Thesis Proposal

Suburban Wellness Center
Germantown, Maryland

Prepared by Cory J. Abramowicz
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Faculty Advisor: Dr. James Freihaut

Cory J. Abramowicz
Mechanical Option
Faculty Advisor: Dr. James Freihaut

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Executive Summary

The Suburban Wellness Community Center is a two story 64,800 square foot building which contains a variety of spaces. On the first level is a fitness center and on the second level are conference rooms, offices and private practicing doctor's offices. In the northwest corner of the first floor is the swimming pool area which consists of a large four lane lap pool, a therapy pool, public spa as well as a sauna and steam room. South of this room is the basketball court and racquetball courts which are two stories in height. In the center of the building are the men's and women's lockers rooms and a two story tall atrium with cardiovascular machines and the registration desk. The east side of the first floor holds the free weight rooms in the north and studio spaces for group exercise classes in the south. On the second story in the center of the north part of the building are restrooms and conference rooms. The southeast corner of the second story includes an imaging office which can perform X-Rays, MRIs and ultrasounds. The rest of the space on the second floor has yet to be leased out.

For the spring 2008 semester, the proposed mechanical redesign is a combination of various LEED strategies. Specifically, a redesigned dehumidifier for the swimming pool with more efficiency heat exchange to heat the pool water, roof top units which supply more outdoor air to the spaces and an intensive green roof accessible to members for group exercise classes. Possibilities for improving the emissions given off by the existing mechanical system will also be researched.

The proposed breadths as a result from the mechanical redesign are a structural breadth which will analyze the existing roof system and a construction management breadth which will analyze how the LEED requirement affects the construction process. The addition of an intensive green roof will introduce more loading to the roof structure and with the structural breadth, the existing roof system's effectiveness will be analyzed. Since LEED has several prerequisites for the construction proves, various construction processes will be analyzed.

This report also includes a summary of the building use and mechanical system, alternative redesigns considered, the methods that will be used to research and a research schedule for spring 2008.

Building Summary

The Suburban Wellness Community Center is a two story 64,800 square foot building which contains a variety of spaces. On the first level is a fitness center and on the second level are conference rooms, offices and private practicing doctor's offices. In the northwest corner of the first floor is the swimming pool area which consists of a large four lane lap pool, a therapy pool, public spa as well as a sauna and steam room. South of this room is the basketball court and racquetball courts which are two stories in height. In the center of the building are the men's and women's lockers rooms and a two story tall atrium with cardiovascular machines and the registration desk. The east side of the first floor holds the free weight rooms in the north and studio spaces for group exercise classes in the south. On the second story in the center of the north part of the building are restrooms and conference rooms. The southeast corner of the second story includes an imaging office which can perform X-Rays, MRIs and ultrasounds. The rest of the space on the second floor has yet to be leased out.

Two single packaged combination heating and electric, air-cooled cooling units provide conditioned air to most of the building. RTU-1 which is located on the west side of the building supplies to the southwest corner while RTU-2 located on the east side of the building supplies to the east half of the building. A separate air handling unit is used to supply conditioned air strictly to the swimming pool facility. RTU-1 supplies to the basketball court, racquetball courts, group cycling room and the cardiovascular machine room. RTU-2 supplies to the locker rooms, weight training area, circuit training area, fitness center offices and group workout studios. Both supplies to the spaces using a VAV box system with electric reheat which ensures sufficient individual space conditioning control. A variable speed fan drive is also used to give even more control over the conditioning of the supply air.

The northwest corner of the building which holds the swimming pool facility is conditioned by a dehumidification unit and compressor unit. AHU-1 supplies to the swimming pool facility which has a four lane wide lap pool, public spa and a therapy pool. This space needed a separate unit because of the criterion that must be met for swimming pools. To avoid thermal discomfort and a high evaporation rate, the humidity ratio, air temperature and water temperature must all be kept around a certain range. The humidity ratio must be kept in a certain range, typically between 50% and 60%, and the air temperature must be kept between 80°F and 88°F or 2°F above the desired water temperature. Swimming pool water temperature is also an important factor because of the temperature ranges needed depending on what the swimming pool is used for. Aside from the rooftop units and air handling units, the building also utilizes unit heaters and electric ceiling heaters to heat the stairwells.

Also located near the swimming pool facility is the main mechanical room of the Suburban Wellness Center. Two 800 MBH gas fired water heaters have been placed in the mechanical room to supply hot water throughout the building. To heat the three swimming pools, one 400 MBH and two 250 MBH gas fired pool heaters have been installed. Especially during the winter months when temperatures drop below freezing, these pool heaters take some of the loading off of the dehumidification unit.

Redesign Alternatives

The Suburban Wellness Center has domestic electric hot water heaters located in each area a tenant is occupied. This proves to be a good configuration because it gives responsibility to each of the tenants for the maintenance of their hot water system. However, this is not a good strategy for energy conservation. An option would be to centralize the hot water system by installing a boiler to supply hot water throughout the building. The initial expense of a boiler and flow meters to measure the monthly hot water consumption of each tenant would be a major concern for the owner, but the energy saved over the life span of the equipment would pay for the initial cost.

Proposed Redesign

The Leadership in Energy and Environmental Design (LEED) Green Building Rating System is the nationally accepted benchmark for the design, construction, and operation of energy conscience buildings. The main purpose of this building rating system is to improve public health and the environment as well as reduce operating costs for the building and potentially increase occupant productivity. The five main categories in which points can be attained are sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality.

