

## 1 Introduction

### 1.1 General

This series of articles summarizes the definitions, abbreviations and notation, references, and design assumptions for the manual, but the summary is not comprehensive. Additional definitions, abbreviations and notation, and references are given with specific sections and articles in the manual.

### 1.2 Units

*Bridge Design Manual* is written in dual units. Customary U.S. or English units are given first, and SI metric units are given second, in parenthesis.

### 1.3 Definitions

See additional definitions with each major article.

**Article** refers to any numbered subdivision within a section of a direct reference such as AASHTO *Standard Specifications for Highway Bridges*, *Bridge Design Manual*, or *Standard Specifications for Highway and Bridge Construction*. All of the following are articles: 1.1, 1.1.1, 1.1.1.1, and 1.1.1.1.1.

**Average span length (ASL)** is the average length of the two spans adjacent to a pier. See Figure 1.3-1.

**Bridge length (BL)** for structural design is the length from centerline of abutment bearing to centerline of abutment bearing. See Figure 1.3-1. In some situations bridge length may be taken as the length from expansion joint to expansion joint.

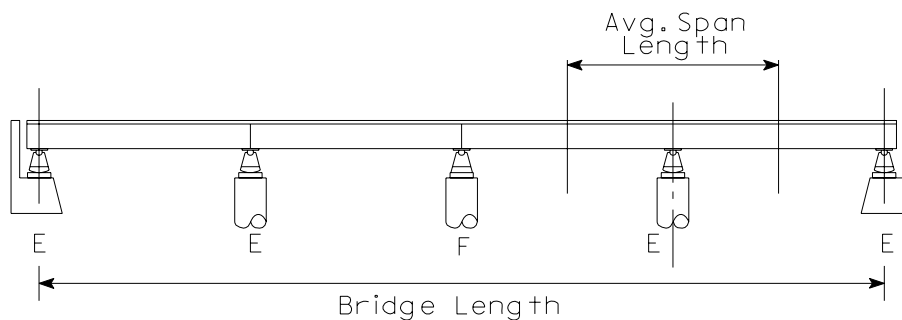


Figure notes:

- E indicates an expansion support.
- F indicates a fixed support.

**Figure 1.3-1. Length definitions**

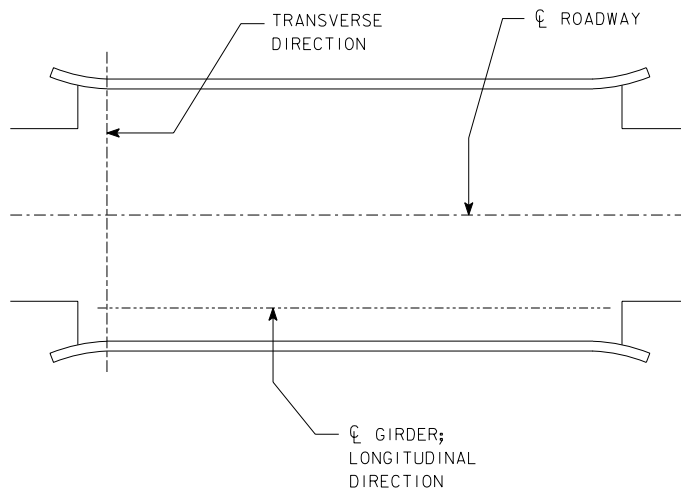
**Built-in wearing surface** is taken as the top one-half inch (13 mm) of the original bridge deck. Weight of the built-in wearing surface is considered part of Dead Load 1, but the wearing surface is not considered to contribute to the strength or stiffness of any part of the superstructure.

**Dead Load 1 (DL1)** is non-composite dead load including beams, deck, haunches, and diaphragms. It is applied to the beams *before* the deck concrete cures.

**Dead Load 2 (DL2)** is composite dead load including barrier rails, future wearing surface, sidewalks, curbs, and medians. It is applied to the composite beams *after* the deck concrete cures. Curing of the concrete deck changes the load-carrying behavior of the superstructure by making the deck composite with the beams in PPCB and CWPG bridges and by imparting continuity over piers in PPCB bridges, except at expansion joints. Parts of Dead Load 2 are applied differently depending on design conditions.

**Future wearing surface (FWS)** is a concrete or hot mix asphalt overlay applied to the original bridge deck. Office practice is to consider the future wearing surface part of Dead Load 2 at 20 psf (960 Pa) but to neglect any potential contribution of the overlay to strength or stiffness of the superstructure.

