STEEL NEWS

AISC and ASE Host Staggered Truss Presentation and Construction Tour

Not surprisingly, Friday, February 8 was a cold, cloudy day in Chicago—not the best day to spend outdoors. But that didn't stop nearly 200 engineers, contractors, and others in the steel industry from taking an open-air construction site tour in the city's River North neighborhood. And that's because it wasn't just any site. The project, a 17-story Staybridge Suites hotel, will be the first staggered truss steel building ever constructed in Chicago.

The tour began with a breakfast presentation, sponsored by AISC and the Associated Steel Erectors. While filling up on a hearty breakfast to prepare them for the cold, participants were provided with an overview of the project by AISC's midwestern regional engineer, Tabitha Stine, and members of the construction team: Duke Miglin of owner/developer Miglin Properties LLC; structural engineer Socrates Ioannides of Structural Affiliates International, Inc.; architect Matt Dumich of Valerio Dewalt Train; Scott Robbins of steel fabricator/erector K&K Iron Works; and Jeff Rodgers of the project's general contractor, Walsh Construction Company.

While high-rise residential and hotel projects are often constructed with concrete, Stine noted that a staggered truss system—which works in tandem with precast concrete plank—can weigh 20% to 30% less, be erected quicker, and allow for more column-free space than when using a concrete framing system for the same project. AISC's Steel Solutions Center provided the project team with a conceptual design study featuring the staggered truss concept in 2003.

According to Robbins, the project will use 815 tons of structural steel in the form of approximately 1,500 erectable pieces. There will be 115 steel trusses and 100 columns in the building.

After breakfast, participants were bused to the jobsite a few blocks away and were given the opportunity to walk through multiple levels of erected steel framing. Construction began in the summer of 2007, and the building is scheduled to open later this year. The finished structure will house more than 200 suites.

For more information on the Staybridge Suites staggered truss project, including photos, PowerPoint presentations from the breakfast, and a live webcam, visit **www.aisc.org/staybridge**. For more information on the staggered truss structural framing system, please go to **www.aisc.org/residential** or contact the AISC Steel Solutions Center at 866.ASK.AISC or solutions@aisc.org.

STEEL BRIDGES

Myths and Realities Report on Steel Bridges Now Available

Did you know that modular prefabricated short-span steel bridges can be permanent structures? Or that bridge joints are not a prerequisite for steel bridges? Or that advanced, high-performance, EPA-approved steel bridge coatings can last more than 25 years? These topics and others are highlighted in a new free publication, *Steel Bridge Construction: Myths and Realities*, an updated, fact-based publication that addresses a wide range of topics about steel bridges.

Made available through a joint effort between AISC, the National Steel Bridge Alliance (NSBA), and the American Iron and Steel Institute (AISI), the 25-page document compiles and corrects top myths and misperceptions about the viability of steel in bridge design and construction for a wide range of bridge types.

The report references expert articles and studies from organizations such as the Federal Highway Administration (FHWA) and the American Association of State Highway Transportation Officials (AASHTO), as well as the Strategic Highway Research Program, professional associations, industry analysts, and academia.

One such reference refutes the perception that the life expectancy of a steel bridge is shorter than alternative materials. In fact, a 1992 study by Lehigh University analyzed the deterioration rates of the 577,000 bridges listed in the FHWA National Bridge Inventory and concluded that superstructure material type—steel, concrete, or other—was not an indicator of a bridge's life expectancy. Instead, life expectancy is strongly dependent on a bridge's age and average daily traffic.

The report also includes myth-busting analysis about topics such as the reality of maintenance-free bridges (regardless of material), cost competitiveness of simple-span bridges less than 140 ft in length, the viability of weathering steel, the value of jointless bridge decks, and the availability of simple, more economical bridge bearings.

To download a free PDF version of *Steel Bridge Construction: Myths and Realities*, visit AISI's web site at **www.steel.org/bridges/Myths_and_Realities.pdf**. To order printed copies of the report, visit **www.steel.org** and click "Shop AISI"—or call 202.752.7100 and ask for item #D432-07. Or, you can communicate your request via e-mail: mmccrady@steel.org.

ENGINEERING JOURNAL

First Quarter 2008 Article Abstracts

The following papers appear in the first quarter 2008 issue of AISC's *Engineering Journal*. *EJ* is also available online to AISC members and ePubs subscribers at www.aisc.org/epubs.

