

<p>Project Title:</p>	<p>Portable sign supports for aluminum signs with variation on mounting height.</p>
<p>Project Synopsis:</p>	<p>There is a need to place temporary signs within channelizing devices so they are visible for the traveling public. This requires a minimum sign height of 3 ft measured from the top of pavement to the bottom of the sign. MASH testing will be conducted to aide in the development of a crashworthy sign stand for temporary applications.</p>
<p>Project Goal(s):</p>	<p>Develop a design for a sign stand for rigid signs that can be placed within channelizing devices at a mounting height of 3' or greater. Sign size needs to range from 2' x 2' (4 square feet) to 4' x 4' (16 square feet).</p>
<p>Project Background:</p>	<p>In work zones, when signs are placed among channelizing devices, they can be visually blocked. Currently, there is not a tested sign stand that can hold a rigid (aluminum) sign at a height necessary to be placed among channelizing devices, only roll-up signs. A sign stand that can place the sign above these devices is needed to provide appropriate sight distance and decision time.</p> <p>See attached figures for proper and improper placement at the bottom of the page.</p>
<p>Proposed Work Plan:</p>	<p><u>Tasks:</u></p> <ol style="list-style-type: none"> 1. Literature Review and Engineering Analysis 2. Construction and Demolition 3. MASH TL-3 Full-Scale Crash Testing and Reporting <ul style="list-style-type: none"> • Note: Budgeting for four (4) full-scale crash tests

Deliverables:	<p>Compile summary report to document research effort, including literature review, CAD details, crash testing, and recommendations for further research in the event of the system failing testing criteria.</p>
Urgency and Expected Benefit:	<p>Successful MASH evaluation of a temporary sign stand will improve safety in work zones and allow for the installation of signs among channelizing devices that can be seen with adequate time for decision making.</p>
Problem Funding and Research Period:	<p>Total Estimated Cost = \$115,000</p> <p>Work Schedule: (Estimated Project Duration = 10 months from initiation of the project)</p> <ul style="list-style-type: none"> • Task 1 = 3 months • Task 2 = 3 months • Task 3 = 4 months
Developer(s) of the Problem Statement:	<p>Name: Shawn Debenham / Justin Wilstead / Brian Crossley / Ken Johnson</p> <p>Email: sdebenham@utah.gov / jwilstead@utah.gov / bcrossley@pa.gov / ken.johnson@state.mn.us</p> <p>Phone: 801-971-9575 / 801-910-2507 / 717-265-7562</p>

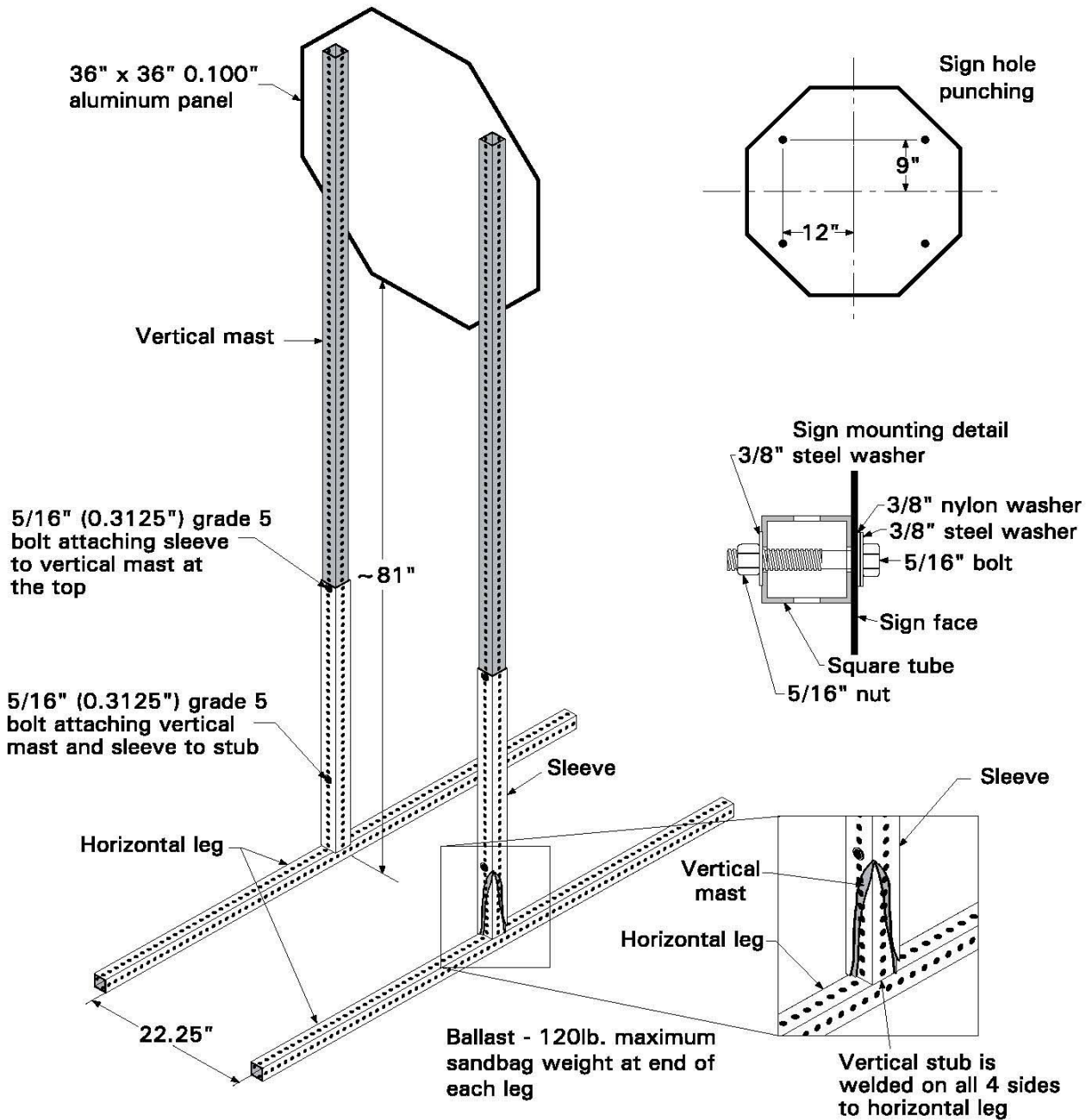


Figure 1. Improper sign height among channelizing devices.



Figure 2. Proper sign height among channelizing devices.

Temporary Sign Stand Examples



Parts List:

