

Practical MATTERS

BY CHRISTINA HARBER, S.E., P.E.

AISC's archive of webinars provides plenty of practical advice to propel practicing engineers onward and upward in their careers.

EVERYONE FROM FRESH-FACED COLLEGE GRADUATES to veteran engineers shares a common need for continuing education.

University engineering programs typically focus on the essentials: engineering theory and basic design. But many practical subjects are never covered, so recent graduates are expected to learn on the job. As engineers gain experience, they can expect to be assigned increasingly complex projects that require new technical expertise. Thus, it is vital, no matter where you are in your career, that continuing education resources be economical and easy to access. And AISC makes it easy for engineers of all experience levels to keep on learning.

In addition to in-person seminars and live webinars, AISC offers a collection of recorded webinars that can be viewed at any time for free. This allows you to learn about a variety of steel construction topics anywhere, whether at the office, on the train or at home. Archived webinars can be accessed by going to: www.aisc.org/educationarchives. You can take advantage of this free resource to gain the knowledge and skills you need to succeed on the job.

There are many hidden gems in the AISC webinar vault that can help you at your job immediately. Topics include seismic design, connections, retrofit, stability, ethics, sustainability and more. These archived webinars are typically past live webinars or presentations from NASCC: The Steel Conference.

Ten to Start

There are hundreds of webinars that can be viewed on the AISC website. Before diving in, a good place to start is my personal list of the Top 10 Archived Webinars Recommended for the Practicing Engineer (in no particular order):

1. **“High-Strength Bolting”** by **Geoffrey Kulak (1.5 hours)**. Connection design is often mysterious to the new engineer; few cover this topic at the college level. Geoffrey Kulak starts with the basics and focusses on bolting fundamentals and behavior. This webinar begins with an introduction to bolt ma-

terial properties and moves on to the loading of bolted connections and the determination of bolt forces. Connection limit states are examined, including bolt shear, tension and combined stress, block shear rupture and bolt bearing. Kulak also covers bolts in slip-critical joints, the essentials of pretensioning, bolt installation procedures and inspection requirements. Watch this webinar and gain confidence that you are selecting suitable bolt types, properly designing your bolted connections and properly specifying installation and inspection procedures for your projects.

2. **“Field Fixes”** by **James M. Fisher and Lawrence A. Kloiber (6.0 hours)**. In the real world, errors occur during construction, and some errors require the engineer to design a fix. It takes years of experience for an engineer to develop strategies to prevent construction problems through better design and to correct problems once they happen. This webinar can help an engineer without a lot of field experience to learn from the experience of others. After watching this webinar, you will be able to anticipate design decisions that are sensitive to problems during construction, as well as learn how to avoid them and have possible solutions available in case you do need to design a field fix. Construction mistakes covered in this webinar

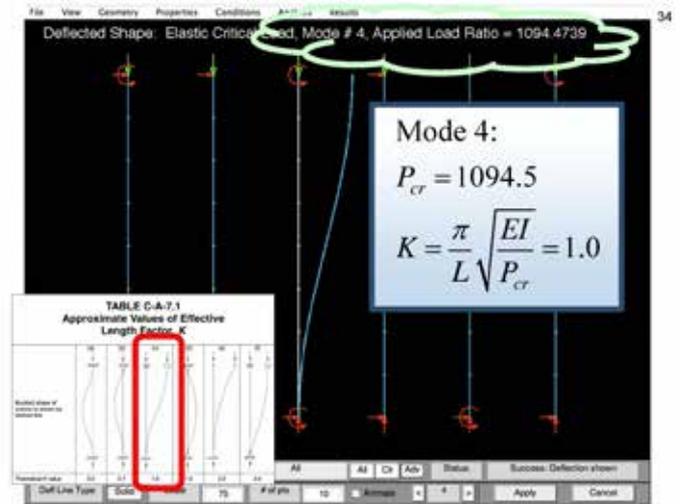
Christina Harber (harber@aisc.org) is a senior engineer – continuing education with AISC.



include anchor rods in the wrong position, façade connections to spandrel beams, connection fit-up problems, camber problems, rooftop units at unintended locations and modifications to steel joists.

3. “Rules of Thumb for Steel Design” by Socrates A. Ioannides (1.0 hour). In order to have a feeling for initial sizing of a member or lateral system, an engineer needs to have a lot of design experience or else a mentor who will readily share their experience. This webinar gives an engineer at any experience level a bag of tricks to use for initial sizing at the schematic design phase or a way to give fairly accurate sizes while put on the spot at a meeting with clients. Take advantage of the experience of Socrates Ioannides and his colleagues as he readily shares his tips. Topics include approximation of section properties and the initial sizing of beams, truss members and columns. Construction topics are also covered, such as estimating steel tonnage, cost and construction time.

