Executive Summary

Context

For the last half century, America's public school buildings have been designed with an expected 40-year life cycle. At the end of the life cycle period, most building systems are worn out, requiring entirely new plumbing, electrical and mechanical systems, upgraded structural systems as well as work arounds to accommodate accessibiity requirements and newer modes of learning.

The Mt. Ararat Middle School is well within the life-cycle of primary building systems. However, the fiber cement cladding that was installed in early 2000 is generally considered to have a 20-year life span. It has, therefore, reached its anticipated life cycle.

Current code requirements that strictly limit the use of foam plastic insulation in wall assemblies, means that XPS insulation boards like those installed at the Middle School can only be installed as part of wall assemblies that have passed a flame apparatus test known as NFPA 285. It is not practical to use XPS in exterior wall assemblies due to its tendency to respond poorly to flames and generate large volumes of toxic fumes. All new construction regulated by the International Building Code (on which the MUBEC is based) should now either use non-combustible insulation such as semi-rigid mineral fiber board or polyiso insulation that is part of a tested wall assembly.

Analysis

There are some differences between the construction details as drawn and the actual installed condition. CHA identified those conditions and analyzed the built condition in order to identify the causes for failed cladding and water infiltration around windows. This building is slightly unconventional in that it does not contain a separate air/water control layer such as building paper. Typically this layer would be placed inboard of the expected due point of the wall assembly and that a location where it would function as a drainage plane for either weather-driven moisture or condensation could accumulate and then be directed out of the wall assembly with flashing. It appears based on CHA's analysis that the outside face of 1" XPS insulation is intended to function as the drainage plane. Using the insulation in this manner is difficult because it requires meticulous taping and sealing of all XPS board seams. Without the seams being taped, water is allowed to drop behind the insulation to the face of the sheathing and then enter window assemblies, causing leaks at window frames.

It is our assessment that the damage observed on the faces and edges of the fiber cement cladding is part of the natural course of its service life. This material does deteriorate over time due to exposure to weather. Its possible that the lifespan of the product was shortened due to direct contact with the XPS insulation, as there is no air space between the presumed drainage plane of the XPS board and the back side of the cladding.

Recommendations

Based on the analysis of the existing drawings and the built condition, CHA Architecture recommends installing a new weather resistive, back-vented, back-drained exterior rainscreen classing system, including new mineral fiber board continuous insulation. Water damaged or non-functional windows should be replaced at the same time such that a new vapor-permeable air and water resistive barrier can be tied into the new window installation. Any damaged sheathing should be replaced as well.

CHA Architecture recommends the cladding be replaced with new corrosion-resistant, factory primed and painted metal wall panels.

This work can be phased over multiple years, if preferred; however, the air and water barrier as well as the insulation should not be left exposed to the elements longer than recommended by the manufacturer.

MSAD No. 75 Envelope Analysis Report

May 31, 2021

Updated July 2021

Prepared by: CHA Architecture

INTRODUCTION

Introduction

PURPOSE OF THE REPORT

The MSAD No. 75 School District contracted with CHA Architecture, P.C. to conduct an analysis of the existing cladding at the Mt. Ararat Middle School and make recommendations for recladding the existing building.

The report had several major objectives, including:

- Understanding the intent of the construction details as well as the installed conditions
- Propose a recladding approach to address failing fiber cement siding and possible replacement of vinyl clad wood windows.
- Provide cost estimating of proposed recladding approach with separate line items for additional insulation and replacement of windows.
- Provide approach for phased recladding over multiple years

WORK CONDUCTED FOR THE REPORT

CHA Architecture reviewed construction documents, including drawings and specifications, provided by MSAD No. 75. CHA Architecture inspected existing conditions, including some selective demolition to confirm installation details. Proposed recladding concept details were created for the purpose of providing cost estimating to replace all fiber cement siding.

ACKNOWLEDGEMENTS

The members of the design team would like to thank Mark Conrad and Chris Shaw for providing documentation, multiple building tours, and for answering questions.

CLADDING ANALYSIS

Existing Cladding Analysis

Components of the building enclosure of the Mt. Ararat Middle School are failing. Many fiber-cement clapboards have softened and at the finished coating has become delaminated from the core material. Facilities staff have replaced numerous clad wood window sashes that have been severely damaged by water infiltration, and it's likely that many additional wood frames and sashes have been damage in the same manner. Some steel doors are rusting / rotting.

This report will describe the original construction, as documented in the limited drawings and specifications provided by the School District and observed on the site, identify deficiencies in the existing design and construction that may be causing the observed problems, and suggest corrective actions to prevent further damage to the building enclosure.

Building Description

Program Areas

The Mt. Ararat Middle School in Topsham, Maine was constructed in the late 1990s and early 2000s from construction documents dated April 20, 1999. The building contains an academic section, that houses typical middle school functions such as classrooms, labs, administrative areas, a cafeteria and a commercial kitchen and a performing arts center that includes a large auditorium and associated spaces to support the performing arts.

Classroom wings are typically three stories above grade plane, with some two-story and single-story wings. The performing arts center consists of a double-height auditorium adjacent to one- and two-story areas.

The entire complex is built with non-combustible materials with an unprotected steel and concrete structural frame. This is categorized as Construction Type II-B in the International Building Code and Construction Type II (0,0,0) by NFPA Standard 220. This has been the most common construction type used for school construction in Maine for the last 80 years.

The building includes some areas from a previously existing building on the site. These areas appear to be built with a composite structural system that includes load-bearing masonry and steel framing that was typical of mid-20th century school construction.

The code allows combustible materials to be used in Type II-B building enclosure and structural systems but establishes specific protections and limitations for their use. Allowed combustible materials include wood blocking and nailing strips, wall and ceiling finishes, foam plastic insulation materials, sealants, and roof coverings.

Building Enclosure

The building enclosure is also common for a school building of this period:

- Internally-drained low-slope roof assembly
    - Single plane EPDM membrane
    - High density fiber-board cover layer
    - Multiple layers of polyisocyanurate rigid roof insulation board
    - Corrugated steel roof deck.
    - Roof assemblies of this type will sometimes include a sheet vapor retarder installed directly over the roof deck or on a layer of gypsum board installed over the metal deck. Drawings don't indicate that a roof vapor retarder was installed.
- Poured-in-place concrete slab on grade floor, foundation walls and footings
    - Extruded polystyrene insulation board is generally provided either vertically at the interior or exterior face of the foundation wall or horizontally under the slab on grade for a specified distance from the foundation wall, as required by the energy code.
- Windows
    - Windows are wood with vinyl cladding applied to exposed exterior surfaces and sealed, insulated, double-glazed vision panels.
    - Original windows are residential grade. Many have been replaced by Facilities.
- Exterior doors and frames are typically formed sheet steel with insulated door leaves. Some aluminum storefront frames and aluminum entrance systems were installed at main entrances.
- Exterior walls
    - Conventional paper-faced interior gypsum board panels
    - Sheet polyethylene vapor retarder (specified but not shown in details) behind gypsum board
    - 6" cold-formed metal stud framing extending from floor to floor
    - Fiberglass batt insulation between cold-formed metal studs
    - 5/8" Type-X, moisture-resistant (not fiberglass faced) gypsum sheathing
    - 1" extruded polystyrene (XPS) continuous insulation board
    - Horizontal fiber-cement clapboards attached to framing through the XPS insulation boards (at the academic wing only)
    - Formed metal wall panels attached to continuous metal z-furring that penetrates the XPS insulation boards (at Performing Arts Center only)

- Details show concrete foundation walls extending above the slab on grade at many areas. This part of the exterior wall is insulated with 2 ½” rigid insulation interrupted by metal furring and covered with interior gypsum wall board.
- Details show some areas of existing solid masonry exterior walls with no insulation and others with metal stud interior furring and batt insulation, added when the Middle School was constructed.

Problematic Details and Conditions

Water infiltration

It’s often difficult to identify the exact point of water infiltration through the building enclosure. What appears to be a water problem in a wall can often be traced back to a small discontinuity in a roof membrane, an incomplete seal between wall and roof membranes at a parapet or headwall, or a poorly clamped roof drain. Once inside the building, water can follow a circuitous path from its original point of entry to the point where damage has occurred.

Water and air infiltration tend to occur at transitions, and unfortunately, most buildings contain many of them. These can involve changes in plane, like roof to wall joints, changes in wall back-up construction from metal stud to concrete to CMU or changes in cladding materials. Roofs often fail at skylight or mechanical equipment curbs or at other points where the membrane is penetrated. The requirement for movement joints and control joints within the same material assembly also creates discontinuities that can lead to leaks. Transitions occur where above-grade walls meet foundations or below-grade walls.

The largest and most commonly occurring transition in most building occurs where punched openings for windows and doors interrupt the exterior wall assembly. At these locations, the thermal, vapor and air/water control layers in the wall must transition without interruption from the wall and be sealed to the window or door frame.

The typical wall assembly at the Middle School, described above, is slightly unconventional in that it does not contain a separate air/water control layer such as building paper, Tyvek a synthetic self-adhering sheet membrane. This layer would typically be placed inboard of the expected due point of the wall assembly and at the location point where it could function as a drainage plane where weather-driven moisture could accumulate and then be directed outside of the wall assembly by flashing materials.

