

## TRIENNIAL STRATEGIC PLAN (TSP)

**Evaluation Period: February 1, 2017 to January 31, 2020**

*Please note that rows and boxes below expand as you enter the information*

### PART 1: Committee Name and Scope

*This is an opportunity to review the officially approved name and scope that are posted on the TRB website and consider any necessary changes. If changes are needed, include the proposed scope statement and/or name and justification for the changes.*

**NOTE: A proposed committee name and/or scope change must have the approval of 2/3 of the official members of the committee. The balloting done at a committee meeting that has less than 2/3 of the members in attendance must be augmented with e-mail balloting of the members not in attendance.**

Committee Code *	AFH70
Committee Name *	Standing Committee on Fabrication and Inspection of Metal Structures
- Date(s) reviewed	
- Change, if proposed***	
- No. of official members approving change/total number of members **	
Committee Scope *	This committee is concerned with the fabrication, manufacturing, and inspection of metal structures.
- Date(s) reviewed	
- Change, if proposed ***	
- No. of official members approving change/total number of members **	

\* Show current, as it currently appears in the [TRB Online Directory](#)

\*\* Includes Chair, Standing Committee Members, Emeritus Members, and Young Members

\*\*\* Show proposed, or Not Applicable

The committee has reviewed its name and scope every year (2018, 2019, 2020) at the committee meeting during the TRB Annual Meeting and did not require any changes. The discussion has been recorded in the minutes of the committee meetings.

**PART 2: Committee Accomplishments**

NOTE: We have provided much of the information you need for boxes 2.2, 2.4, and 2.7 below and in attachments A, B, and C. We ask that you provide the remaining information.

**2.1**

Year	2017	2018	2019	2020
Number of Members in Attendance at Annual Meeting		14	9	14
Number of Visitors in Attendance at Annual Meeting		15	16	17
Number of Papers Reviewed		4	0	
Total Number in Attendance at Mid-Year Meeting	NA	NA	12	

**2.2**

Sessions and workshops sponsored/cosponsored at the Mid-Year meeting, including name of co-sponsoring committee(s) if applicable (by year):

NOTE: Sessions and workshops sponsored/cosponsored at the Annual Meeting are listed in attachment A. **List** below all sessions and workshops sponsored/cosponsored at Mid-Year meeting, including name of co-sponsoring committee(s) if applicable (by year).

None.

**2.3**

**Provide** title(s) and presenter(s) for informal presentations made at Annual Meeting and Mid-Year Committee meetings (by year):

Informal presentations made at the annual meeting by year:

**2018**

“Fabrication of VDOT’s Rt. 340 A1010 Steel Plate Girder Bridge,” Jason Provines, VDOT

**2019**

“Analysis of CVN Impact Testing of unwelded ASTM A709 Grade 50CR and welded 50CR using various Fillers,” Xuemeng “John” Xia, University of Virginia

**2020**

“Coating Inspection System for Steel Bridges,” Paul Fuchs, Fuchs Consulting Inc.

“Use of PAUT during Steel Bridge Fabrication,” Ronnie Medlock, Steve Amspacher, Jim Leeser, and Robin Dunlap, High Steel Structures LLC.

**2.4**

**Provide** titles of -new research need statements (RNS) posted in TRB’s RNS database (by year):

NOTE: Attachment B shows all statements currently posted in TRB’s RNS database.

**2018**

Open Rib Steel Orthotropic Decks <https://rns.trb.org/details/dproject.aspx?n=43229>

Adaptation of Additive Manufacturing for Transportation Applications

<https://rns.trb.org/details/dproject.aspx?n=43230>

Repair or Replacement of Damaged Anchor Bolts

<https://rns.trb.org/details/dproject.aspx?n=43228>

**2020**

Performance-Based Tolerances for Fabrication of Steel Bridge Members

<https://rns.trb.org/details/dproject.aspx?n=43195>

Refinement of Steel Bridge Ultrasonic Testing Techniques

<https://rns.trb.org/details/dproject.aspx?n=43196>

Development of Alternative Measures of Weld Quality

<https://rns.trb.org/details/dproject.aspx?n=43197>

**2.5**

**Provide** title(s) of RNS submitted for funding consideration:

NOTE: If funded, include research project title/number and name of funding organization(s).

Rational Tolerances for Fabrication of Steel Bridge Members

- Ranked alternate for funding by AASHTO COR in 2019 after a couple of iterations. Unfortunately, not funded. The RNS is being revised and resubmitted for funding consideration in 2021.

