

Refer to: HSA-10/WZ-126

Mr. Paul Lang
Lang Products International
1870 E. 50th Street
Inver Grove Heights, Minnesota 55077

Dear Mr. Lang:

Thank you for your letters of March 26, 2002 and July 12, 2002, to Mr. Nick Artimovich of my office requesting Federal Highway Administration (FHWA) acceptance of your company's LTT-1 portable sign stand as a crashworthy traffic control device for use in work zones on the National Highway System (NHS). Accompanying your letter was a report of crash testing conducted by E-Tech Testing Services, Inc. and a video of the tests. You requested that we find this stand 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." You also requested acceptance of numerous variations in sign size, shape, material, attachment methods, etc., some of which are discussed under "findings" below.

Introduction

The FHWA guidance on crash testing of work zone traffic control devices is contained in two memoranda. The first, dated July 25, 1997, titled "INFORMATION: Identifying Acceptable Highway Safety Features", established four categories of work zone devices: Category I devices were those lightweight devices which could be self-certified by the vendor, Category II devices were other lightweight devices which needed individual crash testing, Category III devices were barriers and other fixed or massive devices also needing crash testing, and Category IV devices were trailer mounted lighted signs, arrow panels, etc. 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.

A brief description of the device follows:

The LTT-1 portable sign consists of a 1220 x 1220 mm (48 x 48 inch) diamond shaped 12.7 mm (½ inch) thick MDO plywood sign attached to 44.5 mm square, 2.7 mm thick (1 ¾ inches x 12 ga) perforated square steel tube uprights supported by 50.8 mm square, 3.0 mm thick (2 inches x 11 ga) steel tube removable arched legs. The uprights are secured onto the arched legs by a 22 inch x 1.5 inch x 1.5 inch x 3/16 inch receiver stud that fits inside the lower portion of the uprights. This stud is permanently welded onto the arched leg in a perpendicular orientation. All tubing is ASTM A500 Grade B steel. The fasteners are 76.2 mm (3 inch) long 7.9 mm (5/16 inch) grade 5 bolts secured by nylon insert lock nuts. The height of the bottom tip of the sign was a nominal 304.8 mm (12 inches) above ground level.

Testing

Full-scale automobile testing was conducted on your company's devices. Two stand-alone examples of the device were tested individually; one at a 90 degree orientation and the next was impacted head-on. The complete device as tested is shown in Enclosure 1. In the test report, the device is identified as "SF-R48," a designation you have changed to "LTT-1". The crash test is summarized in the table below:

Test Number	42-1012-001	42-1012-002
Test Article	SF-R48 Long Term Temporary Sign	
Height to Bottom of Sign	305 mm	
Height to Top of Sign	2030 mm	
Flags or lights	None	
Test Article Mass (each)	39.2 kg, plus four 16 kg sandbags	
Vehicle Inertial Mass	832 kg	817 kg
Impact Speed, Head-on	----	100.1 km/hr
Impact Speed, 90 Deg.	100.1 km/hr	----
Velocity Change, Head-on	----	2.92 m/sec
Velocity Change, 90 deg.	3.16 m/sec	---
Vehicle crush	Deep crease to hood	Dents to hood and grille
Occupant Compart. Intrusion	None	None
Windshield Damage	No contact	Just touched, no cracks

Findings

Damage was limited to sheet metal damage of the hood, and damage to the bumper and grille of the test vehicle. Velocity change for the 90 degree test was in the “acceptable” range while the velocity change for the head-on impact was in the “desirable” range. The results of the testing met the FHWA requirements and, therefore, the devices described above and shown in the enclosed drawings for reference are acceptable for use on the NHS under the range of conditions tested, when proposed by a State.

Variations to the devices as tested

A number of variations to the tested sign and support were included in your March 26, 2002, letter with a request that they be considered acceptable. We concur that the following variations are also acceptable for use (except as noted below):

1. **Sign substrates.** The tested sign was 48 x 48 x 0.5 inch MDO plywood that weighed approximately 25 pounds. You requested the following variations be accepted:
 - 1a. All types and grades of ½ inch plywood substrates.
 - 1b. All rigid substrates of lesser mass, including 0.100 inch and 0.080 inch aluminum.
 - 1c. All semi rigid substrates for which we have testing history, including Endurance (Lexan), Coroplast (Safety Core, SafetyPlast), Alpollic, Renolite, Dibond and Alupalite (aluminum – plastic laminates).
 - 1d. Use of two signs, back to back, when the combined weight of the two signs does not exceed 25 pounds.
 - 1e. Use of 36 x 36 inch sign blanks of any rigid or semi rigid material when the mass of the sign does not exceed 25 pounds. This includes back-to back signs. The heaviest single sign in this size is ¾ inch plywood which weighs 19 pounds. These smaller signs are to be mounted such that their center is at the same height as the tested 48 x 48 inch signs.

