



U.S. Department  
of Transportation

**Federal Highway  
Administration**

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

In Reply Refer To:  
HSA-10/WZ-222

Mr. Jeff Anderson  
POCO Incorporated  
42000 Van Born Road  
Canton, Michigan 48188

Dear Mr. Anderson:

Thank you for your letter of December 1, 2005, requesting the Federal Highway Administration (FHWA) acceptance of your company's portable sign stand for supporting 4 x 5 foot rigid sign panels as a crashworthy traffic control device for use in work zones on the National Highway System (NHS). Accompanying your letter were reports of crash testing conducted by KARCO Engineering and video of the tests. You requested that we find these devices acceptable for use on the NHS under the provisions of National Cooperative Highway Research Program (NCHRP) Report 350 "Recommended Procedures for the Safety Performance Evaluation of Highway Features."

### **Introduction**

The FHWA guidance on crash testing of work zone traffic control devices is contained in three memoranda. The first, dated July 25, 1997, titled "INFORMATION: Identifying Acceptable Highway Safety Features," established four categories of work zone devices: Category I devices are those lightweight devices which are to be self-certified by the vendor, Category II devices are other lightweight devices which need individual crash testing but with reduced instrumentation, Category III devices are barriers and other fixed or heavy devices also needing crash testing with normal instrumentation, and Category IV devices are trailer mounted lighted signs, arrow panels, etc. for which crash testing requirements have not yet been established. The second guidance memorandum was issued on August 28, 1998, and is titled "INFORMATION: Crash Tested Work Zone Traffic Control Devices." This later memorandum lists devices that are acceptable under Categories I, II, and III. Our new acceptance process was outlined in our memorandum "FHWA Hardware Acceptance Procedures – Category 2 Work Zone Devices" dated November 11, 2005.

A brief description of the devices follows:

The tested sign stand was made of 2 vertical masts of 1.5" x 1.5" square cold rolled steel (CRS) tubing, 14 ga wall thickness, and 96 inches long. The bottom portion of the vertical



masts is reinforced with a 48-inch long section of 1" ID black pipe, spot-welded in place. The footprint is made of 2 horizontal legs of 2" x 2" hot rolled steel angle. The angle has a thickness of 0.1875" and each leg is 72" long. The vertical masts slide inside a vertical stub, or socket, welded to each leg.

Each socket is constructed of 2" CRS tubing, with a wall thickness of approximately 3/16" (7 gage steel). The socket is welded to the base at all available intersections. The breakaway device, composed of a section of 1.5" x 1.5" x 14 ga x 12" long CRS tubing (mast material without any 1" pipe inside) is welded to a section of 1.75" x 1.75" x 14 ga x approximately 7.5" long Telespar perforated square steel tubing. The Telespar overlaps the 12" long section of tubing by approximately 3.5", and is welded around the perimeter. This then overlaps the sign mast by approximately 4". This subassembly is fastened to the bottom portion of the sign mast by placing a 5/16"-18 x 2.25" bolt through a corresponding hole drilled in the mast, approximately 1" from the end. This 'extension' to the mast sits in the socket on the foot.

The support structure is ballasted with two 35 pound sandbags placed on each leg. The vertical masts are further reinforced by an X-brace constructed of 1.25" x 1.25" hot rolled steel angle that is 0.125" thick and 66 inches long. The sign panel is a 48" x 60" reflective plywood panel, 5/8 inches thick. The panel is fastened to the vertical uprights by four 5/16" – 18 zinc plated bolts, 3.5" in length. A 1.25" diameter washer is placed under the bolt head and a 0.625" x 1.25" spacer is placed between the sign panel and the vertical mast. The total height of the assembly is 132" and the total weight is 134 pounds.

The CRS square tube and angle elements are ASTM A-36 steel, and the "black pipe" is ASTM A-500 Grade B.

