



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

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

March 22, 2005

In Reply Refer To: HSA-10/B-69B

Mr. Owen S. Denman, P.E.  
President  
Barrier Systems, Incorporated  
180 River Road  
Rio Vista, California 94571-1208

Dear Mr. Denman:

In June 2000, the Federal Highway Administration accepted your Reactive Tension System (RTS) using either steel-clad or concrete Quickchange Moveable Barrier (QMB) segments as a longitudinal traffic barrier at the National Cooperative Highway Research Program (NCHRP) Report 350 test level 3 (TL-3). This acceptance was based on tests conducted on straight sections of barrier anchored at both ends but otherwise free to deflect upon impact. The reported dynamic deflections were 700 mm for the Steel QMB units and 610 mm for the Concrete QMB units.

To reduce deflection further, you tested a Concrete QMB system, again anchored at both ends, but backed by a steel angle iron bolted to a simulated bridge deck 12 inches behind the field side of the barrier. Twenty-foot lengths of 3-inch x 4-inch x ½-inch thick angle iron were attached to the simulated concrete deck through the 3-inch leg of the angle with ¾-inch diameter x 8-inch long threaded anchor rods on 2-foot centers set in epoxy to a depth of six inches. The 4-inch leg of the angle was vertical and faced the backside of the barrier. To quantify the effectiveness of this treatment, you included with your February 23, 2005, letter, copies of a test report prepared by Safe Technologies, Incorporated entitled "Barrier Systems, Incorporated, Concrete Reactive Tension System – Quickchange Moveable Barrier, (RTS-QMB) – Limited Deflection Test" which described the impact of a pickup truck at a nominal impact speed of 100 km/h and at a 25-degree angle into a concrete RTS-QMB system installed with the steel angle described above installed 12 inches behind the barrier proper. Enclosure 1 shows the test installation. In this test, the barrier was anchored at both ends and its dynamic deflection was reported as 473 mm. A summary of the test results is shown as Enclosure 2. As noted therein, all NCHRP Report 350 evaluation criteria for a TL-3 barrier were satisfied.

Based on the information you provided, I concur that the RTS-QMB barrier, with a steel angle iron backup installed as described above, continues to meet the evaluation criteria for a TL-3



barrier and exhibits less dynamic deflection than the barrier without restraint. To remain fully effective along its entire length, the installation must be anchored at both ends as per your recommendations.

