



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

1200 New Jersey Ave., S.E.  
Washington, DC 20590

October 25, 2007

In Reply Refer To:  
HSSD/SS-154

Ms. Sandra Lautenberg  
V.P. Operations, North America  
Trueform LLC  
177 Fieldcrest Avenue  
Edison, NJ 08837

Dear Ms. Lautenberg:

In your letter of July 26, 2007, you requested the Federal Highway Administration (FHWA) acceptance of your company's Elite bus stop sign support system for use on the National Highway System (NHS). Accompanying your request was a report from the E-TECH Testing Services. You requested that we find this device acceptable for use on the NHS under the provisions of the National Cooperative Highway Research Program (NCHRP) Report 350 "Recommended Procedures for the Safety Performance Evaluation of Highway Features."

### **Requirements**

Sign supports should meet the guidelines contained in the NCHRP Report 350, "Recommended Procedures for the Safety Performance Evaluation of Highway Features." The FHWA memorandum, "ACTION: Identifying Acceptable Highway Safety Features" of July 25, 1997, provides further guidance on testing requirements of sign supports and outlines procedures for pendulum testing and estimation of high-speed breakaway performance of sign supports from low-speed pendulum test results.

### **Product description**

The Elite bus stop sign support system includes a 9.8 to 13.1 foot (3m to 4m) extruded aluminum (material specification 6063-T6) post, lower timetable and upper route display signs, concrete foundation with socket tube mounting option, service line or solar powered lighting, and accompanying mounting hardware. The aluminum post is weakened 18 inches (0.45 m) from the bottom with a 1/2 inch (13 mm) diameter hole through the cross section just above the foundation socket tube such that the post fractures near or below the ground level when impacted.



### **Test article installations**

Two Elite bus stop sign support systems were tested. Each test article was configured with the “worst case” triple lower timetable display, solar light, and concrete anchor block with the tube socket option. The pendulum tested installation used a securely welded steel foundation to simulate the concrete anchor block with socket tube. In each installation the test article was assembled according to the manufacturer’s instructions and the total test article mass was 121 pounds (55 kg).

### **Testing**

Testing was conducted to evaluate performance at the test level 2 (TL-2) conditions according to NCHRP Report 350 criteria. After consultation with the FHWA Office of Safety, it was determined that the low speed (35 km/h) compliance testing (Test 2-60) be accomplished using a pendulum test apparatus and that the high speed (70 km/h) testing (Test 2-61) be completed using the 820C test vehicle. The pendulum bogie was built according the specifications of the Federal Outdoor Impact Laboratory's (FOIL) pendulum, and the frontal crush of the aluminum honeycomb nose of the bogie simulated the crush of an actual vehicle. Tests with pendulums are acceptable for most breakaway supports with the exceptions of base bending or yielding supports.

### **Findings**

For each test the velocity change and deceleration were both within acceptable limits. There was no appreciable stub height to measure from the ground line. The results of the pendulum test (Test 2-60) yielded a maximum change in velocity of 12.8 ft/s (3.9 m/s). The results of the higher speed 820C vehicle impact (Test 2-61) yielded a maximum change in velocity of 7.5 ft/s (2.3 m/s) and maximum ridedown acceleration of -1.2 g's. The vehicle bumper impacted the support at 17.3 inches (440 mm) above ground level and the sign support rotated above the vehicle, made contact with the rear windshield and caused the rear windshield to shatter. A summary of the testing results are enclosed.

The results of crash testing met the FHWA requirements and, therefore, the Elite bus stop sign support system as described above and shown in the enclosed drawings for reference are acceptable for use as TL-2 devices on the NHS under the range of conditions tested, when proposed by a State. The condition of the sign supports due to the damage from impact are classified as not being repairable. For systems that will be wired in ground for power, all electrical wiring connectors must be breakaway.

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

- Our acceptance is limited to the crashworthiness characteristics of the devices 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 device 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 device being marketed is significantly different from the version that was crash tested, it reserves the right to modify or revoke its 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 they will meet the crashworthiness requirements of the FHWA and the NCHRP Report 350.
- To prevent misunderstanding by others, this letter of acceptance, designated as number SS-154, shall not be reproduced except in full. As this letter and the supporting documentation which support it become public information, it will be available for inspection at our office by interested parties.
- The Trueform LLC Elite bus stop sign support system is a patented product and is considered "proprietary." When proprietary devices are *specified by a highway agency* for use on Federal-aid projects they: (a) must be supplied through competitive bidding with equally suitable unpatented items; (b) the highway agency must certify that they are essential for synchronization with 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. These provisions do not apply to exempt non-NHS projects. Our regulations concerning proprietary products are contained in Title 23, Code of Federal Regulations, Section 635.411, a copy of which is enclosed.
- This acceptance letter shall not be construed as authorization or consent by the FHWA to use, manufacture, or sell any patented device. Patent issues are to be resolved by the applicant and the patent owner.


