# Harvard Hildreth Phase 2 Feasibility Study
# 16 Lancaster County Rd.
# Harvard, MA 01451

**Date: September 23, 2021**

**Mechanical Engineer: Chris Plasse**

**Electrical Engineer: Robert Del Mastro Jr.**

## I. GENERAL REQUIREMENTS

HVAC, Plumbing, Fire Protection components shall be seismically restrained to meet the requirements of the Commonwealth of Massachusetts State Building Code. Critical HVAC, Plumbing, Fire Protection and Medical Gas/Vacuum components shall be designed to operate after a design seismic event, documentation shall be provided by equipment suppliers in accordance with ASCE/ANSI 7-05.

Mechanical systems for this project will be designed consistent with the following documents and other requirements:

1. Massachusetts State Building Code (9th Edition), consisting of:
   a. International Building Code, 2015 Edition with MA Amendments.
   b. International Mechanical Code, 2015 Edition with MA Amendments.
2. Massachusetts Fire and Electrical Code, consisting of:
   a. National Electrical Code (NFPA 70), 2017 Edition.
3. ASHRAE 62.1 – Ventilation and Air Quality, 2016
4. ASHRAE Fundamentals, 2017

## II. EXISTING CONDITIONS

### A. GENERAL

The observations in this section of the report are a result of one site visits by Liro Engineers on September 15, 2021. **The observations made are a result of a visual inspection of the existing MEP systems while the building was not in use.** This section of the report will summarize our findings.

### B. EXISTING HVAC SYSTEM

1. The existing HVAC system contains (5) external Lennox condensing units, (3) 2 ton units, (1) 2-1/2 ton unit, and (1) 3 ton unit. The condensing units each serve an associated coil attached to a furnace in the mechanical room. In the machine room there are (4) Lennox gas fired furnaces and (1) hot water furnace. The furnaces are forced hot air units. An 18x18 duct is serving outside air to each of the units return, the duct is attached to a 36x36 louver at the rear of the building.
2. The attic of the building has a lover on either end of the building. The

louvers each have a small fan for exhaust.

3. The main entry vestibule has (2) door air curtains fed from above with hot water heating coils.
4. The electrical room and janitor closet are being exhausted to roof with inline fans.
5. The bathrooms are ducted to a common exhaust duct with an inline fan being vented out through the roof.
6. There didn't appear to be any central BMS system for the building, each of the units had individual controls mounted in the mechanical room.

C. EXISTING PLUMBING SYSTEMS

1. There is an existing triangle prestige excellence 110 heating boiler/hot water heater in the mechanical room. The heater feeds all of the sinks throughout the building via hot water loop piped through the building.

D. EXISTING FIRE PROTECTION SYSTEMS

1. Not observed.

E. EXISTING ELECTRICAL SYSTEMS

1. Normal Distribution

The normal service appears to come from a pole mounted transformer marked with 120 208 indicating a 208/120v service and has 3 conductors from the transformer to a conduit that travels underground and assumed to feed the building's main distribution panel MDP (refer to figures 1 & 2).

The service feeders enter a wire trough which feed a class 320 utility meter, which in turn feeds the main distribution panel MDP (refer to figures 3 & 4).

The main distribution panel for the building is a 400A, 208Y/120V, 3PH, 4W panel with 400A main breaker, 42 pole. The panel is rated at 10KAIC. The panel is labeled MDP (refer to figure 5). This panel is full, and you cannot add any more circuit breakers.

Panel MDP has no breaker labeled with a panel in the room. It is assumed that panel SDP has taped the feeder to panel MDP.

Panel labeled SDP is a 225A, 208Y/120V, 3PH, 4W panel with 200A main breaker, 30 pole. The panel is rated at 10KAIC. The panel has an 100A-2P breaker labeled on the panel in marker panel ELA. A conduit from the ATS that feeds panel ELA is connected to SDP. It is assumed that panel SDP feeds the ATS that in turn feeds panel ELA (refer to the existing riser diagram on drawing SKE-1). Panel SDP has (4) spaces available to add future breakers.