2. **Sign shapes.** The tested sign was a 48 x 48 inch diamond which has a diagonal measurement of approximately 67.5 inches. You requested that other shapes be acceptable providing:
 - 2a. The mass does not exceed 25 pounds, the top of the sign does not exceed 80 inches (approximate height of tested sign), and the center of the sign is set at 45 to 47 inches (as was the tested sign.) The following signs were specifically requested:
 - 2b. STOP signs, YIELD signs, or square signs with a maximum dimension of 48 inches.
 - 2c. Vertical rectangles with a maximum vertical dimension of 60 inches.
 - 2d. Horizontal rectangles with a maximum horizontal dimension of 60 inches.
 - 2e. Combination or multi-panel signs, such as detour assemblies with a route marker and a direction indicator arrow.

3. **Sign attachment bolt pattern.** The tested signs were fastened with a 24 inch square bolt pattern. You requested the following variations to that pattern:
 - 3a. Variations that include a maximum horizontal dimension of 48 inches and a minimum of 18 inches; maximum vertical dimension of 36 inches and a minimum of 12 inches.
 - 3b. Variations that include more than four bolts.
 - 3c. Variations for the 36 x 36 inch diamond, and other shapes/sizes discussed above.

4. **Upright locking hardware.** The tested signs used 5/16 inch x 3 inch long grade 5 zinc plated hex bolts to secure the leg assembly into the upright tubes. The bolt was secured with a nylon insert lock nut. You requested the following variations:
 - [4a. and 4b. Your request referred to eliminating the nut for bolts (screws) that penetrate the upright tube. Upon further discussion you retracted that request.]
 - 4c. Any grade 5 bolt or better, with a diameter greater than 5/16 inch.
 - 4d. Optional use of quick release snapper pins, hitch pins, and cotter pins.
 - 4e. Use of non-locking nuts and wing nuts as alternate hardware.

5. **Sign attachment hardware.** The tests used four 5/16 inch x 3 inch x grade 5 hex bolts for attaching the signs to the uprights. The top washer was a standard cut iron washer, and the second was a 1.25 inch fender washer that was 0.062 thick. You requested the following variations:
 - 5a. Bolts of 5/16 inch diameter in grade 8.
 - 5b. Bolts of 3/8 inch diameter in all grades.
 - 5c. Fender washers of up to 1 ½ inch diameter.
 - 5d. Use of alternative lock nuts, such as center lock nuts, castle lock nuts, top lock nuts, and the use of lock washer for securing the sign attachment hardware.
 - 5e. Use of conventional (non-locking) hex nuts, square nuts, and wing nuts.
 - 5f. As requested in your July 12, 2002, letter, “rubber bumpers” may be used in lieu of flat washers.

6. **Upright Tube Member.** The tested stands used 1 ¾ inch square, 12 gage Telespar uprights, with 7/16 inch holes spaced at 1 inch centers. You requested the following variations:
 - 6a. Use of non-perforated 1 ¾ inch square, 12 gage Telespar uprights.
 - 6b. Use of 1 ¾ inch square 12 gage structural tubing as an alternative to the Telespar tubes.
 - 6c. The top of the “receiver stud” may be cut at an angle to facilitate assembly as requested in your July 12, 2002, letter.

7. **Sand Bag Request.** The tested stand was ballasted by four 35 pound sand bags. You requested the option to use:
 - 7a. Up to 8 sand bags, (two per foot.)
 - 7b. Varying weights of sand bags from 20 pounds to 50 pounds (to a maximum of 300 pounds).