Judging from the location of the vertical leg of the flashing at the Middle School windows, it’s appears that the outside skin of the 1” XPS insulation layer was assumed to be the water control layer. It's likely that the specification required joints in XPS boards to be either sealed with spray foam insulation or taped or both. This would have been done to assure a continuous air and waterproof membrane. In theory this is acceptable, but in realty it's challenging to tape and seal the thousands of feet of joints between insulation panels.

These joint materials are not designed to be elastic, so they have a tendency to open up over time as the boards, spray foam, and tapes expand, contract or become brittle over time. These unsealed joints become pathways for wind-driven water that inevitably finds its way behind cladding materials, such as fiber cement, to the face of the sheathing behind. Since the vertical legs of window head flashings are sealed to the face of the XPS insulation, not to the face of the sheathing, this water is free to drop along the plane of the face of the sheathing and to enter into the unprotected head of the window frame.

It's likely that this dynamic is at work in the Middle School walls and that this is a major cause of the damage to wood windows. Since the wall design seems to assume that water will not get through the outside face of the XPS insulation, it's unlikely that joints between sheathing boards were sealed. This might allow water to penetrate further into the wall assembly to the batt insulation between the studs.

Fiberglass batt insulation is particularly vulnerable to water damage. If enough water is present, it can become compressed and lose its insulating properties and creating cold spots in the wall assembly. Fiberglass batts can also become breeding grounds for microbes, as organic materials bourn by water are filtered out and held in place by the fiberglass.

It's also worth noting that the sheathing used in this project is not the most conventional product for that application. It appears to meet the specified requirements for 5/8" Type-X sheathing, but it doesn't appear to be a fiberglass-faced product that we currently specify. There were, and are still, moisture resistant sheathings available that don't have a fiberglass face. These products are similar to traditional green or purple MMR boards used at wet walls of toilet rooms or kitchens. This material offers some resistance to moisture, but not the same level as fiberglass sheathing.

It's our assessment that the damage observed on the faces and edges of fiber cement clapboards is part of the natural course of its service life. Even low-maintenance cladding materials like fiber cement can be expected to deteriorate over time due to exposure to the weather. It is possible that their lifespan was shorted by being in direct contact with the XPS insulation boards. The hairline space between the two materials can hold water instead of allowing it to drain away. Providing even a small, but continuous ventilation plane between the materials may have slowed the moisture damage to the clapboards.

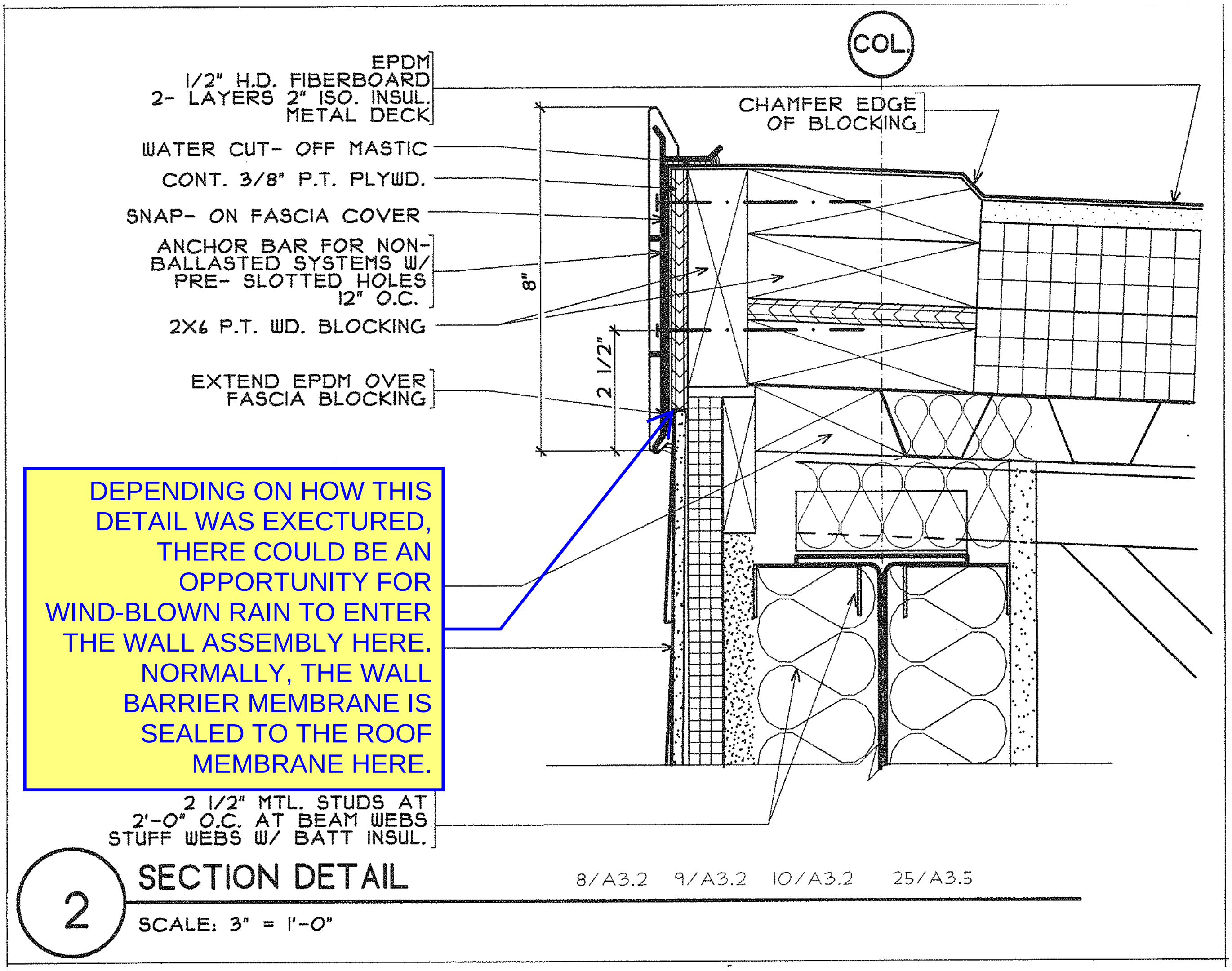
Code Compliance

As mentioned above, the Middle School was built using IBC Type II-B, non-combustible, unprotected construction. This means that the primary structural elements are steel and concrete and the majority of the other materials in the building are non-combustible. Then building code limits the heights and areas of buildings based on construction type, occupancy classification and other factors.

The code strictly limits how and where combustible materials can be used in non-combustible construction types. For example, foam plastic insulation is allowed in Type II-B buildings, but because of the extreme smoke, generation, flame spread and liquification that can occur when some plastics are exposed to fire, its permitted applications are limited. Foam plastic insulation must be separated from occupied interior spaces by a thermal barrier and protected by an ignition barrier when used in attic walls and ceilings. The use of foam plastic insulation in exterior walls is also regulated by the code. This means that XPS boards like those installed at the Middle School can only be installed as part of wall assemblies that have passed a flame apparatus test known as NFPA 285.

Numerous wall assemblies that include foam plastic insulation have passed this test, but most these assemblies include polyisocyansurate insulation boards, not XPS. The basic difference being that polyiso is thermoset plastic materials that hold its shape and smolder slowly under fire conditions. By contrast thermoplastics like XPS respond poorly to flames, burn rapidly and generate large volumes of toxic fumes. The only practical way to use XPS in a multi-story building is to use it as part of an EIFS system or behind a masonry veneer cavity wall with approved firestopping details around all window and door openings.

