758 MARRETT ROAD
LEXINGTON, MASSACHUSETTS 02421

Prepared for:

Michael McKeon
Kaestle Boos Associates
325 Foxborough Boulevard #100
Foxborough, Massachusetts 02035
October 29, 2013

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INTRODUCTION

This updated structural evaluation of the Minuteman High School, located at 758 Marrett Road in Lexington, MA, was undertaken at the request of Mr. Michael McKeon, AIA, of Kaestle Boos Associates, Foxborough, Massachusetts.

The purpose of this structural evaluation was to reassess the structural condition of the Minuteman High School buildings, using the findings in Odeh Engineers' previously issued 2008 Minuteman Career & Technical High Preliminary Structural Examination Report as a starting basis for this report. This structural re-assessment of the Minuteman High School building was to determine whether structurally deficient conditions that were identified in the 2008 report had worsened. In addition, this updated structural evaluation report will be integrated with the Seismic Evaluation report that is concurrently being performed by Odeh Engineers.

STANDARD OF CARE AND USE OF REPORT

Please note that the results of this investigation are limited to visual observations of the accessible areas only. While we have made our best efforts to thoroughly review the areas of concern, many conditions were concealed by architectural finishes or were otherwise inaccessible, and therefore additional damage or other unforeseen conditions may be present. The findings of this report therefore represent our best professional opinion based on the information available to us at this time.

We understand that this report is intended for use only by Kaestle Boos Associates and their client to evaluate the existing structural condition of the Minuteman High School building. In any budgeting, the owner must carry adequate contingency for hidden or unforeseen conditions that are not identified or are worse than described herein.

Please note that all dimensions of the existing structure given herein are approximate and based on measurements of representative members. Dimensions can and will vary, and must be considered as "+/-" in all cases (whether or not the "+/-" symbol is indicated).

DOCUMENTS AVAILABLE

Kaestle Boos Associates provided Odeh Engineers with a virtually complete set of the original Architectural and Structural Design Drawings to assist in the creation of this report.

KEY PLAN

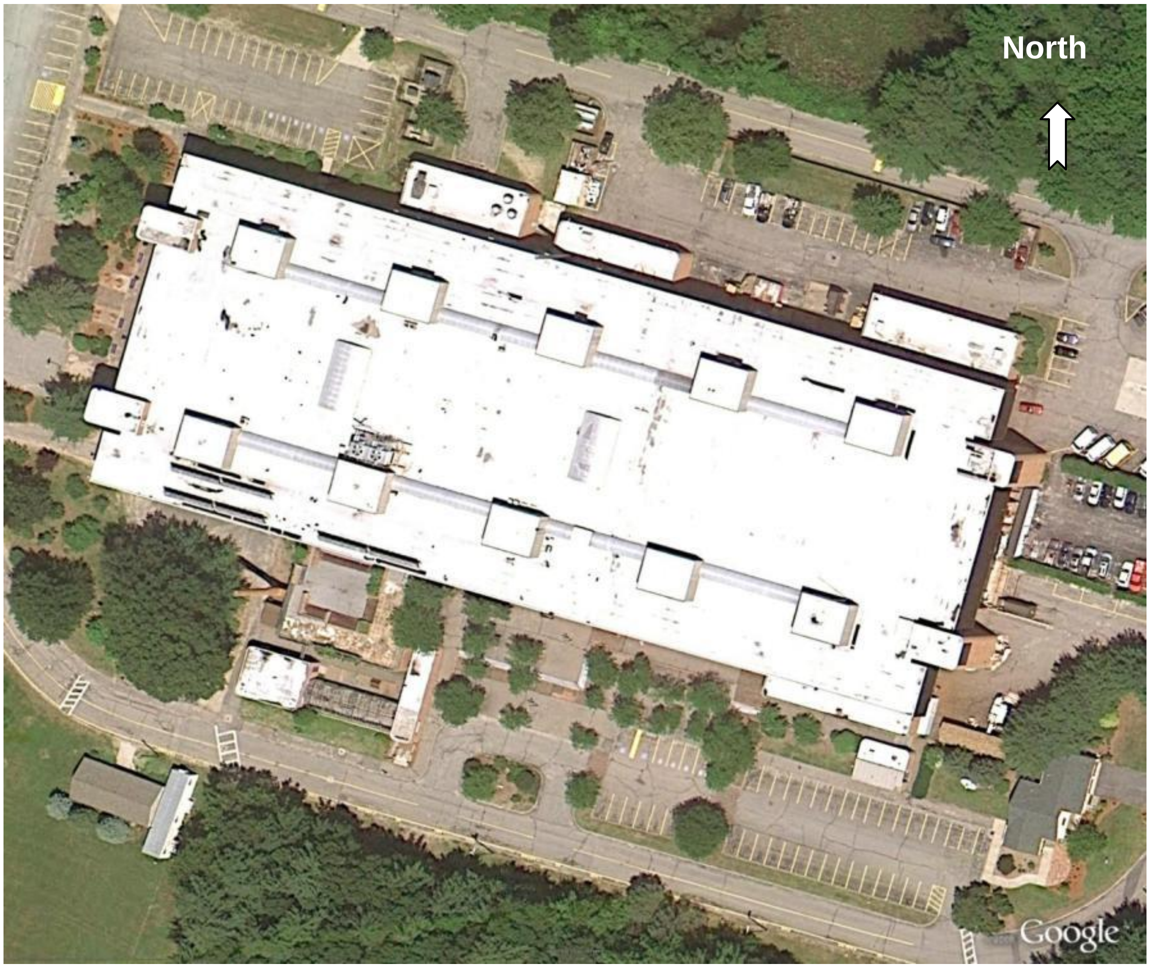

FIGURE 1

Aerial photograph of the Minuteman High School located at 758 Marrett Road in Lexington, Massachusetts. This Key Plan is oriented such that north is vertically up in this image.

ACTIONS TAKEN

Odeh Engineers, Inc. undertook the following actions to complete this structural evaluation:

- On Tuesday, June 19, 2012, Odeh Engineers Project Engineer Dan Batt, P.E. and Field Engineer Paul Wilkinson visited the Minuteman High School. Upon arrival, the Engineers made their presence known to Mr. Matthew MacLean, Facilities Coordinator for the Minuteman High School. Mr. MacLean assigned a member of the Minuteman High School maintenance staff to accompany and assist the Engineers in accessing the building spaces. The Project Engineer and the Field Engineer subsequently conducted a visual examination and assessment of the Minuteman High School building looking for evidence of corrosion, deterioration, displacement, cracks and other indications of structural decay and/or distress.
- On Wednesday, July 11, 2012, Odeh Engineers Field Engineer Paul Wilkinson returned to the Minuteman High School building to perform further investigation of the multi-story building expansion joints.
- Prepared this written summary of findings and recommendations.

DESCRIPTION OF EXISTING STRUCTURE

The Minuteman High School main building is a large, multi-story, steel-framed building constructed on cast-in-place concrete foundations. The ground floor of the building is a concrete slab on grade. A large, below-ground cast-in-place concrete swimming pool is located at the western end of the building.

The exterior walls are typically constructed with brick veneer cavity walls, or with either corrugated or standing-seam Cor-Ten metal siding panels.

The one-story kitchen cafeteria and shop buildings located on the north side of the building are constructed with steel columns supporting steel roof girders and steel roof beams. The steel roof framing supports concrete slabs on composite metal deck.

The one-story Boiler Room on the south side of the building is a steel-framed building with a formed, cast-in-place concrete roof slab bearing on the steel roof beams. The roof of the Boiler Room building was formerly used as an outdoor patio area. The roofing system on this building is unknown.

The elevated floors and the roof of the multi-story main school building are typically constructed with steel columns supporting steel girders and steel beams. The steel framing of the elevated floors and the roof support concrete slabs on composite metal decking.

There are two expansion joints, running north/south through the multi-story building at approximately the one-third points in the school building. The building is laterally braced in the north/south direction with braced frames. Moment frames are used to brace the building in the east/west direction.

The two pairs of stair towers at the east and west ends of the building are constructed with concrete block masonry back-up walls with a brick veneer. The masonry block back-up walls support the steel framing for the metal pan stairs and the metal deck roof at the top of the stair towers.

The roofing system on the school building is a non-ballasted rubber roofing membrane.

OBSERVED STRUCTURAL DEFICIENCIES, POTENTIAL PROBLEM AREAS, AND COMMENTS

The following structural deficiencies and potential problem areas were observed by Odeh Engineers, Inc. during our investigation of the existing building. Each observation is accompanied by comments on the cause and impact of the deficiency. Please refer to the photographs in Appendix A for additional information.

- **Cracks in the concrete floor slab-on-grade throughout the school building:** Numerous cracks were observed in the ground floor concrete slab on grade. **(Photo #1)**
    - **COMMENT:** The cracks in the Ground Floor concrete slab on grade appear to be shrinkage cracks caused by improper construction or improper curing of the concrete floor slab. These cracks degrade the usefulness and serviceability of the concrete floor slab, but are not structurally detrimental.

- **Cracks and spalls in the concrete floor slab in the natatorium and abutting pool filter room:** Several cracks and spalls were observed in the concrete apron around the swimming pool and in the floor of the adjacent filter room. **(Photo #2.)**
    - **COMMENT:** The cracks and spalls in the apron around the swimming pool and in the pool filter room are likely exacerbated by the corrosive action of the chlorine that is contained both in the water and in the air in these rooms. Preventative actions should be taken to repair these cracks and spalls to arrest further degradation of the floor slabs in these rooms.

- **Deteriorated metal form deck under concrete between pool and surge tank in pool filter room:** It was reported to Odeh Engineers that the metal deck under the concrete in the tunnel area between the pool and the pool surge tank in the filter room was deteriorated. This area can only be accessed when the pool is drained. **(No photos available.)**
    - **COMMENT:** Odeh Engineers review of the original structural drawings

for this area shows metal form deck at this location. It appears that the metal form deck is used only to act as a temporary form for the cast-in-place concrete slab until the concrete hardened. Provided the structural concrete remains in good condition, the deteriorated metal form deck could be removed with no adverse effects. Alternatively, the metal form deck can be left in place, cleaned, and painted with an epoxy coating system.

- **Cracks and spalls in the natatorium concrete bleachers at guardrail inserts:** Large cracks and spalls have occurred at several locations in the natatorium where the guardrails for the bleacher seating around the swimming pool are pocketed into the concrete. **(Photos #3 and #4.)**
    - **COMMENT:** The cracks and spalls in the concrete where guardrails are pocketed into the concrete bleachers appear to be caused by the expansive corrosion of the steel inserts that secure the ends of stainless steel guardrail posts. Under the current conditions, the guardrails may not be able to resist the thrust for which they were designed. Odeh Engineers recommends that the guardrail steel inserts be replaced with stainless steel inserts and the cracked and spalled concrete be repaired with modern, high-performance concrete repair products.

- **Numerous cracks in interior masonry block partition walls:** Throughout the school building, many cracks were observed in the non-bearing concrete masonry block partition walls. The cracks are typically found where the building steel columns are contained within these walls. **(Photos #5 and #6.)**
    - **COMMENT:** The cracks in the interior masonry block partition walls appear to have occurred due to two main reasons. Apparently during construction of these walls, there was not sufficient room provided within the wall cavities to accommodate the movement of the building structural frame. Compounding this problem is the fact that weaknesses in the blocks are created by having to notch the masonry block webs and face shells to accommodate the structural members. The movement of the structural frame due to lateral loads and thermal dimensional changes may impinge upon the notched blocks, causing the walls to move and crack. Secondly, there are virtually no control joints in the masonry walls to allow for dimensional changes in the masonry due to temperature and moisture variations. A third possible factor causing the cracks and displacements in the masonry may involve the expansion joints in the multi-story building. This factor will be addressed later in this section of the report. Although the walls are structurally stable in their current condition, the cracks in the masonry block partition walls substantially reduce the strength of these walls to resist lateral movements during severe wind or seismic events. In addition, fragments of masonry block may fall out of these cracks over time and could cause personal injury.

- **Water infiltration and the growth of vegetation has damaged the exterior**

brick walls of the Boiler Room building and the terrace walls and pavers above the Boiler Room building: Long term water infiltration and the subsequent growth of vegetation has damaged the exterior brick walls of the Boiler Room building and the brick walls and the patio pavers of the terrace above the roof of the Boiler Room building. **(Photos #7 to #11.)**

- **COMMENT:** In addition to damaging the exterior walls of the Boiler Room building, and the terrace walls and pavers above, the water infiltration may be jeopardizing the structural concrete roof slab of the Boiler Room building. It was reported to Odeh Engineers that some minor repairs to the exterior brick veneer walls of the Boiler Room building had been performed since Odeh Engineers previous investigation in 2008. However, no long-term, systematic repairs to these exterior brick walls have been undertaken.

- **The load-bearing masonry block walls at the two pairs of stair towers located at the east and west ends of the school building are cracked and displaced:** The masonry block walls at the two pairs of stair towers are cracked and displaced. The most significant cracks occur in the masonry pillars on each side of the window openings just below the high roof framing elevation. **(Photos #12 to #16.)**
  - **COMMENT:** Based on our recent examination of these structures, it appears that the cracking and displacements of the load-bearing masonry block walls of these stair towers may be due to the movement of the steel frame of the building from thermal expansion and contraction (see discussion of improperly constructed roof expansion joints below), and/or from lateral wind loads.
    Additionally, the tall slender nature of the masonry pillars (which appear to be unreinforced), make them particularly susceptible to flexural cracking due to lateral movement of the stair tower. At the high roof level, the stair structure is not tied back to the main superstructure and therefore these pillars may be moving excessively under wind loads.
    In order to mitigate additional cracking and deterioration of the masonry stairway walls, Odeh Engineers recommends that the slender "pillars" at the top of each stairwell be removed and reconstructed using solid grouted and reinforced masonry piers.

- **The roofing system on the school building has reached the end of its useful life:** The rubber roofing membrane on the roof of the building has reportedly been patched many times. The failed roofing system has led to roof leaks into the building. The roof leaks have caused some corrosion and deterioration of the composite metal roof decking. Many of these roof leaks have occurred at, or near the roof drains, and along the two expansion joints in the building. **(Photos #17 to #20.)**
  - **COMMENT:** The roofing system needs to be replaced as soon as possible. Continuing roof leaks may cause significant deterioration of the composite metal roof decking and the concrete slab. Long-term roof leaks can create serious structural issues if left unattended.

- **Minor cracking of the exterior brick walls:** Minor cracking of the exterior brick walls was noted at several locations. **(Photos #21 and #22.)**
  - **COMMENT:** In general, the cracking of the brick veneer appears to be the result of an insufficient number of control joints to allow for the expansion and contraction of the brick. A maintenance program of repairing the bricks and raking and repointing the mortar joints should be established to prevent water from entering the building envelope through these cracks. The creation of additional control joints should be considered.

- **Failed or missing joint sealants in the exterior brick walls:** Odeh Engineers noted several locations where the sealants in the existing control joints in the exterior brick walls has failed or is missing. **(Photos #23 to #25.)**
  - **COMMENT:** A maintenance program should be established to restore the sealants and the functionality of the control joints to prevent water infiltration and to assure the long-term performance of the brick veneer.

- **Deteriorated closure plates on base of Cor-Ten siding:** The closure plates at the base of the exterior wall vertical metal siding panels have deteriorated at many locations around the building. It was reported to Odeh Engineers that the deterioration of some of the bottom closure plates was so severe that the closure plates were removed. Birds and bees are nesting in the voids of the metal siding panels that are exposed by the deteriorated or missing closure plates. **(Photos #26 and #27.)**
  - **COMMENT:** The deteriorated bottom closure plates for the exterior wall metal siding panels are not structural. This is an architectural issue.

- **No sliding movements of structural frame members was observed at either of the multi-story building roof framing expansion joints:** At all roof framing expansion joint connections observed by Odeh Engineers, there was no evidence of the sliding movements of the roof framing members that is expected at the expansion joints. Furthermore, the roof level expansion joints were not constructed in conformance with the structural details. **(Photos #28 to #31.)**
  - **COMMENT:** The steel members at the roof level expansion joints typically have the greatest amount of movement due to the changes in temperature from the heat of the sun and the winter cold. The roof framing members at the expansion joints are typically covered with a thick, stiff coating of spray-applied fire resistance material (SFRM). Assuming that the expansion joints were functioning properly, cracks should have developed in the SFRM where the opposing sides of the roof framing structural members at the expansion joints would move relative to each other. No cracks in the SFRM or any other indications of movement of the opposing members on each side of the expansion joints were in evidence.

    In addition, the original structural details of the roof level expansion joints show a bent plate supporting the concrete slab from the adjacent girder to the joint. In the existing construction, no bent plate was installed and the metal decking extending from the roof girder to the joint supports the concrete roof slab. This means that the concrete roof slab effectively ties together both sides of the expansion joint, likely restraining the movement of the joint.

The apparent lack of functioning expansion joints may cause excessive movements of the steel framing over the length of the building and may be exacerbating the cracking and displacements of the masonry walls found throughout the building.

As part of any renovation, Odeh Engineers recommends that the expansion joints be reviewed and perhaps repaired to allow for improved movement in the steel frame. Odeh Engineers will also address concerns related to seismic loading through these joints in a separate report on seismic deficiencies in the building.

CONCLUSION

The building is in generally good condition with the exception of the localized deficiencies identified above. Odeh Engineers has performed additional investigation into specific areas of cracking and structural distress observed in our previous report from several years ago, and provided additional guidance on the potential causes and repairs of these items.

We trust that this report meets your needs at this time. Should you have any questions, or require any additional information, please do not hesitate to contact this office.

Sincerely,

Paul Wilkinson
Field Engineer

David J. Odeh, PE, SECB
Principal in Charge

APPENDIX A: PHOTOGRAPHS

Photo #1

Photo of one of the many cracks in the ground floor concrete slab on grade found throughout the school building.

Photo #2

This photo shows some of the cracks and spalls in the natatorium and pool filter room concrete floor slab.

Photo #3

This photo shows one of the several locations where cracks and spalls have occurred where the natatorium bleacher seating guardrails are pocketed in the concrete.

Photo #4

This photo shows another location where cracking and spalling of the natatorium bleacher seating has occurred where the guardrails are pocketed in the concrete.

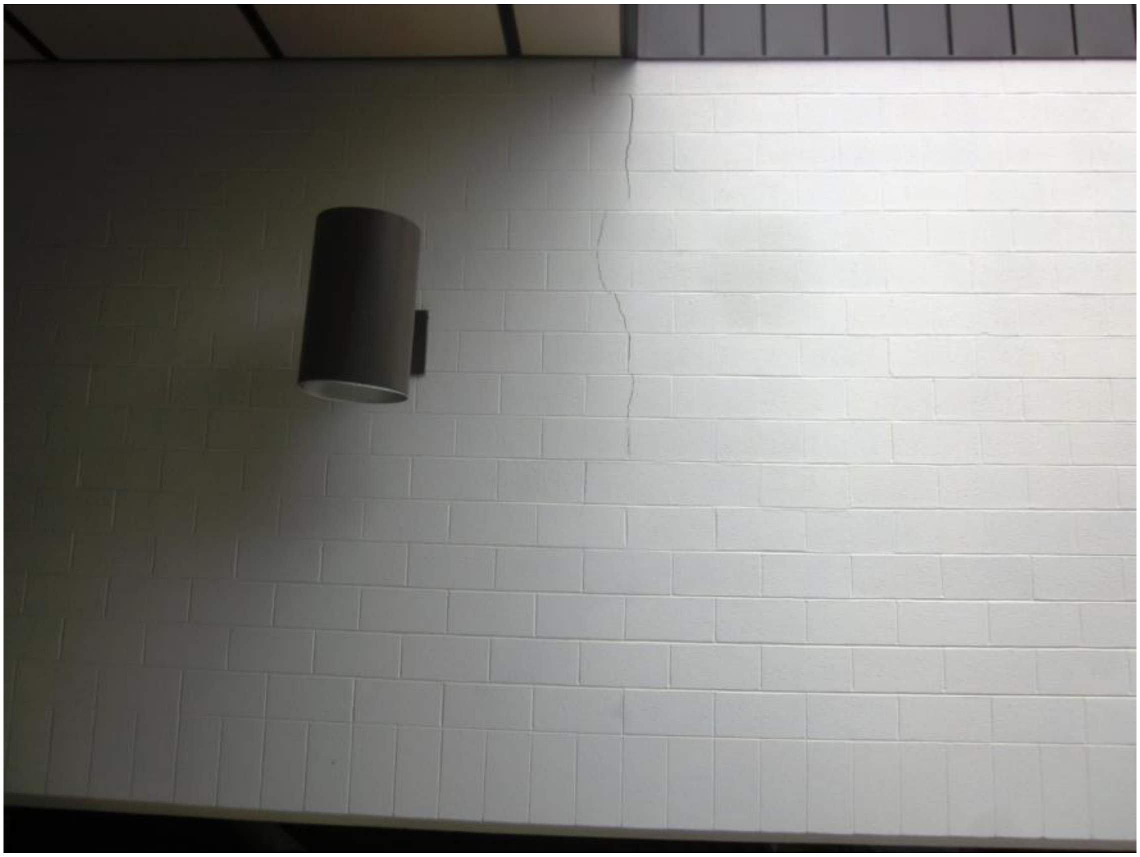

Photo #5

This photo shows one of the many cracks found in the non-bearing interior masonry block partition walls.

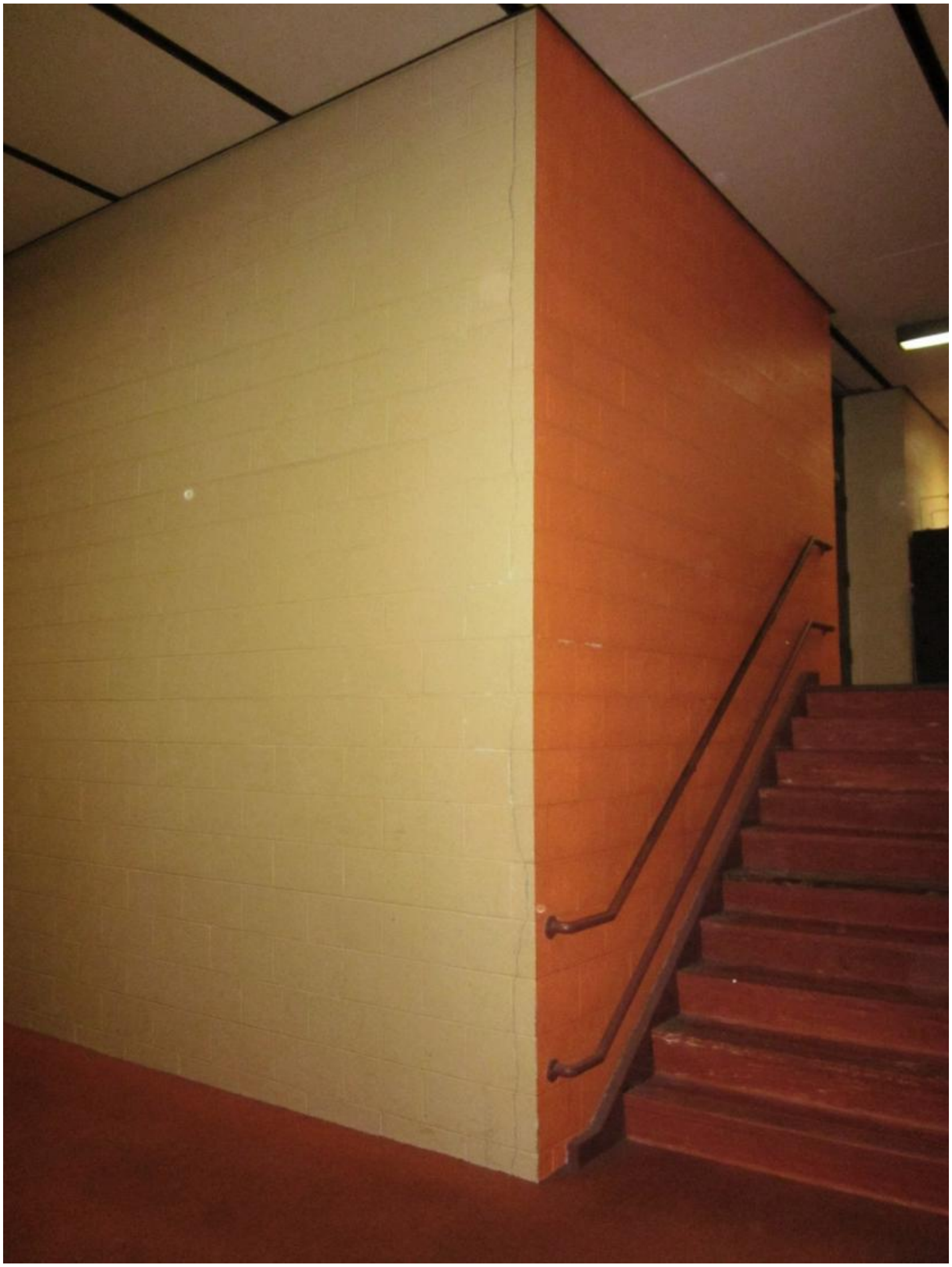

Photo #6

This photo shows another of the many locations throughout the school building where the interior masonry block partition walls are cracked.

Photo #7

This photo shows the damage to the brick walls and the patio pavers at the terrace above the roof of the Boiler Room building due to long-term water infiltration and vegetative growth.

Photo #8

This photo shows another view of the damage done to the terrace above the Boiler Room roof from long-term moisture infiltration and vegetative growth.

Photo #9

This photo shows the efflorescence leaching from the exterior brick walls along the east side of the Boiler Room building resulting from water infiltrating these walls from the terrace above.