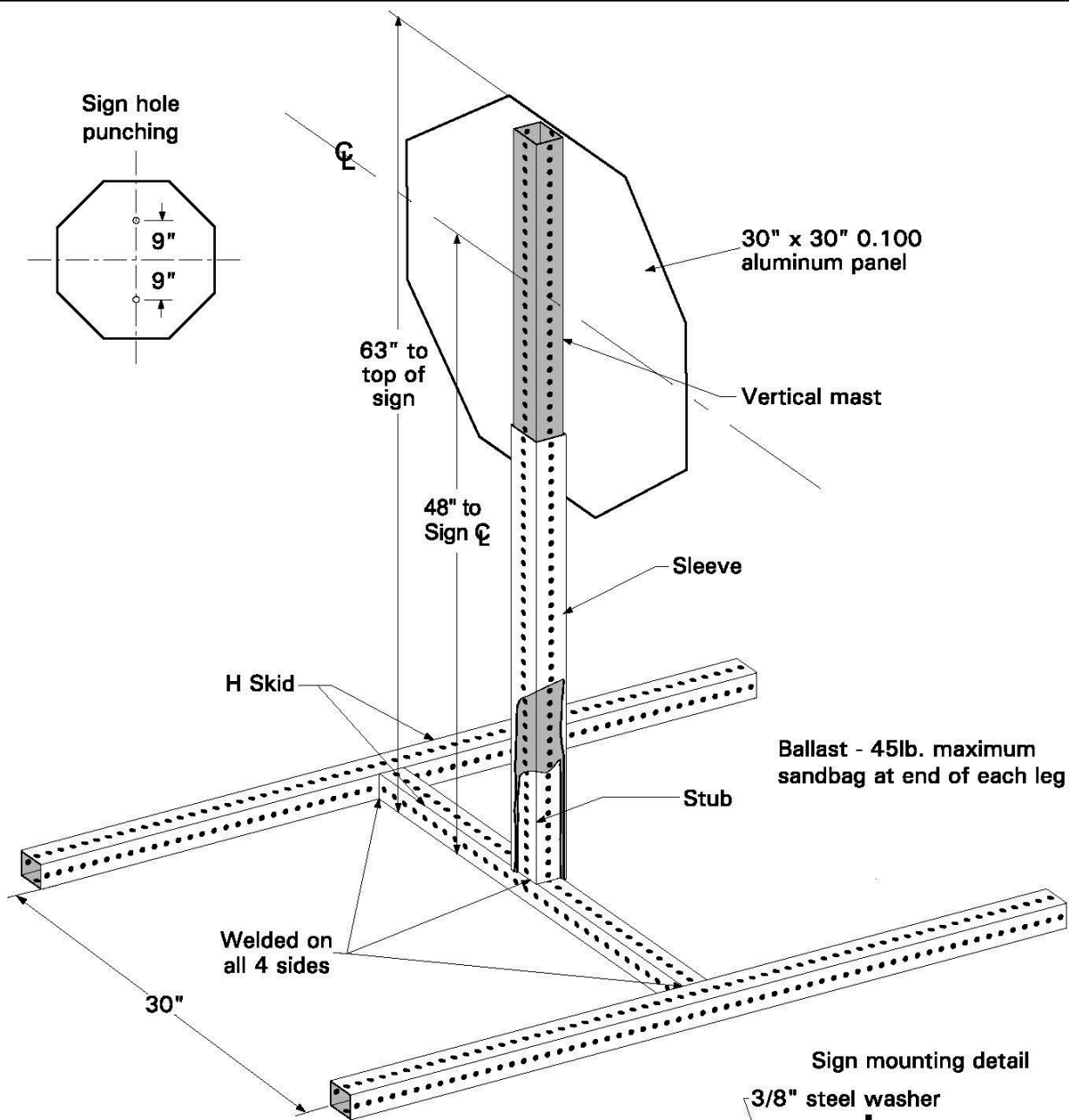
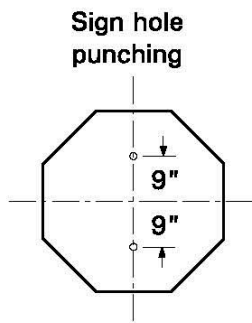
All square tube 12 gauge galvanized steel with 0.4375" holes on either 1" centers or drilled as needed.
 (2) Vertical masts - 2" x 2" x 108" long.
 (2) Sleeves - 2.25" x 2.25" x 36" long.
 (2) Horizontal legs - 1.75" x 1.75" x 72" long.
 (2) Legs, vertical stubs - 1.75" x 1.75" x 12" long.
 Sign mounting hardware: 5/16" (0.3125") stainless steel or grade 5 zinc plated bolts and washers, nylon insert lock nut, and nylon washers against sign face.

APPROVED
12/1/05

DATE OF REV.

**NCHRP 350 COMPLIANT
TALL PORTABLE SIGN STAND
FOR 36" X 36" STOP**





Ballast - 45lb. maximum sandbag at end of each leg

Parts List:

All square tube 12 gauge galvanized steel with 0.4375" holes on either 1" centers or drilled as needed.

(2) H skid, horizontal legs - 2" x 2" x 30" long.

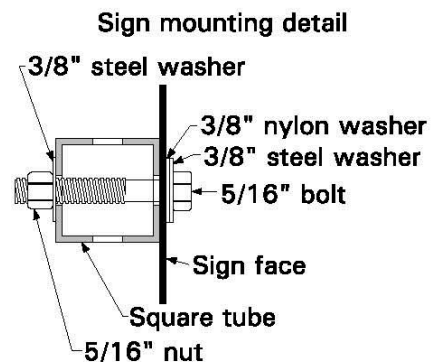
(1) H skid, cross bar - 2" x 2" x 30" long.

(1) H skid, vertical stub - 2" x 2" x 12" long.

(1) Vertical mast - 2.25" x 2.25" x 60" long.

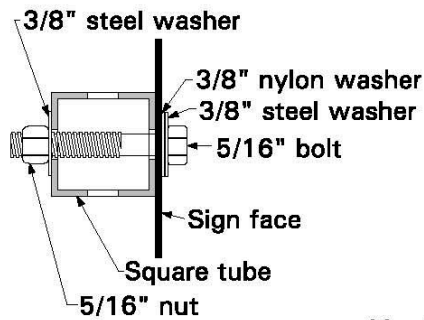
(1) Sleeve - 2.5" x 2.5" x 36" long.

Sign mounting hardware: 5/16" (0.3125") stainless steel or grade 5 zinc plated bolts and washers, nylon insert lock nut, and nylon washers against sign face.

