ULTIMATE COMPRESSIVE CAPACITY OF A "K"-BRACE CONNECTION DETAIL

Re-issue of CISC Technical Memorandum No. 5, 1985.02.22

January 9, 2002

To: CISC Fabricator, Associate Erector, Detailer, Professional and Technical Members

Re: CISC Technical Memorandum No. 5, 1985.02.22

Ultimate Compressive Capacity of a "K"-Brace Connection Detail

In 1985, CISC issued the following Technical Memorandum No. 5 to all CISC Chief Contacts. Since that time the industry has undergone significant change. Therefore, due to the importance of the information contained in this memorandum, it is being re-issued so that it be brought to the immediate attention of all involved and appropriate action taken. Subsequent to the original issue of the Technical Memorandum, the following technical papers related to this topic have been published.

1) Bjorhovde, R. and Chakrabarti, S.K., Tests of Full-Size Gusset Plate Connections, J. of the Struct. Div., ASCE 111(3), 1985, pp.667-686.

2) Cheng, J.J.R., Yan, M., and Hu, S.Z., Elastic Buckling Strength of Gusset Plate Connections, J. of Struct. Engrg., ASCE, 120 (2), 1994, pp. 538-559.

3) Gross, J.L., Experimental Study of Gusseted Connections, Engrg. J., AISC, 27(3), 1990, pp. 89-97.

4) Yamamoto, K., Akiyama, N., and Okumura, T., Buckling Strength of Gusseted Truss Joints, J. of the Struct. Div., ASCE, 114(3), 1988, pp. 575-590.

5) Hu., S.Z. and Cheng, J.J.R., Compressive Behavior of Gusset Plate Connections, Struct. Engrg. Rep. No. 153, Dept. Of Civil Engrg., Univ. of Alberta, 1987, p. 148.

Yours truly,

Michael I. Gilmor, P.Eng.,
Vice-President Operations

CISC TECHNICAL MEMORANDUM NO. 5

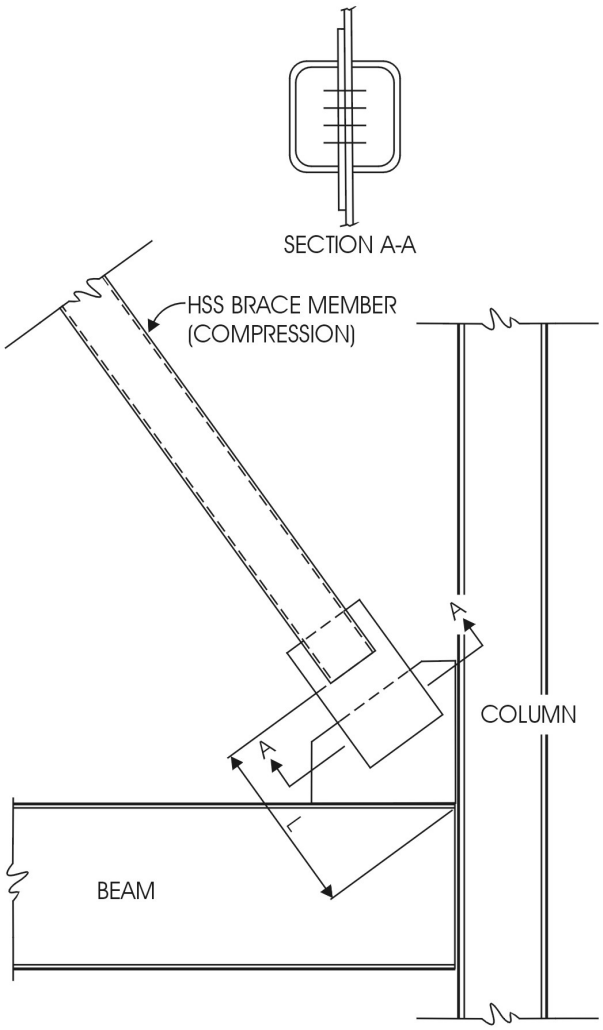
Re: Ultimate Compressive Capacity of a "K" Brace Connection Detail

Sketch "A" on the attached sheet shows part of a "K" brace joint detail. The brace member is a large hollow structural section (HSS), and the connection consists of a flat plate welded into a slot in the HSS. The HSS and the connection plate are connected to the gusset plate at the beam-column joint with bolts in a simple lap splice.

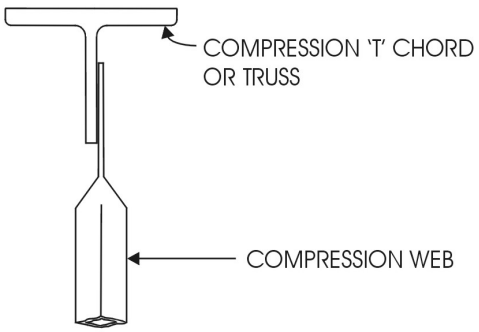
Although this type of detail has been used successfully in "X"-bracing systems for tensile loads, its use in "K"- bracing under compressive loads had come under scrutiny. It has been reported that this detail has failed in compression in a structure in Canada. A detailed analysis, such as a finite element, together with an actual test of a full-size specimen have shown that using an effective length factor, K, of 1.2, a length, L, measured from the end of the tube to the point where the centre line meets the supporting beam or column flange, and designing the connection solely for axial load significantly overestimates the ultimate capacity of this detail. The actual failure load measured in the test was only 75% of the specified (working) load. Significant lateral deflection of the gusset plate at low loads was observed in the test due to the eccentric line of action of the forces.

Although specific design recommendations for the detail shown are not available at this time, the use of a stiffener is highly recommended.

Sketch "B" shows a somewhat similar detail of a connection of a crimped square HSS to the stem of a "T" compression cord. A failure of such a truss, also in Canada, is recorded in the technical literature. Although the actual cause of failure is still to be determined, susceptibility to a similar mode of failure as described for the detail in Sketch "A" can be envisaged.



Sketch 'A'



Sketch 'B'