8. **Sign Sheeting.** The sign substrates were faced sheeted with 3M Diamond Grade with 3M Scotchal legend. You requested the use of alternative retroreflective sheeting, or the use of signs without retroreflective sheeting.
9. **Production Modifications for Leg Tube.** The 2 x 2 inch leg tube used in the tests did not include any perforations or embossed/stenciled identification. You requested that rain drainage holes and embossed/stenciled identification marks be accepted. These are acceptable as discussed in your July 12, 2002, letter.

You also spelled out three scenarios for the use of these stands that are beyond the scope of laboratory crash testing and asked that your stand be listed as “exempt” from the need for additional testing. It has been our policy that the crash testing of devices according to NCHRP Report 350 is meant to discriminate between devices when tested “on a level playing field,” both figuratively and literally. We recognize that there are many situations in the “real world” highway environment where the tested devices may be in use and, because of topography or the presence of other road features, may not perform as they did when tested. As we do not require testing for these scenarios, there is no need for specific waivers for:

- A. Mounting of the sign stand on a slow-moving shadow vehicle.
- B. Use of longer legs when the sign stand straddles a median barrier.
- C. Use on stepped or sloped terrain where one leg has to be made longer in order to present a level sign.

Please note the following standard provisions that apply to 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 FHWA and NCHRP Report 350.
- To prevent misunderstanding by others, this letter of acceptance, designated as number WZ-126 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 Lang Products International Long Term Temporary SF-R48 sign is in patent – pending status product and 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 for use on Federal-aid projects, except exempt, non-NHS 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.