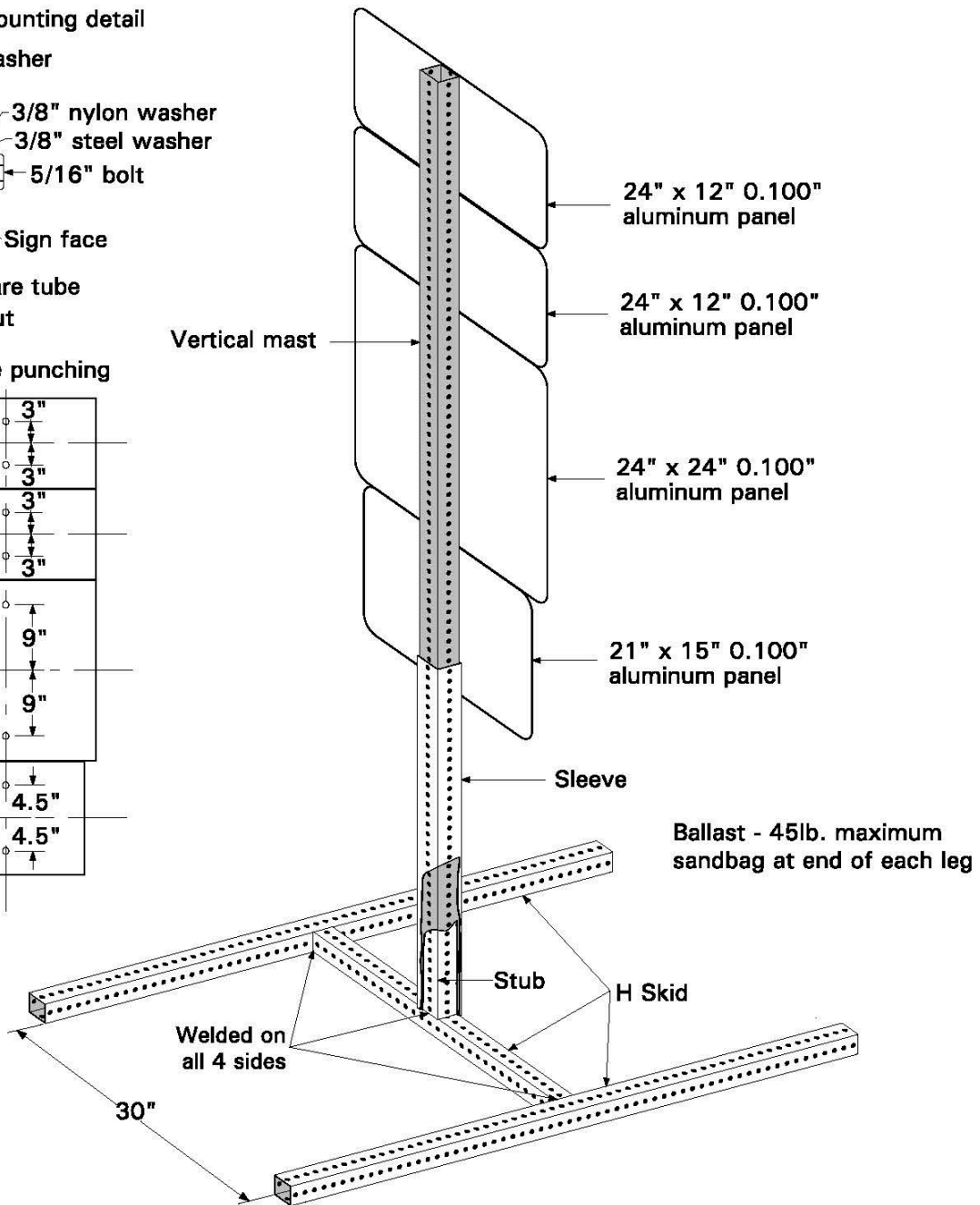
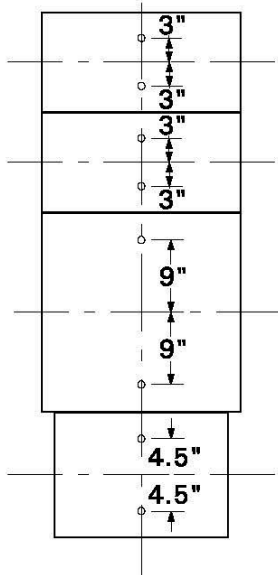


<p>APPROVED 7/15/05</p>	<p>DATE OF REV.</p>	<p>NCHRP 350 COMPLIANT PORTABLE SIGN STAND FOR 30" X 30" STOP SIGN</p>		
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Sign mounting detail



Sign hole punching



Parts List:

All square tube 12 gauge galvanized steel with 0.4375" holes on either 1" centers or drilled as needed.

(2) H skid, horizontal legs - 2" x 2" x 60" long.

(1) H skid, cross bar - 2" x 2" x 30" long.

(1) H skid, vertical stub - 2" x 2" x 12" long.

(1) Vertical mast - 2.25" x 2.25" x 96" long.

(1) Sleeve - 2.5" x 2.5" x 36" long.

Sign mounting hardware: 5/16" (0.3125") stainless steel or grade 5 zinc plated bolts and washers, nylon insert lock nut, and nylon washers against sign face.

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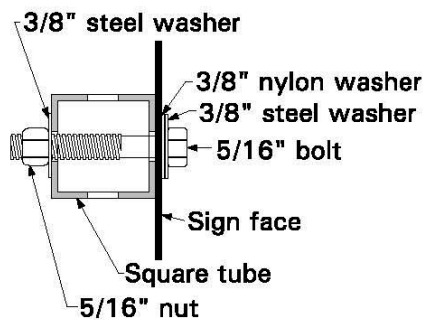
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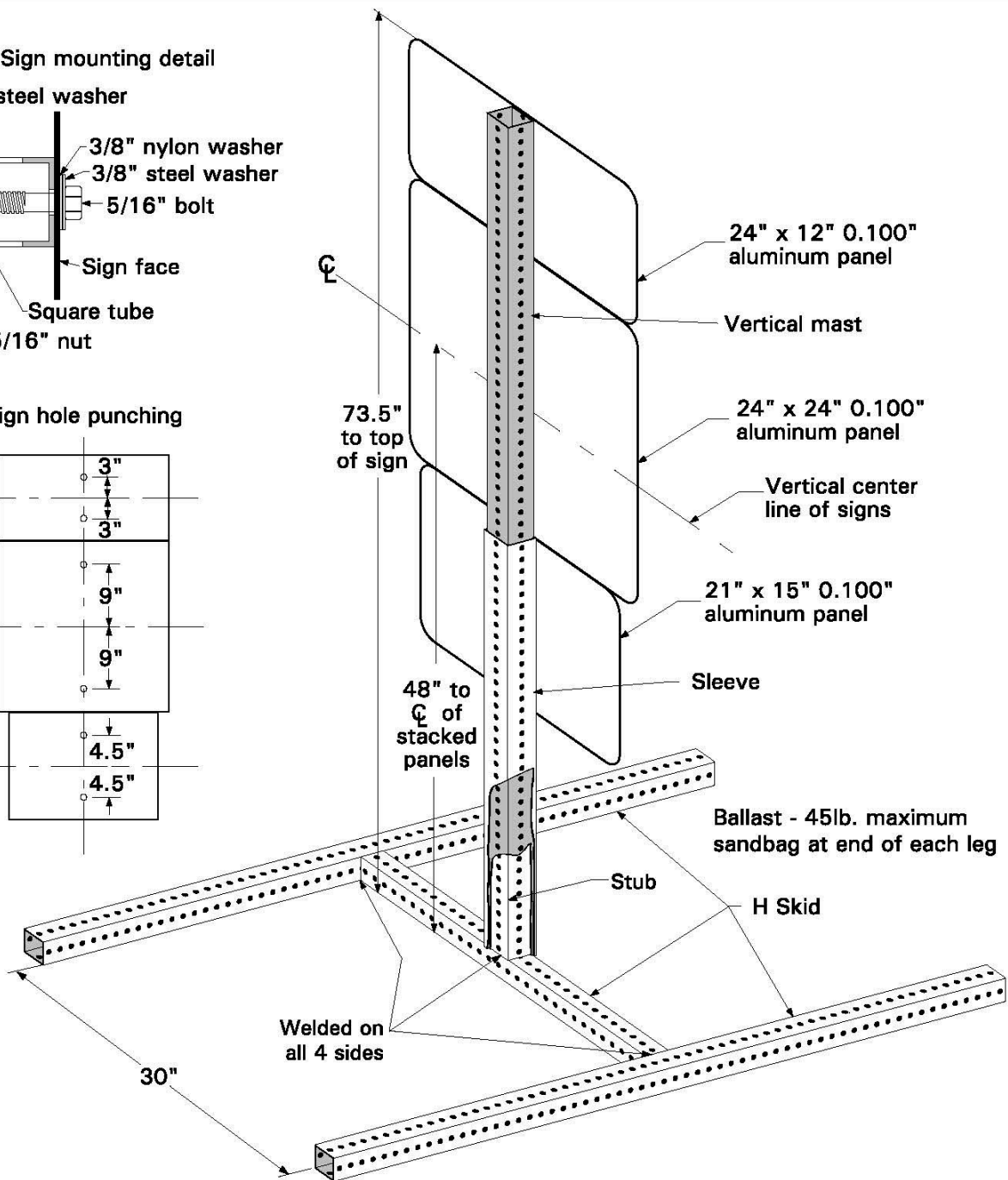
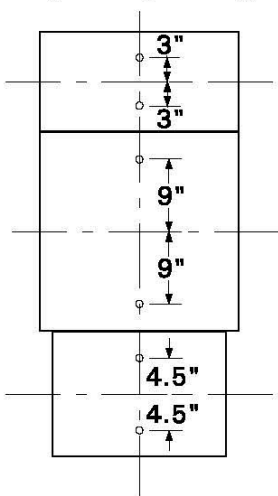
**NCHRP 350 COMPLIANT
PORTABLE SIGN STAND FOR
DETOUR ASSEMBLY WITH 8' MAST**



Sign mounting detail



Sign hole punching



Parts List:

All square tube 12 gauge galvanized steel with 0.4375" holes on either 1" centers or drilled as needed.

