



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

1200 New Jersey Ave., SE  
Washington, D.C. 20590

October 23, 2013

In Reply Refer To:  
HSST/SS-115A

Bret Eckert, P.E.  
Engineering Applications Manager  
Trinity Highway Products  
3617 Cincinnati Avenue  
Rocklin, California 95765

Dear Mr. Eckert:

This letter is in response to your request for the Federal Highway Administration (FHWA) to review a roadside safety system for eligibility for reimbursement under the Federal-aid highway program.

Name of system:	U-Bracket Sign Support
Type of system:	Breakaway Small Sign Support
Test Level:	NCHRP Report 350 TL-3
Testing conducted by:	N/A
Date of request:	5/15/2013

#### **Decision**

The following device is eligible, with details provided in the form which is attached as an integral part of this letter:

- U-Bracket Sign Support on slip base or breakaway coupling.

Based on a review of the analysis submitted by the manufacturer certifying the device described herein meets the crash test and evaluation criteria of the National Cooperative Highway Research Program (NCHRP) Report 350, the device is eligible for reimbursement under the Federal-aid highway program. Eligibility for reimbursement under the Federal-aid highway program does not establish approval or endorsement by the FHWA for any particular purpose or use.

The FHWA, the Department of Transportation, and the United States Government do not endorse products or services and the issuance of a reimbursement eligibility letter is not an endorsement of any product or service.

**Requirements**

To be found eligible for Federal-aid funding, roadside safety devices should meet the crash test and evaluation criteria contained in the NCHRP Report 350 or the American Association of State Highway and Transportation Officials' Manual for Assessing Safety Hardware (MASH).

**Description**

The device and supporting documentation are described in the attached form.

**Summary and Standard Provisions**

Therefore, the system described and detailed in the attached form is eligible for reimbursement and may be installed under the range of conditions tested.

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

- This finding of eligibility does not cover other structural features of the systems, nor conformity with the Manual on Uniform Traffic Control Devices.
- Any changes that may influence system conformance with NCHRP Report 350 criteria will require a new reimbursement eligibility letter.
- Should the FHWA discover that the qualification testing was flawed, that in-service performance reveals safety problems, or that the system is significantly different from the version that was crash tested, we reserve the right to modify or revoke this letter.
- You are expected to supply potential users with sufficient information on design and installation requirements to ensure proper performance.
- You are expected to certify to potential users that the hardware furnished has the same chemistry, mechanical properties, and geometry as that submitted for review, and that it will meet the crash test and evaluation criteria of the NCHRP Report 350.
- To prevent misunderstanding by others, this letter of eligibility is designated as number SS-115A and shall not be reproduced except in full. This letter and the test documentation upon which it is based are public information. All such letters and documentation may be reviewed at our office upon request.
- This letter shall not be construed as authorization or consent by the FHWA to use, manufacture, or sell any patented system for which the applicant is not the patent holder. The FHWA does not become involved in issues concerning patent law. Patent issues, if any, are to be resolved by the applicant.

Sincerely yours,



Michael S. Griffith  
Director, Office of Safety Technologies  
Office of Safety

Enclosures



## Request for Federal Aid Reimbursement Eligibility Of Highway Safety Hardware

<b>Submitter</b>	Date of Request:	May 15, 2013	<input checked="" type="radio"/> New <input type="radio"/> Resubmission
	Name:	Bret Eckert, P.E.	Signature: <i>Bret Eckert</i>
	Company:	Trinity Highway Products	
	Address:	3617 Cincinnati Ave., Rocklin, CA 95765	
	Country:	USA	
	To:	Michael S. Griffith, Director FHWA, Office of Safety Technologies	

I request the following devices be considered eligible for reimbursement under the Federal-aid highway program.

Help

System Type	Submission Type	Device Name / Variant	Testing Criterion	Test Level
'SS': Breakaway Sign Supports, Mailboxes, & other small sign supports	<input checked="" type="radio"/> Physical Crash Testing <input type="radio"/> FEA & V&V Analysis	Small Sign Supports / U-Bracket	NCHRP Report 350	TL3

By submitting this request for review and evaluation by the Federal Highway Administration, I certify that the product(s) was (were) tested in conformity with the NCHRP Report 350 (Report 350) and that the evaluation results meet the appropriate evaluation criteria in the Report 350.

