T R U M P

INTERNATIONAL HOTEL & TOWER

C H I C A G O

Thesis Proposal Executive Summary
Alternative Systems Investigation

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A EXECUTIVE SUMMARY

Trump Tower utilizes several creative design solutions in the mechanical system but does not maximize potential of energy efficiency. The existing condenser water system does take advantage of utilizing the Chicago River to dissipate heat, but the existing baseboard electric resistance heating system is archaic and inefficient. Further investigation of several integrative design solutions by maximizing the potential of the current systems within Trump Tower may be able to optimize energy utilization, decrease the ambient load profile, and reduce both mechanical and electrical system size and footprint.

The primary existing mechanical cooling system for Trump Tower is the central refrigeration plant in Lower Level 4. Four electric centrifugal chillers provide 4,800 tons of chilled water to meet the cooling load, and 25,000 GPM of Chicago River Water is pumped into the building to cool the condensers. The chilled water serves terminal fan coil units in the hotel and residential portions of the building as well as mechanical air handling units.

Heating is currently provided by electric resistance coils in air handling units as well as supplemental baseboard perimeter wall heating on all levels. The lobby spaces are conditioned from dedicated mechanical systems located at the mechanical level above the main lobby. Gas service is available, but only utilized for restaurant service, residential cook tops, fire places, and retail kitchens in addition to an onsite diesel emergency generator located within the parking ramp helix.

Firstly, Phase Change Materials (PCMs) will be investigated to reduce ambient load profiles. Phase change materials take advantage of the latent heat of fusion to store large amounts of heat energy without a significant rise in temperature. Utilization of PCMs within the building massing will be investigated in their impacts to improve thermal comfort, reduce peak power loads and mechanical equipment size, and regulate energy loss due to overcompensation of HVAC&R equipment through simultaneous heat gain and heat rejection.

There are numerous methods for incorporating PCMs into building materials. There are concerns for how the PCM installation may impact other building systems. When complete, Trump Tower will be the tallest concrete building ever built with a total of 175,000 cubic yards of 10,000+ psi concrete used to complete the tower. A portion of research will be designated to investigating how the PCM filled capsules may impact the structural integrity of the concrete structural system and discovering the appropriate proportions of ingredients to optimize both the mechanical system energy utilization and the structural system integrity.

Secondly, replacement of the electric resistance baseboard heating system with a central hot water plant system will be investigated. This will allow the building owner to control emissions of the central plant on site and will optimize the conversion of fossil fuel to heat by eliminating the steps to convert the energy into electricity. It may also increase the required space for mechanical equipment however. The interest to the owner may be due to the fact that, although a portion of the building will consist of privately owned condominiums, a significant portion of the building including the hotel and public spaces will be owned, operated and maintained by the building owner. The increase in first cost will be paid off in the reduction to the owner's own utility bills. This will also serve to reduce the incoming electrical service significantly, and a portion of research will be designated to investigating the electrical system size and peak power reduction.