(2) H skid, horizontal legs - 2" x 2" x 60" long.

(1) H skid, cross bar - 2" x 2" x 30" long.

(1) H skid, vertical stub - 2" x 2" x 12" long.

(1) Vertical mast - 2.25" x 2.25" x 72" long.

(1) Sleeve - 2.5" x 2.5" x 36" long.

Sign mounting hardware: 5/16" (0.3125") stainless steel or grade 5 zinc plated bolts and washers, nylon insert lock nut, and nylon washers against sign face.

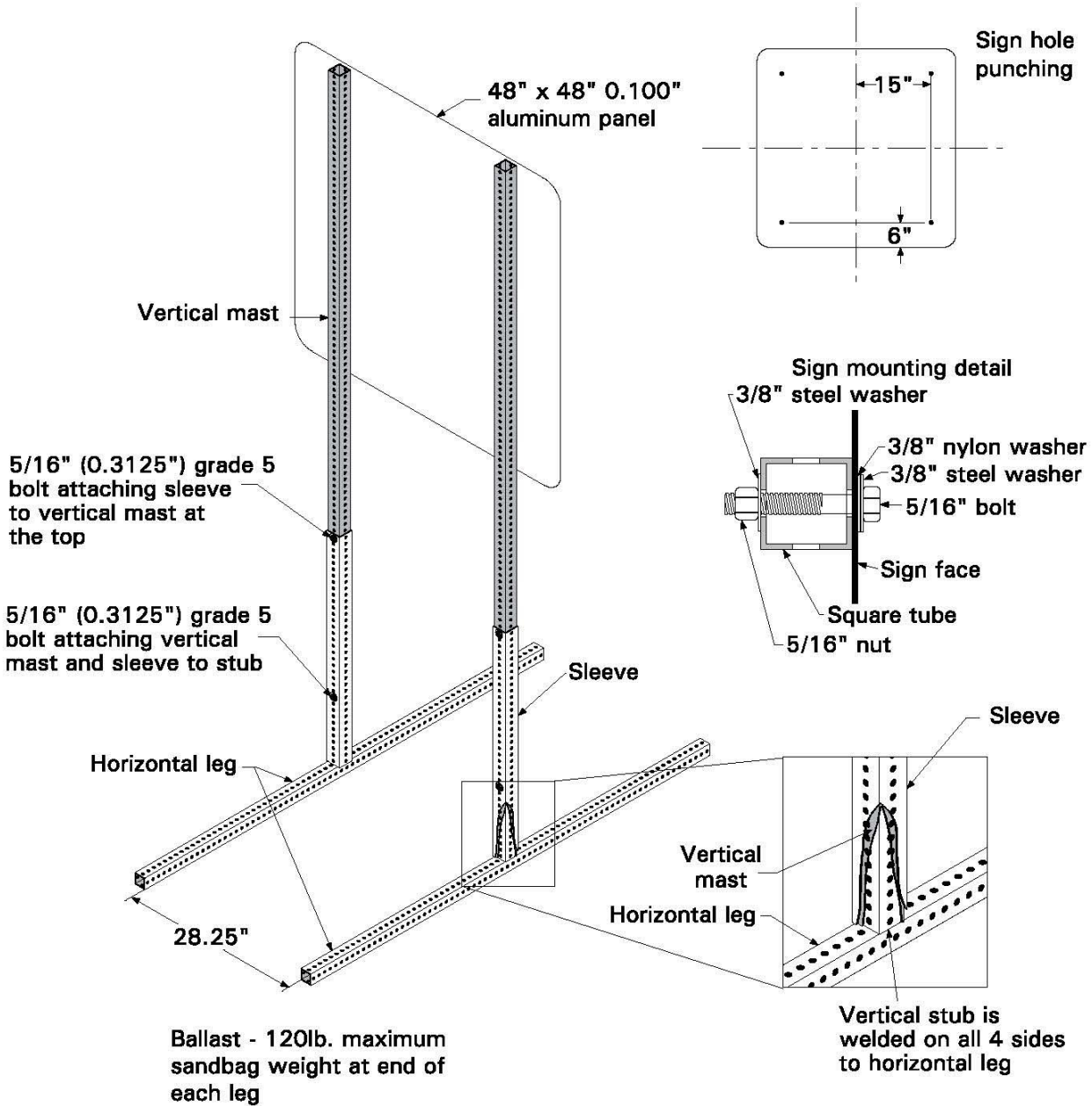
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7/15/05

DATE OF REV.

