BUILDING SYSTEMS ASSESSMENT

Riverdale Presbyterian Church
6513 Queens Chapel Road
University Park, MD 20782

December 3, 2013

Prepared by

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SCOPE OF WORK

To identify, analyze, and quantify the conditions of the mechanical, electrical, plumbing and fire protection systems in the building; and to provide a narrative of the repairs, replacement, and/or upgrades to these building systems and their components as may be required in conjunction with building renovations and upgrades to accommodate the proposed uses of the Town, and to meet current code requirements related to these systems.

The Scope of Work for the Building Systems Assessment shall include:

1. Review of existing building documentation.

2. On site field survey as required to evaluate the condition of the existing mechanical, electrical, plumbing and fire protection systems, as well as the buildings they serve.

3. Provide a written report, developed by a Professional Engineer. The report shall include narrative of the repairs, replacement, or upgrades to these building systems and their components as may be required in conjunction with building renovations and upgrades to accommodate the proposed uses by the Town, and to meet current code requirements related to these systems. Note that renovations and upgrades may require phasing, as it is possible that the existing congregation of the Church may lease back the Sanctuary, adjacent offices, and possibly portions of the lower level below the Sanctuary, renovations in these areas may be deferred to a later date. The report shall address phasing as required, as well as provisions for the continuing use of portions of the facility during the renovation phase(s).

4. Coordinate with the Town's consulting Architect, as well as other consultants contracted by the Town as related to this assessment.

EXECUTIVE SUMMARY

The primary focus of this report is to evaluate the existing conditions of the HVAC, Plumbing, Electrical, and Fire Protection systems and provide recommendations for reuse or replacement of existing systems.

DESCRIPTION OF THE EXISTING BUILDING AND HVAC SYSTEMS

Building Description

The Church and the education annex were constructed in the early 1950's. Together they comprise approximately 26,000 square feet on three floors. The Town is exploring the feasibility of acquiring the Property for use as a Town Hall and related governmental and community services. The Town government serves approximately 2500 residents and has

a police and public works department, both of which would be housed on the Property. Possible uses also include community meeting space, religious services, child care, and senior activity/care.

The Church building has three floors – Lower Level, First Floor, and Second Floor. The Lower Level contains the Fellowship Hall, Commercial Kitchen, Toilets, Storage Rooms, Mechanical Room, etc. The First Floor comprises of the Sanctuary, Vestibule, and Church Offices. The Second Floor consists of a Balcony on one side of the Sanctuary and a Youth Play area and Organ Chamber on the other side (located above the Church Offices).

The Annex Building also have three floors which are used for offices, classrooms, church library, shelter bedrooms, music rooms, toilets, utility rooms, storage rooms, sitting areas, kitchen, etc.

Ceiling heights vary throughout the building: the office areas have a ceiling height of ±9'; the Sanctuary has a ceiling height of ±20'. The majority of spaces have acoustic ceiling tiles, with the exception of the Sanctuary which has plaster ceilings.

Description of Existing HVAC Systems

Church Building:

In the Sanctuary, there are several radiators and a split system air-conditioning unit (AC-1 and Condensing Unit-1) with associated ductwork and air distribution system. The entrance Vestibule and stairs are heated by cast iron radiators.

Church Offices are served by radiators and Window-Mounted Air-Conditioning (WAC) units. The Pastor's bathroom is not ventilated.

The Fellowship Hall is served by a hot-water radiant floor system which is not working at present; a split system air-conditioning unit (AC-2 and Condensing Unit-2) with associated ductwork and air distribution system; and a gas furnace.

The Commercial Kitchen is served by a split system air-conditioning unit (AC-3 and Condensing Unit-3) with associated ductwork and air distribution system located near the sidewall, and a wall mounted kitchen exhaust fan (KEF-1).

The Mechanical Room contains four (4) steam boilers (B-1 thru B-4), two (2) pumps (P-1 and P-2), a steam to hot water heat exchanger (HX-1), condensate return pump, and uninsulated piping and fittings. Refer to Table-1 for the capacities and conditions of the boilers, pumps and other equipment.

Toilets near the Choir area are heated and ventilated by electrical base board heaters, ceiling fans, and/or operable windows. Toilets near the Mechanical Room are heated by electrical heaters and ventilated by operable windows.

The Elevator (Lift) Machine Room is ventilated through transfer grilles.

Annex Building:

Ground Floor:
The Ground Floor of the Annex Building is served by a hot-water radiant floor system that is supplemented by electrical baseboard heaters in the SE and NE Classrooms. Some of the rooms are provided with WAC units.

Kids and Shelter's toilets are ventilated by ceiling fans.

The Mechanical Room contains one hot-water boiler (B-5), seven pumps (P-3 and P-9), and uninsulated piping and fittings. Refer to Table-1 for the capacities and conditions of the boilers, pumps, and other equipment.

First Floor:
The First Floor of the Annex Building is served by hot-water radiators and WAC units.

Men's and Women's Toilets are heated by radiators and ventilated by operable windows.

Second Floor:
Similar to the First Floor, this floor is served by a hot-water radiators and WAC units.