Block Shear Equations Revisited... Again

HOWARD I. EPSTEIN AND LANCE J. ALEKSIEWICZ

Shortly after block shear was first identified as a possible failure mode for coped beam connections, design equations to account for it were incorporated into ASD provisions. These equations never changed, partly due to ASD not being updated since 1989. However, LRFD treatment of block shear changed with each new Specification. Over the years, it was suggested that the effect of eccentricity was missing from block shear equations. On the surface, it appears that the effect of eccentricity on the block shear strength of connections, as suggested by previous investigators, has now been incorporated into the latest unified Specification. For many connections, however, nothing has changed. It is the conclusion of this paper that additional important cases need to be shown in Commentary Figure C-J4.2 of the 2005 AISC Specification for which block shear equations now incorporate a new factor to account for connection eccentricity. In particular, as a minimum, angles connected by only one leg or tees connected by their flanges should also be included with other connections for which block shear capacities are now reduced.

Topics: Connections – Moment; Connections – Simple Shear; Specifications, Codes and Standards

Designing Compact Gussets with the Uniform Force Method

LARRY S. MUIR

The Uniform Force Method (UFM) is the preferred method given for determining the forces that exist at gusset interfaces. The UFM provides a standardized way to obtain economical, statically admissible force distributions for vertical bracing connections. One criticism of the method is that it sometimes results in oddly shaped or disproportionately large gusset plates. To overcome this perceived limitation of the UFM, designers have been seeking out alternate methods. This paper demonstrates that removing one unnecessary geometrical constraint from the formulation of the UFM will allow greater freedom in gusset geometry, while maintaining the efficiencies that result from the method. A new formulation of the UFM is presented, and the strengths and weaknesses of other proposed design methods are also explored.

Topics: Connections – Simple Shear; Connections – Moment; Lateral Systems; Detailing

Limit State Response of Composite Columns and Beam-Columns, Part II: Application of Design Provisions for the 2005 AISC Specification

ROBERTO T. LEON AND JEROME F. HAJJAR

The 2005 AISC Specification contains substantial changes to the design provisions for composite members and composite columns in particular. This paper presents detailed and cross-sectional analysis and design examples for composite columns illustrating the new provisions. The paper focuses on providing a detailed description of the development of simplified equations for the creation of interaction curves for composite beam-columns. This is the second part of a two-part paper; the first paper contains detailed discussion of the development of the new provisions.

Topics: Composite Construction; Columns and Compression Members; Combined Loading

Investigation of Flange Local Bending under Flexible Patch Loading

LYLE P. CARDEN, GOKHAN PEKCAN, AND AHMAD M. ITANI

The limit state of flange local bending due to applied flexible patch loads was investigated both experimentally and analytically in this study. Analyses showed that an unstiffened beam, supporting a timber or steel post similar to those found in bridge falsework, should be designed for a combination of flange bending and post strength. A series of experiments and finite element analyses were conducted to observe and quantify this limit state and to develop predictive methods for the evaluation of joint capacity. An interaction method was introduced in which both flange bending and timber post crushing capacities are considered. An alternative method that utilizes an effective bearing area of the post was developed, yielding more accurate capacity predictions when a steel post is used. Blocking, sometimes placed between the flanges, increased the capacity of the joint region by up to 70% with a timber post; in contrast, with a steel post, blocking improved the joint capacity by less than 25%. A post eccentricity of up to 1/6 of the flange width resulted in a reduction of flange-timber post joint strength by 10% to 15%. The effect of a post eccentricity was negligible with a steel post. Finally, equations to calculate the ultimate load for flange local bending are presented in both LRFD and ASD formats.

Topics: Bridges; Erection; Non-Building Structures

Effects of Nonverticality on Steel Framing Systems - Implications for Design

ANDREA E. SUROVEK AND JUSTIN JOHNSON

The first section of the paper describes the types of initial imperfections typically considered in planar frame analysis and their effect on members and framing systems. This is followed by a discussion of how the effects of imperfections are treated in the AISC Specification. A parametric study is presented in which the sensitivity of framing systems to imperfection effects is investigated with respect to a number of parameters, including slenderness ratios, leaning load levels, gravity to lateral load ratios, and lateral frame stiffness, as measured by a second-order to first-order drift ratio. In addition to the sensitivity study, a number of columns and simple frames were analyzed with and without imperfections using the direct analysis approach for assessing frame stability outlined in Appendix 7 of the AISC Specification. The differences in the interaction checks for simple columns and frames are used to discuss the current limits on when imperfection effects may be neglected.

