



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

April 13, 2006

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

In Reply Refer To:  
HSA-10/SS-133

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 ½ 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.

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

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,

*/original signed by George E. Rice, Jr./*  
*~for~*

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

Enclosures

FHWA:HSA-10:NArtimovich:tb:x61331:4/12/06

File: h://directory folder/artimovich/SS133-SpokaneFIN.doc

cc: HSA-10 (Reader, HSA-1; Chron File, HSA-10; MMcDonough, HSA-10;  
N.Artimovich, HSA-10)

TRIANGULAR SLIP BASE NOTES

1. THE LIFTING DEVICE MAY CONSIST OF WELDED RAMPS OR 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 INSIDE DIAMETER OF THE SIGN POST SHALL BE CUT THROUGH THE CENTER OF THE TOP PLATE WITH THE HOLE EDGE BEVELLED AS DETAILED
3. THE TOP AND BOTTOM BASE PLATES AND LIFTING DEVICE SHALL CONFORM WITH THE REQUIREMENTS OF A.S.T.M. A36, A441 OR A572 GRADE 50.
4. ALL STRUCTURAL STEEL SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A163. THE ENTIRE SUPPORT SHALL BE GALVANIZED FROM THE TOP DOWN TO A MINIMUM DEPTH OF 6" INTO THE FOUNDATION. ALL NUTS, BOLTS AND WASHERS SHALL BE GALVANIZED IN ACCORDANCE WITH THE ZINC SPECIFICATION OF ASTM B484
5. ALL HIGH STRENGTH BOLTS SHALL CONFORM TO ASTM A328 (ASTM A448 MAY BE SUBSTITUTED FOR A ASTM A328 PROVIDED PROPER BOLT HEAD, NUT AND/OR WASHER CLEARANCES ARE MAINTAINED) ALL HIGH STRENGTH NUTS SHALL BE OF SUCH CAPACITY AS TO DEVELOP THE BOLT STRENGTH.

