Tobin & Vassal Lane Upper Schools

Cambridge, MA

Existing Conditions Assessment

For

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Table of Contents

A. INTRODUCTION

This report describes the existing conditions assessment of the mechanical, electrical, plumbing, fire protection, telecommunications and security systems for the Tobin Montessori and Vassal Lane Upper Schools in Cambridge, MA.

B. MECHANICAL SYSTEMS

1. General

The building heating, ventilating and air conditioning (HVAC) systems utilize electric type heating and cooling equipment.

The main building control system is equipped with pneumatic controls.

With the exception two (2) indoor air handling units and the associated roof-mounted air cooled condensing units which appear to have been installed approximately 10 years ago, the HVAC systems are at or near their estimated service life. The following table lists the average (median) estimated service life (ESL) in years according to the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) 2015 Fundamentals Handbook.

EQUIPMENT DESCRIPTION	MEDIAN YEARS
Unit Ventilators	20
Rooftop Heating and Ventilating Units	20
Electric Heating Coils	15
Exhaust Fans	25
Pneumatic Controls	20
Electric Motors	18
Motor Starters	17

2. Air Handling Units and Condensing Units

There are nine (9) air handling units serving various spaces within the building.

Existing air handling unit AC-1, located in a level 1 mechanical room, provides heating ventilation and air conditioning for the kitchen and some small office areas. An associated split air cooled condensing unit located on the roof provides mechanical cooling for the unit. AC-1 and the associated condensing unit appear to have been replaced approximately 10

years ago. The refrigeration system utilizes R-410A refrigerant. The unit is equipped with an electric heating coil connected to the unit supply air discharge ductwork. Duct-mounted electric heating coils provide individual space heating control.

Existing air handling unit AC-2, located in a level 1 mechanical room, provides heating ventilation and air conditioning for the cafeteria and some small office areas. An associated split air cooled condensing unit located on the roof provides mechanical cooling for the unit. AC-2 and the associated condensing unit appear to have been replaced approximately 10 years ago. The refrigeration system utilizes R-410A refrigerant. The unit is equipped with an electric heating coil connected to the unit supply air discharge ductwork. Duct-mounted electric heating coils provide individual space heating control.

Existing air handling unit AC-3, located in a mechanical penthouse, provides heating ventilation and air conditioning for the auditorium and the main building entry space. An associated split air cooled condensing unit located on the roof provides mechanical cooling for the unit. AC-3 and the associated condensing unit appear to be original equipment.

Existing air handling unit HV-1, located in a level 1 mechanical room, provides heating and ventilation for the level 1 storage area. HV-1 appears to be original equipment.

Existing air handling unit HV-2, located in a level 1 mechanical room, provides tempered make-up air for the kitchen hoods. HV-2 appears to be original equipment.

Existing air handling unit HV-3, located in a mechanical mezzanine space near the west side of the gymnasium provides heating and ventilation for the original locker room areas on the south side of the gymnasium. An associated in-line fan located on the mechanical mezzanine provides exhaust air for these spaces. HV-3 and the associated in-line fan appear to be original equipment.

Two (2) existing air handling units HV-4 and HV-5 located in mechanical mezzanine spaces near the north side of the gymnasium provide heating and ventilation for gymnasium. Each unit is provided with an in-line fan which provides exhaust air for the gymnasium. HV-4, HV-5 and the associated in-line fans appear to be original equipment.

Existing air handling unit HV-6, located in a mechanical space near the east side of the gymnasium provides heating and ventilation for the original locker room areas on the east side of the gymnasium. An associated roof-mounted fan provides exhaust air for these spaces. HV-3 and the associated roof-mounted fan appear to be original equipment.