### Testing

Full-scale automobile testing was conducted on your company' devices. Two stand-alone examples of the device were tested in tandem, one oriented perpendicular and the next placed six meters downstream turned at 90 degrees to face head on, as called for in our guidance memoranda. In this case the perpendicular sign was placed first to avoid the situation where a sign struck head-on would lie on the vehicle and shield it from impact with the second sign.

The tests are summarized in the table below.

	NCHRP Report 350 Test 3-71	
Report Number	TR-P25172-02-NC	
Sign Stand Tested	Perpendicular	Head-On
Mounting heights: bottom	1828 mm (6 feet)	
Mounting heights: top	3353 mm (11 feet)	
Flags? Lights?	None	None
Mass of Test Vehicle	799 kg test inertial weight	
Impact Speed	103.4 kmh (64.3 mph)	95.2 kmh (59.2 mph)
Velocity Change	2.17 m/s	
Extent of contact	Uprights made contact at roof line but signs hit roof only.	

Windshield Damage	Minor overall cracking, with more cracking at point of impact of sign legs with roofline.
Other notes	Driver vision not impaired by the cracking.

### Findings

Damage was limited to minor deformation of the roof, and windshield cracking. The signs in both the perpendicular and head-on impacts cleared the top of the windshield before contacting the roof. Impact of the uprights at the roof line above the windshield led to minor cracking overall with more modest cracking at the actual point of impact. There were no holes made through the glass, nor did the windshield separate from the frame. The results of the testing met the FHWA requirements and, therefore, the devices described in the various requests above and detailed in the enclosed drawings are acceptable for use on the NHS under the range of conditions tested, when proposed by a State.

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 WZ-222 shall not be reproduced except in full. This letter, and the test documentation upon which this letter is based, is public information. All such letters and documentation may be reviewed at our office upon request.
- The POCO portable sign support includes patented products that may be considered "proprietary." The use of proprietary work zone traffic control devices in Federal-aid projects is generally of a temporary nature. They are *selected by the contractor* for use as needed and removed upon completion of the project. Under such conditions they can be presumed to meet requirement "a" given below for the use of proprietary products on Federal-aid projects. On the other hand, if 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. 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 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.

