U.S. Department
of Transportation
Federal Highway

Administration

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

Refer to: HSA-1/WZ-79

MS. KELLY FISH
TECHNICAL SERVICES ENGINEER
ALUSUISSE COMPOSITES
205 WEST 5TH STREET
P.O. BOX 507
BENTON, KY 42025

Dear Ms. Fish

Thank you for your April 4 letter to Mr. Nicholas Artimovich of my office requesting Federal Highway Administration (FHWA) acceptance of your company's Dibond 2 mm aluminum laminate substrate signs for use on crashworthy work zones sign stands on the National Highway System (NHS). Accompanying your letter was a report from E-Tech Testing Services, Inc., and a video of crash tests conducted on a Model MGS48A temporary sign stand by Middle Georgia Signs. You requested that we find your company's substrates acceptable as alternates to similar sign substrate materials manufactured by Mitsubishi (Alpolic) and Reynolds Metals (Reynolite) 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."

A cooperative round of crash tests was conducted by E-Tech. Upon our initial review of an earlier test of the MGS48A stand we noted that the signs (substrate of 3 mm "Reynobond" by Reynolds Metals) were mounted below the one foot minimum required by the Manual on Uniform Traffic Control Devices (MUTCD). We discussed this matter with E-Tech and learned that you had also contracted with them to test stands using Dibond substrates. We reached agreement that E-Tech would conduct the 100 kmh test using the same MGS48A stands and your company's Dibond signs mounted at the correct height of one foot. If the dynamic performance of the Dibond sign appeared to match that of the Reynobond sign, we would consider the materials comparable and that the stand could be found acceptable using either substrate. That, indeed, is the conclusion we reached.

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 devices for which you are requesting acceptance follows:

The Dibond sign substrate is two sheets of aluminum sandwiching a solid core of extruded thermoplastic material formed in a continuous process with no glues or adhesives between dissimilar materials. The individual aluminum sheets are 0.30 mm (0.0118 inch) thick. The alloy is AA3003 painted material, and the unit weight of the 2 mm thick composite panel is 2.73 kg per square meter (0.56 pounds per square foot.)

The Middle Georgia Sign Model MGS48A is a compact lightweight portable sign system featuring an "A-Frame" support. The stand has four 3.175 mm formed angle iron steel upright legs interconnected with spread bars of similar construction. The material specification is ASTM A499-89 for all angle iron steel used in the sign support (this is the same "re-rolled rail steel" specification used for breakaway u-channel ground-mounted sign supports.) The uprights are "hinged" with 12.7 mm diameter by 19.1 mm long ASTM A307 zinc plated bolts with nylon lock nuts. The uprights, spread bars, and sign connect with 7.94 mm diameter by 19.1 mm long fasteners of the same type.

The tested MGS48A signs each supported a 1219 mm square aluminum laminate sign made of 2 mm thick "Dibond" substrate. The top of the sign is bolted to the upper spread bar at a single point using standard flat washers to increase the bearing area. The base of the sign rests in steel sign holder brackets attached to the uprights. When deployed the bottom of the sign is a nominal 305 mm above ground level in accord with the minimum height requirement of the MUTCD. Flag holders, made up of electrical mechanical tubing, are bolted to an upright on each side of the support. Two 457 mm square vinyl fabric flags with wooden dowels were installed in the holders.

Testing

Two full-scale automobile tests were conducted on the stands. The first using Reynobond and the second using your company's signs. Two stand-alone examples of the device were tested in tandem in each test, one head-on and the next placed six meters downstream turned at 90 degrees, as called for in our guidance memoranda. The complete devices as tested are shown in the Enclosure 1.

The crash tests are summarized in the table below:

Test Number	32-1641-001	33-4478-001
Test Article	MGS48A with 3 mm Reynobond	MGS48A with 2 mm Dibond
Height to Bottom of Sign	152 mm	304 mm
Height to Top of Sign	1816 mm	2028 mm
Flags or lights	Two flags	Two flags
Test Article Mass (each)	20.7 kg	19.1 kg

Vehicle Inertial Mass	828 kg	810 kg
Impact Speed, Head-on	102.5 km/h	103.2 km/h
Impact Speed, 90 Deg.	98.3 km/h	99.0 km/h
Velocity Change, Head-on**	1.2 m/s	1.2 m/s
Velocity Change, 90 deg.**	n/a	1.2 m/s
Vehicle crush	dents to bumper and hood grill cracked	dents to bumper and hood, grill cracked
Occupant Compart. Intrusion	none	none
Windshield Damage	contact, but no cracking	minor cracking

**The velocity change recorded for the head-on hit is the difference between the impact speed of the vehicle into the first stand and then into the second. The velocity change for the 90 degree hit was not recorded for the first test.

Findings

Damage in the Reynobond test was limited to cosmetic damage to the sheet metal of the test vehicle. Only minor windshield cracking resulted from the 90 degree impact with the Dibond sign. The results of the testing met the FHWA requirements. The thinner (2 mm) Dibond was more flexible, allowing greater windshield contact than the 3mm Reynobond. However, these tests do show comparable performance between the two substrates. The performance of these two signs appear similar to the 2 mm Alpolic aluminum laminate tested by others. This allows FHWA to consider Dibond, Alpolic, and the Reynolds Metals products equivalent *when substrates are of the same thickness.* Specifically, 2 mm Dibond, Alpolic, and Reynolite (the name Reynolds Metals uses for their thinner aluminum laminate product) may be used interchangeably *on work zone traffic control devices which have been accepted for use with any of the other 2 mm aluminum laminate substrates* and are acceptable for use on Test Level 3 devices on the NHS under the range of conditions tested, when proposed by a State. Note that only the MGS48A portable sign stand described above has been tested with a 3 mm aluminum laminate sign.

Please note the following standard provisions which 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 MUTCD.
- 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-79 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.
- Dibond materials are patented and therefore 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,

Frederick G. Wright, Jr.
Program Manager, Safety

2 Enclosures