



U.S. Department
of Transportation
**Federal Highway
Administration**

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

February 10, 2011

In Reply Refer To:
HSST/B-215

Ms. Karla A. Lechtenburg, MSME
Research Associate Engineer
Midwest Roadside Safety Facility
527 Nebraska Hall
Lincoln, NE 68588-0529

Dear Ms. Lechtenburg:

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:	Free Standing F-Shaped Temporary Concrete Barrier System
Type of system:	Temporary Barrier
Test Level:	American Association of State Highway and Transportation Officials (AASHTO) Manual for Assessing Safety Hardware (MASH) Test Level 3 (TL-3)
Testing conducted by:	Midwest Roadside Safety Facility (MwRSF)
Date of request:	August 17, 2010
Date initially acknowledged:	August 29, 2010
Task Force 13 Designator:	SWC09 (same as existing)

You requested that we find this system acceptable for use on the NHS under the provisions of the AASHTO MASH.

Requirements

Roadside safety devices should meet the guidelines contained in the MASH.

Decision

The following device was found acceptable, with details provided below:

- Free Standing F-Shaped Temporary Concrete Barrier System



Description

The test installation was 62.34-m (204.5 feet) in length and consisted of sixteen (16) 3,810-mm (12 feet 6 inches) long, F-shaped temporary concrete barriers placed on the concrete tarmac without any attachment between the barriers and the tarmac. The concrete used for the barriers consisted of Iowa's Barrier Mix, with a minimum 28-day concrete compressive strength of 34.5 MPa (5,000 psi). The minimum concrete cover varied at different positions of rebar in the barrier. Minimum concrete cover of 51 mm (2 inches) was used along the top of the vertical stirrup rebar and the bottom longitudinal rebar. Minimum concrete cover of 44 mm (1-3/4 inches) and 25 mm (1-inch) were used along the sides of the vertical stirrup rebar and at the rebar around the anchor bolt block, respectively. All steel reinforcement in the barrier was ASTM A615 Grade 60 rebar, except for the loop bars which were ASTM A706 Grade 60 rebar. Barrier reinforcement consisted of three (3) No. 5 and two (2) No. 4 longitudinal bars, twelve (12) No. 4 bars for the vertical stirrups, and six (6) No. 6 bars for the anchor bolt block reinforcement loops. Each of the five longitudinal rebar was 3.71 m (12 feet 2 inches) long. The vertical spacing of the lower, middle, and upper longitudinal bars were 165 mm (6-1/2 inches), 368 mm (14-1/2 inches), and 780 mm (29 1/8 inches) from the ground to their centers, respectively. The 1,829-mm (72 inches) long, vertical stirrups were bent into the shape of the barrier with varied spacing longitudinally. The 889-mm (35 inches) long anchor bolt block loops were bent into a U-shape and were used to reinforce the anchor bolt area. The barriers used a pin and loop type connection comprised of two sets of rebar loops on each barrier interconnection. Each loop assembly was configured with three (3) ASTM A706 Grade 60 No. 6 bars that were bent into a loop shape. The vertical pin used in the connection consisted of a 32-mm (1-1/4 inches) diameter x 711-mm (28 inches) long round bar composed of ASTM, A36 steel. The pin was held in place using one (1) 64-mm wide x 102-mm long x 13-mm thick (2-1/2 inches x 4 inches x 1/2 inches) ASTM A36 steel plate with a 35-mm (1 3/8 inches) diameter hole centered on it. The plate was welded 64 mm (2-1/2 inches) below the top of the pin. A gap of 92 mm (3 5/8 inches) between the ends of two (2) consecutive barriers was formed from the result of pulling the connection taut. Design details are provided as enclosure to this correspondence.

Crash Testing

Physical crash test for TL-3 as per MASH requires that longitudinal barrier systems be subjected to the following two full-scale vehicle crash tests:

1. Test Designation 3-10. A 1,100-kg (2,425-lb) passenger car impacting at a nominal speed and angle of 100.0 km/h (62.1 mph) and 25 degrees, respectively.
2. Test Designation 3-11. A 2,270-kg (5,004-lb) pickup truck impacting at a nominal speed and angle of 100.0 km/h (62.1 mph) and 25 degrees, respectively.

