COLORADO SPRINGS CHARTER ACADEMY
ELECTRICAL ASSESSMENT

GENERAL ASSESSMENT SCOPE

The electrical scope includes evaluation of the electrical service and distribution, convenience power, lighting, lighting controls, associated with the Colorado Springs Charter Academy located in Colorado Springs, Colorado. There are three buildings associated with the school, the main elementary school, a middle school located on the north side of the campus and a gymnasium building located to the south. Each building will be addressed separately in the assessment.

The evaluation also includes electrical system recommendations associated with possible HVAC renovations of the main elementary school building. The State of Colorado governs school buildings and has currently adopted the following building codes:

2021	International Building Code (IBC)
2021	International Existing Building Code (IEBC)
2021	International Fire Code (IFC)
2021	International Mechanical Code (IMC)
2021	International Energy Conservation Code (IECC)
2021	NFPA 170
2017	International Code Council (ICC) A117.1 Standard For Accessible And Usable Buildings And Facilities
2021	Colorado Plumbing Code (CPC)
2021	Colorado Fuel Gas Code (CFGC)
2023	National Electrical Code (NEC)

MAIN ELEMENTARY SCHOOL BUILDING

GENERAL HISTORY

The Main Elementary School building was originally constructed in 1966. The auditorium of the school was completed in 1971. A ground level lecture hall was converted to three classrooms in 2008.

ELECTRICAL SERVICE AND DISTRIBUTION – EXISTING CONDITIONS AND DEFFICIENCIES

The existing Electrical Utility Service connects to the building underground from a pad mounted three phase transformer located on the west side of the building across from the entry drive.

The Electrical Distribution equipment consists of a 1200 amp 480/277 volt three phase service with an 800 amp neutral. Record documents indicate the main bus in the 'M' section as 800 amps with a 600 amp neutral. The Main Distribution Switchboard is located in the basement mechanical electrical room on the west end of the building. The facility does not have centralized emergency power generation (engine-generator or battery-inverter).

Existing Main Switchboard

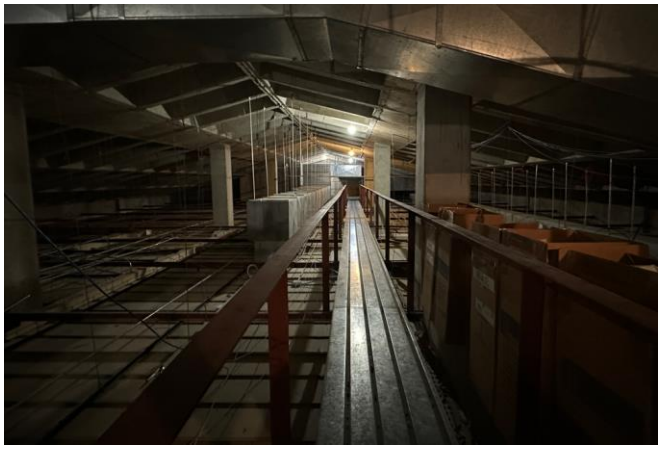
Basement Mechanical/Electrical Room

The face of the switchgear has evidence that water may have infiltrated the main switchgear. Odin Electric was able to open the switchgear on November 7, 2024. Their site visit coincided with a snowstorm and revealed water dripping inside the switchgear. The images below show corrosion of internal switchgear components and water pooling at the bottom of the base of the switchgear (left and right sides).

Water Infiltration and Subsequent Corrosion of Main Swithgear

A crawlspace that is accessible from the basement runs the length of the building. The crawlspace allows for routing conduits to the ground level panelboards. The attic also has catwalks that allow access to above the level 2 rooms.

Conduits in Crawlspace



Attic Catwalk

Branch Circuit Panelboards

All of the school's branch circuit panelboards are original with minimal modifications. The majority of the branch panelboards are rated at 225 amps. Most of the panelboards are located in the corridors. Based on the markings of the original panelboard directories, there have been few modifications to the branch circuits in the building. Based on the equipment factory labels/nameplates the existing electrical distribution equipment are assumed to be rated at the minimum fault current levels of 10,000Amps.