Cross-arm pipe mount

The cross-arm pipe mount to the

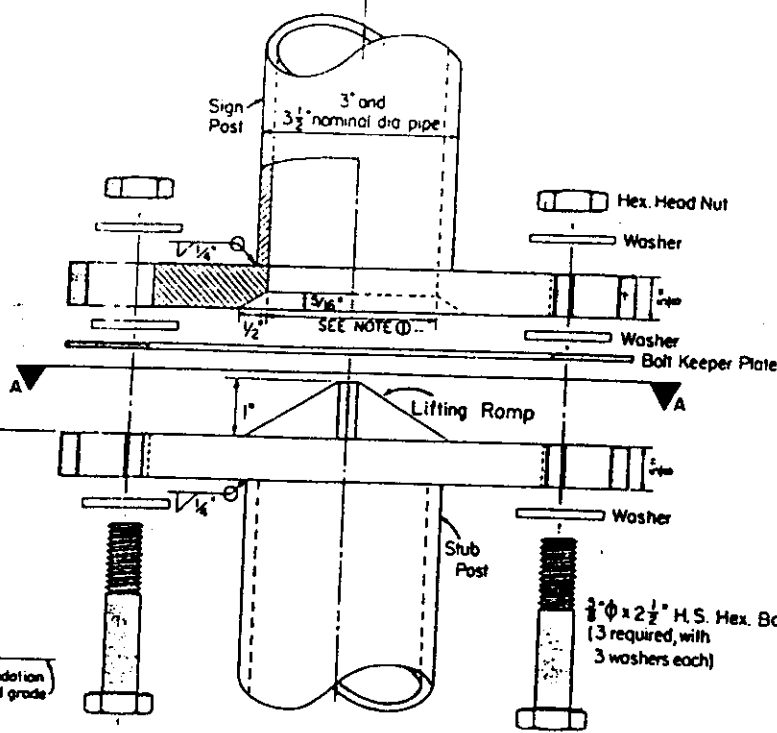
OF TRIAL

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 FLANGE POST.
3. TIGHTEN ALL BOLTS THE MAXIMUM POSSIBLE WITH 15" TO 18" WRENCH TO BED WASHERS AND SHIMS AND TO CLEAN BOLT THREADS, THEN LOOSEN EACH BOLT IN TURN AND RETIGHTEN BOLTS IN A SYSTEMATIC ORDER TO THE PRESCRIBED TORQUE OF 400 INCH-POUNDS. DO NOT OVERTIGHTEN.
4. BURR THREADS AT JUNCTION WITH NUT USING A CENTER PUNCH TO PREVENT NUT LOOSENING.

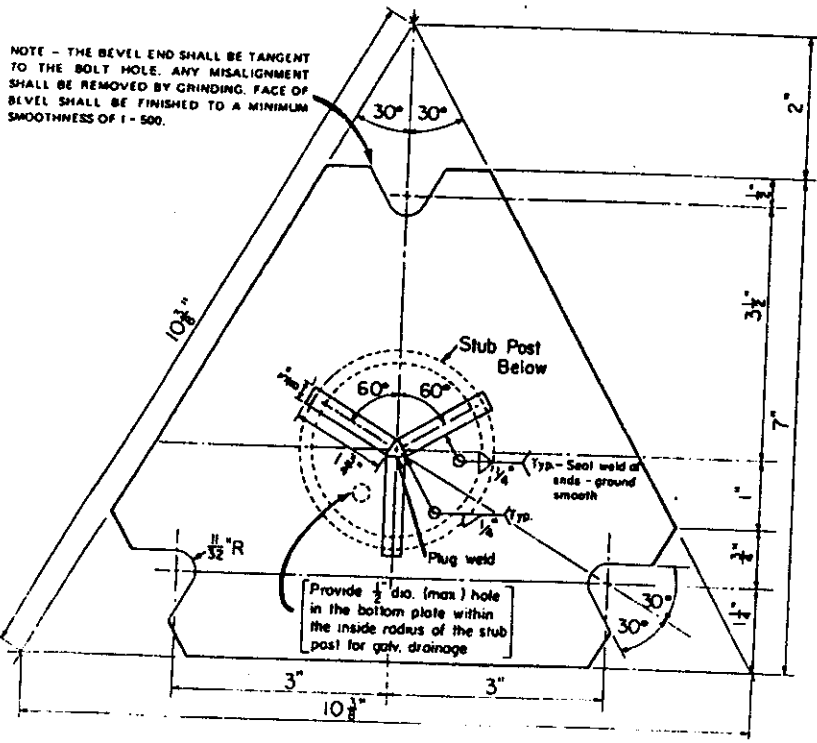
The Slip Post

Permissible Shop Splice



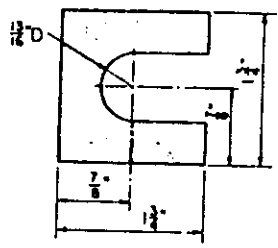
Sign Post & Stub Post Elevation

TRIANGULAR SLIP BASE



View A-A

NOTE - THE BEVEL END SHALL BE TANGENT TO THE BOLT HOLE. ANY MISALIGNMENT SHALL BE REMOVED BY GRINDING. FACE OF BEVEL SHALL BE FINISHED TO A MINIMUM SMOOTHNESS OF 1 - 500.

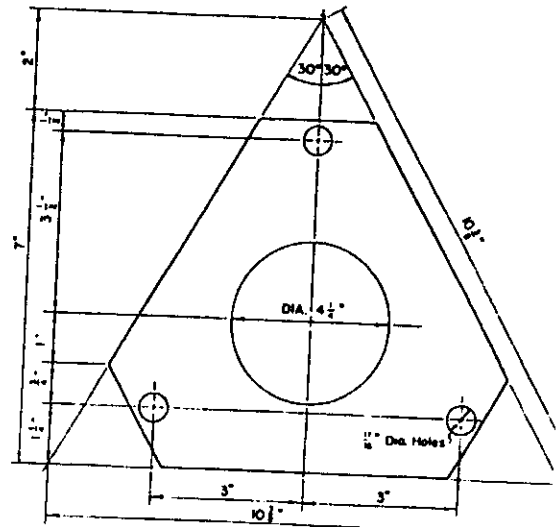


SHIM DETAIL

FURNISH 2-012" THICK AND 2-012" THICK SHIMS PER POST. SHIMS SHALL BE FABRICATED FROM BRASS SHIM STOCK OR STRIP CONFORMING TO A S.T.M. -836