Photo #10

This photo shows another view where water infiltration from the terrace above is damaging the south brick wall of the Boiler Room building.

Photo #11

This photo shows the efflorescence leaching from the west exterior wall of the Boiler Room building due to water infiltration from the terrace above.

Photo #12

This photo shows the typical cracking of the masonry block walls found at each of the multi-story stair towers located at the east and west ends of the school building.

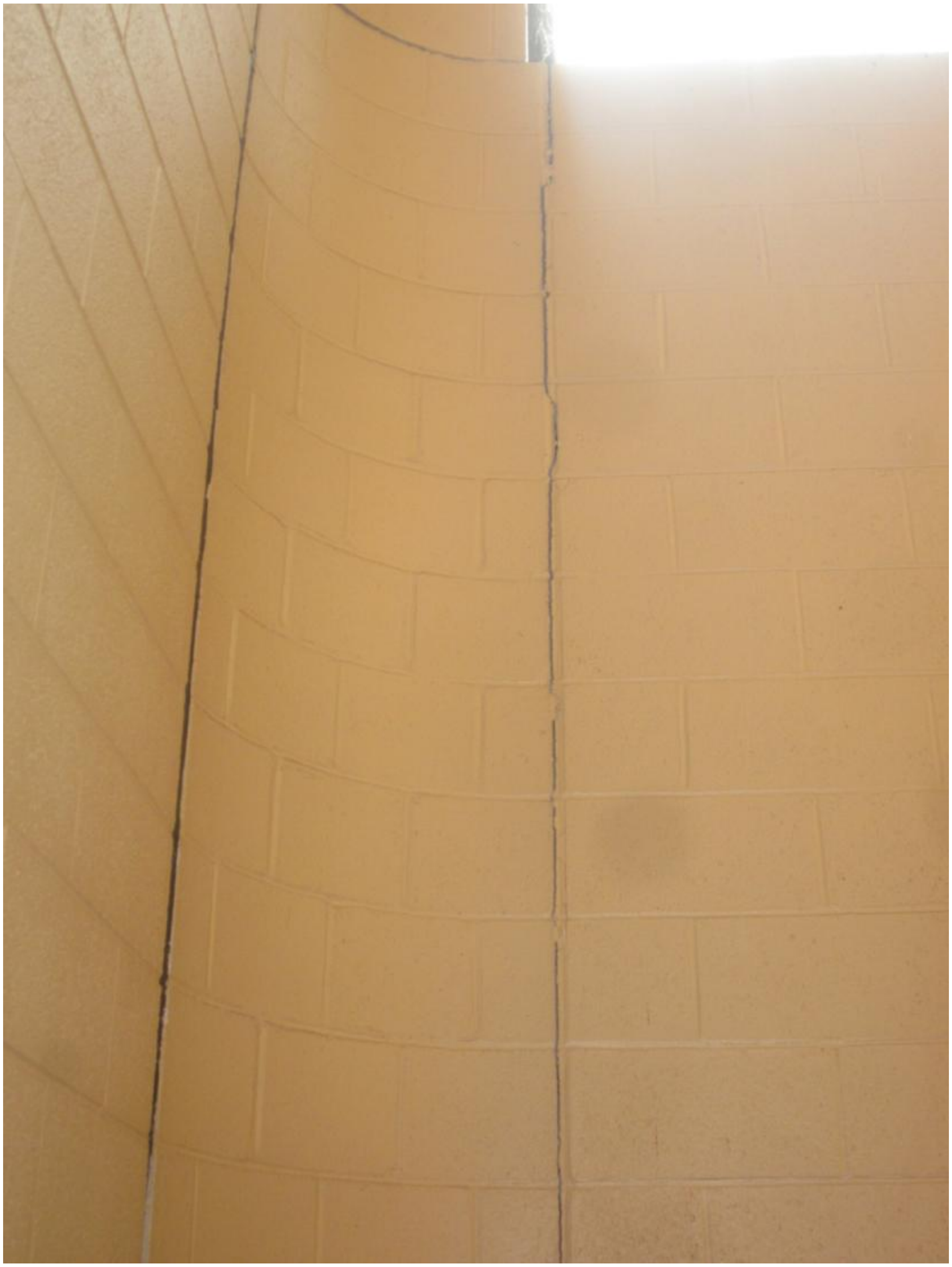

Photo #13

This photo shows the vertical crack in the load-bearing masonry block walls of one of the multi-story stair towers at the east and west ends of the building.

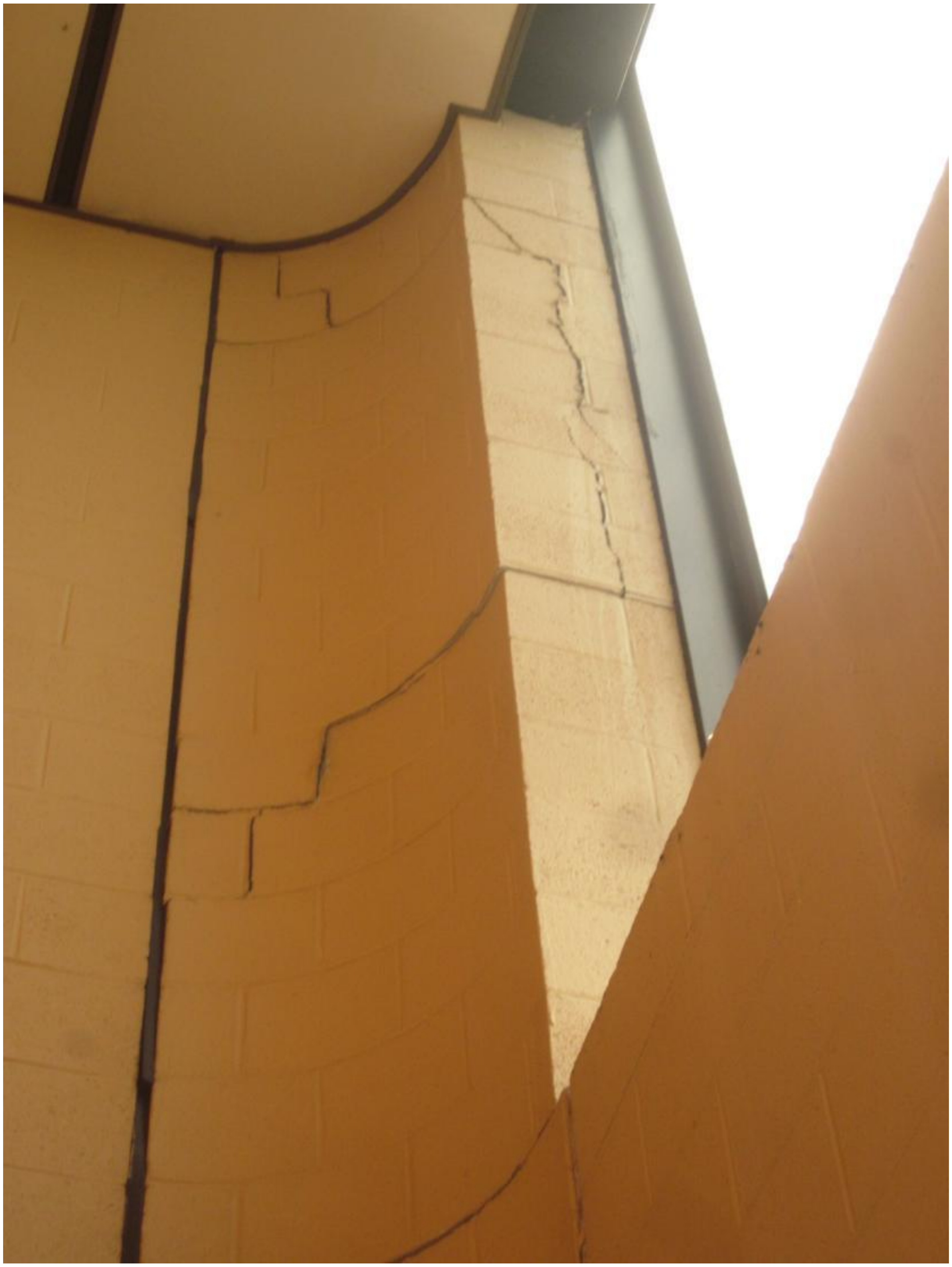

Photo #14

This photo shows the cracking and displacements of the masonry pier along the window of the multi-story stair towers at the east and west ends of the school building.

Photo #15

This photo shows the cracking and displacement of another of the concrete block walls in the stair towers at the east and west ends of the school building.

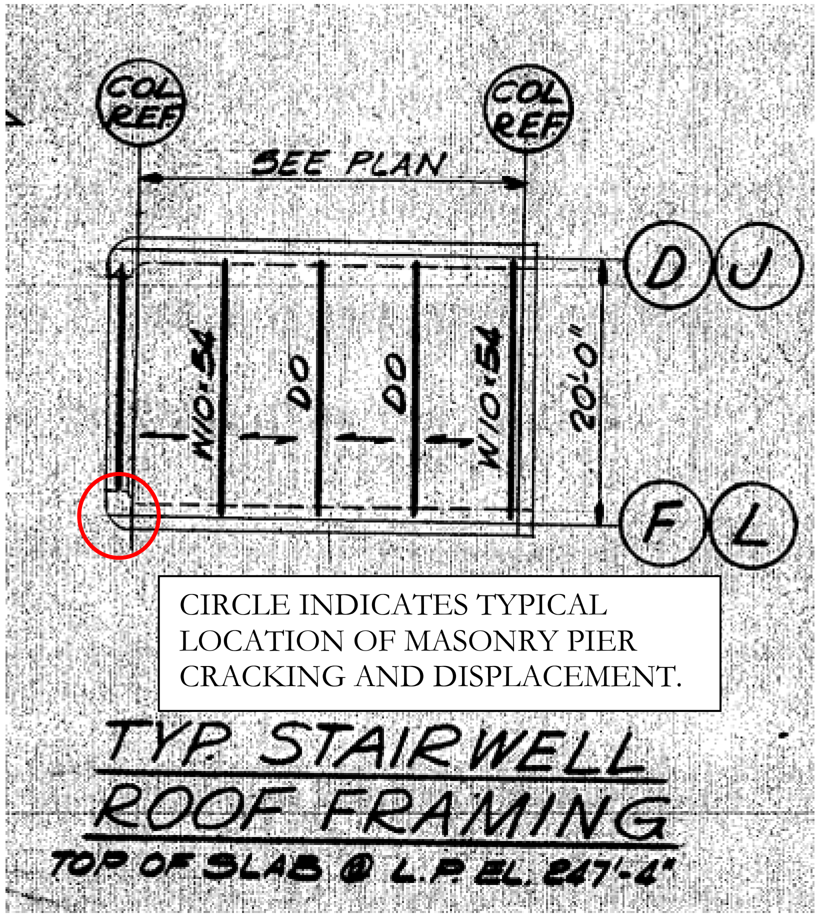

Photo #16

This photo shows a copy of the typical stairwell roof framing of the stair towers at the east and west ends of the school building.

Photo #17

This photo shows some of the many patches in the aged roofing system on the school building roof.

Photo #18

This photo shows one of the locations where minor corrosion of the composite metal roof deck has occurred apparently from leaks in the roofing membrane.

Photo #19

This photo shows the corrosion of the composite metal roof decking along one of the expansion joints in the roof of the school building.

Photo #20

This photo shows another of the roof leaks that has occurred along the expansion joint adjacent to the Instructional Media Center.

Photo #21

This photo shows one of the locations where minor cracking of the exterior brick veneer has occurred.

Photo #22

This photo shows another location where cracking of the brick veneer has occurred.

Photo #23

This photo shows one of the many locations where the joint sealant in the exterior brick wall control joint is partially missing.

Photo #24

This photo shows another location where the sealant in the exterior brick wall control joint is missing.

Photo #25

This photo shows another location where the sealant is missing from the top of the control joint, and the sealant is being squeezed out from the lower portion of the exterior brick veneer control joint.

Photo #26

This photo shows the deterioration of the bottom closure plate at the base of the Cor-Ten metal siding on the west side of the school building.

Photo #27

This photo shows a location where the bottom closure plate for the exterior wall metal siding panels was reportedly removed due to significant deterioration of the closure plate.

Photo #28

This photo shows one of the steel roof beams framing into a steel roof girder along the west expansion joint of the multi-story building. The gray material on the roof beam and girder is the spray-applied fire resistance material (SFRM). The roof beam is seated on a slide-bearing assembly mounted on the roof girder. No visible evidence of cracking of the SFRM or other indications of movement of the steel framing on opposite sides of the expansion joint can be seen.

Photo #29

This photo shows another of the sliding-bearing assemblies located along the west expansion joint of the multi-story building. Again no evidence of the expected movement of the framing members on opposing sides of the joint can be seen.

Photo #30

This photo shows the sliding-bearing assembly located along the east expansion joint of the multi-story building. Note the lack of the bent plate and the installation of the metal roof decking between the roof girder and the joint.

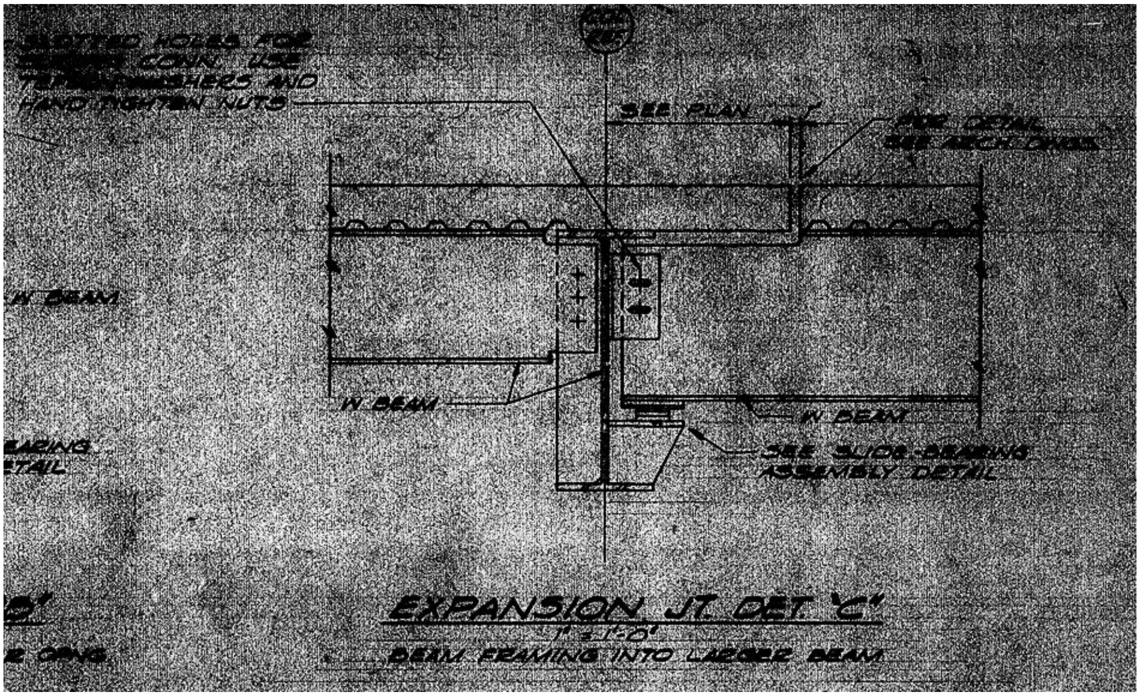

Photo #31

This photo shows a copy of the typical roof framing level expansion joint detail in the multi-story building. Notice the steel bent plate that was to extend from the roof girder to the slab expansion joint.

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Prepared for:

Michael McKeon
Kaestle Boos Associates
325 Foxborough Boulevard #100
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October 28, 2013

TABLE OF CONTENTS

INTRODUCTION AND SCOPE OF WORK

At the request of Mr. Michael McKeon, AIA, of Kaestle Boos Associates in Foxborough, MA, Odeh Engineers performed this Seismic Evaluation of the Minuteman High School located at 758 Marrett Road in Lexington, MA.

The existing building is a high school that was constructed around 1972-73. We understand that the building is being considered for substantial mechanical, electrical, and plumbing (MEP) system upgrades to improve its energy efficiency, and may also be modified architecturally.

In February 2009 this office prepared a preliminary seismic evaluation of the existing building based on the superseded 7th Edition of the Massachusetts State Building Code. Since this time, Massachusetts has adopted a new 8th Edition building code based on the International Existing Building Code 2009 (IEBC 2009) with selected amendments which has been in effect since February 6, 2011.

In order to update the original 2009 study and satisfy your request for a more generalized seismic evaluation of the existing building, we undertook the following scope of work:

- Performed a new evaluation of the structure based on the provisions of the 8th Edition of the Massachusetts State Building Code, to identify Code-required seismic upgrades that would be triggered by the proposed MEP and architectural renovations, using the "work area method" ("work area" refers to the type and square foot area of the building being impacted by the proposed project).

  Note that the IEBC 2009 provides several methods of compliance for seismic loading on the structure, with different triggers for seismic retrofit depending on the type of renovations that are being performed. For example, if the proposed building renovations are non-structural, such as replacement of mechanical equipment, only limited seismic retrofit would be triggered. On the other hand, if major portions of the structural framing are modified by the renovations, a complete seismic retrofit to modern standards may be triggered. This is explained in more detail in the "Building Code Requirements" section of this report.

- Performed a "Tier 1 Evaluation" of the building using FEMA 310/ASCE 31-03 "Seismic Evaluation of Existing Buildings", 2003, for a "Life Safety" performance level.

  ASCE 31-03 is a standard that is intended to establish the likely performance of a building for a design level earthquake. Using a multi-tiered approach, the standard can be used to evaluate a building for either "Life Safety" or "Immediate Occupancy" performance levels (see Appendix D for definitions of these terms as well as other technical terms used in this report).

While not a substitute for the Code, ASCE31-03 is a referenced standard in the current edition of the Massachusetts State Building Code. Unlike the Building Code, the standard is voluntary and not specifically triggered by renovations or other work on the building. Also unlike the Building Code, the standard allows the user to select a "Performance Level" for retrofit, instead of using one set of prescriptive requirements. ASCE 31-03 is useful for owners to establish the expected performance of a building and develop a program of voluntary seismic retrofit. It can also be used (as an optional alternate) to satisfy the requirements of the Building Code when a major seismic retrofit is triggered.

The ASCE 31-03 standard requires a multi-tiered evaluation approach, starting with a "Tier 1 Evaluation", which involves the completion of checklists of evaluation statements that identifies potential deficiencies in a building based on the performance of similar buildings in past earthquakes. The Tier 1 Evaluation consists of three sets of checklists that allow a rapid evaluation of the structural, nonstructural, and foundation/geologic hazard elements of the building and site conditions. "Quick Checks", or rapid calculations based on simplified assumptions, are also performed during a Tier 1 Evaluation to help identify seismic deficiencies. If deficiencies are identified for a building using these Tier 1 checklists, a more detailed Tier 2 evaluation, and possibly a Tier 3 detailed evaluation, of the building may subsequently be conducted to further investigate potential deficiencies.

- Developed recommendations for seismic upgrades to comply with the "Life Safety" performance level of ASCE31-03.

A separate but related study of non-seismic structural deficiencies in the building was also completed under a different contract by this office. The results of this study were published in a separate report dated 7-30-2012 and titled "Minuteman High School – Structural Evaluation 2012 Update".

This report summarizes our findings and recommendations from the seismic study.

STANDARD OF CARE AND USE OF REPORT

Please note that the results of this Tier 1 evaluation are limited to visual observations of the accessible areas only. The Tier 1 evaluation does not consist of any destructive testing as it is intended to be a screening phase only, per ASCE 31-03. While we have made our best efforts to thoroughly review the areas of concern, many conditions were concealed by architectural finishes or were otherwise inaccessible, and therefore additional damage or other unforeseen conditions may be present. The findings of this report therefore represent our best professional opinion based on the information available to us at this time.

We understand that this report is intended for use only by Kaestle Boos Associates and their client to evaluate the seismic deficiencies of the Minuteman High School building. In any budgeting, the owner must carry adequate contingency for hidden or unforeseen conditions that are not identified or are worse than described herein.

Please note that all dimensions of the existing structure given herein are approximate and based on measurements of representative members. Dimensions can and will vary, and must be considered as "+/-" in all cases (whether or not the "+/-" symbol is indicated).

DOCUMENTS AVAILABLE

Kaestle Boos Associates provided Odeh Engineers with a virtually complete set of the original Architectural and Structural Design Drawings to assist in the creation of this report. The drawings we received are numbered S-1 to S-12, prepared by Drummey Rosane Anderson of Wellesley, Massachusetts dated 9 August 1972.

ACTIONS TAKEN

Odeh Engineers, Inc. undertook the following actions to complete this structural evaluation:

- On Tuesday, June 19, 2012, Project Manager Daniel Batt, PE and Field Engineer Paul Wilkinson visited the Minuteman High School. Upon arrival, the engineers made their presence known to Mr. Matthew MacLean, Facilities Coordinator for the Minuteman High School. Mr. MacLean assigned a member of the Minuteman High School maintenance staff to accompany and assist the Engineers in accessing the building spaces. The engineers subsequently conducted a visual examination and assessment of the Minuteman High School building.
- On Wednesday, July 11, 2012, Field Engineer Paul Wilkinson returned to the Minuteman High School building to perform further visual investigation of the multi-story building expansion joints and to compare the as-built condition to the details provided in the original structural drawings.
- Reviewed available drawings.
- Completed ASCE 31-03 Checklists found in Appendix A.
- Prepared structural calculations found in Appendix B.
- Prepared this written summary of findings and recommendations.

DESCRIPTION OF EXISTING STRUCTURE

The Minuteman High School is composed of three main levels (Ground Floor, Second Floor, and Third Floor) as shown on the Key Plans shown in Figures 1-3 below. There is also a framed "Mall" level which is between the Ground Floor and Second Floor levels. This mall level, which is shown on Figure 2: Second Floor Key Plan is near the center or the building and consists of the restaurant, bakery, gift shop, and bank.

