Structural Stability Research Council

NEWSLETTER

Volume 1, Issue 2 September 23, 2011

Welcome Again!

This is the second electronic newsletter the Structural Stability Research Council has produced. In this issue you will find several specialty articles as well as overviews of current research projects and an advanced program for the upcoming Annual Stability Conference in April. We hope you enjoy the issue!

Copies of this and all future newsletters will reside on the SSRC website at http://stabilitycouncil.org . Be sure to use the website as well to keep up-to-date regarding available publications, stability related courses, the next Annual Stability Conference, etc.

From an old/new SSRC Member - Riccardo Zandonini

I personally owe much to SSRC. When I arrived in Lehigh at the end of the 70's as Technical Secretary of SSRC, I had almost no International experience. I worked hard to build up the first edition of a document comparing the Codes in the main geographical areas (The World View), and I left Lehigh one year later with a good knowledge of the 'steel world' and a 'network' of relationships with scientists, engineers and Institutions.

Since then, and for almost 15 years, I was involved in various activities of the Council and attended most of the Annual Meetings. It was for me an important forum for closely following the developments in the North American research in the field of steel construction. Besides, it provided me with the opportunity to meet friends and discuss with them topics of common interest.

My increasing involvement into the management of my University restrained substantially my research activities and the related mobility.

For a good number of years I hence left SSRC, even if I followed its major changes from a distance. I knew about the 'wedding' with AISC for the Annual meeting, and I was wondering about the practical result of it. This year, finally, I made the decision and attended the Pittsburgh NASCC.

It was a mixed adventure. Mixed in the sense that at the very first moment I was somehow confused by the environment totally different from the one I remembered from my past experience. I enjoyed the SSRC sessions and I felt nostalgic of the past! However, I started to wander along the exhibition booths and to attend the AISC sessions as well. The result was that I gradually became acquainted with the various components of NASCC, and enjoyed all of them. The general feeling was that SSRC is maintaining its role, while at the same time it recognizes its belonging to the wide community of the steel construction world.

Before leaving Pittsburgh, I renewed my SSRC membership in the belief that it's really worthwhile to maintain alive my relationship with the Council. I am ready for the next meeting!

Inside this issue:

News/Announcements

2012 Beedle Award Winner: Professor Peter Birkemoe

Peter C. Birkemoe, Ph.D., P.Eng., Professor Emeritus Department of Civil Engineering, University of Toronto, has over 45 years in experience in structural engineering involving research, practice, and teaching related to design and behavior of steel structures and is a member of the Canadian Standards Association Committee on Steel Design S16, the Research Council on Structural Connections, the Structural Stability Research Council and served on the Ontario Highway Bridge Design Code Committee (section on Steel Bridges).

Professor Birkemoe's experimental and analytical investigations on the behavior of HSS members, led to the special strength classification for manufactured cold formed, heat-treated tubular members. Extensive large scale testing and analysis of fabricated circular tubular members examined the effects of weld induced residual stresses and geometric imperfections (including damage) on the behavior of beam-columns in offshore applications. Other research on stability conducted by Professor Birkemoe includes the examination of safety of curved bridges during construction and the study of sustained plastic deformation beyond development of full yield properties. With particular expertise in research and design practice for connections employing high strength structural bolts and related structural behavior, he works with various code/specification writing bodies in Canada and the United States. He is currently conducting research on field practices of high strength bolting

Professor Trahair Honored at NASCC/SSRC

Professor Nick Trahair was honored at the North American Steel Construction Conference in Pittsburgh this spring on May 13th where he received the 2011 Lynn S. Beedle Award. This annual meeting of the SSRC was also a chance for Nick, now Professor Emeritus at the University of Sydney, to see many of his engineering, research and academic colleagues from around the world.

Nick's research and teaching are in structural stability are well known, specifically in the area of lateral buckling of steel beams, and as the co-author of a popular text on the design of steel structures. His book Flexural-Torsional Buckling of Structures provides a major resource for researchers and designers.

Professor Trahair gave his Beedle Award Presentation entitled "Wagner's Beam Cycle" during the SSRC Track on the morning of the last day of the NASCC. The topic he addressed remains an area of theoretical development that retains some controversy on the validity of the assumptions used to obtain some of the buckling formulae found in specifications today. He assured the audience that there was no direct correlation with the work of the famous composer. His presentation and thoughts on this matter were well received and are quite timely because shortly the SSRC may be guiding some experimental work on obtaining evidence on the validity of the "assumptions."

Congratulations Nick

Beedle Award Details

The award has been established in honor of the late Lynn S. Beedle, an international authority on stability and the development of code criteria for steel and composite structures. He was a leader and outstanding contributor to the work of the Structural Stability Research Council for a period of more than 50 years, establishing the council as the preeminent organization worldwide in the area of structural stability. Through Lynn Beedle's dedicated work and leadership in the national and international arenas, the structural engineering profession has seen advanced concepts developed into practical engineering tools. He consistently and successfully endeavored to advance collaboration between researchers, engineers, and code writers worldwide.

Recipients of the Lynn S. Beedle Award must meet the following criteria:

Longtime member of SSRC.