Corridor recessed branch panelboard

Classroom recessed branch panelboard

ELECTRICAL SERVICE AND DISTRIBUTION RECOMMENDATIONS

The distribution equipment should be replaced due to significant water damage and because it has been in service for approximately 60 years. The ability of the overcurrent devices (breakers, fused and non-fused switches) to adequately protect the feeders, circuits, equipment, and occupants, under normal operation is suspect, and under an abnormal event (fault/short circuit) is highly suspect. The safety concerns from the water damage cannot be overstated. School maintenance personnel have been told to avoid the equipment. Due to the age of the equipment and the corrosion, testing is not recommended because the testing itself could likely render the equipment inoperable. Replacement equipment, both new and original equipment parts are not readily available if at all available, and any further damage to the existing equipment would result in significant downtime. The feeder conductors serving the branch panelboards should also be replaced due to their age. It is unclear where exactly water is entering the conduits that penetrate the equipment. The original conduits are likely compromised in multiple locations and thus provide a path for water to enter the switchgear. The new switchgear should be located above grade to eliminate gravity fed flow of water in the future.

The overall electrical service will need to be increased to serve the new chiller. Based on the size of the school, the new service should be 2500 amps. The recommendation would be to locate the new 2500 amp switchgear and metering section on the west exterior wall. The new main gear would be used to back feed a new 1200 amp switch board. The conduits to the new 1200 amp board would be routed inside the building. The existing below grade building conduit wall penetrations that serve the 1200 amp switchboard would be filled and sealed. The existing underground main service feeder conduits should be removed where practical.

The existing 300kVA Colorado Springs Utility (CSU) Electric Service Transformer is capable of supplying 25,800 Amps of fault current. CSU may want to install a larger service transformer which will result in higher fault current values. A full Fault-Current / Arc-Flash study would need be performed to determine the actual level of fault current available at each component of the distribution equipment. The larger service size will result in higher fault currents to the downstream branch circuit panelboards. To achieve adequate fault current capacity, most, if not all of the school's branch circuit panelboards will need to be replaced.

Any new Distribution Switchboards and Branch Circuit Panelboards shall be full size commercial electrical branch circuit panelboards with fully rated phase and neutral copper bussing and bolt on breakers mounted in NEMA 1 enclosures with a Door-in-Door panel cover. The branch breakers will be molded-case type with mechanical lugs. The new electrical distribution equipment can be specified to match the existing distribution equipment, or be specified to be provided by one of the manufacturers listed below:

- Eaton Corp.; Cutler-Hammer Products.
- General Electric Co.
- Westinghouse/Siemens/ITE

- Square D Co.
- Howard Industries – Transformers Only
- International Transformer Corporation – Transformers Only

CONVENIENCE POWER – EXISTING CONDITIONS AND DEFICIENCIES

The vast majority of the existing convenience outlets are original and not tamper resistant. The quantity of outlets appears to be adequate for the school. The library was converted to a computer room and utilizes tombstone outlets due to the glass walls on the north and south sides. Some of the outlets have been removed or are loose. Cords are used to serve tabletop computers in the middle of the room. The cords present a tripping hazard. There is also an amperage draw safety concern with the number of devices served by the outlets.

Computer room tombstone receptacles

CONVENIENCE POWER – RECOMMENDATIONS

Current code requires tamper resistant receptacles for schools. The existing receptacles should be replaced with tamper-resistant type. The library (computer room) receptacles should be replaced as the tombstone outlets are old and, in some cases, loose. General convenience receptacles should be located near all large mechanical equipment located on the roof and within any utility rooms.

POWER SERVING MECHANICAL SYSTEMS

The mechanical systems are powered with the original fused disconnect motor control center. Due to the age of the equipment, it should be replaced with new fused disconnects or circuit breakers. In addition, new mechanical systems will have digital controls that will negate the need for motor starters that were part of the original electrical and mechanical systems.

Switchboard with fused disconnects for mechanical systems

LIGHTING – EXISTING CONDITIONS AND DEFICIENCIES

Interior Areas

Fluorescent lighting is the primary light source used in the interior of the building. Most of the luminaires are original but they were updated with T8 lamps and electronic ballasts. The original lenses in the classroom luminaires are yellowing and brittle. The main entry lobby and the library utilize pendant luminaires. The library pendant luminaires have been retrofitted with compact fluorescent lamps and are noted to be operating on 277 volts. Several circulation areas where the light levels appeared to be insufficient. One stairwell was relying on daylighting as the existing wall mounted luminaire was missing.

The auditorium downlighting was partially operational. There was light spilling above the luminaires which is not typical. The downlights may have been retrofitted with an LED source. There were LED theatrical luminaires at the front of house position with a few luminaires over the stage.