Sincerely yours,

*/Original Signed by/*

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

2 Enclosures

**Appendix F**

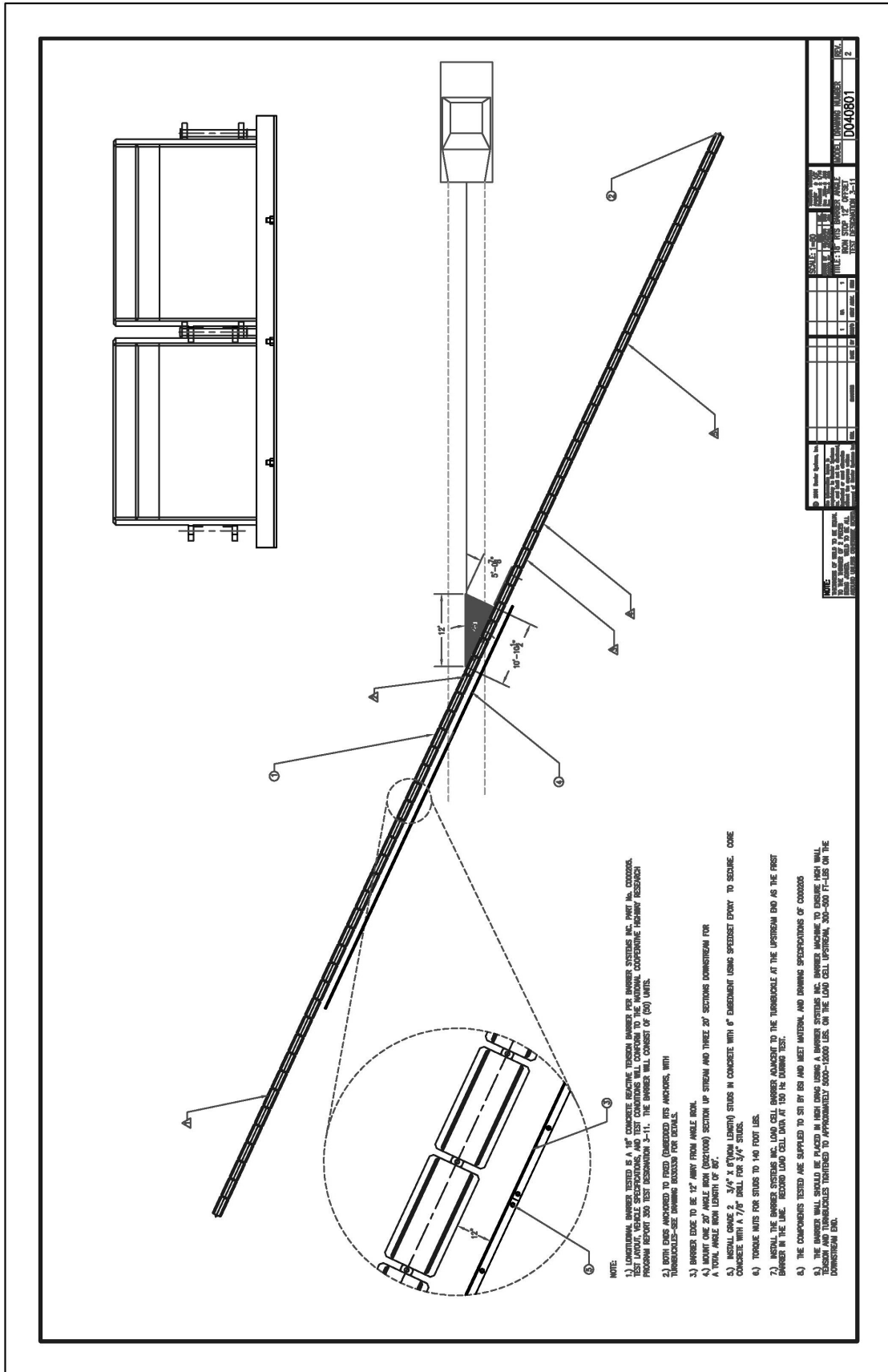
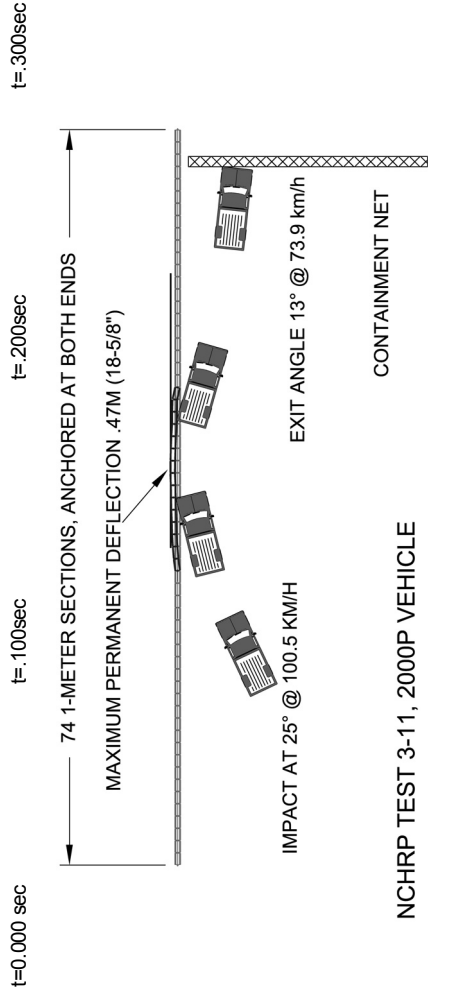
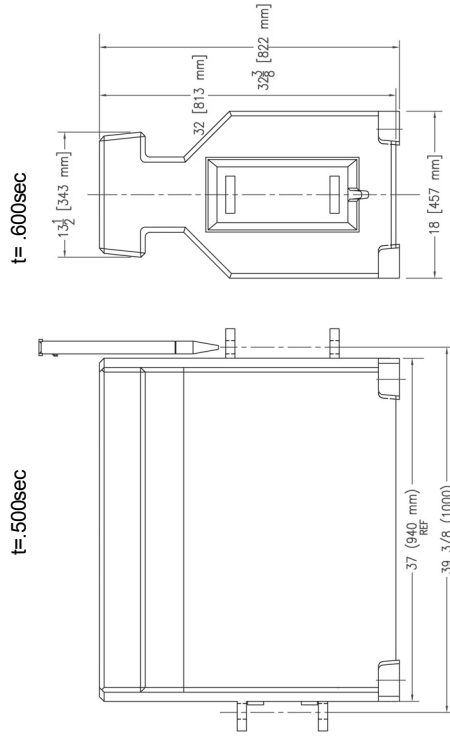
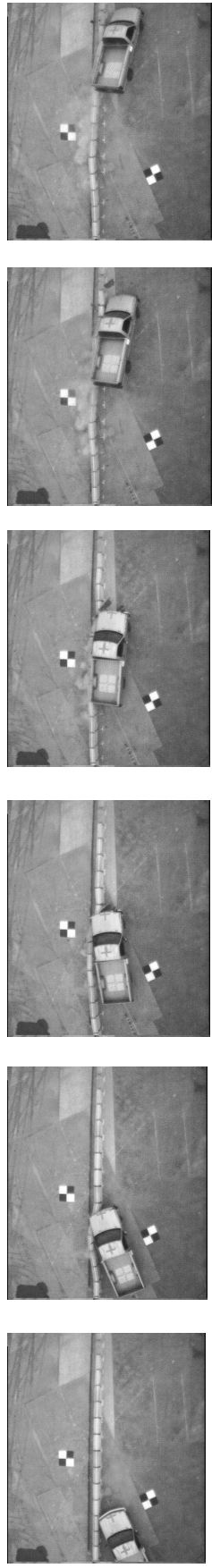


