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Abstracts of Conference Papers

On October 19th and 20th, 2000 the 15th International Specialty Conference on Cold-Formed Steel Structures will be held in St. Louis, Missouri. The technical program and conference registration will be available in August 2000. For further information regarding the conference, contact either the Center for Cold-Formed Steel Structures, (Telephone: 573-341-4471, Fax: 573-341-4476, e-mail: ccfss@umr.edu) or UMR Continuing Education (Telephone: 573-341-4132, Fax: 573-341-4492: e-mail: bonnieu@umr.edu). This Technical Bulletin provides a brief summary for the 45 papers that will be presented and will appear in the conference proceedings:

"A Design Approach for Complex Stiffeners," A.T. Sarawit and T.B. Pekoz

A design approach for laterally braced cold-formed steel flexural members with edge stiffeners other than simple lips is presented. The method integrates distortional buckling into a unified effective width approach.

"Design of Cold-Formed Steel Plain Channels," F. Yiu and T.B. Pekoz

A design procedure for plain channels bending about either the major or minor axis of the cross section is presented. The scope of the study covers laterally braced beams, columns, and beam-columns.

"Web Crippling of Single Web Cold Formed Steel Members Subjected to End and Interior Two Flange Loading," B. Beshara and R.M. Schuster

The findings from an experimental study of end-two-flange and interior-two-flange loading are summarized in the paper. A design equation is presented.

"Tests and Design of Cold-Formed Unlipped Channels Subjected to Web Crippling," B. Young and G.J. Hancock

Unlipped channels were studied for the end-one-flange, interior-one-flange, end-two-flange and interior-two-flange loading conditions. A comparison of tested strength to design strengths predicted by AS/NZS 4600 and the AISI Specification were generally unconservative for small depth-to-thickness ratios. New design equations are presented.

"Experimental Investigation of Cold-Formed Channels Subjected to Combined Bending and Web Crippling," B. Young and G.J. Hancock

The combination of interior-one-flange loading and bending was investigated for unlipped channels. A comparison of the tested load capacity and the predicted design strength specified by AS/NZ 4600 and the AISI Specification revealed that the specifications generally yielded conservative strength predictions.

"Web Crippling Behaviour of Channels with Flanges Restrained," B. Young and G.J. Hancock

Both the end-two-flange and interior-two-flange web crippling loading conditions, were investigated. The influence of restrained flanges was studied experimentally as well as a comparison of the tested design strengths to predicted design strengths.

"FE Models for Sheeting Under Interaction Load," H. Hofmeyer, J. Kerstens, B. Snijder, and M. Bakker

The web crippling behavior of trapezoidal sheeting was studied analytically using finite element models. A four-node shell element with extra displacement shapes was used. Good agreement was obtained between tested and finite element results.

"Lateral Strength of Wind Load Bearing Wall Stud-To-Track Connection," S.R. Fox and R.M. Schuster

Reported are the results and analysis of a collection of end-one-flange web crippling tests of common stud-to-track connections. Two failure modes were identified, web crippling of the stud and punch-through of the track flange. Design equations are presented for both failure modes.

"Strength of Bearing Stiffeners in Cold Formed C-Sections," S.R. Fox and R.M. Schuster

Described is an experimental investigation that addressed the influence of stiffener end gap, fastener configurations, and bearing width on the two-flange loading capacity of a web stiffened C-section.

"A Theoretical and Experimental Analysis of Cold-Formed Steel Shapes Subjected to Bending – Channel and Simple Lipped Channel," R.M. Goncalves, M. Malite, and C.E. Javaroni

Discussed in the paper are the results of bending tests carried out on channel shapes commonly used in Brazil. Design criteria are proposed based on the test results.

"Lateral Bracing Connections for C-Sections Subjected to Bending," B. Beshara and R.A.LaBoube

The behavior of cold-formed C-section assemblies under bending was investigated. Each assembly had lateral bracing at mid-span. Emphasis was placed on the effect of the mid-span brace connection and the effect of drywall attached to the tension flange.

"Lateral Buckling of Prismatic Members About an Imposed Axis of Rotation," L.K. Sokol

Based on an analytical study, an improved behavior model for lateral buckling was developed by taking into account the torsional stiffness of the cross section.

"Calibration of Cold Formed Steel Shear Equations," B. Craig and R.M. Schuster

Using available test data from the literature, a calibration was performed based on the S136 and AISI reliability indices, calibration coefficients and shear equations. Both factors of safety and phi factors are proposed for the limit states of shear yielding, inelastic buckling and elastic buckling.