4. “Modules for Learning Structural Stability” by Ronald D. Ziemian (1.5 hours). To many engineers, the topic of structural stability brings on flashbacks of differential equations and confusion for those fortunate enough to have taken a class on this subject. Ronald Ziemian offers a hands-on tool to aid engineers in visualizing and understanding structural stability. Through free software, you can experiment with simple structures in this virtual lab to observe the effects of bracing, loading and boundary conditions on stability behavior (see Figure 1). You will develop a better understanding of elastic and inelastic flexural and lateral torsional buckling, inelastic force redistribution and second-order effects.



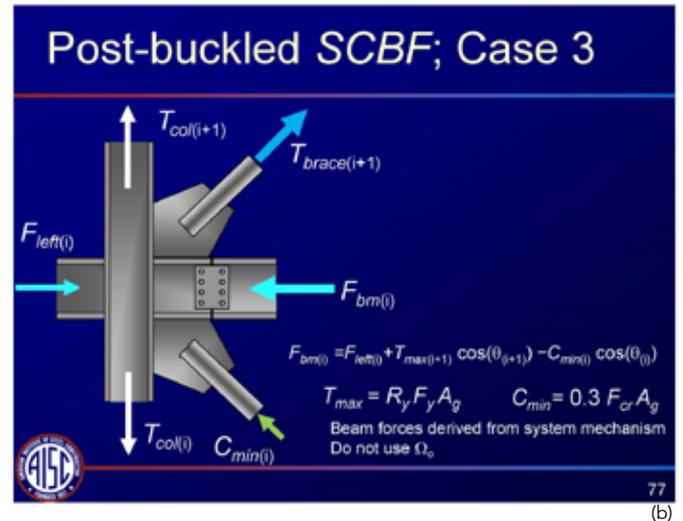
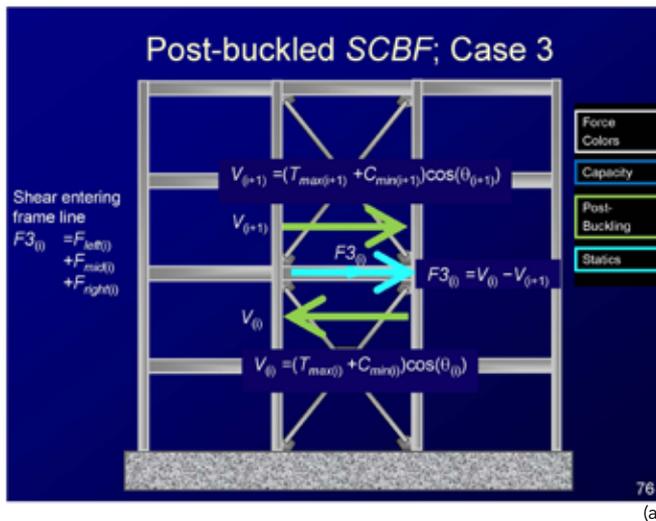
▲ Figure 1. A virtual lab from the “Modules for Learning Structural Stability” webinar.

5. “Load Path! The Most Common Source of Engineering Errors” by Carol Drucker (1.5 hours). As a highly experienced connection design engineer, Carol Drucker has seen her share of structural drawings. While load paths in design seem like common sense, it is an area that is often overlooked. This webinar is an opportunity for you to look at real examples of both good and absent load paths. Drucker highlights details for gravity load transfer, collectors, truss connections, bracing connections, moment connections, detailing for thermal expansion and design for davits. She also encourages designing with erection in mind in order to eliminate potential load path problems.

6. “A New Approach to Design for Stability” by R. Shankar Nair (1.0 hours). This webinar highlights a major change made in the 2005 *Specification* regarding design for stability. While 2005 seems like a long time ago, these provisions still are current, having been only modestly improved in more recent editions. First, the webinar takes a stroll down memory lane to review how we were designing for stability before 2005. Problems with pre-2005 stability design included calculated moments that were too low, incorrect and un-conservative. The effective length factor, K , had to be determined, which can be tricky in some real-world conditions. This led to the development of changes which debuted in the 2005 *Specification*. The preferred method, the direct analysis method, include both initial imperfections (through notional loads or direct modeling of initial imperfections) and inelasticity (through reduced member stiffness) in the second order analysis. Therefore, a K -factor of 1 can be used in the determination of member capacity which eliminates

