Mr. Gerald Okihara, P.E.
Traffic Design Engineer
City of Spokane
808 West Spokane Falls Blvd
Spokane, Washington 99201-3343

Dear Mr. Okihara:

Thank you for your E-mail correspondence of December 14, 2005, requesting the Federal Highway Administration (FHWA) acceptance of generic 2-inch and 2.5-inch schedule 40 pipes with pipe couplers as breakaway sign support systems for use on the National Highway System (NHS). You referenced the August 1989 test report from the Texas Transportation Institute (TTI) titled “Generic Small Sign Support System and Validation of Acceptable Support Performance”. You requested that we find those supports 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.” On April 6, 2006, TTI sent us the attached PDF scans of the Texas standard drawings as the best information they had available. We will take this opportunity to formally accept all the generic supports that were successfully tested under the referenced TTI study.

Introduction
Testing of the supports was in compliance with the guidelines contained in the NCHRP Report 350 and Report 230, Recommended Procedures for the Safety Performance Evaluation of Highway Appurtenances. Requirements for breakaway supports are those in the American Association of State Highway and Transportation Officials' Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals. As the test and evaluation criteria for breakaway supports did not change materially from Report 230 using the 1800-pound car to Report 350, the results remain valid.

A brief description of the tested sign supports follows:

1. **Two U-Channel supports with bolted lap splice at ground level**
   This installation consisted of a 6 ft wide by 5 ft tall plywood sign panel mounted on two Franklin steel four-pound-per-foot supports. These supports were attached to two 40-inch long stubs driven into “strong” soil at 36 inches on center. The supports were attached to
the stubs in a 3.0-inch nested splice (stubs in front of the supports) with \(\frac{1}{2}\) inch spacers and 5/16 inch Grade 9 bolts, nuts, and washers. The bottom of the sign was mounted at 5 feet.

2. **Pipe supports with threaded coupler at ground level**
   This installation consisted of a 4 ft wide by 5-foot tall plywood sign panel mounted with three cast u-bolts to a single 2 ½ inch schedule 40 steel pipe T-top support. A 2 ½ inch x 24 inch steel pipe was embedded in an 18-inch diameter x 30 inch deep concrete footing in strong soil. The top of the stub pipe and bottom of the signpost were threaded. The sign support was then attached to the footing using a pipe collar coupling.

3. **Pipe Post on multi-directional (triangular) slip bases**
   The sign installation consisted of a U-frame constructed of 2-inch diameter steel pipe welded to a 3-inch diameter steel pipe support. The U-frame dimensions were 9 ft 1.5 inches on one side and 4 ft 6 inches on the other. The spacing between the U-frame uprights was 2 ft 8.5 inches. The 3-inch schedule 40 pipe support was 4 ft 10 inches long and equipped with a triangular slip base. A 3 inch x 36 inch steel pipe with triangular slip base and lifting ramp (FHWA note: this lifting ramp should be omitted) was embedded in a concrete footing 18 inches in diameter x 42 inches long. The concrete footing was placed in “strong” soil. The sign base was attached to a footing using 5/8 inch x 2 ½ inch high strength hex bolts, washers, and nuts. All signs were attached using 2 cast pipe clamps per sign with u-bolts. The lowest sign was mounted at 5 ft from the ground.

**Testing**
Full-scale automobile testing was conducted on these generic sign supports devices, all of which were founded in “strong” soil. The complete devices as tested are shown in the Enclosures.

<table>
<thead>
<tr>
<th>Test #</th>
<th>Speed</th>
<th>Vehicle Mass</th>
<th>Support</th>
<th>Occup.Speed</th>
<th>Delta V.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1122-6A</td>
<td>18.9 mph</td>
<td>816 kg</td>
<td>Dual Franklin 4 ppf posts</td>
<td>3.1 m/s</td>
<td>3.2 m/s</td>
</tr>
<tr>
<td>1122-7</td>
<td>60.5 mph</td>
<td>816 kg</td>
<td>Dual Franklin 4 ppf posts</td>
<td>None</td>
<td>2.4 m/s</td>
</tr>
<tr>
<td>1122-8</td>
<td>20.6 mph</td>
<td>816 kg</td>
<td>2.5” Pipe coupler in concrete</td>
<td>4.6 m/s</td>
<td>4.9 m/s</td>
</tr>
<tr>
<td>1122-9A</td>
<td>60.7 mph</td>
<td>816 kg</td>
<td>2.5” Pipe coupler in concrete</td>
<td>None</td>
<td>3.0 m/s</td>
</tr>
<tr>
<td>1122-10</td>
<td>19.7 mph</td>
<td>816 kg</td>
<td>Triangular slip base</td>
<td>None</td>
<td>1.8 m/s</td>
</tr>
<tr>
<td>1122-11</td>
<td>59.8 mph</td>
<td>816 kg</td>
<td>Triangular slip base</td>
<td>None</td>
<td>2.5 m/s</td>
</tr>
</tbody>
</table>

Occup. Speed: Occupant Impact Speed: Speed at which a theoretical front seat occupant will contact the windshield. In meters per second.
Delta V: Speed change of the test vehicle. In meters per second.
**Findings**

Damage was limited to bumper, hood, and roof damage. No direct windshield contact was observed in any of the above tests. Velocity changes were all within acceptable limits. The U-channel stubs, and the 3-bolt slip base were both designed and installed with stub heights no greater than 4 inches. The 2.5-inch pipe stub was installed with the threaded coupler flush with the ground surface.

