

AMERICAN ASSOCIATION OF
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AASHTO
THE VOICE OF TRANSPORTATION

Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals



Sixth Edition 2013

Foreword

The sixth edition of *Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals* supersedes the fifth edition and its 2010 and 2011 interims. It includes changes approved by the Highways Subcommittee on Bridges and Structures in 2012.

Design guidelines for fatigue-critical multisided tubular sections are included in Section 5, “Steel Design.” Additional guidance is provided on longitudinal seam welds, tube-to-transverse plate connection welds, anchor bolt installation, and stiffened connections. New figures for fillet-welded gusseted box connections and ring-stiffened box connections are provided as commentary. Section 5 also includes updates to hand-hole welds, weld inspection, and provides new figures for holes and cutouts.

The scope of Section 11, “Fatigue Design,” is expanded to allow design of support structures using nominal stress-based classifications of typical connection details, or using the alternate local stress-based and/or experiment-based methodologies presented in Appendix D. New tables are provided for determining the fatigue resistance of typical connection details in support structures for finite and infinite life designs. The scope of Section 11 is expanded to include separate provisions for high-mast lighting towers, including a combined wind load for a simplified approach to derive fatigue damage from all the load effects due to natural wind.

The Specifications are based on the allowable stress design methodology and are intended to address the usual structural supports. Requirements more stringent than those in the Specifications may be appropriate for atypical structural supports. The commentary is intended to provide background on some of the considerations contained in the Specifications; however it does not provide a complete historical background, nor detailed discussions of the associated research studies. The Specifications and accompanying commentary do not replace sound engineering knowledge and judgment.

AASHTO Highways Subcommittee on Bridges and Structures

Preface

The sixth edition of *Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals* supersedes the fifth edition and its 2010 and 2011 interims. It includes changes approved by the Highways Subcommittee on Bridges and Structures in 2012.

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SECTION 1

INTRODUCTION

1.1—SCOPE

The provisions of these *Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals*, hereinafter referred to as the Specifications, are applicable to the structural design of supports for highway signs, luminaires, and traffic signals. The types of supports covered in these Specifications are discussed in Article 1.4. The Specifications are intended to serve as a standard and guide for the design, fabrication, and erection of these types of supports.

These Specifications are not intended to supplant proper training or the exercise of judgment by the designer, and they include only the minimum requirements necessary to provide for public safety. The Owner or the designer may require the design and quality of materials and construction to be higher than the minimum requirements.

The commentary directs attention to other documents that provide suggestions for carrying out the requirements and intent of these Specifications. However, those documents and the commentary are not intended to be a part of the Specifications.

C1.1

These Specifications are the result of National Cooperative Highway Research Program (NCHRP) Project 17-10 and the corresponding NCHRP Report 411. At the discretion of the Owner, proprietary solutions may be considered. These solutions may address both new structures and the repair or rehabilitation of existing structures. Testing of proprietary solutions shall model actual conditions as closely as possible, and the test methods and results shall be published. These Specifications are intended to replace the previous edition, *Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals* (2009).

The commentary discusses some provisions of the Specifications with emphasis given to the explanation of new or revised provisions that may be unfamiliar to users of the Specifications. The commentary is not intended to provide a complete historical background concerning the development of this and previous Specifications, nor is it intended to provide a detailed summary of the studies and research data reviewed in formulating the provisions of the Specifications. However, references to some of the research data are provided for those who wish to study the background material in depth.

1.2—DEFINITIONS

Arm—A cantilevered support, either horizontal or sloped.

Bridge Support—Also known as span-type support; a horizontal or sloped member or truss supported by at least two vertical supports.

Cantilever—A support, either horizontal or vertical, supported at one end only.

Designer—The person responsible for design of the structural support.

High-Level Luminaire Support—Truss-type or pole-type tower that provides lighting at heights greater than about 17 m (55 ft), typically using 4 to 12 luminaires.

High-Mast Lighting Tower (HMLT)—Another description for a pole-type high-level luminaire support.