DISCUSSIONS WITH MEMBERS OF THE CONGREGATION AND THE TOWN'S ARCHITECT

During our site visit, the following items were discussed with Members of the Congregation and the Town's architect:

a. At present, the temperature and comfort levels in the building are poor during both the winter and summer seasons.
b. We were informed that air balance data is not available.
c. Two outdoor condensing units were replaced in 1996.
d. As-built HVAC system drawings are not available.
e. The majority of the HVAC equipment is old, and being utilized beyond their recommended economical life cycles.
f. The existing building ATC controls are original to the building construction.

EVALUATION OF THE EXISTING HVAC SYSTEM CONDITIONS AND RECOMENDATIONS FOR PROPOSED NEW HVAC SYSTEMS

Existing HVAC System Conditions

A. With the exception of two condensing units and a gas furnace, all of the mechanical equipment and systems both in the Church Building and in the Annex have served longer than their recommended economical lives and should be replaced with new units with the renovation of the building.

B. Operable windows are the main source of outside air intake in the building.

C. Church Building:

1. Mechanical Room: Combustion air is provided through doors.
2. Our observations are as follows;
   a. Fellowship Hall:
      (i) Radiant floor system in the Fellowship Hall has been abandoned in place due to water leaks.
      (ii) A gas furnace (GF-1) provides heating capabilities in the Fellowship Hall, but its flue vent is improperly installed.
      (iii) Door louvers of the Storage Room, where AC-2 and AC-3 are installed, serve as a means of return air for AC-2. Thus the storage room is being used as a return air plenum. A storage room with combustible construction cannot be used as a return air plenum.
      (iv) A very small duct is providing outside air for AC-2 which is not equipped with economizer controls.
      (v) Common areas are not properly ventilated.
      (vi) Controls are manual and antiquated.
      (vii) Due to lack of controls on the radiators, the radiators tend to overheat the space.

   b. Kitchen:
      (i) Supply and return air registers are on the same wall which does not provide proper air circulation in the space.
      (ii) There is no fire protection (Ansul type) system and make-up air unit for the kitchen hood.
      (iii) There is no hood for the dish washing area.

   c. Toilets: Either the toilet rooms have no exhaust fans or the fans are not functioning.

   d. Radiators: Single pipe heating system for the radiators is very inefficient and controls valves on each radiator are not provided.

   e. Sanctuary, Vestibule, and Balcony:
      (i) AC-1 is not equipped with economizer controls.

(ii) Common areas are not properly ventilated.
(iii) Controls are manual and antiquated.
(vii) Due to lack of controls on the radiators, the radiators tend to overheat the space.

f. Offices:
(i) Due to lack of controls on the radiators, the radiators tend to overheat the space.
(ii) WAC units are very inefficient.

g. Annex Building:
(i) We were informed that the radiant floor system on the Ground Floor is functional.
(ii) Similar to the Church Building, radiators in this building do not have controls and do not provide reliable performance.
(iii) WAC units are of various vintages and are very inefficient.
(iv) Common areas are not properly ventilated.
(v) Most of the windows have single pane glass.
(vi) Main entrance doors and windows have several of leaks.
(vii) There are numerous maintenance issues.
(viii) Energy consumption is very high due to older and less efficient equipment.

D. Code violations based on 2012 codes:
(i) Existing walls, roof, windows, and partitions do not meet the requirements of the 2012 International Building and Energy Conservation codes.
(ii) Outside air is through operable windows and doors. None of the air handling units are equipped with outside air intake capabilities and the units do not have economizer cycle controls.
(iii) Other violations are noted in description of Existing Conditions.

Recommendations:
<u>New HVAC Systems</u>
Codes Used: IMC-2012, ASHRAE Standard 90.1-2010, 62.1-2010

<u>Design Inputs:</u>
ASHRAE 2009 - Fundamentals:

Location: Washington DC, Reagan AP
Outdoor Temperature:
Summer – 94.3 Deg. F Dry Bulb / 76 Deg. F Wet Bulb
Winter – 16.3 Deg. F Dry Bulb
Indoor Temperature:
Summer – 75 Deg. F Dry Bulb, 50% RH
Winter – 70 Deg. F Dry Bulb

Building Envelope:

Building Envelope	Minimum Required by Code *	Recommended
Walls above Grade	R - 9.5	R - 12.5 if feasible.
Walls Below Grade	R - 7.5	R - 12.5 if feasible.
Roof (Attic)	R - 38	R - 38
Slab on Grade, Floors	R -10 for 24", Perimeter Insulation	R -10 for 24", Perimeter Insulation if feasible.
Fixed Windows	U - 0.38	U - 0.38
Entrance Doors	U - 0.77	U - 0.6

International Energy Conservations Code (IECC) 2012

Ventilation: Ventilation should be in compliance with IMC 2012.

