Thesis Proposal

Richard T. Flood Jr. & Sally Elliot Flood Athletic Center
Salisbury, CT

Prepared for:
Dr. William P. Bahnflath
Department of Architectural Engineering
The Pennsylvania State University

Prepared by:
Woong June Chung
Mechanical Option

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1.0 Executive Summary

The assignment required AE 481 students to organize the information from technical assignments and write a proposal to redesign the mechanical system. Technical assignments consist of evaluation of ASHRAE standard 62.1 and ASHRAE standard 90.1 which cover estimation of ventilation and energy efficiency. Documents also include information about usage of natural gas and electricity.

Analysis of technical assignments concluded that Richard T. Flood Jr., & Sally Elliot Flood Athletic Center needs more outside air. New proposed mechanical systems for the facility are replacement of different capacity air handling units, installing combined heat and power system and geothermal system.

New air handling units will improve the air quality of the building. CHP and geothermal system will reduce the cost of operation of the building. Initial cost of CHP and geothermal system will be higher than current system and payback period of combined heat and power system is very long. But since the building is school facility, the owner will operate the building for an extended period of time. Combined heat and power system will provide heat while generating electricity. Payback period of geothermal system is 5 to 10 years. The system life is approximately 25 years inside component and 50 years or more for ground loop.

Installation of the mechanical system will cause building to modify in different field. Two breadth topics were picked and one is acoustical breadth topic. During the research of CHP and geothermal system, I have explored noise problem with systems. The other one is electrical breadth topic. Installation of new system will change the requirement of power to operate the building.

The timetable of next semester is attached according to the proposal.

2.0 Background

Richard T. Flood Jr., & Sally Elliot Flood Athletic Center is 102,000 square feet gymnasium building. The gymnasium is two story multifunctional building that consists of basketball courts, offices, squash courts, wresting rooms, locker rooms, storages, and hockey rink. The building is a part of Salisbury School facilities and located in Salisbury, Connecticut.

The building has (9) air handling units and (1) ventilating and dehumidifying unit for ice rink. Each of air handling units is located near the serving area. Table 1 explains how big the space is for each unit to serve and how many units were used for each space.

Function	Area	# of AHU
Basketball court	15026 ft^2	2 AHU
Offices	5965 ft^2	2 AHU
Squash court	14160 ft^2	1 AHU
Wrestling room with locker room spaces	6454 ft^2	1 AHU
Weight room with locker room spaces	6178 ft^2	1 AHU
Storage	3883 ft^2	2 AHU
Hockey rink	20700 ft^2	1 AHU

