Now You See It...

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Column shapes that aren't listed in the tables in the *Steel Manual* aren't off-limits, but there are important connection considerations.

KEEPING ON TOP OF W-SHAPE CRITERIA IS A MUST, as select W-shape columns have disappeared from and reappeared in the *Steel Manual's* tables from edition to edition. For example, allowable axial loads and design axial strengths for selected W4, W5, W6, and W8 column members in compression were provided in the 9th edition ASD manual and the 2nd edition LRFD manual. However, the design strengths in axial compression for these members were eliminated by the AISC Committee on Manuals and Textbooks from the tables in the 3rd edition LRFD manual. The primary reason was the difficulty and associated costs encountered when connecting W-shape members to these column sections. While W8 shapes have been reinstated in the 13th edition's Table 4-2, Available Strength in Axial Compression, these shapes do present difficulties in connecting framing members.

Conventional two-sided connections, such as double-angle and shear end-plate connections, cannot be used when connecting to the web of W4, W5, and W6 columns, due to dimensional properties of the sections. Figure 1 illustrates critical column dimensions restricting use of the conventional connections for W4, W5, W6, and W8 columns.

It's important to address the difficulties and limitations of connecting W-shape members to W6 columns, with the understanding that the connection difficulties escalate when connecting to the smaller sizes. Connections to the webs of these columns are essentially limited to extended single-plate connections. T-distances eliminate the use of two-sided double-angle and shear end-plate connections. Under limited conditions, a shear-end plate connection may be used for connecting W-shape members to the web of W6 columns. The shear-end plate width is limited to the column T-distance (4½ in.), so the bolt diameter is limited to ⅝ in. in diameter to provide adequate clearances for tightening the bolts and to provide adequate bolt edge distances. As shown in Figure 2(a), seated connections cannot be used to connect W-shape members to the W6 column webs. Column flange widths and T-distances simply do not allow access for welding the seat angles to the column webs. In essence, connections to the column webs are limited to extended single-plate connections in conjunction with conventional single-plate connections to the column flanges as shown in Figure 2(b). Extended single-plate connections can be used for both square and skewed framing.

Although W8 columns that were eliminated from the compression

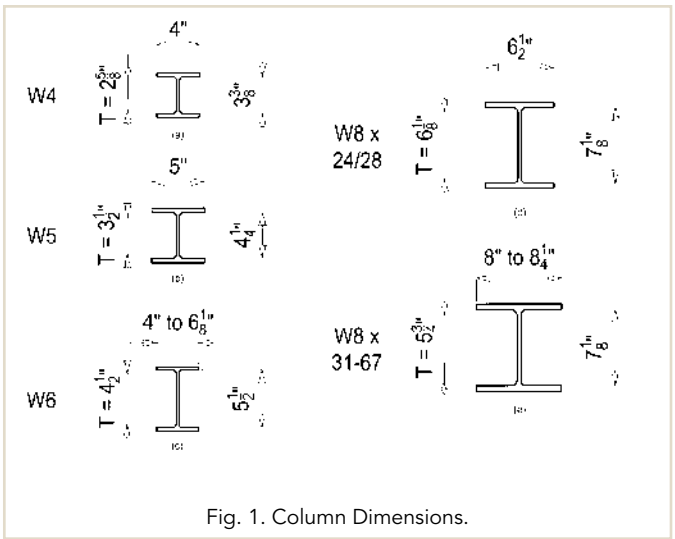

Fig. 1. Column Dimensions.

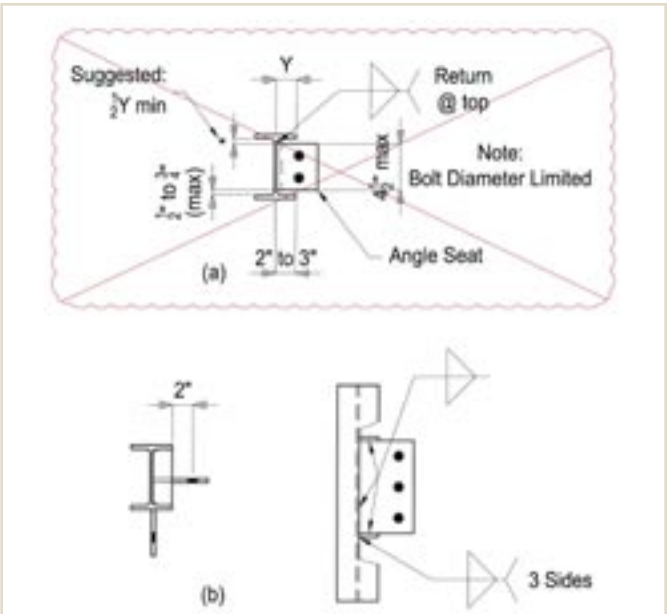

Fig. 2. W6 Columns.

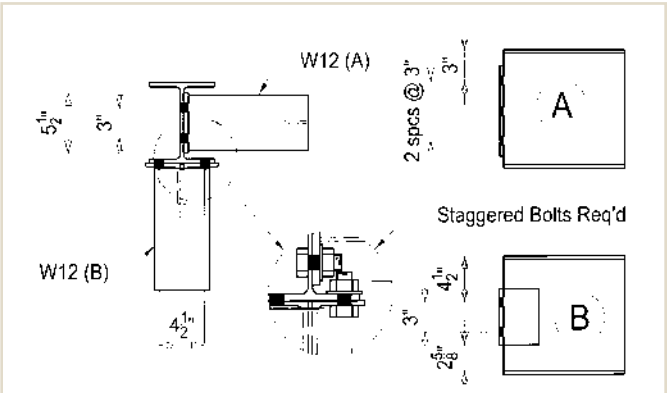

Fig. 3. W8 Columns.

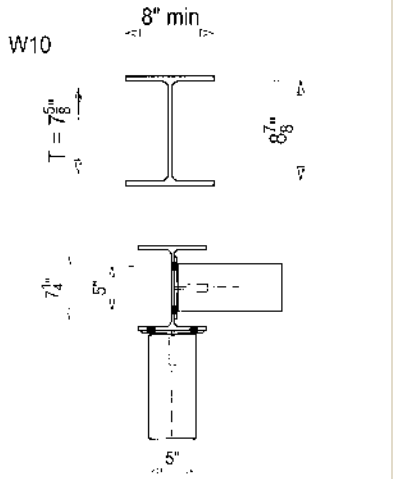

Fig. 4. W10 and Deeper Columns.

strength tables in the 3rd edition manual have been reinstated in the 13th edition, these sections also present difficulties for connecting W-shaped members. End-plate connections should be used for two-sided connections to the column webs instead of double-angle connections due to the T-distance limitations for W8 columns. Bolts must also be staggered to prevent interferences between the bolts to the column flanges and the bolts to the column webs. Staggering prevents using the maximum number of rows within the flanges of most W-shape members framing to the W8 columns. This condition decreases the available connection strengths of the framing members and is illustrated in Figure 3.

Use of W10 and deeper columns eliminates the need for special connections and allows the use of conventional two-sided double-angle and shear end-plate connections. Connection costs are decreased when these conventional connections are used. Conventional connections to W10 columns are illustrated in Figure 4.

Even though the available column strengths for W4, W5, and W6 columns have been removed from the tables, designers are not prohibited from using these sections, if necessary. However, they should be aware that using these sections results in increased fabrication costs that may substantially exceed the savings they provide in material costs. Slenderness criteria for compression elements must be determined using the 13th edition AISC *Specification for Structural Steel Buildings* Section B4 with strength reductions determined by Section E7. MSC

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