Occupancy: IMC 2012 (924 people: sum of all space occupancies)

Our recommendations are as follows:

1. The building envelope should be brought to comply with codes and regulations of 2012.
2. All existing HVAC systems should be replaced with new units. We are proposing a four pipe chilled and hot water system for the entire building which has the following advantages:
   a. Overall capacity of the chiller will be smaller than sum of the capacities of individual units.
   b. Chiller will be more efficient.
   c. Boilers:
      (i). Option #1: If the renovation of the Sanctuary, Balcony, and Offices is scheduled for the future, then existing boilers (B-1 thru 4) should serve both buildings. This will allow continuity of the Church's activities in the building during the renovation of rest of the building.
      (ii) Option #2: Existing boilers should be replaced by high efficiency hot water boilers if both buildings are renovated in one phase.
   d. Four pipe chilled and hot water system will help in the phased construction of the project as the Church may continue to use the Sanctuary, Raised Alter, Balcony, and Offices using its existing HVAC system (AC-3 and CU-4) and radiators, while the rest of the building is under renovation for the Town.
   e. For the hot water system, the existing heat-exchanger and associated pumps should be replaced to serve both buildings.

f. New air handing units for the Ground Floor and First Floor of the Annex Building should have Variable Air Volume (VAV) boxes and controls
g. This system will provide flexibility during the future modification of the various spaces in the building. Smaller, quieter, ceiling and/or floor mounted fan coil units will be provided in the spaces with lower ceiling heights.
h. The Kitchen should be provided with a new split system having duel cooling coils, i.e. DX and chilled water coils, and hot water heating coil.
i. A new kitchen hood should be provided with a make-up air unit.
j. Outside air intake and economizer cycle control should be provided for all HVAC systems in compliance with applicable codes and regulations.
k. Commissioning: All new systems should be commissioned in compliance with IECC 2012.

Space	Number of Occupants	Approx. Capacity of New HVAC System (Tons)	Proposed systems
Church Building:			
Town Meeting Hall	315	30	Several air handling units (AHU) and fan coil units (FCU) due to low ceiling heights.
Town Green Room	136	15	Same as Meeting Hall
Kitchen	2	5	DX split systems with four pipe chilled and hot water coils.
Church, Sanctuary, and Balcony	330	30	Use existing systems during phased construction and provide a new air handling unit if these areas are renovated at the same time as rest of the building.
Church Offices	1000	3.5	DX split systems using existing gas furnace with zone dampers and room by room control.
Misc. Areas:			
Corridors			Supply air from AHUs.
Stairs			Hot water cabinet heaters.
Toilets			Supply air from AHUs and provide exhaust fans.
Storage Rooms			Provide provisions for heating and ventilation.

Annex Building:			
Lower Level, Offices	28	7.5	VAV type air handling unit.
First Floor, Offices	26	7.5	VAV type air handling unit.
Second Floor, Daycare	57	8	Two 4-pipe air handling units, i.e. one for each side.
Misc. Areas			
Elevator Machine Room			Ductless cooling system.
Stairs			Hot water cabinet heaters.
Toilets			Supply air from AHUs and provide exhaust fans.
Storage Rooms			Provide provisions for heating and ventilation.

1. T
   he new systems shall be properly selected based on the weather conditions and requirements of applicable codes to provide adequate comfort conditions for the users.
2. New Direct Digital automatic temperature control systems shall be provided.
3. Balance all supply, return, exhaust, and intake air terminal devices.

EVALUATION OF PLUMBING SYSTEMS:

Church Building:

A. Water Service: 1.5" service and meter are located in the Boiler Room with another meter for the irrigation system.

B. Hot Water Heater: gas fired, tank-type, water heater is located in the Boiler Room. Hot water recirculating system is not provided.

C. Mixing valves for hot water are not provided.

D. Fixtures:
   (i) Flush valve type water closets and floor-mounted urinals are provided in the toilets with wall hung lavatories.
   (ii) Service sink in the Mechanical Room needs cleaning and maintenance.
   (iii) Fixtures are functional, but do not meet present day codes as the fixtures use too much water.

E. The Kitchen is equipped with:
   (i) Hand sink
   (ii) Veggie sink
   (iii) Dirty dishes sink with a garbage disposer
   (iv) Dishwashing machine having a hot water temperature boosting system.

There is no grease interceptor in the kitchen. Water connection to the ice machine is provided without a backflow preventer and the associated indirect drain pipes are not properly aligned with the floor drain.

F. Electrical Water Coolers (EWC): One EWC with exposed water and sewer piping is provided on each floor of the Annex Building, but are not in compliance with ADA requirements.

G. Water: Uninsulated copper piping is provided for most of the cold and hot water systems.

H. Sewer: Cast iron piping is used for sewer piping.

I. Storm Water System: Consisting of gutters and down spouts which are either connected to boots or spilling on grade. Most of the down spouts are in very poor conditions and should be replaced.

