Executive Summary

The ECMC Skilled Nursing Facility is a new 296,000 square foot assisted living facility located on the ECMC campus in Buffalo, NY. The building has unique design features, such as a radial plan geometry and sloped roof layout, and the project cost roughly $95 million to construct. The main framing system consists of composite steel framing with a large mechanical penthouse located on the top floor. The building's main lateral system consists of 16 concentrically braced frames, where 8 frames can be found at the end of each wing while another 8 frames are located surrounding the building core.

This final thesis report examines the redesign of the buildings structural system in a different location, primarily the high seismic region of Los Angeles, CA. In this new location, the ECMC Skilled Nursing Facility will be prone to high seismic forces, soil liquefaction, and large deflections. Specifically, the structural redesign will focus on three major structural systems:

- Foundation System
- Gravity System
- Lateral Force Resisting System

To explore alternative solutions for earthquake design, base isolation was incorporated into the buildings structural lateral force resisting system. Without isolation, the building period for the original design in this new location was considered slightly flexible (T=1.475 sec). However, after base isolation was incorporated into the new design, the building period increased to 4.180 sec, reducing the damaging effects of story drift. The axial loads experienced in the ground floor columns was quite large, causing many of the column members to increase in size, some reaching sizes of W14x283.

Another alternative to reducing seismic forces was by reducing the slab on deck depth. To do this, the existing 2" composite decking was replaced with 3" composite decking, allowing for more strength at larger spans and also a reduction in slab thickness of 5-1/4" to 5". Framing members were sized up slightly from their original design; however it is potentially due to the increase in live load from 40psf to 80psf. Columns remained relatively unchanged except for a few throughout the building.

The analysis of the structural depth begins with a verification of dead and live loads found using the IBC 2006 edition as well as ASCE 7-10. Afterwards, lateral loads such as wind and seismic were calculated using ASCE 7-10, following both the Main Wind Force Resisting System procedure for wind and the Equivalent Lateral Force procedure for seismic. Once these loads were found, specific load combinations were chosen to

determine which load case or combination of load cases controlled the design of the lateral system. It was found that seismic effects produced a base shear of 6550 kips and wind produced a base shear of 1071 kips in both the X and Y directions. Overturning moments of 350,694 ft-k and 54,353 ft-k were found for both seismic and wind respectively.

Not only should the structural system be evaluated in this new location, so should the mechanical HVAC systems. Los Angeles, CA is considered to have a semi-arid climate, which is largely different than that of Buffalo, NY. Although temperatures do not vary much in the summer season, winter can produce much colder temperatures in the Buffalo, NY location. An enthalpy verification check of the HVAC systems was performed for both summer and winter seasons, and it was found that the existing systems were adequate for winter heating and summer cooling. Additionally, since the HVAC system consists of a variable air volume (VAV) system, the volume of supply air can be adjusted to produce the necessary comfort levels required by industry standards.

With changes in building design come cost and schedule impacts. With the incorporation of lead rubber base isolation in the structures lateral system, the project cost increased drastically since each isolator was estimated to cost around $20,000 each. In addition, the increase in column shape sizes also produced a slight increase in structural steel costs of roughly $200,000. Deep foundations had also contributed to the project cost in a negative way, however they impacted the project schedule the most by adding another 156days to the schedule for installation. Overall, it was expected that the project cost and schedule would increase due to the use of base isolation and deep foundations. However, since the building does host a large number of residents and a higher risk category, it seemed to be the necessary solution for design in the area of Los Angeles, CA.