On this date, 1989: The Berlin Wall came down. The world changed in a minute. I barely noticed. I think I had an exam that day and another exam the next day. Familiar?

LESSON 31: THE END OF STEEL BEAMS
Wednesday, November 9, 2016

EXAM 5 FRIDAY (STILL OK?). IT WILL COVER LESSONS 24 TO 29. A Q&A session will be held at 8pm on Thursday.

LESSON OBJECTIVES
1. Design a rolled beam, considering bending moment, shear, and deflection.
2. List and Apply the limitations of each of the AISC Part 3 design aid to beam design/analysis problems (continued from Lesson 30).
3. Select a steel beam using the AISC Part 3 design aids, as applicable, using the easiest legitimate method (continued from Lesson 30).
4. Use the Principle of Superposition and the Table 3-23 formulae to determine the deflections of beams.
5. Evaluate LTB problems for continuous beam spans in which a slab only provides lateral support of the compression flange.

READING:
SEGUI: pp. 189 to 244.

REQUIRED REFERENCES
- AISC Part 3 Design Aids. Notably: Table 3-1 (C_b factors), Table 3-2 (Z_x Table for W-Shapes), Table 3-3 (I_x Table for W-Shapes), Table 3-4 (Z_y table for W-Shapes in weak-axis bending), Table 3-6 (Maximum Uniform Load Tables), Table 3-10 (W-Shapes vs. Unbraced Length), Table 3-23 Shears, Moments, and Deflections.

Homework (Due Monday. Standard Homework Assignment):
Use ASD, unless noted otherwise (problem 2). Note that it is customary to determine the C_b factor based on the moment diagram that does not consider beam self-weight (as this affects the shape of the moment diagram very little and the self-weight is typically unknown until the design has been selected).

0. (on your own. Do not hand in). A simply-supported A992 wide-flanged I-shape is bent about its weak axis by a uniform load of 1 klf, in addition to its self-weight, over a span of 10-ft. Select the lightest section, considering moment, only.

Thoughts:
- Should/could Table 3-10 be used?
- Can Table 3-6 be used?
- Can Table 3-2 be used?
- Can Table 3-4 be used?
  (answer: W8x21)
1. The I-section consists of a \( \frac{1}{2}'' \times 18'' \) web and 1''x10'' flanges
   a. Reviewing Strength of Materials, if it is subjected to an applied vertical shear force of 100 kips, determine the elastic shear stress for \( y = 0, 5, 9, 9.5, 10 \) inches and plot a graph of \( \tau \) versus \( y \)-position.
   b. If the I-section is A572 material, determine the \( V_n/\Omega \) per AISC

![I-section diagram]

2. Segui 5.11-5a. Yes, LRFD, only. It is good to exercise those muscles. Use the easiest possible method (design aids).

3. Segui 5.6-1b. Consider moment, only. Which design aids are applicable?

4. Segui 5.10-5b. You will need to use AISC table 3-23.

5. The beam shown below supports a slab that prevents the top flange from moving laterally (in or out of the page), as slabs always do. However, the regions of negative moment are considered unbraced because the bottom flange is in compression without bracing. A, B, C, and D are simple supports. E and F are internal pins. All members are W21x44.
   a. Draw the moment, determine the controlling moment.
   b. Determine the maximum unbraced length, \( L_b \) and the \( C_b \) factor (considering the previous moment diagram).
   c. Determine if the W21x44 is adequate for maximum positive bending moment (it is considered braced for this position)
   d. Determine if the W21x44 is adequate for maximum negative bending moment (it is considered to have an unbraced length).

![Beam diagram]