2020 Interim Revisions

GUIDE DESIGN SPECIFICATIONS FOR BRIDGE TEMPORARY WORKS

2nd Edition | 2017

GSBTW-2-I1 | ISBN 978-1-56051-739-9

American Association of State Highway and Transportation Officials
AASHTO

Documents
Document Sharing Hub
Full document details: AASHTO GSBTW-2-2017 interim revisions 2020

GUIDE DESIGN SPECIFICATIONS FOR BRIDGE TEMPORARY WORKS

2nd Edition | 2017

GSBTW-2-I1 | ISBN 978-1-56051-739-9

American Association of State Highway and Transportation Officials
AASHTO

Documents
Document Sharing Hub

© 2019 by the American Association of State Highway and Transportation Officials.
All rights reserved. Duplication is a violation of applicable law.

Full document details: AASHTO GSBTW-2-2017 interim revisions 2020

American Association of State Highway and Transportation Officials
444 North Capitol Street, NW, Suite 249
Washington, DC 20001
202-624-5800 phone/202-624-5806 fax
www.transportation.org

© 2019 by the American Association of State Highway and Transportation Officials. All rights reserved. Duplication is a violation of applicable law.

ISBN: 978-1-56051-739-9 Pub Code: GSBTW-2-H

Documents
Document Sharing Hub
© 2019 by the American Association of State Highway and Transportation Officials.
All rights reserved. Duplication is a violation of applicable law.
Full document details: AASHTO GSBTW-2-2017 interim revisions 2020

2020 INTERIM REVISIONS INSTRUCTIONS AND INFORMATION

General

AASHTO has issued proposed interim revisions to the *AASHTO Guide Design Specifications for Bridge Temporary Works*, Second Edition (2017). This packet contains the revised pages. They are designed to replace the corresponding pages in the book.

Affected Articles

Underlined text indicates revisions that were approved in 2019 by the AASHTO Committee on Bridges and Structures. ~~Strikethrough text~~ indicates any deletions that were likewise approved by the Committee. A list of affected articles is included below.

All interim pages are displayed on a pink background to make the changes stand out when inserted in the second edition binder. 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.

2020 Changed Articles

2.3.5.2
APPENDIX C
APPENDIX E

Documents
Document Sharing Hub

© 2019 by the American Association of State Highway and Transportation Officials.
All rights reserved. Duplication is a violation of applicable law.

Full document details: AASHTO GSBTW-2-2017 interim revisions 2020

THIS PAGE LEFT BLANK INTENTIONALLY

Documents
Document Sharing Hub
© 2019 by the American Association of State Highway and Transportation Officials.
All rights reserved. Duplication is a violation of applicable law.
Full document details: AASHTO GSBTW-2-2017 interim revisions 2020

GUIDE DESIGN SPECIFICATION FOR BRIDGE TEMPORARY WORKS

TABLE OF CONTENTS

SECTION 1—INTRODUCTION
1.1—SCOPE 1-1
1.2—RELATED PUBLICATIONS 1-1
1.3—DEFINITIONS 1-2
1.4—METRIC CONVERSIONS 1-3

SECTION 2—FALSEWORK
2.1—FALSEWORK DRAWINGS 2-1
2.2—MATERIALS AND MANUFACTURED COMPONENTS 2-2
2.2.1—General 2-2
2.2.2—Structural Steel 2-2
2.2.2.1—Identification and Properties 2-2
2.2.2.2—Salvaged Steel 2-3
2.2.2.3—Welding 2-3
2.2.3—Wood 2-4
2.2.3.1—Allowable Stresses 2-4
2.2.3.2—Modification Factors 2-4
2.2.3.3—Used Lumber 2-4
2.2.4—Other Materials 2-5
2.2.5—Manufactured Components 2-5
2.2.5.1—General 2-5
2.2.5.2—Maximum Loadings and Deflections 2-5
2.2.5.3—Factor of Safety 2-6
2.3—LOADS 2-6
2.3.1—General 2-6
2.3.2—Loads and Load Combinations 2-6
2.3.2.1—Loads and Load Designation 2-6
2.3.2.2—Load Combinations and Load Factors 2-7
2.3.2.3—Load and Resistance Factored Design 2-8
2.3.2.4—Allowable Stress Design 2-10
2.3.3—Dead and Live Loads 2-10
2.3.3.1—Dead Load 2-10
2.3.3.2—Live Load 2-10
2.3.3.2.1—Construction Live Load 2-11
2.3.3.2.2—Impact 2-11
2.3.3.3—Minimum Vertical Load 2-11
2.3.4—Construction Loads 2-11
2.3.4.1—Construction Dead Load 2-11
2.3.4.2—Material Loads 2-12
2.3.4.3—Personnel and Equipment Load 2-12
2.3.4.3.1—General 2-12
2.3.4.3.2—Individual Personnel Load 2-12
2.3.4.3.3—Uniformly Distributed Loads 2-13
2.3.4.3.4—Concentrated Loads 2-13

