Existing Conditions Report

PENTUCKET REGIONAL HIGH SCHOOL

24 Main Street, West Newbury, MA 01985

March 23, 2015

CGKV Architects, Inc.

LIN ASSOCIATES, INC. CONSULTING ENGINEERS

FITZEMEYER & TOCCI ASSOCIATES, INC.

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TABLE OF CONTENTS

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I. INTRODUCTION

The Pentucket Regional School District hired CGKV Architects, Inc. to examine and report on existing architectural and structural conditions at the Pentucket Regional High School. CGKV's consultant, Lin Associates, prepared the structural conditions report. Under separate contract, the District hired Fitzemeyer & Tocci Associates to examine and report on existing mechanical, electrical, and plumbing [MEP] systems. This report will serve as an umbrella for the work of all three design firms.

Preparation of this report was limited by time and budget constraints. This report is generally limited to examining existing drawings and other documentation provided by the District as well as conducting a brief visual observation of existing physical conditions. [CGKV visited the school on February 25, 2015.] The report does not analyze enrollment issues or educational programming, except to the limited extent expressed to us by District personnel.

The District possesses a trove of documentation on the construction, repair, upkeep, and maintenance of Pentucket High School which was helpful in our review of the building but which cannot be fully summarized here. One document worth noting is an August 2009 draft report prepared for the Massachusetts School Building Authority [MSBA] by STV Incorporated. This 2009 document provided the District with an examination of all its school facilities and was intended to help guide future planning efforts. Three specific issues affecting the High School were identified at that time: (1) the inconvenient location of High School technical education facilities across the campus at the Middle School building; (2) deterioration of the existing modular classrooms; and (3) the need for upgrades to existing science classrooms to meet the desired curriculum. To date, none of these issues has been addressed, and the removal of the four damaged modular classrooms in 2014 put further pressure on the District to provide sufficient educational space for High School classes.

CGKV benefitted from the input of several officials of the Pentucket Regional School District, including but not limited to: Jeffrey Mulqueen, Superintendent; Greg Labrecque, Business Manager; and Greg Hadden, Facilities Manager.

II. GENERAL BUILDING DESCRIPTION

Pentucket Regional High School was originally constructed in the mid- to late-1950s as a Junior-Senior High School. The Pentucket Regional School District provided CGKV with a fairly complete set of blue prints prepared by the firm of Korslund, Le Normand & Quann, Inc. Architects, dated October 11, 1956. A major renovation and addition project took place in the mid-1990s in accordance with drawings dated August 18, 1993, prepared by Mount Vernon Group. In 2001, four modular classrooms were added and the cafeteria was expanded. CGKV will refer to these three main ages of building development as the 1956 portion, the 1993 portion, and the 2001 portion per the dates on the available drawings.

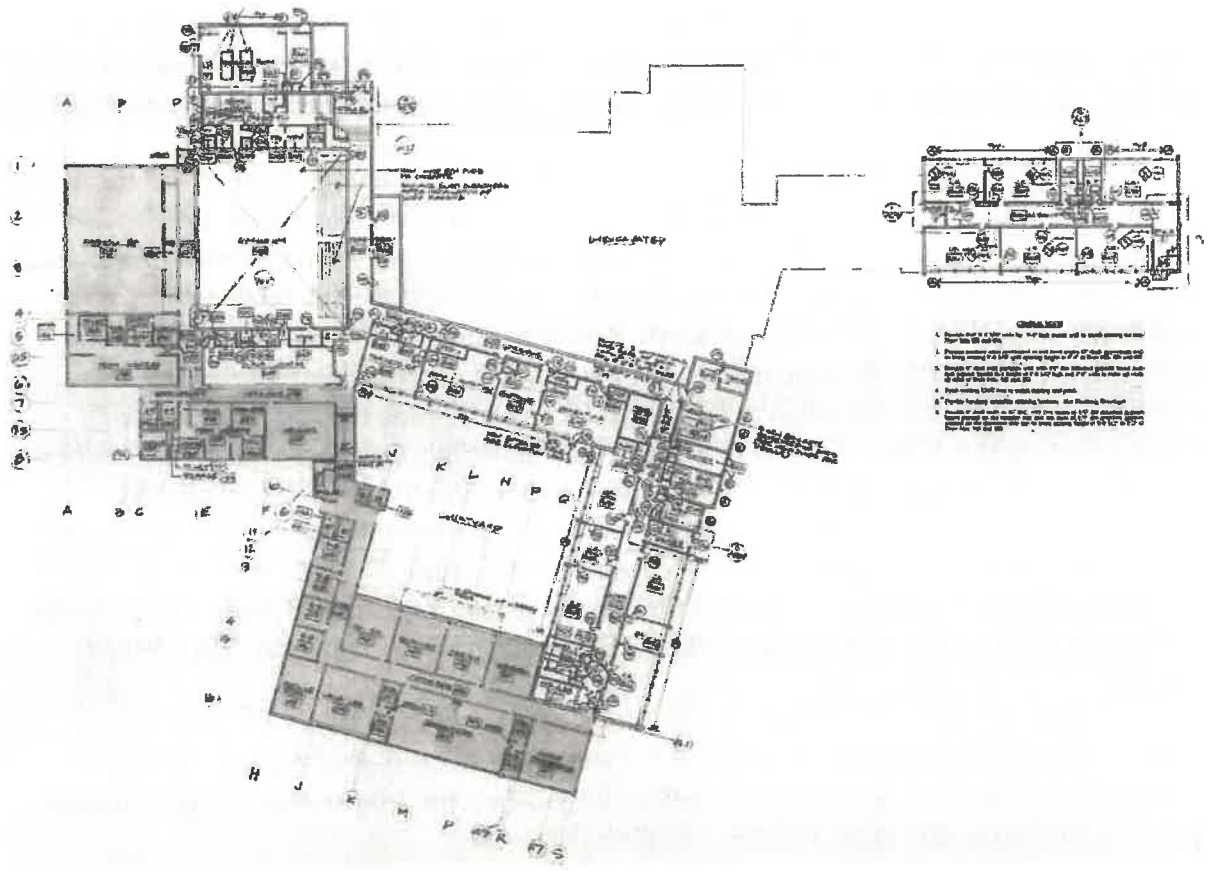

Figure 01: Ground Floor Plan, from August 18, 1993 construction drawings prepared by Mount Vernon Group. [1993 addition shaded in grey.]

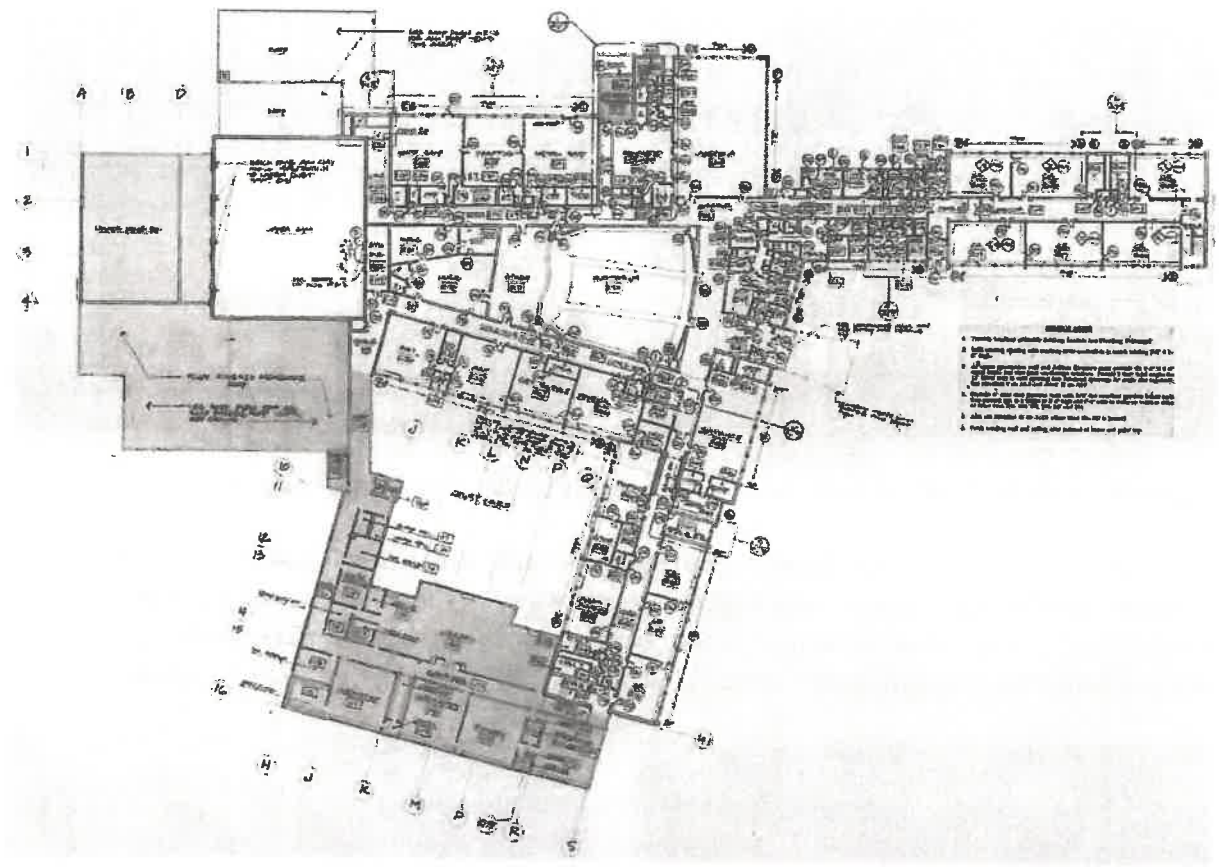

Figure 02: First Floor Plan, from August 18, 1993 construction drawings prepared by Mount Vernon Group. [1993 addition shaded in grey.]

