



March 31, 2009

In Reply Refer To: HSSD/B-190

Mr. Jorge D. Hinojosa, P.E.
Bexar Concrete Works I, Ltd.
P.O. Box 700250
San Antonio, TX 78270

Dear Mr. Hinojosa:

This letter is in response to your request for the Federal Highway Administration (FHWA) acceptance of a roadside safety system for use on the National Highway System (NHS).

Name of system: F-Shape Concrete Traffic Barrier with Quick-Bolt Connection
Type of system: Portable concrete barrier system
Test Level: MASH-08 Test Level 3
Testing conducted by: Texas Transportation Institute
Date of request: November 19, 2008

You requested that we find this system acceptable for use on the NHS under the provisions of the proposed American Association of State Highway and Transportation Officials' Manual for Assessing Safety Hardware 2008 (MASH-08).

Requirements

Roadside safety systems should meet the guidelines contained in the NCHRP Report 350. The FHWA Memorandum "Identifying Acceptable Highway Safety Features" of July 25, 1997, provides further guidance on crash testing requirements of longitudinal barriers. You have chosen to anticipate the adoption of the MASH-08, an option that FHWA has offered with the understanding that additional testing may need to be done if changes to the test criteria are made before MASH-08 is formally adopted.

Description

The precast segments used in the construction of the test installation were 30 feet in length and had a standard F-shape profile. The barrier segments were 32 inches in height, 24 inches wide at the base, and 9-1/2 inches wide at the top. Horizontal reinforcement consists of eight #5 bars placed symmetrically about the vertical centerline of the barrier. Vertical reinforcement consists of #4 bars spaced 12 inches on center. Spacing of the vertical bars is reduced to provide additional strength within 5 feet of the barrier ends.

Ten inch long sections of 1 1/2-inch diameter PVC pipe are horizontally cast into the end of each segment that provide access for feeding the threaded rod from one barrier into another and for securing the nuts and washers once the rod is in place. A 3-inch diameter, 12-inch long bolt retraction cavity extends from the hand hole further into the barrier. Two #5 “hairpin” shaped bars extend horizontally along the top and bottom of the PVC sleeve, hand hole, and bolt retraction cavity. Three #5 stirrups enclosed these hairpins bars to provide further strength to the connection. The barrier connection is made with two 7/8-inch diameter, 2 ft 1-inch long steel rods. A 3-inch square x 3/8-inch thick plate washer and nut are used on each end of the threaded rod.

The completed test installation consisted of eight barrier segments connected together for a total length of approximately 240 ft. The concrete was specified to be 3600 psi and reinforcing steel was grade 60. The threaded rods were fabricated from SAE Grade 5 or equivalent steel, and the plate washers were A-36 steel. Details of the barrier segment are shown in the enclosure for reference.

Crash Testing

Two full-scale crash tests are required under the proposed Manual for Assessing Safety Hardware. Test 3-10 using a 2420-pound passenger car has already been conducted on the New Jersey safety shape concrete barrier under NCHRP Project 22-14(2) at the Midwest Roadside Safety Facility. As the Jersey shape is known to be a “worst case scenario” among rigid barriers, Test 3-10 will be waived for the Bexar concrete traffic barrier. Test 3-11 using a 5000-pound quad-cab pickup was conducted to evaluate the strength of the barrier connection and for determining the maximum barrier deflection or working width.

The Test Data Summary Sheet for test 4000001-BCW1 is enclosed for reference and shows the maximum occupant impact velocity was 22.3 feet per second (40 fps is allowed) and the maximum ridedown acceleration was 13.1 G’s (20 G’s is allowed.) Both of these maximum values were the lateral components. The maximum dynamic deflection was 31.0 inches. The maximum roll angle was 17 degrees and the vehicle exited the barrier within the “exit box” limits.

Findings

The MASH-08 Test 4000001-BCW1 met the appropriate evaluation criteria, therefore, the Bexar Concrete Traffic Barrier described above and detailed in the enclosed drawings is acceptable for use on the NHS under the range of conditions tested, when such use is acceptable to a highway agency.