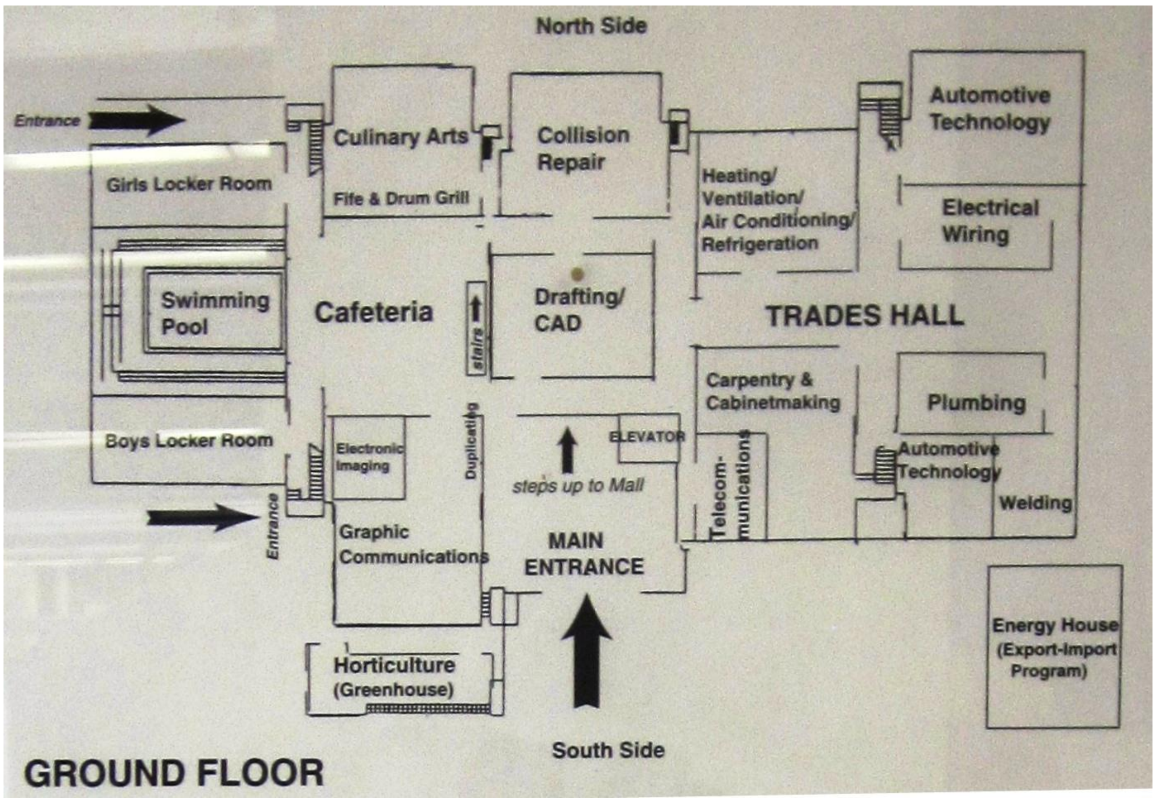


Figure 1: Ground Floor Key Plan

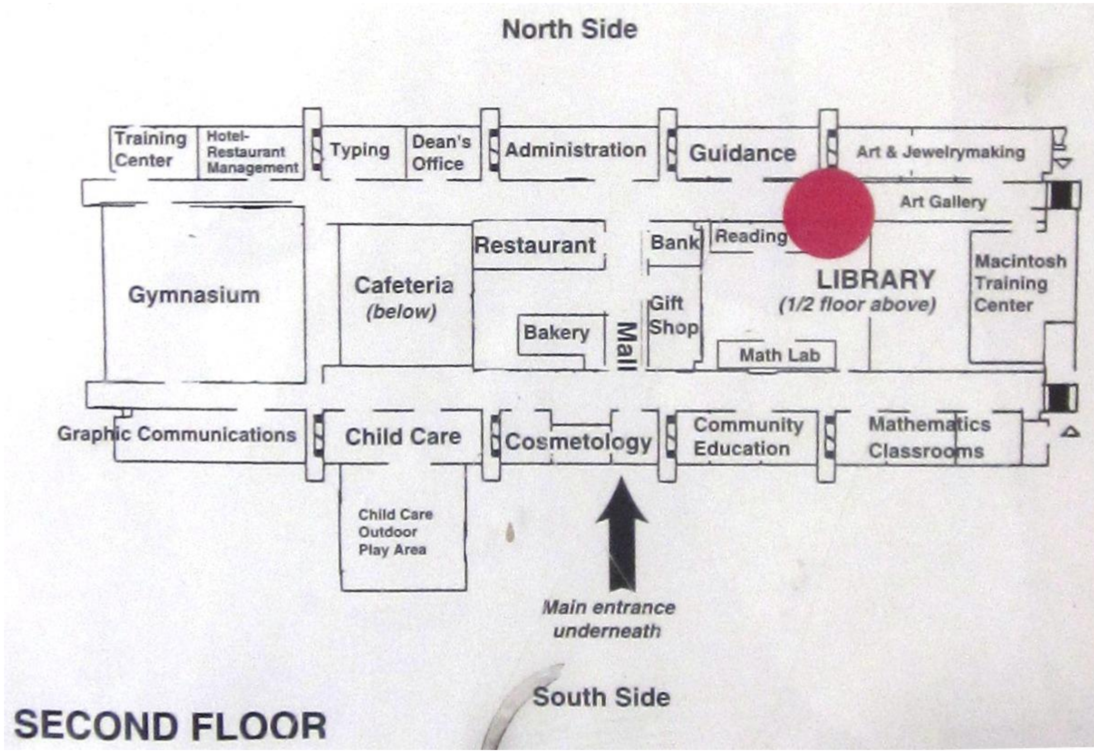


Figure 2: Second Floor Key Plan

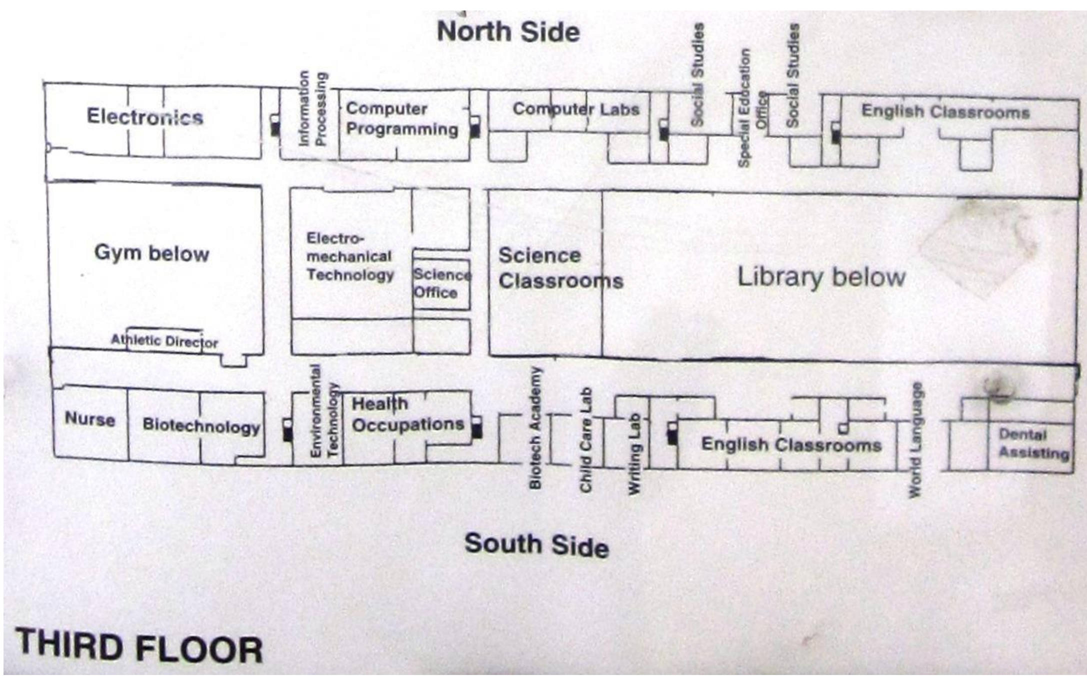


Figure 3: Third Floor Key Plan

The Minuteman High School building is a large, multi-story, steel-framed building constructed on cast-in-place concrete foundations. The ground floor of the building is a concrete slab on grade. A large, below-ground cast-in-place concrete swimming pool is located at the western end of the building, see Figure 1.

The exterior walls are typically constructed with brick veneer cavity walls, or with either corrugated or standing-seam "Cor-Ten" metal siding panels.

The one-story portions of the Culinary Arts, Collision Repair, and Automotive Technology areas located on the north side of the building are constructed with steel columns supporting steel roof girders and steel roof beams. The steel roof framing supports concrete slabs on composite metal deck.

The one-story Energy House on the south side of the building, See Figure 1, is a steel-framed building with a formed, cast-in-place concrete roof slab bearing on the steel roof beams. The roof of the Energy House building was formerly used as an outdoor play area for the childcare center located adjacent to this area, which has since been relocated to a separate building near the school. The roofing system on this building could not be determined as the area has pavers atop the roof.

The elevated floors and the roof of the multi-story main school building are constructed with steel columns supporting steel girders and steel beams. The steel framing of the elevated floors and the roof support concrete slabs on composite metal decking.

The superstructure has an irregular layout (meaning that floors have different shapes on each floor and do not regularly align with each other), with multiple framed floor levels. The main framed levels per the original structural framing plans are designated as "Mall" "Second Floor", and "Third floor", see Figures 4-6. There is also a framed roof level, see Figure 7. Some levels have multiple floor areas that are disconnected, as can be seen from the original structural framing plans which are shown in Figures 4-7. In particular, the Mall Level is composed of several isolated sections, as will be discussed in more detail later in this report, see Figure 4.

In general, the lateral force resisting system comprises the following structural systems:

- Horizontal floor and roof diaphragms consisting of composite concrete slabs on steel deck. Diaphragms are the horizontal floor and roof structures that servie to carry seismic loads to the vertical bracing systems of the structure.
- North-South direction: concentric steel braced frames, with wide flange columns and double angle braces, with shallow footing foundations.
- East-West direction: Two pairs of moment resisting frames (four lines total) extending most of the length of the building, located near the central axis of the structure in the east-west direction. The frames consist of wide flange columns and wide flange beams with welded connections, and rest on concrete footing foundations.

- Note that in several areas of the intermediate Mall level, diaphragms are not directly attached to the vertical bracing or moment frame lines, meaning that these areas do not have an explicitly designed bracing system. See Figure 4.

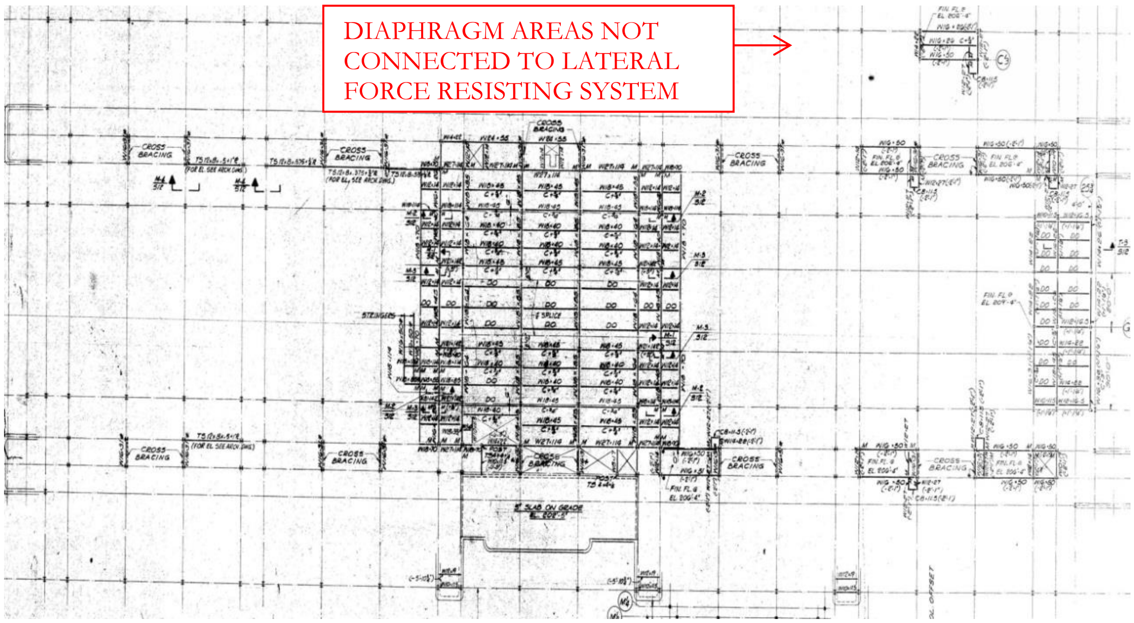


Figure 4: Mall Framing Plan (scan of original design drawing)

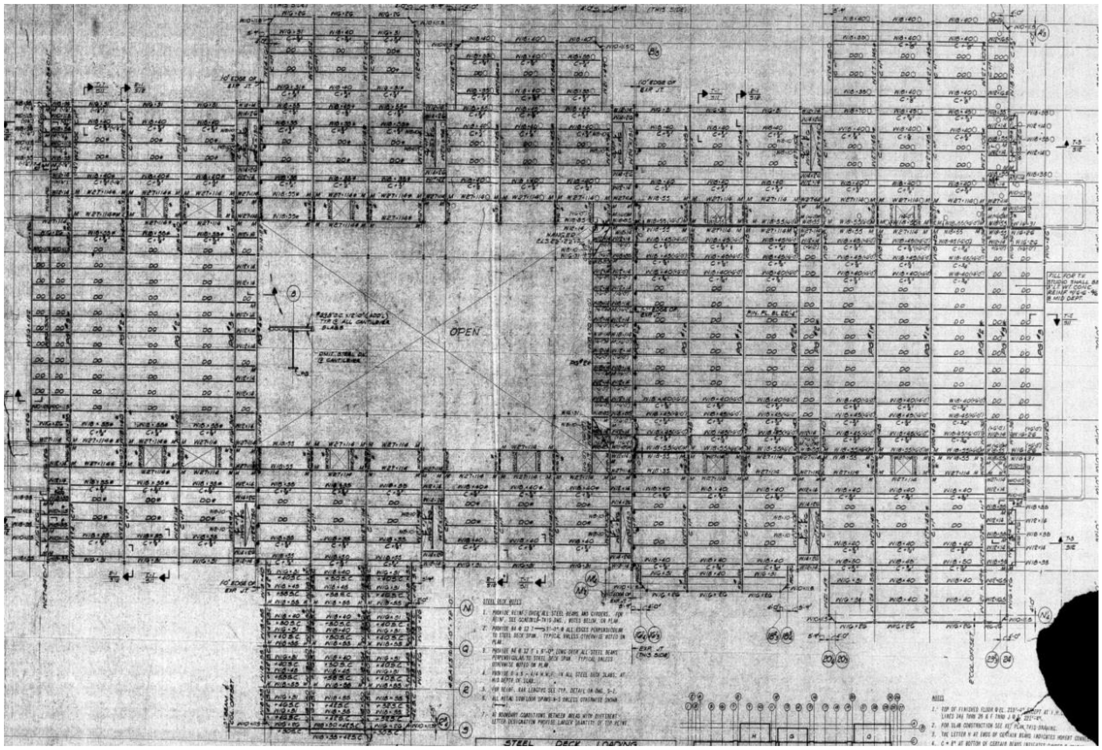


Figure 5: Second Floor Framing Plan (scan of original design drawing)

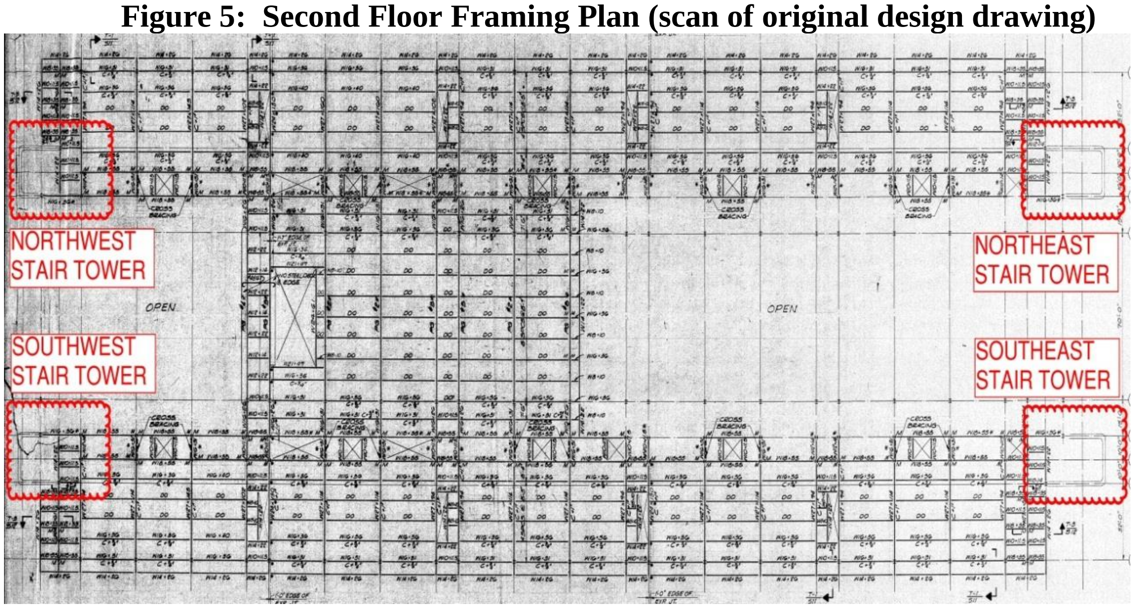


Figure 6: Third Floor Framing Plan showing Stair Towers(scan of original design drawing)

The original structural drawings indicate two expansion joints, running north/south through the multi-story building at approximately the one-third points in the school building, See

Figure 7.

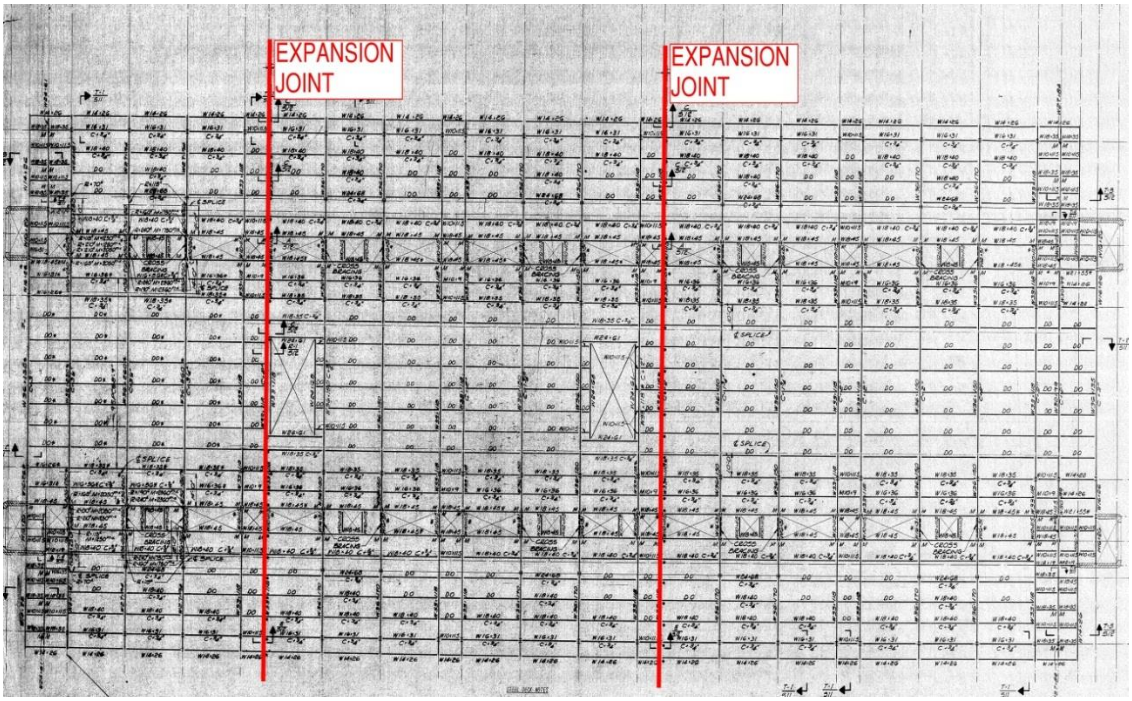


Figure 7: Roof Framing Plan showing Expansion Joints

The two pairs of stair towers at the east and west ends of the building are constructed with concrete block masonry back-up walls with a brick veneer. The masonry block back-up walls support the steel framing for the metal pan stairs and the metal deck roof at the top of the stair towers.

The roofing system on the school building is a non-ballasted rubber roofing membrane.

FEMA310/ASCE31-03 TIER 1 EVALUATION

The following ASCE 31-03 Tier 1 Evaluation checklists were completed, as required per ASCE 31-03 Table 3-2 based on a "Life Safety" level of evaluation for a structure in a zone of moderate seismicity, which is applicable for Massachusetts.

- 3.7.3 – Steel Moment Frames with Stiff Diaphragms – Basic Structural
- 3.7.4 – Steel Braced Frames with Stiff Diaphragms – Basic Structural
- 3.8 – Geologic Site Hazards and Foundations
- 3.9.1 – Basic Nonstructural Component Checklist

Based on the site visit, review, and "quick check" calculations (see Appendix B), the following ASCE 31-03 checklist items were found to be non-compliant per the ASCE 31-03 requirements (See Appendix A for actual completed checklists):

From 3.7.3 – Steel Moment Frames with Stiff Diaphragms

- **INTERFERING WALLS:** All concrete and masonry infill walls placed in moment frames shall be isolated from structural elements.

Comments: Based on limited visual observation, the masonry infill walls (defined as steel frames with masonry "infill") along the north and south sides of the gymnasium are in moment frames and these masonry infill walls do not appear to be isolated as required from the steel framing. ASCE 31-03 requires this isolation because the masonry is likely unreinforced and was not explicitly designed to accommodate seismic loads on the structure.
Numerous vertical cracks were observed in these masonry walls possibly due to the fact that the infill walls are not properly isolated from the surrounding steel structure. As the steel structure deflects, as designed, under wind loads and gravity loads, the stiff masonry infill walls, which are constructed directly against the steel structure, cannot accommodate these movements possibly resulting in cracks. See photos #1 and #2.

From 3.7.3 – Steel Moment Frames with Stiff Diaphragms and 3.7.4 – Steel Braced Frames with Stiff Diaphragms

- **TORSION:** The estimated distance between the story center of mass and the story center of rigidity shall be less than 20 percent of the building width in either plan dimension for Life Safety.

Comments: There are torsional irregularities in portions of the building near large openings in the diaphragm (such as to the north and south of the opening in the second floor and third floor). The center of mass of each of these areas is offset from the center of rigidity by more than the allowed 20 percent of the diaphragm width.

- **MASS:** There shall be no change in effective mass more than 50 percent from one story to the next for Life Safety.

Comments: Due to the unique layout of the Minuteman High School, this criterion is not satisfied. The "Mall", "Second Floor:", "Third Floor", and "Roof" have been analyzed as separate levels due to the fact that each is at a different elevation and has an isolated diaphragm. The mass of adjacent levels changes by more than the allowed 50 percent. See appendix B for calculations.

- **DETERIORATION OF STEEL:** There shall be no visible rusting, corrosion, cracking, or other deterioration in any of the steel elements or connections in the vertical- or lateral-force-resisting systems.

Comments: Various steel beams and areas of steel deck show signs of deterioration. The deck at the roof level shows corrosion from water infiltration at various locations. See photo #3.

- **TRANSFER TO STEEL FRAMES:** Diaphragms shall be connected for transfer of loads to the steel frames for Life Safety.

Comments: Various areas at the east side of the building, such as at the low roof overhang above the loading dock at the east façade, as shown on "Figure 4: Mall Framing Plan" do not appear to be connected to steel moment frames or cross-bracing. Therefore there is no lateral load path to resist lateral loads in these isolated diaphragms.

FROM 3.9.1 – Basic Nonstructural Component Checklist

- **UNREINFORCED MASONRY (PARTITIONS):** Unreinforced masonry or hollow clay tile partitions shall be braced at spacing equal to or less than 10 feet in levels of moderate seismicity.

Comments: Unreinforced masonry did not appear to be braced at a spacing of 10 feet or less at various locations throughout the building. See photo #4 for a typical example of this condition.

- **SHELF ANGLES:** Masonry veneer shall be supported by shelf angles or other elements at each floor 30 feet or more above ground for Life Safety.

Comments: Shelf angles did not appear to be present in masonry veneer walls spanning more than 30 feet, such as at the exterior stair cores, which are over 40 feet high. See Photo #5.

- **URM WALLS (STAIRS):** Walls around stair enclosures shall not consist of unbraced hollow clay tile or unreinforced masonry with a height-to-thickness ratio greater than 12-to-1.

Comments: The walls in both east stair towers and west stair towers did not appear to meet this requirement. The ratio of height-to-thickness exceeds the criterion stated above. The walls do not appear to be reinforced because of the extensive cracking and displacement observed in these walls.

- **TALL NARROW CONTENTS:** Contents over 4 feet in height with a height-to-depth ratio or height-to width ratio greater than 3-to-1 shall be anchored to the floor slab or adjacent structural walls.

Comments: Various contents throughout the building do not meet this criterion. "Contents" are defined as any non-structural element inside of the building, such as furniture, cabinets, and equipment. The filing and storage cabinets in the Special Education are area do not meet this criterion. See photos #6 and #7.

- **ATTACHED EQUIPMENT:** Equipment weighing over 20 lbs. that is attached to ceilings, walls, or other supports 4 feet above the floor level shall be braced.

Comments: Various mechanical units and other equipment hanging from the ceilings and attached to walls are not braced. See photos #8 and #9.

In addition to the ASCE 31-03 checklists noted above, it was also found that the roof level expansion joints were not constructed in conformance with the structural details on the original structural design drawings, see Figure 8 below. Instead of providing for a sliding joint in the roof plane (as indicated in the drawings), we observed that the joint in fact appears to be rigidly connected and unable to displace independently on each side as originally intended in the design (see photographs #10 and #11).

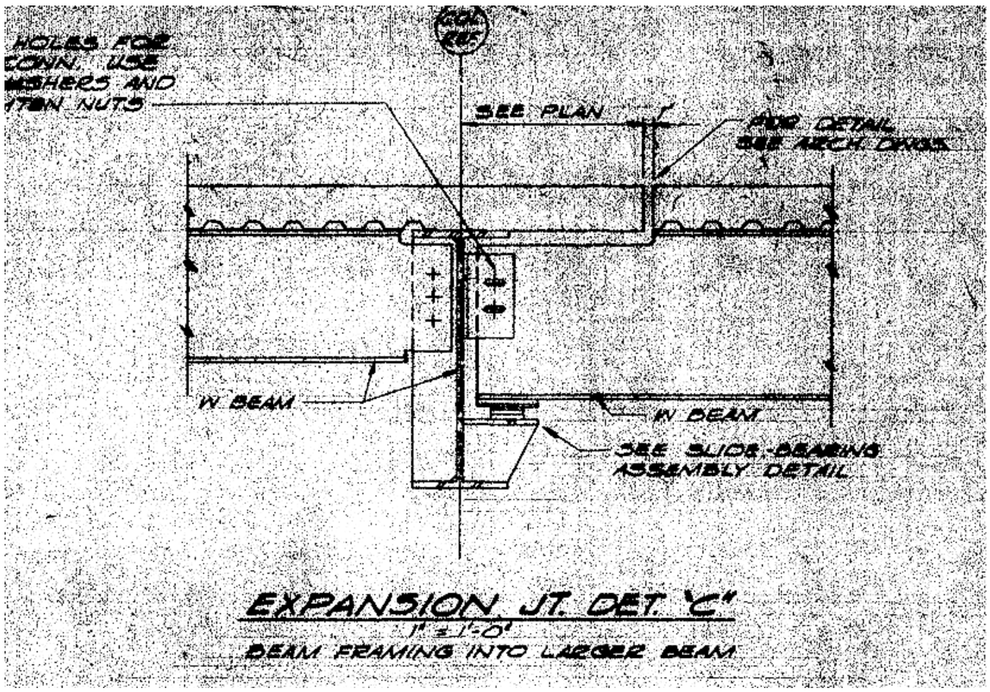


Figure 8: Typical roof framing level expansion joint detail from the original structural design drawings.

The roof framing members at the expansion joints are typically covered with a thick, stiff coating of spray-applied fire resistance material (SFRM), which appears to be original to the structure and is undisturbed even though it bridges between structural elements to either side of the expansion joint (see photos #10 and #11). Assuming that the expansion joints were functioning properly, cracks should have developed in the SFRM where the opposing sides of the roof framing structural members at the expansion joints would move relative to each other. No cracks in the SFRM or any other indications of movement of the opposing members on each side of the expansion joints were in evidence as would be expected if the expansion joints were moving.

