

THE MANUAL FOR BRIDGE EVALUATION

2020 Interim Revisions



AMERICAN ASSOCIATION
OF STATE HIGHWAY AND
TRANSPORTATION OFFICIALS

AASHTO

3rd Edition • 2018

This is a preview. [Click here to purchase the full publication.](#)

Pub. Code: MBE-3-I2

ISBN 978-1-56051-733-7

THIS PAGE INTENTIONALLY LEFT BLANK.

THE MANUAL FOR BRIDGE EVALUATION

2020 Interim Revisions



AMERICAN ASSOCIATION
OF STATE HIGHWAY AND
TRANSPORTATION OFFICIALS
AASHTO

3rd Edition • 2018

Pub. Code: MBE-3-I2-OL
ISBN 978-1-56051-733-7

[This is a preview. Click here to purchase the full publication.](#)



American Association of State Highway and Transportation Officials
555 12th Street, NW, Suite 1000
Washington, DC 20004
202-624-5800 phone/202-624-5806 fax
www.transportation.org

© 2020 by the American Association of State Highway and Transportation Officials. All rights reserved. Duplication is a violation of applicable law.

ISBN: 978-1-56051-733-7

Pub Code: MBE-3-I2

This is a preview. Click here to purchase the full publication.

2020 INTERIM REVISIONS

INSTRUCTIONS AND INFORMATION

General

AASHTO has issued proposed interim revisions to the *Manual for Bridge Evaluation*, Third Edition (2018). 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 blue background to make the changes stand out when inserted in the third edition binder. They also have a page header displaying the page 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.

2020 Changed Articles

SECTION 6: LOAD RATING

6A.6.10

6B.5.2.1

6B.5.3.1

APPENDIX A

Example A1—*Replaced in its entirety*

Example A7—*Replaced in its entirety*

2020 Added Articles

SECTION 6: LOAD RATING

6A.6.10

C6A.6.10

6A.6.10.1

6A.10

THIS PAGE INTENTIONALLY LEFT BLANK.

6A.5.2.1—Concrete	6-37
6A.5.2.2—Reinforcing Steel	6-37
6A.5.2.3—Prestressing Steel	6-38
6A.5.3—Resistance Factors	6-38
6A.5.4—Limit States	6-38
6A.5.4.1—Design-Load Rating	6-39
6A.5.4.2—Legal Load Rating and Permit Load Rating	6-39
6A.5.4.2.1—Strength Limit State	6-39
6A.5.4.2.2—Service Limit State	6-39
6A.5.4.2.2a—Legal Load Rating	6-39
6A.5.4.2.2b—Permit Load Rating	6-40
6A.5.5—Maximum Reinforcement	6-40
6A.5.6—Minimum Reinforcement	6-40
6A.5.7—Evaluation for Flexural and Axial Force Effects	6-41
6A.5.8—Evaluation for Shear	6-41
6A.5.9—Secondary Effects from Prestressing	6-42
6A.5.10—Temperature, Creep, and Shrinkage Effects	6-42
6A.5.11—Rating of Segmental Concrete Bridges	6-43
6A.5.11.1—Scope	6-43
6A.5.11.2—General Rating Requirements	6-43
6A.5.11.3—Application of Vehicular Live Load	6-43
6A.5.11.4—Design-Load Rating	6-43
6A.5.11.5—Service Limit State	6-44
6A.5.11.5.1—Legal Load Rating	6-44
6A.5.11.5.2—Permit Load Rating	6-44
6A.5.11.6—System Factors: ϕ_s	6-44
6A.5.11.7—Evaluation for Shear and Torsion	6-47
6A.5.12—Rating of Reinforced Concrete Box Culverts	6-47
6A.5.12.1—Scope	6-47
6A.5.12.2—General Rating Requirements	6-48
6A.5.12.3—Structural Analysis of Box Culverts	6-48
6A.5.12.4—Load Rating Equation for Box Culverts	6-49
6A.5.12.5—Limit States	6-50
6A.5.12.6—Resistance Factors	6-50
6A.5.12.7—Condition Factor: ϕ_c	6-50
6A.5.12.8—System Factor: ϕ_s	6-51
6A.5.12.9—Materials	6-51
6A.5.12.10—Loads for Evaluation	6-51
6A.5.12.10.1—Dead Loads	6-51
6A.5.12.10.2—Earth Pressure	6-51
6A.5.12.10.2a—Vertical Earth Pressure: EV	6-51
6A.5.12.10.2b—Lateral Earth Pressure: EH	6-51
6A.5.12.10.2c—Uniform Surcharge Loads: ES	6-51
6A.5.12.10.3—Live Loads	6-52
6A.5.12.10.3a—Live Load Distribution	6-52
6A.5.12.10.3b—Dynamic Load Allowance: IM	6-53
6A.5.12.10.3c—Live Load Surcharge: LS	6-53