- A worldwide leading stability researcher or designer of structures with significant stability issues.
- A leader in fostering cooperation between professionals worldwide.
- Significant contributions to national and international design code development.

The SSRC Executive Committee serves as the award committee. The award may be presented as frequently as annually. An individual can only receive the award once. The award is presented at the SSRC Annual Stability Conference. It consists of a framed certificate, signed by the SSRC Chair and Vice Chair.

THE BEEDLE AWARD WAS ESTABLISHED TO HONOR THE LATE LYNN S. BEEDLE, A LEADER AND OUSTANDING CONTRIBUTER TO SSRC

SSRC Continuing Education Opportunity

At the 2011 NASCC a four-hour short course titled "Cold-Formed Steel Design for Secondary Building Framing Members" was presented by SSRC. The course was created and presented by Roger LaBoube and Mike Seek.

For many years cold-formed steel products have been used by the pre-engineered building manufacturers for roof and wall framing. Although engineers are versed in the use and design of hot-rolled steel members, they often lack an understanding of the behavior and design requirements for cold-formed steel members. Mixed structural framing systems, consisting of hot-rolled main frame members and cold-formed purlins and/or girts, can translate into a highly competitive framing solution. However, to properly combine hot-rolled and cold-formed members requires a clear understanding of the design requirements for the different components of the system. Using an example problem Roger LaBoube provided an overview of the behavior and the design of cold-formed steel members. Mike Seek presented an in-depth discussion of bracing requirements for cold-formed steel purlin roof systems. Available resources that may be useful for the design of cold-formed steel members were also discussed.

Because over 40 participants attended the course and favorable reviews were provided, SSRC plans to again sponsor this course at the 2012 NASCC.

A NEW SHORT COURSE ("COLD-FORMED STEEL DESIGN FOR SECONDARY BUILDING FRAMING MEMBERS") WAS PRESENTED AT THE 2011 NASCC

SSRC Participates in Eurosteel 2011

SSRC WAS A SUPPORTING ORGANIZATION FOR THE EUROSTEEL 2011 CONFERENCE AND WAS REPRESENTED BY IN THE PLENARY SESSION BY TED GALAMBOS AND BEN SCHAFER

Europe's leading steel researchers and practitioners recently wrapped up one of their major conferences: Eurosteel. Eurosteel 2011 was held in Budapest, Hungary on the campus of the Budapest University of Technology and Economics from 31 August to 2 September. SSRC was a supporting organization for the conference and was formally represented in the plenary session by longstanding SSRC member Professor Ted Galambos and current SSRC Vice-Chair Professor Ben Schafer (see photo). In his plenary address Professor Galambos reflected on the state of steel research and codes in Europe, including the role SSRC has played in that development.

The Eurosteel conference chairmen and host was SSRC member Professor Laszlo Dunai from the Budapest University of Technology and Economics. His team organized the three day conference with over 400 papers and numerous parallel sessions covering all aspects of steel construction. The conference reception was held while on a cruise of the Danube river, and the conference dinner was held in the main hall of the primary building of the university. The European Committee for Constructional Steelwork (ECCS) was the primary sponsor for the conference and selected papers were published in the ECCS journal: *Steel Construction*. The complete three volume (well over 1000 pages!) proceedings were also published, and definitively represent the state–of-the-art, particularly in Eurocode related steel research.

Professor Cris Moen, SSRC member and Chairmen of the SSRC Thin-walled Structures Task Group, reflected on the conference: "For me, Eurosteel was a great opportunity to learn about European perspectives on integrating structural stability into design. I met several researchers with similar research interests, and I'm excited about the future potential for collaboration. SSRC is definitely well known and respected at this conference. I had been communicating with many of the attendees through our SSRC Thin-walled Structure Task Group email list, and it was really nice to put faces with names. Many of the Europeans I met are planning to attend the 2012 SSRC Annual Stability Conference or the 2012 MS&T International Specialty Conference on Cold-formed Steel [SSRC also serves as a supporting organization for this conference]."

Professor Jerome Hajjar, SSRC member, also reflected on the conference and SSRC's role: "Eurosteel 2011 in Budapest provided an outstanding venue to learn about the latest research and practice in steel structures. SSRC was well represented at the conference, led by SSRC Vice-Chair Professor Ben Schafer, who gave a keynote presentation on cold-formed steel design, along with several members of SSRC from around the world."

The next Eurosteel will be held in Naples in 2014 with SSRC member Prof. Riccardo Zandonini serving as the conference Chair and host.

Professor Laszlo Dunai (podium) and honorary panel members in the plenary session of Eurosteel 2011, note SSRC credit on slide. (photo credit J.F. Hajjar)

Guide to Stability Design Criteria, Sixth Edition - Buy one today!