Documents
Document Sharing Hub

© 2019 by the American Association of State Highway and Transportation Officials.
All rights reserved. Duplication is a violation of applicable law.
Full document details: AASHTO GSBTW-2-2017 interim revisions 2020

2.3.4.4—Horizontal Construction Load, C_h 2-14
2.3.4.5—Equipment Reactions, C_R 2-14
2.3.4.5.1—Rated Equipment 2-14
2.3.4.5.2—Non-Rated Equipment 2-14
2.3.4.5.3—Impact 2-15
2.3.5—Environmental Loads 2-15
2.3.5.1—Risk Category 2-15
2.3.5.2—Wind 2-15
2.3.5.2.1—~~Design Wind Speed~~ General 2-15.1
2.3.5.2.2—~~Frameworks without Cladding~~ Design Wind Speed 2-15.1
2.3.5.2.3—~~Accelerated Wind Region~~ Wind Load 2-15.2
2.3.5.2.3a—General 2-15.2
2.3.5.2.3b—Wind Pressure 2-15.2
2.3.5.2.3c—Wind Load 2-15.4
2.3.5.2.3d—Point of Wind Load Application 2.15.5
2.3.5.2.4—Frameworks without Cladding 2-15.5
2.3.5.2.5—Wind Load Transmitted to Temporary Shoring from the Bridge Superstructure 2-15.6
2.3.5.3—Snow 2-16
2.3.5.4—Earthquake 2-16
2.3.5.4.1—Applicability 2-16
2.3.5.4.2—Use of ASCE 7 2-17
2.3.5.4.3—Other Standards for Earthquake Resistant Design 2-17
2.3.5.5—Stream Flow 2-17
2.3.5.6—Ice Loads 2-18
2.4—DESIGN 2-18
2.4.1—General 2-18
2.4.2—Deflection 2-19
2.4.3—Slenderness 2-19
2.4.4—Overturning and Sliding 2-19
2.4.5—Steel Beam Grillages 2-20
2.4.6—Proprietary Shoring Systems 2-20
2.4.7—Traffic Openings 2-21
2.5—FOUNDATIONS 2-22
2.5.1—General 2-22
2.5.2—Footings 2-22
2.5.3—Pile Foundations 2-24
2.5.4—Foundations for Heavy-Duty Shoring Systems 2-24

SECTION 3—FORMWORK
3.1—MATERIALS AND FORM ACCESSORIES 3-1
3.1.1—General 3-1
3.1.2—Sheathing 3-1
3.1.3—Structural Supports 3-3
3.1.4—Prefabricated Formwork 3-3
3.1.5—Stay-in-Place Formwork 3-3
3.1.6—Form Accessories 3-3
3.2—LOADS 3-4
3.2.1—Vertical Loads 3-4
3.2.2—Lateral Pressure of Fluid Concrete 3-4

Documents
Document Sharing Hub

© 2019 by the American Association of State Highway and Transportation Officials.
All rights reserved. Duplication is a violation of applicable law.

