96-153

RICHMOND ENGINEERING

3010 – 29th AVENUE SW, TUMWATER, WA 98512 • (360) 956-0384 • FAX 352-1275

96-153

CAPITOL PARK BUILDING DEFICIENCIES STUDY

Final Report
June 7, 1996
Project No. 96-153

PREPARED FOR

State of Washington
Department of General Administration
Division of Capitol Facilities

PREPARED BY

Richmond Engineering
3010 29th Ave. SW
Tumwater, WA 98512

1 INTRODUCTION

1.1 PURPOSE

This report presents the findings of the Capitol Park Building Deficiencies Study, which evaluated the Capitol Park Building for deficiencies in all major building systems and determined the areas of critical need. This work was authorized under Project No. 96-153 between the State of Washington and Richmond Engineering.

1.2 BUILDING DESCRIPTION

The Capitol Park Building is located at 1063 Capitol Way in Olympia, Washington. The structure is a two-story, wood framed building built in the early 1900's. A parking garage is located under the street-level main floor, and reached by a ramp off a side street. The wood frame is reinforced with concrete columns along the exterior walls on the north, east and south sides; the west wall is reinforced concrete.

The building currently houses two restaurants on the main floor, as well as a television station. The space occupied by the TVW studio, formerly a bowling alley, rises structurally to the roof, giving the second floor less square footage than the first. This space has recently been remodeled, as have the restaurants. No significant changes are anticipated in building use.

1.3 ABOUT THE SURVEY

Scope

The scope of the study encompasses all parts of the building. It does *not* include asbestos removal or communications systems upgrades (such as might be needed for computers.

The recommendations made here are based on the understanding that building usage will remain essentially the same. As usage changes, system requirements will change, and will likely cause changes to the recommendations and cost. All cost estimates are budgetary figures only.

Method

The building survey was conducted by visual methods only. Richmond Engineering conducted the mechanical systems study. Richmond Engineering was supported in conducting the remaining studies by: MC Squared Inc., structural systems; Tres West Engineers, Inc., electrical systems; and MSGS Architects, architectural systems. Documentation assistance was provided by Technical Communication Consultants, Inc.

Deficiency Prioritization

It would be most design-effective and therefore cost-effective to do all the required work on the building at one time. Because this may be impossible from a funding standpoint, the work is prioritized. Prioritization is based on three parameters:

- Giving a high priority to work that resolves life/safety issues
- Grouping together work that is functionally related
- Grouping together similar work disciplines

Given these parameters, the following priority rankings were assigned to each problem area:

- The priority 1 items are related to seismic (structural) upgrades and associated architectural and mechanical work that should be done at the same time. Because of the potential for a major earthquake in the area, failure to complete the seismic upgrade carries a high risk to life/safety and to the integrity of the entire building.
- The priority 2 items are also important from a health and safety standpoint, but carry a lesser level of risk, or are better deferred until the integrity of the structure is assured.
- The priority 3 items are comfort- or code-related, without major life/safety implications.

Each building deficiency was assigned a priority rating of 1, 2, or 3, with 1 being the highest priority.

1.4 About This Report

The remainder of this report presents the results of the Capitol Park Building Deficiencies Study. It begins with an Executive Summary of the findings. The Executive Summary lists the deficiencies by priority and by system, then discusses the findings.

Following the Executive Summary are individual sections for each of the four main building systems: structural, architectural, electrical, and mechanical. These sections provide the details—the problem, solution, estimated cost, and priority— for each deficiency.

