Chapter 3 Loads

3.1 Type of Loads 3-1
3.1.1 Dead Loads 3-1
3.1.2 Live Loads 3-1
3.1.3 Earthquake Loads (see Chapter 4) 3-2
3.1.4 Other Loads 3-2
3.2 Application of Loads 3-3
3.2.1 Wind Load 3-3
3.3 Use of Computer Software 3-4
3.3.1 Protection of Intellectual Property 3-4
3.3.2 Policy on Open Source Software 3-4
3.3.3 Approved Software Tools 3-4
3.99 Bibliography 3-4
Appendix 3-B
Appendix 3-B-1 HL 93 Loading for Bridge Piers 3-B-1

AASHTO LRFD loading specifications shall be the minimum design criteria used for all bridges. For falsework and formwork design loads, see standard specifications 6-02.3(17)A.

3.1 Type of Loads

3.1.1 Dead Loads

Use values in AASHTO except as herein modified:

ITEM	LOAD
Reinforced Concrete	160 lb/ft^3
Stay-in-Place Form for Box Girder (of the cell area)	5 lb/ft^2
Traffic Barrier (32” - F Shape)	470 lb/ft
Traffic Barrier (42” - F Shape)	730 lb/ft
Traffic Barrier (34” - Single Slope)	505 lb/ft
Traffic Barrier (42” – Single Slope)	690 lb/ft
Future Wearing Surface (1.5”)	20 lb/ft^2
Soil, Compact	125 lb/ft^3

3.1.2 Live Loads

A. General

Live load design criteria is specified in the lower right corner of the bridge preliminary plan sheet. The Bridge Projects Unit determines the criteria using the following guideline:

- HL93 — New bridges and bridges widening with new substructure designed in accordance to AASHTO LRFD Specifications.
- HS-20 — Detour bridges and widening bridges with no addition of substructure.

B. Load Factor γ_{EQ} for Live Load

The γEQ load factor for the live load in Extreme Event-I Limit State, as specified in the LRFD Table 3.4.1-1 for the majority of bridges, shall be equal to 0.0. For bridges located in urban areas susceptible to daily heavy congestion, γEQ shall be equal to 0.5 unless otherwise directed by the WSDOT Bridge Design Engineer. The γEQ factor should be applied to the live load force effect obtained from the bridge live load analysis. Live load mass is ignored in the dynamic analysis.

C. Distribution to Superstructure

1. Concrete Box Girders

For cast-in-place multicell box girders, the following method is used for the live load distribution for both moment and shear instead of using the AASHTO-LRFD live load distribution factor as specified in tables 4.6.2.2.2b-1, 4.6.2.2.2d-1, 4.6.2.2.3a-1, and 4.6.2.2.3b-1.

The number of design lanes, including fractional lanes, shall be taken as the curb-to-curb roadway width in feet divided by 14, and the multiple presence factors shall not be applied to the live load distribution factor.

The correction factor for skewed bridges as specified in AASHTO LRFD table 4.6.2.2.3c-1 shall be applied to the shear distribution factor.

D. Distribution to Substructure

A reduction factor shall be applied in the substructure design for multiple loadings in accordance with AASHTO.

3.1.3 Earthquake Loads (see Chapter 4)

3.1.4 Other Loads

A. Ice Load

In accordance with WSDOT HQ Hydraulics Office criteria, an ice thickness of 12 inches shall be used for stream flow forces on piers in both Western and Eastern parts of State of Washington.

B. Downdrag

Use load factors for downdrag $\gamma_P = 1.00$ instead of the value in LRFD Table 3.4.1-2, for both maximum and minimum situations.

3.2 Application of Loads

3.2.1 Wind Load

Wind load acting on the superstructure shall be based on the bridge elevation exposed by the wind, the height of which usually consists of the girder depth and traffic barrier height.

3.3 Use of Computer Software

3.3.1 Protection of Intellectual Property

Many of the software tools used by the Bridge and Structures Office are licensed from commercial software vendors. WSDOT is committed to using these tools only as allowed by law and as permitted by software license. WSDOT employees shall comply with the terms and conditions of all licensing agreements and provisions of the Copyright Act and other applicable laws.

Before using any software tools WSDOT employees shall read and understand Instructional Letter 4032.00, Titled "Computer Software Piracy Prevention, and the Protection of Intellectual Property"[1].

3.3.2 Policy on Open Source Software

It is the policy of the Bridge and Structures Office to license its own engineering software as open source, and to prefer and promote the use of open source software, within the bridge engineering community.

To support this policy on open source bridge engineering software, the Bridge and Structures Office is a founding and participating member of the Alternate Route Project. The purpose of the Alternate Route Project is to serve as a focal point for the collaborative and cooperative development of open source bridge engineering software tools.

3.3.3 Approved Software Tools

A list of approved software tools available for use by WSDOT bridge design engineers is available at http://wwwi.wsdot.wa.gov/eesc/bridge/software. Note that this list is only available on the WSDOT intranet. WSDOT does not require consulting engineers to use any specific software tools, so long as the use of the tools are in accordance with sound engineering practice, and does not violate software licensing agreements and Copyright law.

When using personal design tools created by others, such as a spreadsheet or MathCAD document, the designer is responsible for thoroughly checking the tool to ensure the integrity of the structural analysis and design.

3.99 Bibliography

1. California Department of Transportation, *Bridge Design Practice*, 1993.