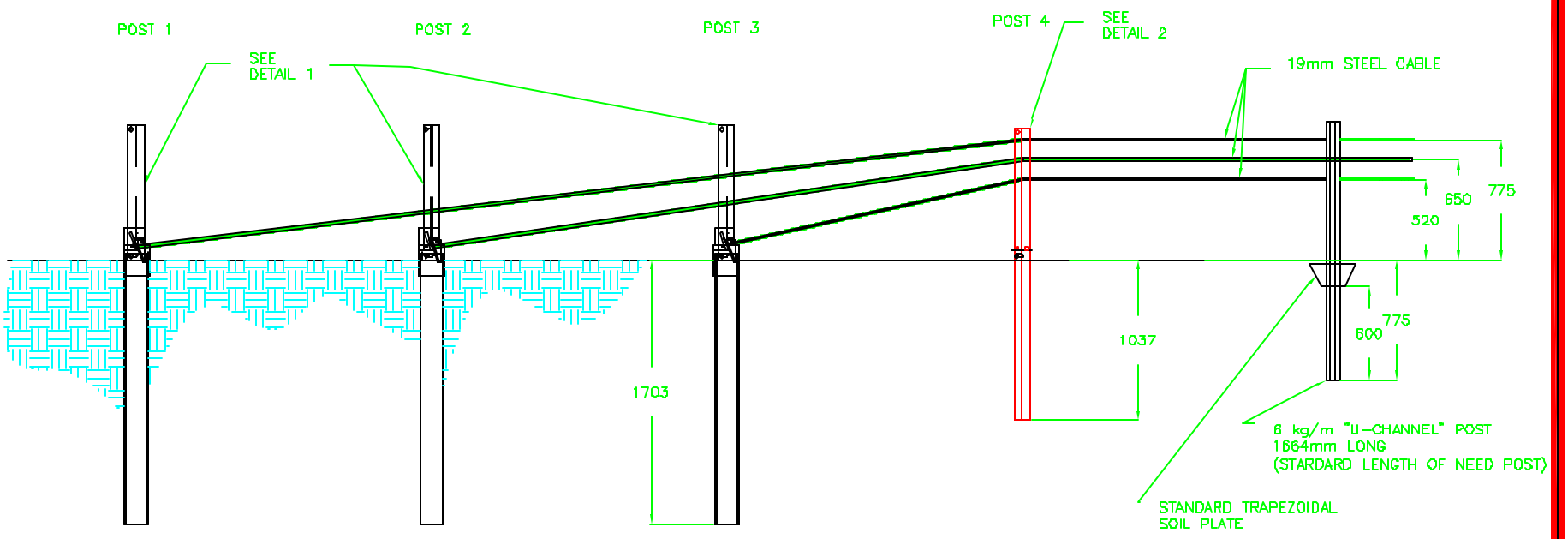
The 3-strand cable barrier described above is acceptable for use on the National Highway System as an NCHRP Report 350 test level 3 (TL-3) barrier. Although tested as a median barrier, this design may be used as a roadside barrier with all three cables on the traffic side of the posts at heights of approximately 610 mm, 685 mm, and 760 mm above the ground. Your posts and locking hook bolts may also be used with the current NCHRP Report 350 concrete anchor block terminal and the standard 3-strand cable rail with its reduced cable tension, 5.0-m post spacing, and a dynamic deflection of 3.5 m. Use of the patented locking hook bolts is likely to reduce the barrier dynamic deflection to some extent.

Since both the TTI anchor and the locking hook bolts at each line post are considered proprietary, the provisions of Title 23 CFR, Section 635.411 apply to the use of this system on federally funded projects.