2 EXECUTIVE SUMMARY

2.1 SUMMARY OF DEFICIENCIES BY PRIORITY

Priority 1 Items

Component	Item	Cost	System
Roof and floor diaphragm	Upgrade subdiaphragm connections	Total cost $970,000	Structural
Interior partition walls	Redesign/reconstruct as shearwalls		Structural
Exterior columns	Install steel member cross bracing		Structural
Occupancy type	Code review	$1,500	Architectural
Roofing	Reroof in case of seismic upgrade	$170,000	Architectural
Corridors	Upgrade to one hour assemblies	$90,000	Architectural
Exterior windows	Replace with insulated glazing assemblies	$110,000	Architectural
Exterior walls	Exterior coating of dryvit finish	$30,000	Architectural
HVAC systems	Preliminary HVAC design	$6,500	Mechanical
	Total priority 1	$1,378,000	

Priority 2 Items

Component	Item	Cost	System
Branch circuit wiring	Replace rubber-insulated wiring	$160,000	Electrical
Exit/egress illumination	Install code-compliant exit and egress lighting fixtures	$9,000	Electrical
Fire alarm system	Extend system to entire building and upgrade to ADA requirements	$25,000	Electrical
Service panels and branch panels	Replace outdated and overloaded panelboards and feeders	$120,000	Electrical
Service disconnects/metering	Group in one location	$90,000	Electrical
	Total priority 2	$404,000	

Priority 3 Items

Component	Item	Cost	System
Exterior walls	Insulate from the interior	$120,000	Architectural
Stairs	Replace handrails	$20,000	Architectural
Elevator	Install new shaft and elevator	$100,000	Architectural
Garage	Add second stair exit	$25,000	Architectural
Toilet rooms	Install centralized toilet rooms	$100,000	Architectural
Interior lighting	Replace inefficient fixtures with energy efficient type	$60,000	Electrical
Basement parking garage	Install new exhaust fans	$7,500	Mechanical
Basement mechanical room, maintenance shop, storage room, and common areas	Install new heat pump	$8,000	Mechanical
Restaurant: northeast corner, ground floor	Install new range hood and heating system	$29,000	Mechanical
Restaurant: southeast corner, ground floor	Upgrade range hood and replace HVAC system	$36,000	Mechanical
Vacant doctor's offices	Replace heat pump	$5,000	Mechanical
Offices (exclusive of the TVW studio)	Replace existing heating systems	$180,000	Mechanical
	Total priority 3	$690,500	

2.2 SUMMARY OF DEFICIENCIES BY DISCIPLINE

Structural Systems

Component	Item	Cost	Priority
Roof and floor diaphragm	Upgrade subdiaphragm connections	Total cost $970,000	1
Interior partition walls	Redesign/reconstruct as shearwalls		1
Exterior columns	Install steel member cross bracing		1
	Total structural	$970,000	

Architectural Systems

Component	Item	Cost	Priority
Occupancy type	Code review	$1,500	1
Roofing	Reroof in case of seismic upgrade	$170,000	1
Corridors	Upgrade to one hour assemblies	$90,000	1
Exterior windows	Replace with insulated glazing assemblies	$110,000	1
Exterior walls	Exterior coating of dryvit finish	$30,000	1
Exterior walls	Insulate from the interior	$120,000	3
Stairs	Replace handrails	$20,000	3
Elevator	Install new shaft and elevator	$100,000	3
Garage	Add second stair exit	$25,000	3
Toilet rooms	Install centralized toilet rooms (optional)	$100,000	3
	Total architectural	$766,500	

Electrical Systems

Component	Item	Cost	Priority
Branch circuit wiring	Replace rubber-insulated wiring	$160,000	2
Exit/egress illumination	Install code-compliant exit and egress lighting fixtures	$9,000	2
Fire alarm system	Extend system to entire building and upgrade to ADA requirements	$25,000	2
Service panels and branch panels	Replace outdated and overloaded panelboards and feeders	$120,000	2
Service disconnects/metering	Group in one location	$90,000	2
Interior lighting	Replace inefficient fixtures with energy efficient type	$60,000	3
	Total electrical	$464,000	

Mechanical Systems

Component	Item	Cost	Priority
HVAC systems	Preliminary HVAC design	$6,500	1
Basement parking garage	Install new exhaust fans	$7,500	3
Basement mechanical room, maintenance shop, storage room, and common areas	Install new heat pump	$8,000	3
Restaurant: northeast corner, ground floor	Install new range hood and heating system	$29,000	3
Restaurant: southeast corner, ground floor	Upgrade range hood and replace HVAC system	$36,000	3
Vacant doctor's offices	Replace heat pump	$5,000	3
Offices (exclusive of the TVW studio)	Replace existing heating systems	$180,000	3
	Total structural	$272,00	

3 STRUCTURAL SYSTEM DEFICIENCIES

Following are the structural deficiencies identified for the Capitol Park Building.

