Executive Summary

The main goal in designing the Army Reserve Center was to achieve a LEED Silver or Gold certification while maintaining good design practices such as following the applicable codes and following the requests of the United States Army Corps of Engineers. The codes that were followed were the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) Standard 62.1 and 90.1, the United Facilities Criteria (UFC) 4-171-05 and 3-400-02, and all applicable National Fire Protection Association (NFPA) codes and standards. To achieve this goal, a constant volume air handling unit was used for the auditorium, two variable air volume air handling units were used for the entire second floor and the core of the first floor, and smaller unit ventilators met the loads and ventilation requirements for the classrooms on the first floor and several other smaller zones on the first floor.

In order to make the Army Reserve Center more energy efficient, a variable refrigerant flow (VRF) system was used to take care of the heating and sensible cooling loads. The outside air required by ASHRAE and the latent cooling load were taken care of using a dedicated outdoor air system (DOAS). Another option that was explored was the use of a DOAS to handle the latent loads and the outside air requirements and a ground couple heat pump (GCHP) to handle the remaining loads.

The systems were designed based on ASHRAE Standards using Microsoft Excel for the majority of calculations with some calculations done by hand. The Army Reserve Center was modeled with these systems in place using Trane Trace 700.

It was found that the best alternative for the Army Reserve Center was the combination of a DOAS system and a VRF system. This combination had the lowest first cost, saved mechanical space, and saved energy when compared to the existing VAV system. However, the combination of a GCHP and DOAS used the least amount of energy.

An acoustical study and a structural study were also performed. The acoustical study involved analyzing the sound created by the rooftop condensing units for VRF system. The structural study determined the roof deck, joists, and girders that are needed to support the additional weight of the rooftop condensing units for the VRF system.