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Wei-Wen Yu Center for Cold-Formed Steel Structures

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In the first issue of the *CCFSS News* dated August 1990, it was stated that one of the primary objectives of the center is to provide effective and efficient technical services to engineers, researchers, steel producers, product manufacturers, building officials, government agencies and other interested individuals. To attain this particular goal, *Technical Bulletins* will be published with the *CCFSS News* as needed beginning this issue of the newsletter.

The contents of the bulletin may include newly developed design provisions, specification interpretations, design examples, new test procedures, recent technical publications and other interesting items.

The following two subjects resulted from the January 22-25, 1992 meeting of the AISI Committee on Specifications:

## 1. Interpretation of Section C3.1.3 of the 1989 Addendum to the 1986 Edition of the AISI Specification

*Question asked by Gary Nichols of Southern Building Code Congress International Inc., Birmingham, Ala.*

We are requesting an interpretation of Section C3.1.3 of the 1989 Addendum to the 1986 *AISI Specification for the Design of Cold-Formed Steel Structural Members*. Our question concerns determining the design moment for continuous span purlin systems which are lapped over the supports. Should the design moment be determined assuming a constant cross-section between supports (ignoring increased stiffness at lapped regions near the supports) or should the moment be determined based on increased stiffness in the lapped regions?

## B. Interpretation by the AISI Committee on Specifications:

You ask if it is appropriate to apply the provisions of Section C3.1.3 to moments obtained from an elastic analysis taking into account the increased stiffness of the purlin system at supports due to lapping of the purlins since the test results on which the provisions are based were verified by comparing them to the calculated moment for a constant section member.

Your request was submitted to Sub-

committee 5 on Channels and Z-Sections for review and recommendation. The following interpretation and explanation was made by the subcommittee and approved by the Committee on Specifications by letter ballot.

For the nineteen tests used to verify the provisions of Specification Section C3.1.3, the ratio of moment calculated from test results (without considering the additional stiffness at the laps) to moment predicted by the specification varied from 1.19 to 0.84 with a mean of 1.01 and a coefficient of variation of 8 percent. This is considered excellent correlation. The moments from the test results were recalculated using an elastic analysis taking the additional stiffness into account. The ratios of these moments to the moments predicted by the specification varied from 1.13 to 0.81 with a mean of 0.96 and a coefficient of variation of 8 percent.

The variation between the moments obtained by the two methods is less than the normal test scatter in the verification procedure and is not considered significant.

It is, therefore, appropriate to apply the provisions of Section C3.1.3 of the 1989 Addendum to the 1986 Specification to moments obtained from either of the following methods:

- i. Elastic analysis which accounts for the additional stiffness of the purlin system due to lapping of the members, or
- ii Elastic moments neglecting the additional stiffness due to lapping.

The method of analysis chosen must be left to the judgement of the designer.

## 2. Test Methods for Mechanically Fastened Cold-Formed Steel Connections

During recent years, the use of various new types of mechanical fasteners in cold-formed steel construction results in the need for standardized tests for cold-formed steel connections. The AISI Committee on Specifications approved a new document at its January 1992 meeting. It provides the requirements for testing and evaluating the mechanically fastened connections, in which the fasteners are either in

shear or in tension. These test procedures for mechanically fastened cold-formed steel connections were developed by Subcommittee 6 on the basis of the test methods successfully used in the past. The objective is to evaluate actual field connections using standard or alternate test specimens and fixtures.

This new document contains the following ten sections: 1. Scope, 2. Applicable Documents, 3. Terminology, 4. Significance, 5. Apparatus, 6. Test Unit, 7. Test Specimens and Fixtures, 8. Test Procedures, 9. Calculation, 10. Report, and References. The entire document will be included in Part VII of the future editions of the *AISI Cold-Formed Steel Design Manual*. Copies of the document titled "Test Methods for Mechanically Fastened Cold-Formed Steel Connections" can be obtained from American Iron and Steel Institute, 1101 17th Street, NW, Suite 1300, Washington, DC 20036-4700, USA.

## Publications

The following are some of the publications related to cold-formed steel structures published during 1991. Please notify the Center of additional publications.

- ### A. Specifications, Design Manuals, Reference Books, and Textbooks.
- *LRFD Cold-Formed Steel Design Manual*, American Iron and Steel Institute, 1991 Edition.
  - *Preliminary Design Guide for Cold-Formed C- and Z-Members*, American Iron and Steel Institute, March 1991.
  - *Cold-Formed Steel Design Computer Programs*, American Iron and Steel Institute, June 1991.
  - *Automotive Steel Design Manual*, American Iron and Steel Institute, Revision 3, February 1991.
  - *Composite Deck Design Handbook*, by R. B. Heagler, L. D. Luttrell, and W. S. Easterling, Steel Deck Institute, 1991.
  - *Lightweight Steel Framing Design Manual*, Canadian Sheet Steel Building Institute, CSSBI 51M-91.



- *Design in Cold-Formed Steel*, Canadian Sheet Steel Building Institute and University of Waterloo, 1991.
- *Specification for the Design of Cold-Formed Stainless Steel Structural Members*, ANSI/ASCE-8-90, American Society of Civil Engineers, 1991.
- *Cold-Formed Steel Design*, by W. W. Yu, Textbook, John Wiley & Sons, 1991.