Table 1

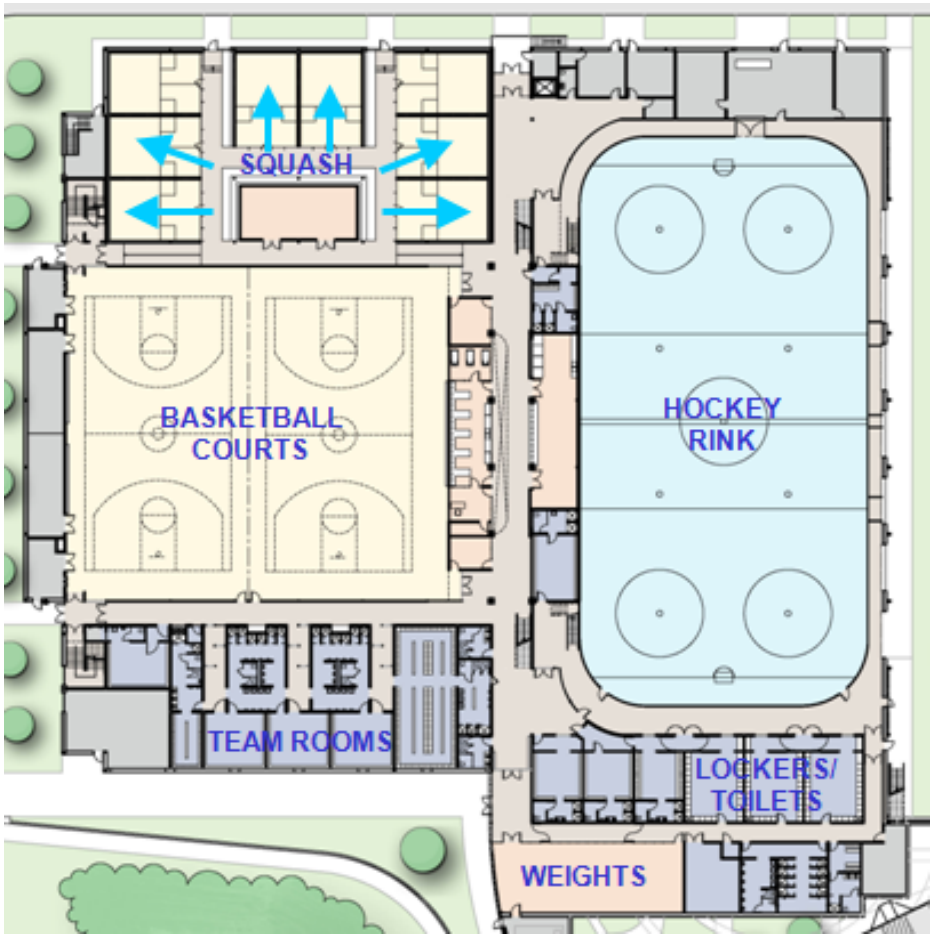

Figure 1 (First Floor)

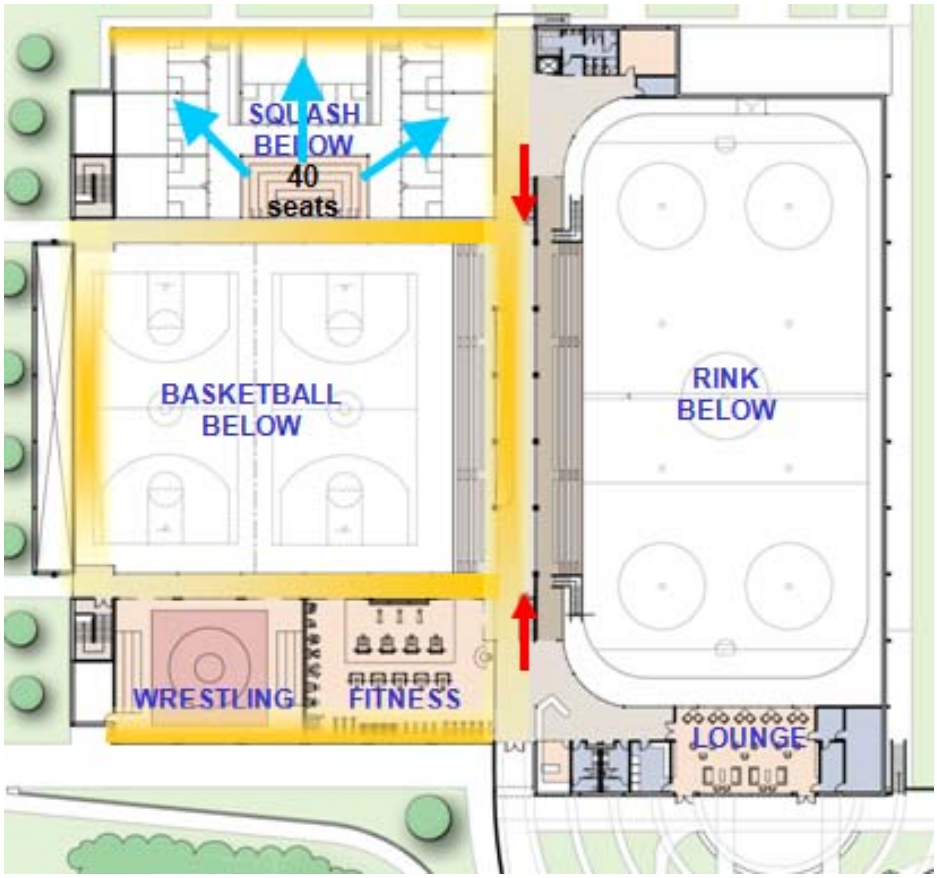

Figure 2 (Second Floor)

Figure 1 and Figure 2 describe the function of the spaces in the building. Figure 1 is a sketch of first floor of the building and Figure 2 is a sketch of second floor of the building.