In addition, the original structural details of the roof level expansion joints show the roof deck stopping at the girder and the roof slab cantilevering beyond the girder to the expansion joint. In the existing construction, this was not found to the case. The roof deck continued beyond the girder, contrary to what was shown on the structural drawings. There are also 2x shims installed between the deck and the beam below, which do not appear to coincide with the design intent of the joint. It appears that the expansion joints were not constructed in conformance with the original design details and intent thus resulting in the concrete roof slab effectively tying together both sides of the expansion joint, likely restraining the movement of the joint. The apparent lack of functioning expansion joints may cause excessive movements of the steel framing over the length of the building and may be exacerbating the cracking and displacements of the masonry walls found throughout the building, especially at the stair towers (see photos #12 and #13).

BUILDING CODE REQUIREMENTS

Structural analysis of the existing buildings is governed by the current Massachusetts Building Code, 8th Edition. Chapter 34 of this Code, "Existing Structures", indicates that the International Existing Building Code 2009 (IEBC 2009) is to be followed, with Massachusetts amendments (dated August 6, 2010).

The IEBC classifies alterations as Level 1, Level 2, or Level 3, depending on the amount of work (both structural and non-structural for the overall project) to be performed, as well as the occupancy of the building and the proposed scope of structural modifications.

Alteration - Level 1

- Scope: Level 1 alterations include the removal and replacement or the covering of existing materials, elements, equipment, or fixtures using new materials, elements, equipment, or fixtures that serve the same purpose.
- Key structural requirements for "Level 1" work include:
    - Where roofing is to be replaced, wall anchors must be introduced to transfer seismic forces from roof to existing load-bearing walls (no such conditions appear to exist at the school based on our initial study).
    - Unreinforced masonry parapets and chimney elements must be braced to withstand seismic forces.
    - Roof diaphragms and their connections to the main wind force resisting system must be evaluated for the wind loads prescribed by Chapter 16 of the Code for new structures and reinforced if required.

Alteration - Level 2

- Scope: Level 2 alterations include the reconfiguration of space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment.
- Key structural requirements for "Level 2" work include:
    - That the building, as altered, conforms to the minimum requirements established for Level 1 as well as the additional requirements for Level 2 work.
    - New structural members and their connections and anchorage must conform to the Code requirements for new buildings.
    - Where existing structural elements carrying gravity loads are altered (or loads increased due to the renovations, including the effects of snow drifting), such

members must be reinforced to meet the requirements of the Code for new structures.
  - The demand/capacity ratio for existing structural elements carrying lateral loads may not be increased by more than 10% without triggering the requirements for Level 3 work (see below). Furthermore, any building *alteration* that results in the creation of a seismic irregularity (such as a torsional irregularity, soft story, or weak story) will trigger the requirements of Level 3 work.

Alteration - Level 3

- Scope: Level 3 alterations apply where the work area exceeds 50 percent of the aggregate area of the building.
- Key structural requirements for "Level 3" work include:
  - That the building, as altered, conforms to the minimum requirements established for Levels 1 and 2 as well as the additional requirements for Level 3 work.
  - For major alterations (alterations involving structural work exceeding 30% of the total floor and roof areas of the building), the structure as altered must comply with the minimum wind loading prescribed for new buildings, as well as a reduced percentage of the seismic loading prescribed for new buildings.
  - Unreinforced masonry elements (which would likely include the stair towers referenced above and in our concurrent structural report) would require retrofitting per the requirements of Appendix A of the IEBC. Appendix A requirements include enforcement of maximum span/width ratios, bracing and anchorage of wall elements, and possibly reinforcement of deficient members.

Note that, where seismic analysis is required to demonstrate compliance with the IEBC provisions in any alteration category, it is permissible to use the evaluation and design procedures specified in FEMA310/ASCE 31-03. Thus, the Tier 1 analysis results provided in the previous sections of this report may be considered a good guide to the seismic retrofitting requirements that would be required for higher levels of work (such as substantial structural alteration of part or all of the structure).

In order to determine the final upgrade requirements to the structure, we would need to review a plan of proposed modifications and additions to the building to determine which alteration level would be triggered per the IEBC requirements. In addition, we will need to perform some additional investigation to confirm the various elements of the lateral force resisting system within the existing structure.

The above discussion applies only to the *existing* structural elements. All new work is required to conform to the requirements of the current building Code for new structures.

SUMMARY AND RECOMMENDATIONS

In general the Minuteman High School appears to be in sound structural condition to resist gravity and wind loading (with the exception of deficiencies identified in our separate report dated 7-30-2012 and titled "Minuteman High School – Structural Evaluation 2012 Update").

However, there are a number of important deficiencies in the seismic force resisting system that were identified by the Tier 1 study that should be considered for any potential retrofit of the building. *Unless a substantial structural alteration is performed on the building, there is no explicit requirement in the Massachusetts State Building Code to correct these deficiencies*. However, if the owner desires to improve the safety and reliability of the structure for earthquake loading, we believe that the following minimum work would be required to achieve a Life Safety performance level in conformance with ASCE 31-03:

- Correct torsional irregularity in the upper floor level diaphragms by introducing new bracing or moment resisting frames near the exterior of the building in the longitudinal direction.
- Correct load path deficiencies at isolated diaphragm levels by introducing new bracing or moment resisting frames tied directly to these floor areas.
- Review the vertical irregularity in floor mass (due to substantial additional mass at roof level of building compared to some lower levels) as part of a more detailed seismic study to better understand the influence of this condition on the dynamic response of the structure. Implement supplemental or strengthened bracing and moment resisting frames to ensure adequate capacity of the lateral force resisting system.
- Implement and/or improve the seismic bracing of mechanical, electrical, and plumbing equipment.
- Provide bracing and anchorage of heavy architectural components (such as heavy lighting fixtures) and tall/slender contents (such as filing cabinets).
- Provide out of plane bracing for unreinforced masonry partition walls within the building.
- Correct deficiencies in the building expansion joints to allow for adequate seismic movement across the joint and proper isolation of the individual parts of the superstructure as intended by the original design.
- Provide adequate flexible joints between existing masonry infill walls at gymnasium and surrounding moment resisting frames (to ensure displacement compatibility with the system and prevent unintended transfer of seismic loads to the gym walls).
- Rebuild and/or strengthen deficient portions of the unreinforced masonry walls at the stair towers (as also described in the 7-30-2012 Structural Evaluation Report) to correct seismic deficiencies

Using a more comprehensive seismic analysis, the most cost-effective scheme for implementing these retrofits can be engineered. Should the owner wish to proceed with some or all of these seismic upgrades, we would recommend that a more detailed Tier 2 evaluation be performed to better understand the deficient conditions and provide more specific engineering solutions (such as new braced frame locations and sizes). This procedure would involve creation of a computer model of the building to more accurately model the potential forces and displacements of the structure. The more detailed analysis and design is required to create a realistic cost estimate for the retrofit work.

In the meantime, should you have any questions of need more information, please do not hesitate to contact us at 401/724-1771.

Best Regards,

David J. Odeh, PE, SECB
Principal

Daniel Batt, PE
Senior Structural Engineer
Project Manager

Julie Marton, EIT
Structural Engineer

APPENDIX A: CHECKLISTS

APPENDIX B: CALCULATIONS

APPENDIX C: PHOTOGRAPHS

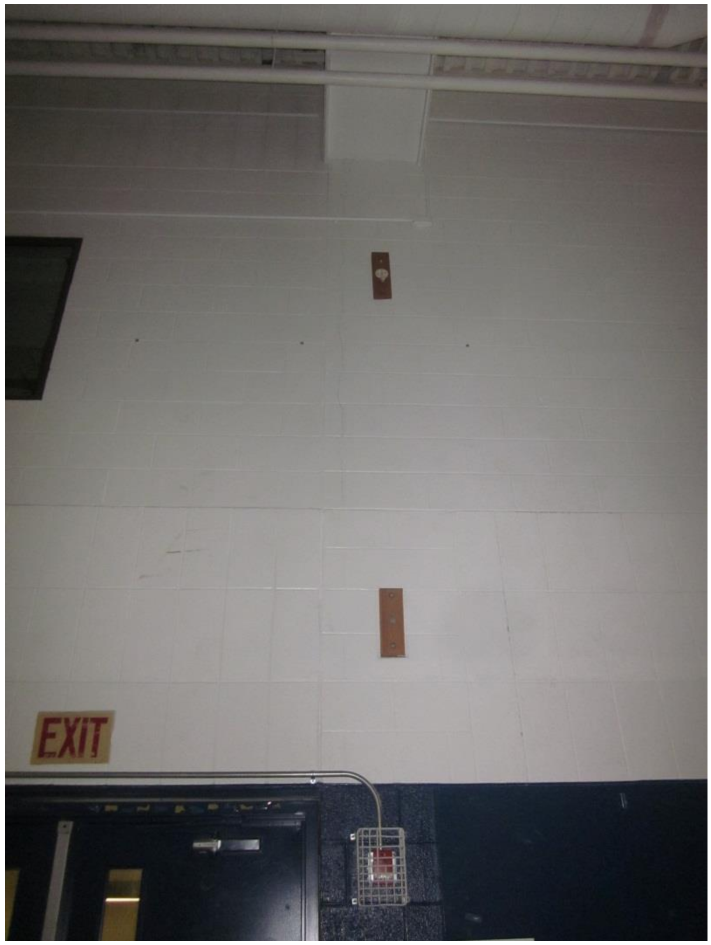


Photo #1

This photo shows a presumed location of a steel moment frame column within the gymnasium north wall. Vertical cracks are present possibly due to the lateral movement of the column, which cannot be accommodated by the masonry infill wall.

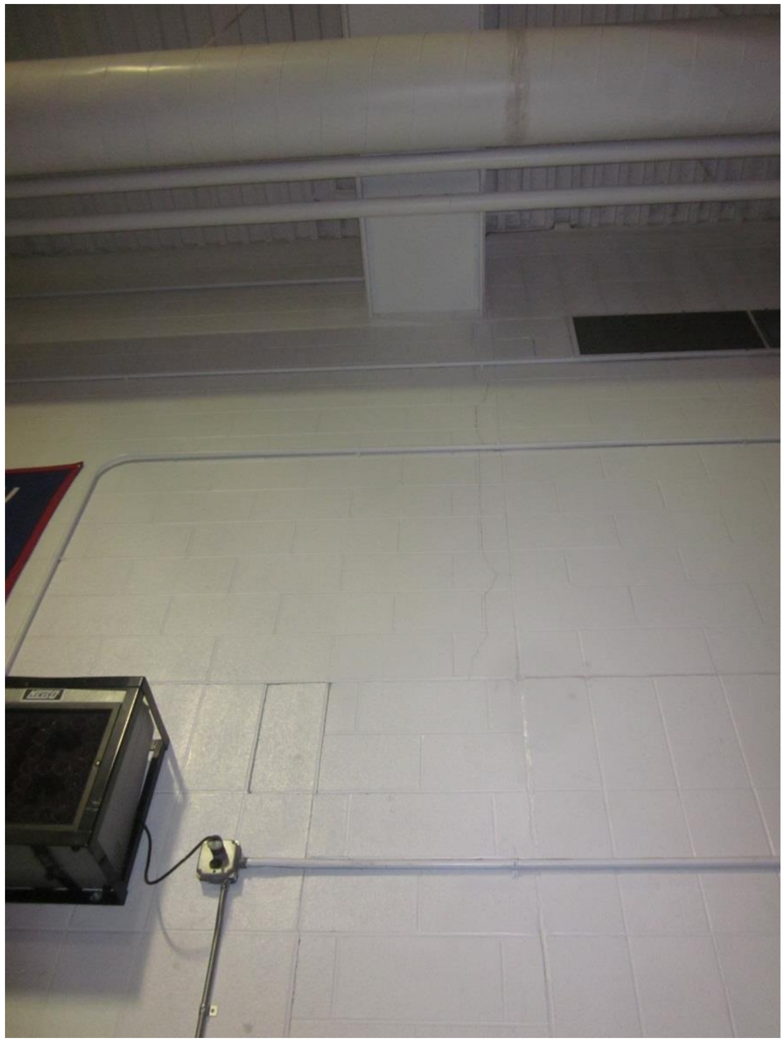


Photo #2

This photo shows another area of cracked masonry infill wall within a moment frame in the gymnasium north wall.

Photo #3

This photo shows the corrosion of the composite metal roof decking along one of the expansion joints in the roof of the school building.

Photo #4

This photo shows a typical unreinforced masonry wall which is not braced at a spacing equal to or less than 10 feet.

Photo #5

This photo shows one of the exterior stair cores. The masonry veneer is over 40 feet high and no shelf angles appear to be present.

Photo #6

This photo shows filing cabinets that are not anchored to the floor slab or adjacent structural walls.

Photo #7

This photo shows other piece of large equipment that is not anchored to the floor slab or adjacent structural walls.

Photo #8

This photo shows a piece of equipment suspended from the ceiling with no lateral bracing present.

Photo #9

This photo shows another mechanical unit suspended from the ceiling with no lateral bracing present.

Photo #10

This photo shows one of the sliding-bearing assemblies located along the west expansion joint of the multi-story building. No evidence of the expected movement of the framing members on opposing sides of the joint can be seen.

Photo #11

This photo shows another of the sliding-bearing assembly located along the east expansion joint of the multi-story building. Note the installation of the metal roof decking between the roof girder and the joint, contrary to what was shown on the structural drawings. There are also 2x shims installed between the deck and the beam below, which do not appear to coincide with the design intent of the joint.

Photo #12

This photo shows the typical cracking of the masonry block walls found at each of the multi-story stair towers located at the east and west ends of the school building.

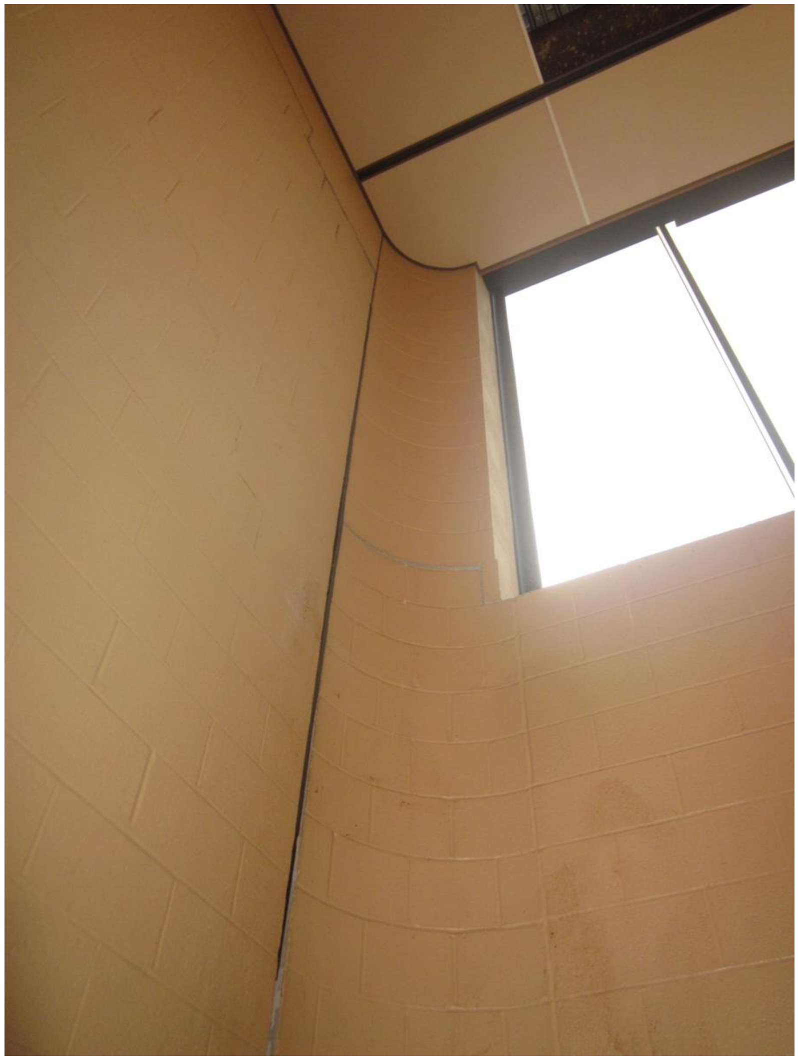


Photo #13

This photo shows the vertical crack in the load-bearing masonry block walls of one of the multi-story stair towers at the east and west ends of the building.

APPENDIX D: DEFINITIONS

ACTION: An internal moment, shear, torque, axial load, deformation, displacement, or rotation corresponding to a displacement due to a structural degree of freedom; designated as force or deformation controlled.

ASPECT RATIO: Ratio of full height to length for concrete and masonry shear walls; ratio of story height to length for wood shear walls; ratio of span to depth for horizontal diaphragms.

BASE: The level at which the horizontal seismic ground motions are considered to be imparted to the structure.

BASIC NONSTRUCTURAL CHECKLIST: Set of evaluation statements that shall be completed as part of the Tier I Evaluation. Each statement represents a potential nonstructural deficiency based on performance in past earthquakes.

BASIC STRUCTURAL CHECKLIST: Set of evaluation statements that shall be completed as part of the Tier I Evaluation. Each statement represents a potential structural deficiency based on performance in past earthquakes.

BENCHMARK BUILDING: A building designed and constructed or evaluated to a specific performance level using an acceptable code or standard listed in Table 3-1.

BRACED FRAME: A vertical lateral-force-resisting element consisting of vertical, horizontal, and diagonal components joined by concentric or eccentric connections.

CAPACITY: The permissible strength or deformation for a component action

COLLECTOR: A member that transfers lateral forces from the diaphragm of the structure to vertical elements of the lateral-force-resisting system.

CONCRETE FOOTING: A cast-in-place concrete element below grade that supports the structure above.

CONTENTS: Any non-structural elements within the building including, but not limited to, furniture, cabinets, mechanical units, electrical equipment, machinery, etc.

CROSS WALL: A wood-framed wall sheathed with lumber, structural panels, or gypsum wallboard.

DESIGN EARTHQUAKE: A percentage of the Maximum Considered Earthquake. See Maximum Considered Earthquake.

DIAPHRAGM: A floor or roof system that serves to interconnect the building and acts to transmit lateral forces to the vertical resisting elements.

DIAPHRAGM EDGE: The intersection of the floor or roof diaphragm and a shear wall, frame, or collector element.

FLEXIBLE DIAPHRAGM: A diaphragm with a maximum lateral deformation of twice or more the average
story drift.

FULL-BUILDING TIER 2 EVALUATION: An evaluation beyond a Tier 1 Evaluation that involves a complete analysis of the entire lateral-force-resisting system of the building using the Tier 2 analysis procedures defined in ASCE31-03.

GEOLOGIC SITE HAZARDS AND FOUNDATIONS CHECKLIST: Set of evaluation statements that shall be completed as part of the Tier I Evaluation. Each statement represents a potential foundation or site deficiency based on the performance of buildings in past earthquakes.

IMMEDIATE OCCUPANCY PERFORMANCE LEVEL: Building performance that includes damage to both structural and nonstructural components during a design earthquake, such that: (a) the damage is not life threatening, so as to permit immediate occupancy of the building after a design earthquake, and (b) the damage is repairable while the building is occupied.

LATERAL-FORCE-RESISTING SYSTEM: The collection of frames, shear walls, bearing walls, braced frames, and interconnecting roof and floor diaphragms that provides earthquake resistance to a building.

LEVEL OF LOW SEISMICITY CHECKLIST: Set of evaluation statements that are completed as part of the Tier I Evaluation for buildings in levels of low seismicity being evaluated to the Life Safety Performance Level.

LEVEL OF SEISMICITY: A degree of expected earthquake hazard. For this standard, levels are categorized as low, moderate, or high, based on mapped acceleration values and site amplification factors in ASCE 31-03.

LIFE SAFETY PERFORMANCE LEVEL: Building performance that includes damage to both structural and nonstructural components during a design earthquake, such that: (a) partial or total structural collapse does not occur, and (b) damage to nonstructural components is nonlife-threatening.

LOAD PATH: A route or course along which seismic inertia forces are transferred from the superstructure to the foundation.

MASONRY INFILL: A panel of masonry (which can consist of concrete block, brick, stone, marble, etc.) placed within a steel or concrete frame. Panels separated from the surrounding frame by a gap are termed "isolated infills." Panels that are in full contact with a frame around its full perimeter are termed "shear infills."

MAXIMUM CONSIDERED EARTHQUAKE (MCE): An earthquake based on the lesser of probabilistic values with a 2-percent probability of exceedence in 50 years and 150 percent of the median deterministic values at a given site.

MEANS OF EGRESS: A path for exiting a building, including, but not limited to, doors, corridors, ramps, and stairways.

MOMENT-RESISTING FRAME (MRF): A frame capable of resisting horizontal forces due to the members (beams and columns) and joints resisting forces primarily by flexure.

NORMAL WALL: A wall perpendicular to the direction of seismic forces.

PIER: Vertical portion of a wall between two horizontally adjacent openings. Piers resist axial stresses from gravity forces and bending moments from combined gravity and lateral forces.

POINTING: The partial reconstruction of the bed joints of a masonry wall by removing unsound mortar and replacing it with new mortar.

QUICK CHECK: Analysis procedure used in Tier 1 Evaluations to determine if the lateral-force-resisting system has sufficient strength and/or stiffness.

REINFORCED MASONRY: Masonry having both vertical and horizontal reinforcement (steel reinforcing bars) that conform to minimum requirements as set forth in ASCE 31-03.

RIGID DIAPHRAGM: A diaphragm with a maximum lateral deformation of less than half the average story drift.

SHEAR WALL: A wall that resists lateral forces applied parallel with its plane. Also known as an in-plane wall.

STIFF DIAPHRAGM: A diaphragm with a maximum lateral deformation equal to half or more than half but less than twice the average story drift.

SUPPLEMENTAL NONSTRUCTURAL CHECKLIST: Set of nonstructural evaluation statements that shall be completed as part of the Tier 1 Evaluation for buildings in levels of moderate or high seismicity being evaluated to the Immediate Occupancy Performance Level.

SUPPLEMENTAL STRUCTURAL CHECKLIST: Set of evaluation statements that shall be completed as part of the Tier 1 Evaluation for buildings in levels of moderate seismicity being evaluated to the Immediate Occupancy Performance Level, and for buildings in levels of high seismicity.

TIER 1 EVALUATION: Completion of checklists of evaluation statements that identifies potential deficiencies in a building based on performance of similar buildings in past earthquakes.

TIER 2 EVALUATION: The specific evaluation of potential deficiencies to determine if they represent actual deficiencies that may require mitigation. Depending on the building type, this evaluation may be a Full-Building Tier 2 Evaluation, Deficiency-Only Tier 2 Evaluation, or a Special Procedure Tier 2 Evaluation.

TIER 3 EVALUATION: -A comprehensive building evaluation implicitly or explicitly recognizing nonlinear response.

UNREINFORCED MASONRY: Masonry construction that does not satisfy the definition of reinforced masonry.

UNREINFORCED MASONRY BEARING WALL: An unreinforced masonry wall that provides vertical support for a floor or roof for which the total superimposed vertical load exceeds 100 pounds per lineal foot of wall.

Heating, Ventilating, and Air-Conditioning Systems

Executive Summary:

The Minuteman Regional Vocational Technical School has mostly original HVAC systems from when the school was built in 1975, 38 years ago. A 2009 performance energy contract with Siemens replaced the entire heating and cooling plant, added DDC controls to the boiler room and in the Penthouses, added VFD's and demand control ventilation to the Penthouse air handlers, replaced some of the control dampers that experience high leakage, and added a MeLink demand control variable speed controls to the kitchen and culinary pots hoods.

The Central Plant is in excellent condition, the remainder of the HVAC systems are at the end of their useful life. Ductwork distribution may be able to be salvaged in some areas.

Heating Plant:

The heating and cooling plant were replaced in 2009 under a performance energy contract with Siemens. The boiler room has two individual Cleaver Brooks FLX-700-800-160HW 8000MBH gas-fired flexible water tube boilers, and a smaller Cleaver Brooks FLX-700-160HW 2000 MBH gas-fired flexible water tube boiler, which is dedicated to the production of domestic hot water and pool heating.

All boilers are tied into a common hot water supply header. The smaller boiler has been manually valved off the supply header. The smaller boiler has a dedicated pump that circulates raw boiler water to the domestic hot water storage tanks. There is no back-up for this pump. The smaller boiler cannot heat the school during the shoulder seasons due to water flow issues and mixing, which would result in reduced supply water temperatures being supplied to the building. The building heating loop is fed by (2) variable speed pumps, which maintain a set differential pressure in the piping loop. There are (2) different building heating pumps with one serving as a back-up.

The boilers are directly tied into the primary building heating loop, so there is variable water flow through the boilers. Each 8000 MPB boiler has a motorized isolation valve to shut off flow through the idle boiler to prevent mixing and the reduction of supply water temperature. The large boilers are controlled by a sophisticated modulation firing control, the smaller boiler has simpler lo-hi firing control. The draft of all (3) boilers are controlled by modulating “Exhaust” dampers in the breeching, which maintain proper draft at each respective boiler. There are two metal chimneys that run inside an unpainted back iron exterior stack for support. The black iron stack is covered in surface rust. One of the large boilers has a dedicated metalbestos vent and the other is tied into a common breeching with the smaller boiler, and vent into a shared metalbestos vent.

Cooling Plant:

Chilled water is produced by a 700 ton York electric centrifugal chiller. The compressor is variable speed for capacity control. The existing split case chilled water and condenser water pumps were rebuilt during the 2009 cooling plant upgrades. There are (2) chilled water pumps, with one back-up.

The variable speed pump maintains a set differential pressure in the chilled water piping system. There is only one condenser water pump, which is constant speed with soft start. A new two cell Marley open cooling tower was installed on the roof, in excellent condition. The tower fans are variable speed for capacity control.

