Proposal for Revising the Mechanical System of 148 14th St Hoboken, New Jersey

AE 482 Senior Project

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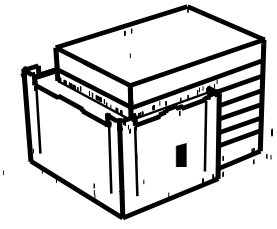


Background

Hoboken Residential is a seven story apartment building. The original shell and structure is a five story, 35,000 sf 1920's masonry building. New construction adds 3000 sf of space to each of the original five floors, and adds two new floors of about 7000 sf each. The finished building will have six floors of condominiums, a ground floor of retail space, and an unoccupied basement of 6500 sf. Two roof top air handling units provide tempered outdoor air. The 15000 CFM unit supplies outdoor air to individual fan coil units in the apartments. The 1755 CFM unit supplies 100% outdoor air to egress corridors. For the retail space, only a capped duct between the first floor and roof is provided for 3000 CFM. The duct for the apartment supply is capped at the basement to allow for basement ventilation fit-out as well. The basement receives tempered outdoor air from the larger RTU. Two fans on the roof supply unconditioned ventilation to the boiler room and to pressurize the stairwell, and various exhaust fans reject air from the apartments. A 117 ton central boiler & hot water loop provides heat via fin tube radiators in the apartments. A 104 ton central chiller / cooling tower system provides chilled water for cooling coils in the fan coil units. The present design meets the criteria for a Silver LEED rating.

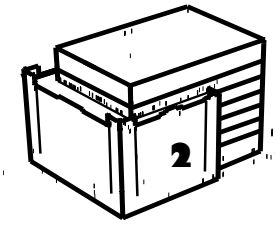
Strategy for evaluating the effectiveness of building mechanical systems

Due to past studies, the present system appears effective and presents no obvious flaws or issues. Therefore a study should be performed to see if another type of system could be a better fit, or is more effective in meeting project goals. Defining what the project goals are presents several difficulties due to the fact it is a condominium building, and the total cost is not assumed by the owner. What the owner's priorities and interests are, and whether the developer or condominium owner pays for the different expenses, has a wide range of possibilities.

To evaluate mechanical systems for this building, I will define a priority matrix. The matrix will compare the importance of all the possible factors against each other, and define how well any system meets those priorities. The result can be summed into a single number. Comparing the final number for each scenario will determine which systems are superior for that specific scenario.

The priority factors which I will define:

1. LEED rating
2. Yearly maintenance and miscellaneous expenses to owner
3. Metering, and the need or ability for owner to manage this.
4. Yearly utility costs to condominium purchasers
5. First costs to owner



6. Ability to reclaim additional first costs
7. Thermal Comfort
8. Indoor air quality

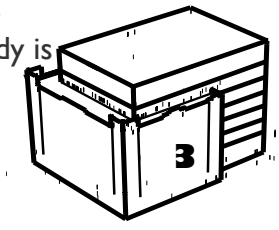
LEED:
After reviewing the construction documents and LEED accreditation plan, these are the points that are dependent on the mechanical design, and accomplished by the present design:
1 – 15% energy reduction over 90.1
1 – 20% energy reduction over 90.1
1 - No HFC's or Halons
1 - No CFC's
1 – Low flow fixtures
Depending on the proposed design, I could trade the above points for these potential points, or attain enough new ones to gain a Gold rating.
1 - 5% renewable energy
1 – 25% energy reduction over 90.1
1 – 30% energy reduction over 90.1
1 - Ventilation Effectiveness
1 - Carbon Dioxide Monitoring
1- Innovation for decreasing emissions

Costs:
I must research how billing is distributed for gas, electricity, and central heating and cooling for condominiums. I need to see how much a change in total heating costs affects the monthly bills of each resident. For example, does the utility charge the owner first, and then he hires someone to bill the residents, or does the utility charge the apartment owners directly? If the owner must do some of the metering, how much of this extra cost must he incur, and how much is reflected in the cost of the condominiums?

Ability to reclaim first costs:
I need to estimate a percent increase buyers would be willing to pay for a superior product.

Thermal comfort:
Thermal comfort of a given design will be determined to be superior or inferior to standard quality. This will be determined by ASHRAE standards unless further study is needed. I am assuming thermal comfort is determined by air distribution, humidity, air velocity, temperature and controllability.

Indoor air quality:
Indoor air quality of a given design will be determined to be superior or inferior to standard quality. This will be determined by ASHRAE standards unless further study is



needed. I am assuming thermal comfort is determined by mold, contaminants, and filtering.

Proposed Systems to Evaluate

I will evaluate two new options that appear to meet the most criteria, two in which either could be the most cost effective. At this time the best possible choices are closed loop geothermal and direct exchange air conditioners. I will evaluate variations on the present system as well.

Proposed system 1 – Closed or Open Loop Geothermal

-Drilled Wells for Loops or Well Pumps
-Central heat pumps, or localized heat pumps
-Heating
    - hydronic fin tube radiators
    - hydronic floor radiant heating
    - heating coils in fan coil units
-Cooling
    - cooling coils in fan coil units from geothermal
    - coils supplied by chiller and cooling tower
-Ventilation
    -tempered air through roof top units
    -separate air intake for each apartment

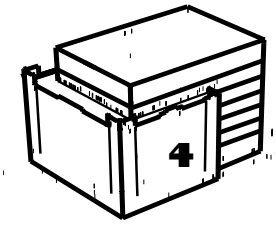
From the soils test, the water table is directly under building. Some more research will be done to determine what the minimum heat transfer capabilities would be from the known properties.

Proposed System 2 - Direct air exchange air conditioning units

- Split system, or wall / window mounted units
- AC unit heating or resistive heating
- Ventilation through unit

Proposed System 3 – Variations of present design

-Use localized heat pumps for cooling instead of central chiller
-Use at-source water heaters
    -radiant floor
    -fin tube radiators



Steps to Evaluate Systems

-Choose one or two geothermal and DX formats that I believe will meet the most criteria
-Estimate needed capacities, materials, and costs with R. S. Means
-Determine if there is a need to change choices thus far
-Calculate energy costs and needs with ASHRAE guidelines
-Do a detailed cost estimate of system and format
-Estimate total respective costs to owner and condo owners
-Do any studies needed to see if system meets criteria
-Evaluate results with matrix, and establish it a rating for each priority scenario.
-Develop a timeline to effectively demonstrate the results in the reports Schizophrenic
-Determine if any other studies should be done to demonstrate effectiveness and a timeline for those.

Breadth Studies

-Replace patinaed zinc panels with recycled aluminum panels. Perform a detailed cost estimate for the zinc and the aluminum, evaluate their environmental impact (or at least recycled content) and compare.

-Do a detailed study on the effects of residents using compact fluorescents instead of incandescents. Determine the impact on the electrical bills of each resident.

Concluding Remarks

To evaluate any proposed system, I needed a way to quantify the parameters. I have decided to do this by using a priority matrix. However, I may find that the assumptions I have to make to finish the evaluation in one semester will override any accuracy I might gain with a priority matrix. Also, it might be difficult to explain the intrinsic meaning in a presentation. If that were so, I would have to find another way to demonstrate why any given system was superior. Also I do not have the experience to say that DX and geothermal are the best alternatives. However, I feel that between these and variations of the present system, I have covered the full scope of designs that could be used in this sort of building and will have a fair indication of what the optimum is.