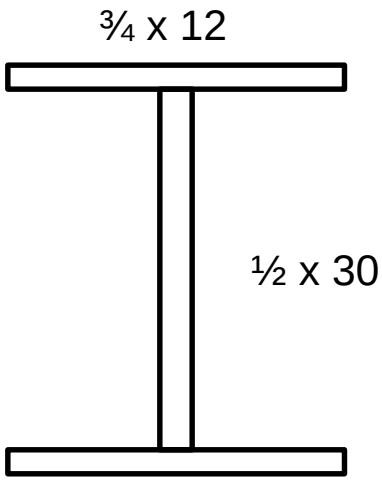
HW4 (Due April 25) CIVL 3131

Problem 1:

A simply supported built-up I-section beam of 28 ft span carries a concentrated load *P* at mid-span. The load is 20% dead load and 80% live load. Determine the maximum service load *P* that can be permitted to be carried. The beam is laterally braced at the two supports as well as the mid-span. Live load deflection may not exceed L/360 (*not* an *AISC Specification* requirement).



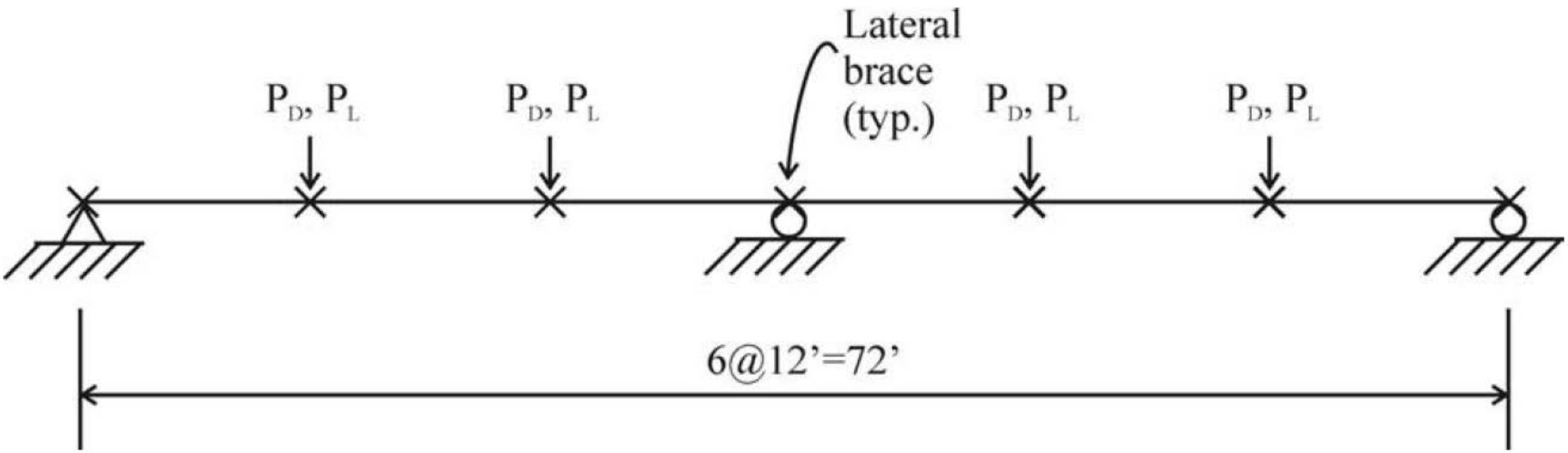
Problem 2:

- The two-span continuous girder shown below is subjected to the following unfactored loads:
  P_{DL} = 45 kips (dead)
  P_{LL} = 30 kips (live)
- For this problem, there is no live load reduction, but do consider “pattern loading” such that the member demands are maximized (two primary cases considering: positive moment in a span and negative moment at the center support).
- Consider self-weight of the member in the design, but self-weight need not be considered when calculating Cb.
- No deflection check is required.
- Lateral bracing is provided at the load and support points.
- Analysis may be conducted using tabulated solutions (such as Table 3-23 in the AISC *Manual)* or using computer tools (such as MASTAN2). If a computer program is used, do not submit many pages of output, but clearly summarize the key results.

a) Select the lightest W section (A992 steel) for the given loading. (Design tables in AISC *Steel Construction Manual* may be used to make your selection, but clearly document your procedures and present calculations that verify the design strength values from the table.)

b) For the critical loading case(s) that account for pattern loading, plot factored shear force and bending moment diagram

c) Calculate (do not refer to a table) the design shear strength and show that it is adequate.



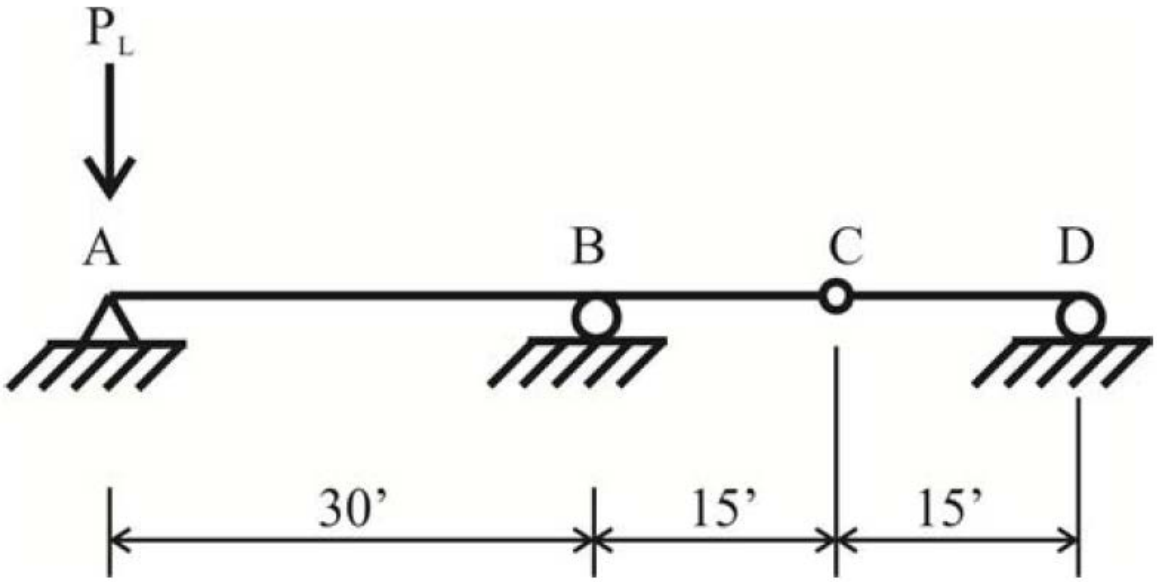
Girder Elevation

Problem 3:

A two-span beam has a large live load (P_L = 100 kips, unfactored) that can be placed anywhere between A and D. Since the dead load (beam self-weight) is small compared to the live load, it will be neglected in this problem. The beam has a hinge at C, is oriented for strong-axis bending and has both flanges laterally braced at A, B, C and D.

a) Identify two locations where P_L should be placed to maximize moment demand. For each load location, determine the (M_{max}, L_b, c_b) combination that will be used for design.

b) Choose the lightest W section (A992), F_y = 50 ksi) for the flexural demands from a). Check for shear.



Problem 4:

A critical stage of construction is shown in the photo. The contractor will need to temporarily place a 40 kip load on top of one of the beams at mid-span. These beams are pin-connected to the cantilevered girders. Choose the lightest A992 Gr 50 steel section to support this construction load. There is no deflection criteria. Ignore beam self-weight for this problem. Show all check!