Identification of the individual or organization responsible for the product:

Contact Name:	John Intagliata	Same as Submitter <input type="checkbox"/>
Company Name:	Trinity Highway Products	Same as Submitter <input checked="" type="checkbox"/>
Address:	3617 Cincinnati Ave., Rocklin, CA 95765	Same as Submitter <input checked="" type="checkbox"/>
Country:	USA	Same as Submitter <input checked="" type="checkbox"/>

### PRODUCT DESCRIPTION

<input type="radio"/> New Hardware	<input checked="" type="radio"/> Modification to Existing Hardware	Non-Significant - Effect is positive or Inconsequential
<p>The U-Bracket post was originally accepted by the FHWA as per Eligibility Letter SS-115 dated November 13, 2002. Eligibility Letter SS-115 is primarily concerned with the T-Bracket and U-Bracket connection to a three-bolt slip base and resultant delta V of the vehicle and occupant impact speed upon impacts with these types of devices. This modification will not change the slip base or ground connection and is only concerned with the U-Bracket.</p> <p>This request is to accept the as-tested article as per SS-115 with the following modification:</p> <p>1. Incorporate up to a 2" hole within the U-Bracket to stub joint for galvanizing venting and draining. The U-Bracket tube will be made from identical 2-3/8" tubing with the only change being the enlarged vent/drain hole. There will be no change to the overall weight or dimensions of the U-Bracket post.</p> <p>This modification is considered Non-Significant and will have an inconsequential effect.</p>		

## Request for Federal Aid Reimbursement Eligibility Of Highway Safety Hardware

<b>Submitter</b>	Date of Request:	May 15, 2013	<input checked="" type="radio"/> New <input type="radio"/> Resubmission
	Name:	Bret Eckert, P.E.	Signature:
	Company:	Trinity Highway Products	
	Address:	3617 Cincinnati Ave., Rocklin, CA 95765	
	Country:	USA	
	To:	Michael S. Griffith, Director FHWA, Office of Safety Technologies	

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Contact Name:	John Intagliata	Same as Submitter <input type="checkbox"/>
Company Name:	Trinity Highway Products	Same as Submitter <input checked="" type="checkbox"/>
Address:	3617 Cincinnati Ave., Rocklin, CA 95765	Same as Submitter <input checked="" type="checkbox"/>
Country:	USA	Same as Submitter <input checked="" type="checkbox"/>

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## CRASH TESTING

A brief description of each crash test and its result:

Required Test Number	Narrative Description	Evaluation Results
3-60 (820C)	Not Applicable	
S3-60 (700C)	Not Applicable	
3-61 (820C)	The Engineering Analysis shows inconsequential differences between stress, strain, factor of safety and fatigue safety when comparing U-Brackets with 1/2" and 2" diameter drain holes. This modification does not affect the structural integrity or function of the U-Bracket.	WAIVER REQUESTED
S3-61 (700C)	Not Applicable	

Full Scale Crash Testing was done in compliance with MASH by the following accredited crash test laboratory (cite the laboratory's accreditation status as noted in the crash test reports.):

Laboratory Name:	Texas Transportation Institute	
Laboratory Contact:	Dean C. Alberson, Ph.D., P.E.	Same as Submitter <input type="checkbox"/>
Address:	3135 TAMU College Station, TX 77843-3135	Same as Submitter <input type="checkbox"/>
Country:	USA	Same as Submitter <input type="checkbox"/>
Accreditation Certificate Number and Date:	A2LA Certificate Number: 2821.01 April 30, 2014	

## ATTACHMENTS

Attach to this form:

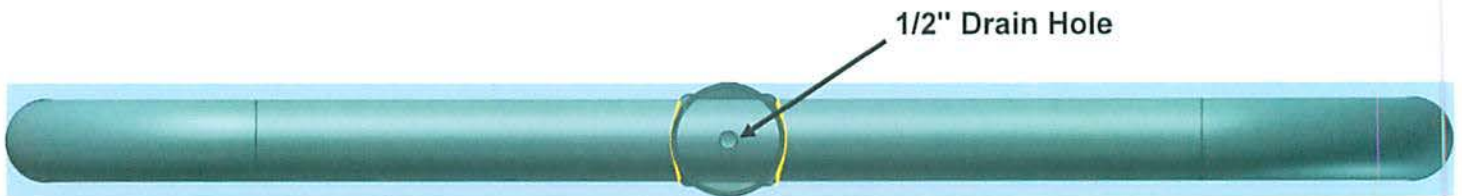
- 1) A copy of the full test report, video, and a Test Data Summary Sheet for each test conducted in support of this request.
- 2) A drawing or drawings of the device(s) that conform to the Task Force-13 Drawing Specifications [[Hardware Guide Drawing Standards](#)]. For proprietary products, a single isometric line drawing is usually acceptable to illustrate the product, with detailed specifications, intended use, and contact information provided on the reverse. Additional drawings (not in TF-13 format) showing details that are key to understanding the performance of the device should also be submitted to facilitate our review.

**FHWA Official Business Only:**

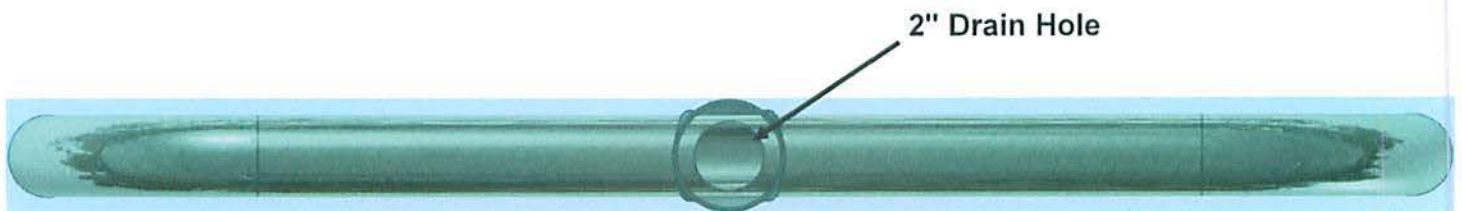
Eligibility Letter		AASHTO TF13	
Number	Date	Designator	Key Words
B-115A	November 1, 2013		Breakaway Sign Support Slip Base Sign Support U-bracket for breakaway sign supports



# Engineering Analysis for Galvanizing Drain Hole Enlargement on U-Bracket Sign Support



Existing Part



Proposed Part

May 14, 2013

John Intagliata, Research Engineer  
Trinity Highway Products



Photo 1 - U-Bracket mounted on a sign support pole in a standard slipbase mount.

### U-Bracket Application

U-Brackets are an accessory to sign support slipbase systems and are typically used to display several signs together at equal heights. U-Brackets are a non-proprietary item and have been tested to NCHRP 350 Test Level 3. Details of the testing can be found in FHWA letter HSA-10/SS-115.

### Problem

Hot-dip galvanizing the U-Bracket in its present design poses a challenge because the single drain hole is not large enough for the air in the tubes to escape, which causes the U-Bracket to float in the galvanizing tank.

Normally, when parts are hot dip galvanized per ASTM A123, for example, several of them are hung on a rack to maximize the throughput of the operation. The rack of parts is submersed into the molten zinc bath for the specified period of time, then the parts are removed and suspended briefly above the tank so that the excess zinc is allowed to drain.

If the parts have geometric features that trap air, such as tubes and passageways, adequately sized drain holes need to be provided so that the part can expel the air as the part is being lowered into the galvanizing tank and so that the excess molten galvanizing can drain when the part is removed from the tank. If a part has inadequate drain holes, it will not submerge properly and it can float on the surface of the molten zinc, not to mention unwanted pools of zinc will solidify on the part.



## Proposed Solution

Increasing the drain hole diameter to 2 inches from the current 1/2 inch will allow the U-Bracket part to be fully submersible in the hot dip galvanizing tank so that it does not float on the surface of the molten zinc bath. An engineering analysis was performed on the part and it showed that increasing the drain hole to 2 inches has no effect on the structural integrity, function and performance of the part.

## Set Up

Engineering analysis, using ANSYS v13.0, was performed on both the U-Bracket with a 1/2 inch diameter drain hole and with a 2 inch diameter drain hole. The drain hole is located centered inside the mounting nipple.