Sincerely yours,

A handwritten signature in blue ink that reads "George E. Rice, Jr." with a stylized flourish at the end.

George E. Rice, Jr.  
Acting Director, Office of Safety Design  
Office of Safety

Enclosures

Test 2-60

 <p><b>E-TECH Testing Services, Inc.</b> 3617 B Cincinnati Avenue Rocklin, CA 95765 PHONE (916) 645-8188 FAX (916) 645-3653</p>	<p><b>Trueform Engineering Ltd. Elite</b> <b><u>Bus Stop System</u></b></p>	<p>Test Report No. 311 Issue Date: May 18, 2007 Revision: 0 (supercedes earlier revisions)</p>
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**a. Testing laboratory**

- a.1. Name: E-TECH Testing Services, Inc.
- a.2. Address: 3617B Cincinnati Avenue  
Rocklin, CA 95765  
USA
- a.3. Telephone number: (916) 645-8188
- a.4. Facsimile number: (916) 645-3653
- a.5. Test site location: Rocklin, California, USA

**b. Report number**

E-TECH Test Report No: 311

**c. Client**

- c.1. Name: Trueform LLC  
787 Seventh Ave. – 9th Floor  
New York, N.Y. 10019
- c.2. Telephone number: Tel. 604-306-8207  
Designated contact person: Mr. Richard Simpson
- c.3. Facsimile number: Fax 866-402-8323


**d. Test item**

- d.1. Received date: January 11, 2007
- d.2. Tested date: February 14, 2007  
Name of test item: Elite Bus Stop
- d.3. Photographs: Enclosure No. 1
- d.4. Drawings: Enclosure No. 2
- d.5. Material Certification: Enclosure No. 3

**e. Test procedure**

- e.1. **Evaluation Criteria**
  - e.1.1. Maximum change in velocity: per AASHTO, NCHRP 350, FHWA  
16.4 ft/s (5.0 m/s)
  - e.1.2. Maximum ridedown acceleration: 20 g's
  - e.1.3. Maximum substantial stub height: 4 in. (100 mm)
- e.2. **Test type**
  - e.2.1. Target impact speed: Pendulum  
21.8 +/- 2.5 mi/h (35 +/- 4 km/h)
  - e.2.2. Target impact angle: 0 deg +/- 1.5 deg C.L.
  - e.2.3. Target inertial test mass: 1800 +/- 55 lb (820 +/- 25 kg)

Test 2-60

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**e.3. Installation**

e.3.1. The test article was the Elite Bus Stop sign support system. The mass of the sign support including signs was 121 lb (55 kg). The extruded aluminum upright post was inserted into a 6" x 6" x 1/4" (150 x 150 x 6 mm) galvanized steel tube foundation socket which was in turn securely welded to a rigid steel foundation plate to simulate a concrete anchor block foundation. The upright supports was installed and secured according to the manufacturer's specifications. The pendulum mass was accelerated to the nominal 21.8 mi/h (35 km/h) test speed by raising it to a height of 15.8 ft (4.8 m) and releasing it to swing freely into the test article.

e.3.2. Photographs: Enclosure No. 4

**e.4. Pendulum Tester**

e.4.1. Model: E-TECH Equip. ID #205 with 10 stage crushable FOIL bogie nose

e.4.2. Test Inertial Mass: 1855 lb (843 kg)

e.4.3. Photographs: Enclosure No. 4

**f. Results**

f.1.1. Test: #465-B

f.1.2. Date: February 14, 2007

f.1.3. Weather conditions at test: 55 °F (13 °C) clear, sunny

f.1.4. Impact speed: 21.8 mi/h (35 km/h)

f.1.5. % difference from target speed: 0 %

f.1.6. Impact angle: 0 deg.

f.1.7. % difference from target angle: 0%

f.1.8. Impact severity: 29.4 ft-kip (39.9 kJ)

f.1.9. Impact within tolerance limits:  Yes  No

f.1.10. Maximum change in velocity: 12.8 ft/s (3.9 m/s) at loss of contact

Maximum ridedown acceleration: N/A (flail space not reached)

f.1.11. Maximum stub height: Below grade

f.1.12. General description of test sequence: The pendulum mass was accelerated to the test speed by raising it to a height of 15.8 ft. (4.8 m) and releasing it to swing freely to engage the test article 18 in.(457 mm) above ground level. The crushable nose collided with the installation on center, dynamically loaded the support upright, and fractured the aluminum extrusion below grade level. All applicable evaluation criteria were met.

