



AASHTO
LRFD Bridge Construction Specifications
3rd Edition • 2010



**American Association of State
Highway and Transportation Officials**



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ABBREVIATED TABLE OF CONTENTS

The *AASHTO LRFD Bridge Construction Specifications*, Third Edition, contains the following 32 sections:

1. Structure Excavation and Backfill
2. Removal of Existing Structures
3. Temporary Works
4. Driven Foundation Piles
5. Drilled Shafts
6. Ground Anchors
7. Earth-Retaining Systems
8. Concrete Structures
9. Reinforcing Steel
10. Prestressing
11. Steel Structures
12. Steel Grid Flooring
13. Painting
14. Stone Masonry
15. Concrete Block and Brick Masonry
16. Timber Structures
17. Preservative Treatment of Wood
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25. Steel and Concrete Tunnel Liners
26. Metal Culverts
27. Concrete Culverts
28. Wearing Surfaces
29. Embedment Anchors
30. Thermoplastic Pipe
31. Aluminum Structures
32. Shock Transmission Units

FOREWORD

The first broadly recognized national standard to design and construct bridges in the United States was published in 1931 by the American Association of State Highway Officials (AASHO), the predecessor to AASHTO. With the advent of the automobile and the establishment of highway departments in all of the American states dating back to just before the turn of the century, the design, construction, and maintenance of most U.S. bridges was the responsibility of these departments and, more specifically, the chief bridge engineer within each department. It was natural, therefore, that these engineers, acting collectively as the AASHTO Highways Subcommittee on Bridges and Structures, would become the author and guardian of this first bridge standard.

This first publication was entitled *Standard Specifications for Highway Bridges and Incidental Structures*. It quickly became the *de facto* national standard and, as such, was adopted and used by not only the state highway departments but also other bridge-owning authorities and agencies in the United States and abroad. The title was soon revised to *Standard Specifications for Highway Bridges* and new editions were released about every four years. AASHTO released the 17th and final edition in 2002.

The body of knowledge related to the design of highway bridges has grown enormously since 1931 and continues to do so. Theory and practice have evolved greatly, reflecting advances through research in understanding the properties of materials, in improved materials, in more rational and accurate analysis of structural behavior, in the advent of computers and rapidly advancing computer technology, in the study of external events representing particular hazards to bridges such as seismic events and stream scour, and in many other areas. The pace of advances in these areas has accelerated in recent years. To accommodate this growth in bridge engineering knowledge, the Subcommittee on Bridges and Structures has been granted authority under AASHTO's governing documents to approve and issue Bridge Interims each year, not only with respect to the Standard Specifications but also to enhance the twenty-odd additional publications on bridges and structures engineering that are under its stewardship.

In 1986, the Subcommittee submitted a request to the AASHTO Standing Committee on Research to assess U.S. bridge design specifications, to review foreign design specifications and codes, to consider design philosophies alternative to those underlying the Standard Specifications, and to render recommendations based on these investigations. This work was accomplished under the National Cooperative Highway Research Program (NCHRP), an applied research program directed by the AASHTO Standing Committee on Research and administered on behalf of AASHTO by the Transportation Research Board (TRB). The work was completed in 1987, and, as might be expected with continuing research, the Standard Specifications were found to have discernible gaps, inconsistencies, and even some conflicts. Beyond this, the specification did not reflect or incorporate the most recently developing design philosophy, load-and-resistance factor design (LRFD), a philosophy which has been gaining ground in other areas of structural engineering and in other parts of the world such as Canada and Europe.

From its inception until the early 1970s, the sole design philosophy embedded within the Standard Specifications was one known as working stress design (WSD). WSD establishes allowable stresses as a fraction or percentage of a given material's load-carrying capacity, and requires that calculated design stresses not exceed those allowable stresses. Beginning in the early 1970s, WSD was adjusted to reflect the variable predictability of certain load types, such as vehicular loads and wind forces, through adjusting design factors, a design philosophy referred to as load factor design (LFD). Both WSD and LFD are reflected in the current edition of the Standard Specifications.

A further philosophical extension considers the variability in the properties of structural elements, in similar fashion to load variabilities. While considered to a limited extent in LFD, the design philosophy of LRFD takes variability in the behavior of structural elements into account in an explicit manner. LRFD relies on extensive use of statistical methods, but sets forth the results in a manner readily usable by bridge designers and analysts.

