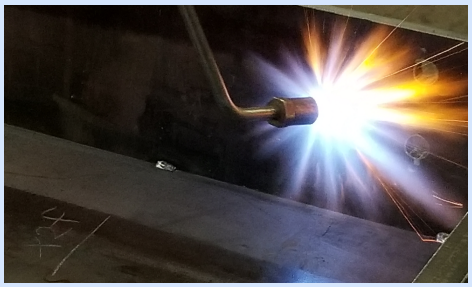
Steel Bridge Fabrication QC/QA Guidelines

G4.1-2019











American Association of State Highway and Transportation Officials

AASHTO

American Association of State Highway and Transportation Officials
National Steel Bridge Alliance
AASHTO/NSBA Steel Bridge Collaboration
Documents
Document Sharing Hub
Full document details: AASHTO G4.1-2019

PREFACE

This document is a standard developed by the AASHTO/NSBA Steel Bridge Collaboration. The primary goal of the Collaboration is to achieve steel bridge design and construction of the highest quality and value through standardization of the design, fabrication, and erection processes. Each standard represents the consensus of a diverse group of professionals.

It is intended that Owners adopt and implement Collaboration standards in their entirety to facilitate the achievement of standardization. It is understood, however, that local statutes or preferences may prevent full adoption of the document. In such cases, Owners should adopt these documents with the exceptions they feel are necessary.

Cover graphics courtesy of Atema Inc.and High Steel Structures, LLC.

DISCLAIMER

The information presented in this publication has been prepared in accordance with recognized engineering principles and is for general information only. While it is believed to be accurate, this information should not be used or relied upon for any specific application without competent professional examination and verification of its accuracy, suitability, and applicability by a licensed professional engineer, designer, or architect.

The publication of the material contained herein is not intended as a representation or warranty of the part of the American Association of State Highway and Transportation Officials (AASHTO) or the National Steel Bridge Alliance (NSBA) or of any other person named herein, that this information is suitable for any general or particular use or of freedom from infringement of any patent or patents. Anyone making use of this information assumes all liability arising from such use.

Caution must be exercised when relying upon other specifications and codes developed by other bodies and incorporated by reference herein since such material may be modified or amended from time to time subsequent to the printing of this edition. The authors and publishers bear no responsibility for such material other than to refer to it and incorporate it by reference at the time of the initial publication of this edition.

Copyright © 2019 by the AASHTO/NSBA Steel Bridge Collaboration
All rights reserved.

AASHTO Document No: NSBASBFQC-2

ISBN: 978-1-56051-740-5

Documents
Document Sharing Hub

Full document details: AASHTO G4.1-2019

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
444 North Capitol Street, N.W. Suite 249
Washington, D.C. 20001

EXECUTIVE COMMITTEE
2019–2020

OFFICERS:

PRESIDENT: Patrick McKenna, Missouri*

VICE PRESIDENT: Victoria Sheehan, New Hampshire*

SECRETARY-TREASURER: Scott Bennett, Arkansas

EXECUTIVE DIRECTOR: Jim Tymon, Washington, D. C.

REGIONAL REPRESENTATIVES:

REGION I: Vacant
Diane Gutierrez-Scaccetti, New Jersey

REGION II: Melinda McGrath, Mississippi
Russell McMurry, Georgia

REGION III: Mark Lowe, Iowa
Craig Thompson, Wisconsin

REGION IV: Kyle Schneweis, Nebraska
James Bass, Texas

IMMEDIATE PAST PRESIDENT: Carlos Braceras, Utah

***Elected at the 2019 Annual Meeting in St. Louis, Missouri**

Documents
Document Sharing Hub

Copyright © 2019 by the AASHTO/NSBA Steel Bridge Collaboration
All rights reserved.

Full document details: AASHTO G4.1-2019

This page intentionally left blank.

Documents
Document Sharing Hub

Copyright © 2019 by the AASHTO/NSBA Steel Bridge Collaboration
All rights reserved.