**Longitudinal** is the direction associated with the roadway centerline of construction and main girders. See Figure 1.3-2.



**Figure 1.3-2. Longitudinal and transverse direction definitions**

**National Highway System (NHS)** is composed of the Interstate and Commercial and Industrial Network. Routes in Iowa including the following, as illustrated in Figure 1.3-3.

- Interstate routes: I-29, I-35, I-74, I-80, I-129, I-235, I-280, I-380, and I-480
- Federal routes: US 18 east of IA 60, US 20, US 30, US 34, US 52 north of US 20, US 61, US 63 north of US 20, US 63 south of IA 92, US 71, US 75, US 151 north of US 30, US 169 north of IA 141 and south of US 18, US 218 south of US 18 and north of I-380
- State routes: IA 14, IA 60, IA 141 east of US 169, IA 163 east of I-235, and IA 330

There are additional routes in urbanized areas as summarized below, however, the designer is cautioned to check the latest NHS maps because of complexity of routes and corridor shifts.

- Cedar Rapids: IA 100
- Council Bluffs: US 6 west of I-80
- Davenport: US 67 west of I-74
- Des Moines: US 65 south of I-80, US 69 south of I-235, IA 5, IA 28
- Sioux City: IA 12
- Waterloo: IA 58 north of US 20

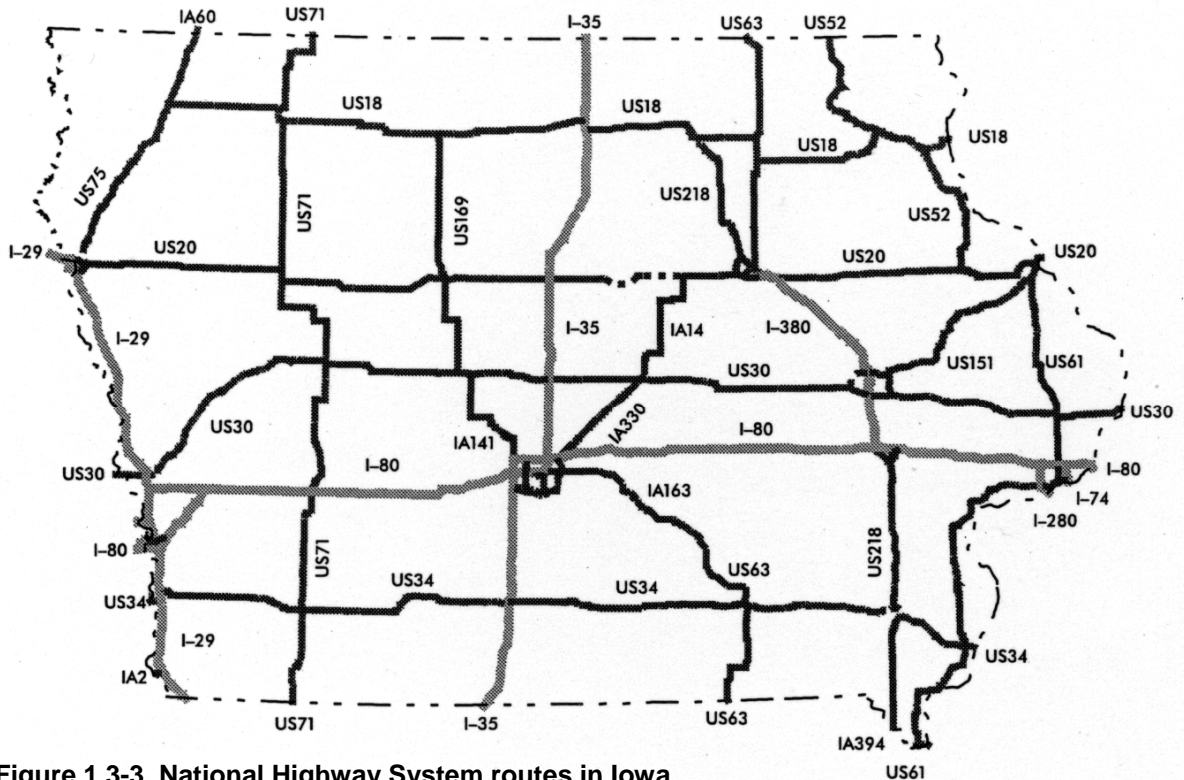


Figure 1.3-3. National Highway System routes in Iowa

**Natural ground elevation** is the average natural ground elevation along the longitudinal centerline of the foundation.

