Steel Interchange

Steel Interchange is an open forum for *Modern Steel Construction* readers to exchange useful and practical professional ideas and information on all phases of steel building and bridge construction. Opinions and suggestions are welcome on any subject covered in this magazine. If you have a question or problem that your fellow readers might help to solve, please forward it to *Modern Steel Construction*. At the same time feel free to respond to any of the questions that you have read here. Please send them to:

Steel Interchange
Modern Steel Construction
1 East Wacker Dr.
Suite 3100
Chicago, IL 60601

Answers and/or questions should be typewritten and double spaced. Submittals that have been prepared by word-processing are appreciated on computer diskette (either as a wordperfect file or in ASCII format).

The opinions expressed in *Steel Interchange* do not necessarily represent an official position of the American Institute of Steel Construction, Inc. It is recognized that the design of structures is within the scope and expertise of a competent licensed structural engineer, architect or other licensed professional for the application of principles to a particular structure.

Information on ordering AISC publications mentioned in this article can be obtained by calling AISC at 312/670-2400 ext. 433.

A quick equation for calculating Rigid Frame Displacement from Lateral Loads without resorting to a computer:

It is sometimes necessary to rapidly calculate a rigid frame displacement from the lateral load without the computer application.

Simple theoretical formulas are presented below; they were derived using a moment-area theorem for symmetrical rectangular frames.

Nomenclature:

h = frame height
I_{BM} = moment of inertia of beam
I_{COL} = moment of inertia of column
L = frame span
P = lateral load
E = modulus of elasticity
Δ = displacement

For two-hinged frame (Figure 1):

$$\Delta = \frac{Ph^2}{6E}\left(\frac{h}{I_{COL}} + \frac{L}{2I_{BM}}\right)$$

For fully fixed frame (Figure 2):

$$\Delta = \frac{Ph^3}{12EI_{COL}}\left(\frac{3K+2}{6K+1}\right)$$

$$K = \left(\frac{I_{BM}}{I_{COL}}\right)\left(\frac{h}{l}\right)$$

These simple formulas could be very useful even in the age of computers. The book, *Rigid Frame Formulas* by A. Kleinlogel is a very good reference.

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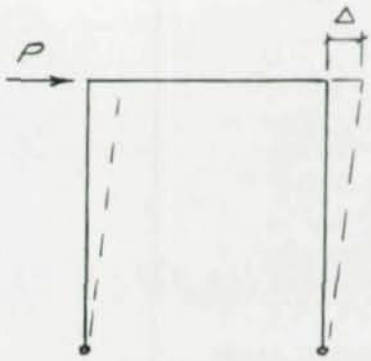

Fig.1 Two-hinged frame

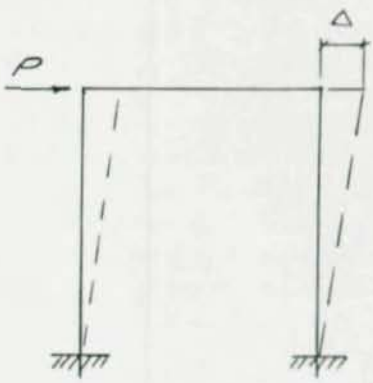

Fig.2 Fully fixed frame

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New Questions

Listed below are questions that we would like our readers to answer or discuss. If you have an answer or suggestion please send it to the Steel Interchange Editor. Questions and responses will be printed in future editions of Steel Interchange. Also, if you have a question or problem that readers might help solve, send these to the Steel Interchange Editor.

Connection Holes

Does anyone have any information pertaining to the acceptability of burning connection holes in connection material using an automated burning device? AISC only addresses the burning of short and long slots and indicates that it is acceptable with proper cleanup.

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Weld Considerations

In developing the strength of a connection or the required length of weld to develop the member strength, the welds "a" and "b" were first considered (see diagram at right). These welds were parallel to the load. Then as the codes and research continued weld "c" was included, thus increasing the capacity of the member. Later weld "d" was introduced.

However, in the current AISC design criteria (Allowable Stress Design and Load and Resistance Factor Design) this weld has not been addressed. Upon questioning AISC, I was referred to the American Welding Society Code. Upon examination weld "d" was omitted here as well. Additionally, my review of current materials on this particular subject has yielded no further information.

Questions:

A. Can weld "d" be used to develop or determine the strength of the connection (member)?

B. If weld "d" is used to develop the strength of the connection, are there restrictions or parameters that must be placed on the weld (i.e. placement, size, etc.)?

C. Does weld "d" take away from the joint efficiency (strength)? With "d" there is a concentrated area of weld, inducing large amounts of heat because of the welding process. Because of this introduction of heat, material properties are altered resulting in members which are less ductile than ASTM A36 steel.

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