Full document details: AASHTO GSBTW-2-2017 interim revisions 2020

3.2.2.1—Form Pressure 3-4
3.2.2.2—Form Pressure-Reduced Hydrostatic Head 3-5
3.2.3—Horizontal Loads 3-6
3.3—DESIGN 3-6
3.3.1—General 3-6
3.3.2—Allowable Stresses 3-7
3.3.3—Deflection 3-7
3.3.4—Safety Factors for Form Accessories 3-7

SECTION 4—TEMPORARY RETAINING STRUCTURES
4.1—GENERAL 4-1
4.2—TYPES OF RETAINING STRUCTURES 4-1
4.3—LATERAL EARTH PRESSURES 4-1
4.3.1—Cantilever Walls 4-2
4.3.1.1—Wall Movement Necessary for Active Pressures 4-2
4.3.1.2—Active Pressures 4-2
4.3.1.3—At-Rest Pressures 4-3
4.3.1.4—Passive Pressures 4-4
4.3.2—Braced Excavations 4-5
4.3.3—Surcharge Pressures 4-13
4.4—STABILITY 4-13
4.5—COFFERDAMS 4-13
4.5.1—Cantilever Walls 4-13
4.5.2—Braced Cofferdams 4-14

APPENDICES
APPENDIX A—MAXIMUM DESIGN VALUES FOR UNGRADED STRUCTURAL LUMBER A-1
APPENDIX B—AISC PROVISIONS FOR WEBS AND FLANGES WITH CONCENTRATED FORCES B-1
B.1—Flange Local Bending B-1
B.2—Web Local Yielding B-1
B.3—Web Local Crippling B-2
B.4—Web Sideway Buckling B-3
B.5—Web Compression Buckling B-4
B.6—Web Panel Zone Shear B-4
B.7—Unframed Ends of Beams and Girders B-5
B.8—Additional Stiffener Requirements for Concentrated Forces B-5
B.9—Additional Doubler Plate Requirements for Concentrated Forces B-6
APPENDIX C—~~SELECT ASCE 7 WIND PROVISIONS~~ UNUSED ..... ~~C-1~~
~~C.1—Basic Wind Speed, V ..... C-1~~
~~C.2—Design Wind Force, F ..... C-1~~
~~C.3—Velocity Pressure Exposure Coefficient, K_Z ..... C-2~~
~~C.4—Topographic Factor, K_{zt} ..... C-2~~
~~C.5—Wind Directionality Factor, K_d ..... C-3~~
~~C.6—Gust Effect Factor, G ..... C-3~~
~~C.7—Force Coefficient, C_f ..... C-3~~
~~C.8—Projected Area, A_f ..... C-3~~
APPENDIX D—SELECT ASCE 7 SEISMIC PROVISIONS D-1
D.1—Risk-Targeted Maximum Considered Earthquake, MCE_R D-1
D.2—Site Class and Site Coefficients, F_a and F_v D-1

Documents
Document Sharing Hub

© 2019 by the American Association of State Highway and Transportation Officials.
All rights reserved. Duplication is a violation of applicable law.
Full document details: AASHTO GSBTW-2-2017 interim revisions 2020

D.3—Design Spectral Acceleration Parameters, S_{DS} and S_{D1} D-2
D.4—Estimate Fundamental Period of Falsework, T_a D-2
D.5—Seismic Response Coefficient, C_s D-2
D.6—Seismic Base Shear and Equivalent Lateral Force, V and F_{eq} D-2
APPENDIX E—SAMPLE ~~WIND AND~~ SEISMIC CALCULATIONS E-1
APPENDIX F—FOUNDATION INVESTIGATION AND DESIGN F-1
F.1—Subsurface Investigation F-1
F.2—Relative Density of Granular Deposits F-1
F.3—Consistency of Cohesive Soils F-2
F.4—Unified Soil Classification System F-3
F.5—Potential Problem Soils F-4
F.6—Extended Foundation F-5
F.7—AASHTO and ASTM Reference Standards F-5
APPENDIX G—CONVERSION OF EQUATIONS FROM US CUSTOMARY UNITS TO SI METRIC UNITS G-1

REFERENCES R-1

Documents
Document Sharing Hub

© 2019 by the American Association of State Highway and Transportation Officials.
All rights reserved. Duplication is a violation of applicable law.
Full document details: AASHTO GSBTW-2-2017 interim revisions 2020

