

Fuller Middle School Feasibility Study
Framingham, MA
Electrical Existing Conditions Systems Report
J#680 015 00.00
L#58621/Page 1/November 1, 2017

ELECTRICAL

Executive Summary:

The original building was constructed in the late 1950s with a minor classroom renovation during 1967. Most of the systems are original to the building and although functioning, have outlived their intended useful life. The facility's four electrical services are provided by Eversource and are primary metered. Other incoming utilities include telephone, cable TV, fiber, and fire alarm.

The power distribution system is original and generally in poor condition. Most of the lighting systems have been retrofitted with new lamps and ballasts, but most light fixtures, switches and wiring were reused. The fire alarm system control panel has been upgraded however it is still non-addressable. The system wiring, notification and detection were reused. System coverage is generally inadequate and not code compliant.

The existing generator has been removed. The emergency lighting systems consist of self-contained battery units with inadequate coverage. Exit signs are generally old and some do not have battery back-up and provide inadequate coverage

The existing communications and security systems are minimal and should be replaced with state of the art integrated systems.

We recommend replacement of the Electrical and Communications/Security systems under a renovation program.

Power Distribution System:

The primary three phase service runs overhead along Flag Drive. The facility is serviced by three vaults with four electrical services. Primary service No. 1, originates on utility pole and runs underground into a utility transformer located inside vault "A" on the west end of the building.

Primary service No. 2 runs in (1) 3" conduit in the crawl space from vault "A" into Vault "B" on the central part of the building.

Primary service No. 3 runs in (1) 3" conduit in the crawl space from Vault "B" into Vault "C" on the east end of the Building.

Each vault has access through an areaway from the exterior of the building, available only to the utility company. Secondary services between the vaults and the switchboards consists of General Electric busduct.

Vault "A" has two transformers, A & K. Transformer "A" feeds an 800 ampere, 120/208V, 3 phase, 4 wire switchboard "A" which services the west side of the building.

Transformer "K" feeds a 1000 ampere, 277/480V, 3 phase, 4 wire distribution panelboard which services the kitchen complex.

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Vault "B" has one transformer "B" which feeds a 1600 ampere, 120/208V, 3 phase, 4 wire switchboard "B" feeding the central portion of the building.

Vault "C" has one transformer "C" which feeds a 2000 ampere, 120/208V, 3 phase, 4 wire switchboard "C" feeding the east side of the building.

The vault mounted transformers are owned by the utility company and due to their age are likely to contain PCBs.

The switchboards, distribution panels and panelboards are of the breaker type.



Typical Corridor Panels



Kitchen Panel



Entryway to Vault



Vault Transformer

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The busduct and switchboards were manufactured by General Electric and are generally in fair to poor condition.



Busduct to Vault



Switchboard



Switchboard

The Electric Rooms and vaults are located in the crawl space and have been subjected to moisture and water seepage. Door and door hardware are not in compliance with current codes which require panic hardware.

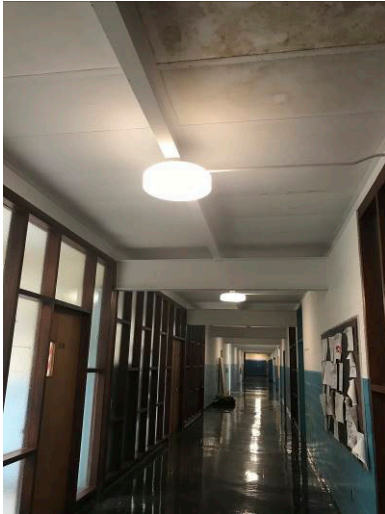
Local and remote panels, generally installed flush in Corridors, are of the breaker type, are generally full and in poor condition. Most panelboards are original General Electric panels.

Most switchgear is original to the building and is obsolete. Replacement parts are scarce as switchgear is no longer manufactured. The switchgear, due to its age and condition, should be replaced under a renovation program.

