

INDUSTRY NEWS

AISC Hosts Local Engineering Group for Webinar on Employee Engagement and Gender Equity

AISC recently hosted 35 members (and 25 members remotely) of the Structural Engineers Association of Illinois' Women in Structural Engineering group (SEAOI-WISE) for a networking reception and a webinar on gender equity and employee engagement in the structural engineering profession, presented by the Structural Engineering Engagement and Equity (SE3) Committee of the Structural Engineers Association of Northern California (SEAONC).

Last year, the SE3 committee administered a nationwide survey on employee engagement and gender equity in the profession, for which they received more than 2,100 completed responses from practicing structural engineers. The survey investigated a variety of measures of engagement (satisfaction) and equity regarding career advancement, compensation and work-life balance. This webinar shared the most significant findings of the study, including why 56% of respondents have considered leaving the profession, the prevalence of the gender pay gap and the importance of mentorship.

Study findings indicated respondents are generally satisfied with their careers. While overall career satisfaction was reported to be high, there were a variety of areas where improvement appeared to be needed, including career development, pay and benefits and work-life balance. Additionally, though respondents generally reported being satisfied with their careers, a majority indicated that they had considered leaving the profession at some point. Seven percent of the respondents were people who had already left the structural engineering profession, and they cited many of the same reasons for leaving as those who had considered leaving (poor work-life balance, high stress, low pay) with the addition of poor management/leadership.

Some survey responses varied significantly by gender. Notable differences included how men and women define career success, why they leave the profession and perceptions of their work environment. Men and women both reported that their

top reasons for considering leaving the profession were seeking better work-life balance, less stress and higher pay, but women rated better work-life balance highest among these factors while men rated higher pay as their top reason. A pay gap between women and men was shown to exist at almost every level of employment, most notably at the principal level. And those who take on more caregiving responsibility (regardless of gender) were generally less satisfied with their career advancement, even if they were satisfied with their career overall. Survey results indicated women perceive they are the primary caregivers, increasing with age and reaching a high of 81% as they move into their fifties and beyond. In contrast, men felt they contributed approximately 35% of the caregiving. For those reporting that they are responsible for over 50% of the caregiving responsibilities, almost a quarter felt it negatively affected their motivation at work. This loss of motivation was reflected more strongly in the women participants, which correlates with the higher percentage of caregiving and their subsequent lower satisfaction with work-life balance.

SE3 has formulated a list of best practices derived from the findings that can be used to begin the workplace discussion on where improvements in engagement and equity in the profession can be made by employers, managers and staff. These include management training; aligning daily tasks with employee career goals; creating a workplace where all engineers have access to a mentor (internal or external); reducing employee burnout and adopting policies to improve engagement during periods of high workload; performing annual compensation audits to ensure pay equity is achieved; creating a robust, transparent work flexibility program (with input from staff) and empowering employees to use it; and providing comprehensive support to employees with children and dependents.

This recorded webinar is available at www.seaoi.org. For more information on the SE3 project, including the full survey report, visit www.se3project.org.

People and Firms

- Cincinnati-based engineering firm **Schaefer** has absorbed its **Entertainment Structures Group** (ESG), a structural engineering division for the entertainment market, and has begun formally branding it under the Schaefer name. ESG began in 2002 with a group of Schaefer employees who were passionate about special and temporary structures, theaters and rigging. Because the entertainment market requires unique strategies and skill sets, Schaefer spun off the division into its own entity in order for the group to focus time and effort on growing ESG's experience, service offerings and market share. Over the past 15 years, the division has thrived, engineering structures for some of the biggest names in entertainment including Taylor Swift, Elton John and Cirque du Soleil. (See "Final Approach" in the June issue, available at www.modernsteel.com, for a Schaefer-designed project.)
- **Thornton Tomasetti** senior principal **Stephen Lew, PE**, has retired after 36 years with the company. Based in the Boston office, he was involved in the design, management and evaluation of hundreds of projects across New England and around the world. Although he stepped down from full-time work this past spring, he will continue to be involved in special projects with the firm.