Luminaire—A complete lighting unit consisting of a lamp or lamps together with the parts designed to distribute the light, to position and protect the lamps, and to connect the lamps to the electric power supply.

Mast Arm—A supporting arm designed to hold a sign, signal head, or luminaire in an approximately horizontal position.

Monotube—A support that is composed of a single tube.

Overhead Sign—A sign suspended above the roadway.

Owner—The person or agency having jurisdiction for the design, construction, and maintenance of the structural support.

Pole—A vertical support that is long, relatively slender, and generally rounded or multisided.

Pole Top—A descriptive term indicating that an attachment is mounted at the top of a structural support, usually pertaining to one luminaire or traffic signal mounted at the top of a pole.

Roadside Sign—A sign mounted beside the roadway on a single support or multiple supports.

Sign—A device conveying a specific message by means of words or symbols, erected for the purpose of regulating, warning, or guiding traffic.

Span Wire—A steel cable or strand extended between two poles, commonly used as a horizontal support for small signs and traffic signals.

Structural Support—Support designed to carry the loads induced by attached signs, luminaires, and traffic signals.

Traffic Signal—An electrically operated traffic control device by which traffic is regulated, warned, or directed to take specific actions.

Truss—A structural support, usually vertical or horizontal, composed of framework that is often arranged in triangles.

1.3—APPLICABLE SPECIFICATIONS

The following specification documents may be referenced for additional information on design, materials, fabrication, and construction:

- *Standard Specifications for Highway Bridges,*
- *AASHTO LRFD Bridge Design Specifications,*
- *Standard Specifications for Transportation Materials and Methods of Sampling and Testing,* and
- *Book of ASTM Standards.*

1.4—TYPES OF STRUCTURAL SUPPORTS

Structural supports are categorized as follows:

- Sign support structures,
- Luminaire support structures,
- Traffic signal support structures, and
- A combination of these structures.

1.4.1—Sign

Structural supports for signs include both overhead and roadside sign structures that are intended to support highway traffic signs and markers.

C1.4.1

Typical overhead and roadside sign supports are shown in Figure C1.4.1-1. Overhead sign structures are generally of the bridge or cantilever type. It is also common to support signs on existing grade separation structures that span the traffic lanes.

