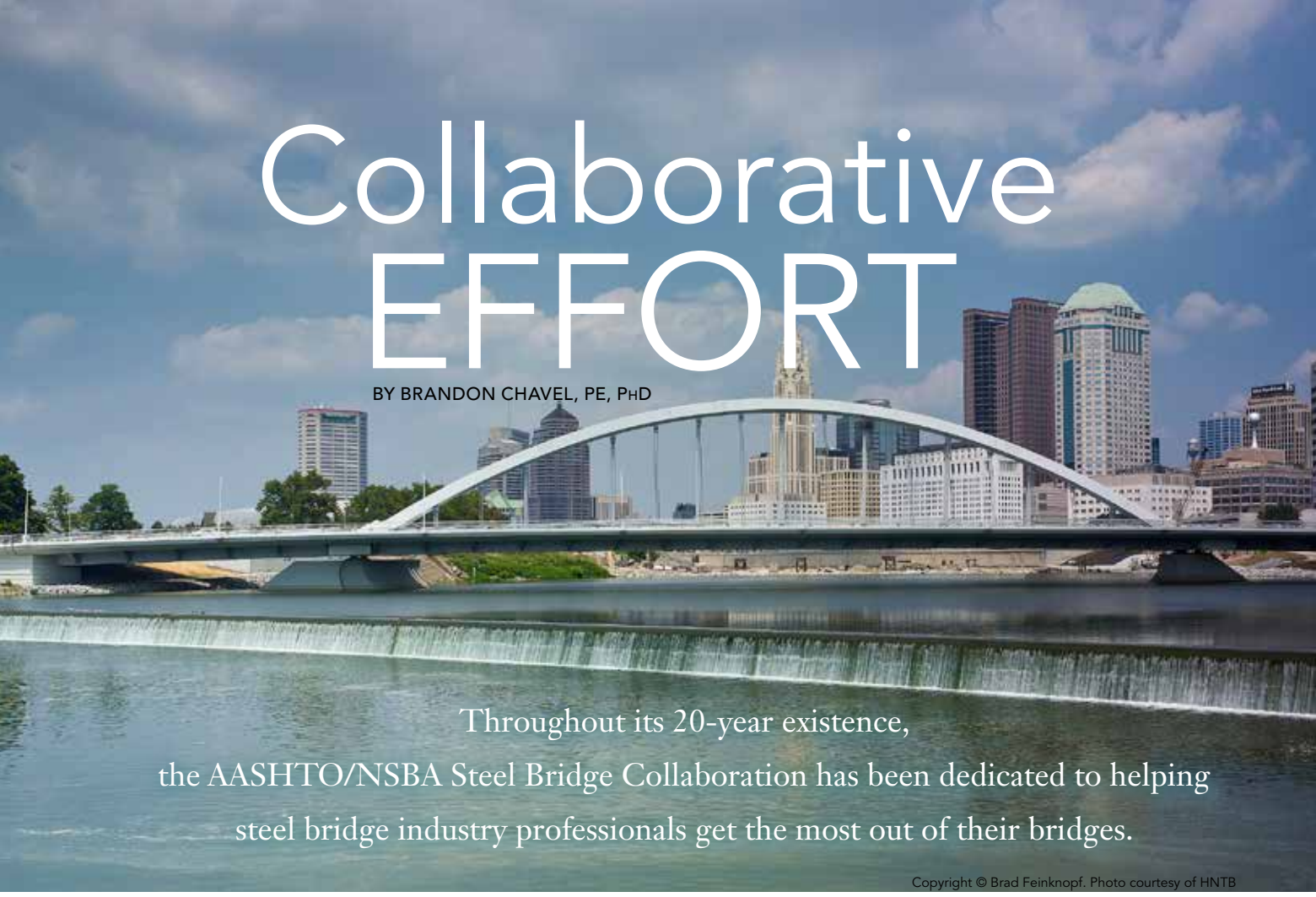
Collaborative EFFORT

BY BRANDON CHAVEL, PE, PHD



Throughout its 20-year existence, the AASHTO/NSBA Steel Bridge Collaboration has been dedicated to helping steel bridge industry professionals get the most out of their bridges.

