15 October 2014

EXISTING CONDITIONS ASSESSMENT / SCHEMATIC DESIGN SUBMISSION

FOR

PARTIAL ROOFING AND WINDOW REPLACEMENT PROJECTS AT THE GENERAL JOHN NIXON ELEMENTARY SCHOOL

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DRAFT

PREPARED FOR

SUDBURY PUBLIC SCHOOLS

MSBA ACCELERATED REPAIR PROGRAM
BWA Project No. 1420

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EXECUTIVE SUMMARY

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EXECUTIVE SUMMARY

GOALS AND OBJECTIVES

The goal of the Town of Sudbury (TOS) through the Sudbury Public Schools and the Owner's Project Manager, SKANSKA, is to partially replace the existing roofing and window systems at General John Nixon Elementary School (NES) through the auspices of the Massachusetts School Building Authority (MSBA) Accelerated Repair Program. The objective of this report is to analyze the existing conditions at the building, make design recommendations, review applicable regulations, estimate construction cost and establish a project schedule.

FINDINGS AND RECOMMENDATIONS

BAKER|WOHL ARCHITECTS, with its consultants PEDA Inc (for structural engineering), and Vertex Companies, Inc. (hazardous materials consultant), performed field investigations of existing conditions. These findings are presented in Section 2 of this Report.

The building and the project are evaluated with regards to the various building codes and regulations in Section 3.

Design options have been considered with the Town, and a scope of work established. The work consists of the replacement of 5,000 sf of sloped shingle roofing with new shingles, and the replacement of 3,300 sf of existing single glazed aluminum windows with new thermal break, aluminum windows with insulated glazing. This scope, together with

schematic design specifications and drawings is fully itemized in Section 4. **We certify that the proposed project meets the sustainability requirements of the MSBA Accelerated Repair Program.**

COSTS

The cost estimate for this scope of work is **$605,000**. This includes a 5% design contingency. The cost estimate prepared by BWA is present in Section 5.

IMPLEMENTATION SCHEDULE AND NEXT STEPS

This Report is to be submitted by SKANSKA by 15 October 2014 to the MSBA. The next goal is bid the project as early in the Winter of 2015 as possible. See Sections 6 and 7.

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EXISTING CONDITIONS ANALYSIS

2a

SCOPE OF STUDY

Baker|Wohl Architects (BWA) and our consultants Vertex Companies, Inc. (Hazardous Materials Investigations), and Paul E. Donahue Associates (PEDA) (Structural Consultant) undertook this investigative study under the direction of the Town of Sudbury (TOS) and the Owner's Project Manager (OPM), Skanska. The purpose of the study is to review the existing conditions at General John Nixon Elementary School (NES) and establish the criteria for the partial roof and window replacement projects under the MSBA's Accelerated Repair Program.

Recommendations are made with respect to the scope of construction, design considerations and construction procurement for both projects.

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FIELD OBSERVATIONS and EXISTING CONDITIONS DATA

Data for this report has been obtained from the following sources:

- Input from Jim Kelly, Director of Town of Sudbury Combined Facilities and Joe Kupczewski, Maintenance Director for Sudbury Public Schools
- Miscellaneous drawing sheets for the original construction project Concord Road (Nixon) Elementary Schools, by S.W.

Haynes & Assoc., Inc. Architects, dated 19 May 1959

- Miscellaneous drawing sheets for the project Nixon Elementary School Renovations, by Architectural Resources, Inc, dated 23 May 1990
- Miscellaneous drawing sheets for the project Nixon Elementary School Additions, by Architectural Resources, Inc, dated 15 September 1994
- Cafetorium Roof Claim Letter by Town of Sudbury Facilities to Certainteed Roofing Corporation, dated 9 April 2014
- Owner provided photographs documenting Cafetorium roof condition and related roof test cuts (taken 6 April 2014), and structural repairs to steel column at Cafetorium (taken 1 Jan 2014)
- Window & Door Condition Survey Report, Nixon Elementary School by Russo-Barr Associates, Inc., dated 24 January 2014
- Re-Caulking Quote Letter, Nixon Elementary School by Chapman Waterproofing Company, dated 6 September 2013
- Hazardous materials sampling report, Limited Pre-Renovation Survey, by Vertex Companies, Inc., dated 28 August 2014
- Field visits by BWA on 18 August 2014 and 29 August 2014
- Field visits by structural consultant Paul E. Donahue Associates (PEDA) on 29 August 2014 and subsequent report dated 4 September 2014 , Dead Load Report, dated 25September 2014 and Supplement, dated 1 October 1 2014.

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BACKGROUND INFORMATION

Nixon Elementary School was constructed in 1959 as an approximately 28,000 sf elementary school. In 1990, the structure underwent renovations, including the re-facing of the exterior walls of the existing classroom wing with brick masonry to match the forthcoming 1994 addition. In 1994 an approx. 32,000 sf addition was constructed to add another classroom wing plus core facilities, including a gymnasium, media center and specialty classrooms. The building contains about 60,000 sf on one single level. It serves about 395 students grades PK – 5.

Original Building Construction: The building has a combination of steel framing and masonry bearing walls. The Cafetorium has a sloping roof constructed of 2” thick tongue & groove wood plank deck on glue-laminated wood beams, and has asphalt shingle roofing. The balance of the original structure has a flat roof of cementitious deck bulb tees & over steel bar joists, and has more recently installed single ply membrane roofing. Windows are the original mill finish aluminum frame without thermal break and with single glazing. Exterior doors are wood or hollow metal in wood frames, except at the Cafetorium and main entry vestibule, where the frame is mill finish aluminum.

Re-faced Original Classroom Wing Construction: This area has steel framing supporting a flat roof structure of cementitious deck & bulb tees over steel bar joists. It has more recently installed single ply

membrane roofing. Windows were replaced with pre-painted, thermal break aluminum with thermal glazing at the time of the re-facing.

Addition Construction: The addition is a load-bearing masonry structure with brick veneer supporting a roof structure of cementitious deck & bulb tees on steel bar joists and has single ply membrane roofing. Windows are pre-painted thermal break aluminum with thermal glazing.

Nixon Elementary School does not appear to be listed in the Massachusetts Historical Commission Cultural Resource Information System (the data base for identifying historical properties).

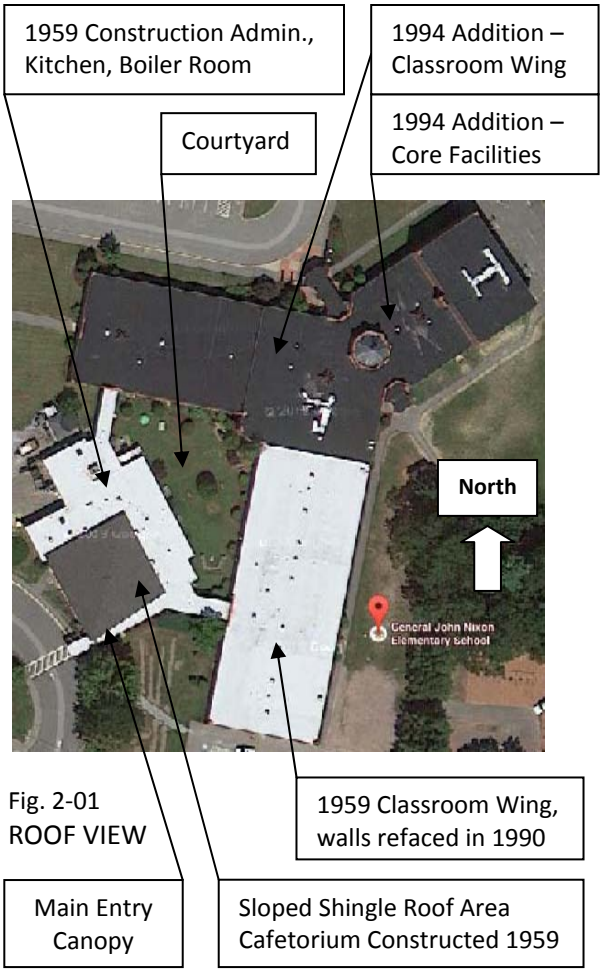

Fig. 2-01
ROOF VIEW

2d

EXISTING SHINGLE ROOF ASSESSMENT

Nixon Elementary School consists of several roof types – a sloped section with shingle roofing, and two sections of flat single ply roofing. Flat roofs at older construction are roofed in PVC membrane, and at the addition construction is roofed in EPDM membrane.

Fig. 2-02
SOUTH FACE OF CAFETORIUM ADJACENT TO ENTRY CANOPY

Fig. 2-03
VIEW EAST OF SLOPED SHINGLE ROOF AND ADJACENT FLAT ROOF OF 1959 CONSTRUCTION

THE SHINGLE ROOFING OVERVIEW

There is 5,000 sf (plan view) of sloped shingle roofing (Fig. 2-01) with an approximately 3/12 pitch. There is no attic below, and the roof deck and structural framing are exposed to view in the Cafetorium space below.

The roof structure consists of wood glue - laminated (glu-lam) beams and main girder. The center main girder spans diagonally across the Cafetorium space. It is sloped from a high point in the southwest corner at the building's front face, to a low in the north corner, where it rests on a heavy steel beam above the stage proscenium. It forms a sloping ridge (or hip) down the center of the roof. Beams, sized progressively larger according to the span, run from the sloped ridge down the sidewalls. The deck is tongue & groove 2"x6" nominal wood plank, which spans directly across the beams.

The girder, beams and deck extend out past the exterior wall and are exposed at the overhanging soffit.

There are some water stains on the deck and beams near the ceiling perimeter in the area of the lowest portions of the roof.

ORIGINAL ROOFING

The original construction 1959 drawings show that built up roofing was installed directly on top of the wood plank deck, without any insulation.

Fig. 2-04
CAFETORIUM ROOF STRUCTURE & DECK, SOUTHWEST CORNER

Fig. 2-05
CAFETORIUM ROOF STRUCTURE & DECK AT PROSCENIUM

Fig. 2-06
CAFETORIUM OVERHANGING SOFFIT WITH EXPOSED WOOD DECK AND GLU-LAM BEAMS

Fig. 2-07
ROOF CUT SHOWING TOP OF WOOD DECK, VAPOR BARRIER, INSULATION, NAILER BOARD, UNDERLAYMENT & SHINGLES

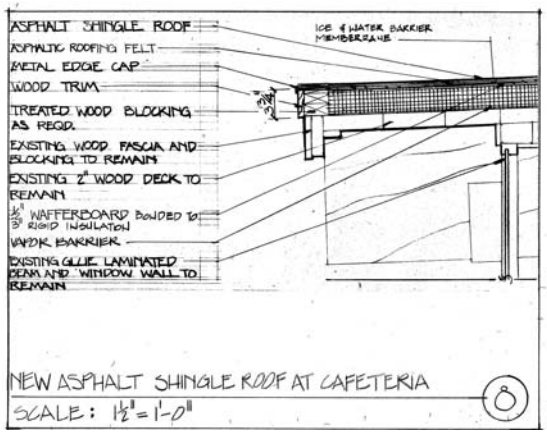

Fig. 2-08
1990 ROOF EDGE DETAIL FOR SHINGLE ROOF
PREFINISHED FASCIA & GUTTER ADDED LATER

Fig. 2-09
SLOPED CENTER RIDGE WITH AREA OF PREVIOUS SHINGLE REPAIR

SHINGLES

The current shingle roof was installed June 1990 using a 25-year shingle. Existing drawing indicate that the original built up roofing was removed down to the deck prior to the re-roofing.

Roof cuts by the Owner's roof consultant were performed earlier this year. These revealed that the shingle roofing system was installed per the 1990 drawings. The re-roofing included a vapor barrier directly on top of the deck, 3" rigid insulation board with top nailable layer of oriented strand board. Over that was installed underlayment and asphalt shingles. A drip edge runs the full perimeter of the roof. At the location of the roof cut, the insulation, nail board and deck appeared to be dry.

TOS maintenance staff report that repairs have been performed on the roof recently to replace missing or worn shingles.

Fig. 2-10
DRIP EDGE CONDITION

Fig. 2-11
TYPICAL GUTTER, FASCIA & MAIN GIRDER – NORTHEAST CORNER

Fig. 2-12
CENTER SLOPED RIDGE AND GUTTER – SOUTHEAST CORNER

Fig. 2-13
DOWNSPOUT TO SPLASHBLOCK ON FLAT ROOF-NORTHEAST CORNER

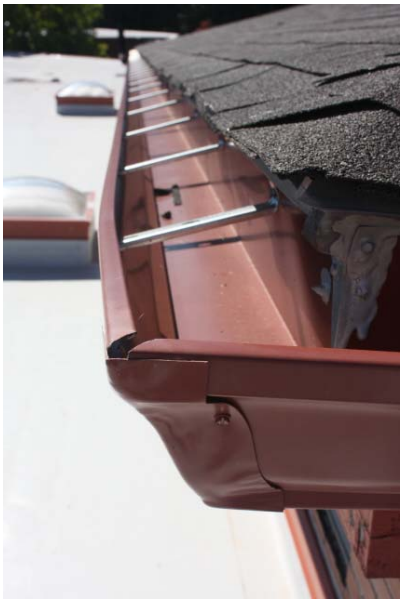

Fig. 2-14
TYPICAL GUTTER AT SLOPED SHINGLE ROOF

FASCIA, GUTTERS & DOWNSPOUTS

Town of Sudbury maintenance staff report that new prefinished aluminum fascia, gutters and downspouts were installed a couple of years ago. These appear to be in very good condition and can be reused.

STORMWATER MANAGEMENT

The sloped shingle roof drains to a pre-finished aluminum gutter at its full perimeter, with downspouts at the two lowest corners of the roof (southeast and northwest). The downspouts deliver stormwater onto splash blocks set on the adjacent lower flat roof. From there the runoff makes its way to roof drains located nearby on the flat roof. Overflow scuppers were installed at the flat roof system as a part of the previous re-roofing of those areas.

Fig. 2-15
DOWNSPOUT TO SPLASHBLOCK SET ON FLAT ROOF- NORTHWEST CORNER

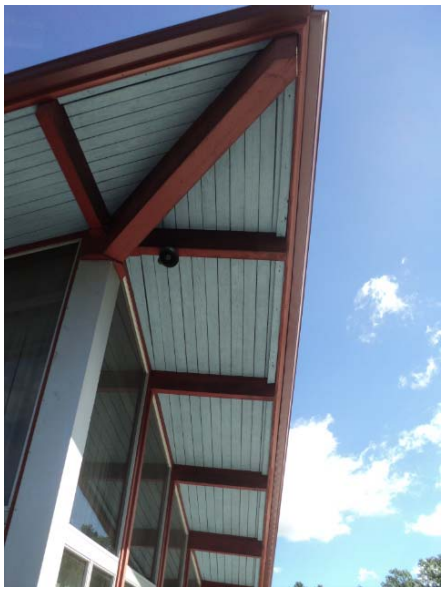

Fig. 2-16
CAFETORIUM SOFFIT WITH EXPOSED WOOD DECK AND GLU-LAM BEAMS AT SOUTHWEST CORNER

Fig. 2-17
LADDER TO ROOF WITH SECURITY DEVICE, LOCATED WITHIN COURTYARD

ROOF OVERHANG

The Cafetorium roof has wide overhangs which expose the underside of the wood decking and the cantilevered glu-lam girder and beams to view. Where visually accessible, damage to the decking and beams is not evident. They are both currently painted and refinishing should be performed as a part of the work. Covering this area with a metal soffit system is not recommended given all the complexity of the beam sizing and the visual continuity of the deck and structure from inside to out.

FLASHING

There are no roof penetrations or mechanical system components on the sloped roof. There are no roof-to wall-intersections within the shingle roof, as the sloped roof is higher than the adjacent flat roof.

ROOF ACCESS

An existing ladder in the courtyard provides access to the main flat roofs, which has a security device, installed by the maintenance staff, to prevent unauthorized use.

STRUCTURAL – CAFETORIUM ROOF
by PEDA (Structural Consultant)

DECKING

After 54 years of "drying", the roof deck planks have undergone significant dimensional changes in the direction perpendicular to grain. This dimensional change or shrinking of the plank has negated the benefits of the tongue and groove, and now allows planks to act independently. The structural diaphragm requirement for the roof decking has been compromised. It is recommended that the existing 2" x 6" plank roof decking be strengthened to re-establish the structural diaphragm. This may be accomplished by installing an appropriate thickness of plywood over the entire roof surface.

At the connection between the deck planks and the roof beams there is an angled filler. This was done to provide a flat surface on the sloped beam for nailing. It is recommended that the condition and frequency of fastening be observed when the existing roofing is removed and the deck is open to view prior to reroofing.

DEAD LOAD ASSESSMENT

The original 1959 documents do not provide information on the design loads. No other documentation of the original structural design criteria has been found.

The original roofing was a built up roofing system setting directly on the deck, which provided a minimum load compared to replacement roofing systems. Due to this, the proposed replacement roofing exceeds 5% increase in dead loading. An analysis was done on the roof framing capacity for carrying the increased loads. This revealed that all of the framing members, except for one beam can support the new roof dead load. This one member may require reinforcing. Additional analysis is recommended to further study the condition, and to see whether there are alternatives to reinforcing this beam.

Additionally, efforts are in progress to verify the weight of the original roofing system. Nixon School was one of two sister schools built at the same time. At its sister school, the original roofing is still intact – located within an enclosed attic formed by subsequent construction above the old roof. The weight of this roofing will be measured and used to update the structural evaluation.

UPLIFT

Inadequate information was available on the existing building documents to perform an evaluation without computer modeling.

COLUMN REPAIR

As discussed in the next section of this report, an existing column on the west side of the Cafetorium had suffered damage in the past. (see Figures 2-22 & 2-23) It was repaired by welding a channel along the outside of the column, at the top. It is recommended that this and the other exterior wall column in the cafetorium be examined when the existing windows are removed for replacement – while they can be viewed and accessed all four sides. Additional welding is recommended at prior repair, as the welding was limited at the time, to what could be reached with the windows in place.

Structural findings report may be found in Appendix 8b.

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ASSESSMENT OF EXISTING WINDOW & EXTERIOR DOORS AT 1959 CONSTRUCTION

GENERAL

Windows that still remain from the original construction are mill finish aluminum, without a thermal break. These windows are single glazed with either glass or polycarbonate. This makes the window system energy inefficient. Projecting operable sash windows are provided intermittently. Many of these are no longer functioning. Those that have lost seals have been sealed shut and in some places hardware is broken. A cementitious glazed-in panel generally located near the floor, was found to be asbestos containing. Caulking and glazing materials were also found to be asbestos containing. See also Section 2g Hazardous Materials.

CAFETORIUM

The west wall of the Cafetorium is almost fully covered with window wall stretching from the floor slab up to the underside of the sloping roof framing and deck. The windows run between the slender wall support columns and upwards between the glu-lam beams. The steel tube lally columns are exposed at the exterior, and both are a point of thermal heat transfer and require regular painting. Wood trim boards cover the joint between column and window. These trims have peeling paint and are loose or damaged in a few places.

Two tiers of light steel horizontal braces run between columns to provide lateral support. These have aluminum covers to match the window system. The original structural drawings show that the southwest corner column is a wide flange steel member. It has a mill finish aluminum cover.

There are five pair of projected operable sash within the window system. These are no longer opening properly. There is a glazed in solid panel at the base of the window wall, which conceals the perimeter baseboard radiation. The radiation has a metal cover and wood stool trim board to provide a finished interior closure. The window wall columns at the interior of the Cafetorium are trimmed out in painted wood.

Fig. 2-18 MAIN ENTRY CANOPY & SOUTHEAST FACE OF CAFETORIUM

At the south wall of the Cafetorium there is a brick masonry wall up to the height of about 8’-0”, running beside the entry canopy. Above is a window wall similar to that on the southwest side.

Fig. 2-19
SOUTHWEST FAÇADE OF CAFETORIUM

Fig. 2-20
SOUTHEAST CAFETORIUM WINDOWS

Fig. 2-21
BASE OF CAFETORIUM WINDOWS AT CANOPY

Town of Sudbury maintenance staff reported that one of the steel lally columns here had become damaged by water intrusion. The water in the concrete expanded in the cold and with subsequent rust the steel cracked. It was recently repaired by welding on a section of steel channel to the exterior.

These steel columns are currently half inside and half outside the building envelope. This provides a path for thermal transfer and cold surfaces for condensation in the heating season.

Fig. 2-22
DAMAGED COLUMN PRIOR TO REPAIR

Fig. 2-23
DAMAGED COLUMN AFTER REPAIR

Fig. 2-24
CAFETORIUM WINDOWS

Fig. 2-25
CAFETORIUM WINDOWS, ADJACENT TO DOORS

Fig. 2-26
MAIN ENTRY VESTIBULE - EXTERIOR

Fig. 2-27
MAIN ENTRY VESTIBULE – INTERIOR

MAIN ENTRY VESTIBULE

A mill finish aluminum storefront airlock vestibule was added onto the main entry doors sometime after the original construction. These appear to be of some age. The storefront system is set directly on top of the sidewalk and runs up under the entry canopy. It is single glazed without thermal break. A closure was built at the ceiling where the canopy stands off of the Cafetorium wall. An aluminum closure was also provided at the head of storefront, under the canopy to enclose framing members, and provide a clean surface to meet the storefront. The interior dimensions are several inches too small to accommodate ADA wheelchair access. The outside doors are oversized, which may make opening them more difficult for young children.

The original main entry door themselves have wood door and frame, with glazed sidelight and transom.

ACCESSIBILITY

The Town of Sudbury indicated that, other than the main entry vestibule, the school is currently fully accessible. Therefore no review of accessibility was performed.

BOILER ROOM, RECEIVING & KITCHEN

Operable sash at the boiler room are located especially high, and are difficult to reach. At the kitchen, a make-shift shield was installed outside to prevent pedestrians from running into the corners of the project out sash when open.

Doors to the kitchen and receiving are associated with the window masonry opening. The door frame is made of wood, set against the aluminum window frame. The door into receiving is 3'-0" wide, but a wider double door is needed to accommodate larger items delivered to the school. The existing wood door frame is heavily gouged.

A pair of doors leads into an Outdoor Storage Room, next to the Kitchen. These are wood doors in a wood frame and are in a simple brick opening, not associated with windows.

Fig. 2-28
WINDOWS & DOORS AT KITCHEN/STORAGE

Fig. 2-29
WINDOWS & DOORS AT RECEIVING - EXTERIOR

Fig. 2-30
WINDOWS AT BOILER ROOM & LOUVERS BELOW

Fig. 2-31
WINDOWS & DOORS AT RECEIVING - INTERIOR

ADMINISTRATION

Windows at the administration areas are composed of window wall assemblies stretching vertically from the floor up to the roof framing, and horizontally across several rooms. New window systems will need to coordinate with a series of interior elements. A cementitious glazed-in panel is used near the floor, to shield perimeter fin tube radiation and metal cover inside. A wood window stool is provided to cover the gap. Where CMU partitions run perpendicular into the window wall, an 8" wide aluminum cover is provided. A smaller 4" cover is provided to cover steel tube lally support columns. Rooms having existing suspended ceilings already have a sloped transition up to the top of the windows. Thru-window type air conditioning units are currently use for summer cooling in the offices. These are mounted in solid panels within the window wall system. TOS plans to continue to use this arrangement with the replacement windows. Solid insulated panels with provisions for remounting the window air conditioning units and an existing exhaust louver in the Teachers' Room, both need to be incorporated in the new design.

Fig. 2-32
COURTYARD WINDOWS AT ADMINISTRATION

Fig. 2-33
COURTYARD WINDOWS AT ADMINISTRATION

Fig. 2-34
INTERIOR OF ADMIN WINDOWS

Fig. 2-35
COURTYARD WINDOWS AT CMU PARTITION INTERSECTION

WINDOW TREATMENTS

In the Cafetorium room darkening and glare control are currently provided with tiered insulated drapes. Jim Kelly said that these must be fire treated every 2 years. Wood boards had to be added across the aluminum window framing at the inside to enable mounting of the drapes. The triangular tops of the window configuration make it difficult to install operable window treatments. Drapes are difficult to open and close. It is understood that room darkening is needed within the Cafetorium for presentations.

In the Administration, existing older horizontal blinds are used for light control. It is unlikely that these will still be serviceable with the replaced windows.

Fig. 2-36
FIRE TREATED DRAPES AT THE CAFETORIUM WINDOWS

Fig. 2-37
ADMINISTRATION WINDOWS SHOWING WINDOW BLINDS AND CEILING ABOVE

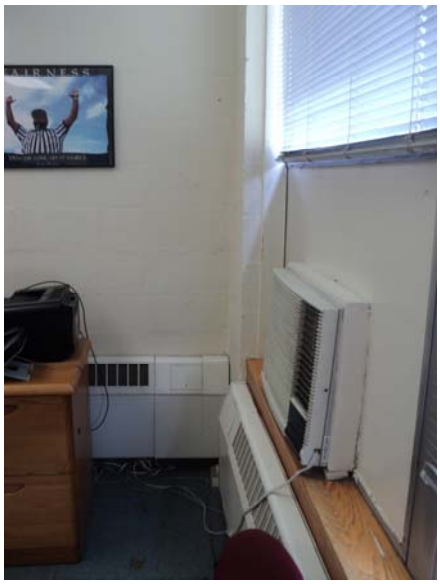


Fig. 2-38
ADMINISTRATION WINDOWS SHOWING WINDOW BLINDS, AIR CONDITIONING UNIT, BASEBOARD RADIATION & WOOD WINDOW STOOL

2F

ASSESSMENT OF EXISTING BRICK MASONRY CAULKING AT 1990 CONSTRUCTION

GENERAL

The typical classroom façade is the same in both the 1990 & 1994 construction as seen in Figure 2-31. There are regularly spaced vertical control joints. Between these is a repeating window pattern of one center large opening and smaller flanking windows.

Fig. 2-39
TYPICAL MASONRY CONTROL JOINT & WINDOW OPENINGS AT 1990 & 1994

MASONRY JOINTS AT 1990 CONSTRUCTION

Joints in this area were typically found to be cracked and split, or have separated from the surfaces, resulting in openings where air and water can enter the envelope.

Fig. 2-40
MASONRY CONTROL JOINT, 1990 CONSTRUCTION

Fig. 2-41
WINDOW PERIMETER JOINT, 1990 BUILDING

Fig. 2-42
MASONRY CONTROL JOINT, 1990 CONSTRUCTION

Fig. 2-43
WINDOW PERIMETER JOINT, 1990 BUILDING

Fig. 2-44
WINDOW PERIMETER JOINT & METAL-TO-METAL JOINT OPERABLE SASH TO FRAME, 1990 BUILDING

ALUMINUM –TO-ALUMINUM JOINTS AT THE 1990 WINDOWS

Joints between the operable sash and the surrounding window frame are aged and dried out. There is some concern for leakage at these joints. The large center window in each classroom has gasketted joints.

STEEL LINTELS

Steel lintels are typically used at the heads of masonry openings in the 1990 construction. Some peeling paint is evident at many of the steel lintels.

Fig. 2-45
LINTEL ABOVE WINDOW OPENINGS AT 1990 CONSTRUCTION, PEELING PAINT AND SEPARATED CAULKING ARE EVIDENT

Fig. 2-46
LOUVER AT THE BACKSIDE OF THE CAFETORIUM – PERIMETER CAULKING TO BE ABATED & REPLACED

Fig. 2-47
ACT WINDOW PANEL & WOOD TRIM WITH LEAD PAINT AT CAFETORIUM

2g

HAZARDOUS MATERIALS

Hazardous Materials consultant Vertex tested various existing roofing, window and caulking materials for the presence of asbestos and lead. Findings may be summarized as follows:

- No hazardous materials associated with the shingle roofing system were found.
- Lead was found on the red painted surfaces at the roof overhanging soffit, beams, lintels, and trim boards of the 1959 construction. The contractor must follow generally-understood regulations for the disposal of items with lead paint.
- Asbestos is present in the window and louver caulking and glazing as well as door perimeter caulking materials.
- Glazed-in opaque panels at the base of 1959 windows are asbestos containing.
- No asbestos was detected in the masonry expansion/control joint caulking.

The report of hazardous materials findings may be found in Appendix 8a.

3

APPLICABLE REGULATIONS AND STANDARDS

3a

APPLICABLE CODES AND REGULATIONS

- 780 CMR (2009 International Building Code with Massachusetts Amendments)
- 2009 International Existing Building Code (with Massachusetts Amendments)
- 2009 International Fire Code
- 2009 International Mechanical Code
- 521 CMR (Massachusetts Architectural Access Board)
- 527 CMR (Board of Fire Prevention Regulations)
- 248 CMR (Massachusetts Plumbing Code)
- MSBA Accelerated Repair Program Sustainability Requirements

APPLICABLE CODES, REGULATIONS AND REFERENCES

MASSACHUSETTS STATE BUILDING CODE (780 CMR) 8th Edition – AMENDMENT TO IBC 2009 AND IEBC 2009
INTERNATIONAL BUILDING CODE (2009)
INTERNATIONAL EXISTING BUILDING CODE (2009)
MASSACHUSETTS STATE STRETCH ENERGY CODE Appendix 120 AA, MA 8th Edition Building Code

PRELIMINARY BUILDING CODE REVIEW

ITEM	REFERENCE	REQUIRED/ALLOWED	PROPOSED
CLASSIFICATION OF WORK	IEBC / 403.1	Level 1 Alterations include the removal and replacement or covering of existing materials, elements, equipment or fixtures using new materials, elements, equipment or fixtures that serve the same purpose	Proposed scope of work is Re-roofing a portion of existing roof (Cafetorium) and select window and door replacement in kind. The classification of work is Level 1 Alterations.
ALTERATIONS – LEVEL 1	IEBC / 601.1	Level 1 alterations as described in Section 403 shall comply with the requirements of this chapter.	Proposed work shall meet requirements of IEBC 2009 Chapter 6.
BUILDING ELEMENTS AND MATERIALS	IEBC / 602.4	Materials and methods – All new work shall comply with materials and methods requirements in the International Building Code, International Energy Conservation Code....as applicable, that specify materials, standards detail of installation and connection, joints, penetrations, and continuity of any elements, component, or system in the building.	Proposed re-roofing and window replacement meet or exceed requirements of IBC 2009 and IECC 2009
FIRE PROTECTION	IEBC / 603.1	Alterations shall be done in a manner that maintains the level of fire protection provided.	Proposed work shall be done in a manner that maintains the existing level of fire protection.
MEANS OF EGRESS	IEBC / 604.1	Alterations shall be done in a manner that maintains the level of protection provided for the means of egress.	The proposed scope of work includes replacing existing doors in kind. The existing level of protection provided for means of egress is unaffected by the proposed work.
STRUCTURAL	IEBC / 606.2	Where addition of roofing results in addition of dead load, supporting structural components shall comply with the gravity load requirements of the IBC 2009.	Existing roofing is being removed to the structural deck. Existing roofing thickness is approximately 3". The new roofing system will have a minimum of 5" insulation. The preliminary structural analysis by the engineer indicates that proposed re-roofing work may increase the dead load by more than 5% and has recommended further investigation of the existing structural system.
	IEBC / 606.2.1	Exception number 1. "Structural elements where the additional dead load from the roofing or equipment does not increase the force in the member by more than five percent ", do not need comply with the IBC 2009.	
ROOFS	IBC / 1507.2.2	Asphalt shingles shall only be used on roof slopes of 2" per foot or greater. Double underlayment application is required for slopes between 2" per foot and 4" per foot	The existing roof deck slopes 3 3/8" per foot. Double underlayment shall be provided.
STRETCH ENERGY CODE	Stretch Energy Code	Projects funded by the MSBA Accelerated Repair Program are subject to the provisions of the Massachusetts Stretch Energy Code.	The proposed work shall comply with stretch energy code.
	Table 502.2 – Building Envelope Requirements – Opaque Assemblies	Climate Zone 5a: Roofs: Insulation entirely above deck: R-25ci	R-25ci provided over the existing deck.
	Table 503.2 – Building Envelope Requirements – Fenestrations	<u>Framing Materials with or without thermal break</u> Curtain Wall and Storefront System – .42 Operable Windows, Fixed Windows and Doors other than Entrance Doors U-Factor – 0.45 Entrance Door U-Factor – .80	<u>Proposed products comply:</u> Aluminum Curtain Wall and Store Front System – .31 Operable Windows, Fixed Windows and Doors other than Entrance Doors U-Factor – 0.31; Translucent Insulated Panels – .23 Proposed FRP Faced Aluminum Doors U-factor .29
SAFETY GLAZING	IBC 2009 2406.4	The following shall be considered specific hazardous locations requiring safety glazing materials: 1. Glazing in swinging doors except jalousies 6. Glazing in an individual fixed or operable panel adjacent to a door where the nearest exposed edge of the glazing is within a 24-inch arc of either vertical edge of the door in a closed position and where the bottom exposed edge of the glazing is less than 60 inches above the walking surface.	Safety Glazing is provided where required.
EXISTING BUILDINGS	521 CMR/3.3.1 521 CMR/3.3.1.B	If the work being performed amounts to less than 30% of the full and fair cash value of the building and: b. If the work costs $100,000 or more, then the work being performed is required to comply with 521 CMR. In addition, an accessible public entrance and an accessible toilet room, telephone, drinking fountain (if toilets, telephones and drinking fountains are provided) shall also be provided in compliance with 521 CMR.	We are advised by the owner that the building is fully accessible. Therefore, no accessible analysis is performed for the building. However, the existing entrance vestibule is proposed to be made larger to accommodate maneuvering clearances.