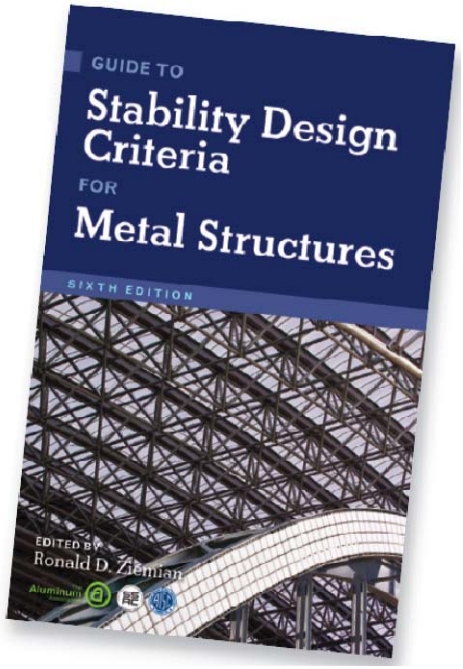
In the Spring of 2010, the sixth edition of SSRC's definitive publication *Guide to Stability Design Criteria for Metal Structures* became available. Often described as an invaluable reference for designing metal structures, the Guide is written by SSRC task group members who are leading experts in a wide range of structural stability topics. In fact, the book is heavily referenced in the commentaries to the latest editions of the AISC, AISI, AASHTO, and Aluminum design specifications.

In addition to providing updated chapters on beams, beam-columns, bracing, and plates, the Guide provides significantly revised chapters on columns, plates, box girders, curved girders, composite columns as well as structural systems, frame stability, and arches. Of particular note are two chapters, one on thin-walled (cold-formed) metal structural members and the other on stability under seismic loading, which include unprecedented coverage and easily justify the purchase of this 1100 page book.

From topics of the direct analysis method to the direct strength member design, the Guide provides comprehensive coverage of many state-of-the-art topics. Complete with over 350 illustrations, plus references and technical memoranda, the *Guide to Stability Design Criteria for Metal Structures, Sixth Edition* offers detailed guidance and background on design specifications, codes, and standards worldwide.

Be sure to purchase your copy today! The best way to purchase the Guide is via the SSRC website at

PURCHASE THE GUIDE AT HTTP://STABILITYCOUNCIL.ORG



2011 SSRC Structural Stability Conference

The 2011 SSRC Structural Stability Conference was held May 10-14, 2011 in Pittsburgh, Pennsylvania. The conference was held in conjunction with the AISC North American Steel Conference.

The 2011 Beedle Award recipient was Prof. Nicholas Trahair, Emeritus Professor of Civil Engineering at the University of Sydney (see article below). The 2011 Vinnakota Award was awarded to Khanh Le Tran, PhD student at Paris-Est University, France.

Visit the 2011 conference page at http://stabilitycouncil.org with links to view the program, table of contents of the proceedings during the Steel Conference and access downloads from the Task Group sessions held on the 10th.

Ongoing Stability Research

Finite Strip Modeling of Thin-Walled Members

Zhanjie Li & Ben Schafer
Johns Hopkins University; Sponsored by National Science Foundation

Thin-walled members have cross section instability (i.e., local and distortional) in addition to global buckling (Euler) of the member. To assess the stability of thin-walled members, an advanced tool is needed to overcome the limitations in current numerical tools like finite strip (FSM) and finite element methods (FEM). A new finite strip method is developed, implemented and validated to account the general end boundary conditions: pin-pin, fixed-fixed, fixed-pin, fixed-free, and fixed-guided and use these solutions to extend the constrained finite strip method (cFSM). In addition, the existing cFSM solutions for pin-pin boundary conditions are recast into the new generalized notation for general end boundary conditions. Basis formulation, orthogonalization and normalization are discussed in details. Moreover, an automatic mode identification method for shell finite element analyses has been proposed which uses a special system of modal base functions, referred to as cFSM base functions. By extrapolating the cFSM base functions to FEM context, a fairly sizeable minimization problem is required for assigning the contributions to the fundamental buckling deformation classes. A set of generalized base functions is proposed to handle all kinds of end boundary cases, such as mixed boundary conditions and semi-rigid boundary conditions. Following the similar procedure, modal identification of collapse analysis of thin-walled members modeled using material and geometric nonlinear shell finite element analysis is studied. The method enables the quantification of failure modes and tracks the evolution of the buckling classes as well. For design purpose, application of the constrained finite strip method and modal identification with direct strength method are proposed.

Use of Knuckle Curves for Assessment of Bracing Effectiveness

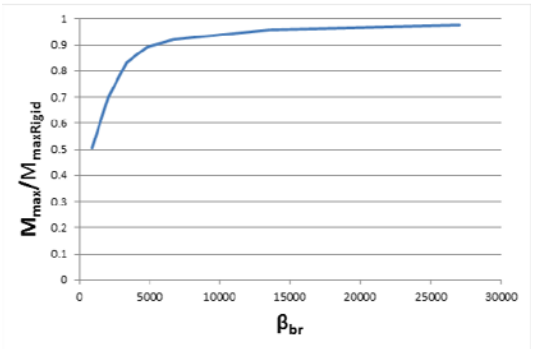
Cliff Bishop & Don White
Georgia Institute of Technology; Sponsored by Metal Building Manufacturers Association

A knuckle curve, as depicted in the figure, is a plot of system strength versus a general bracing stiffness. Originally termed by Horne and Grayson (1983), this chart is a useful way of representing how the strength of a structural system is affected by bracing. In general, there is a "knuckle" value where a small decrease in stiffness leads to a sharp decrease in system capacity. Conversely, there is a "plateau" characterized as the location where any increase in bracing stiffness produces little to no increase in system strength. In many situations, design engineers should strive for stiffness values that lie somewhere above the knuckle but not too far along the plateau as to be uneconomical.