Full document details: AASHTO G4.1-2019

AASHTO COMMITTEE ON BRIDGES AND STRUCTURES, 2019

CARMEN E.L. SWANWICK, *Chair*
SCOT BECKER, *Vice Chair*
JOSEPH L. HARTMANN, Federal Highway Administration, *U.S. DOT Liaison*
PATRICIA J. BUSH, *AASHTO Liaison*

ALABAMA, William "Tim" Colquett, Eric J. Christie, Randall Mullins
ALASKA, Richard A. Pratt, Leslie Daughtery, Elmer E. Marx
ARIZONA, David L. Eberhart, David Benton, Pe-Shen Yang
ARKANSAS, Charles "Rick" Ellis, Michael Hill, Joe Sartini
CALIFORNIA, Thomas A. Ostrom, Gedmund Setberg, Dolores Valls
COLORADO, Michael Collins, Stephen Harelson, Jessica Martinez
CONNECTICUT, Timothy D. Fields, Mary E. Baker
DELAWARE, Jason N. Hastings, Jason Arndt, Craig A. Stevens
DISTRICT OF COLUMBIA, Konjit C. "Connie" Eskender, Donald L. Cooney, Richard Kenney
FLORIDA, Sam Fallaha, William Potter, Jeff A. Pouliotte
GEORGIA, Bill DuVall, Douglas D. Franks, Steve Gaston
HAWAII, James Fu, Kevin Murata, John Williams
IDAHO, Matthew M. Farrar
ILLINOIS, Carl Puzey, Tim A. Armbrecht, Jayme Schiff
INDIANA, Anne M. Rearick, Andrew Fitzgerald, Stephanie Wagner
IOWA, James S. Nelson, Ahmad Abu-Hawash, Michael Nop
KANSAS, Karen Peterson
KENTUCKY, Bart Asher, Andy Barber, Marvin Wolfe
LOUISIANA, Zhengzheng "Jenny" Fu, Artur D'Andrea, Chris Guidry
MAINE, Wayne L. Frankhauser, Jeff S. Folsom, Michael H. Wight
MARYLAND, Maurizio Agostino, Jesse Creel, Jeffrey Robert
MASSACHUSETTS, Alexander K. Bardow, Joe Rigney
MICHIGAN, Matthew Chynoweth, Rebecca Curtis, Richard E. Liptak
MINNESOTA, Kevin L. Western, Arielle Ehrlich, Ed Lutgen
MISSISSIPPI, Justin Walker, Scott Westerfield
MISSOURI, Dennis Heckman, Greg E. Sanders
MONTANA, Stephanie Brandenberger, Amanda Jackson, Dustin E. Rouse
NEBRASKA, Mark J. Traynowicz, Mark Ahlman, Fouad Jaber
NEVADA, Jessen Mortensen, Troy Martin
NEW HAMPSHIRE, Robert Landry, David L. Scott
NEW JERSEY, Eddy Germain, Xiaohua "Hannah" Cheng
NEW MEXICO, Shane Kuhlman, Kathy Crowell, Jeff C. Vigil
NEW YORK, Richard Marchione, Brenda Crudele, Ernest Holmberg
NORTH CAROLINA, Brian Hanks, Scott Hidden, Girchuru Muchane
NORTH DAKOTA, Jon D. Ketterling, Jason R. Thorenson
OHIO, Timothy J. Keller, Alexander B.C. Dettloff, Jeffrey E. Syar
OKLAHOMA, Steven J. Jacobi, Walter L. Peters, Tim Tegeler
OREGON, Albert Nako, Tanarat Potisuk
PENNSYLVANIA, Thomas P. Macioce, Richard Runyen, Louis J. Ruzzi
PUERTO RICO, (Vacant)
RHODE ISLAND, Georgette K. Chahine, Keith Gaulin
SOUTH CAROLINA, Terry B. Koon, Hongfen Li, Jeff Sizemore
SOUTH DAKOTA, Steve Johnson, Dave Madden, Todd S. Thompson
TENNESSEE, Ted A. Kniazewycz

Documents
Document Sharing Hub

Copyright © 2019 by the AASHTO/NSBA Steel Bridge Collaboration
All rights reserved.