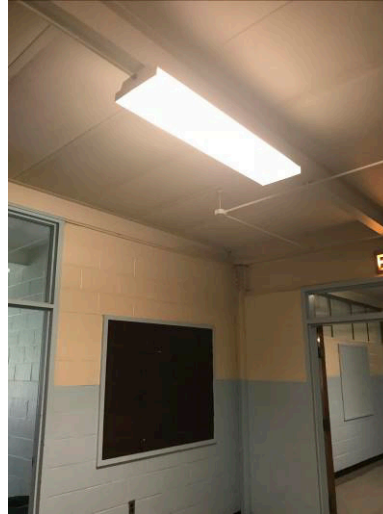
Interior Lighting:

The interior lighting has been retrofitted over the years with T8 lamps and electronic ballasts, however most existing fixtures, wiring and switches are original. Corridor lighting generally consists of surface acrylic drums with screw in CFL and LED lamps as well as 1x4 surface acrylic wraparound fixtures with two T8 lamps. Corridor lights are locally switched.

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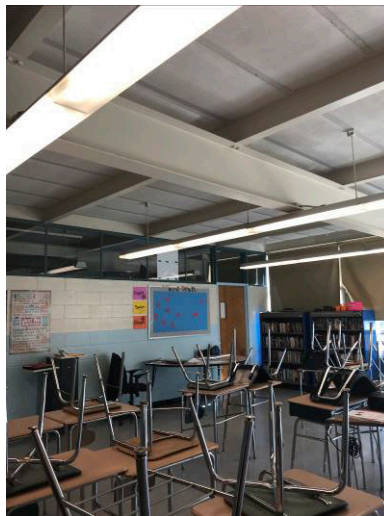


Corridor Lights



Corridor Lights

Classroom lights consist of three continuous rows of 12” pendant mounted acrylic wraparound fixtures with a single T8 lamp. Fixtures are multi-switched by row. Classrooms do not have occupancy sensors or dimmable photosensors.



Classroom Lights

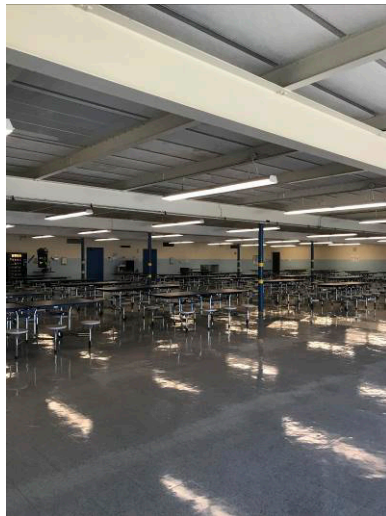
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The Gymnasium and fitness center have 2x4 fluorescent high bays with three T5HO lamps with lens and wireguards. Space is well lit. Lights are breaker controlled.

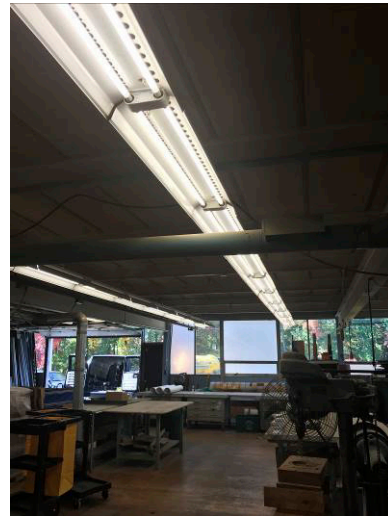


Gymnasium Lights

Cafeteria lighting consists of pendant wraparound fixtures with two T8 lamps.



Cafeteria Lights



Shop Lights

Shops have pendant industrial strips with (2) T8 lamps locally switched.

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Kitchen/Servery has pendant wraps with two T8 lamps. Fixtures are not damp/wet location rated. Light switches exceed ADA height. Kitchen hood has globe fixtures with wireguards.



