LESSON OBJECTIVES

1. Compute the adequacy of any steel member subjected to combined axial and bending, considering all three possible bending “weak links” (e.g., in bending, plastic bending, local buckling, and lateral-torsional buckling) using the bilinear interaction (equations H1-1a and H1-1b)

REFERENCE

- AISC H1 and H2
- Any references needed for bending and axial, individually, are needed in combined bending-axial.

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### Table 4–1 (continued)

**Available Strength in Axial Compression, kips**

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Table 3–10 (continued)

W Shapes

Available Moment vs. Unbraced Length

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$G_y = 1$

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Unbraced Length (0.5-ft increments)
Table 3-4 (continued)  

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**ASD**  
LRFD

$^f$ Shape exceeds compact limit for flexure with $F_y = 50$ ksi.
Homework (Due Wednesday. Standard Assignment).
Consider PM, only, for all problems (do not consider shear or deflection). Assume Preferred Material Specifications.

1. Determine whether the beam-column (combined bending-axial) shown is adequate per ASD.
   Given: The pin-ended W12x96 A992 member is subjected to ASD applied end moments and forces, as shown. Bending is about the strong axis, only. For second-order effects, take the $B_{1x}$ (moment magnifier) to be 1.05.

2. Determine how much live load can safely be applied (per ASD) to the beam-column if it is subjected to its own uniform self-weight, plus a uniform live load, while also subjected to 30 kips axial load. Bending is about the x-x axis and the material is A992. The W21x48 beam is laterally braced at its ends, only. For second order effects, assume $B_1 = 1.05$.

3. Repeat the previous, except now the beam is considered to have continuous lateral bracing.

4. The top chord of the roof truss shown is composed of W10x33 members, in strong-axis bending. Because the W10x33 supports a roof deck, it is considered to have continuous lateral support. Determine if the W10x33 is adequate per ASD for the worst location. Take $B_1 = 1.05$. All connections are pins. HINT: You will need to recall your knowledge of Tributary Areas & Load Path in order to do a truss analysis; e.g., the distributed load is carried by the W10 members to joints, resulting in 44kips applied to interior top-chord joints and 22kips applied to the end top joints. With this, you can do a truss analysis to obtain the maximum top chord force. In addition to this, you need to consider the top chord to be a simple span (between pinned truss joints) in order to obtain the maximum moment. ANOTHER HINT: Method of Sections is probably much easier than Method of Joints. FINAL HINT: What is the controlling KL? What is $L_b$?