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

- This acceptance 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 acceptance 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 our 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, and that it will meet the crashworthiness requirements of the FHWA and the NCHRP Report 350.
- To prevent misunderstanding by others, this letter of acceptance is designated as number B-190 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.
- The Bexar Concrete Quick Bolt Connection is a patent-pending product and considered proprietary". If proprietary systems are specified by a highway agency for permanent use in Federal-aid projects, except exempt, non-NHS projects, (a) they must be supplied through competitive bidding with equally suitable unpatented items; (b) the highway agency must certify that they are essential for synchronization with the 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 system for which the applicant is not the patent holder. The acceptance letter 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.

Sincerely yours,



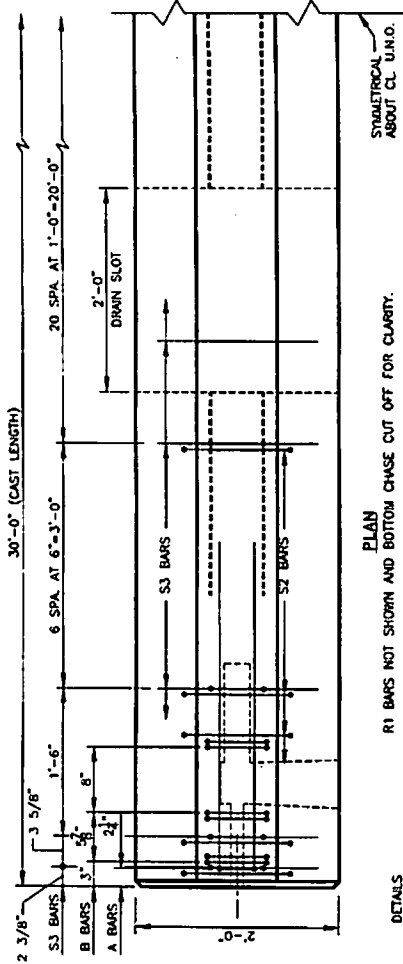
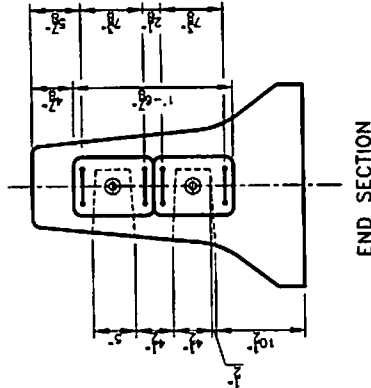
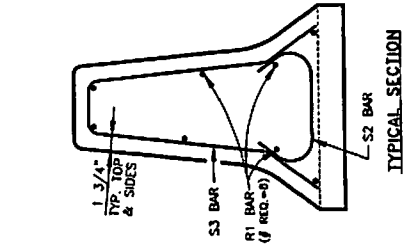
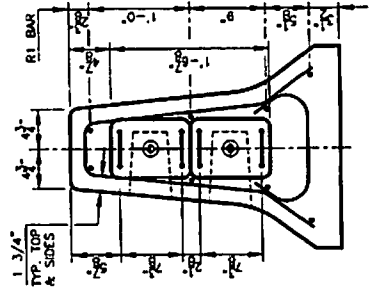
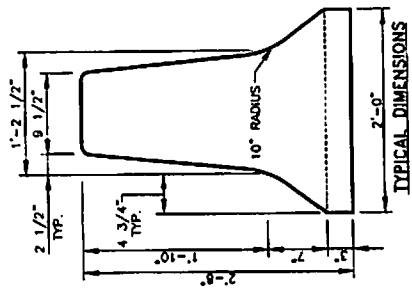
David A. Nicol, P.E.
Director, Office of Safety Design
Office of Safety

