



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

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

May 2, 2011

In Reply Refer To:
HSST/SS-171

Mr. Pratip K. Lahiri, P.E.
Manager, Specifications and Standards Section, POD 23
Design Quality Assurance Bureau
New York State Department of Transportation
50 Wolf Road
Albany, New York 12232

Dear Mr. Lahiri:

This letter is in response to your request for the Federal Highway Administration (FHWA) acceptance of a roadside safety system for use on the National Highway System (NHS).

Name of system:	Aluminum Pedestrian Signal Pole
Type of system:	Breakaway Support Structure
Test Level:	NCHRP Report 350 TL-3
Testing conducted by:	Midwest Roadside Safety facility
Date of request:	November 30, 2010
Date completed package received:	December 6, 2010
Request initially acknowledged:	December 7, 2010

You requested that we find this system acceptable for use on the NHS under the provisions of the National Cooperative Highway Research Program (NCHRP) Report 350 "Recommended Procedures for the Safety Performance Evaluation of Highway Features."

Requirements

Roadside safety devices should meet the guidelines contained in the NCHRP Report 350 or the American Association of State Highway and Transportation Officials' Manual for Assessing Safety Hardware (MASH). Requirements for breakaway supports are those in the American Association of State Highway and Transportation Officials' (AASHTO) Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals.

Decision

The following device was found acceptable:

- New York State DOT Aluminum Pedestrian Signal Pole



Description

The aluminum pedestrian signal pole includes an aluminum pole and a pedestrian “hand/man” signal. The aluminum pole is attached to a rigid foundation by a frangible aluminum base plate and four bolts.

The pole is a 10 ft (3.1 m) tall, round aluminum pole with a 1/8 inch (3 mm) wall thickness. The pole has a top outside diameter of 4½ inches (114 mm) and a bottom outside diameter of 6 inches (152 mm). A 5/32 inch (4 mm) thick, 24 inches (610 mm) tall internal reinforcing sleeve is located at the bottom of the pole and serves to strengthen the base of the pole against premature yielding during an impact. A handhole is placed through both the pole and the internal sleeve and centered at a height of 18 inch (457 mm).

The pole base plate is a 10¼ inch (260 mm) square with a thickness of 5/8 inch (16 mm). The bolt circle is 9½ inches (241 mm) in diameter, and the pole was inserted and welded to a 3½ inch (89 mm) tall cylinder, as measured from the bottom of the base plate. Enclosure 1 and Enclosure 2 illustrate the details of the pole.

The pedestrian “hand/man” signal conformed to Standard Sheet No. 680-10 used by New York State DOT. The signal is mounted to the pole using a top-mounted attachment bracket, as shown in Enclosure 3. The signal is attached to the bracket by inserting the top, threaded portion of the bracket into the hole at the bottom of the signal. The combined weight of the signal and bracket was 26 lb (12 kg). After attachment to the pole, the total system weighed 59 lb (27 kg).

Crash Testing

A pendulum testing was conducted on the test articles described above by Midwest Roadside Safety facility. The pendulum test was conducted according to NCHRP 350 test designation 3-60 as a surrogate for a full crash test with an 820C car.

Findings

According to NCHRP 350, test designation 3-60 and test designation 3-61 are to be conducted for support structures for Test Level 3 acceptance. In both tests full scale automobile testing with 820C small car is required.

In this request, test 3-60 was conducted using a pendulum. The mass of the pendulum was 861 kg and the pendulum was configured to represent the front-end crush stiffness of a 1979 Volkswagen Rabbit two-door sedan as a small car.

According to the test results, as reported by the Midwest Roadside Safety facility, the test article passed test 3-60 conducted using the pendulum. In this test, maximum vehicle velocity change was below the maximum allowable limits of NCHRP 350 (Enclosure 5). In this test, the pole broke away from the base plate assembly in a controlled and predictable manner. The signal pole fell in front of the surrogate vehicle, neither the signal box nor the fractured pole showed any potential for penetrating or causing larger deformations to the occupant compartment.

