Executive Summary

The focus of this report is to investigate an alternative structural system for Rockville Metro Plaza II. The original concrete design inherently has its advantages and disadvantages. A new structural system comprised mainly of steel was chosen to compare to the original. This report will explore in depth the pros and cons of each system and compare the two against one another. This investigation will aim to minimize any impacts to architecturally important features such as open floor plans and occupant views. The investigation will also aim to keep the realities of economics, constructability, and scheduling in mind.

Figure 1: South West Corner – by JMV

For this report, the subgrade parking structure was left as originally designed and the seismic base was taken to be at grade. The levels above grade were redesigned using composite beams, lightweight concrete on composite metal decking, and steel supporting columns. A hybrid system of steel and concrete elements was employed as the lateral system.

The use of steel beams resulted in deeper floor depths than in the original design, and thus the redesigned structure's height was adjusted accordingly. This change in story height as well as the change in the building's mass at each floor elicited the need for recalculated seismic and wind loads. After the loads were recalculated and applied to the structure, it was determined that wind controlled the design of the structure's lateral system. Additionally, the design of the lateral system was governed by drift more so than by strength requirements. Overall building torsion and overturning were also investigated and found to be suitable for the redesign.

An architectural study was conducted in order to assess the realistic implications which inevitably come along with the alternative system. The layout of the lateral system was given great consideration and the resulting design was selected with the goal of keeping the floor plan open and the views unhindered. Implications regarding the constructability of the system were also considered. The economical and scheduling impacts of each of the two systems were determined and weighed. It was determined that the steel structure would have an approximate cost of $5.888 million versus the concrete structure, which was found to cost $6.23 million. This resulted in savings of approximately 5% on the total structure's cost. The schedule study proved the steel system to produce a shorter erection time as well.