Servery's Fixtures

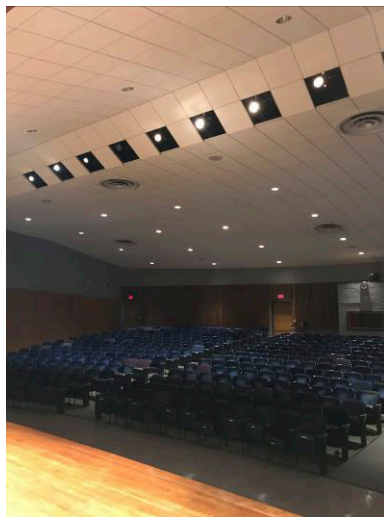


Hood Lights

Auditorium has recessed downlights with LED screw-in par lamps for house lighting. Isle lights integral to seat arm rest being used. Lights are controlled with preset dimmable door entry stations.



Stage Dimming Rack



Auditorium Lights



Stage Lights

Stage work lights consists of industrial strips of RLM fixtures.

Performance lighting consist of two wall mounted trims each with four fixtures and front of house fresnels. Stage has two electrics with border lights and fresnels.

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The original Major dimming rack is still in place but has been augmented with a newer strand lighting 24 dual dimmer rack and controls.

Typical Toilet Room has wraparound fixture on a local switch.

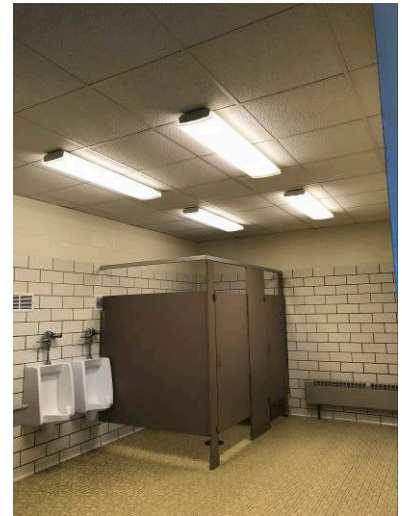
Locker Rooms have continuous rows of wraparound fixtures with T8 lamps on local switches. Fluorescent vapor tight/wet location exist over showers.



Office Lights



Shower Lights



Toilet Room Lights

The office areas are lit with recessed 2x2 parabolic fixtures with T8U lamps and wraparound fixtures with T8 lamps.

The interior lighting is generally in fair to poor condition. Lighting has been upgraded with T8 lamps and electronic ballasts.

School does not have occupancy sensors or dimmable sources to conserve energy.

The facility does not have an automated lighting control system.

Lighting is functional with most spaces fairly well lit however fixtures are original and of utility grade and in need of upgrade.

The lighting systems should be replaced with LED sources under a renovation program.

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Exterior Lighting

The exterior lighting for the front parking area consists of utility poles with HID floods located across the street. The side parking has (1) utility pole with a cobra head.



Pole with Mini-Flood

The parking areas are inadequately lit.

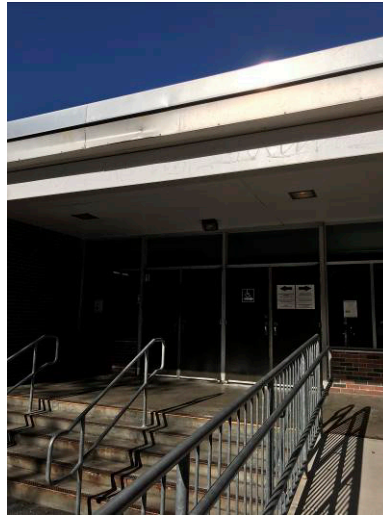
HID wall packs are located around building perimeter including over egress doors. Fixtures are not of the cut-off type. Fixtures do not have quartz restrike for instant lighting upon a power loss.



Exterior Wall Pack

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The Main Entrance canopy has recessed HID fixtures with acrylic lens and ceiling mounted wall packs.