3.1 ROOF AND FLOOR SUBDIAPHRAGM CONNECTIONS

Problem

Typically, buildings of this age do not have subdiaphragm connections. These are mechanical connections between the edge of the roof and floor diaphragms and their supporting exterior walls. During earthquakes, buildings without these connections are susceptible to the roof or floor system pulling away from the supporting walls and collapsing. Efforts to verify existence of these type of connections were unsuccessful. Selective demolition of the building will be required to further investigate the absence of these connections.

Solution

Subdiaphragm connections for the roof and floor systems need to be sized and spaced for connection to the columns at the exterior walls. This would consist of possible addition of new framing members at required anchor locations. Anchors would be drilled and epoxied into the existing columns.

3.2 INTERIOR PARTITION WALL MODIFICATIONS

Problem

Originally, the interior walls of this buildings were designed strictly as bearing walls. All of these walls have either sheetrock, or plaster over wood lath on both sides of the walls.

Even though it was not the original intention, these sheetrocked and plastered walls do have some (minimal) lateral resistance capacity.

Modification of these interior partition walls into wood sheathed shearwalls with holdowns will strengthen the building's ability to resist lateral forces during earthquakes.

Solution

Interior partition wall modifications would involve redesigning them as shearwalls. This would consist of the following:

1. Locating appropriate interior partition walls.

2. Removing the finishing on the walls.

3. Making appropriate connections of the walls to roof and floor diaphragms.

4. Installing holdown anchors at the corners of these walls.

5. Adding sheathing to one or both sides of the walls.

6. Refinishing the wall to the owner's satisfaction.

3.3 Exterior Column Bracing

Problem

At the north, south, and east walls there are structural concrete columns spaced a maximum of 23 feet apart. These columns are the only structural component (at these exterior wall lines) capable of providing any vertical, or lateral resistance. In terms of lateral resistance, these three exterior walls are the weakest component of the building.

Solution

Steel member cross bracing will most likely need to be installed between the existing columns at designated locations. These cross bracing members would angle vertically between columns and floor levels to form an "X" brace.

3.4 Concrete Slab

Problem

Cracking of the concrete slab-on-grade and of the concrete deck over the parking garage exists.

Solution

All of the cracks will need to be cleaned and then filled with an epoxy type grout.

3.5 WEST EXTERIOR WALL

Problem

There are large cracks in several locations on this wall. Most of these cracks have been crudely repaired in the past. It is obvious that these previous repair efforts have failed and are in need of proper attention.

Once crack repairs have been made, weather protection of the wall needs to be addressed.

Solution

Power wash entire surface of wall. Thoroughly clean existing cracks in the wall. Repair cracks by pressure injection of epoxy grout.

Primer and paint entire wall surface for protection against the weather.

3.6 ESTIMATED COSTS

At this point in time, a full scope of work to be performed on this building is preliminary. Accurate total costs to upgrade the building are limited by the current scope of the investigation. Costs will have to be based on our past experience with this type of work.

With this in mind, we estimate costs for seismic upgrading of this building will fall between $15 to $20 per square foot.

The main floor is 28,000 sq. ft., the upper floor is 13,400 sq. ft., and the basement if 14,500 sq. ft. Based on the main and upper floors, total repair costs should be in the $621,000.00 to $828,000.00 range.

3.7 REPAIR PHASING

Seismic upgrade repairs for this building could be performed together as one project, or in phases for portions of the building as funds are available.

4 ARCHITECTURAL SYSTEM DEFICIENCIES

Following are the architectural deficiencies identified for the Capitol Park Building.

4.1 OCCUPANCY TYPE

Problem

The building current use is a mixed occupancy of a garage, office space, and restaurants. There are some options in selecting an occupancy type, but it should be consistent for all future work.