Only test designation 3-11 was conducted for the free-standing temporary barrier system described within the description section of this correspondence.

In addition, as per MwRSF email correspondence dated January 28, 2011 regarding test designation 3-10, no testing of the 1100C vehicle was conducted as part of the MASH testing of the F-shape PCB because the small car test is considered less critical due to lower impact energy and deflection. Also, previous testing of safety shapes with small cars has historically proven successful.

Findings

The analysis of the crash test results showed that the Free Standing F-Shaped Temporary Concrete Barrier System impacted with 2270P test vehicle as per MASH adequately contained and redirected the vehicle with controlled lateral displacements of the barrier system. There were neither detached elements nor fragments which neither showed potential for penetrating the occupant compartment nor presented undue hazard to other traffic. Deformations of, or intrusion into the occupant compartment that could have caused serious injury did not occur. The test vehicle did not penetrate nor ride over the temporary concrete barrier system and remained upright during and after the collision. Vehicle roll, pitch, and yaw angular displacements were noted, but they were deemed acceptable because they did not adversely influence occupant risk safety criteria nor cause rollover. After collision, the vehicle's trajectory revealed minimum intrusion into adjacent traffic lanes. In addition, the vehicle exited the barrier within the exit box. Therefore, test designation 3-11 as conducted on the free-standing temporary concrete barrier system was determined to be acceptable according to the TL-3 safety performance criteria found in MASH. A physical crash test summary is included as enclosure to this correspondence. In addition, the requested waiver of test designation 3-10 and reasoning as provided within this correspondence is also accepted.

Therefore, the system described in the requests 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 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 AASHTO MASH.
- To prevent misunderstanding by others, this letter of acceptance is designated as number B-215 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 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,

A handwritten signature in blue ink that reads "Michael S. Griffith". The signature is written in a cursive style with a blue background highlight.

