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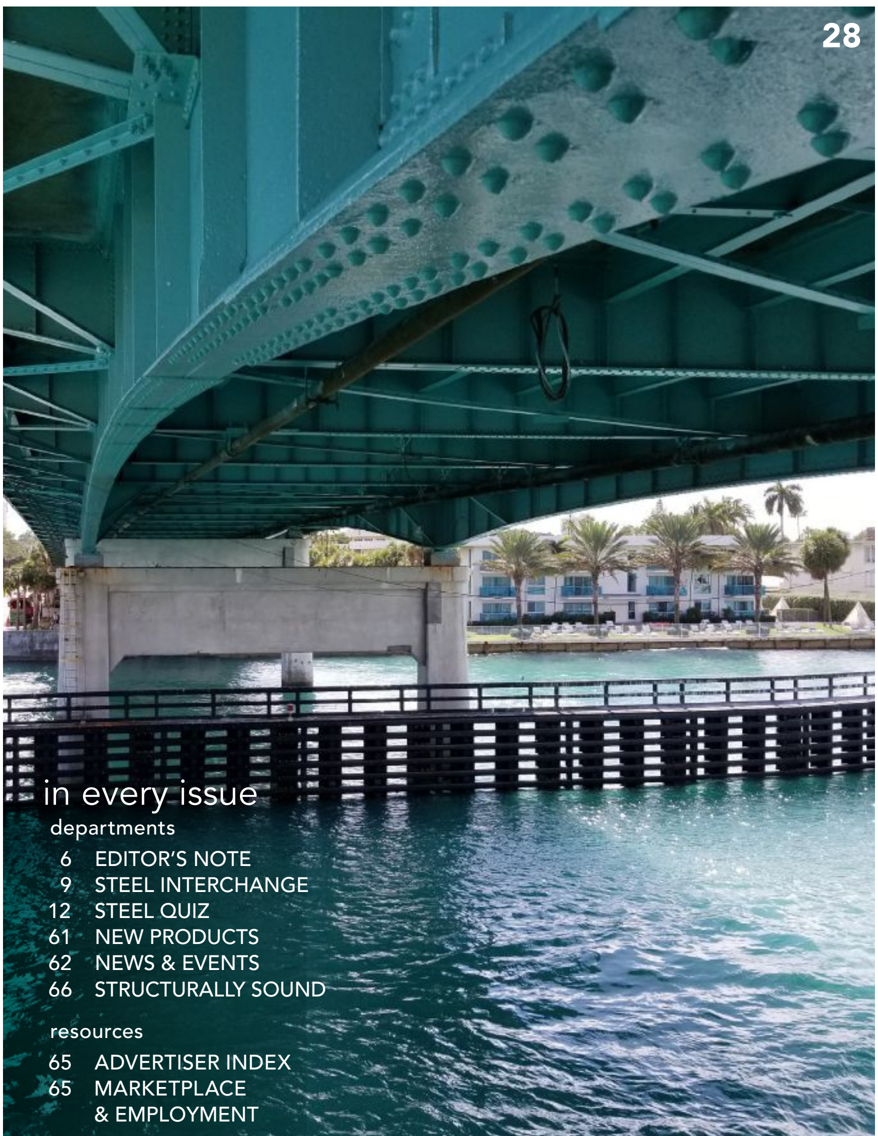
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ON THE COVER: The Dublin Link, one of this year's Prize Bridge Award winners, connects two sides of Dublin, Ohio, literally and figuratively, p. 28. (Photo: Cory Klein)

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IRON WORKERS INTERNATIONAL SETS THE STANDARD HIGH WITH **ACCREDITED RIGGER & SIGNAL PERSON CERTIFICATION**

The National Commission for Certifying Agencies (NCCA), the accrediting body of the Institute for Credentialing Excellence, has granted accreditation to the Iron Workers International Certification Board's (I.I.C.B.) Rigging & Signalperson Certification Program.

WHY IS IT IMPORTANT?

MEET REQUIREMENTS

OSHA's Subpart CC requires signal person qualification by a third-party qualifier.

MEET DEMAND

While an OSHA letter of interpretation recognizes apprenticeship programs that train and assess riggers and signal persons as third-party qualified evaluators, many contractors, states and municipalities require a Qualified Rigger and Signal Person Certification.

REDUCE COST

Third party certification comes with a hefty price tag without input on testing from subject matter experts, ironworkers and their contractors. The Iron Workers' certification eleminates the recertification cost of $500 per person.

IMPROVE SAFETY

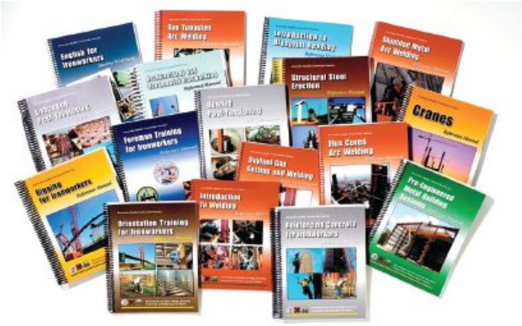
Ensuring that only trained, skilled and competent ironworkers complete rigging and signaling tasks elevates workplace safety standards and reduces risk.

WHAT IS IT?

Iron Workers International Certification Board's (I.I.C.B.) Rigging & Signalperson Certification Program is accredited by the National Commission for Certifying Agencies (NCCA), the accrediting body of the Institute for Credentialing Excellence. The I.I.C.B. joins an elite group of more than 130 organizations representing over 315 programs that have obtained NCCA accreditation.

HOW IS IT DONE?

- ☑ 6,000 HOURS OF HANDS ON EXPERIENCE
- ☑ 3-PART EXAM
- ☑ TESTING & RECERTIFICATION EVERY 5 YEARS
- ☑ IRON WORKERS RIGGING & CRANE COURSE



editor's note

On a recent trip to the Virginia Tech campus, I was walking past the Hokie football team's outdoor practice field with some colleagues when we noticed a small group of young men with a football.

There were no coaches and it didn't seem to be an "official" practice, so I thought maybe they were just some random students taking advantage of the warm, sunny weather and the fact that the field wasn't currently in use by the team.

The group set up a pass play, and I watched the receiver *fly* down the field and cut left to the sideline while the quarterback *launched* the ball. "He overthrew it," I thought. I was wrong. Right before he reached the sideline, the receiver turned back and leaped, almost casually, what seemed like eight feet in the air, stretched out to his full length, pulled the ball in, and landed both feet inbounds in what, if this had been an actual game, would definitely have made the highlight reel.

This wasn't just a group of students messing around. These guys were clearly on the team roster. Heck, the receiver looked like he might be ready for the NFL. I've seen plenty of football games in person, but watching the speed, accuracy, and perfect timing and coordination of the play up close and at field level really makes you appreciate just how elite these athletes are.

The field was right next to the Hokies' indoor practice facility, where more speed, accuracy, and perfect timing and coordination—which we were also able to witness up close—were on full display, once again at an elite level. But this wasn't more football practice. Rather, we were watching the 34 student steel bridge teams that had qualified for the 2022 AISC/ASCE Student Steel Bridge Competition (SSBC) National Finals, which took place in person for the first time since 2019.

Narrowed down from 138 teams at 20 Regional Competitions across the country, the finalists are the best of the best college and university student teams that design, fabricate, and build scale-model steel bridges. The bridges, which must span approximately 20 ft and carry 2,500 lb without failing, are judged on efficiency, economy, lateral and vertical deflection, aesthetics, weight, and construction speed. And to give you an idea of just how fast these teams can assemble their bridges—all while being cheered on by spectators and fans and closely monitored by judges—the best time in the construction category was under four minutes!

This year's overall winner was the University of Florida, with the University of Alaska, Fairbanks, and Lafayette College coming in second and third place, respectively. You can see the full competition results (overall and by category) at **aisc.org/ssbc**. And keep an eye out for a full write-up and lots of great pictures of the competition in next month's issue.

Congratulations to all of this year's teams!

Geoff Weisenberger
Chief Editor

Modern Steel Construction

Editorial Offices
130 E Randolph St, Ste 2000
Chicago, IL 60601
312.670.2400

Editorial Contacts
CHIEF EDITOR
Geoff Weisenberger
312.493.7694
weisenberger@aisc.org

PUBLISHER
Keith A. Grubb, SE, PE
312.804.0813
grubb@aisc.org

GRAPHIC DESIGN MANAGER
Kristin Hall
773.636.8543
hall@aisc.org

EDITORIAL DIRECTOR
Scott Melnick
312.804.1535
melnick@aisc.org

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Advertising Sales
M.J. Mrvica Associates, Inc.
2 W Taunton Avenue
Berlin, NJ 08009
856.768.9360
mjmrvica@mrvica.com

Address Changes and Subscription Concerns
312.670.2401
subscriptions@aisc.org

Reprints
Kristin Hall
hall@aisc.org

If you've ever asked yourself "Why?" about something related to structural steel design or construction, *Modern Steel*'s monthly Steel Interchange is for you! Send your questions or comments to **solutions@aisc.org**.

Flanges and Webs with Concentrated Loads

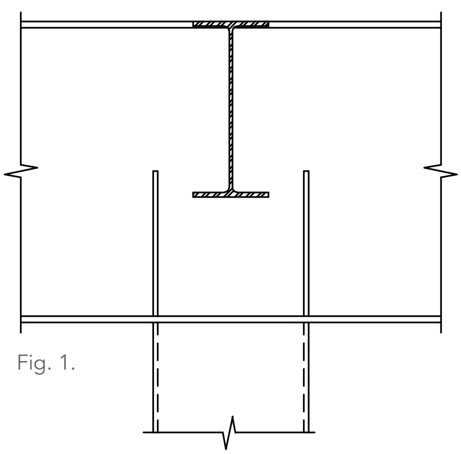


Fig. 1.

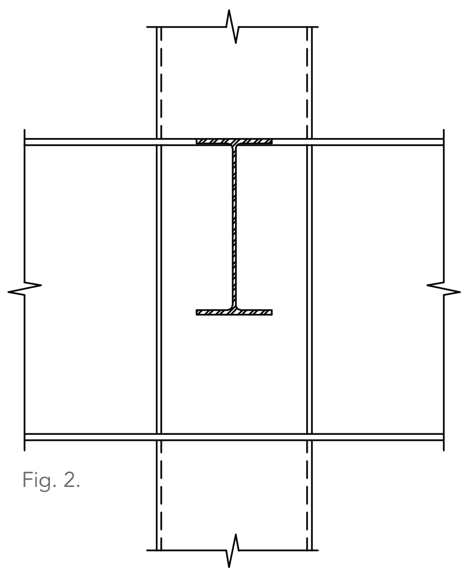


Fig. 2.

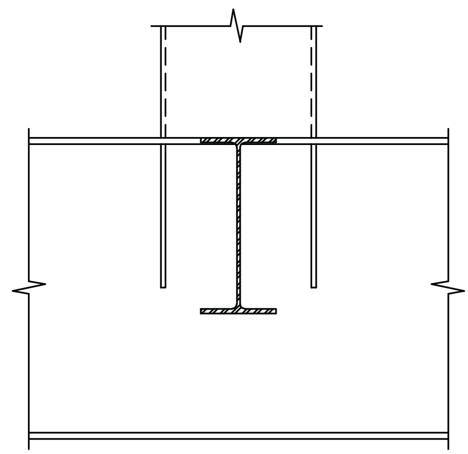


Fig. 3.

Looking at Figure 1, should web compression buckling be checked per the requirements of Section J10.5 of the AISC *Specification for Structural Steel Buildings* (ANSI/AISC 360)?

Section J10.5 of the *Specification* "applies to a pair of compressive single-concentrated forces or the compressive components in a pair of double-concentrated forces, applied at both flanges of a member at the same location." The equation in Section J10.5 is based on a plate buckling model in which the compression force is applied to opposite ends of the plate, like a column. The provided detail in Figure 1 appears to have concentrated compressive forces applied at only one flange; therefore, Section J10.5 would not apply.

There could be exceptions to this. For example, there could be a massive piece of machinery sitting on the beam right above the column that produces all or most of the load in the column. In such a case, I would check the buckling on the beam web—though I might modify the check somewhat as suggested in the Commentary: "Equation J10-8 is applicable to a pair of moment connections and to other pairs of compressive forces applied at both flanges of a member, for which l_b/d is approximately less than 1, where l_b is the length of bearing and d is the depth of the member. When l_b/d is not small, the member web should be designed as a compression member in accordance with Chapter E."

Relative to Figure 2, for which web buckling should be considered, the check in Section J10.5 assumes a pinned-pinned model for the web acting as a column. This means that lateral movement (sidesway) must be restrained for the check to be applicable. More generally, all the Section J10 stability checks assume that some level of restraint will be provided.

Larry S. Muir, PE

Flanges and Webs with Concentrated Loads (cont.) >>

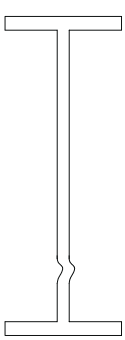
All mentioned AISC publications, unless noted otherwise, refer to the current version and are available at **aisc.org/publications**.

Flanges and Webs with Concentrated Loads (cont.)

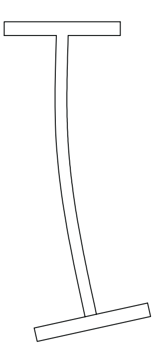
Do AISC *Specification* Sections J10.3, J10.4, J10.5, or J10.7 require full-depth stiffeners for the details shown in Figures 1 and 3?

In some cases, full-depth stiffeners are explicitly required. In other cases, they may be required to satisfy the intent, though they may not be explicitly required. In all cases, the stiffeners (and their connections) should be designed based on a rational model, which likely means you will draw free-body diagrams of the stiffeners. The forces in the free-body diagrams should conform to the descriptions in Section J10.8.

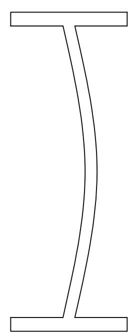
Section J10.8: Additional Stiffener Requirements for Concentrated Forces also states: "Transverse stiffeners shall extend a minimum of one-half the depth of the member except as required in Sections J10.3, J10.5, and J10.7."



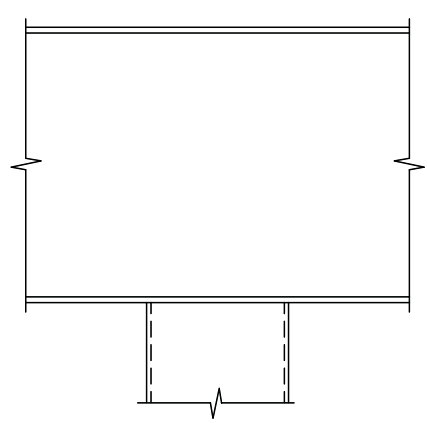
Section J10.3: Web Local Crippling states: "When required, a transverse stiffener, a pair of transverse stiffeners, or a doubler plate extending at least three-quarters of the depth of the web shall be provided."



Section J10.4: Web Sidesway Buckling states: "When the required strength of the web exceeds the available strength, local lateral bracing shall be provided at the tension flange or either a pair of transverse stiffeners or a doubler plate shall be provided" or "local lateral bracing shall be provided at both flanges at the point of application of the concentrated forces." Partial-depth stiffeners may not be sufficient. Framing an infill beam into the continuous beam could help provide local lateral bracing to avoid the need to use stiffeners.



Section J10.5: Web Compression Buckling states: "When required, a single transverse stiffener, a pair of transverse stiffeners, or a doubler plate extending the full depth of the web shall be provided."



Section J10.7: Unframed Ends of Beams and Girders states: "At unframed ends of beams and girders not otherwise restrained against rotation about their longitudinal axes, a pair of transverse stiffeners, extending the full depth shall be provided." This applies to Figures 1 and 2 (on the previous page). Part 2 of the AISC *Steel Construction Manual* includes a discussion about "Beams and Girders Framing Continuously Over Columns" and states: "When an infill beam frames into the continuous beam at the column top, the required stability normally can be provided by using connection element(s) for the infill beam that cover three-quarters or more of the T-dimension of the continuous beam. Alternatively, connection elements that cover less than three-quarters of the T-dimension of the continuous beam can be used in conjunction with partial-depth stiffeners in the beam web along with a moment connection between the column top and beam bottom to maintain alignment of the beam/column assembly."

You should try to minimize the need for stiffeners when possible, as they are labor-intensive from a steel fabrication standpoint. They can be avoided by using beams with thicker flanges or webs and/or by providing sufficient restraint using infill beams or diagonal bracing. You can use AISC *Specification* Appendix 6 to ensure the stability of the assembly. In addition, discussing the assembly with the fabricator can help to identify the most economical detail.

Larry S. Muir, PE

Larry Muir is a consultant to AISC.

This month's questions and answers were developed by Yasmin Chaudhry, a staff engineer in AISC's Steel Solutions Center, in collaboration with NSBA Staff.

To help celebrate the 2022 Prize Bridge Award winners (page 28), this month's quiz tests your knowledge of information found in recent guidelines published by AASHTO/NSBA.

The recent AASHTO/NSBA guidelines are all available for download at **aisc.org/nsba**. Quiz answers can be found on page 14.

1 **True or False:** Nonredundant steel tension members (NSTM) have replaced the fracture-critical member (FCM) designation in the recently released *FHWA National Bridge Inspection Standards.*

2 AASHTO/NSBA *Collaboration Guidelines to Design for Constructability and Fabrication* (G12.1-2020) recommends which minimum plate girder flange thickness for welded girder construction?
a. 3/8 in. **b.** ½ in. **c.** ¾ in. **d.** 1 in.

3 AASHTO/NSBA G12.1-2020 recommends which minimum plate girder web thickness for welded girder construction?
a. 3/8 in. **b.** 7/16 in. **c.** ½ in. **d.** 5/8 in.

4 What is the most cost-effective corrosion protection strategy for steel bridges?
a. A709-50CR (A1010)
b. Uncoated weathering steel
c. Metallizing (thermal spray)
d. Three-coat paint system

5 While they may not be as exciting at first glance as the bridges that won this year's NSBA Prize Bridge Awards, "routine steel I-girder bridges" are the workhorse structure type. NSBA developed a *Guide to Navigating Routine Steel Bridge Design* to help designers navigate the provisions of the AASHTO *LRFD Bridge Design Specifications* for just these types of bridges. Which of the following is *not* a characteristic of a "routine steel I-girder bridge" as defined by the guide?
a. Straight (non-curved) girders
b. Constant deck width
c. Span lengths exceeding 200 ft
d. Steel grades/yield strengths of 36 ksi or 50 ksi

6 **True or False:** The *Guide to Navigating Routine Steel Bridge Design* referenced in the previous question is meant to be read cover to cover.

7 **True or False:** As defined by the 9th Edition AASHTO *LRFD Bridge Specification*, steel primary members are allowed to have plasma-cut bolt holes.

Everyone is welcome to submit questions and answers for the Steel Quiz. If you are interested in submitting one question or an entire quiz, contact AISC's Steel Solutions Center at 866.ASK.AISC or **solutions@aisc.org**.

1 **True.** The recently published *National Bridge Inspection Standards* was accompanied by an FHWA Memorandum (dated May 9, 2022) that replaced the June 12, 2012 memorandum *Clarification of Requirements for Fracture Critical Members* and clarified/updated the existing term as "nonredundant steel tension member (NSTM)." State transportation departments, federal agencies, and tribal governments may choose to develop or use current procedures to show that a member without load path redundancy has a system or internal redundancy such that it is not considered an NSTM.

2 **c.** ¾ in. Section 1.3 of G12.1 recommends a minimum plate girder flange thickness of ¾ in. for welded girder construction. This is recommended to reduce deformation and the potential for weld defects and increase corrosion durability.

3 **c.** ½ in. Section 1.3 G12.1 recommends a minimum plate girder web thickness of ½ in. for welded girder construction. Per the 9th Edition AASHTO *LRFD Bridge Design Specifications*, Article 6.10.2.1 requires webs without longitudinal stiffeners to have a depth/web thickness ratio of no more than 150.

4 **b.** Uncoated weathering steel. Uncoated weathering steel is an inexpensive, low-maintenance corrosion-protection solution that should be considered if a bridge location meets the guidelines specified by FHWA Technical Advisory 5140.22 *Uncoated Weathering Steel in Structures*. (This was also the method of corrosion protection used by the I-91 Interchange 29 Exit Ramp Flyover Bridge, which won the 2022 NSBA Bridge of the Year Award.) Additional information on corrosion protection systems can be found in Section 5.1 of G12.1.

5 **c.** Span lengths exceeding 200 ft. The *NSBA Guide to Navigating Routine Steel Bridge Design* lists many characteristics that define a "routine steel I-girder bridge," but span lengths exceeding 200 ft is not one of them. The correct characteristic is actually span lengths *not* exceeding 200 ft.