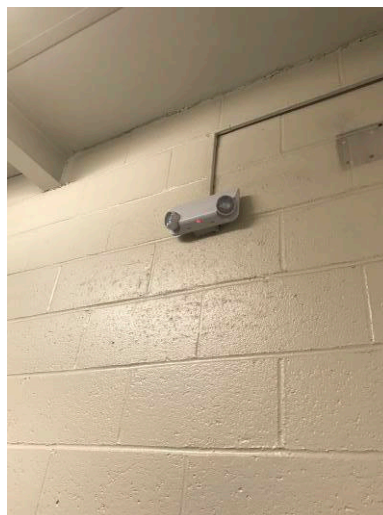
Canopy Fixtures

The exterior lighting should be replaced with LED sources of the cut-off type.

Emergency Standby System:

The facility does not have a generator. The original natural gas generator used for emergency lighting has been removed.

Emergency lighting consists of battery units with integral heads. Emergency lighting coverage is generally inadequate.



Battery Unit

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Exterior doors do not have emergency lights, currently required by code.

Exit signs range from newer functional internally lit with battery back-up to original exit signs without battery back-up. Coverage is inadequate in many spaces.

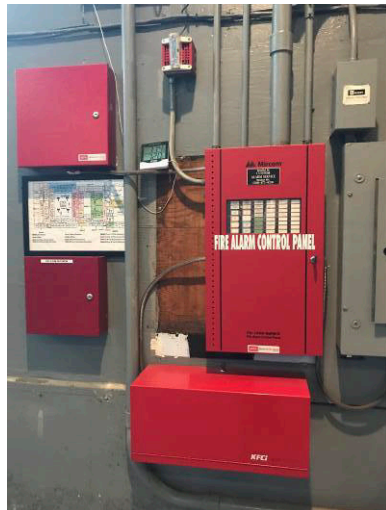


Old Functional Exit

The life safety systems are original and no longer code compliant. These systems should be replaced under a renovation program.

Fire Alarm System:

The fire alarm system for the facility consists of a newer replacement zoned (non-addressable) Mircom FA-1000 series fire alarm control panel located in the Boiler Room. A remote LED annunciator is located outside the Main Lobby. The newer panel replaced the former FACP now used as a splice box. The existing zones were extended and monitored with addressable modules. The existing horn circuits were reconnected to the new panel.



Fire Alarm Control Panel

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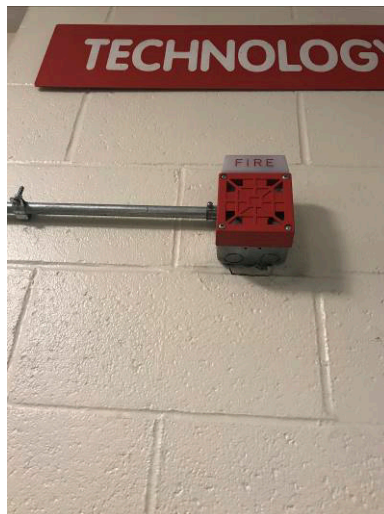
The form of alarm transmission is via a local energy master box connected with IMSA Cable located outside the main lobby.



Master Box, Annunciator, & Key Box

Smoke detectors exist in corridors but generally exceed NFPA spacing standards.

Horn/strobes exist but are not ADA compliant and generally offer inadequate coverage, some exceed ADA mounting height. Classrooms do not have horn/strobes.



Horn/Strobe

Toilet Rooms generally do not have strobes. Nurse's Suite does not have smoke, CO detector or horn/strobe.

Pull stations exist at egress doors however some exceed ADA mounting height.

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Corridor doors do not have magnetic held-open devices. Doors are held open with wooden blocks.

Kitchen hoods suppression system is not connected to fire alarm system.

Although a newer control panel was installed, existing wiring and devices were generally reused.

Current codes require voice evacuation for PK-12 Schools in lieu of horns. Voice evacuation enables the transmission of alert messages, pre-recorded or live, over the fire alarm speakers as well as over the paging speakers.

The existing fire alarm system does not meet current codes and should be replaced under a renovation program.

Communications/Security/Miscellaneous:

Telephone, Cable TV, fiber, and fire alarm enter building underground into Main Electric Room in 3” conduits.

