Section 1 – Executive Summary

The First Albany Building is a 12 story, 180,000 square feet structure designed for mixed-use office space and condominiums. The building's footprint is approximately 115' x 137'. It is located in downtown Albany, NY. The foundation is a concrete slab on grade over a network of reinforced concrete grade-beams and pile caps. The first floor is at grade and the building has no basement. H-piles were driven to practical refusal to fully support the building. Gravity loads are resisted by a reinforced concrete slab supported by a grid of simply supported steel beams and girders. Partial composite beam and composite deck design was incorporated in to the building. The main lateral force resisting system is comprised of concentric steel braced frames. There are five braced frames, two in the East – West direction and three in the North – South Direction, all located in the core of the building. The braced frames each act as a vertical, cantilevered truss.

For educational purposes a new building site in Charleston, South Carolina was chosen for a visually identical building with a different structural system. The site was chosen because it poses more risk for significant seismic activity and severe winds from hurricanes. A new floor system was designed using full composite action (slab and beam) for the reason of reducing the weight of the floor system. A new main lateral force resisting system was designed using special reinforced concrete shear walls located around the core of the building. Even though this system adds considerable weight, it was chosen because it has a higher response modification factor for determining seismic loads (R = 6, verses 5 for composite steel and concrete concentrically braced steel frames). To further reduce design seismic forces and base shear, a dynamic analysis was performed (Modal Superposition).

From an architectural standpoint, the building is relatively unchanged. The only difference is a slight layout change to the core of the building having minimal affects on building traffic patterns. Elevator shafts where slightly shifted and re-oriented to obtain a symmetric layout.

Gravity and wind loads were determined from ASCE 7-05 chapters 4 and 6 respectively. Seismic loads were determined by a dynamic analysis and as outlined by chapter 12. To aid in the lateral and modal analyses, a three dimensional mathematical model was created and solved using ETABS. Seismic base shears were found to be slightly higher than the minimum allowed (85% of the seismic response coefficient (Cs) multiplied by the effective seismic weight).

Strength requirements of the lateral system were controlled by seismic forces in the upper stories and by wind forces in the lower stories. However, the factor that controlled the entire design was permissible story drift due to wind (L/400 or 0.25%). In the east-west direction there are four separate shear walls having thicknesses of 16 inches. In the north-south direction there are three shear walls each 20 inches thick each coupled with a single bay concrete moment frame.

Two other areas of study were also conducted. The new structural system had little effect on construction costs and scheduling (breadth topic 1). The new location poses higher cooling demands so various other systems were looked at to reduce energy demands and consumption. A reflective roof surface and solar array would help reduce energy costs for the new building.