The main service is grounded to a ground rode in the electric room which

appears to bond all panels in the room. No connection to the incoming water line was observed (refer to figures 6 & 7).

The existing service's capacity is 320 amperes at 208/120v, 3 phase.
The total power capacity for the building is 320A x .36 = 115.2 kva.
This is 21.74 va/sf of capacity.

2. Emergency Distribution

There is no emergency distribution system in the building.

3. Standby Distribution

The standby distribution system is from (1) panel labeled ELA, which is fed from an ATS. One side of the ATS is fed from panel SDP and the other side is fed from a generator.

Panel labeled ELA is a 200A, 240/120V, 1PH, 3W MLO panel with 16 poles. This panel is feed with 208V 1PH under normal power and 240V 1PH under standby power.

This can cause a potential problem if a two-pole breaker is added to the panel. The load would experience two different voltages depending on mode of operation.

The panel is populated with (7) 20A-1P breakers feeding 120V loads only, so there is no immediate danger of suppling 240V to equipment from the generator.

The generator is a natural gas generator rated at 12KW/12KVA, PF=1, 50A, 240V, 1PH. The generator has an output breaker sized at 70A to protect the ATS(refer to figure 8). The ATS is also protected from an 100A circuit breaker in panel SDP.

The ATS has no label on the outside to determine its size. The normal side of the ATS is protected by an 100A circuit breaker in panel SDP. The standby side of the ATS is protected by an 70A circuit breaker in the generator. It is assumed that the ATS is rated at 100A based on its circuit breaker protection.

4. Electric Room

The electric room has fire alarm, phone, nurse call and IT equipment in the room. There are working space issues with the IT equipment in the room. Room is too small for all the equipment located in the room.

5. Code Issues

1. Working space about electrical equipment.
2. No arc flash labels on electrical panels and equipment.
3. FACP fed with Romex wire.
4. MC cable not installed in neat and workmanlike manner.
5. Derating of MC cable not done.
6. Face plates missing on some devices throughout the building.
7. Incoming water line not grounded to service.

6. Recommendations

Bond the incoming water main and provide bonding jumper around meter.
Replace panels MDP and SDP with (1) 84 pole panel.
Remove phone, IT, nurse call and fire alarm equipment from electric room.
Resize the electric room to eliminate all code violations.
Remove generator and standby distribution system or replace generator with one that matches building voltage.
Provide new rooms for fire alarm equipment, phone, and IT equipment.

F. EXISTING FIRE ALARM SYSTEMS

1. System

The existing FACP is a Fire Lite MS-10UD by Honeywell, a conventional system. The FACP connects to cell phone dialer master box (DSC). There is an annunciator located in the main door vestibule. Pull stations are present at all exit doors. Heat detectors are present throughout the building.
Horn/strobes are present throughout the building (refer to figures 9 & 11).

2. Code Issues

1. No smoke/heat detector over FACP
2. FACP required to be in 2 hr fire rated room, need to confirm.
3. No coverage in electrical/mechanical rooms.
4. Missing coverage in a few spots
5. FACP power wiring is Romex (refer to figure 10).

3. Recommendations

Replace system with addressable system with smoke detectors over heat detectors inside building in most areas. Provide full coverage including attic space. Replace Romex wiring.

G. EXISTING NURSE CALL SYSTEMS

1. System

System consists of pull stations in bathrooms, ceiling light outside bathroom and a buzzer. The controller located in electrical room

2. Code Issues

No code issues observed.

3. Recommendations

Remove the system not required by new tenant.

## H. EXISTING LIGHTING

1. Normal lighting

The existing lighting consists mainly of 2x4 fluorescent lighting throughout the building. There does exist some fluorescent down lights and some fluorescent track lighting. The lighting is controlled by switches with no occupancy /vacancy sensors or Bi-level lighting controls.