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

Enclosures

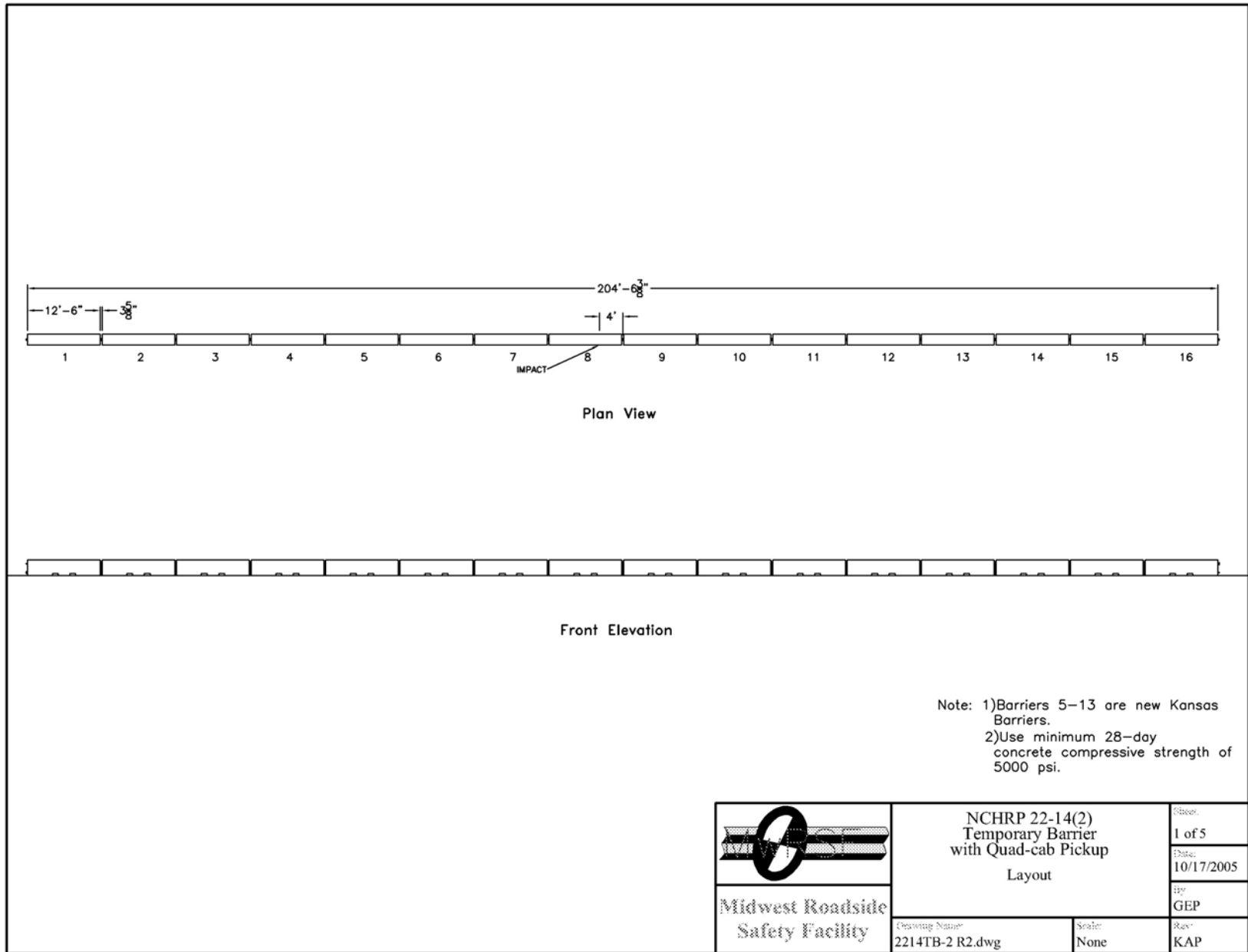


Figure A-1. Layout for Free-Standing Temporary Barriers (English)