The data cabling infrastructure is generally CAT5 and CAT6. Typical IDF communications racks are located throughout the school. Racks are not located within conditioned dedicated rooms. Wireless access nodes exist throughout school. Typical classroom does not have data outlets.

The paging system console, located within the Administration Area, is a Bogen Model MCP-3A. Paging is through a desktop digital telephone handset. Paging speakers exist throughout the school.



Paging Console



Corridor Speaker & Wireless Access Node

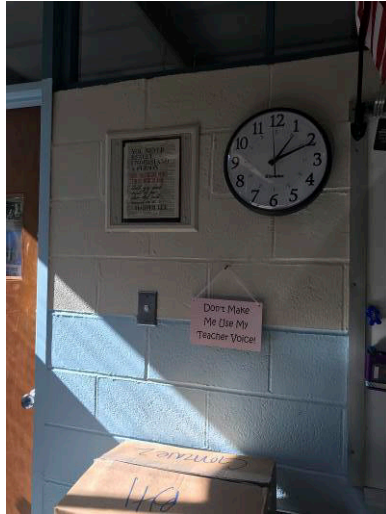
Each classroom has a Cisco desk-mounted telephone handset to communicate with the Main Office. A push button, wall speaker, and clock also exist.

The Auditorium has front of house wall mounted loud speakers. Auditorium local sound system is portable.

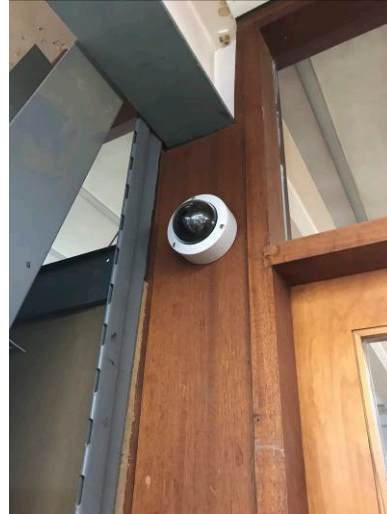
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Various system clocks have failed and have been replaced with battery clocks.

The Lathem Bell and master clock system controller is located in the Main Office.



Clock/Speaker & Pushbutton



CCTV Camera

There is an intercom station at the Main Entrance with door release at administration via desk phones. Four exterior cameras exist located at Main Entrance and dumpsters. Cameras connect to remote site via fiber. Camera display monitor exists at main office.

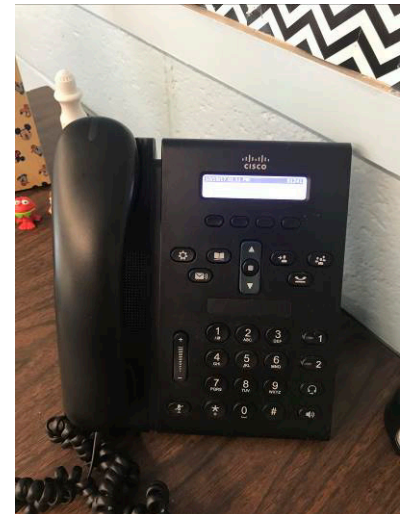
Card access proximity readers exist at selected exterior doors.



Security Keypad



Door/Intercom & Proximity Reader



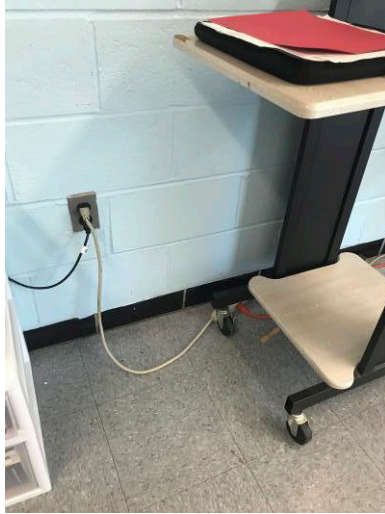
Desk Phone

Corridors have intrusion system passive infrared, PIR sensors.