f.1.13. Photographs: Enclosure No. 4



t = 0.000 sec



t = 0.100 sec



t = 0.200 sec



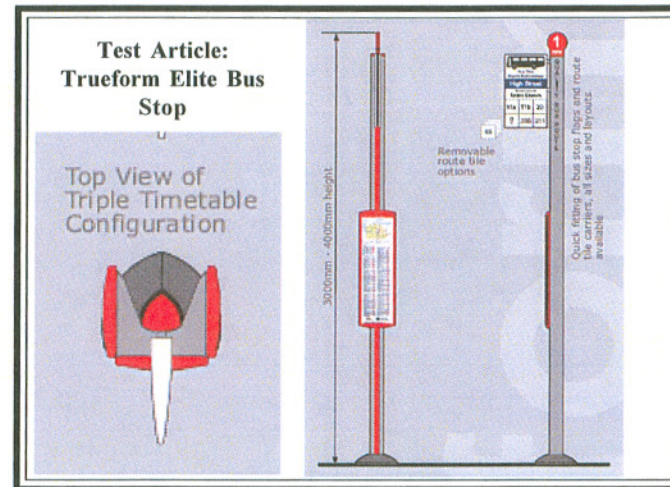
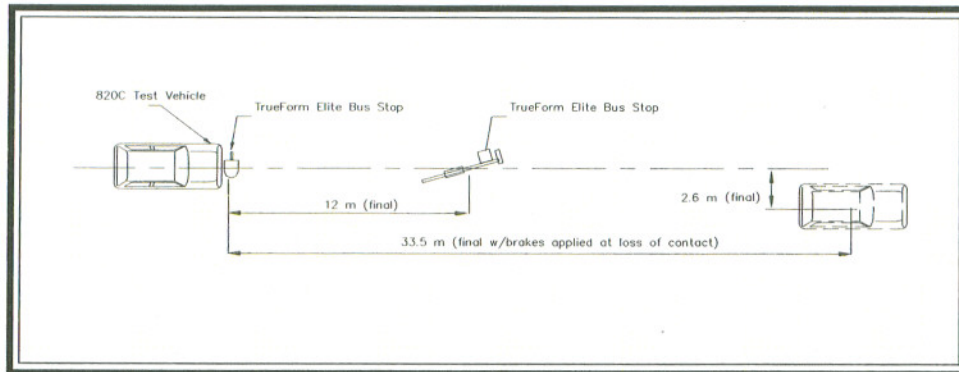
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t = 0.400 sec



t = 0.500 sec



**General Information**

Test Agency ..... E-TECH Testing Services, Inc.  
 Test Designation ..... NCHRP 350 Test 2-61  
 Test No. .... 64-2721-001  
 Date ..... 4/13/07

**Test Article**

Type ..... Trueform Engineering Elite  
 Bus Stop Sign Support System  
 Impact Orientation ..... Normal, centerline  
 Size and/or dimension and material  
 of key elements ..... 6063-T6 extruded aluminum upright

**pole**

..... Triple Timetable lower sign 900 mm  
 ..... Route ID upper sign 460 x 900 mm  
 ..... Concrete foundation block with  
 ..... Tube socket option  
 ..... Mass - 55 kg

**Test Vehicle**

Type ..... Production Model  
 Designation ..... 820C  
 Model ..... 1991 Ford Festiva  
 Mass (kg)  
 Curb ..... 767  
 Test inertial ..... 801  
 Dummy ..... 75  
 Gross Static ..... 876

**Impact Conditions**

Speed (km/h) ..... 70.3  
 Angle (deg) ..... 0  
 Impact Severity (kJ) ..... 152.7

**Exit conditions**

Speed (km/h) ..... 62.0  
 Angle (deg) ..... 0

**Occupant Risk Values**

Impact Velocity (m/s)  
 x-direction ..... 2.3  
 y-direction ..... 0.3

**Ridedown Acceleration (g's)**

x-direction ..... -1.2  
 y-direction ..... 0.8

**European Committee for Normalization (CEN) Values**

THIV (km/h) ..... 8.5  
 PHD (g's) ..... 1.3  
 ASI ..... 0.5

**Test Article**

Maximum Stub Height (mm) ..... Below Grade

**Vehicle Damage**

Exterior  
 VDS ..... FC-2  
 CDC ..... 12FCEN2

**Interior**

OCDI ..... AS0000000  
 Maximum Deformation (mm) ..... Negligible

**Post-Impact Vehicular Behavior (deg - rate gyro)**

Maximum Roll Angle ..... -3.3  
 Maximum Pitch Angle ..... -1.3  
 Maximum Yaw Angle ..... 4.0