These curves may be created using experimental tests or finite element simulations with both geometric and material nonlinearities. First, a frame is analyzed assuming stiffness values for the braces that approach a rigid condition. Subsequently, a series of simulations is run with less and less stiffness where, in each case, the strength of the system is compared to the capacity assuming the fully rigid bracing case.

Current research at Georgia Tech centers around an assessment of bracing stiffness requirements for complex bracing configurations utilized in typical metal building structures. Through the creation of these such curves for a myriad of scenarios, including systems that exhibit significant inelasticity, structural engineers can better understand the true demands on the bracing in these systems and develop improved design methodologies for assessing these demands.

Knuckle Curve



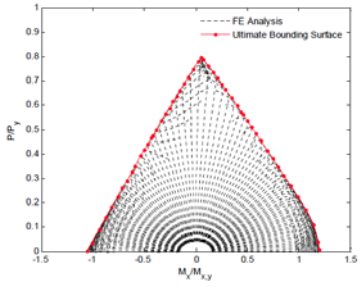
Section Capacity of Cold-Formed Steel Members by DSM

Yared Shifferaw & Ben Schafer
Johns Hopkins University; Sponsored by National Science Foundation

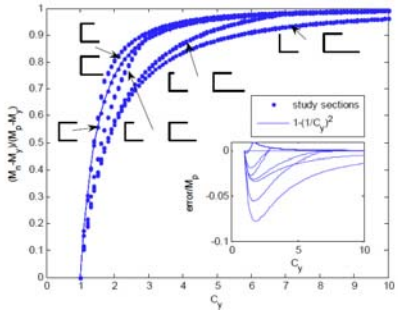
This study aims at advancing the Direct Strength Method under three objectives. The first objective is to provide and verify a general design method for prediction of reserve inelastic bending capacity in cold-formed steel members potentially subject to local, distortional, and/or lateral-torsional buckling modes. The strain capacity that can be sustained in inelastic local and distortional buckling is investigated through existing experiments coupled with nonlinear finite element analysis. The resulting relationships for inelastic local, distortional, and lateral-torsional buckling provided in a Direct Strength Method format are adopted in the cold-formed steel AISI Specification.

The second objective is to explain why cold-formed steel angles may have significant post-buckling reserve in global buckling, as observed in fixed-ended tests, and to provide design guidance for locally slender cold-formed steel angles. Specific attention is paid to the unique aspects of cold-formed steel angles under compression: (1) the separation, or lack of, between local-plate and global torsional buckling and (2) the specific impact of end boundary conditions, with particular emphasis on warping (longitudinal) deformations. Utilizing developed nonlinear collapse analysis with shell finite element models, and existing testing, alternatives to current design methods are explored.

The third objective is to directly examine the stability and strength of cold-formed steel beam-columns under the combined actions of axial loading and bending. Complete yielding and stability solution under direct combined actions for symmetric and non-symmetric cross-sections, which are then modeled to failure with nonlinear finite element analysis, demonstrate that ultimate strength envelopes (a) do not agree with linear interaction equations used in design and (b) do provide a basis for formulating a Direct Strength Method for beam-columns.



Normalized major axis bending vs. axial load for local FE collapse analysis



Accuracy of simplified expression for sections with first yield on top flange

Tubular Cross Frame Details

Anthony Battistini, Weihua Wang, Todd Helwig, Michael Engelhardt, & Karl Frank
The University of Texas at Austin; Sponsored by Texas Department of Transportation

Cross frames are critical to the stability of straight and curved steel bridges. The cross frames provide lateral stability to the bridge system and increase the individual girder buckling capacity. Conventional cross frames are often fabricated from angle members to make an X-type brace. The basic goal of our research project is to improve the fundamental behavior of the cross frames by utilizing tubular members. Since tubular members are more efficient in compression than angles, a single diagonal cross frame (Z-type) can provide an effective brace.

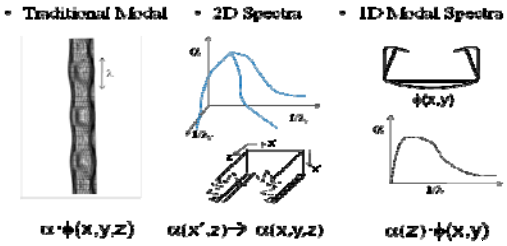
In order to facilitate construction, a simple connection design is necessary to connect the tubes to the cross frame connection plates. Currently, cast steel connections are being created, which have been engineered to reduce stress concentrations. The wooden pattern of the connection is completed and are currently being cast. The possibility of using a T-stem connection is also being investigated. For this connection, the tube would be welded to the flange of a WT section and the stem would connect to the bridge girder. Utilizing a 220 kip MTS Universal Testing Machine at the Ferguson Structural Engineering Laboratory, tension and fatigue tests were performed on this detail using both square and round HSS sections. A full-scale test setup has recently been constructed to measure the stiffness and strength of full-size cross frames to validate analytical equations used for bracing design.