With the advent of these specifications, bridge engineers had a choice of two standards to guide their designs, the long-standing AASHTO *Standard Specifications for Highway Bridges*, and the alternative, newly adopted *AASHTO LRFD Bridge Design Specifications*, and its companions, *AASHTO LRFD Bridge Construction Specifications* and *AASHTO LRFD Movable Highway Bridge Design Specifications*. Subsequently, the Federal Highway Administration (FHWA) and the states mandated that LRFD standards be used to design all new and total replacement bridges after 2007. For more information on FHWA's LRFD policy, please visit <http://www.fhwa.dot.gov/bridge/lrfd/index.htm>.

A new edition of these specifications will be published every two years, followed by an interim edition the immediate year after its release. The Interim Specifications have the same status as AASHTO standards, but are tentative revisions approved by at least two-thirds of the Subcommittee. These revisions are voted on by the AASHTO member departments prior to the publication of each new edition of this book and, if approved by at least two-thirds of the members, they are

included in the next new edition as standards of the Association. AASHTO members are the 50 State Highway or Transportation Departments, the District of Columbia, and Puerto Rico. Each member has one vote. The U.S. Department of Transportation is a nonvoting member.

Annual Interim Specifications are generally used by the States after their adoption by the Subcommittee. Orders for these annual Interim Specifications may be placed by visiting our website, bookstore.transportation.org, or by calling 1-800-231-3475 (toll free within the U.S. and Canada). A free copy of the current publication catalog can be downloaded from our website or requested from the Publications Sales Office.

The Subcommittee would also like to thank Mr. John M. Kulicki, Ph.D., and his associates at Modjeski and Masters for their valuable assistance in the preparation of the LRFD Specifications.

AASHTO encourages suggestions to improve these specifications. They should be sent to the Chairman, Subcommittee on Bridges and Structures, AASHTO, 444 North Capitol Street, N.W., Suite 249, Washington, DC 20001. Inquiries as to intent or application of the specifications should be sent to the same address.

AASHTO Highways Subcommittee on Bridges and Structures
February 2010

PREFACE

Units

The *AASHTO LRFD Bridge Construction Specifications*, Third Edition, uses U.S. Customary units only. Per a decision by the subcommittee in 2009, SI units will no longer be included in this edition or future interims.

References

If a standard is available as a stand-alone publication—for example, the ACI standards—the title is *italicized* in the text and listed in the references. If a standard is available as part of a larger publication—for example, the AASHTO materials specifications—the standard’s title is not italicized and the larger publication—in this case, *Standard Specifications for Transportation Materials and Methods of Sampling and Testing*, 29th Edition—is listed in the references.

Unit Abbreviations

Most of the abbreviations commonly used in LRFD Construction are listed below. Also, please note the following:

- Abbreviations for singular and plural are the same.
- Most units of time have one-letter abbreviations. Unit abbreviations are always set in roman type, while variables and factors are set in *italic* type. Thus, “2 h” is the abbreviation for “two hours.”

Table i—Frequently-Used Unit Abbreviations

Unit	Abbreviation
cubic foot	ft ³
cubic inch	in. ³
cubic yard	yd ³
degrees Fahrenheit	°F
foot	ft
foot-kip	ft-kip
foot per hour	ft/h
foot per minute	ft/min
foot per second	ft/s
foot pound	ft · lb
foot pound-force	ft · lbf
foot second	ft · s
gallon	gal
hour	h
Hertz	Hz
inch	in.
joule	J
kilonewton	kN
kilopascal	kPa
kip per foot	kip/ft
kip per square inch	ksi
kip per square foot	kip/ft ²
megapascal	MPa
microinch	μin
micron	μm
mile	mi
minute	min (min. for “minimum”)

Table i (continued)—Frequently-Used Unit Abbreviations

Unit	Abbreviation
newton	N
newton meter	N · m
newton per meter	N/m
ounce	oz
pascal	Pa
pascal second	Pa · s
pound	lb
pound-force	lbf
pound-force foot	lbf · ft
pound-force inch	lbf · in.
pound-force per foot	lbf/ft
pound-force per inch	lbf/in.
pound-force per pound	lbf/lb
pound-force per square foot	psf
pound-force per square inch	psi
pound per cubic foot	lb/ft ³
pound per cubic inch	lb/in. ³
pound per cubic yard	lb/yd ³
pound per foot	lb/ft
pound per inch	lb/in.
pound per hour	lb/h
pound per square foot	lb/ft ²
pound per yard	lb/yd
radian	rad
radian per second	rad/s
quart	qt
second	s
square inch	in. ²
square foot	ft ²
square mile	mi ²
square yard	yd ²
year	yr

Note: There are no abbreviations for *day*, *degree* (angle), *kip*, *mil*, or *ton*.