The facility does not have a lightning protection system.

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The receptacle coverage is inadequate in most spaces. Typical classroom has one duplex receptacle per wall. Extension cords were noted being used throughout Classrooms and Labs. The use of extension cords for permanent wiring is a code violation.



Classroom Extension Cord Use

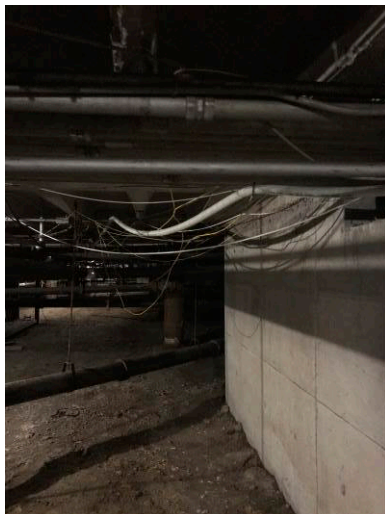
Various receptacles near sinks are not GFI type including Nurse's suite and kitchen.

There is no emergency power off devices in the Kitchen to kill power to equipment under hood.

Boiler Rooms do have emergency power off, EPO stations at entrance door to kill power to boilers during an emergency.

The facility does not have a bi-directional antenna system used to enhance communications with portable radios by First Responders.

Most wiring runs within crawl space.



Crawl Space Wiring

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Recommendations:

Main Distribution System:

- The existing electrical services should be upgraded with a single 277/480 volt system to provide the required capacity for the building load based on 10 watts per square foot power consumption. A new pad-mounted transformer with new primary and secondary service should be provided. The vault-mounted transformers would be removed when no longer needed.
- The proposed secondary switchgear should be installed in a dedicated main electric room, and sized in accordance with current NEC minimum workspace requirements. New panelboards should be provided as required. The new panelboards should be located in electrical rooms located in each wing of the building. The electrical rooms should be sized in accordance with current NEC minimum workspace requirements.
- Computer grade panelboards with double neutrals and with surge protective devices should be provided for computer receptacles to mitigate harmonic distortion of non-linear computer loads.
- Additional duplex receptacle for general purpose power should be provided throughout the facility as required. Additional duplex receptacles for computer workstations in classrooms/labs should be installed and circuited to the computer grade panelboards outlined above.
- Each classroom should have a minimum of 2 duplex receptacles per teaching wall and 2 double duplex receptacles on dedicated circuits at classroom computer workstations. The Teacher's workstation should have a double duplex receptacle also on a dedicated circuit.
- Office areas will generally have 1 duplex outlet per wall. At each workstation a double duplex receptacle will be provided
- Corridors should have a cleaning receptacle at approximately 30-40 foot intervals.
- Exterior weatherproof GFI receptacles should be installed at exterior doors.

Emergency Distribution System:

- Provide a new exterior emergency generator and automatic transfer switches to provide emergency backup power for life safety and critical standby loads (i.e.; freezers, communications and security equipment, boilers, pumps, etc.) Dedicated 2-hour fire rated emergency rooms shall be provided within the building. Life safety system will feed all code required egress lighting and exit signs.
- Emergency life safety lighting shall be provided for all egress ways and should be provided in toilet areas and other public spaces as required by NFPA 101 Life Safety Code.

Lighting System:

- In general, the existing lighting system should be upgraded as required based on the proposed architectural renovations.
- Classroom lighting fixtures will consist of surface or pendant-mounted direct/indirect luminaires with LED lamps and electronic drivers. The fixtures will be pre-wired for automatic dimming control where natural daylight is available and also for multi-level switching. Occupancy sensors and dimming sensors will be provided.

