U.S. Department of Transportation
Federal Highway Administration

1200 New Jersey Ave., SE
Washington, D.C. 20590

January 6, 2012

In Reply Refer To:
HSST/B-227

Dave Olson
Design Policy, Standards, & Research Manager
Washington State Department of Transportation
P.O. Box 47329
Olympia, Washington 98504-7329

Dear Mr. Olson:

This letter is in response to your request for the Federal Highway Administration (FHWA) to review a roadside safety system for eligibility for reimbursement under the Federal-aid highway program.

Name of system:	High Tension 3-cable median and roadside barriers
Type of system:	Generic cable barrier system
Test Level:	NCHRP Report 350 Test Level 3
Testing conducted by:	Texas Transportation Institute
Task Force 13 Designator:	SGM01b
Date of request:	December 23, 2010
Date initially acknowledged:	January 7, 2011
Date of completed package:	January 7, 2011

Decision:
The following device is eligible, with details provided below:

- High Tension 3-cable median and roadside barriers

Based on a review of crash test results submitted by the manufacturer certifying the device described herein meets the crashworthiness criteria of the National Cooperative Highway Research Program (NCHRP) Report 350, the device is eligible for reimbursement under the Federal-aid highway program. Eligibility for reimbursement under the Federal-aid highway program does not establish approval or endorsement by the FHWA for any particular purpose or use.

The FHWA, the Department of Transportation, and the United States Government do not endorse products or services and the issuance of a reimbursement eligibility letter is not an endorsement of any product or service.

Requirements
Roadside safety devices should meet the guidelines contained in the NCHRP Report 350 or the

FHWA:HSST:NArtimovichr:sf:x61331:1/3/12
File: s://directory folder/HSST/Artimovich/ B-227_WashHiTensionCable.docx
cc: HSSI (NArtimovich)

American Association of State Highway and Transportation Officials' Manual for Assessing Safety Hardware (MASH). The FHWA Memorandum "Identifying Acceptable Highway Safety Features" of July 25, 1997 provides further guidance on crash testing requirements of longitudinal barriers.

Description

The purpose of this test program was to develop a generic, high-tension 3-cable roadside and median barrier using the same length-of-need design as the current low-tension generic cable systems. The 476-foot long test installation consisted of a 336 ft length modified Weak-Steel Post Wire Rope Guardrail System SGR01a-b with posts spaced at 16 feet. A high-tension terminal anchored each end. Wire rope heights are the same as detailed in the SGR01a-b specification. The system was terminated with Trinity terminals that utilize wire rope Controlled Release Posts (CRP). Standard 3x7 non-prestretched wire ropes were used to match field applications of the system. A splice connection was placed in the second clear span downstream of first contact with the test vehicle.

A Crosby 3/4-inch G-416 epoxy socket was used for termination of each wire rope. The epoxy socket termination performed as well as the field swage termination; however, this termination presented a higher risk of an unsuccessful full-scale test due to snagging at the termination site. It is expected that if the epoxy socket termination is successful the field swage would also be successful. Each epoxy socket requires 86 cc. of Crosby Wirelock W416-7 socket compound. A standard Crosby HG-226 1-inch x 12-inch eye and eye turnbuckle were used to connect the two epoxy sockets at each splice. A 1-inch x 6-inch Crosby G-291 eye bolt with double nuts was used to terminate the wire ropes at the CRP. Tension of the wire ropes prior to the full-scale crash test was 5620-5640 lb.

You asked that field swaged fittings, previously crash tested at TTI on cable barrier systems, would be found eligible. Dynamic testing of the field swage fitting at Texas Transportation Institute (TTI) indicates that field swaged fittings performed better than the Crosby epoxy socket used in the full scale crash test. We concur that field swaged fittings (such as the Trinity parts 5873 and 5874 included in the TTI evaluation) are eligible as an alternative to the Crosby epoxy sockets.

Enclosed for reference is the test data summary sheet showing the crash test and results which were in reasonably close conformity with NCHRP Report 350. The vehicle remained upright and deflected the barrier 10.2 feet. A working width of 11 feet should be used for design purposes.

Findings

The system described above and detailed in the enclosed drawings is eligible for reimbursement and should be installed under the range of conditions tested, when such use is acceptable to a highway agency.

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

- This letter provides a AASHTO/ARTBA/AGC Task Force 13 designator that should be used for the purpose of the creation of a new and/or the update of existing Task Force 13 drawing for posting on the on-line 'Guide to Standardized Highway Barrier Hardware' currently referenced in AASHTO Roadside Design Guide.

- This finding of eligibility is limited to the crashworthiness characteristics of the systems and does not cover their structural features, nor conformity with the Manual on Uniform Traffic Control Devices.
- Any changes that may adversely influence the crashworthiness of the system will require a new letter.
- Should the FHWA discover that the qualification testing was flawed, that in-service performance reveals unacceptable safety problems, or that the system being marketed is significantly different from the version that was crash tested, we reserve the right to modify or revoke this letter.
- 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 review, and that it will meet the crashworthiness requirements of the FHWA and the NCHRP Report 350.
- To prevent misunderstanding by others, this letter of eligibility is designated as number and shall not be reproduced except in full. This letter and the test documentation upon which it is based are public information. All such letters and documentation may be reviewed at our office upon request.
- This letter shall not be construed as authorization or consent by the FHWA to use, manufacture, or sell any patented system for which the applicant is not the patent holder. The finding of eligibility is limited to the crashworthiness characteristics of the candidate system, and the FHWA is neither prepared nor required to become involved in issues concerning patent law. Patent issues, if any, are to be resolved by the applicant.
- Although the barrier performed well under ideal test impact conditions with the two test vehicles, the likelihood of passenger car underrides of any cable system may increase as the post spacing increases, particularly when the barrier is installed on non-level or slightly irregular terrain and the cables are not restrained from lifting at each post. Consequently, some transportation agencies have limited post spacing to approximately 6m (20 feet) for cable barriers. The dynamic deflection of the barrier is likely to increase when it is installed along the convex sides of horizontal curves, and when distances between anchorages exceed the 102m (336-foot) test length.

