Plainfield Public Library

Plainfield, Illinois

Facility Infrastructure Assessment

KJWW#11.0712.00

February 9, 2012

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for
Plainfield Public Library
Plainfield, Illinois

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INTRODUCTION

Plainfield Public Library was constructed in the 1940's in Plainfield, Illinois. Since then, the original facility has undergone a significant addition in 1990 and now totals roughly 27,000 square feet. KJWW Engineering Consultants was contracted to perform a facility infrastructure assessment of the mechanical, electrical, plumbing, fire protection systems, equipment in the facility and provide analysis and recommendations for the short plus long term future planning of the library. AltusWorks was contracted through KJWW to provide architectural services for the evaluation of the existing architectural building systems, with particular focus on the building envelope systems.

OBJECTIVES

The purpose of this infrastructure assessment is to analyze the existing library infrastructure to determine condition, capacity, age and arrangement as well as to provide feedback that may improve the current system operation. Systems analyzed as part of this report will include the following:

- Heating Systems
- Cooling Systems
- Airside and Terminal Equipment
- Plumbing Systems
- Fire Protection System
- Electrical Systems
- Building Envelope Systems

The end result of this report will be a strategic tool to provide useful reference material for the facility staff to plan for future growth of the facility and to assist with the operation.

EXECUTIVE SUMMARY

Based upon the results of our field survey, drawing review, and meetings with the facility personnel, the following upgrades and replacement projects as presented in this report are recommended for Plainfield Public Library. We have established a priority for the projects for the purpose of planning. We have classified the projects into three tiers: Projects that should be implemented as soon as possible in order to remain open and operate efficiently, 0-2 years (Tier 1), Projects that should be implemented in 2-5 years (Tier 2) and Projects that should be implemented in 5-10 years (Tier 3). Where possible, the projects have been ordered by their need and potential for energy conservation relative to capital cost (payback). Further discussion of the system deficiencies and proposed corrections can be found in the body of this

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report. Estimated costs are hard costs only and do not include design fees and other soft costs associated with construction projects.

Tier 1 (0-2 years):

- Ductwork Sealing and Distribution Improvements: This project would take steps to correct the existing ductwork deficiencies and sealant issues that persist throughout the systems. This cost is an allowance and could vary based upon discoveries once the entire ceiling space is explored.
  - Estimated Cost: $50,000

- Air Handling Systems Replacement & Control Upgrade: Replacement of central building air handling units and controls.
  - Estimated Cost: $200,000 – $250,000
  - Cost Includes 4 roof top units, each approximately 10,000 cfm
    - Roof Top Units: $40,000 per unit (including setting units)
    - Control Upgrades and Front End $75,000

- Data Closet Cooling Upgrade: Replacement of the existing residential style unit with properly designed cooling.
  - Estimated Cost: $50,000
  - Cost of cooling upgrade alone would be substantially less than $50,000, however, we believe that proper cooling of the room will require the size of the room to be expanded in order to accommodate the amount of equipment contained within the current closet.

- Stabilize envelope and address issues that are contributing to ongoing deterioration:
  - Roof: replace damaged/deteriorated shingles and rubber roofing, reinstate ridge vent operation, tuckpoint copings, coat rubber roof, repair skylight and cupolas, replace curbs and crickets.
  - Masonry Walls: Tuckpoint original entry surround and replace expansion joints.
  - Windows/Doors: Repair deteriorated windows, paint doors and correct locking deficiency at main entry.
  - Site: scrape and paint exterior steel stair assemblies, regrade at north to redirect surface water, repair parking lot.
  - Estimated Cost $235,000

- Thermal Scan Switchboard and Panelboards.
  - Estimated Cost $10,000

- Trace Branch Circuits in each Panelboard.
  - Estimated Cost $10,000

- Cover Plates for Open Junction Boxes.
  - Estimated Cost $2,000

- Generator & ATS Inspection and Test.
  - Estimated Cost $2,000

Tier 2 (2-5 years):

- Zone Air Distribution Corrections & Controls: Corrections to ductwork distribution and upgrade of terminal controls on HVAC airside and perimeter fin tube heating. This would include box controllers, thermostats, new control valves for fin tube radiation and central control system.
  - Estimated Cost: $150,000 - $200,000
  - Breakout Costs: Front End Controls: $15,000, Box Controllers and Thermostats: $2,500 per zone (30 Zones), Control valves: $350 per valve (30 Zones), Hot Water Piping Work to Match Terminal Box Zones: $25,000, Ductwork Distribution Corrections: $50,000

- Plumbing Fixture Upgrade Fixture upgrades throughout the facility would increase the fixture reliability and reduce water usage. Lavatory flow would be reduced to 0.5 gallons per minute to conform with the requirements for public lavatories in the Illinois Plumbing Code. Water closets could be reduced to 1.28 gallons per flush and urinals would be reduced to 0.125 or 0.5 gallons per flush.
  - Estimated Cost: $30,000
  - Costs assume that no piping modifications are required.
  - Breakout Costs:Water Closets: $1,500 each (10 total), Urinals: $1,500 each (2 total) Lavatories: $1,000 each (8 total), Miscellaneous Faucet Upgrades for Fixtures: $2,500

- Hot Water Circulation System: Install recirculation pump and piping to remote hot water uses in order to improve the operation of the building hot water system. Cost includes rough estimate for circulation pump with power ($1,500) and piping modifications, recirculation piping with valve trim ($11,000) and insulation ($2,500).
  - Estimated Cost: $15,000

- Secondary Roof Drainage Secondary roof drainage is a requirement of the authority having jurisdiction and that system is required to be separate from the primary drainage system. This new drainage system would "daylight" out of the side of the building.
  - Estimated Cost: $27,000
  - Breakout Costs: Roof Drains: $1,000 each (2 total), Piping and Lambs tongue with Opening and Shaft Work to Conceal: $25,000

- Short term repairs that coordinate with mechanical recommendations and address aging systems.
    - Roof: Reset roof drains and additional roof repairs.
    - Masonry Walls: Restore original Library exterior masonry walls and rebuild window and door lintels.
    - Windows/Doors: Replace windows, upgrade thermal performance in coordination with mechanical improvements, remove and replace power door operator.
    - Site: Remove and replace concrete at main entrance, address settlement.
    - Estimated Cost $500,000-$525,000

- Replace Exit Signs with LED Type
    - Estimated Cost $10,000

- Add Occupancy Sensors in Enclosed Rooms.
    - Estimated Cost $5,000

- Replace Exterior Building Mounted Lights with LED Type.
    - Estimated Cost $10,000

- Replace Interior HID Lights with LED Type.
    - Estimated Cost $50,000

Tier 3 (5-10 years):

- Heating Plant: Replace existing boiler with a high efficiency boiler. This cost may vary greatly based upon type of boiler, changes to configuration and piping rework. We believe a good budgetary number for this work is as follows. We suggest completing schematic design for the replacement prior to finalizing any funding.
    - Estimated Cost: $200,000 - 250,000

- Long term repairs intended to extend the life of the building another 10-15 years.
    - Roof: Replace shingle and rubber roofing system.
    - Estimated Cost $575,000 - $600,000

- Replace Generator & ATS
    - Estimated Cost: $25,000

- New Addressable Fire Alarm System: Although the existing fire alarm system is in good condition, it will reach its useful lifetime in 5-10 years and should be upgraded with an addressable system.
    - Estimated Cost: $100,000

- Replace Lighting and Controls Throughout: This cost may vary greatly based upon type of fixtures, extent of lighting control and technology available at the time of the project. We believe a good budgetary number for this work is as follows. We suggest completing schematic design for the replacement prior to finalizing any funding.
    - Estimated Cost: $300,000 - $400,000

INFRASTRUCTURE ANALYSIS

The following portion of the report is a summary of the existing library systems with respect to operation, capacity, age and overall condition. The recommendations discussed are based on our field investigation of the existing systems, conversations with library staff, and review of the record drawings available.

HEATING PLANT

Background & Findings

The library is provided with hot water via one (1) boiler. The boiler (B-1) provides hot water to perimeter radiation and terminal heating devices throughout the building. The rooftop units are not served by the boiler, instead utilizing a gas fired heating coil. The boiler was installed as a part of the addition in 1990. It has an output capacity of 780 MBH (900 MBH input). Based upon a cursory analysis, this capacity appears to be adequate to serve the present needs of the library.