J. Floor drains are provided without trap primers.

NUMBER OF EXISTING FIXTURES:

Church Building	Fixture	Numbers
Ground Floor, Men's Toilet near Mechanical Room	Water Closet	1
	Urinal	1
	Lavatory	1
Ground Floor, Women's Toilet near Mechanical Room	Water Closet	2
	Lavatory	1
Ground Floor, Men's Toilet near Choir Room	Water Closet	1
	Floor Mounted Urinal	1
	Lavatory	1
Ground Floor, Women's Toilet near Choir Room	Water Closet	1
	Lavatory	1
Kitchen	Hand Sink	1
	Veggie Sink	1
	Dirty Dish Sink with Disposer	1
Mechanical Room	Service Sink	1
First Floor, Pastor's Toilet	Water Closet	1
	Lavatory	1

Annex Building	Fixture	Numbers
Ground Floor, Kids Toilet	Water Closet	1
	Lavatory	1
	Water Closet	1
Ground Floor, Shelter's Toilet	Lavatory	1
	Shower	1
Ground Floor, Electrical Water Cooler	EWC	1
First Floor, Men's Toilet	Water Closet	1
	Floor Mounted Urinal	1
	Lavatory	1
	Water Closet	2
First Floor, Women Toilet	Lavatory	1
Janitor Closet	Service Sink	1
Kitchenette	Kitchen Sink	1
First Floor, Electrical Water Cooler	EWC	1
Second Floor, Electrical Water Cooler	EWC	1

Plumbing Work:

1. Toilets are not in compliance with ADA.

Proposed Plumbing Systems:

1. Existing conditions of all underground water, sewer, and storm water should be verified as these systems have served the building for more than 60 years.
2. New cold and hot water, sewer, vent, and gas piping should be provided inside the building.
3. Although existing plumbing fixtures are in fair conditions, new water saving type fixtures and faucets should be provided in all toilets.
4. Floor drains with trap primers should be provided in all toilets in the common areas.
5. All down spouts should be properly connected to the boots, or spill on the splash blocks based on the site conditions.
6. Existing water heaters should be refurbished and relocated.
7. Based on IPC 2012, Building should have following numbers of fixtures as a minimum for an occupancy of 924 people,

Type of Occupancy	Number of People	Fixture	Basis	Number of Fixtures
Assembly, A-3	**782**			
Men	391	Water Closet	1 per 150	3
		Lavatory	1 per 200	2
Women	391	Water Closet	1 per 75	6
		Lavatory	1 per 200	2
Drinking Fountain, EWC			1 per 1000	1
Service Sink			1	1
Education, E	**70**			
Men	35	Water Closet	1 per 50	1
		Lavatory	1 per 50	1
Women	35	Water Closet	1 per 50	1
		Lavatory	1 per 50	1
Drinking Fountain, EWC			1 per 100	1
Service Sink			1	1
Business, B	**74**			
Men	37	Water Closet	1 per 25 for first 50	2
		Lavatory	1 per 40 for first 80	1
Women	37	Water Closet	1 per 25 for first 50	2
		Lavatory	1 per 40 for first 80	1
Drinking Fountain, EWC			1 per 100	1
Service Sink			1	1

Number of Fixtures Required:
Water Closets = 15
Laboratories = 8
Drinking Fountains = 3
Service Sinks = 3

Proposed:
Water Closets = 18
Urinal = 2
Laboratories = 17
Showers = 2
Drinking Fountains = 1
Service Sinks = 1

Fire Protection System:

The existing building is not protected by any sprinkler system with the exception of two rooms which have a limited area sprinkler system fed from the domestic water pipes.

Proposed System:
Based on code analysis, it is recommended that the building should be fully sprinkled in compliance with applicable codes including, but not limited to, International Building Code Para 504.2 and NFPA 13.

A 6" domestic water service should be provided with necessary valves and fittings, and a new sprinkler system should be interlocked with an all new Fire Alarm System, and should be monitored by a 24/7 security company.

EXISTING BUILDING HVAC SYSTEM EQUIPMENT LIST (TABLE-1)

Unit No.	Manufacturing Company	Model Number, Serial Number	Capacity / Type	Unit Present Conditions	Recommended Economical Life as Per ASHRAE Standard
Church Building:					
AC-1	Carrier	40RR024	20 Ton Cooling Capacity	Fair Condition. 38 Years Old Unit	15 Years
CU-1	Trane	TTA024B3	20 Ton Cooling Capacity	Good Condition. 17 Years Old Unit	15 Years
AC-2	Carrier	40RR012	10 Ton Cooling Capacity	Fair Condition. 38 Years Old Unit	15 Years
CU-2	Trane	TTA120A3	10 Ton Cooling Capacity	Good Condition. 17 Years Old Unit	15 Years
GF-1	York	P4HUC16N09 201A	115 MBH Heating Capacity	Good Condition. 10 Years Old Unit	15 Years
AC-3	Carrier	Unknown	3 Ton Cooling Capacity	Fair Condition. 38 Years Old Unit	15 Years
CU-3	Carrier	38EN036	3Ton Cooling Capacity.	Good Condition. 25 Years Old Unit	15 Years
Kitchen Exhaust Fan, PRV-1	Unknown		Approximately 1200 Exhaust Flow Capacity	Poor, seems to be more than 20 years old.	15 Years
Boilers, B-1 thru B-4	Slant Fin	Caravan, GX300Z	300 MBH Heating Capacity Each/ Gas Fired	Fair Condition. 23 Years Old Units	25 Years