Sincerely yours,

Michael S. Griffith
Director, Office of Safety Technologies
Office of Safety

Enclosures

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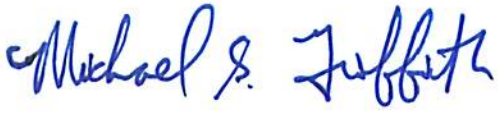

Michael S. Griffith
Director, Office of Safety Technologies
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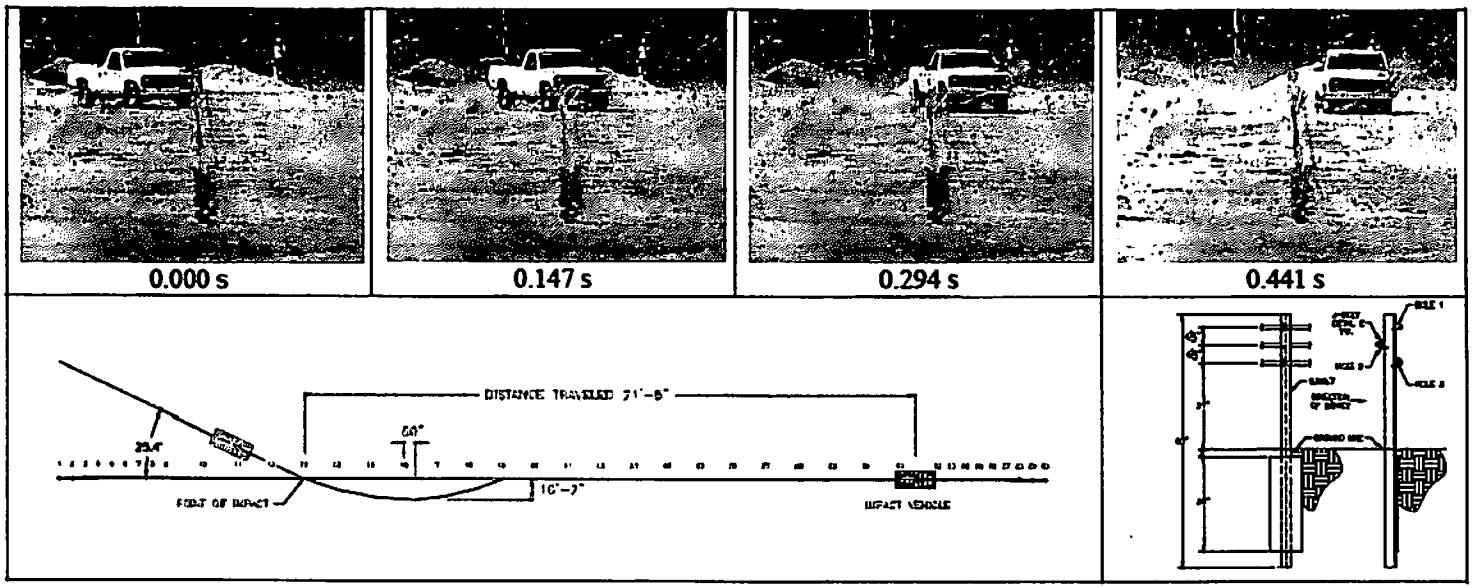

General Information	
Test Agency	Texas Transportation Institute
Test No.	405160-11-1
Date	2008-07-11
Test Article	
Type	Longitudinal Barrier
Name	Retrofitted wire rope Barrier System
Installation Length (ft)	476
Material or Key Elements	SGR01a-b with 3x7 non-prestretched wire rope tensioned to 5620-5640 lb and epoxy sockets
Soil Type and Condition	Standard Soil, Dry
Test Vehicle	
Type	Production
Designation	2000P
Model	1999 Chevrolet C2500 Pickup Truck
Mass (lb)	
Curb	4894
Test Inertial	4522
Dummy	No dummy
Gross Static	4522

Impact Conditions	
Speed (mi/h)	62.3
Angle (deg)	25.4
Exit Conditions	
Speed (mi/h)	N/A
Angle (deg)	N/A
Occupant Risk Values	
Impact Velocity (ft/s)	
Longitudinal	6.9
Lateral	10.5
THIV (km/h)	13.5
Ridedown Accelerations (g's)	
Longitudinal	-16.4
Lateral	15.2
PHD (g's)	16.9
ASI	0.67
Max. 0.050-s Average (g's)	
Longitudinal	-3.8
Lateral	5.5
Vertical	-2.3

Test Article Deflections (ft)	
Dynamic	10.2
Permanent	N/A
Working Width	11.0
Vehicle Damage	
Exterior	
VDS	11LD2
CDC	11LDEW2
Max. Exterior	
Vehicle Crush (inches)	11.8
Interior	
OCDI	LF1000000
Max. Occupant Compartment Deformation (inches)	2.2
Post-Impact Behavior	
(during 1.0 sec after impact)	
Max. Yaw Angle (deg)	33
Max. Pitch Angle (deg)	5
Max. Roll Angle (deg)	17

Figure 5.15. Summary of results for *NCHRP Report 350* test 3-11 on the low-tension wire rope barrier system.