BRIDGE INDUSTRY PROFESSIONALS are faced with many decisions as they journey through the steel bridge superstructure design, fabrication and construction process.

The designer is faced with choosing the right bridge type, understanding the structural behavior, running the appropriate analysis, designing the bracing, creating the appropriate fatigue details and selecting a suitable bearing configuration. Fabricating the steel elements is just as important, encompassing material procurement considerations, web and flange cutting and sizing issues, welding and assembling connections and selecting the desired fit condition if the bridge alignment is curved and/or the supports are skewed.

Furthermore, designers should—and erection engineers must—consider how the bridge may be constructed, including common steel erection methods and possible crane placements, girder shipping lengths and weights and the deck-casting sequence. Fortunately, there are several published references that can be used to aid in the development of efficient and economical steel bridge superstructures from design through construction.

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Leading the way is the AASHTO/NSBA Steel Bridge Collaboration, a joint effort between the American Association of State Highway and Transportation Officials (AASHTO) and the National Steel Bridge Alliance (NSBA). This collaboration brings together representatives from state departments of transportation, the Federal Highway Administration (FHWA), academia and various industry groups related to steel bridge design, fabrication and inspection. For the last 20 years, the group's mission has been to provide a forum where professionals can work together to improve and achieve the quality and value of steel bridges through standardization of design, fabrication and erection. Currently, there are 10 working Collaboration Task Groups in which members volunteer their time and resources with the intent of developing resources that provide steel bridge industry professionals with best practices. The Task Groups include:

- TG 1 – Detailing
- TG 2 – Fabrication Specification
- TG 4 – QA/QC
- TG 8 – Coatings
- TG 10 – Erection
- TG 11 – Steel Bridge Design Handbook
- TG 12 – Design for Economy and Constructability
- TG 13 – Analysis of Steel Bridges
- TG 15 – Data Modeling for Interoperability
- TG 16 – Orthotropic Deck Panels

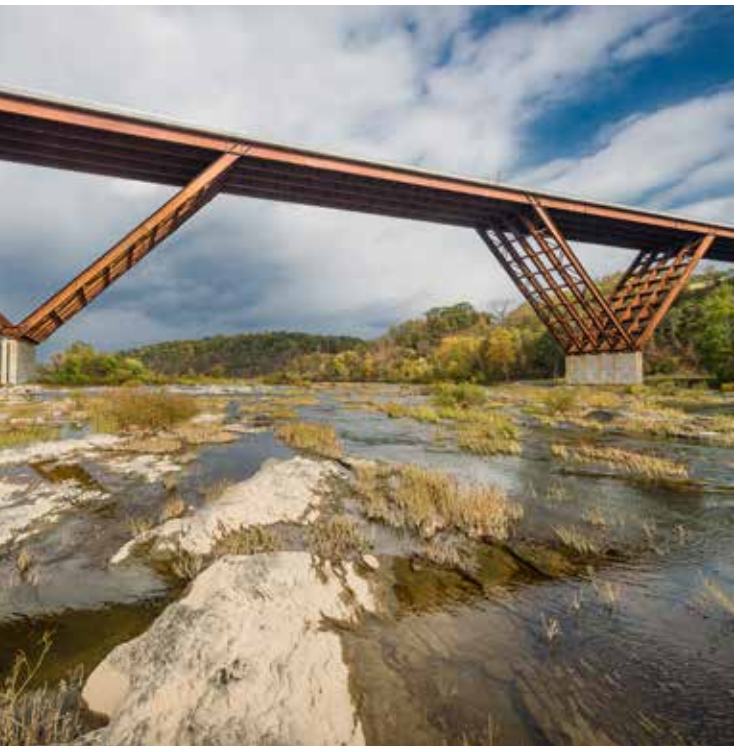
Over the last 20 years, these groups have produced essential resources, in the form of specifications or guidelines, that are available free to the steel bridge community. The specifications are written in standard specification language so they can be adopted in whole as part of the contract document, as applicable, and continue to be a priority for the Collaboration as they provide a means of standardization when adopted as a part of project's contract documents. The guidelines are written as references to be used during the design, fabrication and construction processes and are a consensus of best practices developed by industry. Referencing these specifications and/or guidelines allows for a common language across all stakeholders, including owners, engineers, fabricators and erectors, while also facilitating the standardization of steel bridges.

