BRIDGES

First Span of New Tappan Zee Bridge Opens

The first span of New York's Tappan Zee Bridge replacement—officially renamed the Governor Mario M. Cuomo Bridge (after current Gov. Andrew Cuomo's father, the late Gov. Mario Cuomo)—opened to westbound traffic in late August. The three-mile-long, twin-span steel crossing, which is on track to open next year and on budget at $3.98 billion, is one of the largest active bridge projects in the nation and a testament to the work and capabilities of America's steel fabricators and constructors.

The new bridge is being built by Tappan Zee Constructors, a design-build LLC composed of Fluor Corporation, American Bridge Company, Granite Construction Northeast and Traylor Bros. Three AISC/NSBA member fabricators, High Steel Structures, Hirschfeld Industries and Canam-Bridges, have together provided more than 110,000 tons of structural steel while playing a key role in the support of more than 7,700 jobs. And just as the fabrication was provided domestically, so too was the steel production, with 160,000 tons of steel plate for both the superstructure and sheet pilings coming from AISC member ArcelorMittal. The design-build approach generated more than $1 billion in savings compared with state and federal cost estimates.

"Our members have really proven their mettle, meeting customer needs and delivering domestic structural steel for the new bridge over the past four years," said Danielle Kleinhans, PE, PhD, vice president of bridges and managing director of NSBA. "This bridge demonstrates that the U.S. steel industry has the capacity and know-how to fabricate even the largest of U.S. infrastructure projects."

The bridge features a proven steel girder system, with center-to-center spacing of 25 ft and additional floor beams to support the deck. Essentially, it's the same system used on bridges throughout the U.S., simply on a far greater scale. As John O'Quinn, president of High Steel Structures, explained, "This has been a fantastic project to work on. It's very straightforward in terms of fabrication and constructability. Everything we used on this bridge can typically be seen on bridges the general public drives over/under in their daily travels—the only major difference being that most of the Tappan Zee girders are 12 ft deep and weigh upwards of 100 tons." High Steel Structures has fabricated more than 800 steel girders used to construct the new bridge.

Dennis Hirschfeld, CEO of Hirschfeld Industries, added, "We are excited to be a part of such a monumental bridge project of this size and historic nature. The combination of experience and resources that we as U.S. fabricators bring to this project is strong and important to its success, and we are proud that Hirschfeld was recognized as a company that has the capability and strength to handle a job of this magnitude."

The 1,200-ft main span serves as the iconic signature of the new bridge. The 419-ft-high towers support more than 14 miles of stay cables and create a sleek and clean aesthetic.

The new bridge is expected to last at least 100 years without the need for major repairs. For more about the bridge, visit **www.newnybridge.com**.

People and Firms

- **Paul Schulz** has been promoted to president of AISC associate bender-roller **Max Weiss Company**. Schulz, who has three decades of experience in the metal rolling/shaping industry, joined the company in 2006 as vice president and CFO. He added COO to his responsibilities this past spring before being named president.

- The **ASTM F16.96 Subcommittee on Bolting Technology**, part of the **ASTM F16 Committee on Fasteners**, is hosting a meeting to acquaint engineers and technologists with the subcommittee. Scheduled for the afternoon of Wednesday, November 29, the meeting will be cohosted by the **Industrial Fastener Institute (IFI)**. The program will include a short business meeting along with several technical presentations on bolting-related topics. It is open to the public, and there is no charge to attend. For further details on the meeting and membership in F16.96, contact **Joseph Barron** at **b.j.barron@hii-nns.com**. In addition, an agenda will be posted at **www.astm.org/committee/F16.htm**.

- **Pietro "Pete" Giovenco, PE**, has been named CEO of engineering and architecture firm **Bergmann Associates**. For the past nine months, he has served as president and COO of the firm, where he has worked for 28 years. Giovenco takes over from **Tom Mitchell, PE**, who served as CEO for 14 years and who will stay on as executive vice president for client relations and business development. Giovenco will also continue to serve as president of the firm.

PRIZE BRIDGES

2018 Prize Bridge Competition Now Accepting Entries

NSBA is now accepting entries for the 2018 Prize Bridge Competition. The biennial competition honors innovative steel bridges constructed in the U.S.