Hot water is distributed throughout the building by two (2) primary hot water pumps arranged in a lead/lag arrangement. Valves at terminal devices are two-way and volume control at the plant level is achieved with a main bypass valve. The pressure sensor that controls this valve is near the boiler. During our site visit, the bypass valve was observed "chattering" while trying to find an appropriate setting. This is indicative of control issues that should be further investigated.

Boiler plant and distributed hot water system controls are all unitary. Self-contained "Danfoss" valves are located at each section of perimeter fin tube radiation. These valves are not interfaced in any fashion with the ventilation system. Cabinet unit heaters have manufacturer provided thermostats that control the fan and heating sections.

The boiler controls reset hot water temperature based on outside air temperature and control boiler staging and pump operation.

Conclusions & Recommendations

The existing heating plant at the library is in average condition given its age and provides adequately for the building. The boiler is robust and will likely operate with regular maintenance for many years. However, we believe the following upgrades to the heating system will provide improved efficiency and reliability for the library:

- Upgrade of Perimeter Heating Controls and Pumping: This project would remove the existing "Danfoss" valves and install control valves throughout the system. This project would be combined with the airside control upgrade and tie the airside systems to the same control point as the heating side to provide optimized control.

- Boiler Replacement: As a long term project, we recommend that the boiler be replaced with new, high efficiency boiler. Two smaller boilers may be chosen at that time to increase the system redundancy.

COOLING SYSTEMS

Background & Findings

The library is provided with air conditioning via the four (4) roof top units. The units utilize direct expansion cooling integral to the modular unit. Each unit has one compressor that can modulate with 2 stages. Refer to the 'Air Handling Systems' portion of this report for further details regarding the roof top units.

The only other cooling equipment within the facility is a 1.5 ton unitary air conditioner located within the technology closet on the first floor. This unit is a residential style cooling unit that is not appropriate for the usage or location installed.

Conclusions & Recommendations

Refer to the 'Air Handling Systems' portion of this report for recommendations related to this unitary equipment.

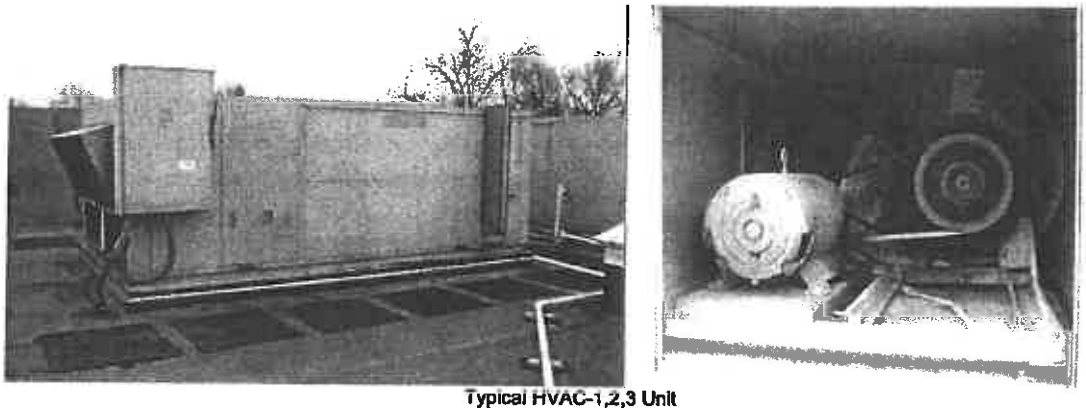
We recommend that the cooling to the technology closet be replaced with a more suitable unit. As a part of this work, the closet may need to be expanded.

AIR HANDLING SYSTEMS

Background & Findings

Four (4) packaged rooftop units are located on the roof of the building to service individual areas and floors. These units were added as a part of the library expansion in 1990, and most of them are in poor condition due to ages beyond their useful life expectancy. The roof top units utilize inlet guide vanes to modulate airflow to the terminal air boxes, which is inefficient compared with variable frequency drives. The following is a brief summary of the units, their usage, condition, and any issues that were observed during our field survey.

HVAC-1: Location: Roof, Service: 11,000 cfm gas fired, direct expansion cooled roof top unit serving the first floor. This unit is in poor condition and has experienced operational issues, including compressor failure. The compressor was recently replaced due to failure.

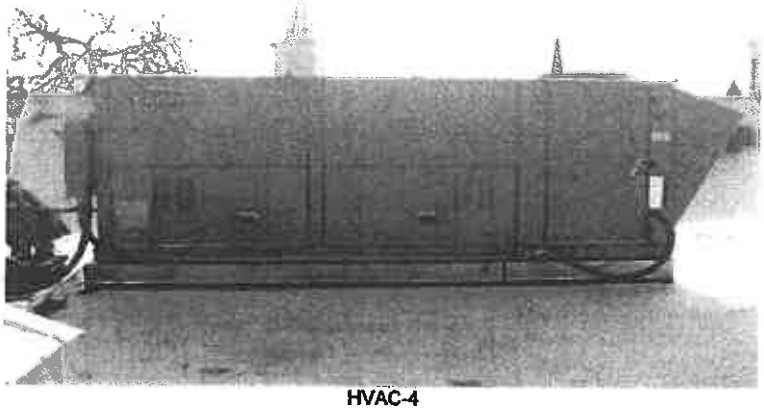


Typical HVAC-1,2,3 Unit

HVAC-2: Location: Roof: 9,400 cfm gas fired, direct expansion cooled roof top unit serving the first floor. This unit is in poor condition and has experienced operational issues.

HVAC-3: Location: Roof: 7,800 cfm gas fired, direct expansion cooled roof top unit serving the Lower Level. This unit is in poor condition and has experienced operational issues.

HVAC-4: Location: Roof: 8,000 cfm, gas fired, direct expansion cooling roof top unit serving the Lower Level. This unit is in average to poor condition.



HVAC-4

The following is a summary of the issues observed during our walkthrough, conversations and drawing review:

- Roof curbs height: Roof curbs on all four (4) roof top units were all approximately 8". At a minimum, we recommend 12" curbs for these units based on industry practices. However, due to the surrounding sloped roofs, it would be beneficial to increase this amount to 18". Roof curb modifications could easily be incorporated into a project to replace the roof top units in the near future.

- Outside air dampers operation: During both visits, outdoor air dampers on all roof top units were 100% closed. It was not possible to determine the cause for this issue because no building automation exists to interface with these units. This is limiting the ventilation provided to the building and causing the roof top units to underperform in terms of discharge air temperature (when outside air could be used for free cooling) and airflow. This maintenance issue should be resolved as soon as possible as the present condition fails to meet code or recommended guidelines for indoor air quality.

- Although humidification is shown on the design documents for the air handling systems within the building, no active humidification currently exists. Conversations with facility staff indicate that these humidifiers were never operational and were removed/decommissioned. Further exploration on this topic revealed that no preservation or rare book storage uses exist in the building and no static electricity issues were mentioned or observed.

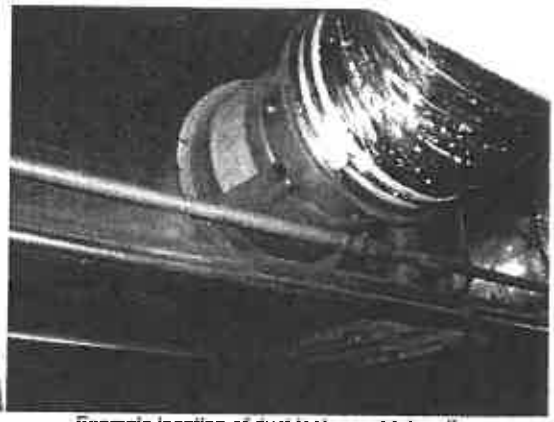
- Terminal air box controls were retrofitted in the late 1990's to Krueter analog electronic controls. These controls are outdated and provide challenges to building staff. We believe that is a factor in the erratic control of room temperatures and discomfort to occupants, as well as wasting energy. These retrofit controls are not mounted well to the boxes and one instance was discovered where the controls had become detached from the box. We recommend a complete replacement of terminal controllers and control system. It is unlikely given the existing equipment, that any of the existing hardware can be re-used reliably.

- Perimeter HVAC Arrangement: The perimeter HVAC zones have fin tube at each window location (controlled locally by sensing element) and a floor grille from the zone terminal air box (controlled from the thermostat). These devices likely "fight" each other consistently in an attempt to control space temperature because the devices are not controlled through the same control device, resulting in substantial wasted energy. In addition, we believe that the terminal air box minimums have been reset to 0% (from the design of 30%) which could reduce ventilation levels below code minimums during heating mode.