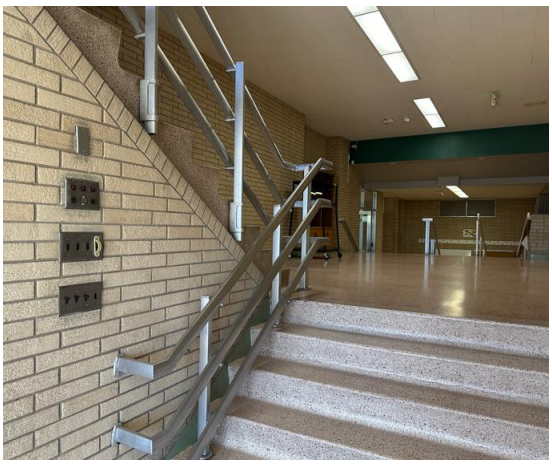
While there appeared to be adequate Exit signage, there were numerous areas that lacked emergency egress luminaires. The emergency/egress lighting in the existing building does not meet the current code. From the original drawings, the exit signs were connected ahead of the main disconnect. This is no longer normal practice. The exit signs have been replaced with LED type and are functional. Frog-eye type emergency lighting was installed in the 2008 classroom renovation.

The interior lighting is controlled via local switches located throughout the facility. The original classroom lighting controls allow for the row of lighting nearest the window wall to be controlled separately for daylight harvesting. The 2008 renovated classrooms are equipped with occupancy sensors. Other areas of the school are not equipped with occupancy sensors or daylight harvesting photocells. The current energy code requires automatic off controls in the form of occupancy sensors for the interior lighting.

Original classroom luminaires T8 lamps

Three classrooms (2008) 2x4 T8 luminaires

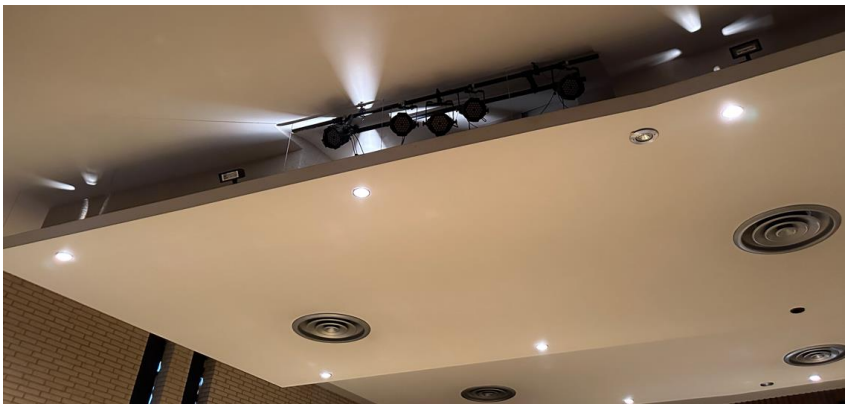
Stairwell with missing wall luminaire

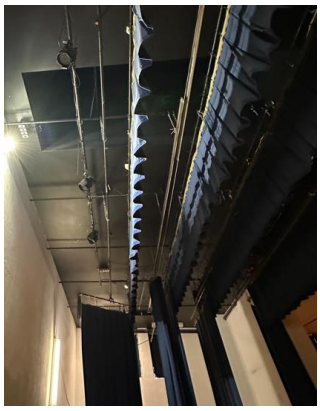


Original Corridor luminaires with original switching

Original library lighting (now computer room)

Globe style lobby lighting





Auditorium and stage with LED theatrical lights

Exterior Areas

Most of the exterior entries of the building are illuminated with recessed lensed luminaires and wall mounted luminaires. There are some pole luminaires at the entry drive leading to the Middle School. There is no emergency lighting at the exterior entrances.

No pole lighting at main entry drive

Recessed lighting at entries

LIGHTING – RECOMMENDATIONS

Given the age of the existing luminaires, it is recommended that they be replaced with more current LED technology. The result will be a more efficient system that can also be easily dimmed to meet user preferences. In addition, the light output of the LED sources is significantly higher than previous light sources, allowing fewer luminaires than currently installed within a space or area.

