Always go to other people's funerals, otherwise they won't come to yours. – Lawrence Peter "Yogi" Berra

LESSON 11: EXACT K-VALUES IN RIGID FRAMES – GA, GB METHOD
Wednesday, September 21, 2016

LESSON OBJECTIVES
1. Illustrate the influence of beam (girder) stiffness on the K value of columns in rigid frames.
2. Compute KL for a rigid frame using the “GA, GB method” and compute the nominal (Pn), allowable (ASD, Pa), and design (LRFD, \( \phi P_a \)) column strength.

REFERENCE AND READING
- AISC pp. 16.1-510 to 16.1-514 (Fig. C-A-7.1, C-A-7.2)
- AISC Chapter E (beginning on page 16.1-32)
- Review the course webpage for Monday’s “K-practice” powerpoint.
- TEXTBOOK: SEGUI PAGES 146 TO 151, particularly example 4.12 (note: Segui’s coverage of “inelastic effects on rigid frame buckling, found on pages 152 to 155, is not covered in CE311).

GA and GB Alignment Charts: To use – compute G at each end and connect values with a straightedge. Be sure that you are using the correct chart (braced or unbraced). See AISC pp. 16.1-512 to 16.1-513.

Note: AISC recommends that K not be taken less than 1, without a more rigorous analysis (which is beyond the scope of this course). Hence, when K is less than 1, report the value, but use K=1.

No Class on Friday, but the homework is still due Friday, so that it can be graded and returned by Monday.
HOMEWORK (Due Friday. This is the last lesson on Exam 2, so it needs to be handed in on Friday so that it can be graded and returned by Monday)

1. a. Given: All beam and column EI’s are the same and all lengths are the same. All connections are rigid, including the connection to the fixed foundation. For which column (A or B) would K be lower? Briefly explain.

b. Given: All beam and column EI’s are the same and all lengths are the same. All connections are rigid, except as noted. For which center column (A or B) would K be lower? Briefly explain.

c. Given: Beam and column EI’s are either “Big” or “Small”, as noted, but all lengths are the same. All connections are rigid, including the connection to the fixed foundation. For which left column (A or B) would K be lower? Briefly explain.

d. For the plane shown, what is the theoretical K value for column AB? Given: Fixed base (foundation), rigid (moment-resisting) column-girder connections. Girder is W16x26. Column is considered to have infinite EIx.
2. Determine the nominal buckling strength $P_n$ of:
   a. Column AB (between the ground and the 2nd floor)
   b. Column BC (between the 2nd floor and the roof)

Use exact K-values (AISC $G_a$, $G_b$ method).

**Given:**

The building is a simple-braced (all connections are pins) building in one direction (note the figures, below), but a rigid-unbraced frame in the other direction. Note the column orientations, carefully.

All story heights are 12-ft.

All columns are W10x33, A992 specification.

Beam sizes and spans: see figures, below. All beams are oriented in strong-axis bending, for the gravity loads.

**Simple-Braced Frame View.** All beams are 24'-long, W18x35

**Rigid-Frame View.** All beam-column connections are rigid. The longer beam span is 24’, with W18x35’s. The shorter beam span is 20’ with W16x26’s.
3. Spreadsheet Assignment. Given: An Excel workbook entitled “Lesson 11 Lab Tube Common Database” has been placed in each student’s network directory (same as in Lesson 10). This file simply contains the section database for the most commonly-used tube section in the CE311 Lab. Rename your Lesson 10 assignment “{YourName} Lesson 11 Assignment” and then copy the worksheet that contains the section database into this workbook. Make a copy of your Lesson 10 worksheet within this workbook, calling it “Lab Sized Columns.” See Example, below.

To “submit” this assignment, simply save it right where it is (in your folder on the network). Whatever is there, after the deadline, will be graded.

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1 This thing will be a huge help, in lab.