Solution

During the first phase of work on the building, review the occupancy with building officials, consider the trade-offs among the options, and select an appropriate occupancy type for application to future work.

Estimated Cost

$1,500.00

Priority

1

Comments

Actual Building Size

Parking Garage Level:	14,500 ft^2
Main Floor Level:	28,000 ft^2
Upper Floor Level:	13,400 ft^2

1994 Uniform Building Code

Occupancy Types: B—Offices
B—Eating establishments less than 50
A3—Eating establishments more than 50

Allowable Floor Area, Building Type B: Type VN—8,000 ft^2
Type V1—14,000 ft^2
Type IIIN—12,000 ft^2
Type III1—18,000 ft^2

Allowable Floor Area, Building Type A3: Type VN—6,100 ft^2
Type V1—10,500 ft^2
Type IIIN—9100 ft^2
Type III1—13,500 ft^2

Sprinkler System

The basic allowable floor area may be doubled in buildings of more than one story if the building is provided with an approved automatic fire sprinkler system throughout.

The building can be classified as one of the following with an approved automatic fire sprinkler system:

Type V1
Type IIIN
Type III1

4.2 ROOFING

The building was reroofed in 1987. The roof covering is single ply membrane. Rigid insulation was added to the roof at the time of the reroofing work. Current life expectancy is 12–15 years.

Problem/Solution

The building would require reroofing if seismic upgrading of a roof diaphragm is required.

Estimated Cost

$170,000.00

Solution

Replace all exterior windows and doors with insulated glazing assemblies during any major network renovation work.

Estimated Cost

$110,000.00

Priority

1

4.5 EXTERIOR WALLS

The building exterior wall system is painted concrete. Most of the exterior wall surface was painted approximately two years ago.

Problem

The alley (west) side has not been painted and is in need of a new finish coating to repair cracks and for weather protection.

Solution

Exterior walls require a coating of dryvit finish.

Estimated Cost

$30,000.00

Priority

1

4.6 EXTERIOR WALLS

The wall interiors are furred with wood studs with minimum insulation.

Problem

Insulation is insufficient.

Solution

During any building remodel or renovation work, the exterior wall surfaces should receive, from the interior, new insulation with an R-value of not less than 19.

Estimated Cost

$120,000.00

Priority

3

4.7 STAIRS

The building is served by one main stair for the Garage, Main Level, and Upper Level floor areas. The Garage and Main floor areas are separated by a fire rated door at the Main floor level, and this separation is required to remain.

Problem

The stair handrails are not in conformance with current accessibility requirements.

Solution

Replace the handrails and upgrade stair finish.

Estimated Cost

$20,000.00

Priority

3

4.8 ELEVATOR

Problem

The building is not equipped with an elevator. This could become an issue due to ADA requirements.

Solution

Install a new shaft and elevator to serve the Garage, Main, and Upper floors.

Estimated Cost

$100,000.00

Priority

3

4.9 GARAGE

The Garage area is concrete construction. Vehicle access is via a steep ramp on Union Street. Access to the building from the Garage is via an interior stair which also serves as an exit.

Problem

Code requires a second exit out of the Garage area.

Solution

Add a second stair exit out of the Garage area.

Estimated Cost

$25,000.00

Priority

3

4.10 TOILET ROOMS

Problem

Toilet rooms are scattered throughout the building. Although the toilet rooms have been modified for improved accessibility, some still do not meet the latest accessibility standards.

In addition, the number of existing toilet fixtures do not meet the minimum code requirements.

Solution

Remove existing toilet rooms and build new centralized toilet rooms (one men's and one women's) on each floor.

The current WAC requires the following fixture counts for Group B:

Offices, Main Floor (21,000 ft^2):

107 occupants
Women's: 4 fixtures
Men's: 4 fixtures

Eating establishments, Main Floor (6,600 ft^2):

220 occupants
Women's: 4 fixtures
Men's: 4 fixtures

Estimated Cost

$100,000.00

Note that the cost of providing accessibility upgrades only is $15,000.00.