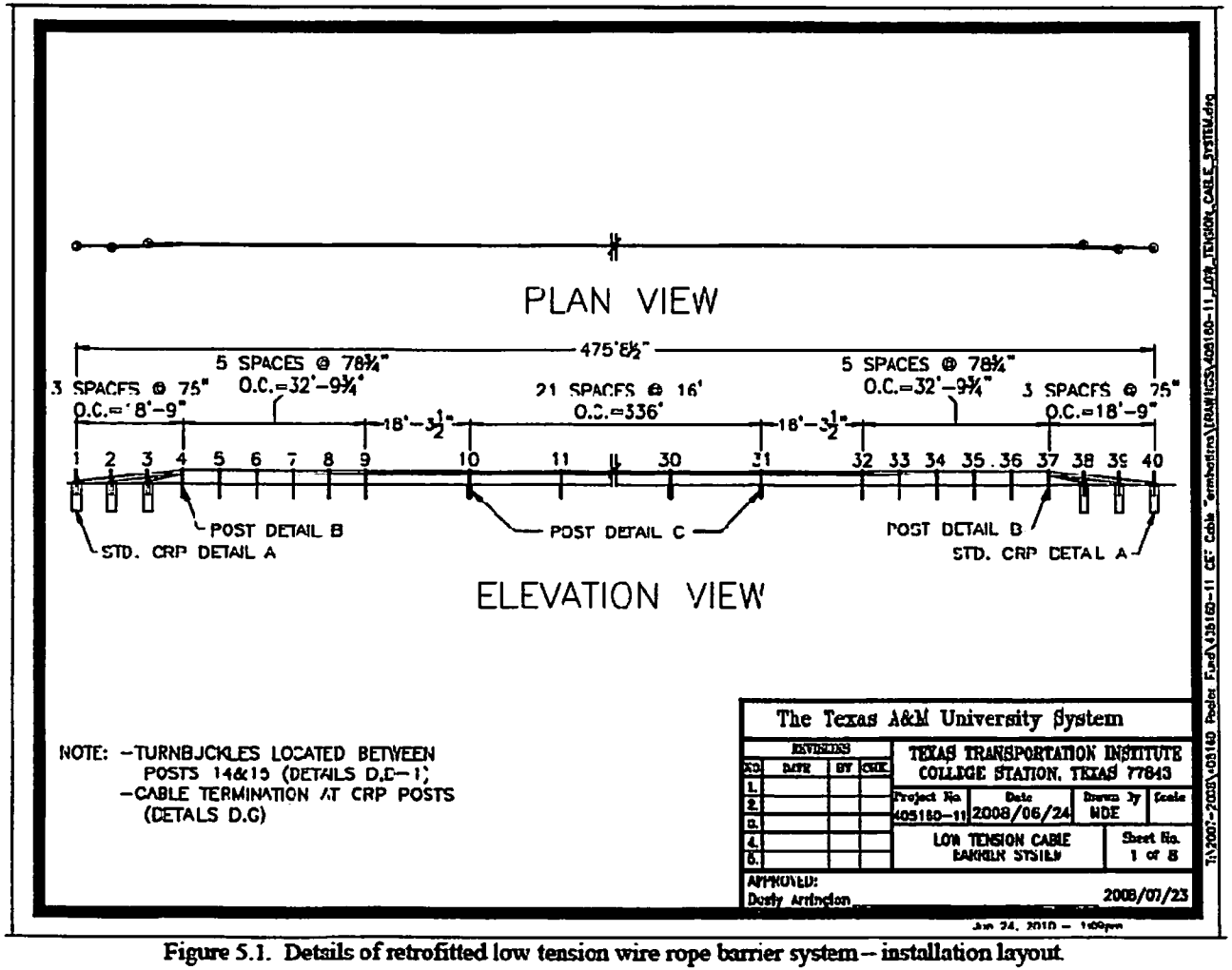

Figure 5.1. Details of retrofitted low tension wire rope barrier system – installation layout.