**Office** refers to the Office of Bridges and Structures, Iowa Department of Transportation.

**Section** refers to a chapter or division of a direct reference such as AASHTO *Standard Specifications for Highway Bridges*, *Bridge Design Manual*, or *Standard Specifications for Highway and Bridge Construction*. The following are examples of sections: 1., 2., and 3.

**Section Leader** is the supervisor of the Office of Bridges and Structures preliminary bridge section, detail design section, or consultant coordination section.

**Substructure** is any construction below the bearing seats or, in the absence of bearings, below the soffit of the superstructure.

**Transverse** is the direction normal to the roadway centerline of construction and main girders. See [Figure 1.3-2](#).

## 1.4 Abbreviations and notation

**Transverse** is the direction normal to the roadway centerline of construction and main girders. See [Figure 1.3-2](#).

See additional abbreviations and notation with each major article.

**ASL**, average span length

**BL**, bridge length

**CCS**, continuous concrete slab

**CWPG**, continuous welded plate girder

**D**, dead load, including both Dead Load 1 and Dead Load 2

**DL1**, Dead Load 1

**DL2**, Dead Load 2

**FWS**, future wearing surface

**I**, live load impact

**L**, live load, HS20 (MS-18) truck load or lane load, whichever has greater effect; military load, if applicable

**LRFD**, load and resistance factor design

**N**, number of lanes likely to become one directional during service life of the bridge [AASHTO-I 3.12.1]

**N or N-value**, standard penetration test number of blows per foot (300 mm). N also may be given as **SPT**

**NO**, the Standard Penetration Number, in the soils information chart reference.

**NHS**, National Highway System

**OBS**, [Office of Bridges and Structures](#)

**PPCB**, pretensioned prestressed concrete beam.

## 1.5 References

### 1.5.1 Direct

Throughout *Bridge Design Manual* there are frequent, direct references to specific portions of standards, publications, and update memos. Direct references are included in brackets [ ] using the abbreviations given below. Applicable references to the AASHTO standard specifications are given with each article heading.

Although the latest editions are listed below there are some circumstances in which documents referenced in this manual have been prepared on the basis of previous editions.

[AASHTO-division article, table, or figure] refers to *AASHTO Standard Specifications for Highway Bridges, 17<sup>th</sup> Edition* with current errata changes - design, seismic design, or construction division with article, table, or figure number.

[AASHTO-LRFD article, table, or figure] refers to *AASHTO LRFD Bridge Design Specifications, 3<sup>rd</sup> Edition* with 2005 interim revisions with article, table, or figure number.

[AASHTO-Temp article, table, or figure] refers to *Guide Design Specification for Bridge Temporary Works* with article, table, or figure number.

[AASHTO-Sign article, table, or figure] refers to *AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, 4<sup>th</sup> Edition* with 2002 and 2003 interim revisions with article, table, or figure number.

[BDM article, table, figure, or note] refers to *Bridge Design Manual* with article, table, figure, or plan note number. (Available on the Internet at [www.dot.state.ia.us/bridge/manualindex.htm](http://www.dot.state.ia.us/bridge/manualindex.htm))

[IDOT DS-number] refers to an Iowa Department of Transportation developmental specification, which is a hybrid of a supplemental specification and special provision.

[IDOT PPM policy number] refers to a policy in the Iowa Department of Transportation *Policies and Procedures Manual*.

[IDOT SS article] refers to Iowa Department of Transportation *Standard Specifications for Highway and Bridge Construction, Series 2001* with article number. (Available on the Internet at: [http://165.206.203.37/Start\\_Here.htm](http://165.206.203.37/Start_Here.htm)[www.eri.dot.state.ia.us/](http://www.eri.dot.state.ia.us/))

[OBS MM No. number] refers to a policy-update, methods memo issued by the Office of Bridges and Structures, Highway Division with memo number, dated 2001 or later. (Available in *Bridge Design Manual Commentary* and on the Internet at: <http://www.dot.state.ia.us/bridge/manualindex.htm>)

[OBS SS sheet number] refers to an Office of Bridges and Structures, Highway Division “Standard Sheet” with sheet number. (Available on the Internet at: <http://www.dot.state.ia.us/bridge/standardindex.htm>)

[OD DM article, table, or figure] refers to the Office of Design, Highway Division *Design Manual* with article, table, or figure number. (Available on the Internet at: <http://www.dot.state.ia.us/design/desman.htm>)