Typical perimeter HVAC arrangement

- Duct Construction and Distribution: During our field survey, many instances of duct air leakage from the roof top unit to the terminal air boxes were observed. This was confirmed by review of the balancing report for the 1990 building addition and conversations with building staff. Many stagnant areas exist in the building and the balancing report shows several areas that achieved less than 50% of design airflow during balancing, which results in discomfort to occupants. The areas with shortages focus on the lower level. This can be attributed to crimped flexible ductwork in many locations and leakage of medium pressure ductwork. Most low pressure ductwork appeared to be sealed. Formal duct static pressure calculations were not performed for the building, but this should be included as a part of any project to correct these issues or replace the roof top units to confirm the pressure drop within the system.

Crimped ductwork on box inlet



Example location of duct leakage at take-off

Conclusions & Recommendations

The existing roof top units at the library are in poor condition and should be replaced as soon as funding is available. As a part of this project, the systems should be evaluated in detail to eliminate many of the operational issues experienced in the building as well as raising the unit curbs. The new units should be designed to provide the proper amounts of outdoor air. In addition, we believe the following upgrades to the airside systems will provide improved efficiency and reliability for the library:

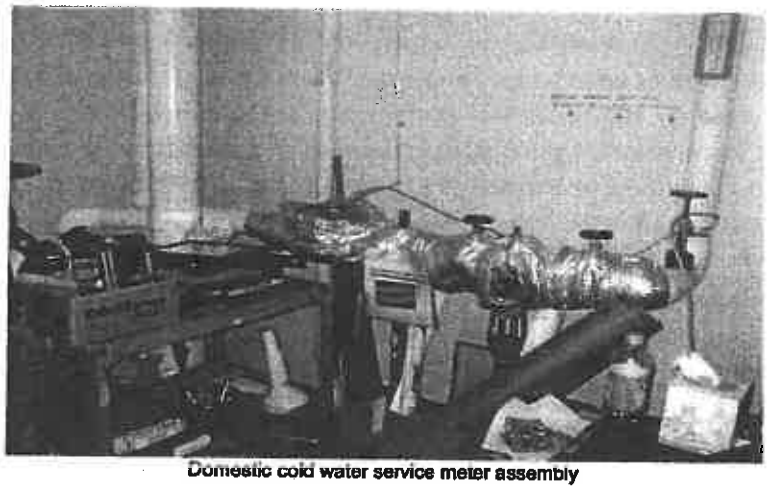
- Duct Sealing and Improvements to Distribution: This project would take steps to correct the existing ductwork deficiencies and sealant issues that persist throughout the systems.
- Upgrade of Perimeter HVAC: This project would replace the terminal air box controls and thermostats as well as remove the existing "Danfoss" valves and install control valves throughout the system.

PLUMBING SYSTEMS

Background & Findings

Cold Water

Presently a 6" combined cold water service enters the building in the basement. The 6" is a combined water service serving both fire protection and domestic uses.



Domestic cold water service meter assembly

The domestic water system is currently not softened, as the city system is lake water which is typically low in hardness level. The water is distributed from the incoming service to the building uses. Piping is copper with soldered joints and appears to be in good condition. No booster pump is installed or required based on city water pressure.

Domestic Hot Water

The domestic hot water for the library is produced by one (1), 50 gallon, electric water heater located within the Basement mechanical/electrical room. The hot water system is not equipped with circulating piping and pumps to maintain temperature throughout the facility during low usage periods. This results in significant time to provide hot water to some fixtures.

From tagging on the water heater, it appears to be roughly 5.5 years in age. The average life expectancy of this equipment is 10-12 years. As the age of the water heater increases, it should be monitored to avoid failure and maintenance budgeting should allow for replacement in roughly 5 years.

Hot water piping is copper with soldered joints and appears to be in good condition. Small portions of un-insulated pipe were observed that could be addressed easily as a low cost maintenance improvement.

Sanitary and Vent Systems

Sanitary and vent piping within the facility is primarily Schedule 40 polyvinyl chloride (PVC) and appears to be in good condition.

Sump and sewage ejectors are located in the basement. One sewage ejector services all sanitary usages at the lower level including toilet rooms and a break room. The sewage ejector is in good condition and operates reliably according to facility staff. Elevator and drain tile sump pumps are also located at the basement level. All pumps are original to the 1990 addition, and although there are no major related projects for this equipment, engineering staff should monitor the equipment during the upcoming years for repair/replacement under maintenance work.

Drain tile sump pump

Building sewage ejector

Storm Systems

The flat portion of the library roof is equipped with four (4) roof drains. These drains sit at roughly equal elevations spaced equally around the roof. Because the clamping ring sits too high, a minor amount of ponding occurs on the roof during rain events. No secondary storm drainage exists on this roof. The

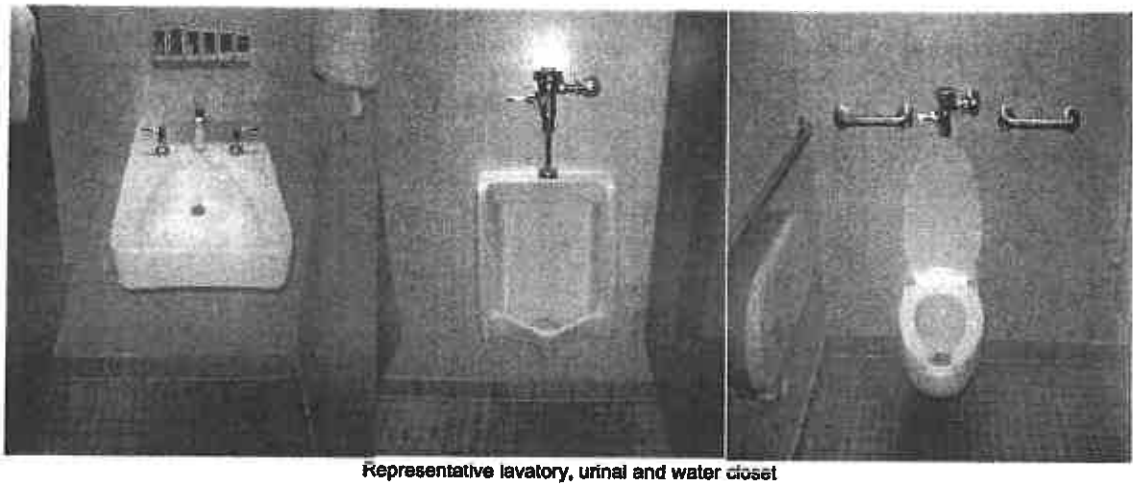
gutter system on the perimeter of the sloped roof portions of the building ties into the interior storm piping from the roof drains and exits the building to the north.

The drawings indicate a complete foundation drain tile systems for the 1990 addition portion of the building. The drain tile drainage is routed to a settling basin/sump pump located at the west end of the basement.

Plumbing Fixtures

The existing plumbing fixtures in the various toilet rooms throughout the facility appear to be in good condition. Based on conversations with facility staff, maintenance issues on the fixtures are limited, and usually focus on the flush valves. The flow rates associated with the fixtures are as follows:

- Water Closets: 1.6 gallons per flush with manual flush valves
- Urinals: 1.0 gallons per flush with manual flush valves
- Lavatories: 2.5 gallons per minute with manual controls



Representative lavatory, urinal and water closet

Conclusions & Recommendations

Based on this information, we recommend that the domestic water service be maintained in its current configuration. However, several projects present themselves after review of the plumbing system

- Plumbing Fixture Upgrade: Fixture upgrades throughout the facility would increase the fixture reliability and reduce water usage. Lavatory flow would be reduced to 0.5 gallons per minute to conform with the requirements for public lavatories in the Illinois Plumbing Code. Water closets could be reduced to 1.28 gallons per flush and urinals would be reduced to 0.125 or 0.5 gallons per flush.
- Hot Water Circulation System: Install recirculation pump and piping to remote hot water uses in order to improve the operation of the building hot water system.

- Secondary Drainage Installation: Secondary roof drainage is a requirement of the authority having jurisdiction and that system is required to be separate from the primary drainage system. This new drainage system would "daylight" out of the side of the building.