6A.6—STEEL STRUCTURES.....	6-55
6A.6.1—Scope.....	6-55
6A.6.2—Materials.....	6-55
6A.6.2.1—Structural Steels	6-55
6A.6.2.2—Pins.....	6-56
6A.6.2.3—Wrought Iron.....	6-56
6A.6.3—Resistance Factors	6-56
6A.6.4—Limit States	6-57
6A.6.4.1—Design-Load Rating	6-57
6A.6.4.2—Legal Load Rating and Permit Load Rating	6-57
6A.6.4.2.1—Strength Limit State	6-57
6A.6.4.2.2—Service Limit State.....	6-57
6A.6.5—Effects of Deterioration on Load Rating	6-59
6A.6.6—Tension Members.....	6-62
6A.6.6.1—Links and Hangers.....	6-62
6A.6.6.2—Eyebars.....	6-62
6A.6.7—Noncomposite Compression Members.....	6-63
6A.6.8—Combined Axial Compression and Flexure.....	6-64
6A.6.9—I-Sections in Flexure	6-64
6A.6.9.1—General	6-64
6A.6.9.2—Composite Sections	6-65
6A.6.9.3—Non-Composite Sections.....	6-66
6A.6.9.4—Encased I-Sections	6-66
6A.6.9.5—Cross-Section Proportion Limits	6-66
6A.6.9.6—Riveted Members	6-66
6A.6.9.7—Diaphragms and Cross-Frames.....	6-66
6A.6.10—Evaluation for Shear	6-67
6A.6.10.1—End Panels.....	6-67
6A.6.11—Box Sections in Flexure.....	6-67.2
6A.6.11.1—Diaphragms and Cross-Frames.....	6-67.2
6A.6.12—Evaluation of Critical Connections.....	6-67.2
6A.6.12.1—General	6-67.2
6A.6.12.2—Bearing-Type Connections.....	6-68
6A.6.12.3—Slip-Critical Connections	6-68
6A.6.12.4—Pinned Connections.....	6-68
6A.6.12.5—Riveted Connections	6-68
6A.6.12.5.1—Rivets in Shear	6-68
6A.6.12.5.2—Rivets in Shear and Tension.....	6-70
6A.6.12.6—Gusset Plates	6-70
6A.6.12.6.1—Resistance Reduction for DL/LL Ratio.....	6-71
6A.6.12.6.2—Fastener Shear Resistance	6-71
6A.6.12.6.3—Bolt Slip Resistance	6-73
6A.6.12.6.4—Bearing Resistance at Fastener Holes	6-74
6A.6.12.6.5—Multilayered Gusset and Splice Plates	6-74
6A.6.12.6.6—Gusset Plate Shear Resistance.....	6-75
6A.6.12.6.7—Gusset Plate Compressive Resistance	6-76
6A.6.12.6.8—Gusset Plate Tensile Resistance	6-78
6A.6.12.6.9—Chord Splices	6-80