Enclosures

CONTRACTOR

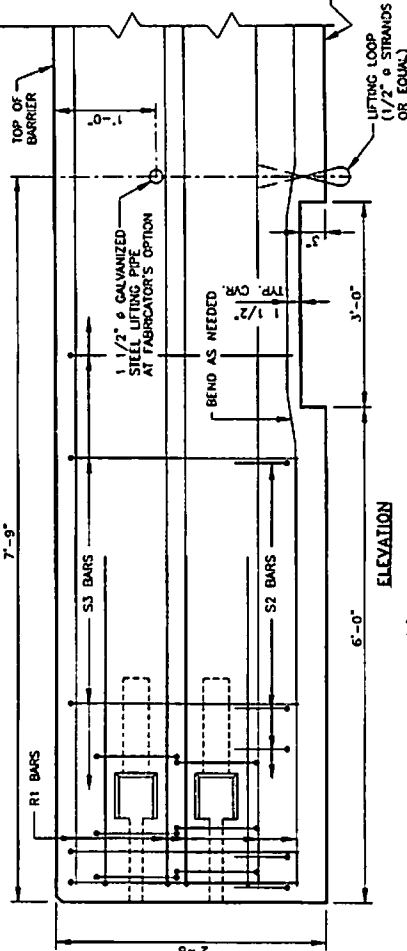
COUNTY

#XXXX

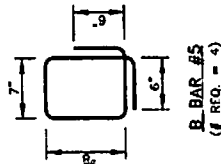


PLAN
R1 BARS NOT SHOWN AND BOTTOM CHASE CUT OFF FOR CLARITY.

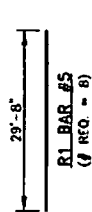
SYMMETRICAL ABOUT CL. UNO.



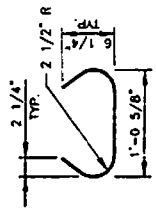
ELEVATION



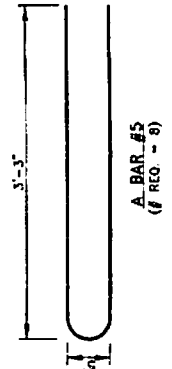
B BAR #5
(# REQ. = 4)



R1 BAR #5
(# REQ. = 8)



S2 BAR #5
(# REQ. = 20)



A BAR #5
(# REQ. = 8)

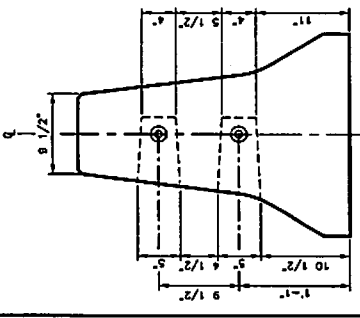
FOR APPROVAL
JULY 03 2008
Bexar Concrete Works I, Ltd.

TOTAL NUMBER REQUIRED - XX EACH
TOTAL LINEAR FT. THIS PROJECT - XXX LF

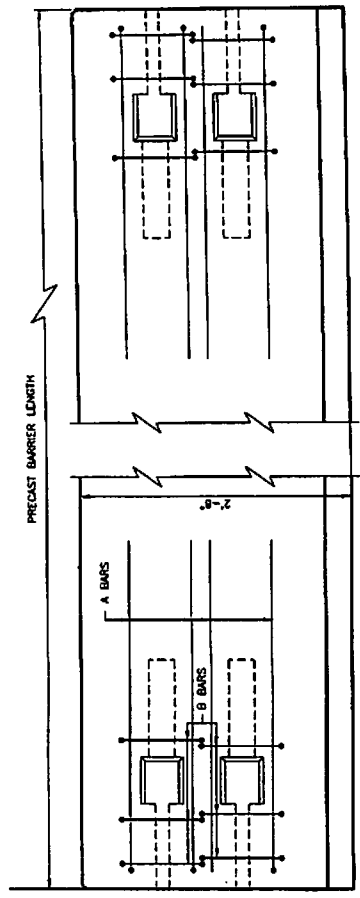
CSB (1)-04 ~ (F-SHAPE)
QUICK-BOLT CONNECTION

FABRICATOR/PREPARED BY BEXAR CONCRETE WORKS I, LTD.		CONTRACTOR	
STATE	PROJECT	STATE	PROJECT
DISTRICT	BR 2007 (077)	DISTRICT	BR 2007 (077)
COUNTY	SECTION	COUNTY	SECTION
BAR	XXX	BAR	XXX
DRAWN BY	CHECKED BY	DRAWN BY	CHECKED BY
AMU	MUR	AMU	MUR
DATE	DATE	DATE	DATE
07-03-08	07-03-08	07-03-08	07-03-08
SHEET 1 OF 2	FS-1	SHEET 1 OF 2	FS-1