Condenser water is made-up from the old geothermal wells, to save on town water consumption. This well water is treated then stored in insulated tanks in the boiler room. There is a back-up connection to town water.

Piping:

Hot and chilled water piping is Schedule 40 black steel which appears is insulated with fiberglass insulation with an all service jacket. Most of the insulation is noted to be in fair condition. The piping in the mechanical Penthouse appears in poor condition. Number 4 fuel oil was originally provided throughout the boiler room through an overhead Schedule 40 black steel piping system from exterior buried tanks. Fuel oil is no longer used since natural gas was provided in recent years.

Controls:

The automatic temperature controls for the entire building are through a central pneumatic automatic temperature control system. The system is provided with a single air storage tank with Sullair remote dual compressors and dual motors mounted on a concrete pad adjacent to the air storage tank. Located adjacent to the air storage tank is a wall mounted refrigerated air dryer which is provided with an oil and water separator. Both the refrigerated air dryer and the compressed air storage tank are provided with manual blow down lines and appear to operate.

Although the pneumatic system is considered to be in fair to poor condition, it should be upgraded to include a new direct digital automatic temperature control system throughout the building. As part of the 2009 performance energy contract, the entire heating/cooling plant is controlled by DDC controls. There is also DDC controls in the Penthouses to control air-handling equipment. Penthouse valve controls are still pneumatically actuated, tied into the DDC system.

Air Distribution Systems:

The entire heating, ventilation and air-conditioning system originates in (10) roof mounted mechanical Penthouses. Each mechanical Penthouse is provided with either one or two floor mounted air-handling units, each of which are provided with a combination of supply fans, chilled water cooling coil, filter section, and a combination return air outside air mixing box. Each air-handling unit receives a direct source of outside ventilation air from a continuous intake louver which runs the entire length of each mechanical Penthouse. On the opposite wall is also a continuous louver which is utilized for relief and exhaust air.

The louvers appear to have been modified in the field and were not supported adequately allowing the louver blades to be unsupported vertically at each side of the door. The fresh air intake and the relief air connections to the louvers did not meet adequate design standards allowing the effective free area of the louvers to be minimized due to the very short connection of sheet metal. The outside air intake ductwork was insulated with rigid fiberglass insulation, much of which has surface damage. The supply air and return air ductwork is not insulated. The air-handling units are in poor condition and generally have reached their maximum serviceable life.

Each air-handling unit is provided with an in-line return air fan which returns air from each of the occupied spaces directly to its associated supply air-handling unit. All ductwork associated with return air systems are un-insulated galvanized sheet-metal. Each system provided with return air and exhaust air dampers which allow the return air to be recycled back to the air-handling unit or discharged to the exterior through the wall mounted louver. The relief air connections to the louver do not meet adequate design standards allowing the effective free area of the louvers to be minimized due to the very short connection of sheet metal. The air handlers serve a quadrant of the building, first and second floors.

As part of the 2009 energy performance contract, variable frequency drives were added to all air handlers that have cooling coils. The respective return fan also received a variable frequency drive. Air handler outside air dampers are being controlled by a CO2 sensor located in the unit return. Some of the more deteriorated Penthouse damper assemblies were repaired/replaced during the 2009 energy performance upgrades.

Supply air ductwork to the individual occupied areas travels vertically though central shafts to the respective zones which they serve. All supply ductwork provides air at a constant supply air presumably approximately 55 degrees (for those units with cooling) and approximately 70 degrees (for those units without cooling). All supply air travels in the medium pressure high velocity distribution ducting system which terminates in each occupied area at the ceiling mounted velocity reduction terminal unit.

Each terminal unit is a static velocity reduction box which is of galvanized sheet-metal, internally lined with acoustic liner. Each velocity reduction box is also provided with hot water heating coil which ties into the recirculating hot water distribution system. Each coil is provided with a modulating hot water valve controlled by a pneumatic wall mounted thermostat.

At the discharge of each velocity reduction terminal unit, is a small length of un-insulated galvanized sheet metal ductwork with a single supply diffuser for providing ventilation and temperature air to each occupied area. All ceiling diffusers are noted to have surface soiling with overall condition consistent with their age.

All supply ductwork was soiled on the exterior, however, was not damaged and can be reused. All velocity reduction terminal units, discharge ductwork beyond the velocity reduction terminal units reached their maximum serviceable life and should be replaced with new pressure independent document control VAV boxes with new hot water coils.

In a number of locations, additional spaces were created utilizing full height partitions; however, the mechanical systems were not modified adequately to address the proper amount of ventilation and supply air to these newly created spaces. As a result, many of the spaces are considered non-code compliant with the result and deficiency in ventilation air. In addition, supply diffusers are located incorrectly very close to adjacent walls resulting in draft conditions.

<u>Public Toilet Areas:</u>

The individual public toilet areas are provided with a combination of ceiling and wall mounted exhaust registers generally located in the area of the plumbing fixtures. All exhaust registers were noted to be slightly soiled and in some damage. The exhaust system is made up of galvanized sheet metal ductwork which terminates with Penthouse and roof mounted exhaust fans. Limited ventilation control is being maintained throughout all toilet spaces and it does appear that the exhaust fans are running.

It was noted that there was no mechanical make-up air provided for any of the toilet spaces. It appears that all make-up air for the spaces is through the combination of undercut doors and door louvers. This use contributes to the poor ventilation in the rooms.

<u>Kitchen:</u>

The kitchen and culinary arts area is provided with heating and ventilation air for the general space provided from a roof mounted air-handling unit located within mechanical Penthouse Number 3. The air-handling unit is typical to all remaining units described above, however, the distribution system is of the low velocity low-pressure design. This system is not provided with any velocity reduction terminal units. The equipment has reached the maximum serviceable life.

In addition to the above, the kitchen is provided with two additional air-handling units which are located at the ceiling of the kitchen itself. Each air-handling unit is provided with a supply fan, hot water heating coil with face and bypass control, and a direct source of outside air through wall mounted intake louver. Each unit is of the 100% outside air design and are intended as makeup air for centrally located exhaust hood located within the kitchen. Overall all duct work, equipment, and supply diffusers have reached their maximum serviceable life.

The exhaust hood is of the canopy style stainless steel design which is ducted directly through a dedicated exhaust system to roof mounted exhaust fan. The hood is clean and is provided with cartridge filters which can be cleaned and vapor tight incandescent lighting. As part of the 2009 energy performance contract, MeLink Demand control ventilation controls were retrofitted to the main hood and culinary arts hood. These controls vary the speed of the hood exhaust fans based on use, to save energy. A temperature sensor and infrared beam sense heat and smoke, and increate the hood exhaust fan speed accordingly. A secondary kitchen is located adjacent to the primary kitchen which was at one time used as a McDonald's restaurant. The secondary kitchen is provided with a kitchen preparation area including stainless steel exhaust hood with roof mounted exhaust fan, and a glass-fired rooftop make-up air unit. The restaurant is no longer in service and the entire system has been abandoned in place. The exhaust hood has been removed and the exhaust duct has been capped. The old McDonalds make-up air unit remains and is abandoned in place.

Gymnasium, Pool, and Locker Areas:

The gymnasium, locker rooms, and pool area are all served by two common air-handling units located in mechanical Penthouses 1 &2. Each air-handling unit is of the ventilation and heating design.

The gymnasium is provided with typical velocity reduction terminal units which are typically located throughout the entire building. All equipment was noted to be in similar conditions to the remainder of the building.

The locker rooms are provided with typical velocity reduction terminal units which are typically located throughout the entire building. All equipment was noted to be in similar condition to the remainder of the building.

The pool area is provided with typical velocity reduction terminal units which are typically located throughout the entire building. All equipment was noted to be in similar condition to the remainder of the building. Air distribution for the pool area utilizes side wall supply registers located approximately 16 feet above the floor which discharge horizontally across the pool area. All supply registers are noted to have surface soiling and contamination and generally have reached their maximum serviceable life.

There is no dehumidifier or control scheme to address humidity generated by the pool.

Along the exterior wall of the pool is a continuous length of fin tube radiation located beneath the slab. There is extensive soiling and contamination on the discharge grill in the fin tube elements.

Pool Filter Room:

The pool filter/pump room has minimal exhaust and not make-up air and requires improvement. The existing exhaust register is mounted at the ceiling, and is not effective in removing chlorine vapors as chlorine vapors are heavier than air. An exhaust system appropriate to this application should be installed. A severely corroded 3/4" copper water line should be replaced in the filter room. There is a build-up of flakes on the floor from the corroding copper in the chlorine rich environment.

Vocational Training Area:

All vocational training areas are served by individual air-handling units located within the roof mounted mechanical Penthouse as described above. All air-handling equipment is noted to be in similar condition to the remainder of the building. Located within this space were also hot water horizontal unit heaters for space heating.

The woodworking area is provided with a dust collection system and through the communication of a spiral wound galvanized exhaust system, convey all woodworking particulate between machinery and an outside mounted dust collection unit. The dust collection unit is exhaust only. Staff reports that the dust collector shaker is problematic and in need of replacement.

The welding area is provided with a series of welding benches located at one side of the space. A canopy type capture hood was recently installed over the bank of benches, replacing a flexible exhaust snorkel system. This canopy hood is ducted to a space mounted centrifugal exhaust fan. Other stand-alone welding benches are provided with a flexible exhaust capture type snorkel system that ties into an overhead common exhaust duct which is ducted to a space mounted centrifugal exhaust fan. The exhaust system does operate and appears to be sized with common industrial ventilation standards. Because of its use, the system is extremely contaminated and replacement is recommended.

The automotive repair area is provided with an under floor vehicle capture exhaust system which through the use of flexible hoses connected to the exhaust tailpipes, other vehicles ventilate exhaust gases to the exterior of the building. The sheet-metal ductwork which is located between the floor and the fan is damaged and vented. It does appear that the system is sized in accordance with the common industrial ventilation standards, however considering its age and use, replacement is recommended. The under floor vehicle capture exhaust system is constant volume, rather than variable volume depending upon the number of hoses in use.

It appears that there is no interlock between these vocational area exhaust fans and the Penthouse air handlers supplying air to the spaces. Depending on how many exhaust fans are operating, the vocational areas could be starved for make-up air, which reduces the effectiveness of the exhaust system. The Penthouse air handler outside air dampers should be interlocked to the number of operating exhaust fans so the space receives adequate make-up air.

Administration Area:

The administration area is served by a single air-handling unit located within the roof mounted mechanical Penthouses as described above. All air-handling equipment is noted to be in similar condition as remainder of the building.

The administration offices are provided with typical velocity reduction terminal units which are typically located throughout the entire building. All equipment was noted to be in similar condition to the remainder of the building. At 7 locations, window style air-conditioning units are mounted in interior walls with the condensing sections discharging condensate and heat into an adjacent circulating corridor. This resulting condition is causing the communicating corridor to overheat and impose an additional air-conditioner load into this corridor. Since the window style air- conditioners are installed indoors rather than in a window, the condensate cannot drain to outdoors as originally designed. These air conditioners only operate when needed.

Entrances, Vestibules, and Corridors:

The main entrances and vestibules were all provided with hot water cabinet unit heaters adjacent to each doorway. It was noted that generally all heaters were slightly damaged, dirty, and contaminated, however as we understood, it does operate and maintain reasonable heating control at all entrances and doorways. All units are generally in need of cleaning, and considering the age and general poor condition, should be replaced at this time. Communicating corridors throughout the entire building are provided with a limited amount of ventilation which does not appear adequate to meet the current building code requirements. No exhaust systems are provided, ventilation should be added to improve overall air quality.

Electrical Systems

Existing Conditions:

Electrical Distribution System:

The site is primary metered. The primary service originates on a utility pole and runs underground to an exterior pad mounted utility primary switch. Adjacent to the primary switch is a pad mounted transformer which feeds an existing 4000 amperes, 277/480 volts, 3 phases, 4 wire switchboard located in the main electrical room on the ground level. The switchboard is manufactured by Eaton Cutler-Hammer and has a 2000A digitrip main circuit breaker with ground fault interrupter, GFI protection. The switchboard was installed in 2009 and is excellent condition.

The switchboard feeds a series of panelboards located throughout the school. The switchboard also feeds a 500KVA, 480V to 120/208V, 3Ø, 4W transformer which feeds a 1600A switchboard, all replaced in 2009 and in excellent condition. The 120/208V switchboard is also located with the main electrical room.

This switchboard also feeds an automatic transfer switch for normal/emergency panelboards. The transfer switch and emergency panels are located within the fire alarm room.

Although the site is primary metered, it appears that the primary switch cubicle and pad mounted transformer is owned by the Utility Company.

The electrical distribution system, in general, is old with exception to the service and main switchboard the condition ranges from good to poor. The distribution equipment although relatively well maintained, is over 30 years old and at the end of its useful life.

Standby Generator:

The emergency system consists of two 45Kw/56.25Kva, 277/480 volt, 3 phase, 4 wire propane gas generators within exterior enclosures. The generator manufacturer is Onan with (1) 100 ampere automatic transfer switch housed in the fire alarm control panel room.

The automatic transfer switch manufacturer is Onan and feeds normal/emergency panelboards located throughout the facility.

The emergency system is in violation of current codes as it does not maintain separation of emergency and standby loads. The equipment including the automatic transfer switch and panelboards are not housed within dedicated spaces with properly rated assemblies.

Emergency Lighting and Exit Signs:

The emergency lighting consists of the same normally on fixtures connected to the two generators in corridors, stairwells and other circulation spaces.

Corridor lighting consists of surface 1’x4’ fixtures with prismatic lens with (2) T8 lamps and electronic ballasts. Lighting control consists mainly of local switches.

Typical classroom consists of 1x4 surface mounted fixtures, with prismatic lenses with (2) T8 lamps and electronic ballasts. Lighting controls consist of single pole switch by the entrance installed in the classroom.

Shop lighting consists of cover lighting with T8 lamps and 2'x4' high bay 6 lamp T8 fluorescent fixtures and supplementary fluorescent strips. The lighting is in excellent condition.

Labs consist of multiple rows of surface fixtures, with prismatic lens with (2) T8 lamps and electronic ballasts similar to classrooms. Controls are typical local switches.

Media center consists of mainly continuous rows of pendant fluorescent fixtures with prismatic lens with (2) T8 lamps and electronic ballasts controlled with local switches.

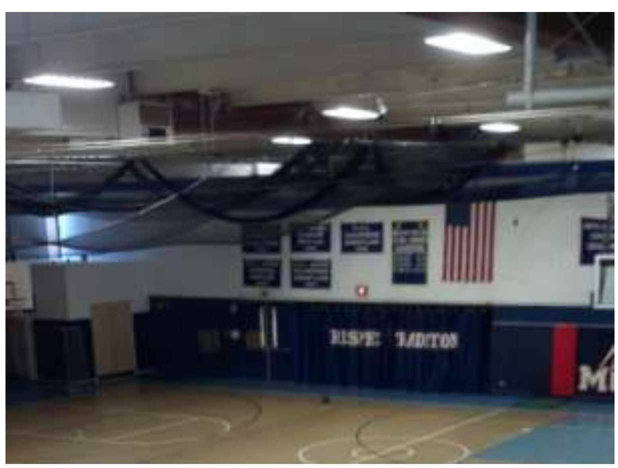
Cafeteria consists of 2'x4' high bay 6 lamp T8 fluorescent fixtures and supplementary fluorescent strips. The lighting is in excellent condition.

Kitchen, locker room, etc. Consist of fluorescent vapor tight surface fixtures with (2) T8 lamps and electronic ballasts.

Toilet rooms consist of recessed 2'x4' fixtures with T8 lamps and electronic ballasts and surface mounted 1'x4', fixtures with T8 lamps and electronic ballasts.

Offices and support spaces generally consist of 1'x4' fixtures and 2'x4' recessed with prismatic lens with (2) T8 lamps and electronic ballasts. Spaces are generally single switched. Mechanical spaces typically have 4' strips with (2) T8 lamps and electronic ballasts.

Gymnasium lighting consists of 2'x4' high bay 6 lamp fluorescent high output fixtures installed in 2009 and are in excellent condition.



Pool lighting consists of surface fluorescent vapor tight fixtures installed in 2009. Fixtures appear to be switch controlled via multipole relays.

Exterior Lighting:

Exterior lighting consists of pole mounted HID fixtures as well as building mounted floods, time clock controlled. Pole lights seem to have been retrofitted with additional flood lights.

Fire Alarm:

The existing fire alarm system consists of a conventional Faraday fire alarm control panel located in the fire alarm control panel room. System smoke detector coverage consists of mainly smoke detectors adjacent to corridor smoke doors only. Horn/strobe units exist mainly in corridors and are generally not of the ADA type. Some ADA compatible horn/strobe units have been added within one wing but mounting heights exceed ADA guidelines. The system transmits a signal to the fire department via a digital dialer. The existing Faraday Fire Alarm system is obsolete.

Communications System:

The paging system consists of a 3 zone all call system with one microphone and minimal functionality. The system is operational but not adequate for the school's needs.

There is currently no master clock system. All existing clocks are of the battery type.

There is a fairly new server closet with (2) racks with a variety of network switch manufacturers, the newer switches were Nortel. The room is air conditioned, clean and the equipment is in good condition.

There is an MDF room located in the library with no ceiling and no dedicated air conditioning. There is one data rack with fiber. The backbone is of a star topology and 62.5 micron fiber is used. There are multiple IDF closets fed from this location. Horizontal data wiring is CAT 5.

Security System:

The security system consists of control panel in the break room keypads and the door contact only. A CCTV system is installed Panasonic NVR with IP cameras covering the exterior of the building.

PLUMBING & FIRE PROTECTION EXISTING CONDITIONS

Executive Summary

The Minuteman Regional Vocational Technical School has received minimal maintenance on the plumbing systems and equipment over its occupied years with the exception of recent upgrades of the water services, water heater, air compressors, water closets and urinals. Even with adequate maintenance, systems will gradually deteriorate due to scale and poor water conditions. Although most of the systems are working adequately at this time, the major equipment and systems are near the end of their useful life. Along with aging systems, many of the systems are not up to current codes. If it is anticipated that major modifications are planned for this building then the plumbing systems should be considered for an overall upgrade and a complete fire protection system installed.

Fixtures:

Fixtures other than the toilets and urinals are generally original, indicating the time of there installation. Some fixtures have been replaced to try to meet the accessibility codes.

The existing water closets bowls and flush valves were replaced with 1.6 GPF fixtures. The water closets are wall mounted vitreous china, flush valve type with siphon jet action. Some flush valves had the interior workings replaced to make them 1.6 GPF. Other 1.6 GPF flush valves were new and required a supply piping offset. The water closets are in good condition.

Typical Water Closet

Typical Urinal

The urinals and flush valves have been replaced with 1.0 GPF fixtures. Some of the flush valves required a supply piping offset, see picture. The urinals are wall hung, vitreous china, flush valve type with siphon jet action. The urinals are in good condition.

Lavatories in large toilet rooms are wall hung vitreous china. In smaller toilet rooms the lavatories are a mixture of china and stainless steel self-rimming bowls in a vanity. The faucets are widespread 8” metering type faucet with hot and cold water push buttons and a separate spout. The lavatories are in fair condition.

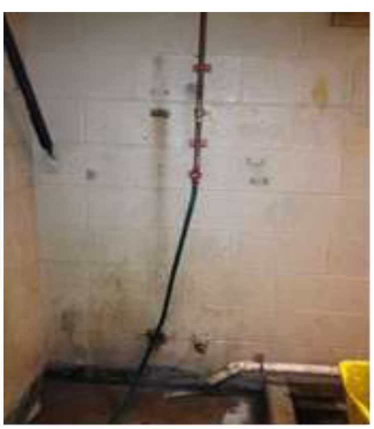
Typical lavatories in large toilet rooms

Typical lavatories in small toilet rooms

Typical Drinking Fountain

Typical Mop Receptor

The electric water coolers and drinking fountains are fully recessed, all stainless steel finish with pushbutton control. Water drinking fountains area are rusted and in poor condition and non ADA compliant.



Hose Connection without Vacuum Breaker

Showers in locker Room

The locker room showers are old but appear to be in fair condition. Some modifications have been made due to failure of the shower valve controls. A mixing valve is located above the ceiling. Some of the shower heads are not functional.

The janitor's sinks are cast iron rolled rim wall hung type with stainless steel rim or heavily stained molded stone mop receptors. The wall hung faucets have been replaced and now have vacuum breakers. The mop receptor basins are in poor condition. Janitors sinks do not have proper backflow prevention.

Water System:

The building is supplied with two domestic water services, one from the north and the other from the south which have had their curb stops, water meters, pressure reducing valves, backflow preventers and shutoff valves replaced recently. The north side domestic water service is a 4" service and the south side domestic water service is a 6" service. The domestic water pressure is approximately 90 psi.

Boiler Room Water Service

Water Heaters Fed from Boilers

The domestic hot water heating equipment has recently been replaced and is now indirect fired off the building heating boilers. There are five domestic hot water storage tanks each with heat exchanger. There are 2 large boilers and 1 small summer boiler. There are two master thermostatic mixing valves on the system in parallel however a single valve meets the present load. The system distributes 140 degree hot water to the kitchen and 120 degree water to the rest of the building and the swimming pool. There are three return systems with aquastats and circulator pumps. The circulating pump are old and appears to be in damaged condition. There are reports that it is difficult to obtain hot water in some areas of the building indicating possible problems with the 120 degree recirculation system. Piping in pool equipment room copper piping and supports are severely corroded.

There are two abandoned geothermal tanks and one abandoned solar hot water tank. Both of these systems are abandoned in place. The late 1970's solar collector tubes have failed and are no longer available so they are abandoned on the roof. The 140 degree electric point-of-use hot water booster heater in the kitchen is no longer required and has been abandoned in place.

Abandoned Solar Collector

Domestic Hot Water Mixing Valves

Drainage System:

The sanitary and storm drainage piping systems are cast iron. The exposed piping is visibly in good condition.

The sanitary drainage system is piped to a municipal sewer system. There are no reports or re-occurring problems with the sanitary drainage system other than the locker room floor drains drain extremely slow or not at all. The floor drains in the kitchen are in very poor condition.

Typical Roof Drain

Typical Kitchen Floor Drain

The science waste is drained with glass drum traps and glass piping directly into the sanitary system. There is no separate science waste piping system or neutralization for the science waste. There are floor drains at each emergency shower in science labs.

The roofs are drained by roof drains and interior piping that exits the building and connects to the municipal storm system. The roof perimeter has a parapet approximately a foot high with no scuppers or secondary roof drains. Strainers have been removed allowing debris to enter into the system. Installed strainers do not meet code.

The floor drains in the trade areas of the school are piped to an exterior gasoline/oil separator prior to discharging into the municipal sewer system. The converted automotive shop does not have any floor drains. Each mechanical penthouse has a floor drain.

There are grease interceptors at the kitchen and teaching kitchen three pot sinks however there is no exterior grease interceptor. Dishwasher does not have a grease interceptor.

Generator Propane Tank

Kitchen & Science Lab Propane Tanks

Natural Gas and Propane Gas Systems:

The building has 2 PSI elevated natural gas service that feeds only the three heating boilers. There are (3) 1,000 gallon, above ground propane tanks on the property, two on the north side and one on the south side of the building. Propane is provided for an exterior generator by a single 1,000 gallon tank within a shed. Propane is provided for the kitchens and science labs by two 1,000 gallon tanks within a fenced area outside. Propane is provided to the trade shops by a single 200 gallon tank located outside the shops. Each science lab has a master gas shutoff valve located in a recessed cabinet.

Trade Shop Propane Tank

Duplex Air Compressors & Dryer

Compressed Air System:

There is a central duplex air compressor in the boiler room that supplies the carpentry and automotive shops with multiple compressed air drops and hose reels. The compressed air distribution system pressure is 140 PSI. Each compressed air drop is provided with a quick connect fitting. The central air compressors also provide air to the science labs. The air compressors, receiver and dryer are relatively new and in good condition.

Kitchen:


Kitchen

The kitchen equipment is generally aged but in working condition which indicates the vintage of the time of installation. The cooking equipment is all propane fired. There are manual emergency shutoff valves on the gas supply to the kitchen and training kitchen cooking equipment. Exhaust hoods are provided with fire suppression systems.

There is a three pot sink in the main kitchen that has a point-of-use grease interceptor. The three pot sink in the restaurant kitchen has a grease interceptor recessed in the floor. Kitchen has eye wash station and

Fire Protection:

There is no fire protection sprinkler or standpipe system installed in the main building; however, there is a limited area fire protection sprinkler system in the wood shop and spray booth that is supplied off of the domestic water system. There is a 4” double check valve with a flow switch located in the wood shop. Valves are locked and chained and not properly supervised. Supply pipe from the domestic system is steel piping.

Carpentry Shop with Sprinklers

Sprinkler System DCVA & Flow Switch

RECOMMENDATIONS:

Fixtures:

- Provide water conserving handicap accessible fixtures throughout the building in compliance with current code.
- If a major building up-grade is not done, refer to the following items.
- Replace all lavatories with new low flow fixtures, including handicap accessible fixtures.
- Replace all electric water coolers with new, including handicap accessible fixtures.
- Replace all mop receptors and janitor sinks with new fixtures and provide backflow protection for soap dispensers to comply with code.
- Replace showers with new low flow fixtures, handicap accessible fixtures. Replace floor drains and mixing valves
- Replace emergency showers with accessible fixtures with tempered water with a recirculation system.
- Water of the appropriate temperature would need to be supplied to fixtures whether by a two temperature piping system or through the use of tempering valves and/or fixtures.

Water System:

- Replace copper water piping and valves throughout the building.