"Elastic-Plastic Interactive Buckling of Thin-Walled Steel Compression Members," D. Dubina and V. Ungureanu

The paper shows the use of a proposed "plastic-elastic" approach for the analysis of plain and lipped channel sections subjected to compression. The local-overall interactive buckling modes are regarded as the interaction between the local rigid-plastic mode and the overall-elastic mode.

"Stub Column Tests on Cold-Formed Steel Angle Sections," M. Dhanalakshmi and N.E. Shanmugam

An investigation of the ultimate load capacity of non-perforated and perforated equal angle cold-formed steel stub columns is presented. A comparison of experimental and finite element failure loads shows that the finite element model is capable of predicting the ultimate load capacity.

"Compression Tests on Cold-Formed Angles Loaded Parallel with a Leg," D. Popovic, G.J. Hancock, and K.J.R. Rasmussen

A series of compression tests on cold-formed steel angles with slender cross sections were performed. The test data was compared with the design rules of the Australian and American specifications. Improved design rules are presented.

"Finite Element Analysis of Cold-Formed Channel Columns," B. Young and J. Yan

A numerical investigation of the behavior and strength of plain and lipped channel columns is summarized. The results from the numerical study are compared with the design column strengths calculated by the Australian/New Zealand, American, and European specifications.

"The Structural Behavior of Composite Beams in Cold-Formed Shapes," M. Malite, W.A. Nimir, R.M. Goncalves, and J.J. deSales

The structural behavior of composite beams, constituted of cold-formed double channels connected to the concrete slab by shear connectors was investigated. The test results are compared with classic theoretical models of composite beam design.

"Flexural Behavior of Profiled Composite Beams," J.Y. Song and Y.B. Kwon,

The behavior of composite beams composed of cold-formed steel sheeting and normal strength concrete was studied. A series of flexural tests were executed and analytical methods to trace the nonlinear behavior of the composite beams were developed.

"Spatial Buckling Behaviour of High-Rise Rack Frames," L.H. Teh, G.J. Hancock and M.J. Clarke

The paper summarizes a study for global buckling behavior of high-rise rack frames composed of thin-walled open sections. It is concluded that the simple element used in many commercial programs for 3D frame analysis is not sufficiently refined for accurate linear buckling analysis of high-rise steel storage rack frames.

"Structural Stability of Braced Scaffolding and Formwork with Spigot Joints," J. Enright, R. Harriss, A.T. Kearney, G.J. Hancock

The paper describes tests on sub-assemblages of scaffolding with and without spigot joints. The results are compared with a nonlinear inelastic finite element frame analysis. Conclusions are given regarding the modeling of spigot joints and the effect of the spigot joints on the strength of scaffolding systems.

"Dynamic Behaviour of Residential Floor Systems Using Cold-Formed Steel Joists," L. Xu, Z. Ling, W.C. Xie, Y. Liu, and R.M. Schuster

Presented are the results of a recent study on the performance of residential floors supported by cold-formed steel C-sections. Test results are presented and compared with analytical results.

"Optimum Design of Cold Formed Steel Residential Roof Trusses," L. Xu, H. Min, and R.M. Schuster

A computer-based optimal design approach for residential roof trusses using cold-formed steel C-sections is presented. Design examples are presented to demonstrate the applicability and efficiency of the proposed approach.

"Automated Design of Steel Trusses," S-Y. Chen, B. Mobasher, and S.D. Rajan

A software system was developed for the optimal design of roof truss systems. Numerical experience using the developed methodology shows that optimal designs can be obtained.

"Structural Behavior of Cold-Formed Steel Header Beams for Residential Construction," S.F. Stephens and R.A. LaBoube

An experimental and analytical study was conducted to determine the structural behavior of cold-formed steel header beams subjected to combined bending and interior-one-flange loading. Observations are made regarding the ability of the AISI specification to adequately estimate the load carrying capacity.

"L-Header Testing, Evaluation and Design Methodology," N.R. Elhajj, and R. A. LaBoube

For both gravity and uplift tests, the behavior of L-header assemblies was investigated. Based on the test results, design rules are proposed.

"Purlin Design to AISI LRFD Using Rational Buckling Analysis," M.J. Clarke and G.J. Hancock

This paper summarizes the existing two approaches to purlin design in the AISI specification, and it presents a third approach based on the use of elastic rational buckling analysis to determine the lateral buckling strength of the purlin system.

"The Racking Performance of Long Steel-Frame Shear Walls Under Monotonic and Cyclic Loading," A.J. Salenikovich, J.D. Dolan, and W.S. Easterling

The response of cold-formed steel-frame shear walls to lateral forces is the focus of this paper. Results are presented for both monotonic and cyclic tests of full-size shear walls with and without openings.