Priority

3

5 ELECTRICAL SYSTEM DEFICIENCIES

Following are the electrical deficiencies identified for the Capitol Park Building.

5.1 BRANCH CIRCUIT WIRING

Problem

The building contains a mixture of newly installed conduit with THW/THHN wiring and old wires equipped with rubber and cloth type insulation that is oxidized and cracked.

Solution

Replace all wiring that has aged rubber insulation.

Estimated Cost

$160,000.00

Priority

2

5.2 EXIT/EGRESS ILLUMINATION

Problem

Existing exit and egress illumination does not comply with code requirements.

Solution

Install battery backup type exit and egress lighting fixtures in all exit paths.

Estimated Cost

$9,000.00

Priority

2

5.3 FIRE ALARM SYSTEM

Problem

1. Though the current fire alarm system covers the entire building, it does not meet current code requirements. Over half of the automatic smoke detectors in exit corridors are spaced a greater distance than required by code. Heat detectors are used to protect some of the office space, rest rooms, and storage rooms. Some spaces are not protected with either automatic smoke or heat detectors.
2. The current fire alarm system does not comply with ADA code requirements.

Solution

1. Update fire alarm system to meet code requirements.
2. Install horn/strobes to meet ADA requirements.

Estimated Cost

$25,000.00

Priority

2

5.4 SERVICE PANELS AND BRANCH PANELS

The building contains a mixture of newly installed circuit breaker panelboards, load center type panelboards, and screw-on fuses type panelboards.

Problem

1. Some of the older types panelboards may not be able to withstand short circuit currents from the service transformer.
2. Overload conditions exist in several branch panelboards.
3. Panelboard serving computers and data terminal equipment is not equipped with voltage suppression system.

Solution

Replace all outdated and overloaded panelboards and feeders.

Estimated Cost

$120,000.00

Priority

2

5.5 SERVICE DISCONNECTS/METERING

The building is served from Puget Power overhead transformer with service drops spread over five different locations with 16 meter bases and 17 service disconnects.

Problem

Code requires all service drops to be grouped in one location, and a maximum of six service disconnects are allowed for each service voltage configuration. (Six disconnects are allowed for 240 volt, 3 phase delta service, and six disconnects are allowed for 120/240 volt, single phase service.)

Solution

Remove all remote meters, and group all service disconnects to the main electrical service panel located in the electrical room. This panel is rated at 1600 amperes (120/240 volt, 3 phases, 4 wires) and has adequate capacity to serve the entire building. Building electrical demand is estimated at 750 amperes, based on Puget Power demand metering records and an analysis of the past year's utility billings.

Estimated Cost

$90,000.00

Priority

2

5.6 INTERIOR LIGHTING

Interior lighting is a mixture of incandescent fixtures, standard fluorescent fixtures, and energy efficient fluorescent fixtures.

Problem

The incandescent and standard fluorescent fixtures do not comply with energy code requirements.

Solution

Replace inefficient lighting fixtures with energy efficient fluorescent fixtures to comply with energy code requirements. Do this as part of the design in any overall building remodel.

Estimated Cost

$60,000.00

Priority

3

6 MECHANICAL SYSTEM DEFICIENCIES

Following are the mechanical deficiencies identified for the Capitol Park Building.

Note that the TVW Studio, located on the ground floor of the central west side of the building, was extensively remodeled approximately two years ago. New HVAC systems were installed to service this studio at that time. The new system complies with present Indoor Air Quality and Nonresidential Energy Codes. No modification or upgrade is needed at this time.

6.1 HVAC SYSTEMS

Problem

It is anticipated that building upgrade will be conducted in phases, with structural and electrical upgrades preceding HVAC work. To prevent possible rework, upgrades to building structural and electrical systems must take into account anticipated future HVAC needs.

Solution

Conduct a preliminary HVAC design for use in corresponding structural and electrical design.

Estimated Cost

$6,500.00

Priority

1

6.2 BASEMENT PARKING GARAGE

The basement area consists has a 12,660 sq. ft. parking garage which has an opening for vehicle traffic on the North West corner, and four window openings equally spaced along the North wall.