SUDBURY PERMANENT BUILDING COMMITTEE

278 Old Sudbury Road
Sudbury, MA 01776

GEN. JOHN NIXON ELEMENTARY SCHOOL PARTIAL ROOF AND WINDOW REPLACEMENT

472 CONCORD ROAD
SUDBURY, MA 01776

Baker | Wohl ARCHITECTS

132 Lincoln Street, Boston MA 02111 617.350.7420
www.baker-wohl.com

Issue

No.	Description	Date
1	30% SUBMISSION	10.15.14

DRAWING TITLE
PRELIMINARY BUILDING CODE REVIEW

SHEET NO.
A0.1

PROJECT NO.

3c

SUSTAINABILITY REQUIREMENTS FOR THE MSBA ACCELERATED REPAIR PROGRAM

ATTACHMENT G
Sustainability Requirements for the Accelerated Repair Program

Executive Summary

MSBA's Green School program provides incentives for a District to increase the energy efficiency and sustainability for its new construction and major renovation / addition projects, using either the US Green Building Council's LEED for Schools or the Massachusetts Collaborative for High Performance Schools criteria. MSBA's Accelerated Repair Program provides an opportunity to apply similar sustainable standards to specific building systems, more appropriate for repair projects that include replacement of roofs, boilers and/or window systems. This standard will use the Massachusetts Stretch Energy Code (780 CMR Appendix 120 AA) as a basis for those projects that include the replacement of those systems within their scope of work.

Districts seeking MSBA funding for the replacement, repair, or upgrade of the roof, boiler and/or windows at their school facilities will be required to follow the Stretch Energy Code's prescriptive requirements as a mandatory requirement.

What is the Stretch Energy Code?

The Stretch Energy Code is a set of enhanced building system energy-efficiency requirements, listed in Appendix 120 AA of the Massachusetts 7th Edition Basic Building Code. For commercial buildings, it is similar to the latest International Energy Conservation Code (IECC 2009), with enhancements that require about 20% greater building energy efficiency. The prescriptive requirements are based on the Core Performance program of the New Buildings Institute.

> An overview of the Stretch Energy Code can be viewed here:
> http://www.mass.gov/Eeops/docs/dps/inf/stretch_code_overview_jun05_09.pdf
> The full Stretch Energy Code text can be viewed here:
> http://www.mass.gov/Eeops/docs/dps/inf/appendix_120_aa_jul09_09_final.pdf

The following tables, from portions of the Stretch Code, are replicated here to show minimum standards for the replacement of roofs, windows, and boilers. For more information, refer to the code in its entirety.

Roof Replacement

(From 502 : Envelope Requirements, Table 502.1.2 – Building Envelope Requirements, Opaque Elements) and Table 502.2 – Building Envelope Requirements, Opaque Assemblies)

Maximum U – factors :

Roofs	
Insulation entirely above deck	U-0.039
Metal buildings (with R-5 thermal blocks)	U-0.049
Attic and other	U- 0.027

Minimum R – values :

Roofs		Note: IECC 2009 equivalent
Insulation entirely above deck	R-25 ci	Zone 7
Metal buildings (with R-5 thermal blocks [a,b])	R-13 + R-19	Zone 7
Attic and other	R-38	Zone 2-7

a. Thermal blocks are a minimum R-5 of rigid insulation, which extends 1-inch beyond the width of the purlin on each side, perpendicular to the purlin.

b. The first R-value is for faced fiberglass insulation batts draped over purlins. The second R-value is for unfaced fiberglass insulation batts installed parallel to the purlins. A minimum R-3.5 thermal spacer block is placed above the purlin/batt, and the roof deck is secured to the purlins. Reference: ASHRAE/IESNA 90.1 Table A2.3 including Addendum "G"

Window Replacement

(From 502 : Envelope Requirements, 502.3.2 Maximum U-factor and SHGC, Table 502.3 – Building Envelope Requirements, Fenestration, 502.4.1 Window and door assemblies, and 502.4.2 Curtain wall, storefront glazing and commercial entrance doors.)

For vertical fenestration, the maximum U-factor and solar heat gain coefficient (SHGC) shall be as specified in Table 502.3, which is uniformly set at 0.40. For skylights, the limit is set at 3% of roof area, but can be expanded to 5% of roof area in conjunction with automatic daylighting controls. In all cases, the maximum U-factor and solar heat gain coefficient (SHGC) shall be as specified in Table 502.3 below

Maximum U - factor and SHGC :

Framing materials other than metal with or without metal reinforcement or cladding	
U-Factor	0.35
Metal framing with or without thermal break	
Curtain Wall/Storefront *U*-Factor	0.42
Entrance Door *U*-Factor	0.80
All other *U*-Factor [a]	0.45
SHGC- All Frame Types	
SHGC	0.40
Skylights (3% maximum, or 5% maximum with automatic daylight controls [b])	
U-Factor	0.45
SHGC	0.40

a. All other includes operable windows, fixed windows and doors other than entrance doors.

b. Automatic daylighting controls shall meet the requirements of Section 505.2.2.1.3

The air leakage of window, skylight and door assemblies that are part of the building envelope shall be determined in accordance with AAMA/WDMA/CSA 101/I.S.2/A440, or NFRC 400 by an accredited,

independent laboratory, and labeled and certified by the manufacturer. Window and skylight air leakage shall not exceed 0.2 cfm/ft2 at 1.57 pounds per square foot (psf) (75Pa), or 0.3 cfm/ft2 at 6.24 psf (300 Pa). Door assembly air leakage shall not exceed 0.3 cfm/ft2 for all other products at 1.57 psf (75Pa).

Exceptions:
a. Site-constructed windows and doors that are sealed in accordance with Section 502.4.8.

Curtain wall, storefront glazing and commercial-glazed swinging entrance doors and revolving doors shall be tested for air leakage at a pressure of at least 1.57 pounds per square foot (psf) (75 Pa) in accordance with ASTM E 283. For curtain walls and storefront glazing, the maximum air leakage rate shall be 0.06 cubic foot per minute per square foot (cfm/ft2) (1.1 m3/h × m2) of fenestration area. For commercial glazed swinging entrance doors and revolving doors, the maximum air leakage rate shall be 1.00 cfm/ft2 (18.3 m3/h × m2) of door area when tested in accordance with ASTM E 283.

Boiler Replacement - REVISION

(Revised from 507 : Alternative Prescriptive Compliance Packages, 507.2.1 Efficient Mechanical Equipment)

Boilers shall meet the minimum efficiency requirements below:

Source Color Legend	ASHRAE 189.1	Combined*	189.1 Based**

Equipment Type	Fuel	Size Category	Minimum Efficiency
Hot Water	Gas	< 300,000 Btu /h	89% AFUE[f]
		300,000 Btu /h - 2.5 mBtu /h	89% Et[f]
		> 2,500,000 Btu /h	91% Ec[f]
	Oil	< 300,000 Btu /h	89% AFUE[f]
		300,000 Btu /h - 2.5 mBtu /h	87% Et[f]
		> 2,500,000 Btu /h	87% Ec[f]
Steam	Gas	< 300,000 Btu /h	75% AFUE
		300,000 Btu /h - 2.5 mBtu /h	77% Et/79% Et*** & 80% Ec
		> 2,500,000 Btu /h	77% Et/79% Et*** & 80% Ec
	Oil	< 300,000 Btu /h	80% AFUE
		300,000 Btu /h - 2.5 mBtu /h	81% Et & 83% Ec

* Combined rating – ASHRAE 189.1 modified by adding elements of IECC 2009 & ASHRAE 90.1-2007 to ensure efficiencies are as rigorous as current Massachusetts building code.
** 189.1 Based ratings – ASHRAE 189.1 lowered until three commercial boilers are available.
*** Lower Et rating applies to gas-fired, natural draft boilers, higher Et to all other types.
f Systems shall be designed with lower operating return hot water temperatures (<130°F) and use hot water reset to take advantage of the higher efficiencies of condensing boilers.

4

DESIGN RECOMMENDATIONS

4a

PARTIAL ROOF & WINDOW REPLACEMENT PROJECT DESIGN RECOMMENDATIONS

SELECTED SCOPE OF ROOF WORK

REPLACE SHINGLE ROOFING AT CAFETORIUM

- Remove existing shingle roofing, underlayments, nailable insulation, and vapor barrier down to the deck
- Examine decking and blocking and their fastening, replace any damaged materials; refasten loose items
- Install vapor retarder, 5” rigid insulation in 2 overlapping layers.
- Install 5/8” thick FRT tongue & groove plywood , fastened through the insulation and into existing wood plank substrate
- Provide additional perimeter treated wood roof blocking
- Install 50-year warranty asphalt shingles, with felt underlayment, self-adhering sheet underlayment, drip edge

EXTEND FASCIA AND REUSE GUTTER

- Remove and reinstall existing prefinished aluminum gutter and downspouts
- Install new prefinished aluminum fascia extension (to match the existing) above and lapping over existing to cover added insulation thickness.

SELECTED SCOPE OF WINDOW WORK

REPLACE EXTERIOR WINDOWS IN THE 1959 CONSTRUCTION

- Remove existing windows, doors frames, and aluminum entry vestibule in accordance with asbestos abatement procedures
- Replace with prefinished aluminum thermal break frames with a combination of thermal low-E glazing, insulated glazed-in aluminum faced panels, and translucent insulated wall panels (for higher insulating value and glare control)
- Install treated wood blocking for shim and/or fastening
- Provide transitions to existing interior sills, partitions and ceilings
- Provide aluminum sills, transitions, and covers over existing exposed steel columns at Cafetorium, and at concealed columns and intersecting partitions at the Administration Area
- Install perimeter sealant joint at replacement windows, entry and doors
- Cover or repaint wood trim at head of windows to be replaced in accordance with lead paint abatement procedures
- Prep & paint exposed exterior tongue & groove wood plank soffit at Cafetorium
- Prep & paint exposed exterior glue laminated wood girder/beams at Cafetorium
- At the prior column repair on the southeast wall of the Cafetorium, perform additional welding at the added channel section (while windows are removed) to ensure best attachment. Examine remaining column and repair any damage found
- Provide window roller shades at select areas for glare control and room darkening

REPLACE REMAINING EXTERIOR DOORS & FRAMES IN THE 1959 CONSTRUCTION

- Provide new doors heavy duty fiberglass faced flush doors and aluminum frames, most of these are adjacent to and associated with the window replacement work
- Widen the door from the Custodial Room to enable receiving large items in through that opening
- Provide all new entry vestibule at main entry, with new exterior and interior doors and frames and related transitions
- Relocate or temporarily support and remount Electrical/Security items related or adjacent to doors
- Abate asbestos containing perimeter caulking at existing louvers at the 1959 construction; recaulk and repaint louvers at the Cafetorium stage and Boiler Room

REPLACE SEALANT JOINTS IN THE 1990 CONSTRUCTION

- Cut out and remove existing caulking, clean and prime surfaces to receive new sealant joints.
- Install backer rod and sealant at masonry control joints
- Install backer rod and sealant at full perimeter of existing masonry openings
- Install sealant at metal to metal joints within the existing thermal break aluminum window systems
- Scrape, clean and repaint steel lintels at openings included in the re-sealing work

SELECTED SCOPE OF ABATEMENT WORK

ABATE HAZARDOUS MATERIALS, AS NECESSARY

- Asbestos containing panels, mastic, caulking, stops at window and door replacement work shall be removed in accordance with regulations
- Wood trims associated with window systems to be replaced shall be removed and disposed of according to regulations
- Lead paint at the exterior exposed glue laminated wood structural girders/beams and wood trim at windows/doors shall be abated/ encapsulated according to regulations

4b

OUTLINE SPECIFICATIONS – REROOF REPLACEMENT

CONTRACT FORMS AND BIDDING DOCUMENTS

CONTRACT INFORMATION

The project shall be delivered / contracted using MGL c. 149. For this bid the roofing contractor shall be designated the General Contractor.

Building permit fees are waived by the Town of Sudbury.

DIVISION 1 - GENERAL REQUIREMENTS

010000 SUMMARY OF WORK

The work consists of replacement of approximately 5,000 sf of sloped shingle roofing at General Nixon Elementary School.

Work includes removal of existing sloped shingle roofing system down to the wood deck, including shingles, underlayments, nailer board, rigid insulation, and vapor barrier. Provide replacement roofing system: Asphalt shingles (including felt underlayment and self-adhering sheet underlayment) installed over 5/8" tongue & groove plywood nailing surface, 5" total rigid insulation (installed in 2 overlapping layers), and vapor barrier.

The roofing replacement project shall include all miscellaneous work typically associated with roofing replacement projects, including – but not limited to – the following: provide additional roof blocking and prefinished fascia extension – both to account for height of added insulation thickness; remove and reinstall existing gutters and downspouts.

010200 UNIT PRICES

The Unit Prices for items set forth below shall be used to determine adjustments to the Contract Sum when changes in the Work involving said items are made in accordance with the General Conditions and other sections of the Contract Documents.

The Owner may accept or reject any Unit Price at its discretion. If a Unit Price is rejected, indicated work, if required, will be performed as a Change Order determined in accordance with the General Conditions of Contract.

The Contractor shall submit Unit Prices for the following items as part of its bid:

SCHEDULE OF UNIT PRICES

No.	ITEM	UNIT	Quantity in Base Bid	ADD	DEDUCT
1.	Replace deteriorated existing 2" thick x 6" wide tongue & groove wood plank deck	L.F.	100	$10.00	$8.00
2.	Replace deteriorated roof edge blocking	L.F.	50	$3.60	$3.00

011000 LABOR REGULATIONS

Comply with state and federal EEO and wage requirements, including:

- Equal Employment Opportunity Goals
- Labor Regulations
- Wage Rates: Assume federal prevailing wages.

DIVISION 2 – EXISTING CONDITIONS

020800 ASBESTOS ABATEMENT

Not Used

024100 SELECTIVE DEMOLITION

Work includes the following:

- Removal and disposal of existing roofing systems – asphalt shingles, drip edge, underlayments, felts, nailer board, insulation, and vapor barrier– down to the deck.
- Note: Existing perimeter wood blocking to remain.
- Note: Existing prefinished metal roof edge/fascia to remain in place.
- Note: Existing prefinished metal gutters and downspouts are to be removed, saved and re-installed.

DIVISION 3 – CONCRETE

Not Used

DIVISION 4 – MASONRY

Not Used

DIVISION 5 - METALS

Not Used

DIVISION 6-WOOD AND PLASTICS

061053 MISCELLANEOUS CARPENTRY

Work includes the following:

- Examine existing roof blocking for signs of rot or damage. Replace damaged plank in accordance with matching new materials. (Refer to unit prices.) Add pressure treated wood blocking to build up to height of new insulation and plywood.
- Examine existing plank deck for signs of rot or damage. Replace damaged plank in accordance with matching new materials. (Refer to unit prices.) Refasten existing wood plank deck to wood glu-laminated structural girder and beams.

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

073113 ASPHALT SHINGLES

Work includes the following:

- Glass-fiber-reinforced asphalt shingles to be installed at sloped roof with self-adhering sheet underlayment, felts, and perimeter drip edge.
- 5/8" thick tongue & groove exterior grade plywood nailing surface.
- Rigid insulation in 2 overlapping layers to 5" total thickness.
- Vapor retarder.
- Miscellaneous accessories: roofing nails, fasteners for attaching plywood through the insulation into the deck.

See full specification section.

076200 FLASHING AND SHEET METAL

Work includes the following:

- Fascia cover with concealed splice plates, 050 formed aluminum prefinished 2-coat fluropolymer, with continuous clip strip - to match existing.
- Reinstall existing gutters & downspouts.

079200 JOINT SEALANTS

Work includes the following:

- Exterior joints in vertical surfaces: High-performance ultra-low modulus silicone; Dow 790 and 795 or equal by Pecora or Sonneborn.

DIVISION 8- DOORS AND WINDOWS

Not Used

DIVISION 9 - FINISHES

Not Used

DIVISION 10 - SPECIALTIES

Not Used

DIVISION 11 - EQUIPMENT

Not Used

DIVISION 12 - FURNISHINGS

Not Used

DIVISION 21 – FIRE SUPPRESSION

Not Used

DIVISION 22 – PLUMBING

Not Used

DIVISION 23 – HVAC

Not Used

DIVISION 26 - ELECTRICAL

Not Used

SECTION 073113

ASPHALT SHINGLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Examine all Drawings and all Sections of the Specifications for requirements and provisions affecting the work of this Section.

1.2 SUMMARY

A. This Section includes the following:
1. Asphalt shingles.
2. Felt underlayment.
3. Self-adhering sheet underlayment.
4. Rigid insulation
5. Plywood nailing surface
6. Vapor retarder
7. Fasteners, adhesives, and other accessories required for complete roof installation.
8. Sealants.
9. Warranty.
10. Temporary facilities and support equipment required for work of this section including, but not limited to, staging, chutes, hoists, lifts, weather protection and protection of adjacent existing roofs.

B. Related Sections include the following:
1. Section 061053 – MISCELLANEOUS CARPENTRY
2. Section 076200 –METAL FLASHING AND SHEET METAL, for metal flashings, facia system extensions, and reinstallation of existing metal gutter and downspouts.
3. Section 079200 – JOINT SEALANTS, for material requirements for sealants installed by this Section.

1.3 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For each type of asphalt shingle indicated.
1. Include similar Samples of trim and accessories involving color selection.
2. Plywood nailer board fastening patterns.
3. Fascia extension details and sheet metal profiles.

C. Samples for Verification: For the following products, of sizes indicated, to verify color selected.
1. Asphalt Shingle: Full-size asphalt shingle strip.
2. Ridge and Hip Cap Shingles: Full-size ridge and hip cap asphalt shingle.
3. Self-Adhering Underlayment: 12 inches square.

4. Rigid Insulation: 12 inches square.
5. Vapor Retarder: 12 inches square.

D. Qualification Data: For Installer.

E. Pull-out Test Reports: For fasteners for each type of substrate indicated, demonstrating that proposed fasteners meet specified performance requirements.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for asphalt shingles, underlayment, insulation, plywood, and vapor retarder.

G. Research/Evaluation Reports: For asphalt shingles.

H. Maintenance Data: For asphalt shingles to include in maintenance manuals.

I. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:
1. Three years minimum experience in application of asphalt shingle roofing.
2. Minimum of five satisfactory, warranted projects of similar size, scope and complexity of roofs within the last five years.

B. Source Limitations: Obtain ridge and hip cap shingles ridge vents felt underlayment and self-adhering sheet underlayment through one source from a single asphalt shingle manufacturer.

C. Fire-Test-Response Characteristics: Provide asphalt shingle and related roofing materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
1. Exterior Fire-Test Exposure: Class A; ASTM E 108 or UL 790, for application and roof slopes indicated.

D. Shop Drawings: There shall be no deviation from the contract documents or approved shop drawings without prior written approval of the Architect and roofing system manufacturer.

E. Pre-installation Conference: Conduct conference at Project site. Comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to roofing system including, but not limited to, the following:
1. Meet with Owner, Architect, Owner’s Project Manager (OPM), roofing Installer, roofing system manufacturer's representative, roofing demolition subcontractor, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.

8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store roofing materials in a dry, well-ventilated, weathertight location according to asphalt shingle manufacturer's written instructions. Store underlayment rolls on end on pallets or other raised surfaces. Do not double-stack rolls.
   1. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.

B. Protect unused underlayment, insulation and plywood from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

1.7 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit asphalt shingle roofing to be performed according to manufacturer's written instructions and warranty requirements.
   1. Install self-adhering sheet underlayment within the range of ambient and substrate temperatures recommended by manufacturer.

B. The roofing and wall system shall be made weathertight at the end of each workday.

C. Protect adjacent existing roof surfaces throughout the construction period.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace asphalt shingles that fail in materials or workmanship within specified warranty period. Materials failures include manufacturing defects and failure of asphalt shingles to self-seal after a reasonable time.
   1. Material Warranty Period: 50 years from date of Substantial Completion, prorated 1/600 per month.
   2. Wind-Speed Warranty Period: Asphalt shingles will resist blow-off or damage caused by wind speeds up to 110 mph for 10 years from date of Substantial Completion.
   3. Algae-Discoloration Warranty Period: Asphalt shingles will not discolor 15 years from date of Substantial Completion.
   4. Workmanship Warranty Period: 10 years from date of Substantial Completion.

B. Special Project Warranty: Roofing Installer's warranty, on warranty form at end of this Section, signed by roofing Installer, covering Work of this Section, in which roofing Installer agrees to repair or replace components of asphalt shingle roofing that fail in materials or workmanship within the following warranty period:
   1. Warranty Period: Five years from date of Substantial Completion.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Asphalt Shingles: 10% of each type, in unbroken bundles.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2.2 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

A. Laminated-Strip Asphalt Shingles: ASTM D 3462, ASTM D 3018 Type I, laminated, multi-ply overlay construction, glass-fiber reinforced, mineral-granule surfaced, and self-sealing.
   1. Weight: 340 lbs per square.
   2. Wind Resistance: ASTM D 3161, Class F, 110 mph.
   3. Butt Edge: Straight cut.
   4. Strip Size: Manufacturer's standard.
   5. Algae Resistance: Granules treated to resist algae discoloration.
   6. Color and Blends: As selected by Architect from manufacturer's full range.
   7. Basis of Design: The specification is based on the following product. Other products are acceptable subject to compliance with requirements:
      a. Landmark TL Ultimate, by CertainTeed Corporation.
   8. Available Manufacturers:
      a. Atlas Roofing Corporation.
      b. Elk Corporation of Dallas.
      c. GAF Materials Corporation.
      d. IKO.
      e. Malarkey Roofing Company.
      f. Owens Corning.
      g. PABCO Roofing Products.
      h. TAMKO Roofing Products, Inc.

B. Hip and Ridge Shingles: Manufacturer's standard units to match asphalt shingles.

2.3 UNDERLAYMENT MATERIALS

A. Felts: ASTM D 226 or ASTM D 4869, Type I, asphalt-saturated organic felts, nonperforated.

B. Self-Adhering Sheet Underlayment, Granular Surfaced: ASTM D 1970, minimum of 55-mil-thick sheet; glass-fiber-mat-reinforced, SBS-modified asphalt; mineral-granule surfaced; with release paper backing; cold applied.
   1. Available Products:
      a. ALCO-NVC Inc.; ALCO Shield.
      b. Atlas Roofing Corporation; StormMaster DG.
      c. Carlisle Coatings & Waterproofing, Div. of Carlisle Companies Inc.; Dri-Start "G."
      d. Celotex Corporation; Celo-Guard.
      e. CertainTeed Corporation; WinterGuard.
      f. GAF Materials Corporation; Weather Watch.
      g. Henry Company; Eaveguard.
      h. IKO; ArmourGuard.
      i. Johns Manville International, Inc.; Roof Defender.

2.4 PLYWOOD NAILING SURFACE

A. General: Provide 5/8” tongue and groove plywood exterior grade C-C touch sanded suitable for use as underlayment.

2.5 Polyisocyanurate ROOF INSULATION

A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.

B. Polyisocyanurate Board Roof Insulation: Rigid, cellular thermal insulation with polyisocyanurate closed cell foam core and manufacturer's standard glass fiber mat facing laminated to one side, and glass fiber mat facing laminated to the other (as indicated below); complying with ASTM C 1289 Type II, Class 1, Grade 3 and the following.
1. R Value: 7.30 per 1-1/2-inch thickness, calculated per the 15-year time-weighted average Long Term Thermal Resistance (LTTR) per ASTM C1303.
2. Minimum Compressive Strength: 25 psi.
3. Minimum Density: 1.5 pcf.
4. Board Size: 48 inches square.
5. Provide tapered insulation as indicated.
6. Available Manufacturers:
    a. Apache Products Company.
    b. Atlas Roofing Corporation.
    c. Celotex Corporation.
    d. Firestone Building Products Company.
    e. GAF Materials Corporation.
    f. GenFlex Roofing Systems.
    g. Hunter Panels, LLC.
    h. Johns Manville International, Inc.
    i. Koppers Industries.
    j. RMAX.
    k. Or approved equal.

C. Non-Tapered Insulation: In locations where roof insulation is indicated to be uniformly thick, provide in two layers, as follows:
1. Bottom layer: 2-1/2” thick.
2. Top layer: Balance of remaining thickness required. Provide with glass fiber mat facing as part of thickness required.

2.6 VAPOR RETARDER

A. Loose-layed Vapor Retarder: 10 mil thick minimum polyethylene vapor retader. Water Vapor Permeance of 0.013 perm per ASTM E 96, supplied by primary roofing system manufacturer.
1. Tape: Pressure-sensitive tape of type recommended by vapor-retader manufacturer for sealing joints and penetrations in vapor retarder.

2.7 ACCESSORIES

A. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.

B. Roofing Nails: ASTM F 1667; aluminum, stainless-steel, copper, or hot-dip galvanized steel wire shingle nails, minimum 0.120-inch- diameter, barbed shank, sharp-pointed, with a minimum 3/8-inch- diameter flat head and of sufficient length to penetrate 3/4 inch into solid wood decking or extend at least 1/8 inch through OSB or plywood sheathing.
1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.

C. Felt Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized steel wire with low profile capped heads or disc caps, 1-inch minimum diameter.

2.8 MECHANICAL FASTENERS FOR PLYWOOD/INSULATION & DECK REFASTENING

A. Wood to Metal and Wood to Concrete: Factory-coated steel screws meeting performance requirements as indicated for pull-out and uplift resistance.
   1. Deckfast #14 screw, by Construction Fasteners, Inc., Wyomissing, PA.
   2. Insul-Fixx #14, by SFS Stadler, Brunswick, OH.
   3. Insul-Tite #14, by Burlington Mfg. Corp., Archbold, OH.
   4. Olympic Fastener #14-10, by Olympic Manufacturing Group, Agawam, MA.
   5. Tapcon ¼-inch diameter, Phillips flat head anchor, by ITW Buildex, Itasca, IL.
   6. Roofgrip #14-10, by ITW Buildex, Itasca, IL.
   7. Rawl Drive or Rawl Spike, by The Rawlplug Co., Inc., New Rochelle, NY.
   8. Rawl Deck #14 Deck Screw, by The Rawlplug Co., Inc., New Rochelle, NY.
   9. Length: Sufficient to penetrate, but not go fully through, wood plank substrate 1-1/2 inches, unless greater length is recommended by fastener manufacturer for application indicated. Fasteners shall not be visible at the interior of the space.

2.9 METAL FLASHING AND TRIM

A. Sheet Metal Flashing and Trim: Comply with requirements in Section 076200 –METAL FLASHING AND SHEET METAL.
   1. Sheet Metal: Aluminum, Kynar finished.

B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item.
   1. Drip Edges: Fabricate in lengths not exceeding 10 feet with 2-inch roof deck flange and 1-1/2-inch fascia flange with 3/8-inch drip at lower edge.

PART 3 - EXECUTION

3.1 EXAMINATION & GENERAL INSTALLATION REQUIREMENTS

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
   1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
   2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored; and that provision has been made for flashings and penetrations through asphalt shingles.
   3. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work. For damaged decking, refer to UNIT PRICING.

B. Cooperate with inspection and test agencies engaged or required to perform services in connection with installing specified roofing system.

C. Code Compliance: Install and test, where required, adhered roofing system to comply with governing regulations and the following insurance requirements:
   1. Factory Mutual 1-75 for wind uplift rating.
   2. Minimum assembly fire-resistant rating of Class A per ASTM E108.

D. Protect the existing property, other work and residents from all hazards associated with roofing work.
   1. Provide necessary protection to the roofing system to maintain water-tightness during the project duration. Do not allow water to enter roofing system.
   2. Protect existing property and other work from spillage of roofing materials, and prevent liquid materials from entering or clogging drains and conductors.

3. Replace or restore to the satisfaction of the Architect existing property and other work damaged by the Contractor's operations or lack of diligence under the provisions of this Contract.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 VAPOR-RETARDER INSTALLATION

A. Loosely lay polyethylene-sheet vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches and 6 inches, respectively.
1. Seal side and end laps with tape.

B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into membrane roofing system. Lap and seal to roofing membrane.

3.3 INSULATION INSTALLATION & PLYWOOD NAILING SURFACE INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation where required under area of roofing to conform to slopes indicated.

D. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 inches or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

G. Mechanically Fastened Plywood and Insulation: Install each layer of insulation, nailing board, and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type, and in accordance with the roofing manufacturer's requirements.
1. Fasten insulation according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.
   a. Field: Sixteen (16) fasteners per 4' x 8' insulation board.
   b. Perimeters (eight (8) feet in for the perimeter of all roof area): Twenty-one (21) fasteners per 4' x 8' insulation board.
   c. Corners (eight (8) feet in either direction from a corner): Increase the fastening rate by fifty (50) percent from that of the field of the roof.
   d. Any insulation board that spans between two areas of differing fastening rates shall be fastened utilizing the more stringent fastening rate over the entire board surface.

H. Offset joints of plywood nailing board 6 inches in both directions from joints of insulation system.

3.4 UNDERLAYMENT INSTALLATION

A. Single-Layer Felt Underlayment: Install single layer of felt underlayment on roof deck perpendicular to roof slope in parallel courses. Lap sides a minimum of 2 inches over underlying course. Lap ends a minimum of 4 inches. Stagger end laps between succeeding courses at least 72 inches. Fasten with felt underlayment roofing nails.
   1. Install felt underlayment on roof deck not covered by self-adhering sheet underlayment. Lap sides of felt over self-adhering sheet underlayment not less than 3 inches in direction to shed water. Lap ends of felt not less than 6 inches over self-adhering sheet underlayment.

B. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free, on roof deck. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install at locations indicated below, lapped in direction to shed water. Lap sides not less than 3-1/2 inches. Lap ends not less than 6 inches staggered 24 inches between courses. Roll laps with roller. Cover underlayment within seven days.
   1. Eaves: Extend from edges of eaves 36 inches beyond interior face of exterior wall.
   2. Rakes: Extend from edges of rake 36 inches beyond interior face of exterior wall.
   3. Valleys: Extend from lowest to highest point 18 inches on each side.
   4. Hips: Extend 18 inches on each side.
   5. Ridges: Extend 18 inches on each side without obstructing continuous ridge vent slot.

3.5 METAL FLASHING INSTALLATION

A. General: Install metal flashings and other sheet metal to comply with requirements in Division 7 Section "Sheet Metal Flashing and Trim."
   1. Install metal flashings according to recommendations in ARMA's "Residential Asphalt Roofing Manual" and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

B. Rake Drip Edges: Install rake drip edge flashings over underlayment and fasten to roof deck.

C. Eave Drip Edges: Install eave drip edge flashings below underlayment and fasten to roof sheathing.

3.6 ASPHALT SHINGLE INSTALLATION

A. Install asphalt shingles according to manufacturer's written instructions, recommendations in ARMA's "Residential Asphalt Roofing Manual," and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

B. Install starter strip along lowest roof edge, consisting of an asphalt shingle strip at least 7 inches wide with self-sealing strip face up at roof edge.
   1. Extend asphalt shingles 3/4 inch over fascia at eaves and rakes.
   2. Install starter strip along rake edge.

C. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.

D. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.

E. Fasten asphalt shingle strips with a minimum of six roofing nails located according to manufacturer's written instructions.

1. When ambient temperature during installation is below 50 deg F, seal asphalt shingles with asphalt roofing cement spots.

F. Ridge and Hip Cap Shingles: Maintain same exposure of cap shingles as roofing shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds. Fasten with roofing nails of sufficient length to penetrate sheathing.
1. Fasten ridge cap asphalt shingles to cover ridge vent without obstructing airflow.

3.7 ROOFING INSTALLER'S WARRANTY

A. WHEREAS <**Insert name**> of <**Insert address**>, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
1. Owner: Sudbury Public Schools
2. Address: 40 Fairbank Road, Sudbury, MA 01776
3. Building Name: General Nixon Elementary School
4. Address: 472 Concord Rd, Sudbury, MA 01776
5. Acceptance Date: <**Insert date.**>
6. Warranty Period: Five years.
7. Expiration Date: <**Insert date.**>

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
a. lightning;
b. peak gust wind speed exceeding 110 mph;
c. fire;
d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
f. vapor condensation on bottom of roofing; and
g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said

alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.

5. During Warranty Period, if original use of roof is changed, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this <**Insert day**> day of <**Insert month**>, <**Insert year**>.
   1. Authorized Signature: <**Insert signature.**>
   2. Name: <**Insert name.**>
   3. Title: <**Insert title.**>

END OF SECTION

4c

OUTLINE SPECIFICATIONS – WINDOW REPLACEMENT

CONTRACT FORMS AND BIDDING DOCUMENTS

CONTRACT INFORMATION

The project shall be delivered / contracted using MGL c. 149. For this bid the window contractor shall be designated the General Contractor.

Building permit fees are waived by the Town of Sudbury.

DIVISION 1 - GENERAL REQUIREMENTS

010000 SUMMARY OF WORK

The work consists of approximately 3,300 sf of window replacement work, related door replacement and recaulking work at General Nixon Elementary School.

Work includes asbestos and removal of indicated existing window and door systems in their entirety, as well as the main entry vestibule at the 1959 areas of the building. Work also includes replacement with new thermally efficient fixed and operable aluminum window, transluscent insulated wall panels, storefront entrances, and flush fiberglass faced doors.

Work includes repainting or covering (with prefinished aluminum) exposed wood and steel surfaces adjacent to windows. Some of these surfaces have tested positive for coatings containing lead and need to be treated accordingly.

Work also includes recaulking of brick masonry control joints, and window metal-to-metal joints at the 1990 building.

While the walls are open at the Cafetorium, the top of the tube lally columns (in the exterior wall) are to be examined for signs of splitting or other damage. Any found to be damaged are to be repaired in accordance with unit pricing provided.

The window replacement project shall include all miscellaneous work typically associated with window replacement projects, including – but not limited to – the following: trims, stops, sills, shims, transitions to adjacent interior surfaces, and perimeter sealants.

010200 UNIT PRICES

The Unit Prices for items set forth below shall be used to determine adjustments to the Contract Sum when changes in the Work involving said items are made in accordance with the General Conditions and other sections of the Contract Documents.

The Owner may accept or reject any Unit Price at its discretion. If a Unit Price is rejected, indicated work, if required, will be performed as a Change Order determined in accordance with the General Conditions of Contract.

The Contractor shall submit Unit Prices for the following items as part of its bid:

SCHEDULE OF UNIT PRICES

No.	ITEM	UNIT	Quantity in Base Bid	ADD	DEDUCT
1.	Repair existing column – install steel channel section welded to top portion of concrete filled steel tube lally column	L.F.	10	$360.00	$300.00

011000 LABOR REGULATIONS

Comply with state and federal EEO and wage requirements, including:
- Equal Employment Opportunity Goals
- Labor Regulations
- Wage Rates: Assume federal prevailing wages.

DIVISION 2 – EXISTING CONDITIONS

020800 ASBESTOS ABATEMENT

Work includes the following:
- Removal and disposal of window systems, door frames, and main entry storefront vestibule to be replaced, including glazed-in cementitious panel under windows, window glazing, caulking within and at perimeter.
- Removal and disposal of perimeter caulking at indicated louvers (louvers to remain in place).
- Note: Existing air conditioning units and an exhaust louver within the windows systems are to be salvaged and reinstalled in the new window wall system. Glazed-in panels in which these are currently mounted are to be disposed of.

024100 SELECTIVE DEMOLITION

Work includes the following:
- Removal and disposal of doors to be replaced.
- Removal and disposal of wood trims at the interior of the cafetorium except for bottom stool, which is to be salvaged for reuse.
- Note: Existing interior window stool and transition trims are to be salvaged for reuse.

- Note: Existing louvers are to remain.

DIVISION 3 – CONCRETE

Not Used

DIVISION 4 – MASONRY

Work includes the following:

- Enlarging of existing exterior masonry wall opening at the Receiving Area to accommodate installation of a wider pair of doors instead of the existing single door, including disposal of the removed materials.

DIVISION 5 - METALS

076200 FLASHING AND SHEET METAL

Work includes the following:

- Above new windows at the Administration, Kitchen, Receiving and Boiler Room - Fascia cover with concealed splice plates, 050 formed aluminum prefinished 2-coat fluropolymer, with concealed fastening.

DIVISION 6-WOOD AND PLASTICS

061053 MISCELLANEOUS CARPENTRY

Work includes the following:

- Pressure treated wood blocking, nailers and shims needed for installation of the new window and door systems.
- Trims and transitions to existing building elements at the new windows including interior window stools, intersecting partitions, ceilings. Reuse existing where possible.

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

079200 JOINT SEALANTS

Work includes the following:

- Exterior joints in vertical surfaces: High-performance ultra-low modulus silicone; Dow 790 and 795 or equal by Pecora or Sonneborn.
- Replacement perimeter sealants at existing louvers where indicated.
- Replacement sealants at masonry control joint and perimeter of masonry openings at 1990 construction.
- Removal of existing sealants (where not a part of asbestos abatement) and cleaning and preparation of surfaces to receive replacement sealants.
- Backer rods and bond breakers at replacement sealants.

DIVISION 8 - DOORS AND WINDOWS

081743 FLUSH FIBERGLASS FACED DOORS AND FRAMES

Work includes the following:
- Prefinished flush fiberglass faced doors with thermal glazing.
- Prefinished aluminum door frames.
- Heavy duty hardware for doors, including coordinating with existing security systems.

See full specification section.

084113 ALUMINUM ENTRANCES

Work includes the following:
- Prefinished aluminum thermal break storefront systems with thermal glazing.
- Sealants, including perimeter of wall opening.
- Miscellaneous accessories: Trims, transitions, and fastenings to provide a complete installation.

See full specification section.

084523 TRANSLUCENT INSULATED WALL PANEL SYSTEMS

Work includes the following:
- Translucent insulated wall panel systems - based on Kalwall 2-3/4" wall system.
- Sealants, including perimeter of wall opening.
- Miscellaneous accessories: Sub-framing, trims, transitions, and fastenings to provide a complete installation.

085113 ALUMINUM CURTAIN WALL

Work includes the following:
- Prefinished aluminum thermal break window systems with thermal glazing – fixed and operable.
- Glazed-in aluminum faced insulated panels.
- Sealants, including perimeter of wall opening.
- Replacement sealants at existing window metal-to-metal joints at 1990 construction.
- Miscellaneous accessories: Panning, snap trim, prefinished aluminum covers at columns and intersecting partitions, fastenings

See full specification section.

087100 DOOR HARDWARE

Work includes the following:
- Door Hardware for replacement doors.
- Coordinate electronic security hardware at main entrance and security door contacts at all doors.

See full specification section.

088000 GLASS & GLAZING

Work includes the following:
- Glazing for new window and door systems.
- Miscellaneous accessories: Shims, spacers, gaskets, sealants as required for installation of glazing.

DIVISION 9 - FINISHES

099000 PAINTING

Work includes the following:

- Painting of existing exposed exterior wood plank soffits, girders and beams at the Cafetorium.
- Painting of existing louvers as indicated.
- Painting of existing exposed steel lintels at both replacement windows and windows at the 1990 building to be recaulked.
- Painting of new items not already prefinished.
- Preparation of surfaces to be repainted.
- Coordinate with existing lead abatement.

DIVISION 10 - SPECIALTIES

Not Used

102800 SIGNAGE

Not Used

DIVISION 11 - EQUIPMENT

Not Used

DIVISION 12 - FURNISHINGS

122000 WINDOW TREATMENTS

Work includes:

- Fabric roller shades at replacement windows at all Administration area and in the Cafetorium at windows and panels below approximately 13 feet above floor level (below the main sections of translucent wall panels).

DIVISION 21 – FIRE SUPPRESSION

Not Used

DIVISION 22 – PLUMBING

221000 PLUMBING

Not Used

DIVISION 23 – HVAC

230001 HVAC

Not Used

DIVISION 26 - ELECTRICAL

260001 ELECTRICAL WORK

Work includes the following:

- Removal, temporary support and reinstallation of electrical items associated with door security and items required to be relocated to accommodate enlarged door openings.

SECTION 084413

GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. The Metal Windows Contractor is designated the Prime Contractor. All references to "Contractor" or "General Contractor" in the Contract Documents shall be interpreted as referring to the Prime Contractor.

C. Examine all Drawings and all Sections of the Specifications for requirements and provisions affecting the work of this Section.

1.2 SUMMARY

A. Section Includes: Work of this Section consists of installing all materials furnished under this Section, including all equipment, labor, services, and incidental items required to complete work as shown on Drawings and specified in this Section for the following:
   1. Preparation of the rough openings and installation of shimming, blocking, sheet air barrier flashing, and sealants for installation of new aluminum entrances.
   2. Conventionally glazed aluminum curtain walls installed as stick assemblies, with project-out windows.
   3. Salvaging and reinstalling existing exhaust fan.

B. Related Sections:
   1. Shimming and blocking to prepare existing openings is specified in Section 061053 – MISCELLANEOUS ROUGH CARPENTRY.
   2. Section 072129 – SPRAY-APPLIED FOAM THERMAL INSULATION for filling frame cavities with spray foam insulation.
   3. Section 076200 – SHEET METAL FLASHING AND TRIM, for new metal flashing of selected exterior sills and vertical metal flashing between windows at locations indicated on the drawings.
   4. Section 079200 – JOINT SEALANTS for installation of joint sealants installed with glazed aluminum curtain walls.
   5. Section 088000 – GLASS AND GLAZING, for glazing of greenhouse curtain wall.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by manufacturer's standard glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
   1. Glazed aluminum curtain walls shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
   2. Failure also includes the following:
      a. Thermal stresses transferring to building structure.

b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

B. Delegated Design: Design glazed aluminum curtain walls, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Structural Loads:
1. Wind Loads:
a. Basic Wind Speed: 100 mph.
b. Importance Factor: 2.
c. Exposure Category: B.

D. Structural-Test Performance: Test according to ASTM E 330 as follows:
1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

E. Deflection of Framing Members: At design wind pressure, as follows:
1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding L/175 of the glass edge length for each individual glazing lite, or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 1/8 inch, whichever is smaller.
a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

F. Seismic Performance: Glazed aluminum curtain walls shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
1. Component Importance Factor: 1.5.

G. Water Penetration under Static Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

H. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
2. Test Interior Ambient-Air Temperature: 75 deg F.

I. Energy Performance: Glazed aluminum curtain walls shall have certified and labeled energy performance ratings in accordance with NFRC.
1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.45 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.40 as determined according to NFRC 200.
3. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.30 cfm/sq. ft. of fixed wall area as determined according to ASTM E 283 at a minimum static-air-pressure differential of 1.57 lbf/sq. ft.

4. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 25 as determined according to NFRC 500.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For glazed aluminum curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.
   1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
   2. Include full-size isometric details of each vertical-to-horizontal intersection of glazed aluminum curtain walls, showing the following:
      a. Joinery, including concealed welds.
      b. Anchorage.
      c. Expansion provisions.
      d. Glazing.
      e. Flashing and drainage.
      f. Integration of windows into framing system.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

E. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:
   1. Joinery, including concealed welds.
   2. Glazing.
   3. Flashing and drainage.

F. Delegated-Design Submittal: For glazed aluminum curtain walls indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

G. Qualification Data: For qualified Installer.

H. Seismic Qualification Certificates: For glazed aluminum curtain walls, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

I. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified preconstruction testing agency, for glazed aluminum curtain walls, indicating compliance with performance requirements.

J. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating glazed aluminum curtain walls that meet or exceed energy performance requirements indicated and of documenting this performance by certification, labeling, and inclusion in lists.

B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
   1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

D. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

E. Energy Performance Standards: Comply with NFRC for minimum standards of energy performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.
   1. Provide NFRC-certified glazed aluminum curtain walls with an attached label.

F. Pre-installation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for glazed aluminum curtain walls by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delay of work.

1.7 WARRANTY

A. Special Assembly Warranty: Standard form in which Installer agrees to repair or replace components of glazed aluminum curtain walls that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Noise or vibration created by wind and thermal and structural movements.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      d. Water penetration through fixed glazing and framing areas.
   2. Warranty Period: 10 years from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
   1. EFCO Corporation.
   2. Kawneer North America; an Alcoa company.
   3. Vistawall Architectural Products; The Vistawall Group; a Bluescope Steel company.
   4. Wausau Window and Wall Systems.

B. Basis-of-Design Product: Kawneer, Model “1600 Wall System 1”, Kawneer, Model “1600 S.G. (Sloped Glazing)” and Kawneer “Glassvent Visually Frameless” windows.

C. Acceptable Air Barrier Products: Subject to compliance with requirements, air barrier products that may be incorporated in the work include, but are not limited to, the following:
   1. Carlisle Coatings & Waterproofing; CCW-705.
   2. Grace, W. R. & Co.; Perm-A-Barrier.
   3. Henry Company; Blueskin SA.
   4. Meadows, W. R., Inc.; SealTight Air-Shield.
   5. Rubber Polymer Corporation; Rub-R-Wall SA.
   6. Tremco, Incorporated; ExoAir 110.
   7. Or approved equal.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   1. Sheet and Plate: ASTM B 209.
   2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
   3. Extruded Structural Pipe and Tubes: ASTM B 429.
   4. Structural Profiles: ASTM B 308.
   5. Welding Rods and Bare Electrodes: AWS A5.10.

B. Steel Reinforcement, if required: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
   1. Structural Shapes, Plates, and Bars: ASTM A 36.
   2. Cold-Rolled Sheet and Strip: ASTM A 1008.
   3. Hot-Rolled Sheet and Strip: ASTM A 1011.

2.3 FRAMING

A. Framing Members: Manufacturer's standard extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
   1. Construction: Thermally broken.
   2. Glazing System: Retained mechanically with gaskets on four sides.
   3. Glazing Plane: Vertical and sloped.
   4. Rain Screen: Pressure equalized.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
   1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
   2. Reinforce members as required to receive fastener threads.

D. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
   1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

E. Concealed Flashing: Manufacturer's standard corrosion-resistant.

F. Framing Sealants: Manufacturer's standard silicone sealant.

2.4 PROJECT-OUT & PROJECT-IN WINDOWS

A. Provide project-out and project-in windows designed to integrate with framing system, with the following characteristics and components:
   1. Meets performance requirements of the overall curtain wall system.
   2. Sightlines: Visually frameless.
   3. Hinges: Stainless steel, four-bar hinges.
   4. Locking: Multi-point, positive cast white bronze locking hardware.
   5. Operation: Pivot shoe roto-operator.
   6. Limiter: Maximum 8” opening.
   7. Insect screen.

2.5 GLAZING

A. Glazing and Gaskets: Comply with Section 088000 – GLASS AND GLAZING.

B. Glazing Sealants: As recommended by manufacturer.
   1. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 SHEET AIR BARRIER FLASHING

A. For bridging movement joints and other applications not recommended for application of air/moisture barrier system by manufacturer, provide flexible self-adhering membrane of self-healing (nailable) rubberized asphalt integrally bonded to polyethylene sheeting, formed into uniform flexible sheets, minimum 40 mil thickness, and the following:
   1. Physical Properties:
      a. Tensile Strength: 1200 psi min; ASTM D412.
      b. Ultimate Elongation: 200 percent min; ASTM D412.
      c. Low Temperature Flexibility: Unaffected to -45 deg. F(-43 deg. C); ASTM D1970.
      d. Water Absorption: Max. 0.1 percent weight gain after 48 hrs. of immersion at 70 deg. F(21 deg. C), ASTM D570.
      e. Compatible with specified paint systems.

2.7 ACCESSORY MATERIALS

A. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

2.8 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by de-scaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:
1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted hairline joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from exterior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
7. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
8. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.

D. Curtain-Wall Framing: Fabricate components for assembly using shear-block system.

E. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

A. General:
1. Color and Gloss: Custom-colored frames to match exterior frame finish and color of new aluminum windows per Section 085113 - ALUMINUM WINDOWS. Finish shall be either High Performance Organic Coating or Clear Anodized, as selected by Architect.
2. Comply with the NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

B. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.

C. High Performance Organic Coating: AA C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: chemical conversion coating, acid chromate fluoride phosphate pretreatment; Organic Coating: as specified below). Prepare, pre-treat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's instructions.
1. Fluorocarbon 2 Coat Coating System: Manufacturer's standard 2 coat thermocured system, complying with AAMA 2605, composed of specially formulated inhibitive primer and fluorocarbon color topcoat containing not less than 70 percent polyvinyldene fluoride resin by weight.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:
   1. Comply with manufacturer's written instructions.
   2. Do not install damaged components.
   3. Fit joints to produce hairline joints free of burrs and distortion.
   4. Rigidly secure non-movement joints.
   5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
   6. Seal joints watertight unless otherwise indicated.

B. Metal Protection:
   1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
   2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

D. Install components plumb and true in alignment with established lines and grades.

E. Install glazing as specified in Section 088000 – GLASS AND GLAZING.

3.3 ERECTION TOLERANCES

A. Erection Tolerances: Install glazed aluminum curtain walls to comply with the following maximum tolerances:
   1. Plumb: 1/8 inch in 10 feet.
   2. Level: 1/8 inch in 20 feet.
   3. Alignment:
      a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
      b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
      c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
   4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.4 FIELD QUALITY CONTROL

A. Owner Testing: Owner may engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing and inspecting of representative areas of glazed aluminum curtain walls shall take place as installation proceeds to determine compliance of installed assemblies with specified requirements.
   1. Water Spray Test: Before installation of interior finishes has begun, greenhouse area shall be tested according to AAMA 501.2 and shall not evidence water penetration.

C. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.5 CLEANING AND REPAIR

A. Clean the completed system, inside and out, promptly after installation, exercising care to avoid damage to coatings.

B. Damaged Work: Replace framing and other components of the work that have been damaged or have deteriorated beyond successful repair by means of finish touch-up or similar minor repair procedures.
   1. Components with defects visible after repair from 5 feet away, as determined by the Architect, shall be removed and replaced with new units.

END OF SECTION 084413

SECTION 084113

ALUMINUM ENTRANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. The Metal Windows Contractor is designated the Prime Contractor. All references to "Contractor" or "General Contractor" in the Contract Documents shall be interpreted as referring to the Prime Contractor.

C. Examine all Drawings and all Sections of the Specifications for requirements and provisions affecting the work of this Section.

1.2 SCOPE OF WORK

A. Section Includes: Work of this Section consists of installing all materials furnished under this Section, including all equipment, labor, services, and incidental items required to complete work as shown on Drawings and specified in this Section for the following:
   1. Preparation of the rough openings and installation of shimming, blocking, sheet air barrier flashing, and sealants for installation of new aluminum entrances.
   2. Architectural-grade factory-glazed entrance doors and field-glazed aluminum storefront units of the performance class indicated and following types. Furnish units complete with hardware, glazing, weatherstripping, sill, transition mullions where required, and standard or specified anchorages, attachments, and accessories, with custom color:
      a. Entrance doors, with insulating glass, as part of an aluminum storefront system.
   3. Aluminum-faced insulated panels.
   4. Infill frame cavities with spray foam insulation as shown on drawings.

B. Related Sections: The following sections contain requirements that are work of this Section:
   1. Shimming and blocking to prepare existing openings is specified in Section 061053 – MISCELLANEOUS ROUGH CARPENTRY.
   2. Section 072129 – SPRAY-APPLIED FOAM THERMAL INSULATION for filling frame cavities with spray foam insulation.
   3. Section 076200 – SHEET METAL FLASHING AND TRIM, for new metal flashing of selected exterior sills and vertical metal flashing between windows at locations indicated on the drawings.
   4. Joint sealing between aluminum windows and adjacent masonry installed as work of this Section is specified in Section 079200 – JOINT SEALANTS.
   5. Glazing requirements for factory-glazing of aluminum entrances are specified in Section 088000 – GLASS AND GLAZING.

1.3 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM):
   1. ASTM E283--Standard Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors.
   2. ASTM E330--Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

3. ASTM E331--Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
4. ASTM E547--Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential.

B. American Architectural Manufacturers Association (AAMA):
1. AAMA/WDMA/CSA 101/I.S.2/A440-05--Standard/Specification for Windows, Doors and Unit Skylights.
2. AAMA 603.8--Voluntary Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum.
3. AAMA 606.1--Voluntary Guide Specifications and Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum.
4. AAMA 608.1-- Voluntary Guide Specification and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum.
5. AAMA 902.2--Voluntary Specification for Sash Balances.
6. AAMA 1503.1--Voluntary Test Method for Thermal Transmittance of Windows, Doors, and Glazed Wall Sections.

1.4 SYSTEM PERFORMANCE REQUIREMENTS FOR REPLACEMENT ALUMINUM ENTRANCES

A. General: Provide aluminum door units that comply with performance requirements specified, as demonstrated by testing manufacturer's corresponding stock systems according to test methods indicated.
1. Minimum Performance Requirements: AW-90.

B. Installed Performance: Provide aluminum entrances capable of obtaining results sixty-seven percent (67%) of the following Performance Requirements when field tested.

C. Design Requirements: Comply with structural performance, air infiltration, water penetration and life cycle requirements indicated in AAMA/WDMA/CSA 101/I.S.2/A440-05 for type, grade, and performance class of entrance units required.

D. Testing: Test 48” x 96” size of each type of required entrance unit through a recognized independent testing laboratory or agency, in accordance with ASTM E 330 for structural performance, with ASTM E 283 for air infiltration, and with ASTM E 547 and E 331 for water penetration. Provide certified test results.
1. Structural Performance: Provide entrance units with no failure or permanent deflection in excess of 0.4 percent of any member's span after removal of the imposed load, for a positive (inward) and negative (outward) test pressure of 105 lb/sq. ft.
2. Air Infiltration: Provide units with air infiltration rate of not more than 0.1 cfm/ft. of operable sash joint for an inward test pressure of 6.24 lb/sq. ft.
3. Water Penetration: Provide units with no water penetration as defined in the test method at an inward test pressure of 15.0 lb/sq. ft.
4. Thermal Transmittance: Provide door units that have a U-value maximum of 0.45 BTU/hour/sq. ft./deg F at 15-mph exterior wind velocity, when tested in accordance with AAMA 1503.1.
6. Life Cycle: Provide entrance units that have been tested according to AAMA 910-93 and passed. The minimum number of cycles for vent and hardware cycling is 1250.

1.6 SUBMITTALS

A. General: Submit the following in accordance with Conditions of the Contract and Division 01 Specification Sections.

B. Product data for each type of entrance required, including construction details and fabrication methods, profiles and dimensions of individual components, data on hardware, glazing, accessories, and finishes, and recommendations for maintenance of exterior surfaces.

C. Shop drawings for each type of entrance required. Include information not fully detailed in manufacturer's standard product data and the following:
   1. Layout and installation details, including anchors.
   2. Elevations of typical door unit elevations at 3/4-inch scale.
   3. Full-size section details of typical composite members, including reinforcement.
   4. Glazing details.
   5. Accessories.

D. Samples for Color Selection: Submit sample of specified finish on 8-inch-long sections of aluminum sheet or extruded aluminum, showing evidence of matching color of existing aluminum windows.

E. Certification: If product literature does not demonstrate, in the sole opinion of the Architect, compliance with specified performance requirements, the Architect reserves the right to require submission of certification by a recognized independent testing laboratory or agency showing that each type, grade, and size of entry unit complies with performance requirements indicated.

F. Qualification Data: For qualified Installer.

G. Maintenance Data: Submit manufacturer's maintenance and cleaning instructions for doors, including maintenance and operating instructions for hardware.

H. Warranties: Submit manufacturer's standard warranty.

1.7 QUALITY ASSURANCE

A. Standards: Requirements for aluminum doors, terminology and standards of performance, and fabrication workmanship are those specified and recommended in AAMA/WDMA/CSA 101/I.S.2/A440-05 and applicable general recommendations published by AAMA.

B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
   1. Manufacturer is to have a minimum of 5 years experience in the production of pre-hardwared and pre-assembled door systems, using the type of materials specified for this project.
   2. Obtain door and frame components from same manufacturer.
   3. Evidence of a compliant documented quality management system.

C. Single-Source Responsibility: Provide all entrance units from one source and produced by a single manufacturer.

D. Design Concept: The drawings indicate the size, profiles, and dimensional requirements of the aluminum entrance types required and are based on the specific type and model indicated. Aluminum doors by other manufacturers may be considered provided deviations in dimensions and profiles are minor and do not change the design concept, and that indicated performance requirements are complied with, as judged solely by the Architect.

E. Varying Sizes: The drawings indicate, by reference to approximate sizes, several basic entrance designations in the drawings. References in the drawings to a particular entrance designation are

not an indication that every entrance with that designation is exactly the same size. Each entrance may vary in size and shall be field measured prior to ordering.

F. First Entrance Installation: The Architect and representatives of the Owner shall be present at the first entrance installation to inspect method of attachment and quality of construction. Upon written approval by the Architect, the first door installation will establish the standards required for all subsequent work, which shall be of equal or higher quality.

1.8 PROJECT CONDITIONS

A. Field Measurements: Check actual entrance openings by accurate field measurement before fabrication. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of work.

1.9 DELIVERY, STORAGE, AND HANDLING

A. General: Do not deliver entrances to project site until immediately prior to installation.

B. Deliver entrance units in manufacturer’s original, unopened packaging. Package entrances with corner blocks to protect corners and edges from impact damage and glass from breakage.

C. Store units in an upright position, off the ground, in a clean and secure storage area protected from weather, theft, damage, and soiling until time of installation.

D. Protect entrance finishes from damage due to marring or contact with masonry before and during installation.

1.10 WARRANTY

A. Aluminum Entrances Warranty:
1. Submit a written warranty, executed by the entrances manufacturer, agreeing to repair or replace entrances and glazing units that fail in materials or workmanship within the specified warranty period. Failures include but are not necessarily limited to:
   a. Failure of fasteners, balances and other hardware.
   b. Failure of weather-stripping and sealants.
   c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   d. Failure of insulating glass, including failure of hermetic seal of air space (beyond that due to glass breakage) as evidenced by intrusion of dirt or moisture, internal condensation or fogging, and other visual indications of seal failure or performance.
2. Warranty Period: 10 years after the date of Substantial Completion.

A. The warranty shall not deprive the Owner of other rights or remedies that the Owner may have under other provisions of the Contract Documents and is in addition to other warranties made by the Contractor under requirements of the Contract Documents.

1.10 MAINTENANCE SERVICE

A. Door Hardware:
1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

2. Initial Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door hardware operation at rated speed and capacity. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Door Manufacturers: Subject to compliance with requirements, window manufacturers offering products that may be incorporated in the work include the following:
1. Kawneer.
2. Peerless Products, Inc
3. EFCO.
4. Graham Architectural Products Corporation.
5. Or approved equal.

B. The drawings for Marlborough High School are based on the following door. Other products will be accepted subject to limitation in “Quality Assurance” article:
1. Aluminum Entrances: Kawneer Trifab VG 451T Series, 4 ½”x 2” nominal dimensions with center glazing.

C. The drawings for Francis Kane Elementary School are based on the following doors. Other products will be accepted subject to limitation in “Quality Assurance” article:
1. Aluminum Entrances: Kawneer Trifab VG 451T Series, 4 ½”x 2” nominal dimensions with center glazing.

D. Acceptable Air Barrier Products: Subject to compliance with requirements, air barrier products that may be incorporated in the work include, but are not limited to, the following:
1. Carlisle Coatings & Waterproofing; CCW-705.
2. Grace, W. R. & Co.; Perm-A-Barrier.
3. Henry Company; Blueskin SA.
4. Meadows, W. R., Inc.; SealTight Air-Shield.
5. Rubber Polymer Corporation; Rub-R-Wall SA.
6. Tremco, Incorporated; ExoAir 110.
7. Or approved equal.

2.2 MATERIALS

A. Aluminum Extrusions: Provide alloy and temper recommended by the door manufacturer for the strength, corrosion resistance, and application of required finish, but not less than 22,000-psi ultimate tensile strength and not less than 0.062 inch thick at any location for main frame and sash members.

B. Fasteners: Provide aluminum, nonmagnetic stainless steel, or other materials warranted by the manufacturer to be non-corrosive and compatible with aluminum door members, trim, hardware, anchors, and other components of door units.
1. Reinforcement: Where fasteners screw-anchor into aluminum less than 0.125 inch thick, reinforce the interior with aluminum or nonmagnetic stainless steel to receive screw threads or provide standard non-corrosive pressed-in splined grommet nuts.

2. Exposed Fasteners: Except where unavoidable for application of hardware, do not use exposed fasteners. For application of hardware, use stainless steel fasteners.

C. Anchors, Clips, and Entrance Accessories: Fabricate anchors, clips, and door accessories of aluminum, nonmagnetic stainless steel, or hot-dip zinc-coated steel or iron complying with the requirements of ASTM B 633; provide sufficient strength to withstand design pressure indicated. Clips shall be continuous.