2. Emergency Lighting

The existing emergency lighting consists of EBUs along path of egress, not functioning and battery ballast in select fixtures throughout building. Exit signs located along the path of egress and are not functioning.

3. Site Lighting

The existing site lighting consists of Spotlights on building illuminating grass on two sides of the building and pole mounted lights in the parking lot. A lighting control relay in electric room appears to control these lights on a time clock.

4. Code Issues

1. Building does not meet the energy code
2. EBUs and Exits signs not working.

5. Recommendations

Replace existing light fixtures with new LED light fixtures and provide lighting controls for the building meeting the energy code requirements. Replace all emergency exit signs.

## I. EXISTING TELECOMMUNICATIONS SYSTEMS

1. General

The incoming service for IT and phone service is in the electric room under the wire trough (refer to figure 3). PBX service provider equipment is utilizing copper wire (refer to figures 12 & 13). IT service provider is utilizing fiber optic cable (refer to figures 15 &16).

2. AV System

No AV system was observed.

3. Security System

No Camaras present inside or outside of building was observed.
No motion sensors observed within the building.

4. Phone System

The phone system is by a PBX service provider equipment utilizing copper wire (refer to figures 12 & 13).

5. IT System

The IT system is by an IT service provider utilizing fiber optic cable that terminates in a rack in the electric room (refer to figures 14,15 &16). A secondary telecommunications room exists with another rack fed from the rack in the electric room. This rack also has PBX patch panels.

The equipment does not appear to be functioning and a lot of cables are missing from the racks.

Some data jacks and phone jacks throughout the building.
Cables for WIFI in ceiling in some places without WIFI equipment.

6. Code Issues

1. Working space about electrical equipment in electric room and second IT room.
2. Cable not installed in neat and workmanlike manner.
3. Cables abandoned in place.

7. Recommendations

1. Complete gut with new design.
2. VOIP phone system and remove old PBX system.

## III. PROPOSED HVAC SYSTEMS

A. GENERAL

1. The existing system would require a significant amount of work to

reuse. The age of the condensing units/coils is pushing 20 years, will likely need to be replaced soon. The boiler/domestic water heater is approaching 20 years of age, will likely need to be replaced soon. The furnaces providing heat to the building are approaching 20 years of age, will likely need to be replaced soon. The refrigerant used in the cooling coils is HCFC-22, this refrigerant has since been banned due to its high global warming potential. As of January 1, 2020 HCFC-22 is no longer being produced or imported. The insulation on the ductwork and the piping are both below the required R value per code and would need to be completely replaced. The outside air going to the units would need to be balanced to ensure proper amount of OA is being provided per ASHRAE 62.1, otherwise would need to upsize/replace. The attic has insufficient ventilation, needs to be updated. Entirety of the ductwork system will need to be pressure tested and repaired to ensure there are no leaks. The entirety of the piping system would need to be pressure tested and repaired to ensure no leaks. The exhaust fans serving the bathrooms, electrical room, and janitor closet should be replaced, the ductwork seemed to be in good condition and can likely be reused.

2. Due to the amount of work needed to bring the existing system up to code and the age of the system, we recommend a new high efficiency HVAC system be installed, and the existing systems be demolished.

B. New HVAC

1. We recommend the use of a new Mitsubishi (or similar) VRF system for the new building. The loads were calculated based upon 350 sf/ton of cooling, and 40 btu/hr/sf for heating. The system will consist of the following:

   a. (2) 8-ton outdoor high efficiency condensing units which will feed the indoor heat pump units via refrigeration lines.

   b. Cassette style heat pump units provided in each of the enclosed office spaces, conference room, and storage units as required.

   c. (2) ducted style heat pump units for the two large gathering halls

   d. (3) new inline exhaust fans. One serving the rest rooms, one serving electrical and janitor closet, and one serving the kitchen.

   e. (1) new 1200 cfm ERV unit utilizing existing intake louver at rear of building. This unit will serve outside air required per ASHRAE 62.1 to each of the spaces within the building. This system benefits from reusing the return air the heat/cool the incoming outdoor air via a heat exchanger during winter/summer.