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Bolt Keeper Plate Detail

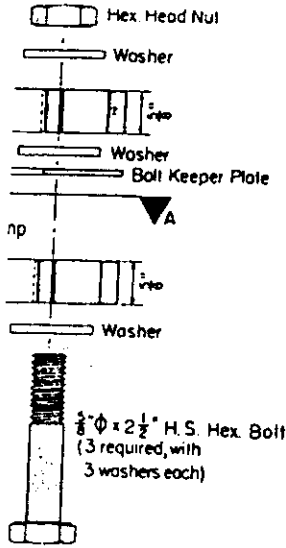
Bolt Keeper Plate shall be 30 ga galvanized sheet steel

**TRIANGULAR SLIP BASE NOTES**

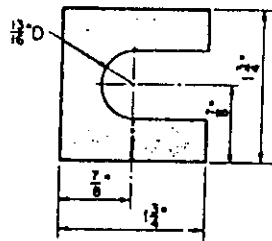
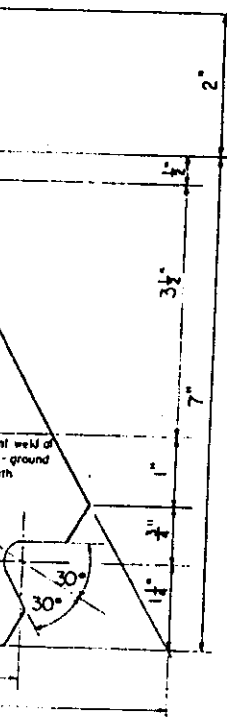
1. THE LIFTING DEVICE MAY CONSIST OF WELDED RAMPS OR A CONICAL SHAPE FORMED INTO THE CENTER OF THE BOTTOM BASE PLATE
2. THE TOP PLATE OF THE TRIANGULAR SLIP BASE SHALL HAVE THE SAME EXTERIOR DIMENSIONS AS THE BOTTOM PLATE. THE LIFTING DEVICE SHALL BE A PART OF THE BOTTOM PLATE. ONLY A HOLE EQUAL TO THE INSIDE DIAMETER OF THE SIGN POST SHALL BE CUT THROUGH THE CENTER OF THE TOP PLATE WITH THE HOLE EDGE BEVELLED AS DETAIL.
3. THE TOP AND BOTTOM BASE PLATES AND LIFTING DEVICE SHALL CONFORM WITH THE REQUIREMENTS OF A.S.T.M. A36, A441 OR A572 GRADE 50.
4. ALL STRUCTURAL STEEL SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A163. 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 B454.
5. ALL HIGH STRENGTH BOLTS SHALL CONFORM TO ASTM A328 (ASTM A448 MAY BE SUBSTITUTED FOR ASTM A328 PROVIDED PROPER BOLT HEAD, NUT AND/OR 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. SHIMS AS REQUIRED TO PLUMB POST.
3. TIGHTEN ALL BOLTS THE MAXIMUM POSSIBLE WITH 12" TO 18" WRENCH TO BED WASHERS AND SHIMS AND TO CLEAN BOLT THREADS. WHEN LOOSEN EACH BOLT IN TURN AND RETIGHTEN BOLTS IN A SYSTEMATIC ORDER TO THE PRESCRIBED TORQUE OF 488 INCH-POUNDS. DO NOT OVERTIGHTEN.
4. BURR THREADS AT JUNCTION WITH NUT USING A CENTER PUNCH TO PREVENT NUT LOOSENING.