1. **Two 4 pound-per-foot, 60 ksi U-Channel supports with bolted lap splice at ground level**
   - Note that single post installations may be used.
   - Note that 80-ksi steel U-channels may be used.
   - Note that 3 pound per foot and lighter posts may be used.

2. **2.5 inch diameter schedule 40 pipe supports with threaded coupler at ground level**
   - Note that 2.0-inch diameter schedule 40 pipe supports and bases may be used.

3. **3-inch diameter schedule 40 pipe post on multi-directional (triangular) slip base**
   - Note that the riser should be omitted from triangular slip base designs as testing of other triangular slip bases showed it to be an impediment to proper operation.

The results of testing met the FHWA requirements and, therefore, the 3 breakaway devices described above and shown in the enclosed drawings for reference are acceptable for use as test level 3 devices on the NHS under the range of conditions tested, when proposed by a State or municipality.

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.
- Contractors and suppliers should certify 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-133 shall not be reproduced except in full. As this letter and the supporting documentation that support it become public information, it will be available for inspection at our office by interested parties.
- This acceptance letter shall not be construed as authorization or consent by the FHWA to use, manufacture, or sell any patented device for which the applicant is not the patent holder. The acceptance letter is limited to the crashworthiness characteristics of the
candidate device, 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,

/signed by George E. Rice, Jr./

~for~

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

Enclosures
TRIANGULAR SLIP BASE NOTES

1. The lifting device may consist of welded ramps on a conical shape formed into the center of the bottom base plate.

2. The top plate of the triangular slip base shall have the same exterior dimensions as the bottom plate. The lifting device shall be a part of the bottom plate only a hole equal to the depth diameter of the main post shall be cut through the center of the top plate with the hole edge beveled as detailed.

3. The top and bottom base plates and lifting device shall conform with the requirements of ASTM A-325, ASTM or A-327, Grade 50.

4. All structural steel shall be galvanized in accordance with ASTM A-123. The entire support shall be galvanized from the top down to a minimum depth of 8' into the foundation. All nuts, bolts, and washers shall be galvanized in accordance with the zinc specification of ASTM B-654.

5. All high-strength bolts shall be conform to ASTM A-325. ASTM A-449 may be substituted for ASTM A-325. Provide a proper bolt head, nut and washer clearances are maintained. All high-strength nuts shall be of such capacity as to develop the bolt strength.

BOLTING PROCEDURE FOR ASSEMBLY OF BASE CONNECTION

1. Assemble post to stub with bolts and with one flat washer on each bolt between plates as shown.

2. Shim as required to plumb post.

3. Tighten all bolts to the maximum possible with 1/8" to 1/2" wrench to 150 lbs. and then tighten each bolt in turn and retighten bolts in a systematic order to the prescribed torque of 600-800 ft. lbs. Do not overtighten.

4. Draw threads at junction with not being a center punch to prevent日后 bending.

SHIM DETAIL

FURNISH 1/8" X 1/4" THICK AND 2" X 2/3" THICK SHIMS PER POST. SHIMS SHALL BE FABRICATED FROM BRASS SHIM STOCK OR STRIP CONFORMING TO ASTM A-327.
TRIANGULAR SLIP BASE NOTES

1. The lifting device may consist of welded plates or a C-channel beam covered with a plate.
2. The top plate of the triangular slip base shall have the same extension dimensions as the bottom plate.
3. The lifting device shall be part of the top plate or an equal to the base diameter of the plate.
4. The top and bottom base plates and lifting device shall be of the same size as required.
5. ALL STRUCTURAL STEEL SHALL BE G COLLECTION WITH ACCOR ACCORDING TO THE REQUIREMENTS OF ASTM A542 AND A441.
6. ALL HIGH STRENGTH BOLTS SHALL BE CONFORM TO ASTM A325.

BOLTING PROCEDURE FOR ASSEMBLY OF BASE CONNECTION:

1. ASSEMBLE PORTION OF BOLTS AND WITH ONE FLAT WASHER ON EACH BOLT BETWEEN PLATES AS SHOWN.
2. ASSEMBLE PORTION OF BOLTS AND WASHERS.
3. TIGHTEN ALL BOLTS TO THE MAXIMUM POSSIBLE WITH 1/2" TEETH WRENCH AS SHOWN AND TO CLEAR BOLT THREADS.

SHIM DETAIL

FURNISH 2" x 0.25 T1 THICK AND 2" x 0.25 T1 THICK SHIMS PER POE: SHADE SHALL BE FABRICATED FROM BRASS, SHIM STOCK OR STEEL CONFORMING TO AST B 119.

BREAKAWAY PIPE COLLAR COUPL

PIPE COLLAR COUPLING SHALL BE USED FOR SIGNS SUPPORTED ON 3" DIAMETER AND LARGER PIPE POSTS.

GENERAL NOTES:

1. DESIGN CONFORMS WITH AASHTO SPECIFICATIONS FOR CONSTRUCTION OF STRUCTURAL SUPPORTS FOR HIGHWAY & MATERNAL AND FABRICATION SHALL CONFORM TO THE REQUIREMENTS OF THE SPECIFICATIONS.

2. WHERE SOIL ROCK IS ENCOUNTERED, FOOTING SHALL BE EXTENDED TILL ROCK HAS BEEN EXCAVATED INTO THE ROCK.
The cross arm of the pipe mount should be parallel to one side of the triangular slip base, and approximately perpendicular to the direction of traffic.

**ORIENTATION OF TRIANGULAR SLIP BASE**

**WELDED PIPE MOUNT DETAILS**

**Friction Cap Details**

**Pipe Mounting Details**

**BREAKAWAY PIPE COLLAR COUPLING**