6A.6.12.6.10—Edge Slenderness	6-82
6A.6.12.6.11—Refined Analysis.....	6-83
6A.7—WOOD STRUCTURES.....	6-86
6A.7.1—Scope.....	6-86
6A.7.2—Materials	6-86
6A.7.3—Resistance Factors.....	6-86
6A.7.4—Limit States	6-86
6A.7.4.1—Design-Load Rating.....	6-86
6A.7.4.2—Legal Load Rating and Permit Load Rating.....	6-87
6A.7.5—Dynamic Load Allowance.....	6-87
6A.7.6—Evaluation of Critical Connections	6-87
6A.8—POSTING OF BRIDGES.....	6-87
6A.8.1—General.....	6-87
6A.8.2—Posting Loads.....	6-87
6A.8.3—Posting Analysis.....	6-88
6A.8.4—Regulatory Signs.....	6-90
6A.8.5—Speed Limits	6-90
6A.9—SPECIAL TOPICS.....	6-91
6A.9.1—Evaluation of Unreinforced Masonry Arches.....	6-91
6A.9.1.1—General.....	6-91
6A.9.1.2—Method of Analysis.....	6-91
6A.9.1.3—Allowable Stresses in Masonry.....	6-91
6A.9.2—Historic Bridges	6-92
6A.10—REFERENCES.....	6-92
APPENDIX A6A—LOAD AND RESISTANCE FACTOR RATING FLOW CHART	6-93
APPENDIX B6A—LIMIT STATES AND LOAD FACTORS FOR LOAD RATING.....	6-94
APPENDIX C6A—LRFD DESIGN LIVE LOAD (HL-93) (LRFD DESIGN ARTICLE 3.6.1).....	6-96
APPENDIX D6A—AASHTO LEGAL LOADS.....	6-97
APPENDIX E6A—LIVE LOAD MOMENTS ON LONGITUDINAL STRINGERS OR GIRDERS (SIMPLE SPAN).	6-100
APPENDIX F6A—VARIATION IN MOMENT RATIO WITH SPAN LENGTH.....	6-102
APPENDIX G6A—RATING OF CONCRETE COMPONENTS FOR COMPRESSION PLUS BENDING.....	6-103
APPENDIX H6A—RATING OF STEEL MEMBERS FOR COMPRESSION PLUS BENDING	6-104
APPENDIX I6A—RATING OF STEEL COMPRESSION MEMBERS WITH ECCENTRIC CONNECTIONS (SECANT FORMULA METHOD).....	6-106
PART B—ALLOWABLE STRESS RATING AND LOAD FACTOR RATING.....	6-108
6B.1—GENERAL	6-108
6B.1.1—Application of Standard Design Specifications	6-108

6B.2—RATING LEVELS	6-109
6B.2.1—Inventory Rating Level	6-109
6B.2.2—Operating Rating Level	6-109
6B.3—RATING METHODS	6-109
6B.3.1—Allowable Stress: <i>AS</i>	6-109
6B.3.2—Load Factor: <i>LF</i>	6-109
6B.4—RATING EQUATION	6-110
6B.4.1—General	6-110
6B.4.2—Allowable Stress	6-111
6B.4.3—Load Factor	6-111
6B.5—NOMINAL CAPACITY: <i>C</i>	6-111
6B.5.1—General	6-111
6B.5.2—Allowable Stress Method	6-111
6B.5.2.1—Structural Steel	6-112
6B.5.2.1.1—Combined Stresses	6-132
6B.5.2.1.2—Batten Plate Compression Members	6-132
6B.5.2.2—Wrought Iron	6-132
6B.5.2.3—Reinforcing Steel	6-133
6B.5.2.4—Concrete	6-133
6B.5.2.4.1—Bending	6-133
6B.5.2.4.2—Columns	6-134
6B.5.2.4.3—Shear (Diagonal Tension)	6-135
6B.5.2.5—Prestressed Concrete	6-135
6B.5.2.6—Masonry	6-135
6B.5.2.7—Timber	6-137
6B.5.3—Load Factor Method	6-138
6B.5.3.1—Structural Steel	6-138
6B.5.3.2—Reinforced Concrete	6-140
6B.5.3.3—Prestressed Concrete	6-140
6B.6—LOADINGS	6-142
6B.6.1—Dead Load: <i>D</i>	6-142
6B.6.2—Rating Live Load	6-142
6B.6.2.1—Wheel Loads (Deck)	6-143
6B.6.2.2—Truck Loads	6-143
6B.6.2.3—Lane Loads	6-144
6B.6.2.4—Sidewalk Loadings	6-145
6B.6.2.5—Live Load Effects: <i>L</i>	6-145
6B.6.3—Distribution of Loads	6-145
6B.6.4—Impact: <i>I</i>	6-145
6B.6.5—Deflection	6-146
6B.6.6—Longitudinal Loads	6-146
6B.6.7—Environmental Loads	6-146
6B.6.7.1—Wind	6-146
6B.6.7.2—Earthquake	6-146
6B.6.7.3—Temperature, Creep, and Shrinkage	6-146