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Structural Option
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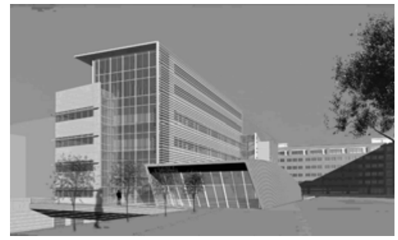

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Executive Summary:

For this technical report I looked at 5 alternatives to the current structural system of the typical bays and then compared the pros and cons of each of the alternative systems to the original system. The current system is a concrete one-way system which spans in the east-west direction for each of the 3 bays that make up this cross-section of the building. The 5 alternatives that I reviewed were: composite steel girders, beams and decking; non-composite steel girders, beams, and concrete slab; steel girders, joists, and concrete slab; two-way concrete slab with drop panels, and a one-way concrete system. Through my analysis I found that all of these alternatives could be viable solutions for my building's structural system. Each alternative resulted in a lighter system, that normally had a smaller structural floor depth than the current system as well. This system allowed for no additional weight on the foundation system, and due to the upward stability of the ground the foundation, could actually be made smaller. I found that a main concern that developed due to the lighter systems was an increased susceptibility to vibration. However, when looking at the girder design of the one-way slab systems, it was noticed that this susceptibility may not be as great as originally thought. Due to a very low deflection, which in turn results in a high stiffness, the vibrations are decreased. This assumption may not be the case for all the structural systems, especially the steel framed systems. This assumption does, however, give an even more persuasive option with the alternatives looked at compared to the current system, due to very little drawbacks and possible money savings because of less time or material spent. The time savings is from the quick erection process of steel as compared to that of concrete for the steel structures, and the decrease in the amount of material (based on weight) of the concrete structures.

After comparing all of the alternatives to the current system, I found that although all the systems made for viable alternatives, at this time, the concrete alternatives were better suited for this structure. This is mainly due to the high amount of labor available for concrete work in the DC area as compared to the less common steel contractor. Also, no additional fireproofing is needed as compared to the spay on fireproofing that is needed for the steel components. Additional lateral support is also not needed in these concrete systems, due to the stout profile as the CDRH laboratory, the monolithic construction causing all joints to be fixed is all the lateral support that is needed, as compared to the necessity to have bracing or moment connections in the steel frames. Of the concrete systems, one system seemed to stand out. The one-way system, which had its supporting members turned perpendicular to the current system (spanning the shorter direction) in the controlling bay seemed to be the best alternative of them all. This system allowed for a great reduction in weight as well as depth, as compared to the current system, however, due to the low deflection, should have good stability against vibration. The only downfall of this system is that it does cause a change in the direction of the final bay as compared to the other two bays found in this system. This can be resolved by making the other bays span the long direction, which would result in a larger system, however, also allow for continuity of the building. Another resolution would be to leave the system with two different span directions, which may cause for a lack of continuity of the structural system, but a more economic building overall.