The 1956 school is centered on its First Floor auditorium, which is surrounded by a two-story classroom wing to the south; athletic facilities to the west; studios, kitchen, and cafeteria to the north; and the main public entrance to the east. Additional two-story classroom wings radiate out to the east and to the south. The main (First Floor) level is situated on the high point of the site, which slopes away to the west, south, and east. A lower (Ground Floor) level includes the bottom story of classroom wings to the south and to the east, and the double-height gymnasium at the west side of the building, which is flanked by locker rooms and support spaces.

Figure 03: Main 1956 building entrance.

Figure 04: 1956 "Junior wing."

The 1993 addition and renovation project expanded the athletic facilities to the west and south of the 1956 gymnasium and included a new auxiliary gym, team locker rooms, and a weight room. A two-story L-shaped classroom wing was constructed to the south of the original building, creating a new central courtyard surrounded by academic spaces.

Figure 05: 1993 classroom wing.

Figure 06: 1993 classroom wing (right) creating exterior courtyard.

In 2001, a one-story quartet of modular classrooms was added to the east of the 1956 east classroom wing (known as the "Junior wing"). At that same time, the existing cafeteria was expanded towards the north to add a few hundred square feet to the dining facilities.

The rupture of a 6" water main below the "Junior wing" in April 2014 caused significant damage to that section of the building as well as to the modular classrooms. As a direct result, the modular classroom wing was removed.

Figure 07: East end of the 1956 "Junior wing" where modular classrooms were removed in 2014.

According to the District, the school currently totals approximately 208,000 square feet in area.

The 1956 structure consists of concrete slabs on grade with shallow spread footings; exterior load-bearing masonry walls and/or steel columns and beams and/or pre-cast concrete columns; cast-in-place concrete waffle slabs supporting the upper (first) floor of two-story classroom wings; and steel beam, joist, and truss roof framing supporting a tee bulb, form board, and poured gypsum roof deck. The 1993 additions featured conventional slabs on grade with shallow spread footings; structural steel framed roof and floor structures supporting concrete-filled metal deck at the first (upper, main) floor and metal roof decks. The roof structure at the 1993 two-story classroom wing is pitched. Exterior walls at the 1993 athletic facility expansion are face brick with CMU back-up, and walls at the classroom wing are face brick backed up by steel stud framing and gypsum sheathing.

III. OBSERVATION OF EXISTING CONDITIONS

A. Exterior Envelope

Roofs:

With the exception of the two-story 1993 classroom wing, all roofs at Pentucket Regional High School are comprised of single-ply PVC membrane over 3" minimum rigid insulation over gypsum concrete roof deck (at 1956 sections) or metal roof deck (at 1993 sections). The current roof membrane dates back to the 1993 renovation and addition project. The Garland Company performed a detailed inspection of the existing roof in October 2010 and found it to be in generally good condition at that time. [Winter conditions and the presence of snow on the roof prevented CGKV from making any direct observation of existing conditions during our site visit.] The current PVC roof, at around twenty years of age, has most likely reached the end of the maximum warranty available at the time of its installation. The Garland report recommended scanning for areas of possible wet insulation and repairing portions of the existing roof system prior to installing a liquid-applied coating over the entire roof. Alternatively, the District should consider removal of the existing roofing system down to the existing structural roof deck and installation of a full new roof system to include a vapor retarder, polyisocyanurate insulation of minimum thickness required by current energy codes, protective cover board, and new single-ply membrane.

The 1993 classroom wing is topped by a 5:12 pitched roof comprised of 1-1/2" metal deck, 5/8" exterior plywood, asphalt felt, and asphalt shingles. A substantial attic space, housing mechanical equipment in some areas, is situated above the top (First) floor occupied spaces. According to 1993 drawings, the attic space is ventilated with a continuous soffit vent at the perimeter and a continuous ridge vent (at the northwest leg) or aluminum roof louvers (at the main portion). The insulation layer (fiberglass batts) in the roof assembly is located immediately above the top floor finished ceiling assembly, which is a suspended acoustical tile system in most areas and gypsum board at some portions of the media center. The 1993 drawings do not indicate the presence of a vapor retarder.

Figure 08: Pitched asphalt shingle roof at 1993 classroom wing.

Figure 09: 1993 classroom wing attic space. [Note sprayed on fire-proofing.]

The Aulson Company inspected the asphalt shingle roof in November 2014 and found that the shingles are in need of replacement due to cracking and splitting. The District reports active leaks under certain weather conditions in this portion of the school.

At the time of CGKV's visit to the school, we observed significant ice-damming at the perimeter of the 1993 classroom wing. Deteriorated shingles, active leaks, and ice dams could all result from the original design and/or construction of the roof system at this portion of the facility. CGKV accessed the attic space to the south of the media center and found it to be relatively warm despite outdoor air temperatures being well below freezing. This suggests that the attic space may be inadequately ventilated. The lack of a vapor retarder as part of the insulation layer may also negatively impact the performance of the roof assembly. Lastly, according to the 1993 drawings, the roof assembly does not include an ice and water shield, which, at minimum, would normally be located at the lowest three to four feet of the roof perimeter.

Replacement of asphalt shingles at the 1993 classroom wing will require care to ensure that existing fire-proofing applied to the roof structure and to the underside of the roof deck is not dislodged.

Ice dams and icicles at the perimeter of the 1993 classroom wing are a danger to pedestrians below. The District installed caution tape at one set of exterior doors directly below an ominous group of icicles to prohibit use of those doors except in the case of emergency.

Figure 10: Icicles above egress doors at 1993 classroom wing.

Figure 11: Caution tape at 1993 egress doors below icicles.

Exterior Walls:

Winter weather conditions interfered with a detailed evaluation of exterior walls. The District generally did not report issues of concern at most exterior wall assemblies. One notable exception is at the 1993 classroom wing. The north elevation of this wing includes a projecting gable feature that defines the media center. The wall assembly at this projecting form is comprised of face brick backed-up by steel studs and gypsum sheathing. There are also large areas of cement plaster on 1/2" cement backer board at the upper gable and surrounding the exterior windows. The roof rake edge is flush with the gable end wall.

There are significant problems with water intrusion at this exterior elevation, which can be clearly seen at damaged interior finishes within the media center. Similarly, exterior edges of the cement plaster assembly are deteriorated and rusting. This condition warrants further exploration. Unchecked and continuing water intrusion can further deteriorate the exterior wall structure and possibly lead to the introduction of mold into the wall assembly.

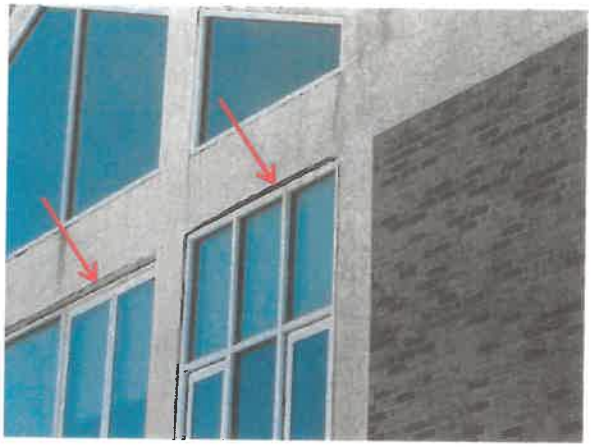

Figure 12: Evidence of water intrusion at perimeter of windows to cement plaster exterior finish at 1993 classroom wing north elevation.

Figure 13: Damaged interior finishes at 1993 media center.

Existing exterior walls at the 1956 classroom wings are constructed of face brick with CMU back-up, or, at the primary elevations, of pre-cast concrete mullions infilled with window units (replaced ca. 1993) and pre-cast concrete "Mosai" panels. "Mosai" panels are pre-cast concrete wall panels featuring an exposed aggregate on the outside surface. They were frequently used in building projects from the 1940s through the 1960s, and feature in many buildings designed by Korslund, Le Normand & Quann. Exterior brick, pre-cast concrete mullions, and "Mosai" panels at Pentucket Regional High School appear to have held up well.

Figure 14: 1956 classroom wing at exterior courtyard.

Figure 15: Pre-cast concrete mullions, "Mosai" panels, and replacement aluminum windows.

The original 1956 construction generally did not include insulation or vapor retarders as part of the exterior envelope. Insulation was added to the 1956 roofs when the current PVC membrane was installed around 1993, though the thickness does not meet current energy codes. The exterior walls at the 1956 portions of Pentucket Regional High School are not thermally efficient and allow the transfer of heat energy through the assembly.

The 2001 cafeteria expansion is clad in molded plastic faux brick panels. The plastic panels are in very poor condition. They are cracked and broken in a number of locations.

Windows:

All windows from the original 1956 building were replaced as part of the 1993 renovation and addition project. The existing windows are aluminum-framed with 1" insulated glass. Operable sashes are typically project-out casements. Since 1993, the District has installed custom interior insect screens at many locations, including wicket screens to access latch hardware. The District did not report any pervasive concerns with existing exterior window systems. CGKV did observe some deterioration of gaskets at insulated glass, though these defects did not appear to affect the insulated glass unit seals.

Figure 16: Typical aluminum windows at 1993 classroom wing.

Figure 17: Deteriorated gaskets at aluminum windows.

CGKV observed issues with south-facing windows at the 1956 gymnasium. Some sort of glazing treatment has deteriorated and resulted in a crazed pattern on the surface of the glass. Physical Education faculty report that uncontrolled glare at these windows disrupts athletic activities inside the gym.