**B. Journal of Structural Engineering, American Society of Civil Engineers.**

- "Uplift Capacity of Z-Purlins," by R. A. LaBoube, Vol. 117, No. 4, April 1991, pp. 1159-1166.
- "Cold-Formed Steel Channel Struts," by E. Murtha-Smith and P. Magyar, Vol. 117, No. 4, April 1991, pp. 1276-1295.
- "Effect of Residual Stress on Cold-Formed Steel Column Strength," by C. C. Weng, Vol. 117, No. 6, June 1991, pp. 1622-1640.
- "Shear Strength of Composite Plate Girders with Web Cutouts," by T.M. Roberts and R. I. M. Al-Amery, Vol. 117, No. 7, July 1991, pp. 1897-1910.
- "T-Joints in Rectangular Hollow Sections Subject to Combined Actions," by X. L. Zhao and G. J. Hancock, Vol. 117, No. 8, August 1991, pp. 2258-2277.
- "Elasto-Plastic Interaction Buckling of Cold-Formed Channel Columns," by Y. L. Guo and S. F. Chen, Vol. 117, No.8, August 1991, pp. 2278-2298.
- "Thin-Walled Cold-Formed Steel Composite Beams," by R. P. Nguyen, Vol. 117, No. 10, October 1991, pp. 2936-2952.
- "Interaction of Local and Overall Instability of Compressed Box Columns," by S. Zuyan and Z. Qilin, Vol. 117, No. 11, November 1991, pp. 3337-3355.
- "Cold-Formed Steel Z-Sections with Sloping Edge Stiffeners under Axial Load," discussion by R. A. LaBoube, Vol. 117, No. 12, December 1991, pp. 3831-3832.

**C. Journal on Thin-Walled Structures, (J. Rhodes and K. P. Chong, eds.), Elsevier Applied Science.**

- "Web Crippling of Multi-web Deck Sections," by J. Studnicka, Vol. 11,

No.3, 1991, pp. 219-231.

- "Postbuckling Interaction Analysis of Cold-Formed Thin-Walled Channel Sections by Finite Strip Method," by Y. L. Guo and S.F.Chen, Vol. 11, No. 3, 1991, pp. 277-289.
- "Two-Beam Model for Static Analysis of Mono-Symmetric Thin-Walled Cantilevers," by B. S. Smith and W. Jesien, Vol. 11, No. 4, 1991, pp. 343-358.
- "The Elastic Buckling Behaviour of a Multi-celled Panel under Almost Pure Bending," by S. C. Tillman and A. F. Williams, Vol. 11, No. 4, 1991, pp. 359-373.
- "Energy Dissipation and Associated Failure Modes when Axially Loading Polygonal Thin-Walled Cylinders," by A. G. Mamalis, D. E. Manolakos, A. K. Baldoukas, and G. L. Viegelaahn, Vol. 12, No. 1, 1991, pp. 17-34.
- "Buckling of Plates with a Hole under Tension," by S. Shimizu, S. Yoshida, and N. Enomoto, Vol. 12, No. 1, 1991, pp. 35-49.
- "Stability of Rack Structures," by G. M. Lewis, Vol. 12, No. 2, 1991, pp. 163-174.
- "A Nonlinear Elastic Spline Finite Strip Analysis for Thin-Walled Sections," by Y. B. Kwon and G. J. Hancock, Vol. 12, No. 4, 1991, pp. 295-319.
- "Interactive and Local Buckling of Thin-Walled Members," by P. K. Basu and M. N. Akhtar, Vol. 12, No. 4, 1991, pp. 335-352.
- "Interactive Buckling of Beams in Bending," by C. M. Menken, W. J. Groot, and G. A. J. Stallenberg, Vol. 12, No. 5, 1991, pp. 415-434.

**D. Steel Structures - Recent Research and Developments, (S. L. Lee and N. E. Shanmugam, eds.), Elsevier Applied Science, May 1991.**

- "Design of Purlins Accounting for Torsional Restraint from Screw Fastened Sheeting," by G. J. Hancock, N. L. Ings, and N. S. Trahair, pp. 60-71.
- "Plastic Deformations in Cold-Bent HSS Members," by J. B. Kennedy, pp. 72-83.
- "Some Interesting Phenomena which Can Occur in Light Gauge Steel

Members," by J. Rhodes, pp. 128-139.

- "American LRFD Design Criteria for Cold-Formed Steel Structural Members," by L. E. Hsiao, S. H. Lin, W. W. Yu, and T. V. Galambos, pp. 140-151.
- "The Strength of Built-Up Type 3CR12 Corrosion Resisting Steel Axially Loaded Compression Members," by P. J. Bredenkamp, G. J. Van den Berg, and P. Van der Merwe, pp. 275-287.
- "The Behaviour of Thin-Walled I-Section Columns," by A. J. Davids and G. J. Hancock, pp. 382-395.
- "Elasto-Plastic Interaction Buckling in Cold-Formed Box Beam-Column," by Y. Guo, pp. 396-405.
- "The Flexural Behaviour of Thin-Walled Singly Symmetric Columns," by K. J. R. Rasmussen and G. J. Hancock, pp. 406-417.
- "A Bearing System of Cold-Formed Sheet Steel Elements for Industrialized Housing," by J. O. Bats, pp. 418-428.
- "Bending Behaviour of Long-Span Steel Sheeting: Test and Simulation," by A. de Martino, A. Ghe R. Landolfo, and F. M. Mazzolani, pp. 429-438.
- "Collapse Behaviour of Edge Stiffened Thin-Walled Sections," by L. K. Seah, J. Rhodes, and B. S. Lim, pp. 439-450.
- "The Behaviour of Thin-Walled Frame Systems," by S. H. Tan and J. Rhodes, pp. 451-460.
- "A Quintic Finite Strip for Thin-Walled Structures," by P. W. Khong and J. Rhodes, pp. 461-470.
- "Experimental Investigation of Connection Behaviour in Light Gauge Racking Systems," by S. Parsanejad and T. Anderson, pp. 543-553
- "Tensile Strength of Arc Spot Weld Connections," by R.A. LaBoube and W.W. Yu, pp. 643-651.