D. Compression-Type Glazing Strips and Weatherstripping: Unless otherwise indicated, and at the manufacturer's option, provide compressible stripping for glazing and weatherstripping such as molded EPDM or neoprene gaskets complying with AAMA SG-1, molded PVC gaskets complying with ASTM D 2287, or molded expanded EPDM or neoprene gaskets complying with ASTM C 509, Grade 4.
1. Provide weatherstripping locked in to extruded grooves in the stiles and bottom rail.

E. Sealants:
1. For sealants required within fabricated door, provide door manufacturer's standard, permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement, and compatible with sealants used in the manufacture of insulating glass units and all other materials with which the compounds may come in contact.

2.3 HARDWARE

A. General: Provide the manufacturer's standard hardware fabricated from aluminum, stainless steel, or other corrosion-resistant material compatible with aluminum and of sufficient strength to perform the function for which it is intended.

2.4 ACCESSORIES

A. General: Provide the manufacturer's standard accessories that comply with indicated standards.

B. Installation Trim: Provide sills, transition mullion, and other accessories as indicated on drawings, or if not indicated, where required to properly install door, meet performance requirements, and achieve result indicated.

2.5 FABRICATION

A. General: Fabricate aluminum entrances units to comply with indicated standards. Include a complete system for assembly of components and anchorage of door units.
1. Provide units that are reglazable without dismantling framing.
2. Weepholes: Provide weepholes and internal passages to conduct infiltrating water to the exterior.

B. Preglazed Fabrication: Preglaze window units at the factory using manufacturer’s standard glazing beads, gaskets, and sealants. Comply with requirements of Section 088000 – GLAZING and AAMA/WDMA/CSA 101/I.S.2/A440-05.

2.6 ALUMINUM-FACED INSULATED PANELS

A. Insulated Spandrel Panels: Laminated, metal-faced flat panels with no deviations in plane exceeding 0.8 percent of panel dimension in width or length.
1. Overall Panel Thickness: 1 inch.

2. Exterior Skin: Aluminum.
   a. Thickness: 0.063 inches.
   b. Finish: Matching framing system.
   c. Texture: Smooth.
   d. Backing Sheet: 1/8-inch-thick, tempered hardboard.
3. Interior Skin: Aluminum.
   a. Thickness: 0.063 inches.
   b. Finish: Matching framing system.
   c. Texture: Smooth.
4. Thermal Insulation Core: Manufacturer's standard extruded-polystyrene board.
5. Surface-Burning Characteristics: For exposed interior surfaces of panels, when tested according to ASTM E 84 as follows:
   a. Flame-Spread Index: 25 or less.
   b. Smoke-Developed Index: 450 or less.

2.7 SHEET AIR BARRIER FLASHING

A. For bridging movement joints and other applications not recommended for application of air/moisture barrier system by manufacturer, provide flexible self-adhering membrane of self-healing (nailable) rubberized asphalt integrally bonded to polyethylene sheeting, formed into uniform flexible sheets, minimum 40 mil thickness, and the following:
   1. Physical Properties:
      a. Tensile Strength: 1200 psi min; ASTM D412.
      b. Ultimate Elongation: 200 percent min; ASTM D412.
      c. Low Temperature Flexibility: Unaffected to -45 deg. F(-43 deg. C); ASTM D1970.
      d. Water Absorption: Max. 0.1 percent weight gain after 48 hrs. of immersion at 70 deg. F(21 deg. C), ASTM D570.
      e. Compatible with specified paint systems.

2.8 FINISHES

A. General: Comply with the NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

B. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.

C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: Nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare openings before beginning installation. Ensure openings to receive frames are plumb, level, square, and in tolerance.
   1. Surfaces shall be visibly dry and free of construction debris.
   2. Wood nailers shall be sound and free of voids, rot or other deterioration.
   3. Take care not to disturb interior finishes.

B. Notify the Architect immediately of any inconsistencies between field conditions and existing conditions shown on the drawings.

C. Prepare rough opening and install of shims, blocking, sheet air barrier flashing, and sealants.

3.2 INSTALLATION

A. Comply with manufacturer's specifications and recommendations for installation of door units, hardware, operators, and other components of the work.

B. Do not install damaged components.

C. Set entrance units plumb, level, and true to line, without warp or rack of frames or sash. Provide proper support and anchor securely in place. Do not anchor through sill.
1. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other dissimilar materials.
2. All entrances shall be installed uniformly. Do not vary installation details or dimensions relative to other construction from door to door.

D. Coordinate installation with other components of the work.
1. Refer to Section 079200 – JOINT SEALANTS for compounds, sealers, joint fillers, and gaskets to be installed concurrently with and after window units.
2. Install sheet air barrier flashing in accordance with manufacturer’s instructions and to form an air- and water-tight barrier to the exterior. Install in a manner to shed water to the exterior. Form end-dams at the sill and lap the jambs over the end-dams.

3.3 ERECTION TOLERANCES

A. Install aluminum-framed systems to comply with the following maximum erection tolerances:
1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet total length.
2. Alignment:
a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

3.4 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating leaf and hardware to provide a tight fit at contact points and at weatherstripping for smooth operation and a weathertight closure.

B. Clean aluminum surfaces promptly after installation of entrances. Exercise care to avoid damage to protective coatings and finishes. Remove excess glazing and sealant compounds, dirt, and other substances. Lubricate hardware and other moving parts.

C. Clean glass of preglazed units promptly after installation of entrances.

D. Initiate and maintain protection and other precautions required through the remainder of the construction period, to ensure that, except for normal weathering, window units will be free of damage or deterioration at the time of Substantial Completion.

3.5 FIELD QUALITY CONTROL

A. The Owner reserves the right to conduct tests of installed doors by a qualified independent testing agency. The Contractor shall bear the costs of testing and reinstalling entrance installations that fail.

END OF SECTION

SECTION 081743

FRP-FACED ALUMINUM DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. The Metal Windows Contractor is designated the Prime Contractor. All references to "Contractor" or "General Contractor" in the Contract Documents shall be interpreted as referring to the Prime Contractor.

C. Examine all Drawings and all Sections of the Specifications for requirements and provisions affecting the work of this Section.

1.2 SUMMARY

A. Section Includes:
1. Preparation of the rough openings and installation of shimming, blocking, sheet air barrier flashing, and sealants for installation of new aluminum entrances.
2. Fiberglass reinforced polyester (FRP)-faced doors with aluminum frames.
3. FRP-faced insulated panels.
4. Air conditioner sleeves and grilles.
5. Infill frame cavities with spray foam insulation, as shown on drawings.
6. Custom-colored frames to match exterior frame finish and color of new aluminum windows.

B. Related Sections:
1. Section 061053 – MISCELLANEOUS CARPENTRY, for shimming and blocking.
2. Section 072129 – SPRAY-APPLIED FOAM THERMAL INSULATION for filling frame cavities with spray foam insulation.
3. Joint sealing between aluminum frames and adjacent masonry installed as work of this Section is specified in Section 079200 – JOINT SEALANTS.
4. Section 085113 – ALUMINUM WINDOWS, for exterior frame finish and color.
5. Section 087100 – DOOR HARDWARE, for door operating hardware.
6. Glazing requirements for factory-glazing of door vision lites and field-glazing of transoms/sidelights are specified in Section 088000 – GLASS AND GLAZING.

1.3 REFERENCES

A. AAMA 1503-98 - Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.

B. ANSI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcings.

C. ASTM B 117 - Operating Salt Spray (Fog) Apparatus.

D. ASTM B 209 - Aluminum and Aluminum-Alloy Sheet and Plate.

E. ASTM B 221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

F. ASTM D 256 - Determining the Pendulum Impact Resistance of Notched Specimens of Plastics.

G. ASTM D 543 - Evaluating the Resistance of Plastics to Chemical Reagents.

H. ASTM D 570 - Water Absorption of Plastics.

I. ASTM D 638 - Tensile Properties of Plastics.

J. ASTM D 790 - Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

K. ASTM D 1308 - Effect of Household Chemicals on Clear and Pigmented Organic Finishes.

L. ASTM D 1621 - Compressive Properties of Rigid Cellular Plastics.

M. ASTM D 1623 - Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.

N. ASTM D 2126 - Response of Rigid Cellular Plastics to Thermal and Humid Aging.

O. ASTM D 2583 - Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.

P. ASTM D 5420 – Impact Resistance of Flat Rigid Plastic Specimens by Means of a Falling Weight.

Q. ASTM D 6670-01 - Standard Practice for Full-Scale Chamber Determination of Volatile Organic Emissions from Indoor Materials/Products.

R. ASTM E 84 - Surface Burning Characteristics of Building Materials.

S. ASTM E 90 - Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.

T. ASTM E 283 - Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

U. ASTM E 330 - Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

V. ASTM E 331 - Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

W. ASTM F 476 - Security of Swinging Door Assemblies.

X. ASTM F 1642-04 – Standard Test Method for Glazing Systems Subject to Air blast Loading.

Y. NWWDA T.M. 7-90 – Cycle Slam Test Method

Z. SFBC PA 201 - Impact Test Procedures.

AA. SFBC PA 203 - Criteria for Testing Products Subject to Cyclic Wind Pressure Loading.

BB. SFBC 3603.2 (b)(5) - Forced Entry Resistance Test.

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Provide door assemblies that have been designed and fabricated to comply with specified performance requirements, as demonstrated by testing manufacturer's corresponding standard systems.

B. Air Infiltration: Test specimen shall be tested in accordance with ASTM E 283 at pressure differential of 6.24 psf. Door shall not exceed 0.90 cfm per linear foot of perimeter crack.

C. Water Resistance: Test specimen shall be tested in accordance with ASTM E 331 at pressure differential of 7.50 psf. Door shall not have water leakage.

D. Indoor air quality testing per ASTM D 6670-01: GREENGUARD Environmental Institute Certified including GREENGUARD for Children and Schools Certification.

E. Hurricane Test Standards, Single Door with Single-Point Latching:
1. Uniform Static Load, ASTM E 330: Plus or minus 75 pounds per square foot.
2. Forced Entry Test, 300 Pound Load Applied, SFBC 3603.2 (b)(5): Passed.
3. Cyclic Load Test, SFBC PA 203: Plus or minus 53 pounds per square foot.
4. Large Missile Impact Test, SFBC PA 201: Passed.

F. Blast Test, Doors and Frames, ASTM F 1642-04, 6 psi / 41 psi-msec: Minimal Hazard.

G. Swinging Door Cycle Test, Doors and Frames, ANSI A250.4: Minimum of 25,000,000 cycles.

H. Cycle Slam Test Method, NWWDA T.M. 7-90: Minimum 5,000,000 Cycles.

I. Swinging Security Door Assembly, Doors and Frames, ASTM F 476: Grade 40.

J. Salt Spray, Exterior Doors and Frames, ASTM B 117: Minimum of 500 hours.

K. Sound Transmission, Exterior Doors, STC, ASTM E 90: Minimum of 25.

L. Thermal Transmission, Exterior Doors, U-Value, AAMA 1503-98: Maximum of 0.29 BTU/hr x sf x degrees F. Minimum of 55 CRF value.

M. Surface Burning Characteristics, FRP Doors and Panels, ASTM E 84:
1. Flame Spread: Maximum of 200, Class C.
2. Smoke Developed: Maximum of 450, Class C.

N. Surface Burning Characteristics, Class A Option On Interior Faces of FRP Exterior Panels and Both Faces of FRP Interior Panels, ASTM E 84:
1. Flame Spread: Maximum of 25.
2. Smoke Developed: Maximum of 450.

O. Impact Strength, FRP Doors and Panels, Nominal Value, ASTM D 256: 15.0 foot-pounds per inch of notch.

P. Tensile Strength, FRP Doors and Panels, Nominal Value, ASTM D 638: 14,000 psi.

Q. Flexural Strength, FRP Doors and Panels, Nominal Value, ASTM D 790: 21,000 psi.

R. Water Absorption, FRP Doors and Panels, Nominal Value, ASTM D 570: 0.20 percent after 24 hours.

S. Indentation Hardness, FRP Doors and Panels, Nominal Value, ASTM D 2583: 55.

T. Gardner Impact Strength, FRP Doors and Panels, Nominal Value, ASTM D 5420: 120 in-lb.

U. Abrasion Resistance, Face Sheet, Taber Abrasion Test, 25 Cycles at 1,000 Gram Weight with CS-17 Wheel: Maximum of 0.029 average weight loss percentage.

V. Stain Resistance, ASTM D 1308: Face sheet unaffected after exposure to red cabbage, tea, and tomato acid. Stain removed easily with mild abrasive or FRP cleaner when exposed to crayon and crankcase oil.

W. Chemical Resistance, ASTM D 543. Excellent rating.
1. Acetic acid, Concentrated.
2. Ammonium Hydroxide, Concentrated.
3. Citric Acid, 10%.
4. Formaldehyde.
5. Hydrochloric Acid, 10%.
6. Sodium hypochlorite, 4 to 6 percent solution.

X. Compressive Strength, Foam Core, Nominal Value, ASTM D 1621: 79.9 psi.

Y. Compressive Modulus, Foam Core, Nominal Value, ASTM D 1621: 370 psi.

Z. Tensile Adhesion, Foam Core, Nominal Value, ASTM D 1623: 45.3 psi.

AA. Thermal and Humid Aging, Foam Core, Nominal Value, 158 Degrees F and 100 Percent Humidity for 14 Days, ASTM D 2126: Minus 5.14 percent volume change.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's product data, including description of materials, components, fabrication, finishes and installation.

B. Shop Drawings: Submit manufacturer's shop drawings, including elevations, sections and details, indicating dimensions, tolerances, materials, fabrication, doors, panels, framing, hardware schedule and finish. Submit details of main frame corner joint construction on doors, stile and rail size, core material, vision lite moldings, louvers and factory finishing specifications. Include details of hardware reinforcing material, size and thickness, locations on both door(s) and frame, and method of attachment.

C. Samples:
1. Door: Submit manufacturer's sample of door showing face sheets, core, rails, stiles, joint construction, edge trim and finish.
2. FRP-Sheet Color: Submit manufacturer's 8-inch-square samples of standard colors of FRP-sheet for door facing.
3. Aluminum Frame Finish and Color: Submit 8-inch-long extruded sample of aluminum frame finish and color, showing match to finish and final color selected for aluminum windows, as indicated in Section 085113 – ALUMINUM WINDOWS.

D. Test Reports: Submit certified test reports from qualified independent testing agency indicating doors comply with specified performance requirements.

E. Qualification Data: For qualified Installer.

F. Maintenance Data: Submit manufacturer's maintenance and cleaning instructions for doors, including maintenance and operating instructions for hardware.

G. Warranties: Submit manufacturer's standard warranty.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
   1. Manufacturer is to have a minimum of 5 years experience in the production of pre-hardwared and pre-assembled door systems, using the type of materials specified for this project.
   2. Obtain door and frame components from same manufacturer.
   3. Evidence of a compliant documented quality management system.

B. Single Source Responsibility: Provide all entrance units from one source and produced by a single manufacturer.

C. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
   1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

D. Varying Sizes: The drawings indicate, by reference to approximate sizes, several basic door and frame designations in the drawings. References in the drawings to a particular window designation are not an indication that every window with that designation is exactly the same size. Each door and frame may vary in size and shall be field measured prior to ordering.

E. First Entrance Installation: The Architect and representatives of the Owner shall be present at the first entrance installation at each school to inspect method of attachment and quality of construction. Upon written approval by the Architect, the first door installation will establish the standards required for all subsequent work, which shall be of equal or higher quality.

1.7 DELIVERY, STORAGE, AND HANDLING

A. General: Do not deliver entrances to project site until immediately prior to installation.

B. Deliver entrance units in manufacturer’s original, unopened packaging. Package entrances with corner blocks to protect corners and edges from impact damage and glass from breakage.

C. Store units in an upright position, off the ground, in a clean and secure storage area protected from weather, theft, damage, and soiling until time of installation.

D. Protect entrance finishes from damage due to marring or contact with masonry before and during installation.

1.8 PROJECT CONDITIONS

A. Field Measurements: Check actual openings by accurate field measurement before fabrication. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of work.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Noise or vibration caused by thermal movements.
      c. Deterioration of finish and other materials beyond normal weathering.
      d. Water leakage through fixed glazing and framing areas.
      e. Failure of operating components.
   2. Warranty Period: 10 years from date of Substantial Completion.

1.10 MAINTENANCE SERVICE

A. Door Hardware:
   1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
   2. Initial Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door hardware operation at rated speed and capacity. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Commercial Door Systems.
   2. Special-Lite Inc.
   3. Kawneer.
   4. Or approved equal.

B. The FRP Faced Aluminum Door drawings for Marlborough High School and for Francis Kane Elementary School are based on the following door. Other products will be accepted subject to limitation in “Quality Assurance” article:
   1. FRP Faced Aluminum Doors: Commercial Door Systems - F500HD Wide Style FRP Series.

C. Acceptable Air Barrier Products: Subject to compliance with requirements, air barrier products that may be incorporated in the work include, but are not limited to, the following:
   1. Carlisle Coatings & Waterproofing; CCW-705.
   2. Grace, W. R. & Co.; Perm-A-Barrier.

3. Henry Company; Blueskin SA.
4. Meadows, W. R., Inc.; SealTight Air-Shield.
5. Rubber Polymer Corporation; Rub-R-Wall SA.
6. Tremco, Incorporated; ExoAir 110.
7. Or approved equal.

2.2 MATERIALS

A. Aluminum Members: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   1. Sheet and Plate: ASTM B 209.
   2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.

B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
   1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
   2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
   3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

C. Fasteners:
   1. Material: Aluminum, 18-8 stainless steel, or other noncorrosive metal.
   2. Compatibility: Compatible with items to be fastened.
   3. Exposed Fasteners: Screws with finish matching items to be fastened.

2.3 FRP FACED ALUMINUM DOORS

A. Door Construction:
   1. Door Thickness: 1-3/4-inch overall thickness.
   2. Stiles and Rails: Aluminum extrusions made from prime-equivalent billet that is produced from 100% reprocessed 6063-T6 alloy recovered from industrial processes. Main frame tube is to be a single extruded unit measuring 1 1/2” x 5 1/2” (O.D.) on both side stiles, and 6” (O.D.) Top and Bottom rails. Spliced extrusions that are joined together to measure 6” will not be accepted.
      a. Side Stiles: Minimum 3/16” thick hinge edge wall.
      b. Top and Bottom Rails: Minimum 1/8” thick outside edge wall (tie rod spline built into tube).
      c. All Rails and Stiles: Minimum 1/8” thick face walls.
      d. All Rails and Stiles: Minimum 1/8” thick inside edge wall.
   3. Corners: Mitered.
   4. Main Frame Joinery: Mortise and Tenon joint assembly on all four joints.
   5. Provide joinery of 3/8-inch diameter full-width tie rods through extruded splines (2 at top and 1 at bottom) integral to standard tubular shaped stiles and rails reinforced to accept hardware as specified.
   6. Securing Internal Door Extrusions: 3/16-inch angle blocks and locking hex nuts for joinery. Welds, glue, or other methods are not acceptable.
   7. Insert 7 Ga. Steel closer reinforcing into head rail.
   8. Furnish extruded stiles and rails with integral reglets to accept face sheets. Lock face sheets into place to permit flush appearance.
   9. Rail caps or other face sheet capture methods are not acceptable.
   10. Extrude top and bottom rail legs for interlocking continuous weather bar.
   11. Meeting Stiles: Pile brush weatherseals. Extrude meeting stile to include integral pocket to accept pile brush weatherseals.

12. Bottom of Door: Install bottom weather bar with nylon brush weatherstripping into extruded interlocking edge of bottom rail.
13. Glue: Use of glue to bond sheet to core or extrusions is not acceptable.

B. Face Sheet:
1. Material: High impact FRP, 0.120-inch thickness, finish color throughout.
2. Protective coating: Abuse-resistant engineered surface. Provide FRP with protective coating.
3. Texture: Sandstone.
4. Color: Color to be selected from manufacturer's color chart.
5. Adhesion: The use of glue to bond face sheet to foam core is prohibited.

C. Core:
1. Material: 25 psi density polystyrene with a flame spread rating of no more than 25 or 5 pcf density polyurethane foam.
2. Urethane core doors will require a letter from the manufacturer offering a special guarantee that the FRP face sheets will not delaminate (bubble) for a period of 25 years, and that the manufacturer will cover all replacement costs if delamination does occur.
3. R-Value: Minimum of 9.

D. Cutouts:
1. Manufacture doors with cutouts for required vision lites.
2. Factory install vision lites.

E. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.

F. Inter-loc Edge Trim: All aluminum trim to be completely removable. All parts of the door to be replaceable and repairable in the field. No fastening devices to be exposed on the Stile Edge Trims.

G. Door Hardware: As specified in Section 087100 – DOOR HARDWARE.

2.4 FRP-FACED INSULATED PANELS

A. FRP Panels:
1. Size: As indicated on the drawings.
2. Thickness: 1 inch overall with 1"x1"x1" (1/8" thick) aluminum frame surrounding the perimeter of the panel.

B. Face Sheets:
1. Material: FRP, 0.120-inch thickness, finish color throughout. Abuse-resistant engineered surface.
2. Texture: Sandstone.
3. Color: Color to match FRP door face sheet.

C. Insulated FRP panels:
1. Insulated Panels: Two 0.120-inch minimum thickness FRP sheets.
2. Core Material: 3/4" thick, 25 psi density polystyrene with a flame spread rating of no more than 25 or 5 pcf density polyurethane foam.
3. Urethane core panels will require a letter from the manufacturer offering a special guarantee that the FRP face sheets will not delaminate (bubble) for a period of 10 years, and that the manufacturer will cover all replacement costs if delamination does occur.

4. If urethane core is used, insert aluminum liner between FRP material and urethane core and aluminum channel perimeter frame.
5. Form components to function as single unit.
6. R-Value: Minimum of 4.

D. Class A Flame Spread and Smoke Developed Rating:
1. Class A flame spread and smoke developed rating on interior faces of exterior panels and both faces of interior panels.
2. Flame Spread: ASTM E 84: Maximum of 25.
3. Smoke Developed: ASTM E 84: Maximum of 450.

2.5 ALUMINUM DOOR FRAMING SYSTEMS

A. Tubular Framing:
1. Size and Type: As indicated on the Drawings.
2. Materials: Aluminum extrusions made from prime-equivalent billet that is produced from 100% reprocessed 6063-T6 alloy recovered from industrial processes, 1/8-inch minimum wall thickness.
3. Applied Door Stops: 0.625-inch high, with screws and weatherstripping. Door stop shall incorporate pressure gasketing for weathering seal. Counterpunch fastener holes in door stop to preserve full metal thickness under fastener head.
4. Frame Members: Box type with 4 enclosed sides. Open-back framing is not acceptable.
5. Caulking: Caulk joints before assembling frame members.
6. Joints:
   a. Secure joints with fasteners.
   b. Provide hairline butt joint appearance.
7. Field Fabrication: Field fabrication of framing using stick material is not acceptable.
8. Applied Stops: For side, transom, and borrowed lites and panels. Applied stops shall incorporate pressure gasketing for weathering seal. Reinforce with solid bar stock fill for frame hardware attachments.
9. Hardware:
   a. Pre-machine and reinforce frame members for hardware in accordance with manufacturer's standards and hardware schedule.
   b. Factory install hardware.
10. Anchors:
   a. Anchors appropriate for wall conditions to anchor framing to wall materials.
   b. Door Jamb and Header Mounting Holes: Maximum of 24-inch centers.
   c. Secure head and sill members of transom, side lites, and similar conditions.
11. Side Lites:
   a. Factory pre-assemble side lites to greatest extent possible.
   b. Mark frame assemblies according to location.

B. Removable Mullions:
1. Size: 2-inch by 3-inch.
2. Type: Not visible from the building exterior.
3. Material: Aluminum extrusions to match tubular frames.
4. Weatherstriping: Dual, full-length.
5. Hardware: Pre-machine and reinforce frame members for hardware in accordance with manufacturer's standards and hardware schedule.
6. Anchors:
   a. Concealed top and bottom fittings, with internal locking bolt.
   b. Anchors appropriate for floor conditions to anchor mullion to floor materials.
7. Pre-wired for electrified hardware where indicated. Provide internal cable restraints and moister-sealed electrical connectors.

2.6 GLAZING SYSTEMS

A. Glazing: As specified in Section 088000 – GLASS AND GLAZING.

2.7 VISION LITES

A. Factory Glazing: 1-inch glass insulating units.

B. Lites in Exterior Doors: Allow for thermal expansion.

C. Rectangular Lites:
1. Size: As indicated on the Drawings.
2. Factory glazed with screw-applied aluminum stops anodized to match perimeter door rails.

2.8 RECESSED FLUSH PULLS

A. Type and Size: Recessed pull handle, 6” x 8 1/2” x 1-9/16”.

B. Material and Fabrication: Extruded aluminum 6063-T6 alloy components welded together.

C. Finish: Match door edge trim.

D. Installation: Factory installed. Provide all necessary reinforcements and modifications to door for receiving the recessed flush pull. Secure pull to main frame of door without fastening devices exposed to the fingers when hand is inserted into pull.

2.9 HARDWARE

A. Premachine doors in accordance with templates from specified hardware manufacturers and hardware schedule specified in Section 087100 – DOOR HARDWARE.

2.10 AIR CONDITIONER SLEEVES AND GRILLES

A. Air Conditioner Sleeves: Galvanized steel solid-sided wall case with baked enamel or powder-coated finish. Fabricate with provision for drainage to exterior.

B. Accessories:
1. Rear Grille: Architectural grade aluminum horizontal louver, profile as indicated on drawings; finish color to match window framing.
a. Standard grille furnished with sleeve is not acceptable.
2. Case angles for securing case to wall or window framing.
3. Insulated metal interior sleeve cover.

C. Acceptable Product: GE Appliances Model RAB 48 Wall Case with accessories as noted.

2.11 SHEET AIR BARRIER FLASHING

A. For bridging movement joints and other applications not recommended for application of air/moisture barrier system by manufacturer, provide flexible self-adhering membrane of self-healing (nailable) rubberized asphalt integrally bonded to polyethylene sheeting, formed into uniform flexible sheets, minimum 40 mil thickness, and the following:
1. Physical Properties:
a. Tensile Strength: 1200 psi min; ASTM D412.

b. Ultimate Elongation: 200 percent min; ASTM D412.
c. Low Temperature Flexibility: Unaffected to -45 deg. F(-43 deg. C); ASTM D1970.
d. Water Absorption: Max. 0.1 percent weight gain after 48 hrs. of immersion at 70 deg. F(21 deg. C), ASTM D570.
e. Compatible with specified paint systems.

2.12 FABRICATION

A. Sizes and Profiles: Required sizes for door and frame units, and profile requirements shall be as indicated on the Drawings.

B. Coordination of Fabrication: Field measure before fabrication and show recorded measurements on shop drawings.

C. Assembly:
1. Complete cutting, fitting, forming, drilling, and grinding of metal before assembly.
2. Remove burrs from cut edges.

D. Welding of doors or frames is not acceptable.

E. Fit:
1. Maintain continuity of line and accurate relation of planes and angles.
2. Secure attachments and support at mechanical joints with hairline fit at contacting members.

F. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
1. Profiles that are sharp, straight and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

G. Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
1. At exterior doors, provide compression weather stripping at fixed stops.

H. Door Hardware Installation: Factory install door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed door hardware before applying finishes.

I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.13 ALUMINUM FINISHES

A. General:
1. Color and Gloss: Custom-colored frames to match exterior frame finish and color of new aluminum windows per Section 085113 – ALUMINUM WINDOWS. Finish shall be either High Performance Organic Coating or Clear Anodized, as selected by Architect.

2. Comply with the NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

B. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.

C. High Performance Organic Coating: AA C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: chemical conversion coating, acid chromate fluoride phosphate pretreatment; Organic Coating: as specified below). Prepare, pre-treat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's instructions.
1. Fluorocarbon 2 Coat Coating System: Manufacturer's standard 2 coat thermocured system, complying with AAMA 2605, composed of specially formulated inhibitive primer and fluorocarbon color topcoat containing not less than 70 percent polyvinyldene fluoride resin by weight.

D. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: Nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare openings before beginning installation. Ensure openings to receive frames are plumb, level, square, and in tolerance.
1. Surfaces shall be visibly dry and free of construction debris.
2. Wood nailers shall be sound and free of voids, rot or other deterioration.
3. Take care not to disturb interior finishes.

B. Notify the Architect immediately of any inconsistencies between field conditions and existing conditions shown on the drawings.

C. Prepare rough opening and install of shims, blocking, sheet air barrier flashing, and sealants.

3.2 INSTALLATION

A. General:
1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Anchor frames securely in place.
5. Rigidly secure non-movement joints.
6. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
7. Seal joints watertight unless otherwise indicated.
8. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
9. Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 – JOINT SEALANTS to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

F. Install glazing as specified in Section 088000 – GLASS AND GLAZING.
1. Structural-Sealant Glazing:
   a. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
   b. Install weatherseal sealant according to Section 079200 – JOINT SEALANTS and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

G. Exterior Doors: Install doors to produce smooth operation and tight fit at contact points.

H. Install perimeter joint sealants as specified in Section 079200 – JOINT SEALANTS to produce weathertight installation.

3.3 ERECTION TOLERANCES

A. Install aluminum-framed systems to comply with the following maximum erection tolerances:
1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet total length.
2. Alignment:
   a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
   b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

3.4 ADJUSTING

A. Adjust door and door hardware to function smoothly as recommended by manufacturer.
1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch, measured to the leading door edge.

3.5 CLEANING

A. Clean doors promptly after installation in accordance with manufacturer’s instructions.

B. Do not use harsh cleaning materials or methods that would damage finish.

3.6 PROTECTION

A. Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.

3.7 FIELD QUALITY CONTROL

A. The Owner reserves the right to conduct tests of installed windows by a qualified independent testing agency. The Contractor shall bear the costs of testing and reinstalling window installations that fail.

END OF SECTION 081743

SECTION 087100

DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. The Metal Windows Contractor is designated the Prime Contractor. All references to "Contractor" or "General Contractor" in the Contract Documents shall be interpreted as referring to the Prime Contractor.

C. Examine all Drawings and all Sections of the Specifications for requirements and provisions affecting the work of this Section.

1.2 SUMMARY

A. This Section includes the following permanent door hardware, to the extent not furnished in other sections:
1. Hinges.
2. Lock cylinders and keys.
3. Lock and latch sets.
4. Exit devices.
5. Closers.
6. Door trim units.
7. Protection plates and stops.
8 Weatherstripping for exterior doors.
9. Thresholds.

B. Furnish, install finish hardware necessary for doors as enumerated in the sets or as indicated or required by actual conditions at the building. Some minor variation may be required.

C. Related Sections: The following Sections contain requirements that relate to this Section:
1. Section 061503 – MISCELLANEOUS ROUGH CARPENTRY for blocking.
2. Section 081743 – FRP-FACED ALUMINUM DOORS AND FRAMES, for factory and field preparation of FRP faced aluminum doors and aluminum frames for door hardware.
3. Section 084113 – ALUMINUM STOREFRONT ENTRANCES, for factory and field preparation of aluminum doors and frames for door hardware.

D. Temporary Hardware: Door hardware at temporary entrances is included in Division 1.

1.3 REFERENCES

A. NFPA-80, "Fire Doors & Windows", 1992 Edition.
B. NFPA-101, The Life Safety Code, 1994 Edition.
C. DHI Installation Guide, 1986 Edition.
D. DHI, Keying Terminology, 1989 Edition.
E. ANSI/BHMA Standards as listed.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification sections.
   1. All submittals required by this Section shall be prepared by a certified Architectural Hardware Consultant (AHC) acceptable to the Architect. Include name, address, telephone number, and qualifications of preparer with initial submittal.