Pumps, P-1 & P-2	Bell & Gossett	Unknown	Fractional HP Motor	Fair condition.	20 Years
Domestic Water Heater	Unknown		50 Gallons, 50 MBH	Fair Condition	22 Years
Heat Exchanger	Bell & Gossett	WU-86-24	Unknown	Poor Condition, Rusted. Needs To Be Replaced	20 Years
Ventilation Fans, Various Locations	Unknown		50 to 100 CFM Exhaust Air Flow	Poor Condition. Needs To Be Replaced	25 Years
Annex Building:					
Boiler, B-5	National	5#66	1000 MBH Input, 80% Efficient	Original Equipment 1954, Poor Condition	25 Years
Pumps, P-3 thru P-9	Unknown		Small In-Line Pumps for Zone Heating	Fair Condition	20 Years
Window AC Units	Various	-	-	Poor to Fair	10 Years
Cast Iron Radiators	-	-	-	Original Equipment, Fair Condition	25 Years
Electrical Base-Board Heaters	-	-	-	Fair condition	10 Years
Water Heater	-	-	50 Gallons Storage, 4.5 KW Heater	Good Condition	22 Years
Duct Work and Insulation	Unknown	-	-	Poor Condition. 30 Years Old. Needs To Be Replaced	24 Years

Air Devices, Air Louvers, and Control Dampers	Unknown	-	-	Poor Condition. More than 30 Years Old. Needs To Be Replaced	27 Years
Piping & Valves	Unknown	-	-	Poor Condition. 30 Years Old. Needs To Be Replaced	20 Years
Automatic Control Systems	-	Unknown	Electrical Controls	Poor Condition. 30 Years Old. Needs To Be Replaced	20 Years

EXISTING HVAC SYSTEMS CONDITIONS PHOTOS:

Photo 1: Boiler B-5 with Inline Pumps

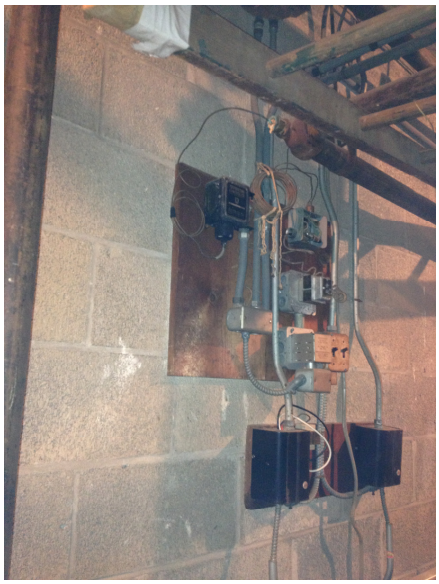

Photo 2: Controls for Boiler B-5

Photo 3: Louver for Combustion Air for Boiler B-5

Photo 4: Uninsulated Piping in Annex Mechanical Room

Photo 5: Air Conditioning Units (AC-1 and AC-2) in the Storage Room

Photo 6: Supply and Return Air Registers in the Kitchen

Photo 7: Kitchen Hood

Photo 8: Limited Area Sprinkler System

Photo 9: Steam to Hot Water Heat-Exchanger

Photo 10: Steam Boilers (B-1 Through B-4)

Photo 11: Outside Air Intakes for AC-1 and AC-2

Photo 12: Wall-Mounted Kitchen Exhaust Fan

EXISTING PLUMBING SYSTEMS CONDITIONS PHOTOS:

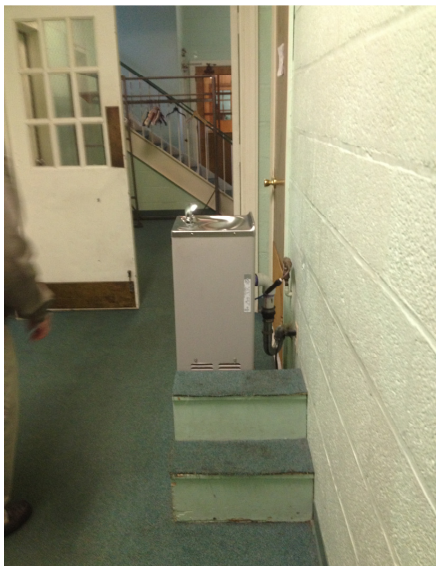

Photo 13: Non-ADA Electric Water Cooler with Exposed Piping

Photo 14: Existing Plumbing Fixtures

Photo 3: Plumbing Piping and Drain Without Any Grease Interceptor

Photo 4: Incoming Water Service and Meter

Photo 5: Damaged Downspout

EVALUATION OF EXISTING ELECTRICAL SYSTEM

BUILDING ELECTRICAL DISTRIBUTION

Existing Service

The existing in-coming service to the building is 208V, 3ø, 4W estimated to be at 400A. The service is fed overhead from (3) transformers mounted on a Pepco power pole located at the south-east side of the building on 43rd Ave. The overhead service (see Photo E1) feeds into a meter located in the Boiler Room on the Ground Floor. The meter feeds a wire trough (see Photo E2) which is the tap off point for a 30A disconnect switch for the emergency systems, a 200A, 3ø, 4W disconnect switch for the exterior HVAC units, and a 200A, 3ø, 4W disconnect that feeds a second wire trough.