6 **False.** The publication is not meant to be read cover to cover. Pages 21-41 of the *Guide* cover all the applicable code checks for routine steel bridge design from the 9th Edition AASHTO *LRFD Bridge Design Specifications*. The other subsequent pages are detailed background information for the designer.

7 **False.** Article 11.4.8.1.1 of AASHTO *LRFD Bridge Construction Specifications* specifically disallows plasma-cut holes in steel members that are designated as primary. AASHTO/NSBA document S2.1: *Steel Bridge Fabrication Guide Specification* echoes this in Section 4.6.3, where it states: "Holes in longitudinal primary members must be drilled full-size, or else made subsize by other means and then reamed full size."

Living in a Material World

BY DEVIN HUBER, PE, PhD AND DOUG REES-EVANS

The latest versions of the AISC *Specification* and *Seismic Provisions* include a streamlined approach to material listings.

NEW VERSIONS OF TWO of AISC's most well-known standards will soon be published: the *Specification for Structural Steel Buildings* (AISC 360-22) and the *Seismic Provisions for Structural Steel Buildings* (AISC 341-22).

The new format for listing acceptable materials in the 2022 versions of both documents represents a significant change from what was published in the previous versions (in 2016). You can see the critical differences in Section A3 between the previous and new versions of both publications in Figures 1 and 2 (the latter is on the following spread). In both 2022 standards, a table is now provided that lists acceptable materials. Read on for a summary of and the reasoning behind these revisions.

Section A3.1 Revisions for the *Specification*

Several changes are apparent in Section A3.1 for the *Specification*:

- A3.1a has been renamed from "ASTM Designations" to "Listed Materials." The language of A3.1a has also been revised to reflect the new format for how materials approved for use in the *Specification* are listed.
- Table A3.1: Listed Materials provides a listing of acceptable materials approved for use in the *Specification*, which replaces the list from the 2016 version. The table lists the allowable grades/strengths and any other specific limitations for the ASTM standards referenced in the *Specification*.
- Section A3.1b is a "new" section called "Other Materials" that states, "Materials other than those listed in Table A3.1 are permitted for specific applications when the suitability of the material is determined to be acceptable by the engineer of record (EOR)."

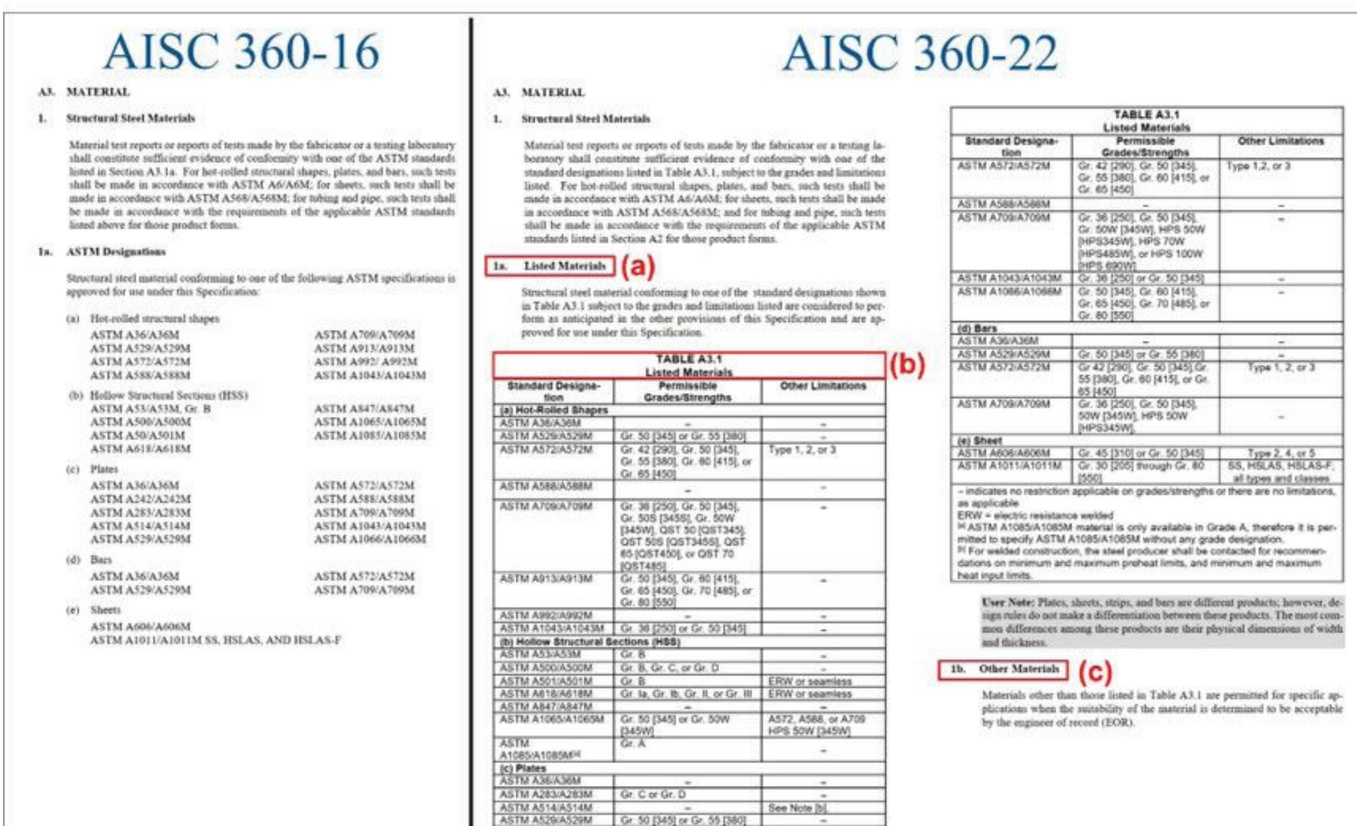
Table A3.1 provides *Specification* users with a very clear list of materials with permissible grades, strengths, and any other limitations (such as manufacturing restrictions or fabrication considerations) approved for use in the *Specification* without any further qualification needed. In using the table, it is important to note that the ASTM standards listed are limited to the editions listed in Section A2 of the *Specification*. As an example, if an engineer is considering ASTM A500/500M round hollow structural sections (HSS) for a braced frame, the permissible grade for this material is Grade C per A500/A500M-21, which is the referenced version of the ASTM Standard noted in Section A2 of the *Specification*. The user would need to refer to this version of the ASTM Standard when using the *Specification* and not any other potentially newer or previous revisions that may exist.

The addition of section A3.1b provides language in the main body of the *Specification* that provides discretionary judgment of the EOR to qualify materials not listed in Table A3.1. The 2016 *Specification* provided only Commentary language regarding the EOR's ability to use discretion in choosing unlisted materials. This revision provides definitive language for allowing engineering judgment to be exercised with respect to choosing steel material for a given project.

Table A3.1 is to be read in conjunction with the updated referenced ASTM Standards in Section A2 of the *Specification*. It evolved in response to concerns regarding various structural steel grades and products that were accepted as part of an ASTM Standard but were either not appropriate for use in steel fabrication and construction or where inadequate supporting data existed to accept it into the *Specification* as a listed material. Thus, the table lists materials that are generally acceptable for steel fabrication and construction and intentionally excludes materials that do not meet the assumptions behind the provisions of the *Specification*.

A couple of specific examples that motivated this revision are described further in the Commentary that will accompany the main body of the 2022 *Specification*. Some of the provided reasoning includes the omission of ASTM A572/A572M Type 5 material due to potential problems associated with welding. Another example is limiting HSS products to those manufactured with electric-resistance welding (ERW) for seams or seamless products, as those using furnace welding have not been able to consistently demonstrate they can achieve the full strength of the base metal.

Per the Commentary of the upcoming 2022 *Specification*, "This *Specification* lists those products/materials that are commonly useful to structural engineers and those that have a history of satisfactory performance as anticipated in the other provisions of the *Specification*. Other materials may be suitable for specific applications, but the evaluation of those materials is the responsibility of the engineer specifying them." The latter statement is now supported by a "new" Section A3.1b entitled "Other Materials" that states, "Materials other than those listed in Table A3.1 are permitted for specific applications when the suitability of the material is determined to be acceptable by the engineer of record (EOR)." This revision was deemed necessary by TC 10 and the Committee on Specifications to provide some flexibility to the EOR in exercising their engineering judgment when determining if a material not listed in Table A3.1a is appropriate for use in their given structure.



AISC 360-16

A3. MATERIAL

1. Structural Steel Materials

Material test reports or reports of tests made by the fabricator or a testing laboratory shall constitute sufficient evidence of conformity with one of the ASTM standards listed in Section A3.1a. For hot-rolled structural shapes, plates, and bars, such tests shall be made in accordance with ASTM A6/A6M; for sheets, such tests shall be made in accordance with ASTM A568/A568M; for tubing and pipe, such tests shall be made in accordance with the requirements of the applicable ASTM standards listed above for those product forms.

1a. ASTM Designations

Structural steel material conforming to one of the following ASTM specifications is approved for use under this Specification:

(a) Hot-rolled structural shapes
ASTM A36/A36M, ASTM A529/A529M, ASTM A572/A572M, ASTM A588/A588M, ASTM A709/A709M, ASTM A913/A913M, ASTM A992/ A992M, ASTM A1043/A1043M

(b) Hollow Structural Sections (HSS)
ASTM A53/A53M, Gr. B, ASTM A500/A500M, ASTM A501/A501M, ASTM A618/A618M, ASTM A847/A847M, ASTM A1065/A1065M, ASTM A1085/A1085M

(c) Plates
ASTM A36/A36M, ASTM A242/A242M, ASTM A283/A283M, ASTM A514/A514M, ASTM A529/A529M, ASTM A572/A572M, ASTM A588/A588M, ASTM A709/A709M, ASTM A1043/A1043M, ASTM A1066/A1066M

(d) Bars
ASTM A36/A36M, ASTM A529/A529M, ASTM A572/A572M, ASTM A709/A709M

(e) Sheets
ASTM A606/A606M
ASTM A1011/A1011M SS, HSLAS, AND HSLAS-F

AISC 360-22

A3. MATERIAL

1. Structural Steel Materials

Material test reports or reports of tests made by the fabricator or a testing laboratory shall constitute sufficient evidence of conformity with one of the standard designations listed in Table A3.1, subject to the grades and limitations listed. For hot-rolled structural shapes, plates, and bars, such tests shall be made in accordance with ASTM A6/A6M; for sheets, such tests shall be made in accordance with ASTM A568/A568M; and for tubing and pipe, such tests shall be made in accordance with the requirements of the applicable ASTM standards listed in Section A2 for those product forms.

1a. Listed Materials (a)

Structural steel material conforming to one of the standard designations shown in Table A3.1 subject to the grades and limitations listed are considered to perform as anticipated in the other provisions of this Specification and are approved for use under this Specification.

TABLE A3.1
Listed Materials (b)

Standard Designation	Permissible Grades/Strengths	Other Limitations
(a) Hot-Rolled Shapes		
ASTM A36/A36M	–	–
ASTM A529/A529M	Gr. 50 [345] or Gr. 55 [380]	–
ASTM A572/A572M	Gr. 42 [290], Gr. 50 [345], Gr. 55 [380], Gr. 60 [415], or Gr. 65 [450]	Type 1, 2, or 3
ASTM A588/A588M	–	–
ASTM A709/A709M	Gr. 36 [250], Gr. 50 [345], Gr. 50S [345S], Gr. 50W [345W], QST 50 [QST345], QST 50S [QST345S], QST 65 [QST450], or QST 70 [QST485]	–
ASTM A913/A913M	Gr. 50 [345], Gr. 60 [415], Gr. 65 [450], Gr. 70 [485], or Gr. 80 [550]	–
ASTM A992/A992M	–	–
ASTM A1043/A1043M	Gr. 36 [250] or Gr. 50 [345]	–
(b) Hollow Structural Sections (HSS)		
ASTM A53/A53M	Gr. B	–
ASTM A500/A500M	Gr. B, Gr. C, or Gr. D	–
ASTM A501/A501M	Gr. B	ERW or seamless
ASTM A618/A618M	Gr. Ia, Gr. Ib, Gr. II, or Gr. III	ERW or seamless
ASTM A847/A847M	–	–
ASTM A1065/A1065M	Gr. 50 [345] or Gr. 50W [345W]	A572, A588, or A709 HPS 50W [345W]
ASTM A1085/A1085M[a]	Gr. A	–
(c) Plates		
ASTM A36/A36M	–	–
ASTM A283/A283M	Gr. C or Gr. D	–
ASTM A514/A514M	–	See Note [b]
ASTM A529/A529M	Gr. 50 [345] or Gr. 55 [380]	–
ASTM A572/A572M	Gr. 42 [290], Gr. 50 [345], Gr. 55 [380], Gr. 60 [415], or Gr. 65 [450]	Type 1,2, or 3
ASTM A588/A588M	–	–
ASTM A709/A709M	Gr. 36 [250], Gr. 50 [345], Gr. 50W [345W], HPS 50W [HPS345W], HPS 70W [HPS485W], or HPS 100W [HPS 690W]	–
ASTM A1043/A1043M	Gr. 36 [250] or Gr. 50 [345]	–
ASTM A1066/A1066M	Gr. 50 [345], Gr. 60 [415], Gr. 65 [450], Gr. 70 [485], or Gr. 80 [550]	–
(d) Bars		
ASTM A36/A36M	–	–
ASTM A529/A529M	Gr. 50 [345] or Gr. 55 [380]	–
ASTM A572/A572M	Gr 42 [290], Gr. 50 [345] Gr. 55 [380], Gr. 60 [415], or Gr. 65 [450]	Type 1, 2, or 3
ASTM A709/A709M	Gr. 36 [250], Gr. 50 [345], 50W [345W], HPS 50W [HPS345W]	–
(e) Sheet		
ASTM A606/A606M	Gr. 45 [310] or Gr. 50 [345]	Type 2, 4, or 5
ASTM A1011/A1011M	Gr. 30 [205] through Gr. 80 [550]	SS, HSLAS, HSLAS-F, all types and classes

– indicates no restriction applicable on grades/strengths or there are no limitations, as applicable
ERW = electric resistance welded
[a] ASTM A1085/A1085M material is only available in Grade A, therefore it is permitted to specify ASTM A1085/A1085M without any grade designation.
[b] For welded construction, the steel producer shall be contacted for recommendations on minimum and maximum preheat limits, and minimum and maximum heat input limits.

User Note: Plates, sheets, strips, and bars are different products; however, design rules do not make a differentiation between these products. The most common differences among these products are their physical dimensions of width and thickness.

1b. Other Materials (c)

Materials other than those listed in Table A3.1 are permitted for specific applications when the suitability of the material is determined to be acceptable by the engineer of record (EOR).

Fig. 1. Comparison between Section A3.1 of the 2016 and 2022 versions of the *Specification* (with Sub-Sections A3.1c to A3.1e omitted).

Section A3.1 Revisions for the *Seismic Provisions*

The revisions for Section A3.1 for the *Seismic Provisions* are similar to those implemented in the *Specification* and are shown in Figure 2. The main revisions are as follows:

- The language describing the exceptions for members of a seismic force-resisting system (SFRS) to have a specified yield stress greater than 50 ksi has been reformatted to explain the specific exceptions more clearly. There were no technical changes made to the language itself, so this can be considered an editorial change.
- Table A3.1: Listed Materials lists acceptable materials permitted for use in the SFRS described in Chapters E, F, G, and H and replaces the list from the version. The table lists the allowable grades/strengths and any other specific limitations for the ASTM standards referenced in the document.

Table A3.1 in the *Seismic Provisions* was developed essentially as a parallel effort and with similar reasoning as to Table A3.1 in the *Specification*. The main difference with the *Seismic Provisions* version of the table is that the listed materials are those intended to be part of an SFRS. As such, they are expected to exhibit the desired material properties for use in those systems, including adequate material ductility to help dissipate seismic input energy through controlled inelastic deformations of the structure, along with having reasonable weldability for fabrication and construction. One important consideration is that the materials listed apply only to steel in the SFRS. Materials that could be used for other parts of the structure that are not part of the SFRS are listed in Table A3.1 of the *Specification*. Users should also note the exceptions to some of the yield strength limitations for specific SFRS members and systems provided in the language of Section A3.1.

The listed materials in Table A3.1 have demonstrated proven performance when used in the various types of SFRS that are designed in accordance with the *Seismic Provisions*, and the table needs to be read closely in conjunction with the other language of Section A3.1—in particular, the language describing the exceptions to

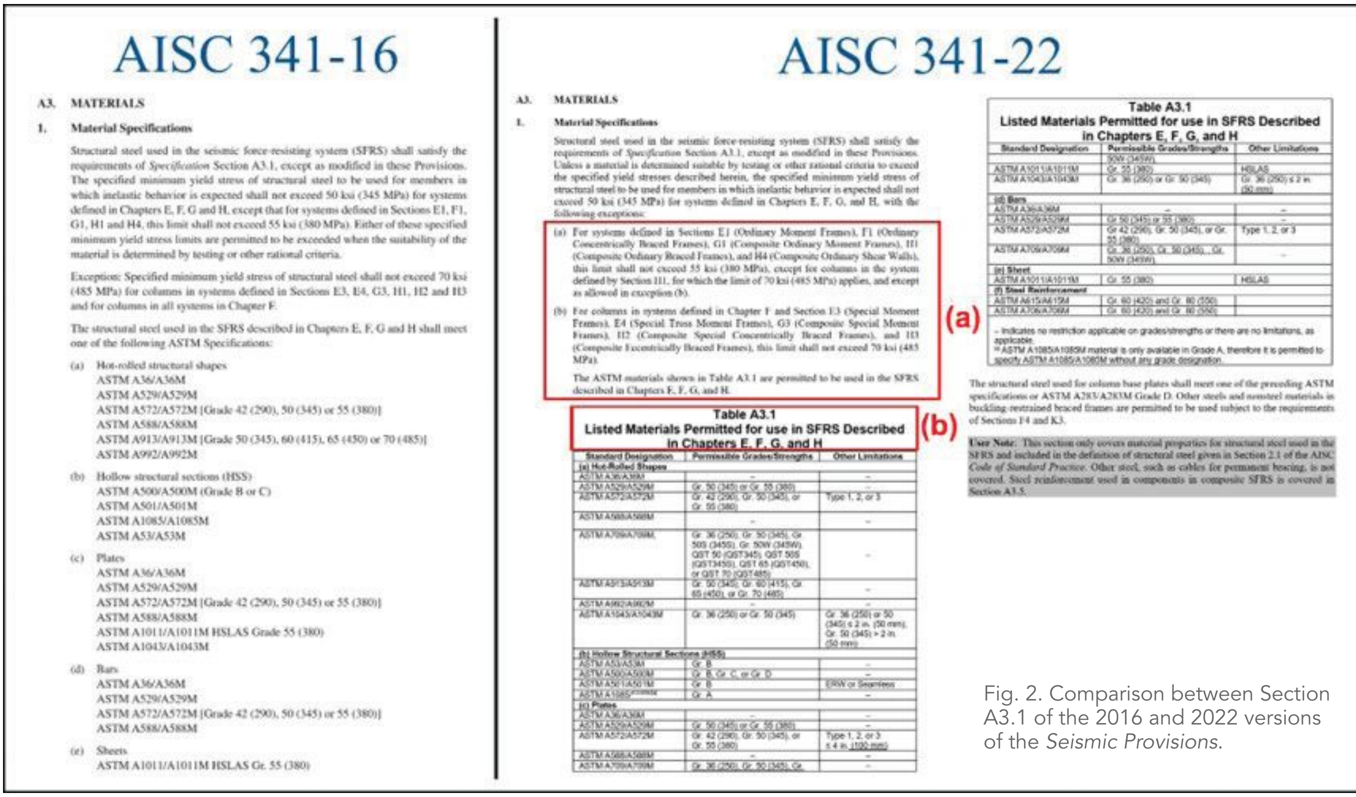


Fig. 2. Comparison between Section A3.1 of the 2016 and 2022 versions of the *Seismic Provisions*.

the limiting yield stress for various SFRS includes a broad exception stating, "The specified minimum yield stress limits are permitted to be exceeded when the suitability of the material is determined by testing or other rational criteria." Again, this language provides the EOR some leverage when trying to qualify materials in specific applications on a given project.

These are the primary changes to look for in Section 3.1 of the 2022 AISC *Specification* and *Seismic Provisions*. Both publications (as well as all other AISC standards and specifications) are available as free downloads at **aisc.org/specifications**. ■

Devin Huber (**huber@aisc.org**) is AISC's director of research. **Doug Rees-Evans** is the quality assurance manager with New Millennium Building Systems.