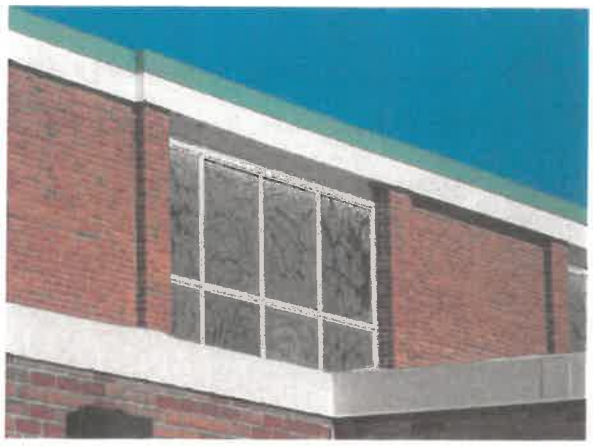

Figure 18: Deteriorated glazing treatment at south-facing windows in the 1956 gymnasium.

Doors:

Like the exterior windows, all exterior doors were replaced as part of the 1993 renovation and addition project. Primary entrance doors are aluminum-framed. Other doors are hollow metal with hollow metal frames. Exterior doors are in generally poor condition, unsuitable for the degree of use they've seen over nearly twenty years. Aluminum doors and frames have suffered the most, with screwed connections loosening over time. Door hardware is also deteriorated and is an ongoing maintenance concern. The District has found it necessary to supplement original ca. 1993 overhead door closers with new surface-mounted closers.

Figure 19: Aluminum doors and frames at main building entrance.

Figure 20: Original (ca. 1993) and supplemental overhead door closers/stops.

The fit and operation of existing exterior doors is problematic. Weather seals are ineffective, either through general deterioration or through wracking and sagging of

door and frame components. Conditions at the southwest exterior door at the 1993 gymnasium have made that door virtually inoperable, raising serious concerns about the available means of effective egress from that space.

Figure 21: Damaged egress door from 1993 gymnasium.

B. Interior Finishes

The original 1956 building includes some highly durable finishes, such as glazed structural wall tile, painted structural concrete, and plaster on metal lath, that are in good condition. Other 1956 finishes that remain in place are showing signs of wear. These include vinyl asbestos floor tile, adhered acoustical panels, and wood wainscot in classrooms.

The 1993 classroom addition was constructed with common and less durable interior finishes, such as painted gypsum wall board, thin set ceramic wall tiles, vinyl composition floor tiles, and suspended acoustical tile ceilings. Despite being only around 20 years old, many of these finishes are worn and have been damaged by frequent interior plumbing failures and water intrusion at the exterior envelope.

Typical interior finishes throughout different portions of the building are summarized below.

1956 Classrooms:	Floors:	Original vinyl asbestos tile [VAT] (or asbestos-containing asphalt tile) is in place at most 1956 classrooms. Most VAT was removed in the "Junior wing" and replaced with vinyl composition tile [VCT] or painted epoxy as part of post-flood event repairs.
	Walls:	Typical classroom walls consist of a variety of original surfaces and finishes, including stained

plywood dado (wainscot); wood-framed tack boards, peg boards, and chalk boards; adhered acoustical tiles; and wood bookshelves at the window wall elevation.

Ceilings: Classroom ceilings at the Ground Floor are the painted underside of the cast in place structural concrete waffle slab. First Floor classroom ceilings are painted plaster on metal lath.

Figure 22: 1956 Ground Floor classroom.

Figure 23: 1956 First Floor classroom.

1956 Corridors:

Floors: Most 1956 corridors have vinyl asbestos floor tile, with the exception of the "Junior wing" where VAT was mostly replaced by VCT or painted epoxy.

Walls: Glazed structural tile, adhered acoustical tiles, painted homasote, and recessed metal lockers are common at 1956 corridors. Renovation projects have introduced some areas of painted CMU and gypsum wall board.

Ceilings: 1956 corridor ceilings at the Ground Floor are the painted underside of the cast in place structural concrete waffle slab. First Floor corridor ceilings are painted plaster on metal lath.

Administration:

Floors: Administrative spaces flank the main building entrance at the 1956 First Floor. Spaces have been renovated and reconfigured over the years. Original flooring was typically VAT. Much of it has been replaced or covered with VCT and carpet.

Walls: Painted concrete block is common in many of the administrative spaces. Painted gypsum wall board is also present at newer spaces created during

reconfiguration projects.

Ceilings: Most ceilings in the administrative areas are plaster on metal lath, though more recently created spaces incorporate suspended acoustical tile ceilings.

Figure 24: 1956 corridor.

Figure 25: Main administrative office suite.

Auditorium:

Floors: The auditorium floor is painted concrete with carpeted aisles.

Walls: Walls are mostly painted CMU, with painted plywood panels installed on the walls at the front 1/3 of the space.

Ceilings: The auditorium ceiling is asbestos-containing acoustical plaster on metal lath.

Figure 26: 1956 auditorium.

Figure 27: 1956 auditorium.

1956 Gymnasium:	Floors:	The floor in the 1956 gymnasium is a traditional wood sports flooring assembly.
	Walls:	1956 gym walls are painted CMU and/or pumice block, with glazed structural tile featured at the lower portion of end walls. Vinyl-faced foam pads have been installed at end walls for safety.
	Ceilings:	Steel trusses and the underside of the roof deck are left exposed and are painted.
1956 Locker Rooms:	Floors:	1956 locker room floors are painted concrete, with a granolithic finish or ceramic tiles at shower areas.
	Walls:	1956 locker room walls are typically glazed structural tile, with some areas of painted CMU.
	Ceilings:	Sprayed acoustical plaster and/or painted exposed roof deck are found at main locker room spaces, with cement plaster at ancillary spaces.

Figure 28: 1956 gymnasium.

Figure 29: 1956 locker room.

1956 Stairs Halls:	Floors:	Stair halls in the 1956 building have a variety of floor finish materials, including original VAT, VCT, and epoxy. Rubber stair treads and risers were installed as part of the 1993 project.
	Walls:	Stair hall walls are typically glazed structural tile, with some areas of adhered acoustical panels.
	Ceilings:	Ceilings at the Ground Floor portions of stair halls are painted concrete, with some plaster soffits. First Floor stair hall ceilings are painted plaster on metal lath.

Figure 30: 1956 stair hall.

1993 Classrooms:	Floors:	Flooring throughout the majority of the 1993 classrooms is VCT, which, despite its age of less than 20 years, is considerably worn. Sheet vinyl is used in some science labs.
	Walls:	Wall finishes at 1993 classrooms are almost exclusively painted gypsum wall board at the Ground Floor and a combination of painted CMU and painted gypsum wall board at the First Floor.
	Ceilings:	Suspended acoustical tile is used at 1993 classroom spaces, and painted gypsum wall board can be found at some storage and support spaces.

Figure 31: 1993 classroom.

Figure 32: 1993 classroom.

1993 Media Center:	Floors:	The media center is largely carpeted, with some areas of VCT.
	Walls:	Painted gypsum wall board is prevalent throughout the media center. Areas of significant

water damage are visible at the exterior wall. (See Figure 34.)

Ceilings: Painted gypsum wall board is used at the ceiling within the media center, and suspended acoustical tile ceilings can be found in ancillary spaces.

Figure 33: 1993 media center.

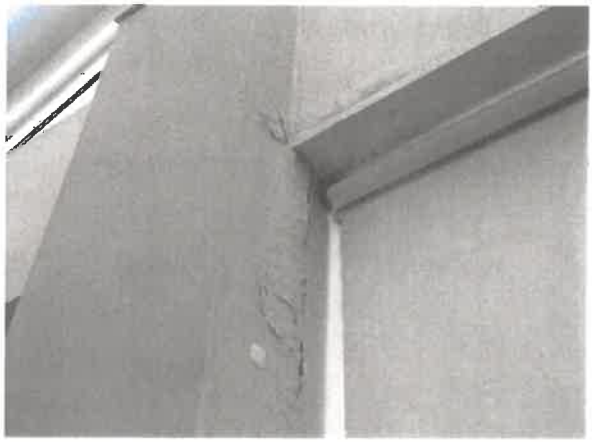

Figure 34: Damaged gypsum wall board at media center exterior wall.

1993 Gymnasium:

Floors: The floor in the 1993 gymnasium is a vented and cushioned wood sports flooring assembly.

Walls: Walls at the 1993 gym are comprised of glazed concrete block at the lower 7'-4" with painted CMU and acoustical CMU above.

Ceilings: The 1993 gym ceiling is painted steel trusses and painted metal roof deck.

Figure 35: 1993 gymnasium.

1993 Locker Rooms:	Floors:	Ceramic tile is common at 1993 locker and shower rooms.
	Walls:	1993 locker and shower room walls are a combination of painted CMU and ceramic tile.
	Ceilings:	Ceilings are typically painted gypsum board.
1993 Corridors:	Floors:	VCT is used at 1993 classroom wing corridors.
	Walls:	1993 classroom wing corridor walls are finished with ceramic tile at lower portions with painted gypsum wall board above.
	Ceilings:	Suspended acoustical tile makes up the finished ceiling at 1993 classroom wing corridors.
Cafeteria:	Floors:	Original vinyl asbestos tile remains in place throughout most parts of the 1956 cafeteria. The 2001 expansion has VCT.
	Walls:	Glazed structural tile, with some areas of painted cement plaster, comprise the wall finishes at 1956 portions of the cafeteria, while walls at the 2001 expansion are painted gypsum wall board.
	Ceilings:	The cafeteria ceiling is primarily suspended acoustical tile.

Figure 36: 1993 corridor.

Figure 37: Cafeteria.

C. Accessibility

CGKV did not perform a detailed accessibility survey at Pentucket Regional High School. The 1993 renovation and addition project would have been required by building codes in effect at that time to adhere to a number of accessibility standards, and it appears that the design provided appropriate accommodations. The addition

includes a two-stop elevator located at the intersection of the 1993 classroom wing and the 1993 physical education addition. Accessible toilet rooms were also added in the 1993 classroom and PE additions. Stairs, handrails, and doorways built in 1993 appear to be accessible.