B. Product data including manufacturers' technical product data for each item of door hardware, installation instructions, finish, and other information necessary to show compliance with requirements.
   1. Provide name and telephone number of manufacturer’s representative for each submitted product.

C. Hardware Schedule, in the scheduling format recommended by DHI.

D. AHC Certification: Provide certification by Architectural Hardware Consultant responsible for preparing submittals that all proposed products comply with specified requirements and will operate as intended.

E. Upon request from the Architect, submit samples of each proposed hardware item to be used in this project. All samples will be returned after completion of the project.

F. Templates for proper machining for the required templated hardware.

G. Keying Schedule: Supply a complete keying schedule, in the format by Owner. Coordinate preparation of keying schedule with Owner’s Representative.

H. Information for inclusion in Operation and Maintenance Manuals, including the following:
   1. A final copy of the approved and as-built hardware schedule.
   2. A final copy of the approved keying schedule.
   3. Catalog cuts for each item used in the project.
   4. Parts list and numbers for each item.
   5. Maintenance instructions for each item.
   6. Name, address and phone number of local representative for each item.

1.5 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain each type of hardware from a single manufacturer.

B. Supplier: Hardware supplier shall be engaged in regularly contracting work and be staffed to expedite the work. The firm shall have been furnishing finish hardware on similar projects in the vicinity of this project for no less than five (5) years

C. Certified Architectural Hardware Consultant: Where indicated in “Submittals” article, submittals shall be prepared and coordinated by a certified Architectural Hardware Consultant (AHC).

D. UL Labeling: For electrically-operated components, provided UL-labeled and listed components approved for application intended.

E. Design Concept: Requirements for design, grade, function, size, and other distinctive

qualities of each type of finish hardware are indicated in the "Hardware Schedule" at the end of this Section by reference to one product and manufacturer. Similar items by other manufacturers will be accepted if, in the opinion of the Architect, they are substantially equal to the specified product.

1.6 DELIVERY, STORAGE AND HANDLING

A. Hardware shall be delivered to the job site in the manufacturer's original packages, marked to correspond with the approved hardware schedule door numbers.

B. Do not deliver hardware until immediately prior to installation. Store hardware in a secure room and guard against theft.

C. Do not use permanent hardware items for temporary construction facilities or building security. Provide temporary locksets on secure doors as required; do not install permanent hardware until shortly before time of Substantial Completion.

1.7 EXTRA MATERIALS

A. Furnish quantity of extra materials indicated below to the Authority. Extra materials shall be delivered in manufacturer’s original packaging, clearly labeled to identify contents.

B. Extra Materials:
1. Cores: 4 complete sets for Marlborough High School, and 4 complete sets for Kane Elementary School

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Manufacturers offering products that may be incorporated in the Work include but are not limited to the following.

B. Hinges:
1. Hager Companies, St. Louis, MO.
2. Stanley Hardware, New Britain, CT.
3. Bommer Company, Lundrum, SC.
4. Or Approved Equal.

C. Locksets/Latchsets:
1. Yale Security Inc., Charlotte, NC.
2. Corbin/Russwin, Berlin, CT.
3. Schlage, San Francisco, CA.
4. Or Approved Equal.

D. Exit Devices:
1. Von Duprin, Indianapolis, IN.
2. Corbin/Russwin, Berlin, CT.
3. Yale Security Inc., Charlotte, NC.
4. Or Approved Equal.

E. Door Closers:
1. Norton Door Closers, Charlotte, NC.
2. Corbin/Russwin, Berlin, CT.
3. LCN, Princeton, IL.
4. Or Approved Equal.

F. Push/Pulls:
1. Hager Companies, St. Louis, MO.
2. Rockwood, Rockwood, PA.
3. Ives, New Haven, CT.
4. Or Approved Equal.

H. Kick Plates:
1. Hager Companies, St. Louis, MO.
2. Rockwood, Rockwood, PA.
3. Ives, New Haven, CT.
4. Or Approved Equal.

I. Door Stops:
1. Hager Companies, St. Louis, MO.
2. Rockwood, Rockwood, PA.
3. Ives, New Haven, CT.
4. Or Approved Equal.

J. Thresholds And Gasketing:
1. Hager Companies, St. Louis, MO.
2. National Guard Products, Memphis, TN.
3. Pemko, Memphis, TN.
4. Ives, New Haven, CT.
5. Or Approved Equal.

2.2 MATERIALS, GENERAL

A. General: Requirements for design, grade, function, size, and other distinctive qualities of each type of finish hardware are indicated in the "Hardware Schedule" at the end of this Section. The product designations and names of three manufacturers are listed for each hardware type required for the purpose of establishing minimum requirements. Provide either the products designated or the approved comparable product of another manufacturer that complies with requirements.

B. Base Metals: Produce hardware units of basic metal and forming method indicated using manufacturer's standard non-ferrous metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units for finish designations indicated.

C. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware that has been prepared for self-tapping sheet metal screws.
1. Exposed Fasteners: All exposed fasteners at secure side of opening shall be tamper-proof, security type, requiring use of special tools to remove.

D. Furnish screws for installation with each hardware item. Provide counter-sunk Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any

condition) screws to match hardware finish.

E. Provide concealed fasteners for hardware units that are exposed when door is closed except to the extent no standard units of type specified are available with concealed fasteners.

F. Finishes: Except as otherwise indicated, provide all units in BHMA/ANSI 626 finish (satin chromium plated), or manufacturer's finish most closely resembling 626.

G. Accessories: Hardware Schedule includes major components and operating items. Provide accessory components as required for complete and proper operation of each specified hardware item as scheduled, whether or not accessories are specifically noted in the schedule.

2.3 BUTT HINGES

A. Templates: Provide only template-produced units.
1. Furnish interior hinges templated for 1-3/8 inch thick doors, where scheduled.

B. Materials:
1. Furnish hinge units at exterior and interior wet locations of solid brass or non-ferrous stainless steel in indicated finish.
2. Furnish hinge units at other interior locations of ferrous steel in indicated finish.
3. Paint grade hinges will not be accepted.

C. Screws: Provide security fasteners complying with the following requirements:
1. For metal frames install security fasteners into drilled and tapped holes.
2. Finish fastener heads to match surface of hinges or pivots.

D. Hinge Pins: Except as otherwise indicated, provide nonrising pins with flat button tips and matching plug, finished to match leaves.

E. Number of Hinges: Provide 1-1/2 pair per door leaf.

F. Provide hinges sized as indicated in schedule, or if not indicated, as specified in reference standards. Hinge widths shall be as required to clear door trims.

G. Provide exterior hinges with security studs.

2.4 CONTINUOUS, GEAR-TYPE HINGES

A. Standard: BHMA A156.26.
1. Listed under Category N in BHMA's "Certified Product Directory."

B. General: Minimum 0.120-inch thick, hinge leaves with minimum overall width of 4 inches; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

C. Extruded-aluminum, pinless, geared hinge leaves; joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.

2.5 LOCK CYLINDERS AND KEYING

A. Keying: Coordinate keying with Owner and as follows:

1. Furnish and deliver seven copies of each unique exterior entrance door keys to Owner.
2. Apartment Entry Doors: Apartment entry and egress doors shall be keyed alike, and key shall open main exterior entrance doors at Building A.
3. Townhouse Entry Doors: Townhouse entry and egress doors shall be keyed alike.
4. Mechanical rooms: mechanical, electrical rooms shall be keyed alike.

B. Metals: Construct lock cylinder parts from brass or bronze, stainless steel, or nickel silver.

C. Key Material: Provide keys of nickel silver only.

D. Interchangeable Cylinder Cores: Furnish all lock cylinders with removable, interchangeable cores for instant rekeying. Cores shall be removable by use of special control key.

2.6 LOCKS, LATCHES, AND BOLTS

A. Cylinder Locksets: Provide cylindrical locksets that conform to or exceed the following ANSI/BHMA standards. Provide knurling on levers as required by code:
1. Extra Heavy Duty Commercial Grade locksets, A156.2, Series 4000, Grade 1; Schlage D Series or equal.

B. Strikes: Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set, unless otherwise indicated.
1. Electric Strikes: Where indicated in sets and on drawings, provide fully mortised (concealed in frame), wrought stainless steel electric strike, rated for a minimum of 500,000 cycles, 2300 lb. minimum forcing strength, and compatible with indicated locksets and frame. Provide power supply unit if power supply characteristics furnished under Section 16100 are incompatible with strike (see electrical drawings for specifications).

C. Lock Throw: Provide 1/2-inch minimum throw of latch for bored and pre-assembled types of locks unless greater throw is required for fire-rated assemblies.

2.7 EXIT DEVICES

A. Provide fire rated, rim-mounted or mortised lock exit devices as listed in sets, from one of the listed manufacturers or approved equal that conforms with ANSI/BHMA A156.3 standard Grade 1 and have the proper UL listings and labels.

B. Provide dogging on exterior devices only at locations where it currently exists.

C. Electric Strikes: Where indicated in sets and on drawings, provide electric strike compatible with mortise lockset.

D. Cylinders: Provide lock cylinders with interchangeable cores for all exit devices, as listed. Keying shall be compatible with specified master key design.

2.8 DOOR CLOSERS

A. Provide surface mounted door closers with metal covers that comply with ANSI/BHMA A156.4 grade 1 and have a ten (10) year warranty. Provide parallel arm closers unless otherwise indicated.

B. Provide mounting brackets and other accessories as required for proper installation.

C. Provide BF, H, DA or UNI options only when listed in sets. Provide a factory sized closer at all fire rated openings. Multi-sized closers are NOT acceptable at rated openings.
   1. Where “hold-open” features are listed in sets, provide hold-open feature that requires special tool to adjust, to prevent unauthorized use.

2.9 DOOR CONTROL HARDWARE AND TRIM

A. Door Pulls: Provide offset door pulls from one of the listed manufacturers or approved equal that complies with ANSI 156.6 Unless otherwise listed in sets, pulls shall be 1" inch in diameter, 12" inches on center and have the proper clearance for handicap (H) accessibility.

B. Door Push Plates: Provide door plate for pack-to-back mounting with pulls, from one of the listed manufacturers or approved equal, that complies with ANSI 156.6, without exposed through-bolts.

C. Protective Plates: Provide kick plates from one of the listed manufacturers or approved equal that conforms with ANSI 156.6. Thickness shall be 0.050 inch and shall have bevels on 3 edges. Unless otherwise noted, kick plates shall be12 inches high. The width of the kick plates shall be less 2 inches for single doors and less 1 inch for pairs of doors.

D. Door Stops: Provide door stops from one of the listed manufacturers or approved equal that conforms with ANSI 156.16, Grade 1. Furnish floor stops only when wall stops are not practical. Provide adequate internal wall blocking for all wall stops.

E. Threshold And Weatherstripping: Provide perimeter weatherstripping, door sweeps, thresholds, astragals from one on the listed manufacturers or approved equal at all exterior openings and other openings as listed in schedule.
   1. Threshold depth shall match frame depth.
   2. Furnish full-saddle type thresholds where floor finish elevation at either side of opening is identical.
   3. Furnish half-saddle type thresholds where floor finish elevation at either side of opening Varies more than ¼-inch. Butt square edge to raised floor elevation.
   4. Scribe thresholds to fit tight to frame rabbets.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors, frames and conditions under which the work is to be performed, with Installer present. Notify the Architect of any detrimental conditions to the proper completion of the installation.

B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Mount hardware units at heights indicated in following applicable publications, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by Architect.
   1. "Recommended Locations for Builders Hardware for Standard Steel Doors and

Frames" by the Door and Hardware Institute.

B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in Section 099000. Do not install surface-mounted items until finishes have been completed on the substrates involved.

C. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

D. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

E. Set thresholds in a continuous full bed of latex-modified cement grout.

F. Door Bottoms and Sweeps: Set units to properly contact floor or threshold, provide tight seal, and operate without binding or excessive force.

3.3 ADJUSTING, CLEANING, AND DEMONSTRATING

A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.

B. Clean adjacent surfaces soiled by hardware installation.

C. Adjust operation of electrical devices after electrical connections are complete. Arrange for testing of hardware where devices are connected to fire alarm system.

3.4 PROTECTION

A. Provide proper protection of all hardware items until time of Substantial Completion.

3.5 HARDWARE SCHEDULE

A. General: Provide hardware for each door to comply with requirements of this Section, hardware set numbers indicated in door schedule, and in the following schedule of hardware sets.
   1. Hardware sets indicate quantity, item, manufacturer and product designation, and size as applicable.
   2. Lockset Designs: Provide the Schlage lockset and latchset designs designated below, or if by another manufacturer, one that matches those designated:

B. Hardware Sets (DRAFT ONLY – TO BE REVIEWED):

HARDWARE SET NO. 1 – Main entry vestibule inner doors, pair with removable mullion.

1.	Hinge:	Continuous Hager 780-112HD x 85”, Clear Anodized.
2.	Exit Device:	Rim Type, Von Duprin 99NL-OP, US32D.
3.	Rim Cylinder:	Removable Core Housing, Sargent 6034, US26D.
4.	Remov Mullion:	Von Duprin
5.	Closer:	LCN 4041.
6.	Threshold:	Hager 412S by width of opening.

7. Door Sweep: Hager 750S by size of opening.

HARDWARE SET NO. 2 – Main entry vestibule exterior doors, pair with removable mullion

1. Hinge: Continuous Hager 780-112HD x 85", Clear Anodized.
2. Exit Device: Rim Type, Von Duprin 99NL-OP, US32D.
3. Electric Strike: 1 each, Adams Rite 74R1, connected to door release / intercom system.
4. Rim Cylinder: Removable Core Housing, Sargent 6034, US26D.
5. Remov Mullion: Von Duprin
6. Closer: LCN 4041.
7. Threshold: Hager 412S by width of opening.
8. Door Sweep: Hager 750S by size of opening.

HARDWARE SET NO. 3 – Cafetorium exterior doors, pair with removable mullion

1. Hinge: Continuous Hager 780-112HD x 85", Clear Anodized.
2. Exit Device: Rim Type, Von Duprin 99NL-OP, US32D.
3. Rim Cylinder: Removable Core Housing, Sargent 6034, US26D.
4. Remov Mullion: Von Duprin
5. Closer: LCN 4041.
6. Threshold: Hager 412S by width of opening.
7. Door Sweep: Hager 750S by size of opening.

HARDWARE SET NO. 4 – Kitchen exterior door, single

1. Hinge: Continuous Hager 780-112HD x 85", Clear Anodized.
2. Mortice lock/lever: .
3. Cylinder: Removable Core Housing, Sargent 6034, US26D.
4. Closer: LCN 4041.
5. Threshold: Hager 412S by width of opening.
6. Door Sweep: Hager 750S by size of opening.
7.

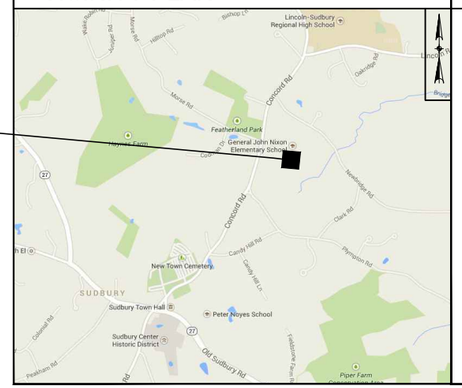
HARDWARE SET NO. 5 – Receiving & Storage exterior doors, pair with active leaf/flush bolts.

1. Hinge: Continuous Hager 780-112HD x 85", Clear Anodized.
2. Mortice lock/lever:
3. Cylinder: Removable Core Housing, Sargent 6034, US26D.
4. Closer: LCN 4041.
5. Threshold: Hager 412S by width of opening.
6. Door Sweep: Hager 750S by size of opening.

END OF SECTION

GEN. JOHN NIXON ELEMENTARY SCHOOL
PARTIAL ROOF AND WINDOW REPLACEMENT

VICINITY PLAN



LIST OF DRAWINGS

ARCHITECTURAL

G0.0	COVER SHEET
A0.1	PRELIMINARY BUILDING CODE REVIEW
A2.1	DEMOLITION AND PROPOSED FLOOR PLAN
A2.2	PROPOSED ROOF PLAN
A3.1	BUILDING ELEVATIONS
A3.2	EXISTING ELEVATIONS

BWA PROJECT No. 1420

GEN. JOHN NIXON ELEMENTARY SCHOOL
PARTIAL ROOF AND WINDOW REPLACEMENT

472 CONCORD ROAD
SUDBURY, MA 01776

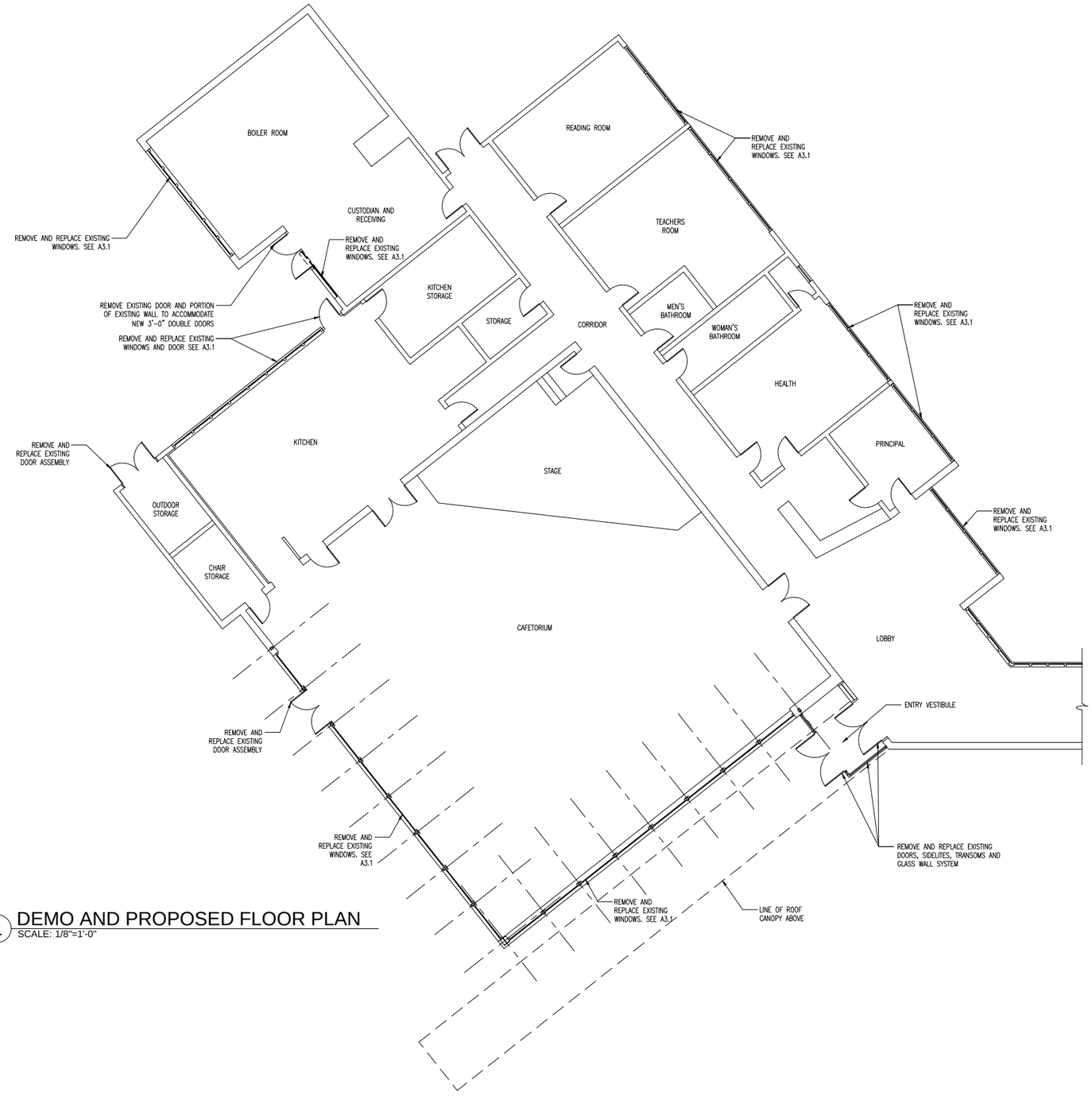
OWNERS: SUDBURY PERMANENT BUILDING COMMITTEE
278 Old Sudbury Road
Sudbury, MA 01776

OWNER'S PROJECT MANAGER: SKANSKA
253 Summer Street, 1st Floor Boston, MA 02210 617.574.1524

ARCHITECT: Baker | Wohl ARCHITECTS
132 Lincoln Street, Boston MA 02111 617.350.7420
www.baker-wohl.com

STRUCTURAL: Peda Inc.
P. O. Box. 724, Pembroke MA 02359 781.335.1880

DATE: 15 OCTOBER 2014



1 DEMO AND PROPOSED FLOOR PLAN
SCALE: 1/8"=1'-0"

SHEET NOTES

CODED NOTES

LEGEND

SUDBURY PERMANENT BUILDING COMMITTEE

278 Old Sudbury Road
Sudbury, MA 01776

GEN. JOHN NIXON ELEMENTARY SCHOOL PARTIAL ROOF AND WINDOW REPLACEMENT

472 CONCORD ROAD
SUDBURY, MA 01776

Baker | Wohl
ARCHITECTS

132 Lincoln Street, Boston MA 02111 617.350.7420
www.baker-wohl.com

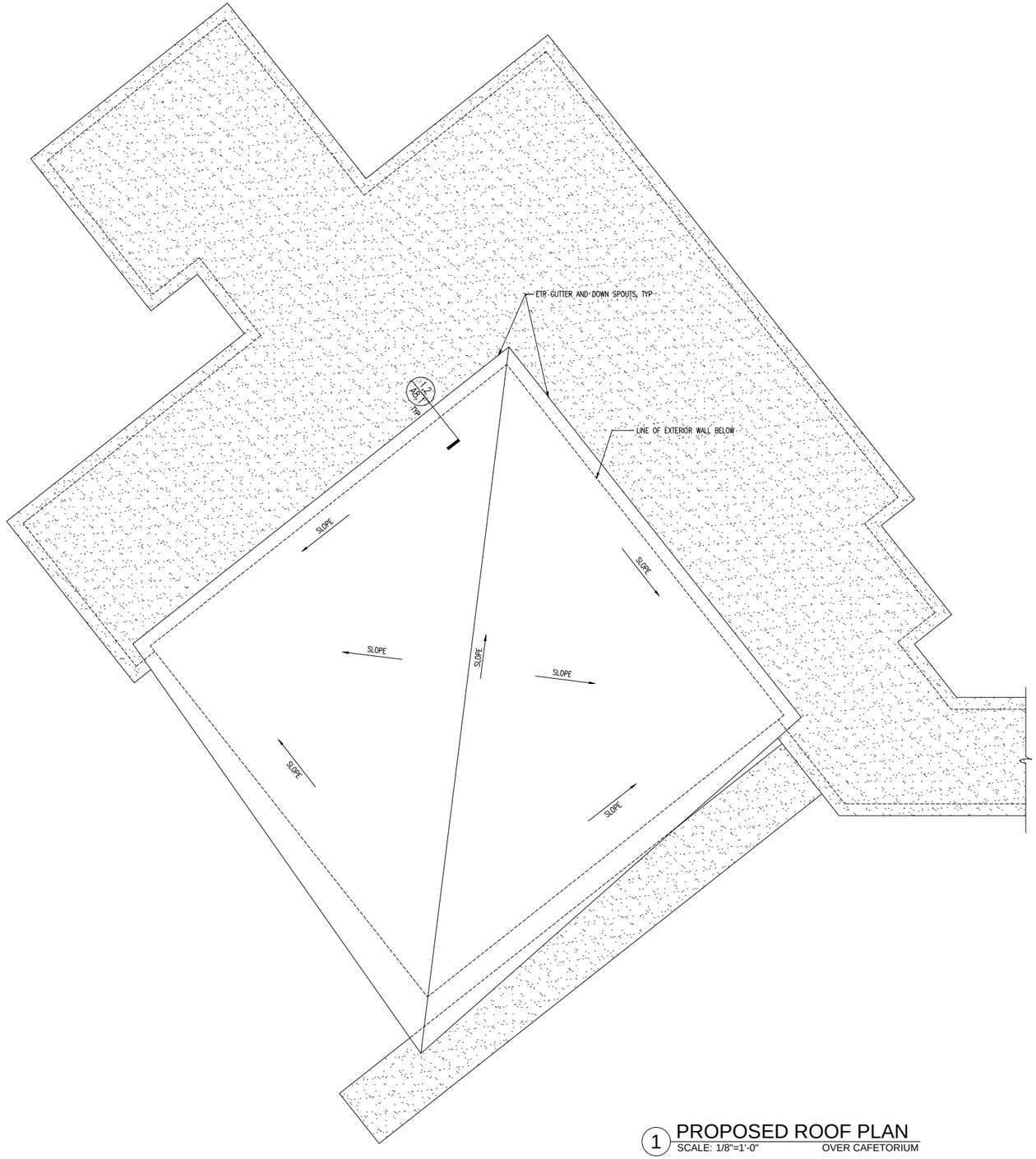
Issue

No.	Description	Date
1	30% SUBMISSION	10.15.14

DRAWING TITLE
DEMOLITION AND PROPOSED FLOOR PLAN

SHEET NO.
A2.1

PROJECT NO. 1420



1 PROPOSED ROOF PLAN
SCALE: 1/8"=1'-0" OVER CAFETORIUM

SHEET NOTES

CODED NOTES

LEGEND

ETR ROOF; NOT IN CONTRACT

SUDBURY PERMANENT BUILDING COMMITTEE

278 Old Sudbury Road
Sudbury, MA 01776

GEN. JOHN NIXON ELEMENTARY SCHOOL PARTIAL ROOF AND WINDOW REPLACEMENT

472 CONCORD ROAD
SUDBURY, MA 01776

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Issue

No.	Description	Date
1	30% SUBMISSION	10.15.14

DRAWING TITLE
PROPOSED ROOF PLAN

SHEET NO.
A2.2

PROJECT NO.

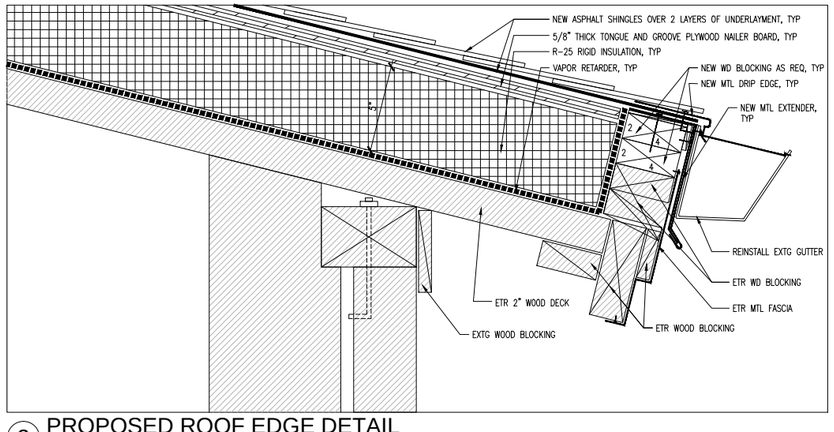
SHEET NOTES

CODED NOTES

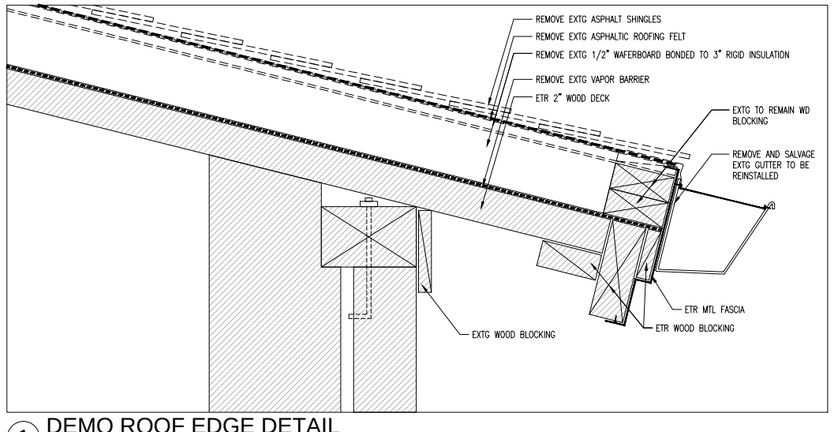
LEGEND

EXTG CONSTRUCTION TO REMAIN

DEMOLITION WORK



2 PROPOSED ROOF EDGE DETAIL
SCALE: 3" = 1'-0"



1 DEMO ROOF EDGE DETAIL
SCALE: 3" = 1'-0"

SUDBURY PERMANENT BUILDING COMMITTEE

278 Old Sudbury Road
Sudbury, MA 01776

GEN. JOHN NIXON ELEMENTARY SCHOOL PARTIAL ROOF AND WINDOW REPLACEMENT

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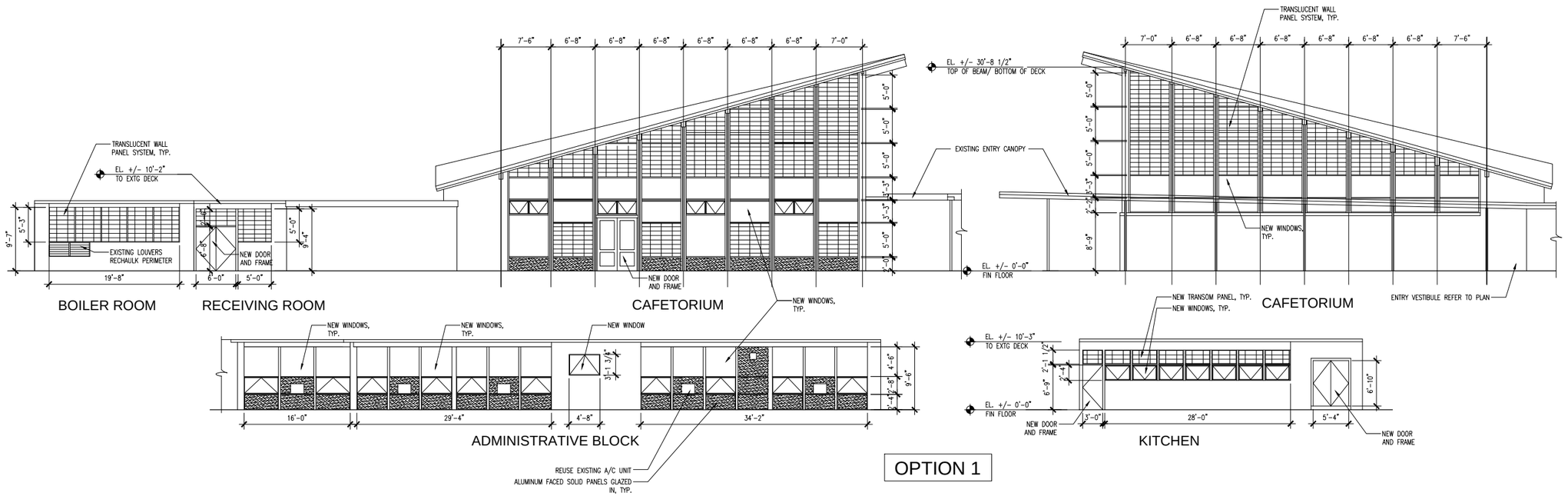
Issue

No.	Description	Date
1	30% SUBMISSION	10.15.14

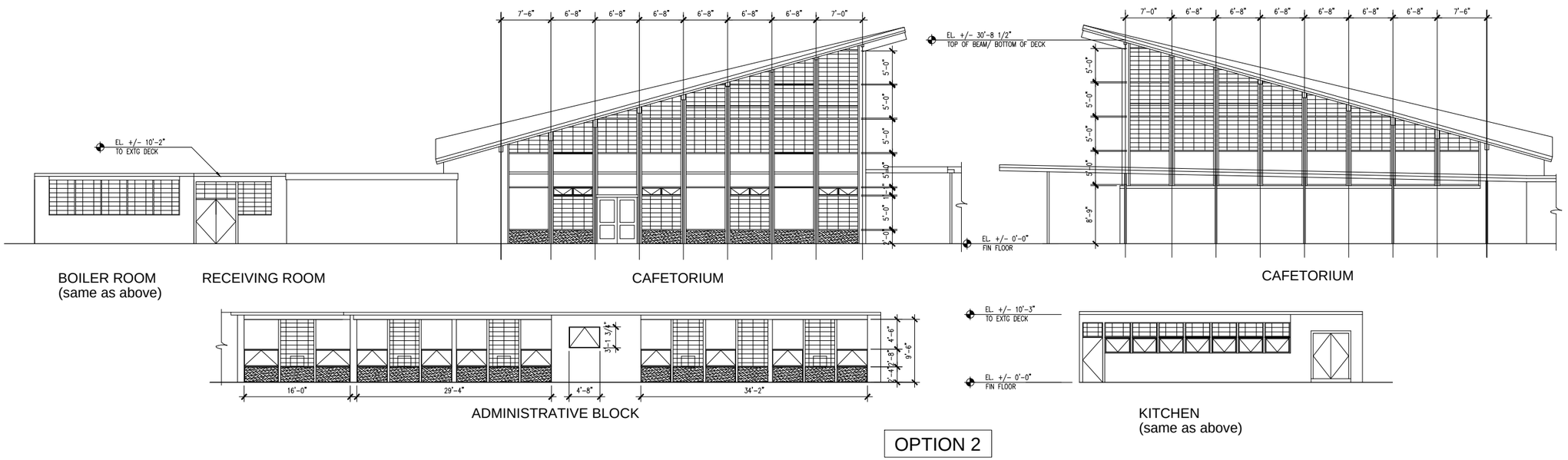
DRAWING TITLE
TYPICAL ROOF DETAILS

SHEET NO.
A8.1

PROJECT NO.



