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Structural Option
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The Hub on Chestnut
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Executive Summary

Structural Technical Report 3

The contents of this report provide a detailed analysis of the lateral force resisting system of The HUB on Chestnut located in Philadelphia, Pennsylvania. The original designed lateral system is an ordinary moment frame. Structurally, the building is constructed of monolithically poured concrete columns and flat slabs to integrate all elements of the structure. The design features large uniform concrete columns with the tops and bottoms overly reinforced to provide strength due to an abundance of moment. The structural design does not incorporate any shear walls, braced frames, or any other special constraints. Analysis will include the interaction of gravity, wind, and seismic loading conditions. The main wind force resisting system (MWFRS) was investigated considering a fully enclosed, rigid building. The seismic-resisting system was analyzed with an ordinary concrete moment frame. Gravity loads have been taken from previous analysis and technical reports. Loading includes live load and snow load reduction where they are applicable. All loading conditions have been determined in conjunction with the use of industry codes and standards (*ASCE 7-02, ACI 318-03, IBC 2003).* Although, the building is located in Philadelphia, a non-hurricane and low-seismic region, the structure must be designed to accommodate an event of an earthquake.

Two analytical methods have been used in determining the lateral distribution throughout the structure. A preliminary hand-calculated analysis was performed using industry codes and then the results were compared to the output data of ETABS v8.5. Both procedures produced the wind and seismic forces that are exerted onto the building. Base shear and overturning moment are the focal points used in comparison. In both cases, the seismic condition was the controlling case over wind. The controlling load combination was $0.9D + 1.0E$. Seismic forces had created significantly higher values in both methods.

The performance of the lateral system was also evaluated on horizontal drift. A chosen criterion on $L/400$ was set as a controlling limit. The structural system produced a ratio well within this parameter. The final drift ratio was found to be $L/635$.

With the aid of ETABS, a model was created to represent the entire structure as well as several simulations to replicate deflections and movement with various loading combinations. I felt that ETABS was a great advantage in understanding the lateral force resisting system because of its ability to present the user with thorough and direct output data.

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PHILADELPHIA, PA

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