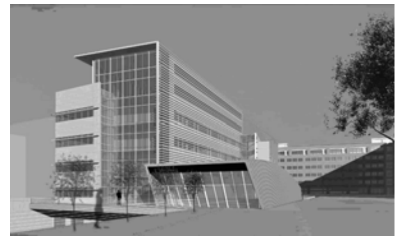
Timothy Mueller
Structural Option
Walter Schneider



FDA CDRH Laboratory

Silver Spring, Maryland

Technical Assignment #3—Lateral System Analysis and Confirmation Design

Executive Summary:

The FDA CDRH Laboratory is an office and laboratory space located on the Food and Drug Administration's White Oak Consolidation Campus. It is a four story building with a full below grade ground floor and fifth floor penthouse suite. With a high bay laboratory located on its west side. It has a total square footage of 139,805 and a height of 86' above grade.

The building is made mainly out of cast-in-place concrete. Which allows for its frame, made of pan-joist and columns to act as both a gravity and lateral system. Due to the monolithic nature of the building's concrete structural system, all the members are fixed and allow loads to travel through them. They also allow the transfer of moments caused by lateral forces.

Through this assignment I was able to continue my analysis of the building's lateral system that was touched upon in Technical Assignment #1. I looked at many different factors relating to lateral forces, from story drift and the overturning moment of the entire building, to the shear caused by torsion and the strength found in single lateral resistive members.

I used both computer analysis and hand calculations throughout this assignment and found that computers make for very quick work of intricate details of a building that could take hours and even days to solve out by hand. However, without any hand calculations, an error in computer calculations can easily be lost in the many outputs of a computer. Quick hand calculations, do not take a great deal of time and can reinforce what a computer has already stated, allow the engineer to be more confident in the computer output and understanding of the building system, as well as possibly show a better outlook of what members can handle rather then what they will endure.

By looking at my system with both a computer program, and by hand, I proved that the original engineer of the CDRH Laboratory designed a structural system that can withstand all the lateral conditions that I tested. The slight differences in exact numbers between the original system and the design requirements that I looked at could be caused by many circumstances, including but not limited to, new code requirements in the codes and design criteria that I used as compared to the original design codes, as well as rounding when converting dimensions from metric to English units.

I found that seismic lateral loads control as was estimated in Technical Assignment #1, and the controlling equation was 1.2D + 1.0E + 0.5L + 0.2 S. I also found that the overall deflection of the building was satisfactory to the criteria of H/400 , however, torsion did need to be taken into account when looking at the shear on members. Lastly I found exactly how much loading a single member can handle when both gravitational and lateral forces are applied. This analysis proved that the CDRH Laboratory's columns are designed to resist any load that they are predicted to encounter.

The overall outcome from this project was that a building that is very heavy such as the CDRH Laboratory, and that is made of primarily concrete, will not be affected by wind, however, seismic can cause for some problems. However, a short, "squat" building, also like the CDRH Laboratory, will resist seismic loads very well. When these two conditions are combined, the building itself can resist many lateral forces, and will not need additional lateral resisting systems, such as shear walls, or additional foundation elements to prevent overturn. However, when designing a building, one must also look at all conditions to be sure that no assumption is broad and that there is a good base of knowledge of what information is being provided either by a computer program or by hand calculations.