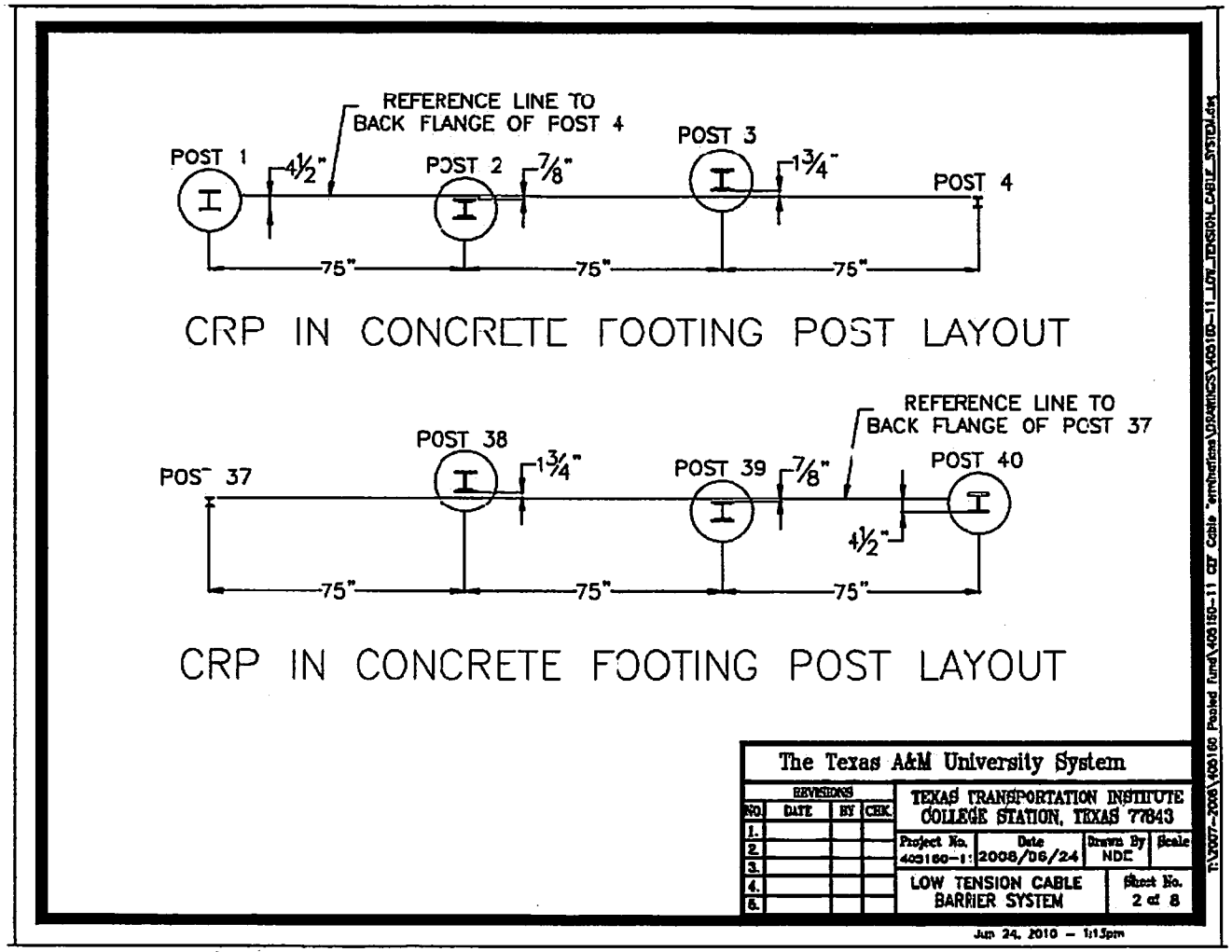

Figure 5.2. Details of retrofitted low-tension wire rope barrier system – CRP layout.