Industrial Indicators

BY JOE DARDIS

When focusing in on the various segments of the industrial sector, the picture becomes clearer in terms of which ones can provide the best opportunities for steel design and construction over the next few years.

Fig. 1.
Projected Capital Spending for Industrial Projects

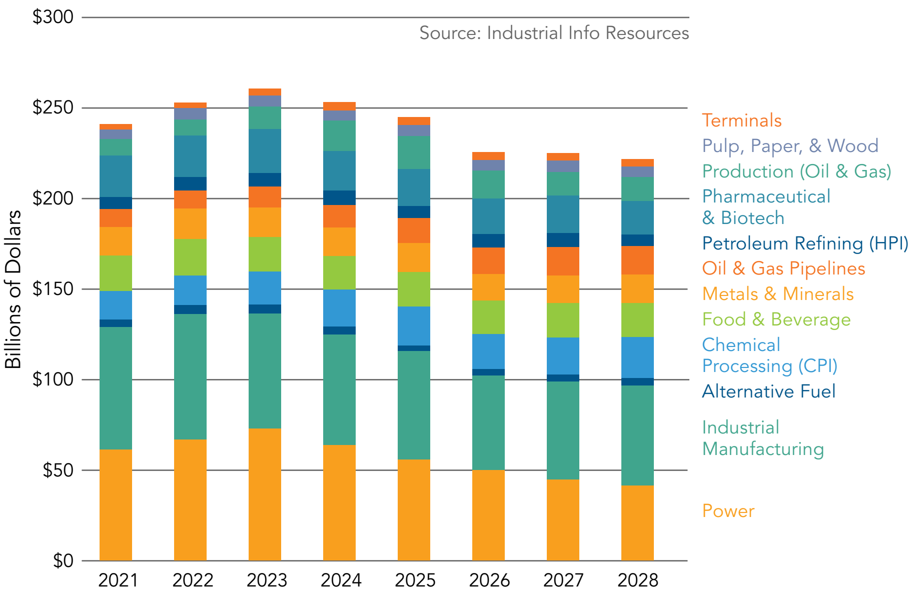
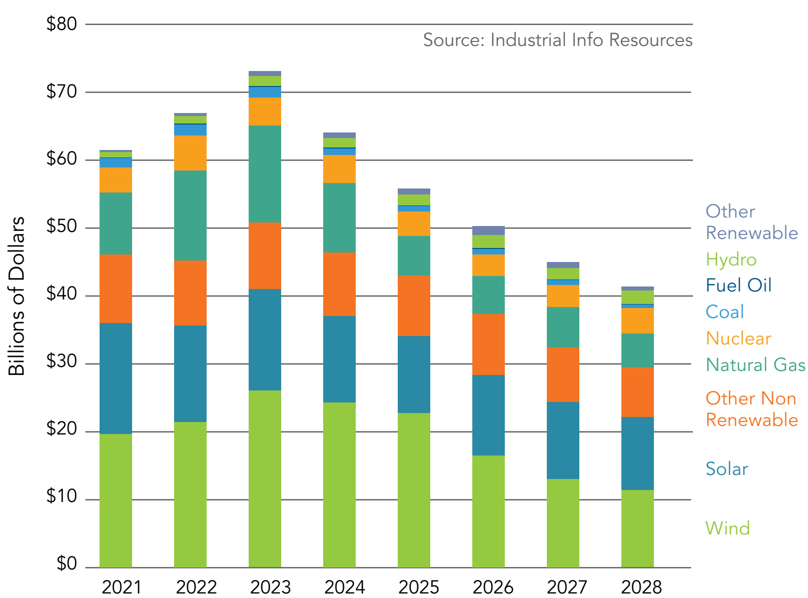


Fig. 2.
Projected Capital Spending of Power Sector



BACK IN DECEMBER OF 2021, we highlighted the industrial sector and discussed the overall expected trends for capital spending. This month, we'll revisit that sector and take a closer look at what's really moving the needle.

To recap from December, Figure 1 shows the (updated) overall industrial forecast for the next several years. Capital spending for industrial projects is projected to rise 4.9% and 3.1% in 2022 and 2023, respectively, before beginning a steady decline for the next several years. But what's behind the change? Taking a deeper look at the year-to-year deviation, we see that most of the movement comes from the power, industrial manufacturing, and oil and gas production sectors.

Power generation (Figure 2) is the largest of the industrial segments and is responsible for the largest amount of capital spending changes from year to year. This segment is evolving quite dramatically, as most new capital spending is flowing into solar energy and wind power, along with battery storage projects. Much of the shift into solar energy and wind power is driven by tax incentives and mandated renewable energy targets. In addition, the U.S. infrastructure bill includes a clean energy standard, which could drive even more capital spending into the power segment. Solar and wind are projected to account for roughly 53% of power generation spending in 2022 and roughly 61% by 2025. However, after that new capacity is built up, the power sector is expected to decline significantly in the years after.

Other movers in the power sector include natural gas and coal. Capital investment in coal power generation has been declining for years and is expected to continue doing so. This will help bolster the natural gas sector, which acts as an alternative "bridge" fuel to help sustain power demands while renewable options are being developed.

The second-largest industrial segment is industrial manufacturing (Figure 3), which includes the automotive, distribution, and data center industries. Automotive, which was once the largest component of this segment, is expected to face continued turbulence in 2022 as supply problems with semiconductors have reduced the capital spending outlook by roughly 25% for 2022. Subsequently, it's no surprise to see that capital spending in the semiconductor and computer segments is expected to rise significantly in the next several years to meet that demand. We also expect the automotive industry to significantly shift its production strategy in the coming years as the various manufacturers continue to develop electric vehicle lines. Anyone who watched this year's Super Bowl (or at least the ads) knows that automotive companies are investing heavily in electric cars and will likely have to commit money into capital investment for new and existing facilities.

The biggest mover in the industrial manufacturing sector, however, is data centers. As everyday life shifted to Zoom calls and online shopping over the last couple of years, data centers had to carry a lot of weight. We should expect capital spending in 2022 to roughly double that of 2020 as we continue with the "new normal." This is undoubtedly a positive sign for the steel industry as data centers are typically steel-framed. In addition, the load requirements in data center projects call for more robust designs and use heavier steel shapes as compared to traditional office or warehouse projects.

Lastly, the oil and gas production segment (Figure 4) is expected to see significant movement over the next several years. U.S. production levels have recovered from the pandemic downturn, and demand has rebounded faster than most had anticipated. Commodity prices are continuing to increase and, generally, upward trends in oil prices tend to drive capital spending. While capital spending isn't projected to move too much in the short term, it is expected to more than double by 2025.

Fig. 3.
Projected Capital Spending of Industrial Manufacturing Sector

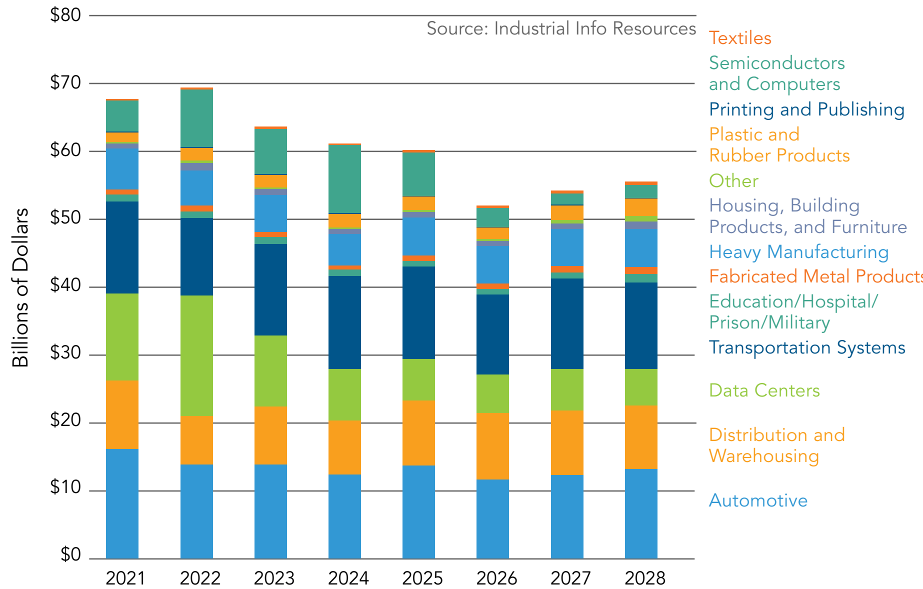
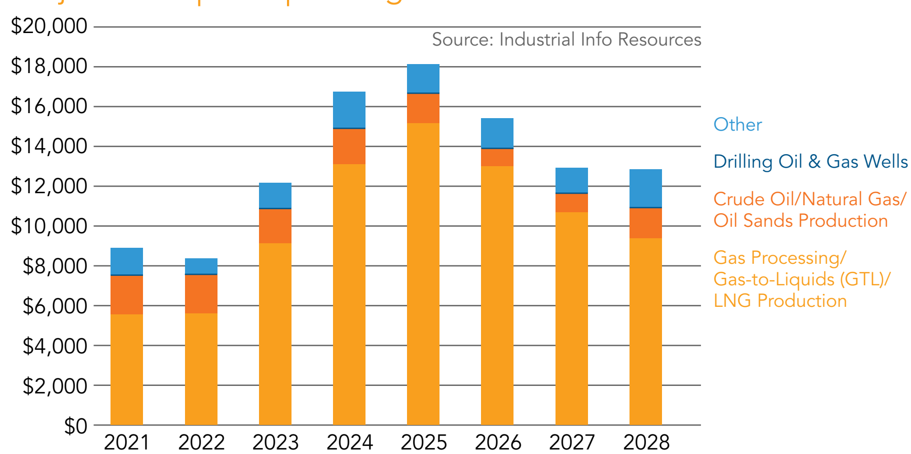
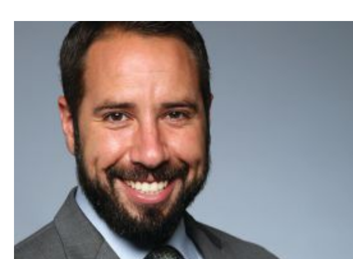


Fig. 4.
Projected Capital Spending of Oil & Gas Production Sector



Ultimately, the industrial sector is poised for a healthy 2022 and 2023. As many AISC member fabricators perform work for the industrial sector, the rise in capital spending in the near term could definitely drive increased demand for fabricated steel. However, it may be worth keeping long-term projections for overall capital and labor investment strategies in the backs of our heads. ■



Joe Dardis (**dardis@aisc.org**) is AISC's senior structural steel specialist for the Chicago market.

Master of Metal

INTERVIEW BY GEOFF WEISENBERGER

Rae Ripple's life tree has branched off many times. And it's taken her to exactly where she wants to be.

All photos: Courtesy of Rae Ripple

Field Notes is *Modern Steel Construction*'s **podcast series**, where we interview people from all corners of the structural steel industry with interesting stories to tell. Listen in at **modernsteel.com/podcasts**.

WHEN I TALKED TO DESIREE "RAE" RIPPLE in early May, she was in her truck, waiting for her son to take a standardized test.

Coincidentally, it was at the same building where she took her fire academy entrance exam many years ago. Rae isn't currently a firefighter, though she still holds her certifications and is happy to help her local fire department in Big Springs, Texas—where she lives with her fiancée and two kids—if the need arises. She isn't a tow truck driver, though she has performed that job in the past as well. She also spent time as a stunt rider, though we didn't even get a chance to discuss that (seemingly awesome) role in our limited time conversing. And she was recently a contestant on the Netflix series *Metal Shop Masters*—oh, and just published her first children's book.

But the role she's best known for is that of an artist, both as a painter of murals, a metal sculptor, and a master welder (in fact, she's sponsored by AISC associate members Hypertherm and Lincoln Electric, among other companies). All the other roles she's played—in addition to being the mother of two teenagers—have forged or been forged by this one. Read on to learn about all of them, as well as her advice for the next generation of girls considering a job in the trades.

Where are you from?

I'm originally from Fort Worth, but I grew up basically all along I-20, near Odessa and Fort Worth and Dallas. I was basically a gypsy as a kid.

Speaking of roads, and this is a terrible pun, but what put you on the road to becoming a metal artist, or even an artist in general?

It kind of happened by accident, like what Bob Ross used to say, "A happy little accident!" I could never really pinpoint

exactly when it started until somebody asked, "What did you do before you started doing metal sculpting and painting?" And the answer was, "I made cakes." I think where it started was when I went to a yard sale, and they had a Care Bears cake pan. And my daughter was about to turn two or three, and she was obsessed with Care Bears. So, I baked the cake, I decorated it, and it turned out great. It wasn't done in the middle, but it looked fabulous, and that's kind of what started it all. From there, people said, "You should make cakes!" or "Can you make me a cake?" And I started this little side hustle of making cakes. But there was no real money in it, so I got out of it. And then from there, I just started kind of painting on canvas and on random things and, you know, things I would find and furniture or whatever. And then somebody brought me a piece of sheet metal and said, "Hey, can you paint me a ranch sign on this?" and I was like, "Yeah, absolutely!" And it went from there, and then I discovered tin snips and baling wire and rivets and started creating all these cool 3D pieces. I wanted to take it to the next level and started welding. At the time, women in welding weren't common, especially where I live, which is in the heart and soul of the oil and gas industry, and so trying to find somebody to teach me how to weld was just not happening. I signed up for a welding class, and they handed me a book, but I have dyslexia and am really not that great at reading—which is kind of funny because I just wrote a book—so I dropped the class and just watched hundreds of hours of YouTube. And now we're here. I don't even know how it happened. It just happened.

That is quite the origin story! What was it like picking up a plasma cutter and a welding stick for the first time?

I became addicted to the smell and the fire the very first time I picked up a plasma cutter. There's something about playing with fire that is just so powerful. And metal is beautiful. A lot of the stuff that I work with is scrap metal, so it's all found metal with a weathered patina. There's a lot of the Texas skies and weather embedded in these materials, and you can create something amazing that was once trash, just sitting in the field. A lot of the vehicles I cut have been sitting at farms and on ranches in the middle of nowhere forever, and now they have a whole new life. It's amazing what a plasma cutter and a welding stick can do.

How much time do you spend on your art?

Well, I do this for a living now, so every day I'm working on something, whether designing or out in the shop or finagling something. But it's not necessarily work; it's just what I love to do. You find what you love, and you learn how to make money with it. That's what somebody told me a long time ago. And this is something I love, and I'm just blessed that I get to take care of my family doing what I love. I'm so grateful for it. Everything I do is so different from the last thing, something new and fresh and like starting over.

That's great! Can you tell me a bit about how your work has evolved over the years?

Wow, it has evolved a lot. If you saw some of my early work, it is so bad. Like I want so badly to be able to just take those things back from early customers and say, "Let me make you something better because this is so bad!" I actually just posted the very first piece I ever cut and welded on Facebook, and it looks terrible. I gave it to my best friend, and she actually cherishes it, but every time I look at it, I'm thinking that it's so ugly.

Anyway, when I was working as a tow-truck driver, I would find all these really cool, unique pieces in scrap piles whenever I would go on these tows or long hauls and work on just cutting that stuff up and putting it together. When I started, I never really thought that I would be doing this for a living. I just did it because my soul craved it, and my mind craved it, and it was an outlet for me. And the more and more I did, the better and better my work got, but I think it wasn't really until I was in the fire academy that my work really kind of took off and people started taking notice. And that's what got me focused on these fire extinguisher sculptures that I used to do; I don't really do them as much anymore. I was in this fire extinguisher class in the academy, and when we started taking them apart, the instructor was telling us all these chemicals and all these things in them, but I didn't care what he was saying. I just want to know what these cans are made of, and can I cut them up? That's all I cared about. I've always done sculpture work, but the fire extinguishers, I think, are what caught everybody's attention because firefighters love memorabilia, and they'll buy any and all of it.

I have more questions about the sculptures, but let's back up for a second. You went to the fire academy? And you were also a tow truck driver?

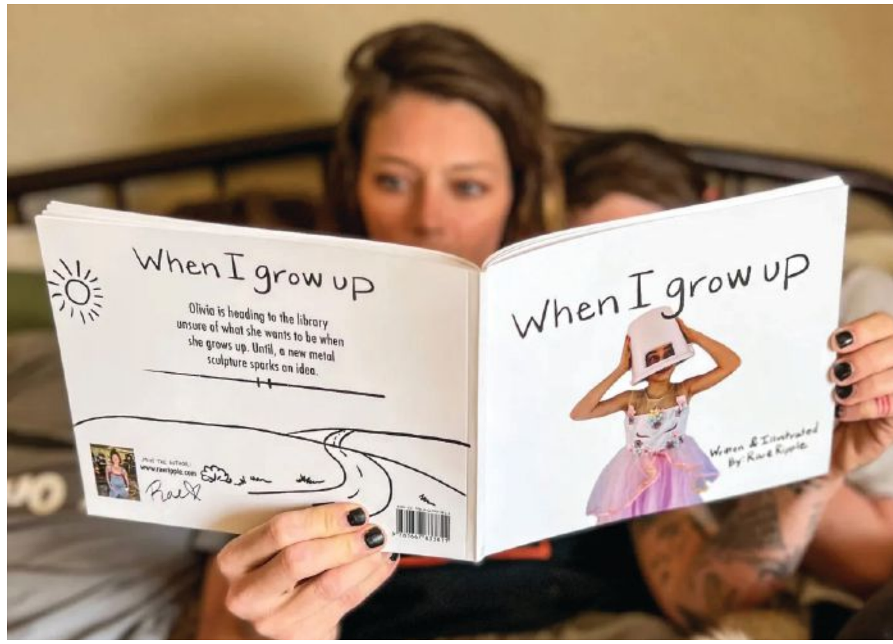
I was actually a waitress in college, and one of my regular customers was a tow truck driver. And he was complaining about work and how they never had enough good help, and I asked if he knew someone who would hire me. He did, and they hired me basically as a joke and because they wanted to see me fail as a female. And then I ended up getting on with a really great company after that. But the first company just handed me the keys to this massive tow truck and said, "Well, I guess you want a job, so go figure it out." I worked a lot of crashes, some really horrific ones, and I eventually worked a crash that just changed everything, and I decided I wanted to become a firefighter. And so I started studying and got accepted into the fire academy and became a firefighter. And from there, I eventually left to do art full time. So that's what I was doing before I became a full-time artist.

Quite the path! Back to sculpting, you were on *Metal Shop Masters* last year on Netflix. Can you talk about that journey? How do you get on the show in the first place?

Well, they kept emailing me and I thought it was a scam, so I didn't even reply. But they kept trying, and I was like, "Man, these guys are persistent," so I like emailed them back, and it was legit, and I thought, "Okay, this is real. This is happening." They started casting before the pandemic, and then the pandemic happened, and so everything in the world shut down. And honestly, I didn't even think that it was going to go through. And then one day in like, August, they said, "Congratulations! You made the show! Also, you need to build this avatar of you in a week or two, and then we're going to pick it up." It was so fast-paced, just absolutely insane. I don't say this in a negative way whatsoever, but it was like I got kidnapped and was told that I'd need to make a whole year's worth of art in just a few days, and I'd only have 10 hours to do each sculpture. But it was such a great experience because I was in my comfort zone whenever it came to the art, and it really pushed me to the limit, and I really learned a lot about myself and what I'm capable of. I'm forever grateful for that show. It changed my art for the better, and I picked up a lot of amazing things from the other artists that I got to be around, which is pretty cool. I didn't think I'd make it past the first round, to be 100% honest with you. I didn't even pack enough clothes because I was just thankful to be a part of the show and have my face on Netflix and have people get to see what I do. But with every elimination, I made it through and the next day, we would go straight into the next episode. And I would call my fiancé and my family at home and say, "Today's the day I'm going home," but I wouldn't go home. I made it almost all the way to the end. It was crazy. Really incredible.

I understand that your kids are 13 and 18. Are either of them following in your footsteps or artistically inclined?

They're both very artistically inclined, which is kind of crazy. Not something I expected because I didn't really discover my own passion for art until later in life. Chloe is my oldest. She knows how to weld. Will she do it? Absolutely. But she doesn't necessarily like it. She doesn't want to be dirty. She doesn't want to get burned. But she does know how to do it, so if she needs to deliver, she can. But my son, Kash, is always in the shop with me. He's always holding things for me, and every sculpture everybody gets has a little piece of Kash in it too. I think he wants to follow in my footsteps as far as metal fabrication. Chloe paints, but she does other stuff too, like these really like cool felt characters and other stuff that she makes with felt. But she started this whole five-minute painting series, where she paints landscapes in five minutes or less, and it's, like, the most incredible thing I've ever seen in my life. I mean, I'm her mother, so of *course* it's the most incredible thing I've ever seen, but seriously, she's very, very talented, and she'll paint a mural, like on the door in her own room, and then keep painting new ones over it.