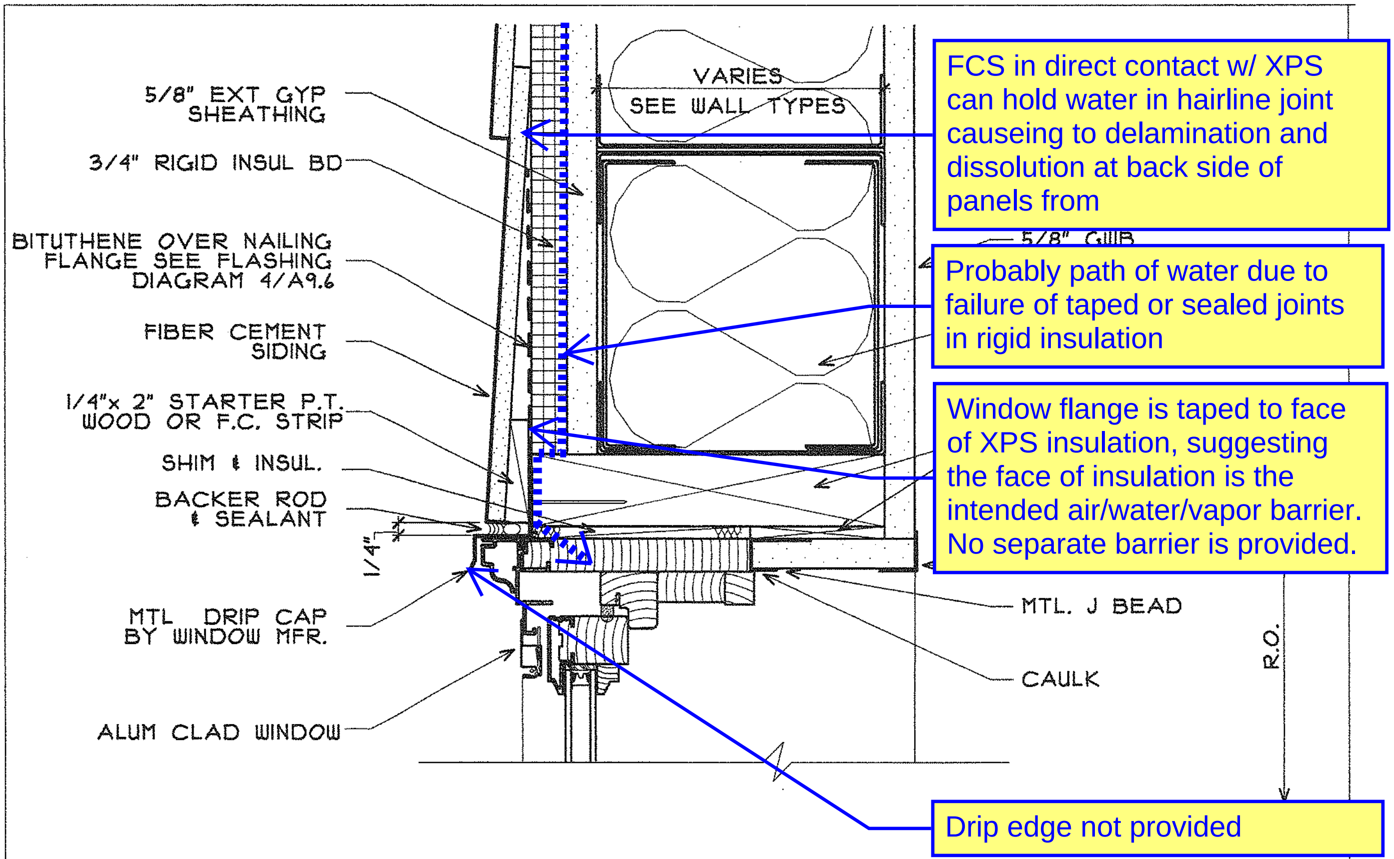
Until about 10 years ago, there was widespread misunderstanding of the NFPA 285 requirement, even though it had been in the code in one form or another for many years. All new construction regulated by the IBC should now either use non-combustible insulation like semi-rigid mineral fiber board or polyiso insulation that is part of a tested wall assembly.



Roof fascia observed at the building (formed and nailed brake metal) does not appear to be the same heavy-duty type of fascia drawn and noted in the detail above (two-piece with extruded aluminum anchor bar with snap on painted metal finish fascia).

The product shown in the detail has a continuous, rigid anchor bar that hold the roof membrane tightly to the roof edge blocking. This would have provided greater resistance to wind uplift and provide a generally more uniform joint than a shop-bent metal fascia held down with metal clips.

Sealing this joint against water infiltration is critical, particularly at windward facades of tall buildings that are exposed to higher wind pressures. Water that enters a wall assembly at the top of the can travel a long distance before its effects are recognized. This can make pinpointing the source of water infiltration difficult.



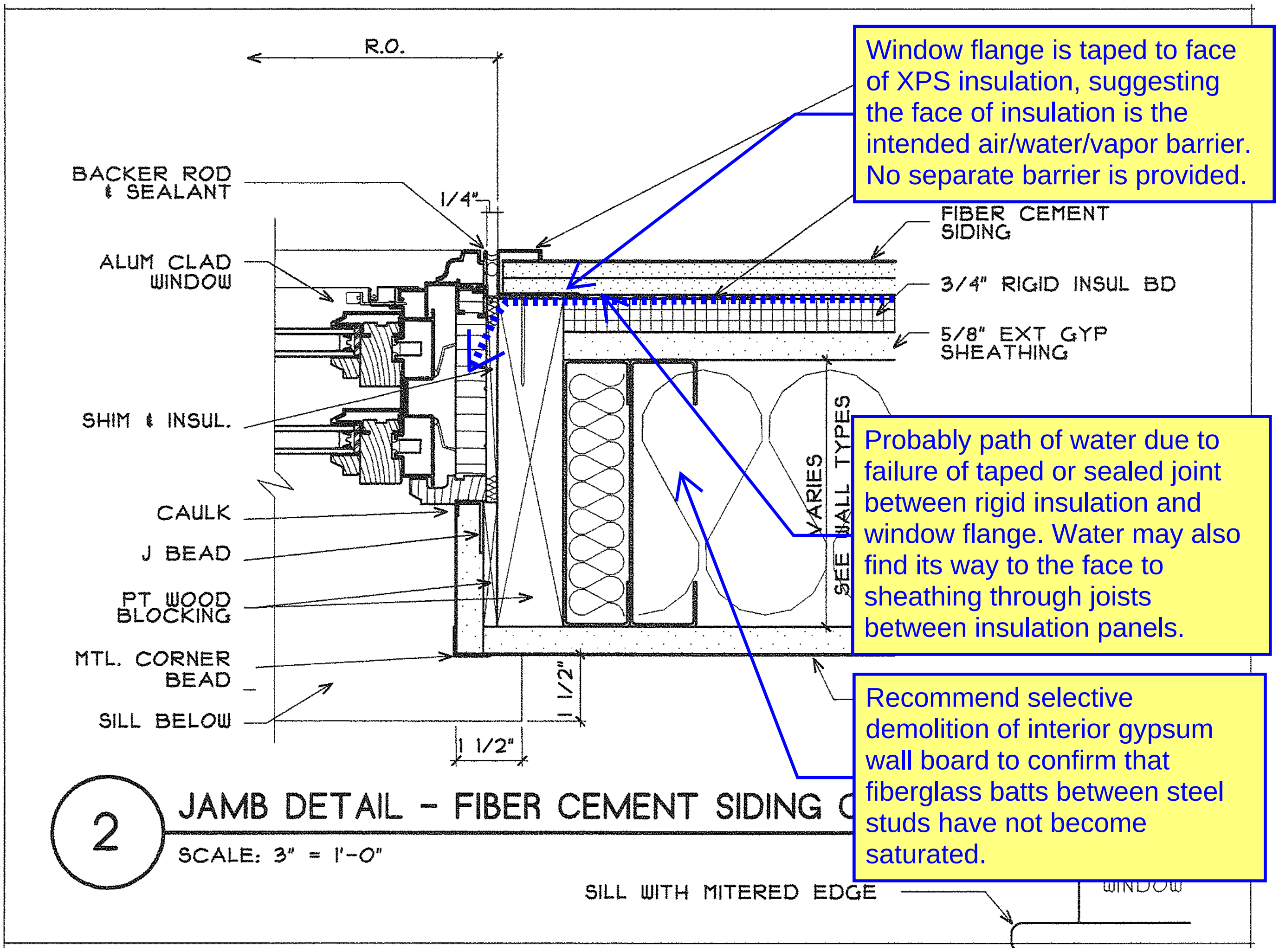
1 HEAD DETAIL - FIBER CEMENT SIDING CONDITION
SCALE: 3" = 1'-0"

Installed condition does not match detail in some locations. U-shaped metal trim at window heads creates a trough that holds water against the FCS, leading to delamination and dissolution.

U-shaped trim also concentrates water flow to the jambs, instead of allowing it to drip along the length of the window head. This concentrated flow is likely to cause delamination and dissolution of FCS at cut edges of clapboards, particularly since to sealant is present between clap board edges and jamb trim.

Another variation includes what appears to be head drip flashing, bent upwards to form a trough. Metal jamb trim is provided here to receive the clapboard ends, and substantial amount of sealant has been provided between clapboard ends and metal trim and between the metal trim and a separate piece of vertical window trim.