The second wire trough (see Photo E3) is the connection point for the existing 240V, 1ø distribution system that is original to the building. We presume that the introduction of the exterior HVAC units required the original single phase service to be upgraded to three phase. The second wire trough is the tap off point for the original 100A, 1ø, 3W disconnect switch that feeds three panels in the Annex side of the building; the 200A, 1ø, 3W distribution panel located in the Staircase Closet on the Ground Floor that feeds the two panels in the Church side of the building; and for (4) 240V, 1ø, load centers serving various branch circuits.

Distribution and Branch Panels

The Church side of the building is served by an existing 200A, 1ø, 3W distribution panel (see Photo E4) located in the Staircase Closet on the Ground Floor. The distribution panel is original to the Church side of the building which was constructed in 1950 and probably relocated to the Staircase Closet after the construction of the Annex. It is a Federal Noark type fused panelboard with fused connections for branch circuit panels located in the Vestibule and the Fellowship Hall. Both branch circuit panels are in poor condition. The panelboard in the Fellowship Hall (see Photo E5) has life safety issues with two wooden blocks being used as space filler in the panel.

The Annex side of the building is served by an existing 100A, 1ø, 3W disconnect switch that feeds three small panel (see Photo E6) located in the main hallways of the Ground, 1st, and 2nd floors. Each panel contains as least 16 poles and has room for additional circuits, but is unlikely to have the capacity to support them.

Evaluation

The existing service is undersized for the building and would not support the needs of the new Town Center. There is limited spare load capacity in any of panelboards though room for additional circuits is available in some panels. We reason that the availability of gas heating and appliances, the frugal use of electric heating/cooling units, and the limited number of branch circuits available for each floor has allowed the church to function acceptably within the limits of its incoming service.

The building electrical distribution devices and branch circuit panels are mostly original to the construction of the Church and Annex, dating back to 1950 and 1974 respectively. The distribution devices and panels are past the acceptable life cycle recommendation of 35-40 years and are considered to be in poor condition, due to lack of proper maintenance.

Recommendation
Given the age and the poor condition of the panels as well as capacity limitations, it is highly recommended that the entire distribution system be upgraded and replaced with new. Phasing should not be considered as all of the existing 1ø, 3W electrical panels need to be replaced with new 3ø, 4W panels. The recommended size of the new service is estimated to be 1200A.

Emergency System
Panels serving the building's emergency systems are fed from a 30A, 1ø, 3W disconnect switch that taps off the incoming service wire trough. The disconnect switch feeds a small, vertically mounted pullbox from which a (4) pole load center (see Photo E7) containing (4) single pole, 20A circuit breakers serves the emergency lighting circuits throughout the building. A (2) pole fuse box also taps off the pullbox to feed the Fire Alarm Control Panel (see Photo E2).

Evaluation
The disconnect switch, load center, pullbox, and associated conduits show signs of rust and degradation, and appear to be original to the building construction.

The existing system does not have an emergency stand-by power generator, which is a design requirement for the new lifts and emergency shelter located in the Ground Floor Town Hall.

Recommendation
Replace the entire emergency system and integrate the emergency lighting circuits for the majority of the building into localized panels.

According to ICC 500, for a hurricane shelter a stand-by emergency generator is (at minimum) required to supply power to life safety systems and critical branch lighting circuits. Where required by the AHJ, the standby electrical power system shall also supply power to selected HVAC circuits. Depending on whether HVAC circuits are required to be served, the capacity of the standby generator is estimated to be 25kVA- 50kVA at 208V, 3ø. The duration of the standby electrical power system is determined by shelter type – tornado shelters require a minimum of 2 hours of continuous run-time, while hurricane shelters require a minimum of 24 hours. The standby generator must be independent of off-site fuel or water sources, so the generator cannot be of natural gas type. As it is unlikely the generator would be installed indoors, per ICC 500 the standby generator and associated distribution panels, cabling, fuel supply storage tanks, fuel lines, and other critical systems would need to be protected from design event conditions and put in a location that is accessible by a protected access route located within the hurricane shelter.

Fire Alarm System

The fire alarm system is a notification system only consisting of a connected series of bells and pullboxes (see Photo E8). The pullboxes are located predominately near the floor landings of each staircase and at the end of some corridors. Some egress doors lack a pullbox station such as in the Vestibule and the Fellowship Hall. Large, wall mounted, notification bells are located above or close to each pullbox station. Smaller, ceiling mounted bells (see Photo E9) are located in the Kitchen, Organ Chamber, and in some of the stairwells, boiler rooms, and closets.

The existing Shelter Room located in the Annex has beds available for use by church patrons and has a residential smoke detector mounted onto the wall. A second smoke detector is mounted over the door inside the Custodian Supply Room.

Evaluation

The entire fire alarm and safety system is outdated and does not meet current NFPA and IBC requirements for the building type that it is serving. There are no detection devices interconnected with the system and the notification devices of the systems need to be manually initiated.

Given the limitations of the fire alarm system, the existing elevator does not have a recall system interconnected to any smoke detector or alarm wiring.

