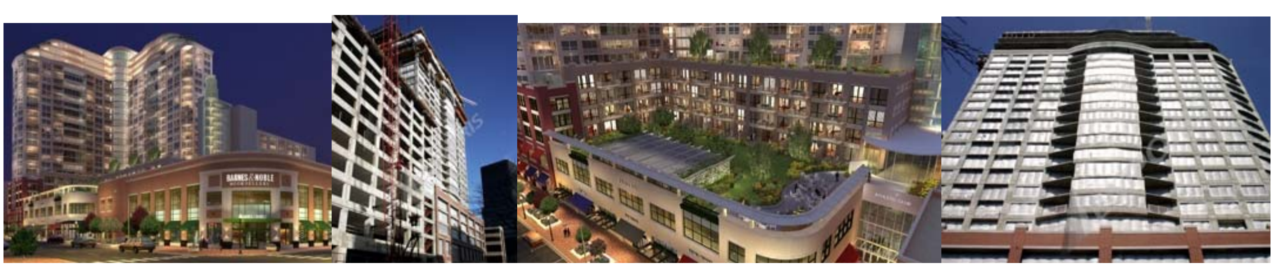
CONCLUSIONS



This analysis presented in this report aims to produce a new building design that is efficient in material usage, constructability, and time, while maintaining the quality of the original design. To accomplish this goal, the existing reinforced concrete system was replaced by a new steel gravity and lateral system.

Composite steel beams were chosen for the floor framing to limit the overall building height as much as possible. The beam sizes were also restricted to W16s on floors 2-7 and ranged between W8x10 and W16x31. On levels 8-25 the beams were limited to W14s and ranged in size from W8x10 to W14x22. Despite these limitations, the building height was still increased from 260.5 feet to 283.25 feet, which is an overall increase of 22.75 feet. The gravity column sizes varied between W10x33 and W14x193. The lateral system, however, required larger member sizes to provide adequate stiffness and lateral resistance. The beam sizes ranged between W16x89 and W14x82, and the columns were sized W14x257 to W14x370. The cross bracing was made up of 2 L8x8x3/4. This design resulted in a total building drift of 5.6254 inches, which is less than the allowable drift of H/600, or 5.665 inches.

With this new design, the building weight was greatly reduced. The foundations sizes were able to be decreased. The original foundation sizes varied between a 15’-6” bell diameter and 6’-0” shaft diameter caisson to a 6’-0” bell and 2’-6” shaft. The new design results in caisson sizes that range between a 3’-0” bell and a 7’-0” bell.

By changing the primary structural system of Sherman Plaza from reinforced concrete to structural steel, other building systems were also impacted. Two breadth studies were performed to determine the effect the structural material change had on the construction management and on building acoustics.

An estimate was performed of the costs of the exterior cladding and structural materials for each system from R.S. Means. The steel system resulted in a total cost of $17.45 million, and the reinforced concrete system had a total cost of $25.63 million. The steel system, therefore, was $8.18 million less expensive than the concrete system. R.S. Means was also used to perform a schedule estimate. The steel system took a total of 1146 days to complete, while the concrete system took 2660 days. Therefore, the steel system could be erected 1514 days faster than the concrete system.

The first acoustical analysis was between the existing 8 inch concrete floor system and the new floor system of a 3 inch slab on metal deck. The existing floor system was found to have an adequate transmission loss. The new system, however, was not acceptable according to the NC-25 noise criteria curve. Even with additional sound absorbing floor and ceiling materials, the new system did not meet NC-25 criteria, but did fall below NC-30 standards.

The second analysis investigated the transmission loss of one of the concrete shear walls from the original structural system. The shear wall was found to have an acceptable transmission loss to reduce the mechanical room noise. Based on the acceptable sound pressure levels, a new wall system was chosen to replace this wall. Three alternatives were analyzed. The chosen wall system was made up of 3 5/8" steel channel studs with two layers 5/8" gypsum board on both sides and 3" mineral-fiber insulation in the cavity.

In all, the steel structural system was an effective design for this building. The composite steel produced an efficient gravity system that worked well with the given column layout. The drawback to this system, however, was that the structural system's ceiling to floor section depth was greater than that of the existing concrete system. This increase in depth at each floor resulted in an increase of building height from 260.5 feet to 283.25 feet, which is an increase of 22.75 feet.

The newly designed lateral system also produced acceptable results. The design, however, uses a large number of braced frames and moment connections that will increase construction time and costs. The architectural constraints also made the placement of the frames within the building difficult. Since the building was designed to have shear walls provide the lateral resistance, the architecture of the building did not provide many options for braced frame locations. The braced frame system could possibly have been improved if other locations for the frames could have been tested.

The use of an all steel system, however, caused the building weight to be dramatically reduced. The foundation sizes in turn were able to be decreased. Due to the fact that the caissons extend down 70 feet, this size reduction will result in large savings in concrete and in construction time.

Despite any drawbacks of the new steel structural system, the cost estimate and comparison of the two systems showed that the steel system is less expensive by $8.18 million. This savings in cost could compensate for the increase in building height and the large number of lateral braced frames and moment connections. In addition, according to the schedule estimate, the steel system could be erected 1514 days faster than the concrete system. These facts make the new steel redesigned system a viable alternative to the existing reinforced concrete structural system.