OPTION 1



OPTION 2

SUDBURY PERMANENT BUILDING COMMITTEE

278 Old Sudbury Road
Sudbury, MA 01776

GEN. JOHN NIXON ELEMENTARY SCHOOL PARTIAL ROOF AND WINDOW REPLACEMENT

472 CONCORD ROAD
SUDBURY, MA 01776

Baker | Wohl ARCHITECTS

132 Lincoln Street, Boston MA 02111 617.350.7420
www.baker-wohl.com

Issue

No.	Description	Date
1	30% SUBMISSION	10.15.14

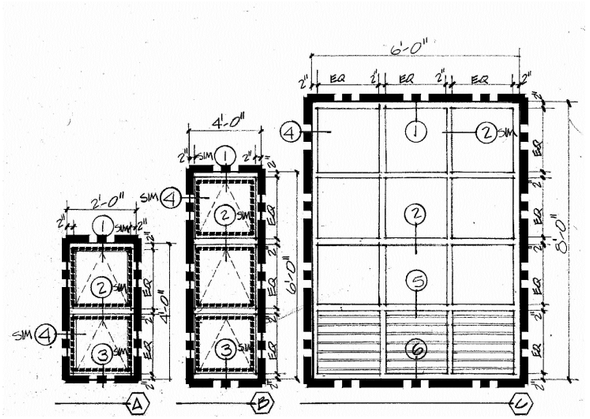
DRAWING TITLE

PROPOSED ELEVATIONS

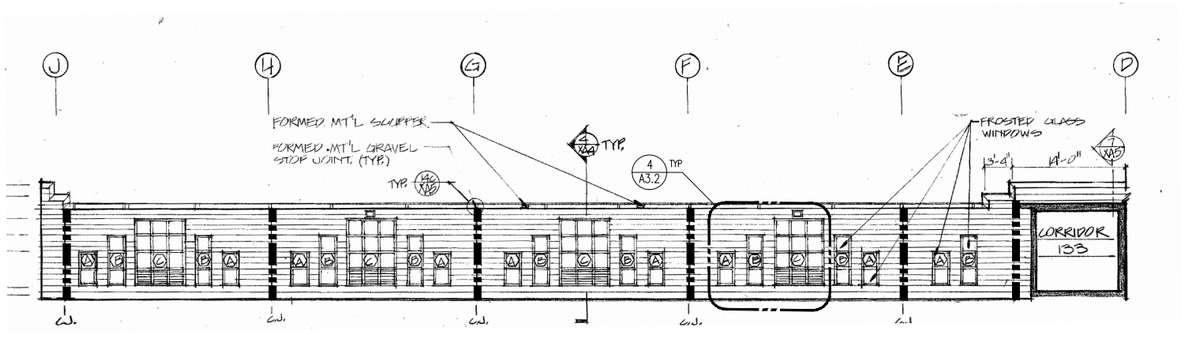
SHEET NO.

A3.1

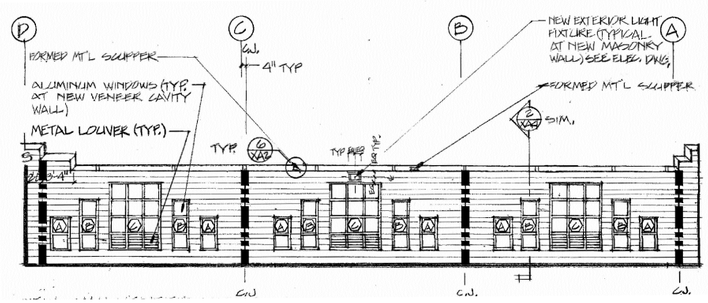
PROJECT NO.



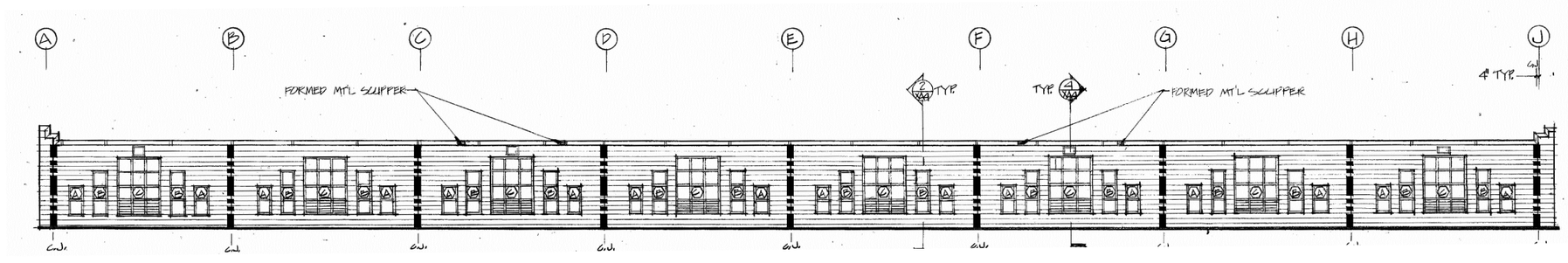
4 EXTG WINDOWS - CAULKING LOCATION
SCALE: NTS



3 EXTG ELEVATION - CAULKING LOCATION
SCALE: APPROXIMATELY 1/8"=1'-0"



2 EXTG ELEVATION - CAULKING LOCATION
SCALE: APPROXIMATELY 1/8"=1'-0"



1 EXTG ELEVATION - CAULKING LOCATION
SCALE: APPROXIMATELY 1/8"=1'-0"

1/8" = 1'-0"
0 4 8 16 FT

SHEET NOTES

CODED NOTES

LEGEND

EXTG MASONRY CONTROL JOINT TO BE RECAULKED

PERIMETER JOINT AT EXTG WINDOWS TO BE RECAULKED

EXTG WINDOW METAL METAL JOINT BETWEEN WINDOW FRAME AND SASH FRAME TO BE RECAULKED

SUDBURY PERMANENT BUILDING COMMITTEE

278 Old Sudbury Road
Sudbury, MA 01776

GEN. JOHN NIXON ELEMENTARY SCHOOL PARTIAL ROOF AND WINDOW REPLACEMENT

472 CONCORD ROAD
SUDBURY, MA 01776

Baker | Wohl
ARCHITECTS

132 Lincoln Street, Boston MA 02111 617.350.7420
www.baker-wohl.com

Issue

No.	Description	Date
1	30% SUBMISSION	10.15.14

DRAWING TITLE
EXISTING ELEVATIONS

SHEET NO.
A3.2

PROJECT NO.

5

COST ESTIMATE

TOWN OF SUDBURY

SUDBURY - GENERAL JOHN NIXON ELEMENTARY SCHOOL PARTIAL ROOF & WINDOW REPLACEMENT

SCHEMATIC DESIGN COST ESTIMATE - DRAFT

PARTIAL ROOFING REPACEMENT PROJECT		QUANTITY		MATL & LABOR	
Section	Description	No. Units	Unit Meas.	Unit Cost	TOTAL COST
	DIVISION 2 - EXISTING CONDITIONS				
020800	Selective demolition	0	ea	$0.00	$0
	Demolition Subtotal				**$0**
	DIVISION 2 - TOTAL				**$0**
	DIVISION 6 - WOOD AND PLASTICS				
061053	Replace damaged wood deck [UNIT PRICE WORK] Allowance	100	lf	$10.00	$1,000
	Replace damaged wood blocking [UNIT PRICE WORK] Allowance	50	lf	$3.60	$180
	New Pressure treated perimeter wood roof blocking (2-1/2" higher)	276	lf	$3.60	$994
	Miscellaneous carpentry - Subtotal				**$2,174**
	DIVISION 6 - TOTAL				**$2,174**
	DIVISION 7 - THERMAL AND MOISTURE PROTECTION				
75400	**Sloped Roofing**				
	Demo existing asphalt shingle roofing systems to deck	4,900	sf	$1.35	$6,615
	New 5" rigid insulation	4,900	sf	$2.00	$9,800
	New plywood nailing surface	4,900	sf	$3.50	$17,150
	New Felt/ice water shield	4,900	sf	$1.15	$5,635
	New Asphalt Shingle Roofing	4,900	sf	$5.50	$26,950
	Asphalt Shingle Roofing - Subtotal				**$66,150**
076200	**Flashing and sheet metal**				
	Remove and reattach existing gutters ad fascia	276	lf	$2.50	$690
	New prefin alum fascia extender at roof perimeter	276	lf	$5.00	$1,380
	Flashing and sheet metal - subtotal				**$2,070**
	DIRECT TRADE COSTS				**$70,394**
	General Conditions	15.0%			$10,559
	OH&P	5.0%			$3,520
	Subtotal				**$84,472**
	Contingency	5.0%			$4,224
	Subtotal				**$88,696**
	Escalation	3.0%			$2,661
	TOTAL PARTIAL ROOFING REPLACEMENT PROJECT				**$91,357**

TOWN OF SUDBURY

SUDBURY - GENERAL JOHN NIXON ELEMENTARY SCHOOL PARTIAL ROOF & WINDOW REPLACEMENT

SCHEMATIC DESIGN COST ESTIMATE - DRAFT

PARTIAL WINDOW REPLACEMENT PROJECT		QUANTITY		MATL & LABOR	
Section	Description	No. Units	Unit Meas.	Unit Cost	TOTAL COST
	DIVISION 2 - EXISTING CONDITIONS				
020800	Asbestos Abatement [solid window panel]	24	ea	$20.00	$480
	Asbestos Abatement [window caulking/stops]	90	ea	$250.00	$22,500
	Asbestos Abatement [door frames]	4	ea	$75.00	$300
	Asbestos Abatement [louver perimeter caulking]	40	lf	$4.00	$160
	Asbestos Abatement [main entry vestibule]	1	ea	$750.00	$750
020800	Selective demolition doors	10	ea	$40.00	$400
	Demolition Subtotal				**$24,190**
	DIVISION 2 - TOTAL				**$24,190**
	DIVISION 4 - MASONRY				
049000	Cut & patch brick masonry to widen door opening at Receiving	10	sf	$300.00	$3,000
	Masonry - Subtotal				**$3,000**
	DIVISON 4 - TOTAL				**$3,000**
	DIVISION 5 - METALS				
053100	Lally column repair at cafetorium[UNIT PRICE WORK] Allowance	10	lf	$360.00	$3,600
	Metals - Subtotal				**$3,600**
	DIVISION 5 - SUBTOTAL				**$3,600**
	DIVISION 6 - WOOD AND PLASTICS				
061053	Trim to existing interior wood stool at admin and cafetorium	170	lf	$5.00	$850
	Temporary protection at replacement window/door openings	3,000	sf	$1.25	$3,750
	Miscellaneous carpentry - Subtotal				**$4,600**
	DIVISION 6 - TOTAL				**$4,600**
	DIVISION 7 - THERMAL AND MOISTURE PROTECTION				
076200	**Flashing and sheet metal**				
	New prefin alum fascia covering header above new windows	143	lf	$15.00	$2,145
	Flashing and sheet metal - subtotal				**$2,145**
079000	**Joint Sealants**				
	Exterior 1990 masonry control joint sealants (incl cut out existing)	307	lf	$10.00	$3,070
	Exterior 1990 masonry opening perimjoint sealants (incl cut out extg)	1,456	lf	$10.00	$14,560
	Exterior 1959 louver opening sealants (cut out extg incl in Abatement)	40	lf	$7.00	$280
	Joint sealants - Subtotal				**$17,910**
	DIVISION 7 - TOTAL				**$20,055**

TOWN OF SUDBURY

SUDBURY - GENERAL JOHN NIXON ELEMENTARY SCHOOL PARTIAL ROOF & WINDOW REPLACEMENT

SCHEMATIC DESIGN COST ESTIMATE - DRAFT

PARTIAL WINDOW REPLACEMENT PROJECT		QUANTITY		MATL & LABOR	
Spec. Section	Description	No. Units	Unit Meas.	Unit Cost	TOTAL COST
	DIVISION 8 - DOORS, WINDOWS & HARDWARE				
080000	**Doors, Windows & Hardware**				
	Aluminum Storefront - Main Entry vestibule interior & exterior	282	sf	$80.00	$22,560
	Transluscent wall panels system	1,281	sf	$70.00	$89,670
	Aluminum Curtainwall - fixed glass	1,239	sf	$110.00	$136,290
	Aluminum Curtainwall - solid panel	323	sf	$110.00	$35,530
	Aluminum Curtainwall - operable	25	ea	$150.00	$3,750
	Aluminum covers at cafetorium columns - insulated	14	ea	$300.00	$4,200
	Flush aluminum/FG doors with frame & hardware - single	1	ea	$2,000.00	$2,000
	Flush aluminum/FG doors with frame & hardware - pair	6	ea	$3,800.00	$22,800
	Perimeter caulking new windows & doors	1,402	lf	$10.00	$14,020
	Exterior 1990 window metal-to-metal joint sealants (incl remove extg)	1,240	lf	$10.00	$12,400
	Doors, Windows & Hardware - Subtotal				**$316,800**
	DIVISION 8 - TOTAL				**$316,800**
	DIVISION 9 - FINISHES				
099000	**Painting**				
	Prep and paint exposed exterior wood girder/beams	20	ea	$50.00	$1,000
	Prep and paint wood plank exterior soffit ovehang at Cafetorium	720	sf	$8.00	$5,760
	Prep and paint cafetorium & boiler room louvers	56	sf	$8.00	$448
	Scrape and paint steel lintels @ 1990 caulking	214	lf	$10.00	$2,140
	Scrape and paint steel columns to be exposed at interior of cafetorium	175	lf	$12.00	$2,100
	Painting - Subtotal				**$11,448**
	DIVISION 9 - TOTAL				**$11,448**
	DIVISION 12 - FURNISHINGS				
	Window Treatments				
120000	New Roller shades at new admin windows	560	sf	$5.50	$3,080
	New Roller shades at new cafetorium windows	816	sf	$5.50	$4,488
	Furnishings - Subtotal				**$7,568**
	DIVISON 12 - TOTAL				**$7,568**
	DIVISION 26 - ELECTRICAL				
260001	Removal and reinstallation of main door security for doors	1	ea	$500.00	$500
	Miscellaneous work associated with reinstallation of door contacts	1	ls	$1,500.00	$1,500
	Relocation/temp support of misc elect adjacent to doors/windows	1	ls	$2,500.00	$2,500
	Electrical - Subtotal				**$4,500**
	DIVISION 26 - TOTAL				**$4,500**
	DIRECT TRADE COSTS				**$395,761**
	General Conditions	15.0%			$59,364
	OH&P	5.0%			$19,788
	Subtotal				**$474,913**
	Contingency	5.0%			$23,746
	Subtotal				**$498,659**
	Escalation	3.0%			$14,960
	TOTAL PARTIAL WINDOW REPLACEMENT PROJECT				**$513,619**

SUMMARY

TOTAL PARTIAL ROOFING REPLACEMENT PROJECT	***$91,357***
TOTAL PARTIAL WINDOW REPLACEMENT PROJECT	***$513,619***
TOTAL BOTH PROJECTS	***$604,975***

6

DESIGN AND CONSTRUCTION SCHEDULE

MSBA GEN JOHN NIXON ES - PARTIAL ROOFING AND WINDOW REPLACEMENT

SCHEDULE

TASK / RESPONSIBILITY			DURATION	TARGET COMPLETION
	Start Date - Notice to Proceed			
TASK 0	Owner/Designer Fee Negotiation and Contract	PBC/BWA		8/29/2014
TASK 1	Existing Conditions and Schematic Design (with Cost Estimate)	summary SD	*6.75 weeks*	10/15/2014
a	As Builts and Site Inspection	BWA	3 weeks	9/19/2014
a1	*Structural and Hazmat findings generated/available*	*PEDA/Vertex*	*2 weeks*	*9/12/2014*
a2	*Present/select window options*	*BWA/PBC*	*1 day*	*9/18/2014*
b	draft report to OPM/PBC	BWA	2 weeks	10/3/2014
c	Review draft report	PBC/OPM	0.5 weeks	10/6/2014
d	Finalize Report / Schematic Drawings	BWA	1.25 weeks	**10/15/2014**
TASK 2	60% Construction Documents (with Cost Estimate)			
a	Notice to Proceed (MSBA approval and PBC accepts Task 1 submission)	PBC	1 day	12/9/2014
b	Design work	BWA	2 weeks	12/23/2014
c	Submission to PBC	BWA		
d	Meeting with owner for document approval and notice to proceed with TASK 3	PBC/BWA	1 week	12/30/2014
TASK 3	100% Construction Documents (with Cost Estimate)			
a	Final Submission to PBC - Complete (includes holidays)	BWA	3 weeks	1/20/2015
TASK 4	Construction Bidding			
a	Bid Documents Available	BWA	8 days	1/28/2015
b	GC Bid Date (from availability of Bid Documents)		33 days	3/2/2015
c	PBC to Review Bids	PBC	0.5 weeks	3/5/2015
TASK 5	Construction			
a	Sign Contract with Contractor	PBC	1 day	3/5/2015
b	Submittals and Window Fabrication	GC	17 weeks	7/2/2015
c	End of School 2014/15 Year (5 snow days) - Mobilize			7/1/2015
d	Construction (Substantial Completion)	GC	7 weeks	8/19/2015
e	(float to beginning of school year)		14 days	
f	Beginning of School 2015/16 Year			9/2/2015
g	Final Completion	GC	12 days	**8/31/2015**

*TARGET COMPLETION DATES are contingent on the designated DURATION periods.

PBC Sudbury Permanent Building Committee
BWA Baker Wohl Architects

UPDATED 10/3/2014

7

NEXT STEPS

7

NEXT STEPS

The following are the next steps in the process of meeting subsequent target dates for the Nixon Elementary School partial roofing and window replacement projects:

1. This report will be submitted to the MSBA by SKANSKA, the OPM, by 15 October 2014 on behalf of Sudbury Public Schools.
2. The Town of Sudbury should provide to BAKER WOHL ARCHITECTS a notice to proceed to complete construction documents by 09 December 2014. The purpose for proceeding straight-away is to bid the project in Winter 2015 in order to obtain most favorable bids (see the schedule in Section 6). There will be two further design phases: a 60% complete submittal and final bid documents.
3. The 100% construction documents will be submitted to MSBA on January 21, 2015.

8

APPENDIX

The Vertex Companies, Inc.
400 Libbey Parkway
Weymouth, MA 02189
PHONE 781.952.6000 | FAX 781.335.3543
www.vertexeng.com

August 28, 2014

Sudbury Public Schools
40 Fairbanks Road
Sudbury, MA 01776

Attn: Mr. Joseph Kupczewski, Facilities Supervisor

Re: **Limited Pre-Renovation Survey**
Nixon Elementary School
472 Concord Road
Sudbury, Massachusetts
VERTEX Project No. 29039

Dear Mr. Kupczewski :

The VERTEX Companies, Inc. (VERTEX) is pleased to provide you with this summary letter indicating the findings of the Limited Pre-Renovation Survey in conjunction with the proposed renovation activities at the Nixon Elementary School in Sudbury, MA (the Site). The following is a summary of the limited survey/inspections as well as our recommendations and conclusions.

Limited Asbestos-Containing Materials Inspections

Massachusetts Department of Labor Standards Certified Asbestos Inspectors Jason Mohre (AI#0000262) and Vincent Agostino (AI#61205) performed a Limited ACM Survey of the areas scheduled for renovation activities on April 28, 2014 and August 21, 2014. The purpose of the surveys was to identify ACMs which may be impacted and/or disturbed during the scheduled renovation activities.

VERTEX collected a total of nineteen (19) representative bulk samples of suspect ACMs within the survey area, which included window caulkings, window glazings and door caulking.

EMSL Analytical Inc. of Woburn, MA, and/or Cinnaminson, NJ using Polarized Light Microscopy (PLM) as described in 40 CFR 763, analyzed the bulk samples. Each bulk sample was analyzed in accordance with U.S. Environmental Protection Agency (EPA) 600/R-93/116 recommended protocol-using PLM.

EMSL Analytical Inc is accredited through the National Voluntary Laboratory Accreditation Program (#101147-0) and is a Massachusetts certified analytical laboratory (AA000188). Please refer to **ATTACHMENT B** which is the Bulk Sample Results by PLM. Please refer to Table I below for a summary of the bulk sample results.

Table I
Summary of Bulk Sample Results

Sample Number	Sample Description	Sample Location	Asbestos Content
B0428-1A	**Exterior Window Caulking**	**Exterior, Boiler Room Window**	**5 % Chrysotile**
B0428-1B	**Exterior Window Caulking**	**Exterior, Kitchen Window**	**Positive Stop**
B0428-2A	**Window Glazing**	**Exterior, Boiler Room Window**	**5 % Chrysotile**
B0428-2B	**Window Glazing**	**Exterior, Kitchen Window**	**Positive Stop**
B0428-3A	**Door Caulking**	**Exterior, Front Door**	**2 % Chrysotile**
B0428-3B	**Door Caulking**	**Exterior, Front Door**	**Positive Stop**
B0428-4A	Window Glazing	Interior, Cafetorium	None Detected
B0428-4B	Window Glazing	Interior, Cafetorium	None Detected
B0821-1A	**Exterior Storefront Window Caulking**	**Exterior, Cafetorium Window**	**5 % Chrysotile**
B0821-1B	**Exterior Storefront Window Caulking**	**Exterior, Cafetorium Window**	**Positive Stop**
B0821-2A	**Exterior Storefront Window Glazing**	**Exterior, Cafetorium Window**	**4 % Chrysotile**
B0821-2B	**Exterior Storefront Window Glazing**	**Exterior, Cafetorium Window**	**Positive Stop**
B0821-3A	**Roof Vent Louver Caulking**	**Exterior, Roof above Cafetorium**	**10 % Chrysotile**
B0821-3B	**Roof Vent Louver Caulking**	**Exterior, Roof above Cafetorium**	**Positive Stop**
B0821-4A	Roof Shingle	Exterior, Roof above Cafetorium	None Detected
B0821-4B	Roof Shingle	Exterior, Roof above Cafetorium	None Detected
B0821-5A	Ice and Water Shield	Exterior, Roof above Cafetorium	None Detected
B0821-5B	Ice and Water Shield	Exterior, Roof above Cafetorium	None Detected
B0821-6A	Building Expansion Joint Caulking	Exterior, Courtyard	None Detected
B0821-6B	Building Expansion Joint Caulking	Exterior, Courtyard	None Detected
B0821-7A	Building Expansion Joint Caulking	Exterior, Courtyard	None Detected
B0821-7B	Building Expansion Joint Caulking	Exterior, Courtyard	None Detected

Table I. Notes:

Bold indicates representative bulk sample analyzed positive for Asbestos (>1% asbestos containing)

Positive Stop indicates representative bulk sample analyzed positive for Asbestos.

Please refer to **ATTACHMENT A** which includes a table summarizing the locations and estimated quantities of the identified ACMs.

Limited Paint Chip Sampling and Lead Analysis

VERTEX performed paint chip sampling of several painted surfaces that may be impacted during the scheduled renovation activities at the Nixon Elementary School on August 21, 2014. VERTEX collected a total of two (2) representative paint chip samples that differed in color and/or substrates. The collected representative paint chip samples were submitted under a chain-of-custody to a licensed laboratory (EMSL Analytical, Inc, Cinnaminson, NJ) for lead analysis (EPA SW-846-3050B/7420). Please refer to **ATTACHMENT B**, which includes the laboratory analytical results. Please refer to Table II below for a summary of the paint chip sample results.

Table II
Summary of Paint Chip Sample Results

Sample Number	Paint Chip Color	Sample Location	Substrate	Lead Concentration (% by Weight)
PC0821-1	Red	Exterior Trim	Wood	2.1 %
PC0821-2	Red	Exterior I-Beam	Metal	0.035 %
PC0821-3	Light Blue	Exterior-Roof Underside	Wood	0.036 %
PC0821-4	Red	Exterior-Lintel	Metal	1.1 %
PC0821-5	Red	Exterior-Box Cover	Wood	7.8 %
PC0821-6	White	Interior Trim	Wood	0.012 %

As identified above, concentrations of lead were detected within all representative paint chip samples collected and analyzed. Based on the sample results all red painted surfaces should be considered lead based paint (greater than 0.5 % by weight) as defined by the Commonwealth of Massachusetts and the Environmental Protection Agency.

Limited Suspect Caulking Sampling and PCB Analysis

VERTEX performed an inspection and sampling of suspect Poly-Chlorinated Biphenyl (PCB) caulking materials that may be impacted during the scheduled renovation activities at the Nixon Elementary School on April 28, 2014. Based on observations made at the time of the sampling, VERTEX collected one (1) representative sample of suspect window caulking materials for PCB analysis via Environmental Protection Agency (EPA) Method 8082A with Method 3035 Soxhlet Extraction. Please refer to **ATTACHMENT D**, which includes the laboratory analytical results.

Based on the laboratory analysis of the representative window caulking sample submitted for PCBs, the reported results did not reveal the presence of PCBs above the standards set forth in Chapter 40 of the Code of Federal Regulations (CFR) in Section 761.62 of the Toxic Substances Control Act (TSCA). PCB bulk product waste and/or PCB containing materials is defined within 40 CFR 761.62 TSCA if the concentration of PCBs detected in the material is greater than or equal to 50 parts per million (ppm) or 50 milligrams per kilogram (mg/kg).

Conclusions

Based on the observations made during the limited inspection and review of the attached analytical results, it has been determined that ACMs are found to exist within the window caulking and glazing as well as door caulking materials.

In addition, it should be noted that asbestos-cement board panels are located under the Cafetorium Storefront Window Units as well as the Window Units within the Courtyard Area.

VERTEX recommends retaining an Asbestos Abatement Contractor to abate the identified asbestos-containing materials identified if the planned renovation activities include impacting and/or disturbing the material.

Composite samples of painted surfaces, including wood, require testing by the Toxicity Characteristics Leaching Procedure (TCLP) for waste classification in accordance with disposal requirements of the EPA. Through TCLP testing it can be determined how waste is to be handled. The General Contractor is required to comply with all applicable Federal, Commonwealth and local Regulations concerning lead-based paint located on surfaces that will be affected by the upcoming work. The General Contractor is required to ensure the protection of workers performing any related demolition work that will affect lead painted surfaces as well as protecting the public and the environment from exposure to lead dust. It is the General Contractor's responsibility to ensure that all applicable regulations are followed. This may include but may not be limited to air quality testing, medical screening of workers, dust barriers, testing of waste for disposal requirements, etc.

All efforts were made to determine the locations of ACMs and suspect caulking, associated with the area proposed for renovation. This report should not be utilized as a Comprehensive Pre-Demolition ACM Inspection Report for demolition of the site building.

Limitations

Professional opinions presented in this summary letter are based on information made available to VERTEX either by review of data provided by others or data gained by VERTEX personnel.

VERTEX affirms that data gathered and presented by VERTEX in this summary letter was collected in an appropriate manner in accordance with generally accepted methods and practices. VERTEX cannot be responsible for decisions made by our client solely on the basis of economic factors.

Conditions described in this summary letter were observed at the time of the inspection, unless otherwise stated.

VERTEX observed only the conditions and locations described in the summary letter at the time indicated.

VERTEX analyzed only the substances, conditions, and locations described in the report at the time indicated.

This survey was limited and should not be utilized for renovation and/or demolition activities outside the proposed work areas inspected.

Please do not hesitate to contact us at your convenience, should you have any questions or comments regarding this summary letter or our recommendations. It has been a pleasure working with you on this project.

Sincerely,

The VERTEX Companies, Inc.