Cast Connection Design

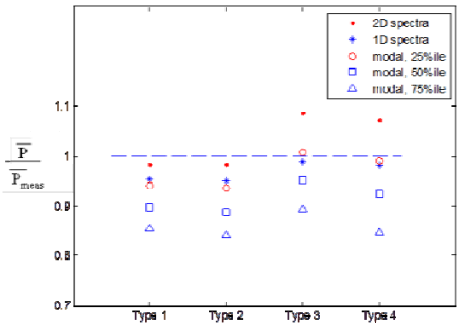
Z-Type Cross Frame

Geometric Imperfections in Cold-Formed Steel Members

Vahid Zeinoddini Meimand & Ben Schafer
Johns Hopkins University; Sponsored by National Science Foundation & Steel Stud Manufacturers Association



Three approaches for simulating imperfections



Average predicted strength normalized by average strength of models with four different sets of models

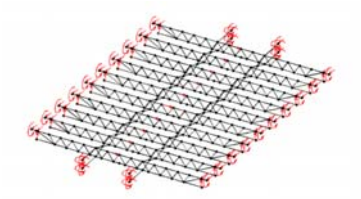
Geometric imperfections play a crucial role in the behavior and strength prediction of thin-walled members. Modeling of imperfections is an important issue in the analysis of structures comprised of thin-walled members. In this study, the preferred approach in modeling is to simulate the geometric imperfections as a "physical reality", as opposed to a mathematical convenience. For such a goal, the distribution and magnitude of the imperfection should be investigated and be tied to available data on measured geometric imperfections.

A program has been conducted to measure geometric imperfections in cold-formed steel at manufacturing plants. The results from this program and available geometric imperfection data on cold-formed steel members are employed to categorize geometric imperfections in cold-formed steel members. Simulation models are introduced that more closely marry simulated imperfection distribution and magnitude to physical reality.

Three methods are presented to generate and simulate imperfection fields: the first is the classical approach employing a superposition of eigenmode imperfections, but scaled to match peaks in the measured physical measurements. The second is a method based on the multi-dimensional spectral representation method, in which imperfections are considered as a two-dimensional random field and simulations are performed taking a spectra-based approach. The third is a novel combination of modal approaches and spectral representation that directly considers the frequency content of the imperfection field, but employs a spectral representation method driven by the cross-sectional eigenmode shapes to generate the imperfection fields. The effect of these different approaches on the simulated strength and collapse behavior of members is investigated using material and geometric nonlinear finite element collapse modeling. The third imperfection generation method, the 1D Modal Spectra method, provides an intriguing new tool in the simulation of thin-walled members .

Research on the Stability of Open-Web Steel Joists

Jonathan Eberle[a], Ron Ziemian[b], & Drew Potts[c]
[a]Virginia Tech, [b]Bucknell University, [c]Pennsylvania College of Technology; Sponsored by Steel Joint Institute



Computer-model of ten parallel joists with cross-bracing anchored at both ends.

Due to the slender nature of open-web steel joists, bracing to prevent lateral torsional buckling is essential. The Steel Joist Institute's specification currently defines the number of required rows of bridging based on joist geometry and limits the slenderness of the bridging. The purpose of our research is to investigate these requirements for various bridging scenarios using nonlinear three-dimensional structural analysis software. The project began by validating the results from 2nd-order elastic analyses through comparisons with previous experimental research on several single unbraced joists.

To date, studies investigating both horizontal- and cross-bridging have been conducted to analyze the benefits of the bridging types and determine the ideal bracing stiffness for a system of parallel joists. Much insight into the methods required for modeling systems of parallel joists was discovered during the early stages of this work. Results of the research show how the bridging forces accumulate for the two types of bridging and also demonstrate the benefits of using cross-bracing. Research investigating the need for requirements in bridging short-span steel joists (less than 30-ft) is currently ongoing. Such recent studies show promise for a reduction in the required number of bridging rows for short span joists. These studies have also confirmed the unconventional joist failure mode of web sidesway buckling when the top chord is properly restrained out-of-plane.

Behavior & Design of Sheathed Cold-Formed Steel Stud Walls

Luiz Carlos Marcos Vieira Junior & Ben Schafer
Johns Hopkins University; Sponsored by American Iron and Steel Institute and Steel Stud Manufacturers Association

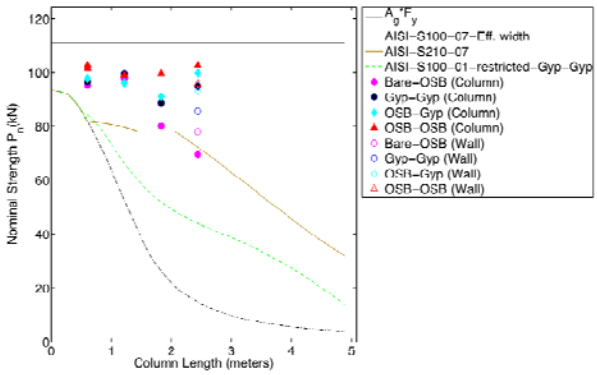
Cold-formed steel may be used to frame the walls, floors, and roofs of modern buildings. The individual cold-formed steel members (studs) have sheathing attached to provide appropriate architectural enclosures. This sheathing also serves to brace the cold-formed steel studs under load. The research in discussion is dedicated to the study of sheathed cold-formed steel walls under axial loads.