Full document details: AASHTO G4.1-2019

TEXAS, Graham Bettis, Bernie Carrasco, Jamie F. Farris

UTAH, Carmen E.L. Swanwick, Cheryl Hersh Simmons, Rebecca Nix

VERMONT, Kristin M. Higgins, Jim Lacroix

VIRGINIA, Kendal R. Walus, Prasad L. Nallapaneni, Andrew M. Zickler

WASHINGTON STATE, Mark A. Gaines, Tony M. Allen, Bijan Khaleghi

WEST VIRGINIA, Tracy W. Brown, Ahmed Mongi

WISCONSIN, Scot Becker, Bill C. Dreher, William L. Oliva

WYOMING, Michael E. Menghini, Jeff R. Booher, Paul Cortez

MARYLAND TRANSPORTATION AUTHORITY, James Harkness

MULTNOMAH COUNTY TRANSPORTATION DIVISION, Jon Henrichsen

NEW YORK STATE BRIDGE AUTHORITY, William Moreau

TRANSPORTATION RESEARCH BOARD, Waseem Dekelbab

U.S. ARMY CORPS OF ENGINEERS— Phillip W. Sauser

U.S. COAST GUARD, Kamal Elnahal

U.S. DEPARTMENT OF AGRICULTURE—FOREST SERVICE, John R. Kattell

Documents
Document Sharing Hub

Copyright © 2019 by the AASHTO/NSBA Steel Bridge Collaboration
All rights reserved.

Full document details: AASHTO G4.1-2019

AASHTO/NSBA STEEL BRIDGE COLLABORATION
CONTRIBUTOR LIST

Bruce Abernathy, Maryland State Highway Administration
Frank Adragna, TRC Companies, Inc.
Camille Bernier, Canam–Bridges
Art Bustos, AISC
Terry Cummings, TRC Companies, Inc.
Denis Dubois, HRV Conformance Verification Associates, Inc.
Steve Duke, Florida Department of Transportation
Philip Dzikowski, Wood Environment and Infrastructure Solutions
Jon Edwards, DOT Quality Services
Sammy Elsayed, Skanska USA Civil
Martin Francis, ArcelorMittal
Karl Frank, NSBA–Consultant
Christopher Garrell, NSBA
John Gast, Consultant
Heather Gilmer, HRV Conformance Verification Associates, Inc.
Rich Giusti Jr., Haydon Bolts Inc.
Caleb Gunter, South Carolina Department of Transportation
Chad Hawkins, South Carolina Department of Transportation
Jamie Hilton, KTA–Tator, Inc.
Robert Horwhat, TRC Companies, Inc.
Adil Khan, Wood Environment and Infrastructure Solutions
Pat Loftus, Industrial Steel Construction, Inc.
Timothy McCullough, Florida Department of Transportation
Ronnie Medlock, High Steel Structures LLC
Teresa Michalk, Texas Department of Transportation
Burl Mitchell, Structural Steel Products Corp.
Raymond Monson, Pennoni Associates Inc.
Justin Ocel, FHWA
Anna Petroski, DOT Quality Services
Brian Raff, AISC
Ronald Runk, High Steel Structures LLC
Phil Sauser, U.S. Army Corps of Engineers
Robert Stachel, HRV Conformance Verification Associates, Inc.
Jonathan Stratton, Structural Steel Products Corp.
Brad Streeter, D.S. Brown
Maury Tayarani, Pennoni Associates Inc.
Dayi Wang, FHWA
Gary Wisch, DeLong's, Inc.

Documents
Document Sharing Hub

Copyright © 2019 by the AASHTO/NSBA Steel Bridge Collaboration
All rights reserved.

Full document details: AASHTO G4.1-2019

This page intentionally left blank.

Documents
Document Sharing Hub

Copyright © 2019 by the AASHTO/NSBA Steel Bridge Collaboration
All rights reserved.

Full document details: AASHTO G4.1-2019

TABLE OF CONTENTS

Section 1—Introduction 1
Section 2—Definitions and Acronyms 3
Section 3—Plant Certifications 5
Section 4—Reference Documents and Personnel Qualifications 7
4.1—Reference Documents 7
4.2—Personnel Qualifications 7
4.2.1—Fabricator 7
4.2.2—Owner 7
Section 5—Management Responsibilities 9
5.1—Team Effort 9
5.2—Owner 9
5.3—Fabricator 9
Section 6—Fabricator Contract Documentation Review and Communication 11
6.1—General 11
6.2—Contract Review 11
6.3—Contract Review Record 11
6.4—Project Communication 12
Section 7—Shop Detailing 13
Section 8—Fabricator Document and Data Control 15
8.1—Review and Approval 15
8.2—Revision Control 15
8.3—Access 16
8.4—Obsolescence 16
8.5—Transmittal 16
Section 9—Fabricator Control of Quality Records 17
9.1—Retention of Quality Records 18
9.2—Availability of Quality Records 18
Section 10—Fabricator Purchasing 19
10.1—Fabrication, Coating, Detailing and the NDE Subcontractor 19
10.2—Selection and Evaluation of Subcontractors and Suppliers 19
10.3—Purchase Orders and Subcontracts 19
10.4—Acceptance of Purchased Product, Materials, and Services 19
Section 11—Material Identification by Fabricator 21
Section 12—Fabrication Process Control 23
Section 13—Inspection and Testing 25
13.1—Inspection 25
13.2—Nondestructive Evaluation 25

Documents
Document Sharing Hub

Copyright © 2019 by the AASHTO/NSBA Steel Bridge Collaboration
All rights reserved.