The existing gas range located in the Church Kitchen does not have any fire suppression system which is required per NFPA 96 for commercial ranges.

Recommendation

Because of the age, condition, and function limitations of the systems available, a new fire alarm system shall be installed throughout with both detection and notification circuits to meet current code requirements. The new elevator shall be interconnected to a detection circuit for recall purposes. The kitchen range (should it remain) needs to be equipped with a fire suppression system.

Telecommunications

The existing building has a limited telecommunications system (see Photo E10) consisting mostly of telephone outlets located in the majority of rooms. Telecommunication cabling is being run unconcealed along and through walls (see Photo E11). Cable TV cabling and associated wireless router (see Photo E12) was noted in a room on the Second Floor of the Annex, but it unclear if it serves the entire building.

Evaluation/Recommendation

The existing telecommunication system is inadequate for the needs of the new Town Hall. The expectation to provide wireless routers throughout the Annex and Ground Floor of the Church Building would require an entirely new telecommunication system and network. Coordination between the telecommunication service utilities and the Town IT department would be required to determine exact system design requirements and scope of work.

Additionally, for the new Emergency Shelter, a two-way emergency communication system would be required between the area of refuge and a central location to allow contact for rescue and aid.

Receptacles

With the exception of the Fellowship Hall, the number of receptacles available in each room and area of the building is sparing at best - approximately 2-3 receptacles per small room and in the corridors; 4-5 receptacles in the larger rooms and the sanctuary.

Evaluation

Receptacles have been painted over (see Photo E13) in several of the rooms, making for life safety concerns. Several of the receptacles seem to be original to the building construction. Receptacle faceplates are missing or show signs of rust and degradation in various rooms and locations.

Most receptacles located in the bathrooms throughout the building and in the kitchens are not GFCI type (see Photo E14) and many receptacles are positioned within 6'-0" of a sink or water source.

Recommendation

It is suggested that the receptacles, faceplates, and associated wiring be removed and replaced with new throughout the building. GFCI type receptacles shall be installed in the kitchens and bathroom areas.

For phased work – with the exception of bathroom spaces – receptacles in the non-renovated spaces allocated the Church can remain as existing. All other space being renovated shall have all new receptacles, faceplates, and associated wiring.

LIGHTING

General Lighting

The majority of lighting fixtures in the building are 2x4, fluorescent, recessed/surface mounted, troffer fixtures with acrylic lens or plastic louver covers. The fixtures are lamped with T12, 40W lamps in the Annex and Church rooms and T8, 32W lamps in the Fellowship Hall, typically (4) lamps per fixture. The acrylic lens show trapped dirt and burn patterns (see Photo E15) from long time use and some lens are missing entirely from fixtures located in the Fellowship Hall and in a few of the Annex rooms. The plastic louver covers are dirty and missing from fixtures located in a few of the Annex rooms. There is one 2x4 fixture that is located through a cutout across the wall of two rooms on the 2nd Floor in the Annex. Lighting fixtures are controlled by toggle switches located throughout.

General lighting in the Sanctuary is provided through uplighting (see Photo E16) from fluorescent strip fixtures mounted in coves running the length of the Sanctuary on both sides.

Additional lighting is provided by (6) downlights (see Photo E17) with 300W PAR56 lamps located at the Apse end of the Sanctuary. Lighting in the Sanctuary is controlled by circuit breaker.

Lighting in staircases and entrances are provided by glass dome/square-shaped light fixtures that are lamped by either with incandescent lamps or compact fluorescents. All lighting is controlled by local toggle switches.

Lighting in most supply closets and boiler rooms are a mix of fluorescent strip lighting fixtures and incandescent sockets (some with pull strings) controlled by local toggle switches.

The Fellowship Hall is also used for theater and play productions and have theatrical lighting fixtures hanging at ±6'-6" AFF which is a building code violation (see Photo E19).

Evaluation
The age, condition, and lamping of the existing troffer fixtures are all reasons to replace for new. The lighting fixtures in the Sanctuary and in most stairwells can remain provided they are cleaned, refurbished, and relamped. There are a few decorative fixtures that could remain, but consideration for lighting budget allowances need to be taken into account as these fixtures use incandescent lamps. The IECC 2012 requires certain lighting reduction measures be taken for new and renovation construction – use of vacancy occupancy sensors devices, daylighting zone control, and a lighting budget allowance for offices that is approximately 0.9 watts per sq. ft.

Faceplates for existing toggle switches in many rooms are rusted, broken, or missing (see Photo E18)

Recommendation
For phased work, all renovated spaces shall have new lighting fixtures, wiring, and controls. Lighting fixtures and controls for the Sanctuary and Church Offices may remain as existing during phased construction.

It is highly recommended that all new lighting, wiring, and lighting controls be provided through out - especially lighting controls for the Sanctuary as the fixtures there are currently controlled by circuit breaker.

Exterior/Site Lighting
Exterior building lighting consists of double-headed incandescent fixtures (see Photo E20) located at each protruding corner of the building and incandescent decorative fixtures located above or to the side of each egress door.

