Deliverable #3 – Design Development – Structures

General

The Design Development (DD) phase presents the final scope of work, designs, cost, schedule, and logistics information to the owner/client. The Project Team is focused on coordinating all project requirements into a comprehensive document. In real life most of the structural designs and calculations have been performed in the Schematic Design phase. For the senior design project, there are still some work related to the structural designs and calculations. We will focus on the calculations and designs of the lateral force resistant systems, connections of the structural systems, and deconflicting.

Process

1. Perform an analysis of the building due to wind load using the design codes you have used in CD and SD. Consider the wind load in one direction (east-west or north-south) and applied on one side of the structure.
2. Assume the lateral loads are transferred to the lateral resisting elements by the vertical tributary areas (Note: This is a simplification. The distribution of the lateral loads should be based on the relative stiffness of the elements, which is the force required to produce a unit displacement of the lateral structural element).
3. Define the load path that the lateral forces will follow, all the way down to the foundation.
4. Calculate the overturning moment for one lateral load resisting system (for example, one reinforced concrete shear wall) and the resisting moment due to the dead loads on the system, including the floor weights calculated in SD.
5. Design the lateral resisting elements to resist the calculated lateral forces (see below for details).
6. Design and detail one typical beam to column connection.
7. Resolve any conflicts in the design with team members.

Deliverables (100 Total Points Possible)

1. Structural calculations for the lateral loads (with a diagram for the floor to floor distribution), overturning moments, the design of the lateral elements (one RC shear wall or one steel frame if both are used in the structure; one shear wall if only shear walls are used; and one frame if only frames are used).
2. The design of one connection (one beam-column connection of a steel frame. If all lateral structural systems are RC shear walls, select a typical RC beam-column connection for analysis and design).
   
   For Tasks 1 and 2, if spreadsheets are to be used, please provide two examples (one for a lateral system and one for a connection) with step by step calculation so that the spreadsheet calculations can be verified.
3. Drawings to show elevations and cross sections of the lateral resisting elements.
4. Drawings to show all necessary structural details for the connections and elements needed to carry the load to the foundation (element sizes, weld lengths, anchor bolt sizes, etc.).

Interim deliverable – Show the result of Task 1 in Deliverables.