The test articles were not crash tested according to test 3-61 (high speed test). However, the results of the high speed tests were estimated using the results from the low-speed test in combination with an analytical extrapolation method described in FHWA Memorandum HNG-

14 for Action: Identifying Acceptable Highway Safety Features dated on July 25, 1997. For the test article described above, the high speed test extrapolation analysis resulted in change in velocity values for the high speed test below the NCHRP 350 limit of 5.0 m/s. Therefore, the test article would likely successfully pass the high speed test.

The AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals require that any “substantial remains” of the breakaway support not project greater than 4 inches above ground level to avoid vehicle undercarriage snagging. After the test portions of the fractured aluminum base plate assembly projected 4½ inches (114 mm) which violates the 4 inch (100 mm) stub height limit. Therefore, the test article does not pass all requirements set forth by FHWA.

In your request letter, you proposed two alternative modifications to the system design in order to overcome the issue associated with the remaining stubs:

1. The leveling nuts, which are 1 inch high, will be specified to be embedded in the grout as shown in Enclosure 4 (Option 1). This will ensure that the distance from the ground to the top of the collar, assuming the same break point, will be less than 4 inches high.
2. The concrete foundation used for the system will be specified to be level with the surrounding ground and any sidewalk. In addition, in order to ensure that the maximum height to the top of the collar from the foundation does not exceed 4 inches, two alternatives can be implemented:
 - a. The existing collar height is kept (3 ½ inches) and shims (Enclosure 5) are used to level the pole instead of nuts; or
 - b. The height of the collar is reduced to 3 inches and 1 inch or 7/8 inch high leveling nuts are used.

I concur in either of the proposed modifications on the grounds that they can ensure that the remaining stubs will not exceed the 4 inch limit.

Therefore, the system described in the requests above and detailed in the enclosed drawings is acceptable for use on the NHS under the range of conditions tested, when such use is acceptable to a highway agency.

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

- This acceptance is limited to the crashworthiness characteristics of the systems 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 system 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 system being marketed is significantly different from the version that was crash tested, we reserve the right to modify or revoke our 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 verify that hardware installed has essentially the same chemistry, mechanical properties, and geometry as that submitted for acceptance, and that it will meet the crashworthiness requirements of the FHWA and the NCHRP Report 350.
- To prevent misunderstanding by others, this letter of acceptance is designated as number SS-171 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 acceptance 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 acceptance letter is limited to the crashworthiness characteristics of the candidate system, 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,

A handwritten signature in blue ink, appearing to read "George E. Rice".A small, stylized handwritten signature in blue ink, likely belonging to Michael S. Griffith.