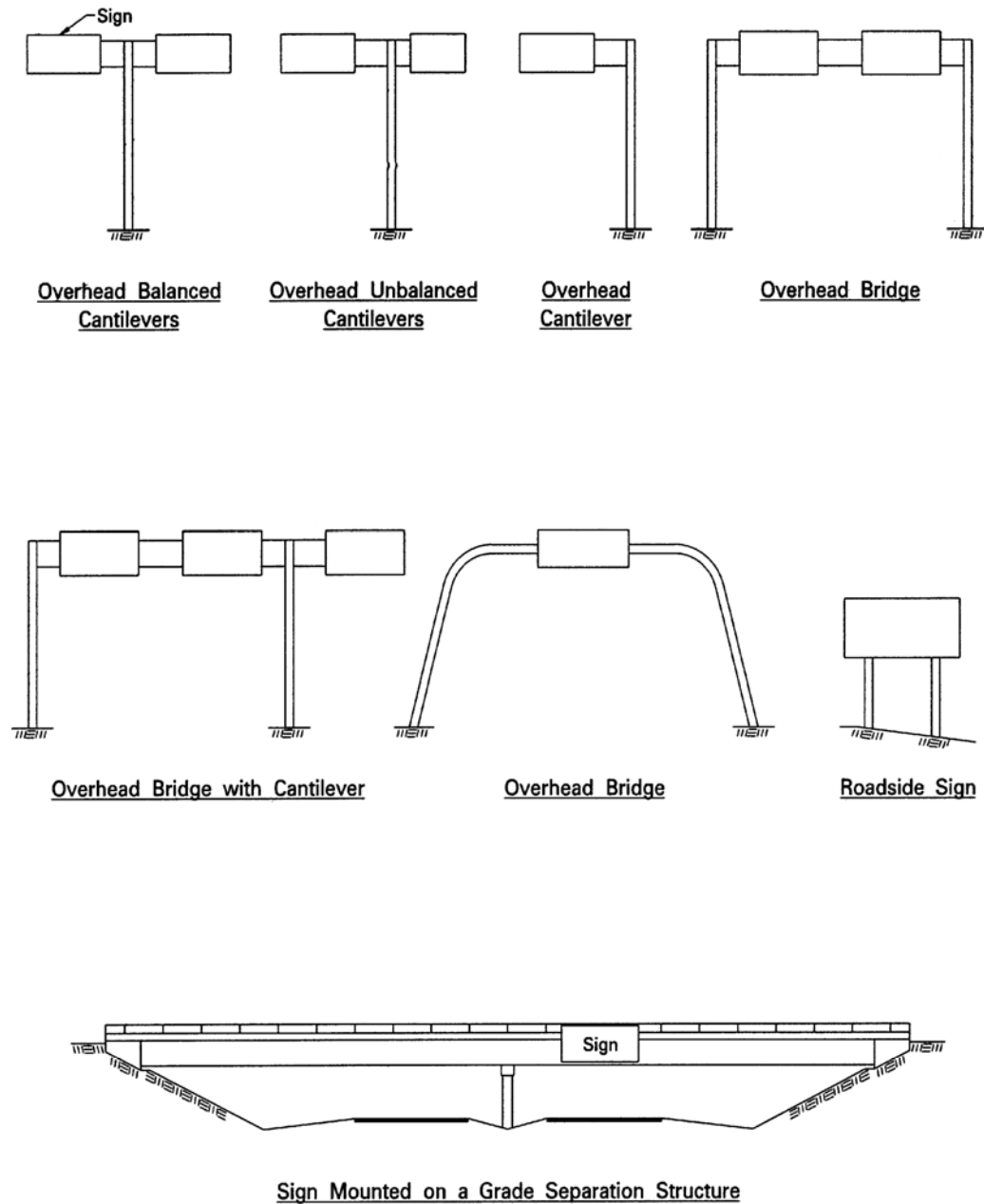


Figure C1.4.1-1—Sign Supports

1.4.2—Luminaire

Structural supports for luminaires include typical poles with luminaire arms, typical poles with luminaires mounted at pole top, and high-level luminaire supports (both truss type and pole type).

C1.4.2

The lighting of modern highways includes the use of typical lighting poles, generally tubular shafts that support one or two luminaires and range in height from about 9 m (30 ft) to 17 m (55 ft). High-level luminaire supports normally range in heights from about 17 m (55 ft) to 46 m (150 ft) or more, usually supporting 4 to 12 luminaires; they are used to illuminate large areas. Typical luminaire supports and high-level luminaire supports are shown in Figure C1.4.2-1.