The new LED lighting system would need to comply with the State's adopted 2021 International Energy Conservation Code (IECC). The code will require occupancy sensors or timeclock controls to meet automatic off requirements for both the interior and exterior areas. The lighting controls for most areas would also have dimming capability to meet the current energy code. The new lighting systems should be designed using the Illumination Engineering Society (IES) guidelines for illumination levels depending upon space function. Flat panel type LED luminaires are an economic choice for providing quality LED lighting for interior school environments. Exterior LED luminaires would also be required to meet the current energy code. Due to the exterior entry canopy construction, the new exterior LED luminaires may need to be surface mounted to simplify installation. For better safety, new pole mounted LED luminaires are recommended at the main entry pick-up and drop off area.

The existing Exit and Egress luminaire should be thoroughly tested or replaced to ensure that the batteries are in good working order. Based on the record documents, the system of emergency egress luminaires does not meet the current code. Emergency luminaires should be added to achieve the required one footcandle egress illumination levels. The most cost-effective way of meeting the code would be to install individual wall or ceiling mounted luminaires that are equipped with an integral battery, frog-eye type luminaires. In addition, exterior emergency lights or luminaires with integral emergency batteries should be installed to meet code.

FIRE ALARM – EXISTING CONDITIONS AND RECOMMENDATIONS

The existing Fire- Alarm System is a Simplex 4100 and was installed in 2016. The Fire Alarm Control Panel (FACP) is located in the reception administration area with an annunciator device facing the lobby entry. The fire alarm system notification is handled through strobes and horns. The placement of detection and notification devices within the facility and individual spaces was not fully inspected.

The State code now requires that all school fire alarm systems include voice annunciation. Any major renovation or building addition would require a fire alarm system replacement that includes voice annunciation. Voice annunciation requires horns be replaced with speakers, combination horn/strobe units replaced with speaker/strobe units and additional speakers, speaker strobes installed to meet the sound levels required by code. At a minimum, the system should be tested to fully evaluate any deficiencies.

MIDDLE SCHOOL BUILDING

GENERAL HISTORY

The Middle School building was originally constructed in 1986 with an interior renovation in 2010.

ELECTRICAL SERVICE AND DISTRIBUTION – EXISTING CONDITIONS

The existing Electrical Utility Service connects to the building underground from a pad mounted single phase transformer located on the east side of the building in the adjacent property. The meter is located on the north exterior wall just outside the main mechanical/electrical room.

The Electrical Distribution equipment consists of a 400 amp 204/120 volt single phase service.

The Main Distribution Panel (MDP) is located in the first floor mechanical/electrical room and serves four electrical panels (A, B, C and D) and the main air handling unit (AHU-1).

Main Distribution Panel in Mechanical/Electrical Room

ELECTRICAL SERVICE AND DISTRIBUTION RECOMMENDATIONS

The electrical distribution equipment is in good condition and there is spare capacity in the branch circuit panelboards. While not nearly as critical as the elementary school, the main distribution panel and the branch circuit panelboards are 38 years old and should be replaced. The feeder conductors serving the branch panelboards should also be replaced due to their age.

Any new Distribution Panelboard and Branch Circuit Panelboards shall be full size commercial electrical branch circuit panelboards with fully rated phase and neutral copper bussing and bolt on breakers mounted in NEMA 1 enclosures with a Door-in-Door panel cover. The branch breakers will be molded-case type with mechanical lugs. The new electrical distribution equipment can be specified to match the existing distribution equipment, or be specified to be provided by one of the manufacturers listed below:

- Eaton Corp.; Cutler-Hammer Products.
- General Electric Co.
- Westinghouse/Siemens/ITE
- Square D Co.

CONVENIENCE POWER SYSTEMS AND RECOMMENDATIONS

The existing convenience outlets are original and not tamper-resistant. The quantity of outlets appears to be adequate for the school.

Current code requires tamper resistant receptacles for schools. The existing receptacles should be replaced with a tamper-resistant type.

POWER SERVING MECHANICAL SYSTEMS AND RECOMMENDATIONS

The main air handling unit is served by the main distribution panelboard. The other mechanical equipment is served by the local branch circuit panelboards. Given the age of the existing feeders serving the existing main air handling unit, any mechanical equipment upgrades would warrant new feeder and overcurrent protection equipment.