Problem

The windows have been removed from the openings to allow ventilation, but no positive ventilation is present. The Indoor Air Quality Code ventilation requirement for this area is 19,000 cfm.

Solution

Add exhaust fans in the four window openings along the North wall to exhaust 19,000 cfm. The make up air will flow down the drive into the basement parking area and the basement will be very slightly negative pressure to help prevent fumes from entering the building.

Estimated Cost

$7,500.00

Priority

3

6.3 Basement Mechanical Room, Maintenance Shop, Storage Room, and Common Areas

Problem

1. These areas have no positive ventilation. They total approximately 2,185 sq. ft. and need a total ventilation of 375 cfm. outside air to comply with the Indoor Air Quality Code.
2. The ventilation system needs to be such that it will create a slightly positive pressure to eliminate the potential of pulling air and exhaust fumes in from the parking garage.
3. Added ventilation will adversely affect the present heating system.

Solution

Option 1: Install a ducted gas furnace with an economizer for positive ventilation, proper heat control and zone control in the basement.

Option 2: Install a split system heat pump with ducted air distribution and an economizer for positive ventilation, proper heat control and zone control in the basement.

Estimated Cost

Option 1:	Gas furnace	$6,000.00
Option 2:	Heat pump	$8,000.00

Priority

3

6.4 RESTAURANT: NORTHEAST CORNER, GROUND FLOOR

Problem

1. There is no exhaust hood over the range. The only exhaust in this area is a small exhaust fan in the ceiling blowing out through a duct to the roof and another small exhaust fan blowing out into the adjacent storage area.
2. The restaurant has inadequate ventilation and no air conditioning.
3. There is no system available to provide make-up air for a range exhaust hood.

Solution

1. Install a new range hood and exhaust fan, complete with hood fire suppression system.
2. Install a split system heat pump or a gas furnace with air conditioning. The condensing unit can be placed on the roof with the refrigerant lines coming down through a small chase in the second floor to the air handling unit. The air handling unit will require an economizer. The fresh air intake and exhaust air can be ducted through the side wall near the ceiling due to the extreme ceiling height.
3. Interlock the economizer dampers with the range exhaust hood to provide sufficient make-up air for the exhaust hood.

Estimated Cost

Range hood with fire suppression system:	$12,000.00
New heating system with economizer:	$15,000.00
Interlock economizer to range hood for make-up air:	$2,000.00

Priority

3

6.5 RESTAURANT: SOUTHEAST CORNER, GROUND FLOOR

Problem

1. The restaurant contains a cocktail lounge of approximately 935 sq. ft. This lounge requires 2,800 cfm. ventilation air per the Indoor Air Quality Code. It may also require additional smoke removal equipment.
2. The kitchen area has an existing range hood with dry chemical fire suppression. The exhaust air volume may, or may not be sufficient per code.
3. There is no make-up air system for the range exhaust hood.
4. The heat pump supplying the restaurant is old and in extremely poor condition. It is a Day and Night unit and has no detectable identification. We guess that this is approximately a 3 ton unit. The total air flow from this size unit would be 1,200 cfm. maximum.
5. The restaurant has a second floor area containing an office and two rest rooms. By code, the heating and air conditioning in these areas can not be controlled by the same thermostat that controls the ground floor area.

Solution

1. Install a complete new HVAC system dedicated to this restaurant. This will require approximately 10 tons of air conditioning because of the outside air requirement.
2. Confirm the adequacy of the range hood exhaust and install a new fan and exhaust duct if necessary.
3. Provide make up air for the range exhaust hood. This may be provided by interlocking the HVAC economizer as suggested for the restaurant on the North East corner of the building.

4. Provide a fan powered terminal unit from the HVAC system with separate thermostat control for the upstairs office and hall. The rest room exhaust fans will provide infiltration air around the doors to heat or cool the rest rooms.
5. Upstairs area included in #4 above.