2. This configuration allows for a lot of flexibility. The highly efficient units will also be a significant improvement over the existing system. The new ERV will ensure that the proper amount of outdoor air is being fed to meet code. The system will require little maintenance for upkeep.

## IV. PROPOSED ELECTRICAL SYSTEMS

C. GENERAL

1. The proposed new loads are calculated below.

| Design Loads (va/sf) | | | | | |
|---|---|---|---|---|---|
| Lighting Load | General Receptacle Load | General Equipment Load | HVAC Load | Miscellaneous Load | Total |
| 3 | 2 | 2 | 8 | 1.3 | 16.3 |

| Kitchen Equipment Load | | | |
|---|---|---|---|
| Equipment | Load (va) | Number | Total (va) |
| Oven | 8,780 | 2 | 17,560 |
| Refrigerator | 1,440 | 2 | 2,880 |
| Dishwasher | 1,500 | 2 | 3,000 |
| | | | 23,440 |

| **Design Load** | **va/sf** | **sf** | **Load (va)** |
|---|---|---|---|
| Lighting Load | 3 | 5,300 | 15,900 |
| General Receptacle Load | 2 | 5,300 | 10,600 |
| General Equipment Load | 2 | 5,300 | 10,600 |
| HVAC Load | 8 | 5,300 | 42,400 |
| Miscellaneous Load | 1.3 | 5,300 | 6,890 |
| Kitchen Equipment Load | - | - | 23,440 |
| | | | **109,830** |

The calculated new load for the building is 109,830 va or 109.83 kva. This load is below the existing service size of 115.2 kva.

2. Electrical components shall be seismically restrained to meet the requirements of the Massachusetts State Building Code. Critical Electrical components shall be designed to operate after a design seismic event, documentation shall be provided by equipment suppliers in accordance with ASCE/ANSI 7-05.

3. Electrical systems for this project will be designed consistent with the following documents and other requirements:

   a. Massachusetts State Building Code (9th Edition), consisting of:

      1. International Building Code, 2015 Edition with MA Amendments.

      2. International Energy Conservation Code, 2015 Edition with MA Amendments.

      3. Massachusetts Electrical Code 527 CMR 12.00, consisting of:

a. National Electrical Code (NFPA 70), 2020 Edition with MA Amendments.

4. Massachusetts Fire Code 527 CMR 1.00, consisting of:

a. National Fire Code (NFPA 1), 2015 Edition with MA Amendments.

5. NFPA-101 - Life Safety Code 2015 Edition.

b. Illumination Engineering Society of North America, (IESNA) - lighting design handbook.

c. TDMM - BISCI handbook for telephone and data design and integration

D. Demolition Scope of Work

1. The demolition scope of work consists of the following:

a. Complete demolition of the existing Fire Alarm System

b. Complete demolition of the existing Nurse Call System

c. Complete demolition of the exiting phone and IT equipment and cabling maintaining the incoming fiber from the service provider.

d. Complete demolition of the generator and associated electrical distribution system.

e. Complete demolition of abandoned cabling not to be reused,

f. Selected demolition of existing electrical equipment not to be reused

E. New Electrical Scope of Work

1. Incoming Electrical Service

a. Grounding

The existing service ground is a ground rod in the existing electrical room. The ground will be extended to bond building steel and the main water line. A bonding jumper will be provided around the water meter.

b. Meter Location

The existing meter location will be maintained.

2. Electrical Distribution

The electrical service will terminate in a new doubletub service rated panel sized at 400 amperes. The new panel will be a 208/120v, 3ph, 4W, 22KAIC panel that will replace the existing panels MDP and SDP (refer to SKE-1 proposed).

Branch circuit wiring will be 600V rated with THWN or THHN insulation. MC cabling is allowed with dedicated ground wire. All branch circuits to have a dedicated ground wire.