LIGHTING – EXISTING CONDITIONS AND DEFICIENCIES

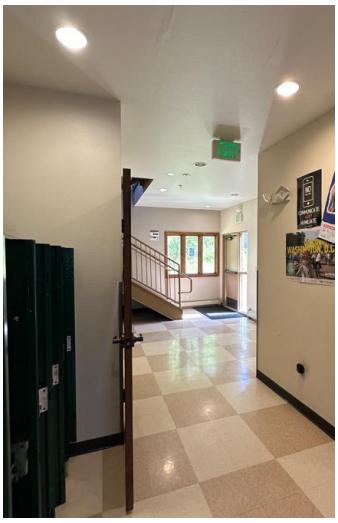
Interior Areas

The interior lighting was replaced in 2010 with T5 fluorescent luminaires and compact fluorescent recessed downlights. The classroom lighting consists of pendant mounted linear direct/indirect luminaires. These luminaires are equipped with electronic ballasts and integral occupancy sensors. The ceilings in the building are inaccessible gypsum board type.

The exit signs are LED type and are functional. Frog-eye type emergency lighting were installed in the 2010 renovation. These emergency luminaires are not LED.

The classroom lighting is controlled via local switches. The corridor lighting does not have local switching but is controlled with ceiling mounted occupancy sensors. The facility manager indicated that they need to replace the compact fluorescent lamps in the downlights at an unusually high rate.

Cable hung direct/indirect classroom lighting



Corridor fluorescent downlights

Exterior Areas

The exterior of the building has recessed lensed luminaires, wall mounted luminaires and bollards. There are some pole luminaires that illuminate the parking area and entry drive. These pole lights do not meet the Colorado Springs lighting standards as they are not full cut-off rate. The exterior lighting is controlled by a timeclock. According to the record drawings and the site survey, none of the exterior lighting was replaced in 2010.

Not full cut-off pole mounted luminaires at parking lot

Bollard luminaires in courtyard

LIGHTING – RECOMMENDATIONS

The existing fluorescent lighting is 14 years old and therefore not a critical item that needs to be replaced. New LED lighting would, however, provide energy savings for the school and allow for the lighting to be dimmed. Given that all of the ceilings are inaccessible, wireless lighting controls would be a good option if they were to be replaced. Given the age of the existing exterior luminaires, it is recommended that they be replaced with more current LED technology. The pole light heads should be replaced with full cut-off rated LED pole heads to meet the Colorado Springs standards. The new exterior LED lighting system would need to comply with the State's adopted 2021 International Energy Conservation Code (IECC). This code requires that the lighting be dimmed or turned off after hours. Exterior emergency lights or luminaires with integral emergency batteries should be installed to meet code.

FIRE ALARM – EXISTING CONDITIONS AND RECOMMENDATIONS

The existing Fire Alarm System is a Simplex 4010. The Fire Alarm Control Panel (FACP) is located at the main entry on the west end of the building. The fire alarm system notification is handled through strobes and horns.

The fire alarm system is likely the original system as no records indicate that it has been replaced. Given the age of the fire alarm system, it should be replaced. The placement of detection and notification devices within the facility and individual spaces was not fully inspected.

The State code requires that all school fire alarm systems include voice annunciation. Any major renovation or building addition would require a fire alarm system replacement that includes voice annunciation. Voice annunciation requires horns be replaced with speakers, combination horn/strobe units replaced with speaker/strobe units and additional speakers, speaker strobes installed to meet the sound levels required by code. At a minimum, the system should be tested to fully evaluate any deficiencies.

GYM BUILDING

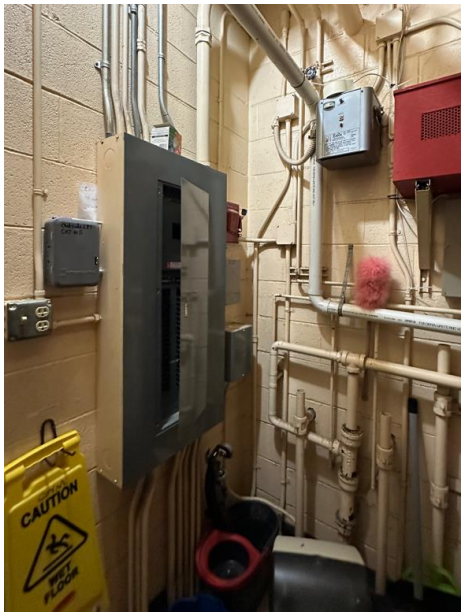
GENERAL HISTORY

The gym building was constructed in 1975.

ELECTRICAL SERVICE AND DISTRIBUTION – EXISTING CONDITIONS

The existing Electrical Utility Service connects to the building underground from a pole mounted single phase transformer located on the north side of the building. The meter is located on the east exterior wall just outside the main mechanical/electrical room.