To investigate the stress level on the U-Bracket inside the mounting nipple, a horizontal load of 527  $lb_f$  (264  $lb_f$  on each arm) was applied to each U-Bracket arm. This load represents a 40 mph wind acting on a 96" tall x 180" wide x 1/8" thick sign panel mounted on the U-Bracket. Additionally, a vertical downward load of 300  $lb_f$  (150  $lb_f$  on each arm) was applied to the top of the U-Bracket arms. This load represents the weight of the signs and hardware. To simulate being mounted to a sign support pole, a fixed support was placed on the bottom surface of the mounting nipple and a cylindrical support was placed on the inside wall of the mounting nipple.

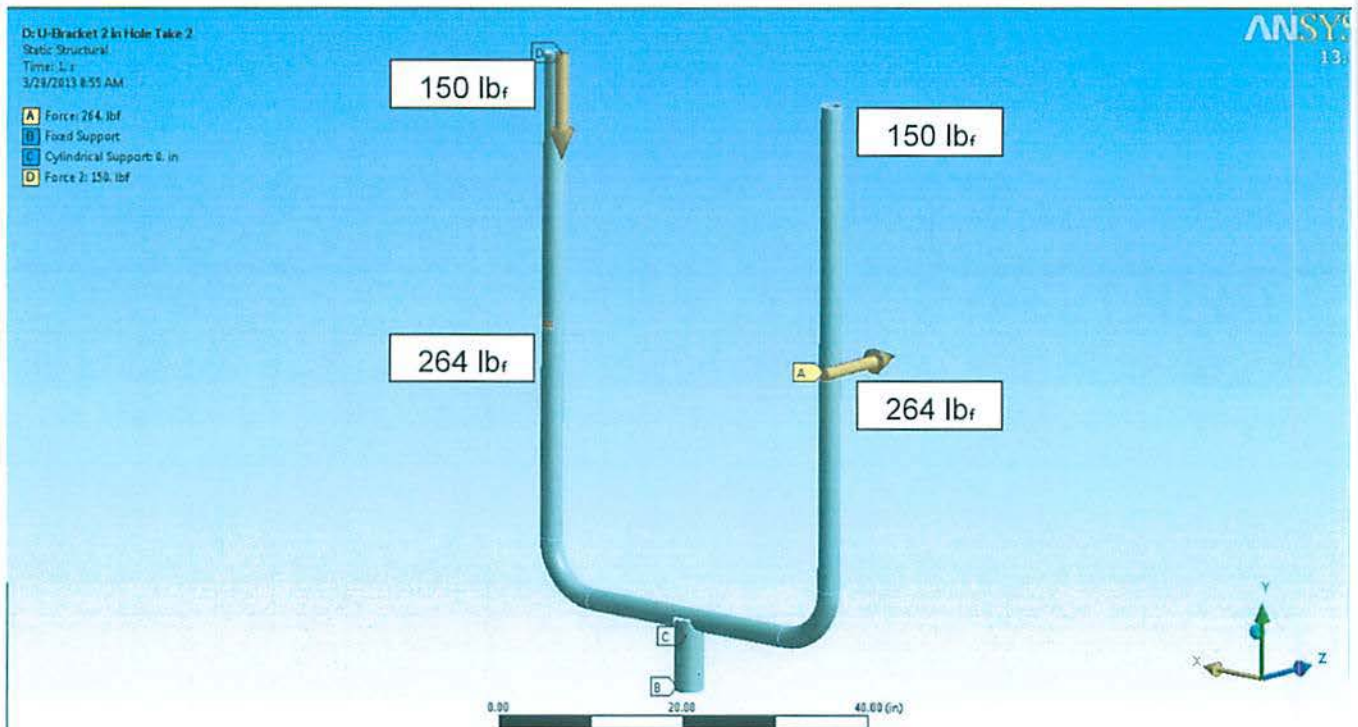


Figure 1 - Set Up of U-Bracket.