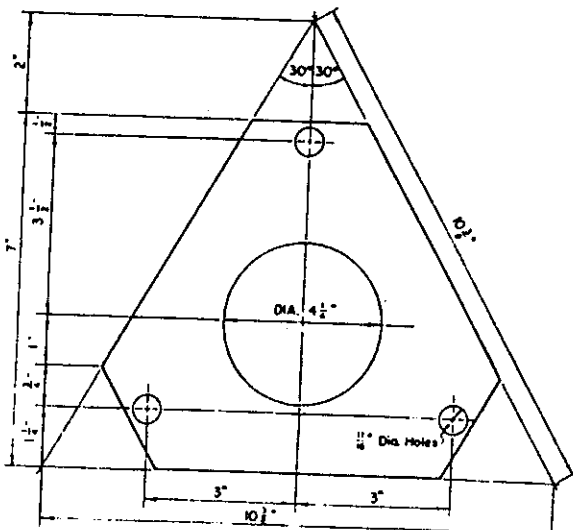


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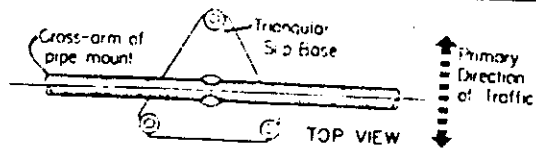
**SHIM DETAIL**

FURNISH 2-012" THICK AND 2-032" THICK SHIMS PER POST. SHIMS SHALL BE FABRICATED FROM BRASS SHIM STOCK OR STRIP CONFORMING TO A.S.T.M. -836



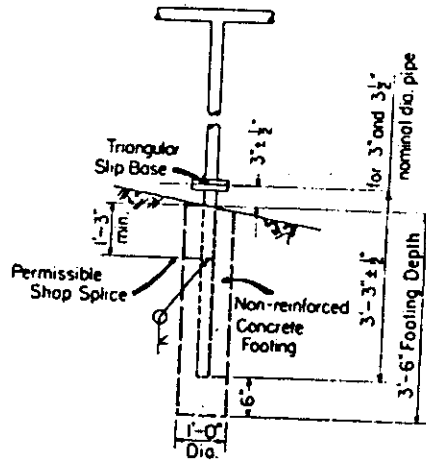
**Bolt Keeper Plate Detail**

Bolt Keeper Plate shall be 30 ga galvanized sheet steel



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**

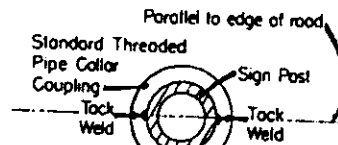


**Triangular Slip Base Foundation Details**

TRIANGULAR SLIP BASE SHALL BE USED FOR SIGNS SUPPORTED ON 3" DIAMETER AND LARGER PIPE POSTS.

**GENERAL NOTES:**

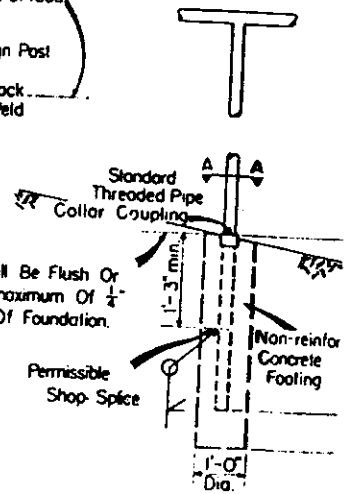
- DESIGN CONFORMS WITH A.A.S.H.T.O. SPECIFICATIONS FOR CONSTRUCTION OF STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS.
- MATERIAL AND FABRICATION SHALL CONFORM TO THE REQUIREMENTS OF THE SPECIFICATIONS.
- WHERE SOLID ROCK IS ENCOUNTERED, FOOTING SHALL BE EXTENDED TWO FEET MINIMUM INTO THE ROCK.