**NCHRP 350 COMPLIANT
PORTABLE SIGN STAND
FOR DETOUR ASSEMBLY**



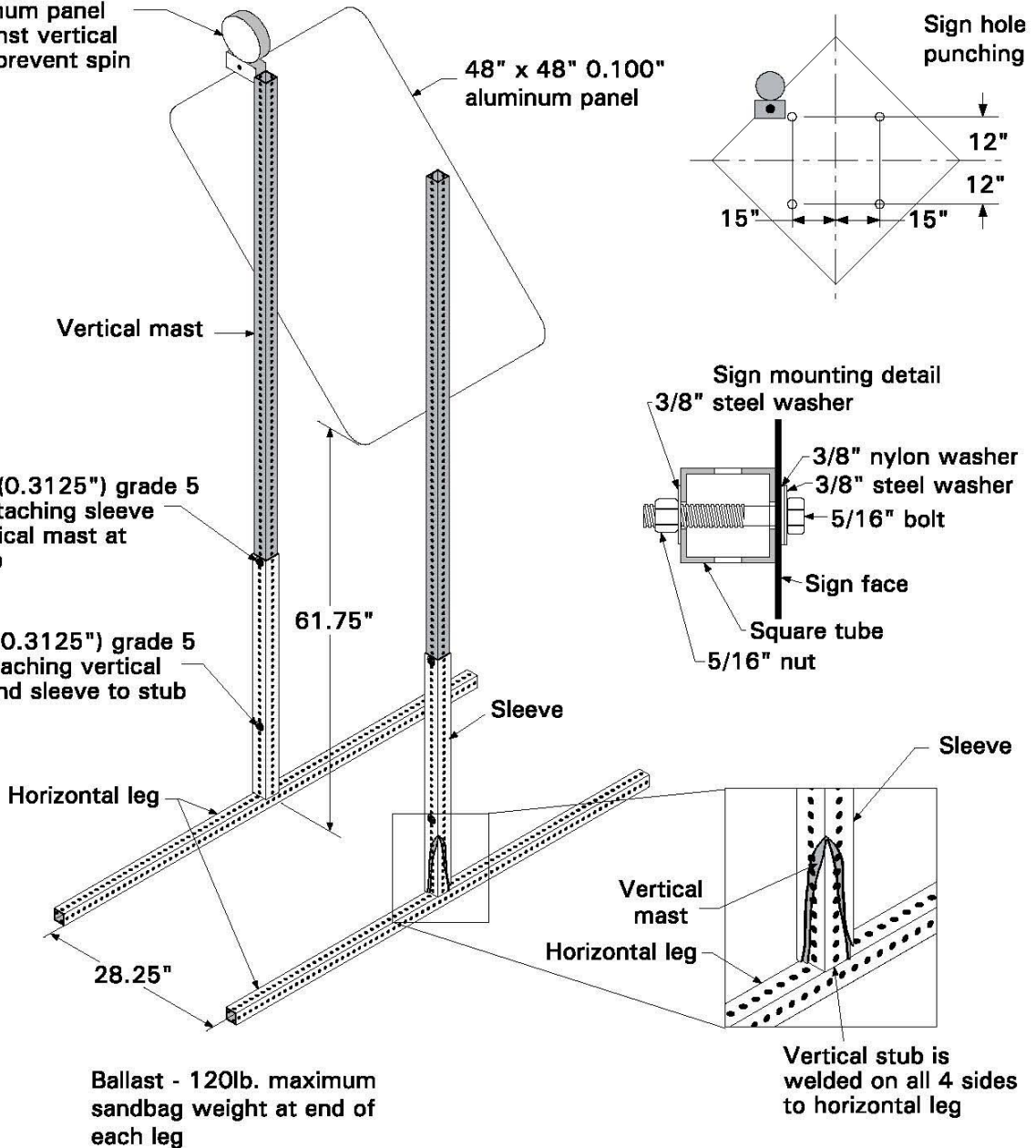


Parts List:

- All square tube 12 gauge galvanized steel with 0.4375" holes on either 1" centers or drilled as needed.
- (2) Vertical masts - 2" x 2" x 108" long.
- (2) Sleeves - 2.25" x 2.25" x 36" long.
- (2) Horizontal legs - 1.75" x 1.75" x 72" long.
- (2) Legs, vertical stubs - 1.75" x 1.75" x 12" long.
- Sign mounting hardware: 5/16" (0.3125") stainless steel or grade 5 zinc plated bolts and washers, nylon insert lock nut, and nylon washers against sign face.

<p>APPROVED 12/1/05</p>	<p>DATE OF REV.</p>	<p>NCHRP 350 COMPLIANT PORTABLE SIGN STAND FOR 48" X 48" EXIT PANEL</p>		
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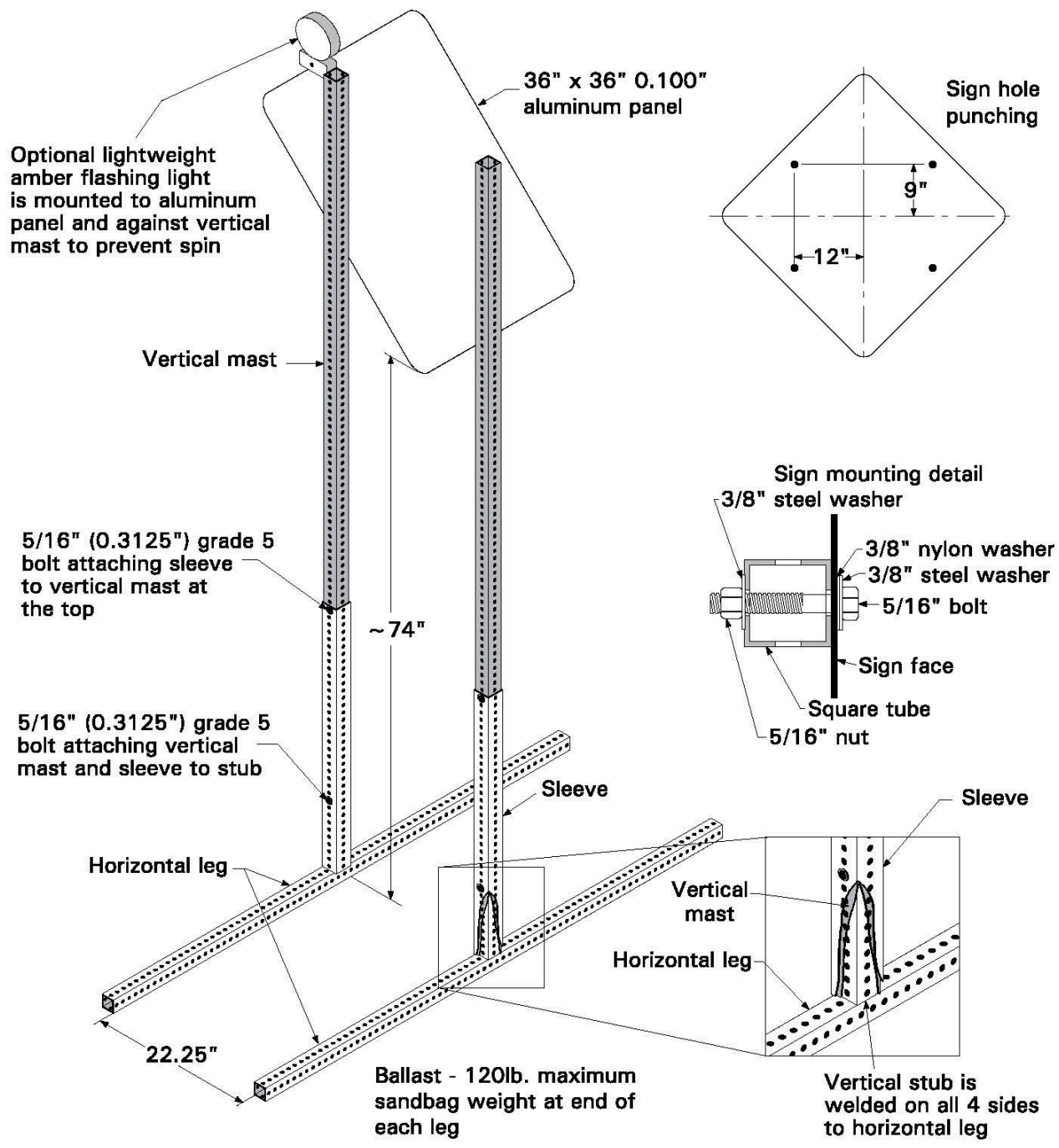
Optional lightweight amber flashing light is mounted to aluminum panel and against vertical mast to prevent spin



Parts List:

All square tube 12 gauge galvanized steel with 0.4375" holes on either 1" centers or drilled as needed.
 (2) Vertical masts - 2" x 2" x 108" long.
 (2) Sleeves - 2.25" x 2.25" x 36" long.
 (2) Horizontal legs - 1.75" x 1.75" x 72" long.
 (2) Legs, vertical stubs - 1.75" x 1.75" x 12" long.
 Sign mounting hardware: 5/16" (0.3125") stainless steel or grade 5 zinc plated bolts and washers, nylon insert lock nut, and nylon washers against sign face.