GUIDE DESIGN SPECIFICATION FOR BRIDGE TEMPORARY WORKS

LIST OF FIGURES

Figure 4.3.2-1—Apparent Earth Pressure Distributions for Anchored Walls Constructed from the Top Down in Cohesionless Soils 4-6
Figure 4.3.2-2—Apparent Earth Pressure Distributions for Anchored Walls Constructed from the Top Down in Soft to Medium Stiff Cohesive Soils 4-7
Figure 4.3.2-3—Unfactored Simplified Earth Pressure Distributions for Permanent Non-Gravity Cantilevered Walls with Discrete Vertical Wall Elements 4-8
Figure 4.3.2-4—Unfactored Simplified Earth Pressure Distribution and Design Procedures for Permanent Non-Gravity Cantilevered Walls with Continuous Vertical Wall Elements Embedded in Granular Soil Modified after Teng (1962) 4-9
Figure 4.3.2-5—Unfactored Simplified Earth Pressure Distributions for Temporary Non-Gravity Cantilevered Walls with Discrete Vertical Wall Elements 4-10
Figure 4.3.2-6—Unfactored Simplified Earth Pressure Distributions for Temporary Non-Gravity Cantilevered Walls with Continuous Vertical Wall Elements 4-11
~~Figure C.1(a)—Basic Wind Speeds for Occupancy Category II Buildings and Other Structures ..... C-6~~
~~Figure C.1(b)—Basic Wind Speeds for Occupancy Category III and IV Buildings and Other Structures ..... C-8~~
~~Figure C.2—Topographic Multipliers for Exposure *C* ..... C-10~~
Figure D.1(a)—S_1 Risk-Adjusted Maximum Considered Earthquake (MCE_R) Ground Motion Parameter for the Conterminous United States for 1.0 sec Spectral Response Acceleration (5 Percent of Critical Dumping), Site Class B D-3
Figure D.1(b)—S_1 Risk-Adjusted Maximum Considered Earthquake (MCE_R) Ground Motion Parameter for the Conterminous United States for 1.0 sec Spectral Response Acceleration (5 Percent of Critical Dumping), Site Class B D-4
Figure D.2—S_1 Risk-Adjusted Maximum Considered Earthquake (MCE_R) Ground Motion Parameter for Alaska for 1.0 sec Spectral Response Acceleration (5 Percent of Critical Dumping), Site Class B D-5
Figure D.3—S_1 Risk-Adjusted Maximum Considered Earthquake (MCE_R) Ground Motion Parameter for Hawaii for 1.0 sec Spectral Response Acceleration (5 Percent of Critical Dumping), Site Class B D-6
Figure D.4—S_1 Risk-Adjusted Maximum Considered Earthquake (MCE_R) Ground Motion Parameter for Puerto Rico and the United States Virgin Islands for 1.0 sec Spectral Response Acceleration (5 Percent of Critical Dumping), Site Class B D-7
~~Figure E.1—Falsework Tower Elevation ..... E-2~~
Figure E.~~2~~1—Falsework Tower Elevation E-7

Documents
Document Sharing Hub

© 2019 by the American Association of State Highway and Transportation Officials.
All rights reserved. Duplication is a violation of applicable law.
Full document details: AASHTO GSBTW-2-2017 interim revisions 2020

