Executive Summary

This senior year thesis project is an investigation into Oklahoma University Children's Medical Office Building and a potential new design that would be practical while accomplishing energy savings, reduced emissions, and better controllability for occupant comfort. The Oklahoma University MOB is part of the hospital campus in downtown Oklahoma City, Oklahoma. It is a 12 story mid-rise building that is reserved primarily for offices. The following report contains two parts, the first of which is the study of the existing conditions such as building envelope, designed systems (emphasizing on the mechanical systems), code compliances, and climate and locale amongst others. The second part of this document contains a proposed redesign of the building which is comprised of three sections.

The main mechanical depth is the main section of the redesign proposal. In this section a variable refrigerant volume mechanical system was designed in place of the existing variable air volume system. The variable refrigerant volume system was designed to be paired with floor-by-floor dedicated outdoor air system units to provide the building with 100% outdoor air. The VRF and DOAS couple successfully achieved combined annual electricity and gas savings of 11% as well as reduced the amount of emissions produced. The VRF system also added increased occupant controllability based on the heat recovery option, which allows for simultaneous heating and cooling. Overall, the proposed VRF system outperformed the existing VAV system, except for its high first cost. A life cycle cost analysis discovered the simple payback period of the VRF and DOAS system combination to be approximately fifteen years, even with the annual energy savings, which could discount the system as a viable option.

The next two analyses compared the electrical and acoustical characteristics of the system to that of the variable air volume system. For the acoustical breadth, the sound power levels created by the indoor evaporator units and DOAS system were compared against the VAVs and AHUs in the closest rooms downstream from the main mechanical room. Both systems met the acoustical requirements of rooms and rated similarly in noise criteria values.

Finally, the electrical connections were calculated for both of the systems air handling devices. They were then compared against each of to see if the DOAS units required larger connections than the existing AHUs. It was discovered that the DOAS unit connections were smaller than that of the existing air handling units, which was found to be a good indicator that the existing panel board and power distribution could accommodate the DOAS units. Additional connections were calculated for the outdoor VRF units to get a better understanding of the electrical load they will require.