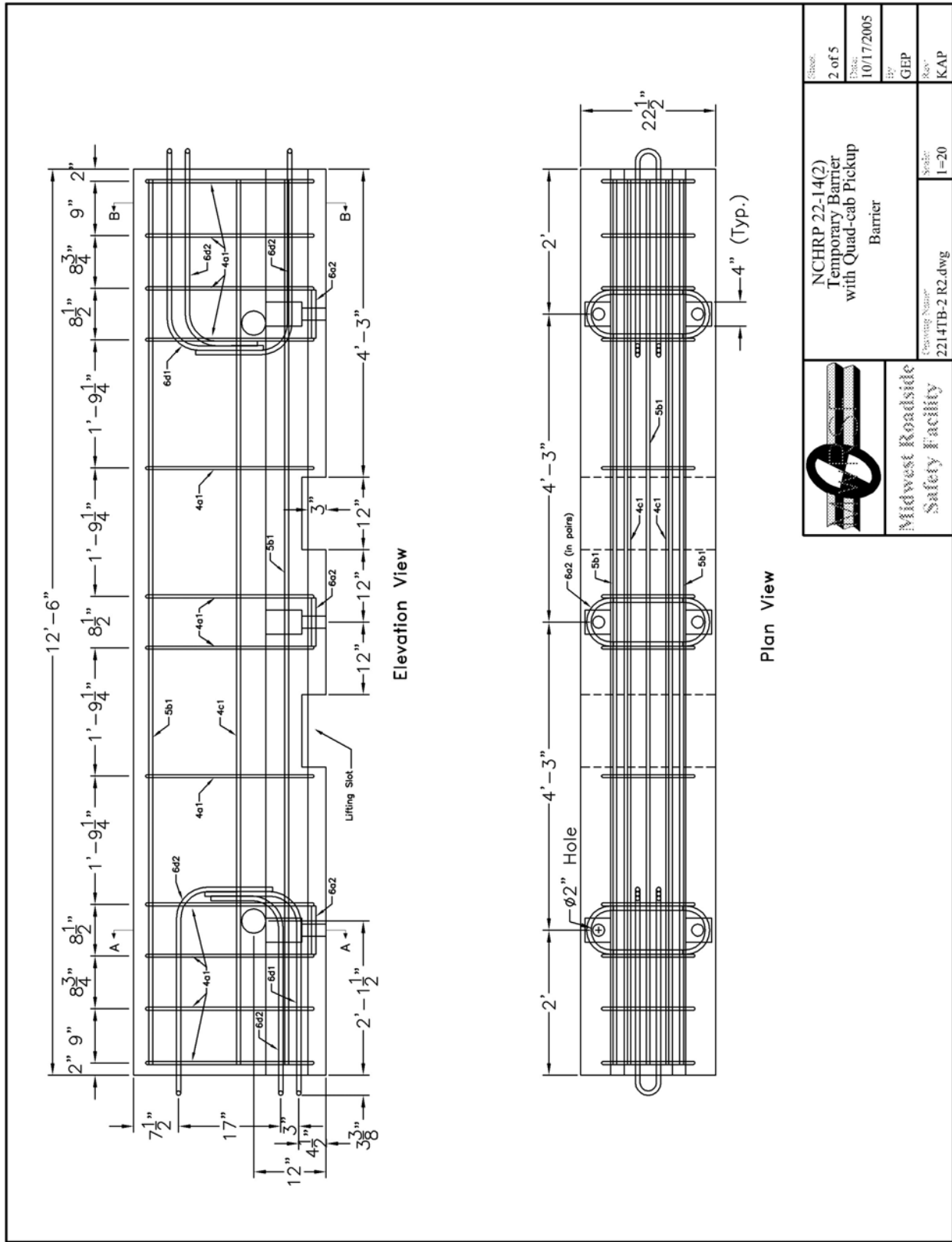


Figure A-2. Temporary Barrier Design Details (English)