Topics: Analysis; Columns and Compression Members; Stability and Bracing

Capacity Design of Vertical Boundary Elements in Steel Plate Shear Walls

BY JEFFREY W. BERMAN AND MICHEL BRUNEAU

Consistent with capacity design principles, the 2005 AISC Seismic Provisions require that the vertical and horizontal

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BOOK REVIEW

The Life and Times of an Engineering Giant

Professor Wai-Fah Chen is one of the major figures in the history of modern civil engineering. He is known to the steel construction community for his many contributions to structural analysis, stability theory and its applications, and behavior of connections. Many of the results of his research have found their way into several specifications of the AISC. He was a member of the AISC Committee of Specifications for many years, and he is presently an emeritus member of this group.

After his recent retirement as the dean of engineering at the University of Hawaii, he sat down and wrote a 450-page book, *My Life's Journey—Reflections of an Academic*, that delightfully combines his personal life experiences and family history; a history of the intellectual and practical developments in structural engineering, engineering mechanics, plasticity theory, and geo-engineering in the past half-century; experiences in engineering education; reminiscences about teachers, colleagues, and friends; reviews of his research contributions; and general philosophical comments on the past, present, and future of the civil engineering profession in general and the academic teaching/research community in particular.

Wai-Fah Chen had a very adventurous youth during World War II and the following Chinese Civil War, eventually ending up in Taiwan where he obtained his BCCE degree. He describes these early years through a lively narrative, setting the tone for the rest of the book. Many of the readers of MSC will find their name, or the names of their teachers and colleagues, in the book. They will also be able to trace the origin of many of the criteria that are now a part of their daily design life. Engineering teachers will appreciate learning about the origins of steel design, concrete design, and soil mechanics concepts from the many books authored by Chen and his students.

Professor Chen is truly a giant in our professional field. Readers will not only be delighted and educated by this book, but will also feel proud to be part of a dynamic and creative profession.

—By Ted Galambos, University of Minnesota

EVENTS

Engineering Conference Seeks Presenters

Presentation proposals are now being accepted for the for the 2008 Structural Engineers' Buildings Conference & Expo, to take place October 2–3 in Atlanta. One-page proposals should be submitted by May 15 to Amy Walsh at awalsh@zweigwhite.com or online at **www.sebuildings.com**. Please call 508.651.1559 with questions. Applicants will be notified of acceptance in June. Conference themes include:

- ✓ Building Codes: Navigating Your Way through the Updates and Changes
- ✓ Wind Design: Mitigating the Effects of Natural Hazards on the Built Environment
- ✓ Industry Evolution: Market Changes Affecting Your Business
- ✓ Business Management: Successful Strategies for Effective Leadership
- ✓ Technical Innovation: Cutting Edge Building Design Techniques and Tools

ENGINEERING JOURNAL

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boundary elements of steel plate shear walls be designed to remain essentially elastic while the web plates yield under seismic loading. However, determination of the design loads for vertical boundary elements to reliably achieve capacity design is difficult, and a reasonably accurate approximate procedure is needed. This paper presents such a procedure for determining those design loads for the vertical boundary elements of steel plate shear walls so that the desired component yielding sequence is achieved. The procedure combines an assumed plastic collapse mechanism with a linear model of a vertical boundary element to determine the maximum axial forces, shear forces, and moments for vertical boundary elements considering fully yielded web plates and horizontal boundary elements hinging at their ends. Two methods for capacity design given in the commentary of the seismic provisions are also reviewed, and their shortcomings are identified. Then, design loads for the vertical boundary elements of two different steel plate shear walls are determined with the proposed procedure and the two current procedures. Results are compared with nonlinear static analysis results. The proposed procedure is shown to give VBE design loads that are significantly closer to the nonlinear static analysis results than the two current procedures.

Topics: Seismic Design; Lateral Systems; Analysis

Current Steel Structures Research

REIDAR BJORHOVDE

This regular feature of the *Engineering Journal* provides information on new and ongoing research around the world. In the 13th installment, research projects are summarized on the following topics: residual stresses in hot-rolled shapes of S460 steel, influence of the Bauschinger effect on deflections of cambered beams, equivalent moment distribution factors for lateral-torsional buckling, controlled rocking of steel-framed buildings with replaceable energy dissipating fuses, and software for design of plate structures against plate buckling.

Topics: Research

Correction

February's SteelWise article, "Simple Shear Connection Limit States," was written by Erika Winters-Downey and Matthew Fadden. Both authors were listed in the table of contents, but Fadden's name was inadvertently omitted from the article.