Sincerely yours,

Carol H. Jacoby, P.E.
Director, Office of Safety Design

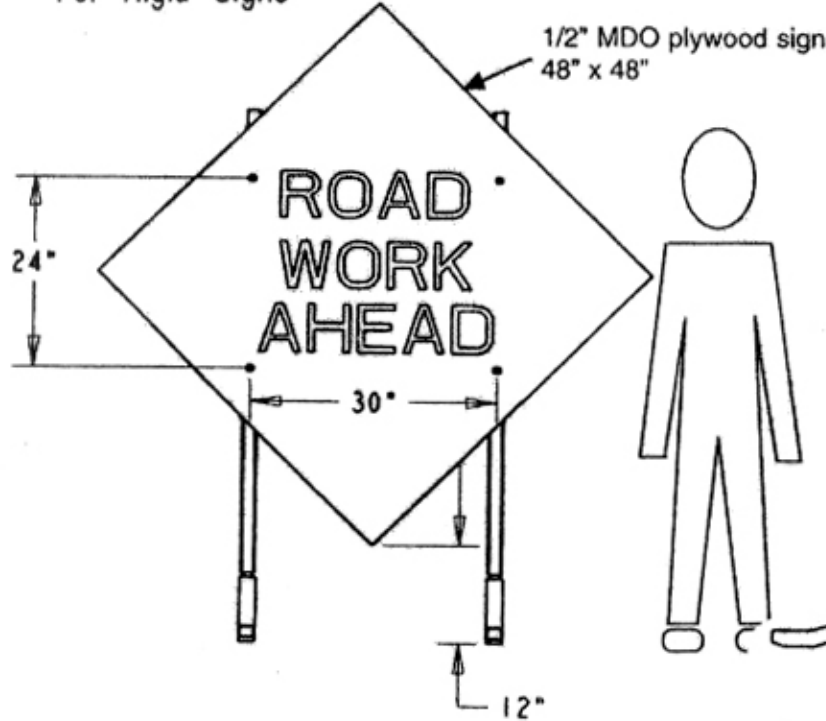
Enclosure



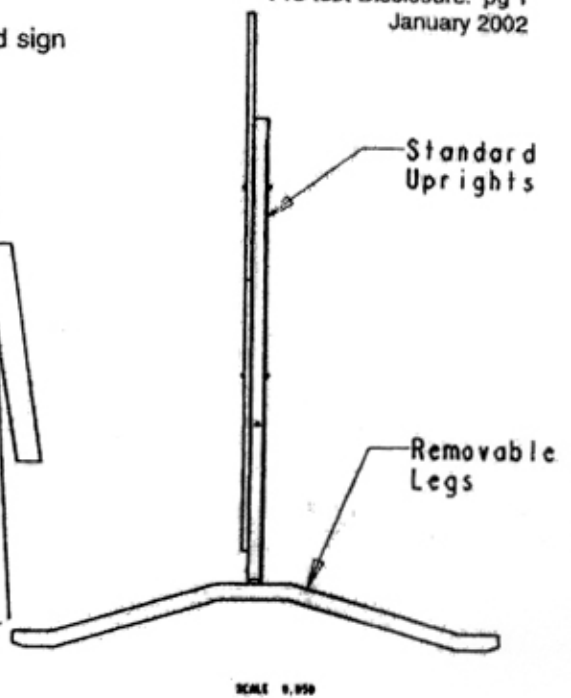
C. Illustrations

Sign Support

For Rigid Signs



Lang Products Int'l, Inc.
877-478-2637
Pre-test Disclosure: pg 1
January 2002



Removable Arched Leg w/ 22" Center-Welded Stud Arch Height = 7" +/- 0.4"