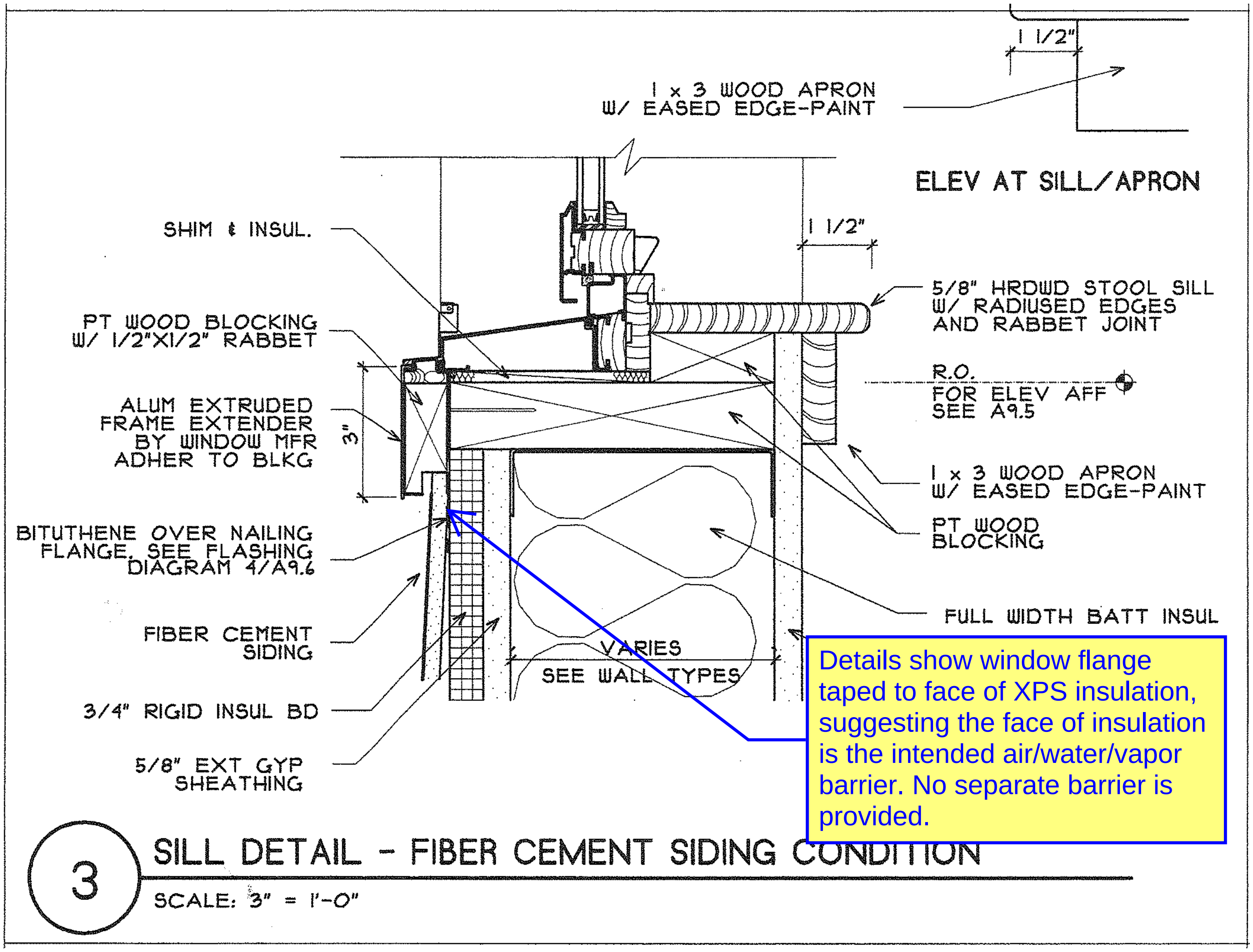
Sealant is a double-edged sword. When properly applied, sealant is part of a system that keeps water out of a wall assembly. Where water has already infiltrated the wall assembly, sealant can have a detrimental affect of trapping water with the wall assembly.



This variation of the window jamb condition resembles the drawn detail, with the addition of sealant between the FCS clapboards and metal J-trim.

The use of flanged windows is assumed based on the construction details. It's possible that If windows without flanges were installed, creating a different and possibly more complicated condition at window perimeters.

Damage to interior gypsum wall board caused by water moving through wall assembly layers dropping at window jambs. This raises concern about additional water damage to fiberglass batt insulation installed installed between cold-formed metal studs.



Details call for an extruded aluminum frame extender below the window units sill. These typically lock into a slot in the window unit, providing a tight that's resistant to water infiltration.

The existing sill appears to have been shop-fabricated from pre-finishes brake metal; it's not an extruded peice that would have come from the window manufacturere's standard kit of parts.

While the installed condition is probably not as weather-resistant as the detailed condition, it's unlikely that the sill constitutes is a major water infiltration route, because the window head has already interrupted the vertical flow of water within the wall assembly. However, water damage may be evident below the corners of the sill because of water traveling withing the wall along window jambs.

Many fasteners have pulled away from the clap boards, suggesting that not all fasteners are attached to steel studs. Gypsum sheathing has very little fastener-holding capacity and fasteners driven into gypsum sheathing will work themselves out over time as the clapboards are subjected to wind and weather.

Some fasteners are not concealed behind clapboards. These may have been installed originally or installed later as attempts to force rippling clapboards to lie flat. This is problematic because clapboards of this type are know to expand and contract with variation in temperature and humidity. Bituthane strips placed behind vertical butt joints may have been the installer's way of trying to assure weather tightness at these dynamic joints.

Fixing lower corner of the clapboards works against these expansion and contraction forces. Boards that are not free to move will be prone to crack or ripple.

Under the best of circumstances, fiber cement boards of this type will not last indefinitely, and the ones at the middle school are clearly at the end of their service life and should be replaced.

Given their poor condition, and the lack of a conventional weather resistive membrane in the wall assembly, it's fortunate that more water infiltration through walls has not occurred.

Replacing the clapboards with formed metal wall panels, similar to those installed at the Orion Center and adding a continue weather-resistive barrier to the face of the existing sheathing can be expected to solve these problems. No cladding system can be expected to be completely water tight, so adding a weather resistive membrane layer behind the cladding that's properly flashed to expel infiltrating water, is critical to the integrity and longevity of the wall assembly.

A multitude of different fasteners were used, some of which were interior grade and have rotted and failed.

Existing Conditions

Selective, explorative demolition was performed to confirm the causes of the water infiltration previously described. Demolition revealed that the condition of the sheathing was predominantly excellent. Selective removal of interior drywall below window corners to confirm damage to batt insulation between steel studs or possible corrosion of steel studs was performed. **

It is apparent that the j-channel at the window head is holding water and seeping into the cementitious siding above the head.

**** All photos showing exposed substrate are after removal by the District to assist with investigation. Material was reinstalled after inspection.**

Poly-iso insulation is attached with button fasteners; fasteners have been covered with sealant. Seams of poly-iso insulation have not been sealed, and as suspected are a potential path for water getting to the sheathing.

Location of window head flashing confirmed that the assumed plane of water is the face of the poly-iso insulation.

Ice and Water Shield has been turned up at the sill transition below the siding. However, there is evidence of a gap between the Ice and Water Shield and the poly-iso insulation, exposing the paper-faced sheathing.

Paper-faced sheathing is showing some signs of damage where exposed to the water plane.

Window blocking has been wrapped with a vapor barrier product, mechanically fastened to the sheathing behind the insulation.

Damage to the siding at the outside sill corners of the windows indicated that water trapped in the j-channel at the head of the window eventually travels down the jambs, seeping into the siding.

Flashing joints at the window head and the top of masonry transition do not overlap and are not sealed.

Gypsum board used as a spacer at the window head to hold siding off head flashing.

Selective, explorative demolition was performed at the interior face of the envelope wall. The wall was opened at four rooms approximately one foot outboard of window jambs and directly below window openings. Locations were selected where window sashes had been replaced due to water damage. Openings were made at floor level behind the wall bases in order to minimize damage.
Openings were made in the following locations:

- Room 1234 OT/PT
- Room 1340 Classroom at the northeast exposure to the courtyard
- Room 2634 Library break-out room
- Corridor in the Orion Center

The assumption was that there would be evidence at the bottom of the wall of compressed insulation, mold, or any other evidence of water within the stud cavity.

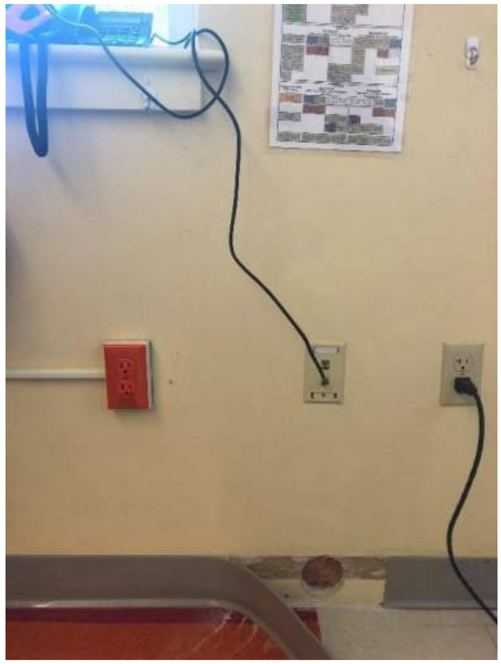
The presence of a sheet polyethylene vapor retarder on the cavity-side face of the interior gypsum wall board was confirmed. This item was included in the project construction specifications, but it was not shown on the architectural details.

At all locations, no evidence of water infiltration into the wall cavity and not evidence of water damage to the sheathing was observed.

The interior face of sheathing is solid, and no water marking or discoloration that could be attributed to water infiltration was observed. Similarly, no corrosion or water-borne deposits were observed on cold-formed metal stud or track surfaces.

At the ground level, some cavity fiberglass batt insulation is discolored, but this discoloration is limited to batts within an inch or so of the sheathing. The discoloration appears to be from accumulated dust trapped between insulation fibers. This suggests that there is some convective action (air movement) occurring within the stud cavity. Although this is not idea, it is a common phenomenon within insulated stud cavities.