**2.6**

**Provide** titles of synthesis topics submitted (by year):

NOTE: **List** any synthesis topic(s) funded in a research program.

**2018**

Fabrication Requirements for Stainless Steel Application using Thicker Materials  
Additive Manufacturing Practices

**2020**

Workforce development for sustainable and reliable infrastructure using Phased Array  
Ultrasonic Testing

**2.7**

Membership Make-up: Please see Attachment C provided by TRB for summary details.

NOTE: **Comment** on demographics, balance or lack of balance of membership. Provide an action plan to address any deficiencies. See attachment C for summary details.

The committee strives to maintain a fair balance of all demographics. The committee would like to increase membership from the western part of the country as well as increase the racial and gender diversity of the committee membership.

**2.8**

Provide any of the following:

- Any special publications, such as TR circular, and conference proceedings
- Sponsored or co-sponsored specialty conferences, symposia, workshops, webinars or other joint efforts with other TRB committees, other TRB entities, or other organizations (i.e. AASHTO, FHWA, State DOTs, ASTM, ASCE, and/or other modes of transportation)

**2020**

Co-sponsored Workshop with AFH40: Automating Bridge Construction Through Robotics and 3D Printing

- Actively participated, including identification of presenters.

### **PART 3: Committee Future Outlook Statement and Committee Three-Year Plan (Limit 1,500 words total)**

#### **Committee Future Outlook Statement**

*The committee future outlook statement should include a discussion of the primary factors and influences that will shape the transportation community and topic(s) within the committee's scope over the short- (one to three years) and long-term (four to seven years). This statement should include:*

- *Identification of emerging, critical, and cross-cutting issues **within the committee scope** (these issues could have been -identified by the committee, Section, Group, Technical Activities Council, TRB Executive Committee, or other transportation committees and organizations);*
- *Identification of emerging, critical, and cross-cutting issues **outside the committee scope** that provide opportunities for liaison and collaborative efforts (these issues could also come from a wide range of sources).*

The committee is concerned with the fabrication and manufacturing of metallic transportation structures, which primarily includes bridges and ancillary sign/luminaire support structures. The committee focuses on the study of new fabrication and inspection procedures and materials that enhance the competitiveness, durability, and cost-efficiency of these types of structures and improve productivity. To this effect, the committee's near term goal over the next one to three years is to facilitate the transfer of technology and the newly developed knowledge base, and to promote workforce training. In the long term, the goal of the committee over the next four to seven years is to identify emerging, critical, and cutting edge technological advances that can increase productivity in fabrication of metal structures, and to facilitate related research, information generation, and policy development adaptation to the transportation needs of the 21st century.

In keeping with the primary mission of TRB, the committee will focus on fostering research needs statements, organizing workshops, and technical sessions to help achieve the simple goal of developing cost-effective fabrication practices. Some of the topics discussed in the committee activities are based in technology transfer and implementation, and the committee will continue to work with other external organizations that have purview over fabrications standards for metal structures. Such organizations are the American Welding Society (AWS), the American Institute of Steel Construction (AISC), the American Iron and Steel Institute (AISI) Welding Advisory Group, the American Railway Engineering and Maintenance-of-way Association (AREMA) Committee 15-Steel, the Research Council of Structural Connections (RCSC), the AASHTO National Transportation Product Evaluation Program (NETPEP), the Mid-Atlantic States Structural Committee for Economic Fabrication (SCEF), the AASHTO/NSBA Steel Bridge Collaboration Task Groups 2, Fabrication and Repair, 8 Coatings, 15, Data Modeling for Interoperability, and 16, Orthotropic Deck Panels; the AASHTO technical committees under the Subcommittee of Bridges and Structures including T-4 (Construction), T-12 (Structural Supports for Signs, Luminaries, and Traffic Signals), T-14 (Steel), and T-17 (Metals Fabrication); and the American Society for Nondestructive Testing (ASNT).