3. Space Mounted Heating, Ventilating and Air Conditioning Units

Heating, ventilation and air conditioning for the classroom spaces is provided by self-contained type unit ventilators located around the perimeter of the building. The units are equipped with electric heating coils and packaged direct expansion cooling. Each unit is provided with an outside air intake louver through the wall which provides ventilation air. Exhaust air for the

classrooms is provided by several exhaust fans located at various locations throughout the building. It has been reported by the school that the original unit ventilators were replaced in 1992.

Additional unit ventilators similar to the equipment described above are also provided for the cafeteria.

4. Ancillary Mechanical Systems

Dedicated exhaust fans are provided for the toilet room areas, kitchen hoods and laboratory fume hoods.

The kiln located in the art classroom is provided with a dedicated exhaust system.

C. PLUMBING SYSTEMS

1. Domestic Water Service

The existing 6-inch domestic water service enters the storage area beneath the gymnasium and is provided with a 6-inch gate valve and is immediately reduced to 3-inch in size. The 3-inch domestic water meter is provided with a remote read and is located in the ground level plumbing shop. It has been reported the existing copper water pipe located throughout the building experiences pin-hole leaks which frequently requires replacement.

Hot water is currently provided by a simplex electric water heater with integral storage. The heater was manufactured by Patterson Kelley in 1970. Water is heated to 140-degrees and mixed down to 120-degrees with a Leonard thermostatic mixing valve to serve the domestic plumbing fixtures. 140-degrees is piped to serve the kitchen equipment. The 120-degree domestic hot water is fully circulated back to the heater with the use of a Bell & Gossett circulation pump. There are visible signs of corrosion at the existing thermostatic mixing valve and on the water heater insulation jacket.

2. Sanitary Drainage

Sanitary piping collects waste from the domestic plumbing fixtures located on the second and third levels and discharge it to the municipal sanitary sewer located in Vassal Lane by gravity. An 8-inch sanitary sewer exits the west crawl space and a 5-inch sanitary sewer exits the east crawl space. The sanitary waste collected from level 1 fixtures is piped to a duplex sewage ejector located in the west crawlspace. The sewage ejector discharges into the existing 8-inch sanitary sewer and appears to be in fair condition. The visible sanitary waste pipe located in the crawlspaces is in fair condition. There are several locations where the piping is severely corroded and will require replacement.

Grease waste generated from the triple-bowl pot sink located in the kitchen is provided with a recessed grease interceptor. The outlet of this interceptor is piped directly to the sanitary sewer. There are no grease interceptors serving the kettles and there is no exterior grease interceptor as required by the Cambridge sewer department. All fixtures and equipment generating grease laden-waste shall be piped to a PDI approved grease interceptor as required by the Massachusetts Plumbing Code.

The sinks located at the third floor science classrooms are provided with acid-resistant waste piping but there are no pH neutralization systems in place. All waste is piped directly to the sanitary sewer. Laboratory sinks shall be provided with a waste neutralization system as required by the Massachusetts Plumbing Code.

3. *Storm Drainage*

The building is provided with conventional roof drains at the main level of flat roof. The use of scupper drains and downspouts were observed at architectural features that extend higher than the main roof level. The roof drains are piped down through the building and discharge to the municipal storm sewer in Vassal Lane by gravity. A 12-inch sanitary sewer exits the west crawl space and a 12-inch sanitary sewer exits the east crawl space. There was no observed secondary overflow roof drain system or scupper drains at the main roof level.

A duplex sump pump is located in the west crawl space and collects storm water from area drains located outside of the building. The sump pump discharges into the existing 12-inch storm sewer and appears to be in fair condition.

4. *Plumbing Fixtures*

Plumbing fixtures in public toilet rooms consist of wall-mounted water closets with manual flush valves, wall-mounted urinals with manual flush valves and wall-mounted china lavatories with manual faucets. It appears some of the water closets have been updated with 1.6 gallons per flush units and some lavatory faucets have been replaced. Plumbing fixtures located at the classrooms in the Vassal Lane Upper School consist of floor mounted water closets with manual flush valves and counter mounted lavatories with manual faucets. It appears many of the lavatory sinks and faucets have been replaced.