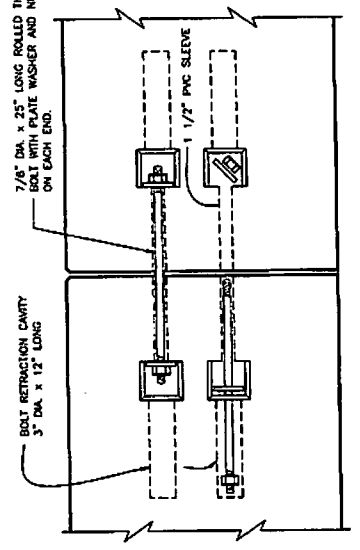
- NOTES
1. ALL REINFORCING STEEL SHALL BE GRADE 60.
 2. CHAMFER ALL EXPOSED CORNERS 3/8" UNLESS OTHERWISE SPECIFIED.
 3. THE CONCRETE SHALL BE CLASS C OR H, UNLESS OTHERWISE SPECIFIED.
 4. INCLUDING CONCRETE COMPRESSIVE STRENGTH 1500 PSI.
 5. CURE TIME SHALL BE 28 DAYS = 3600 PSI.
 6. ALL BAR DIMENSIONS ARE CENTRIFUGAL TO CENTRIFUGAL.



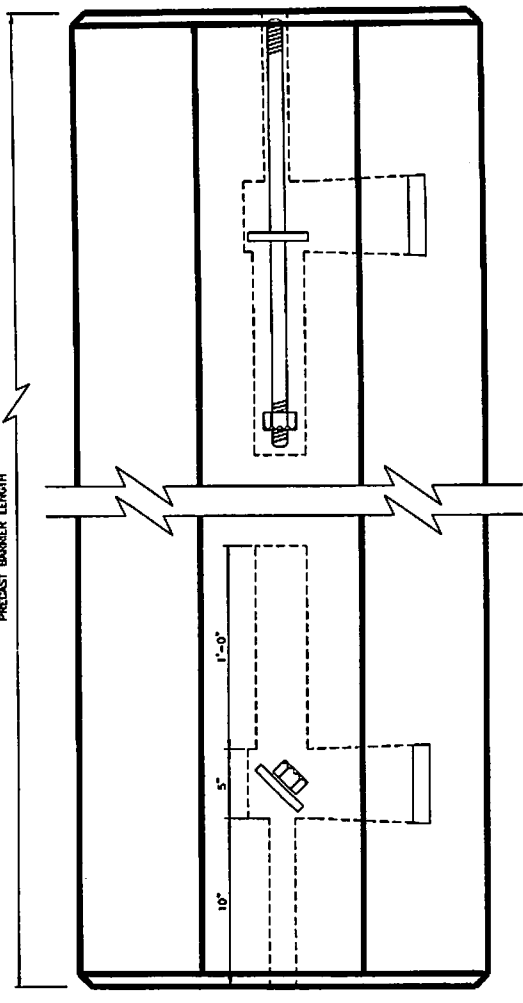
PRECAST BARRIER END VIEW



PRECAST BARRIER ELEVATION VIEW
SEE SHEET FS-1 FOR REINFORCING DETAILS



ELEVATION VIEW SHOWING JOINT CONNECTION TYPE "QUICK-BOLT"



TOP VIEW

FOR APPROVAL
JULY 03 2008
Bexar Concrete Works I, Ltd.