Achieving efficient and economical fabrication through a complete paperless or digital process has been a vision of the committee in recent years. The committee envisions that a single computational model of a bridge could be built by a bridge engineer which, through the use of software translators, could be used to; 1) make a structural analysis model, 2) serve as the basis for shop drawings and programming for CNC fabrication and database of quality control documentation and, 3) be used as part of an asset management visualization for the bridge owner to store as-built geometry, inspection records, and repair/maintenance history. Over the past three years, there has been some progress towards streamlining fabrication processes for achieving economy by adopting digital information flow, digital and phased array ultrasonic inspection (PAUT), laser scanning of fabricated components and virtual assembly, and digital data exchange between design and fabrication. However, the cross-cutting efforts of transforming fabrication and inspection practices to a paperless future is yet to be fully realized. Significant research has been completed on PAUT, a Transportation Pooled Fund research project has been initiated on effective digital data exchange and data flow, and an open-source data model for bridge information modeling (BrIM) is in the works. In addition, there are examples of implementing some aspects of paperless construction in bridge projects. In the short term, the committee sees a need for disseminating newly developed information through lectern sessions, workshops, presentations, white papers, e-circulars and webinars. Within

the next three years, the committee sees further research, implementation, and synthesis of information in the four areas noted above for bringing paperless fabrication to more mainstream and closer to reality, including the development of best practice documents, guide specifications, and training material.

The committee also envisions the fabrication of transportation structures utilizing new metals having advantageous properties. In recent years the committee has been engaged in gathering and disseminating information related to the fabrication of bridge structures using novel stainless steels for corrosion protection and enhanced service life. This has opened up a short term need for exploring the issues related to hybrid fabrication involving low-carbon and stainless steels.

Another short term need within the scope of the committee that seems to perpetually arise is workforce development. This is also a cross-cutting activity that affects almost all the TRB sections. There is continuously a need to attract younger generations to the subject matter, ensure the current generations can impart their knowledge, continually train the existing new workforce, and replenish the generation of workforce lost through attrition. There is also a need to disseminate newly generated knowledgebase and educating the workforce in emerging technology. The committee and its members are active in these activities.

A longer-term vision of the committee that may not be implemented in large measures in the near term is automated (robotic) fabrication, including the application of additive manufacturing principles to the fabrication of transportation structures. This topic area has gained significant interest over the past few years, particularly with respect to fabrication involving non-metals (plastics and concrete). The committee has remained engaged in this topic by arranging lectern sessions and workshops at the TRB Annual Meetings, developing research synthesis statements, and creating dialogues with other industries such as aerospace and mechanical equipment manufacturing industries for learning from their experience. The committee envisages that eventually, the ability to print a bridge or its components will be feasible. It would drastically alter the way metallic structures are fabricated, eliminating the need for cutting, drilling, and welding of plates to make bridges, but at the same time opening new avenues of exploration, specifically in relation to material properties, inspection, and quality control.

Another longer-term vision of the committee in achieving efficient and economical fabrication is the use of structural adhesives for metal connections. With the advent of new adhesives having superior properties and less demanding curing conditions, the use of adhesives is certainly a possibility. There are potentials for using adhesives as a sealer to prevent corrosion. The committee will remain engaged in this topic, including developing research needs and synthesis statements, gathering and disseminating information, and developing new knowledgebase.

Durability remains a focus area for the committee. Modern solutions vary from the use of weathering steel and stainless steel to paint, galvanizing, metalizing, and combinations of them. The committee is concerned not only with the development and advancement of new durability solutions but also the effective implementation, particularly as this relates to fabrication practices. For example, improvements are needed in shop seal welding practices to improve the performance of coatings in service.

### **Committee Three-Year Plan**

*The committee plan is a short, focused statement of where the committee wants to go and how to get there. The committee plan may include, but is not limited to:*

- ***projects, activities and products** that the committee will undertake during the next three years to address the emerging, critical, and cross-cutting issues identified above;*
- *how the current or proposed changed membership composition will respond to issues identified above;*
- *strategies to encourage significant involvement by the committee's Young Members, state DOT members, and other key constituents, both during committee meetings and at other times;*

- *committee’s communication activities, and efforts to provide assistance and technology transfer to the transportation community;*
- *research – for the TRB committees, “research” is a very broad concept that can begin with providing the user perspective on research needs, writing research needs statements, tracking research, understanding the funding available for research in their topic area, developing case studies, lessons learned, disseminating research, technology transfer, and other activities that will advance the state of the practice. Potential research activities are:*
  - *research directions, results, and needs or gaps;*
  - *plan for maintaining and augmenting the Research Need Statements (RNS) database;*
  - *efforts to address research implementation and user needs, and ways to identify research use and implementation.*

The committee has fulfilled most of its goals set in the last TSP (2017). The committee CCC has established a web presence, which is regularly updated with the latest ongoing research and other information of interest to the committee. The committee has been active in developing RNSs and pursuing AASHTO sponsorship. In 2018 the committee CRC took over as the Chair of the committee, and it took some time to identify a suitable replacement. The new CRC took charge in 2019 and the committee activities with RNS increased significantly. Nevertheless, in 2018-19, the committee pursued a top-rated RNS for funding through AASHTO COBS T-17 Welding. The RNS was selected for funding as an alternate. Unfortunately, the RNS was not funded due to the paucity of funds. The committee is refining this RNS and resubmitting for funding again in 2021.