Meet the Speakers

- ▶ **Geoffrey Kulak** is Professor Emeritus at the University of Alberta’s Department of Civil Engineering and the author of AISC’s Design Guide 17: *High Strength Bolts—A Primer for Structural Engineers*.
- ▶ **James M. Fisher** is the vice president emeritus of Computerized Structural Design and a member of the AISC Committee on Specifications.
- ▶ **Lawrence A. Kloiber** is the retired vice president of engineering at LeJeune Steel Co. and an emeritus member of the AISC Committee on Specifications.
- ▶ **Socrates A. Ioannides** is the owner of Structural Affiliates International, Inc.
- ▶ **Ronald D. Ziemian** is a professor of civil and environmental engineering at Bucknell University and a member of the AISC Committee on Specifications.
- ▶ **Carol Drucker** is a principal with Drucker Zajdel Structural Engineers and a member of the AISC Committee on Specifications.
- ▶ **R. Shankar Nair**, senior vice president of exp US Services, Inc., is an emeritus member of the AISC Committee on Specifications.
- ▶ **Rafael Sabelli** is a seismic design expert at Walter P Moore’s San Francisco office and a coauthor of Design Guide 20: *Steel Plate Shear Walls*. He is also a member of the AISC Committee on Specifications and Committee on Manuals.
- ▶ **Duane K. Miller**, manager of engineering services with the Lincoln Electric Company, is the author of AISC’s Design Guide 21: *Welded Connections—A Primer for Engineers*. He is also a member of the AISC Committee on Specifications.
- ▶ **Charles Carter** is AISC’s chief engineer and vice president of engineering and research.
- ▶ **Terri Meyer Boake** is a professor of architecture at the University of Waterloo in Waterloo, Ontario, Canada, and an AESS expert.



▲ Figure 2 (a and b). Determination of post-buckled SCBF connection forces from the “Where Did that Force Come From?” webinar.

any confusion associated with determining K . This webinar will ensure that you understand the approach to stability design that was introduced in 2005 and is still applicable today.

7. “Where Did that Force Come From?” by Rafael Sabelli (1.5 hours). In seismic design, combining diaphragm and braced-frame forces is not a straightforward process. When a vertical force distribution due to wind load or seismic load in an $R = 3$ system is applied to a braced frame, every part of the structure is in equilibrium. There are some situations, however, that are not so straightforward, and the engineer will need to make adjustments to certain member forces. One such situation arises in a mechanistic analysis assuming a post-buckled state in a special concentrically braced frame (SCBF). In Figure 2a, forces in the braces at level i and $i+1$ are the expected tensile strength and the expected compression post buckling strength. The connections at level i , shown in Figure 2b, are not in equilibrium unless a chord force is assigned at the floor level i . This force is determined through statics. At this point, you may start to wonder where all these forces came from and how best to achieve equilibrium. There is no one correct way to handle these situations. Rafael Sabelli dives into this force balancing quandary by examining rational ways to determine forces in this situation.

8. “Weld Details – Good, Bad and Ugly” by Duane K. Miller (1.5 hours). Engineers need to understand connections, and welds are no exception. When engineers incorrectly specify welds, the welds end up resisting undesirable forces for which they were not designed. This even includes prequalified welds when used under the wrong conditions. Duane Miller, the expert on welding, offers a list of good weld criteria and counters it with examples of bad and ugly welds. The tips given in this webinar can be applied to welds in any situation. Be prepared to use the information that you learn immediately, regardless of where you are in your career.

9. “SteelDay 2015: Steel and the Phantasmagoria” by Charles J. Carter (1.0 hour). Don’t be fooled by the enigmatic title: This one is full of very specific resources and commonsensical advice. Engineers often waste precious time searching for resources and reinventing the wheel when they encounter a design problem that is new to them. Charles Carter of AISC discusses the many resources available to engineers such as AISC manuals, design guides, design examples, specifications, codes, standards and relevant articles.

10. “Architecturally Exposed” by Terri Meyer Boake (1.0 hour). This Top 10 AISC Webinar list is no beauty pageant, but if it were, this webinar would be the winner. Terri Meyer Boake explains the rise of architecturally exposed structural steel (AESS) and the fabrication techniques used to accomplish aesthetically pleasing steel structures. Most of the photographs in this webinar were taken by Boake herself. You will be inspired by the unique structures she presents and understand how the engineering and economy of these structures relies heavily on fabrication techniques.

You can watch and learn from these 10 selected webinars—or any other of the hundreds of other recorded webinars offered by AISC—for free. These programs give you insights from the experts into real-world design and construction techniques, opportunities and solutions. Take advantage of this vault of resources to broaden your engineering knowhow. Happy viewing and learning!

Credit where Credit is Due

All of the webinars mentioned in the Top 10 list can be viewed for PDH credit at www.aisc.org/educationarchives. For licensed engineers seeking professional development hours, some of the archived webinars can be watched for credit. After watching the webinar, purchase the quiz for that webinar. After taking and passing the quiz, you will receive a PDH certificate.