GUIDE DESIGN SPECIFICATION FOR BRIDGE TEMPORARY WORKS

LIST OF TABLES

Table 2.1-1—Minimum Mechanical Properties of Structural Steel by Shape, Strength, and Thickness 2-2
Table C2.2.2.2.1—Early ASTM Steep Specifications..... 2-3
Table 2.3.2.2-1—Load Combinations and Load Factors..... 2-9
Table 2.3.4.3.3-1—Classes of Working Surfaces for Combined Uniformly Distributed Loads 2-13
Table 2.3.4.3.4-1—Minimum Concentrated Personnel and Equipment Loads 2-13
Table 2.3.5.2.3b-1—Design Height, z 2-15.3
Table 2.3.5.2.3b-2—Drag Coefficient, C_D..... 2-15.3
Table C2.3.5.2.3b-1—Drag Coefficient for Trussed Towers 2-15.3
Table C2.3.5.2.3b-2–Drag Coefficient for Lattice Frameworks..... 2-15.4
Table 2.3.5.2.3c-1—Area of the Structure..... 2-15.5
Table 2.5.2-1—Presumptive Soil-Bearing Values..... 2-23
Table 2.5.2-2—Ground Water-Level Modification Errors..... 2-23
Table C3.1.2-1—Form Materials with Data Sources for Design and Specification..... 3-2
Table 3.2.2.2-1—Chemistry Factor, F_c..... 3-6
Table 3.2.2.2-2—Unit Weight Factor, F_w..... 3-6
Table 3.3.4-1—Minimum Safety Factors of Formwork..... 3-7
Table A.1—Maximum Design Values for Ungraded Structural Lumber..... A-1
~~Table C.1—Velocity Pressure Coefficient, K_z..... C-3~~
~~Table C.2—Wind Directionality Factor, K_d..... C-4~~
~~Table C.3—Force Coefficients for Trussed Towers, C_f..... C-4~~
~~Table C.4—Force Coefficients for Open Signs & Lattice Frameworks, C_f..... C-4~~
~~Table C.5—Force Coefficients for Solid Freestanding Walls and Signs..... C-5~~
Table D.1—Site Coefficient, F_a..... D-1
Table D.2—Site Coefficient, F_v..... D-1
~~Table E.1—Velocity Pressure Exposure Coefficient..... E-3~~
~~Table E.2—Velocity Pressure at Each Height Zone..... E-3~~
~~Table E.3—Wind Pressure at Each Falsework Height Zone..... E-4~~
~~Table E.4—Wind Load per Tower for Each Height Zone..... E-5~~
Table F.1—Determination of Relative Density Based on Standard Penetration Resistance F-2
Table F.2—CPT and SPT Values for Various Soils..... F-2
Table F.3—Consistency of Cohesive Soils F-3
Table F.4—Soil Classification According to the United Soil Classification System F-4

Documents
Document Sharing Hub

© 2019 by the American Association of State Highway and Transportation Officials.
All rights reserved. Duplication is a violation of applicable law.
Full document details: AASHTO GSBTW-2-2017 interim revisions 2020

2.3.4.5.3—Impact

The reaction of equipment shall be increased by 30 percent to allow for impact, unless other values (either larger or smaller) are recommended by the manufacturer, are required by the authority having jurisdiction, or are justified by analysis.

2.3.5—Environmental Loads

The basic reference for computation of environmental loads is the 2010 edition of ASCE 7. The requirements of ASCE 7 shall apply except as modified herein.

2.3.5.1—Risk Category

Unless otherwise required by the authority having jurisdiction, the Risk Category, as defined in ASCE 7, shall be taken as Risk Category II for all environmental loads during construction, regardless of the Risk Category assigned for the design of the completed structure.

C2.3.5.1

During construction, the primary occupancy of a structure is by construction personnel. As such, the risk to loss of human life is comparable to that for Risk Category II buildings as defined in ASCE 7. Circumstances in which the engineer may consider a higher Risk Category, or in which some authorities have required such consideration, include construction work immediately adjacent to essential facilities in which a construction failure would imperil operation of the essential facility.

2.3.5.2—Wind

~~Except as modified herein, wind loads shall be calculated in accordance with procedures in ASCE 7. Select provisions from ASCE 7-10 have been reproduced in Appendix C. Design wind pressures shall be based on design wind speeds calculated in accordance with Section 2.3.5.2.1. The basic wind pressure shall be increased by 5 psf for falsework members over or adjacent to traffic openings.~~

~~*2.3.5.2.1—Design Wind Speed*~~

~~The design wind speed shall be taken as the basic wind speed in ASCE 7. Basic wind speed maps from ASCE 7-10 have been reproduced in Appendix C.~~

~~*2.3.5.2.2—Frameworks without Cladding*~~

~~Structures shall resist the effect of wind acting upon successive unenclosed components.~~

~~Treatment of staging, shoring, and falsework with regular rectangular plan as trussed towers in accordance with ASCE 7 shall be permissible. Unless detailed analyses are performed to show that lower loads may be used, no allowance shall be given for shielding of successive rows or towers.~~

