pennsylvania
DEPARTMENT OF TRANSPORTATION
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MEMO

470-09-3

DATE: February 9, 2009

SUBJECT: Traffic Signal Supports
Supplemental Installation and Inspection Procedures

TO: All District Executives

FROM: Richard H. Hogg, P.E. /s/
Deputy Secretary for Highway Administration

This strike-off letter is anticipated to result in minimal time and resource allocations from the Engineering Districts.

Recently, a traffic signal support that spanned three lanes of traffic along US 30 failed and collapsed. The loading (signs and signal heads) on the mast arm was less than the maximum allowable loading indicated in PennDOT Publication 148 "Traffic Standards – Signals (TC-7800 Series)" and Publication 149 "Traffic Signal Design Handbook."

An investigation and testing conducted by the Bureau of Construction and Materials of this recent traffic signal support failure indicated that the anchor bolts failed as the result of fatigue-induced crack initiation and growth. Additional traffic signal supports in the vicinity of the failed support were inspected and were found to have several discrepancies requiring investigation and/or correction.

Therefore, in an effort to proactively identify, evaluate, and correct issues that may otherwise contribute to a structural failure on existing or future traffic signal supports (including mast arm and strain pole installations), the attached supplemental installation and inspection procedures shall be followed immediately.

Attachment A applies when installing new traffic signal supports. Attachment B applies when inspecting new traffic signal support installations. Attachment B is also to be utilized when Engineering District personnel inspect traffic signal installations in conjunction with the initial traffic signal turn-on, the 30-day test described in Section 950.3 of PennDOT Publication 408 "Specifications," and when municipalities conduct recommended annual routine signal maintenance and inspection activities. These procedures will be incorporated into the next updates to PennDOT Publication 191 "Guidelines for the Maintenance of Traffic Signal Systems" and Publication 408 "Specifications."

The Bureau of Construction and Materials and the Bureau of Highway Safety and Traffic Engineering are working with the Bureau of Municipal Services to develop a uniform package of information on the material covered in this strike-off letter that will be distributed directly to each municipality that owns a traffic signal so that the information can be further disseminated to municipal engineers, contractors, and other key personnel. This municipal outreach information will also be shared with the Engineering Districts.

Questions concerning initial construction installation should be referred to Tucker Ferguson, P.E., Director, Bureau of Construction and Materials at (717) 787-6989. Questions regarding traffic signal support standards, specifications, and maintenance should be referred to Glenn C. Rowe, P.E., PTOE, Acting Director, Bureau of Highway Safety and Traffic Engineering at (717) 787-7350.

Attachments

4700/DPF(3-0333)/lap(7-3620)

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ATTACHMENT A

Supplemental Installation Procedures for Traffic Signal Supports*

Pre-Installation

1. Verify that the traffic signal supports were inspected at the fabrication plant in accordance with Section 1104.01 of PennDOT Publication 408 "Specifications." Structures inspected during fabrication are stamped (accepted) by one of several PennDOT authorized consultant inspection agencies. Use of approved fabricators ensures that traffic signal supports are produced in accordance with the approved shop drawings, correct weld procedures are followed, etc.

2. Verify that anchor bolts, high-strength bolts, nuts, and washers are from approved producers listed in PennDOT Publication 35 (Bulletin 15) "Approved Construction Materials." Materials from non-approved sources of supply cannot be used. Use of non-approved materials may result in loss of tension, corrosion, and other unacceptable outcomes.

Bolt Installations and Testing

1. Arm to shaft or column connection using high-strength bolts.

    a. High-strength bolts, nuts, and washers used must be verified via rotational capacity testing as indicated in Pennsylvania Testing Method 427 (PTM 427) found in PennDOT Publication 19 "Field Test Manual."

    b. Install bolt assemblies as specified in Section 1050.3(c)7 'Connections Using High-Strength Bolts' of PennDOT Publication 408 "Specifications."

    c. Following installation, inspection verification must be performed in accordance with Pennsylvania Testing Method 429 (PTM 429) found in PennDOT Publication 19 "Field Test Manual."