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

Enclosures

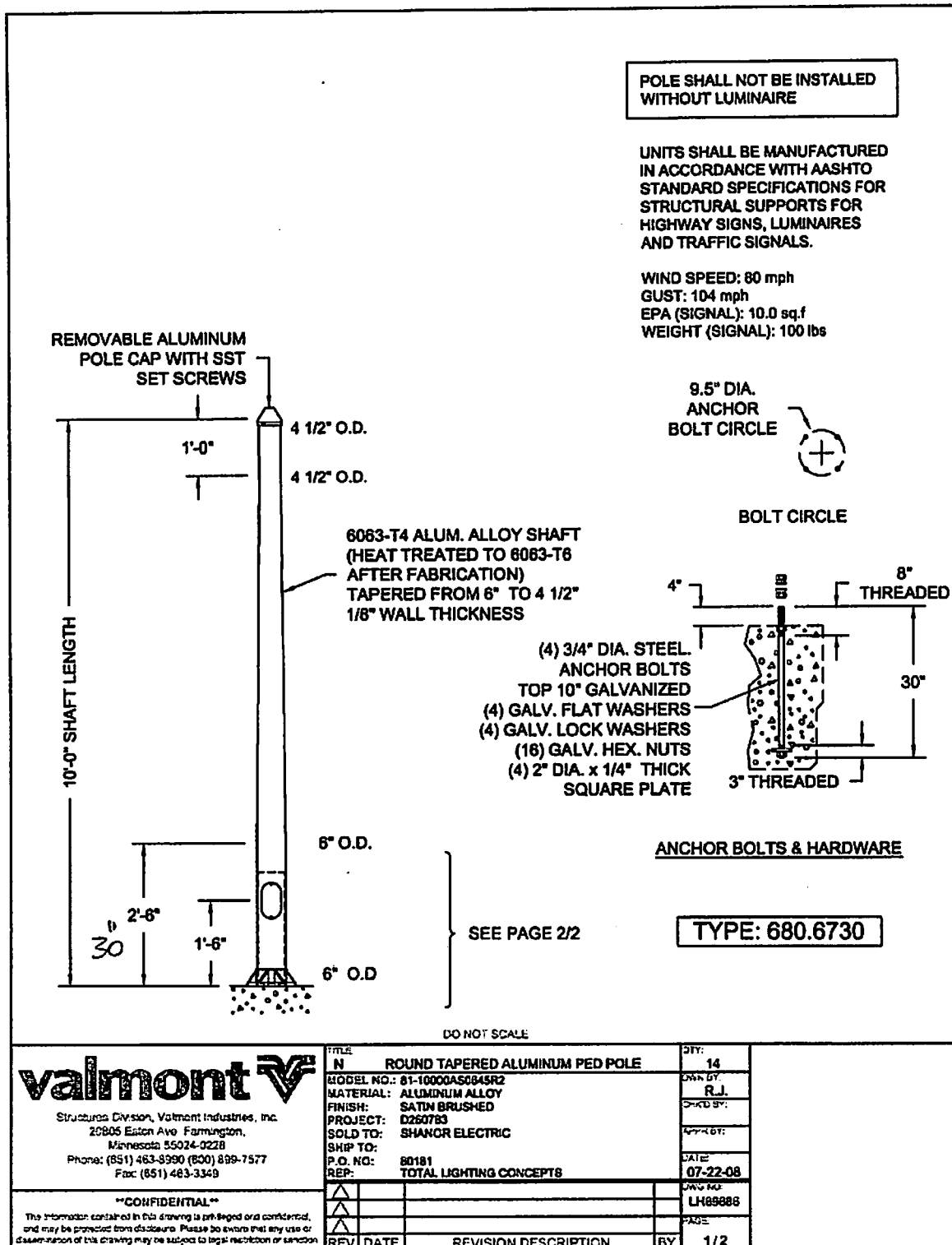


Figure 20. Aluminum Pedestrian Pole Details

Enclosure 1

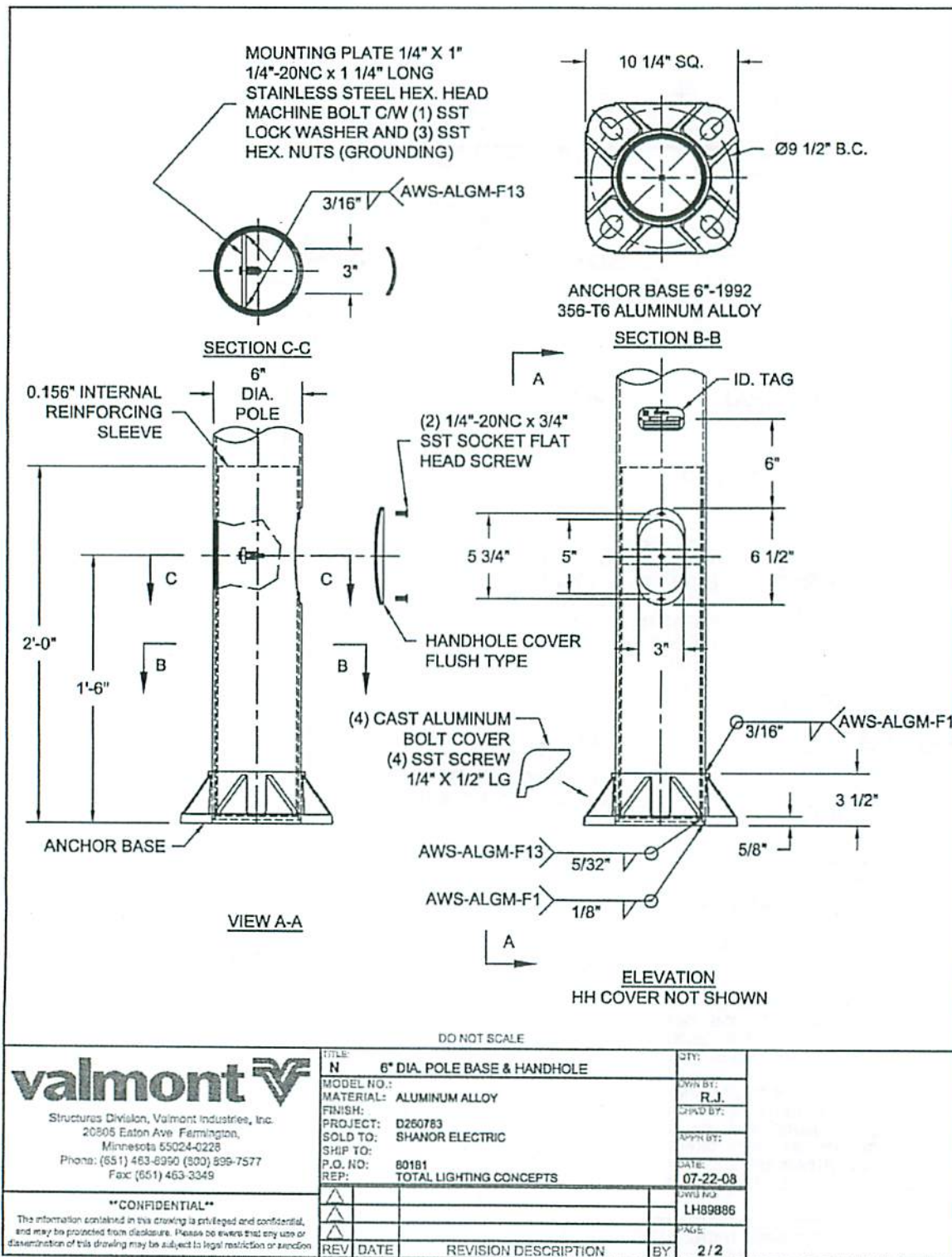


Figure 21. Aluminum Pedestrian Pole Base Details

Enclosure 2

STATE OF NEW YORK DEPARTMENT OF TRANSPORTATION	
U.S. CUSTOMER STANDARD SHEET	
PEDESTRIAN SIGNALS AND FLASHING BEACON INSTALLATION DETAILS	
PROJECT NO. 680-10	REVISION NO. 02-01-01
EFFECTIVE DATE: 01/06/09	
DESIGNED BY: [Signature]	
CHECKED BY: [Signature]	