The construction for the Suburban Wellness Center was completed in November 2002. Around that time, energy consumption wasn't a major issue in the building industry and so the LEED certification wasn't as popular as it is today. Many buildings were engineered to do one function and often time energy efficient technology originally implemented into the building was value engineered out because of the initial expenses. The Suburban Wellness Center didn't attempt any LEED credits and was never checked for a LEED certification. The proposed redesign is to implement green design techniques and strategies to gain a LEED certification. Energy consumption is a major issue in the building industry now and finding anyways to conserve energy would be very beneficial for the Suburban Wellness Center.

A credit that is very important to the LEED Checklist is Credit 1: Optimize Energy Performance. This credit has a possible ten points which is quite a bit considering there are only 69 points on the LEED Checklist. Ways to go about doing this could be to redesign the rooftop units supplying conditioned air to the building or redesign the air handling unit and compressor used to supply conditioned air to the swimming pool space. Several manufacturers who design dehumidifying units are integrating heat recovery into their systems to utilize the energy being expelled into the atmosphere.

One HVAC manufacturer that engineers more efficient systems is Dectron Inc. Their DRY-O-TRON model maintains a constant humidity ratio in the pool area, but also recovers energy to provide free pool water heating. This is done using the hot gas that comes from the compressor. When the compressor is running, it expels hot gas which is normally expelled into the air, however with this technology, the hot gas is redirected into a heat exchanger which transfers the heat energy into the water which goes to the pool. The DRY-O-TRON also uses another process to recycle recovered heat. When warm humid air passes through the dehumidifying coil and cooled below its dew point, the air condenses and the heat captured can also be used to heat the water from the pool. These processes

of heating the pool water using heat recovered from the unit can save the owner 80% on what it would normally cost to heat the pool using electricity or gas. Another technology Dectron Inc. has implemented into their dehumidifying units are Smart Saver Heat Recovery Coils. These coils extract the heat from the exhaust air stream and transfer it to the outdoor air stream using a passive refrigerant system loop. The heat recovered is determined by the temperature difference between indoor air and outdoor air. Below is a payback analysis of a system using the Smart Saver.

Other strategies proposed are CO_2 sensors in the workout spaces which supply more outdoor air when an increase in occupancy is detected. Motion sensor lighting controls can be used to control the lighting in the room depending if the room is occupied or not. Other methods of gaining certification are using recycled materials, using low-e glass glazing, and low VOC paints and sealants. The gas fired water heaters will also be considered and redesigned depending on their emissions levels. Another design method proposed is an intensive green roof which will be accessible to fitness center patrons. Green roofs have a number of benefits including the reduction of heating and cooling loads on the buildings, the filtration of pollutants and CO_2 in the air, as well as the filtration of pollutants and heavy metals in rainwater. This would also allow members to participate in group classes outside. Imagine doing yoga while still breathing in the fresh outdoor air and feeling the crisp grass blades against your bare feet. This redesign was chosen because LEED is not only changing our buildings but also the way we engineer. With this redesign, the LEED certification process will be further researched which will result in several benefits for the future.

Breadth Topics

Implementing an intensive green roof is structurally load intensive so a proposed breadth topic is to redesign the structural system on the roof to support this increased load. Currently the roof has composite steel decking which are supported by W14x74 steel beam spaced five feet on center. When designed, the system originally was only suppose to support dead loads from the rooftop units and snow loads, but with the addition of a green roof, the steel member would need to be redesigned.

The LEED certification process also specifies several prerequisites that must be taken during the construction of the project. The techniques and methods used during the construction process will be researched to discover what the additional cost gaining a LEED certification would be.

Tools and Methods of Research

Trane Trace 700 was used during technical assignment two and will also be used throughout the research of the redesign. This will allow the comparison of different systems implemented into the building's design. Other energy analysis programs such as Energy-10 and eQuest may also be used. LEED Checklists and case studies from buildings similar to the Suburban Wellness Center will also be used to research which strategies worked and which did not.

For the structural breadth, structural modeling programs will be utilized to discover which system will work best for the intensive green roof. The program that is used should be able to determine if the existing design will be feasible to support the intensive green roof.

The construction breadth will include discussing various construction management processes with people well acquainted with the industry and the best ways to include LEED throughout the construction of the project.

Spring Schedule

The following is a schedule for the spring semester research on the proposed mechanical redesign.

Due Date	Week		Task
	7-Jan-08	13-Jan-08	Research LEED Points
	14-Jan-08	20-Jan-08	Research LEED Points
	21-Jan-08	27-Jan-08	Energy Conservation Study
	28-Jan-08	3-Feb-08	Energy Conservation Study
	4-Feb-08	10-Feb-08	Compile Mechanical Redesign Research
	11-Feb-08	17-Feb-08	Structural Analysis
24-Feb-08			Final LEED Checklist Due
	18-Feb-08	24-Feb-08	Structural Analysis
	25-Feb-08	2-Mar-08	Construction Methods Research
2-Mar-08			Structural Model and Analysis Due
	3-Mar-08	9-Mar-08	Construction Methods Research
	10-Mar-08	16-Mar-08	Spring Break/Extended Research Buffer
	17-Mar-08	23-Mar-08	Wrap up research and analysis of unresolved issues
	24-Mar-08	30-Mar-08	Compile Final Report
31-Mar-08			Final Report Due
14-Apr-08			Presentations Due

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