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Thesis Proposal

Final Breadth Proposal for Spring 2010 Project

WESTINGHOUSE ELECTRIC CO. NUCLEAR ENGINEERING HEADQUARTERS CAMPUS

Pittsburgh, PA

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Architectural Breadth

To reduce the external thermal load on the Building, an architectural breadth will be explored. A study of the building's façade will be done to determine how to lower summer solar gains as well as reducing winter thermal losses. Coloration of the façade and roof will be explored to optimize solar loads of the building. Also, other façade treatments like double skin, phase-changing wall material and thermal massing will be researched.

In addition, building orientation will be examined to determine the optimal orientation for effective solar gain as well as effective daylighting.

Lighting Breadth

In addition to an architectural breadth, a lighting breadth will be done with an overall goal to reduce the lighting requirements for the open office spaces. Light shelves will be explored to possibly reduce the need for as much artificial lighting. These light shelves can be projected from the building's façade to also act as a solar shade. The implementation of solar shades has an architectural aspect to them as they will be a prominent feature on the building's façade.

Overall, the addition of light shelves may be an inexpensive addition with major impacts to the design of the building's mechanical system.

Tools for Analysis

Architectural Breadth

The architectural breadth will focus on façade treatment and building orientation. A study will be done to see how a darker exterior wall and a lighter roof will impact the solar load on the building. The façade study will be done using an Excel Macro program published by ASHRAE. This program simulates building thermal loading for any possible façade. If Phase-changing material is pursued, a secondary program will have to be developed to take into account the changing Heat Capacity values.

The orientation optimization study will be done in Trane Trace. The Trace program allows the simulated building to be rotated 360 degrees. This will allow for an easy determination of an optimized orientation.

Lighting Breadth

The Lighting Breadth encompasses a study of how the use of light shelves can reduce the lighting energy usage. Therefore a lighting simulation program will be run on a typical office space to determine the effectiveness of the shelves. Additionally, the solar shade aspect of this addition will be modeled into the existing Trane Trace model to determine its overall effect in reducing the cooling load.