Lab Objectives:
1. Illustrate the powerful influences of span length and structural depth on structural stiffness.
2. Illustrate the powerful influence of unbraced length on column buckling.
3. Estimate truss deflections using the moment of inertia of the top and bottom chords, applying beam deflection formulae.
4. Identify probable (but not assured) structural instability by identifying any planes within the structure that exclusively consist of pin-connected rectangles.
5. Identify real pinned-connection and rigid connections.

Schedule for Today
- Lab Expectations
- Small groups: Cost Estimating per 2017 Steel Bridge Rules
- Lesson: Structural Efficiency
  - Learn about important efficiency issues (structural depth, span, compression member length)
- Predict deflection of a uniformly-loaded truss and then load-test it.
- Discuss real pinned and rigid connections and their influence on stability.
- Identify pinned and rigid connections on the steel sculpture.

Homework (due next lab period)

Problem: Estimate the total cost of this bridge, according to the 2017 Rules; i.e., the sum of the Structural Efficiency and Construction Economy.

Given:
- The bridge uses the AC footings, as shown.
- The bridge is 20-ft-long
- The bridge meets all dimensional requirements and there are no penalties
- Assume a temporary pier will be used.
- The total bridge weight is 200 lbs
- Everything is made from 1” Square tubing with 1/16” wall thickness
- The top surface of the top chord is at the exact maximum height, allowed by the rules
- The bottom surface of the bottom chord is at the exact minimum clearance (over the river), allowed by the rules
- The bottom chord is composed of built-up girder sections like the ones shown in lab. The girder sections are exactly 6” deep, from top to bottom (therefore, the centroids of the 1” tubes are 5” apart)
- Assume 2-person-minutes per member to estimate Construction Economy.

GROSSLY SIMPLIFY THE LOADING & DEFLECTION TARGETS, AS FOLLOWS:
- Treat the 2400-lb load (which is actually applied over two 3-ft-wide grates that can have multiple locations) as a UNIFORMLY-DISTRIBUTED LOAD over the entire length.
- Treat the three deflection target locations, as follows (the actual deflection target locations are randomly located):
  - DbL and DbR are located at x = 10 ft (see figure, above)
  - DcL is located at x = 19 ft (see figure, above)

State any other assumptions that you believe need to be made.
Hand this sheet in at the beginning of Lab 2. Put answers in the boxes, only, but bring your work to lab on a separate page, for discussion.

1. What is the height of the top surface of the top chord?

2. What is the height of the bottom surface of the bottom chord (girder)?

3. Compute the moment of inertia of this bridge:

4. Compute DbL and DbR. Go to the Manual of Steel Construction, Table 3-23 (page 3-213) and use the appropriate formula for deflection.

5. Compute DcL. Go to the Manual of Steel Construction, Table 3-23 (page 3-213) and use the appropriate formula for deflection.

6. Compute the Structural Efficiency (cost):

7. Estimate the minimum number of members that would be in this bridge. Note: this is truly an estimate. Think carefully about member lengths and the limitation of the 4 x 6 x 36 inch box. Be prepared to illustrate your estimate with your teammates.

8. Based on the previous estimate and the 2-person-minute-per-member assumption, compute the Construction Economy (cost)

9. Compute the Total Cost