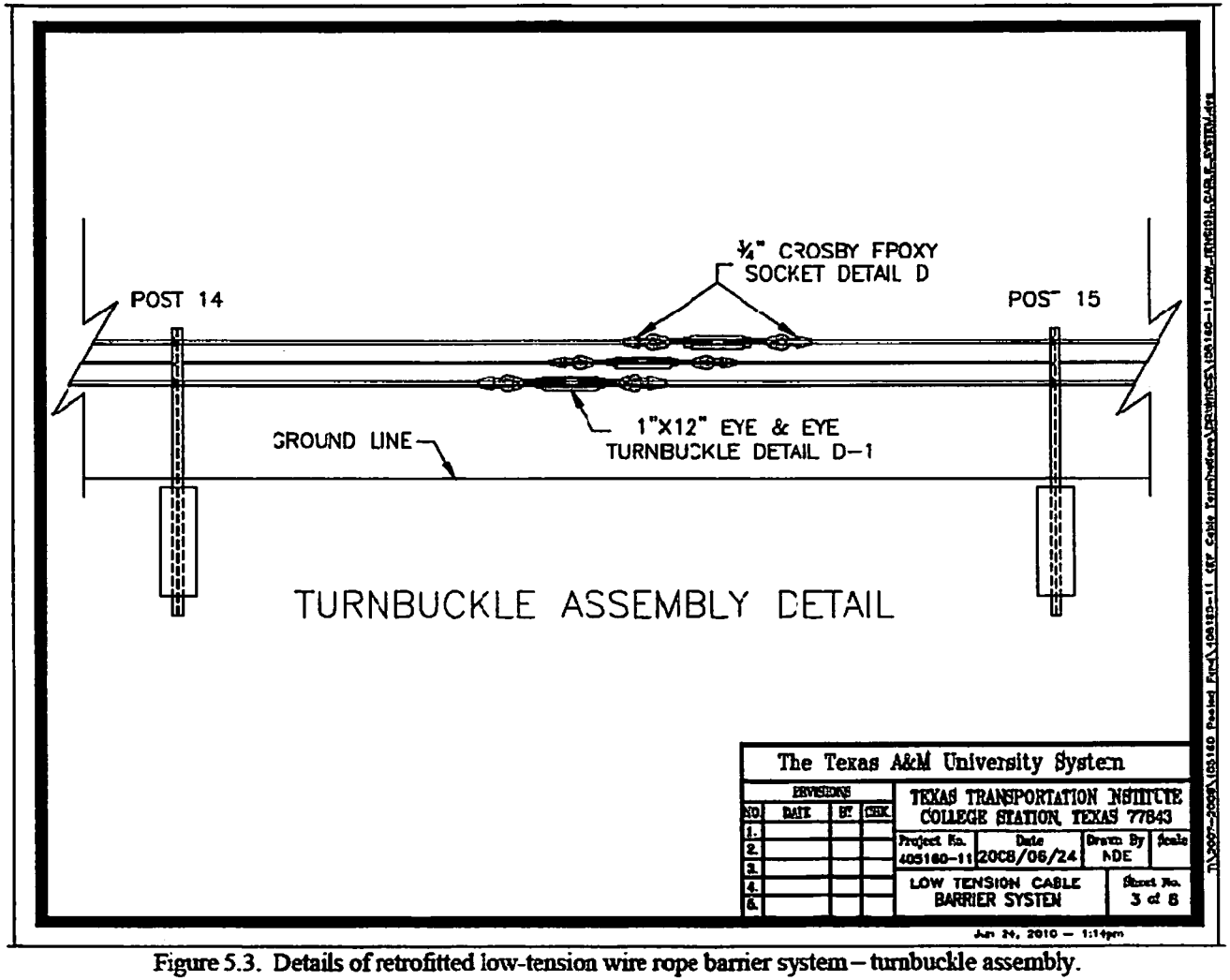

Figure 5.3. Details of retrofitted low-tension wire rope barrier system – turnbuckle assembly.

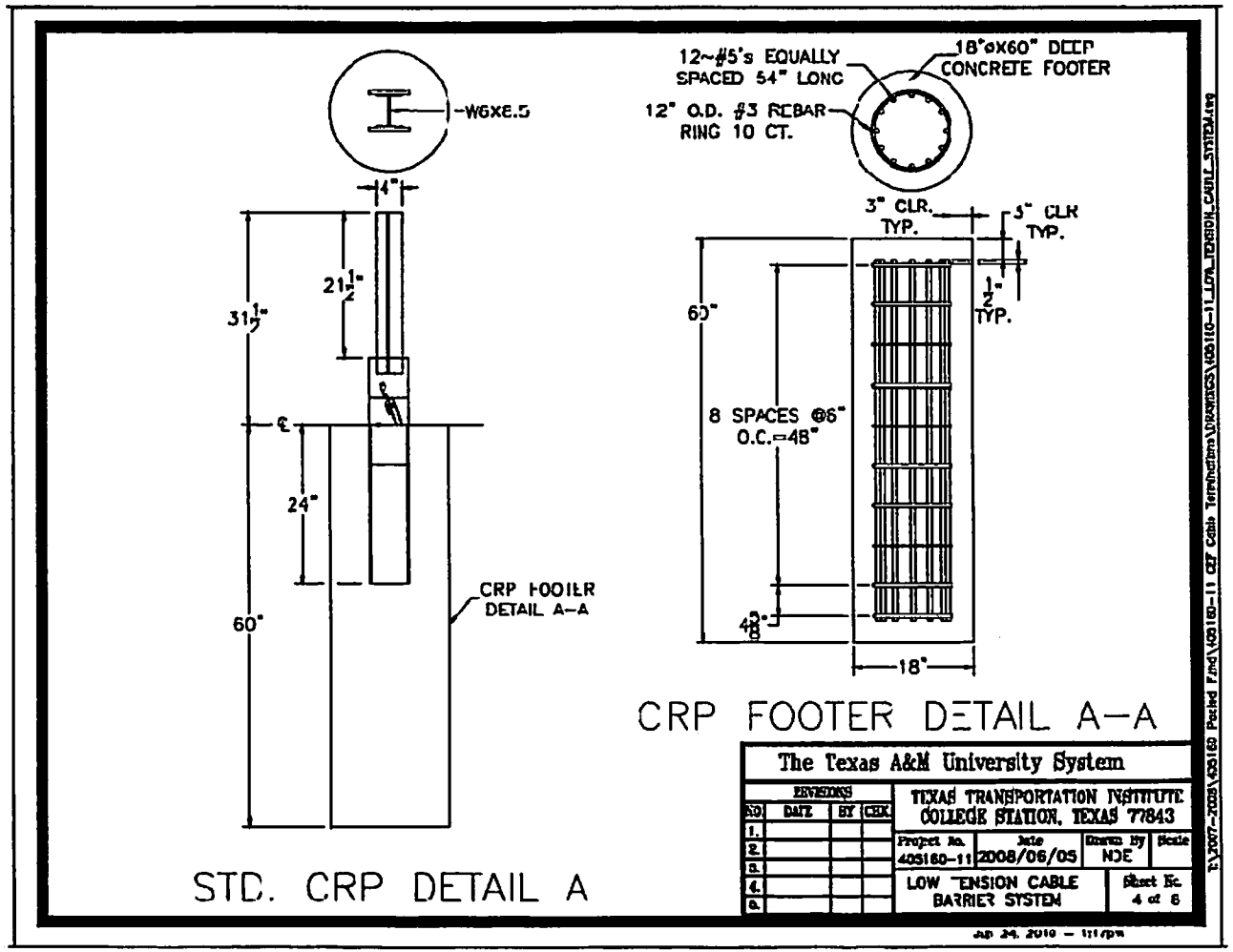

Figure 5.4. Details of retrofitted low-tension wire rope barrier system – CRP detail.