Feeders and branch circuits to have full size neutrals. Sharing of neutrals is not permitted in feeders or branch circuits.

A complete equipment grounding system shall be provided such that all metallic structures, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, metal fences, and all other conductive items operate continuously at ground potential and provide a low impedance path to ground for possible fault currents.

A new copper ground bus for properly bonding and grounding all electrical panels will be provided in the electrical room.

Branch circuits and feeders will be provided for the following:

a. General receptacles

b. Furniture

c. Kitchen Equipment

d. HVAC Equipment

e. Telecommunications Equipment

f. AV & Security equipment.

g. Lighting

F. Lighting

The lighting for the building will utilize new LED 2x4 and 2x2 light fixtures with dimming ballast. Emergency egress lighting will utilize EBUs and battery ballast in the light fixtures.

Lighting controls will consist of wall mounted vacancy sensor with dimming in offices, occupancy sensors in corridors and a lighting control system in the large assembly areas.

New battery power exit signs will be provided throughout the building.

Site lighting will remain as is and will be wired to the new panel.

G. New Fire Alarm Scope of Work

A new voice evacuation system will be provided consisting of the following:

a. A new addressable Fire Alarm Control Panel with voice evacuation capability and batteries.

b. New addressable heat detectors located in attic, equipment spaces and the warming kitchen.

c. New addressable smoke detectors located throughout the building. Full coverage will be required due to the building not being sprinklered.

d. New addressable pull stations will be located at all exit doors.

e. New speaker/strobe units will be located throughout the building.

f. New strobe only units will be located in conference rooms.

g. New Fire Alarm Beacon will be provided on the exterior.

h. New Knox Box will be provided at the front exterior entrance.

i. New Radio or Cell Phone dialer Master Box will be provided

The proposed location of the FACP and Master Box will be in main door vestibule subject to fire department approval.

H. New Telecommunications Scope of Work

1. AV and Security

An allowance of $20,000 will be carried for AV and security scope of work to be determined in the future.

2. New MDF room

A new main IT room will be built 10’ x 10’ to accommodate all telecommunications and service provider equipment. Fire rated plywood will be on all the walls to accommodate service provided equipment

3. Phone and Data

Phone service will be converted into a VOIP system and will utilize the same existing fiber cable from the service provider as the data system. A new 19” rack will be provided with the following equipment:

a. fiber equipment

b. Patch panels

c. Phone distribution panels

d. Data distribution panels

4. Telecommunications Raceway Systems, Pathways and Spaces

a. Pathways consisting of conduits, and J-Hooks will be designed to properly support the Structured Cabling System. The design will provide the pathways for both vertical and horizontal cabling.
b. All telephone/data outlets will have 3/4”(for up to 4 cables) or 1-

1/4” (for 5-10 cables), conduit stubbed out of the wall to an accessible ceiling.

c. The existing TR room will be used and patch panels provided as required for the number of devices in the project plus 25% spare capacity.

5. Telecommunications Cabling

a. The telecommunications Structured Cabling System will be designed to meet the current and foreseeable needs for the telecommunications systems

b. CATV distribution will consist of .500 coax from the main equipment room to each of the TR’s. Amplifiers and splitters will then distribute the signal to each drop.

c. All data cabling will be designed with category 6e cable. Voice cabling will utilize cat 6e for VoIP systems, cable and jacks will be terminated on wall panels in the respective TR. All cables will be homerun to the closest TR and terminated as required.

d. Distribution of CATV will be over RG6 quad shield coax copper cable. Each cable will be homerun to the closest TR and terminated.

e. Permanent offices will have a minimum of two outlets consisting of at least one voice and one data cable. Flexible workstations will have a minimum of one outlet consisting of one voice and one data cable.

I. Bid Alternative

As a bid alternative a new 175kw/219kva 208/120v, 3ph, 4w natural generator will be provided to provide standby power to the building (refer to SKE-1 bid alternate). A new natural gas generator will be located where the existing generator is located. The gas service will be upsized as needed to accommodate the new gas load. A new 400A, 4 pole ATS will be provided in the electric room and connected to the incoming service, the generator and the new main panel.