GALVANIZING

AGA Announces Galvanizing Award Winners

The American Galvanizers Association (AGA) has announced the winners of the 2017 Excellence in Hot-Dip Galvanizing Awards, several of which employed the services of AISC associate member galvanizers. The 17 winning projects demonstrate the creative range and complexity of hot-dip galvanizing of steel structures; more than 120 projects were submitted.

All submissions were judged online by a panel of architects and engineers. Visit www.galvanizeit.org/eawinners for details on the winning projects as well as photos.



▲ The new Goodale Parking Garage in Columbus, Ohio, was the Transportation winner in AGA's 2017 Excellence in Hot-Dip Galvanizing Awards. The project used 275 tons of structural steel, fabricated by Wanner MetalWorx (an AISC member and certified fabricator).

CERTIFICATION

Mark Trimble Named AISC Vice President of Certification

Mark W. Trimble, PE, has joined AISC as its new vice president of certification. In his new role, he manages the AISC Certification program, which certifies more than 1,400 fabricators, erectors and manufacturers of buildings, bridges, bridge components and hydraulic structures.

Previously, Trimble was a vice president at Huntington Steel & Supply Company, an AISC member and certified



fabricator. A graduate of the University of Kentucky, he has served on the board of directors for both AISC and the West Virginia Society of Professional Engineers. And for the past four years, he has been chair of the planning committee for NASCC: The Steel Conference.

"I'm excited to have Mark join the team at AISC," stated AISC's president, Charles J. Carter, SE, PE, PhD. "His perspective as an engineer and a fabricator will help us to better serve the needs of those who participate in the AISC Certification program and the needs of those who specify it. It also will help AISC better serve our customers and members in all the other activities we undertake."

The AISC Certification program sets the quality standard for the structural steel industry and is the most recognized national quality certification

program for the industry. The program focuses on the entire process of fabrication and erection with the goal of building quality structures from the start by advocating error prevention rather than error correction. Rather than certifying end product, the program concentrates on process and is designed to ensure the certified facility has the personnel, experience and procedures in place to successfully complete a project.

"I'm thrilled to join AISC," said Trimble. "I've experienced firsthand the benefits certification brings to a fabricator and the opportunities it creates to make a company better. I look forward to helping to grow and continue to improve the program."

For more information on AISC Certification, please visit www.aisc.org/certification.

UNIVERSITY RELATIONS

AISC Announces New Online Resources for Educators and Students

AISC has created two new web pages for educators and students: one focusing on structural steel textbooks and the other on internships.

Visit www.aisc.org/textbooks to learn more about textbooks that will be updated,

along with their availability dates.

And visit www.aisc.org/internships to see a list of student internship opportunities in the steel industry. Students can view available internships and link to the appropriate company

sites or contacts. The service is free to students and the companies posting their internships.

Visit www.aisc.org/universityprograms to learn more about AISC's university programs in general.

GOVERNMENT AFFAIRS

AISC Calls on Commerce Department to Expand Steel Trade Remedies

AISC recently testified to the U.S. Commerce Department that foreign fabricated steel is eroding the competitiveness of U.S. steel fabrication, and imposing trade remedies is essential to preserve the capacity of U.S. steel fabricators to serve critical national defense and security needs.

David Zalesne, president of Owen Steel Company of Columbia, S.C. (an AISC member and certified fabricator) and vice chair of the AISC Board of Directors, told the Commerce Department, “The historical focus of remedies on steel production alone has opened doors for foreign steel companies to expand to downstream manufactured and fabricated steel products.”

“Any tariffs or quotas that are imposed must be extended downstream from mill-produced steel to also include fabricated steel, to be effective.”

According to AISC, imported fabricated structural steel has increased 136%

in the past five years, which is far in excess of the growth of the U.S. market in the same time period.