Drinking fountains are a combination of recessed or surface mounted and are generally in fair condition. A new combination drinking fountain and bottle filer is provided in the cafeteria. Janitors closets consist of floor-mounted molded stone basins and faucets with vacuum breakers which are in fair condition. Classroom sinks are stainless steel with manual faucets and appear to be in fair condition.

The third floor science classrooms are provided with emergency showers and eyewashes. Tepid water is supplied to the fixtures by point-of-use thermostatic mixing valves. The fixtures and valves appear to be in good condition. Science classroom sinks include epoxy basins and

faucets with integral vacuum breakers. General classroom sinks are stainless steel with manual faucets.

5. Natural Gas

A natural gas service enters the site near the main entrance along Vassal Lane. The 2-inch line is installed along the exterior of the building and enters the east crawl-space above grade. The gas meter is located within the east crawlspace. Natural gas was originally installed in the building to serve the generator, classroom cooking stoves and gas turrets in the science classrooms which have all since been removed.

D. FIRE PROTECTION SYSTEMS

1. General

The building currently does not have an automatic sprinkler system. There are no standpipes within the egress stairwells or at the auditorium stage.

E. ELECTRICAL SYSTEMS

1. Electrical Distribution

The Tobin Montessori and Vassal Lane Upper Schools primary electric service originates underground from a utility manhole on Vassal Lane. An electric transformer vault room is located inside the building and hosts the utility-owned transformer with a secondary service of 480/277-volt. From the transformer a 3000A, 3Ø, 4 Wire bus duct is providing power to a 3000A, 480/277V, 3Ø, 4 Wire Main Switchboard.

Satellite electrical rooms are located on each wing and floor. Each room accommodates 480/277-volt panelboards and three-phase dry-type transformers providing 120/208-volt power to local electrical consuming loads.

Generally, much of the electrical infrastructure appears to be original to the building and is beyond typical service life. It is generally accepted that the maximum life of an electrical system is thirty (30) years. Beyond that point, it becomes increasingly difficult to cost effectively maintain the system. Wire insulation and equipment failure becomes more common as the system ages, with an increase in outage longevity due to the design of the system and the availability of replacement parts. Often new systems need to be installed to bypass the old system without the benefit of a comprehensive plan designed for the needs of the system. The following is a list of typical life expectancies of equipment.

EQUIPMENT	EXPECTED LIFE (YEARS)
LV molded case circuit breakers	17
LV power circuit breakers	20
Dry-type transformers	25-30
Liquid filled transformers	30
LV and MV cables	20
Motors and motor starters	20-30

References used to evaluate the electrical, lighting and fire alarm systems include:

- Occupational Safety and Health Act (OSHA).
- Massachusetts Electrical Code (MEC).
- National Electrical Safety Code (NESC).
- National Electrical Manufacturers' Association (NEMA).
- National Fire Protection Association (NFPA).
- Institute of Electrical and Electronics Engineers (IEEE).
- Illumination Engineering Society of North America (IESNA)

The panelboards are beyond their useful life and replacement parts are very difficult to find. Cable insulation failure within a panelboard can create a fire and safety hazard.
The ratings of the equipment are not listed on the equipment forcing this equipment to be replaced to ensure adequate ratings. With underrated equipment, a short circuit in the electrical system could create a catastrophic failure of the equipment and a potentially dangerous condition for anyone near the panelboard at the time of the failure. Beyond this, an arc flash incident energy model is required to the proper procedures and protective measures needed to operate and maintain equipment.

Electrical protective devices must be properly studied and adjusted to verify that emergency/life safety and elevator circuits are properly coordinated and code compliant. The coordination is essential to providing electrical systems that are more reliable when faults occur within the system. The coordination of devices will ensure that these systems stay energized and provide power that is utilized for the safety of the occupants.