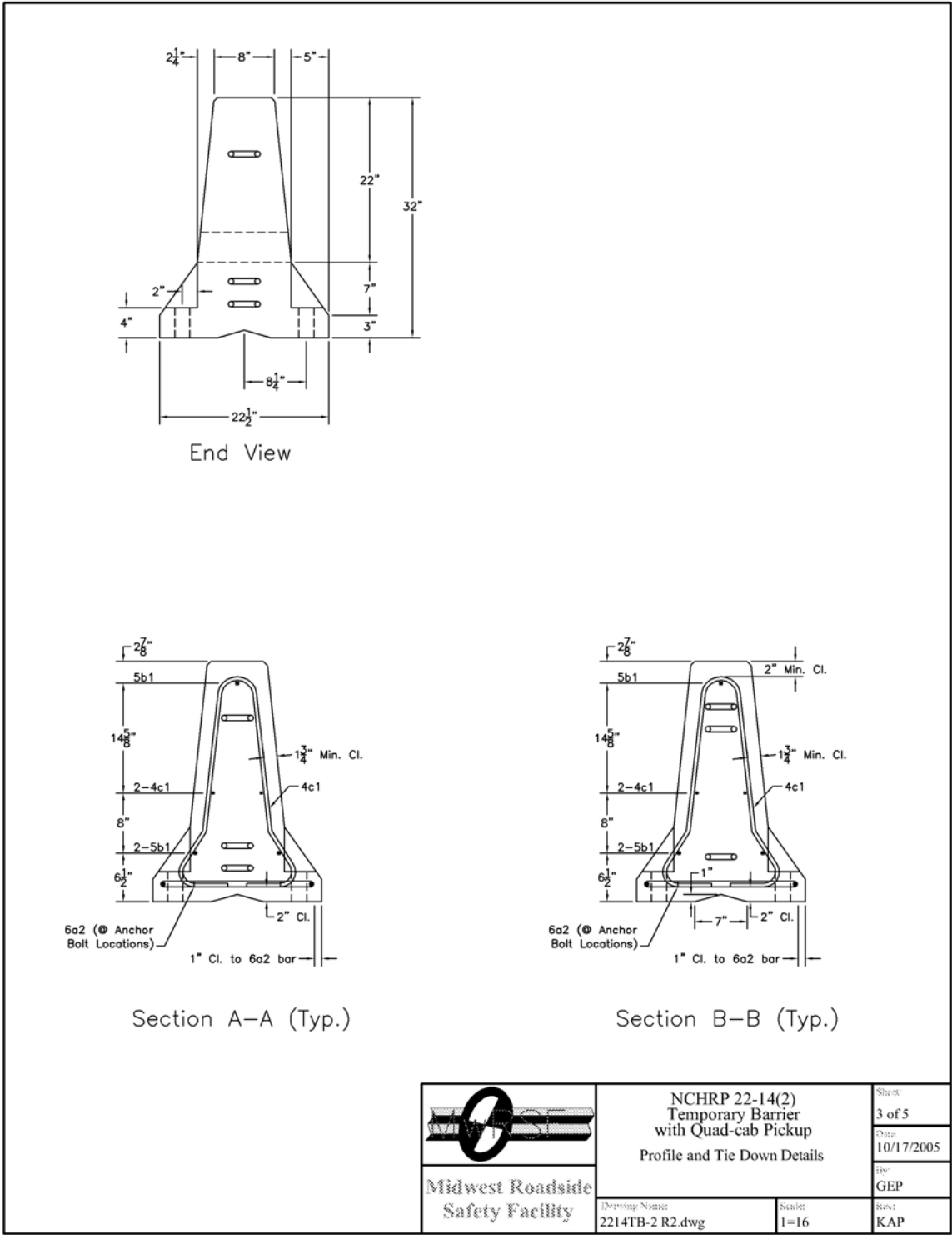


Figure A-3. Temporary Barrier Profile Details (English)