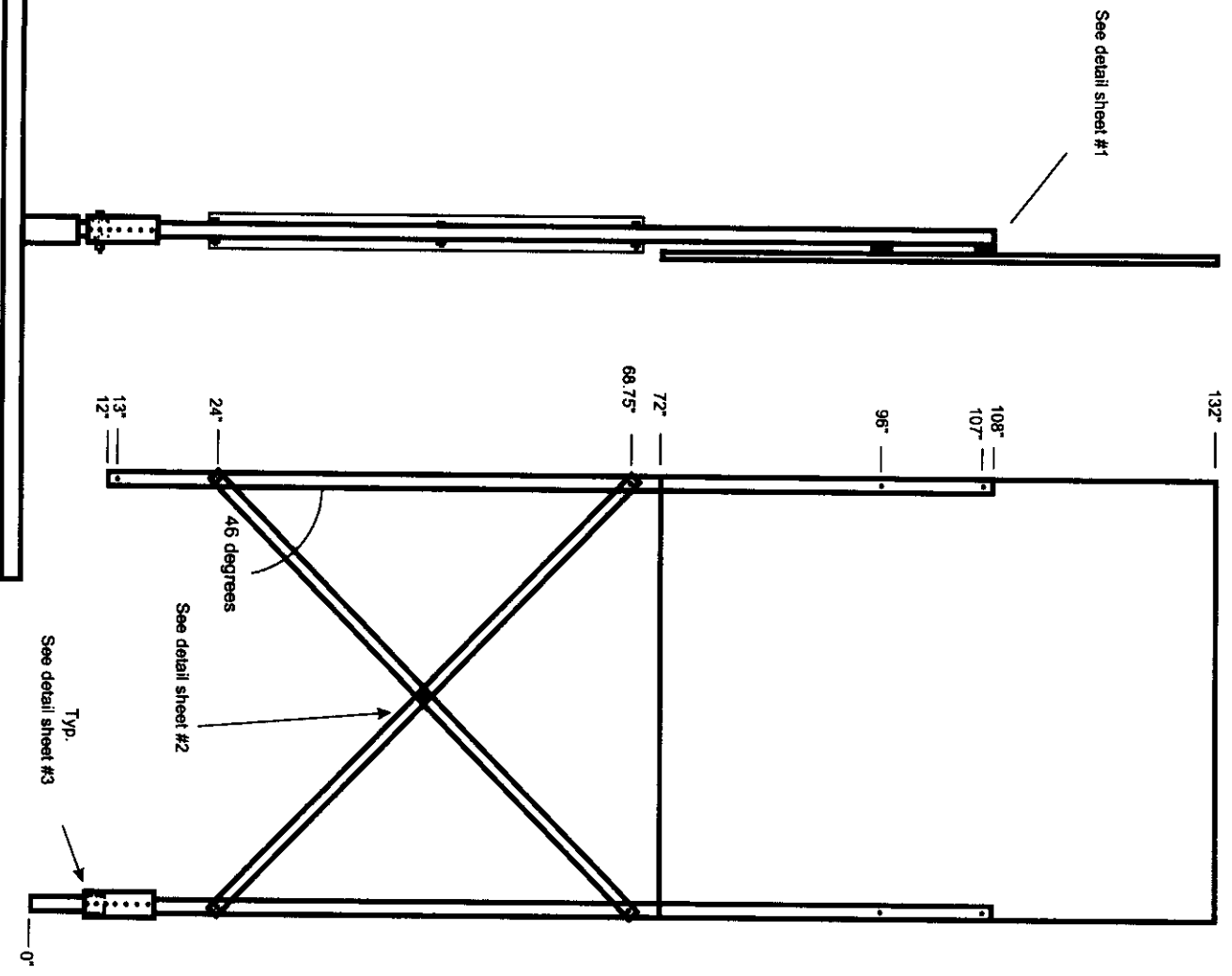
Sincerely yours,

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

Enclosures

FHWA:HSA-10:NArtimovich:tb:x61331:2/10/06  
File: h://directory folder/artimovich/WZ222-POCOfin.doc  
cc: HSA-10 (Reader, HSA-1; Chron File, HSA-10;  
N.Artimovich, HSA-10)

# Overall View



## Proposed Rigid Panel Sign Support System

Legs (horizontal portion) - 2" x 2" x .1875" thick x 72" long cold rolled steel angle.

Legs (vertical portion) - 2" C.R.S. Square tubing (1/8" wall thickness) x 8" tall.

Vertical portion of the leg is continuously welded to angle at all available intersections.

Vertical mast - 1.5" x 1.5" x 14 gage wall x 96" Cold Rolled Steel Tubing.

Vertical mast members punched with .3438" dia. hole at 4 (four) locations for mounting bolts (1" and 12" from each end), plus one hole approximately 56.75" from the bottom. Each mast contains a 4" long section of nominal 1" schedule 40 pipe inserted ~~antiflashed~~ bottom portion with a small weld.

Masts slide inside vertical portion of legs. No bolts or fastening device is used.

Panel - Reflective plywood, .625" thick x 48" x 60".