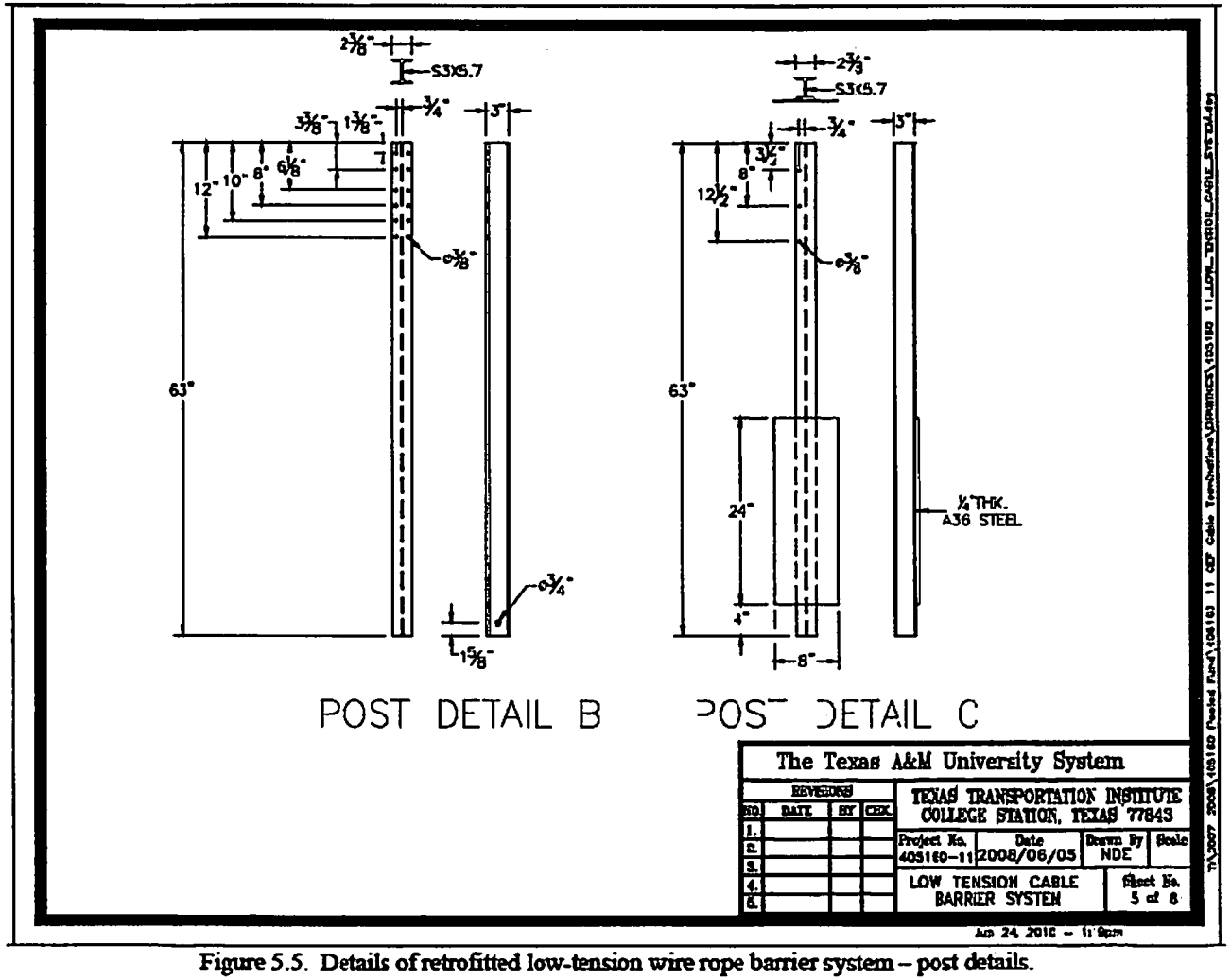

Figure 5.5. Details of retrofitted low-tension wire rope barrier system – post details.