It's a great outlet. Speaking of outlets, not only have you been a painter, a sculptor, a welder, a firefighter, and a tow truck driver, but now you're an author as well. Can you tell me a little bit about your book, which I understand is called *When I Grow Up*?

Yes! A children's book is something I've always wanted to do, and I think there are a lot of little girls with parents in the trades. And so that seed is planted way earlier than I think anybody really realizes. There needed to be something out there that a little kid can find in the library, and if they want to know something about welding, they can pick up a book about welding or at least about a little girl that wants to be a welder when she grows up, and that's where the idea came from.

This just came out, yes?

It launched on May 3 and then sold out everywhere, and **www.readersfavorite.com** just gave it a five-star review, which was so cool. And you can find it everywhere online—Amazon, Target, Walmart—and I'm working to possibly get it into stores too.

Congratulations! That's wonderful to hear. Touching upon the book's theme, do you have advice for girls and young women when it comes to getting into the trades?

I do! When I first started this, when I first started *anything* that I've done in my entire life, I've failed. I don't know how many times, over and over—countless times. I've hit rock bottom. I've been through it all. I've seen it all. And my greatest advice to anyone that's looking to either start something new or is just trying to get their lives together or trying to build the life that they love is that it's okay to fail. And here's why: Because if I hadn't failed every single time, then I wouldn't be here talking to you about all the things that I've done or all the things that are coming up, or any of that kind of stuff. Failures aren't failures. They're simply redirections, and redirections are eventually going to put you exactly where you want to be in life. So don't be scared to fail. If it doesn't work out, it doesn't work out because something else better is going to happen for you. That spot where it didn't work out is like a branch growing out from a tree that you follow, and that leads somewhere else and branches out again, and then before you know it, you're doing what you love. ■

*This column was excerpted from my conversation with Rae. To hear more from her, including her exhilarating experience painting a mural on a train bridge, check out the July Field Notes podcast at **modernsteel.com/podcasts**. You can also follow her and see more of her art on Instagram at **@raeripple**.*

Geoff Weisenberger (**weisenberger@aisc.org**) is chief editor of *Modern Steel Construction*.

Mentoring Toward Equity

BY KATERINA JONES

What does it take to become a successful female mentor in the steel industry? It's not about just becoming "one of the guys."

THERE ARE COUNTLESS ARTICLES out there talking about the importance and value of mentorship.

And they're right. Positive mentorship can be the difference between a short-lived career and a lifelong successful one—especially for professional women in male-dominated industries such as structural engineering and steel fabrication and erection.

I immigrated to the U.S. from the Czech Republic when I was ten years old, not knowing a word of English. I worked two jobs in high school to help my mother make ends meet and worked *three* jobs while attending college full-time on an academic scholarship. I spent a lot of time in the restaurant industry, working on the weekends and holidays, envious of the customers at the table. It was my sheer determination that led me to where I am now, being a wife, mother, and professional and gaining knowledge and experience from many male-dominated industries. But along the way, the importance of finding opportunities to help other women advance in their careers has become abundantly clear.

Supporting Professional Growth

According to a recent survey from *Business News Daily*, 56% of American workers have had a professional mentor, while 76% believe that mentorship is important. After working in male-dominated industries like construction and motorcycle equipment, I am passionate about helping other women as they pursue careers in these and related industries. I have experienced the difference hard work and women can make, not only through mentoring other women but also by bridging the gap with men in these industries to help them understand gender differences and the various values and experiences women can offer their companies.

When I started my career, I felt the right thing to do was to become "one of the guys," understanding the language and learning their way of communicating with one another. I was passionate about my work and projects and intensely focused on client service, and I was certainly gaining confidence within the industries where I worked. But along this journey, I began to realize the importance of stepping outside this mold and understanding the distinct differences between men and women—particularly in the areas of communication. I was fortunate to work in a company environment where diverse voices were encouraged. Other women haven't always been so lucky, and many haven't had the same fortune when it comes to having supportive senior management. This is where mentorship becomes so critically important.

I know this because I've seen it firsthand through my involvement with building materials associations and organizations where I've had the luxury of meeting hundreds of other professional women. Learning from these women has been instrumental in furthering my own professional career, as well as shaping the type of mentor I've now become to other professional women of all career levels inside my own organization.

I've also made it a priority to focus on nominating female colleagues for industry awards and speaking engagements so they can shine under their own spotlight, as well as to encourage them to attend the Women's Forums from various associations for additional growth opportunities. I wanted to become a strong female mentor who could demonstrate to others how to be successful without having to just be one of the guys. I've made it a goal to be strong and demonstrate how it's okay to be female, even feminine, in manufacturing and other industries.

Not only is it important for women to have mentors, but it's also important that they have mentors who are also women. (That's not to say that women should *only* have female mentors, but it is beneficial for at least one of them to be female—someone who has experienced the same trials and tribulations and with whom they have a shared experience.) Outside of professional talent and hard work, sometimes women need support from others to champion their ideas and goals that may not always receive the same amount of direction and prioritization as those of male colleagues.

The right mentorship goes beyond emotional support and advice. It can be imperative in helping future female leaders understand and successfully navigate the political minefields that every organization encounters, male-dominated or otherwise.

Best Practices

Finding mentors can be challenging for professional women, particularly younger ones. Mentors, like portfolios, should be very diversified. You should seek mentors with similar interests—but also different interests. You should seek mentors of various age groups if they have sincere wisdom to share; they don't all have to be a generation or more older than you.

And choose mentors who can support you in difficult times but who also challenge you and push you to be even better than you think you can be. Mentors are special people who have the ability to see your potential and can help you reach that potential even when there are difficult situations to navigate.

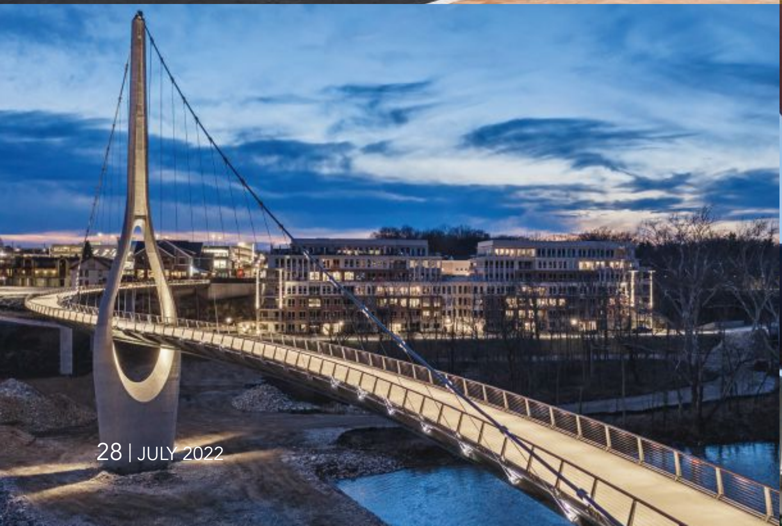
Lastly, mentors aren't always going to come to you. Most organizations don't formally assign a mentor to new employees—and again, your mentor doesn't even have to be someone you work with (and keep in mind that direct managers aren't necessarily the best candidates for mentors). You may have to seek them out, engage them, and perhaps even bluntly request their expertise and time as a mentor. Chances are, they'll be happy to help. But you'll never know until you try.

When you acknowledge the importance of mentors and can identify the appropriate one(s), you'll almost certainly see the benefits, and you may just make a lifelong ally in your professional journey—which is a positive experience for anyone but, again, is even more important for women navigating traditionally male-dominated industries. And who knows: It just might lead to some of these industries being less and less male-dominated and increasingly equitable over time. ■

To learn about AISC's Equity, Diversity, and Inclusion efforts, visit ***aisc.org/equity****.*

Katerina Jones is vice president of marketing and business development at Fleet Advantage (**www.fleetadvantage.com**), which focuses on truck fleet business analytics, equipment financing, and life-cycle cost management.

CONGRATS TO OUR 2022 WINNERS!



2022 PRIZE BRIDGE AWARDS

AISC AND THE NATIONAL STEEL BRIDGE ALLIANCE are proud to announce the winners of the 2022 Prize Bridge Awards.

"These projects demonstrate the creativity and skill of the structural steel design and construction industry," said AISC's president, Charles J. Carter, SE, PE, PhD. "This is our opportunity to celebrate the achievements of these project teams."

More than 600 bridges of all sizes from all across the United States have received a Prize Bridge Award since Pittsburgh's Sixth Street Bridge won the first competition in 1928. Some of those bridges, such as the Wabash Railroad bridge in Wayne County, Mich., which won a prize in 1941 and still carries railroad traffic more than 70 years later, have outlasted the companies that built them.

A team of four nationally recognized experts in bridge design and construction served as this year's jury:

- Domenic Coletti, principal bridge engineer, HDR Inc.
- Jamie Farris, bridge deputy director, Texas Department of Transportation
- Finn Hubbard, vice president, Fickett, Inc.
- Natalie McCombs, senior technical advisor, HNTB

Judges weighed each project's use of structural steel from both an architectural and structural engineering perspective, with an emphasis on: creative solutions to the project's program requirements; applications of innovative design approaches in areas such as connections, gravity systems, lateral load resisting systems, fire and/or blast protection; the aesthetic and visual impact of the project; innovative use of architecturally exposed structural steel (AESS); technical or architectural advances in the use of the steel; and/or the use of innovative design and construction methods. The program also recognizes the importance of teamwork, coordination, and collaboration in fostering successful projects.

New this year is the Bridge of the Year Competition. The 2022 World Steel Bridge Symposium in Denver (March 23–25) featured presentations from the teams behind the three finalists selected by our judges. Presenters outlined what made their bridges so noteworthy. The three finalists were:

- I-91 Interchange 29 Exit Ramp Flyover Bridge (medium span)
- Metro-North Railroad Bridge over Atlantic Street (short span)
- Green Street Pedestrian Bridge (special purpose)

The winner was I-91 Interchange 29 Exit Ramp Flyover Bridge.

Read on to learn more about—and see lots of great images of—all of this year's winners.

Major Span

- National Award: I-74 Mississippi River Bridge – Westbound Span
  Bettendorf, Iowa/Moline, Ill.
  submitted by Modjeski and Masters

Medium Span

- National Award: I-91 Interchange 29 Exit Ramp Flyover Bridge
  Hartford, Conn.
  submitted by CHA Consulting
  (also Bridge of the Year)
- Merit Award: Arlington Memorial Bridge
  Washington, D.C./Arlington County, Va.
  submitted by High Steel Structures

Short Span

- National Award: Metro-North Railroad Bridge over Atlantic Street
  Stamford, Conn.
  submitted by Atane Consulting

Rehabilitation

- National Award: Baker's Haulover Cut Bridge Rehabilitation
  Bal Harbour, Fla.
  submitted by TranSystems
- Merit Award: Hernando de Soto Bridge
  Memphis, Tenn./West Memphis, Ark.
  submitted by Michael Baker International

Special Purpose

- National Award: Green Street Pedestrian Bridge
  Winston-Salem, N.C.
  submitted by HDR, Inc.
- Merit Award: Dublin Link Pedestrian Bridge
  Dublin, Ohio
  submitted by Endrestudio and Kokosing Construction Co.

Modjeski and Masters

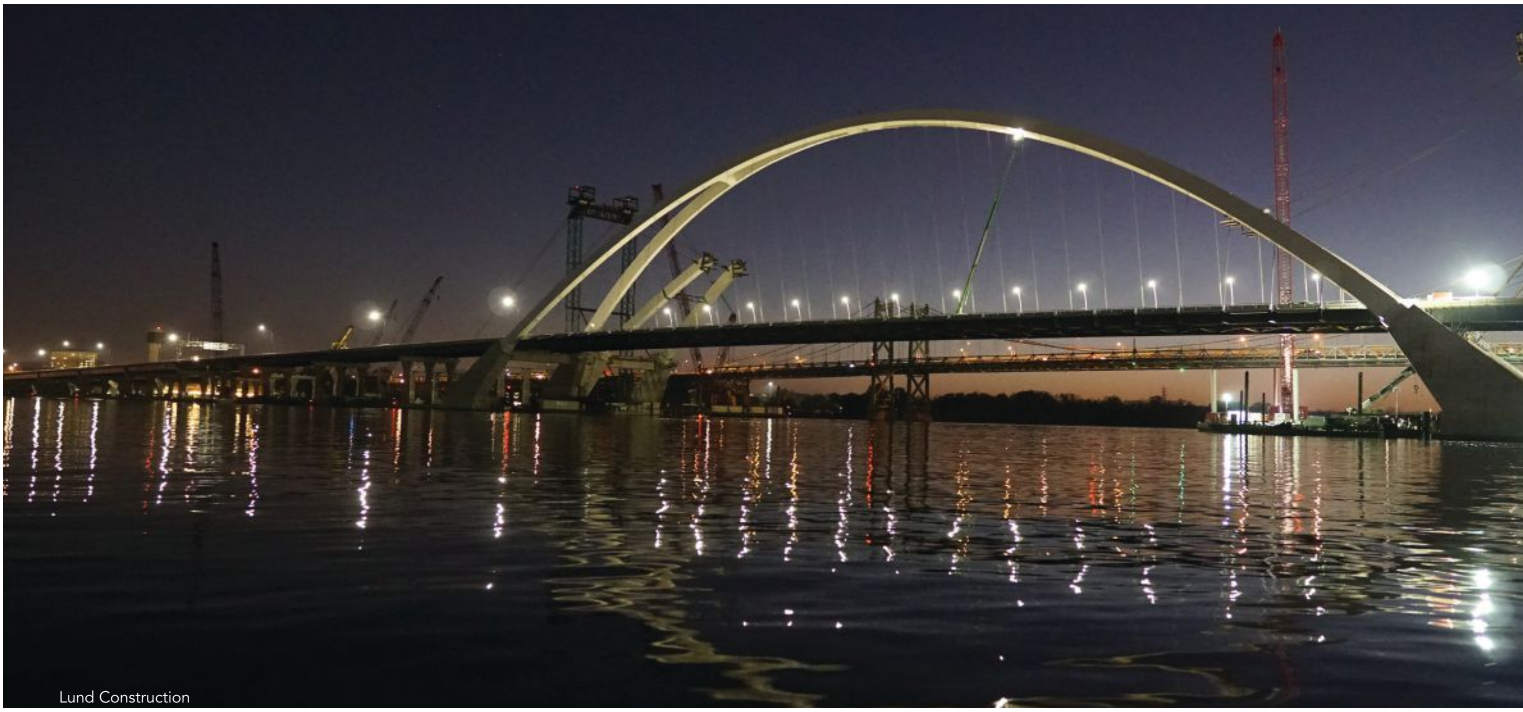
NATIONAL AWARD Major Span

I-74 Mississippi River Bridge—Westbound Span, Bettendorf, Iowa/Moline, Ill.

THE IOWA-ILLINOIS MEMORIAL BRIDGE was long known as the crown jewel of the I-74 corridor through the Quad Cities region.

The bridge spans the Mississippi River between Moline, Ill., and Bettendorf, Iowa, and is a vital inter-state link in the area. Recent economic growth in the region has led to ever-increasing traffic demands that have outgrown the corridor's existing infrastructure, and this vital stretch of I-74 had become a pinch point. The Iowa and Illinois Departments of Transportation developed an ambitious improvement plan to alleviate congestion along the corridor and sustain the regional economy. The plan encompassed several objectives, including increasing existing roadway capacities and designing new roadways and interchanges. Most notably, the strategy called for a new I-74 Mississippi River Bridge to replace the existing Iowa-Illinois Memorial Bridge. The new bridge would need to provide a long service life through improved materials and details, easy access for inspection and maintenance, and accommodation for the area's greatly increased traffic.

The westbound span opened in late 2020, and its eastbound twin opened this past December. The new bridge is more than twice as wide as the existing bridge, providing four lanes in each direction, and a multi-use path will connect to paths in Bettendorf and Moline on either side of the river. The geometric configuration of the basket-handled arches and the use of minimal arch rib bracing (two intermediate struts and a crown strut) offer a modern representation of the arch form, and the arch span marks the main navigation



Lund Construction

channel as vehicular travelers pass along the corridor between Iowa and Illinois. Because the new steel arch bridge is in a main navigational channel, it took substantial coordination during the construction phase to minimize impacts on river traffic as the arch segments were installed.

In order to achieve the precision necessary to set the initial arch sections on their foundations, field milling was specified for the embedded steel anchor plates, using techniques and equipment typically employed in the construction of movable bridges. The arch segments are anchored to the foundations using specialized, high-strength stainless steel prestressed anchor rods developed as part of a research project to identify a corrosion-resistant material for this type of application, and the design team chose a duplex stainless steel (grade 2507) with a minimum tensile strength of 116 ksi. After installation, the bars are grouted in their ducts to provide an additional corrosion barrier and bond them to the surrounding concrete. The project also used HPS 70W extensively, both in the arch ribs and the floor system, in areas where the high level of strength could be used to the best advantage.

Bridge Stats

Crosses: Mississippi River

Span length: 800 ft

Total length: 3,405 ft (arch span and steel multi-girder approach structures)

Average width: 98 ft

Steel weight per deck area: 0.075 tons/sq. ft

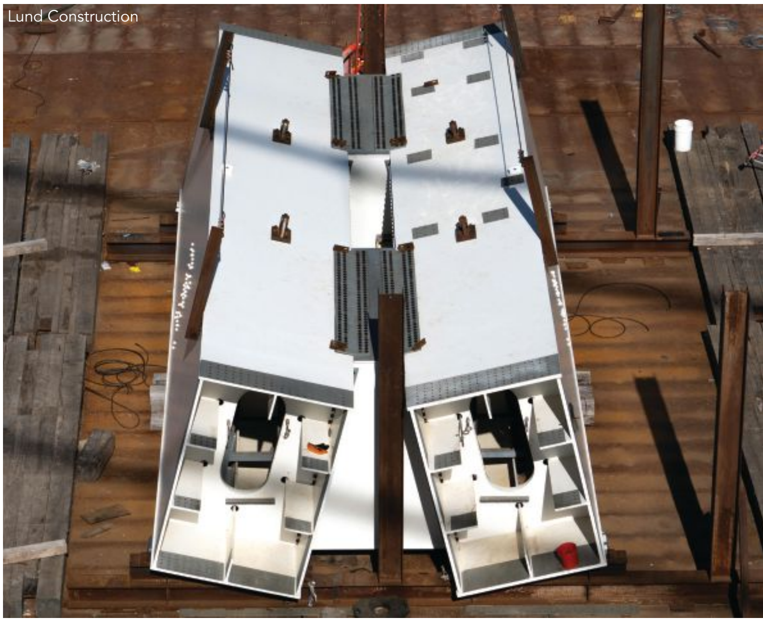
Total structural steel: 4,300 tons

Approximate cost: $34.5 million (engineers' estimate for the superstructure)

Corrosion protection: Stainless steel high-strength prestressed anchor rods, stainless steel reinforcing steel, fluoropolymer paint system, uncoated weathering steel


HNTB


Modjeski and Masters


Lund Construction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When it comes to maintenance, the system consists of an under-deck traveler that can access the entire floor system and includes a scissor lift that rides across the traveler and provides vertical access to the full depth of the edge girders and floor beams. Workers can access the arch ribs by an internal system of walkways and stairs, as well as external hatches and handrails that provide access to the top of the arches.

The concrete deck employs stainless steel exclusively, including in the barriers, to provide a long service life and minimize the need for extensive maintenance and frequent deck replacement. To prevent unwanted oscillations of the bridge in the wind, a system of winglets is installed along the edges of the suspended deck.

The nearness of bedrock to the surface in this area allowed for the use of a true arch bridge rather than a tied arch. This eliminated the long tension ties and the redundancy issues that sometimes accompany them. The slender, tapered arches are inclined toward each other, with minimal bracing between them. This framing scheme, together with the sheer size of the bridge, leaves an indelible mark on the river, signaling the importance of the region and the new crossing.

In addition, the bridge's lighting makes it a stunning nighttime focal point from up and down, and on either side of, the river and beautifully highlights the structural system. The improved highway geometrics and traffic capacity (the westbound arch alone has more deck width for traffic than both of the original suspension bridges combined) provide much-needed room for the region's ongoing economic expansion.