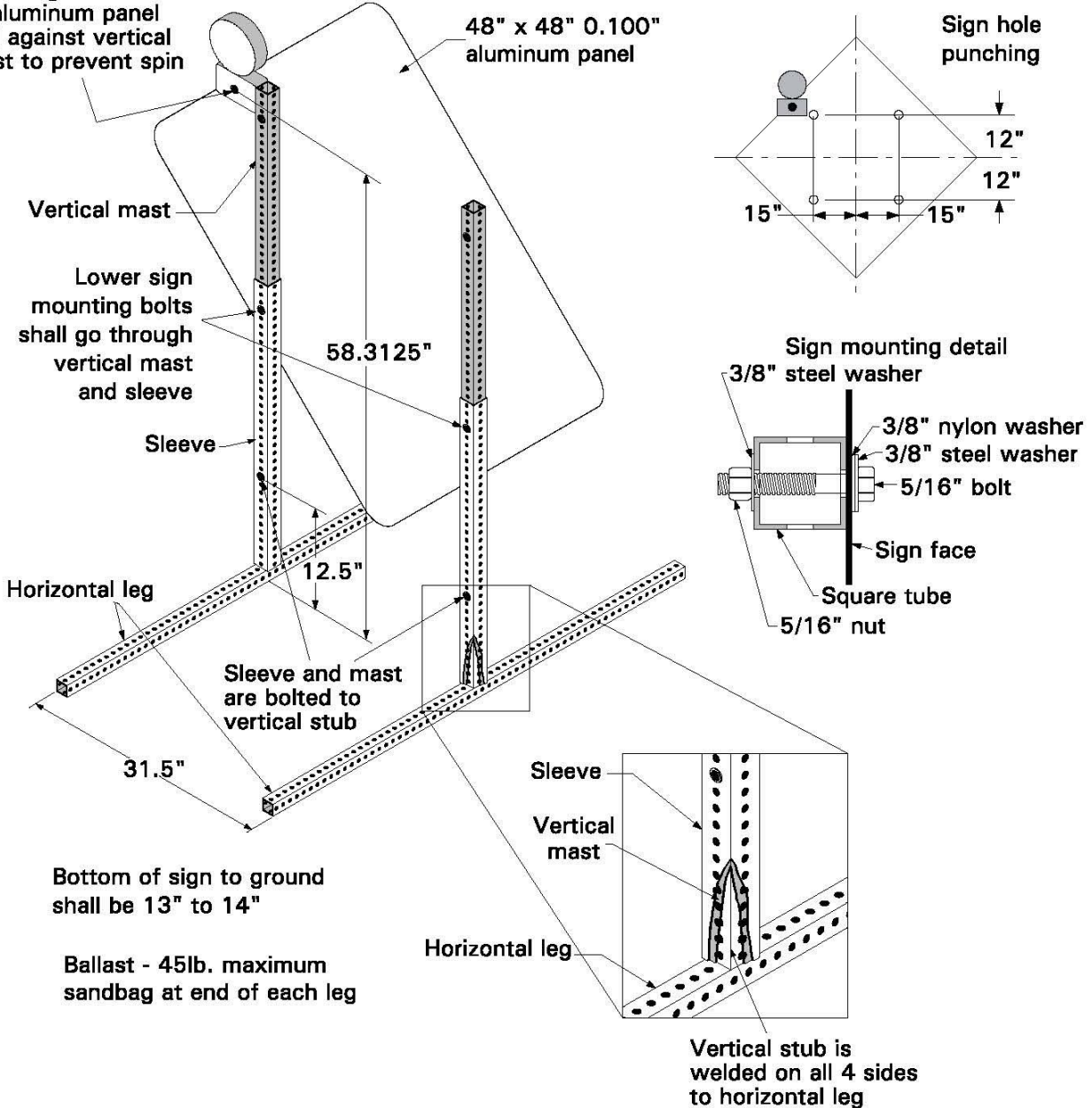
<p>APPROVED 7/15/05</p>	<p>DATE OF REV.</p>	<p>NCHRP 350 COMPLIANT 5 FEET PORTABLE SIGN STAND FOR 48" X 48" DIAMOND</p>		
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Parts List:
 All square tube 12 gauge galvanized steel with 0.4375" holes on either 1" centers or drilled as needed.
 (2) Vertical masts - 2" x 2" x 108" long.
 (2) Sleeves - 2.25" x 2.25" x 36" long.
 (2) Horizontal legs - 1.75" x 1.75" x 72" long.
 (2) Legs, vertical stubs - 1.75" x 1.75" x 12" long.
 Sign mounting hardware: 5/16" (0.3125") stainless steel or grade 5 zinc plated bolts and washers, nylon insert lock nut, and nylon washers against sign face.

<p>APPROVED 12/1/05</p>	<p>DATE OF REV.</p>	<p>NCHRP 350 COMPLIANT TALL PORTABLE SIGN STAND FOR 36" X 36" DIAMOND</p>		
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Optional lightweight flashing amber light is mounted to aluminum panel and against vertical mast to prevent spin



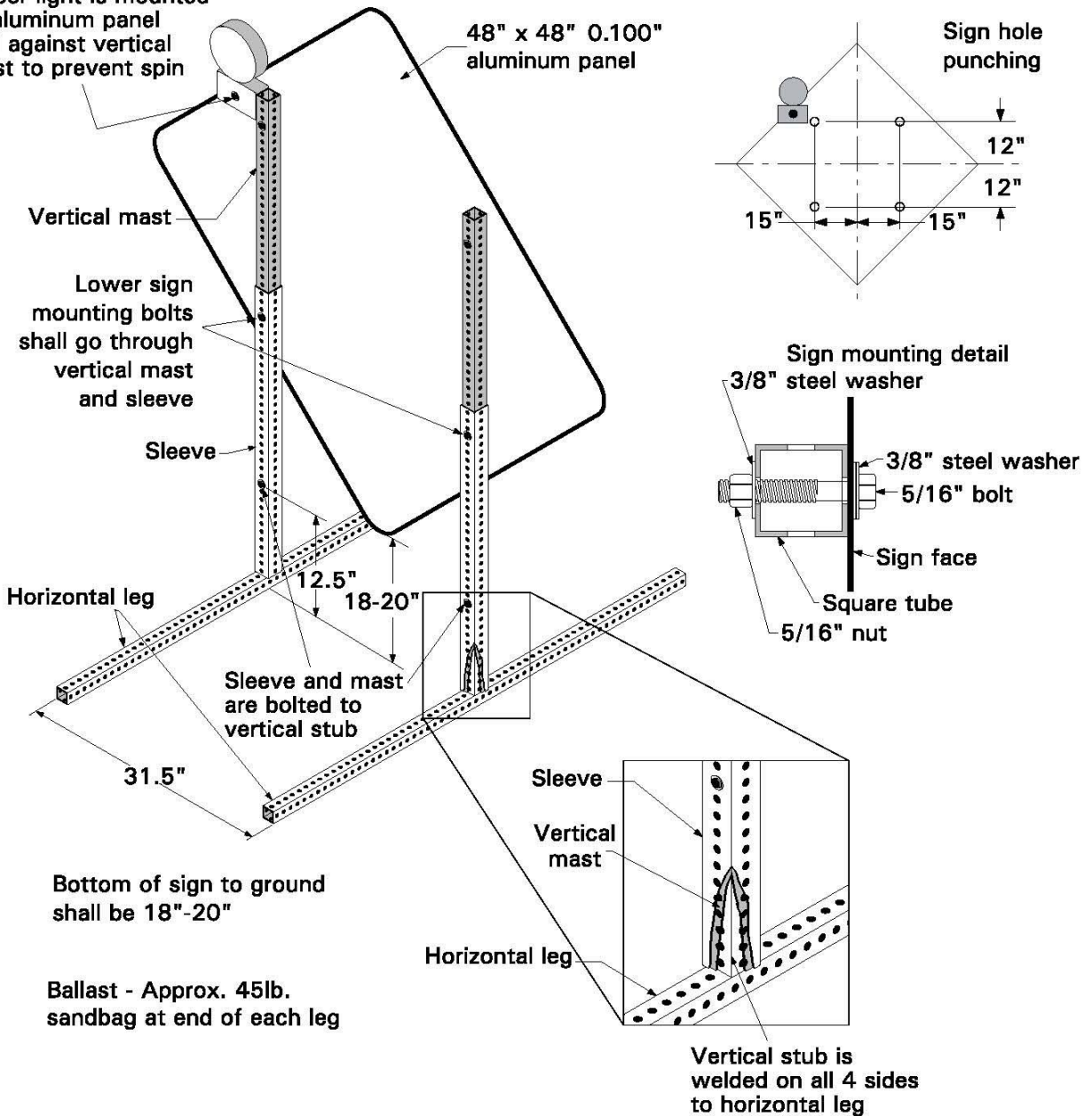
Parts List:

- All square tube 12 gauge galvanized steel with 0.4375" holes on either 1" centers or drilled as needed.
- (2) Vertical masts - 1.75" x 1.75" x 60" long.
- (2) Sleeves - 2" x 2" x 36" long.
- (2) Horizontal legs - 1.5" x 1.5" x 60" long.
- (2) Legs, vertical stubs - 1.5" x 1.5" x 12" long.
- Sign mounting hardware: 5/16" (0.3125") stainless steel or grade 5 zinc plated bolts and washers, nylon insert lock nut, and nylon washers against sign face.
- (1) Optional flashing warning light attached to sign panel.