Current design methods are highly developed regarding the design of isolated cold-formed steel members such as columns and beams, but cold-formed steel wall studs that rely on sheathing for bracing are not fully addressed. A series of tests on single columns with sheathing, and full-scale walls with sheathing are compared with previous design methods adopted by the American Iron and Steel Institute (AISI) Specification . The comparison shows that previous design methods lead to overly conservative strength prediction. This is particularly true for the case of dissimilar sheathing, e.g. oriented strand board on one face and gypsum board on the other face of the stud.

The sheathing supplies beneficial restraint to the wall studs and the stiffness of this sheathing-based restraint is characterized experimentally and analytically in this research. The lateral bracing stiffness and resistance supplied by the fastener-sheathing combination that braces the stud is explored, taking into account typical design variables as well as the influence of humidity and construction flaws. For the first time, the lateral bracing stiffness is correctly divided into a local fastener and global diaphragm stiffness. While local stiffness considers the damage around the fastener connection, the diaphragm stiffness considers the shear stiffness of the whole sheathing.

Particular emphasis on the single-column and full-wall tests is placed on the behavior and the observed limit states given the different sheathing configurations. Demands on the fasteners that connect the sheathing to the studs are also explored analytically and numerically with finite element models of sheathed single columns and sheathed wall studs. A unique application of the Direct Strength Method of design is explored where the sheathing-based restraint is used explicitly in determination of the elastic buckling loads of the wall studs, and then these elastic buckling loads are utilized to determine the strength. An analytical solution for determining the buckling loads is provided, although it is involved and numerical methods are preferred. Good agreement is demonstrated for the new approach both in terms of strength and limit states prediction. The new approach is considered to be a suitable and reliable design method for adoption in the AISI Specification.

Full-scale test of cold-formed steel wall



Design curves, focus on Winter and Pekoz's method

2012 Conference Advanced Program Tuesday, April 17 (annual meeting) through Friday, April 20

SS1: Tu 2:00-3:00 Technical Presentations: Topics in Stability Research (Moderator: Benjamin Schafer)

Flexural and Axial Behaviour of CFRP Strengthened Steel Circular Hollow Section Beams and Short Columns

Jimmy Haedir, Xiao-Ling Zhao, Monash University, Clayton, VIC, Australia

Effects of Splice Configuration on Web Crippling of Lapped Cold-Formed Steel Channels Subjected to Interior Two-Flange Loading*

R. Quzzafi, K. Sennah, Ryerson University, Toronto, ON, Canada; S. Fox, Canadian Sheet Steel Institute, Cambridge, Canada

3D Second-Order Analysis of Industrial Buildings

Zacarias Martin Chamberlain Pravia, Ricardo A. Ficanha, University of Passo Fundo, Passo Fundo, Brazil

SS2: Tu 3:15-4:15 Technical Presentations: Angle & Cruciform Columns (Moderator: Ronald Ziemian)

Flexural Buckling of Simply Supported Columns with "Rigid End Links" - the Key to Interpret Simply Supported Angle Column Test Results?

Enio Mesacasa, Jr., University of Sao Paulo, Sao Paulo, Brazil; Dinar Camotim, Pedro Borges Dinis, Technical University of Lisbon, Lisbon, Portugal; Maximiliano Malite, University of Sao Paulo, Sao Paulo, Brazil

Buckling, Post-Buckling, Strength and Design of Angle Columns

Pedro Borges Dinis, Dinar Camotim, Nuno Silvestre, Technical University of Lisbon, Lisbon, Portugal

Local Inelastic Buckling Behavior of HPS Cruciform Columns

Perry S. Green, Consultant, Myrtle Beach, USA

ANNUAL MEETING (4/17/2012) FROM 2PM TO 8PM, INCLUDES PRESENTATION, GROUP MEETINGS, AND SSRC SOCIAL HOUR

SS3: Tu 4:30-5:40 Task Group Meetings: Parallel Breakout Sessions for Task Groups

Table 1: TG02 Members: stability of steel members

Chair: Don White

Table2: TG03 Systems: stability of steel systems, especially frames

Chair: Chris Foley

TG Chairs Report at ~ 5:30

SS4: Tu 5:50-7:00 Task Group Meetings: Parallel Breakout Sessions for Task Groups

Table 1: TG04: Stability of metal bridges and bridge components

Chair: Dan Linzell Vice-Chair: Qiuhong Zhao

Table 2: TG05 Thin-walled: Stability of thin-walled metal structures

Chair: Cris Moen, Vice-Chair: Cheng Yu

Table 3: TG06 Extreme Loads: stability under extreme loads, seismic, fire,

Co-Chairs: Amit Varma, Robert Tremblay

TG Chairs Report at ~ 6:50

2012 Conference Advanced Program Tuesday, April 17 (annual meeting) through Friday, April 20

SS5: Tu 7:00-7:15 SSRC Annual Business Meeting

SS6: Tu 7:15-8:00 SSRC Social Hour

S1: W 3:15-4:15 Advances in Stability Analysis & Design (Moderator: Ronald Ziemian)