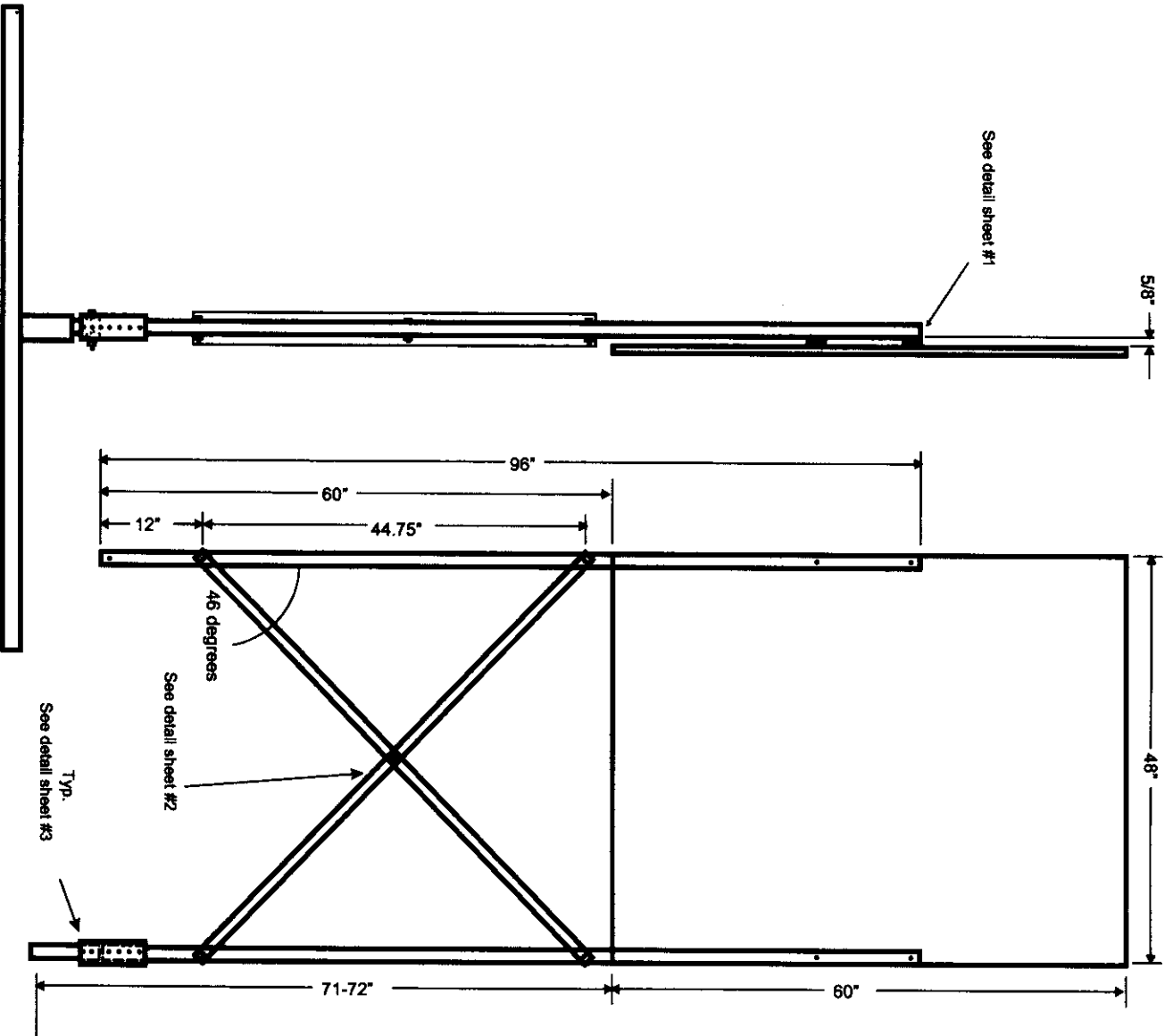
Panel fastened to vertical mast supports with .3125"-18 x 3.5" long zinc plated bolts with .063" thick x 1.25" dia. Zinc plated washer through 3/8" diameter holes in the substrate and a 5/8" thick x 1.25" diameter spacer between the sign panel and the mast.

The vertical mast is fastened to the panel in such a way that the outside "face" of the mast tubing is approximately flush with the edge of the panel, thereby widening the overall surface width at the edge of the assembly along the area of overlap to approximately 2-1/8".

Ballast - Sign tested with approximately 70 lbs of ballast on each horizontal leg.