FHWA Reference HSA-10/WZ-133

<p>APPROVED 7/15/05</p>	<p>DATE OF REV.</p>	<p>NCHRP 350 COMPLIANT PORTABLE SIGN STAND FOR 48" X 48" DIAMOND</p>		
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Optional lightweight flashing amber light is mounted to aluminum panel and against vertical mast to prevent spin



Parts List:

All square tube 12 gauge galvanized steel with 0.4375" holes on either 1" centers or drilled as needed.

(2) Vertical masts - 1.75" x 1.75" x 72" long.

(2) Sleeves - 2" x 2" x 36" long.

(2) Horizontal legs - 1.5" x 1.5" x 48" long.

(2) Legs, vertical stubs - 1.5" x 1.5" x 6-12" long.

Fastening hardware: 5/16" (0.3125") stainless steel or grade 5 zinc plated bolts and washers, nylon insert lock nuts, and nylon washers.

(1) Optional flashing warning light attached to sign panel.

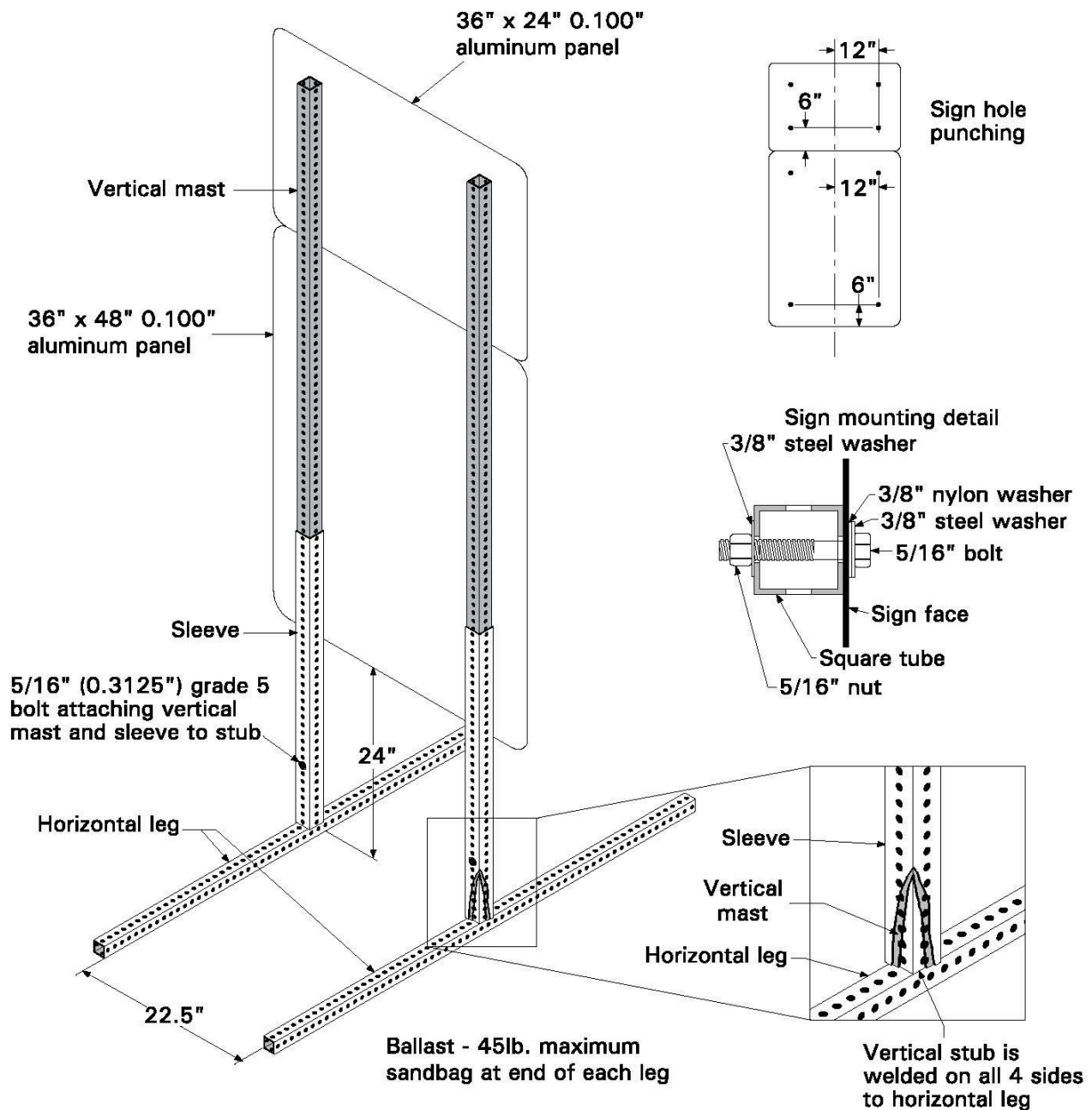
APPROVED

5/3/06

DATE OF REV.

PORTABLE SIGN STAND
FOR 48" X 48" DIAMOND





Parts List:

All square tube 12 gauge galvanized steel with 0.4375" holes on either 1" centers or drilled as needed.

(2) Vertical masts - 1.75" x 1.75" x 90.5" long.

(2) Sleeves - 2" x 2" x 36" long.

(2) Horizontal legs - 1.5" x 1.5" x 60" long.

(2) Legs, vertical stubs - 1.5" x 1.5" x 12" long.

Sign mounting hardware: 5/16" (0.3125") stainless steel or grade 5 zinc plated bolts and washers, nylon insert lock nut, and nylon washers against sign face.

APPROVED

7/15/05

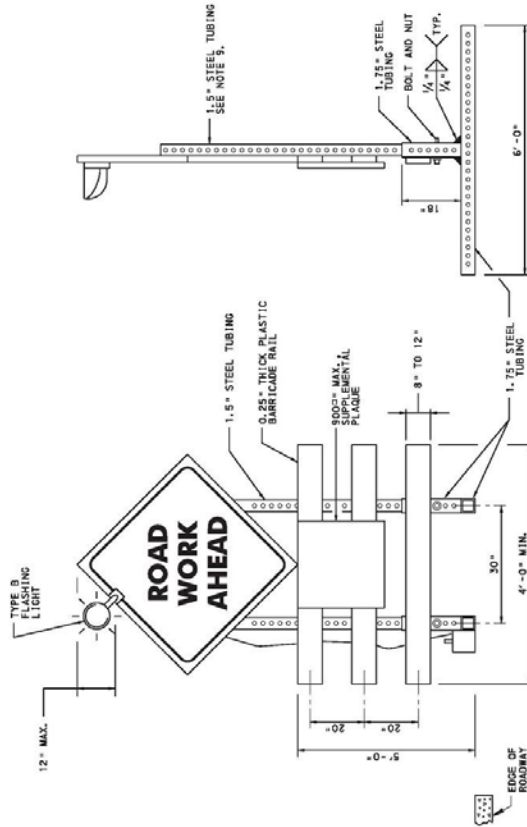
DATE OF REV.