Welcome to the 2012 SSRC Annual Stability Conference

R. Ziemian, Bucknell University, Lewisburg, PA, USA

Stability Analysis and Design of Steel-Concrete Composite Columns*

Mark D. Denavit, University of Illinois at Urbana-Champaign, Urbana, IL, Jerome F. Hajjar, Northeastern University, Boston, MA

First-Order Plastic Hinge Analysis of Thin-Walled Steel Beams using Genaralized Beam Theory

Cilmar Basaglia, Dinar Camotim, Technical University of Lisbon, Lisbon, Portugal

S2: W 4:30-6:00 Stability o Purlins and Joists (Moderator: Clarence Miller)

Flexural Strength of Exterior Metal Building Wall Assemblies with Rigid Insulation

Tian Gao, Cristopher D. Moen, Virginia Tech, Blacksburg, VA

GBT-Based Assessment of the Buckling Behavior of Cold-Formed Steel Purlins Partially Restrained by Sheeting*

Andre Graca, Cilmar Basaglia, Dinar Camotim, Technical University of Lisbon, Lisbon, Portugal; Rodrigo Goncalves, Universidade Nova de Lisboa, Lisbon, Portugal

Computational Studies Aimed at Defining Bridging Requirements for Steel Joists During Erection*

Jonathan Eberle, Virginia Tech, Blacksburg, VA; Ronald D. Ziemian, Bucknell University, Lewisburg, PA; Drew R. Potts, Pennsylvania College of Technology, Williamsport, PA

Capacity of Open-Web Joists Braced by a Standing-Seam Roofing System*

Luke Cronin, Ryan Fehr, Cristopher D. Moen, Virginia Tech, Blacksburg, VA

ANNUAL MEETING (4/17/2012) FROM 2PM T0 8PM, INCLUDES PRESENTATION, GROUP MEETINGS, AND SSRC SOCIAL HOUR

S3: TH 8:00-9:30 Bridge Stability & Bracing (Moderator: Donald White)

Curvature Limitations of Non-Composite Girder Bridges at Construction Stage*

Imad Eldin Khalafalla, Khaled Sennah, Ryerson University, Toronto, ON, Canada

Optimizing Cross Frame Plan Orientation in a Horizontally Curved Steel Bridge - Is it Worth it?*

M. Sharafbayani, D.G. Linzell, Pennsylania State University, University Park, PA

Axial Strength and Stiffness of Tubular Members with T-Stem and Cast Steel Connections*

Anthony Battistini, Weihua Wang, Todd Helwig, Michael Engelhardt, University of Texas at Austin, Austin, TX; Karl Frank, Hirschfeld Industries, Austin, TX

Study of Improved Cross Frames Behaviors by Full Size Laboratory Tests and FEM*

Weihua Wang, Anthony Battistini, Todd Helwig, Michael Engelhardt, University of Texas at Austin, Austin, TX; Karl Frank, Hirschfeld Industries, Austin, TX

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S4: Th 10:00-11:30 Stability of Steel Shear Walls (Moderator: LeRoy Lutz)

Special Plate Shear Wall

David J. Webster, University of Washington, Seattle, WA

Modified PFI Method for SPSWs with Moderate LYP Steel Infill Plates*

Tadeh Zirakian, Jian Zhang, University of California, Los Angeles, Los Angeles, CA

Cold-Formed Steel Sheet Sheathed Shear Walls in Mid-Rise Construction

C. Yu, N. Yanagi, University of North Texas, Denton, TX

Cold-Formed Steel Shear Walls in Ledger-Framed Buildings*

P. Liu, Northeastern University, China, C. Yu, University of North Texas, Denton, TX; B.W. Schafer, Johns Hopkins University, Baltimore, MD

S5: Th 1:15-2:15 Cold Formed Steel Member Stability (Moderator: Roger LaBoube)

Cross-Section Optimization using Simulated Annealing of Cold-Formed Steel Channel Columns

Zacarias Martin Chamberlain Pravia, Moacir Kripka, University of Passo Fundo, Passo Fundo, Brazil

Post-Buckling, Strength and Design of Cold-Formed Steel-Lipped Channel, Zed and Hat-Section Columns Affected by Local-Distortional Interaction*

Rui Fena, Pedro Borges Dinis, Dinar Camotim, Technical University of Lisbon, Lisbon, Portugal,

Stability of Sheathed Cold-Formed Steel Studs under Axial Load and Bending*

K.D. Peterman, B.W. Schafer, Johns Hopkins University, Baltimore, MD

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S6: Th 3:00-4:00 Member Stability (Moderator: Dinar Camotim)

Computed Strength of Uni-Axially Loaded Battened Columns Composed of Four Cold Formed Angles

Mohamed A. El Aghoury, Adel H. Salem, Ain Shams University, Cairo, Egypt; Maged T. Hanna, National Housing and Building Research Center, Cairo, Egypt; Essam A. Amoush, Higher Technological Institute, Cairo Egypt