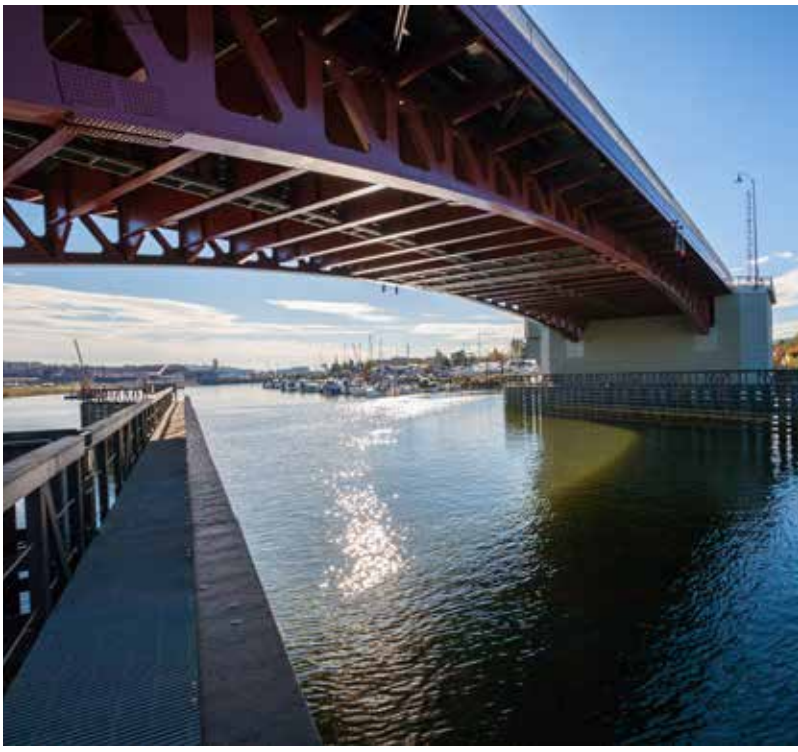
In some cases, individual specifications and guidelines are written with a specific audience in mind. Here, we'll highlight which documents are applicable to which stakeholder, though it should be noted that anyone involved in the steel bridge industry should be familiar with each of these very important and useful documents.

Bridge Engineers

Several of the specifications and guidelines are "must-have" references for all steel bridge engineers, regardless of level of experience and expertise. These references provide bridge engineers with consensus best practices and necessary information to design efficient and economical steel bridges. They are as follows:

- G1.1-2000 *Shop Drawing Approval Review/Approval Guidelines* provides owners and engineers with typical guidelines, as well as an overall framework of responsibilities for the approval of shop drawings. A checklist of common items that should typically be reviewed is provided.
- G1.2-2003 *Design Drawings Presentation Guidelines* should be referenced for the development of design drawings, as it provides advice on the minimum information required to detail and fabricate a steel structure. Sample drawings illustrating the needed information are provided. While most owners have their own standards, additional drawing details may be warranted, as shown in these guidelines, that will help to facilitate detailing and fabrication of the structure.
- G1.4-2006 *Guidelines for Design Details* is a guideline that provides a collection of sample design details that allow for the economical fabrication and erection of bolted splices, cross frames and stiffeners. When in doubt regarding a specific design detail, this should be the engineer's first reference.
- G9.1-2004 *Steel Bridge Bearing Design and Detailing Guidelines* presents steel bridge bearing details that are cost-effective, functional and durable.
- G12.1-2016 *Guidelines to Design for Constructability* provides engineers with design and detailing recommendations to help make steel girder type bridges more easily fabricated and constructable. Engineers should refer to this guideline for a better understanding of certain details can affect fabrication, as well as for general guidance that will allow the engineer to make better informed decisions during design.
- G13.1-2014 *Guidelines for Steel Girder Bridge Analysis* provides the most comprehensive presentation and discussion regarding analysis techniques associated with steel girder bridges. The guideline includes a discussion on line girder, 2D and 3D analysis methods while also helping engineers determine the appropriate level of analysis based on a bridge's geometric aspects. Other topics include the behavior characteristics of curved and/or skewed steel girder bridges, loading considerations, constructability analyses, consideration of detailing methods, cross frame modeling and necessary analysis considerations for phased construction, re-decking and widenings.