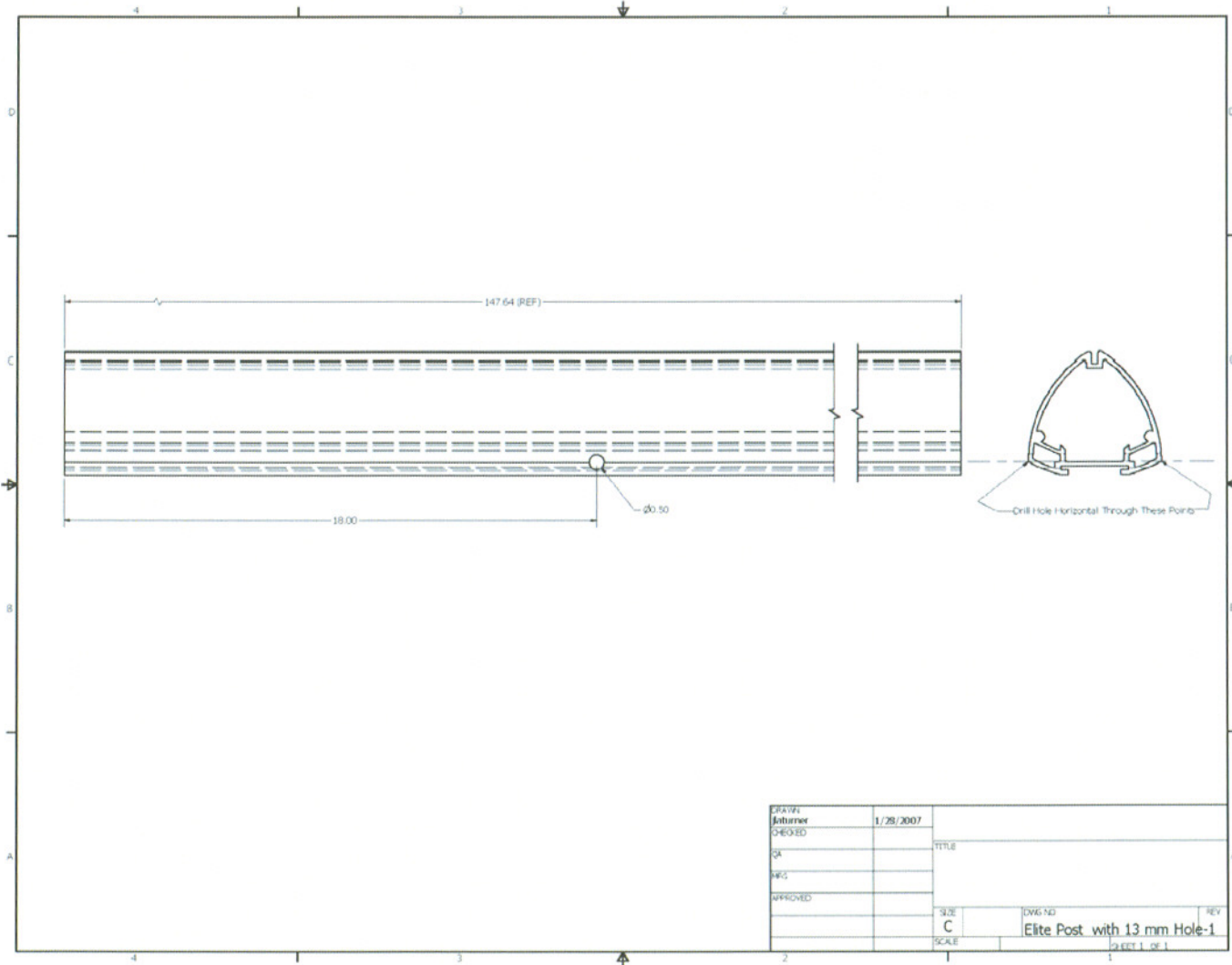
PHONE (818) 645-8188

### Elite Bus Stop System

Test Report No. 311  
Issue Date: May 18, 2007

Revision: 0 (supercedes earlier revisions)