Renovation work performed at the 1956 portions of the building included some attempts at improving accessibility there, including renovating some toilet rooms to provide accessible fixtures and making improvements to stair handrails. A platform lift was installed to provide access to the 1956 shop wing (now art and music), which is 30-36 inches below the First Floor corridor. A stair lift was installed at the west end of the two-story 1956 "Junior wing", which is a half-level above and below the main First Floor level. Some time after 1993, an accessible concrete ramp was constructed at the main building entrance.

Figure 38: 1993 toilet room.

Figure 39: Inoperable stair lift at 1956 "Junior wing."

Figure 40: Platform lift at 1956 studio wing (former technical shops).

Despite a number of beneficial improvements constructed during and after the 1993 project, Pentucket High School is not fully accessible to the extent that would be required for a new building. [See Section IV.] The local building official has deemed the stair lift at the 1956 "Junior wing" to be a hazardous impediment to the means of egress stair and has prohibited its use, thus making this classroom wing inaccessible to wheelchair users. The auditorium includes wheelchair seating areas, but there is no accessible route to the stage or the controls platform. The platform lift at the former shop wing provides a direct path to two of the three instruction spaces, but access to the music practice room requires passing through the adjacent art room.

Figure 41: Non-accessible steps to auditorium stage.

D. Furnishings, Fixtures, Equipment

Most typical 1956 classrooms continue to utilize cabinets, shelving, work stations, and chalkboards that date back to the school's original construction. Many of these amenities have held up fairly well over 60 years, but finishes, hardware, and controls are quite worn and have surpassed their expected service life. This is especially true at classroom shelving units, where the original linoleum countertop surface is damaged and missing at a number of locations. The home economics kitchen is still furnished with cabinets and counters from the 1950s. Science lab work stations are also original, including asbestos-containing countertops, and are outdated.

Figure 42: Damaged countertop surfaces at 1956 classroom shelving units.

Figure 43: 1950s era home economics kitchen cabinets and counters.

The 1993 classroom wing amenities are in fair condition. One notable exception is at science classrooms, where the District expressed concerns about the safety and usefulness of lab benches. The District described ongoing issues with the capacity of the science lab waste water system, which has resulted in some interior flooding events. The District also indicated that science labs at both the 1956 and 1993 sections of the school do not sufficiently accommodate the desired science curriculum. The close configuration or gas cocks, water faucets, and electrical outlets at lab benches is also safety concern to the District.

Figure 44: 1956 science lab work stations.

Figure 45: 1993 science lab work station.

The 1956 corridors contain recessed metal lockers from the school's original construction. Many lockers have been damaged over the years. Where lockers have been damaged beyond repair, painted plywood panels have been installed to cover

damaged components. Newer, non-recessed lockers have been placed in some 1956 corridors to increase capacity. The 1993 classroom addition did not include the installation of additional general purpose lockers.

Figure 46: 1956 corridor lockers.

CGKV did not closely examine the school's kitchen facilities. District personnel describe the equipment there as outdated.

E. Hazardous Materials

A number of what are now known to be hazardous building materials were incorporated into the construction of the 1956 school building and are still present in a number of locations and construction assemblies. The District has a detailed inventory of known and assumed asbestos containing building materials, and inspects the building for those materials, prepares asbestos management plans, and performs asbestos response actions to prevent or reduce asbestos hazards in accordance with AHERA regulations.

Asbestos containing materials [ACM] are classified as either friable or non-friable. Friable ACM is any material that contains more than one percent asbestos and can be crumbled, pulverized, or reduced to dust by the pressure of an ordinary human hand. Non-friable ACM is any material that contains more than one percent of asbestos but cannot be pulverized under hand pressure. Friable ACM can release toxic fibers into the air, is considered more dangerous than non-friable ACM, and falls under federal regulation.

Most friable and accessible ACM has been removed from the building. Some friable pipe insulation can still be found in locations that are generally not accessible to the public, such as the mechanical and electrical Apparatus Room. Pipes located above

1956 First Floor corridor ceilings are insulated with ACM, but the ceilings are hard plaster and access is restricted. Some plaster ceiling materials within the Auditorium and at the lobby outside the Auditorium contain, or are suspected of containing, friable ACM.

The most prevalent non-friable ACM in the building is vinyl asbestos floor tiles, which show wear but are otherwise in good to fair condition. Some areas of vinyl asbestos flooring have been covered over with newer flooring surfaces such as carpet or vinyl tiles. After the major flood that occurred in the "Junior wing" in 2014, repairs to the building interior included removal of existing vinyl asbestos floor tiles at the Ground Floor in that section of the building. Cement-asbestos panels can also be found in transoms above many corridor doorways.

Figure 47: Vinyl asbestos floor tiles at typical 1956 corridors.

Figure 48: Damaged and patched vinyl asbestos floor tiles.

Asbestos containing materials are well managed by the District. The presence of these materials, however, complicates – and sometimes even impedes – repair and maintenance work.

F. Building Structure

Lin Associates, Inc. visited Pentucket Regional High School on February 26, 2015 to conduct a visual evaluation and provide a cursory assessment of structural conditions at the school. Original structural drawings from the 1956 and 1993 construction projects were made available for Lin's review. Lin's observations indicated that the overall building appears to be in fair structural condition. "No significant distress or movement was observed on the building structures."

Lin did note some issues that were visible at the time of their visit, including:

- The 2014 rupture of a six inch diameter hydrant line under the 1956 "Junior wing" created a significant flood that disturbed the underlying bearing soil and caused the concrete slab and adjacent walls to settle. The slab and foundation were stabilized through compaction grouting, but evidence of displaced masonry walls is still visible.

- Stress release cracks are visible at a number of masonry walls, including the 1956 gymnasium, the 1956 auditorium, and the former 1956 metals shop.

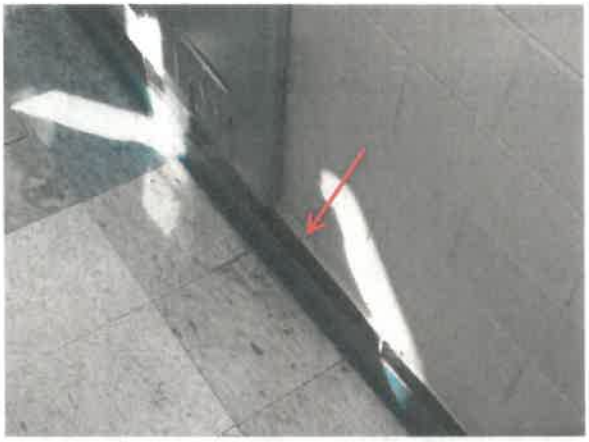

Figure 49: 1956 masonry wall construction displaced by the force of water and silt from 2014 flood event.

Figure 50: Stress release crack at 1956 auditorium.

- Shrinkage cracks in the First Floor cast in place concrete waffle slab are visible at several locations.

- Pre-cast concrete window sills installed at the 1993 classroom wing were apparently insufficiently anchored to the building structure and exhibited movement over the years. These sills have since been anchored to the adjacent brick wall with stainless steel plates.

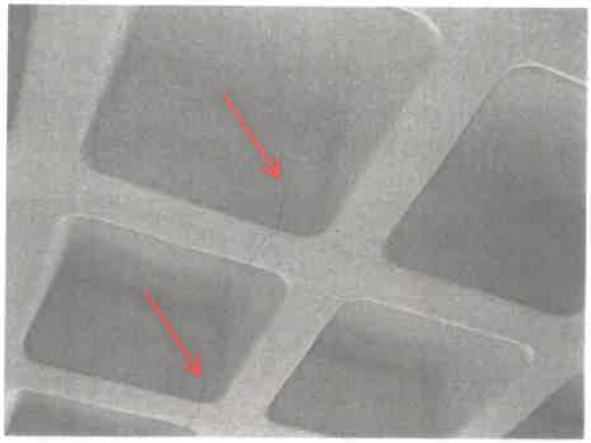

Figure 51: Shrinkage cracks at 1956 cast in place concrete waffle slab.

Figure 52: Stainless steel brackets installed to anchor 1993 pre-cast concrete window sills.

Please see the complete Existing Structural Conditions Building Evaluation, prepared by Lin Associates, Inc., dated March 3, 2015, attached to this report as Appendix A.

G. Building MEP Systems

Fitzemeyer & Tocci Associates, Inc. [F&T] visited Pentucket Regional High School on February 24, 2015 to conduct a visual evaluation and provide a cursory assessment of mechanical, electrical, and plumbing [MEP] conditions at the school. Original MEP drawings from the 1956 and 1993 construction projects were made available for Fitzemeyer & Tocci's review.

Please see the complete Mechanical, Electrical and Plumbing Existing Conditions Report, prepared by Fitzemeyer & Tocci Associates, Inc., dated March 19, 2015, attached to this report as Appendix B.

HVAC:

The heart of the HVAC system is the pair of fire tube steam boilers, installed ca. 1993, located in the boiler room. According to F&T, both boilers are weathered, in poor condition, and are nearing the end of their useful life. One of the boilers is in worse shape than the other and is merely serving as a back-up at this time.

The 1956 Apparatus Room, located at the Ground Floor level beneath the Main Office, includes equipment such as shell and tube steam to hot water heat exchangers, hot water distribution pumps, gate valves, and distribution piping. The

original 1956 heat exchangers are in very poor condition, and gate valves are corroded and do not appear to be operable. According to F&T, equipment in the Apparatus Room, dating back to 1956, appears to be in imminent danger of possible failure, which could cause a large portion of the High School to be without heat.

Figure 53: Existing boilers.