Drainage System:

- Replace all roof drains to comply with code. Architect to provide secondary roof drainage scuppers. Horizontal above ground waste and storm piping should be video inspected for any interior corrosion and blockage. Consider replacement in its entirety if found excessive corrosion due to its age.

- Replace all kitchen floor drains and provide trap primers to comply with current code.
- When the kitchens are upgraded segregate waste piping and extend to an exterior grease interceptor.
- Replace locker room floor drains with ones with sediment buckets and trap primers. Rod and clean out the drainage piping.
- Update acid waste and drainage systems. Update classrooms to provide accessible workstations.

Natural Gas and Propane Gas Systems:

- When the emergency generator is upgraded, upsize the propane tank, piping and valves.
- Remove unused lab piping and equipment. Upgrade existing lab classroom systems and provide accessible work stations.

Kitchen:

- Refer to drainage system.
- If a major building up-grade including the kitchen is not done, refer to the following items.
- Install a manual reset gas valve in-line with each kitchen exhaust hood interlocked with CO detectors to comply with current code.
- Provide interior grease interceptors on all kitchen grease producing fixtures and floor drains

Fire Protection:

- If the existing building is renovated to any substantial degree, a building wide fire suppression system must be provided as required by code
- During a substantial renovation and addition project, code would require that all areas of the building shall be protected with wet fire suppression sprinklers. Unheated area will require a dry system. Exact static and residual flow values will need to be determined from a hydrant flow test. For major upgrade, the existing service and the pump capacity location needs to be re configured for better location and access
- The existing water service and capacity needs to be evaluated for new requirement and to comply with the latest Commonwealth of Massachusetts building code and the National Fire Protection Association (NFPA).

- Where the carpenter shop sprinkler water steel piping connects to the copper domestic water system provide a check valve to keep rusty water from entering the domestic water system.
- Provide sprinklers and a standpipe system throughout the building to comply with current code.

ASTM PHASE I ENVIRONMENTAL SITE ASSESSMENT
MINUTEMAN REGIONAL TECHNICAL HIGH SCHOOL
758 MARRETT ROAD
LEXINGTON AND LINCOLN, MASSACHUSETTS

Prepared for:

Kaestle Boos Associates, Inc.
325 Foxborough Boulevard, Suite 100
Foxborough, Massachusetts 02035

Prepared by:

Ransom Consulting, Inc.
12 Kent Way, Suite 100
Byfield, Massachusetts 01922
(978) 465-1822

Project 101.01007.001
June 7, 2013

EXECUTIVE SUMMARY

The following report presents the findings of a Phase I Environmental Site Assessment (ESA) performed by Ransom Consulting, Inc. (Ransom) for Kaestle Boos Associates, Inc. (KBA), for the property identified as the Minuteman Regional Technical High School, located at 758 Marrett Road in the Towns of Lexington and Lincoln, Middlesex County, Massachusetts. For the purposes of this assessment, the Site is defined as three parcels identified by the Town of Lexington Assessor's Office as Lots 1B, 7B, and 8B on Tax Map 52, and one parcel identified by the Town of Lincoln Assessor's Office as Lot 0, Block 4, on Map 19. The Site as defined herein does not include the daycare center and the southern approximately 6.8-acre portion of Lot 7B. This Phase I ESA was conducted in general accordance with the requirements provided by the ASTM International Designation: E 1527-05, *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process, 2005* (ASTM Standard Practice), the U.S. Environmental Protection Agency (U.S. EPA) All Appropriate Inquiry (AAI) standard, and Ransom's Scope of Work for KBA dated April 1, 2013. The intent of this work was to evaluate environmental conditions at the Site for evidence of recognized environmental conditions (RECs).

The Site is occupied by the Minuteman Regional Highs School building, an "energy house" (a residential structure used as office space by the Massachusetts Association of School Superintendents), storage buildings, parking areas, athletic fields, wooded land, and ponds and wetlands. The high school building, completed in 1975, includes a vocational "Trades Hall," providing classrooms and work space for the automotive repair, plumbing, welding, carpentry, and HVAC training. The high school building is connected to the Town of Lexington municipal water and sewer systems and is currently heated with natural gas; it was converted from oil heat approximately 10 years ago. Two 15,000-gallon No.4 fuel oil tanks remain in a concrete vault located southwest of the building. A 1,000-gallon waste-oil underground storage tank (UST), which was used by the automotive garages at the school building, was removed in 1999. A 5,000-gallon gasoline tank located in an underground concrete vault and an associated pump island were removed from the Site in 1998. No documentation with respect to the conditions of the former tank systems or the environment at the time these systems were removed was available.

Ransom observed aboveground hydraulic vehicle lifts at the Site; these lifts appeared to be in good condition. During the site reconnaissance, Ransom identified evidence of former underground lifts in the plumbing and automotive portions of the Trade Hall. It is unclear how many former underground lifts were located in the high school building and whether the hydraulic fluid oil associated with these lifts has been removed.

During the site reconnaissance, Ransom observed the storage of oil or hazardous material (OHM) including virgin and waste motor oil and fuel oil stored in aboveground storage tanks (ASTs), 55-gallon drums and small containers of vehicle fluids, 55-gallon drums containing fluids recovered from science laboratories in the school, containers of gasoline, pool chemicals, and cleaning chemicals. Ransom also observed equipment which may contain OHM, including hydraulic lifts, elevators, and an electrical transformer. Ransom did not observe a release of OHM to the environment from these sources. Ransom observed floor drains in the high school building; most of these drains discharge directly to the municipal sewer. Floor drains in plumbing and automotive portions of the Trade Hall discharge to oil/water separators, which in turn discharge to the municipal sewer system.

The Site was not identified on the release-related state and federal environmental databases searched for this assessment. None of the surrounding properties identified during the database search are expected to adversely impact environmental conditions at the Site.

Although Ransom did not identify a release of OHM at the Site, based on the information obtained during this ESA, Ransom has identified three RECs:

1. Possible releases of petroleum from a former 5,000-gallon gasoline tank and associated pump island and underground piping. The tank was installed in a concrete vault located east and northeast of the high school building. The tank was removed in 1998. No documentation was available for review describing the integrity of the tank and associated piping and soil conditions at the time the tank was removed;

2. Possible releases of petroleum from a former 1,000-gallon waste-oil UST located north of the high school building which was removed in 1999. As with the 1998 gasoline tank system removal, no documentation was available for review describing the integrity of the tank and associated piping and soil conditions at the time the tank was removed; and

3. Possible releases of hydraulic fluid from former in-ground hydraulic lifts located in the plumbing and automotive portions of the Trade Hall. No documentation was available describing the number, locations, and conditions of the former hydraulic lifts at the Site.

Ransom also identified two non-ASTM RECs:

1. According to the U.S. EPA, caulking (and other building materials) containing polychlorinated biphenyls (PCBs) was commonly used during the construction of school buildings between the 1950s early 1970s. Given the dates of construction of the high school building, it is possible that PCB-containing caulking (or other building materials) was used and remains in place; and

2. Asbestos-containing materials (ACM) are present throughout the interior of the high school building.

Based on the outcome of this assessment, Ransom makes the following recommendations:

1. A limited subsurface investigation (LSI) should be performed in the vicinity of the former gasoline tank, pump island, and associated underground piping, and in the vicinity of the waste-oil UST to determine whether soil and/or groundwater have been adversely impacted in the vicinity of these former tanks;

2. A ground-penetrating radar (GPR) survey of the plumbing and automotive portions of the Trade Hall should be performed to determine the number of underground hydraulic lifts located at the Site, as well as the locations of associated apparatus. Based on the GPR survey, an LSI should be performed in vicinity of the former underground hydraulic lifts to determine whether soil and/or groundwater have been adversely impacted;

3. The two out-of-service, 15,000-gallon No. 4 fuel-oil tanks currently located southwest of the high school building should be removed; and

4. Before building alterations or renovations are made, Ransom recommends that a hazardous materials inventory (HMI) be performed to evaluate building materials for asbestos, lead-based paint, PCBs, and other hazardous materials.

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APPENDICES

1.0 INTRODUCTION

The following report presents the findings of a Phase I Environmental Site Assessment (ESA) performed by Ransom Consulting, Inc. (Ransom) for Kaestle Boos Associates, Inc. (KBA) for the property identified as the Minuteman Regional Technical High School, located at 758 Marrett Road in the Towns of Lexington and Lincoln, Middlesex County, Massachusetts. For the purposes of this assessment, the Site is defined as three parcels identified by the Town of Lexington Assessor's Office as Lots 1B, 7B and 8B on Tax Map 52, and one parcel identified by the Town of Lincoln Assessor's Office as Lot 0, Block 4,on Map 19. The Site as defined herein does not include the daycare center and the southern approximately 6.8 acre portion of Lot 7B. The Site is occupied by the Minuteman Regional Highs School building, an "energy house" (a residential structure used as office space by the Massachusetts Association of School Superintendents), storage buildings, parking areas, athletic fields, wooded land, and ponds and wetlands. Refer to Figure 1 (Appendix A), Site Location Map, to view the general location of the Site on a 7.5-minute topographic quadrangle and Figures 2 and 3 (Appendix B) to view a Site Area Plan and Site Plan, respectively.

1.1 PURPOSE

The primary purpose of this study was to document the inquiry of the environmental professional for all appropriate inquiries for the Site. Specifically, this document is intended to provide the "all appropriate inquiries" for the purposes of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 101(35)(B). Such is applicable to persons seeking to qualify for (i) the innocent landowner defense pursuant to CERCLA Sections 101(35) and 107(b)(3); (ii) the bona fide prospective purchaser liability protection pursuant to CERCLA Sections 101(40) and 107(r); and, (iii) the contiguous property owner liability protection pursuant to CERCLA Section 107(q). This report was not intended as part of the site characterization and assessment with use of a grant awarded under CERCLA Section 104(k)(2)(B). More specifically, the scope is intended to identify conditions indicative of releases or threatened releases of hazardous substances on, at, in or to the Site. The goal of the assessment was to identify "recognized environmental conditions" (RECs) in connection with the Site. The term RECs means:

> *The presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater, or surface water of the property. The term includes hazardous substances or petroleum products even under conditions in compliance with laws. The term is not intended to include* de minimis *conditions that generally do not present a threat to human health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies.*

By performing a Phase I ESA of a parcel of real estate with respect to the range of contaminants within the scope of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 U.S.C. §9601) and petroleum products, a user satisfies one of the requirements to qualify for the innocent landowner, contiguous property owner, or bona fide prospective purchaser limitations on CERCLA liability.

1.2 SCOPE OF WORK

This Phase I ESA was performed in general accordance with the requirements of the ASTM International Designation: E 1527-05, *Standard Practice for Environmental Site Assessments: Phase I Environmental*

Site Assessment Process, 2005 (ASTM Standard Practice) as described in Ransom's scope of work for KBA, dated April 1, 2013, and included the completion of the following tasks:

1. Review municipal records and search state and federal environmental databases for sites or conditions of environmental concern;

2. Review historical land use records to evaluate past use of the Site and adjoining properties;

3. Perform a site reconnaissance to visually and/or physically observe current conditions of the Site and the general land use of surrounding properties; and

4. Conduct interviews with readily available past and present owners, operators, and occupants of the Site.

1.3 SIGNIFICANT ASSUMPTIONS

No significant assumptions were made during the performance of this Phase I ESA.

1.4 LIMITATIONS, EXCEPTIONS, AND DEVIATIONS

Along with the limitations set forth in various sections of the ASTM Standard Practice E 1527-05 protocol, the accuracy and completeness of this report is limited by the following:

1. Access Limitations: Ransom did not enter the former hazardous-waste storage building, located north of the high school building, as well as several small buildings associated with athletic operations at the Site. According to Site contacts, oil or hazardous material (OHM) are not currently stored in these structures. Ransom did not enter each classroom of the high school building.

2. Physical Obstructions to Observations: Due to past renovations and equipment present in technical classroom spaces, Ransom was unable to view all floor and wall surfaces in the Trades Hall portion of the high school building. Woodland areas and dense vegetation prevented clear views of ground surfaces in the west and southwest portions of the Site.

3. Outstanding Information Requests: At the time Ransom published this report, the Lexington Fire Department and Lexington Health Division had not responded to information requests with respect to former underground or aboveground storage tanks or releases of OHM at the Site. Should information be received from these offices which results in a material change to the conclusions and recommendations included herein, Ransom will issue an Addendum to this report. Ransom did not receive a completed User Questionnaire at the time this report was published.

4. Historical Data Source Failure: None.

5. Exceptions: None.

6. Deviations: None.

7. Other: None.

The findings provided by Ransom in this report are based solely on the information reported in this document. Should additional information become available in the future, this information should be reviewed by Ransom and the findings presented herein may be modified. The information obtained from state and local agencies is not necessarily all-inclusive and that files may have been reviewed and purged by officials prior to review by the public. Ransom conducted a reconnaissance of the Site, and neighboring properties were viewed from publicly accessible areas. Ransom makes no conclusions regarding off-site areas which were not evaluated during our reconnaissance of the Site.

1.5 SPECIAL TERMS AND CONDITIONS

This Phase I ESA was conducted in accordance with Ransom's scope of work for KBA, dated April 1, 2013. Authorization was provided in writing by KBA as described above.

1.6 USER RELIANCE

The services and the contents of any project reports and associated documents provided to KBA by Ransom are solely for the benefit of KBA, its affiliates and subsidiaries and their successors, assigns, and grantees. Reliance or any use of this report by anyone other than KBA, for whom it was prepared, is prohibited. Reliance or use by any such third party without explicit authorization in the report does not make said third party a third-party beneficiary to Ransom's contract with KBA. Any such unauthorized reliance on or use of this report, including any of its information or conclusions, will be at the third party's risk. For the same reasons, no warranties or representations, expressed or implied in this report, are made to any such third party.

2.0 SITE DESCRIPTION

2.1 LOCATION AND LEGAL DESCRIPTION

For the purposes of this assessment, the Site consists of four parcels, three of which are located in Lexington and the fourth is located in the Town of Lincoln, as follows:

1. Lexington:

    a. Lot 1B on Map 52: an approximately 0.86-acre parcel occupied by the driveway to the school, located west of Marrett Road;

    b. Lot 7B on Map 52: an approximately 13.4-acre parcel occupied by the high school building, the energy house, parking areas, and other improvements. The southern approximately 6.8-acre portion of this parcel which is occupied by a day care center and surrounding wooded area, is not part of the Site as defined herein; and

    c. Lot 8B on Map 52: an approximately 5.7-acre parcel occupied by the high school building, parking areas, a green house, and other improvements.

2. Lincoln: Lot 1, Block 4 on Map 19: an approximately 33.7-acre parcel occupied by parking areas, storage buildings, athletic fields, wooded land, and other improvements.

The Site is located on the Maynard, Massachusetts, U.S. Geological Survey (USGS) 7.5-minute series Quadrangle and is located at the approximate Universal Transverse Mercator (UTM) coordinates of 47:01:549 meters north and 03:13:363 meters east. The latitude and longitude of the Site are 42° 26' 45" north and 71° 16' 11" west, respectively.

Please refer to the appended Figures 1, 2, and 3 (Appendices A and B), Site Location Map, Site Area Plan, and Site Plan for the layout of the Site and adjoining properties.

2.2 SITE AND VICINITY CHARACTERISTICS

The Site is located in a residential and commercial area of Lexington. The Site is improved with a 310,000-square-foot concrete and steel-framed school building (the high school building) constructed on a concrete foundation. Remaining portions of the Site include the energy house (occupied by offices), small buildings and storage sheds, parking lots, athletic fields, and undeveloped wooded, wetland, and pond areas.

A Site Area Plan, Site Plan, and Photograph Log are included in Appendices B and C, respectively.

2.3 CURRENT USE OF THE PROPERTY

The high school building has been used as a technical vocational high school since it was completed in 1975. The building consists of technical and trades teaching areas focusing on separate industries, including automotive; electrical; welding; carpentry; plumbing; heating, ventilating and air conditioning (HVAC); agriculture; design and visual communication; culinary arts; health technology; cosmetology, dental assistance; biotechnology; and environmental technology. The Site is also occupied by several smaller buildings, including the “energy house,” a residential-style building occupied by the Massachusetts Association of School Superintendents (M.A.S.S).

The high school building is heated with natural gas and is connected to electrical utilities provided by Nstar. The high school building is connected to the Town of Lexington municipal water and sewer services.

2.4 CURRENT USES OF ADJOINING PROPERTIES

As part of Ransom's reconnaissance, observations were made of adjoining properties from the Site or public rights-of-way. Observations included current uses of adjoining properties and visible evidence of potential environmental impacts. Adjoining properties to the Site include the following:

1. North: Undeveloped woodland, part of the Minute Man National Park;
2. East: Electrical substation operated by NStar, an office building, and Marrett Road;
3. South: Wooded land and residential properties along Mill Street; and
4. West: Wooded land and residential properties along Mill Street.

These properties are unlikely to adversely impact environmental conditions at the Site; no adverse environmental conditions were identified at these properties during our reconnaissance, and potentially adverse environmental conditions reported during our review of municipal records and federal and state environmental databases are unlikely to impact the Site.

3.0 USER-PROVIDED INFORMATION

Pertinent environmental information, as identified below in this section, was requested from KBA. At the time this report was published, a completed questionnaire had not been received.

3.1 TITLE RECORDS

No title records in connection with the Site were provided by KBA.

3.2 ENVIRONMENTAL LIENS OR ACTIVITY AND USE LIMITATIONS (AULS)

No environmental liens or activity/use restrictions in connection with the Site were provided by KBA.

3.3 SPECIALIZED KNOWLEDGE

No specialized knowledge in connection with the Site or facility operations was provided by KBA.

3.4 COMMONLY KNOWN OR REASONABLY ASCERTAINABLE INFORMATION

No commonly known or reasonably ascertainable information was provided by KBA.

3.5 VALUATION REDUCTION FOR ENVIRONMENTAL ISSUES

No information pertaining to valuation of the Site was provided by KBA.

3.6 OWNER, PROPERTY MANAGER, AND OCCUPANT INFORMATION

Ransom was provided with information about the Site by Mr. Michael MacLean, facilities coordinator at the high school, and Mr. Michael Clickstein, Maintenance Supervisor at the high school. Information provided by Mr. MacLean and Mr. Clickstein has been included in applicable sections throughout this report. Mr. MacLean and Mr. Clickstein did not identify documented environmental releases in connection with the Site.

3.7 REASON FOR PERFORMING PHASE I ESA

This Phase I ESA was performed in preparation for renovations to be performed at the high school building.

3.8 PREVIOUS ENVIRONMENTAL REPORTS

No previous environmental reports in connection with the Site were provided to Ransom.

4.0 RECORDS REVIEW

4.1 STANDARD ENVIRONMENTAL RECORD SOURCES

Ransom contracted Environmental Data Resources, Inc. (EDR) to conduct a search of federal and state databases containing known and suspected sites of environmental contamination. The number of listed sites identified from the federal and state environmental records within the approximate minimum search distance (AMSD) database listings specified in ASTM Standard Practice E 1527-05 are summarized in the following table. Detailed information for sites identified within the AMSDs is provided in Section 4.1.1, along with an opinion about the significance of the listing to the analysis of RECs in connection with the Site. A copy of the EDR research data and descriptions of the databases is included in Appendix E of this report.

Database Record	AMSD (Miles)	Total Sites Found	On Site	On Adjoining Property
Federal NPL List	1	0	No	No
Federal Delisted NPL List	1	0	No	No
Federal CERCLIS List	½	0	No	No
Federal CERC-NFRAP List	½	0	No	No
Federal RCRA CORRACTS Facilities List	1	0	No	No
Federal RCRA Non-CORRACTS TSD Facilities List	½	0	No	No
Federal RCRA Generators List	¼	1	**Yes**	No
Federal Institutional/Engineering Controls Registries	½	0	No	No
Federal ERNS List	Property Only	0	No	No
State-Equivalent NPL List (SHWS)	1	19	No	No
State Landfill and/or Solid Waste Disposal Site List	½	0	No	No
State Leaking AST List	½	0	No	No
State Registered AST List	½	0	No	No
State Leaking UST List	½	0	No	No
State Registered UST List	¼	0	No	No
State Institutional/Engineering Controls Registries	½	1	No	No
State Drycleaners	¼	0	No	No
State Release Sites	1	23	No	No
State Spills	Property Only	1	**Yes**	No
Brownfield Sites	½	0	No	No
Manufactured Gas Plants	1	0	No	No

4.1.1 Discussion of Database Findings

The Site was identified on the Manifest, Federal Resource Conservation and Recovery Act Conditionally Exempt Small Quantity Generator (RCRA-CESQG), Spills, and FINDS databases. The Manifest database listing indicates that controlled or hazardous waste(s) have been generated at the Site and transported off site for disposal. EDR identifies the hazardous wastes generated at the Site as waste compound cleaning liquid and waste paint. The RCRA-CESQG listing indicates that the Site generates hazardous waste identified as ignitable hazardous wastes and solvents. EDR did not report violations associated with hazardous-waste generation at the Site. The FINDS database listing indicates that the Site is on various non-release information tracking databases.

The Spills database listing pertains to a release of transformer oil in 1987. According to EDR, an unreported quantity of transformer oil was released at the Site on October 8, 1987; Spill Number N87-1258 was assigned to this event. According to EDR, this event was closed in one day and an environmental impact was not reported. The Site is not listed on release or SHWS databases. Based on these considerations, the Spills database listing at the Site does not indicate that adverse environmental impacts occurred at the Site.

As stated in Section 4.3.4, groundwater flow at the Site is presumed to be to the southwest at the majority of the property, and to the northeast in the northeast corner of the property. Cranberry Hill, located to the south-southeast of the Site, is considered to be upgradient relative to the Site.

Federal NPL Sites

No Federal National Priority List (NPL) or proposed NPL sites were identified by EDR within 1 mile of the Site.

Federal Delisted NPL Sites

No Federal Delisted NPL sites were identified by EDR within 1 mile of the Site.

Federal CERCLIS Sites

No Federal Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS) sites were identified by EDR within ½ mile of the Site.

Federal CERCLIS-NFRAP Sites

No Federal CERCLIS No Further Remedial Action Planned (NFRAP) sites were identified by EDR within ½ mile of the Site.

Federal RCRA CORRACTS Facilities

No Federal Resource Conservation and Recovery Act (RCRA) Corrective Action (CORRACTS) facilities were identified by EDR within 1 mile of the Site.

Federal RCRA Non-CORRACTS TSD Facilities

No Federal RCRA Non-CORRACTS Treatment, Storage and Disposal facilities were identified by EDR within ½ mile of the Site.

Federal RCRA Generators

Apart from Minuteman High School, no RCRA generators of hazardous waste were identified by EDR within ½ mile of the Site.

Federal Institutional Control/Engineering Control Registries

No Federal Institutional/Engineering Control sites were identified by EDR within ½ mile of the Site.

Federal ERNS List

No Federal Emergency Response and Notification System (ERNS) sites were identified by EDR on the Site.

State Equivalent NPL/Hazardous Waste Sites

EDR identified 19 State Equivalent NPL/State Hazardous Waste Sites (SHWS) within 1 mile of the Site. All of the identified SHWS have been closed in accordance with the Massachusetts Contingency Plan (MCP); Response Action Outcome (RAO) Statements have been submitted to the Massachusetts Department of Environmental Protection (MA DEP) for these sites. After a review of the addresses of these facilities, the SHWS identified by EDR are considered to be cross/downgradient from the Site. Therefore, the identified SHWS are unlikely to adversely impact environmental conditions at the Site.

State Landfill and/or Solid Waste Disposal Sites

No state landfills and/or solid-waste disposal sites were identified by EDR within ½ mile of the Site.

State LAST Sites

No State Leaking Aboveground Storage Tank (LAST) sites were identified within ½ mile of the Site.

State Registered AST Sites

No state-registered aboveground storage tank (AST) sites were identified by EDR within ¼ mile of the Site.

State LUST Sites

No State Leaking Underground Storage Tank (LUST) sites were identified by EDR within ½ mile of the Site.

State Registered UST Sites

No state-registered aboveground storage tank (AST) sites were identified by EDR within ¼ mile of the Site.

State Institutional Control/Engineering Control Registries

One State Institutional Control/Engineering Control (INST) site was identified by EDR within ½ mile of the Site. Although this INST site was mapped by EDR in the vicinity of Cranberry Hill, the actual location of the INST, according to the listed address, is in a downgradient position relative to the Site. Therefore, the identified INST site is unlikely to adversely impact environmental conditions at the Site.

State Dry Cleaners

No dry cleaners were identified by EDR within ¼ mile of the Site.

State Release Sites

EDR identified 23 State Release (Release) sites within 1 mile of the Site. The identified Release sites have been closed in accordance with the MCP. After a review of the addresses of these facilities, the Release sites identified by EDR are considered to be cross/downgradient from the Site. Therefore, the identified Release sites are unlikely to adversely impact environmental conditions at the Site.

Brownfield Sites

No Brownfield sites were identified by EDR within ½ mile of the Site.

Manufactured Gas Plants

No Manufactured Gas Plants were identified by EDR within 1 mile of the Site.

Orphan Properties

An Orphan Property is a listed facility in the same zip code as the Site which cannot be mapped because of inadequate address information. Ransom reviewed the 32 Orphan Properties identified by EDR, and determined that each of the 32 Orphan Properties are located in positions considered to be crossgradient, downgradient, or hydrologically isolated from the Site, have achieved regulatory closure, or are beyond the applicable ASTM search parameters. Therefore, the Orphan Properties are unlikely to adversely impact environmental conditions at the Site.