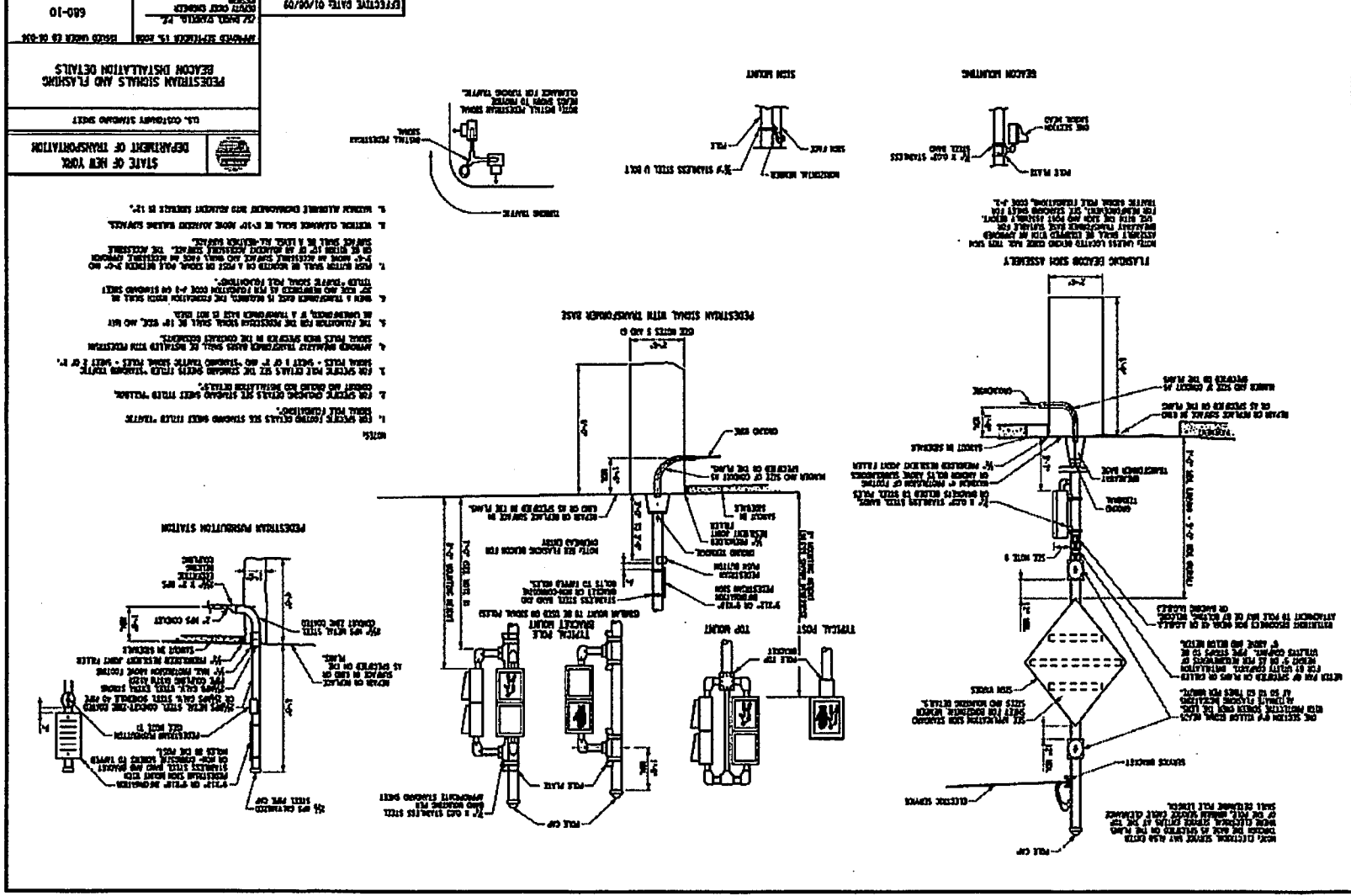
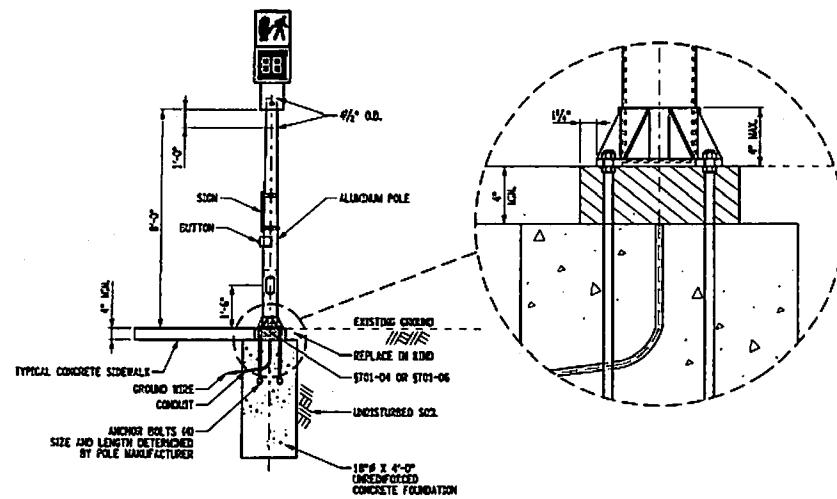
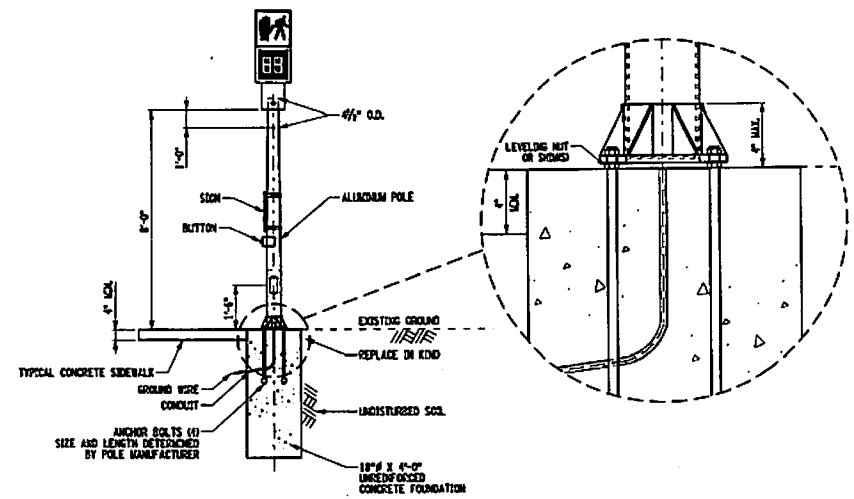