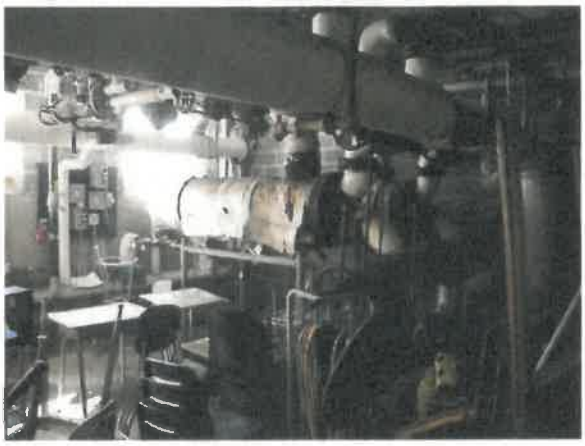

Figure 54: Existing 1950s vintage HVAC equipment in the Apparatus Room.

Terminal units - such as unit heaters, finned tube radiators, and unit ventilators - deliver heat (and in some cases fresh air) to individual spaces within the school. The 1956 sections of the building continue to rely, in most cases, on terminal units that are nearly sixty years old. The District noted that replacement parts are not available for the 1950s vintage unit ventilators and that repair work requires customization or aftermarket retrofitting. Even equipment installed as part of the 1993 project is approaching its 20-25 year life expectancy.

Figure 55: Original unit ventilator in 1956 classroom.

All equipment operates under outdated controls. The District is restricted in its ability to monitor the building HVAC systems for alarms or maintenance issues, and it is difficult to schedule operation to ensure maximum energy efficiency.

Plumbing:

F&T's observations found the gas fired domestic hot water heaters and hot water tanks to be in need of replacement due to age and condition. Piping that dates back to the 1950s is corroded and leading to sporadic pipe point failures. Most of the plumbing fixtures were replaced as part of the 1993 project and appear to be in mostly satisfactory condition. Visible roof drainage system components appeared to be in poor condition. Roof drains in the 1956 gymnasium are reported to leak and drip condensation, causing damage to the wood flooring below.

Figure 56: Plumbing fixtures replaced at 1956 toilet room.

Figure 57: Existing roof drain at 1956 gymnasium.

The 6" water main feeding the high school runs 1,600 feet from State Highway 113 to and under the building. This main has failed at multiple points over the years, including under the parking lot ca. 2000, under the front entrance drive ca. 2005, under the "Junior wing" in April 2014, and under State Highway 113 in January 2015. Several sections of this pipe have been capped and abandoned, leaving the campus without the service of one fire hydrant on the north side of the building.

Figure 58: Flood damage at 1956 "Junior wing" as a result of April 2014 water main break.

Figure 59: Repair work at April 2014 water main break.

Electrical:

The primary electrical service cable enters Pentucket Regional High School through the utility vault located in the Apparatus Room. This primary cable then splits, with one branch routed to a transformer that serves the high school and the other routed to the middle school. The configuration of electrical service and the use of just one primary meter make it impossible to determine the specific electrical demand of the high school versus the middle school. The primary cables are original to the 1956 construction of the building and are in poor physical condition.

The original 1956 main switchboard is still in use, is in poor condition, and is well past its useful life of 25 years. According to F&T, this original switchboard appears to be in imminent danger of possible failure. As part of the 1993 addition and renovation project, an additional section was added to the original switchboard to distribute power to the newer sections of the school. Though in fair physical condition, this newer equipment is getting close to the end of its useful life.

Classrooms in the 1956 portions of the school are not provided with adequate branch circuitry or electrical infrastructure to accommodate modern classroom power requirements. To address this issue, the District has installed panelboards within some classrooms in order provide power to additional receptacles. F&T notes that several of these added panelboards do not have proper working space clearance, are not properly protected from possible damage, and can be a safety hazard to students and faculty.

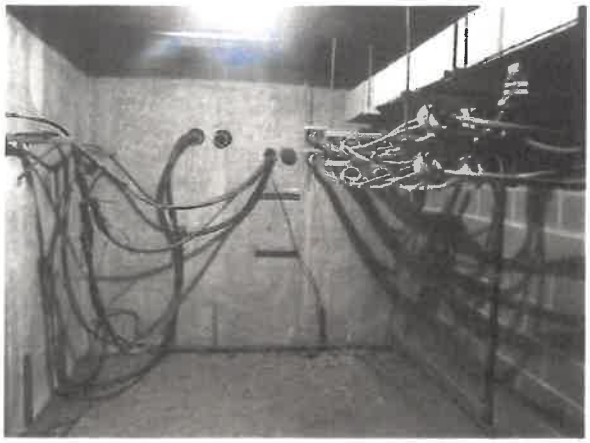

Figure 60: Existing primary electrical service in Apparatus Room utility vault.

Figure 61: Original 1956 main switchboard (right) and added 1993 switchboard in Apparatus Room.

Existing lighting fixtures throughout the majority of the building appear to be in good physical condition. Lighting controls consist of wall mounted switches and some occupancy sensors. A number of failed occupancy sensors have been bypassed. The existing fire alarm system was reportedly upgraded within the last ten years. Security cameras, electronic door controls, intercoms, and digital telephone systems appear to be in fair to good condition, with few issues of concern expressed by the District.

IV. BUILDING CODE ISSUES

A project or projects to make needed improvements to the PRHS facility or its systems, such as HVAC, electrical, or plumbing systems, would be a significant undertaking. Such work would require compliance with numerous building codes and state regulations, three of which are discussed here.

A. 780 CMR Massachusetts State Building Code

The repair, alteration, change of occupancy, addition, and relocation of existing buildings must conform to the provisions of the Massachusetts State Building Code. The State Building Code currently uses the International Existing Building Code 2009 (IEBC 2009) with amendments specific to Massachusetts. The Code provides three methods for compliance: the prescriptive compliance method (where, in general, altered areas must comply with the Code for new construction), the work area compliance method (where the level of compliance is based on the classification of work), and the performance compliance method (which uses a numerical method that allows tradeoffs for code deficiencies).

Broadly speaking, the more complex and extensive a renovation project is, the more likely the Code will require that the building perform similar to a newly constructed building. Replacing a complete building system, such as all the components of the HVAC system, would generally require that that new system comply with the Code for new construction. The existing building would be required to undergo a detailed evaluation of seismic and other structural issues, as well as confirmation of sufficient means of egress capacity.

B. 521 CMR Architectural Access Board

Renovation of Pentucket Regional High School would be regulated by the Massachusetts Architectural Access Board [AAB]. For existing buildings, if the renovation work being performed amounts to 30% or more of the full and fair cash value of the building, then the entire building is required to comply with 521 CMR.

According to the Town of West Newbury, the existing PRHS building is assessed at just over $8 million. A renovation project (or multiple renovation projects conducted over a three year time frame) costing as little as $2.4 million would trigger the requirement that the entire building be brought up to the accessibility standards of a newly constructed facility.

The Architectural Access Board does have in place procedures whereby a building owner who thinks that full compliance with 521 CMR is impracticable may apply to the Board for a variance from 521 CMR. Per AAB, impracticability is defined as a condition where (a) compliance with 521 CMR would be technologically unfeasible, or (b) compliance with 521 CMR would result in excessive and unreasonable costs without any substantial benefit to persons with disabilities.

C. Massachusetts General Law c. 148 s. 26G

MGL Chapter 148 Section 26G may require the installation of an automatic sprinkler system in buildings over 7,500 square feet in aggregate where the proposed work is expected affect 33% or more of the total area of the building or where the cost of the proposed work is 33% or more of the assessed value of the building and is considered "major".

The Automatic Sprinkler Appeals Board takes guidance from a 1989 Massachusetts Appeals Court case to help determine if "major alterations or modifications" are taking place. The Court said that the term "major alterations" shall include "any work, not repairs, which is 'major' in scope or expenditure, and which results in changes affecting a substantial portion of the building". In its decision, the Court looked at the nature of the planned work and would require sprinklers throughout the building if "the extra cost of installing sprinklers would be moderate in comparison to the total cost of the work contemplated..." or "if the physical work being done is of such scope that the additional effort to install sprinklers would be substantially less than it would have been if the building were intact."

V. CONCLUSIONS

In no particular order, conclusions reached in this report include, but are not limited to:

- The existing PVC membrane roof system at flat portions of the school roof has reached its expected useful life span and is a candidate for replacement.
- Asphalt shingles at the 1993 classroom wing are in need of replacement due to cracking and splitting. Additionally, roof replacement should address possible problems with ice dams, attic ventilation, and thermal and moisture control.
- Water intrusion at the north elevation of the classroom wing (particularly at the media center), due to original design or construction issues, is causing damage to exterior and interior finishes. Ongoing water intrusion has the potential to further deteriorate the wall structure and may contribute to the growth of mold within the wall assembly.
- Exterior doors, frames, and hardware have suffered wear and damage and would benefit from replacement to ensure the integrity of school security.
- Many durable interior finishes from the original 1956 construction are in generally fair condition. Others, such as vinyl asbestos floor tile, adhered acoustical panels, and wood wainscot in classrooms are worn.
- The 1993 classroom addition was constructed with less durable interior finishes, such as painted gypsum wall board, thin set ceramic wall tiles, vinyl composition floor tiles, and suspended acoustical tile ceilings, all of which are showing signs of wear.
- Some portions of the facility do not meet basic accessibility standards. The entire "Junior wing" is not accessible, and the auditorium does not include an accessible route to the stage. Any major renovation would likely trigger the AAB requirement that the school be brought up to full compliance with 521 CMR.
- Asbestos containing materials are being appropriately managed by the District, but their presence complicates maintenance and repair activities.
- The existing boilers are in poor condition, are approaching the end of their expected service life, and should be replaced.
- According to F&T, equipment in the Apparatus Room, dating back to 1956, appears to be in imminent danger of possible failure, which could cause a large portion of the High School to be without heat.
- Many terminal units (unit heaters, radiators, unit vents) in the 1956 portions of the school are original, are in poor condition, and are very difficult to service and repair.
- The original 1956 main switchboard is still in use, is in poor condition, and is well past its useful life of 25 years. According to F&T, this original switchboard appears to be in imminent danger of possible failure.