"Lessons from Recent Collapses of Metal Buildings," D.B. Peraza

Case studies of three roof collapses of metal buildings are presented. The significant features of each case study and the lessons learned are discussed.

"Estimation of Restraint Forces for Z-Purlin Roofs Under Gravity Load," M.C. Neubert and T.M. Murray

A new restraint force design procedure having a stronger reliance on engineering principles is proposed. The proposed procedure applies to five bracing configurations: support, third-point, midspan, quarter point, and third-point plus support restraints.

"Yield Strength Increase of Cold-Formed Sections Due to Cold Work of Forming," P.A. Sloof and R.M. Schuster

The purpose of the study was to resolve the difference in design approaches used by S136 and the AISI Specification. Based on the research findings, a design recommendation is formulated.

"The 1999 Supplement to the AISI Design Specification," R.L. Brockenbrough

The major items contained in the 1999 Supplement to the AISI Specification are summarized in this paper.

"Fire Resistance of Loadbearing LSF Assemblies," F. Alfawakhiri and M.A. Sultan

An analytical thermal-structural model for loadbearing steel framed walls exposed to fire on one side is presented. The model illustrates how different heating regimes in cold-formed steel studs cause different failure modes.

"Flexural Wrinkling Behaviour of Lightly Profiled Sandwich Panels," M. Mahendran and D. McAndrew

A series of full scale experiments and finite element analyses were conducted to evaluate the effects of lightly profiled faces and transverse joints on the flexural wrinkling stress of panels. Details of the study and its findings are presented.

"Knee Joints in Cold-Formed Channel Portal Frames," J. Mills

A testing program investigated the performance of knee joints used in C-section portal frames. Design recommendations are proposed based on the findings of the study.

"A General Design Rule for Bearing Failure of Bolted Connections Between Cold-Formed Steel Strips," K.F. Chung and K.H. Ip

The results of a finite element investigation on the structural performance of cold-formed steel bolted connections are presented. Design expressions for the resistance contributions due to both bearing and friction actions are given.

"Experimental Investigation of Cold-Formed Steel Beam-Column Sub-Frames," M.F. Wong, and K.F. Chung

The paper presents the findings of a test program on the investigation of the structural performance of bolted moment connections in beam-column sub-frames.

"Evaluation of Cold-Formed Steel Connections Attached with Pneumatically Driven Pins," S.W. Baur and W. Suaris

An experimental study was conducted to examine the shear and tensile strength of pneumatically driven pin connections. The design equations developed in this study can be used to predict the strength of pneumatically driven pin connections.

"Pull-through Failure of Crest-fixed Steel Claddings Initiated by Transverse Splitting," D. Mahaarachchi and M. Mahendran

A series of two-span cladding tests were conducted on crest-fixed steel cladding systems under simulated wind uplift loads. The findings obtained from this test program are summarized.

"Cyclic Pull-out Strength of Steel Roof and Wall Cladding Systems," M. Mahendran and D. Mahaarachchi

A series of constant amplitude cyclic tests were performed on screw connections into steel battens/purlins. The paper presents the details of the tests and the findings.

"The Development of an Australian Standard for Stainless Steel Structures," K.J.R. Rasmussen

The paper describes the recent development of an Australian standard for cold-formed stainless steel structures. The standard is based on ANSI/ASCE-8 but augmented to provide design rules for cold-formed hollow sections and welded connections.

"Mechanical Properties of Cold Formed Stainless Steel Lipped Channels," M. Macdonald, J. Rhodes, and G.T. Taylor

Described and discussed are the results obtained from a series of tensile tests performed on cold-formed stainless steel Type 304 members of lipped channels.

"Buckling of Cold Formed Stainless Steel Columns Under Concentric and Eccentric Loading," J. Rhodes, M. Macdonald, and W. McNiff

A series of compression tests were performed on stainless steel Type 304 columns of lipped channel cross section. The results are compared to the design specifications in America and in Europe.

"Distortional Buckling of Cold-Formed Stainless Steel Compression Members," A. Liang, G.J. van den Berg, and R.F. Laubscher

The critical buckling strength of cold-formed steel stainless steel compression members, with special emphasis on the method developed by Lau and Hancock for distortional buckling is discussed.

"Eccentrically Loaded Bolted Connections for Type 304 and 3CR12 Stainless Steel Lipped Channels," Q.C. Oliphant, G.J. van den Berg, and P. van Tonder

The results of a study on eccentrically loaded bolted connections in lipped channels are presented. The steels used in the study are AISI Type 304 and Type 3CR12 stainless steel.

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