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- Office lighting fixtures will consist of acrylic recessed direct fixtures with LED lamps and electronic drivers for dual-level switching. Fully dimmable drivers will be provided where natural daylight is available. Lighting levels will be approximately 30 foot candles in classrooms and offices.
- Cafeteria and Auditorium lighting will be upgraded with LED sources and electronic drivers. Theatrical lights with a dimming system will be provided for performances. Large Gym lighting could be reused.
- Corridor lighting will be comprised of recessed acrylic fixtures with LED lamps and electronic drivers. The corridor light level will be designed for approximately 20-foot candles.
- Kitchen and Served lighting will consist of surface 2'x4' acrylic lensed troffers with aluminum frame doors with LED lamps and electronic drivers. Light levels will be approximately 50-75 foot candles.
- Each area will be locally switched and designed for multi-level controls. Each classroom, office space and toilet room will have an occupancy sensor to turn lights off when unoccupied. Daylight sensors will be installed in each classroom and perimeter spaces for automatic dimming of light fixtures.
- The entire school will be controlled with an automatic lighting control system using addressable networked controls for programming lights on and off.
- Exterior site lighting fixtures for area lighting will be pole mounted long life, energy efficient LED luminaries in the parking areas. Building perimeter fixtures will be wall mounted LED over exterior doors. The exterior lighting will be connected to the automatic lighting control system for photocell on and timed off operation. All exterior lighting will be of the cut-off type.

Fire Alarm System:

- A fire alarm and detection system in compliance with ADA should be provided with battery back-up. The system will be of the addressable type where each device will be identified at the control panel and remote annunciator by device type and location to facilitate search for origin of alarms. Smoke detectors will be provided in open areas, corridors, and other egress ways. The sprinkler system will be supervised for water flow and tampering with valves. Voice evacuation speaker/strobes will be provided in egress ways, classrooms, assembly spaces, open areas and other large spaces.
- Strobe only units will be provided in single toilets and conference rooms.
- Manual pull stations will be provided at exit discharge doors.
- The system will be remotely connected to automatically report alarms to fire department via the master box.

Uninterruptible Power System (UPS):

- A three phase centralized Uninterruptible Power Supply (UPS) system should be provided with battery backup. The system will provide conditioned power to sensitive electronic loads and telecommunication systems to bridge over power interruptions of short duration and allow an orderly shutdown of servers during a prolonged power outage. The UPS system will also be connected to the stand-by generator.

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Lightning Protection System:

- A system of lightning protection should be provided. The system will be installed in compliance with the provisions of the latest “Code for Protection Against Lightning” for buildings as adopted by the National Fire Protection Association and the Underwriters’ Laboratories, Inc. for a UL Master Label System. The lightning protection equipment will include air terminals, conductors, conduits, fasteners, connectors, ground rods, etc.

Security/Communications:

- Remove and replace the existing intrusion system and replace with a new addressable system with better coverage using motion detectors on all perimeter rooms on the first level and all corridors on each level. Each exterior door will have door contacts for monitoring door position and security keypads provided at each major entry point to the facility. An integrated CCTV and access control system should be provided with building mounted IP cameras covering the perimeter of the building and each major entrance. Card readers should be provided at major entrances to the building.
- The existing classroom intercom system should be replaced with a state of the art intercom system with web based software. Each classroom should be wired back as an individual home run for private conversations. New speakers should be located throughout the facility to ensure adequate coverage and capable of flexible selective zone paging. The existing master clock system should be replaced with a new GPS based wireless master clock system with repeaters in the IDF closets and 120V wireless secondary clocks located in each classroom, office and large space as needed.
- Tel/Data wiring should be replaced with CAT6 plenum rated cable throughout. Located in conditioned and properly sized MDF/IDF rooms. New outlet locations should be reviewed to accommodate the facilities new technology equipment plan. A new head end room with 50 micron laser optimized multimode and single mode cable to remote dedicated IDF rooms should be provided for gigabit connectivity to the desktop. The new dedicated data closets will ensure that present and future data needs are accommodated.
- The classroom A/V infrastructure should be updated to accommodate the need for A/V equipment. This would include wall mounted projection and box/conduit provisions for updated local sound systems. The local sound system in the large spaces including the gymnasium, cafeteria, and auditorium should be replaced/provided with new up-to-date systems.