Full document details: AASHTO G4.1-2019

Section 14—Fabricator's Calibration and Verification of Inspection Measuring and Testing Equipment ...27
14.1—Inspection and Testing Equipment ...27
Section 15—Control of Nonconformance ...29
Section 16—Corrective Action ...31
Section 17—Handling, Storage, and Delivery of Product and Materials ...33
Section 18—Fabricator Training ...35
18.1—General ...35
18.1.1—Specifications, Codes, and Standards ...35
18.1.2—Material Handling ...35
18.1.3—Material Preparation ...35
18.1.4—Fitting, Fastening, and Shop Assembly ...35
18.1.5—Welding ...36
18.1.6—Nondestructive Evaluation ...36
18.1.7—Surface Preparation and Shop Coating ...36
18.1.8—Reporting and Documentation ...36
Section 19—Audits ...37
19.1—Fabricator ...37
19.2—Owner ...37

Documents
Document Sharing Hub
Copyright © 2019 by the AASHTO/NSBA Steel Bridge Collaboration
All rights reserved.
Full document details: AASHTO G4.1-2019

SECTION 1—INTRODUCTION

The purpose of this document is to provide guidance to Owner Agencies, Fabricators, and Contractors for maintaining and ensuring quality inspection and verification standards for fabrication of steel bridges. This document, intended to replace S4.1, provides information that is complementary to applicable welding codes and AISC standards and will be useful for developing a Fabricator Quality Control (QC) System and corresponding Quality System Manual. Duties and responsibilities of the Fabricators and Owner Agencies are addressed. The predecessor to this document, AASHTO–NSBA Steel Bridge Collaboration S4.1, *Steel Bridge Fabrication QC/QA Guide Specification*, described recommended detailed activities for Fabricators and Owners based largely on the AISC certification program, AASHTO/AWS D1.5M/D1.5 *Bridge Welding Code* requirements and a consensus of professionals in the industry. This document has been written with the assumption that applicable welding codes and AISC certification requirements are met. Where AISC certification is not required, Owners and Fabricators should be familiar with applicable AISC requirements and incorporate similar provisions as appropriate. Topics are organized to have similar document structure to the AISC Certification Program for Steel Bridge Fabricators, in order to bring consistency among varying stakeholders and avoid conflicting information. When Sections are referenced herein, they are sections of this document, not the AISC standards. Numbered section references to AASHTO/AWS D1.5 are from the 2015 edition.

Documents
Document Sharing Hub

Copyright © 2019 by the AASHTO/NSBA Steel Bridge Collaboration
All rights reserved.

Full document details: AASHTO G4.1-2019

This page intentionally left blank.

Documents
Document Sharing Hub

Copyright © 2019 by the AASHTO/NSBA Steel Bridge Collaboration
All rights reserved.

Full document details: AASHTO G4.1-2019

SECTION 2—DEFINITIONS AND ACRONYMS

Terms used in this document are in accordance with the AASHTO–NSBA Steel Bridge Collaboration standards. Terms that are specifically significant to this document are defined as follows:

AASHTO—American Association of State Highway and Transportation Officials

Acceptance—All factors used by the Agency (e.g., sampling, testing, and inspection) to evaluate the degree of compliance with Contract requirements and to determine the corresponding value for a given product.

Agency—Any organization, constituted under federal, state, or municipal laws that is responsible for administering contracts for highway or transportation construction (see Owner).

AISC—American Institute of Steel Construction

ASTM—ASTM International

AWS—American Welding Society

BCI—Bridge Coating Inspector

CAR—Corrective Action Report

CIP—Coating Inspection Program

CMTR—Certified Mill Test Report

CWI—AWS Certified Welding Inspector

Contractor—The Contractor is responsible for proper completion of all tasks required by the Contract. Subcontractors, including Fabricators, Erectors, and field coaters may be used by the Contractor, but the Contractor retains responsibility for all material, operations, and the final product. The Contractor should permit direct subcontractor interaction with the Owner to expedite the project, but subcontractors must obtain the Contractor's approval before implementing any proposed modifications to Contract requirements accepted by the Owner.