The Collaboration: A History

The AASHTO/NSBA Steel Bridge Collaboration was born in 1997, over dinner one night at the spring meeting of the AWS D1 Committee in Phoenix.

At that dinner, Fred Beckmann, Krishna Verma and I chatted about the lack of standard practices in steel bridges. In our collective experience, we knew of many examples where lack of standardization led to higher costs and longer schedules. Further, the broad variety of special requirements often led to errors; what was demanded on one job might be strictly forbidden on another and expectations could sometimes get mixed up, resulting in errors, headaches and costly rework. Frustrated by the unnecessary waste, we hypothesized about the reasons and possible solutions for such great variation. Wasn't there some way to get everyone, or at least many more folks, on the same page?

Clearly, a lack of standards was a fundamental reason for the lack of standardization. For fabrication requirements, most state DOTs used their own specification (typically a "steel structures" item in their standard specifications book) resulting in a great variety of requirements on the shop floor. Conversely, the AASHTO/AWS D1.5 *Bridge Welding Code* demonstrates what is possible when standards exist. Brought into existence in 1988, 49 of 50 states have adopted it to govern bridge welding—thus achieving some standardization for many aspects of steel bridge fabrication.

AASHTO/NSBA
COLLABORATION
CELEBRATING 20 YEARS

The founding trio felt that many more steel bridge construction activities could be standardized if standards existed, and the potential benefits were obvious. We knew that the standards would be strong if a diverse group, representing every aspect of steel bridge design and construction, collaborated to develop them. Further, we recognized that like the *Bridge Welding Code*, such standards would gain greater acceptance in the bridge community if they were approved by both the public and private sectors.

So, we decided to pursue support from AASHTO and NSBA months later at the annual AASHTO Highway SCOBS (Subcommittee on Bridges and Structures) meeting in Jackson, Wyo. Graciously, Ed Wasserman, then chair of T14 – Steel Design Technical Committee, agreed and put me on the agenda to present the concept publicly. At the same venue, Fred and I presented the concept to the NSBA Executive Council, where it received strong support from Arun Shirole, who was the executive director at the time, as well as Pat Loftus, then chair of the NSBA Executive Committee, and permission was eventually granted to found the Collaboration.

During the summer of 1997, Fred and I worked through the details about how to operate the Collaboration. Wanting to be as inclusive as possible, I sent written invitations (by signed letter, since this was before email was in wide use) to more than 300 industry professionals, including reaching out to every state DOT. To help facilitate travel for some potential participants, the first meeting was scheduled for co-location with the fall 1997 meeting of the AWS Structural Welding Committee in Cincinnati. Speakers were arranged to address a variety of topics to help plant the seeds of success.

The meeting found fertile ground indeed; responses were overwhelmingly in favor of the standardization promise envisioned in the Collaboration. Though many could not travel to the meeting, more than 40 industry professionals attended. Walter Gatti of Tensor Engineering and Bob Kase, then of High Steel, presented recommendations for constructable steel bridge detailing. Kim Roddis, then of the University of Kansas, spoke about a pooled fund study she was leading to automate and standardize shop repair procedure. Krishna spoke about new technologies and the need for associated implementation to advance the steel bridge state-of-the-art. I spoke about the broad and often conflicting variety of shop fabrication requirements. And Lou Triandafilou, then with FHWA, spoke about efforts among in the FHWA Region 3 (now the mid-Atlantic) states to standardize practices regionally—similar to the Collaboration's plans at the national level.

Enthusiasm and energy built and after two days of meetings, action plans were in place. Eight task groups were formed to address the first priorities of the Collaboration. The Collaboration was structured such that the task groups would develop standards, then present them to the Main Committee for approval—and upon approval, the standards would be sent to the NSBA and SCOBS. The Main Committee would operate by consensus: Anyone with an interest in steel bridges could participate and vote because the founding body felt it important that everyone be heard.