FIRE PROTECTION SYSTEM

Background & Findings

The library is a fully sprinkled building. A 6" fire protection feed originates from the combined incoming water service and serves the entire building after passing through a backflow preventer. Flow and monitor switches for fire alarm annunciation exist on the main fire protection feed downstream of the backflow preventer in the basement, however, no other zones exist in the building due to its size. The attic spaces within the pitched roof portions of the building are composed of combustible construction and are sprinkled with wet sprinklers as the attic insulation is at the roof. No standpipes are present in the building, nor are they required. No dry or other special fire protection systems were observed within the library.

Fire protection backflow preventer with main monitor and flow switches

Sprinkler coverage throughout the building appeared to be adequate with one exception at the Kalwall skylight area in the main section of the first level. Although the lower ceiling areas of this section are sprinkled, the large skylight area did not appear to be protected.

Based on conversations with facility staff, NFPA 25 inspection, testing and maintenance has not historically occurred within the building, but is now being required by the libraries insurance company. At the time of this report, this work was in the process of being contracted.

Conclusions & Recommendations

No major deficiencies or code concerns were identified within the fire protection system during our review other than the coverage issue mentioned above at the Kalwall system. We recommend that this area be brought into code compliance as soon as possible. The fire protection contractor/consultant that will be

providing NFPA 25 inspection and testing services will likely be able to provide pricing and/or design build services to implement this work.

We also recommend that NFPA 25 inspection and testing continue on a regular basis as identified in the standard in order to maintain and identify shortcomings within the fire protection system.

ELECTRICAL SYSTEMS

ELECTRICAL SERVICE AND DISTRIBUTION

Background & Findings

The existing electrical service is provided by a utility transformer located on the west side of the building. The utility transformer is located in a utility vault immediately west of the main electrical room

The electrical service comes into the building from the utility transformer and terminates in the main switchboard which is rated at 208/120 volts, 3 phase, 1600 amps. The switchboard is Square D with a 1600 amp CT and 1600 amp main fuse disconnect.

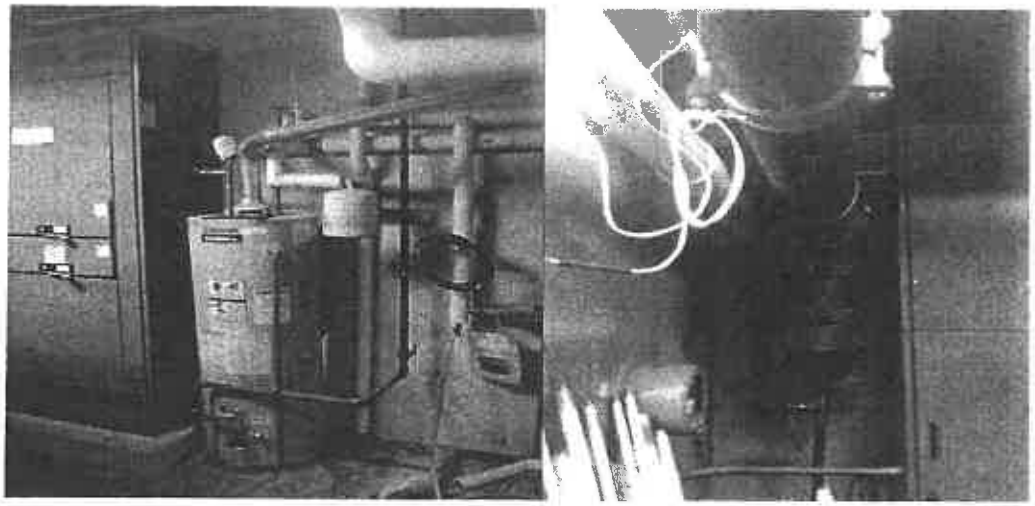
The switchboard is a 4 section switchboard and serves the following:

- Section #1:
  - service pull section
- Section #2:
  - 1600 AMP Main Fuse
  - Tap for ATS
  - RTU-2
  - RTU-3
- Section #3:

- Panel LPBA
- Panel LPBB
- Panel LP1A
- Panel LP1B
- Humidifier #1
- Humidifier #2
- Humidifier #3
- Elevator
- RTU-1

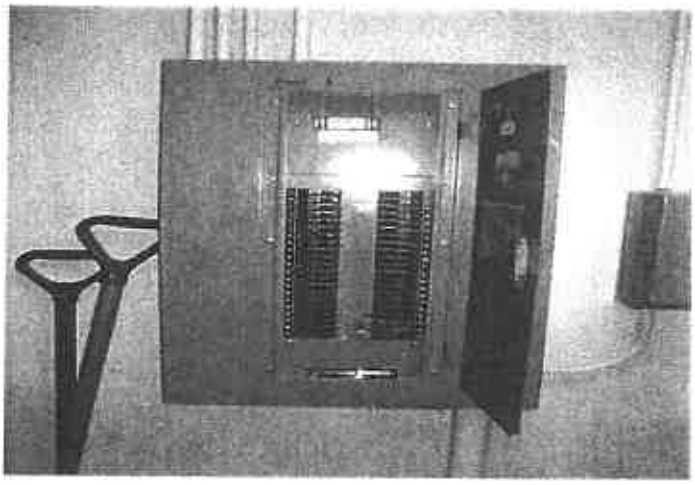
- Section #4:
  - Panel LPBC
  - HVAC
  - Space for Additional Fuses

This switchboard is original to the building and appears to be in good condition. However, on the right side of the switchboard is the water heater and on the left side is a sprinkler line. The location of these is not ideal due to the fact that if there is a leak the switchboard will be exposed to water. Also, this room is being used for storage which is not advisable. There has been no maintenance performed on the switchboard.



Based on the electrical bills for the past year, the peak load on the electrical service was 212.26 kw (590 amps) in July 2011.

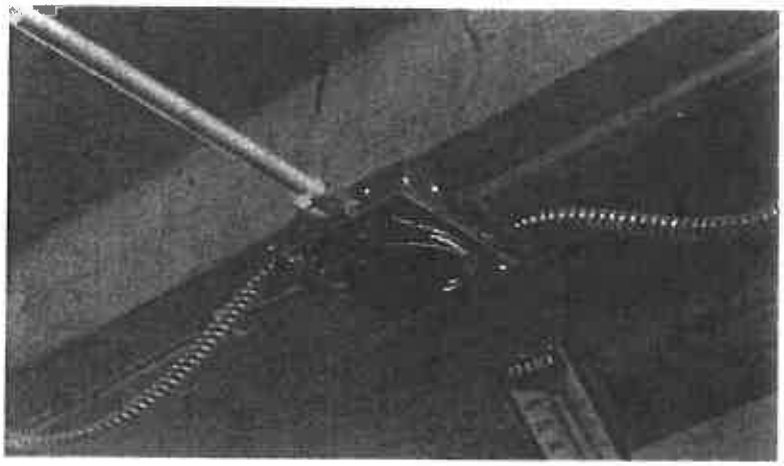
Distribution within the building consists of three lighting panels in the basement and two lighting panels on the first floor. These panels are fed directly from the main switchboard.



These panels are original to the building and appear to be in good condition. However, the panel board labels and directories on each panel are inadequate and do not reflect accurately the branch circuits served. There has been no maintenance performed on the panelboards.

- Panel LP-BA: Square D, 208/120 volts, 3 phase 200 amps, 42 circuits, located in the main electrical room.
- Panel LP-BB: Square D, 208/120 volts, 3 phase 200 amps, 42 circuits with 1 space, located in the janitor's closet.
- Panel LP-BC: Square D, 208/120 volts, 3 phase 225 amps, 42 circuits with 9 spaces, located in the employee lounge.
- Panel LP-1A: Square D, 208/120 volts, 3 phase 200 amps, 42 circuits with 3 spaces, located in the receiving room next to the roof ladder.
- Panel LP-1B: Square D, 208/120 volts, 3 phase 200 amps, 42 circuits, located in the receiving room next to the roof ladder.

Several open junction boxes with exposed wiring were observed. Having open junction boxes is a code violation and presents possible electrical hazard conditions. The exact number of open junction boxes could not be determined as this would require access above all ceilings.



Conclusion & Recommendations

The existing electrical service is adequately sized and has a peak demand of approximately 38% of the service capacity. The existing switchboard and panelboards at the library are in good condition given their age. However, we believe the following actions should be taken to continue with proper operation of the system:

- Thermal scan the switchboard and panelboards to determine the integrity of the bussing and terminations.
- Trace all the branch circuits of the panelboards to accurately identify the loads being served from each branch circuit.
- Provide cover plates for all open junction boxes.
- Remove storage from the main electrical room.