- F&T also notes that some panelboards installed to increase capacity at classrooms do not have proper working space clearance, are not properly protected from possible damage, and can be a safety hazard to students and faculty.
- According to the District, science labs are in need of updating in order to accommodate and support a modern curriculum.
- School staff indicated that the gymnasium is too small to accommodate the desired quantity of spectators during athletic events.
- The District expressed concern that technical education classes are located across the campus at the middle school building.
- The damage to and subsequent removal of the four modular classrooms as a result of the 2014 underground flood event has forced the District to relocate some high school classroom functions to the middle school building. Relocation of high school classes required the middle school media center, superintendent's conference room, and one middle school classroom to be repurposed for high school use.

Although thoughtfully designed and admirably maintained, the existing Pentucket Regional High School building is worn and outdated. The facility presents many challenges to the District's ability to deliver a world class education and to maintain its position as an Innovation School leader in Massachusetts.

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VI. APPENDIX A

Existing Structural Conditions Building Evaluation
Pentucket Regional High School, West Newbury, Massachusetts

March 3, 2015

Lin Associates, Inc.
2001 Beacon Street
Brighton, MA 02135

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LIN ASSOCIATES, INC.
CONSULTING ENGINEERS

STRUCTURAL MEMORANDUM

TO: Jason Knutson - CGKV Architects

FROM: Bob Lie

REGARDING: Existing Structural Conditions Building Evaluation
Pentucket Regional High School, West Newbury, Massachusetts

Date 3 March 2015

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On 26 February 2015, the undersigned visited the school to conduct a visual evaluation of the school. The purpose of this evaluation is to provide a cursory assessment on the structural condition of the school building to support the District's Statement of Interest submission to the Massachusetts School Building Authority.

Mr. Greg Hadden, Facility Manager of the Pentucket Regional School District, assisted the evaluation by providing the background of the school construction and its past expansions. Mr. Hadden then proceeded to show some known structural concerns that he has noticed over the years, including the most recent hydrant line break under the east wing of the school that had necessitated an intensive structural intervention to stabilize the structure surrounding the break.

The undersigned then proceeded to perform a walk-through of the building and conducted visual observations on the accessible areas inside and around the building. No removal of finishes was conducted during this visit.

General Building Description

The original building, built mid to late 1950s, was a "Tee" shape structure with two story classrooms on the east and south wings, gymnasium on the west end and single story support spaces surrounding a two story high Auditorium at the center. Structural system consists of bulb Tee poured gypsum roof deck over steel joists flat roof framing supported on masonry bearing walls, supplemented with structural steel framing. Cast in place concrete waffle slab system is used for the suspended first floor slab. Ground floor is cast in place concrete slab on grade over shallow spread footing bearing on competent soil foundation system. Lateral resisting system for the building is primarily the unreinforced (?) concrete masonry block and brick walls with concrete floor and flexible gypsum roof deck as the horizontal diaphragm elements. Connections of the horizontal diaphragms to the supporting walls were not obvious during the visit since they are mostly concealed by finishes.

The school had a significant addition in the mid 1990's on its south and west ends. A two story classroom and library was built along its southern boundary. High bay one story Physical Education area was built on its western end. Typical structural system consists of structural steel framed roof and floor supporting metal deck roof and concrete filled metal deck first floor. Substructure is comprised of concrete slab on grade at ground floor and shallow spread footing foundation system. Lateral resisting system for the addition is structural steel concentric braced frames.

Cafeteria addition was the latest expansion. Structural system is not known.

Structural As-Built drawings are available for the existing original building and the 1993 addition.

Existing Condition Evaluation

Our observation indicated that the overall building appears to be in fair structural condition. No significant distress or movement was observed on the building structures. Several notable items were observed:

- 6"ø hydrant line traversing north-south under the health office at the east classroom wing burst on early spring last year. Significant amount of fines from the underlying soil had washed up to the inside of the room. The disturbance to the bearing soil had caused the concrete floor and adjacent walls to settle. Under the supervision of registered structural and geotechnical engineers, the slab and foundation was stabilized using

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the compaction grouting method and returned to service. The hydrant line has been cut, capped and filled with cement slurry. The Facility office keeps good record of the stabilization effort.

- Vertical crack was observed on the wall of the gymnasium northwest corner, likely a stress release crack due to lack of movement control joint.
- Step cracks were noted on the glazed tile "pilasters" at the northeast and southeast corner of the auditorium facing the corridor. Similar crack was observed on the masonry walls across the corridor from these "pilasters". Likely cause is the end rotation of the roof beams when subjected to load. Noted that this location is where the low corridor roof meets the high wall of the auditorium, thus can be subjected to significant snow drifting.
- Vertical crack on the east masonry wall of the metal shop, likely a stress release crack due to lack of movement control joint.
- Crack and or movement joint on the slab on grade have translated thru the finish floor tile at several locations.
- Shrinkage cracks on the first floor waffle slab were visible at several locations.
- The EIFS clad façade of the library facing the courtyard exhibited corrosion along its termination around the windows and at the soffit. Closer evaluation of this condition was not possible due to the blocked access into the courtyard from snow accumulation. Evaluation of the photograph appeared to indicate corrosion of the metal termination or corner beads within the EIFS system.
- The 1993 addition brick façade utilized manufactured stone sill under the windows. These sills have exhibited movement over the years, some of them reportedly almost dislodged from the wall. Currently these sills were held back with the use of stainless steel plate bolted to the sill and to the adjacent brick wall. Anchorage of these sills will need to be evaluated in more detail.
- Brick "blade wall" adjacent to door A3 at the east wing showed movement crack at mid-height of first floor window line.
- Boiler room brick chimney appeared to be in fair shape. Efflorescence was noted on the upper portion of the chimney as well as loss of mortar on the brick joints for a few coursed below the cap.
- Plastic "Faux Brick" façade of the cafeteria addition showed impact damages along the bottom of the wall.
- Exterior envelopes appear weather tight with no major leakage observed.

Conclusion

Based on our field evaluation, the existing building appears to be structurally sound. Several deficiencies notes here will need to be investigated further for needed repairs or strengthening.

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Slab Jacking at Health Office at Spring 2014
Due to hydrant line burst under the building.

Vertical Crack at NW Gymnasium Corner

Step Cracking at Glazed Tile Pilaster
Corner of Auditorium

Masonry Vertical Crack at Metal Shop

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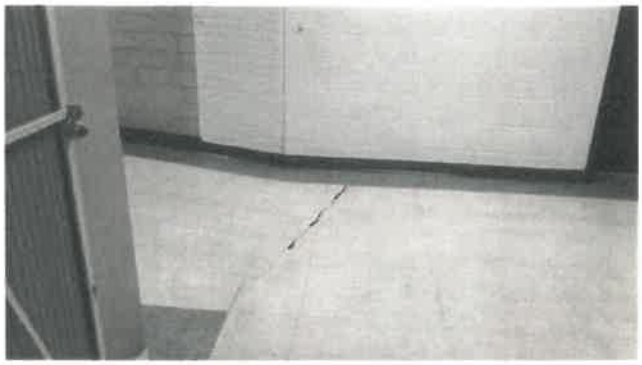

Movement Joint or Crack at Slab on Grade

Library Façade at Courtyard
Note corrosion along its edges

Cast Stone Window Sill Retainer Plate

Blade Wall adjacent to Door A3
Note step crack at window mid-height

Boiler Room Chimney
Note efflorescence and some loss of mortar at joint.

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Cafeteria Addition
Note impact damage on "faux brick" plastic façade

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VII. APPENDIX B

Pentucket Regional High School
Mechanical, Electrical and Plumbing Existing Conditions Report

March 19, 2015

Fitzemeyer & Tocci Associates, Inc.
300 Unicorn Park Drive, Fifth Floor
Woburn, MA 01801

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FITZEMEYER & TOCCI ASSOCIATES, INC.

Pentucket Regional High School

Mechanical, Electrical and Plumbing

Existing Conditions Report

Prepared For:

Pentucket Regional School District

24 Main Street, West Newbury, MA 01985

March 19, 2015

F&T Project No. 150010.01

Prepared By:

Fitzemeyer & Tocci Associates, Inc.
300 Unicorn Park Drive, 5th Floor
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1. EXECUTIVE SUMMARY

The Pentucket Regional High School was originally constructed in 1956. The school was then renovated and additional spaces were added in 1993. There was also a small addition to the Cafeteria in 2001. The current, cumulative size of the building is now approximately 210,000 square feet.

The building consists of classrooms, gymnasiums, locker rooms, an auditorium, bathrooms, a library, administration/office spaces, mechanical rooms, electrical/IT rooms, storage spaces and other miscellaneous areas.

The HVAC system and equipment is either past or nearing the end of its useful life expectancy, as detailed by the HVAC Applications - ASHRAE Handbook. Facility staff has done a commendable job in maintaining, replacing and fixing the equipment and systems as needed; however it is evident that the HVAC system is in need of replacement in the near future. Additionally, the HVAC equipment within the Apparatus Room dating back to 1956, appears to be in imminent danger of possible failure. This would result in a large portion of the school being without heat.

As with the HVAC system, much of the Plumbing systems and equipment is 20+ years old and has surpassed its useful life expectancy. Many of these systems appear to be in need of full replacement.

The majority of the electrical power distribution system, including the buildings electrical service, is in poor physical condition and well past its useful life of 25 years. Equipment is still in operation from the original high school construction in 1956 and no longer has replacement parts available. The original 1956 electrical distribution equipment, including the original Frank Adam switchboard, appears to be in imminent danger of possible failure; which would result in the school being without power.

The lighting system throughout the 1956 original construction was visually in good condition in most areas. There are some fixtures that are worn and in poor condition. The 1993 building addition lighting is in good condition. Both lighting systems did not have any reported issues other than failing occupancy sensors that are being removed and bypassed as they fail..