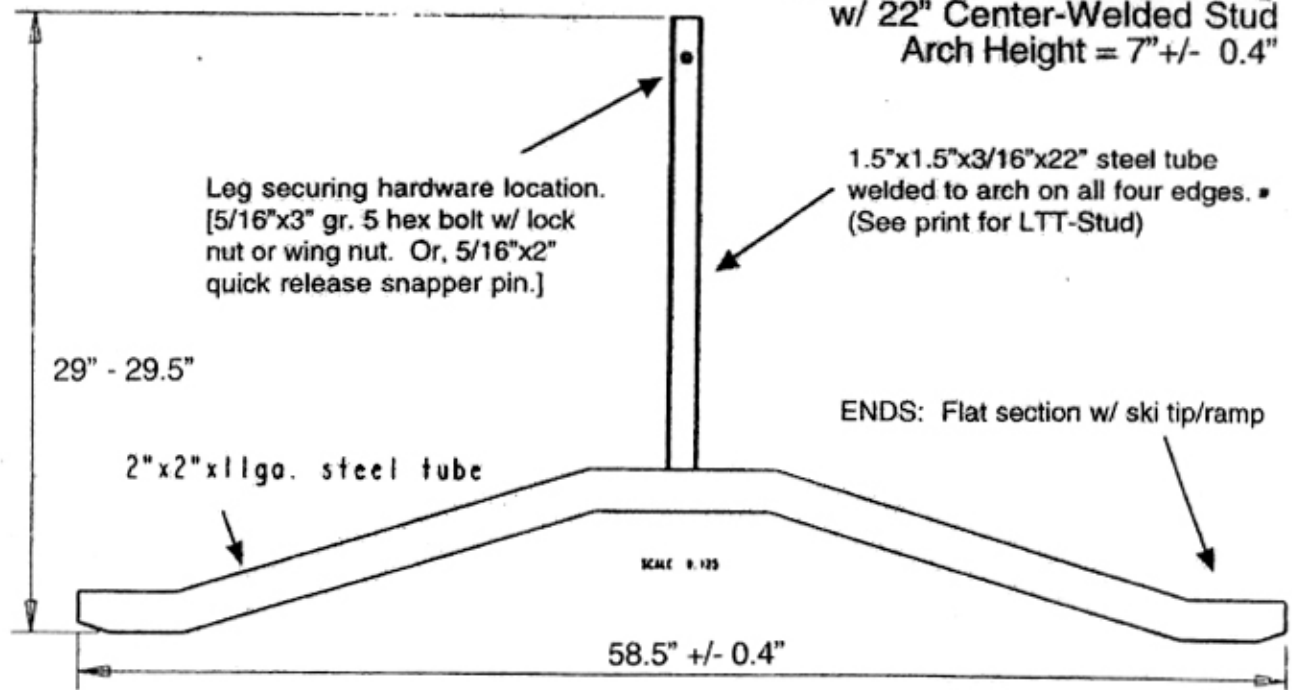


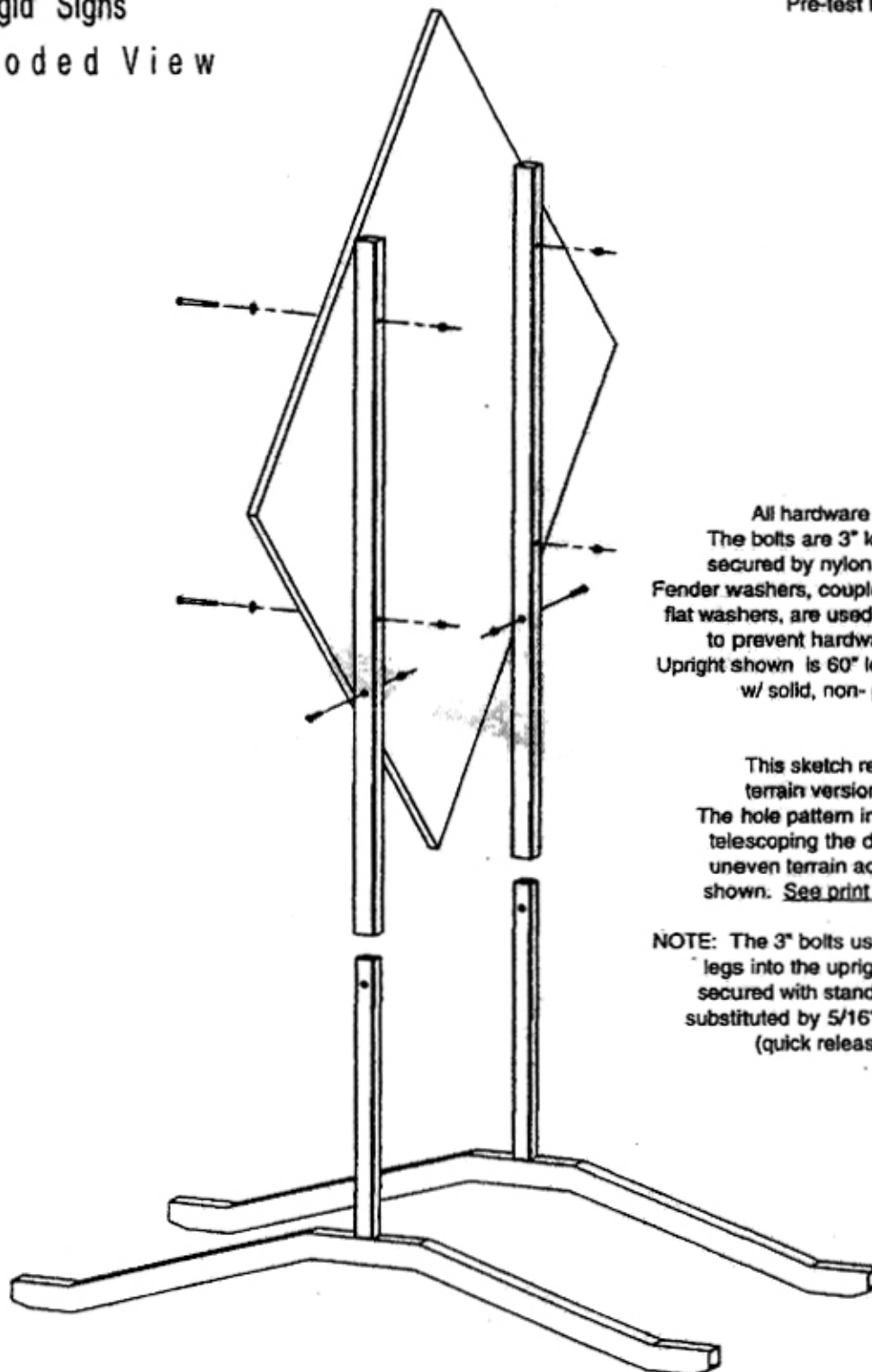
Illustration 1. Long Term Temporary (LTT) Sign System (1 of 3)



Sign Support

For Rigid Signs
Exploded View

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877-478-2637
Pre-test Disclosure: pg 2
January 2002



All hardware is 5/16" grade 5.
The bolts are 3" long and they are secured by nylon insert lock nuts. Fender washers, coupled with standard flat washers, are used on the sign face to prevent hardware pull-through. Upright shown is 60" long tubular steel w/ solid, non-perforated walls.

This sketch represents a level terrain version of this support. The hole pattern in the uprights for telescoping the down-hill stud for uneven terrain adjustments is not shown. See print for LTT-Upright.

NOTE: The 3" bolts used to secure the legs into the upright tubes may be secured with standard wing nuts or substituted by 5/16"x2" square-wire (quick release) snapper pins.

Illustration 1. Long Term Temporary (LTT) Sign System (2 of 3)