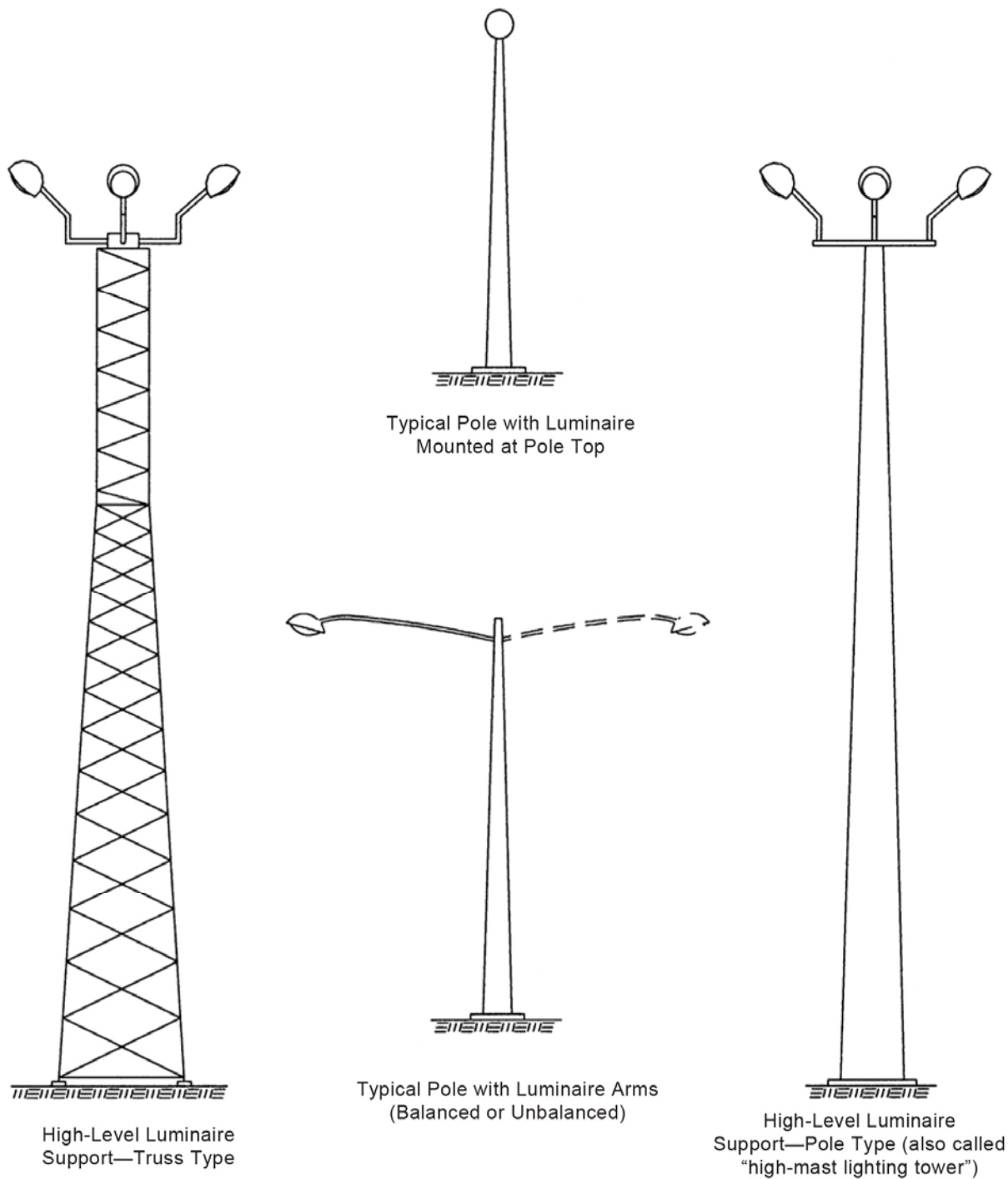


Figure C1.4.2-1—Luminaire Structural Supports

1.4.3—Traffic Signal**C1.4.3**

Structural supports for mounting traffic signals include pole top, cantilevered arms, bridge, and span wires.

Typical traffic signal supports are shown in Figure C1.4.3-1.