Tack Welds to be approx. 180° apart

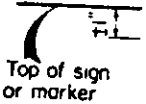
**Section A-A**

Coupling Shall Be Flush Or Projecting a maximum of 1/4" Above Top Of Foundation.

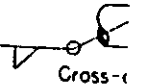


**BREAKAWAY PIPE COLLAR COUPLER**

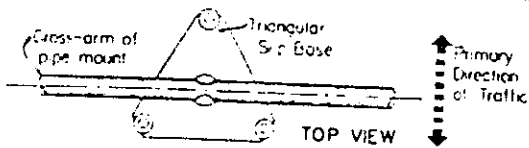
PIPE COLLAR COUPLING SHALL BE USED FOR ALL SIGNS SUPPORTED ON 2" DIAMETER PIPE POSTS.



Top of sign or marker

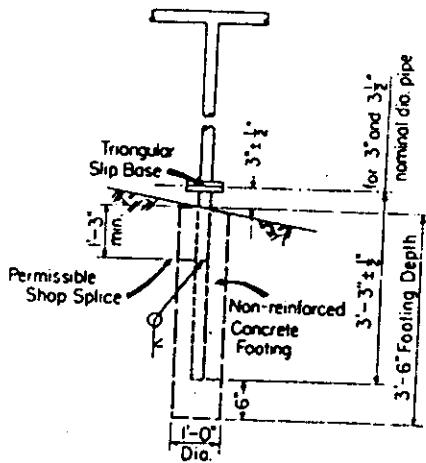


Cross-



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



### Triangular Slip Base Foundation Details

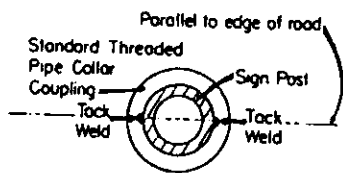
TRIANGULAR SLIP BASE SHALL BE USED FOR SIGNS SUPPORTED ON 3" DIAMETER AND LARGER PIPE POSTS.

#### GENERAL NOTES:

DESIGN CONFORMS WITH A.A.S.H.T.O. SPECIFICATIONS FOR THE DESIGN AND CONSTRUCTION OF STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS.

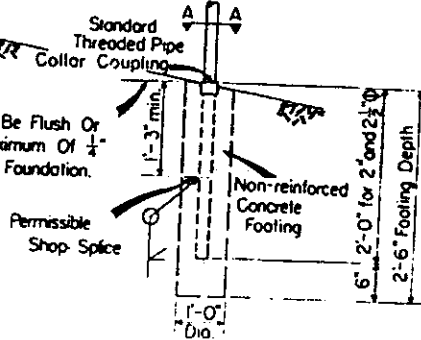
MATERIAL AND FABRICATION SHALL CONFORM TO THE REQUIREMENTS OF THE SPECIFICATIONS.

WHERE SOLID ROCK IS ENCOUNTERED, FOOTING SHALL BE PLAN DEPTH OR EXTEND TWO FEET MINIMUM INTO THE ROCK.



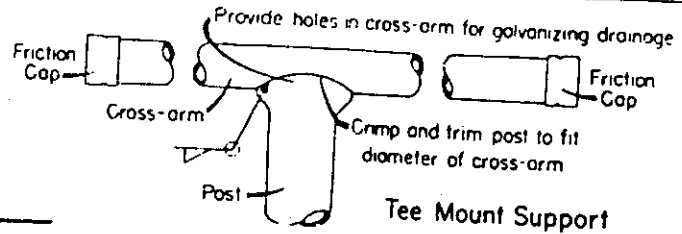
Tack Welds to be approx. 180° apart  
Section A-A

Coupling Shall Be Flush Or Projecting a maximum of 1/4" Above Top Of Foundation.

