1.0 Executive Summary

Park Place Corporate Center One (Park Place 1) provides a unique opportunity to study an old office building with poor energy performance. With today's economy and rising energy rates, a growing number of building owners are looking to renovate older buildings in place of building new, more expensive ones. The study of Park Place 1 offers the chance to understand the effects of central plant modification.

The purpose of this report was to understand and analyze the existing building mechanical systems and then redesign them in an effort to save money and improve performance. This study focuses more on cooling than on heating due to the opportunity for energy savings. The redesign of existing systems does not include a redesign of the heating methods. By extension, because the building is existing, façade redesigns and other building related energy efficiency opportunities were neglected due to cost limitations. As an offshoot of mechanical system redesign, two other building systems—structural and electrical—were also analyzed to understand the possible impacts of changing the mechanical system.

Before addressing the designed systems, the building heating and cooling load was determined using Trane Trace 700. In summary, the total cooling load on the building was around 225 tons. Given the square footage of approximately 100,000 ft^2, a value of 445 ft^2/ton indicated that the building is relatively inefficient by modern construction standards, and thus plant improvements could render substantial cost savings.

To offset the 225 ton cooling load, a design solution came in the form of two packaged DX rooftop units. Each unit was sized at 120 tons with a 20°F air side ΔT and 45,000 cfm's of supply air. While this was adequate, it was simple and offered a chance to redesign a system that could potentially save the owner money.

As an office building, Park Place 1 had a low load factor of around 34%. In doing research, it was determined that thermal energy storage could potentially yield a viable improvement to the existing system. Ice storage became the primary consideration in moving forward from the original design.

To truly understand the impact and potential cost savings of thermal energy storage, several alternatives had to be considered. Since the original design was a completely air dependent system, a chilled water system had to be studied. From that chilled water system, ice storage could be added but in what quantities? An optimization study had to be conducted that would range from including two ice tanks to six. A final study was done to see what the impacts would be of reducing the supply air temperature of the air handling units from 55°F to 50°F. This would save fan energy at potentially little cost to the water side of the system.

The results of the study indicated three primary conclusions pertaining to the different alternatives and a single final conclusion about which system would perform the best over the life of the building. First, the chilled water system was not practical. It had the highest first cost, highest operating cost, and highest energy expenditure of any system. Second, the optimization study determined that two ice storage tanks would yield the shortest payback period. Third, reducing the cfm's in the final alternative justified making the chiller work slightly harder to produce cold water.

The main conclusion and final recommendation was that the system combining two ice storage tanks with a reduced sized air handling unit that provided 50°F supply air would be the best system to install. The evidence to support such conclusions is that it would cost the owner the least amount of money over the life of the building and would have the smallest first cost.

The results of the electrical and structural study indicate that no major changes to either system would be required to implement the proposed mechanical systems. The electrical panelboard that services the mechanical equipment could be reduced from 800 A to 700 A but changes in conductor, conduit, and main distribution panel sizes would be nonexistent. For the structural system, the roof deck would need to be increased in gage by one size but no changes to structural members (beams, girders, and columns) would be required.