Lighting in the parking lot and at the entrance is provided by (4) Pepco owned HID fixture heads mounted onto utility poles (see Photo E21) that run the length of the parking lot and continue onto 43rd Ave from Queens Chapel Rd.

Evaluation
The double-headed fixtures are controlled by timeclock and local toggle switches control the decorative egress fixtures. The egress fixtures do not have battery backup and do not comply with the egress lighting requirement of IBC 2012.

The introduction of the new parking spaces along Queens Chapel Rd and the gated Public Works Parking may require additional street lighting that would be provide necessary safety and illuminations requirements.

Recommendation
Per IECC 2012, provide new photocell and/or astronomical timeclock control for exterior, building mounted fixtures. All egress fixtures to be replaced with fixtures having battery back-up. The existing exterior street lighting needs to be studied to determine if it is adequate for the new parking lot and whether additional parking lot lighting is required.

Emergency Lighting
Evaluation/Recommendation
The building emergency lighting consists generally of exit signs and battery packs fed from (4) single pole, 20A circuit breakers located in the emergency lighting load center. The exit signs are a mix of standard internally-illuminated fixtures and non-standard incandescent socket fixtures (original to building construction) with red glass covers with the word 'EXIT' stenciled across (see Photo E22). Exit signs are properly located, with the exception of the Fellowship Hall where one exit sign is partially blocked by a lighting fixture and in the Ground Floor hallways leading to egress staircases. The wattage or lamp type of the standard exit signs could not be determined from visual inspection and may not comply with IECC 2012 requirement that exit signs shall not exceed 5 watts per side. The non-standard incandescent exit signs must be replaced with standard internally-illuminated fixtures.

Emergency path illumination is provided by battery packs located in most egress corridors, stairwells, and Fellowship Hall. Additional emergency lighting is required and is missing from the Sanctuary, Sanctuary Balcony, Vestibule, Church side hallways on the Ground Floor and 1st Floor, and the Church side storage and youth play area on the 2nd Floor. It is highly recommended that emergency lighting be provided in all bathrooms and the Kitchen.

It is possible that the existing standard exit signs and battery packs be tested and refurbished for continued use - provided they comply with IECC 2012. It is recommended that the entire emergency lighting system be replaced with new. Addition exit signs and battery packs to be added as required.

For the Emergency Shelter and associated support areas, corridors, passageways, and means of egress - emergency lighting must be provided at a minimum of 1 fc with standby lighting levels at a minimum of 10 fc. Both shall be connected to an emergency stand-by power generator. The remaining buildings emergency fixtures shall have battery back-up.

EXISTING ELECTRICAL SYSTEM CONDITION PHOTOS

Photo E1: Overhead In-Coming Service

Photo E2: In-coming Three Phase System and Fire Alarm Panel

Photo E3: Single Phase Distribution System

Photo E4: Church Distribution Panel

Photo E5: Painted Wooden Blocks Inserted into Panel

Photo E6: Annex Second Floor Panel

Photo E7: Emergency Lighting Load Center

Photo E8: Fire Alarm Pull Station and Bell

Photo E9: Small Fire Alarm Bell Located in Closet

Photo E10: Telecommunications Baseboard

Photo E11: Unconcealed Telecommunication Cabling

Photo E12: Cable TV

Photo E13: Receptacle with Painted Face

Photo E14: Non-GFCI Receptacle in Kitchen

Photo E15: Burn Patterns on Acrylic Lens

Photo E16: Sanctuary Cove Lighting

Photo E17: Sanctuary Downlights

Photo E18: Various Toggle Switches

Photo E19: Low Hanging Theater Lighting

Photo E20: Double Headed Exterior Fixture

Photo E21: Parking Lot Lighting on Utility Poles

Photo E22: Non-Standard Exit Sign

REFERENCES:

a) 2012 ASHRAE Handbook, Fundamentals, published by the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. Atlanta, Georgia, 2001

b) 2012 ASHRAE Handbook, HVAC Systems and Equipment, published by the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. Atlanta, Georgia, 2000

c) 2012 International Mechanical Code, published by the International Code Conference, Falls Church,

d) 2012 International Plumbing Code, published by the International Code Conference, Falls Church, Virginia, 1999

e) 2012 International Energy Conservation Code, published by the International Code Conference, Falls Church, Virginia, 1999

f) 2011 National Electrical Code

DISCLAIMERS:

AJ Engineers, Inc. has prepared the MEP Systems Assessment Report for Riverdale Presbyterian Church, 6513 Queens Chapel Road, University Park, MD. This report is based on the physical examination of the referenced site, examination of available construction drawings, and discussions with staff members familiar with the problems being experienced. This report is offered without prejudice and is an analysis based on available information. No destructive testing was performed, nor was any an air balance measurements, or analytical testing of room temperatures, etc. made at the time of the site observation. Findings are based on current industry standards, ASHRAE (American Association of Heating, Refrigerating and Air-Conditioning Engineers, Inc.) recommendations, as well as the professional experience of the author. This report is offered in good faith, with the understanding that AJ Engineers assumes no responsibility for concealed defects, or that his use of this report in any manner other than that intended by the author.