Fabricator—In this document, refers to the facility performing such shop activities as cutting, welding, drilling, punching, bolting, cleaning, and coating of structural steel. The term "Fabricator" also includes project-related agents of the Fabricator, such as those who design proprietary items or prepare shop detail drawings. In some cases the Fabricator may also be the Contractor, but usually the Fabricator is a subcontractor.

FHWA—Federal Highway Administration

Inspection—The examination by the Owner, Contractor, or Fabricator, of processes and products to verify conformance with Contract requirements.

Inspector—When used by itself, the term "Inspector" is to mean either the Owner's Inspector or the Fabricator's QC Inspector.

NACE—NACE International

NCR—Nonconformance Report

NDE—Nondestructive Evaluation

NSBA—National Steel Bridge Alliance

Documents
Document Sharing Hub

Copyright © 2019 by the AASHTO/NSBA Steel Bridge Collaboration
All rights reserved.

Full document details: AASHTO G4.1-2019

Owner—In this document, "Owner" refers to the Owner Agency paying the Contractor to fulfill the terms of the Contract. The Owner also encompasses those preparing the Contract documents, including the structure's adequate design, and individuals authorized to represent the Agency during construction, commonly called the "Engineer" and the "Inspector". The Engineer and Inspector may be employees of the Agency or professional firms contracted by the Agency for the work (see Agency, earlier).

Owner Inspection—Inspection and testing are activities carried out by the Owner to confirm that fabricated materials meet the contract documents and the Fabricator is complying with their QSM. Owner inspection could also include acceptance inspection by representatives of a public-private partnership or Design Build entity.

Owner Inspector—The Owner's representative in matters of Owner inspection.

QC—Quality Control—The system used by the Contractor/Fabricator to monitor, assess, and adjust their production or placement processes to ensure that the final product will meet the specified level of quality. QC includes sampling, testing, inspection, evaluation, and corrective action (when required) to maintain continuous control of the fabrication or placement process.

QCI—Quality Control Inspector—A qualified individual who performs formal QC inspection and testing as defined by the Fabricator's Quality System Manual.

QSM—Quality System Manual—A written document that describes the overall QC operating procedures for the Fabricator. A Fabricator's QSM documents the internal policies for achieving quality and the assignment of responsibility and accountability for QC within the Fabricator's organization. It may also describe the minimum QC requirements expected of parties subcontracted to the Fabricator who supply constituent materials or who are involved in handling or processing of the Fabricator's products. Related terms include Quality Plan, Quality Control Plan, Quality Assurance Manual, and Quality Management.

RFI—Request for Information

SSPC—Society for Protective Coatings

Spot Inspection—The examination of selected portions of the Fabricator's processes or products to verify conformance with Contract requirements.

Documents
Document Sharing Hub

Copyright © 2019 by the AASHTO/NSBA Steel Bridge Collaboration
All rights reserved.

Full document details: AASHTO G4.1-2019

SECTION 3—PLANT CERTIFICATIONS

For the purpose of this guide, plant certification means certification through AISC in the appropriate category for the type of structure being fabricated. This guide also recognizes that the Owner may choose other certification processes as they may deem necessary.

AISC categories for bridge Fabricator are Advanced, Intermediate, and Simple Bridge. There also may be a need for Advanced and Intermediate Bridge certified Fabricators to have the Fracture-Critical endorsement. Refer to Article 2.1 of AASHTO–NSBA S2.1, *Steel Bridge Fabrication Guide Specification* for descriptions of bridge fabrication categories. A Fabricator that supplies bridge components or highway components should be certified to the AISC Metals Component Certification Program.

When a Fabricator applies coatings, the Owner may require certification as defined in Article 3.1 of AASHTO–NSBA S8.1, *Guide Specification for Application of Coating Systems with Zinc-Rich Primers to Steel Bridges.*

It is the responsibility of the Contractor to select a Fabricator that has the correct certifications and endorsements for the work proposed in the Contract documents. It is the responsibility of the Owner to verify that the Fabricator has the correct certifications and endorsements for the work proposed in the Contract documents.

Documents
Document Sharing Hub

Copyright © 2019 by the AASHTO/NSBA Steel Bridge Collaboration
All rights reserved.

Full document details: AASHTO G4.1-2019