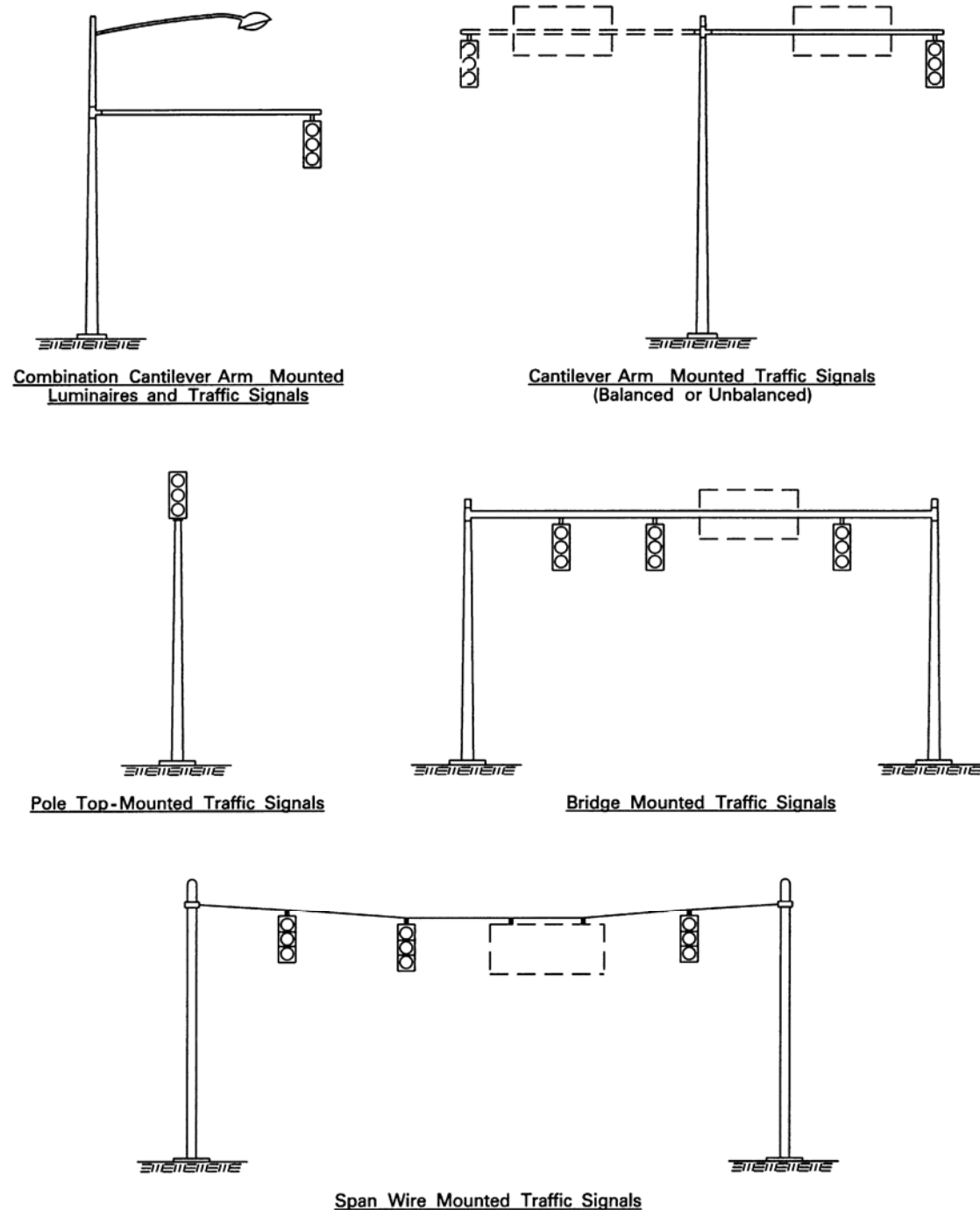


Figure C1.4.3-1—Traffic Signal Structural Supports

1.4.4—Combination Structures

Combination structures include structural supports that combine any of the functions described in Articles 1.4.1, 1.4.2, and 1.4.3.

C1.4.4

Generally, combination structures are composed of a luminaire support and a traffic signal support. Other structures may combine traffic signal or luminaire supports with those for utility lines.

1.5—REFERENCES

AASHTO. 2002. *AASHTO Standard Specifications for Highway Bridges*, 17th Edition, HB-17. American Association of State Highway and Transportation Officials, Washington, DC.

AASHTO. 2009. *AASHTO Transportation Glossary*, 4th Edition. American Association of State Highway and Transportation Officials, Washington, DC.

AASHTO. 2009. *Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals*, Fifth Edition, with 2010 and 2011 Interims. American Association of State Highway and Transportation Officials. Washington, DC.

AASHTO. 2012. *AASHTO LRFD Bridge Design Specifications*, Sixth Edition, LRFDUS-6. American Association of State Highway and Transportation Officials, Washington, DC.