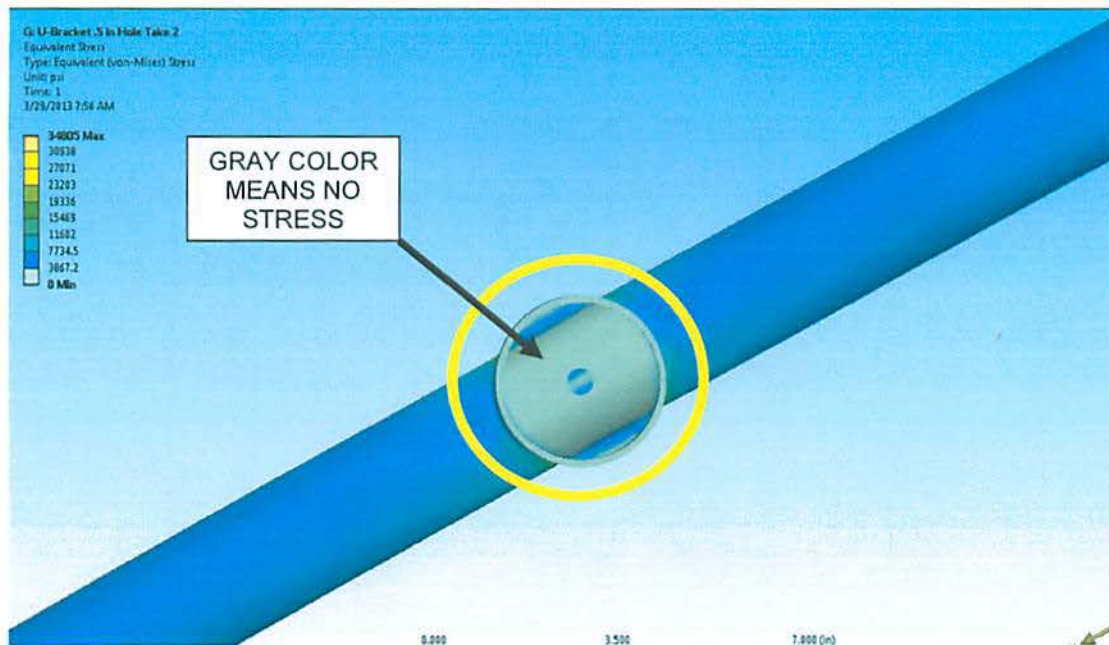


## Results Summary

The increased drain hole size did not have a significant effect on the structural integrity, function or performance of the U-Bracket. As illustrated in Figures 2 and 4 the stress level near the hole inside the mounting nipple remained effectively the same. This is because the material within the mounting nipple is isolated from the rest of the structure by the weld that secures the mounting nipple to the U-Bracket tube. The location of the maximum stress is found at the corners of the welded portion of the mounting nipple where it joins the U-Bracket tube, as seen in color red in Figures 3 and 5.

**Table 1 - Results Summary**

Parameter	Ø1/2" Drain Hole	Ø2" Drain Hole	Difference	Effect
Equivalent Von Mises Stress (Max)	34,805 psi	34,166 psi	639 psi	Insignificant
Equivalent Von Mises Strain (Max)	0.001199 inches	0.001178 inches	0.000021 in	Insignificant
Safety Factor (Min)	1.58	1.61	0.03	Insignificant
Fatigue Safety Factor (Min)	0.359	0.366	0.07	Insignificant



**Figure 2 - Result for 1/2" Diameter Drain Hole, Bottom View.**



Figure 3 - Result for 1/2" Diameter Drain Hole, Oblique View.