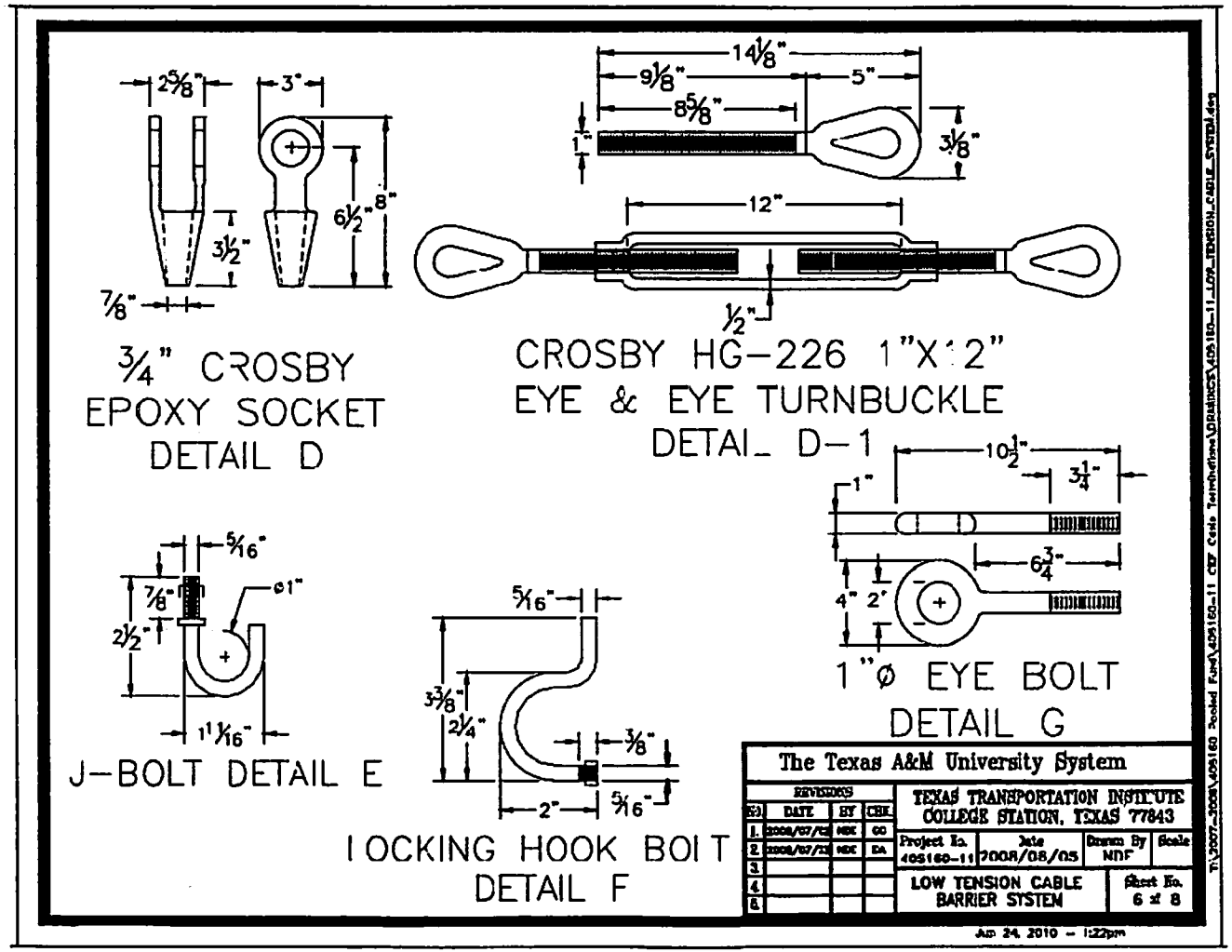

Figure 5.6. Details of retrofitted low-tension wire rope barrier system – CRP layout.