Company		Poco Incorporated	
Project Name		NCHRP 350 Sign Stand - 4' x 5'	
Phone	Sheet Name	Date	
734-397-1677	Overall	November 17, 2005	
Prepared By		J. Anderson	

# Overall View



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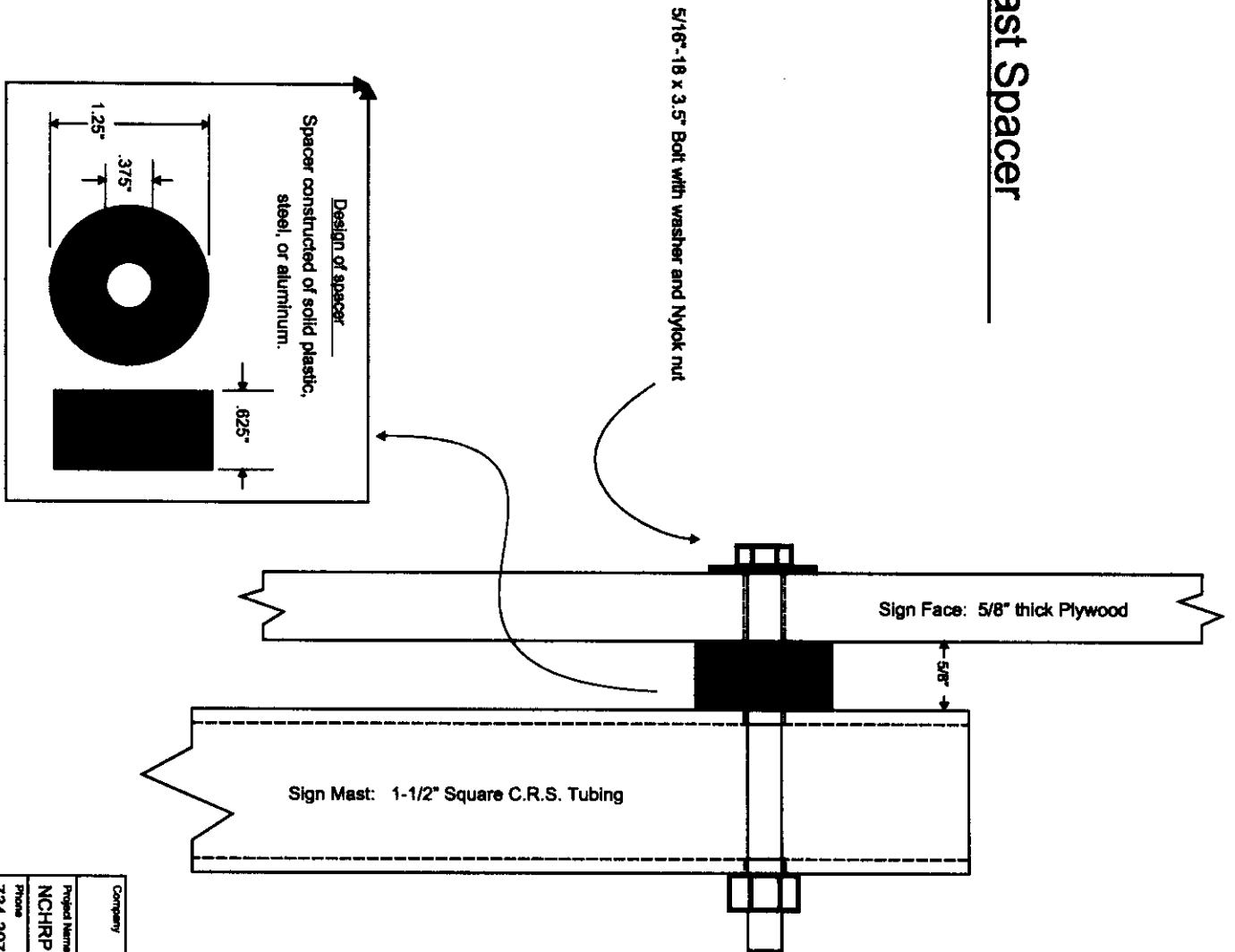
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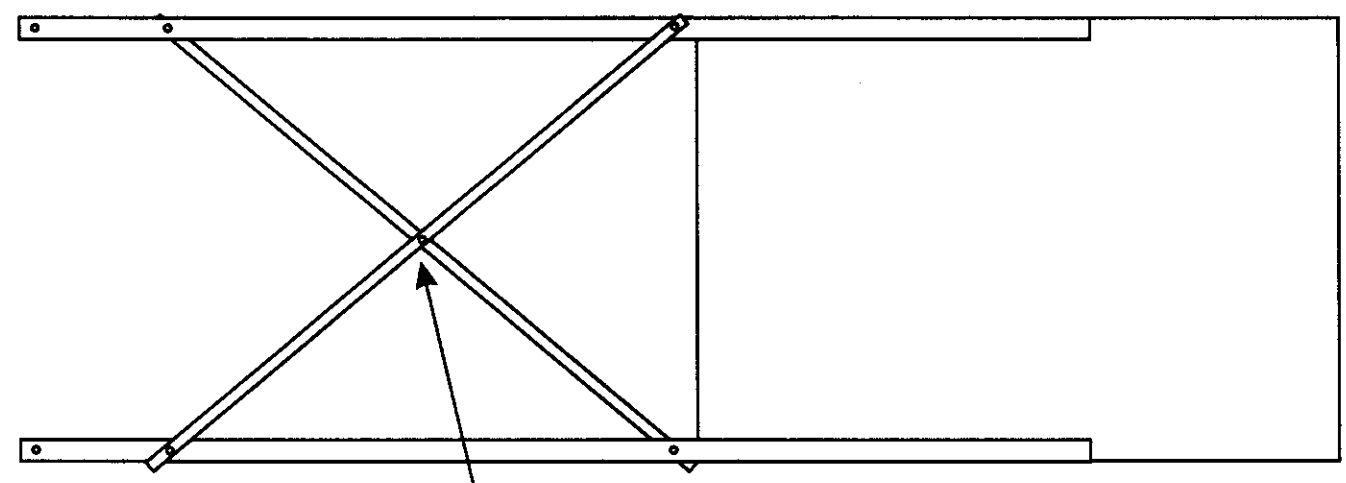
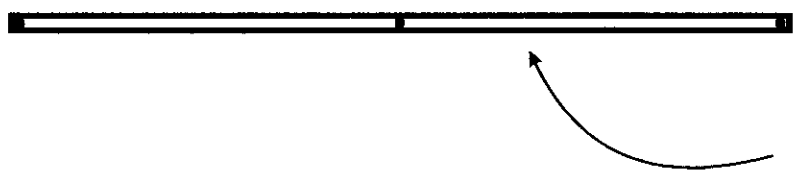
# Sign to Mast Spacer