Owners
Illinois Department of Transportation
Iowa Department of Transportation

General Contractor
Lunda Construction Company

Structural Engineers
Modjeski and Masters, Inc. (superstructure)
Alfred Benesch and Company (substructure)

Steel Team

Fabricator
Industrial Steel Construction, Inc. AISC Certified Fabricator, Gary, Inc.

Detailer
Tenca Steel Detailing, Inc. AISC Detailer, Quebec, Canada

Bearing Manufacturer
R.J. Watson, Inc. AISC Certified Fabricator, Alden, N.Y.

BRIDGE OF THE YEAR
NATIONAL AWARD Medium Span

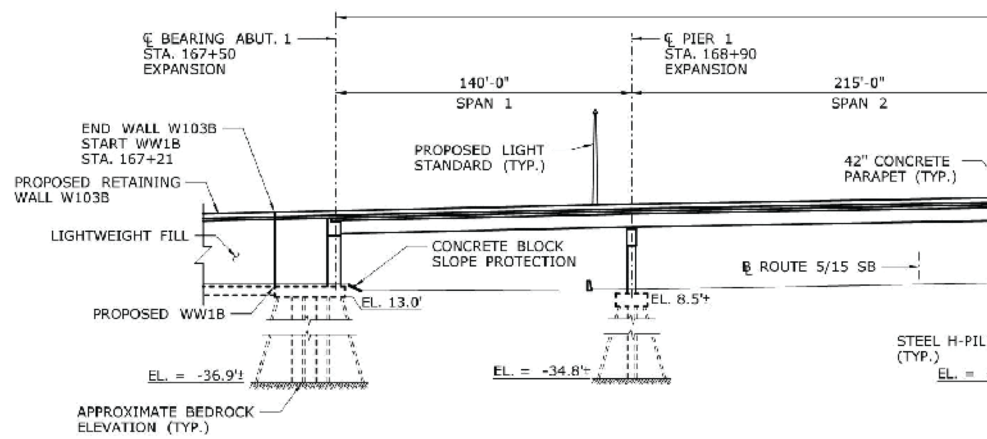
I-91 Interchange 29 Exit Ramp Flyover Bridge

Hartford, Conn.

FOR A LONG TIME, INTERCHANGE 29 in Hartford, Conn., was notorious for congestion.

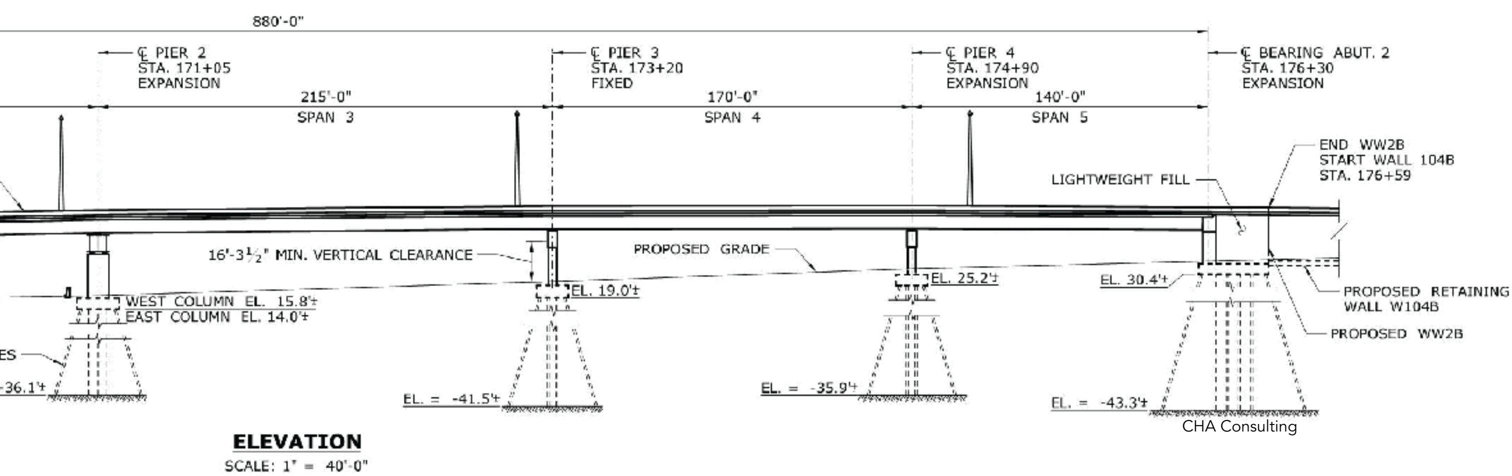
The interchange connects northbound I-91 with Route 5/15, the latter being the major connector between I-91 and I-84 in East Hartford. The original ramp was a single-lane ramp with a steep grade and a significant traffic weave at the intersection with Route 5/15 and saw significant daily back-ups on I-91 that led to numerous accidents and delays. Improvements to the interchange were one of the top priorities of the Connecticut DOT (CTDOT), and the reconfiguration of the interchange resulted in a new high-speed two-lane ramp that crosses over southbound Route 5/15 in a weave configuration.

The new ramp is a straight ramp that crosses a curved roadway at a very flat angle, resulting in significant geometric impacts on the roadway below. The vertical geometry of the roadway below the bridge limited the ability of vehicles to pass under the proposed hammerhead pier caps due to low vertical clearance at the hammerhead piers. There were three potential solutions: raising the bridge, lowering the roadway, or reducing the pier cap's width. The first two options weren't feasible, so the team moved forward with the plan of reducing the pier cap's width and implementing trapezoidal box girders. This solution allowed the design team to locate the bridge bearings closer to the centerline of the bridge, thereby reducing the width of the pier cap by 8 ft. The reduced cap width also reduced the cost of the piers by reducing the volume of concrete and the bending moments acting on the shorter cantilevers. The geometric layout of the bridge also improves its look, as the trapezoidal box girders without exterior stiffeners produce clean lines. When compared to vertical webs, the sloped webs have historically been the look of choice for bridge aesthetics, as the sloping webs draw the eye toward the single columns supporting the pier caps, demonstrating a flow of forces from the superstructure to the ground.



2022 BRIDGE OF THE YEAR

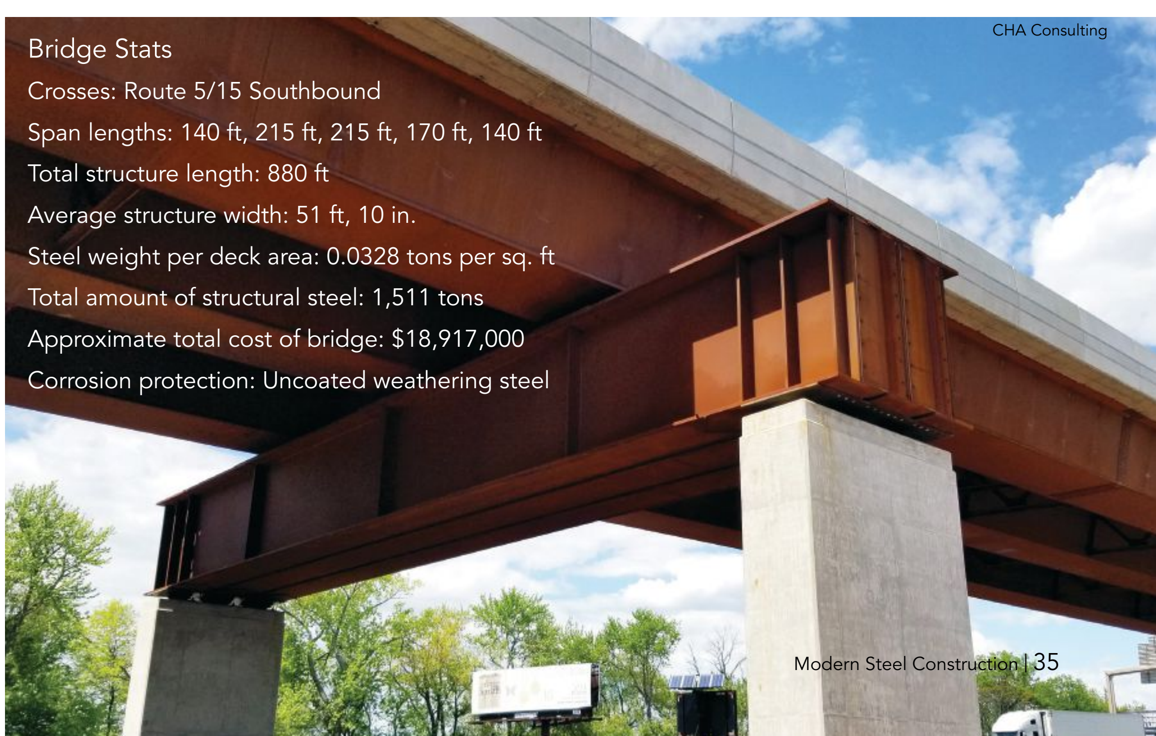
CHA Consulting



CHA Consulting

High Steel Structures

CHA Consulting



Bridge Stats

Crosses: Route 5/15 Southbound

Span lengths: 140 ft, 215 ft, 215 ft, 170 ft, 140 ft

Total structure length: 880 ft

Average structure width: 51 ft, 10 in.

Steel weight per deck area: 0.0328 tons per sq. ft

Total amount of structural steel: 1,511 tons

Approximate total cost of bridge: $18,917,000

Corrosion protection: Uncoated weathering steel

CHA Consulting

Another major factor that makes this bridge stand out is its innovative use of straddle bents. The goal was to design a redundant beam, and the team incorporated the load path redundant members (LPRM) approach. The team accomplished this by converting a typical single-cell box girder section into a three I-girder member. Plate diaphragms were designed using finite element analysis (FEA) to distribute forces equally to each girder and transfer the load should one girder flange fracture. The team also developed an "integral," or framed-in, straddle bent concept and a "stacked" straddle bent scheme with the superstructure on top. There was adequate vertical clearance at the straddle bent location to stack the members, leading to a simpler and more cost-effective design. The design team has developed similar details for an integral "framed in" design. Therefore, the triple I-girder design can be adapted to virtually any steel bridge configuration.

The straddle bent approach used for this project represents a game-changer in the world of steel bridges. To date, all steel straddle bents—again, typically single-cell box sections—have been classified as fracture-critical elements, which has significantly precluded the use of steel for straddle bents. The triple I-girder configuration can provide load path redundancy, thereby eliminating the fracture-critical designation and the related long-term inspection requirements. In addition, the girders can be designed for infinite fatigue life, essentially eliminating the potential for a fatigue crack to develop, let alone a fracture. The triple I-girder design also provides options to the contractor for shipping and handling. The straddle bent can be shipped and erected as one, two, or three pieces, which allows the contractor to achieve maximum efficiency when it comes to truck size and crane size, potentially eliminating an overweight permit, which can lead to reduced costs. This proved to be the case on the Interchange 29 ramp bridge, as the contractor chose to ship the straddle bent girder in two pieces. Once on-site, the two pieces were bolted together on the ground and erected as one piece.

The triple I-girder straddle bent concept offered another surprising benefit: It's a very economical section to fabricate. During design development, when considering fabrication costs, the design team initially felt that the fabrication of three members might be slightly more expensive than the fabrication of a single box girder. The idea was that while the total flange areas of the triple I-girder would be similar to the box girder, the triple I-girder would have three webs as opposed to two, which might increase costs. But the team moved forward with the triple I-girder option since the long-term savings in reduced fracture-critical inspections would offset the perceived initial cost.

Surprisingly, the design team was wrong. The fabrication cost for the triple I-girder turned out to be substantially less than the equivalent box girder, and the fabricator identified a couple

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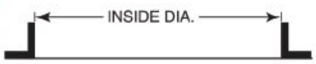
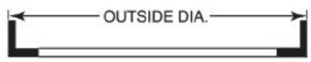


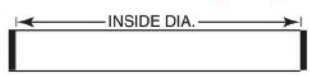
10" x 10" x 1" Angle

2. **Angle Leg In**


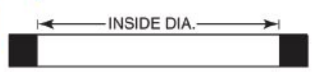
10" x 10" x 1" Angle

3. **Flat Bar The Hard Way**

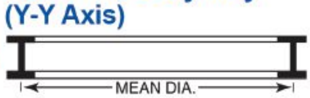

24" x 12" Flat

4. **Flat Bar The Easy Way**


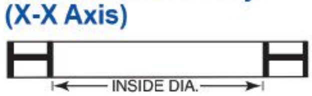
36" x 12" Flat

5. **Square Bar**


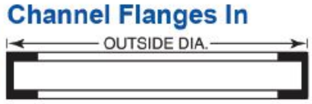
18" Square

6. **Beam The Easy Way (Y-Y Axis)**


44" x 335#, 36" x 925#

7. **Beam The Hard Way (X-X Axis)**


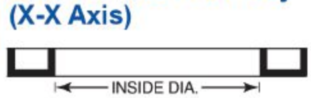
44" x 285#

8. **Channel Flanges In**


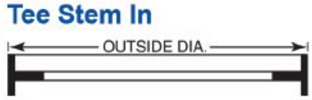
All Sizes

9. **Channel Flanges Out**


All Sizes

10. **Channel The Hard Way (X-X Axis)**


All Sizes

11. **Tee Stem In**


22" x 142 1/2# Tee

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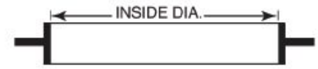
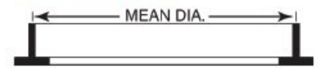
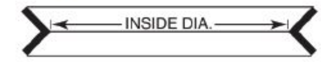
12. **Tee Stem Out**


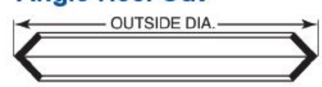
22" x 142 1/2# Tee

13. **Tee Stem Up**


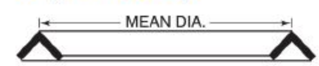
22" x 142 1/2# Tee

14. **Angle Heel In**


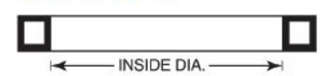
8" x 8" x 1" Angle

15. **Angle Heel Out**


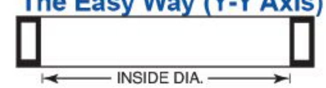
8" x 8" x 1" Angle

16. **Angle Heel Up**


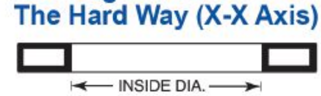
8" x 8"x1" Angle

17. **Square Tube**


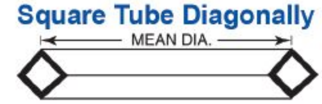
24" x 1/2" Tube

18. **Rectangular Tube The Easy Way (Y-Y Axis)**


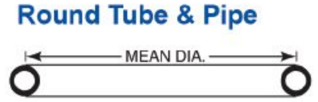
20" x 12" x 5/8" Tube

19. **Rectangular Tube The Hard Way (X-X Axis)**


20" x 12" x 5/8" Tube

20. **Square Tube Diagonally**


12" x 5/8" Square Tube

21. **Round Tube & Pipe**


24" Sched. 80 Pipe

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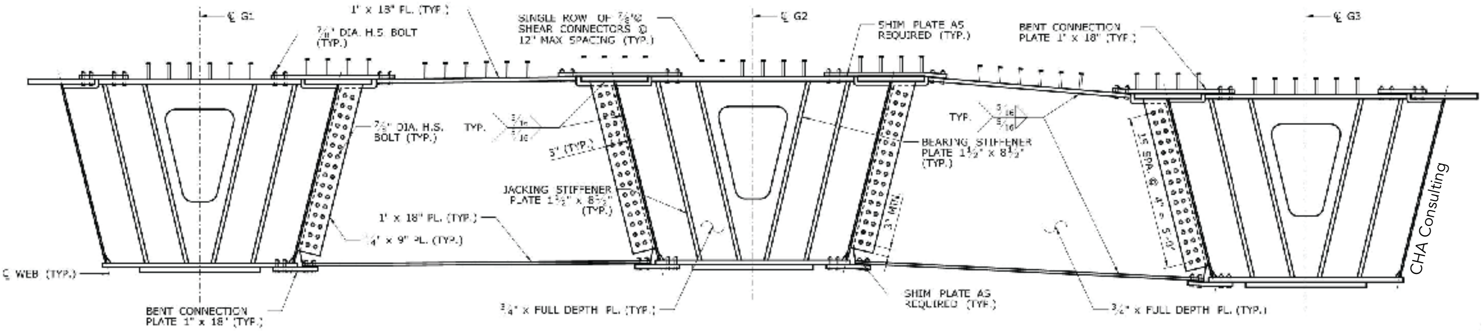


END CROSS FRAMES AT PIER 2

SCALE: ½" = 1'-0"

CHA Consulting

High Steel Structures

of reasons why. Box girders typically require full-penetration groove welds between the webs and the flanges. In addition, some designers specify bolted connections for these locations to provide internal redundancy and obtain a fatigue Category B member. Groove welds and bolting can be very expensive and time-consuming to execute in the shop. Conversely, welding a web to an I-girder flange is a common shop process using conventional beam fabrication equipment, making it very cost-effective. Secondly, welding stiffeners and connection plates on the interior of a box girder is costly due to confined space work that is time-consuming and comes with increased safety risks. While the triple I-girder beams do require interior diaphragms with bolts, modern CNC machinery can quickly cut and drill the plates and holes for the diaphragm. The result of these factors is that the triple I-girder straddle bent can be as much as 50% less than the cost of an equivalent box section.

When it came to corrosion protection for the ramp's superstructure, CTDOT chose uncoated weathering steel. The department has a long history with uncoated weathering steel, dating back to the early 1960s, and recently completed a study of its performance. It found the performance of weathering steel bridges with quality details to be very impressive. In addition, some of the oldest uncoated weathering bridges are still in very good condition after more than 55 years in service, further reinforcing the state's commitment to this corrosion-protection option.

Word has spread about this design. The Texas and Georgia DOTs, two entities that traditionally use concrete straddle bents, have both agreed that the triple I-girder bent is acceptable for widespread use. In the case of the Georgia DOT, steel straddle bents were previously not even allowed for use. Their reversal on this matter is a testament to the design's significance and impact on the steel bridge industry, and these two states and others are looking to make this design a key tool in their steel bridge toolboxes.

Owner

Connecticut Department of Transportation

General Contractor

O&G/BHD, JV

Structural Engineer

CHA Consulting, Inc.

Steel Team

Fabricator

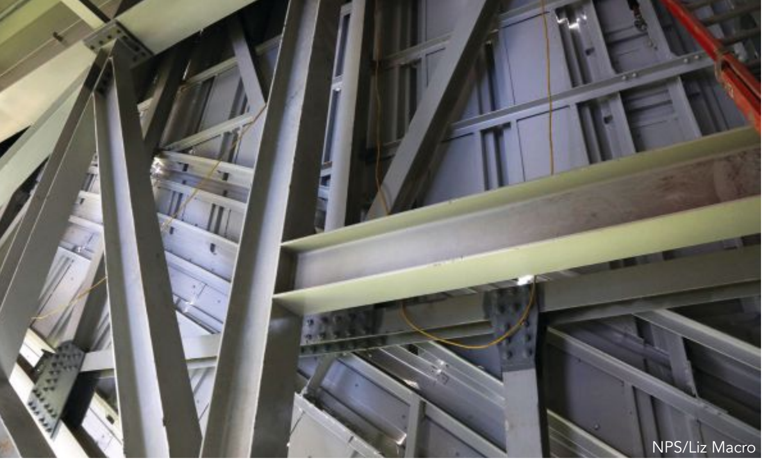
High Steel Structures, Lancaster, Pa.