According to ASHRAE standard 62.1, squash court and wresting room do not comply with minimum requirement of outside air. It is critical to supply outside air to maintain good air quality.

Basketball court and ice rink create big atrium spaces in the building. The building will have high reverberation time and create echoes. 25 Vibro-Accoustics tiles are used to reduce the reverberation time.

3.0 Design Consideration

Resizing AHU

Richard T. Flood Jr., & Sally Elliot Flood Athletic Center is designed to comply with ASHRAE Standards 62.1 and 90.1. The calculation in technical writing one proves that squash court and wrestling room with lockers lack outside air. Considering a lot of visitors to watch the competition in squash court and wrestling room, different capacity air handling units in those facilities should be installed.

Combined Heat and Power System

CHP system is an onsite electricity generator that uses the natural gas to produce electricity. In the process of generating electricity, the heat will come out of the gas turbine or engine. Heat recovery unit can collect the heat to provide steam or hot water for on space heating. Payback period is long but combined heat and power system is applicable because school buildings will operate for an extended period of time.

Geothermal Heat Pump

In the extreme weather condition in Salisbury, Connecticut, geothermal system is very effective system because geothermal system exchanges heat with the earth through heat exchanger. The payback period of the geothermal system is approximately in 5 to 10 years. System life for geothermal component inside is 25 years. Ground loop can be used for more than 50 years. Frequently, one of the biggest problems with geothermal system is amount of spaces used for installation of the system. The system requires at least 350 feet long and 10 feet wide space. It will not be a problem because Salisbury school owns plenty of land around the Flood Athletic Center.

4.0 Breadth Proposal

Acoustical Breadth

Replacement of different capacity air handling units and installation of CHP and geothermal system will create loud noises. Noise factor is very important because Flood Athletic Center has ice rink and basketball court. Big atrium spaces will create high reverberation time which will create echoes. CHP system typically creates noise level of 80 dB and geothermal system typically creates noise level of 7.6 dB. The software TRANE acoustical program will be used to estimate the reverberation time, noise criteria and room criteria.

Electrical Breadth

New proposed mechanical system offers replacement of AHUs and installation of CHP and geothermal system. Installation of new mechanical systems will change the amount of power required to operate.

5.0 Reference

ASHRAE, 2007, ANSI/ASHARE, Standard 62.1-2007, Ventilation for Acceptable Indoor Air Quality. American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc. Atlanta, GA

ASHRAE, 2007, ANSI/ASHARE, Standard 90.1-2007, Energy Standard for Buildings Except Low-rise Residential Buildings. American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc. Atlanta, GA

Michael Rosenfeld, Inc., Mechanical Specification, West Acton, MA

"Geothermal Heat Pumps" U.S. Department of Energy
http://www.energysavers.gov/your_home/space_heating_cooling/index.cfm/mytopic=12640

"Basic Information" Combined Heat and Power Partnership
http://www.epa.gov/chp/basic/index.html

"Noise" Department of Energy &Climate Change
http://chp.decc.gov.uk/cms/noise-2

"Geothermal Heat Pump Problems"
http://neogeothermal.com/geothermal-heat-pump-problems.php

6.0 Timetable

	Start Date	End Date	Tasks
Week 1	Jan 11 2010	Jan 17 2010	Revise Proposal
Week 2	Jan 18 2010	Jan 24 2010	Revise Proposal
Week 3	Jan 25 2010	Jan 31 2010	Resizing AHU
Week 4	Feb 1 2010	Feb 7 2010	CHP system
Week 5	Feb 8 2010	Feb 14 2010	Geothermal System
Week 6	Feb 15 2010	Feb 21 2010	Cost Estimation
Week 7	Feb 22 2010	Feb 28 2010	Selecting Mechanical System
Week 8	Mar 1 2010	Mar 7 2010	Acoustics Breadth Work
Week 9	Mar 8 2010	Mar 14 2010	Spring Break (Catch up)
Week 10	Mar 15 2010	Mar 21 2010	Electrical Breadth Work
Week 11	Mar 22 2010	Mar 28 2010	Organize the information
Week 12	Mar 29 2010	April 4 2010	Presentation Preparation
Week 13	April 5 2010	April 11 2010	Presentation Preparation
Week 14	April 12 2010	April 18 2010	Presentation