EMERGENCY SYSTEM

Background & Findings

There is an emergency generator (208/120 volts, 3 phase, 69 amp output) located in the basement with an ATS located in the main electrical room. The generator is an Onan 20 kw natural gas generator original to the building. The generator is exercised weekly. The total run time on the generator is approximately 320 hours.

The generator feeds panel EMLP-B (208/120 volts, 3 phase, 100 amps, 30 circuits with 6 spaces) located in the main electrical room in the basement. The panel serves exit and emergency lighting, hot water pumps, boiler, sewage ejector, sump pump, elevator lights, receptacle in the boiler room, EMS, fire alarm panel, sprinkler bell, gutter heater, and duct smoke detectors. Based on the loads served by this panel, the generator appears to be loaded to capacity. Panel EMLP-B is original to the building and appears to be in good condition. There has been no maintenance performed on the panelboard.

Conclusion & Recommendations

Generally, the emergency system appears to be adequately sizes for the loads currently served. However, if additional loads are planned to be added to the generator, a larger generator and associated distribution system will be required. We believe the following actions should be taken to for continued proper operation of the system:

- Thermal scan the emergency panelboards to determine the integrity of the bussing and terminations.
- Inspection of the generator and ATS by the manufacturer.

LIGHTING SYSTEMS:

Background & Findings

General Interior Lighting

General interior lighting within the building is fluorescent, however, there is some HID lighting on the first floor. The majority of the light fixtures are original to the building. The lamps on the fluorescent fixtures were changed to energy efficient T8 lamps in 2003.

Lighting controls consist of local switching in each area. This type of lighting controls does not meet the latest energy codes which require automatic shut-off of lighting during unoccupied times.

Illumination appears to be adequate in most areas except some areas served by the indirect HID lighting.

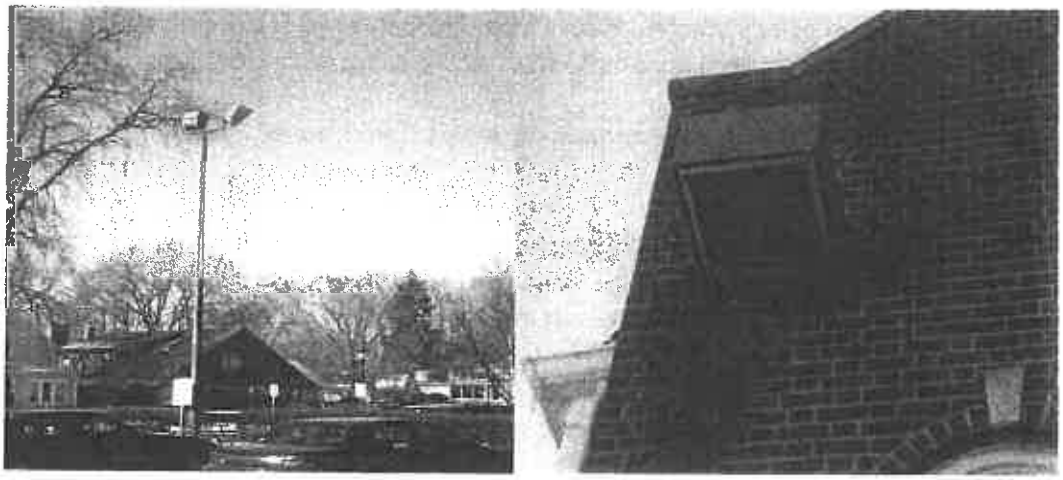
Emergency Lighting and Exiting

The existing emergency lights are selected general area lights connected to the emergency generator which provides continued illumination in the event of a utility power outage. The emergency lighting illumination could not be confirmed due to the fact that the library was occupied and day-lit at the time of the survey.

Exit lights are located throughout the library in the path of egress. The existing exit signs are AC power only since they are fed from the generator. They are in poor condition and not energy efficient.

Exterior Lighting

Exterior lighting consists of building mounted lights on the north side and pole mounted light fixtures in the parking lots. All exterior lights are HID type and controlled by a time clock. The building mounted lights indicate some deterioration and rust. Exterior lighting illumination could not be confirmed due to daylight at the time of the survey.



Conclusion & Recommendations

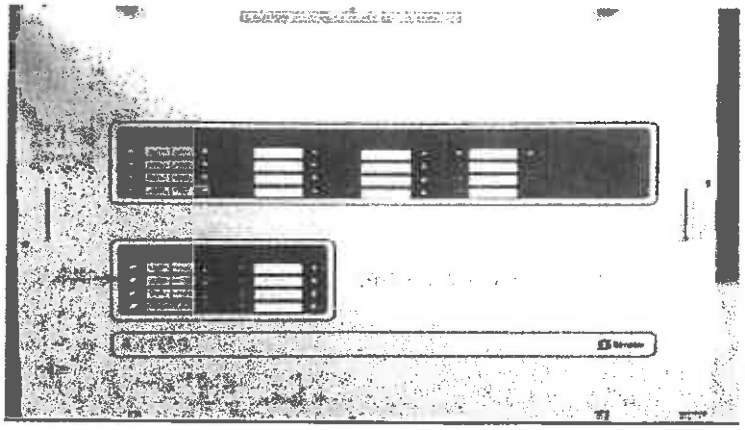
The interior lighting system is in good condition and provides adequate illumination in most areas. The exterior building mounted lights are rusting. The lighting controls consisting of manual switching does not comply with the latest energy codes. We recommend the following:

- Replace the existing exit signs which are in poor condition with new LED exit signs which will be more energy efficient.
- Replace the existing exterior building mounted light fixtures that are deteriorating. Consideration should be given to utilizing LED type fixtures.
- Replace the HID interior light fixtures to provide adequate illumination. Consideration should be given to utilizing LED type fixtures.
- Add occupancy sensors in enclosed spaces such as offices, meeting rooms, computer rooms, etc. for automatic shut-off.

FIRE ALARM

Background & Findings

The fire alarm system is a conventional hardwired Simplex 4002 system. The fire alarm system is powered from panel EMLP-B which is backed by the generator. Pull stations at the exits, duct detectors in the roof top units, smoke detectors, horns and strobes are located throughout the library. The fire alarm system was recently inspected by the manufacturer's representative and the fire department. The system appears to be good condition.



Conclusion & Recommendations

The fire alarm system is in good condition was recently tested by the manufacturer's representative. Continued testing of the system is recommended.

Prepared by: John R. Panek, PE, FPE, LEED AP and Arun K. Garg, PE

JRP:AKG/rns

http://portal/Projects/11.0712.00/ReportStudyNarrativeAddenda/rep_20120209_johpan_pplfacilityassess_mech.docx

Envelope Assessment Report

Plainfield Public Library
15025 South Illinois Street
Plainfield, Illinois 60544

ENVELOPE ANALYSIS

Ellen Stoner of AltusWorks attended the project kick off meeting and performed the site assessment work on January 19, 2012. The envelope systems including exterior walls, roof, windows and doors were evaluated. The interior of the library was visited to review any reported leak conditions and to operate some windows and doors. Following are our observations:

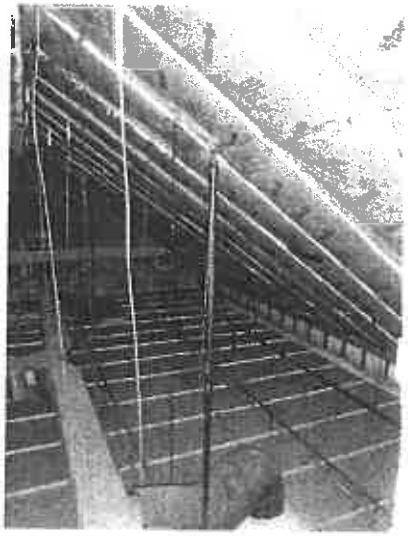
General Building Description:
The Plainfield Public Library is a 2-story rectangular planned Colonial Revival style building with a painted colonnaded portico and pitched roofs. The original library was built circa 1940 and was expanded by a large addition in 1990. The original building is located at the southwest corner and is fully integrated into the current building plan. The new exterior walls are cavity wall construction with brick masonry veneer over concrete masonry units and interior furring. The windows are a combination of fixed and operable wood windows. The entrance doors are a combination of hollow metal and aluminum.