### Enclosure 2 Test Article Drawings



DATE	1/28/2007		
DESIGNED		TITLE	
QA			
WFG			
APPROVED		SIZE	DWG NO
		C	Elite Post with 13 mm Hole-1
		SCALE	SHEET 1 OF 1







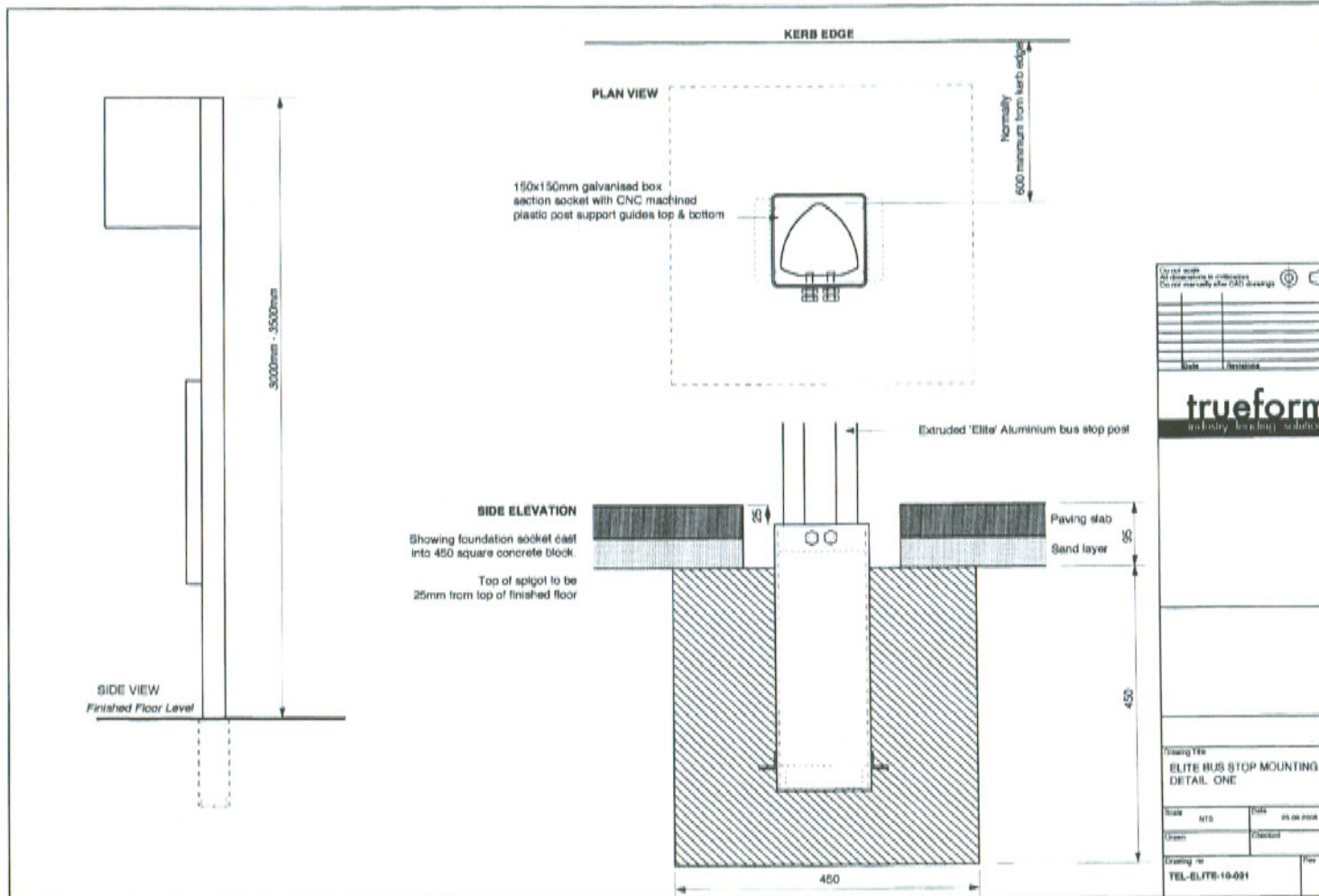
PHONE (016) 645-8188

### Elite Bus Stop System

Test Report No. 311  
Issue Date: May 18, 2007

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### Enclosure 2 Test Article Drawings



Trueform Engineering Ltd. Unit 4, Passmore Trading Estate, Passmore Close, Pump Lane, Hayes, Middlesex UB8 3WQ. Tel: 0161 645 8188 Fax: 0161 645 8781

