

7. Mechanical Problem for ASC Competition

The new Fox Office Building was intended to be served by the campus chilled water plant. The existing central plant currently serves about 50% of the campus buildings and is running at full capacity. An expansion of the existing central plant is in design. This plant expansion would not only serve the new office building, but other campus buildings that are not currently connected to the plant. Construction completion was planned to coincide with the completion of the new office building.

Due to the current economic downturn, the Fox management has is considering cancelling the \$35 million central plant expansion project. This creates a major problem of how to provide chilled water for the air conditioning of the new office building.

At the P4 level of the building there is currently a storage area that just happens to be large enough to house the chillers and their associated pumps and the roof has an area that can accommodate the cooling towers. A route will need to be established for the condenser water piping from the P4 level mechanical central plant to the roof.

As the general contractor, the owner (Fox) has requested that you provide a rough order of magnitude (ROM) budget to add a chilled water plant to your building. Do not incorporate this exercise into your answers for any other section of the Preconstruction problem. This is just one of several potential solution being considered by the Owner.

In order to establish your ROM budget here are the parameters:

- Total capacity of the chilled water plant needs to be calculated. The coil data for the built-up air handling units and the fan coil units have the total cooling capacities specified on the mechanical schedule. To these loads add 10 tons per office level for miscellaneous tenant cooling loads.

$$\text{MBH} = 1000 \text{ BTU/Hr}$$

$$1 \text{ ton} = 12,000 \text{ BTU}$$

rule-of-thumb check approximately 400 cfm / ton

- There will be 2 chillers, each sized at 60% of the system total load. Note that chillers are up-sized so that should a chiller be down for service, the capacity of one chiller could maintain air conditioning during normal outdoor conditions. The budgetary installed cost of a chiller is \$280 per ton.
- Each chiller will have a chilled water pump and a condenser water pump. Capacities of the pumps are determined by the following equation:

$$\text{BTU} = \text{GPM} \times 500 \times \text{differential temperature}$$

chilled water system 16°F temperature differential (44°F > 60°F)

condenser water system 10°F temperature differential (95°F > 85°F)

The budgetary installed cost of a pump is \$9.00 per gpm.

- Cooling towers have a budgetary installed cost of \$126 per ton.

- Budgetary piping costs for the chilled water plant are \$326 per ton. This is based upon a close-coupled plant; meaning that the cooling towers are located adjacent to the chillers. Since the cooling towers are located on the roof, condenser water piping costs (supply and return) from the P4 level central plant to the roof will need to be added.

6" dia pipe	220>700 gpm	\$82 per LF
8" dia pipe	700>1,200 gpm	\$108 per LF
10" dia pipe	1,200>2,000 gpm	\$146 per LF

In addition the chilled water piping will have to be extended from the P1 level to the P4 level central plant.

- The other sub trades have provided the following budgets for the plant addition:

Electrical	\$220,000
Architectural / Structural	\$85,000
Temperature Controls / BAS	\$125,000
Crane & Rigging	\$35,000
Fire Protection	\$15,000

- The scheduled completion of the project will have to be extended by 4 months due to the addition of the chilled water plant (design and permitting). General Condition's costs are at \$110,000 per month.
- Fee on top of all costs for this potential has been negotiated with the owner at 5%.
- You will probably want to look at sheets M-.02, M-1.04, A2.10, A-2.11, A-3.01

Deliverables;

- Calculations for cooling loads, equipment selection, pipe sizing/quantities
- ROM budget estimate for this potential change
- Sketch of proposed roof top equipment and piping
- Sketch of proposed P4 chiller plant equipment and piping risers
- Sketch of proposed roof top equipment in building elevation