Structural Breadth & Energy Recovery Systems Study

As stated above in the 'Energy Recovery Systems in Laboratories' section the choices in energy recovery systems came down to a heat pipe or runaround loop. The main differences between the two systems were the first cost and the location of the exhaust and outdoor air streams. The mechanical systems and outdoor air intakes are located on the 3rd floor while the exhaust fans and ducts are located on the roof. To use a heat pipe system the mechanical equipment would need to be located on the 8th floor where it would be possible to have the outdoor air stream located next to the exhaust air streams. However, even with moving the mechanical system to the 8th floor the outdoor air stream and exhaust air stream are not located next to each other. It is not possible to run the exhaust ductwork next to the outdoor ductwork to install a traditional heat pipe system. A split case heat pipe system from Heat Pipe Technologies was used. The typical heat pipe uses the temperature difference between the two airstreams to create the flow between the two sides of the heat pipe. The split case heat pipe has a single stage pump module which helps the fluid move further by not relying strictly on the temperature difference, however unlike a runaround loop these pumps are very small. A problem with split case heat pipe systems is that they are much more expensive than traditional heat pipe system. The pumps only accommodate either a 200 ft horizontal difference between heat pipe coils or a 25 foot rise. The runaround loop with the piping and pumps connecting the 2 coils allows for the mechanical systems to remain where they are currently located using a larger pump than the split case heat pipe system and a different working fluid. Generally speaking, the effectiveness of the runaround loop and the heat pipe systems is similar, but the first cost of the runaround loop is slightly higher due to the piping, pump and larger amount of working fluid required. However this is not the case with a split case heat pipe system. A study was done to give an idea of the extra costs associated with exchanging the 3rd floor with the 8th floor to allow for the airstreams being close enough to for use of the split case heat pipe system as well as to see if the structure could handle the change of the loads.

The first issue to consider with exchanging the 3rd floor to the 8th floor was the building's structure and the changing of the loads. The building's structural layout and loads were entered into Ram v10.0. Initially the building was laid out with the

original floor arrangement. The loading was switched between the 3rd and the 8th floor. Ram was then run to size the columns and beams needed for this loading arrangement. The suggested beam and column sizes were checked against the current beams and columns in the building. Originally it was thought that the columns would have to be upsized to accommodate the shifting of loads within the building. However this was not the case. The building's structural system was fine as is for either floor arrangement. The RAM model for the Margaret M. Alkek Building for Biomedical Research can be seen below in Figure 13 below.

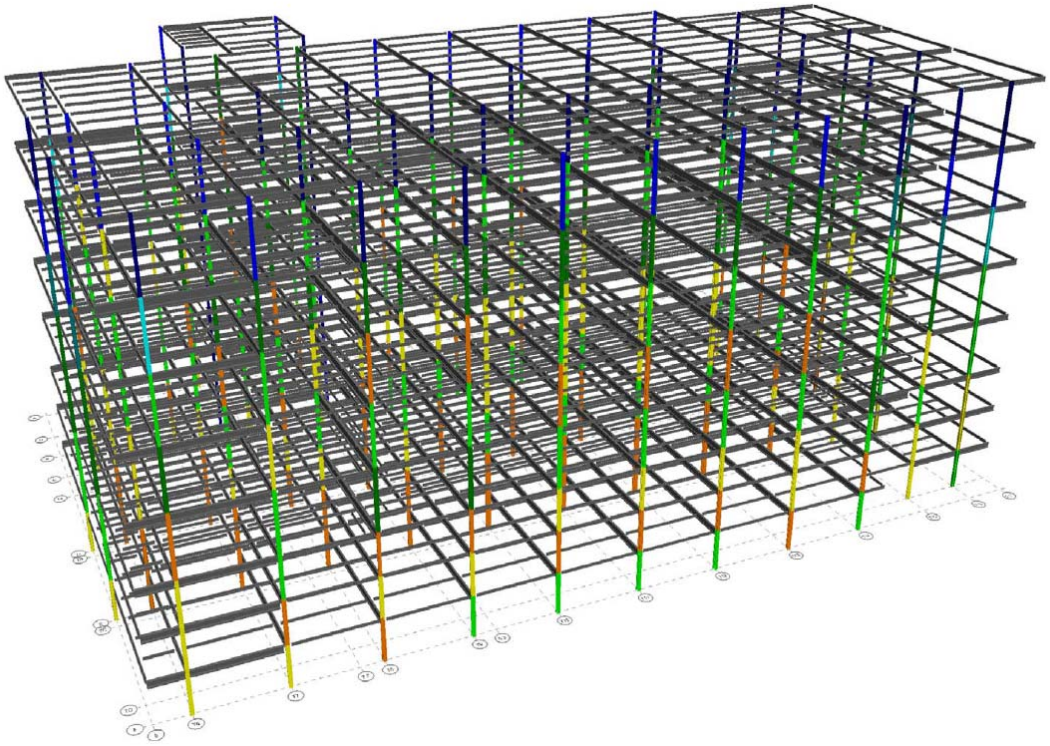

Figure 13

The final area to examine the impact of moving the mechanical systems to the 8th floor was on the mechanical system itself. Riser diagrams, shaft diagrams and floor plans were used to determine which ducts, piping and other mechanical equipment would be impacted by this move. When the mechanical systems were moved to the 8th floor the supply duct going down to the viviarium (levels 1&2) needed to be extended 85 feet. Also there was a return duct that had to be extended approximately 85 feet as well. The rest of the duct work serving the upper levels would remain the same length since the mechanical systems would just be moving

from below the run to above it. The next area that was looked at was the extensive piping system that serves all the mechanical equipment. This area was significant. The campus chilled water supply/return as well as the campus steam loop piping need to be extended up since the heat exchangers being fed to make the buildings chilled water and steam are now located on the 8th floor. The low pressure steam that is being created on the mechanical floor must be extended down to the vivarium once again which is another pipe that needs to be extended. Other piping that is impacted includes hot water supply/return, chilled water supply/return and medium pressure steam return. The table below shows the cost of the heat pipe system versus the runaround loop which ultimately led to the choice to use the runaround loop mainly due to the exurbanite price of the split case heat pipe system.

Split Case Heat Pipe Installation Costs

Item	Quantity	Total Cost
Duct Work	170 feet	$ 19,496
Chilled Water Piping	200 feet	$ 10,914
Process Chilled Water	190 feet	$ 3,032
Hot Water Piping	170 feet	$ 5,950
Steam Main Piping	85 feet	$ 7,225
Condensate Return	125 feet	$ 2,125
Laboratory Heat Pipe	1 system	$ 366,000
Vivarium Heat Pipe	1 system	$ 190,000
	Total:	$ 604,742

Runaround Loop Installation Costs

Item	Quantity	Total Cost
Laboratory Coils	6 coils	$ 18,738
Vivarium Coils	6 coils	$ 18,738
Piping (2.5")	190 feet	$ 4,465
Piping (3")	190 feet	$ 7,505
Pump (Vivarium)	1 pump	$ 3,893
Pump (Lab)	1 pump	$ 3,793
Glycol Ethylene	96 Gallons	$ 1,114
	Total:	$ 58,246

* Pricing for all piping per linear foot was taken from original estimate done for the research tower

**Split case heat pipe system estimated byRick Galie at Air Tectonics

Table 3