CE243B - DESIGN AND RESPONSE OF RC STRUCTURAL SYSTEMS
Problem Set #3: UBC-97 Design and Evaluation

Due dates: (1) – (3) 2 May 2002
(4) 7 May 2002

For the four story reinforced concrete frame building given below, do the following for loads in the north-south direction:

(1) Determine UBC-97 base shear, story forces, and summarize major design requirements to be satisfied (e.g., mass participation, drift limits, deformation compatibility). Use 150 psf dead load and 100 psf live load. Story heights are 15 ft for the first story, 13 ft for levels 2 through 4. Soil conditions are "C". For other information, use the same information as given on HW#1. Note, we could also use FEMA 369 (NEHRP 2000 Provisions).
(2) Create an appropriate 2D model of the system for design (use symmetry). Make appropriate assumptions for initial member sizes. Discuss potential shortcomings of using a 2D model for this building. Assume a fixed base.
(3) Design the structural system (beams, columns, joints). To simplify the design, adhere to the following:
    a. For the LFRS, all beams have the same dimensions. Do not cut any bottom reinforcement, and cut top bars that need not be continued along the entire span an appropriate distance beyond inflection points. All columns have the same cross section dimensions; however, reinforcement may be different for interior and exterior columns. Do not vary column reinforcement more than once over the building height. Note the location of the column splice, but do not design the splice. Be aware that joint design requirements (e.g, joint shear) may control the size of the columns.
    b. For the non-participating system (aka the gravity system), following similar guidelines. Note the column splice is typically just above the floor level and that detailing requirements for the column depend on the expected column response at the design displacement (deformation compatibility requirements).
    c. Note the specific requirements on modeling the LFRS and the gravity system in UBC-97 – that is, it may be more practical to construct two models, one for the LFRS and one for the gravity system.
    d. Assume a rigid diaphragm. We will not design the diaphragm.
(4) Use FEMA 273 guidelines (or FEMA 356 if we get the reports in time) to evaluate the expected performance.
    a. Plot the response spectrum for acceleration and displacement versus period, as well as for Acceleration versus displacement, using Section 2.6 (FEMA 273).
    b. Review modeling requirements as they may be different then UBC-97 and construct a 2D model.
    c. Determine the target displacement using the coefficient method and conduct a pushover analysis
    d. Verify beam, column, and joint performance for the LFRS
    e. Verify beam, column, and joint performance for the "gravity" system.

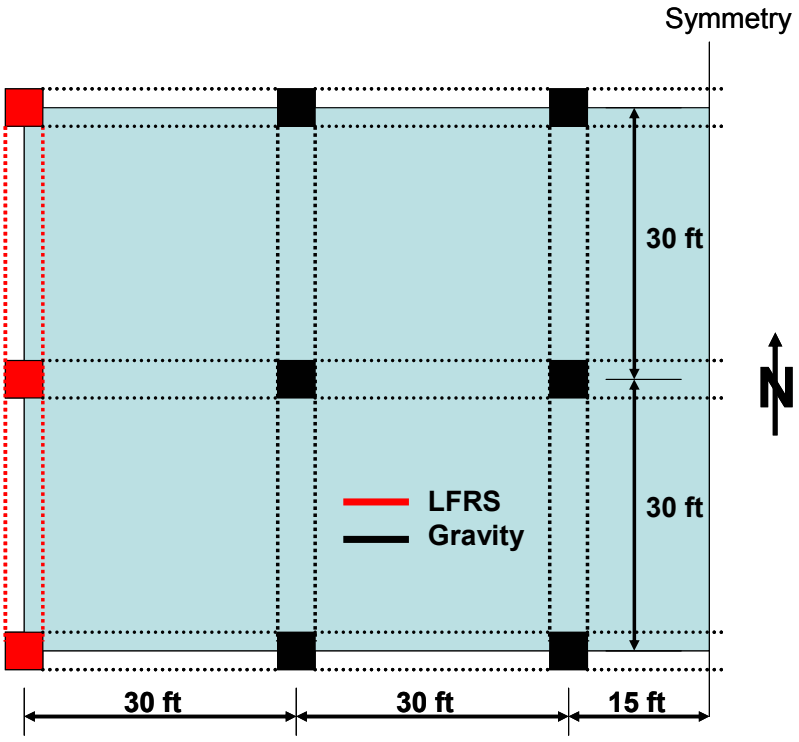

Figure 1: Floor Plan