Figure F-1



**Exit Conditions**

Speed (km/h)..... 73.9 km/h  
 Angle (deg)..... 13

**Occupant risk Values**

Impact Velocity (m/s)  
 x-direction..... 7.4  
 y-direction..... -4.6  
 Ridedown Acceleration (g/s)  
 x-direction..... -7.9  
 y-direction..... 12.3  
 THIV (km/h)..... 29.5  
 PHD (g/s)..... 12.8  
 ASI..... 1.1

**Test Article Deflection (mm)**

Dynamic..... 611  
 Permanent..... 473

**Vehicle Damage**

Exterior  
 VDS..... LFQ-4  
 CDC..... 11FLEE3  
 Interior  
 OCDI..... LF0002000

**Post-Impact Vehicular Behavior (deg-gyro @ c.g.)**

Maximum Roll Angle..... -24.3  
 Maximum Pitch Angle..... -10.7  
 Maximum Yaw Angle..... 59.1

**General Information**

Test Agency..... SAFE TECHNOLOGIES, INC.  
 Test Designation..... NCHRP Report 350 Test 3-11  
 Test No..... QBD08  
 Date..... 1/18/2005

**Test Article**

Type..... Barrier Systems, Inc.  
 18" CRTS/QMB Longitudinal Barrier  
 Installation Length..... 74 meters overall

**Installation Length**

Size and/or dimension and material  
 of key elements..... CRTS Section length 1000mm, height 813mm,  
 width 610mm, mass 726 kg.

**Test Vehicle**

Type..... Production Model  
 Designation..... 2000 kg  
 Model..... 1988 Chevrolet 3/4 Ton Pick-up  
 Mass (kg)

Curb..... 1983  
 Test Inertial..... 1993  
 Dummy(s)..... n/a  
 Gross Static..... 1993

**Impact Conditions**

Speed (km/h)..... 96.4  
 Angle (deg)..... 25  
 Impact Severity (kJ)..... 127.6

Figure 1. Summary of Results-Test #QBD08