4.1.2 Massachusetts Department of Environmental Protection

Ransom also reviewed the MA DEP online database for information pertaining to Site and/or properties in the vicinity of the Site with known and/or suspected environmental contamination and their potential to adversely impact environmental conditions at the Site. No such release sites were identified during Ransom's review of the MA DEP online database; a copy of the search results is included in Appendix D.

4.2 ADDITIONAL ENVIRONMENTAL RECORD SOURCES

4.2.1 Municipal Offices

On April 23, 2013, Ransom visited Town of Lexington Municipal Offices to view information pertaining to the ownership, historical use, and environmental status of the Site. The offices reviewed are described below. Pertinent information obtained during the municipal file reviews is incorporated into the site history presented in Section 4.4 of this report, and copies of records are provided in Appendix D.

Tax Assessor's Office

Ransom obtained property cards and tax maps for the Site from the Town of Lexington and Town of Lincoln Tax Assessor's Offices. The current tax maps document parcel boundaries, the Site's location, and the location of surrounding streets and residential properties. The property cards indicate that the Site is owned by Minuteman Regional Vocational Technology School, which acquired Parcel 7B on February 1, 1972 (Book 12161, Page 443), and Parcel 1B on October 10, 1973 (Book 12534, Page 36). Purchase dates for the remaining two parcel are not listed. Because the high school is a non-profit organization, the buildings at the Site are not assessed for tax purposes and do not appear on the property cards.

Building Department

Ransom reviewed available records at the Town of Lexington Building Department. Records included figures showing layouts of the high school building and surrounding areas, building alteration permits for the school, building permits and a floor plan for the energy house, and other records pertaining to proposals for alterations at the Site. The building department did not have files pertaining to current or historical heating systems at the Site.

Engineering Department

At the Lexington Engineering Department, Ransom reviewed plans confirming that the Site has historically been connected to municipal sewer systems. Ransom also reviewed historical tax maps which showed the boundaries of parcels at the Site. No information pertaining to releases of OHM was available at the Engineering Department.

Town of Lexington Fire Department

The Lexington Fire Department Fire Prevention Division did not respond to Ransom's information requests before this report was published. Should information be received from the Fire Prevention Division that results in a material change to the conclusions and recommendations included herein, Ransom will issue an Addendum to this report.

Health Division

The Lexington Heath Division did not respond to Ransom's information requests before this report was published. Should information be received from the Lexington Health Division that results in a material change to the conclusions and recommendations included herein, Ransom will issue an Addendum to this report.

Conservation Commission

The Lexington Conservation Commission identified wetlands at the Site and abutting properties. No files pertaining to releases of OHM at the Site were available at the Lexington Conservation Commission.

4.3 PHYSICAL SETTING SOURCES

4.3.1 Topography

The topography of the Site is variable, but generally slopes to the southwest. The northeast corner of the Site slopes to the northeast. Based on EDRs research, the general elevation of the Site is approximately 199 feet above mean sea level, as referenced to the National Geodetic Vertical Datum (NGVD). Cranberry Hill is located south of the Site, with an elevation of over 280 feet; regional topography consists of uneven terrain with several hills which have elevations of over 250 feet.

4.3.2 Soils/Geology

According to the U.S. Department of Agriculture (USDA) Soil Conservation Service (SCS), surface soils in the vicinity of the Site are identified as Windsor. Windsor soils are classified as loamy sand, which is well drained to excessively well drained, with very high infiltration rates.

Based on information provided on the USGS Bedrock Geologic Map of Massachusetts, bedrock at the Site and vicinity is identified as sedimentary and volcanic rocks consisting of metamorphosed mafic to felsic flow and volcaniclastic and hypabyssal intrusive rocks, including some diorite and gabbro. Ransom did not observe bedrock outcrops at the Site during our reconnaissance.

4.3.3 Surface Water Bodies/Floodplains

A small pond is located approximately 350 feet southwest of the high school building. Wetlands and streams were observed on the western portion of the Site. Numerous small, unnamed ponds are located within ½ mile of the Site to the north, south, and west.

Based on the Middlesex County, Massachusetts, National Flood Insurance Program Map (FIRM), Community Panel Number 25017C, the Site is not located within a 100- or 500-year flood zone.

4.3.4 Hydrogeology

Based on field observations and Site topography, groundwater at and in the vicinity of the Site is presumed to flow to the southwest, toward nearby wetlands and eventually to Hobbs Brook. Areas in the northeast corner of the Site slope in a northeast direction, toward wetland areas. Cranberry Hill, located to the south-southeast of the Site, is considered to be upgradient from the Site. A groundwater elevation survey was not performed as part of this Phase I ESA; therefore, groundwater flow direction at the Site cannot be confirmed.

4.4 HISTORICAL USE INFORMATION FOR THE PROPERTY

The history of the Site was researched to ascertain past use from the present back to the property's first developed use. Reasonably ascertainable historical information sources researched in this assessment allowed uses of the Site to be traced from the present back to 1894, at which time the Site was undeveloped. The following standard historical sources were reviewed by Ransom:

1. Historical topographic maps provided by EDR, dated 1894, 1915, 1943, 1949, 1950, 1958, 1970, 1979, and 1987 (Appendix F);

2. Aerial Photographs provided by EDR, dated 1952, 1955, 1963, 1969, 1978, 1980, 1985, 1995, 2006, 2008, and 2010 (Appendix F);

3. Historical City Directory Image Report provided by EDR (Appendix F); and

4. Information reviewed at the Town of Lexington and Town of Lincoln Municipal Offices (Appendix F).

The following table is presented as a summary of the historical use of the Site.

Year(s)	Property Use and Observed Details	Reference Source
circa 1894 to circa 1943	Undeveloped land.	Historical topographic maps
Circa 1943 to 1975	Undeveloped land, residential properties.	Aerial photographs, historical topographic maps, municipal research, interviews
1975 to present	The high school building is completed in 1975. Other structures and features have been added since then, including the energy house circa 1989. A former horticultural storage barn and plastic-covered greenhouse were located southwest of the high school building; these structures have been demolished.	Aerial photographs, historical topographic maps, EDR City Directory Image Report, municipal research, interviews, site visit

4.5 HISTORICAL USE INFORMATION FOR ADJOINING PROPERTIES

Historical uses of the adjoining properties are presented in the table below and were identified in the standard historical sources listed above during the course of researching the Site.

Year(s)	Property Use and Observed Details	Reference Source
North		
circa 1894 to present	Residential properties in the early 1900s, undeveloped wooded land (part of Minute Man National Park) in the present day.	Aerial photographs, historical topographic maps, municipal research site visit
East		
circa 1894 to 1966	Undeveloped wooded land and residential properties located along Marrett Road.	Aerial photographs, historical topographic maps, site visit
1966 to 1985	Electrical substation, undeveloped wooded land; Marrett Road.	Aerial photographs, historical topographic maps, municipal records
1985 to present	Electrical substation, office building, Marrett Road.	Aerial photographs, historical topographic maps, EDR city directory image report, municipal records, site visit
South		
circa 1894 to present	Wooded land and residential properties located along Mill Street.	Aerial photographs, historical topographic maps, city directory image report, site visit
West		
circa 1894 to present	Undeveloped wooded land and residential properties.	Historical topographic maps, aerial photographs, site visit

5.0 SITE RECONNAISSANCE

On April 19 and 23, 2013, Ransom conducted a reconnaissance of the Site. Ransom was accompanied by Mr. Michael Clickstein, Maintenance Supervisor for the high school during the site visit. A photograph log is included in Appendix C.

5.1 METHODOLOGY AND LIMITING CONDITIONS

The reconnaissance included observations at the Site for evidence of releases, potential releases of OHM, or a material threat of releases of OHM. Weather conditions at the time of each reconnaissance were cloudy, with intermittent drizzle on the 23rd, and temperatures around 40°–50° Fahrenheit. Ransom's reconnaissance of the Site consisted of a tour of the school building, grounds in the immediate vicinity of the high school building, and walks through some western portions of the Site. Ransom did not access the energy house, the small storage sheds at the site (including a former hazardous-waste storage shed), or all undeveloped areas of the Site. Therefore, Ransom cannot draw conclusions regarding the presence or absence of OHM storage or releases in these areas. According to Mr. MacLean, the former hazardous-waste storage shed has not had a history of a release and is no longer used to store hazardous waste. The building formerly stored waste automotive fluids.

5.2 GENERAL SITE SETTING AND OBSERVATIONS

5.2.1 Interior of High School Building

The Site is improved with the high school building which was completed in 1975. The building occupies a footprint of approximately 110,000 square feet and has a total interior floor space of approximately 310,000 square feet. The ground floor includes the boiler room (southwest portion of the high school building), swimming pool (west), cafeteria (west central), offices, and the "trades hall" (east) which has technical teaching spaces for plumbing, HVAC, automotive, electrical, welding, and carpentry trades.

In the boiler room, Ransom observed natural-gas-fired boilers. The high school building formerly used oil heat; Ransom observed the cut and capped feed pipes leading to the exterior fuel oil tanks. No OHM staining was observed on soil surfaces below these pipes. Floor drains were observed in the furnace room; no staining was observed in the vicinity of these drains; according to Mr. Clickstein, these drains are connected to the municipal sewer system. Adjacent to the pool, Ransom observed the pool filter and chemical room. Pool chemicals appeared to be properly stored; according to Mr. Clickstein, the drains associated with the pool are connected to the municipal sewer system. In the cafeteria, Ransom observed two grease traps, which appeared to be in good condition. An additional grease trap is located in the baking kitchen on the Mall level of the building. According to Mr. Clickstein, these traps are emptied every six months. Baker's Commodities removes grease from the Site.

In the plumbing area, Ransom observed a trench floor drain and markings on concrete floors which indicate that a former hydraulic lift was likely located in the space. According to Mr. Clickstein, the space was previously used by automotive-repair classes. The trench drain is connected to an oil/water separator exterior to the high school building which discharges to the municipal sewer system. Due to floor surfaces over the concrete in this area, Ransom could not determine the number of former hydraulic lifts which were located in the plumbing room or whether underground lift pistons or hydraulic oil reservoirs have been removed. In the HVAC room, Ransom observed fuel-oil-fired furnaces used for teaching purposes. These furnaces are connected to a fuel oil AST, described below. Ransom observed two automotive technology teaching areas; a garage for adult classes is located in the southeast portion of the building, and an automotive shop for high school classes is located in the northeast portion of the building. In the adult garage, Ransom observed five aboveground hydraulic vehicle lifts; these lifts appeared to be in good condition. In the high school garage, Ransom observed eleven aboveground hydraulic lifts which also appeared to be in good condition. Ransom observed evidence of former underground hydraulic lifts in the garage; the number and locations of these lifts could not be determined. Ransom observed a hazardous-waste storage room adjacent to the high school automotive garage; Ransom did not observe evidence of a release of OHM in this room. A drain system is present in the high school garage; these drains discharge to an oil/water separator at the exterior of the high school building which is connected to the municipal sewer system.

On the second floor, Ransom observed classrooms, a media/library center, and offices. On the third floor, Ransom observed science labs, dental assisting offices, a machining lab, and other teaching spaces which use or store OHM. This OHM is described below. No evidence of OHM releases was observed.

Ransom observed three hydraulic elevators in the high school building. Minor staining was observed on the concrete surfaces below the reservoirs and machinery in the elevator machine rooms. The concrete floors were observed to be in good condition and no cracks were observed; therefore, no evidence of a release of OHM to the environment was observed in these rooms.

Ransom observed several maintenance rooms and janitor's closets in the high school building containing common cleaning chemicals and liquids used in building maintenance; these materials appeared to be stored properly and no evidence of a release was observed.

5.2.2 Other Structures and Exterior Site Observations

North of the high school building, Ransom observed a hazardous-waste storage shed which is used to store waste chemicals used in labs in the high school building. This shed is constructed of wood, with a concrete floor. Ransom observed four unlabeled drums and a fire-safe cabinet in the shed. No evidence of a release was observed in or around the shed. An additional hazardous-waste storage shed, described above in Section 5.1, was not entered by Ransom during the site reconnaissance. Ransom observed manholes associated with the oil/water separators north of the high school building; these structures are reportedly cleaned as needed. Outside the HVAC area, Ransom observed an asphalt patch which is reportedly the former location of a waste-oil UST used by the nearby automotive garage. Also north of the high school building, Ransom observed a pad-mounted transformer. No evidence of a release was observed from this transformer. According to Mr. Clickstein, this transformer was replaced in 2010; no releases were reported from the former transformer.

East of the high school building, Ransom observed the storage of car parts and engines. No evidence of a release of OHM from these materials was observed. Ransom observed a hydraulic trash-compactor attached to a general waste dumpster; no evidence of a release of hydraulic fluid was observed at this dumpster. No evidence of OHM dumping in the dumpster was observed. Also east of the building, Ransom observed a concrete pad which was the former location of gasoline fuel pumps. Mr. Clickstein identified a nearby area where a 5,000-gallon gasoline UST was formerly located.

At the southeast corner of the high school building, Ransom observed a storage structure for compressed gas. Ransom observed a large propane tank, as well as small tanks which contain gases used in trade classrooms and in labs. No evidence of liquid storage was observed in this structure.

The energy house is located southeast of the high school building; Ransom did not enter this structure. This structure reportedly uses electric heat and does not store OHM.

Southwest of the high school building, Ransom observed a greenhouse and small attached classroom building. Small containers of OHM (gasoline, cleaners) were observed in this space; no evidence of a release of OHM was observed. South of the greenhouse, Ransom observed manhole covers associated with two fuel-oil tanks located in underground concrete vaults. Southwest of the high school building, Ransom observed a maintenance storage garage containing tools, equipment, and materials to maintain the grounds at the Site, including a tractor and Bobcat. The small containers of OHM observed in this garage appeared to be in good condition. No evidence of a release of OHM from the equipment or containers was observed.

West and southwest of the high school building, Ransom observed parking lots, baseball fields, a football field, and landscaped areas. Several small concrete and wood structures were observed which are used to store a variety of dry materials, including sports equipment. A concessions stand is located adjacent to the football field; Ransom did not enter this structure. The remainder of the Site consists of wooded land, access roads, and a pond and wetland in the southwest portion of the Site.

5.2.3 Hazardous Substances and Petroleum Products

Ransom observed several locations with hazardous substances or petroleum products throughout the high school building. These substances, along with their locations, are described below. Clean Harbors Environmental Services (CHES) reportedly collects and disposes of hazardous waste generated at the Site on a regular basis.

1. ASTs and USTs are located at the Site; these tanks contain petroleum products, and are described in Section 5.2.4, Storage Tanks;

2. Ransom observed pool chemicals stored in the pool filter room. The containers appeared to be properly labeled, and no leaking or damage to the containers was observed;

3. Ransom observed small containers of virgin and waste oil in the automotive shops, including small drums used to collect waste oil from vehicles. The containers appeared to be properly labeled, and no leaking or damage to the containers was observed;

4. In the high school garage, Ransom observed a hazardous-waste storage room, including two 275-gallon virgin motor oil ASTs, one approximately 500-gallon waste-oil AST, one 55-gallon drum containing antifreeze, two 55-gallon drums containing used antifreeze, one 55-gallon drum containing used oil filters, and several smaller containers of oil, lubricants, and other car fluids. No evidence of a release of these chemicals to the environment was observed;

5. Flammables cabinets storing greases, lubricants, chemistry lab supplies, paints, oil, and other flammables were found throughout the facility. The cabinets appeared to be in good condition, and containers located in these cabinets were labeled and no evidence of spills or releases was observed;

6. In the hazardous-waste storage shed, Ransom observed drums containing liquids reportedly collected from laboratories. These drums were not clearly labeled. No evidence of a release from these drums was observed;

7. General cleaning products were found in several maintenance/custodial areas and in janitorial closets located throughout the interior of the high school building. The observed containers appeared to be in good condition;

8. Photo-developing chemicals used in the dental assisting classrooms are disposed of using Chemgone. A container of less than 5 gallons is stored in the dental assisting offices;

9. In the storage garage located southwest of the high school building, Ransom observed containers of gasoline, 5-gallon buckets of transmission fluid, and small containers of other machinery fluids. The containers appeared to be properly labeled, and no leaking or damage was observed.

5.2.4 Storage Tanks

Underground Storage Tanks (USTs) and/or Aboveground Storage Tanks (ASTs)

Two 15,000-gallon No. 4 fuel oil tanks are currently located southwest of the high school building, in concrete vaults located below an asphalt-paved driveway around the high school building. These tanks are no longer in use; the high school building was converted to natural gas heat approximately 10 years ago. Ransom observed cut and capped underground feed lines entering the boiler room from the tanks. Ransom reviewed the results of tank-tightness tests performed on each tank on March 29, 2013. Both tanks are reported to be tight, with no indication of a release of fuel oil. Approximately 550 gallons and 1,900 gallons of fuel oil remain in these tanks. Ransom did not observe the interior of the tank vaults.

According to available information, a 5,000-gallon gasoline tank, formerly located underground in a concrete vault, was removed from the Site on October 19, 1998. This tank was used to store gasoline for on-site refueling of vehicles owned by the school. The tank was located east of the high school building, and connected via underground pipes to a pump island located northeast of the high school. A permit to remove the tank states that the tank was located in a concrete vault. No information pertaining to potential releases from this tank and distribution system or environmental testing completed at the time of its removal was available.

A 1,000-gallon waste-oil UST was formerly located north of the Trades Hall portion of the high school building. This tank contained waste oil generated in automotive shops in the high school. The tank was reportedly removed in early 1999 and an asphalt patch is visible at this location. No information pertaining to potential releases from this tank or environmental testing completed at the time of its removal, was available.

A 1,000-gallon propane UST, located north of the high school building, formerly serviced the building and is no longer in use. Ransom could not determine whether the propane UST remains in place at the Site. Ransom observed propane ASTs which are currently in service.

Ransom observed a 275-gallon No. 2 fuel-oil AST in the HVAC shop, which services the oil-fired heating units used in the technical classroom. This tank appeared to be in good condition; aboveground fill, vent, and feed lines were observed.

Ransom observed the two 275-gallon virgin motor oil ASTs discussed above and one, approximately 500-gallon, waste-oil AST in the high school garage hazardous-waste room. Significant staining was observed on floor surfaces around the waste-oil AST; however, no evidence of a release of OHM to the environment was observed in this room.

A No. 2 fuel oil AST was reportedly located in the former plastic-covered greenhouse located southwest of the school. This tank fueled a heating system used in the greenhouse. CHES reportedly removed this tank when the greenhouse was demolished sometime within the last few years.

5.2.5 Odors

No strong, pungent, or noxious odors, indicative of a release of OHM, were noted at the Site during our reconnaissance.

5.2.6 Pools of Liquid

Ransom did not observe areas of standing water and/or pools of liquid, indicative of a release of OHM, at the Site during our reconnaissance.

5.2.7 Drums

As previously discussed, Ransom observed 55-gallon drums in the two hazardous-waste areas on Site, as well as small drums used to collect waste oil in the automotive garages. The drums appeared to be in good condition. Apart from stains around drums in the automotive hazardous-waste storage room, no staining and/or leaking were observed on or around the drums at the Site. The drums located in the hazardous-waste storage shed were not clearly labeled.

5.2.8 Unidentified Substance Containers

Ransom observed unidentified drums in the hazardous-waste storage shed located north of the high school building. No evidence of a release from these drums was observed. These drums reportedly store chemicals associated with science labs in the high school building.

5.2.9 Polychlorinated Biphenyls (PCBs)

Ransom observed one pad-mounted transformer north of the high school building. This transformer was reportedly installed in the last 3 to 4 years. This transformer appeared to be in good condition. Considering the age of this transformer, it is unlikely to contain PCBs in its mineral oil dielectric fluid (MODF). Pad-mounted transformers have reportedly serviced the high school building since it was constructed in 1975. No history of a release from transformers at the Site was reported by Site contacts; concrete surfaces in the vicinity of the current transformer appeared to be in good condition and no staining and/or leaking was observed.

Hydraulic equipment, which may contain PCBs, was observed at the Site. Aboveground hydraulic lifts were observed in the adult and high school garages; these lifts appeared to be in good condition. Former underground lifts were reportedly used in the plumbing Trade Hall and high school garage at the Site. Ransom could not determine the number of lifts or whether the hydraulic reservoirs and pistons have been removed. The high school building has three hydraulic elevators, which use hydraulic reservoirs. Minor staining was observed on the concrete below these reservoirs; no evidence of a release of hydraulic fluid to the environment was observed. Hydraulic systems are also used in several machines used at the Site (i.e., forklift, trash compactor, tractor, Bobcat, etc.). No evidence of a release of hydraulic fluid from this equipment was observed. Considering the age of these machines, Ransom does not anticipate that PCB-containing hydraulic fluid is present in this equipment.

Ransom observed fluorescent lights throughout the high school building; however, the light ballasts were not visible for assessment. Due to the age of the high school building, old ballasts at the Site could contain PCBs.

According to the U.S. Environmental Protection Agency (EPA), caulking (and other building materials) containing PCBs was commonly used during the construction of school buildings between the 1950s early 1970s. Given the dates of construction of the high school building, it is possible that PCB-containing caulking (or other building materials) was used and remains in place. Ransom did not sample or test caulking or other building materials as part of this assessment.

5.2.10 Pits, Ponds or Lagoons

Ransom observed a small pond southwest of the high school building during our reconnaissance. No oily sheens were observed on this pond.

5.2.11 Stained Soil or Pavement

Neither stained soil nor stained pavement, with the exception of *de minimis* staining in parking lots and automotive classrooms, was observed at the Site during our reconnaissance.

5.2.12 Stressed Vegetation

No stressed vegetation, indicative of a release of OHM, was observed at the Site during our reconnaissance.

5.2.13 Solid Waste

Ransom observed one solid-waste dumpster located east of the high school building. Ransom observed a hydraulic trash compactor connected to this dumpster; no staining or other evidence of OHM disposal was observed surrounding the dumpster or hydraulic compactor.

5.2.14 Wells

No drinking water wells or monitoring wells were observed during the site reconnaissance.

5.2.15 Other

Ransom observed floor drains in the high school garage and the plumbing shop. According to Mr. Clickstein, and site plans reviewed by Ransom, these drains lead to oil/water separators, which are connected to the municipal sewer system. Other floor drains located throughout the high school building flow directly to municipal sewer lines.

Ransom observed three grease traps located in kitchens in the high school building. Grease from these traps is collected and stored in a container located north of the high school building. Baker Commodities removes grease from the Site.

6.0 INTERVIEWS

Ransom interviewed Mr. Michael MacLean, facilities coordinator at the high school, and Mr. Michael Clickstein, Maintenance Supervisor at the high school. Mr. Clickstein provided Ransom with access to the high school building and accompanied Ransom during the site reconnaissance. Information gathered as a result of these interviews has been summarized in this report.

6.1 LOCAL GOVERNMENT OFFICIALS

On April 23, 2013, Ransom visited the Lexington Tax Assessor's Office, Building Department, Conservation Commission, Engineering Department, and Fire Department Fire Prevention Office. Ransom also contacted the Lexington Health Division and Lexington Fire Department, although no reply was received from these departments at the time this report was published. Information gathered as a result of these visits and contacts has been summarized in this report.

7.0 CONCLUSIONS

We have performed a Phase I ESA in general conformance with the scope and limitations of ASTM Standard Practice E 1527-05 and our scope of work prepared for KBA, dated April 1, 2013. Although Ransom did not identify a release of OHM at the Site, based on the information obtained during this ESA, Ransom has identified three RECs:

1. Possible releases of petroleum from a former 5,000-gallon gasoline tank and associated pump island and underground piping. The tank was installed in a concrete vault located east and northeast of the high school building. The tank was removed in 1998. No documentation was available for review describing the integrity of the tank and associated piping and soil conditions at the time the tank was removed;

2. Possible releases of petroleum from a former 1,000-gallon waste-oil UST located north of the high school building which was removed in 1999. Consistent with the 1998 gasoline tank system removal, no documentation was available for review describing the integrity of the tank and associated piping and soil conditions at the time the tank was removed; and

3. Possible releases of hydraulic fluid from former in-ground hydraulic lifts, located in the plumbing and automotive portions of the Trade Hall. No documentation was available describing the number, locations, and conditions of the former hydraulic lifts at the Site.

Ransom also identified two non-ASTM RECs:

1. According to the U.S. EPA, caulking (and other building materials) containing PCBs was commonly used during the construction of school buildings between the 1950s early 1970s. Given the dates of construction of the high school building, it is possible that PCB-containing caulking (or other building materials) was used and remains in place; and

2. Asbestos-containing materials (ACM) are present throughout the interior of the high school building.

8.0 RECOMMENDATIONS

Based on the outcome of this assessment, Ransom makes the following recommendations:

1. An LSI should be performed in the vicinity of the former gasoline tank, pump island, and associated underground piping; and the waste-oil UST, to determine if soil and/or groundwater have been adversely impacted in the vicinity of these former tanks;

2. A GPR survey of the plumbing and automotive portions of the Trade Hall should be performed to determine the number of underground hydraulic lifts located at the Site, as well as the locations of associated apparatus. Based on the GPR survey, an LSI should be performed in vicinity of the former underground hydraulic lifts to determine whether soil and/or groundwater have been adversely impacted;

3. The two out-of-service 15,000-gallon No. 4 fuel oil tanks currently located southwest of the high school building should be removed; and

4. Before building alterations or renovations are made, Ransom recommends that an HMI be performed to evaluate building materials for asbestos, lead-based paint, PCBs, and other hazardous materials.

9.0 ADDITIONAL SERVICES AND NON-SCOPE CONSIDERATIONS

9.1 ADDITIONAL SERVICES

No additional services beyond the standard scope of services prescribed by ASTM Standard Practice E 1527-05 were requested by KBA.