AASHTO Publications Staff
February 2010

CHANGED AND DELETED ARTICLES, 2010

SUMMARY OF AFFECTED SECTIONS

The third edition revisions to the *AASHTO LRFD Bridge Construction Specifications* affect the following sections:

- 3. Temporary Works
- 5. Drilled Shafts
- 11. Steel Structures
- 18. Bearing Devices
- 30. Thermoplastic Pipe

SECTION 3 REVISIONS

Changed Articles

The following Article in Section 3 contains changes or additions to the specifications, the commentary, or both:

3.1.1

Deleted Articles

No Articles were deleted from Section 3.

SECTION 5 REVISIONS

The entire Section 5 has been rewritten.

SECTION 11 REVISIONS

Changed Articles

The following Articles in Section 11 contain changes or additions to the specifications, the commentary, or both:

11.3.1.1	11.4.3.3.2	11.4.11	11.8.3.3.1
11.3.1.4	11.4.3.3.3	11.4.12.2.1	11.8.3.6.4
11.3.1.7	11.4.7	11.4.12.2.3	

Deleted Articles

No Articles were deleted from Section 11.

SECTION 18 REVISIONS

Changed Articles

The following Articles in Section 18 contain changes or additions to the specifications, the commentary, or both:

18.1.5.1.1	18.1.5.2.6	18.3.4.1	18.3.4.4.1	18.3.4.4.5
18.1.5.1.2	18.1.5.2.7	18.3.4.2	18.3.4.4.2	18.3.5
18.1.5.2.3	18.3.2.6	18.3.4.3	18.3.4.4.3	18.6.3
18.1.5.2.4	18.3.2.8	18.3.4.4	18.3.4.4.4	18.8.4.1

Deleted Articles

The following Articles were deleted from Section 18:

18.3.4.2.1

18.3.4.2.2

18.3.4.3.1

18.3.4.3.2

SECTION 30 REVISIONS**Changed Articles**

The following Article in Section 30 contains changes or additions to the specifications, the commentary, or both:

30.5.2

Deleted Articles

No Articles were deleted from Section 30.

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STRUCTURE EXCAVATION AND BACKFILL

1.1—GENERAL

Structure excavation shall consist of the removal of all material, of whatever nature, necessary for the construction of foundations for bridges, retaining walls, and other major structures, in accordance with the contract documents or as directed by the Engineer.

If not otherwise provided for in the contract, structure excavation shall include the furnishing of all necessary equipment and the construction and subsequent removal of all cofferdams, shoring, and water control systems which may be necessary for the execution of the work.

If not otherwise specified in the contract documents, it shall also include the placement of all necessary backfill, including any necessary stockpiling of excavated material which is to be used in backfill, and the disposing of excavated material which is not required for backfill, in roadway embankments or as provided for excess and unsuitable material in Subsection 203.02, *AASHTO Guide Specifications for Highway Construction*.

If the contract does not include a separate pay item or items for such work, structure excavation shall include all necessary clearing and grubbing and the removal of existing structures within the area to be excavated.

Classification, if any, of excavation will be indicated in the contract documents and set forth in the proposal.

The removal and disposal of buried natural or man-made objects are included in the class of excavation in which they are located, unless such removal and disposal are included in other items of work. However, in the case of a buried man-made object, the removal and disposal of such object will be paid for as extra work and its volume will not be included in the measured quantity of excavation, if:

- its removal requires the use of methods or equipment not used for other excavation on the project,
- its presence was not indicated in the contract drawings,
- its presence could not have been ascertained by site investigation, including contact with identified utilities within the area, and
- the Contractor so requests in writing prior to its removal.

1.2—WORKING DRAWINGS

Whenever specified in the contract drawings, the Contractor shall provide working drawings, accompanied by calculations where appropriate, of excavation

C1.1

Subsection 203.02 is located in the *AASHTO Guide Specifications for Highway Construction*.