Jason Mohre
Senior Project Manager

Vincent Agostino
Division Manager

Attachments-

Attachment A- ACMs Locations and Quantities
Attachment B- Bulk Sample Results by PLM
Attachment C- Paint Chip Sample Results
Attachment D- Bulk Sample Results-PCBs

ATTACHMENT A

ACMs LOCATIONS AND QUANTITIES

Appendix A Locations of the Identified Asbestos-Containing Materials Nixon Elementary School-Window Roof Renovation Sudbury, Massachusetts		
Location	**Description**	**Estimated Quantity**
Exterior		
Courtyard	Cement Board Panels under Windows	17 Units
	Window Glazing	17 Units
	Window Caulking	100 lf
Boiler Room	Window Glazing	14 Units
	Window Caulking	180 lf
	Door Caulking	18 lf
Kitchen	Window Glazing	7 Units
	Window Caulking	126 lf
	Door Caulking	18 lf
Cafetorium	Cement Board Panels under Windows	7 Units
	Window Glazing	52 Units
	Window Caulking (Against Metal, Wood and/or Brick)	75 lf
Roof	Roof Vent Louver Caulking	16 lf

Notes:

ft^2 = Square Foot
Unit = Each
lf = Linear Foot

ATTACHMENT B

BULK SAMPLE ANALYSIS RESULTS BY PLM

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (800) 220-3675 / (856) 786-5974
http://www.EMSL.com cinnasblab@EMSL.com

EMSL Order:	041424453
CustomerID:	VERT51
CustomerPO:	
ProjectID:	

Attn: **Vincent Agostino**
Vertex Air Quality Services
400 Libbey Parkway

Weymouth, MA 02189

Phone:	(781) 952-6000
Fax:	(781) 335-3543
Received:	08/22/14 11:45 AM
Analysis Date:	8/26/2014
Collected:	8/21/2014

Project: **Nixon Elementary School / 29039 / Sudbury Public Schools**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos				Asbestos
Sample	**Description**	**Appearance**	**%**	**Fibrous**	**%**	**Non-Fibrous**	**% Type**
B0821-1A *041424453-0001*	Nixon ES / Exterior / Outside - Store Front Window Caulking	Gray/Red Non-Fibrous Homogeneous			95%	Non-fibrous (other)	**5% Chrysotile**
B0821-1B *041424453-0002*	Nixon ES / Exterior / Outside - Store Front Window Caulking						**Stop Positive (Not Analyzed)**
B0821-2A *041424453-0003*	Nixon ES / Exterior / Outside - Store Front Window Glazing	White Non-Fibrous Homogeneous			96%	Non-fibrous (other)	**4% Chrysotile**
B0821-2B *041424453-0004*	Nixon ES / Exterior / Outside - Store Front Window Glazing						**Stop Positive (Not Analyzed)**
B0821-3A *041424453-0005*	Nixon ES / Exterior / Roof - Vent Caulking	Gray Fibrous Homogeneous			90%	Non-fibrous (other)	**10% Chrysotile**
B0821-3B *041424453-0006*	Nixon ES / Exterior / Roof - Vent Caulking						**Stop Positive (Not Analyzed)**
B0821-4A *041424453-0007*	Nixon ES / Exterior / Roof - Roof Shingle	Gray/Black Fibrous Homogeneous	20%	Glass	80%	Non-fibrous (other)	**None Detected**

Analyst(s)

Amy Johnson (4)
Patrick Carr (7)

Stephen Siegel, CIH, Laboratory Manager
or other approved signatory

Initial report from 08/26/2014 11:17:31

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (800) 220-3675 / (856) 786-5974
http://www.EMSL.com cinnasblab@EMSL.com

EMSL Order:	041424453
CustomerID:	VERT51
CustomerPO:	
ProjectID:	

Attn: **Vincent Agostino**
Vertex Air Quality Services
400 Libbey Parkway

Weymouth, MA 02189

Phone:	(781) 952-6000
Fax:	(781) 335-3543
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Project: **Nixon Elementary School / 29039 / Sudbury Public Schools**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos				Asbestos
Sample	**Description**	**Appearance**	**%**	**Fibrous**	**%**	**Non-Fibrous**	**% Type**
B0821-4B *041424453-0008*	Nixon ES / Exterior / Roof - Roof Shingle	Gray/Black Fibrous Homogeneous	15%	Glass	85%	Non-fibrous (other)	**None Detected**
B0821-5A *041424453-0009*	Nixon ES / Exterior / Roof - Ice-Water Shield	Black Non-Fibrous Homogeneous			100%	Non-fibrous (other)	**None Detected**
B0821-5B *041424453-0010*	Nixon ES / Exterior / Roof - Ice-Water Shield	Black Non-Fibrous Homogeneous			100%	Non-fibrous (other)	**None Detected**
B0821-6A *041424453-0011*	Nixon ES / Exterior / Outside - Building Expansion Caulking	Gray Non-Fibrous Homogeneous			100%	Non-fibrous (other)	**None Detected**
		Recommend TEM					
B0821-6B *041424453-0012*	Nixon ES / Exterior / Outside - Building Expansion Caulking	Gray Non-Fibrous Homogeneous			100%	Non-fibrous (other)	**None Detected**
		Recommend TEM					
B0821-7A *041424453-0013*	Nixon ES / Exterior / Outside - Building Expansion Caulking	Black Non-Fibrous Homogeneous			100%	Non-fibrous (other)	**None Detected**

Analyst(s)

Amy Johnson (4)
Patrick Carr (7)

Stephen Siegel, CIH, Laboratory Manager
or other approved signatory

Initial report from 08/26/2014 11:17:31

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (800) 220-3675 / (856) 786-5974
http://www.EMSL.com cinnasblab@EMSL.com

EMSL Order:	041424453
CustomerID:	VERT51
CustomerPO:	
ProjectID:	

Attn: **Vincent Agostino**
Vertex Air Quality Services
400 Libbey Parkway

Weymouth, MA 02189

Phone:	(781) 952-6000
Fax:	(781) 335-3543
Received:	08/22/14 11:45 AM
Analysis Date:	8/26/2014
Collected:	8/21/2014

Project: **Nixon Elementary School / 29039 / Sudbury Public Schools**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
B0821-7B *041424453-0014*	Nixon ES / Exterior / Outside - Building Expansion Caulking	Black Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**

Analyst(s)

Amy Johnson (4)
Patrick Carr (7)

Stephen Siegel, CIH, Laboratory Manager
or other approved signatory

Initial report from 08/26/2014 11:17:31

THIS IS THE LAST PAGE OF THE REPORT.

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (800) 220-3675 / (856) 786-5974
http://www.EMSL.com cinnasblab@EMSL.com

EMSL Order:	041424453
CustomerID:	VERT51
CustomerPO:	
ProjectID:	

Attn: **Vincent Agostino**
Vertex Air Quality Services
400 Libbey Parkway

Weymouth, MA 02189

Phone:	(781) 952-6000
Fax:	(781) 335-3543
Received:	08/22/14 11:45 AM
Analysis Date:	8/26/2014
Collected:	8/21/2014

Project: **Nixon Elementary School / 29039 / Sudbury Public Schools**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos				Asbestos
Sample	**Description**	**Appearance**	**%**	**Fibrous**	**%**	**Non-Fibrous**	**% Type**
B0821-1A *041424453-0001*	Nixon ES / Exterior / Outside - Store Front Window Caulking	Gray/Red Non-Fibrous Homogeneous			95%	Non-fibrous (other)	**5% Chrysotile**
B0821-1B *041424453-0002*	Nixon ES / Exterior / Outside - Store Front Window Caulking						**Stop Positive (Not Analyzed)**
B0821-2A *041424453-0003*	Nixon ES / Exterior / Outside - Store Front Window Glazing	White Non-Fibrous Homogeneous			96%	Non-fibrous (other)	**4% Chrysotile**
B0821-2B *041424453-0004*	Nixon ES / Exterior / Outside - Store Front Window Glazing						**Stop Positive (Not Analyzed)**
B0821-3A *041424453-0005*	Nixon ES / Exterior / Roof - Vent Caulking	Gray Fibrous Homogeneous			90%	Non-fibrous (other)	**10% Chrysotile**
B0821-3B *041424453-0006*	Nixon ES / Exterior / Roof - Vent Caulking						**Stop Positive (Not Analyzed)**
B0821-4A *041424453-0007*	Nixon ES / Exterior / Roof - Roof Shingle	Gray/Black Fibrous Homogeneous	20%	Glass	80%	Non-fibrous (other)	**None Detected**

Analyst(s)

Amy Johnson (4)
Patrick Carr (7)

Stephen Siegel, CIH, Laboratory Manager
or other approved signatory

Initial report from 08/26/2014 11:17:31

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (800) 220-3675 / (856) 786-5974
http://www.EMSL.com cinnasblab@EMSL.com

EMSL Order:	041424453
CustomerID:	VERT51
CustomerPO:	
ProjectID:	

Attn: **Vincent Agostino**
Vertex Air Quality Services
400 Libbey Parkway

Weymouth, MA 02189

Phone:	(781) 952-6000
Fax:	(781) 335-3543
Received:	08/22/14 11:45 AM
Analysis Date:	8/26/2014
Collected:	8/21/2014

Project: **Nixon Elementary School / 29039 / Sudbury Public Schools**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos				Asbestos
Sample	**Description**	**Appearance**	**%**	**Fibrous**	**%**	**Non-Fibrous**	**% Type**
B0821-4B *041424453-0008*	Nixon ES / Exterior / Roof - Roof Shingle	Gray/Black Fibrous Homogeneous	15%	Glass	85%	Non-fibrous (other)	**None Detected**
B0821-5A *041424453-0009*	Nixon ES / Exterior / Roof - Ice-Water Shield	Black Non-Fibrous Homogeneous			100%	Non-fibrous (other)	**None Detected**
B0821-5B *041424453-0010*	Nixon ES / Exterior / Roof - Ice-Water Shield	Black Non-Fibrous Homogeneous			100%	Non-fibrous (other)	**None Detected**
B0821-6A *041424453-0011*	Nixon ES / Exterior / Outside - Building Expansion Caulking	Gray Non-Fibrous Homogeneous			100%	Non-fibrous (other)	**None Detected**
		Recommend TEM					
B0821-6B *041424453-0012*	Nixon ES / Exterior / Outside - Building Expansion Caulking	Gray Non-Fibrous Homogeneous			100%	Non-fibrous (other)	**None Detected**
		Recommend TEM					
B0821-7A *041424453-0013*	Nixon ES / Exterior / Outside - Building Expansion Caulking	Black Non-Fibrous Homogeneous			100%	Non-fibrous (other)	**None Detected**

Analyst(s)

Amy Johnson (4)
Patrick Carr (7)

Stephen Siegel, CIH, Laboratory Manager
or other approved signatory

Initial report from 08/26/2014 11:17:31

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (800) 220-3675 / (856) 786-5974
http://www.EMSL.com cinnasblab@EMSL.com

EMSL Order:	041424453
CustomerID:	VERT51
CustomerPO:	
ProjectID:	

Attn: **Vincent Agostino**
Vertex Air Quality Services
400 Libbey Parkway

Weymouth, MA 02189

Phone:	(781) 952-6000
Fax:	(781) 335-3543
Received:	08/22/14 11:45 AM
Analysis Date:	8/26/2014
Collected:	8/21/2014

Project: **Nixon Elementary School / 29039 / Sudbury Public Schools**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
B0821-7B *041424453-0014*	Nixon ES / Exterior / Outside - Building Expansion Caulking	Black Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**

Analyst(s)

Amy Johnson (4)
Patrick Carr (7)

Stephen Siegel, CIH, Laboratory Manager
or other approved signatory

Initial report from 08/26/2014 11:17:31

THIS IS THE LAST PAGE OF THE REPORT.

ATTACHMENT D

PAINT CHIP SAMPLE RESULTS

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856) 303-2500 / (856) 786-5974
http://www.EMSL.com cinnaminsonleadlab@emsl.com

EMSL Order:	201412117
CustomerID:	VERT51
CustomerPO:	29039
ProjectID:	

Attn: **Jason Mohre**
Vertex Air Quality Services
400 Libbey Parkway

Weymouth, MA 02189

Phone:	(781) 952-6000
Fax:	(781) 335-3543
Received:	08/22/14 9:46 AM
Collected:	8/21/2014

Project: **Nixon School Sudbury / MA/29039**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client Sample Description	*Lab ID*	*Collected*	*Analyzed*	*Lead Concentration*
PC 0821-1	*201412117-0001*	8/21/2014	8/23/2014	2.1 % wt
	Site: Exterior Red on Wood Desc: Paint Chip			
PC 0821-2	*201412117-0002*	8/21/2014	8/23/2014	0.035 % wt
	Site: Exterior Red on I-Beam Metal Desc: Paint Chip			
PC 0821-3	*201412117-0003*	8/21/2014	8/23/2014	0.036 % wt
	Site: Exterior Light Blue on Wood Desc: Paint Chip			
PC 0821-4	*201412117-0004*	8/21/2014	8/23/2014	1.1 % wt
	Site: Exterior Red on Lintel Desc: Paint Chip			
PC 0821-5	*201412117-0005*	8/21/2014	8/23/2014	7.8 % wt
	Site: Exterior Red on Wood Box Cover Desc: Paint Chip			
PC 0821-6	*201412117-0006*	8/21/2014	8/23/2014	0.012 % wt
	Site: Interior/Confrece White on Wood Desc: Paint Chip			

Julie Smith - Laboratory Director
NJ-NELAP Accredited:03036
or other approved signatory

*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements established by the AIHA-LAP, unless specifically indicated otherwise.

Samples analyzed by EMSL Analytical, Inc. Cinnaminson, NJ NELAP Certifications: NJ 03036, NY 10872, PA 68-00367, AIHA-LAP, LLC ELLAP 100194, A2LA 2845.01

Initial report from 08/23/2014 14:15:54

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077
PHONE: 1-800-220-3675
FAX. (856) 786-5974

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

Lead (Pb) Chain of Custody

EMSL Order ID *(Lab Use Only):* 201412117

Company: The VERTEX Companies, Inc.	**EMSL-Bill to:** ☑ Different ☐ Same If Bill to is Different note instructions in Comments**
Street: 398 Libbey Parkway	*Third Party Billing requires written authorization from third party*
City: Weymouth **State/Province:** MA	**Zip/Postal Code:** 02189 **Country:** United States
Report To (Name): Jason Mohre/Vince Agostino	**Telephone #:** 781-952-6000
Email Address: jmohre@vertexeng.com/vagostino@vertexeng.com	**Fax #:** 781-335-3543 **Purchase Order:** 29039
Project Name/Number: Nixon School Sudbury, MA/29039	**Please Provide Results:** ☐ FAX ☑ E-mail ☐ Mail
U.S. State Samples Taken: MA	**CT Samples:** ☐ Commercial/Taxable ☐ Residential/Tax Exempt

Turnaround Time (TAT) Options* - Please Check

☐ 3 Hour | ☐ 6 Hour | ☐ 24 Hour | ☐ 48 Hour | ■ 72 Hour | ☐ 96 Hour | ☐ 1 Week | ☐ 2 Week

**Analysis completed in accordance with EMSL's Terms and Conditions located in the Price Guide*

Matrix	Method	Instrument	Reporting Limit	Check
Chips ■ % by wt. ☐ mg/cm² ☐ ppm	SW846-7000B	Flame Atomic Absorption	0.01%	☒
Air	NIOSH 7082	Flame Atomic Absorption	4 µg/filter	☐
	NIOSH 7105	Graphite Furnace AA	0.03 µg/filter	☐
	NIOSH 7300 modified	ICP-AES/ICP-MS	0.5 µg/filter	☐
Wipe* ASTM ☐ non ASTM ☐ *if no box is checked, non-ASTM Wipe is assumed	SW846-7000B	Flame Atomic Absorption	10 µg/wipe	☐
	SW846-6010B or C	ICP-AES	1.0 µg/wipe	☐
	SW846-7000B/7010	Graphite Furnace AA	0.075 µg/wipe	☐
TCLP	SW846-1311/7000B/SM 3111B	Flame Atomic Absorption	0.4 mg/L (ppm)	☐
	SW846-1131/SW846-6010B or C	ICP-AES	0.1 mg/L (ppm)	☐
Soil	SW846-7000B	Flame Atomic Absorption	40 mg/kg (ppm)	☐
	SW846-7010	Graphite Furnace AA	0.3 mg/kg (ppm)	☐
	SW846-6010B or C	ICP-AES	2 mg/kg (ppm)	☐
Wastewater Unpreserved ☐ Preserved with HNO_3 pH < 2 ☐	SM3111B/SW846-7000B	Flame Atomic Absorption	0.4 mg/L (ppm)	☐
	EPA 200 9	Graphite Furnace AA	0.003 mg/L (ppm)	☐
	EPA 200.7	ICP-AES	0.020 mg/L (ppm)	☐
Drinking Water Unpreserved ☐ Preserved with HNO_3 pH < 2 ☐	EPA 200 9	Graphite Furnace AA	0.003 mg/L (ppm)	☐
	EPA 200.8	ICP-MS	0.001 mg/L (ppm)	☐
TSP/SPM Filter	40 CFR Part 50	ICP-AES	12 µg/filter	☐
	40 CFR Part 50	Graphite Furnace AA	3.6 µg/filter	☐
Other:				☐

Name of Sampler: **Signature of Sampler:**

	Sample #	Location	Volume/Area	Date/Time Sampled
1-	PC0821-1	Exterior Red on wood	Paint chip	08/21/14 1030 AM
2-	PC0821-2	Exterior Red on I beam metal		08/21/14 1040 AM
3-	PC0821-3	Exterior Lt Blue on wood		08/21/14 1047 AM
4-	PC0821-4	Exterior Red on Lintel		08/21/14 1105 AM
5-	PC0821-5	Exterior Red on wood box cover		08/21/14 1117 AM

Client Sample #'s - **Total # of Samples:**

Relinquished (Client): [signature] **Date:** 8-21-14 **Time:** 3:25 pm

Received (Lab): [signature] **Date:** 8/22/14 **Time:** 9:41am EMSL-F

Comments:
BillTo: VERTEX Air Quality Services, LLC, 398 Libbey Parkway, Weymouth, MA, 02189, United States
Attention: Erik Borgesen Phone: 781-952-6000 Email: eborgesen@vertexeng.com Purchase Order: 23662

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

LEAD (Pb) CHAIN OF CUSTODY

EMSL ORDER ID *(Lab Use Only)*: 201412117

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077
PHONE 1-800-220-3675
FAX (856) 786-5974

Additional Pages of the Chain of Custody are only necessary if needed for additional sample information

Sample #	Location	Volume/Area	Date/Time Sampled
6. PC 0821	Interior / confroce white on wood	Paint chip	0821-14 11:34am

Comments/Special Instructions:
BillTo: VERTEX Air Quality Services, LLC, 398 Libbey Parkway, Weymouth, MA, 02189, United States
Attention: Erik Borgesen Phone: 781-952-6000 Email: eborgesen@vertexeng.com Purchase Order: 23662

Page 2 of 2 pages

ATTACHMENT D

BULK SAMPLE RESULTS - PCBs

con-test® ANALYTICAL LABORATORY
39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

May 6, 2014

Jason Mohre
Vertex Engineering - Weymouth
400 Libbey Parkway
Weymouth, MA 02189

Project Location: 472 Concord Rd., Sudbury, MA
Client Job Number:
Project Number: 29039
Laboratory Work Order Number: 14D1122

Enclosed are results of analyses for samples received by the laboratory on April 29, 2014. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Meghan E. Kelley
Project Manager

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Vertex Engineering - Weymouth
400 Libbey Parkway
Weymouth, MA 02189
ATTN: Jason Mohre

REPORT DATE: 5/6/2014

PURCHASE ORDER NUMBER:

PROJECT NUMBER: 29039

ANALYTICAL SUMMARY

WORK ORDER NUMBER: 14D1122

The results of analyses performed on the following samples submitted to the CON-TEST Analytical Laboratory are found in this report.

PROJECT LOCATION: 472 Concord Rd., Sudbury, MA

FIELD SAMPLE #	LAB ID:	MATRIX	SAMPLE DESCRIPTION	TEST	SUB LAB
CS-424-01	14D1122-01	Caulk		SW-846 8082A	

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

CASE NARRATIVE SUMMARY

All reported results are within defined laboratory quality control objectives unless listed below or otherwise qualified in this report.

The results of analyses reported only relate to samples submitted to the Con-Test Analytical Laboratory for testing.
I certify that the analyses listed above, unless specifically listed as subcontracted, if any, were performed under my direction according to the approved methodologies listed in this document, and that based upon my inquiry of those individuals immediately responsible for obtaining the information, the material contained in this report is, to the best of my knowledge and belief, accurate and complete.

Daren J. Damboragian
Laboratory Manager

con-test® ANALYTICAL LABORATORY
39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Project Location: 472 Concord Rd., Sudbury, MA | Sample Description: | Work Order: 14D1122

Date Received: 4/29/2014

Field Sample #: CS-424-01 | Sampled: 4/24/2014 11:30

Sample ID: 14D1122-01

Sample Matrix: Caulk

Polychlorinated Biphenyls with 3540 Soxhlet Extraction

Analyte	Results	RL	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
Aroclor-1016 [1]	ND	0.73	mg/Kg	4		SW-846 8082A	5/2/14	5/5/14 17:28	KAL
Aroclor-1221 [1]	ND	0.73	mg/Kg	4		SW-846 8082A	5/2/14	5/5/14 17:28	KAL
Aroclor-1232 [1]	ND	0.73	mg/Kg	4		SW-846 8082A	5/2/14	5/5/14 17:28	KAL
Aroclor-1242 [1]	ND	0.73	mg/Kg	4		SW-846 8082A	5/2/14	5/5/14 17:28	KAL
Aroclor-1248 [1]	ND	0.73	mg/Kg	4		SW-846 8082A	5/2/14	5/5/14 17:28	KAL
Aroclor-1254 [1]	ND	0.73	mg/Kg	4		SW-846 8082A	5/2/14	5/5/14 17:28	KAL
Aroclor-1260 [1]	ND	0.73	mg/Kg	4		SW-846 8082A	5/2/14	5/5/14 17:28	KAL
Aroclor-1262 [1]	ND	0.73	mg/Kg	4		SW-846 8082A	5/2/14	5/5/14 17:28	KAL
Aroclor-1268 [1]	ND	0.73	mg/Kg	4		SW-846 8082A	5/2/14	5/5/14 17:28	KAL

Surrogates	% Recovery	Recovery Limits	Flag/Qual	
Decachlorobiphenyl [1]	73.2	30-150		5/5/14 17:28
Decachlorobiphenyl [2]	83.2	30-150		5/5/14 17:28
Tetrachloro-m-xylene [1]	84.9	30-150		5/5/14 17:28
Tetrachloro-m-xylene [2]	92.7	30-150		5/5/14 17:28

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Sample Extraction Data

Prep Method: SW-846 3540C-SW-846 8082A

Lab Number [Field ID]	Batch	Initial [g]	Final [mL]	Date
14D1122-01 [CS-424-01]	B095003	0.545	10.0	05/02/14

con-test® ANALYTICAL LABORATORY

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

QUALITY CONTROL

Polychlorinated Biphenyls with 3540 Soxhlet Extraction - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B095003 - SW-846 3540C										
Blank (B095003-BLK1)				Prepared: 05/02/14 Analyzed: 05/05/14						
Aroclor-1016	ND	0.20	mg/Kg							
Aroclor-1016 [2C]	ND	0.20	mg/Kg							
Aroclor-1221	ND	0.20	mg/Kg							
Aroclor-1221 [2C]	ND	0.20	mg/Kg							
Aroclor-1232	ND	0.20	mg/Kg							
Aroclor-1232 [2C]	ND	0.20	mg/Kg							
Aroclor-1242	ND	0.20	mg/Kg							
Aroclor-1242 [2C]	ND	0.20	mg/Kg							
Aroclor-1248	ND	0.20	mg/Kg							
Aroclor-1248 [2C]	ND	0.20	mg/Kg							
Aroclor-1254	ND	0.20	mg/Kg							
Aroclor-1254 [2C]	ND	0.20	mg/Kg							
Aroclor-1260	ND	0.20	mg/Kg							
Aroclor-1260 [2C]	ND	0.20	mg/Kg							
Aroclor-1262	ND	0.20	mg/Kg							
Aroclor-1262 [2C]	ND	0.20	mg/Kg							
Aroclor-1268	ND	0.20	mg/Kg							
Aroclor-1268 [2C]	ND	0.20	mg/Kg							
Surrogate: Decachlorobiphenyl	*2.87*		mg/Kg	4.00		71.7	30-150			
Surrogate: Decachlorobiphenyl [2C]	*2.67*		mg/Kg	4.00		66.8	30-150			
Surrogate: Tetrachloro-m-xylene	*3.14*		mg/Kg	4.00		78.5	30-150			
Surrogate: Tetrachloro-m-xylene [2C]	*2.94*		mg/Kg	4.00		73.4	30-150			
LCS (B095003-BS1)				Prepared: 05/02/14 Analyzed: 05/05/14						
Aroclor-1016	3.3	0.20	mg/Kg	4.00		82.9	40-140			
Aroclor-1016 [2C]	3.1	0.20	mg/Kg	4.00		77.2	40-140			
Aroclor-1260	3.3	0.20	mg/Kg	4.00		81.6	40-140			
Aroclor-1260 [2C]	3.2	0.20	mg/Kg	4.00		78.8	40-140			
Surrogate: Decachlorobiphenyl	*3.15*		mg/Kg	4.00		78.7	30-150			
Surrogate: Decachlorobiphenyl [2C]	*3.08*		mg/Kg	4.00		77.0	30-150			
Surrogate: Tetrachloro-m-xylene	*3.19*		mg/Kg	4.00		79.6	30-150			
Surrogate: Tetrachloro-m-xylene [2C]	*3.08*		mg/Kg	4.00		77.1	30-150			
LCS Dup (B095003-BSD1)				Prepared: 05/02/14 Analyzed: 05/05/14						
Aroclor-1016	4.0	0.20	mg/Kg	4.00		98.8	40-140	17.6	30	
Aroclor-1016 [2C]	3.6	0.20	mg/Kg	4.00		90.5	40-140	15.9	30	
Aroclor-1260	3.8	0.20	mg/Kg	4.00		96.2	40-140	16.4	30	
Aroclor-1260 [2C]	3.7	0.20	mg/Kg	4.00		91.5	40-140	14.8	30	
Surrogate: Decachlorobiphenyl	*3.70*		mg/Kg	4.00		92.4	30-150			
Surrogate: Decachlorobiphenyl [2C]	*3.59*		mg/Kg	4.00		89.8	30-150			
Surrogate: Tetrachloro-m-xylene	*3.79*		mg/Kg	4.00		94.7	30-150			
Surrogate: Tetrachloro-m-xylene [2C]	*3.64*		mg/Kg	4.00		91.1	30-150			

con-test® ANALYTICAL LABORATORY

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

FLAG/QUALIFIER SUMMARY

*	QC result is outside of established limits.
†	Wide recovery limits established for difficult compound.
‡	Wide RPD limits established for difficult compound.
#	Data exceeded client recommended or regulatory level

Percent recoveries and relative percent differences (RPDs) are determined by the software using values in the calculation which have not been rounded.

No results have been blank subtracted unless specified in the case narrative section.

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

CERTIFICATIONS

Certified Analyses included in this Report

Analyte	Certifications

No certified Analyses included in this Report

The CON-TEST Environmental Laboratory operates under the following certifications and accreditations:

Code	Description	Number	Expires
AIHA	AIHA-LAP, LLC	100033	02/1/2016
MA	Massachusetts DEP	M-MA100	06/30/2014
CT	Connecticut Department of Publilc Health	PH-0567	09/30/2015
NY	New York State Department of Health	10899 NELAP	04/1/2015
NH-S	New Hampshire Environmental Lab	2516 NELAP	02/5/2015
RI	Rhode Island Department of Health	LAO00112	12/30/2014
NC	North Carolina Div. of Water Quality	652	12/31/2014
NJ	New Jersey DEP	MA007 NELAP	06/30/2014
FL	Florida Department of Health	E871027 NELAP	06/30/2014
VT	Vermont Department of Health Lead Laboratory	LL015036	07/30/2014
WA	State of Washington Department of Ecology	C2065	02/23/2015
ME	State of Maine	2011028	06/9/2015
VA	Commonwealth of Virginia	460217	12/14/2014
NH-P	New Hampshire Environmental Lab	2557 NELAP	09/6/2014

CHAIN OF CUSTODY RECORD

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Page 1 of

14D1122

Rev 04.05.12

Company Name: VERTEX
Address: 398 Libbey Pkwy
Weymouth, MA
Attention: J. Munce / V. Agostino
Project Location: 472 Concord Rd Sudbury, MA
Sampled By: J. Munce

Telephone: 781-952-6000
Project #: 29039
Client PO#:

Project Proposal Provided? (for billing purposes)
○ yes _____ proposal date

DATA DELIVERY (check all that apply)
○ FAX ○ EMAIL ○ WEBSITE
Fax #: 781-385-3543
Email: jmshredcutters@...
Format: ○ PDF ○ EXCEL ○ GIS
○ OTHER _____
○ "Enhanced Data Package"

Con-Test Lab ID (laboratory use only)	Client Sample ID / Description	Collection Beginning Date/Time	Collection Ending Date/Time	Composite	Grab	*Matrix Code	Conc Code
-01	CS-424-01	4/24/14	1130		X	O	V

ANALYSIS REQUESTED

# of Containers				1								
** Preservation				I								
***Container Code				A								
PCB's w/Soxhlet				X								

Dissolved Metals
○ Field Filtered
○ Lab to Filter

***Cont. Code:
A=amber glass
G=glass
P=plastic
ST=sterile
V= vial
S=summa can
T=tedlar bag
O=Other

**Preservation
I = Iced
H = HCL
M = Methanol
N = Nitric Acid
S = Sulfuric Acid
B = Sodium bisulfate
X = Na hydroxide
T = Na thiosulfate
O = Other _____

*Matrix Code:
GW= groundwater
WW= wastewater
DW= drinking water
A = air
S = soil/solid
SL= sludge
O = other _____

Please use the following codes to let Con-Test know if a specific sample may be high in concentration in Matrix/Conc. Code Box:
H - High; M - Medium; L - Low; C - Clean; U - Unknown

Comments: Window Caulking (CS-424-01)

Relinquished by: (signature)		Date/Time: 4/28/14
Received by: (signature)	4-29-14	Date/Time: 730
Relinquished by: (signature)	4-29-14	Date/Time: 11
Received by: (signature)	3.5° 4.29.14	Date/Time: 1430

Turnaround ††
☐ 7-Day
☐ 10-Day
☑ Other 5-day
RUSH †
☐ †24-Hr ☐ †48-Hr
☐ †72-Hr ☐ †4-Day
† Require lab approval

Detection Limit Requirements
Massachusetts:
Connecticut:
Other:

Is your project MCP or RCP ?
○ MCP Form Required
○ RCP Form Required
○ MA State DW Form Required PWSID # _____

NELAC & AIHA-LAP, LLC Accredited
WBE/DBE Certified

†† TURNAROUND TIME STARTS AT 9:00 A.M. THE DAY AFTER SAMPLE RECEIPT UNLESS THERE ARE QUESTIONS ON YOUR CHAIN. IF THIS FORM IS NOT FILLED OUT COMPLETELY OR IS INCORRECT, TURNAROUND TIME WILL NOT START UNTIL ALL QUESTIONS ARE ANSWERED BY OUR CLIENT.