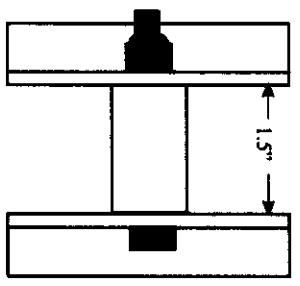
Company	Poco Incorporated		
Project Name	NCHRP 350 Sign Stand - 4' x 5'		
Phone	734-397-1677	Sheet Name	Detail sheet #1
Prepared By	J. Anderson	Date	November 17, 2005

# "X" brace

2 required per sign  
 .125" x 1.25" x 1.25" x 66" hot rolled steel angle  
 with .375" diameter holes located .75" from  
 each end and one .375" diameter hole centered  
 along the length.



Use a 1-1/2" long spacer with  
 a 5/16"-18 x 2" thru-bolt  
 and nut at the crossing point.  
 Spacer on test subject was constructed  
 of 1" nominal diameter  
 schedule 40 steel pipe.

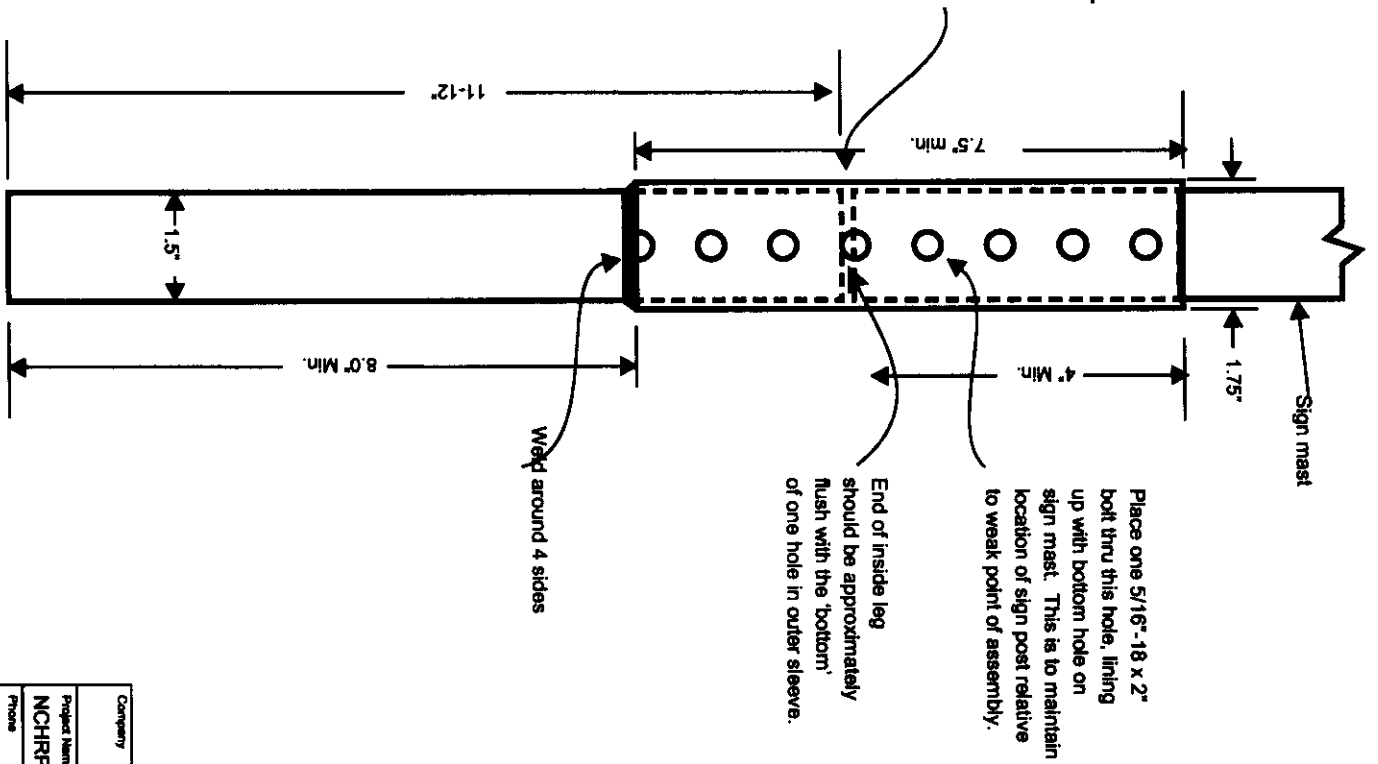


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# Breakaway device

Configuration is designed to maintain between 1/16" and 1/4" between the bottom of the sign mast and the top of the inner tube of the extension.



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Phone	734-397-1677	Sheet Name	Detail sheet #3
Prepared By	J. Anderson	Date	November 17, 2005