The electric room will need to be enlarged to accommodate the new equipment of the bid alternate. A new 400A feeder will need to be routed from the generator to the new ATS. Suggested routing in underground (grassy area) to edge of building and route outside building up to attic space. Route in attic space and down to ATS. Provide an allowance for gas utility to upsize gas feed assume $20,000.

# Figures


Figure 1


Figure 2

Figure 3


Figure 4


Figure 5

Figure 6


Figure 7

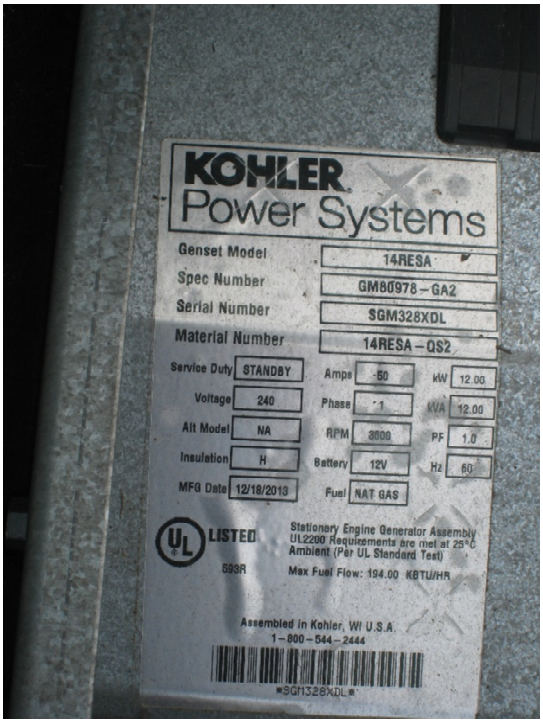


Figure 8


Figure 9

Figure 10


Figure 11

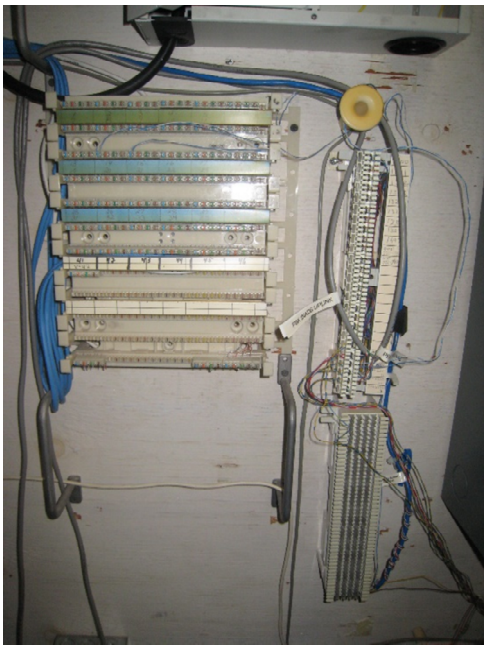

Figure 12

Figure 13

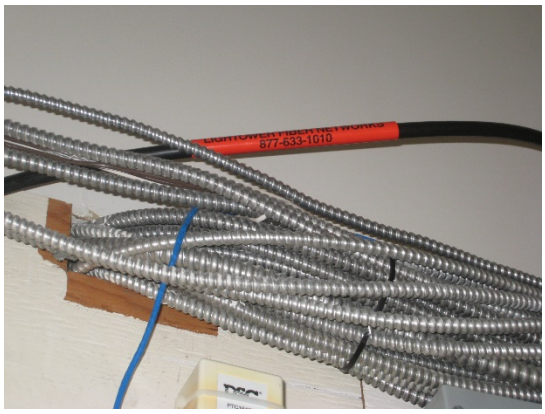

Figure 14

Figure 15

Figure 16