Estimated Cost

HVAC system: (includes second floor fan powered terminal unit)	$30,000.00
Range hood fan (if required):	$3,500.00
Range hood/economizer interlock:	$2,500.00

Priority

3

6.6 Vacant Doctor's Offices: Southwest Corner

This space consists of approximately 1,320 square feet on the ground floor and an apartment unit of approximately 460 square feet on the second floor.

Problem

1. The residential apartment on the second floor is not compatible with the occupancy of the office space below, but the access to the apartment is through the office.
2. The ventilation in the office space will not meet current codes.
3. The upstairs apartment has an old Carrier split system heat pump. The heat pump has no size rating, but appears to be approximately one ton. This unit has no outside air capability.

Solution

1. A determination needs to be made as to the proposed use of this space before upgrades are made.
2. The ground floor office area should be included on the HVAC system with the remaining offices in the building.

3. If the upstairs apartment is converted to office space, it should also be included on the HVAC system with the remaining offices in the building. If the upstairs apartment is to remain a residential occupancy, it should have a new heat pump installed which has outside air capability.

Estimated Cost

The cost for the ground floor office area is included with the OFFICES section below.

It the upstairs apartment is converted to office space, cost is included with the OFFICES section below.

If the upstairs area remains residential, the cost of a new split system heat pump is estimated at $5,000.00.

Priority

3

6.7 OFFICES (EXCLUSIVE OF THE TVW STUDIO)

The building originally was heated by steam which is produced by an electric boiler. Many of the areas have since been converted to heat pump.

Problem

1. The existing gas-fired boiler is expensive to operate.
2. The heat pumps that have been added in some areas do not have sufficient air flow capacity for the present outdoor air requirements.
3. There are heat pumps which supply spaces on both the ground floor and the second floor with the thermostat controlling the unit on the ground floor.
4. The existing system has no central control system to accommodate efficient control. It was noted during our visit that one of the units had a short cycling problem. Without a building control system with diagnostic capability, maintenance on these units is more costly.
5. The existing heat pumps are of various vintage, many have reached or will soon reach their normal life expectancy. Due to their age, these units will also have efficiency levels considerably below the standard for today.

Solution

The existing mix of systems should be replaced. The new system will require approximately sixty (60) tons of air conditioning. This upgrade can be accomplished by any of several methods. Following are three options:

Option 1: Replace the existing heating systems with new roof top systems which accommodate the present zone control, efficiency and outdoor air requirements. These units should be controlled from either a building control system or connected to the existing campus control system. The advantages of this system over option 2 are that it will provide greater life and flexibility.

Option 2: Replace the existing heating systems with hydronic heat pumps. Replace the existing electric resistance steam boiler with a new gas fired hot water boiler and add a chiller to provide chilled water. The advantage of this system is that it is less expensive than option 1 and that the outside air ducting would be simplified from option 1 because several zones can share common intake and exhaust ducts.

Option 3: Replace the existing heating systems with hydronic heat pumps. Replace the existing electric resistance steam boiler with a heat exchanger which is heated by the existing campus steam loop. Add a chilled water feed from the existing campus chilled water loop. The advantage of this system is that it is less expensive than option 1 and that the outside air ducting would be simplified from option 1 because several zones can share common intake and exhaust ducts. The advantage over option 2 is that it would not require a chiller or boiler.

Estimated Cost

Option 1: $180,000.00

Option 2: $150,000.00

Option 3: $140,000.00

Priority

3

7 GENERAL DISCUSSION

7.1 LIFE EXPECTANCY AND RISK IF NOT REPAIRED

In general, the deficiencies listed are life/safety and code-related upgrades, rather than repairs. Some of the HVAC systems are near the end of their expected lives, but the other systems have an indeterminate life expectancy. Therefore, it is not absolutely necessary to complete the upgrades immediately. However, there are risks associated with delaying the work. For example, the structural system can last indefinitely—unless a catastrophic earthquake destroys the building. Also, the Americans with Disabilities Act (ADA) upgrades could be necessitated by a single complaint. Because of the risks, all deficiencies should be corrected as soon as possible.