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Design of Framed-Opening System

Summary

The framed-opening system consists of joist clamps, framing members (channels), T-brackets and bolts. The joist clamps connect the primary channels to the top chords of the joists. The T-brackets connect the secondary channels to the primary channels. Both the joist clamps and the T-brackets have slots. The slots, in combination with spaced holes in the channels' webs, permit adjustment of the framed opening's length and width. The position of the opening between joists can also be adjusted by means of the slots and holes.

Analysis of the joist clamp indicates that it can support an allowable load of at least 1,200 lbs. This is the load that can be applied in addition to the framing weight. The maximum load applied in testing was 3,940 lbs. The failure load was not reached. Analysis and testing considered the bolts, between channel and clamp, to be at the most severe location in the slots.

Analysis of the T-bracket indicates an allowable load of substantially more than 1,200 lbs. A test load of 2,000 lbs was applied with no failure.

The tested framing system used hot-rolled C5 x 6.7 channels (5" deep, weighing 6.7 pounds per foot and made with A36 steel, which has a minimum specified yield of 36 ksi). The maximum span tested was slightly more than 10'. Using the 2005 edition of the AISC Specification, an allowable of 1,230 lbs was calculated for a load applied at the middle of the test span. This assumes the channels to be unbraced over their entire span. The value of C_b was conservatively taken to be one. A maximum test load of 4,660 lbs was attained.

For a better comparison of the test load to the predicted maximum load, a reduced value of test load was calculated. The actual test load was multiplied by the ratio of the minimum specified yield stress to the estimated actual yield. This is a conservative adjustment for the approximately 10' span because this unbraced length is close to the transition from inelastic to elastic buckling. To account for the effect of moment gradient in the test, a more accurate value of C_b , greater than one, was used to calculate an adjusted (increased) value of allowable load. The ratio of the reduced test load to the adjusted allowable load was found to exceed the desired safety factor of 2.0.

Jan. 2008
060874