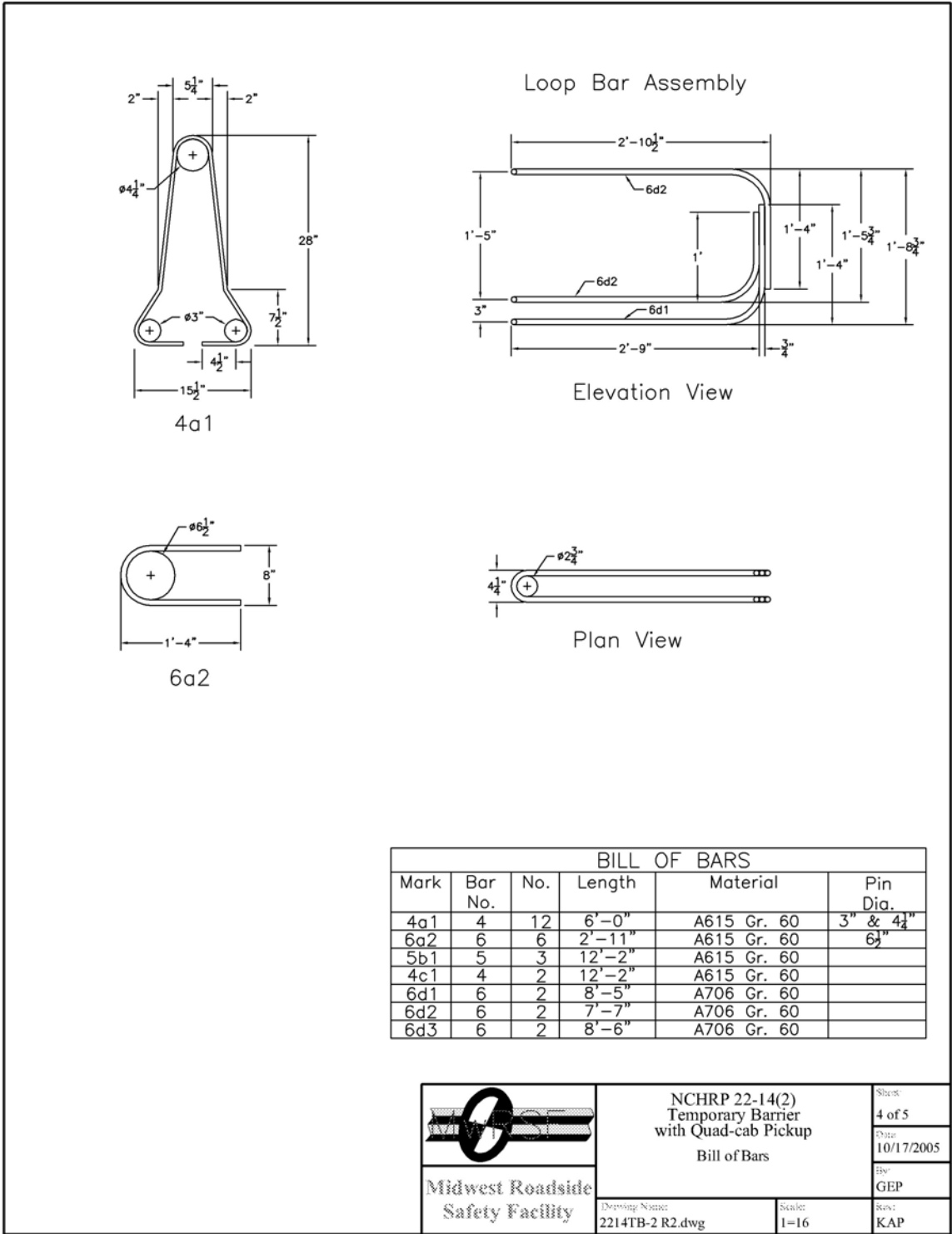


Figure A-4. Temporary Barrier Bill of Bars (English)

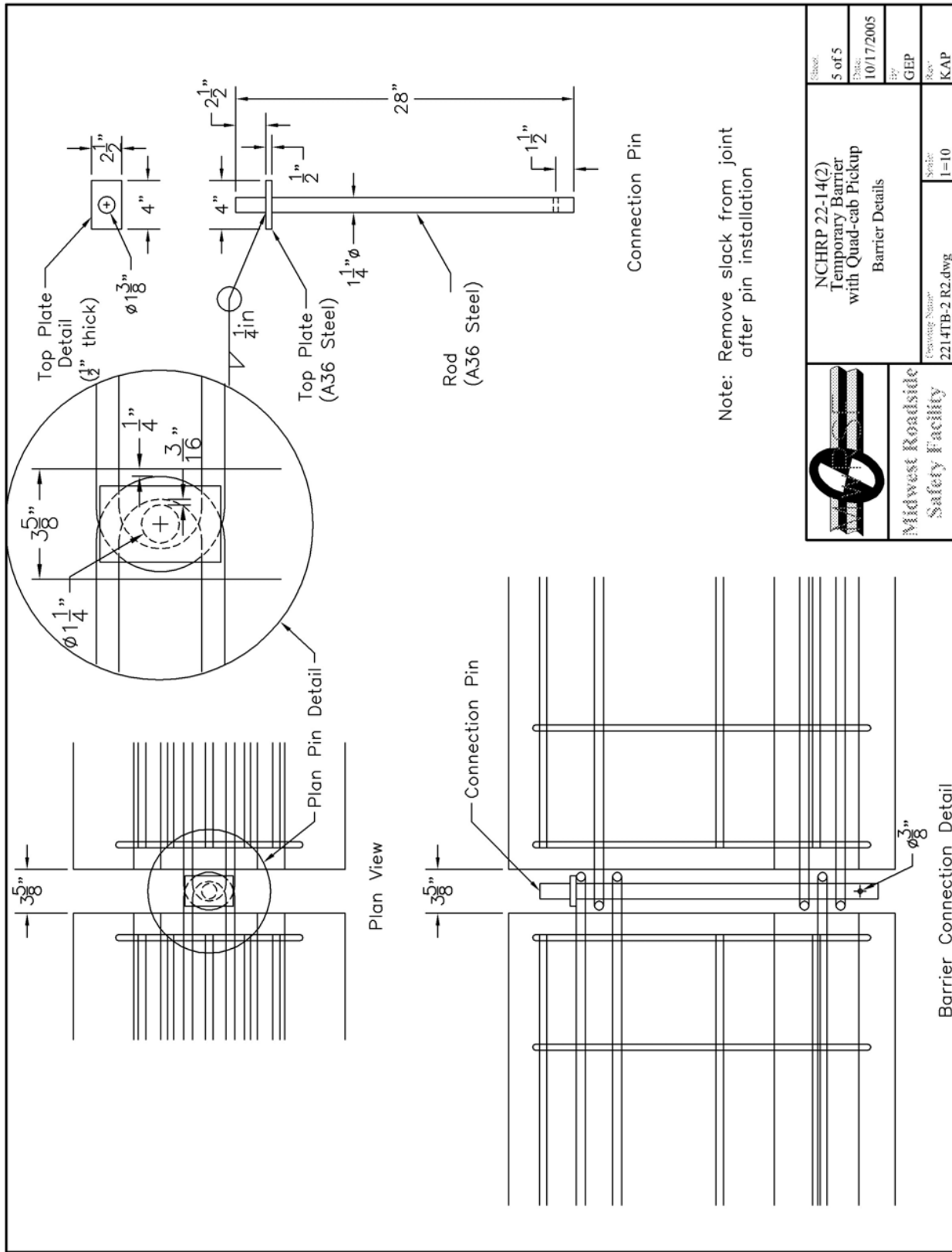
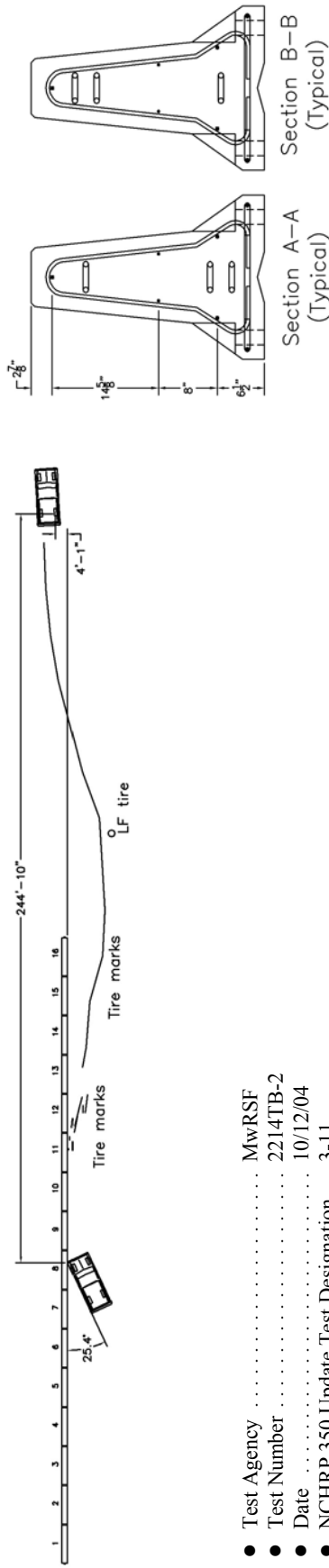