ROOF SYSTEMS:
The new roof profile matches the original gable ended pitched roof system at a 9:12 slope. The main ridge lines run east-west at the north and south extent of the building plan and terminate with masonry gabled walls extending above the roof surface. The north-south connecting roofs are also pitched at a 9:12 slope and terminate as a cross gable into the main roof lines. The center section of the southern roof line is raised over the main entry and ornamented with a colonnaded portico. The northern roof line is embellished with a faceted round roof that corresponds to the semicircular reading room. The east and west elevations are protected by an overhanging eave line. The gabled roofs frame a central flat roof which supports the main mechanical units and is punctured by a central cross skylight which brings daylight into the interior communicating stair.

The 1990's roof structure is composed of 2x12 rafters and plywood sheathing covered either by a shingled roof system or a single ply rubber roof. There is limited attic space at the southwest corner of the building. The other gabled roof sections of the addition have cathedral ceilings. The original 1940's section of the building reportedly has its original plaster ceiling with a suspended acoustic tile ceiling system mounted below. In the attic areas, the rafter spaces are packed with paper-faced batt insulation with a 2" air space above. The exposed and concealed wood elements were painted at the time of construction and the paint system is currently pealing. This failure of the paint system is most likely due to age and deterioration from heat build up below the roofing systems and within the

4224 N MILWAUKEE AVENUE
CHICAGO ILLINOIS 60641
TEL 773 545 1870
FAX 773 545 1898
WWW ALTUSWORKS.COM

wood elements. According to the construction drawings, the cathedral ceilings are similarly insulated with a 2" air space to allow venting of the roof system. There are limited reported leaks and limited evidence of leaking through the roof system and at intersections of roof areas. Signs of leaks consist of water staining at edges of the batt insulation, edges of acoustic tiles, and discoloration of painted attic elements. There is full walk-up access to the roof.

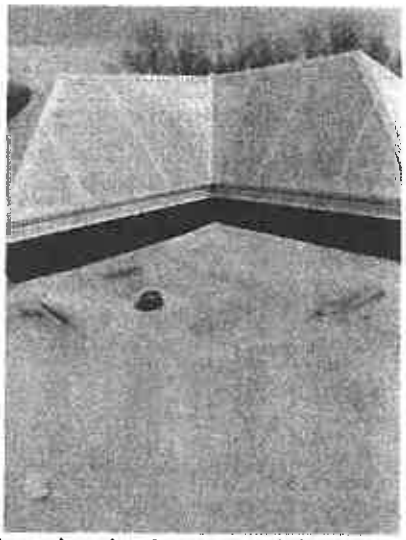


The singled roofs appear original to the construction of the addition with eave and continuous ridge vents. The shingles appear in relatively good condition with localized area of curly. Due to snow coverage, missing aggregate was not noted. One area of leaking with the roof area was reported and corresponds with an area of heavier shingle deterioration. The leaking is most likely due to driving rain, aged shingles, lack of proper shingle overlap or missing felt and water working its way through the joints in the sheathing below the shingles.

The inner sloped and vertical surfaces of the gabled roofs were reroofed in 2009 when the flat roof was replaced with a single-ply rubber roof system. Rubber roof systems are generally recommended for low-slope roofs but there is no slope limitation to the systems as long as the adhesive is properly applied and cured. Rubber membranes can be mounted to steeply sloped and vertical surfaces and does not require venting. The roof was covered in a light snow during our visit so specific deficiencies in the membrane cannot be identified, however, conditions noted include:

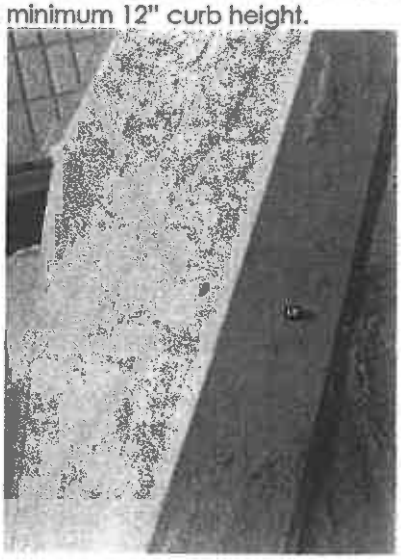
- Wrinkled or pulled membrane on sloped surfaces indicating slippage or other movement in the membrane
- Patching at intersection of sloped roof areas to vertical walls, other sloped areas and flat roof.
- 16 vents are installed at the lower section of the sloped roof area
- Flashing terminations excluding the ridge condition appear to meet minimum industry standards.
- Penetrations at vent stacks, mechanical units and drains appear to comply with industry standards.

With replacement of shingle roofing with single-ply rubber membrane, the manufacturer recommends an 18"-24" extension of the single ply membrane under the shingles thus making the ridge vent inactive. This detail will have short circuited the roof venting and will accelerate the aging of the shingled system and allow heat to build up in the wood members thus contributing to the attic paint failure. Reported leaks at the vent are most likely from driving rain moving water into the ridge vent and following the rubber roof membrane under the shingles, through joints in the sheathing, and into the occupied space. Continuous ridge vent tie-in is a difficult detail and unless installed according to manufacturer's detail, leaking at this condition will continue to be an issue.



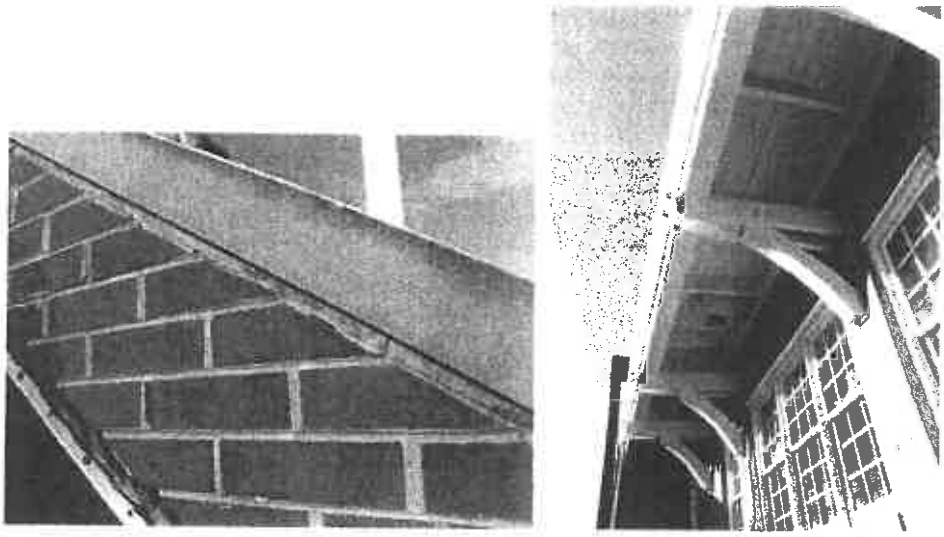
There are four roof drains set in sumps but the clamping ring is set too high and limited water ponds at these areas. There are no crickets around the four large mechanical units creating potential for areas of ponding water.

The roof top mechanical equipment is set on continuous curbs and according to the construction documents, these curbs are vibration isolators, no complaints were reported related to mechanical unit noise beyond air flow. The flashing terminations at the curbs range from 7" to 10" with only 2" clear between the roof membrane and the bottom of the counterflashing. Industry standard recommended a minimum of 8" clear between the bottom of counterflashing and the roof membrane which requires a minimum 12" curb height.



The skylight is identified on the construction documents as a Kalwall system. The system appears in good condition however the aluminum trim is mounted with surface fasteners which are rusting. The fasteners appear to be galvanized steel and were originally separated from the aluminum trim to prevent a galvanic reaction but those washers have deteriorated.

Stone coping up-facing joints at the gable end are reportedly sealed and in good condition as they were not visible due to snow coverage. However, the bed joint below the coping stone is cracked and failing.



The gutters and downspouts are generally functioning but appear to be undersized for the roof area. Reportedly there is a heat tape system to address ice damming and the generation of icicles. However, we noted at the western gutter run that seams were open and an icicle was forming in the joint. The gutters do not appear to slope to drain. There are two interior areas of water damage at the east elevation which correspond with ice damming. Two gutters discharge into the north area well but no related leaks are reported. All but one of the remaining downspouts discharge onto grade. One turns into the building and may connect to an internal downspout. Others may have been added over time.