The committee has taken immediate rectification steps in response to the review comments received on the 2017 TSP. The committee has added 3 young members and involved them in active roles (CCC and CRC). The committee has also added one emeritus member (totaling to 3) and added female and minority members. In the next 3 years the committee is targeting to increase racial diversity, female, DOT, international and industry members to improve the balance of membership.

The committee has also contributed to the Design and Construction Centennial Papers by authoring a paper titled “A Century of Fabrication and Inspection of Metal Structures”.

The committee has identified the following topics as part of the future outlook statement:

- Implementation of PAUT and digital RT research into main stream, and dissemination of new research information, including the committee initiated NCHRP Project 14-35 (NCHRP Report 908). To realize this goal, the committee plans on sponsoring a workshop at the TRB 2022 Annual Meeting with the outcome to publish a TRB Circular summarizing the topic. It is noted that the committee has not released any special publications or Circulars in the prior three years, and this activity will help attain additional performance metrics for the next TSP cycle. Specific to PAUT, the committee seeks to address three items that arose from Project 14-35: 1) improved acceptance criteria (currently the committee’s number one RNS); 2) NDE technician skill and qualification; and 3) calibration adjustments for velocity and attenuation for both PAUT and traditional UT.
- Further to NDE advancement, the committee is cosponsoring the FHWA NDE strategic plan project being in June 2020.
- The committee will disseminate the latest developments related to digital data exchange between design and fabrication (outcome of ongoing Transportation Pooled Fund Study) and Bridge Information Modeling implementations. To realize this goal, the committee plans on organizing a lectern session during the TRB 2022 Annual Meeting.
- The committee will stay engaged and explore research needs and information dissemination related to additive manufacturing/3D printing of transportation structures. To realize this goal, the committee plans on arranging a lectern session at the TRB 2021 Annual Meeting. The committee also plans on pursuing synthesis and research need statements related to this topic. Depending on the data generated, the committee might pursue a workshop on this topic in the TRB Annual Meeting in 2023. The committee would like to summarize the outcome of the workshop as an e-Circular.
- The committee will stay engaged and explore opportunities for the application of adhesives in metal fabrication. To this effect, the committee plans on arranging presentations in the committee meetings.

- The committee will disseminate newly developed information related to hybrid fabrication between traditional carbon steel and stainless steels. To realize this goal, the committee plans on arranging a presentation of ongoing research and examples of implementation during the committee meeting.
- The committee will disseminate new developments related to metal fabrication during the committee meetings. The committee will solicit informal presentations at the committee meetings exploring fabrication practices of other industries (such as ship and offshore industries) to leverage their experiences towards transportation structures. The committee will select six informal committee presentations over the past and next three years and encourage developing them to webinars and publications for the TRR.
- The committee will pursue the following RNS for funding in the next three years. These are top research areas identified by the committee in recent meetings. The committee will collaborate with AASHTO committees T14 and T17 for sponsorship and promoting the RNS for AASHTO funding.
  - Performance Based Tolerances for Fabrication of Steel Bridge Members
  - Refinement of Steel Bridge Ultrasonic Testing Techniques
  - Application of Bridge Information Modeling for Steel Bridge Construction
  - Adoption of Additive Manufacturing for Transportation Structures
- The final goal is to increase knowledge and technology transfer to the transportation community. To assist with technology transfer to the transportation community, the committee proposes to prepare research result digests on recently concluded or likely to be concluded NCHRP research, including NCHRP Projects 10-94, 10-95, and 14-35. To help promote DOT involvement, the committee will continue to reach out to the MidAtlantic States Subcommittee of Economic Fabrication (SCEF) and the North Central States Consortium committee. These two groups meet annually to discuss challenges in fabrication topics, and AFH70 can help to identify research needs to fulfill the gaps, and also to introduce the committees to each other, which may lead to growth of the AFH70 committee.