"The 2018 Prize Bridge Awards program marks 90 years recognizing our nation's bridge owners, designers, fabricators and erectors," said Danielle D. Kleinhans, PE, PhD, AISC's vice president of bridges and NSBA's managing director. "We look forward to another year of amazing entries highlighting economic, aesthetic and innovative steel bridges."

Winners are selected to receive either a Prize Bridge Award or a Merit Award in the following categories:

- Major span: One or more spans greater than or equal to 400 ft
- Long span: Longest span equal to or greater than 250 ft but less than 400 ft
- Medium span: Longest span equal to or greater than 140 ft. but less than 250 ft
- Short span: No single span greater than 140 ft
- Movable span
- Reconstructed: Having undergone major reconstruction, rehabilitation, or widening
- Special purpose: Bridge not identifiable in one of the above categories including pedestrian, pipeline, and airplane

In addition to the above categories, NSBA will also offer special commendation to projects that best exemplify accelerated bridge construction, and projects that exemplify a full range of sustainable attributes.

All award-winning bridges must be built of domestically fabricated structural steel and located in the U.S. (defined as the 50 states, the District of Columbia, and all U.S. territories.) Eligible bridges must have been completed and opened to traffic between May 1, 2015 and September 30, 2017.

An independent panel of judges will select winners based upon the following criteria: innovation, aesthetics, economics, design and engineering solutions. Entries may be judged in more than one category, but an entry can only receive one award.

All of the award-winning bridges will be featured in *Modern Steel*. In addition, winning designers will be presented recognized at the 2018 World Steel Bridge Symposium, which will be held in conjunction with NASCC: The Steel Conference, April 11-13 in Baltimore. Owners of winning entries will be honored at the NSBA networking event during the 2018 AASHTO Subcommittee on Bridges and Structures meeting.

Entries are due by 11:59 p.m. on December 8, 2017. For more information and to enter the competition, please visit **www.steelbridges.org/2018prizebridge**.

IN MEMORIAM

Bridge Expert Jay Yoo Dies

Chai Hong "Jay" Yoo, an Auburn University professor emeritus and a globally recognized expert in strength and stability of thin-walled flexural members, especially as applied to horizontally curved steel bridge girders, passed away from cancer in July at 77.

Originally from Choongjoo, South Korea, Yoo received a B.S. from Seoul National University in 1962. After completing his degree, he served as a civil engineering officer (1st Lt.) in the Republic of Korea Air Force and then as a structural engineer for Pacific Architects and Engineers, Inc., in Saigon. He came to the U.S. in 1967 to continue his education and received an MS in 1969 and a PhD in 1971 from the University of Maryland. He became a professor at Auburn University in 1981 and retired as a professor emeritus in 2007.

Yoo's teaching, research and mentoring contributions over his 40-year career were enormous. He was a fellow of ASCE, a charter member of the Engineering Mechanics Institute, chairman of the Structural Stability Research Council Task Group 14 (Horizontally Curved Girders), associate editor of the ASCE *Journal of Engineering Mechanics* and recipient of ASCE Shortridge Hardesty Award. He also authored over 80 journal papers and two books.

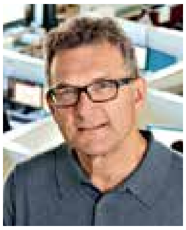
IN MEMORIAM

Seismic Expert Steven B. Tipping Dies

Steven B. Tipping, founder of Tipping Structural Engineers, passed away unexpectedly in August while on a mountain bike ride near his home in El Cerrito, Calif. Born in Ithaca, N.Y., on November 12, 1947, he attended Clemson University, graduating with a BS in structural engineering, then served as a 1st Lt. in the United States Army, which included a tour of duty in Vietnam.

In 1983, Tipping founded structural engineering firm Steve Tipping and Associates, now called Tipping Structural Engineers, which has come to be known as an industry leader in seismic retrofit design. Tipping himself pioneered the use of vertical post-tensioning and idiosyncratic seismic isolation systems.

Tipping was involved with research and education initiatives at AISC and served as a juror for this year's Steel Design Student Competition. He was twice recognized in *Engineering News Record*'s Top 25 news makers and received two Excellence in Structural Engineering Awards from SEAONC (Structural Engineering Association of Northern California) of which he is a past board member and president.