[OD RDD sheet number] refers to the Office of Design, Highway Division “Road Design Details” with sheet number. Formerly the detail manual was referred to as the “green book.” (Available on the Internet at: <http://www.dot.state.ia.us/design/desdet.htm>)

[OD SRP sheet number] refers to an Office of Design, Highway Division “Standard Road Plan” with sheet number. Formerly the plan manual was referred to as the “red book.” (Available on the Internet at: [http://165.206.203.37/Start\\_Here.htmwww.erl.dot.state.ia.us/](http://165.206.203.37/Start_Here.htmwww.erl.dot.state.ia.us/))

[OM IM number] refers to Office of Materials, Iowa Department of Transportation Instructional Memorandum number. (Available on the Internet at: [http://165.206.203.37/Start\\_Here.htmwww.erl.dot.state.ia.us/](http://165.206.203.37/Start_Here.htmwww.erl.dot.state.ia.us/))

### 1.5.2 Indirect

Indirect references are general and infrequent sources of information for *Bridge Design Manual* that usually are not linked with specific article or section numbers. The list below is not complete; see major articles for applicable complete lists.

American Association of State Highway and Transportation Officials (AASHTO). *Guide Specifications for Horizontally Curved Highway Bridges*. Washington: AASHTO, 1993. (The office is evaluating the 2003 edition.)

American Association of State Highway and Transportation Officials (AASHTO). *Manual for Condition Evaluation of Bridges*. Washington: AASHTO, 1994.

American Concrete Institute (ACI). *Building Code Requirements for Structural Concrete (ACI 318-02) and Commentary (ACI 318R-02)*. Farmington Hills: ACI, 2002.

American Institute of Steel Construction (AISC). ~~*Manual of Steel Construction Manual, Volumes I and II, Thirteenth Edition*~~. Chicago: AISC, ~~2005-1989 and 1992~~.

American Railway Engineering and Maintenance-of-Way Association (AREMA). *Manual for Railway Engineering—2002 Edition*. Landover: AREMA, 2002.

American Society for Testing and Materials (ASTM). *2001 Annual Book of ASTM Standards*. West Conshohocken: ASTM, 2001.

American Welding Society (AWS). *Bridge Welding Code, AWS D1.5-2002* with 2003 interim revision. Miami: AWS, 2002.

Dirks, Kermit and Patrick Kam. *Foundation Soils Information Chart, Pile Foundation*. Ames: Iowa Department of Transportation, Office of Road Design, January 1989/September 1994.

Greimann, L.F., R.E. Abendroth, D.E. Johnson, and P.B. Ebner. *Final Report, Pile Design and Tests for Integral Abutment Bridges, HR-273, and Addendum*. Ames: Iowa Department of Transportation and College of Engineering, Iowa State University, 1987.

Lundquist, William A. *Iowa DOT Bridge Design Office Metric Handbook*. Ames: Office of Bridges and Structures, 1994 updated through 1996.

National Steel Bridge Alliance (NSBA). *Highway Structures Design Handbook*. Chicago: NSBA, 1993.

Office of Construction. *Construction Manual*. Ames: Office of Construction, Iowa Department of Transportation, 2006<sup>4</sup>. (Available on the Internet at:  
[http://165.206.203.37/Start\\_Here.htm/www.dot.state.ia.us/construction/index.htm](http://165.206.203.37/Start_Here.htm/www.dot.state.ia.us/construction/index.htm))

Precast/Prestressed Concrete Institute (PCI). *Bridge Design Manual*. Chicago: PCI, 1997 with revisions through 2004<sup>3</sup>.

Sunday, Wayne and Kyle Frame. *New Bridge Construction Handbook*. Ames: Office of Construction, Iowa Department of Transportation, 2000<sup>4</sup>. (Available on the Internet at:  
[http://www.dot.state.ia.us/construction/bridge\\_construction\\_handbook.pdfstructures.htm](http://www.dot.state.ia.us/construction/bridge_construction_handbook.pdfstructures.htm))

## 1.6 Revisions

Users are invited to send suggestions for revisions to the Methods Section of the Office of Bridges and Structures. Suggestions need to be written, with identification of the problem, recommended revision, and reason for recommendation.

All revisions affecting office policy will be approved by the Assistant Bridge Engineer.

After *Bridge Design Manual* is complete, approved policy and editorial revisions will be noted in a log in Appendix A and indicated with a line in the margin of the design manual text.