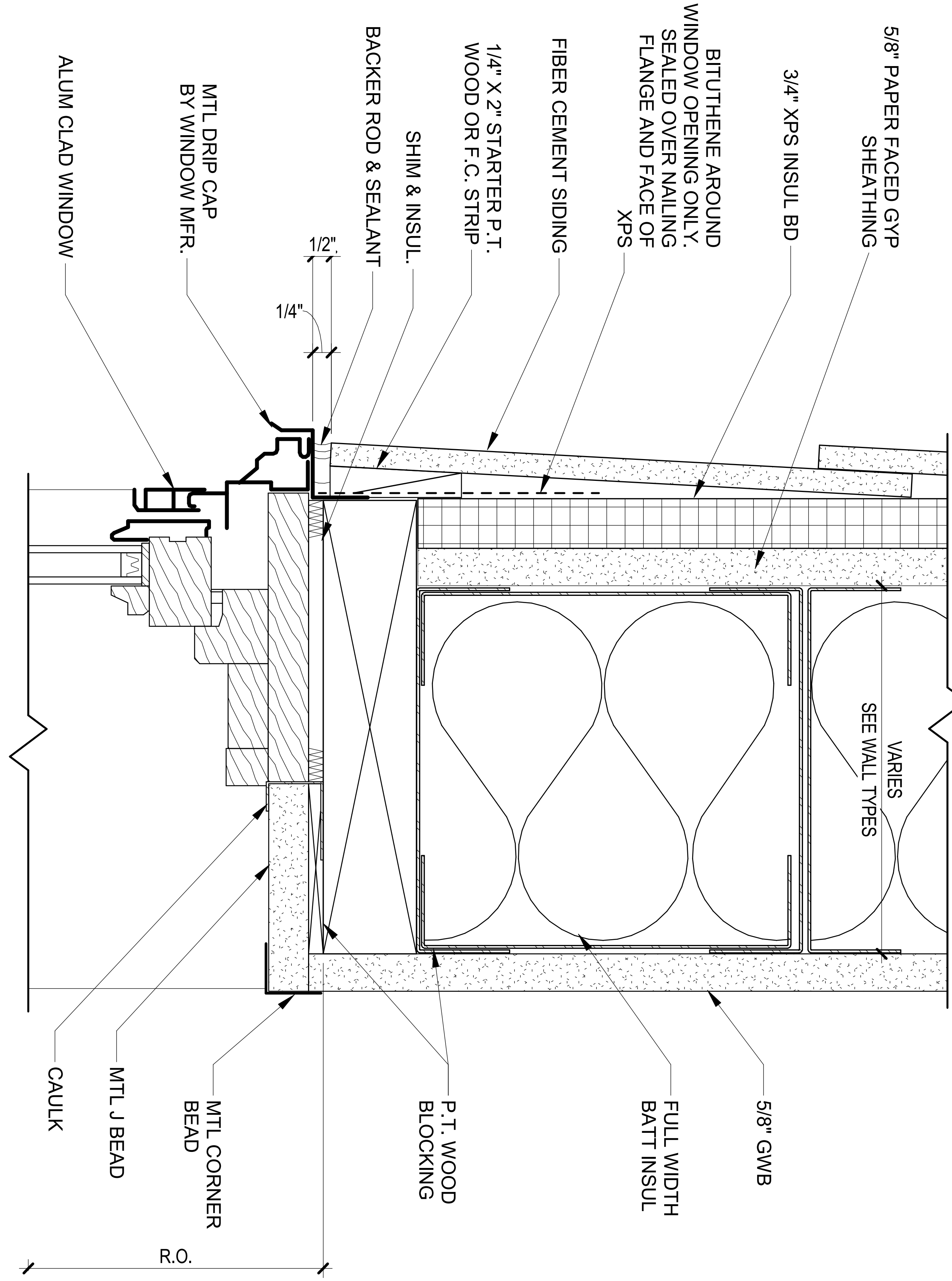
No evidence of water damaged batts, such as compression of batt fibers or the presence of objectionable odor, was detected.



Typical exploration location below window sill.

Typical condition of wall cavity batt insulation.

Batt shows no indication of water infiltration into wall cavity.



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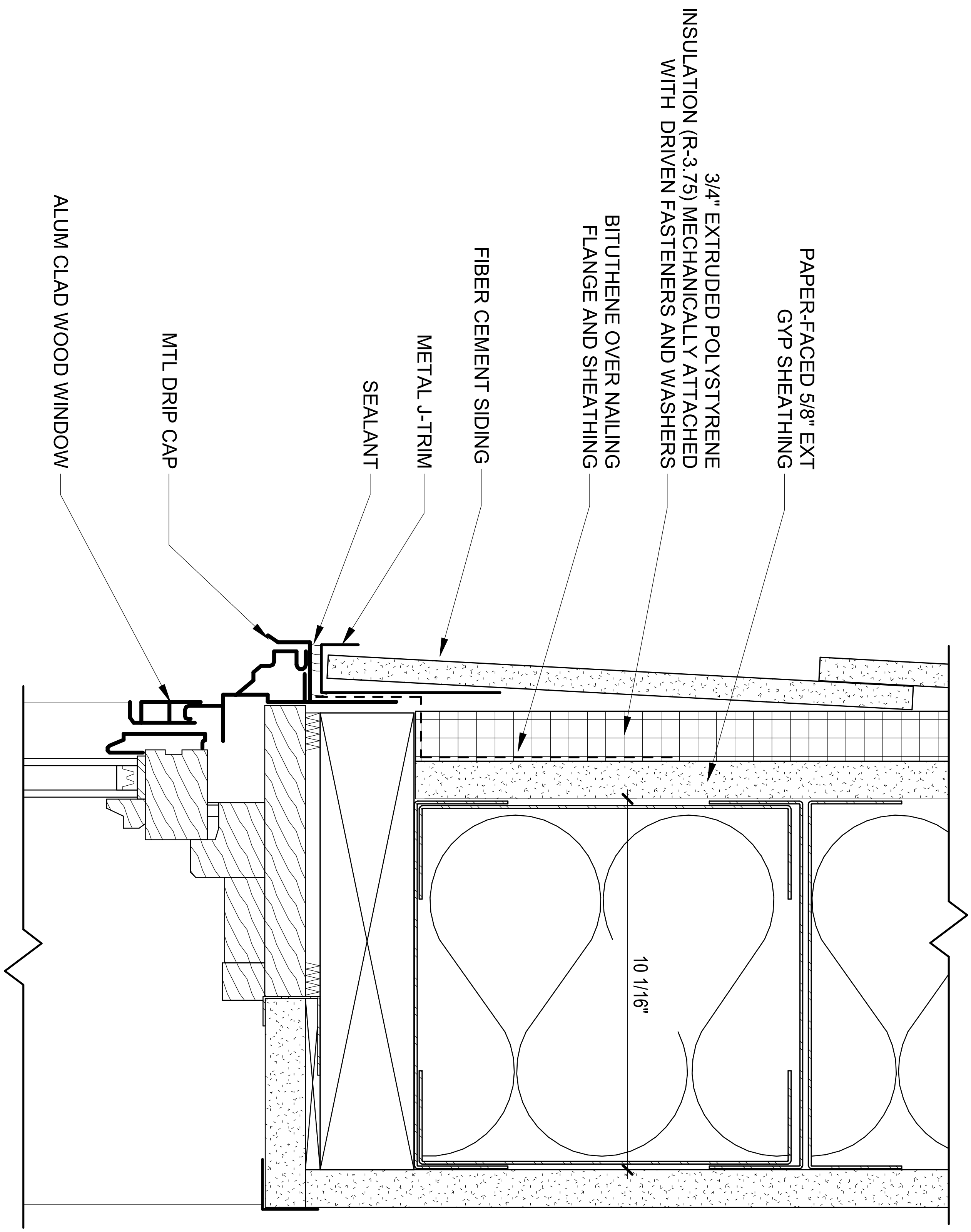
50 REPUBLIC AVENUE TOPSHAM, ME 04086