Figure 22. Pedestrian Signal Installation Details

PROPOSED INSTALLATION DETAILS OF BREAK-AWAY ALUMINUM PEDESTRIAN SIGNAL POLE



ROUND TAPERED ALUMINUM PED POLE
OPTION 1

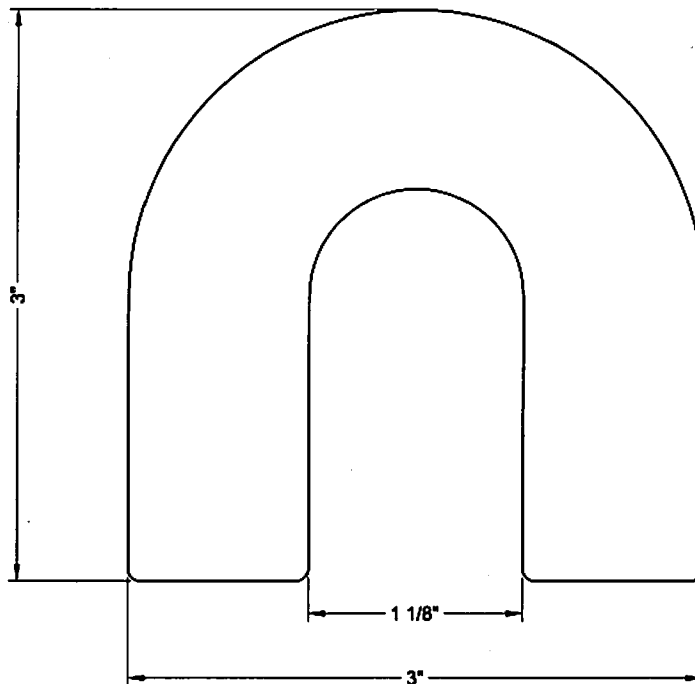
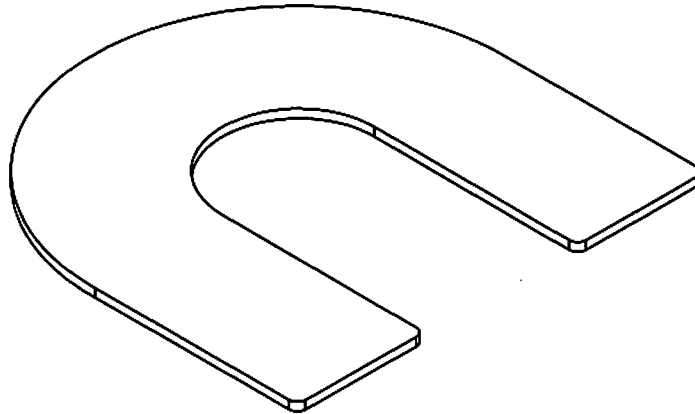


ROUND TAPERED ALUMINUM PED POLE
OPTION 2

FILE NAME = ROUND TAPERED ALUM PED POLE.dgn
DATE/TIME = 11/15/2005 14:25
USER = jgarry



STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION



ALUMINUM SHEET
SHIM (6061-T6 ALLOY)

AVAILABLE
THICKNESSES:

0.031"
0.040"
0.063"
0.090"
0.125"

DO NOT SCALE

valmont 

Valmont Industries, Inc. Structures Division
20805 Eaton Ave Farmington, Minnesota 55024-7932
Phone: (651) 463-8990 (800) 899-7577
Fax: (651) 463-3349

TITLE:
S ALUM. SHIMS FOR 0.75" ANCHOR BOLTS

MODEL NO.:
MATERIAL: ALUMINUM ALLOY
FINISH:
PROJECT:
SOLD TO:
SHIP TO:
P.O. NO:
REP:

QTY:
OWN BY:
CHK'D BY:
APPR BY:
DATE:
11-03-10

DWG NO:

PAGE:

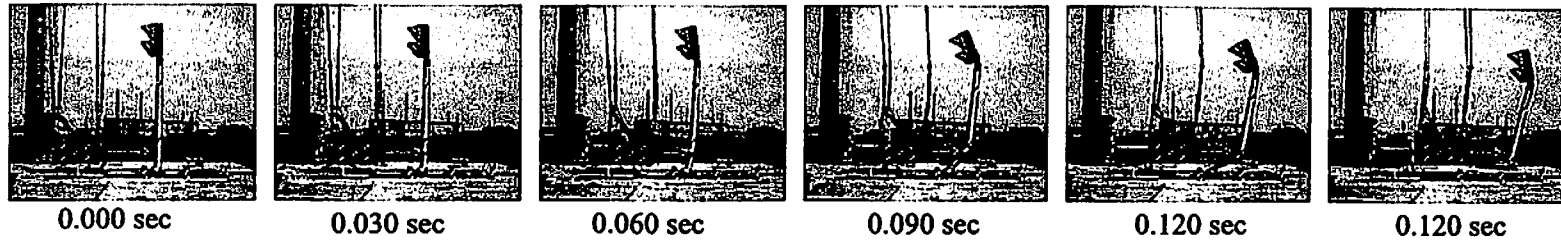
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****CONFIDENTIAL****

The information contained in this drawing is privileged and confidential, and may be protected from disclosure. Please be aware that any use or dissemination of this drawing may be subject to legal restriction or sanction.

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REV	DATE	REVISION DESCRIPTION		BY

Enclosure 5



- Test Agency MwRSF
- Test Facility Valmont-MwRSF/UNL Pendulum
- Test Number NYPP-1
- Date 9/2/2009
- NCHRP Report No. 350 Test Designation No. 3-60
- Test Article Pedestrian "Hand/Man" Signal Pole
- Key Component – Tapered Aluminum Pole
 - Height 7 ft – 8 in. (2.3 m)
 - Bottom Diameter 6 in. (152 mm)
 - Thickness ½ in. (3 mm)
 - Bolt Circle Diameter 9½ in. (241 mm)
- Key Component – Base Plate Assembly
 - Length 10¼ in. (260 mm)
 - Width 10¼ in. (260 mm)
 - Thickness ¾ in. (16 mm)
 - Bolt Circle Diameter 9½ in. (241 mm)
- Key Component – Internal Reinforcing Sleeve
 - Length 24 in. (610 mm)
 - Thickness 5/32 in. (4 mm)
 - Position Base of Pole
- Key Component – Pedestrian Signal
 - Type "Hand/Man" Signal
 - Mount Position Top of Pole
 - Height to Bottom of Signal 8 ft (2.4 m)
- Total Installation Mass 59 lb (27 kg)
 - Pole 33 lb (15 kg)
 - Signal & Bracket 26 lb (12 kg)

- Total Installation Height 10 ft – 3 in. (3.1 m)
- Surrogate Vehicle Pendulum
 - Mass 1,898 lb (861 kg)
 - Impact Head Crushable Nose
- Impact Conditions
 - Speed 22.0 mph (35.4 km/h)
 - Angle 0 deg.
 - Impact Height 17½ in. (445 mm)
- Test Article Damage Moderate
 - Pole Broke Away From Base Plate Assembly
- Stub Height 4½ in. (114 mm)

- Transducer Data (lost contact with pole before t*)

Evaluation Criteria	Transducer		NCHRP Report No. 350 Limit
	EDR-3	EDR-4	
Longitudinal OIV ft/s (m/s)	NA (no occupant contact)	NA (no occupant contact)	≤ 16.4 ft/s (5.0)
Longitudinal ORA g's	NA (no occupant contact)	NA (no occupant contact)	≤ 20 g's
Max. Vehicle ΔV ft/s (m/s)	14.99 (4.57)	13.91 (4.24)	≤ 16.4 ft/s (5.0)
ASI	0.73	0.67	not required

Figure 30. Summary of Test Results and Sequential Photographs, Test No. NYPP-1