Hence, the Collaboration was born, and the initial meeting took place in the fall of 1997. The Collaboration has met twice a year since then, each spring and fall. The past two decades have seen thousands of hours of fruitful discourse among hundreds of professionals in the steel bridge community, as well as the publication of dozens of standards—many now in their second or third edition. Undisputedly, the standards represent the state-of-the-art for the topics they cover. Steel bridges and the needs of the steel bridge community continue to grow and change, but the original mission—improving steel bridge design and construction through the development and implementation of state-of-the-art standards—has remained the same. Here's to the next 20 years!

– By Ronnie Medlock, PE

Fabricators

There are also multiple Collaboration documents geared directly toward fabricators and owners. Several of these are often adopted in whole by owners, or as part of the contract documents for a particular project.

- S2.1-2016 *Steel Bridge Fabrication Guide Specification* provides fabricators with the necessary guidance to better achieve quality and value in the fabrication of steel bridges by providing specification language in regard to material control, workmanship, application of heat and geometric control.
- S4.1-2002 *Steel Bridge Fabrication QC/QA Guide Specification* sets minimum requirements that can be adopted by fabricator's quality control program and by an owner's quality assurance program.
- S8.1-2014 *Guide Specification for Application of Coating Systems* provides consensus procedures for the application of zinc-rich coating systems on steel bridges. It includes requirements with regard to material acceptance, surface preparation and paint application, as well as references to all applicable standards.
- S8.2-2016 *Guide Specification for Application of Thermal Spray Coating (Metallizing) for Steel Bridges* is a specification for shop metalizing practices. With an expected late 2017 publication date, owners can adopt this practice to govern metalizing practices at fabricators. Comprehensively, it addresses fabricator personnel qualifications, quality control manual requirements for metalizing and cleaning and application requirements.
- G1.2-2002 *Shop Detail Drawing Presentation Guidelines* provides a reference for fabricators for the development of shop drawings, while also serving as a reference for owners and engineers approving shop drawings.
- G2.2-2016 *Guidelines for Resolution of Steel Bridge Fabrication Errors* addresses common issues that may occur during the fabrication process and how these errors can be resolved in an ecumenical fashion while also preserving the integrity and resistance of the particular component.
- G4.2-2006 *Recommendations for the Qualifications of Structural Bolting Inspectors* defines the essential factors involved in structural bolting and the qualification of personnel inspecting and monitoring those operations.
- G4.4-2006 *Sample Owners Quality Assurance Manual* provides an example that can be used as a guide by owners or other shop inspection agencies for the development of their own quality assurance procedures.

Contractors and Erectors

One collaboration specification directly addresses the erection of steel girder bridges: S10.1-2014 *Steel Bridge Erection Guide Specification*. This document, which can be adopted by owners in whole or in parts, covers all aspects of steel girder bridge erection, including transportation and job site storage of girders, bolted connections, inspection, repairs and guidance for erection engineering computations. It also includes checklists for erection plans and procedures and erection engineering computations that can be used when assembling or reviewing erection plans, procedures and computations.

Ongoing Collaboration Work

The various task groups continue to develop resources for the steel bridge community. For example, TG10 has been working to update the existing S10.1-2014 *Steel Bridge Erection Guide Specification* while also combining efforts with TG15 to develop an information delivery manual for steel bridges that would standardize the software formatting for erection engineers in a bridge information modeling (BrIM) working environment. TG11 is currently developing a much-needed guideline document for cross frame and diaphragm design in steel I-girder bridges. And TG16 is currently working towards a guideline for more easily manufactured orthotropic decks, evaluating recent research results and industry projects and authoring research needs statements.

For the last 20 years, the AASHTO/NSBA Steel Bridge Collaboration has strived to provide the best available resources to the steel bridge community for the efficient and economical construction of steel bridges. The aforementioned specifications and guidelines focus on providing necessary references and guidance to designers, fabricators, owners and erectors and in many cases, these Collaboration documents are the only such references in existence. All Collaboration members have one goal in mind: to develop methods, strategies and standardizations that others can use on a day-to-day basis. Because of the wide range of Collaboration members, the documents produced by its task groups are consensus industry documents that will provide bridge professionals with the ability to achieve high-quality economical solutions for steel bridges for years to come. ■