ENGINEERING JOURNAL

Fourth-Quarter 2017 *Engineering Journal* Now Available

The fourth-quarter 2017 issue of AISC's *Engineering Journal* is now available at **www.aisc.org/ej**. You can view, download and print the current digital edition. Articles in this issue include:

➤ **Buckling of Conventional and High-Strength Vanadium Steel Double-Angle Compression Members: Computational Parametric Study**
Mark D. Webster, Ahmet Citipitioglu, Ronald L. Mayes, Mohamed M. Talaat and Frank W. Kan

High-strength, low-alloy vanadium (HSLA-V) steel offers higher strength and toughness than conventional steel. The resulting lighter weight and more slender structural components are more susceptible to buckling in compression. A series of conventional Grade 50 steel and HSLA-V (nominal Grade 80) steel angle compression components was tested at Lehigh University's ATLSS laboratory. This study extensively evaluates the 2010 AISC and Steel Joist Institute (SJI) design equations for double-angle buckling, resulting in significant findings and recommendations for both specifications.

Keywords: high-strength vanadium steel, compression, computational parametric study, modification factors, buckling analysis

➤ **Buckling of Conventional and High-Strength Vanadium Steel Double-Angle Compression Members: Computational Parametric Evaluation of Slenderness Modification Factors**
Mohamed M. Talaat, Ronald L. Mayes, Mark D. Webster, Ahmet Citipitioglu and Frank W. Kan

Of particular interest to this study are open-web joists, which utilize double-angle sections—typically for chord members and often for web members. Design code treatment for both global and specifically local buckling of double-angle compression members is evaluated in this study. Code equation predictions of the buckling strength for a wide range of specimens and material strengths are examined and compared to analytical simulations. This paper proposes two alternative modifications to the so-called Q-factor formulation in order to address the nonconservative buckling strength predictions for double-angle compression members with low Q factors. This study concludes that the adoption of a modified Q-factor formulation for local elements of compression members in the element elastic buckling region produces consistent predictions of the buckling strength. This finding is equally applicable to both HSLA-V and conventional steels. For design and other applications where a lower-bound estimate of the strength is required, this combination of proposed Q-factor formulation and AISC built-up member slenderness modification is recommended.

Keywords: high-strength vanadium steel, compression, computational parametric study, modification factors, buckling analysis, Q factor

➤ **The Chevron Effect and Analysis of Chevron Beams—A Paradigm Shift**
Patrick J. Fortney and William A. Thornton

Beam designers and connection designers have a different standard of care in the analysis of beams in inverted V- and V-type braced frames subjected to lateral loads. When the summation of the vertical components of the brace forces is nonzero, (1) beam designers evaluate required beam shear and moment, treating the unbalanced vertical load as a concentrated force acting at the work point of the braces while ignoring any local effects resulting from the brace connection geometry, and (2) the connection designer evaluates the required beam shear based only on the moment acting at the gusset-to-beam interface(s). Thus, the beam designer considers beam span and work point location ignoring the local effect of the connection, and the connection designer considers the local effects of the connection while ignoring beam span and the location of the work point.

This paper proposes a new method for evaluating required beam shear and moment that includes consideration of beam span, location of work point, and the local effects of the connection—a method that can be used by both the beam designer and the connection designer. Discussion is also provided to illustrate how this proposed method can be used to evaluate whether or not the local connection effect dominates the global effect. It is shown that the magnitude of the unbalanced vertical load influences the impact of the local connection effects; when the summation of the vertical brace force components is zero or relatively small, the local connection effects dominate the global effect. Conversely, when the unbalanced vertical load is relatively large, the global effects dominate; in this case, including the local connection effects will predict a smaller required beam moment possibly allowing for lighter beams.

Keywords: chevron effect, braced frames, work point, V-type, inverted V-type, unbalanced vertical load

➤ **Strongback Steel-Braced Frames for Improved Seismic Behavior in Buildings**
Judy Liu

While current AISC provisions have greatly improved the seismic behavior of conventional braced frame systems, they still have a tendency to form weak stories. The strongback system was developed as a method of delaying or preventing weak-story behavior. Conceptually, the inclusion of an "essentially elastic" backbone, or strongback, enforces a nearly uniform drift distribution, thereby engaging adjacent stories upon the initiation of inelastic behavior in the opposite braces. Ongoing work on the strongback braced frame is highlighted.