6.1 MECHANCAL DEPTH: REDESIGN

The mechanical redesign of the Bronx School for Law Government & Justice consisted of two parts, involving both the waterside and airside. The waterside redesign involved implementing an ice thermal storage system. There were many benefits from using ice thermal storage as stated by ASHRAE's *Design Guide for Cool Thermal Storage*. In this instance, there were two main benefits that made ice thermal storage an applicable system to investigate, which were the maximum cooling load of the facility is significantly higher than the average load and the electric utility rate structure included a high demand charge.

As previously stated, the building is a middle/high school, therefore, the majority of the cooling required occurs when the school is in session and when school is in not in session minimal cooling is needed. This scenario translates to a high peak cooling load versus a rather low average or base load. The result, in this case, has a peak load almost 16 times greater than the average load. This outcome leans favorably towards enabling the use of ice thermal storage. The other major advantage of incorporating thermal storage is because of New York City's high demand cost. The demand cost is based on the highest or "peak" use of electricity for any 15-30 minute gap within the on-peak period in a given month. Therefore, the use of thermal storage would allow "shifting" or moving the peak load and distributing it completely or partially to off-peak times.

Ice thermal storage produces water at lower temperatures with the aid of a secondary coolant typically glycol, either ethylene or propylene. The below average chilled water produced, 36-39°F, adds to another benefit of thermal storage by incorporating cold air distribution. The airside analysis took advantage of the lower temperature water from the ice thermal storage and delivered low temperature air, 44-47°F, throughout the spaces within the building. One of main advantages of incorporating cold air distribution with thermal storage is that it has the ability to reduce the first cost in mechanical systems. Generally, the addition of thermal storage adds a significant first cost with the added addition of storage tanks, pumps and controls. However, cold air distribution reduces the required supply air quantity. Correspondingly, the size of fans and ductwork is reduced, which saves on first cost as well as, operating cost. Also the addition of cold air distribution has the potential to offset the cost of the thermal storage system allowing the owner to not only benefit from operating cost savings from thermal storage but also pay less initially compared to a nonstorage system.

Although not specifically analyzed in this report, other applicable benefits of cold air distribution include: possible decrease in floor-to-floor height requirements and improve comfort with lower space relative humidity. The decrease in duct size, can lead to reduction in floor-to-floor height, which transcribes to potential savings in structural, envelope and other building systems costs. There have been studies that the lower space relative humidity maintained by cold-air distribution systems provides improved comfort and indoor air quality (Kirkpatrick & Elleson, 1996).