2. Foundation and base plate connection using anchor bolts.

    a. Base plate anchor bolts, nuts, and washers must be installed and tightened either in accordance with the method described for overhead sign structures in Section 948 of PennDOT Publication 408 "Specifications" or in accordance with the method described in the American Association of State Highway and Transportation Officials'(AASHTO) "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals," Section 5.17.6.2 'Anchor Pretensioning.'

    b. Both methods are similar turn-of-the-nut procedures.

    c. Ensure that the distance between the bottom of each leveling nut and the concrete foundation is less than the bolt diameter, unless indicated

** Addresses structural issues only. Does not address signage, signal heads, electrical, pavement markings, detectors, and other components.*

otherwise on the approved design drawings for the traffic signal support. Note that, if the distance is not less than the bolt diameter, AASHTO's "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals" requires that the bending stresses in the anchor bolts be considered when determining the structural adequacy of the installation.

d. The referenced AASHTO specification is available on PennDOT's intranet via a license agreement with Information Handling Services (IHS).

** Addresses structural issues only. Does not address signage, signal heads, electrical, pavement markings, detectors, and other components.*

ATTACHMENT B

Supplemental Inspection Procedures for Traffic Signal Supports*

The following applies:

- *when inspecting new traffic signal support installations.*
- *when inspecting traffic signal installations in conjunction with the initial signal turn-on and the 30-day test.*
- *when municipalities conduct recommended annual routine traffic signal maintenance and inspection activities.*

Visually Examine the Following Welded and Bolted Connections As Indicated:

Welded Connections

1. Inspect 100% of all welds for visual evidence of cracking.

    a. Cracks on traffic signal supports with mast arms may occur in the vertical column to base plate connection and generally initiate opposite the arm to shaft connection (about 180° from the centerline of the arm for single-arm structures). For strain pole installations, cracks in the shaft or column to base plate connection usually initiate opposite the span wire connections.

    b. For traffic signal supports with mast arms, cracks in the welded connection between the arm or column connection plates usually initiate at the uppermost (12-o'clock) or lowermost (6-o'clock) positions of the connections due to the dead load and oscillation (galloping) caused by wind loads.

2. Document and **immediately** report any evidence of weld metal or base metal cracking to the owner of the traffic signal installation for further investigation. **Immediate action** shall be taken by the traffic signal owner if such cracks are observed.

Bolted Connections

1. Inspect arm to column connections.

    a. Ensure that a washer is used between the connection or flange plate and each nut.

    b. Visually examine the connection. The connection should be tight with no visible gap between the connection or flange plates, bolts, nuts, or washers.

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c. Galvanized nuts, bolts, and washers should not show any significant signs of corrosion.

d. Document and **immediately** report any adverse findings to the owner of the traffic signal installation for further investigation. **Immediate action** shall be taken by the traffic signal owner if adverse findings are observed.

e. Where bolted connections require remedial corrective action, new bolts, washers, and nuts must be used.

2. Inspect the foundation and base plate connection.

a. Remove the grout or rodent screening under the base plate.

b. Remove any debris.

c. Examine the anchor bolts, under the base plate, for signs of bending, cracking, etc.

d. Ensure that leveling nuts are in a snug-tight condition with the bottom of the base plate. Snug-tight is defined as the full force of a man on a 12-inch wrench.

e. Ensure that the distance between the bottom of each leveling nut and the concrete foundation is less than the bolt diameter, unless indicated otherwise on the approved design drawings for the traffic signal support. Note that, if the distance is not less than the bolt diameter, the American Association of State Highway and Transportation Officials' (AASHTO) "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals" requires that the bending stresses in the anchor bolts be considered when determining the structural adequacy of the installation.

f. Replace the grout or rodent screen.

g. Ensure that a hardened washer is present under each top nut.

h. Verify that the top nuts are tight. Remove, lubricate, and retighten any loose nuts using the method described for overhead sign structures in Section 948 of PennDOT Publication 408 "Specifications" or the method described in AASHTO's "Standard Specification for Structural Supports for Highway Signs, Luminaires, and Traffic Signals," Section 5.17.6.2 'Anchor Pretensioning.'

   (1) Both methods are similar turn-of-the-nut procedures.

   (2) The referenced AASHTO specification is available on PennDOT's intranet via a license agreement with Information Handling Services (IHS).

i. Where sufficient anchor bolt stick-out exists, install an additional top nut.

j. Gall the threads above the top nut to prevent loosening.

k. Document findings and corrective action taken. **Immediately** notify the owner of the traffic signal installation where bolt tightening was required or where any other adverse findings occurred. **Immediate action** shall be taken by the traffic signal owner if adverse findings are observed. Improper initial installations and loose anchor bolts can initiate cracks in anchor bolts not visible during inspections. Additional non-destructive testing of the anchor bolt may be warranted at the discretion of the owner of the traffic signal installation.