TITLE	HEAD AS DRAWN
JOB #	067221
DATE	06/01/21
SCALE	3" = 1'-0"
SHEET	2.4-A



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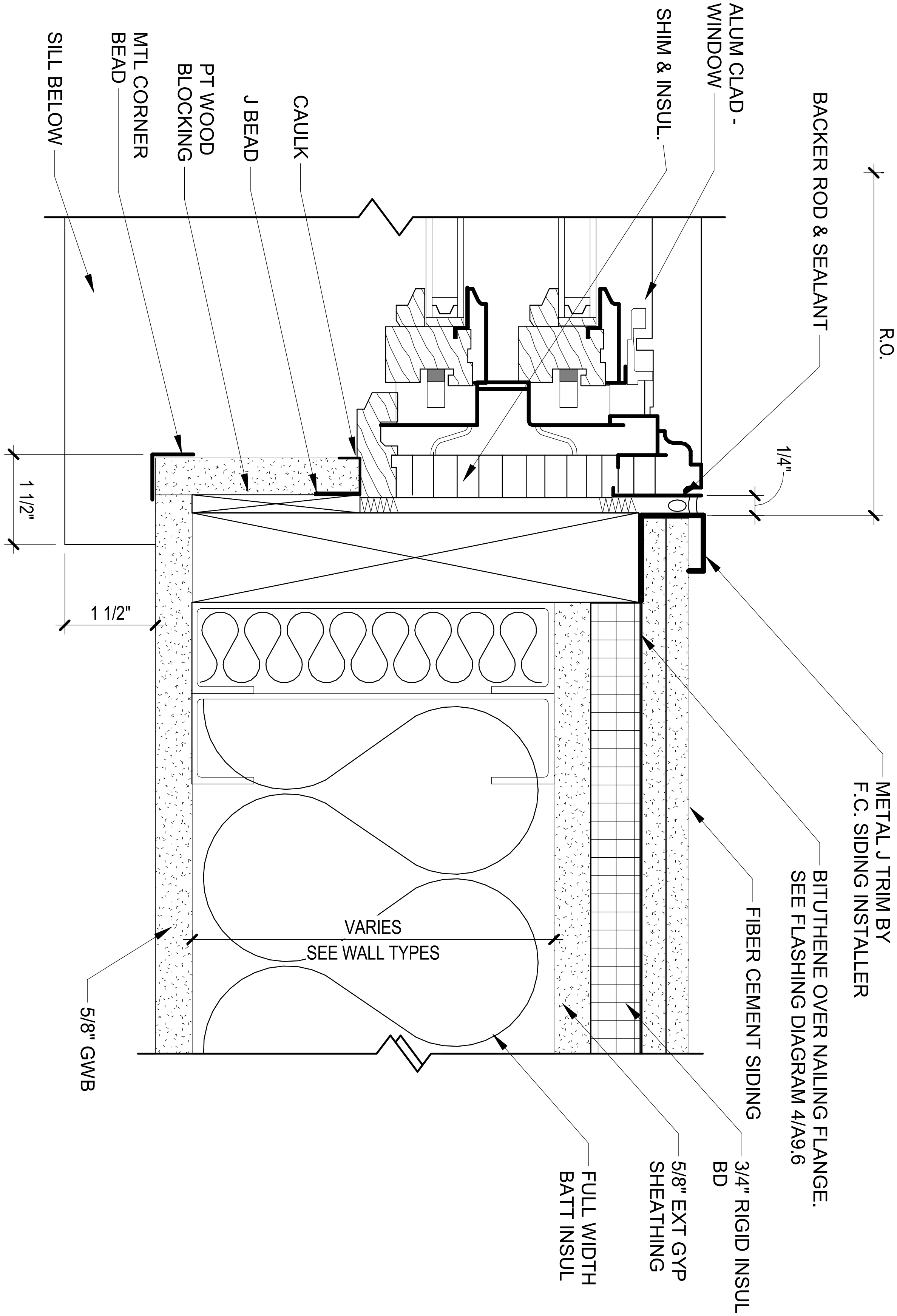
TITLE HEAD AS BUILT	JOB # 067221 DATE 06/01/21 SCALE 3" = 1'-0"	SHEET 2.4-B



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TITLE	JAMB AS DRAWN
JOB #	067221
DATE	06/06/14
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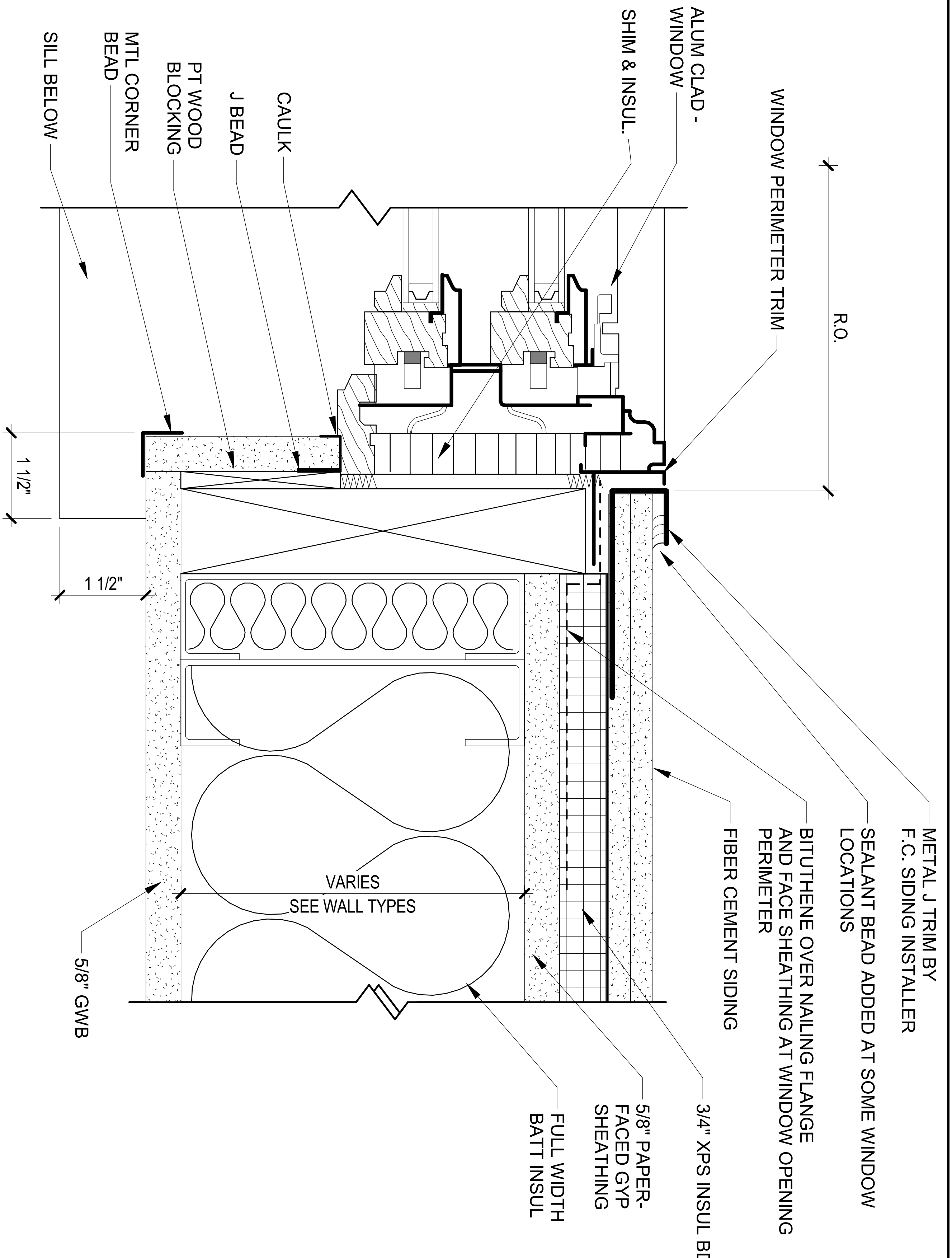
SHEET	2.4-C



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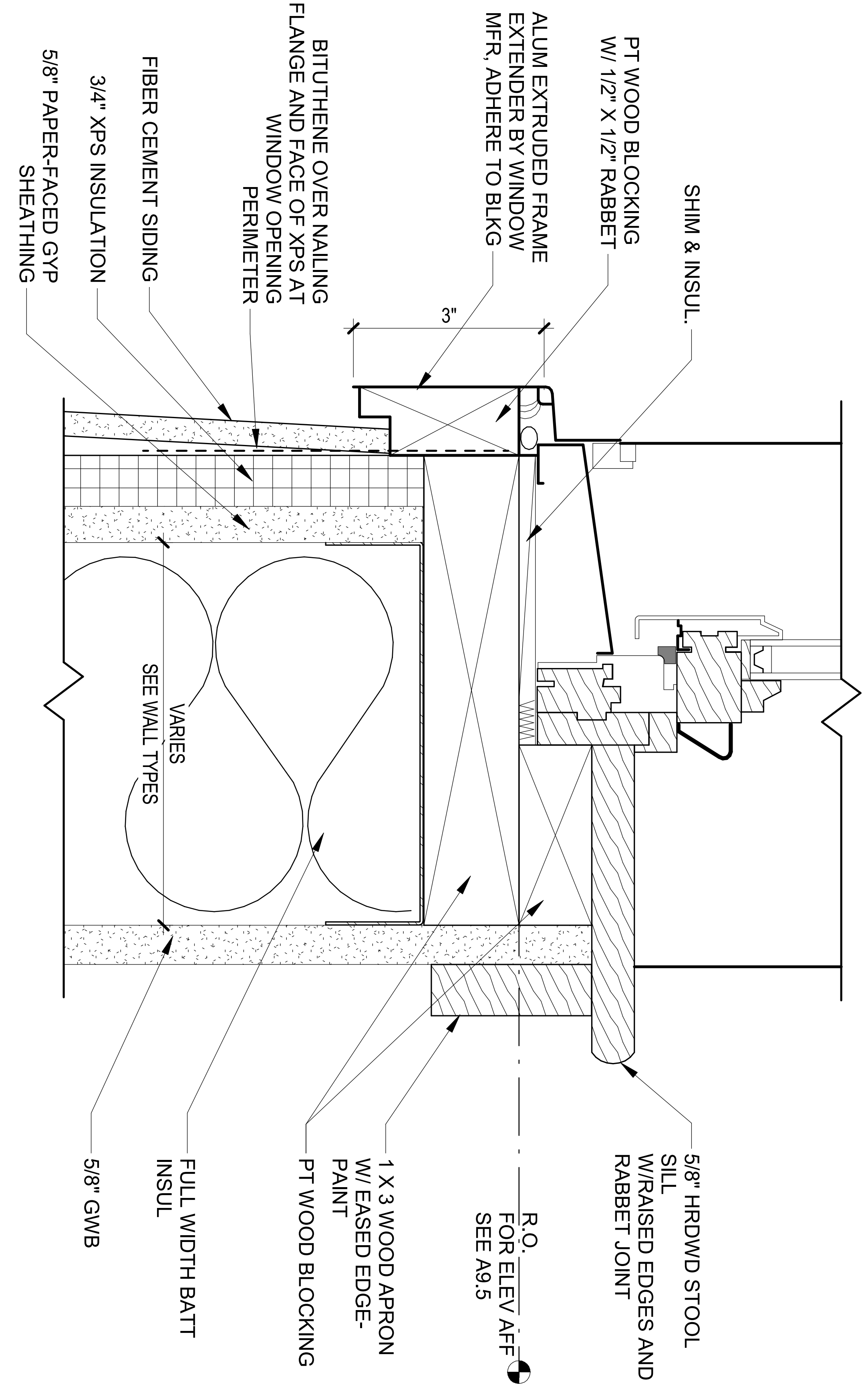
TITLE: JAMB AS BUILT	JOB # 067221	SHEET
	DATE 06/01/21	2.4-D
	SCALE 3" = 1'-0"	