Influence of Imperfections in FEM Modeling of Lateral Torsional Buckling

N. Boissonnade, College of Engineering and Architecture of Fribourg, Fribourg, Switzerland; H. Somja, National Institute of Applied Sciences of Rennes, Rennes, France

Influence of Weak-Axis Flexural Yielding on Strong-Axis Buckling Strength of Wide Flange Columns

Christopher D. Stoakes, University of Iowa, Iowa City, Iowa; Larry A. Fahnestock, University of Illinois at Urbana-Champaign, Urbana, IL

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S7: Th 4:15-5:15 Member Stability Under Fire (Moderator: Amit Varma)

Enhancing the Stability and Fire Performance of HSS Columns through Light-weight Concrete Filling

V.K.R. Kodur, T. Haan, Michigan State University, Lansing, MI

On the Influence of the Constitutive Law on the DSM Design of Cold-Formed Steel Columns Failing Distortionally under Fire Conditions

Alexandre Landesmann, COPPE, Federal University of Rio de Janeiro, Brazil; Dinar Camotim, Technical University of Lisbon, Lisbon, Portugal

Cross-Sectional Stability of Structural Steel at Elevated Temperatures

M. Seif, T. McAllister, National Institute of Standards and Technology, Gaithersburg, MD

S8: F 8:00-9:30 Castellated/Cellular & Corrugated Web Beams (Moderator: Andrea Surovek)

Lateral Torsional Buckling of Cellular Steel Beams*

J. Nseir, College of Engineering and Architecture of Fribourg, Fribourg, Switzerland; M. Lo, National Institute of Applied Sciences of Rennes, Rennes, France; D. Sonck, Ghent University, Ghent, Belgium; H. Somja, College of Engineering and Architecture of Friboug, Fribourg, Switzerland; O. Vassart, ArcelorMittal Commercial Sections, Esch-sur-Alzette, Luxembourg; N. Boissonnade, College of Engineering and Architecture of Fribourg, Fribourg, Switzerland

Assessment of Buckling Stability of Elasctically-Braced Castellated Beams

Hossein Showkati, Urmia University, Iran; Tohid Ghanbari Ghazijahani, Islamic Azad University, Iran; Amir Noori, Bu-Ali Sina University, Iran; Tadeh Zirakian, University of California, Los Angeles, CA

Failure of Eccentrically Loaded Cellular Steel Members*

D. Sonck, Ghent University, Zwijnaarde, Belgium; N. Boissonnade, College of Engineering and Architecture of Fribourg, Fribourg, Switzerland; R. Van Impe, Ghent University, Zwijnaarde, Belgium

Ultimate Capacity of Slender Section Beam-columns with Corrugated Webs

M. El Aghoury, Sherif A. Ibrahim, Ain Shams University, Cairo, Egypt; M.M. Nader, Senior Structural Engineer, Cairo, Egypt

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S9: F 10:00-11:30 Beedle Presentation Session (Moderator: Benjamin Schafer)

Beedle Presentation:

Experimental Studies of Stability: Have we solved the problem?

P. Birkemoe, University of Toronto, Toronto, ON, Canada

Session talks

Experimental Study of Residual Stresses in Thick Steel Plates

R. Thiebaud, J.P. Lebet, Ecole Polytechnique Federale de Lausanne, Lausanne, Switzerland

Geometric Imperfections in Cold-Formed Steel Members*

V.M. Zeinoddini, B.W. Schafer, Johns Hopkins University, Baltimore, MD

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S10: F 2:15-3:15 HSS & Panel Stability (Moderator: Donald Sherman)

Effect of Width-Thickness and Depth-Thickness on the Cyclic Bending Behavior of Hollow Structural Sections*

Matthew Fadden, Jason McCormick, University of Michigan, Ann Arbor, MI

Stability and Strength Prediction of Steel Foam Sandwich Panels

S. Szyniszewski, Johns Hopkins University, Baltimore, MD; B. Smith, University of Massachusetts Amherst, Amherst, MA; J. Hajjar, Northeastern University, Boston, MA; S. Arwade, University of Massachusetts Amherst, Amherst, MA; B.W. Schafer, Johns Hopkins University, Baltimore, MD

Stability of Cylindrical Stiffened Panels

Laurence Davaine, Khanh Le Tran, SNCF, France

S11: F 3:30-5:00 Vinnakota Award Session & Plate Girders (Moderator: Todd Helwig)

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Presentation of the Vinnakota Award

Ronald Ziemian, Bucknell University, Chair SSRC

New Shear Design Criteria for Plate Girders

Sung C. Lee, Doo S. Lee, Dongguk University, Seoul, Korea; Chai H. Yoo, Auburn University, Auburn, AL

Moment-Shear Interaction in Plate Girders

Sung C. Lee, , Doo S. Lee, Dongguk University, Seoul, Korea; Chai H. Yoo, Auburn University, Auburn, AL

Moment-Shear Interaction of Longitudinally Stiffened Plate Girders

Darko Beg, Franc Sinur, University of Ljubljana, Ljubljana, Slovakia

*Denotes that the paper is Vinnakota eligible.