Describing the current situation, Zalesne observed that “offshore access to American construction markets has become so soft that on at least one major project in New York City, steel plate made in China was shipped to a fabricator in Mexico, fabricated into building components there, brought freely into the U.S. under NAFTA rules and shipped 3,000 miles to New York City. And somehow, all of that offshore material, labor and freight was priced to the project below the cost domestic fabricators would have had.”

Steel fabricators are the critical intermediaries in the structural steel supply chain. As an example of the importance of the industry to national defense and security, Zalesne noted that Owen Steel Company was entrusted with the structural steel for the U.S. Capitol Visitor Center—and the

security enhancements that were designed into that structure after the terrorist attacks of 9/11 to protect Members of Congress in the event of a future attack.

On behalf of AISC, Zalesne also suggested that Commerce “designate classes of structures that are strategically sensitive or important,” such as high-rise towers, power plants, port facilities and major bridges, where Commerce could attach domestic steel fabrication requirements for those classes of projects. He further called for a comprehensive review of the impact NAFTA has had on American structural steel markets, adding that domestic fabricators “not only have the capacity and ability to meet current market demands, they have the ability to grow as markets expand.”

For more information about key public policy issues related to steel fabrication, please contact AISC President Charles J. Carter, SE, PE, PhD, at carter@aisc.org.

SEISMIC DESIGN

PEER Releases Updated Tall Building Seismic Design Guide

The Pacific Earthquake Engineering Research Center (PEER) has released the second edition of its *Tall Building Initiative Guidelines for Performance-Based Seismic Design of Tall Buildings*. Sponsored by AISC, Charles Pankow Foundation, Structural Engineering Institute of ASCE (SEI), Structural Engineers Association of California, Federal Emergency Management Agency and ACI Foundation (Concrete Research Council), it serves as an update to the first edition of the document, which was released in 2010.

PEER developed the first edition in response to the growing use of alternative seismic design approaches that go beyond the typical prescriptive requirements of building codes. The document has become a significant reference for structural engineers, and the profession has gained substantial experience in applying these alternate techniques to designing tall buildings.

The use of performance-based seismic design for tall buildings now encompasses structural systems beyond the core

wall-reinforced concrete systems (which were the focus of the first edition), irregular structures and building complexes that include multiple towers on a single podium. This second edition addresses lessons learned in application of the first edition and reflects current knowledge and state-of-practice.

“Typically, the tall buildings using these guidelines take exception to one or more code requirements and, as such, use them to justify the building’s performance as being equivalent to a code-prescriptive design,” says John Hooper, SE, a senior principal with Magnusson Klemencic Associates, Inc., and one of the document’s authors. “Numerous updates were made to this new version, including compatibility with ASCE 7-16 and its newly rewritten Chapter 16: Nonlinear Response History Analysis, with AISC’s LRFD (load and resistance factor design) approach.”

“I believe that this second edition represents a significant step forward in the performance-based seismic design of tall buildings,” expressed James O. Malley,

SE, a senior principal with Degenkolb Engineers, Inc., and another of the document’s authors. “Lessons learned from project applications and major advances in our analytical and ground motion estimation capabilities over the last decade have been incorporated. When combined with ASCE 7-16 and standards such as AISC’s *Specification* and *Seismic Provisions*, we hope the updated version will be an important resource for engineers designing tall and other unique structures.”

“This edition of the guide incorporates the most recent research in seismic design,” noted Larry Kruth, PE, AISC’s vice president of engineering. “This includes methods for using items such as steel plate shear walls for the lateral force resisting system. It’s very comprehensive.”

The new guidelines document is available at peer.berkeley.edu/tbi. AISC’s *Specification for Structural Steel Buildings* (ANSI/AISC 360-16) and *Seismic Provisions for Structural Steel Buildings* (ANSI/AISC 341-16) are both available at www.aisc.org/standards.

Heroic Feats

Per your May editor's note, Santiago Calatrava should be on your list of engineering heroes. His significant works in the U.S. and around the world demonstrate how engineers can push the envelope and build beautiful iconic structures that are a delight to behold and experience.

