

## Design Memorandum

TO: All Design Section Staff  
FROM: Bijan Khaleghi  
DATE: April 19, 2011  
SUBJECT: Fatigue Design Categories For Pole Structures

This memorandum is intended to clarify applicable Fatigue Design Categories for WSDOT pole structures. Two recent fatigue-related failures of high-mast luminaire structures in other states have justified the updating of WSDOT policy to clarify Fatigue Design Categories, and to more closely conform to the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals (Fifth Edition 2009).

WSDOT BDM 10.1.1F, paragraphs two, three and four, are revised to read:

Fatigue Category I for overhead cantilever sign structures (maximum span of 30 ft. and no VMS installation), high level (high mast) lighting poles 100 ft. or taller in height, bridge-mounted sign brackets, and all signal bridges.

Fatigue Category II for high level (high mast) lighting poles between 51 ft. and 99 ft. in height.

Fatigue Category III for lighting poles 50 ft. or less in height with rectangular, square or non-tapered round cross sections, and overhead cantilever traffic signals at intersections (maximum cantilever length 65 ft.). If vehicle speeds are posted at 45 mph or greater, then overhead cantilever traffic signal structures shall be designed for Fatigue Category I.

A new paragraph is added after paragraph four, and shall read:

Sign bridges, cantilever sign structures, signal bridges, and overhead cantilever traffic signals mounted on bridges shall be either attached to substructure elements (e.g. crossbeam extensions) or to the bridge superstructure at pier locations. Mounting these features to bridges as described above will help to avoid resonance concerns between the bridge structure and the signing or signal structure.

Background:

AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals 5<sup>th</sup> Edition 2009 recommends Fatigue Category I for the tallest high mast luminaire installations (those in excess of 100 ft.). Recent fatigue-related

failures of high mast luminaires in Iowa and Pennsylvania have highlighted the need to update WSDOT's fatigue design criteria. Additional description for Fatigue Categories II and III has been added to formalize current design practice in the WSDOT Bridge Office. Resonance issues with lighting structures mounted on bridge decks have contributed to two recent failures (Everett Design Build Project and Lewis and Clark Illumination Rehabilitation Project). Requirements supplied in the new paragraph provided above will help to eliminate any future fatigue-related failures of pole structures mounted on bridges.

If you have any questions regarding these issues, please contact Richard Zeldenrust at 360-705-7196 or Gary Bedi at 360-705-7443.

cc: Mark Gaines, Bridge Construction - 47354  
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## Revised WSDOT BDM 10.1.1F

### F. Fatigue Design:

Fatigue design shall conform to AASHTO Section 11. Fatigue Categories are listed in Table 11-1. Cantilever structures, poles, and bridge mounted sign brackets shall conform to the following fatigue categories.

Fatigue Category I for overhead cantilever sign structures (maximum span of 30 ft. and no VMS installation), high level (high mast) lighting poles 100 ft. or taller in height, bridge-mounted sign brackets, and all signal bridges.

Fatigue Category II for high level (high mast) lighting poles between 51 ft. and 99 ft. in height.

Fatigue Category III for lighting poles 50 ft. or less in height with rectangular, square or non-tapered round cross sections, and overhead cantilever traffic signals at intersections (maximum cantilever length 65 ft.). If vehicle speeds are posted at 45 mph or greater, then overhead cantilever traffic signal structures shall be designed for Fatigue Category I.

Sign bridges, cantilever sign structures, signal bridges, and overhead cantilever traffic signals mounted on bridges shall be either attached to substructure elements (e.g. crossbeam extensions) or to the bridge superstructure at pier locations. Mounting these features to bridges as described above will help to avoid resonance concerns between the bridge structure and the signing or signal structure.

The "XYZ" limitation shown in Table 10.1.4-2 shall be met for Monotube Cantilevers. The "XYZ" limitation consists of the product of the sign area (XY) and the arm from the centerline of the posts to the centerline of the sign (Z). See Appendix 10.1-A2-1 for details.