2. Observations:

a. Most of the electrical rooms are used as storage.

b. Panelboards did not have a label indicating the wiring color code and associated voltages.

c. All panels did not have a label warning of arc flash hazard.

d. Panelboards were not marked to indicate the source of supply location.

e. Slots were found in panelboards with missing circuit breakers and no blank closure plates installed.

3. Emergency Power

The emergency power is provided by a 60 KW, 208Y/120-volt diesel generator from Katolight with a belly tank capacity of 105 gallons. The generator has a 200A breaker and it feeds a Generac automatic transfer switch. The generator and the automatic transfer switch have replaced the original generator and automatic transfer switch in 2003. Apart from this upgrade the original emergency power infrastructure appears to be original to the building and is beyond typical service life.

The current emergency power infrastructure is not code complaint. Code complaint emergency power distribution, including specialty cabling, separation of normal power and emergency power, separation of life safety and stand-by power, and properly rated rooms is required.

4. Lighting and Lighting Controls

In general, the lighting is fluorescent. Lighting levels, especially in the classrooms are not code compliant and appears to be below code compliant levels and recommendations given in the IES (Illuminating Engineering Society) handbook and Energy Star for vertical and horizontal illuminance levels required in a given space.

There are no automatic controls provided for all the other spaces in the building, including all the classrooms, meeting/conference rooms, restrooms and offices as required by the energy code.

There are no day-light controls for all spaces with natural light as required by the energy code.

There is no bi-level switching and/or dimming to achieve multiple light levels within in the offices, meeting/conference rooms, and classrooms as required by the energy code.

The corridor fixtures, site fixtures and building mounted fixtures appears to be controlled by time-clocks located in the electrical rooms.

The emergency lighting system is incorporated as part of the normal lighting system but there is no clear indication which fixtures are in emergency throughout the building.

There is no illuminated exit signs and emergency egress lighting provided in the required classrooms and all required means of egress.

5. Fire Alarm System

The existing fire alarm system panel is a FCI (Fire Control Instruments) and is located inside a room in the Main Office #230 The fire alarm system in general it appears to be serviceable and up to code.

The Tobin Montessori and Vassal Lane Upper School's primary Telecom service originates underground from a utility pole on Vassal Lane. The existing service entrance room for demarcation of voice, data, and CATV utilities is undersized and overcrowded. It is located at the rear of the art classroom on the basement level. The second telecom room on the third level has a vast amount of loose cable that may pose a fire hazard. A large mix of cable types including fiber and UTP run into this room to wall mounted switches. Much of this equipment is old and not suitable for reuse.

Low voltage cables were observed hanging unsupported, leaving them vulnerable to tampering and damage. Some of the conduits observed did not have bushings leaving the cable bundles vulnerable to damage. A mix of cabling technologies were observed representing a spectrum of performance capabilities including Category 5, Category 5e and Category 6 UTP were observed. For Tobin to support current and future technologies with adequate bandwidth, nothing less than Category 6 cable is appropriate. In some locations, water leaks in the ceiling were observed near active low voltage cabling.

No fire stopping was observed. Additionally, numerous instances of cables run through core holes in walls and floors without conduit or fire stopping. All of this is not code compliant.

A Simplex 2350 master time system is in use. School Smart digital clocks and analog clocks in most classrooms. These are operational and appear to meet current school needs. However, Tobin may wish to consider a newer, wireless, network-based system that will integrate with their current EdConnect platform.

6. Security Systems

The current system is Genetec head-end and operating system for access control/CCTV/Intrusion Detection. Although older technology, the system still serves the school's needs. However, it is limited in its ability to expand to provide service in additional areas and utilizes outdated endpoint technology (i.e., cameras, readers, monitoring, etc.) that may become increasingly difficult to replace or repair.

Mechanical

Electrical

Plumbing

Fire Protection

Civil

Structural

Technology

Lighting

Sustainability

Commissioning

RFS engineering

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