9.2 NON-SCOPE CONSIDERATIONS

The following environmental issues are outside the scope (non-scope considerations) of the standard practice defined by ASTM Standard Practice E 1527-05. This Phase I ESA does not identify or evaluate these non-scope considerations:

1. Asbestos-containing building materials;
2. PCBs in building materials;
3. Radon;
4. Lead-based paint;
5. Lead in drinking water;
6. Wetlands;
7. Regulatory compliance;
8. Cultural and historic resources;
9. Industrial hygiene;
10. Health and safety;
11. Ecological resources;
12. Endangered species;
13. Indoor air quality;
14. High-voltage power lines;
15. Biological agents; and
16. Mold.

10. REFERENCES

1. Town of Lexington Municipal Offices
Ransom Visit: April 23, 2013.

2. Massachusetts Department of Environmental Protection
Ransom Online Database Review: April 2013.

3. U.S. Geological Survey, Topographic 7.5-Minute Series, Maynard, Massachusetts, USGS Quadrangle, 1987.

4. Bedrock Geology Map of Massachusetts, Zen et al, 1983.

5. Environmental Data Resources (EDR) Radius Map Report, Historical Topographic Map Report, Certified Sanborn Map Report (No Coverage), Aerial Photograph Report, and City Directory Image Report, April 19–22, 2013.

11. SIGNATURE(S) OF ENVIRONMENTAL PROFESSIONAL(S)

Environmental Professional(s)

We declare that, to the best of our professional knowledge and belief, we meet the definition of an Environmental Professional as defined in §312.10 of 40 CFR Part 312. We have the specific qualifications based on education, training, and experience to assess a property of the nature, history, and setting of the Site. We have developed and performed the all appropriate inquiries in conformance with the standards and practices set forth in 40 CFR Part 312.

____
Heather E. Dudley-Tatman, P.G.
Project Manager

____
Timothy J. Snay, LSP, LEP
Vice President

APPENDIX A

Site Location Map

ASTM Phase I Environmental Site Assessment
Minuteman Regional Technical High School
758 Marrett Road
Lexington and Lincoln, Massachusetts

APPENDIX B

Site Area Plan and Site Plan

ASTM Phase I Environmental Site Assessment
Minuteman Regional Technical High School
758 Marrett Road
Lexington and Lincoln, Massachusetts

APPENDIX C

Photograph Log

ASTM Phase I Environmental Site Assessment
Minuteman Regional Technical High School
758 Marrett Road
Lexington and Lincoln, Massachusetts

APPENDIX D

Supplemental Documentation

ASTM Phase I Environmental Site Assessment
Minuteman Regional Technical High School
758 Marrett Road
Lexington and Lincoln, Massachusetts

APPENDIX E

EDR Radius Map with GeoCheck Report

ASTM Phase I Environmental Site Assessment
Minuteman Regional Technical High School
758 Marrett Road
Lexington and Lincoln, Massachusetts

APPENDIX F

Historical Topographic Maps, Aerial Photographs,
Certified Sanborn Map Report (No Coverage), and EDR City Directory Abstract

ASTM Phase I Environmental Site Assessment
Minuteman Regional Technical High School
758 Marrett Road
Lexington and Lincoln, Massachusetts

APPENDIX G

Qualifications

ASTM Phase I Environmental Site Assessment
Minuteman Regional Technical High School
758 Marrett Road
Lexington and Lincoln, Massachusetts

REPORT
FOR
HAZARDOUS MATERIALS DETERMINATION
SURVEY
AT THE
MINUTEMAN CAREER & TECHNICAL HIGH SCHOOL
LEXINGTON, MASSACHUSETTS

PROJECT NO: 213 114.00

Survey Dates:
May 6-10, 2013

SURVEY CONDUCTED BY:

UNIVERSAL ENVIRONMENTAL CONSULTANTS
12 BREWSTER ROAD
FRAMINGHAM, MA 01702

May 20, 2013

Mr. Mike McKeon
Kaestle Boos Associates, Inc.
325 Foxborough Boulevard, Suite 100
Foxborough, MA 02035

Reference: **Hazardous Materials Determination Survey**
Lexington Minuteman Career & Technical High School

Dear Mr. McKeon:

Thank you for the opportunity for Universal Environmental Consultants (UEC) to provide professional services.

Enclosed please find the report for hazardous materials determination survey at the Minuteman Career & Technical High School, Lexington, MA.

Please do not hesitate to call should you have any questions.

Very truly yours,

Universal Environmental Consultants

Ammar M. Dieb
President

UEC:\213 114\REPORT.DOC

Enclosure

1.0 INTRODUCTION:

UEC has been providing comprehensive asbestos services since 2001 and has completed projects throughout New England. We have completed projects for a variety of clients including residential, commercial, industrial, municipal, and public and private schools. We maintain appropriate asbestos licenses and staff with a minimum of twenty years of experience.

As part of the proposed renovation and demolition project, UEC was contracted by Kaestle Boos Associates, Inc. to conduct the following services at the Minuteman Career & Technical High School, Lexington, MA:

- Asbestos Containing Materials (ACM) Inspection;
- Lead Based Paint (LBP;
- Polychlorinated Biphenyls (PCB's)-Electrical Equipment and Light Fixtures;
- PCB's Caulking and Sealant Sampling;
- Mercury in rubber flooring;
- Cresol flooring;
- Underground Storage Oil Tanks (UST).

The scope of work included the inspection of accessible ACM, collection of bulk samples from materials suspected to contain asbestos, determination of types of ACM found and cost estimates for remediation. Bulk samples analyses for asbestos were performed using the standard Polarized Light Microscopy (PLM) in accordance with the Environmental Protection Agency (EPA) standard.

Bulk samples were collected by an EPA accredited and Massachusetts licensed asbestos inspector Mr. Leonard J. Busa (AI-030673) and analyzed by a Massachusetts licensed laboratory Asbestos Identification Laboratory, Woburn, MA.

PCB's bulk samples were analyzed by a Massachusetts licensed laboratory EMSL, Cinnaminson, NJ in accordance with EPA 3540C/8082 method.

Mercury in rubber flooring samples were analyzed by a Massachusetts licensed laboratory EMSL, Cinnaminson, NJ in accordance with EPA 7471B method.

Samples results are attached.

2.0 FINDINGS:

ASBESTOS CONTAINING MATERIALS (ACM) INSPECTION:

The regulations for asbestos inspection are based on representative sampling. It would be impractical and costly to sample all materials in all areas. Therefore, representative samples of each homogenous area were collected and analyzed or assumed.

All suspect materials were grouped into homogenous areas. By definition a homogenous area is one in which the materials are evenly mixed and similar in appearance and texture throughout. A homogeneous area shall be determined to contain asbestos based on findings that the results of at least one sample collected from that area shows that asbestos is present in an amount greater than 1 percent in accordance with EPA regulations.

All suspect materials that contain any amount of asbestos must be considered asbestos if it is scheduled to be disturbed per the requirements of the Department of Environmental Protection (DEP) regulations.

No additional suspect and accessible ACM were found during this survey. However, hidden ACM may be found during renovation and demolition activities.

Number of Samples Collected

Eighty six (86) bulk samples were collected from the following materials suspected of containing asbestos:

Type and Location of Material

1. Fireproofing at metal shop
2. Fireproofing at room 3S-31
3. Wall plaster for circular section at upper level dining
4. Ceiling plaster at boy's locker room
5. Ceiling plaster at stairwell down to women's locker room
6. Joint compound at ground floor
7. Joint compound at ground floor
8. 2'x 4' Suspended acoustical ceiling tile type I at plumbing shop
9. 2'x 4' Suspended acoustical ceiling tile type I at room 2S-53
10. Interior window glazing caulking
11. Interior window glazing caulking
12. Glazing caulking for small window in metal door at room 2S-22
13. Glazing caulking for small window in metal door at printing
14. Red sealant on metal duct corner at cleaning room by business office
15. Non-suspect lab table at science room 31
16. Transite tab table at room 3S-23
17. Transite table for fume hood at science room 31
18. Small tank insulation at boiler room
19. Small tank insulation at boiler room
20. Small pipe insulation at boiler room
21. Fitting insulation at boiler room
22. Mud on flange at boiler room
23. Fitting insulation at boiler room
24. Mud on flange at boiler room
25. Mud on flange at boiler room
26. White sealant on new insulated pipe at boiler room
27. Pipe insulation protruding from pit wall from exterior
28. Strip of flooring at track hallway
29. Black glue on bottom of wood block floor at hallway by elevator
30. Black glue on bottom of wood block floor at metal shop
31. Stick-on vinyl floor tile at greenhouse
32. Residue white flooring at boy's locker room
33. Resin paper at boy's locker room
34. Orange stair tread at stairwell
35. White with blue spots vinyl floor tile at lobby outside admissions
36. Black mastic for white with blue spots vinyl floor tile at lobby outside admissions
37. Red leveler for white with blue spots vinyl floor tile at lobby outside admissions
38. White with blue spots vinyl floor tile at third floor hallway by classroom 43
39. Mastic for white with blue spots vinyl floor tile at third floor hallway by classroom 43
40. Mastic for white with blue spots vinyl floor tile at barber shop
41. Brown vinyl floor tile at ground floor small drafting
42. Mastic for brown vinyl floor tile at ground floor small drafting
43. Darker brown vinyl floor tile at printing
44. Chocolate vinyl floor tile at hallway and stairwell
45. Sea green/blue vinyl floor tile at 3S-31

46. Deep sea blue vinyl floor tile at science room 31
47. New blue vinyl floor tile at upper level dining
48. Grey vinyl floor tile at trades hall loft office
49. New black vinyl floor tile at art
50. Mastic for new black vinyl floor tile at art
51. Red leveler for new black vinyl floor tile at art
52. Fire orange vinyl floor tile at 3S-22
53. Mastic for fire orange vinyl floor tile at 3S-22
54. Pink vinyl floor tile at third floor machinery lab
55. Mastic for pink vinyl floor tile at third floor machinery lab
56. White/grey vinyl floor tile at 2S-41
57. White/grey vinyl floor tile at 3N-13
58. Mastic for white/grey vinyl floor tile at 3N-13
59. Black with what streaks vinyl floor tile at ground floor hall by career directions
60. Black with what streaks vinyl floor tile at printing
61. Mastic for black with what streaks vinyl floor tile at printing
62. Gymnasium rubber floor
63. Gymnasium rubber floor adhesive
64. Light blue vinyl floor tile at science room 32
65. Linoleum floor covering under light blue vinyl floor tile at science room 32
66. Linoleum adhesive floor covering under light blue vinyl floor tile at science room 32
67. Linoleum floor covering at 3S-21
68. Linoleum floor covering at trades hall office loft
69. Linoleum floor covering at Lacrosse
70. Exterior pink vertical caulking in brick
71. Exterior pink vertical caulking in brick
72. Exterior pink window framing caulking
73. Exterior pink window framing caulking
74. Exterior pink door framing caulking
75. Exterior soft black glazing caulking
76. Interior hard brown glazing caulking for exterior window
77. Interior hard brown glazing caulking for exterior window
78. Interior black framing caulking for exterior window
79. Interior black framing caulking for exterior window
80. Interior thick black glazing caulking for exterior window
81. Exterior window glazing caulking at greenhouse
82. Exterior door framing caulking at snow blower shed
83. Exterior window framing caulking at landscape building
84. Exterior soft black glazing caulking
85. Black caulking on metal covering for window sill
86. Exterior black glue on copper flashing behind brick at side of window

Sample Results

Type and Location of Material	Sample Result
1. Fireproofing at metal shop	No Asbestos Detected
2. Fireproofing at room 3S-31	No Asbestos Detected
3. Wall plaster for circular section at upper level dining	No Asbestos Detected
4. Ceiling plaster at boy’s locker room	No Asbestos Detected
5. Ceiling plaster at stairwell down to women’s locker room	No Asbestos Detected
6. Joint compound at ground floor	No Asbestos Detected
7. Joint compound at ground floor	No Asbestos Detected
8. 2’x 4’ Suspended acoustical ceiling tile type I at plumbing shop	No Asbestos Detected

9.	2'x 4' Suspended acoustical ceiling tile type I at room 2S-53	No Asbestos Detected
10.	Interior window glazing caulking	No Asbestos Detected
11.	Interior window glazing caulking	No Asbestos Detected
12.	Glazing caulking for small window in metal door at room 2S-22	No Asbestos Detected
13.	Glazing caulking for small window in metal door at printing	No Asbestos Detected
14.	Red sealant on metal duct corner at cleaning room by business office	3% Asbestos
15.	Non-suspect lab table at science room 31	No Asbestos Detected
16.	Transite tab table at room 3S-23	20% Asbestos
17.	Transite table for fume hood at science room 31	20% Asbestos
18.	Small tank insulation at boiler room	No Asbestos Detected
19.	Small tank insulation at boiler room	No Asbestos Detected
20.	Small pipe insulation at boiler room	No Asbestos Detected
21.	Fitting insulation at boiler room	No Asbestos Detected
22.	Mud on flange at boiler room	No Asbestos Detected
23.	Fitting insulation at boiler room	No Asbestos Detected
24.	Mud on flange at boiler room	No Asbestos Detected
25.	Mud on flange at boiler room	No Asbestos Detected
26.	White sealant on new insulated pipe at boiler room	No Asbestos Detected
27.	Pipe insulation protruding from pit wall from exterior	No Asbestos Detected
28.	Strip of flooring at track hallway	No Asbestos Detected
29.	Black glue on bottom of wood block floor at hallway by elevator	No Asbestos Detected
30.	Black glue on bottom of wood block floor at metal shop	No Asbestos Detected
31.	Stick-on vinyl floor tile at greenhouse	No Asbestos Detected
32.	Residue white flooring at boy's locker room	No Asbestos Detected
33.	Resin paper at boy's locker room	No Asbestos Detected
34.	Orange stair tread at stairwell	No Asbestos Detected
35.	White with blue spots vinyl floor tile at lobby outside admissions	No Asbestos Detected
36.	Black mastic for white with blue spots vinyl floor tile at lobby outside admissions	No Asbestos Detected
37.	Red leveler for white with blue spots vinyl floor tile at lobby outside admissions	No Asbestos Detected
38.	White with blue spots vinyl floor tile at third floor hallway by classroom 43	No Asbestos Detected
39.	Mastic for white with blue spots vinyl floor tile at third floor hallway by classroom 43	No Asbestos Detected
40.	Mastic for white with blue spots vinyl floor tile at barber shop	No Asbestos Detected
41.	Brown vinyl floor tile at ground floor small drafting	No Asbestos Detected
42.	Mastic for brown vinyl floor tile at ground floor small drafting	No Asbestos Detected
43.	Darker brown vinyl floor tile at printing	No Asbestos Detected
44.	Chocolate vinyl floor tile at hallway and stairwell	No Asbestos Detected
45.	Sea green/blue vinyl floor tile at 3S-31	No Asbestos Detected
46.	Deep sea blue vinyl floor tile at science room 31	No Asbestos Detected
47.	New blue vinyl floor tile at upper level dining	No Asbestos Detected
48.	Grey vinyl floor tile at trades hall loft office	No Asbestos Detected
49.	New black vinyl floor tile at art	No Asbestos Detected
50.	Mastic for new black vinyl floor tile at art	No Asbestos Detected
51.	Red leveler for new black vinyl floor tile at art	No Asbestos Detected
52.	Fire orange vinyl floor tile at 3S-22	No Asbestos Detected
53.	Mastic for fire orange vinyl floor tile at 3S-22	10% Asbestos
54.	Pink vinyl floor tile at third floor machinery lab	No Asbestos Detected
55.	Mastic for pink vinyl floor tile at third floor machinery lab	No Asbestos Detected
56.	White/grey vinyl floor tile at 2S-41	No Asbestos Detected
57.	White/grey vinyl floor tile at 3N-13	No Asbestos Detected
58.	Mastic for white/grey vinyl floor tile at 3N-13	No Asbestos Detected
59.	Black with what streaks vinyl floor tile at ground floor hall by career directions	No Asbestos Detected
60.	Black with what streaks vinyl floor tile at printing	No Asbestos Detected
61.	Mastic for black with what streaks vinyl floor tile at printing	No Asbestos Detected
62.	Gymnasium rubber floor	No Asbestos Detected

63. Gymnasium rubber floor adhesive	No Asbestos Detected
64. Light blue vinyl floor tile at science room 32	No Asbestos Detected
65. Linoleum floor covering under light blue vinyl floor tile at science room 32	No Asbestos Detected
66. Linoleum adhesive floor covering under light blue vinyl floor tile at science room 32	No Asbestos Detected
67. Linoleum floor covering at 3S-21	5% Asbestos
68. Linoleum floor covering at trades hall office loft	Not Analyzed
69. Linoleum floor covering at Lacrosse	2% Asbestos
70. Exterior pink vertical caulking in brick	No Asbestos Detected
71. Exterior pink vertical caulking in brick	No Asbestos Detected
72. Exterior pink window framing caulking	No Asbestos Detected
73. Exterior pink window framing caulking	No Asbestos Detected
74. Exterior pink door framing caulking	No Asbestos Detected
75. Exterior soft black glazing caulking	5% Asbestos
76. Interior hard brown glazing caulking for exterior window	2% Asbestos
77. Interior hard brown glazing caulking for exterior window	Not Analyzed
78. Interior black framing caulking for exterior window	No Asbestos Detected
79. Interior black framing caulking for exterior window	No Asbestos Detected
80. Interior thick black glazing caulking for exterior window	No Asbestos Detected
81. Exterior window glazing caulking at greenhouse	2% Asbestos
82. Exterior door framing caulking at snow blower shed	No Asbestos Detected
83. Exterior window framing caulking at landscape building	No Asbestos Detected
84. Exterior soft black glazing caulking	3% Asbestos
85. Black caulking on metal covering for window sill	No Asbestos Detected
86. Exterior black glue on copper flashing behind brick at side of window	5% Asbestos

Various samples were not analyzed. The Environmental Protection Agency regulations states that should one sample from a homogenous area was found to be greater than 1 percent of asbestos, then the material must be considered asbestos containing.

Observations and Conclusions

All ACM that might be disturbed during the proposed renovation and demolition activities must be removed by a Massachusetts licensed asbestos abatement contractor under the supervision of Massachusetts licensed project monitors.

1. Red sealant on metal duct corner was found to contain asbestos. The ACM was found at various locations.
2. Transite tab table was found to contain asbestos.
3. Transite table for fume hood was found to contain asbestos.
4. Mastic for fire orange vinyl floor tile was found to contain asbestos. The ACM was found at various locations.
5. Linoleum floor covering was found to contain asbestos. The ACM was found at various locations including under newer flooring.
6. Exterior soft black glazing caulking was found to contain asbestos.
7. Exterior window glazing caulking at greenhouse was found to contain asbestos.
8. Exterior black glue on copper flashing behind brick was found to contain asbestos. The demolition contractor will have to segregate the ACM from non-ACM building surfaces for proper disposal in an EPA approved landfill that does not recycle.
9. All remaining suspect materials were found not to contain asbestos.
10. Roofing and flashing material was assumed to contain asbestos. However, roofing material is not required to be removed by a licensed asbestos contractor prior to renovation or demolition.

LEAD BASED PAINT SURVEY (LBP):

A high school is not considered a regulated facility therefore the Massachusetts Lead Law does not apply. All LBP activities performed, including waste disposal, should be in accordance with applicable Federal, State, or local laws, ordinances, codes or regulations governing evaluation and hazard reduction. In the event of discrepancies, the most protective requirements prevail. These requirements can be found in OSHA 29 CRF 1926-Construction Industry Standards, 29 CRF 1926.62-Construction Industry Lead Standards, 29 CRF 1910.1200-Hazards Communication, 40 CFR 261-EPA Regulations. According to OSHA, any amount of LBP triggers compliance.

PCB'S-ELECTRICAL EQUIPMENT AND LIGHT FIXTURES:
Visual inspection of various equipments such as light fixtures, thermostats, exit signs and switches was performed for the presence of PCB's and mercury. Ballasts in light fixtures were assumed not to contain PCB's (labels indicating that "No PCB's" were found).

Tubes in light fixtures, thermostats, exist-signs and switches were assumed to contain mercury.

PCB'S CAULKING AND SEALANT SAMPLING:
PCB's are manmade chemicals that were widely produced and distributed across the country from the 1950s to 1977 until the production of PCB's was banned by the US Environmental Protection Agency (EPA) law which became effective in 1978. PCB's are a class of chemicals made up of more than 200 different compounds. PCB's are non-flammable, stable, and good insulators so they were widely used in a variety of products including: electrical transformers and capacitors, cable and wire coverings, sealants and caulking, and household products such as television sets and fluorescent light fixtures. Because of their chemical properties, PCB's are not very soluble in water and they do not break down easily in the environment. PCB's also do not readily evaporate into air but tend to remain as solids or thick liquids. Even though PCB's have not been produced or used in the country for more than 30 years, they are still present in the environment in the air, soil, and water and in our food.

EPA requires that all construction waste including caulking be disposed as PCB's if PCB's level exceed 50 mg/kg (ppm). An abatement plan might also be required.

Number of Samples Collected

Seven (7) bulk samples were collected from the following.

Type and Location of Material

1. Exterior window framing caulking
2. Exterior vertical caulking in brick
3. Exterior vertical caulking in brick
4. Exterior vertical caulking in brick
5. Interior hard glazing caulking for exterior window
6. Interior soft glazing caulking for exterior window
7. Exterior window glazing caulking at greenhouse

Sample Results

Type and Location of Material	Sample Result
1. Exterior window framing caulking	0.97 mg/kg
2. Exterior vertical caulking in brick	No PCB's Detected
3. Exterior vertical caulking in brick	No PCB's Detected
4. Exterior vertical caulking in brick	No PCB's Detected
5. Interior hard glazing caulking for exterior window	3.7 mg/kg
6. Interior soft glazing caulking for exterior window	No PCB's Detected
7. Exterior window glazing caulking at greenhouse	No PCB's Detected

Observations and Conclusions

PCB's levels in all of the caulking samples were found to be much lower than the EPA limit of 50 mg/kg. No further action is required.

MERCURY IN RUBBER FLOORING:

Number of Samples Collected

Two (2) bulk samples were collected from the following.

Type and Location of Material

1. Rubber floor at gymnasium
2. Rubber floor at gymnasium

Sample Results

Type and Location of Material	Sample Result
1. Rubber floor at gymnasium	0.77 mg/kg
2. Rubber floor at gymnasium	No Mercury Detected

Observations and Conclusions
Mercury levels in the rubber flooring were found to be lower than the EPA limit of 2 mg/kg. No further action is required.

CRESOL FLOORING:
The wood block flooring on the ground floor is oily and odorous. The wood block flooring was assumed to contain Cresol.

UNDERGROUND OIL STORAGE TANKS:
Two underground oil storage tanks were observed at the rear of the school. No records were found on-site for review.

3.0 COST ESTIMATES:

The cost includes removal and disposal of all accessible ACM, hazardous materials and an allowance for removal of inaccessible or hidden ACM that may be found during the renovation and demolition project.

Location	Material	Approximate Quantity	Cost Estimate ($)
Various Locations	Red Sealant on Ducts	3,500 SF	17,500.00
	Fire Orange 12"x 12" Vinyl Floor Tiles and Mastic	2,000 SF	8,000.00
	Linoleum Floor Covering	30,000 SF	135,000.00
	Tubes in Light Fixtures	8,000 Total	80,000.00
	Miscellaneous HAZ MAT and Hidden ACM	Unknown	25,000.00
	Walls and Ceilings Demolition to access ACM	Unknown	25,000.00
Science Labs	Transite Tables/Counter Tops	8 Total	2,800.00
	Fume Hoods	8 Total	1,400.00
Ground Floor	Cresol Wood Block Flooring	20,000 SF	200,000.00

Exterior	Windows	500 Total	87,500.00
	Oil Storage Tanks	2 Total	40,000.00
	Building Flashing[1]	Unknown	100,000.00
	Transite Sewer Pipe[2]	Unknown	30,000.00
Location	Material	Approximate Quantity	Cost Estimate ($)
Estimated Fee for Design, Construction Monitoring and Air Sampling			67,800.00
		Total:	**820,000.00**

[1]: Part of Demolition activities.
[2]: Part of Demolition and addition activities.

4.0 DESCRIPTION OF SURVEY METHODS AND LABORATORY ANALYSES:

Asbestos:

Asbestos samples were collected using a method that prevents fiber release. Homogeneous sample areas were determined by criteria outlined in EPA document 560/5-85-030a.

Bulk material samples were analyzed using PLM and dispersion staining techniques with EPA method 600/M4-82-020.

Polychlorinated Biphenyls:

PCB's samples were analyzed in accordance with EPA 3540C/8082 method.

Mercury in Rubber Flooring:

Mercury samples were analyzed in accordance with EPA 7471B method.

Inspected By:

Leonard J. Busa
Asbestos Inspector

5.0 LIMITATIONS AND CONDITIONS:

This report has been completed based on visual and physical observations made and information available at the time of the site visits, as well as an interview with the Owner's representatives. This report is intended to be used as a summary of available information on existing conditions with conclusions based on a reasonable and knowledgeable review of evidence found in accordance with normally accepted industry standards, state and federal protocols, and within the scope and budget established by the client. Any additional data obtained by further review must be reviewed by UEC and the conclusions presented herein may be modified accordingly.

This report and attachments, prepared for the exclusive use of Owner for use in an environmental evaluation of the subject site, are an integral part of the inspections and opinions should not be formulated without reading the report in its entirety. No part of this report may be altered, used, copied or relied upon without prior written permission from UEC, except that this report may be conveyed in its entirety to parties associated with Owner for this subject study.