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TITLE	SILL AS DRAWN
JOB #	067221
DATE	06/01/21
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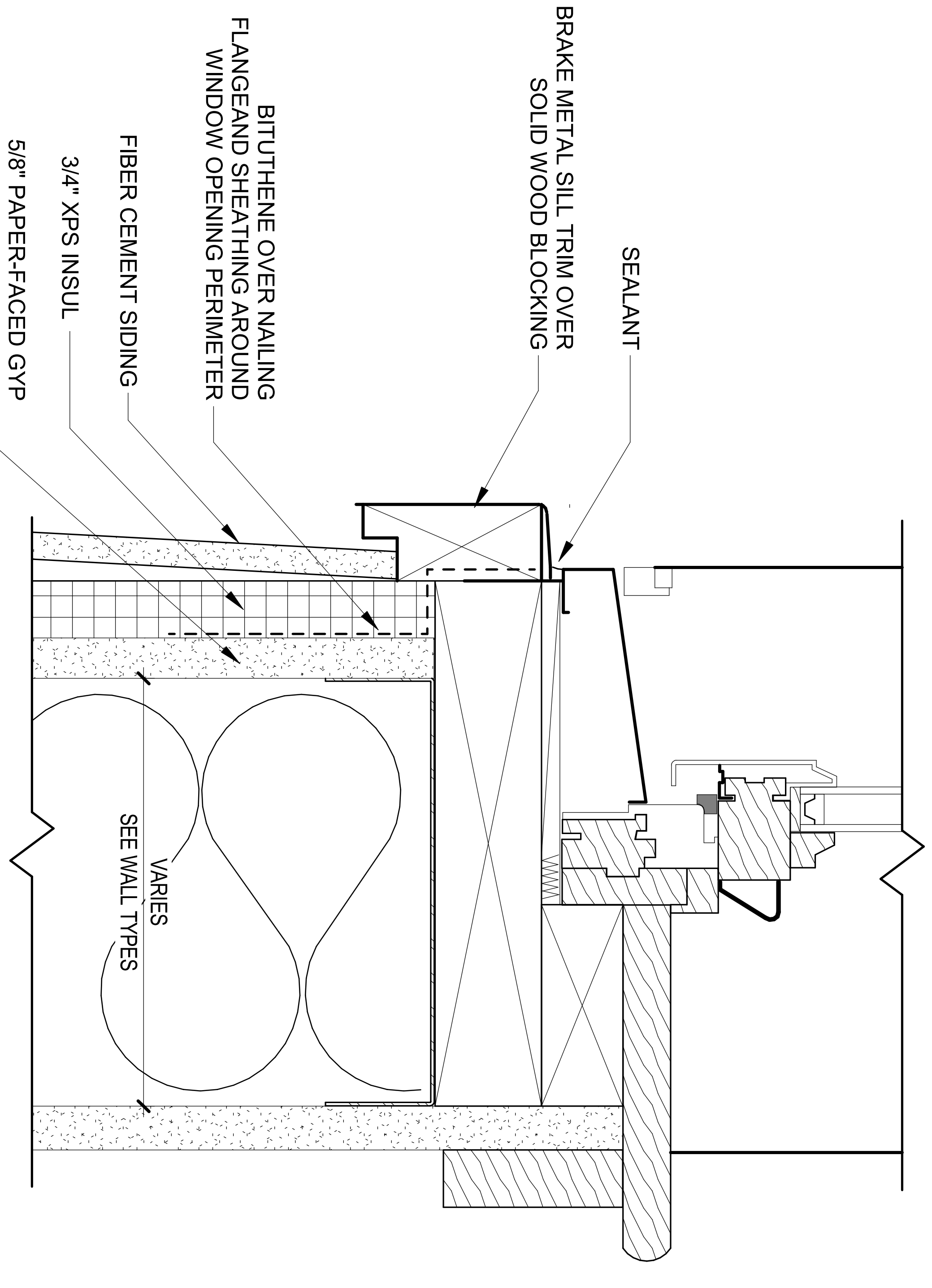
SHEET	2.4-E



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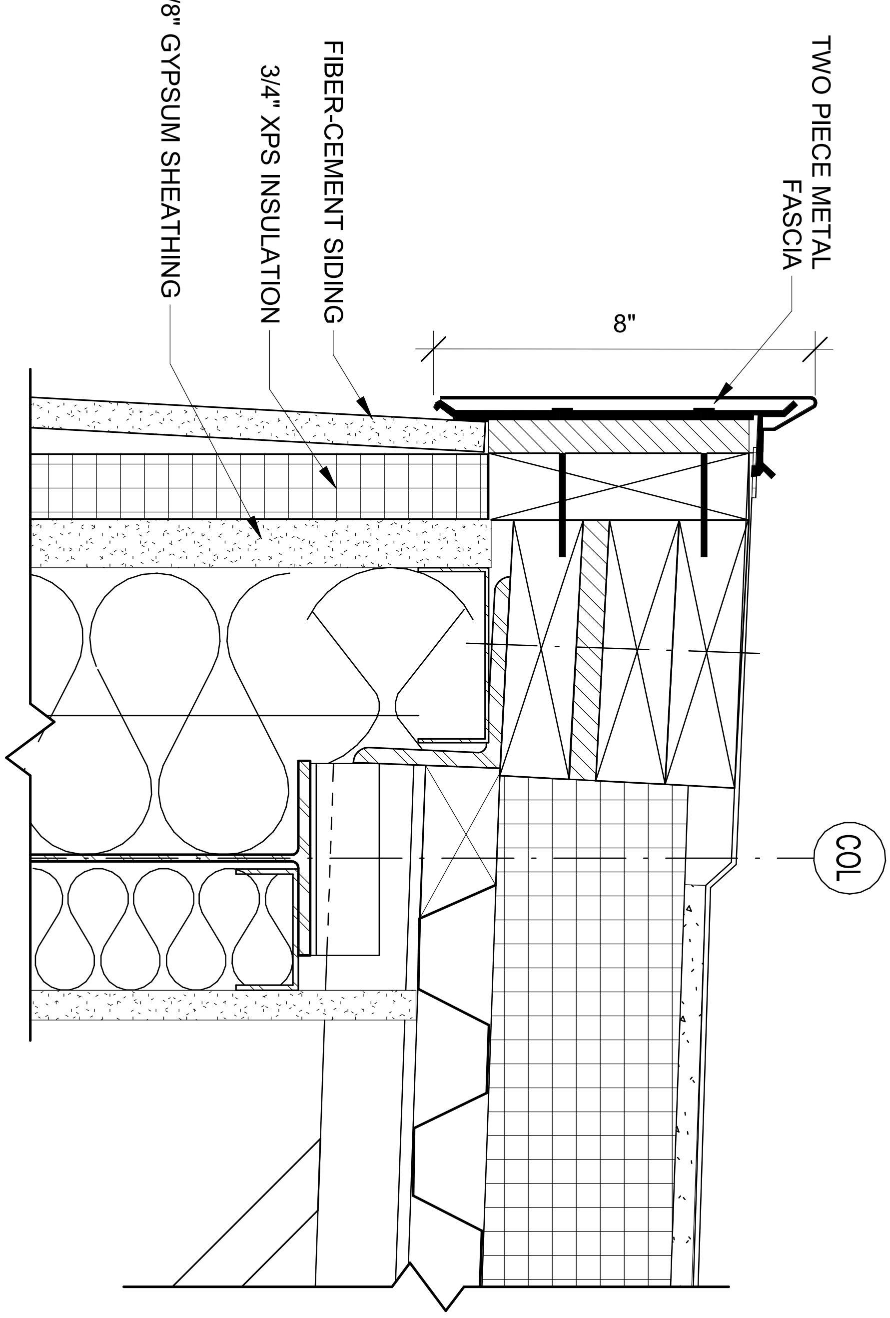
TITLE SILL AS BUILT	JOB # 067221 DATE 06/01/21 SCALE 3" = 1'-0"	SHEET 2.4-F