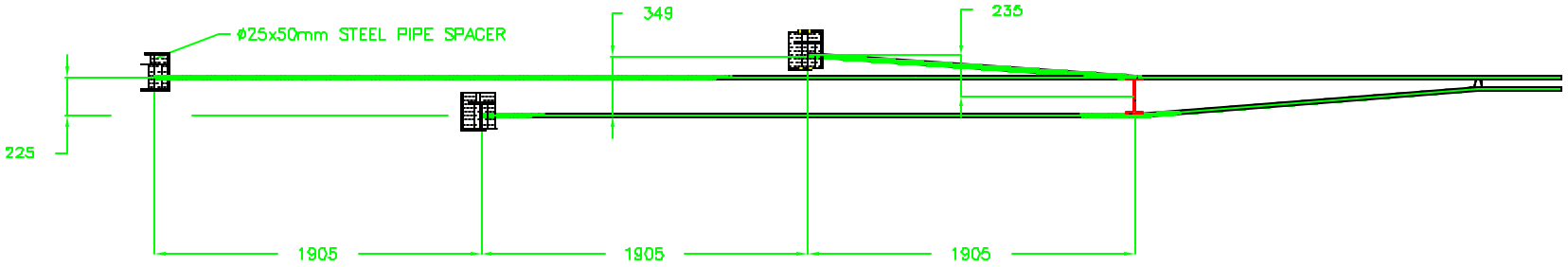
Sincerely yours,

(original signed by Janet A. Coleman)
for
Carol H. Jacoby, P.E.
Director, Office of safety Design

2 Enclosures



ELEVATION



PLAN

The Texas A&M University System

Revisions		
No.	Date	By
1.		
2.		
3.		
4.		
5.		

TEXAS TRANSPORTATION INSTITUTE
COLLEGE STATION, TEXAS 77843

Project No.	Date	Drawn By	Scale
400001-MSC2	11/01	BAS	

STEEL BREAKAWAY CABLE GUARDRAIL TEST INSTALATION

Sheet No. 2 of 4

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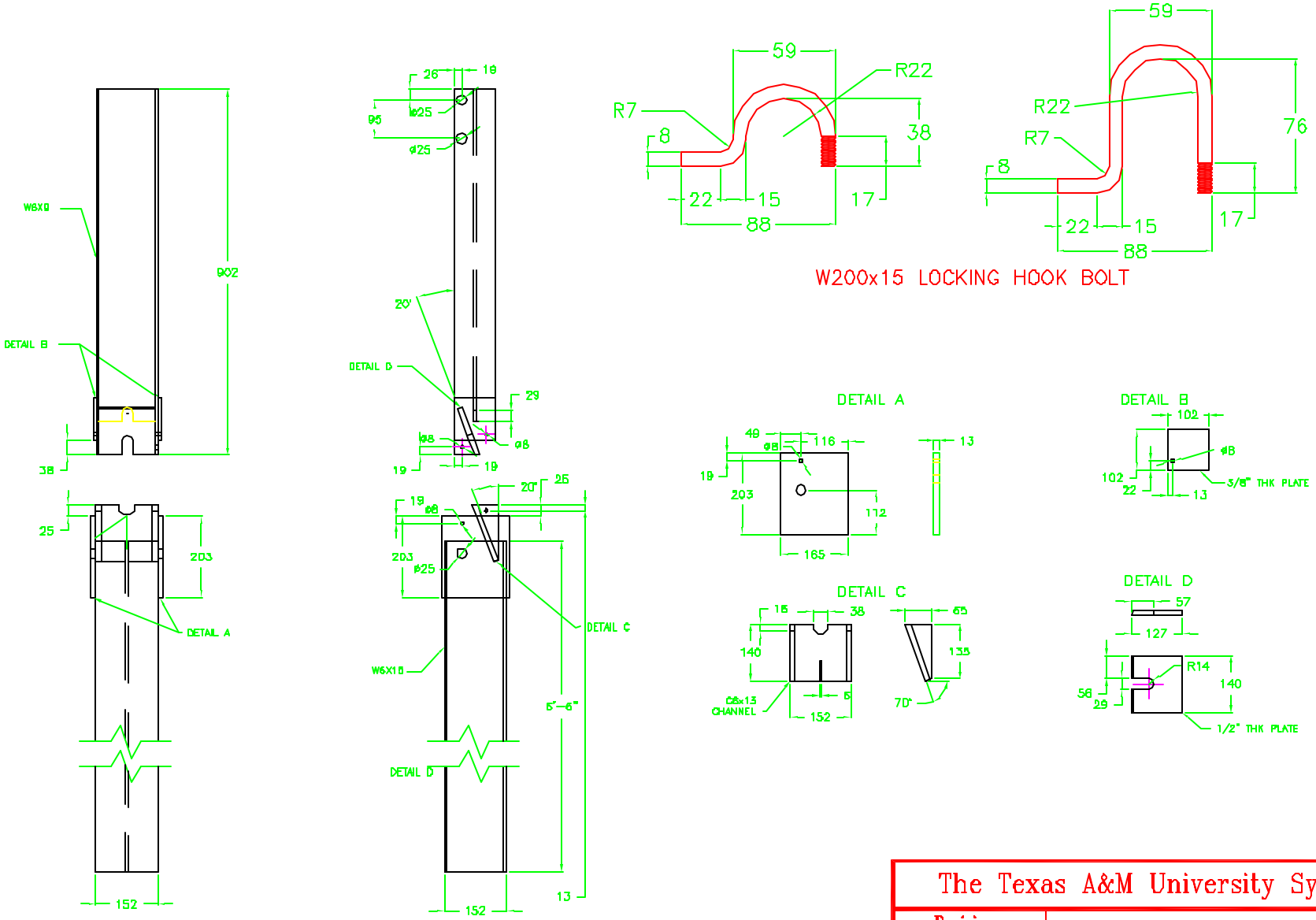
Mar 27, 2002 - 8:14am



