Assignment #2

Due: 28 March 2023

Problem 1

A weightless structure is subjected to lateral load. The beams and columns are both provided with longitudinal and transverse reinforcement. You may assume the following:

* The ACI strength reduction and load factors are satisfactory.

* Nominal strengths accurately represent mean expected strengths in flexure and shear. Furthermore, available dimensions, material properties, and rebar sizes are unlimited so that you will be able to select cross sections exactly matching desired sections. Of course, in practice you will be restricted in these aspects so that overstrengths will not be unusual.

* The upper bound to flexural resistance will be approximately 1.4 times nominal flexural strength for any member subjected to large deformations. The lower bound to shear resistance at this deformation level will be 0.75 times nominal shear resistance. (These subjects will be discussed further during later parts of the course.)

* Member strengths are checked at the faces of connections and along the span. Strength within the joint will be assumed adequate, even though this assumption frequently is incorrect.

(a) Assume the lateral load is due to a live load effect. Calculate required nominal flexural and shear strengths for the beam and columns, referring only to the maximum values along a member span.

(b) Assume the lateral load is due to an earthquake effect. Do not reduce the load shown to account for inelastic deformations. Provide strengths so that significant inelastic action will be restricted to beam flexure. Calculate required nominal flexural and shear strengths for the beam and columns, referring only to the maximum values along a member span.

(c) Tabulate results.

Required nominal strengths

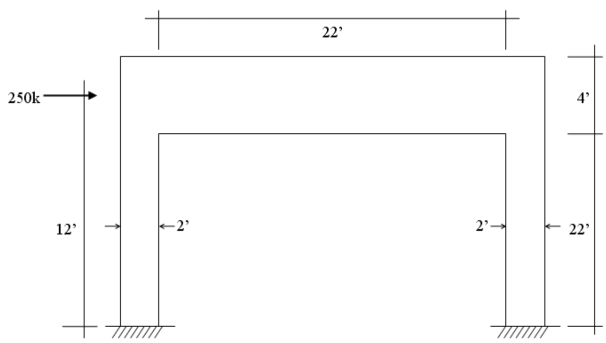
Loading Case	Beam		Column	
	Moment, k-in.	Shear, k	Moment, k-in.	Shear, k
(a) Live Load				
(b) Earthquake				

Problem 2

A #11 grade 60 bar is bent around a pin having a diameter equal to eight times the diameter of the #11 bar.

(a) Using standard bending theory, calculate the maximum tension strain in the bar. Do not get fancy: Simply assume plane sections remain plane, stress-strain relation in compression is equal to that in tension, and ignore any second-order effects such ad Poisson's ratio.

(b) I anticipate that you will find a strain in part (a) much beyond the minimum elongation requirement for a #11 grade 60 bar (see ACI reference paper). And although a typical bar will break in a tension test at a strain not much exceeding the minimum elongation requirement, the bar bent around the pin will probably not break. Why?



Sketch for Problem 1