Erector

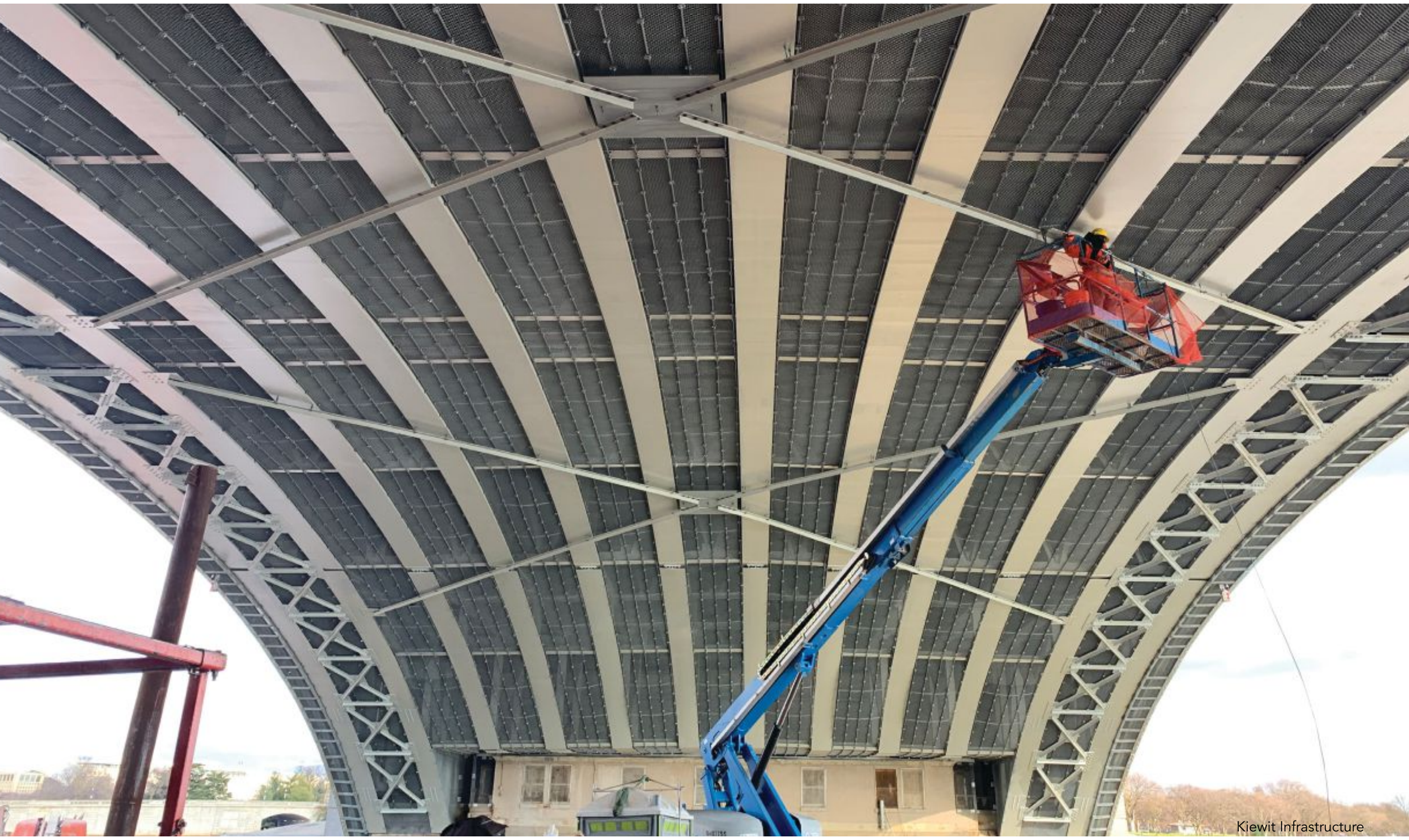
Hartland Building and Restoration Company, East Granby, Conn.

Detailer

ABS Structural Corporation, Melbourne, Fla.

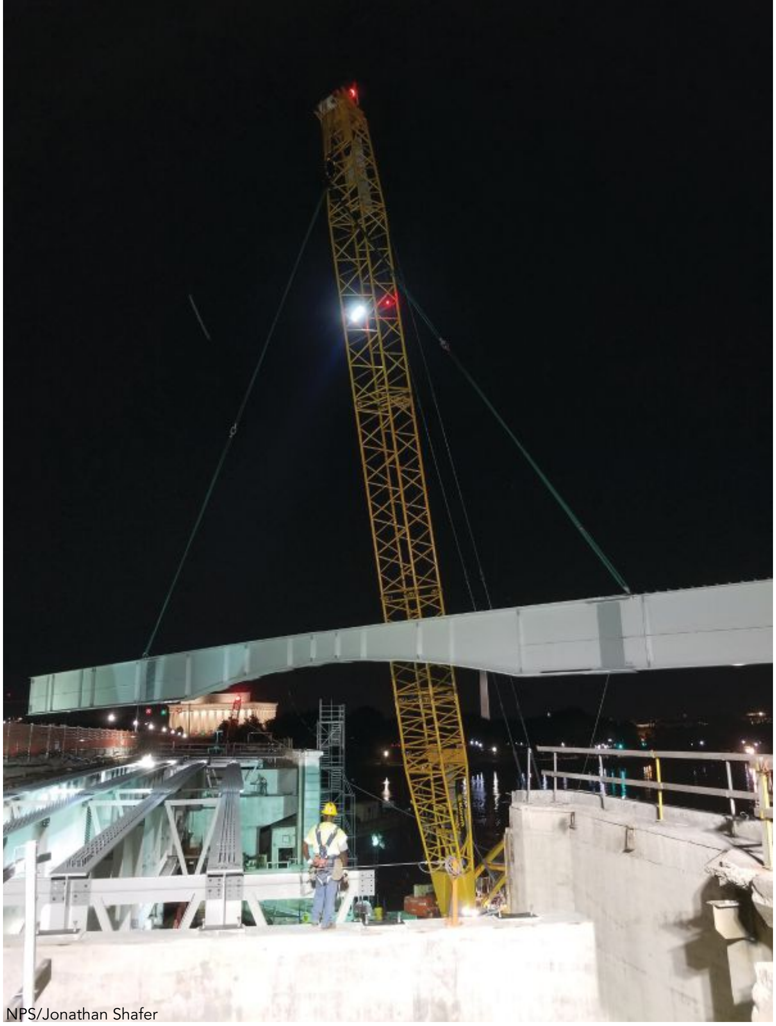

NPS/Liz Macro

NPS/Jonathan Shafer


Kiewit Infrastructure


Kiewit Infrastructure


Kiewit Infrastructure



NPS/Jonathan Shafer

NPS/Jonathan Shafer

MERIT AWARD Medium Span

Arlington Memorial Bridge

Washington, D.C./Arlington County, Va.

THE STRUCTURAL REHABILITATION of Washington, D.C.'s 90-year-old Arlington Memorial Bridge was one of the largest transportation projects in National Park Service (NPS) history and gave new life to the capital's ceremonial entrance while respecting its character, history, and national significance.

A critical link in the region's transportation network used daily by over 65,000 motorists, cyclists, and pedestrians, the bridge is positioned over the Potomac River on a line of sight between Arlington House, the former home of Robert. E. Lee, located in Arlington National Cemetery, and the Lincoln Memorial, the landmark structure is both a cultural monument to the sacrifices and valor of our nation's military personnel and symbolic of the reunification of the North and South following the Civil War.

The bridge's original design comprises ten reinforced concrete arch spans and a center double-leaf steel bascule span. The Chicago-style bascule span's novel design hid the equipment, machinery, and counterweights all below deck, with each leaf concealed by ornamental pressed-metal fascia panels that were carefully designed to blend the span into the overall structure's aesthetic. The bascule span was in active operation from 1932 to 1961 and was permanently closed in the fixed position in 1965 because of a lack of marine traffic.

From 2018 to 2020, the National Park Service and Federal Highway Administration completely rehabilitated the bridge, extending its service life by 75 years. The project included replacing the historic bridge's bascule span, in which the design team paid homage to the original structure in such a way that the new span resembles the original. First established on the renderings during the environmental assessment, the new design was chosen to balance historic preservation goals with constructability, maintenance, and costs.

NPS and FHWA required a design that would protect and enhance the bridge's historic appearance across all facets of the project. Replacing the bascule span was not necessary because other fixed bridges below the Arlington Memorial Bridge prevent tall marine traffic from traveling up the Potomac River. NPS instead worked with engineers and architects to design a new

Bridge Stats

Crosses: Potomac River, George Washington Memorial Parkway, Ohio Drive SW

Span length: Main spans: 31 ft, 11.25 in., 216 ft, 31 ft, 11.25 in.

Total structure length: 2,162 ft (including concrete approach spans)

Average structure width: 94 ft

Steel weight per deck area: 0.048 tons per sq. ft (steel spans only)

Total amount of structural steel: 1,258 tons

Approximate total cost of bridge: $227,000,000

Corrosion protection: Three-coat paint system


NPS/Liz Macro

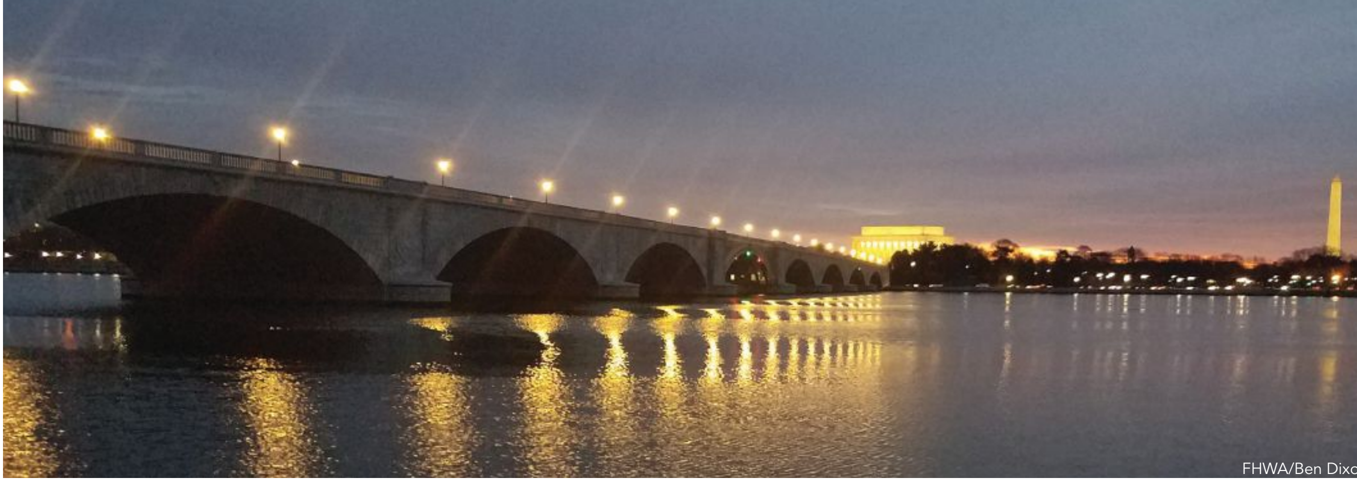
fixed steel superstructure with an under-truss structure that looked similar to the former drawbridge. The new aesthetic features fixed steel plate girders in the main span enhanced by architectural steel components to resemble the bracing in the original bascule design. In addition to the new superstructure, the original look of the span was further achieved by preserving and reusing the bridge's original pressed metal fascia panels.

The new superstructure design uses variable-depth steel plate girders, and the 216-ft-long main span's 12 girder lines feature a curve fabricated into the middle of the web and bottom flange, which fits into the arch shape of the span. The main span steel girders are connected on each end to 31-ft, 11¼-in. rolled beam (W27×84) back spans that traverse over the previous counterweight area. The main span girders were fabricated as three pieces each, then field assembled on a barge at a nearby staging area prior to erection.

The superstructure combines the use of AASHTO M270 (ASTM A709) Grade 50 and AASHTO M270 (ASTM A709) Grade HPS70W. HPS70W was used in the bottom flange (3 in. by 28 in.) in the middle field section due to the reduced depth at the main span. The steel is protected by a three-coat paint system, the color of which was chosen to closely match the bridge's granite stone. After completing structural steel erection, the architectural under-story truss was pinned to the bottom flange of the girders. Then, the restored metal fascia panels were attached to the new superstructure's facia girders using structural steel members with high-strength bolts.

The variable depth under-story truss was used to provide an aesthetic that resembled the original shape of the bascule truss-girders. The new steel superstructure, in combination with the reinstallation of the metal fascia panels, pays homage to the original aesthetic and allows the span to blend in with the adjacent concrete arch spans.

Erection work for the bascule replacement was performed from barges in the Potomac



FHWA/Ben Dixon

River, and a key challenge was maintaining three lanes of traffic on half of the bridge during construction. Since the original bascule span design consisted of edge truss girders and transverse floor beams, the floor beams required support at the center cut line. This was accomplished using an in-water shoring system in combination with a support system under the counterweights.

This support system consisted of interlocked barges, supported by a perimeter of pipe piles, with a series of shore towers supporting each floor beam. The pipe piles were fitted with a series of high-strength threaded rods/rock anchors and jacks that lifted the barges up above the waterline so that the load from the bascule span was transferred from the shore towers to the pipe piles. The temporary shoring remained in place for approximately 12 months during construction, supporting both the weight of the existing bascule steel and live traffic.

Owner
National Park Service

Primary Engineering/Construction Contract Administration
U.S. Department of Transportation
Federal Highway Administration

General Contractor
Kiewit

Structural Engineer
AECOM

Bridge Engineering Consultant
Hardesty and Hanover (bascule span)

Steel Team

Fabricator
High Steel Structures (AISC Certified Fabricator), Lancaster, Pa.

Detailer
DBM Vircon Services (AISC Detailer), Vancouver, Canada

Bender-Roller
Greiner Industries, Inc. (AISC Associate), Mount Joy, Pa.

Bearing Manufacturer
Scougal Rubber (AISC Certified Fabricator), McCarran, Nev.

NATIONAL AWARD Short Span

Metro-North Railroad Bridge over Atlantic Street, Stamford, Conn.

TRAFFIC CONGESTION, railroad inefficiencies, low bridge clearance, roadway flooding, an aging bridge structure, and impacts on future economic development added up to a "perfect storm" of transportation infrastructure problems in Stamford, Conn., one of the Northeast Corridor's most heavily traveled and densely populated areas.

The replacement of the Metro-North Railroad (MNR) Bridge along the New Haven Line provided some relief. But it also came with some challenges, the most prominent being how to maintain uninterrupted train service along the primary commuter route between Connecticut and New York while replacing the five-track structure.

The bridge crosses Atlantic Street, one of Stamford's most important connectors to the downtown area. The thoroughfare is directly east of the Stamford Transportation Center, which houses the Stamford/MNR Station, the CT Transit bus station, commuter parking garages, taxi stands, and corporate shuttle facilities. Interchange access ramps to/from I-95 and multiple one-way east/west streets surround Atlantic Street in the area of the bridge, adding to congestion during peak commuter hours.

The original plate girder bridge, designed by W. H. Moore, was built in 1896. Over the years, most of the legacy railroad bridge crossings along the line have been replaced using traditional construction methods and staged construction, and Atlantic Street and its adjacent crossings within Stamford are the last on the line in Connecticut to be replaced. Incorporating accelerated bridge construction (ABC) techniques provided the confidence that the bridge could be replaced without creating major long-term reductions in service for all commuters. By combining these techniques with careful planning, the bridge was demolished and replaced over a nine-day span without disruption to train service.

The project involved the off-site construction of the new replacement bridge elements, construction of retaining walls to accommodate the future Track #7 and platform for local train service, and widening of Atlantic Street to accommodate new pedestrian walkways, bike lanes, and three northbound and three southbound lanes. Atlantic Street was lowered to increase bridge clearance to 14 ft, 6 in. to allow emergency and commercial vehicular travel. The roadway underpass was reopened to vehicles and pedestrians in a matter of months, whereas traditional construction would have caused years of service disruptions.

The permanent superstructure was divided into three sets of two spans, each carrying two tracks over the permanent structure. "Jump spans" (short temporary spans) were installed in the railroad embankment behind each of the original bridge abutments. These spans were framed with steel beams and supported on steel-encased micro-piles. With the spans in place, the railroad embankment was excavated and the new abutments were constructed beneath live rail traffic. Concurrently, each 700-ton span (750 tons with added ballast) of the new superstructure was constructed off-site at separate assembly areas north and south of the existing bridge. Over a nine-day period, the existing bridge was demolished and the new superstructure rolled in using self-propelled modular transporters (SPMTs). At least two tracks of rail traffic were maintained at all times during the roll-in.

Construction of the center pier also benefitted from an ABC mindset. While the micro-pile-supported, cast-in-place pier footing could be constructed ahead of time, the columns could not be installed until after the existing bridge was demolished. The columns would also be subjected to heavy loads from the superstructure and railroad almost immediately after installation. Steel plate columns were chosen since precast concrete columns would have required cure time for splice sleeves—time that was not available during the nine-day roll-in period. The steel columns were designed with bolted connections that doubled as leveling bolts, allowing vertical adjustment and plumbing of the columns to account for construction tolerances.

While replacing railroad bridges using SPMTs or other ABC techniques has become more common, the "bottleneck" location of the bridge within the line's busiest interlock and in proximity to MNR's Stamford Storage Yard presented its own challenges. Accommodating the traveling public on I-95, city roadways, and the railroad, including pedestrians and bicyclists, required innovations that considered the specific transportation needs of each affected group. Conventional construction techniques would have required more extensive closures and service disruptions. MNR operational impacts were of importance as more than 300 trains pass over Atlantic Street each day, and the bridge is located inside a critical interlock at CP 234, which contains five separate track crossovers between Stamford Station and the Stamford Storage Yard or ten individual switch tracks. These crossovers allow the railroad to control traffic in and out of the station. With operational capacity reaching limits during peak hours, each track out of service would restrict rail operations and limit access to the Stamford Storage Yard just east of the project limits. The project was required to maintain uninterrupted service during all phases of construction, including the bridge demolition and replacement stages.

Solutions focused heavily on planning the most invasive operations for periods of reduced usage, scheduling temporary construction to allow train service to operate during foundation and substructure work, and using off-site and on-site precast components to reduce assembly times. The project worked with railroad staff to identify periods of historically lower ridership, which has traditionally been the week of July 4, when ridership is about 25% lower than other times of the year. The nine-day period surrounding a midweek July 4, 2019, holiday was chosen years in advance of the actual bridge roll-in.

Owner
Connecticut Department of Transportation

Structural Engineer
AECOM

Construction Engineering/Inspection Consultant
Atane Consulting

Steel Team

Fabricator
STS Steel, Inc. AISC CERTIFIED FABRICATOR, Schenectady, N.Y.

Bearing Manufacturer
R.J. Watson, Inc. AISC CERTIFIED FABRICATOR, Alden, N.Y.

Bridge Stats

Span lengths: 70 ft – 70 ft

Total structure length: 146 ft 9⅛ in.

Average structure width: 77 ft 3 in.

Steel weight per deck area: 0.16 tons per sq. ft (superstructure), 0.165 tons per sq. ft (total)

Total amount of structural steel: 1,785 tons in superstructure, 61 tons in pier plate columns

Approximate total cost of bridge: $48,069,356

Corrosion protection: Hot-dip galvanized

All photos: CTDOT

Baker's Haulover Cut Bridge Rehabilitation, Bal Harbour, Fla.

THE BAKER'S HAULOVER CUT BRIDGE is set to live its (next) best life.

Originally constructed in 1948 and previously rehabilitated in 1992 and 2000, it underwent another rehabilitation recently, with a goal of minimizing future maintenance, project cost, and impacts on a highly used roadway linking Miami Beach and the affluent Bal Harbour neighborhood to northern Miami-Dade County over Haulover Cut. The waterway provides access to and from the Atlantic Ocean from the Atlantic Intracoastal Waterway and sits at a location favored by recreational boaters.

The 13-span, 1,255-ft-long bridge, which consists of nine haunched steel riveted girder floor beam main spans and four steel multi-beam approach spans, carries four lanes of traffic, two in each direction. Rehabilitation work included steel repairs and selected member replacement, main span bearing replacement, selected replacement of approach span bearings, concrete repairs, seawall replacement, and painting of all structural steel.

The project came with several challenges from multiple directions. For starters, the road that the bridge carries, SR-A1A/Collins Avenue, is the only north-south thoroughfare running up the barrier islands that are separated from the mainland by the Atlantic Intracoastal Waterway. Any detour of the heavy vehicular, bicycle, and pedestrian traffic would have significant impacts on the overall congested traffic network of Miami-Dade County. Secondly, Baker's Haulover Cut is a major outlet from the protected waters of the Atlantic Intracoastal Waterway to the Atlantic Ocean. It is the primary route for sport fishing and pleasure craft from dockage to the ocean in the northern half of Miami-Dade County, and reduction of vertical clearance in the main channel between bridge fenders was not allowed by the U.S. Coast Guard. Also, water currents through the cut are significant during the majority of the day, making in-water work difficult in all but short periods of slack tide each day.

In addition, the bridge carries infrastructure for eight different utilities, including electric transmission and distribution lines, a water main, cable television, and gas. The electric transmission line, in particular, was vital to the service provided to the affluent Bal Harbour neighborhood on the south side of the bridge, as the electrical network could not put that line out of service and still provide power to the residents, hotels, and other businesses in the area. Therefore, jacking the bridge to replace the bearings and repairing and painting the bridge near these elements would be tricky. Finally, seawall replacement within the Florida DOT (FDOT) right-of-way had been completed adjacent to existing seawalls at both shorelines. At the south shore, a beach and access road for the neighboring hotel needed to be maintained directly adjacent to the seawall, and any settlement of that roadway could not be tolerated. And at the north shore, an electric power facility just north of the seawall extended into the FDOT right-of-way such that care needed to be taken to ensure no damage to that facility. At both shorelines, any repairs for the portions of the walls under the bridge needed to be able to be performed with limited available headroom.