—*Matt Scanlon*
Columbia University

Here are some of my candidates for heroes in structural engineering:

1. Fritz Leonhardt. He's obviously not around anymore, but I received a German-language book written by him as a Christmas present when I was in middle school, and it inspired me to get into engineering as a career.

2. Warren Alexander. A longtime engineer for the New York State DOT, who is to this day one of the top experts on welding and fabrication of steel bridges. He was a mentor and teacher to me when I was a junior engineer over 30 years ago. He's a very good leader as well as being one of the smartest men I've ever met.
3. Theodore Galambos. Obviously, an engineer who needs no introduction in the world of steel, and a personal hero to me. I was fortunate to take a couple of his classes when he was a professor at Washington University. Best teacher I ever had.

There are more in my book but the above three are at the top of my list.

—*Norbert Luft, PE*
NYSDOT Structures
Metals Engineering Unit

Importance of Infrastructure

Thank you for providing such a clear position on one of the country's most important issues in your April editor's note. The infrastructure built 50 to 60 years ago helped the U.S. to become the leader in the world economy. Now, its deterioration is slowing our development. Thank you also for mentioning the AISC white paper on hiring American workers [available at www.aisc.org/hireamerican] and making it better known to the construction community.

One possible addition to the motto "There's always a solution in steel." As my late mentor and good friend Professor M. Braynov (he was the head of the Steel Structures and Bridges Department in the Architecture and Structural University in Sofia, Bulgaria, for many years) used to say, "Steel is an intelligent material, and people working with steel are intelligent people."

—*Roumen Mladjov, SE, PE*

NSBA

NSBA's Bill McEleney Retires

Bill McEleney has retired after nearly 30 years with NSBA/AISC. A respected engineer and leader in the bridge design and construction communities, he's been instrumental in advancing NSBA's market development and technical initiatives and increasing collaboration between NSBA members and industry partners.

After spending 10 years as a regional engineer with AISC's market development department, McEleney joined NSBA shortly after its inception in 1995. For the past two decades, he has served

NSBA as a regional director, managing director and most recently as a consultant. His continuous presence at NSBA has been a stabilizing influence as the organization has grown to be the respected voice of the steel bridge fabrication industry.

"I'm proud to have served this industry for this long," said McEleney. "It's constantly changing and improving, and NSBA/AISC has embraced that and provided the opportunity for my role to change and grow along with the industry."

McEleney was intimately involved in the development of the AASHTO/NSBA Steel Bridge Collaboration and served on its Steering Committee. The Collaboration is a joint effort between AASHTO (American Association of State Highway and Transportation Officials) and NSBA, with representation from state departments of transportation, FHWA (Federal Highway Administration), academia and the various industries related to steel

bridge design, fabrication and inspection. It provides a forum where public and private professionals can work together to improve the quality and value of steel bridges. McEleney also served on various committees associated with AASHTO, AREMA (American Railway Engineering and Maintenance-of-Way Association), TRB (Transportation Research Board), ASCE (American Society of Civil Engineers) and AISC, and was actively involved in supporting the National Student Steel Bridge Competition in its early years.

"Bill has been a steadfast and remarkable representative of the steel industry through his work first at AISC and then during the formation and growth of NSBA," said AISC president Charlie Carter. "He rose based on his talents, initiative and excellent reputation to lead the NSBA staff as its managing director. We are grateful for what he has done in his career and will miss him greatly."



Third-Quarter 2017 Engineering Journal now Available

The third-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:

► **Yield Line Approaches for Design of End Plate Tension Connections for Square and Rectangular HSS Members Using End Plate Tensile Strength**

William A. Thornton

End plates, which are sometimes called flange plates, are a common way to treat HSS members loaded in tension. In this application, prying action must be considered in the design of the plate and bolts. This paper demonstrates that the prying action model can use the end plate minimum tensile strength rather than the yield strength to achieve satisfactory designs. Only connections with bolts on all four sides of the HSS are considered here.