The building is fully equipped with an addressable, voice evacuation fire alarm system that was installed within the past 10 years. The system consist of speaker/strobes, pull stations, heat detectors, smoke detectors, and a graphic annunciator. The first alarm system is in good physical and operating condition and the maintenance staff did not have any report any overall system issues. There are a few damaged smoke detectors noted in the gym but they still are operational. The existing fire alarm system provides adequate coverage and appears to be in compliance with the latest editions of NFPA 72 and the Commonwealth of Massachusetts Building Code (780 CMR).

The building is equipped with 19 CCTV cameras located throughout the building, at key security points; including the office, main entrance, cafeteria and some hallways. In addition, the front door is electronically locked and includes and intercom and CCTV that feeds back to the main office. All security systems are in good physical and operation condition.

Mechanical/Electrical Engineers

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2. HEATING, VENTILATION, AND AIR-CONDITIONING (HVAC)

2.1. Existing HVAC System Evaluation

The existing HVAC system includes systems and equipment from the original 1956 installation, as well as the 1993 installation. The HVAC system and equipment described herein will be compared to the Service Life Estimates, as detailed in the 2011 HVAC Applications – ASHRAE Handbook.

There are currently two (2) existing Cleaver Brooks fire tube, steam boilers (Model CB200) in the Boiler Room. The boilers are dual fire, such that they are able to run on natural gas or fuel oil; although Facility staff operates the boilers primarily on natural gas at this time. Both boilers are weathered and in poor condition. Currently the boilers operate in a duty-standby operation, as Boiler B-2 is in worse condition and has had numerous maintenance issues. Boiler B-2 is merely a back-up at this time. Boiler B-1 appeared to be in better condition, but still appears to be quite fatigued. According to the ASHRAE service life estimates, fire-tube boilers have a life expectancy of 25 years. With the boilers having been installed in 1993, they are nearing the end of their useful life, and are in need of replacement.

The boilers produce steam which are tied into a 12" diameter header, which is original to the 1956 installation. The header is in poor condition, and appears to have needed repairs and corrective measures. From the steam header, there are several branches that serve various systems and equipment. There is a branch that serves the domestic hot water storage tanks (see Plumbing Section herein for storage tank condition), as well as a branch that serves AH-4, which is used for combustion air for the Boiler Room. AH-4 is in poor condition, and when operating is excessively loud. The associated dampers for this unit have been fixed open to allow for entrance of combustion air, however this limits the combustion air and decreases boiler efficiency. There is a 6" diameter branch off the steam header that serves a shell and tube, steam to hot water heat exchanger. The hot water then serves various terminal units throughout the 1993 addition. The shell and tube heat exchanger appeared to be slightly weathered, but is in moderate working condition. According to ASHRAE, a shell and tube heat exchanger has a life expectancy of 24 years. With that, the heat exchanger is nearing the end of its useful life. There are also 10" diameter and 5" diameter branches that exit the Boiler Room and serve various terminal units and then other shell and tube, steam to hot water heat exchangers located in the Apparatus Room.

Within the Apparatus Room, there are two (2) shell and tube, steam to hot water heat exchangers. These heat exchangers are original to the 1956 installation and are in very poor condition. As stated earlier, the shell and tube heat exchangers have a life expectancy of 24 years, and are decades past their useful life expectancy. Additionally there are various gate valves that allow for individual hot water supply and return branches to be isolated. The gate valves also appear to be original to the 1956 installation, are in poor condition and do not appear to be operable. The distribution piping within the Apparatus Room is also mostly original and appears to have needed numerous maintenance upgrades to fix and/or prevent leaking. The equipment within the Apparatus Room, dating back to 1956, appears to be in imminent danger of possible failure. Failure of this equipment, such as the shell and tube heat exchangers, would cause a large portion of the High School to be without heat.

On the waterside of the heat exchangers, there are three (3) hot water distribution, base mounted, end suction pumps that serve the various terminal units throughout the Building. The hot water distribution pumps were installed in 1993, however have needed to be rebuilt, and appear to be worn. According to ASHRAE, base-mounted pumps have a life expectancy of 20 years; therefore the distribution pumps have exceeded their useful life expectancy.

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There are various terminal heating units throughout the school that were installed in 1956 and 1993. Included are unit heaters, cabinet unit heaters, finned tube radiators and unit ventilators.

Hot water unit heaters (including cabinet unit heaters) have an ASHRAE life expectancy of 20 years, and have all exceeded their useful life expectancy. Furthermore, upon inspection, they appeared to be corroded, fatigued and likely have poor heat transfer capability due to corrosion.

Finned tube radiators have an ASHRAE life expectancy of 25 years, and have either far exceeded (1956 radiators) or are nearing the end (1993 radiators) of their useful life expectancy. Finned tube radiators that are original to the building, are in poor condition and do not have the desired heat transfer capability. The finned tube radiators installed in 1993 were in moderate condition, however some appear to be worn as they are in high traffic areas, such as corridors.

Each classroom has a single unit ventilator that provides supply air for ventilation. The unit ventilators are provided with hot water heating coils for tempering incoming air during winter and/or shoulder months. The air is then exhausted via roof mounted exhaust fans. The unit ventilators have an ASHRAE life expectancy of 20 years, thus have all exceeded their useful life. During inspection, it was identified that the unit ventilators installed in 1956 were in very poor condition, as they are quite corroded and fatigued. The unit ventilators installed in 1993 are in the moderate condition and are operable.

The roof mounted exhaust fans have an ASHRAE life expectancy of 20 years, and have all exceeded their useful life expectancy. Facility staff appears to have had to rebuild many of these fans in order to maintain operability. They appeared to be fatigued, however most were operable.

There are various air handling units throughout the school that provide heating, ventilation and in some cases cooling. AH-1, AH-2 and AH-3 all have hot water heating coils in addition to DX cooling coils with remote air cooled condensers for cooling. These were all installed in 1993. AH-1 serves Word Processing, AH-2 serves Computers, and AH-3 serves the Library offices. According to ASHRAE, air handlers and air cooled condensers have a life expectancy of 20 years; therefore these have all exceeded their useful life expectancy. The air handling units were observed to be operational and in moderate working condition; however they are noisy due to age and wear of bearings and fittings.

The school Gym is served by HV-1 and HV-2, which have bottom mounted return air connections, a mixing box and hot water heating coil. These units provide heating and ventilation to the space during times of high occupancy. Both units have a life expectancy of 20 years, thus are past their useful life; as they were installed in 1993. Both are operable, however they are in poor condition with visible corrosion and ripped flexible connections. Furthermore, they quite noisy when operating due to age and corrosion.

The kitchen was previously served with a direct, gas-fired makeup air unit; which has since been deemed inoperable. It is now served by a hot water, air handling unit (HV-3); which serves as the kitchen makeup air unit. There are kitchen canopy hoods over the equipment that is tied into a roof mounted exhaust fan for heat, smoke removal. HV-3 is operable and in moderate condition; however it is past its useful life expectancy of 20 years.

The Office and Administration area are served by three (3) packaged rooftop units that provide cooling. These were all installed in 1993 and are all operable. The rooftop units all have ASHRAE life expectancy's of 15 years, thus have all exceeded their useful life expectancy.

All equipment and system controls are pneumatic, which is an outdated technology, as most schools and facilities have moved to completely electric temperature controls. With electric temperature controls, building HVAC systems can be monitored for alarm or maintenance issues. Additionally, HVAC equipment operation can be scheduled to ensure maximum energy reduction. This older, pneumatic

Mechanical/Electrical Engineers

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system does not have that capability. Pneumatic systems and equipment have an ASHRAE life expectancy of 20 years. There have been several pieces of controls equipment that has been replaced by Facility staff in order to maintain controllability; however there are parts of this system that are now almost 60 years and in need of full replacement.

Fire-Tube Steam Boiler

Condensate Receiver

Apparatus Rm – Corroded Gate Valve

Shell & Tube Heat Exchanger

Pneumatic Compressor

Air Handling Unit AH-1

Rooftop Exhaust Fans

Unit Ventilator (1956)

Unit Ventilator (1993)

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HV-2 with Tom Flex Connection

Finned Tube Radiator

Hot Water Unit Heater

3. PLUMBING

3.1. Existing Plumbing System Evaluation

The existing domestic hot water system is served by two (2) gas fired hot water heaters that are severely corroded and in poor condition. Additionally, there are two (2) domestic hot water storage tanks with steam heating coils that can provide domestic hot water when the boilers are operating. Domestic Hot Water Tank #2 is currently inoperable due to age and corrosion. Domestic Hot Water Tank #1 is operable, however is in poor condition. Currently, Facility staff operates the gas fired hot water heaters and Domestic Hot Water Tank #1 in order to provide sufficient heat to the domestic hot water system. Due to age and condition, the gas fired hot water heaters and hot water tanks are in need of replacement.

The School currently operates its boilers on natural gas, however there is still an underground fuel oil storage tank next to the Boiler Room. The underground storage tank is 10,000 gallons and was installed in 1993. The duplex fuel oil supply pumps were also installed in 1993, and are said to be operable; however they are in poor condition. The fuel oil tank is monitored by a Veeder Root control panel for tank level, tank leak, tank overflow and other alarm and/or monitoring. The fuel oil supply system is still operable, however is near the end of its useful life.

The natural gas service feeds the boilers, domestic hot water heaters and also travels to the Science wing where it feeds various classroom gas turrets. Each classroom appeared to have an emergency gas shut down button or valve, which were said to be operable. The gas service appeared to be in satisfactory condition.

The domestic hot water supply, hot water re-circulation and cold water supply serves various bathrooms, shower areas and classrooms throughout the facility. Some of this piping was replaced in 1993, along with fixture fit-out work; however some of the piping is original to the Facility. Piping that dates back to 1956 would need to be replaced as the age and corrosion is causing sporadic pipe point failure.