All photos this spread: Copyright Alex Menendez/Courtesy of TranSystems

As a project funded with bridge maintenance dollars, it was important that the work be done within the construction funds budgeted by the FDOT. In order to tailor the design scope to the available funding and be as cost-effective as possible, a thorough inspection of the bridge was completed to ascertain conditions and take field measurements, and a full list of needed work was prepared, in order of importance, to address deterioration that reduced the safety and capacity of the bridge, and then work items were pulled from that list to fit the project budget.

In order to determine the deteriorated areas that needed repair on the steel members to improve capacity and to determine the need to maintain the three-span continuous girder-floor-beam-stringer spans bottom flange bracing, which had widespread losses, a complex finite element analysis (FEA) model was prepared in order to analyze these spans. Structural repairs included adding bottom flange cover plates to the floor beams to provide necessary increases in member capacity and girder web repairs at selected gusset plate locations where holes and section loss were present. The analysis results allowed the design team to effectively identify discrete areas that required repair and determine that the bracing was not required. In consultation with FDOT, it was decided that only bracing members with significant section loss and that had the potential to fall from the bridge would be removed. This decision removed more than $1 million from the construction budget, and the remaining bracing was left in place, cleaned, and painted.

Replacing the girder bearings on the three-span continuous steel spans posed its own set of challenges. The existing piers were not much larger than the masonry plates the bearings sat on, so there was no straightforward way to install temporary jacking assemblies under the girder flanges. Jacking the bridge from the floor beams was not possible due to load capacity issues and conflicts with the utilities mounted on the bridge, and a conventional system of jacking towers would have been very difficult to construct in the fast-moving waters of the Haulover Cut. As a result, the contractor proposed jacking the span at each pier using a very stiff saddle that rested on the pier cap between the girders and extended out from the caps and under the girder lines. An equal-displacement jacking system was used to

Bridge Stats

Crosses: Baker's Haulover Cut

Span length:
- Span 1: 50 ft, 2 in.
- Spans 2 and 3: 49 ft, 11¼ in.
- Span 4: 5 ft, 4 in.
- Spans 5 through 7 total: (three-span continuous unit) 351 ft, 5⅜ in.
- Spans 8 through 10 total: (three-span continuous unit) 351 ft ,9⅝ in.
- Spans 11 thru 13 total: (three-span continuous unit) 351 ft, 2⅜ in.

Total structure length: 1,255 ft

Average structure width: 70 ft, 6 in.

Steel weight per deck area: 0.02057 tons per sq. ft

Total amount of structural steel: 1,447 tons

Approximate total cost of bridge: $8,900,000

Corrosion protection: Organic zinc-rich epoxy primer, polyamide epoxy intermediate coat, aliphatic polyurethane appearance coat, and UV-resistant clear finish coat


Courtesy of Bolton Perez

ensure even jacking of the span to avoid racking that could cause deck damage. The FEA model allowed the team to accurately estimate the jacking loads and determine the potential stresses in the top of the deck when a single bearing line was jacked. It also confirmed that jacking the bridge one pier at a time, and not the entire three-span unit at once, was feasible and would not cause unwanted damage.

In order to minimize traffic impacts, these jacking events were scheduled at night in 15-minute durations when traffic loads weren't on the bridge. Local law enforcement was used to block the bridge ends when the contractor had all equipment ready, then the bridge was raised ¼ in., enough for the existing bearing to be slid out. Once the span was shimmed and the load on the jacks released, traffic reopened.

The piers exhibited cracking and spalling near the bridge bearings due to the existing bearings being partially frozen and not adequately accommodating the movement of the superstructure. The old steel fixed and roller bearings on the continuous spans were replaced with high-load multi-rotational (HLMR) bearings in order to accommodate rotational deflections and expansion and contraction in both directions. The new bearings were much shorter than the existing ones, so new pedestals were required to be poured. Base plates were designed so that the new anchor rods could be drilled and grouted into the pier cap prior to jacking the bridge due to inadequate headroom for drilling equipment if jacking was done through the pedestal. The anchor rods were terminated with couplers at the pier cap level so that the pedestals could be formed and poured with the anchor bolt extensions in place once the old bearing had been removed.

As work proceeded, the team worked closely with the construction inspectors when previously inaccessible areas revealed locations with advanced section loss. Members were analyzed to determine adequacy as section losses were discovered by the construction inspectors. In most cases, the members were found to be adequate, which eliminated the need for extra work or change orders.

The bridge bulkheads had significant deterioration caused by constant exposure to the extremely aggressive coastal environment. Fill was eroding through the open joints of the concrete sheet pile walls, causing large settled areas behind the cap. In order to replace the wall within FDOT right-of-way, temporary construction easements were obtained to install temporary sheet piling on adjacent properties to avoid damage, and the area in front of the wall was cordoned off with temporary sheet piling to minimize water current and tidal impacts to the wall during construction. The existing sheet pile wall with deadmen was removed, and new steel sheet piles were installed with sheet pile deadmen, with the concrete facing strengthened with glass fiber reinforced polymer (GFRP) rebar to provide protection for the sheet piling and provide a uniform appearance with the adjacent walls. The facing extended 3 ft below the channel bottom to provide long-term protection for the steel sheet piling, with minimal future maintenance anticipated since nonmetallic reinforcement was used in the concrete facing.

The bridge work required careful coordination with utility agencies to ensure that repairs, span jacking, and painting operations did not create problems or damage the utility infrastructure. The electric utility removed its facilities from the bridge, relocating them using a directional bore, well below the channel bottom. For the other utilities, hangers were lowered slightly to accommodate


Courtesy of Bolton Perez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superstructure jacking operations. Abandoned utilities were removed from the bridge prior to cleaning and painting.

The south side of the bridge is located in a parking area maintained by the town of Bal Harbour and also provides the only access to and from the hotels and condominiums in the area—and access could not be closed off at any time. Construction was organized in six phases to facilitate traffic flow through the still-open section of parking. This allowed the contractor to use closed parking in sections in order to repair and install containment for cleaning and painting. Existing pavers in areas where work below-ground was to take place were carefully removed and stored for restoration at the end of construction. This was done to avoid color differences between any new lots of pavers that would have been required to be purchased.

Owner
Florida Department of Transportation, District 6

General Contractor
Kiewit Infrastructure South Co.

Structural Engineers
TranSystems
Colliers Engineering and Design

MERIT AWARD Rehabilitation

Hernando de Soto Bridge
Memphis, Tenn./ West Memphis, Ark.

ON MAY 11, 2021, a partial fracture of a tie girder on the arch span of the Hernando de Soto Bridge over the Mississippi River between Memphis and West Memphis, Ark., was discovered during a fracture-critical inspection, requiring immediate closure of highway and river traffic.

The challenge was to stabilize the bridge and have construction crews safely repair it to allow traffic to resume. The team used a three-phase approach and conducted nondestructive testing on all tie girder welds to determine other locations for retrofit while the first two phases were ongoing. The three phases were stabilization, member repair, and overall tie girder repair, with the design and construction of each overlapping. This required the collaboration of two owners, two engineers, a contractor, and multiple fabricators. All parties adjusted the approach to meet daily needs and changing conditions. Activities progressed 24 hours a day, supported by extended shifts, for several weeks, and the bridge reopened in just 83 days.

Design, fabrication, and construction were all-day efforts. The design of stabilization repairs was completed within days of testing, then fabrication and construction commenced immediately. The project included three fabricators providing steel, all synced to the contractor's schedule, and the design was tailored for materials available "on the floor" from shops that had advised on the best materials to aid with efficiency. There were no significant RFIs, a testament to design quality and fabricated structural steel.

To reduce the costly closure time, repair plans were designed around available materials. Michael Baker worked with NSBA and the fabricators to locate the HPS70 steel to replace 100-ksi material for Phase 1 and Phase 2 repairs. Simplifying the bolted splice details and the use of high-performance steel led to efficient fabrication and erection, resulting in the shortened closure, and similar details were repeated during Phase 3 repairs to other identified locations in the bridge.

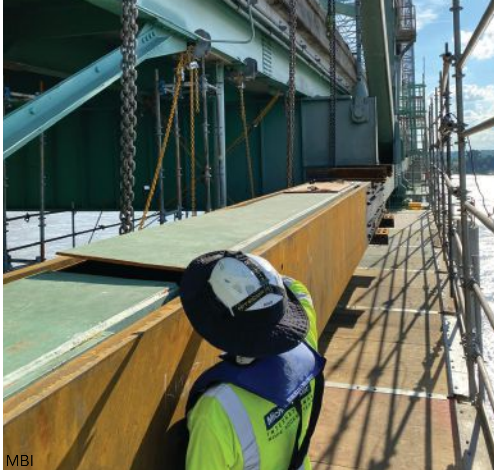
Owners
Tennessee Department of Transportation
Arkansas Department of Transportation

General Contractor
Kiewit Infrastructure South Co.

Structural Engineer
Michael Baker International, Inc.

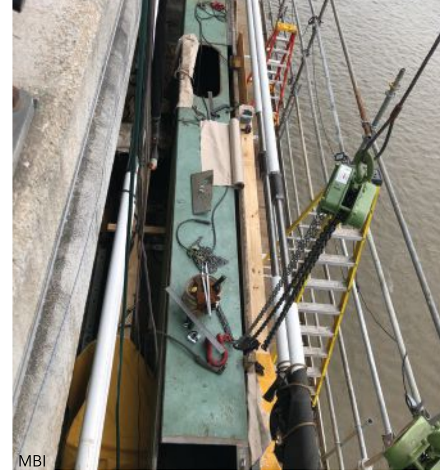
Steel Fabricators and Detailers
W&W | AFCO Steel (AISC Certified Fabricator), Little Rock
Stupp Bridge Company (AISC Certified Fabricator), Bowling Green, Ky.


TDOT


MBI


MBI

MBI

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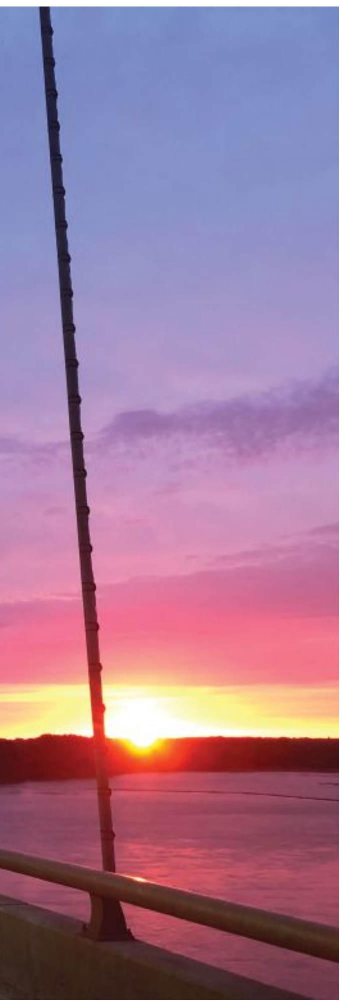
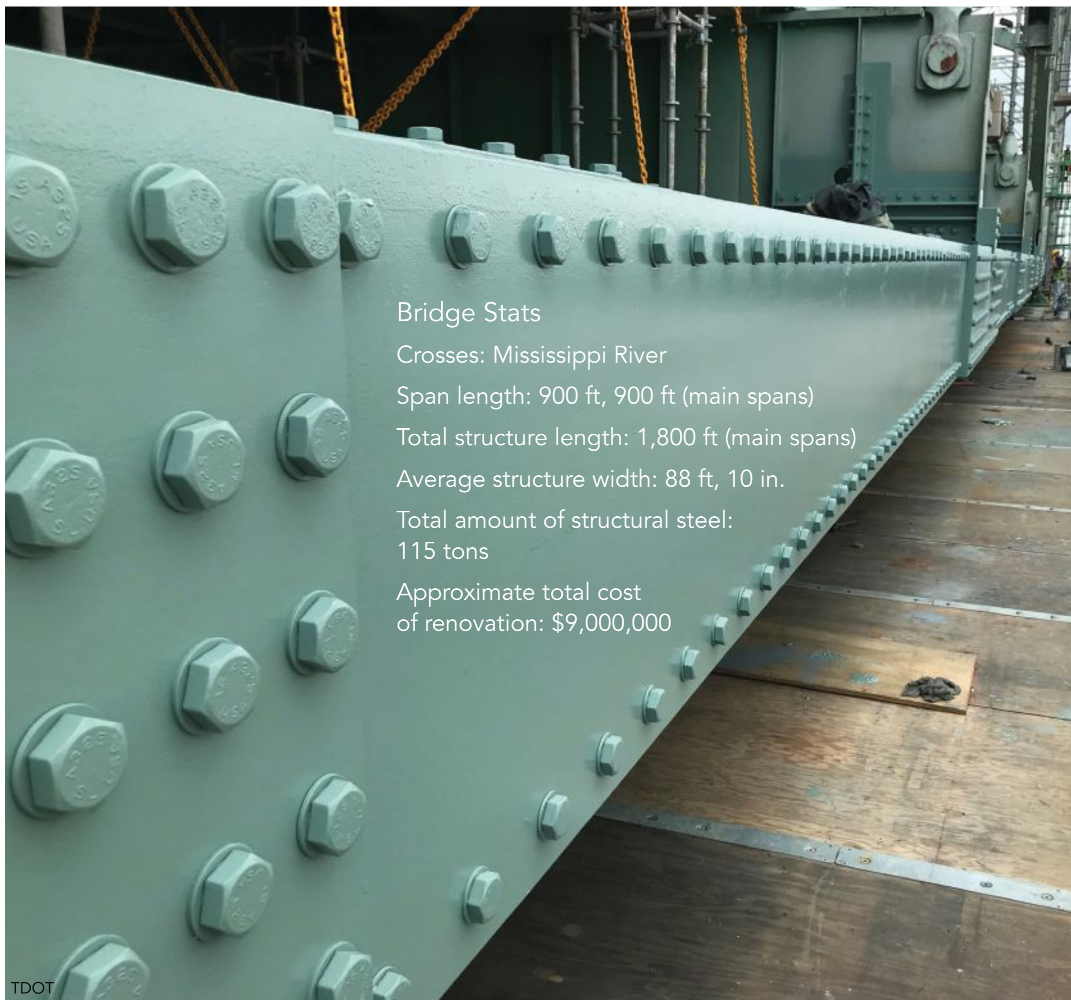




TDOT

Bridge Stats

Crosses: Mississippi River

Span length: 900 ft, 900 ft (main spans)

Total structure length: 1,800 ft (main spans)

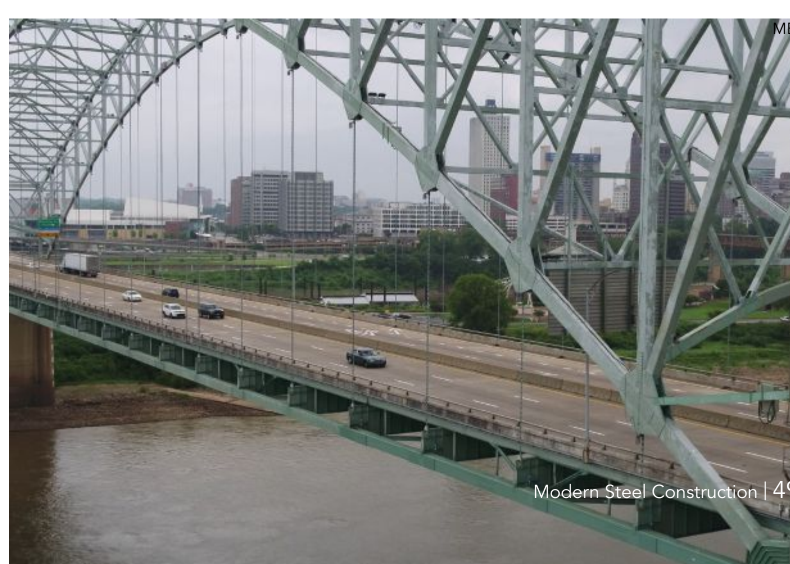
Average structure width: 88 ft, 10 in.

Total amount of structural steel: 115 tons

Approximate total cost of renovation: $9,000,000

W&W | AFCO Steel

TDOT



MBI

HDR

HDR

HDR

NATIONAL AWARD Special Purpose

Green Street Pedestrian Bridge, Winston-Salem, N.C.

THE NEW GREEN STREET PEDESTRIAN AND BICYCLE BRIDGE is a unique multi-ribbed, unbraced, tied-arch structure spanning the newly reconstructed Salem Parkway.

Located in the downtown area of Winston-Salem, N.C., it reconnects the West Salem neighborhood with the city's multi-use path, a nearby baseball stadium, and new developments planned for the area. The arching structure serves as an artful, iconic gateway into downtown that inspires economic development and symbolizes Winston-Salem's 21st-century aspirations.

The North Carolina Department of Transportation (NCDOT), along with Winston-Salem's Creative Corridors Coalition, provided a bridge concept and aesthetic requirements. Without a design precedent to rely upon, the team took the aesthetic vision and transformed it into a viable design. The team collaborated with stakeholders and the City's Creative Corridors Design Review Committee to understand and meet expectations on the bridge's unique features, including geometries, arch shape, hanger rod arrangement, and connection details.

The 32-ft-tall pair of inner arches incline 13° outward from a vertical plane and primarily carry the bridge's dead load. The lower pair of outer arches reach a height of 16 ft and incline 30° outward, supporting pedestrian live loading while carrying a smaller portion of the dead load. Each rib contributing to the overall bridge structure's primary load path required a strategic design approach and a multi-phased staged structural analysis.

Cambered 6 in. at mid-span, the gently-curving bridge deck is supported by a series of radially aligned, stainless-steel hanger rods—nine hanger rods to each arch rib for a total of 36 hangers. For each arch, the plane of the hanger rod group is offset from the centerline plane of the arch rib to provide a constant deck cross section and avoid outriggers. This approach improves the structural stability of the unbraced arch ribs by providing a restoring force against the outward torsional tendency of the ribs' self-weight. Shop-welded upper gusset plates are aligned longitudinally along each steel arch rib and connect the high-strength stainless steel hanger rods to the arches using forks and spherical bearing assemblies. Embedded at the deck level, gusset/base plate anchorages accommodate the dual arch rib configuration. These hanger anchorages uniformly align along each of the bridge's concrete edge beams and provide connection points for the stainless-steel hanger rods between the arch ribs and the bridge deck through forks and spherical bearing assemblies.

The bridge also employs concrete pilasters aligned to accommodate the varying arch rib base plates, which anchor to the pilasters through tension rods. The pilasters were critical aspects since all the arch ribs terminated at this location to tie the deck and foundations

NCDOT

HDR

together. The unique pilaster geometry was driven by the arch rib geometry and the need to simplify steel fabrication at the base plate ends. The pilaster became a geometric nexus that accommodated a wide range of complex geometries, force transfer, and anchor rod alignments in a central location. Combining augmented reality, real-time 3D model viewing, and even a 3D printed model, the team achieved stronger design communication.

HDR's structural engineer developed a powerful centralized parametric bridge design model that was leveraged to balance geometric complexity and design risk and improve confidence in the structural concept. The parametric model allowed for early insights into the structure that would not have been possible any other way due to the geometric complexity and direct influence on design elements. By automating structural models, the team could explore, evaluate, and optimize structural design aspects in ways never previously achieved. The model was beneficial in the staged analysis of the structure and proved to be an efficient way to understand the behavior of the different unique bridge elements and effectively generate production data.

Leveraging state-of-the-art structural engineering tools, signature bridge expertise, and strong technical collaboration between multiple stakeholders, the Green Street Pedestrian Bridge's design tackled aesthetically driven complexities and constructability implications head-on. The team delivered the client's vision through a design that employed structural innovation and ingenuity by leveraging a centralized parametric design approach, expertise, collaboration, and a drive towards practicality for construction.

Owner
City of Winston-Salem

General Contractor
Flatiron Corp.

Structural Engineer
HDR

Steel Team

Fabricator
King Fabrication LLC, Houston

Bender-Roller
Bendco, Pasadena, Texas

MERIT AWARD Special Purpose

Dublin Link Pedestrian Bridge

Dublin, Ohio

THE DUBLIN LINK presents an iconic form while simultaneously evoking a feeling of weightlessness for pedestrians and cyclists as they cross above the Scioto River riparian corridor.