Keywords: HSS connections, end plate, prying action, yield line pattern

► **Design of Wrap-Around Gusset Plates**

Bo Downswell, Fouad Fouad, James Davidson and Robert Whyte

This paper addressed the design of wrap-around gusset plates, which are commonly used where a horizontal brace connects at a beam-to-column intersection. Wrap-around gusset plates must be cut around the column, which can lead to high flexural stresses near the reentrant corner. A rational design method was developed in this paper, based on the results of 15 experimental tests and the corresponding finite element models. The design method, which models the gusset legs as rectangular beams, considers the strength of each leg independently. Because the buckled shapes included both out-of-plane translation and twisting along the leg, the stability behavior is evaluated using a lateral-torsional buckling model according to AISC Specification Section F11. Based on the buckled shape of the specimens and finite element models, design buckling lengths

are recommended. Information is also included for calculating the strength of wrap-around gusset plates with the interior corner cut on a diagonal. Three examples are provided to illustrate the proposed design procedure.

Keywords: wrap-around gusset plate, horizontal braced, design buckling length.

► **Effective Shear Plane Model for Tearout and Block Shear Failure of Bolted Connections**

Lip H. Teh and Gregory G. Deierlein

In spite of many revisions to the block shear requirements of the AISC Specification, the model in the current Specification can result in calculated strengths and failure modes that are inconsistent with published test data. The inconsistencies are primarily related to the assumed interaction of tensile and shear resisting mechanisms, combined with the definition of net and gross shear planes that are unrealistic. Using recently published test results of single-bolt connections in mild and high-strength steel plates, the shear failure planes are observed to be neither the assumed net nor gross shear planes, which are the basis of the current design provision, but rather effective shear planes with a calculated area that is between the net and gross areas. Based on the tensile rupture and shear yielding mechanism, and assuming that the steel on the effective shear planes is fully strain hardened, a simpler and more accurate block shear design equation is proposed. The new equation is straightforward to implement as it requires a simple rearrangement of existing design variables to determine an effective shear failure area. Through verifications against 161 gusset plate specimens, tested by independent researchers around the world, the proposed equation is shown to be significantly more accurate than the current AISC, Canadian, European and Japanese block shear design provisions.

Keywords: block shear, bolted connections, gusset plates, shear-out, shear planes, tearout

► **Analysis and Design of Cable-Stayed Steel Columns Using the Stiffness Probe Method**

German Gurfinkel and Sudarshan Krishnan

The stiffness probe method (SPM) is a new numerical procedure that calculates buckling loads. SPM probes the local stiffness of a given structure at the point of application of a small transverse perturbation force as the applied load is increased. The local stiffness degrades from a maximum for an unloaded structure to zero at the buckling load. An artifice spring is added to the original structure that eventually absorbs the full perturbation force at a prescribed small deflection, thereby keeping structural deformations small as the buckling load is approached. As a result, using an indicator that approaches zero at buckling rather than having to rely on increasingly larger deflections at buckling as in conventional P- Δ methods, SPM ensures an accurate numerical result for the critical load. We use SPM herein to study the behavior of one and two cross-arm cable-stayed columns under applied load. A formula is given to calculate the minimum slenderness that justifies converting a tube into a cable-stayed column. Various factors such as cable prestrain, cable cross-sectional areas, and tiers of cross-arms affecting column strength are examined for a series of cable-stayed columns. We find that cable-stayed columns may buckle either in a one-lobe symmetrical mode or two-lobe anti-symmetrical mode, the latter case being contrary to conventional thinking. A design example for a given cable-stayed column using the AISC Specification is presented. The effect of optimum cable prestrain to enhance column buckling strengths is discussed.

Keywords: analysis, behavior, buckling modes, eigenvectors, cable (slackening, stays, optimum prestraining), columns, design (ASD, LRFD), elastic stability, failure mode, numerical methods, residual tension, cross-arms, load (applied, external), spring (augmented, parallel, series), steel, stiffness probe, strength (enhancement, nominal)