

ABSTRACT

Based on the 2025 ASHRAE Student Competition, a case study was presented in the city of Manchester, England, developing a Medical Office building in the city center. The building will have three floors. One of the tasks in this project is to design a Heating, Ventilation, and Air Conditioning (HVAC) system. Air conditioning systems are essential for commercial buildings to maintain thermal comfort for occupants. Therefore, the Capstone Design team will conduct calculations and simulations for the HVAC system to be implemented in the Medical Office building.

The proposed solution includes performing heating and cooling load calculations using Revit to determine the load that needs to be handled by the HVAC system, as well as conducting energy simulations of the building to design the system and its controls, and to assess the annual energy consumption and performance. Finally, the mechanical system for the HVAC will be designed, including the layout of ducts, chiller, boiler, cooling tower, and AHU (Air Handling Unit).

Based on the heating and cooling load calculations performed using Revit, the total annual cooling load was found to be 774,618 W, and the heating load was 536,269 W. From the building energy simulation, which was tested using three different operational schemes, the best-performing scheme was an HVAC operational schedule from 6 AM to 7 PM, with an energy consumption of 30,656 kWh for cooling and 253,325 kWh for heating. The simulation also resulted in 16 unmet hours over the course of one year, which meets the requirements set by ASHRAE Standard 90.1.

Keywords: HVAC, Cooling and Heating Load, Energy Simulation.