The overhanging eaves at the east and west with their wood detailing are in good condition.

The two decorative cupolas appear in good condition except for some minor discoloration at the corners.

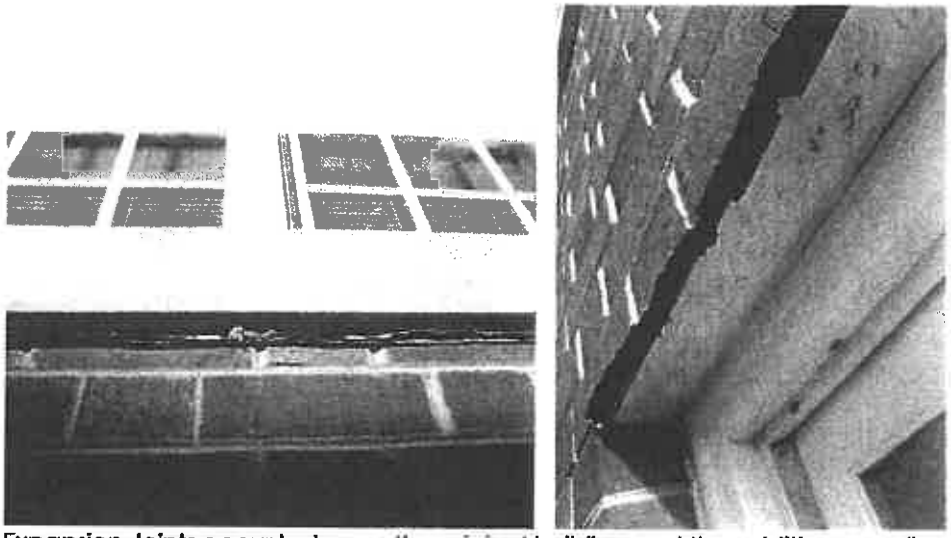
Conclusions and Recommendations:
The roof systems are generally in good condition but the shingle roof is aging due to heat build up. Therefore we recommend some immediate repairs to extend the life span and address some detailing and integration issues. We also recommend that the rubber roof be coated white to conform to energy code and extend the life of the system.

Long term recommendations include replacement of the shingled roof system with a metal roof and provide a proper tie in to the rubber roof system. The rubber roof system will last from 8-15 years so considering its current age, replacement should be anticipated as early as 2017.

MASONRY WALLS:
Approximately half of the original 1940's Library Building exterior brick walls remain visible. The brick appears in sound condition with minor edge spalls, no noticeable displacement, and primarily sound joints. The wall below the original entry where

the stairs were removed has been infilled with matching brick. The limestone surround has open and failed joints. The arched window heads are in good condition. The basement window steel lintels are rusting and creating limited vertical cracking in the brick above. Area adjacent to the chimney on the east elevation has open and failed joints where the flush pointing has eroded. It is difficult to determine if all the walls were flush pointed or only areas as the joints are deeply struck. The gable ends show excessive water run off from the change in the coping slope resulting in biological growth (discoloration) on the face of the masonry and joint erosion. Regardless, the pointing craftsmanship is poor in areas as mortar is smeared onto the face of the brick.

The brick and concrete masonry unit cavity walls are in good condition. No masonry deterioration, displacement or cracking was noted. The window openings are created by a steel lintel and in accordance with the construction drawings flashing and weeps are installed at the head and sill. However, the fabric flashing is exposed to beyond the face of the brick and has become brittle and delaminated. The flashing no longer expels water from the wall. As such the steel lintels are receiving more exposure to water than they should and are developing surface rust. At this point, the rusting is only causing failure to the paint system however, continued exposed will result in rust-jacking, cracking of the brick and water infiltration.



Expansion Joints occur between the original building and the addition as well as along the length of the cavity wall. The sealant is old and cracking and should be replaced.

Conclusions and Recommendations:
The masonry is in good condition however there are some construction details related to the window and door lintels that should be corrected, along with restoring the original masonry, and replacing all expansion joints.

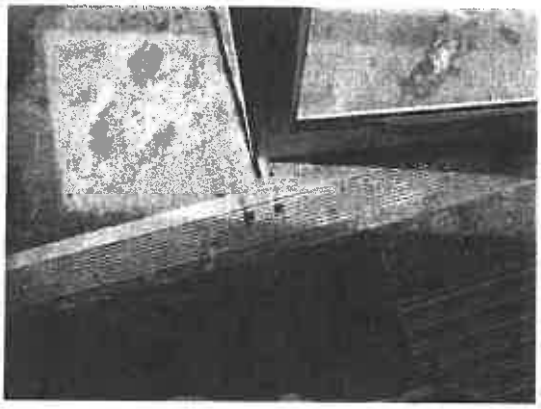
OPENINGS:
Windows:
The windows at the 1940's building were replaced at the same time as the roof system with fixed insulated units. The windows at the addition are original from 1990 and are a combination of fixed and operable units with varying insulated glass thickness. The windows are wood with a wood resin manufactured exterior coating which does not require painting or other maintenance. Several window sills and the lower sections of the jamb and brick mold are showing discoloration due to wood rot behind this exterior coating. The perimeter sealant is in good condition. Reportedly sections of the large fixed windows at the lower level, north elevation have been repaired with Bondo. Windows of this type have an expected life of 20-25 years. The insulated glazing units, although varying from 3/8" to 3/4" have not failed. No signs of fogging or condensation were noted. Many of the operable units have been fixed closed, the few operable units found operated with ease.

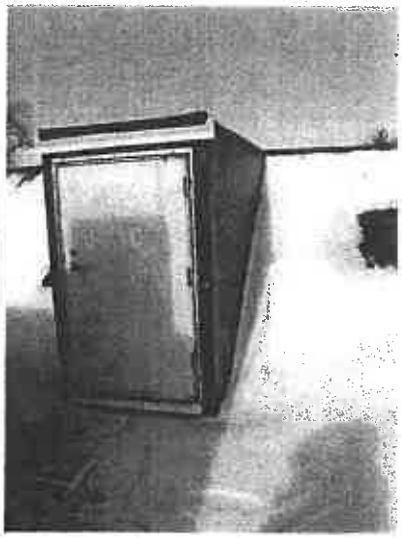
The faceted reading room at the north elevation shows the greatest level of window deterioration and where previous repairs were executed. Window sills are not continuous and provide avenues for water into the wall system.

Several of the windows sills at the northeast section of the building are very close to grade but do not appear to be exhibiting deterioration due to excess water contact.

No interior finish damage was noted at window conditions.

Doors:
The paired main entrance doors are aluminum and glass and reportedly have locking hardware issues. This could be due to the floor strikes being open and unprotected by a cover thus gathering debris and preventing the vertical rod from engaging. The doors are equipped with a commercial grade Stanley power door operated to meet ADA. These units will burnout over time depending on the frequency of use and the wind pressure they must overcome.





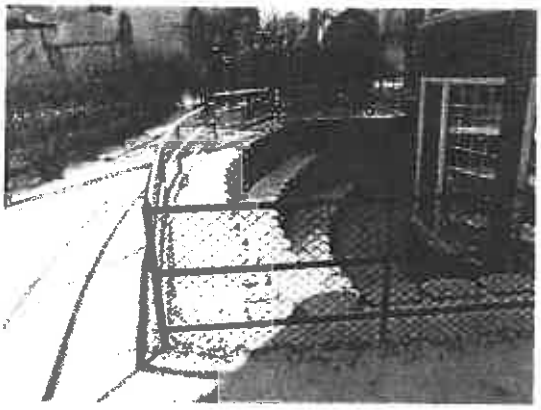
The secondary doors are hollow metal. The staff entrance and basement access at the west is in good condition whereas the roof access door is rusting and requires scraping and painting.

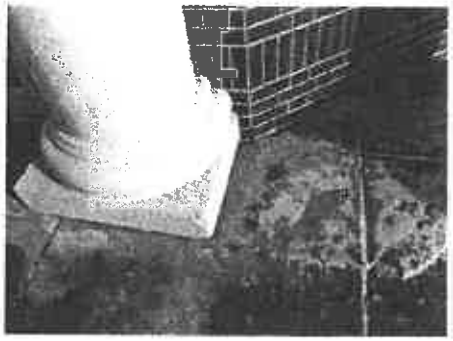
Conclusions and Recommendations:
The window system is approaching its life expectancy. Wood components are beginning to fail which is symptomatic of these newer windows. The glazing thickness is not consistent and is not sufficient to meet energy code. Replacement of the units will be needed in the next 5 years and should be coordinated with any major mechanical upgrade as new windows will impact the sizing of equipment.