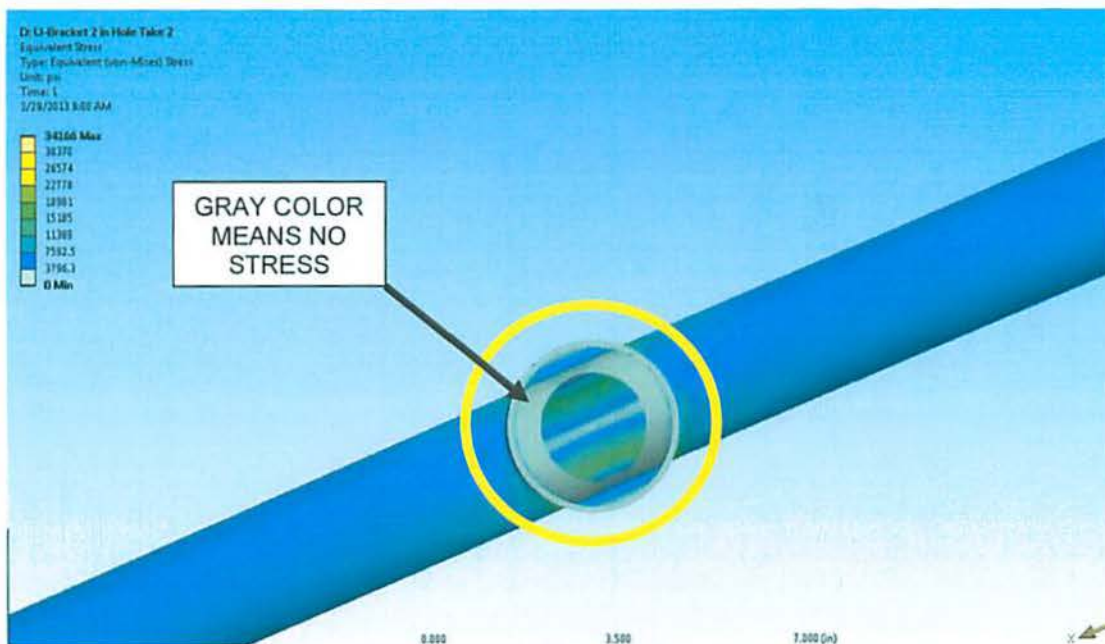


Figure 4 - Result for 2" Diameter Drain Hole, Bottom View.



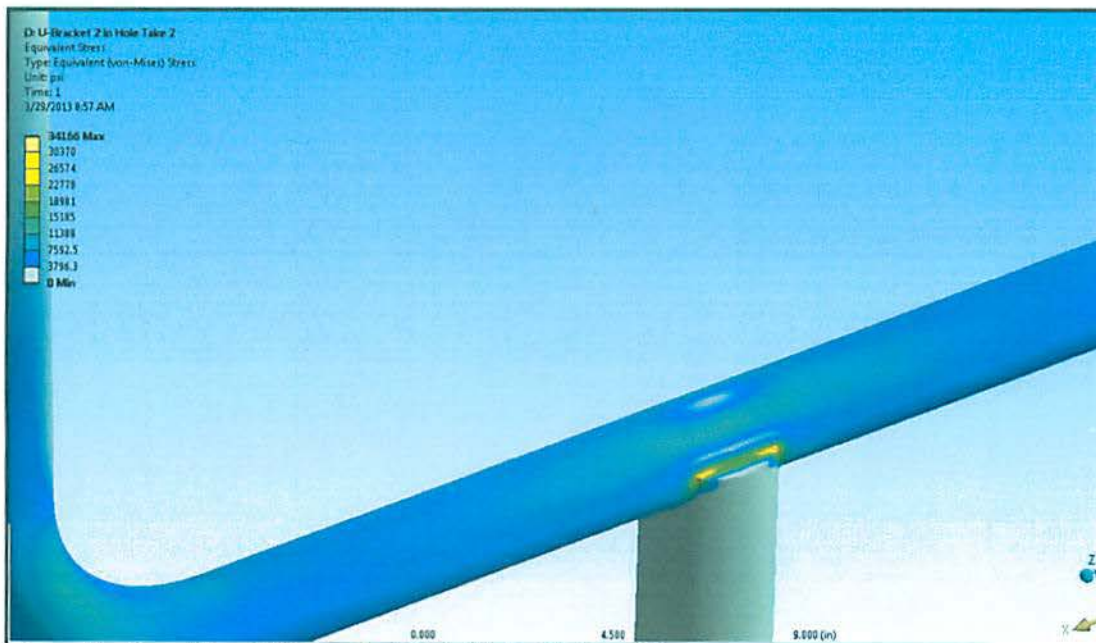


Figure 5 - Result for 2" Diameter Drain Hole, Oblique View.

### Conclusion

The engineering analysis showed that the increased drain hole diameter does not affect the structural integrity, function and performance of the U-Bracket.