In addition to tying together the eastern and western sides of Dublin, Ohio, it is a destination in its own right. The formal aesthetic and structural methods were developed simultaneously to create a single coherent vision. The resulting sinuously curving, structurally unique suspension bridge binds together cultural and economic additions to the city, including a new public library, a dramatic riverbank park, and multiple new entertainment, retail, and office projects at both ends. The structurally innovative locus for the city's ambitious program of urban renewal is also the longest S-curve single-side suspension bridge in the world.

The Scioto River bisects the town, causing a shift in the urban fabric from east to west. The offset between Bridge Park Avenue and West North Street became the impetus for the bridge's S shape. This form has its historical precedent in the S-bridges used to efficiently cross streams in eastern Ohio during the construction of the National Road in the early 19th Century.

The sculptural form is rooted in stress-shaping operations and optimization, and the bridge is supported by an expressive central eye-of-the-needle pylon that the bridge deck passes through, conceptualized as the gateway between the historic town center and the newly developed mixed-use district on the east bank. This central pylon aligns with the main cable at the top, twists down to the eye-of-the-needle (which is perpendicular to the steel bridge deck), and continues twisting to minimize drag and scour from the river at the flood stage.

The triangular steel box girder also morphs throughout the main span, and the single-side stay-cable attachment points shift in order to align the stay cable line of action with the cross-section's shear center. This minimizes the induced torsion in the box-girder. Any incidental torsion is resolved by balancing each side of the S-curve across the central pylon support.

Bridge Stats

Crosses: Scioto River

Span length: Four 65-ft-long approach spans, 500-ft-long suspension span

Total structure length: 760 ft

Average structure width: 14 ft

Steel weight per deck area: 0.04 tons per sq. ft

Total amount of structural steel: 412 tons

Approximate total cost of bridge: $23,000,000

Corrosion protection: Organic zinc-rich primer, epoxy intermediate coat, and top coat

Cory Klein/City of Dublin


Cory Klein


Endrestudio


Cory Klein/City of Dublin


Cory Klein

Because of the lightness and slenderness of the bridge deck, it was critical to have horizontal vibration controls. A combination of tuned mass dampers in the bridge transition zones and a pendulum-tuned damper at the main cable termination point created significant damping of the structure.

Lateral vortex shedding was also found to be a potential problem during wind-tunnel testing. The addition of an inverted vane helped to stabilize the bridge from wind-induced vibrations and also provided a natural place to run deck lighting to highlight the underside of the bridge deck.

The complexity and required precision of the central tower for both aesthetics and structural performance posed one of the biggest challenges to construction. Hundreds of precisely milled CNC form inserts were created from the digital model and installed in a reusable outer form. The design team used the model to precisely lay out every piece of rebar for the central tower and speed up placement during construction. The contractor developed its own model independently, which was compared directly to the design team's model as part of the quality control program.

In addition to the integrated modeling, significant sequencing coordination was required between the assembly of the prefabricated steel box girder sections, the site works for the approach spans and the central pylon, and the routing of electrical and communication lines through the triangular section of the bridge. The fully locked main cable and shifting attachment points of the stay cables also demanded an exceptional level of precision in the erection and finishing of the iconic bridge.

The Dublin Link was designed to be an icon. From the initial competition to its final completion, each aspect of the bridge was conceived simultaneously as a sculptural form, an elegantly efficient structure, and a surprising, dramatic experience for visitors and residents alike. ■

Owner
City of Dublin, Ohio

General Contractor
Kokosing Construction Company, Inc.

Architect/Design Engineer
Endrestudio

Structural Engineer
T.Y. Lin International

Steel Team

Fabricator and Erector
Tampa Steel Erecting (AISC Certified Fabricator), Tampa, Fla.

Detailer
Tensor Engineering Co. (AISC Detailer),
Indian Harbour Beach, Fla.

Bearing Manufacturer
R.J. Watson, Inc. (AISC Certified Fabricator), Alden, N.Y.

This month's New Products section includes a new version of a steel connection software package, a vest designed to keep workers cool in hot work environments, and a robotic assembler and welder that brings increased speed to steel fabrication shops.

IDEA StatiCa Version 22.0

IDEA StatiCa version 22.0 is now live. The new version is geared toward increasing efficiency for structural engineers doing all types of connection designs, from simple to complex, and features several enhancements. Here are a few that will have the biggest impact:

- In an effort to help users avoid having to model things twice, the new version allows them to link their analysis, BIM, and detailing software to IDEA StatiCa, which now includes a link to RAM Structural System.
- Lateral-torsional restraint has been added to allow users to more accurately model members that are stiffened by diaphragms and other elements.
- The previous version included a connection browser for users to save their designs and apply them to future projects. Version 22 takes this a step further with the introduction of the company set, which allows users to save their designs either on their local computer or in the cloud and share them within their company so colleagues don't have to "recreate the wheel" on subsequent projects.

For more information, visit **www.ideastatica.com**.

StaCool Vest

The StaCool Vest Core Body Cooling System helps workers beat the summer heat to stay cool and productive. Its micro-thin, highly breathable materials are easy to care for, providing wearers unsurpassed cooling comfort without compromising mobility. With models that can be worn over or under normal clothing, there is a StaCool Vest to suit any style, preference, and application. ThermoPaks in the front and back of the vest provide hours of cooling, and a spare set is included with each vest to extend cooling time and comfort when the initial set thaws. The vest provides ultimate body core cooling, and a thermal barrier is built in to ensure the wearer does not get too cold. It's ideal for welders, utility workers, power plant employees, foundry workers, industrial/manufacturing employees, construction workers, and anyone wanting to remain cool in hot conditions. For more information, visit **www.stacoolvest.com**.

Abka Agen/Assembly Generator

Abka Automation's Robotic Structural Steel Assembler, Agen (Assembly Generator), provides fully automated manufacturing for the structural steel industry, turning nonrepetitive production into mass production whether there is one piece or hundred pieces. The system fully supports SDS2 and Tekla Structures. With just a few clicks, work orders, including magnet, tack, and weld positions, are generated automatically. Base configuration starts with two industrial robots and can go up to six robots. The more robots you have, the shorter your cycle times are. The robots can assemble and weld parts with high accuracy, with a system tolerance of 0.05 in. The base configuration can handle profiles up to 43 in. in width and 39 ft, 4 in. in length. The system's beam rotators can rotate up to 6 tons and allow the robots to reach all sides of an assembly. For more information, visit **www.abkaotomasyon.com**.

IN MEMORIAM

Steel Industry Remembers Legendary Detailer Walter J. Gatti

Walter J. Gatti, founder of Tensor Engineering, died on April 25 after a brief illness.

Gatti, 88, had boundless energy and a passion for the steel fabrication industry—so much so that he continued to work seven days a week until his recent illness. AISC presented him with a Lifetime Achievement Award in 2004.

Gatti discovered his passion for steel structures during his trips from the Bronx to Brooklyn to attend the State of New York Community College—a daily opportunity to admire some of the country's most iconic bridges.

In 1953, Gatti was asked to estimate a detailing price for a bid to reconstruct the Third Avenue swing span over the Harlem River in New York City. "Being 20 years old and capable of doing anything, including scaling tall buildings, I responded with, 'Of course,'" he said in the March 2006 *Modern Steel Construction* article "Of Plans and Planes" (available in the Archives section at **www.modernsteel.com**). After it won the bid, that company asked him to start a bridge detailing department—a field that was, by Gatti's own admission, absolutely foreign to him at the time.

"When you are thrown in the middle of a lake, you learn to swim quickly or drown," he said. "I avoided drowning by hiring some capable steel detailers and learning from them as fast as I could."

Gatti founded Tensor Engineering in 1958. Over the next decade, Tensor detailed components for the Verrazano-Narrows Bridge, the Throgs Neck Bridge, Robert F. Kennedy Memorial Stadium, and a Kennedy Space Center project that was the largest moveable structure in the world.

"Walter was my boss, mentor, friend, and source of inspiration and strength for over 37 years," said Tensor Engineering president Bill Lally. "His dedication and loyalty to his employees and the steel industry truly surpassed all expectations. He was driven to make the most out of his life and, in the process, pushed all of us to be better. I speak for us all when I say that I will miss his passion, his bellowing laugh, and his intolerance of mediocrity. It has been my honor to work alongside Walter for these years and to be given the privilege to continue his legacy through Tensor Engineering."

He loved his work because, as a structural steel detailer, he made meaningful contributions to the fabrication of structures great and small—including iconic bridges in every major U.S. city.

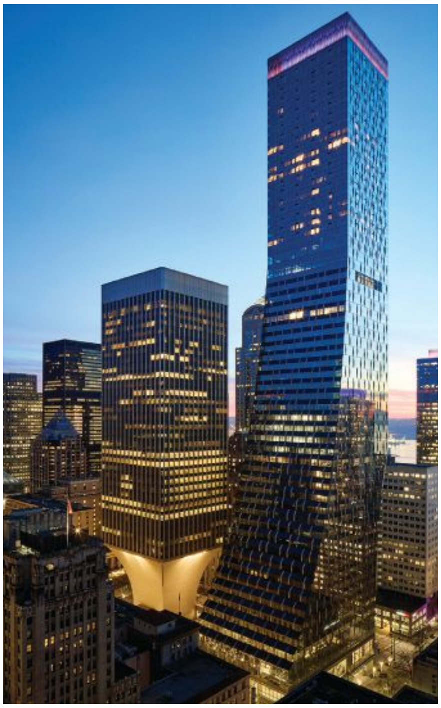
"Walter played a pivotal role in our transition from simpler structures to the soaring, skewed, curved, plate girder bridges that define modern urban highways," said Ronnie Medlock, vice president of technical services at High Steel Structures. "He figured out how to cut plate and build members to satisfy the complex geometries and changing deflection conditions of these bridges, providing solutions for fabricators and selflessly educating countless engineers throughout the country about these behaviors and best practices in steel bridge design. He loved steel bridges, he loved good solutions, and he loved helping fabricators and engineers achieve excellence in their work."

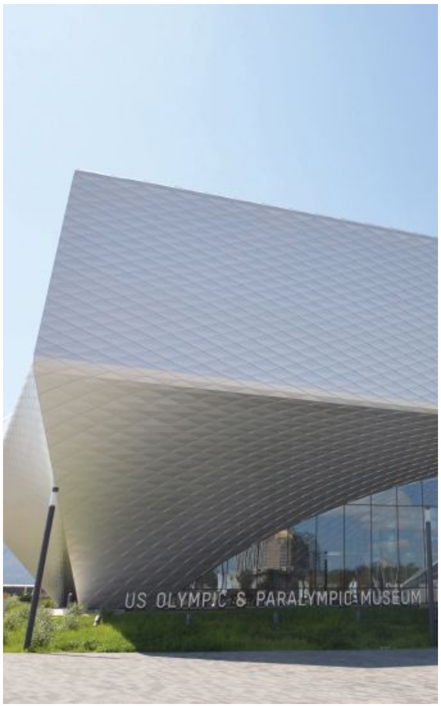
"Walter is my hero!" said HDR's John Yadlosky, noting that he was proud to be one of Gatti's students. "I've had many mentors and learned a lot from many others, but Walter set the bar high, and I tried my best to reach it. He was driven, passionate, and fun. He would listen and negotiate (but you better have your story straight or he would eat you alive). And what I liked the most about Walter was his directness. He would get to the point and address the issues—no muddying the water. Change his mind or get on board, and if not, then get out of the way. Walter saw the end game and got it done. I got on board as soon as I met Walter and never regretted a minute, except maybe buying those $150 bottles of wine (which 15 years ago was a lot!). But Walter paid it back in so, so many ways and lessons learned. Those lessons were not only about engineering, fabrication, and steel construction, but life and living large. I particularly liked the gentle quiet that would come over the room when Walter entered, and he never abused that respect. He just continued to build on it with his next endeavor, task, or simple discussion. I'm going to miss him, but I'll never forget all that he taught me."

Gatti was also a passionate pilot. He first flew as a passenger in 1952, moving to Cleveland to start a job at Babcock and Wilcox. Ten years later, he earned his private pilot's license and flew a single-engine Piper Comanche around the country to expand the bridge detailing team's fabricator base. He had an Airline Transport Pilot rating, which is the highest a pilot can achieve.

AWARDS

AISC's IDEAS² Awards Program Seeks Outstanding Buildings—By September 30





AISC's flagship competition for buildings is now accepting entries for the 2023 IDEAS² Awards.

The Innovative Design in Engineering and Architecture with Structural Steel (IDEAS²) Awards recognize outstanding projects that illustrate the exciting possibilities of structural steel. They are the industry's most prestigious design honor.

The winners will get a prime-time spotlight at NASCC: The Steel Conference in Charlotte, N.C., next April, and the May 2023 issue of *Modern Steel Construction* magazine will feature them. In addition to substantial press support and publicity through AISC's own print and online media, winning teams have the unique opportunity to present their projects to the AEC community during special webinars or live events throughout the year. If possible, AISC will conduct an onsite award presentation during 2023.

"Innovators in the AEC community create amazing steel structures every day," said AISC's president, Charles J. Carter, SE, PE, PhD. "These inspiring structures represent the best of design and construction with American steel, and AISC is honored to recognize the project teams that bring these visions to life."

The IDEAS² Awards showcase the innovative use of structural steel in:

- the accomplishment of the structure's program
- the expression of architectural intent
- the application of innovative design approaches to the structural system
- leveraging productivity-enhancing construction methods

IDEAS² Awards don't only go to high-profile projects. In recent years, AISC has honored everything from public transit projects to monumental stairs to jaw-dropping high-rises. We're looking for innovation and imaginative design in all its forms!

Entries are due by September 30, 2022, and AISC will announce the winners in early 2023.

Visit **aisc.org/ideas2** for more information and to enter. Eligibility requirements are as follows:

- New buildings, expansions, and renovation projects (major retrofits and rehabilitations) are eligible. There is also a category for sculptures, art installations, and nonbuilding structures
- Building projects in the 2023 competition must be located in the U.S. and must be completed between January 1, 2020, and September 30, 2022
- A significant portion of the framing system of a building must be wide-flange or hollow structural steel sections (HSS)
- The majority of the steel used in the project must be domestically produced
- The project must have been fabricated by a company eligible for AISC full membership
- Projects with a unique or distinctive feature fabricated by a company eligible for AISC full membership will also be considered
- Pedestrian bridges entered in the competition must be an intrinsic part of a building and not standalone structures. We encourage members of project teams for standalone bridges to enter the 2024 National Steel Bridge Alliance's Prize Bridge Awards

You can read all about this year's winners in the May 2022 issue, available in the Archives section at **www.modernsteel.com**.

People & Companies

W&W | AFCO Steel will turn the former **LM Wind Power** building at Arkansas' Port of Little Rock into a fabrication shop. The new facility, which will fabricate structural steel for bridges and commercial buildings, will be W&W|AFCO's fifth in the state and will create 115 full-time jobs. The company is an AISC full member and has 19 production facilities in the U.S. "W&W|AFCO Steel is proud to announce this expansion in Little Rock," said **Grady Harvell**, president and COO of W&W|AFCO Steel, in an announcement from the Arkansas Economic Development Commission. "Our bridge operations are headquartered in Little Rock and we are happy to seize the opportunity to make a productive plant out of this vacant building. The new facility will enhance our ability to continue providing competitive steel bridges to the state of Arkansas and the region as well as increase our production capacity for steel building products."

Magnusson Klemencic Associates (MKA) announced the promotion of four employees. **Ian McFarlane, SE, PE**, is now a senior principal, and **Amy Dean, SE, PE**, **Ben Niesen, PE**, and **Matt Streid, SE**, have all been promoted to principal.

Lincoln Electric Holdings, Inc., announced that **Steven B. Hedlund** has been promoted to COO. Hedlund has served as executive vice president and president of the Americas and International Welding segments since 2020 and has also served as a member of the company's executive management team since 2008. As COO, he will continue to lead the welding segments' Higher Standard 2025 Strategy initiatives to advance growth and enhance margin and return performance and will now have responsibility for **The Harris Products Group (HPG)** segment.

TECHNICAL ADVISORY

AISC Issues Technical Advisory about Painting Interior Steel

Anecdotal evidence suggests that specifiers are increasingly requiring that fully enclosed steel members in building structures be primed—and AISC has issued a technical advisory to clarify the matter.

For nearly 70 years, AISC has recommended against painting or priming steel that will be enclosed by building finish, coated with a contact-type fireproofing, or in contact with concrete. Doing so results in unnecessary costs and delays as well as negative environmental impacts.

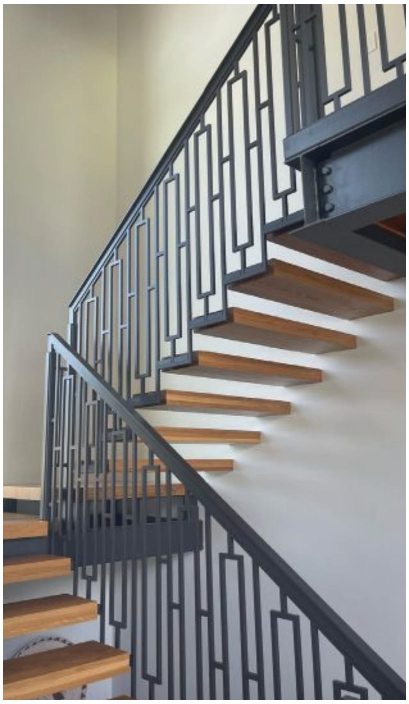
Since the 1993 version, Section M3.1 of the AISC *Specification for Structural Steel Buildings* (ANSI/AISC 360, **aisc.org/specifications**) indicates that shop paint is not required unless specified in the contract documents, with the Commentary stating: "The surface condition of unpainted steel framing of long-standing buildings that have been demolished has been found to be unchanged from the time of its erection, except at isolated spots where leakage may have occurred. Even in the presence of leakage, the shop coat is of minor influence."

A similar situation exists when steel is fireproofed or in contact with concrete; in fact, paint is best omitted when steel is to be fireproofed because primer decreases its adhesion.

There are, of course, exceptions. AISC recommends painting or priming enclosed structures when the expected relative humidity level is above 70%, as well as in industrial structures where the steel will be exposed to corroding chemicals.

AISC's Steel Solutions Center is available to answer any technical questions: 866.ASK.AISC or **solutions@aisc.org**.

Letter to the Editor



Floating Up the Stairs

I was reading your April 2022 issue and enjoyed the Structurally Sound article "Celestial Staircase." I've also designed a "floating" steel-framed stair for my home. The stair uses the handrail as a support for the treads in lieu of a stringer, therefore creating the floating look, and the use of the handrails in this fashion made for a very rigid stair. Great magazine!

—Tim Watkins,
Steel Services, Inc.
Indianapolis

advertiser index

Weaving Steel

IF YOU'RE GOING TO CREATE a structural icon for an area synonymous with innovation and technological advancement, it had better have a wow factor of its own.

That was the idea behind Accumulus, a conceptual woven steel observation tower in San Jose, California's Arena Green Park that was designed to embody material efficiency, integration with nature, net-zero energy use, and public dialogue—and not just draw the eyes but also make them open wide in awe.

The design was one of the finalists of this year's AISC Forge Prize competition, which recognizes visionary emerging architects for designs that embrace steel as a primary structural component and capitalize on steel's ability to increase a project's speed. Made of tempered chromium steel alloy, the tower involves a series of steel trellises that come together to form multiple orbs as the structure rises. Encapsulated in the tower is an ascending, curving pedestrian ramp that provides visitors with 360° views of the city. The design was conceived by Martin Miller of Antistatics Architecture in Ithaca, N.Y., who worked with Brett Manning, vice president of engineering (Western Region) with AISC member and certified fabricator Schuff Steel, to determine the practicality and feasibility of fabricating the steel components.

As tempered steel strip flexes only in the planar axis, the frame takes advantage of advanced computational simulation and artificial intelligence to ensure the straightness of each strip as it wraps the minimal surface form of the structural members. The assembly instructions are embedded in the material itself, with holes labeled to coincide with their matching partners, and simple analog mechanisms are used to overcome the torsional strength of the steel. End rings cap the individual components, creating triangulation and rigidity throughout the diagrid form as well as developing a secure moment of connection between components while maintaining material continuity through the structural lines.

You can read more about Accumulus, as well as the other two Forge Prize finalists, in the August issue.


CALLING ALL
INNOVATORS!
If you recently worked on an amazing project that featured structural steel, we want to hear from you.
Submit it for a 2023 IDEAS² award!
AMERICAN INSTITUTE OF STEEL CONSTRUCTION
AISC
FOUNDED 1921
2023
IDEAS²
AWARDS
Entries close on September 30, 2022
Enter now at aisc.org/ideas2
2022 NATIONAL AWARD
$75 Million to $200 Million
Buddy Holly Hall of Performing Arts and Sciences
Lubbock, Texas
Casey Dunn