DETAIL 1

The Texas A&M University System

Revisions		
No.	Date	By
1.		
2.		
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TEXAS TRANSPORTATION INSTITUTE
COLLEGE STATION, TEXAS 77843

Project No.	Date	Drawn By	Scale
400001-MSC2	11/01	BAS	

STEEL BREAKAWAY CABLE GUARDRAIL TEST INSTALATION

Sheet No. 3 of 4

Mar 27, 2002 - 8:15am

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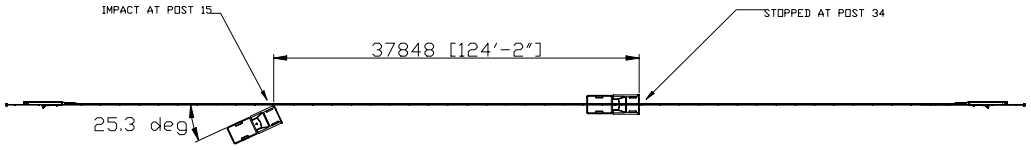
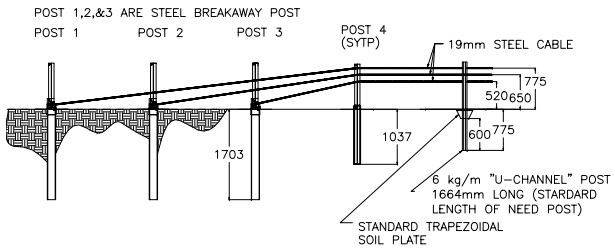
0.293 s

0.977 s

2.688 s





General Information

Test Agency	Texas Transportation Institute
Test No.	400001-MSC2
Date	11/12/01

Test Article

Type	Longitudinal Barrier
Name	Cable Barrier With Marion Steel Posts
Installation Length (m)	101.4
Material or Key Elements	3-Cable Barrier w/Marion Steel 6 kg/m U-Channel Posts & TTI terminal posts
Soil Type and Condition	Standard Soil, Dry

Test Vehicle

Type	Production
Designation	2000P
Model	1997 Chevrolet 2500 Pickup Truck
Mass (kg)	
Curb	2106
Test Inertial	2040
Dummy	N/A
Gross Static	2040

Impact Conditions

Speed (km/h)	100.7
Angle (deg)	25.3

Exit Conditions

Speed (km/h)	69.2
Angle (deg)	6.9

Occupant Risk Values

Impact Velocity (m/s)	
x-direction	3.0
y-direction	3.7
THIV (km/h)	15.4
Ridedown Accelerations (g's)	
x-direction	-6.0
y-direction	8.6
PHD (g's)	8.8
ASI	0.6
Max. 0.050-s Average (g's)	
x-direction	-2.9
y-direction	5.4
z-direction	2.4

Test Article Deflections (m)

Dynamic	1.99
Permanent	1.75
Working Width	2.23

Vehicle Damage

Exterior	
VDS	11FL2
CDC	11FLEW2
Maximum Exterior	
Vehicle Crush (mm)	340
Interior	
OCDI	LF0000000
Max. Occ. Compart.	
Deformation (mm)	7

Post-Impact Behavior

(during 1.0 s after impact)	
Max. Yaw Angle (deg)	34.2
Max. Pitch Angle (deg)	4.1
Max. Roll Angle (deg)	16.1

Summary of results for test 400001-MSC2, *NCHRP Report 350* test 3-11.