AASHTO. 2012. *Standard Specifications for Transportation Materials and Methods of Sampling and Testing*. 32nd Edition, HM-32. American Association of State Highway and Transportation Officials, Washington, DC.

ASTM. 2012. *Book of ASTM Standards*. American Society for Testing and Materials, West Conshohocken, PA.

Fouad, F. H., E. A. Calvert, and E. Nunez. 1998. *Structural Supports for Highway Signs, Luminaires, and Traffic Signals*, NCHRP Report 411. Transportation Research Board, National Research Council, Washington, DC.

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INSTRUCTIONS AND INFORMATION

General

AASHTO has issued proposed interim revisions to *Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals*, Sixth Edition (2013). This packet contains the revised pages. They are not designed to replace the corresponding pages in the book but rather to be kept with the book for fast reference.

Affected Articles

Underlined text indicates revisions that were approved in 2014 by the AASHTO Highways Subcommittee on Bridges and Structures. ~~Strikethrough text~~ indicates any deletions that were likewise approved by the Subcommittee. A list of affected articles is included below.

All interim pages are printed on pink paper to make the changes stand out when inserted in the second edition binder. They also have a page header displaying the section number affected and the interim publication year. Please note that these pages may also contain nontechnical (i.e., editorial) changes made by AASHTO publications staff; any changes of this type will not be marked in any way so as not to distract the reader from the technical changes.

Please note that in response to user concerns, page breaks are now being added within sections between noncontiguous articles. This change makes it an option to insert the changes closer to the affected articles.

2015 Changed Articles

SECTION 5: STEEL DESIGN

5.14.6.1
5.14.6.2
C5.15.2
5.15.5
C5.15.5

SECTION 11: FATIGUE DESIGN

11.7.2
11.9.3.1

INSTRUCTIONS AND INFORMATION

General

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Affected Articles

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Please note that in response to user concerns, page breaks are now being added within sections between noncontiguous articles. This change makes it an option to insert the changes closer to the affected articles.

2019 Changed Articles

SECTION 5: STEEL DESIGN

5.14.6.1
5.14.6.2
5.14.7
C5.14.7

SECTION 11: FATIGUE DESIGN

11.9.2

INSTRUCTIONS AND INFORMATION

General

AASHTO has issued proposed interim revisions to *Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals*, Sixth Edition (2013). This packet contains the revised pages. They are not designed to replace the corresponding pages in the book, but rather to be kept with the book for fast reference.

Affected Articles

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2020 Changed Articles

SECTION 5: STEEL DESIGN

5.15.5

C5.15.5

2022 INTERIM REVISIONS INSTRUCTIONS AND INFORMATION

General

AASHTO has issued proposed interim revisions to the *Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals*, Sixth Edition (2013). This packet contains the revised pages. They are not designed to replace the corresponding pages in the book, but rather to be kept with the book for fast reference.

Affected Articles

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All interim pages are displayed on a green background to make the changes stand out when inserted in the sixth edition binder, and to differentiate them from earlier interims. They also have a page header displaying the interim publication year. Please note that these pages may also contain nontechnical (i.e., editorial) changes made by AASHTO publications staff; any changes of this type will not be marked in any way so as not to distract the reader from the technical changes.

2022 Changed Articles

SECTION 6: ALUMINUM DESIGN

Section has been replaced in its entirety.

APPENDIX D: ALTERNATE METHODS FOR FATIGUE DESIGN

D.1

SECTION 6: ALUMINUM DESIGN

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2025 INTERIM REVISIONS INSTRUCTIONS AND INFORMATION

General

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2025 Changed Articles

SECTION 1: INTRODUCTION

1.2

SECTION 2: GENERAL FEATURES OF DESIGN

2.4.2.4

C2.4.2.4

SECTION 3: LOADS

C3.8.6

Table 3.8.6-1

3.10

SECTION 5: STEEL DESIGN

5.14.3

Table 5.14.3-1

C5.14.3

Figure C5.14.3-1

SECTION 11: FATIGUE DESIGN

Table 11.9.3.1-1