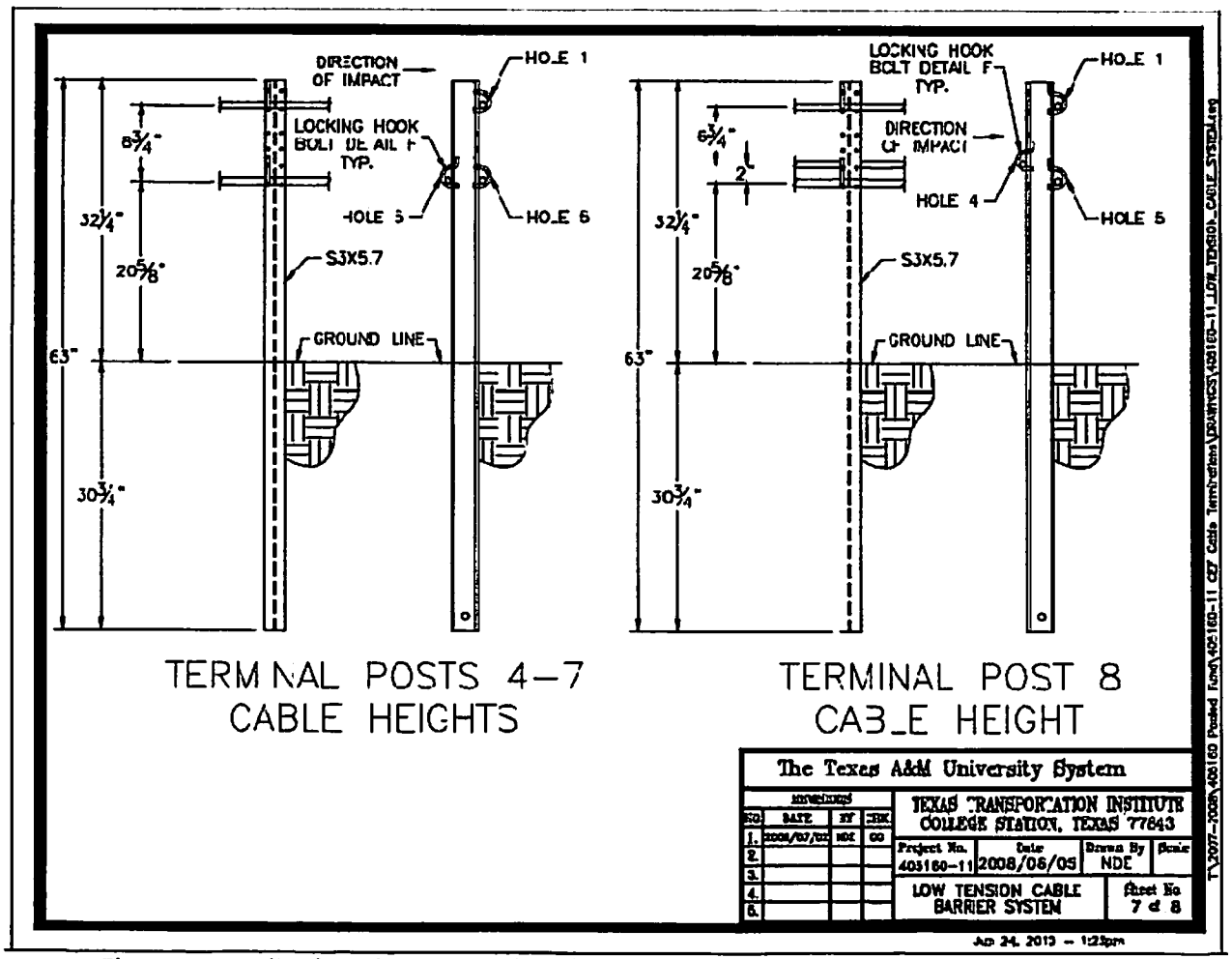

Figure 5.7. Details of retrofitted low-tension wire rope barrier system – terminal post wire rope heights.

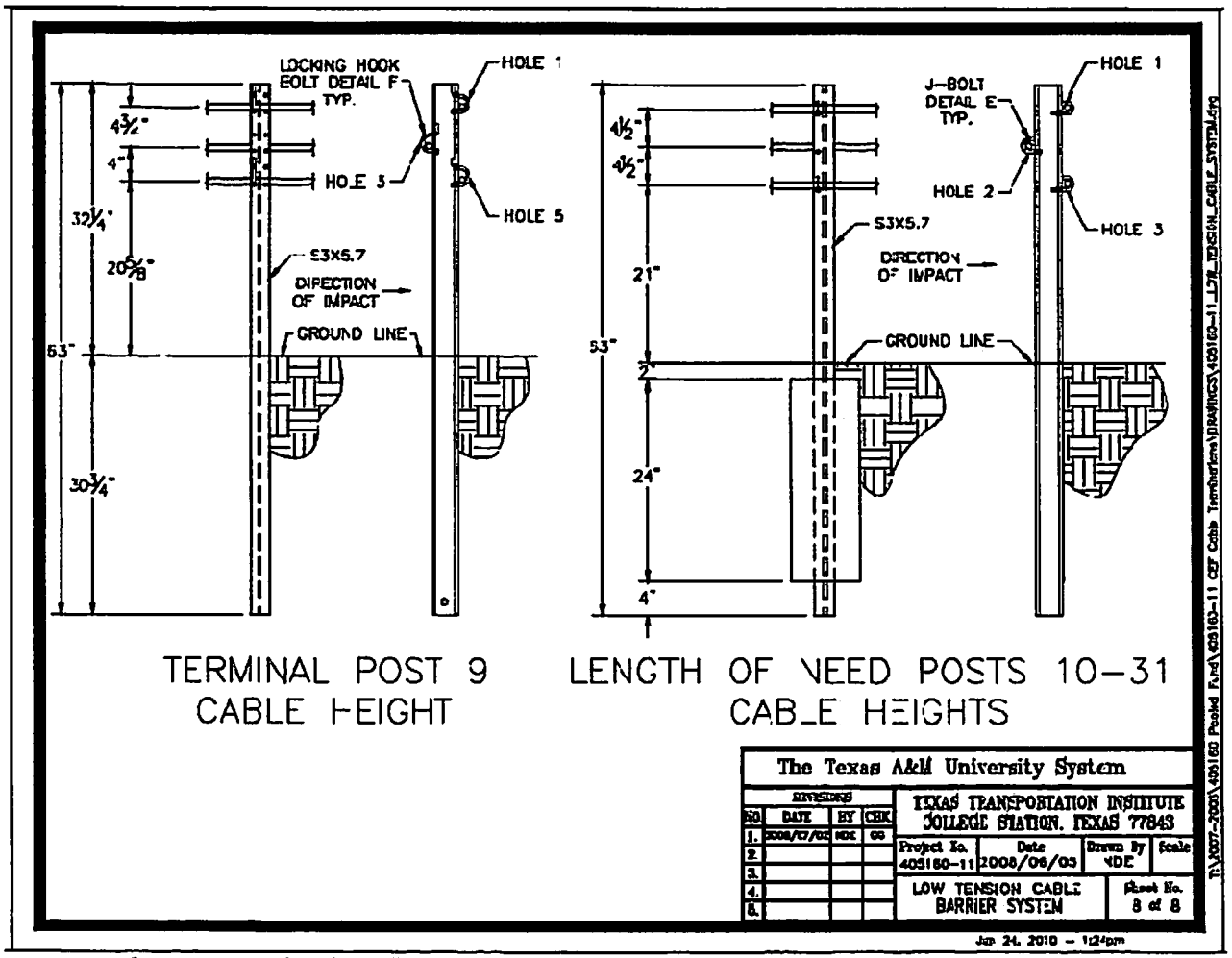

Figure 5.8. Details of retrofitted low-tension wire rope barrier system – LON post wire rope heights.