Infrastructure Study

PRR 07C5717

University of California, Berkeley
Moffitt Library

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Submitted to
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By
Capital Projects

Capital Projects was authorized by the Library Department to conduct an evaluation of the mechanical and electrical systems. Identify the deficiencies in each system and make recommendations for the upgrade, including costs to make the recommended changes.

Executive Summary

Moffitt Library was built in 1970. It is a five-story building with two basement levels, approximately 140,000 gross square feet.

Moffitt Library is no longer able to provide an environment that supports the requirements of the students and staff that use the building. A combination of age, system failures, lack of funds for upkeep and changing ways that students use the facility have all combined to create this situation. The deficiencies of the mechanical and electrical systems have had a significant impact on the usability of the building. Temperatures and ventilation on the floors are not stable, the building is cold in the winter and hot in the summer. There are not sufficient electric outlets to support the expanded use of lap top computers. The lighting no longer is a type that is recommended for computer use or study and the walls, floor and ceiling all show their age.

Minimally, the building should have a new heating and temperature control system installed on all of the floors. Equipment in the mechanical room needs to be replaced and refurbished. Additional electric panels need to be installed throughout the building.

Original Design Intent– Mechanical System

Temperature control was provided to the spaces by fin tube radiators along the perimeter or windows and reheat for the interior areas. Zone thermostats are used to control temperature. The systems are supported by a centralized heating and cooling system in the main mechanical rooms. The building's supply and exhaust fans are also located in these areas. This design was and still is an accepted design approach.

Mechanical Room

- Heating - A pressure reducing station reduces the pressure of the incoming campus steam from 125 psi to 30 psi. The heat exchangers, located in the mechanical room, use the low pressure steam to provide the hot water for the building. Hot water pumps send the water to the preheat coils at the supply fans and to the fin tubes radiators.

- Cooling – An absorption chiller, cooling tower and pumps provide cold water to the tempering coils at the supply fan.

- Building Controls - The buildings HVAC system is monitored and set points can be adjusted by the Barrington System (**EMS).**

Ventilation
Supply fans in the mechanical room would distribute fresh air through out the building. The fans heating/cooling coils temper the supply air to 70 degrees.

Zone Heating
The core of the library would be heated using the excess heat generated from the lighting system. One-half of the lights would remain on at night, and all lights would be on in the morning. The heat from the lights would warm the ceiling air. The "mixing" (induction) boxes located throughout the library would then mix the existing "warm space air" with the proper amount of outside air to either heat/cool the space. Temperature was controlled via a thermostat in the light fixtures. Note: this type of system is no longer used.

In the classrooms and the micro-film room, electric reheat coils were provided for use when the lights were either dimmed or turned off. In these rooms, temperature was controlled by a thermostat on the wall.

The perimeter of the library was to be heated by a baseboard fin tube (radiator) system, one wall fin tube system for each quadrant of the floor. Hot water flows through the tubes and the air is heated as it passes over the hot water pipes. Each quadrant of the building is serviced by a dedicated hot water pump. On each floor, there are multiple locations where the radiator system has a "U" in the system as the horizontal fin tubes drop vertically through the floor in order to bypass a concrete beam, wraps around the beam and then rises vertically back through the floor and continues with the original horizontal fin tubes.

Zone Cooling
No zone cooling.

Corner Classromms
Corner classrooms were added at a later date, and each room is serviced by an individual split system where the evaporator is located in the classroom and the corresponding intake fan is located outside on the roof. Temperature is not interlocked with the main portion of the library.

Current Condition – 2007

- The HVAC system does not work as intended. An energy efficient lighting system retrofit took place a number of years ago. Energy efficient lights put out less heat. This inadvertently reduced the amount of "warm space air" which the building relied upon for heating. In addition, there is little to no temperature control in the building. (Hot water heating pumps were running when the ambient temperature was 90 degrees.) The result: A cold/hot, unpleasant space in which to study. The original design of the heating system is no longer used in today's buildings.

- The electric and hot water reheat coils are largely ineffectual. The heating pipes are clogged and the temperature control has deteriorated.

- The fin-tube (radiator) system is not working due to the lack of flow in the hot water piping system. The piping system is clogged due to mud, scale, corrosion and an absence of chemical treatment. This is especially detrimental in the "U" portion of the system and results in the lack of heating to the perimeter of the building.

- The main supply fans are in good operating condition and able to accommodate additional loads.

- Mechanical equipment, (cooling tower, heating pumps, heat exchangers, pressure reducing station) are either old and beyond their life cycle or abandoned in place and non-functional. Many of the aforementioned equipment are already on the deferred maintenance list.

- The remodeled corner classrooms are not functioning. The evaporator units have plugged filters and the fans only operate when turned on by-hand (on the roof), they fail to run on automatic.

- Air conditioning in only one of the four telecom hub rooms is fully functional. Two of the rooms are quite crowded and there is not adequate room to install the equipment required to provide air conditioning.

- The roof is a light weight concrete deck. The roof has split in numerous locations enabling water to penetrate the structural concrete, resulting in the roof "rotting" and damage to the ceiling in two areas. There is asbestos in the base of the flashing. Roof repair is currently on the deferred maintenance list.

- The electrical panels are fully loaded with no additional circuits available. Additional power is available in the mechanical room, all of the distributed power is used.

Recommendations

1. Abandon the fin tube radiators, the horizontal heating hot water piping and remove all of the terminal heating boxes. Install a new VAV system with reheat coils. New horizontal heating piping and duct modifications will need to be made on each floor. This work will require the removal of the ceiling tiles and significant modifications the ceiling grid. This would be a cost effective time to install a new ceiling and lights. The existing ceiling tiles are shabby and the light quality is poor .[1a, 1b and 1c, $5.2M]

2. Replace the temperature control system, at the zone and building level. [2, $470k]

3. Replace or refurbish the mechanical equipment that has surpassed its life cycle as well as chemically clean the associated piping. [3a, 3b, 3c, 3d, $510k and deferred maintenance list]

4. Upgrade the electrical capacity by providing an additional electrical panel in the basement as well as on each floor, and redistributing the power so that there are enough electrical outlets to accommodate the requirements of today's students. [4, $620k]

5. Replace the three corner fans with new fans, coil, duct distribution and controls. [5, $230k]

6. Replace the roof in its entirety. Waterproof the cooling tower slab with medicrylic. [6, $1.6M, deferred maintenance list]

7. Relocate telecom equipment from telecom hub rooms 404 and 210 to allow for space for air conditioning equipment.

8. The attached spread sheet also provides estimated costs for upgrades and replacement of other building systems.