The Electrical Distribution equipment consists of a 200 amp 240/120 volt single phase service. The electrical panel is located on the lower level in the janitor's closet.



Main electrical panel in janitor's closet

Main electrical panel

ELECTRICAL SERVICE AND DISTRIBUTION RECOMMENDATIONS

The generally accepted life of electrical service distribution equipment is 30 years. Given that the existing equipment is nearly 49 years old it should be replaced. Any new Distribution Panelboard and Branch Circuit Panelboards shall be full size commercial electrical branch circuit panelboards with fully rated phase and neutral copper bussing and bolt on breakers mounted in NEMA 1 enclosures with a Door-in-Door panel cover. The branch breakers will be molded-case type with mechanical lugs. The new electrical distribution equipment can be specified to match the existing distribution equipment, or be specified to be provided by one of the manufacturers listed below:

- Eaton Corp.; Cutler-Hammer Products.
- General Electric Co.
- Westinghouse/Siemens/ITE
- Square D Co.

CONVENIENCE POWER SYSTEMS AND RECOMMENDATIONS

The existing convenience outlets are original and not tamper-resistant. The quantity of outlets appears to be adequate for the gym activities.

Current code requires tamper resistant receptacles for schools. The existing receptacles should be replaced with a tamper-resistant type.

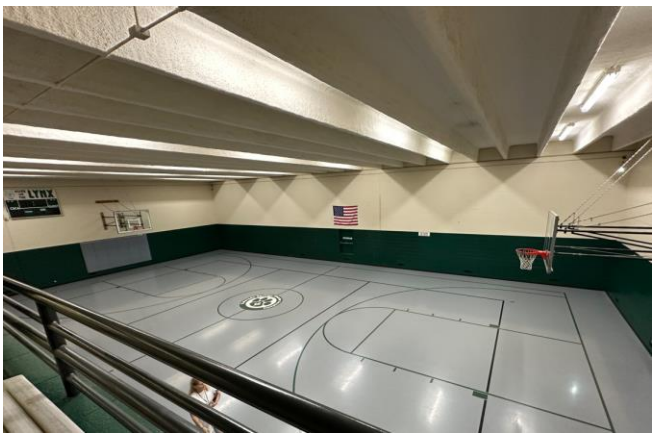
POWER SERVING MECHANICAL SYSTEMS AND RECOMMENDATIONS

The gym's gas furnace is served by the main electrical panel. Given the age of the existing feeders, any

mechanical equipment upgrades would warrant new feeder and overcurrent protection equipment.

LIGHTING – EXISTING CONDITIONS AND RECOMMENDATIONS

The interior lighting consists mainly of fluorescent strip-lights with T8 lamps and electronic ballasts. The exit signs are LED type and are functional. Frog-eye type LED emergency lighting are also functional.



Gym illuminated with fluorescent strip-lights

The age of the existing fluorescent lighting could not be determined. Given that very few lights were out, the luminaires, or lamps and ballasts may have been replaced in the past 10 years. New LED lighting would, however, provide energy savings for the school and allow for the lighting to be dimmed.

LED floodlights illuminate the exterior perimeter of the building. The angle of these flood lights is not ideal as it is a source of glare for visitors and the surrounding neighborhood. To meet the Colorado Springs exterior lighting ordinance, the lights should be aimed straight down but this would limit the lighting coverage for the parking and pedestrian areas. For better safety and security, pole lighting would provide better illumination and is recommended for the parking areas. This would allow for the building mounted lighting to be full cut-off rated to meet the Colorado Springs standards. Any new exterior LED lighting system would need to comply with the State's adopted 2021 International Energy Conservation Code (IECC). This code requires that the lighting be dimmed or turned off after hours. Exterior emergency lights or luminaires with integral emergency batteries should be installed to meet code.

Roof Mounted LED flood lights

FIRE ALARM – EXISTING CONDITIONS AND RECOMMENDATIONS

The age of the existing Fire Alarm System could not be determined. The fire alarm system notification is handled through strobes and horns. The placement of detection and notification devices within the facility and individual spaces was not fully inspected.

The State code requires that all school fire alarm systems include voice annunciation. Any major renovation or building addition would require a fire alarm system replacement that includes voice annunciation. Voice annunciation requires horns be replaced with speakers, combination horn/strobe units replaced with speaker/strobe units and additional speakers, speaker strobes installed to meet the sound levels required by code. At a minimum, the system should be tested to fully evaluate any deficiencies.