**NCHRP 350 COMPLIANT
PORTABLE SIGN STAND
FOR WORK ZONE SPEED LIMIT**



NOTES:

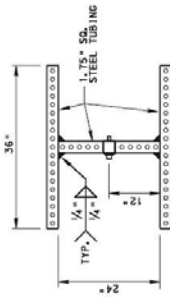
1. PROVIDE SIGN MATERIALS MEETING THE REQUIREMENTS OF PUBLICATION 408, SECTION 1103.4.
2. DIAMOND, RECTANGULAR, OCTAGONAL AND TRIANGULAR SIGNS ARE PERMITTED, WHILE HAVING NO MAXIMUM AREA, THE MAXIMUM WEIGHT OF THE SIGN MAY NOT EXCEED 25 LB.
3. MINIMUM MOUNTING HEIGHT TO TOP OF ALL SIGNS IS 128".
4. SUPPLEMENTAL PLAQUE IS TO BE MOUNTED AS SHOWN.
5. BATTERY CASE MUST BE PLACED EITHER ON THE GROUND OR ATTACHED TO THE SIGN. MAXIMUM ABOVE THE GROUND TO THE SIGN SHALL BE 24".
6. SIGN SUBSTRATE MAY BE WOOD, ALUMINUM, FLEXIBLE (A-B-L-U-P-I), ABS, ALUMINUM / PLASTIC LAMINATE, CORRUGATED POLYPROPYLENE OR POLYETHYLENE.
7. SANDBAG BALLAST SHALL BE PLACED ON THE END OF EACH LEG TO PROVIDE STABILITY.
8. SIGNS AND RAILS ARE TO BE ATTACHED WITH BOLTS AND NUTS.
9. IF TURNED 90°, RETROREFLECTIVE SHEETING MUST BE PLACED ON THE SIDE OF THE BARRICADE IS CLEARLY VISIBLE TO APPROACHING DRIVERS.
10. MAXIMUM OF TWO TYPE B WARNING LIGHTS ON ALL SIGNS ARE ALLOWED WITH 24" SEPARATING LIGHTS ON ROAD CLOSED SIGNS.
11. FLASHING LIGHTS ARE OPTIONAL. WHEN USED, LIGHTS SHALL BE ATTACHED AS SHOWN AND LOCATED ON THE SIDE OF THE SIGN WHICH IS NEAREST TO TRAFFIC.
12. SIGNS SHALL REMAIN IN THE VERTICAL POSITION WHEN LOCATED WITHIN THE HIGHWAY RIGHT-OF-WAY.



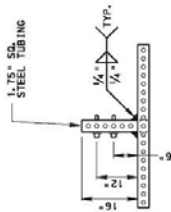
SKID-MOUNTED METAL SIGN SUPPORT

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF MAINTENANCE AND OPERATIONS

TRAFFIC CONTROL SIGNING
TYPE III BARRICADE

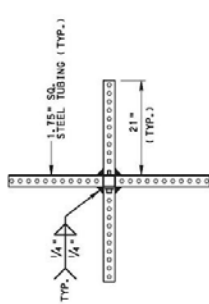


PLAN

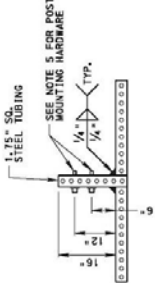


ELEVATION

"H" BASE DETAIL

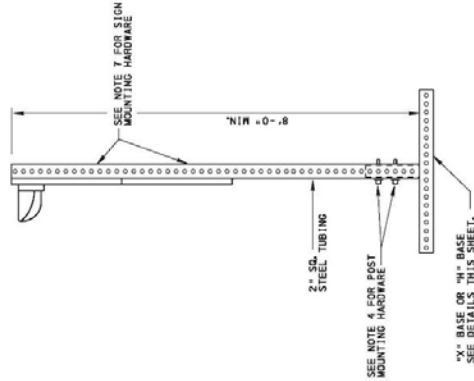
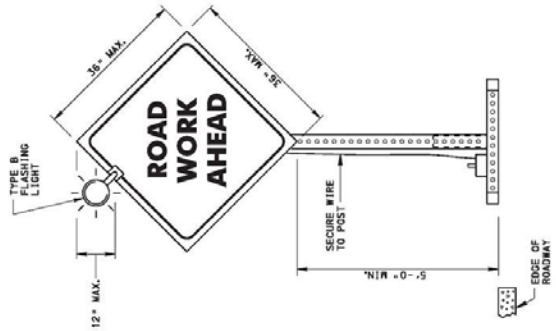


PLAN



ELEVATION

"X" BASE DETAIL



NOTES

1. PROVIDE SIGN MATERIALS MEETING THE REQUIREMENTS OF INDICATION AND SELECTION, AND.
2. DIAMOND, RECTANGULAR, OCTAGONAL AND TRIANGULAR SIGNS ARE PERMITTED. THE MAXIMUM SIGN AREA SHALL NOT EXCEED 9 sq. ft.
3. BATTERY CASE MUST BE PLACED EITHER ON THE GROUND OR 9 INCHES MINIMUM ABOVE THE GROUND TO THE POST OR BASE LEG.
4. SIGN SUBSTRATE MAY BE PLYWOOD, ALUMINUM, ALUMINUM / PLASTIC LAMINATE, CORRUGATED POLYPROPYLENE OR POLYETHYLENE, MAX. WEIGHT 15 LBS.
5. POST: 2" STEEL TUBING SLIDES OVER BASE STUB. 1.75" SQUARE STEEL TUBING WITH 1/4" DIA. FLANGES. LOCK NUTS: USE 3/4" STEEL AND NYLON WASHERS UNDER BOTH THE BOLT AND NUT.
6. SANDRAG BALLAST SHALL BE PLACED ON THE END OF EACH LEG TO PROVIDE STABILITY.
7. SIGN PANEL IS PLACED ON THE VERTICAL SIGN POST WITH TOP EDGE OF SIGN PANEL 1/4" ABOVE THE TOP OF THE SIGN POST. 2" LONG NYLON OR FIBER REINFORCED POLYESTER NYLON INSERT LOCK NUTS, USE 3/4" STEEL AND NYLON WASHERS UNDER BOTH THE BOLT AND NUT.
8. MAXIMUM OF TWO TYPE B WARNING LIGHTS ON ALL SIGNS ARE ALLOWED WITH 24" SEPARATING LIGHTS ON ROAD CLOSED SIGNS.
9. NCHRP 350 TEST LEVEL 3 CRASH TESTED AND APPROVED.
10. FLASHING LIGHTS ARE OPTIONAL. WHEN USED, LIGHTS SHALL BE ATTACHED AS SHOWN AND LOCATED ON THE SIDE OF THE SIGN WHICH IS NEAREST TO TRAFFIC.
11. SIGNS SHALL REMAIN IN THE VERTICAL POSITION WHEN LOCATED WITHIN THE HIGHWAY RIGHT-OF-WAY.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF MAINTENANCE AND OPERATIONS

TEMPORARY PORTABLE
SIGN POST

"H" BASE AND "X" BASE