The Science Wing also has an acid waste system that was installed in 1993. The acid waste piping appeared to be in moderate condition, however the acid waste filter tank appeared to be aged. The acid waste system gets scheduled maintenance to ensure operability, however is at the end of its useful life.

Additionally, the Science Rooms have emergency showers and eye washes that were installed in 1993. These are said to be tested and functional and appeared in moderate condition.

Most of the plumbing fixtures had been added or replaced during the 1993 installation. The fixtures vary as to the condition. Some of the fixtures are operable and in satisfactory condition; while many others

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appeared to be leaking and in poor condition. With the fixtures being 20+ years old, they are at the end of their useful life expectancy.

The roof drainage system, where visible, appeared to be in poor condition. The exposed roof drains within the Gymnasium showed signs of corrosion and failure; and appeared to have needed significant repair in order to maintain operation.

Gas Fired Hot Water Heaters

Domestic Hot Water Tank #1

Fuel Oil Supply Pumps

Emergency Shower

Gymnasium Roof Drain Connection

Natural Gas Service

4. ELECTRICAL

4.1. Existing Electrical System Evaluation

Primary electrical service is provided to the site via overhead cable from Main Street to a utility pole located in the North parking lot of the High School with a riser down the pole to an underground ductbank. A primary utility meter (Meter No. 05 150 776) services both the High School and the Middle School and is installed on the utility pole. The July utility bill indicated a peak electrical demand of 300 kW, however, the exact electrical demand of the high school cannot be determined since the primary meter is used for both buildings. A full year of utility bills was not available to determine the peak demand through a 12 month period. The primary utility cable then enters the building through the Utility Vault located within the Apparatus Room. The primary cable is split within the vault and one cable is then routed from the vault to the pad mounted transformer located at the Main entrance of the High School and the other primary cable is routed up the street to the Middle School transformer. The primary cables are original to the 1956 construction of the building and noted to be in poor physical condition. Maintenance staff indicated there

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was a recorded cable failure that resulted in damaged cable within the vault that required removal of the damaged cable. New cable was spliced with the existing cable within the vault, the primary cable splice did not appear to be installed in accordance manufacturer's requirements. The secondary cable (5 sets) is provided in an underground ductbank from the transformer back through the Primary Cable Vault where it terminates on a bus duct. The bus duct then penetrates the wall of the Primary Cable Vault/Apparatus Room to enter the buildings main switchboard.

The main switchboard to the building is a 1600 Amp, 120/208 Volt, 3 Phase, 4 Wire switchboard manufactured by Frank Adam. The switchboard is original to the 1956 construction of the high school (59 years old) and noted to be in poor physical condition. The switchboard is well past its useful life of 25 years and replacement parts for the switchboard are no longer manufactured making it difficult to perform routine maintenance on the switchboard or find replacement parts. The original 1956 Frank Adam switchboard, appears to be in imminent danger of possible failure. This would result in loss of power to the entire building.

It should also be noted that the Apparatus Room only has one egress door, which is not in compliance with the National Electrical Code (NEC). Article 110.26 (C) of the NEC requires an electrical room with equipment over 1200 Amps to be provided with two means of egress unless double working space clearance is provided in front of the equipment (7'-0"). Due to the mechanical equipment located within the room the additional working space clearance cannot be achieved.

In 1993 an additional section was added to the existing Frank Adam main switchboard. The bus bars within the Frank Adam switchboard were extended to the 1993 switchboard section. The new switchboard section is also rated for 1600 Amps and is a Spectra series switchboard as manufactured by General Electric (GE). The GE switchboard was noted to be in fair physical condition and reaching the end of its useful life of 25 years (switchboard section is approximately 22 years old) and therefore becoming difficult to find replacement parts. The GE switchboard distributes power to the 1993 school addition as well as the 2001 extension of the Cafeteria. The GE panelboards installed during the 1993 addition are in fair physical condition but are getting close to the end of their useful life of 25 years.

The high school still has original 1956 electrical distribution equipment (panelboards) in use in the original building section of the high school. The Frank Adam panelboards are all in poor physical condition and are well past their useful life of 25 years. Many of the panelboards have circuit breakers that are falling apart and maintenance staff are routinely replacing broken circuit breakers. Since replacement breakers are not available for the Frank Adam panelboards, maintenance staff has utilized circuit breakers from existing Frank Adam panelboards that have been removed due to failure/degradation of the panels. Similar to the main switchboard, the original 1956 electrical distribution system which includes Frank Adam panelboards and transformers, appears to be in imminent danger of possible failure. This would result in loss of power to the area(s) that are fed from a failed panelboard.

The High School also has I-T-E panelboards located in the original construction area of the High School. The panelboards are also in poor physical conditions and maintenance staff has indicated circuit breakers are failing within the panelboards.

Classrooms within the 1956 construction only included a single receptacle branch circuit and typically only 2 duplex receptacles, which does not provide adequate branch circuitry or electrical infrastructure within classrooms for to accommodate modern classroom power requirements. Due to the lack of electrical infrastructure, maintenance staff have installed panelboards within classrooms in order to provide power to new receptacles for projectors, general purpose receptacles and computers. The panelboards within classrooms are often being blocked by debris not allowing for proper working space clearance in front of the equipment. The panelboards are also not properly protected from damage when

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installed within the classrooms which can be a safety hazard for students and faculty. Additionally, maintenance staff have been replacing the Frank Adam and I-T-E panelboards as they fail with new GE panelboards.

Primary Meter

Primary Cable Vault

Main Switchboard

Frank Adam Panelboard

Gym I-T-E Panelboard

Typical Classroom Panelboard

The building is not currently equipped with standby power, however, a 40 kW generator was removed from the Middle School in 2014 and is currently planned to be tied into the high school.

The lighting system within the high school mostly consist of fluorescent lamps, which includes compact fluorescent downlights, linear 4'-0" 32 Watt-T8 lamps, 32 Watt-T8 U-Lamps, and 54 Watt-T5HO lamps. The hallways consist mostly of 4'-0" linear fluorescent lighting fixtures and 2'x2' lighting fixtures with fluorescent U-Lamps. The classrooms within the original construction of the building and non-finished areas including mechanical rooms and closets, consist of 1'x4' linear fluorescent lighting fixtures. The classrooms within the 1993 addition consisted of 2'x4' (15 cell) parabolic fluorescent lighting fixtures. The school also includes 1000 Watt, metal halide lighting fixtures within the Gym and LED down lighting fixtures within the kitchen and linear LED lighting fixtures in select locations in the building including the Men's Locker Room.

The existing florescent lighting fixtures within the majority of the building appeared to be in good physical condition except for the lighting fixtures within the main entrance hallways between the main office and cafeteria which had noticeable physical damage.

Emergency lighting is provided within the building via wall mounted battery units and remotes heads. The emergency lighting appeared to be original to the construction and in fair condition. However, proper emergency lighting did not appear to be provided throughout the building along the paths of egress (hallways and stairways).

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Lighting controls consisted of wall mounted switches and some occupancy sensors. The occupancy sensors are in poor operating conditions and many are failing. Failed occupancy sensors are being removed and bypassed for control by the wall mounted switches. Wall plates for switches in the original construction of the building also appeared to be in poor physical condition. Exterior lighting is controlled via a Tork timer switch mounted on the Frank Adam switchboard. During inspection it was noted that the exterior lighting was on, which indicates the timer switch may no longer be working properly or not programmed properly.

Exterior lighting consisted of a combination of wall mounted lights and utility owned flood lighting mounted on utility poles metered separately from the school. The majority of the wall mounted lighting fixtures were visually inspected and appeared in poor physical condition. Some fixtures were either no longer functional or the lamps need to be replaced. The overall lighting within the parking lot did not appear as though it would provide lighting levels that would meet the recommendations of IES for security lighting in parking lots.

Typical 1993 Addition Lights

Typical Hallway Light

Typical 2'x2' Light

The existing fire alarm system consist of an addressable MS-9600LS Fire-Lite main fire alarm control panel (FACP) with voice evacuation system located in the IT Closet within the Main Office, manual pull stations (located at exits and stairways), speaker/strobe devices (located throughout the building), smoke detectors (hallways, classrooms, auditorium, elevator lobbies, and stairways), heat detectors (located in mechanical rooms, kitchens, and laboratory classrooms), and a remote annunciator located at the main entrance to the building. Based upon discussions with maintenance staff, the existing fire alarm system was upgraded within the last 10 years. In addition, the existing fire alarm system appeared to be in compliance with the latest codes including NFPA 72 (National Fire Alarm and Signaling Code), NEC (NFPA 70), and the Massachusetts Building Code (780 CMR). However, it should be noted that the useful life of FACP's is approximately 15 years.

The majority of the fire alarm equipment appeared to be in good physical condition and maintenance staff did not indicate issues with the existing system or devices. However, detectors within Mechanical rooms and within the Gyms appeared to be damaged.

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Main FACP

Typical Speaker/Strobe

Typical Smoke Detector

Gym Smoke Detector

Typical Gym Pull Station

Voice Evacuation Panel

The building is equipped with 19 high definition, fixed mounted, CCTV cameras located at strategic locations throughout the building. This includes the office, main entrance, cafeteria and some hallways. The cameras are in good operational condition and no issues were identified by maintenance staff. However, given the total square footage of the high school (210,000 sf), 19 cameras may not provide complete coverage of the building for security and safety of students/faculty. Camera locations should be evaluated to determine if additional coverage is required.

The High School also has electronically locked doors at the main entrance with a camera and intercom system that is tied back to the secretary desk in the Main Office.

The building is equipped with a digital phone system which is in good operational condition, no issues were expressed by maintenance staff.

The buildings PA/Intercom system appeared to be in fair physical condition, no issues were expressed by maintenance staff. However, it was noted that some existing speakers had physical damage and in need of replacement.

WIFI was provided throughout the building and appeared to have been installed in the last 3 years and appears to be in good condition. Maintenance staff did not indicate any issues with the existing system.

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