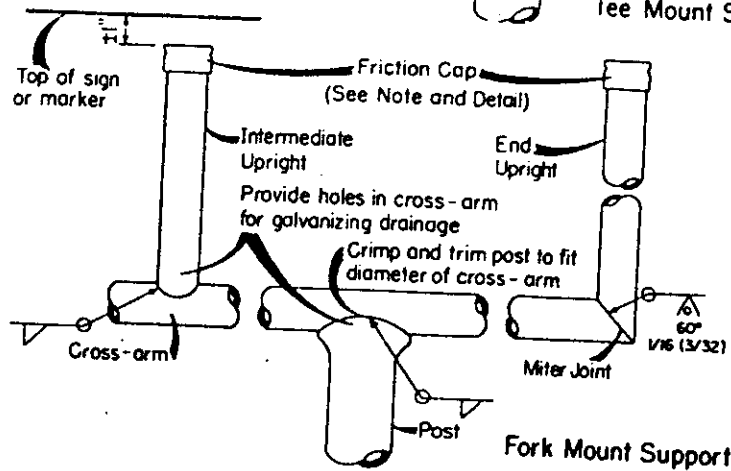


### BREAKAWAY PIPE COLLAR COUPLING

PIPE COLLAR COUPLING SHALL BE USED FOR ALL SIGNS SUPPORTED ON 2" AND 2 1/2" DIAMETER PIPE POSTS



### Tee Mount Support

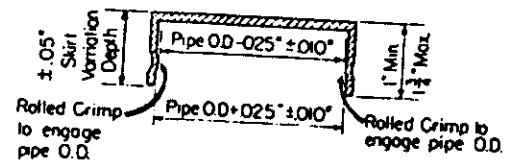


### Fork Mount Support

### WELDED PIPE MOUNT DETAILS

NOTE: THE CONTRACTOR AT HIS OPTION MAY FURNISH STANDARD WEIGHT PIPE CONFORMING TO ASTM SPECIFICATION A 508, A 501 OR ANY OTHER STANDARD WEIGHT STEEL PIPE EITHER OF ELECTRIC RESISTANCE WELDED OR SEAMLESS TYPE, WITH A MINIMUM YIELD STRENGTH OF 35,000 PSI AND A MINIMUM ELONGATION OF 15 PERCENT IN 2 INCHES, AND SHALL HAVE OUTSIDE DIAMETERS AND WALL THICKNESSES WHICH ARE EQUIVALENT TO OR BETTER THAN THOSE SPECIFIED HEREON.

ALL PIPES TO BE WELDED SHALL BE OF WELDABLE QUALITY



### Friction Cap Details

#### NOTES:

FRICION CAPS MAY BE MANUFACTURED FROM EITHER HOT ROLLED OR COLD ROLLED STEEL SHEETS. FOR ALL PIPE SIZES THE MINIMUM SHEET METAL THICKNESS SHALL BE 24 GAUGE.

THE RIM EDGES SHALL BE REASONABLY STRAIGHT AND SMOOTH. CAPS SHALL BE SIZED AND FORMED IN SUCH A MANNER AS TO PRODUCE A DRIVE-ON FRICION FIT AND HAVE NO TENDENCY TO ROCK WHEN SEATED ON THE PIPE. THE DEPTH SHALL BE SUFFICIENT TO GIVE POSITIVE PROTECTION AGAINST ENTRANCE OF RAINWATER. THEY SHALL BE FREE OF SHARP CREASES OR INDENTATIONS AND SHOW NO EVIDENCE OF METAL FRACTURE.

CAPS SHALL HAVE AN ELECTRODEPOSITED COATING OF ZINC IN ACCORDANCE WITH THE REQUIREMENTS OF A.S.T.M. SPECIFICATION A164, TYPE G5.



STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

## PIPE MOUNTING DETAILS FOR SMALL ROADSIDE SIGNS

SMD(1-3)

DRAWING DATE 4-75		STATE	FEDERAL AID PROJECT	SHEET
DESIGNER	1-21 (UP TO DATE)	REVISIONS		
CHECKED				
DATE	1-82			
		COUNTY	SECTION	JOB