Figure A-5. Temporary Barrier Connection Details (English)



0.000 sec 0.122 sec 0.216 sec 0.400 sec 0.498 sec



- Test Agency MwRSF
- Test Number 2214TB-2
- Date 10/12/04
- NCHRP 350 Update Test Designation 3-11
- Appurtenance Free-Standing Temporary Barrier
- Total Length 204 ft - 6 in.
- Key Elements - Barrier
 - Description F-Shape Barrier
 - Length 12 ft - 6 in.
 - Base Width 22.5 in.
 - Height 32 in.
 - Type of Soil NA
- Test Vehicle
 - Type/Designation 2270P
 - Make and Model 2002 Dodge Ram 1500 Quad Cab Pickup
 - Curb 5,035 lbs
 - Test Inertial 5,000 lbs
 - Gross Static 5,000 lbs
- Impact Conditions
 - Speed 61.9 mph
 - Angle 25.4 degrees
 - Impact Location 3 ft - 11.3125 in. upstream barriers 8 & 9 joint
- Exit Conditions
 - Speed 44.9 mph
 - Angle 7.9 degrees
 - Exit Box Criterion Pass
- Post-Impact Trajectory
 - Vehicle Stability Satisfactory
 - Stopping Distance 244 ft - 10 in. downstream
4 ft - 0.5 in. laterally behind
- Occupant Impact Velocity (350 Update)
 - Longitudinal 17.00 ft/s < 39.4 ft/s
 - Lateral 17.28 ft/s < 39.4 ft/s
- Occupant Ridedown Deceleration (350 Update)
 - Longitudinal 7.17 Gs < 20 Gs
 - Lateral 11.37 Gs < 20 Gs
- THIV (not required) 22.60 ft/s
- PHD (not required) 11.52 Gs
- Test Article Damage Moderate
- Test Article Deflections
 - Permanent Set 73 in.
 - Dynamic 79.65 in.
 - Working Width 102.2 in.
- Vehicle Damage Moderate
 - VDS⁵ 11-LFQ-3
 - CDC⁶ 11-LYES4
 - Maximum Deformation 4.25 in. at front floorpan

Figure B-1. Summary of Test Results and Sequential Photographs (English), Test 2214TB-2