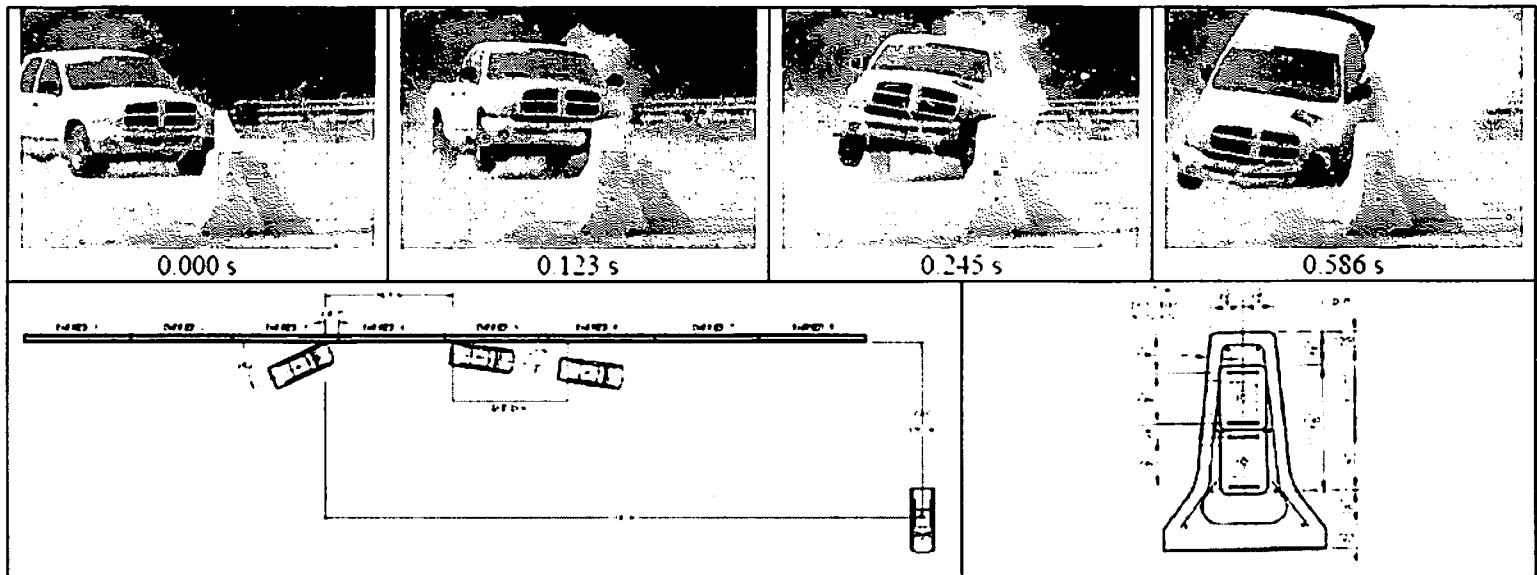
TOTAL NUMBER REQUIRED = XX EACH
TOTAL LINEAR FT. THIS PROJECT = XXX LF

CSB (1)-04 ~ (F-SHAPE)
QUICK-BOLT CONNECTION

FABRICATOR/PREPARED BY
BEXAR CONCRETE WORKS I, LTD.
CONTRACTOR

STATE	TEXAS	PROJECT	BR 2007 (677)
DISTRICT	02	COUNTY	XXX
SECTION	XXX	JOB	SN 171
BEAR	XXX	DATE	07-03-08
DRAWN BY	AMU	CHECKED BY	AMU
SHEET 2 OF 2			FS-2

NOTES:
1. FOR ALL DETAILS AND NOTES NOT SHOWN
SEE OTHER SHEET.



General Information		Impact Conditions		Post-Impact Trajectory	
Test Agency	Texas Transportation Institute	Speed	61.5 m/h	Stopping Distance	170 ft downstream 150 ft toward traffic
Test No.	40001-BCW1	Angle	24.2 degrees	Vehicle Behavior	
Date	2008-09-22	Location/Orientation	3.9 ft upstream of joint 3-4	Max. Yaw Angle	41
Test Article		Exit Conditions		Max. Pitch Angle	-13
Type	Portable Concrete Barrier (PCB) with Quick-Bolt Connection	Speed	Not obtainable	Max. Roll Angle	-17
Name	Bexar Concrete Works CTB	Angle	7.7 degrees	Vehicle Snagging	None
Installation Length	240 ft	Occupant Risk Values		Vehicle Pocketing	None
Material or Key Elements	F-Shaped Barrier	Impact Velocity		Test Article Deflections	
Length	30 ft segments	Longitudinal	14.4 ft/s	Dynamic	31.0 inches
Base Width	24 inches	Lateral	22.3 ft/s	Permanent	26.0 inches
Height	32 inches	Ridedown Accelerations		Working Width	31.0 inches
Soil Type and Condition	Placed on concrete pavement, dry	Longitudinal	-5.2 Gs	Vehicle Damage	
Test Vehicle		Lateral	13.1 Gs	VDS	11LFQ3
Type/Designation	2270P	THIV	28.4 km/h	CDC	11LFES3
Make and Model	2002 Dodge Ram 1500 Quad-Cab	PHD	13.1 Gs	Max. Exterior Deformation	19.7 inches
Curb	4919 pounds	Max. 0.050-s Average		Max. Occupant Compartment Deformation	0.9 inch
Test Inertial	5012 pounds	Longitudinal	-6.0 Gs	OCDi	LF001050
Dummy	No dummy	Lateral	11.7 Gs		
Gross Static	5012 pounds	Vertical	-3.1 Gs		

Figure 5.7 Summary of results for NCHRP Report 350 test 3-11 on Bexar Concrete Works F-shape CTB with Quick-Bolt connection