~~For unenclosed frames and structural elements, wind loads shall be calculated for each element. Unless detailed analyses are performed, load reductions due to shielding of elements in such structures with repetitive patterns of elements shall be as follows:~~

- ~~The loads on the first three rows of elements along the direction parallel to the wind shall not be reduced for~~

~~**C2.3.5.2**~~

~~If local conditions so dictate, and for certain hazardous construction operations, it may be appropriate to apply a minimum strength level wind pressure, such as 16 psf, to design.~~

~~*C2.3.5.2.2*~~

~~Even though the design wind speed during construction may be lower than that for the completed structure, the total wind load may actually be higher due to the cumulative effect of wind acting on many more surfaces and often with higher drag coefficients than in the fully enclosed structure. For common arrangements of elements in typical open frames and temporary structures, shielding effects are small. Considering the changing nature of the bridge silhouette and the arrangement of construction materials on the structure, it is prudent not to assume that loads will be reduced due to shielding, except in certain specific cases.~~

~~For open structures with regular patterns of elements, the direction of maximum force on the structure usually is not parallel to the principal axis of the structure. Shielding effects are minimized, and therefore loads are at their~~

AVA Documents Document Sharing Hub

© 2019 by the American Association of State Highway and Transportation Officials.
All rights reserved. Duplication is a violation of applicable law.

Full document details: AASHTO GSBTW-2-2017 interim revisions 2020

~~shielding.~~

- ~~The loads on the fourth and subsequent rows shall be permitted to be reduced by 15 percent.~~
- ~~Wind load allowances shall be calculated for all exposed interior partitions, walls, temporary enclosures, signs, construction materials, and equipment on or supported by the structure. These loads shall be added to the loads on structural elements.~~

~~Calculations shall be performed for each primary axis of the structure. For each calculation, 50 percent of the wind load calculated for the perpendicular direction shall be assumed to act simultaneously.~~

~~*2.3.5.2.3—Accelerated Wind Region*~~

~~Structures placed near building edges and corners shall resist the higher pressures and suctions that will exist in such regions. The design wind speed shall be factored upward from the basic wind speed by the square root of the suction coefficient for cladding as given in ASCE 7. The calculated wind speed shall be used with appropriate drag factors to calculate loads on structures. At building corners, the resulting pressures shall be assumed to act on adjacent staging structures in horizontal directions parallel to and perpendicular to the enclosure surface. At top edges of enclosures, pressures shall be assumed to act upward as well as horizontally.~~

2.3.5.2.1—General

The wind load provisions presented herein shall be used with conventional bridges in typical settings.

The latest edition of the ASCE 7 shall be used for the design of temporary bridge works used for the construction of:

- Conventional bridges adjacent to cliffs or building edges and corners.
- Cable-stayed, suspension, and arch bridges.
- Any other nonconventional bridges.

Wind loads on the superstructure that are transmitted to bridge falsework shall be determined in accordance with Article 2.3.5.2.5.

2.3.5.2.2—Design Wind Speed

The design 3-second gust wind speed, V, used in the determination of design wind loads on bridge temporary ~~highest, when the direction of the wind is not parallel to the column lines. For this reason, the most severe loads on an open structure include components of load in both principal directions of the structure.~~

~~For guidance on shielding effects and loads on open structures, refer to *Crane and Derricks* (2000), *Wind Loading on Falsework, Part I* (1975), *Wind Loading on Open Framed Structures* (1981), and the *Low Rise Building Systems Manual* (1996).~~

C2.3.5.2.1

Structures placed near building edges and corners are required to be designed to resist the higher pressures and suctions that will exist in such regions. The design wind speed must be factored upward from the basic wind speed by the square root of the suction coefficient for cladding as given in ASCE 7. The calculated wind speed should be used with appropriate drag coefficients to calculate wind loads on such structures. At building corners, the resulting pressures should be assumed to act on adjacent staging structures in horizontal directions parallel to and perpendicular to the enclosure surface. At top edges of enclosures, pressures should be assumed to act upward as well as horizontally.

Documents
Document Sharing Hub

© 2019 by the American Association of State Highway and Transportation Officials.
All rights reserved. Duplication is a violation of applicable law.
Full document details: AASHTO GSBTW-2-2017 interim revisions 2020