Exterior Stairs:
The staff entrance is accessed by a steel pan stair with pipe rails with 9 risers. The basement is accessed by concrete stairs with a pipe rail. The paint system on all metal components has failed.

Site:
Although not included in our contract, there were a couple site elements that require review:

1. Settlement at the main entrance creating cracking in the pavement.
2. Grade appears to slope toward the north area well directly some surface water toward the building.
3. Reportedly there are deficiencies' in the parking lot where utilities were previously replaced, the area repaved is failing.



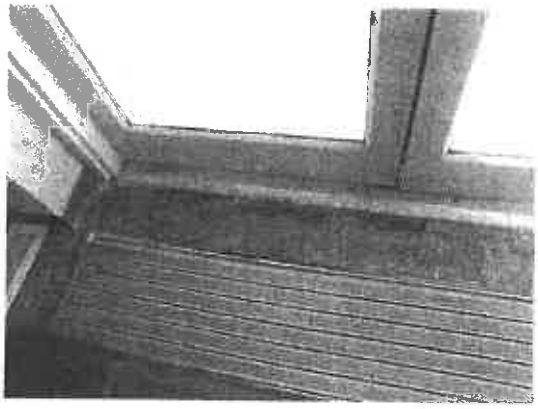


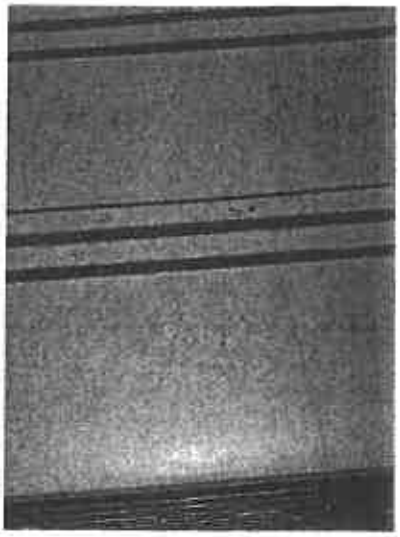
Interior Finishes:

1. Terrazzo cracking at the main entrance. Some cracking at the threshold is related to the site settlement issue discussed above, the other is due to

flexural movement of the stair. Please contact Michael Brawley at Terrazzo Marble & Supply (847) 353-8000 x362 for patching options and color matching.

2. Carpeting is old and stained.





ROOF SYSTEMS			TIMEFRAME					
			<2 YEARS		2-5 YEARS		5-10 YEARS	
Work description	Units	Cost/unit	ESTIMATED REPAIR QUANTITY	ESTIMATED REPAIR COST ($)	ESTIMATED REPAIR QUANTITY	ESTIMATED REPAIR COST ($)	ESTIMATED REPAIR QUANTITY	ESTIMATED REPAIR COST ($)
Remove and replace localized area of shingles, provide felt underlayment, move and replace corresponding attic insulation	SF	$10	80	$800				
Remove vents from rubber roof, patch roof	EA	$450	16	$7,200				
Remove and reslope gutters, reset heat tape	LF	$7	330	$2,310				
Remove and replace shingles and ice and water shield, remove and replace insulation above cathedral ceiling - 20 SF each	EA	$500	2	$1,000				
Coat rubber membrane white	SF	$3	10000	$30,000				
Repair rubber membrane where wrinkled or otherwise distressed	SF	$15	500	$7,500				
Reactivate ridge vent by installing shingles on the inside face of the gabled roofs and terminating the rubber roof 2 feet below the ridge.	LF	$85	310	$26,350				
Grind and point bed joint of stone copings	LF	$15	300	$4,500				
Skylight - remove and place fasteners, scrape and paint trim	LS	$3,600	1	$3,600				
Scrape and paint decorative cupolas	EA	$1,500	2	$3,000				
Remove and extend vibration isolation roof curbs in coordination with roof top unit replacement, reflash	EA	$2,700	5	$13,500				
Remove and reset roof drain to lower elevation, reflash full sump area	EA	$1,950			4	$7,800		
Install crickets at roof top equipment to increase positive drainage of the roof system	EA	$540	4	$2,160				
Additional roof repairs	LS	$5,000			1	$5,000		
Remove and replace shingled roof system with metal roof include gutters and downspouts, resize for roof area.	SF	$15					12700	$190,500
Remove and replace single-ply roof system	SF	$12					10000	$120,000

MASONRY WALLS

Work description	Units	Cost/unit	TIMEFRAME <2 YEARS ESTIMATED REPAIR QUANTITY	<2 YEARS ESTIMATED REPAIR COST ($)	2-5 YEARS ESTIMATED REPAIR QUANTITY	2-5 YEARS ESTIMATED REPAIR COST ($)	5-10 YEARS ESTIMATED REPAIR QUANTITY	5-10 YEARS ESTIMATED REPAIR COST ($)
1940's structure								
Grind and point 100% of exposed masonry walls	SF	$15			2000	$30,000		
Grind and point limestone surround at original entry	SF	$12	45	$540				
Remove and replace damaged face brick, multiple small locations	SF	$65			20	$1,300		
Remove and rebuild brick over window lintels, scrape and paint steel, flash with membrane/ss drip assembly with end dams and install weeps. Scrape and paint exposed surface of underside of lintel	LF	$175			20	$3,500		
Chemicall clean biological growth from masonry	SF	$3			2000	$6,000		
1990's Cavity wall								
Remove and replace backerrod and sealant at all expansion joints	LF	$8	210	$1,680				
Remove and rebuild brick over window lintels, scrape and paint steel, flash with membrane/ss drip assembly with end dams and install weeps. Scrape and paint exposed surface of underside of lintel	LF	$175			400	$70,000		
Remove and reset window sills over thru wall flashing with enddams, weeps and drip edge	LF	$75			400	$30,000		

WINDOWS/DOORS OPENINGS

Work description	Units	Cost/unit	TIMEFRAME <2 YEARS ESTIMATED REPAIR QUANTITY	<2 YEARS ESTIMATED REPAIR COST ($)	2-5 YEARS ESTIMATED REPAIR QUANTITY	2-5 YEARS ESTIMATED REPAIR COST ($)	5-10 YEARS ESTIMATED REPAIR QUANTITY	5-10 YEARS ESTIMATED REPAIR COST ($)
Repair window sills and end of brick mold with wood epoxy	EA	$250	46	$11,500				
Scrape and Paint HM doors	EA	$350	1	$350				
Remove and reset entrance freshold, provide dustproof strike at each vertical locking rod	EA	$750	1	$750				
Remove and replace power door operator	EA	$3,200			2	$6,400		
Remove and replace windows with aluminum clad wood windows. Anticipate another 20-25 year life	EA	$1,750			72	$126,000		

SITE			TIMEFRAME					
			<2 YEARS		2-5 YEARS		5-10 YEARS	
Work description	Units	Cost/unit	ESTIMATED REPAIR QUANTITY	ESTIMATED REPAIR COST ($)	ESTIMATED REPAIR QUANTITY	ESTIMATED REPAIR COST ($)	ESTIMATED REPAIR QUANTITY	ESTIMATED REPAIR COST ($)
Remove and replace cracked concrete walks at entry, provide expansion joint	LS	$3,500			1	$3,500		
Scrape and paint exterior steel stair and railings	LS	$2,500	2	$5,000				
Regrade around north and east elevations, redirect surface water away from the building	SF	$7,500	1	$7,500				
Repair parking lot paving	SF	$4	3500	$12,250				
Subtotal				**$141,490**		**$289,500**		**$310,500**
Escalation			**0.00%**		**7.50%**	$21,713	**15.00%**	$46,575
General conditions bond (11%)				$15,564		$34,233		$39,278
Insurance (1.8%)				$2,827		$6,218		$7,134
Contractor's Fee (5%)				$7,994		$17,583		$20,174
Design contingency (20%)				$33,575		$73,849		$84,732
Construction Contingency (15%)				$30,217		$66,465		$76,259
TOTAL ESTIMATED CONSTRUCTION COSTS				$231,667		$509,561		$584,654

ALL COSTS EXCLUDE ENVIRONMENTAL WORK