PLEASE BE CAREFUL NOT TO CONTAMINATE THIS DOCUMENT

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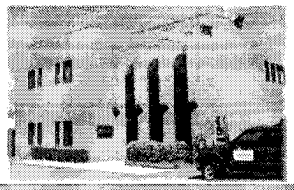


Sample Receipt Checklist

CLIENT NAME: Vertex RECEIVED BY: MC DATE: 4.29.14

1) **Was the chain(s) of custody relinquished and signed?** (Yes) No No CoC Included

2) **Does the chain agree with the samples?** (Yes) No
If not, explain:

3) **Are all the samples in good condition?** (Yes) No
If not, explain:

4) **How were the samples received:**
On Ice (☒) Direct from Sampling ☐ Ambient ☐ In Cooler(s) (☒)

Were the samples received in Temperature Compliance of (2-6°C)? (Yes) No N/A

Temperature °C by Temp blank 3.5 Temperature °C by Temp gun _____

5) **Are there Dissolved samples for the lab to filter?** Yes (No)
Who was notified _____ Date _____ Time _____

6) **Are there any RUSH or SHORT HOLDING TIME samples?** Yes (No)
Who was notified _____ Date _____ Time _____

7) **Location where samples are stored:** 14

Permission to subcontract samples? Yes No
(Walk-in clients only) if not already approved
Client Signature: _____

8) **Do all samples have the proper Acid pH:** Yes No (N/A) _____

9) **Do all samples have the proper Base pH:** Yes No (N/A) _____

10) **Was the PC notified of any discrepancies with the CoC vs the samples:** Yes No (N/A)

Containers received at Con-Test

	# of containers		# of containers
1 Liter Amber		8 oz amber/clear jar	
500 mL Amber		4 oz amber/clear jar	1
250 mL Amber (8oz amber)		2 oz amber/clear jar	
1 Liter Plastic		Plastic Bag / Ziploc	
500 mL Plastic		SOC Kit	
250 mL plastic		Non-ConTest Container	
40 mL Vial - type listed below		Perchlorate Kit	
Colisure / bacteria bottle		Flashpoint bottle	
Dissolved Oxygen bottle		Other glass jar	
Encore		Other	

Laboratory Comments:

40 mL vials: # HCl _____ # Methanol _____
Bisulfate _____ # DI Water _____
Thiosulfate _____ Unpreserved

Time and Date Frozen:

Login Sample Receipt Checklist

(Rejection Criteria Listing - Using Sample Acceptance Policy)

Any False statement will be brought to the attention of Client

Question	Answer (True/False) T/F/NA	Comment
1) The cooler's custody seal, if present, is intact.	NA	
2) The cooler or samples do not appear to have been compromised or tampered with.	T	
3) Samples were received on ice.	T	
4) Cooler Temperature is acceptable.	T	
5) Cooler Temperature is recorded.	T	
6) COC is filled out in ink and legible.	T	
7) COC is filled out with all pertinent information.	T	
8) Field Sampler's name present on COC.	T	
9) There are no discrepancies between the sample IDs on the container and the COC.	T	
10) Samples are received within Holding Time.	T	
11) Sample containers have legible labels.	T	
12) Containers are not broken or leaking.	T	
13) Air Cassettes are not broken/open.	NA	
14) Sample collection date/times are provided.	T	
15) Appropriate sample containers are used.	T	
16) Proper collection media used.	T	
17) No headspace sample bottles are completely filled.	T	
18) There is sufficient volume for all requsted analyses, including any requested MS/MSDs.	T	
19) Trip blanks provided if applicable.	T	
20) VOA sample vials do not have head space or bubble is <6mm (1/4") in diameter.	NA	
21) Samples do not require splitting or compositing.	T	

Who notified of False statements? **Date/Time:**

Doc #277 Rev. 4 August 2013 **Log-In Technician Initials:** CC **Date/Time:** 4.29.14 14:30

PEDA Inc.
CONSULTING ENGINEERS

Sept. 4, 2014

Mr. Ahmed Idris, RA Principal
Baker/Wohl Architects, Inc.
132 Lincoln Street, Unit #4
Boston, Ma. 02111

Re: General Nixon School, Sudbury MA
Site Inspection, August 29, 2014

Dear Mr. Idris:

In accordance with your request, Mr. Craig S. Donahue and Mr. Paul E. Donahue, P. E. conducted a cursory inspection of the exposed ceiling / roof structure of the Cafetorium on August 29, 2014. This inspection was performed in accordance with our Phase I of our Engineering Proposal.

It was also requested that this office review the repair to an exposed exterior building column at the covered walkway elevation. The structural steel tube split or separated at the tube corner at the top. It is assumed that the structural steel tube is concrete filled.

The site observations were taken with the aid of binoculars and a single person electric lift capable of reaching the underside of the roof structure. This lift is basically a static installation and limited for inspection purposes.

EXECUTIVE SUMMARY:

The inspection revealed several items that in our opinion should be further investigated:

Item 1. Roof Decking: The 2x6 tongue and groove planks have shrunk significantly.
- A. The shrinking of the plank width has rendered the advantages of the tongue and groove insignificant. Planks will act independent of each other rather than in unison.
- B. The structural requirement of the roof deck to perform as a diaphragm has been reduced.

Item 2. Roof Beam Connections: The existing glulam beam to glulam girder connection consists of two through bolts. The bolts connect opposing beams by tension. Shrinkage of the glulam beams lessens the "clamping" effect on the glulam girder.

Item 3. The two (2) cantilever roof beams at the exterior front corner require to be further inspected at the connections.

Item 4. The glulam girder was inspected at two locations. Each location exhibited some checking and splitting. It is recommended that a detailed inspection of the girder and roof beams be conducted.

Item 5. Above the stage, HVAC equipment has been hung from the glulam girder. The attachment detail of installing bolts through the body of a glulam beam should be reviewed. The preferred loading of a glulam beam is by compression on the top of the beam.

OBSERVATIONS – MAIN ROOF CAFETORIUM

General:

Based upon this cursory site inspection and review of the Original Building Construction plans, we offer the following comments for your consideration:

Girder:

1. The basic structural roof frame of the cafetorium is constructed as follows:
   a. The primary support is a major sloping glulam roof girder, spanning diagonally through the space, with glulam roof beams parallel to the walls. The girder is supported at one end by a structural steel wide-flange column at the exterior and at the opposite end by a structural steel wide-flange beam. The girder extends over the column at the exterior.
   b. This configuration produces a herringbone shape of framing.
2. The roof decking is 2" nominal thickness, matched 2x6 planks, tongue and grooved. The wood decking spans from beam to beam. As the roof slopes in two directions, a tapered wood filler piece was installed on the glulam beams to allow full contact of the decking to the beam.
   a. The attachment of the filler piece to glulam beam is not known.
   b. The nailing of the plank to the filler piece is not known and may be compromised by the shrinkage.
3. The structural glulam girder varies in depth, with the deepest section at mid-span.
4. The typical roof glulam beams varying in depths due to the span required by the room geometry.

Decking:

1. The basic decking is a nominal 2x6, tongue and groove, finished on the bottom.
   - After 54 years of "drying", the planks have undergone significant dimensional changes in the direction perpendicular to grain.
   - This dimensional change or shrinking of the plank has negated the benefits of the tongue and groove, and now allows planks to act independently.
   - The structural diaphragm requirement for the roof decking has been compromised.

Glulam Roof Beams:

The glulam roof beams appear to be in good condition, as viewed from the floor with the aid of binoculars. The roof beams vary in depth and width depending on their location. The typical roof beam spans from the diagonal ridge girder to a 4x6 or 4x8 Lally column.

Checking and splitting of the glulam beams can only be observed by a close-up inspection.

Review of the Original Construction Structural Plans:

The cafetorium may be considered as basically a "stand alone" structure. The issue is how the lateral loads from wind and seismic are transferred from the roof to the foundation. The Main Wind Force Resisting System is not clearly defined.

It is suggested that an engineering study evaluate the structure for Wind Loads Components and Cladding.

RECOMMENDATIONS:

Decking:

1. It is recommended that the existing 2x6 plank roof decking be strengthened to re-establish the structural diaphragm.

Decking: (Continued)

- This may be accomplished by installing an appropriate thickness of plywood over the entire roof surface.

2. It is also recommended that an appropriate number of locations be selected to expose the fastening of the existing decking to the girder and beams.

- It is necessary to check the condition of the nailing of the plank to the structure.
- It is necessary to ensure that any water leakage did not penetrate through the tapered fill piece to the top of the glulam. Typically, the water will follow the nail into the center of the glulam and cause decay and rotting of the interior of the glulam.

End Connections - Beams

The typical beam end connection is two threaded rods, through bolted to the opposing beam. The skew of the beam to girder angle restricts the typical connection detail. It may be assumed that the design of this connection is similar to a standard friction-type connection in steel design, whereby the tension in the bolts generate significant clamping power to prevent the roof beams from sliding by friction.

Shrinkage of the beams may reduce the clamping effect with the result that the bolts now bear directly on the interior laminations.

1. It is recommended that the bolts be retightened.
   - This tightening must be closely monitored by an Engineer to ensure that no damage occurs to the beam,
2. It is recommended that a new beam end connection be designed and installed.
   - This new connection will transfer the beam loads to the top of the girder for compression bearing.

ISSUES WITH GLU-LAM BEAMS

1. Moisture Control; Wood is a hygroscopic material, which means it naturally absorbs and releases water to balance its internal moisture content with the surrounding environment. The key to controlling decay is to control moisture. Once decay fungi are established, the minimum moisture content for decay to propagate is 22 to 24 percent, so building experts recommend 19 percent as the maximum safe moisture content for untreated wood in service. Water by itself does not harm the wood, but rather, wood with consistently high moisture content enables fungal organisms to grow.
   - Rain water or snow melts will entering into the base of the wall, and "follow" the nailing or other screw-type fastenings "down" into the top layers of the glu-lam.
   - This is a common failing of wood members, decay and rotting of the interior of the wood beam from the top.

2. Roof Beam to Column Connection.

End Rotation of Beams and Girders: Consideration should be given to end rotation of beams resulting from vertical load deflection. Location of fasteners that tend to create end fixity should be avoided. Splitting at fasteners can result unless a connection is designed to develop a fixed end moment sufficient to resist end rotation due to deflection.

2. Roof Beam to Column Connection.
End Rotation of Beams and Girders: Consideration should be given to end rotation of beams resulting from vertical load deflection. Location of fasteners that tend to create end fixity should be avoided. Splitting at fasteners can result unless a connection is designed to develop a fixed end moment sufficient to resist end rotation due to deflection.

3. A glu-lam beam is primarily designed to accept loading from the top only.

GLULAM INFORMATION:

Glulam is made up of wood laminations, or lams, that are bonded together with adhesives. The grain of all laminations runs parallel with the length of the member. Individual lams typically are 1 3/8 inches thick for Southern Pine and 1 1/2" thick for Western species, although other species may also be used. Glulam products typically range in net widths from 2 1/2" to 10 ¾inches, although virtually any member width can be custom produced.

Because they are engineered products, glued laminated timbers are manufactured to meet a range of design stresses. Beams are manufactured with the strongest lams on the bottom and top of the beam, where maximum tension and compression stresses occur. This concept allows the lumber resource to be used more efficiently by placing higher grade lumber in zones that have the maximum stresses and lumber with less structural quality in lower stressed zones.

Checking:

A common moisture related phenomenon in wood is checking. Checking occurs naturally to wood in service. Checks are openings that occur on the surface of the wood and follow parallel to the natural grain of the piece. A close visual evaluation of a check will always reveal torn wood fibers. The cause of checking is shrinkage of the wood fibers as moisture is lost to the surrounding environment. Rapid drying increases this differential moisture content between the inner and outer fibers and increases the chance for checking to occur.

Glulam beams typically exhibit fewer and less severe checks than comparable size sawn lumber timbers due to their relatively low moisture content at time of manufacture. Checks are often observed near a glueline in a glulam member where differential drying stresses are greatest. This most often occurs near the outermost glueline where the amount of surface exposed by the outermost lamination is greatest. Checks are a natural characteristic of wood and are not considered to have a detrimental effect on the strength of the member unless they develop into a full width split.

Camber:

One of the most important design considerations for wood framing is deflection. For longer spans, deflection is often the controlling design factor. While any wood bending member can be designed to minimize deflection, glulam is the only engineered wood product that can be easily cambered to reduce the aesthetic effect of in-service deflections. Camber is curvature built into a fabricated member which is opposite in direction and magnitude to the calculated deflection that occurs under gravity loads. Typically it is recommended that roof beams be cambered for 1.5 times the calculated dead load deflection.

Structural Effects of Shrinkage and Improper Detailing:

Wood expands and contracts as a result of changes in its internal moisture content. While expansion in the direction parallel to grain in a wood member is minimal, dimensional changes in the direction perpendicular to grain can be significant and must be considered in connection design and detailing. In designing connections for glulam members it is important to design and detail the connection such that the members' shrinkage is not restrained. If restrained, shrinkage of the beam can cause tension perpendicular to grain stresses to develop in the member at the connection. If theses stresses exceed the capacity of the member, they may cause the glulam to split parallel to the grain. Once s tension splitting failure has occurred in a member, its shear and bending capacity are greatly reduced.

Effects of Moisture Accumulation:

As most connections occur at the ends of beams where the end grain is exposed, it is critical that these connections be designed to prevent moisture accumulation. This can usually be accomplished by detailing drain holes or slots in box-type connectors and by maintaining a gap of 1/2inch between the wood and concrete or masonry construction. Because most connections require the exposure of end grain due to fastener penetration, even those connections that occur away from beam ends must be considered potential decay locations. Field studies have shown that any metal connectors or parts of connectors that are placed in the "cold zone" of the building (that area outside of the building insulation envelope) can become condensation points for ambient moisture. This moisture has ready access to the inside of the beam through fasteners and exposed end grain. A few examples of these kinds of fasteners are saddle-type hangers, cantilever beam hinges and beam to column connectors.

Connections:

There are seven basic principles which, if followed, will lead to efficient, durable, and structurally sound connections. These principles are:

1. Transfer loads in compression bearing wherever possible.
2. Allow for dimensional changes in glulam due to potential in-service moisture cycling.
3. Avoid the use of details that induce tension perpendicular –to-grain stresses in a member.
4. Avoid moisture entrapment at connections.
5. Do not place glulam in direct contact with masonry or concrete.
6. Avoid eccentricity in joint details.
7. Minimize exposure of end grain.

OBSERVATIONS – EXTERIOR COLUMN REPAIR:

The Owner furnished several pictures of the damage and the repair to a structural steel tube (Lally Column Designation), TS4x6, at the exterior wall adjacent to the covered walkway.

Picture one shows the steel splitting at a corner of the tube for several feet in length starting at the column cap plate or saddle.

Picture two shows a steel plate welded to the tube at the cap plate and bottom of the strengthening plate. The welding of the sides of the strengthening plate is not shown.

Observation:
As the windows were not removed at the location of the strengthening plate, it would be difficult to provide a significant weld due to the obstruction caused by the windows location.

Recommendation:

It is recommended that during the window demolition and removal, that a certified welder be engaged to weld the sides of the strengthening plate.

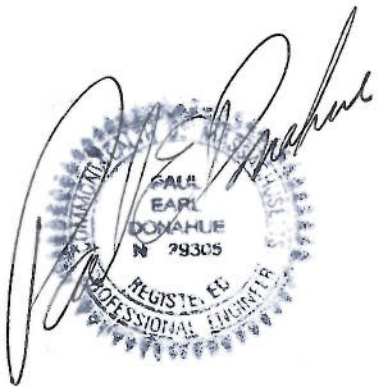
If there are any questions concerning the above, please do not hesitate to call.

Very truly yours,

Paul E. Donahue, P. E.

cc: Craig S. Donahue

attachments: pictures



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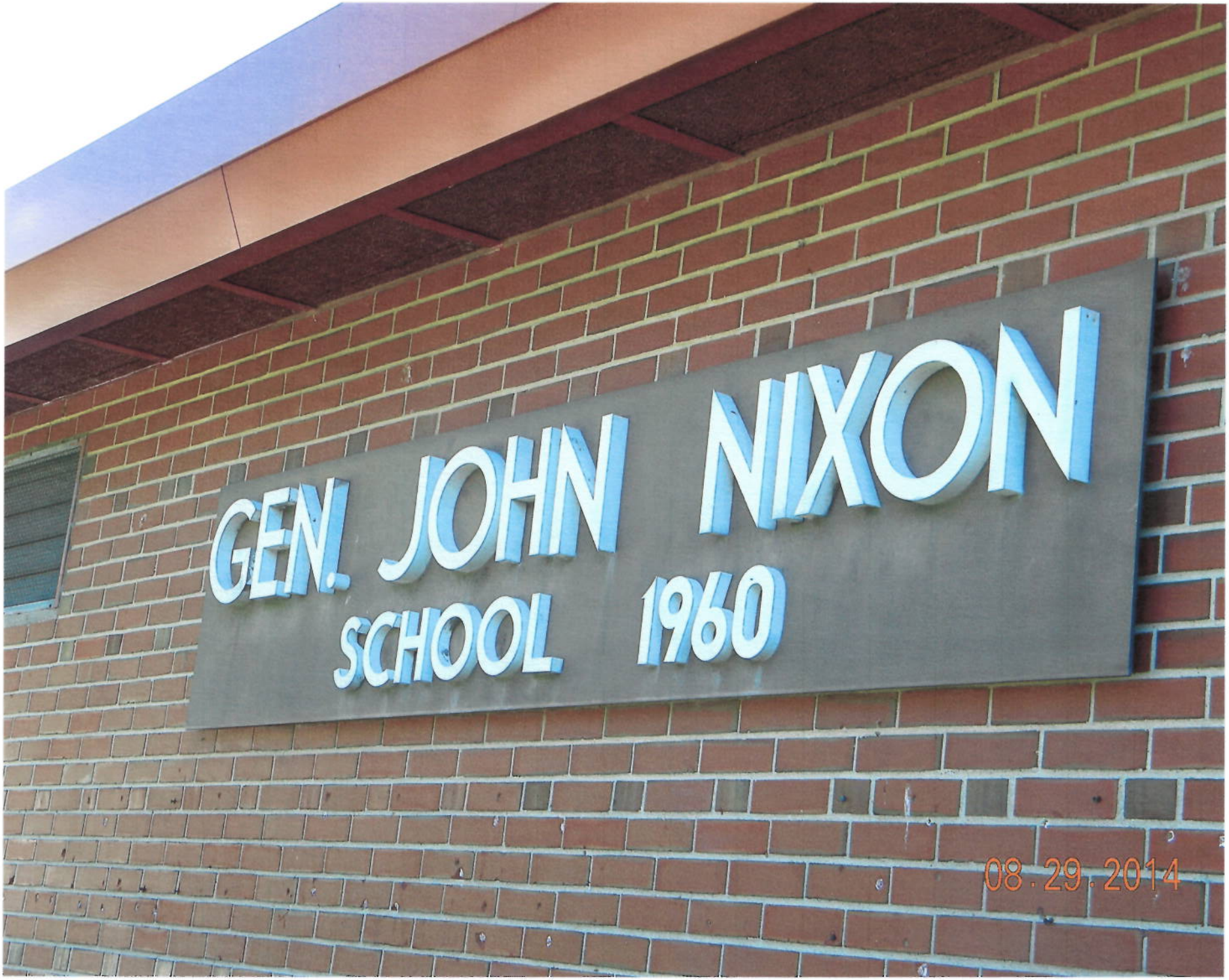
fax 781.626.7018


GEN. JOHN NIXON
SCHOOL 1960
08.29.2014


08.29.2014


08.29.2014


08.29.2014


08.29.2014

08.29.2014


CHECKS
08.29.2014

08.29.2014

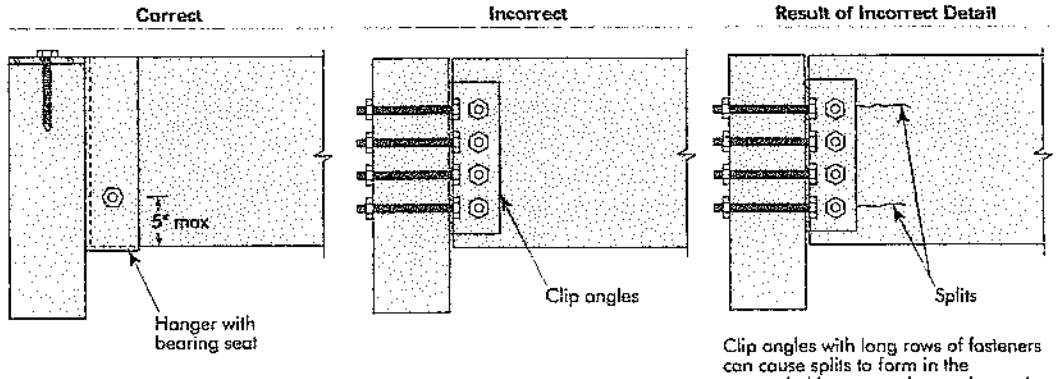

08.29.2014


08.29.2014


08.29.2014

FIGURE 3A

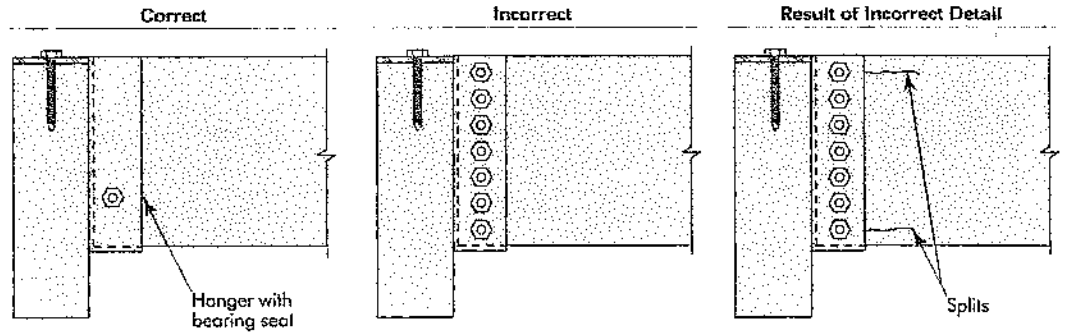
BEAM-TO-BEAM CONNECTION



Clip angles with long rows of fasteners can cause splits to form in the suspended beam, as shown above, due to tension perpendicular-to-grain stresses induced at the bolts due to beam shrinkage. Use a hanger with bearing seat as shown.

FIGURE 3B

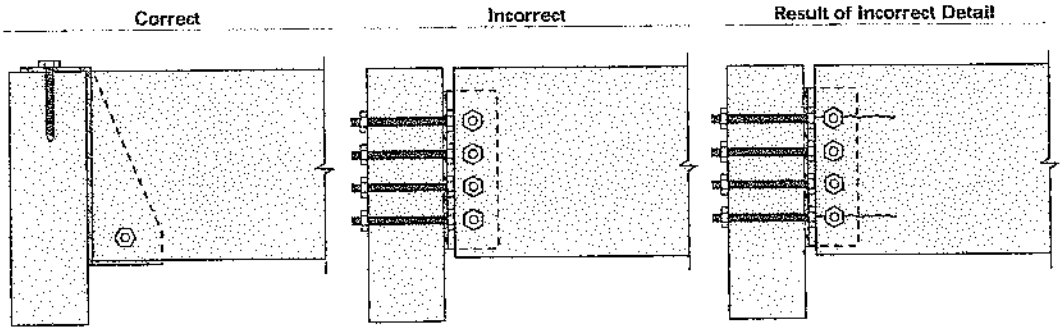
BEAM-TO-BEAM CONNECTION



Side plates on saddle hanger with long rows of fasteners can cause splits to form in beam, as shown, due to beam shrinkage lifting beam off of bearing plate and transferring the loads to the bolts.

FIGURE 7

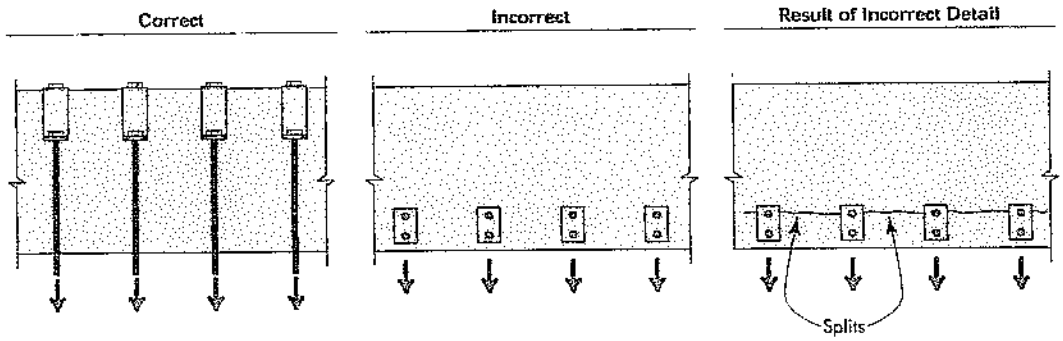
BEAM-TO-BEAM CONNECTIONS USING CONCEALED PLATES



Concealed plate with long row of fasteners can cause splits to form in suspended beam, as shown above. Use a concealed plate with bearing seat, as shown above left.

FIGURE 8

HEAVY CONCENTRATED LOADS SUSPENDED FROM BEAM



Heavy concentrated loads such as heating and air conditioning units, crane rails or main framing members suspended from the bottom of beams induce tension perpendicular-to-grain stresses and may cause splits as shown.

This is not intended to apply to light loads such as from 2x-joists attached to the main beam with light gauge nail-on metal hangers.

PEDA Inc.
CONSULTING ENGINEERS

Sept. 24, 2014

Diane L. Ozelius, AIA
Baker/Wohl Architects, Inc.
132 Lincoln Street, Unit #4
Boston, Ma. 02111

Re: General Nixon School, Sudbury MA
Cafetorium Roof - Change in Dead Load

Dear Diane L. Ozelius:

With regards to the above referenced project, please be advised that we have reviewed the change in dead load imposed on the Cafetorium Roof due to the proposed new roof.

The original building roofing, building constructed in 1959, consisted of Built-up roofing directly installed on the nominal 2" thick wood plank. This is used as the baseline for comparison in determining the additional dead load weight.

Original Construction				
1. Built-up roofing, bituminous smooth surface		2.0 psf		
			Total	2.0 psf
Reroofing in 1990				
1. Built-up roofing	(removed)	2.0 psf		
2. Vapor Barrier			0.1 psf	
3. Insulation, 3" thick rigid, 0.2 psf per 1"			0.6 psf	
4. One-half inch (1/2") thick Waferboard			1.4 psf	
5. A layer of felt			0.1 psf	
6. Asphalt shingles			3.0 psf	
			Total	5.2 psf
Proposed Roofing				
1. Built-up roofing	(removed)	(2.0 psf)		
2. Vapor Barrier			0.1 psf	
3. Rigid Insulation, 3" thick, 0.2 psf per 1"			0.6 psf	
4. One-half inch (1/2") thick Waferboard			1.4 psf	
5. A layer of felt	(remove)	(0.1 psf)		
6. Asphalt shingles	(remove)	(3.0 psf)		
7. Rigid Insulation, 2" thick, 0.2 psf per 1"			0.4 psf	
8. One-half inch (1/2") thick Waferboard			1.4 psf	
9. A layer of felt			0.1 psf	
10. Asphalt shingles			3.0 psf	
			Total	7.0 psf

The change of dead load from the Original Building Construction to the Proposed Roofing System is 5.0 pounds per square foot.

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Pembroke MA 02359
fax 781.626.7018

Diane L. Ozelius, AIA
Baker/Wohl Architects, Inc.
Re: General Nixon School, Sudbury MA
Cafetorium Roof - Change in Dead Load

The existing structure dead load, including roofing systems, was evaluated as follows:

Original		Proposed	
Built-up Roofing	2.0 psf	See Above	7.0 psf
Two inch plank	4.0 psf	Two inch plank	4.0 psf
Glulam beams, average 35 plf	5.5 psf	Glulam beams, average 35 plf	5.5 psf
Glulam girder, average 76 plf	1.2 psf	Glulam girder, average 76 plf	1.2 psf
Total	12.7 psf	Total	17.7 psf

Based upon the above, the proposed new total roof dead load is approximately 39% greater than the original building construction total roof dead load.

If there are any questions concerning the above, please do not hesitate to call.

Very truly yours,

Paul E. Donahue, P. E.

cc: Craig S. Donahue, Project Manager

P. O. Box 724
781.335.1880

peda10 @ aol .com

Pembroke MA 02359
fax 781.626.7018

PEDA Inc.
CONSULTING ENGINEERS

Oct. 1, 2014

Diane L. Ozelius, AIA
Baker/Wohl Architects, Inc.
132 Lincoln Street, Unit #4
Boston, Ma. 02111

Re: General Nixon School, Sudbury MA
Cafetorium New Roof Study

Dear Diane L. Ozelius:

In accordance with a request of BWA Architects, Inc. PEDA Inc. conducted a Preliminary Structural Review of the Cafetorium Roof Structure for the purpose of determining what effect a new roof system will have on the existing structure. This review consisted of the following:

1. A review of the original building construction plans.
2. A cursory site inspection to observe the condition of the wood framing and decking. Please see letter report to BWA Architects, dated Sept. 4, 2014.
   A. A follow-up conversation with Town of Sudbury personnel addressing several of the concerns outlined in the report. Specifically discussed were: the connections of the glulam beams to glulam girder; the checking of the glulam girder; and the exterior cantilevered beam.
   The concerns noted in the report and inspected by the Town appear to be appropriately addressed.
3. A comparison of the Original Building Construction design roof dead loads to the proposed new roof system. Please see letter report to BWA Architects, dated Sept. 24, 2014.
4. At the request of BWA Architects, this office conducted a preliminary review of the structural capacity of two roof beams. Each roof beam occurs twice in the framing. The structural review is shown later in this report.
   A. It is to noted, that there are NO shop drawings, material specifications or other information concerning the design or specifications of the glulam beams or girder. For purposes of this review, information on the glulam beams was taken from: APA The Engineered Wood Association, Glue Laminated Beam Design Tables, Southern Pine Glue Laminated Beams, 24F Southern Pine.

Without benefit of the Original Building Construction design loads, material specifications and glulam shop drawings, certain basic engineering assumptions must be made to review and predict the adequacy of the existing structural system. It is to noted that this review is at the Schematic Phase and will need to be supplemented at a later date.

It is noted that the dead load of the Proposed New Roof System is greater than the Original Building Design dead load. Based upon this increase, a review of several roof beams was conducted. Two of the longest roof beam spans were evaluated. Beam #1 has an approximate span of 48’ and beam #2 has an approximate span of 41’. The following is the determination of the snow load for this Preliminary review:

Verify the adequacy of several roof beams:
Ground snow load, pg = 40 psf
Flat roof snow load, pf = 0.7CeCtIs Pg (.7*1*1*1.1) 40 = 30.8 psf
Snow exposure factor, Ce = 1.0

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Thermal factor, Ct = 1.0
Snow load importance factor, I s = 1.10, Risk Category III, could pose a substantial risk to human life.
Snow drift conditions in accordance with Section 1608.0
Sloped roof snow loads, ps; ps shall be obtained by multiplying the flat snow load by the roof slope factor.
As this is a preliminary review, the various loading conditions have not been analyzed.

Review Beam #1, span of 48' +/- glulam 7" x 19 ½"

Proposed New Roof Design;
The total load per foot applied to the beam is estimated at 6.66' (30.8 psf + 16.5) = 315 plf
Actual Moment = 90,720 foot-pounds
Allowable Tabulated Capacity 24F Southern Pine = 83,380 foot pounds
Original Building Roof Design:
The total load per foot applied to the beam is estimated at 6.66' (30.8 +11.5) = 282 plf
Actual Moment = 81,216 foot-pounds

The proposed new roof design exceeds the tabulated capacity.

Review Beam #2, span of 41' +/- glulam 7" x 17 7/8"

Proposed New Roof Design;
The total load per foot applied to the beam is estimated at 6.66' (30.8 psf + 16.5) = 315 plf
Actual Moment = 66,189 foot-pounds
Allowable Tabulated Capacity 24F Southern Pine = 71,890 foot pounds
Original Building Roof Design:
The total load per foot applied to the beam is estimated at 6.66' (30.8 +11.5) = 282 plf
Actual Moment = 59,255 foot-pounds

The proposed new roof design is within the tabulated capacity.

While beam #1 is shown as exceeding the tabulated capacity, further investigation and analysis is needed arrive at a final determination.

With regard to the Uplift forces, it should be noted that the fastening of the roof plank to the structure is unknown. Secondly, due to the roof slope and the original construction requirement to maintain the roof beams vertical and top surface level, a "tapered filler or wood infill" was inserted to allow the sloping planks a uniform surface for nailing and also provided a flat surface for fastening of the "infill" to the top of the glulam.

The original construction structural drawings do not have any details that show the fastening of the "filler or infill" piece to the glulam or the fastening the plank to the "filler" piece.

Without further information, a definitive "uplift" resistance capacity cannot be calculated.

If there are any questions concerning the above, please do not hesitate to call.

Very truly yours,

Paul E. Donahue, P. E.

cc: Craig S. Donahue, Project Manager

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