Technical Assignment 1

Medical Office Building

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October 6, 2004

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Executive Summary

The structural system of the Medical Office Building is explained and analyzed in this report. The structural system itself is a concrete moment frame on strip footings. Flat one-way slabs span the beams and serve as the floor system. Loads from the floor are transferred to the beams and then to the columns where they are carried to the footings and then the ground. The loads used in the original design of this building have been reevaluated to take into account more recent information.

The original code this building was designed under was BOCA 1997. As a reference to a more modern code, BOCA 1999 was chosen as the major building code. Many of the sections in BOCA refer to ASCE 7. In most cases the data in ASCE7-02 outdates BOCA 1999 and therefore was substituted as necessary. Live loads, roof loads, snow loads and earthquake loads were all calculated in accordance with ASCE 7-02. Wind loads were calculated per BOCA 1999. These results were unexpectedly low and deemed unacceptable for design by the code, therefore a wind pressure of 10 psf was used for the entire building's wind load. The other loads seemed relatively accurate with a net earthquake shear force of 3060 k, a live roof load of 12 psf and a snow load of 19 k.

These loads were used to generate sketches of load distributions. An analysis of these distributions was used to check the agreement between the older code and newer code and spot mistakes in determining the loads. Three system components were tested; a slab, a beam, and a column. The slab had good agreement in both load magnitude and design. The ultimate moments came out to be 17.3'k and 16.8'k for old and new respectively. The new slab was 2" thicker and used more rebar despite having less capacity demand. The beam check did not yield as good results as the slab.

The beam ultimate moment under the new loads was 848.4'k, well above the old 490'k. To further complicate the matter the new beam is also smaller and uses less steel than the original design. It is possible that architecture controlled the decision on beam size, but that does not explain the large discrepancy in the ultimate moment. The column design also had a large size discrepancy, but this is likely due to the analysis of the column only including the gravity loads. The new design was a 16" diameter column with 8 #8's and the old design was a 26" diameter column with 8 #10's. The use of live load reduction factors in the new design may have pushed the column down in size as well.

Since the beam did not check out it will be very important to look at the calculations leading to the ultimate moment under the new code. Once the loads are fixed design of alternate structural systems for the Medical Office Building will commence.