

1.0 Executive Summary

Straumann USA is a combination office and light manufacturing facility in Andover, Massachusetts. The facility underwent a major renovation that was completed in May of 2005. Mechanically, the renovation included the complete removal and replacement of the airside systems while continuing to utilize the central plants of the building. This report will analyze several different mechanical options and compare them to the one implemented in the building. This is for educational purposes only and does not imply there are any errors in the renovation design.

This analysis will consider several changes to the mechanical systems as well as the impacts they have on the electrical requirements and the initial costs of construction. The air system analysis will compare a dedicated outdoor air system (DOAS) with radiant cooling panels to a variable air volume (VAV) system. The central chilled water plant will also be analyzed to determine the effect of replacing the chillers with similar electric centrifugal chillers as well as changing direct-fired absorption chillers. Two options for waterside free cooling will also be explored. The current parallel piping arrangement will be compared with a series free cooling layout.

The analysis of the mechanical systems provided some very interesting results. The DOAS system saved over \$40,000 in energy costs a year when compared with a VAV system. The DOAS system also reduced electrical requirements by removing the need for variable air volume and fan powered boxes. A significant reduction is also seen in DOAS rooftop unit size and cost.

When comparing the chiller types with similar air systems, the absorption chilled water plant is more expensive on an annual basis in both cases. However, the absorption/DOAS system actually saves nearly \$6,000 in annual energy costs when compared to the existing electric/VAV system. The initial cost of such a system is nearly \$650,000 more than the current system resulting in no payback over a period of 20 years.

The series piping arrangement for free cooling did prove that a few additional hours free could be obtained each year, however it must be controlled very carefully in order to prevent the annual energy costs from actually increasing when compared to the standard parallel piping arrangement.

The findings of this report lead to recommending that the DOAS and radiant panel system be implemented rather than that VAV airside system. Even though the initial DOAS cost is \$129,000 more expensive, it can be paid back in 3.7 years. If the chiller plant is to undergo a renovation, it is recommended to replace the existing chillers with updated electric centrifugal chillers rather than switching to direct-fire absorption. It is also recommended to continue to use the current parallel free cooling piping system rather than switching to a series free cooling layout since only a slim increase in free cooling hours is obtained and newer complex controls would be necessary.