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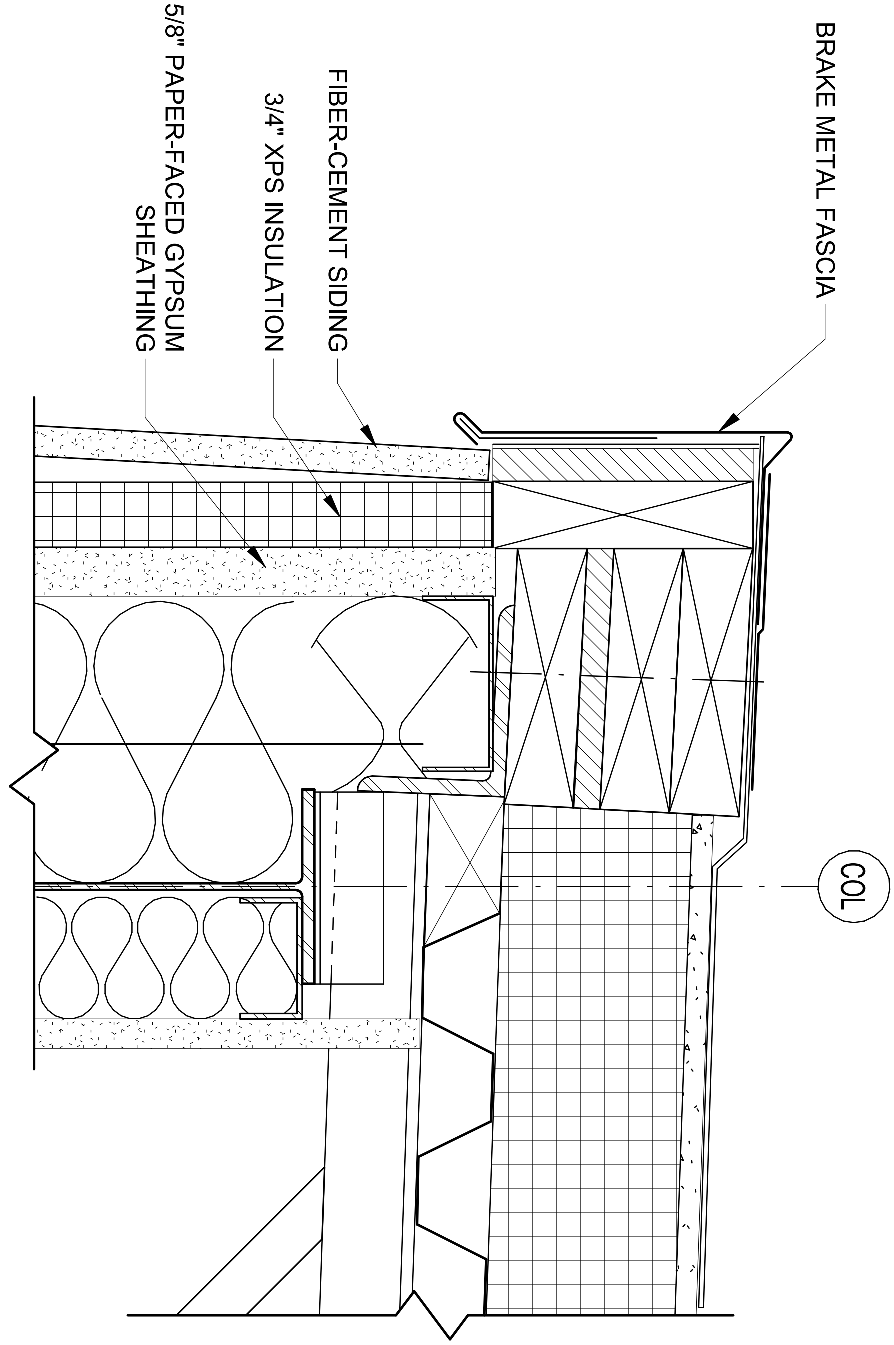
	DATE 06/01/21	
	SCALE 3" = 1'-0"	



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TITLE	ROOF EDGE AS BUILT
JOB #	067221
DATE	06/01/21
SCALE	3" = 1'-0"
SHEET	2.4-H

PROPOSED SCOPE

Recommended Remediation

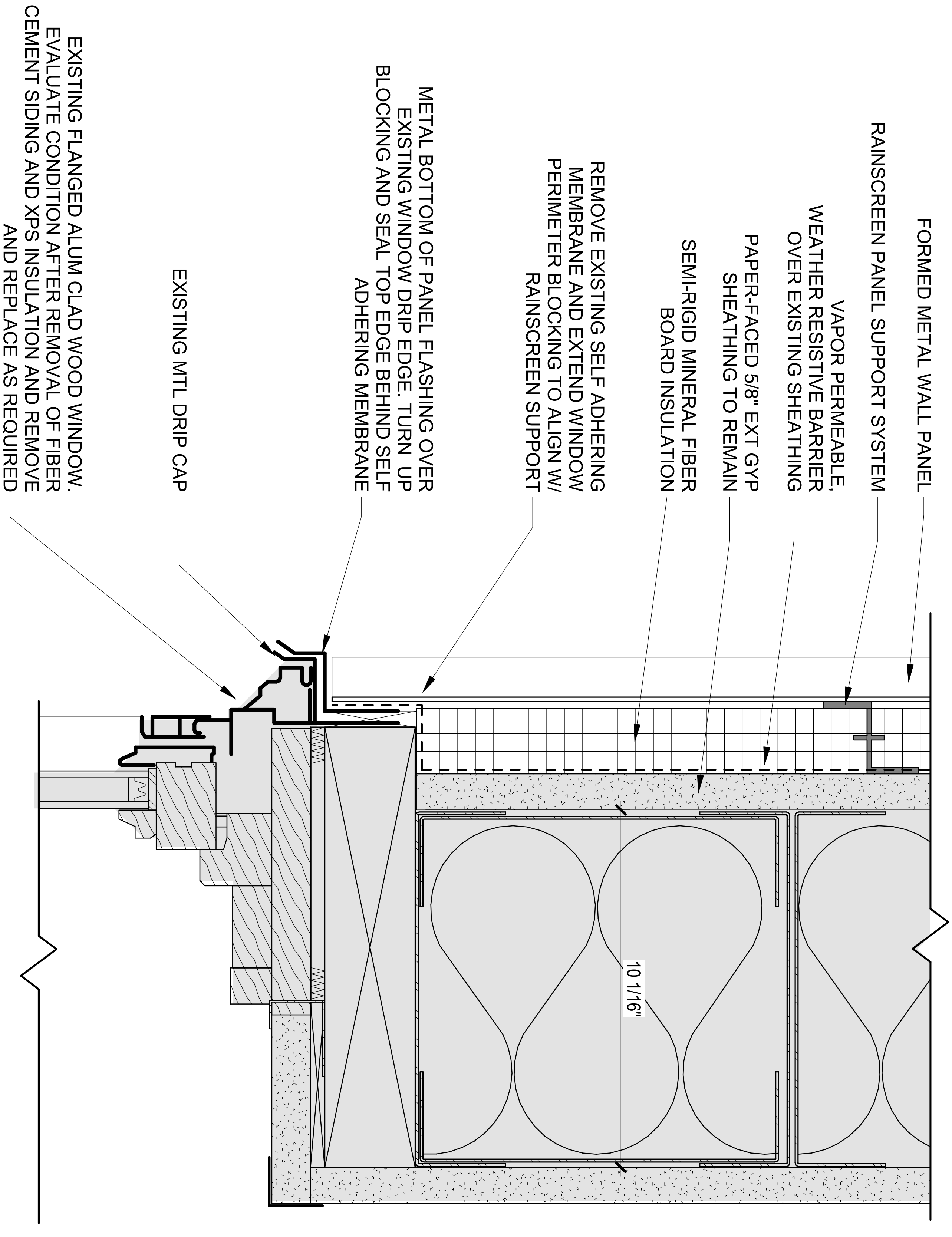
CHA Architecture recommends the following remedial actions:

1. Specify and install a new weather resistive, back-vented, back-drained exterior rainscreen cladding system:
    - Remove clapboards and insulation to expose the existing gypsum sheathing
    - Replace any sheathing boards that appear damaged
    - Seal all gaps between sheathing boards
    - Install a self-adhering, vapor-permeable air and water resistive barrier (sheet applied or fluid-applied)
    - Install a new layer of semi-rigid mineral fiber board continuous insulation over the new wall barrier
    - Specify a rainscreen support system to carry new formed metal wall panels. This system will provide attachment surfaces for the wall panels while maintaining a ventilation system to allow the wall insulation to absorb and release ambient moisture
    - Specify new corrosion-resistant, factory primed and painted metal wall panels, profile and patterning to be determined by the architect.

2. Replace water damaged or non-functional windows and doors frames
    - Remove existing units
    - Provide new wood block as required for installation of new window and door units
    - Provide metal flashings sealed to the weather barrier at all door and window opening heads
    - Provide miscellaneous metal trims and closure preces required to complete wall panel and window/door installation
    - Provide new flanged, high performance window units and seal to weather barrier.
    - Provide new blocking as needed to install flanged windows
    - Replace interior sills and drywall adjacent to window removal.

If widespread water damage to batt insulation is observed, then drywall, batt insulation (and vapor retarder, if present) should be removed at these locations and replaced with similar materials.

The work described above can be performed in phases or at selected whole facades.



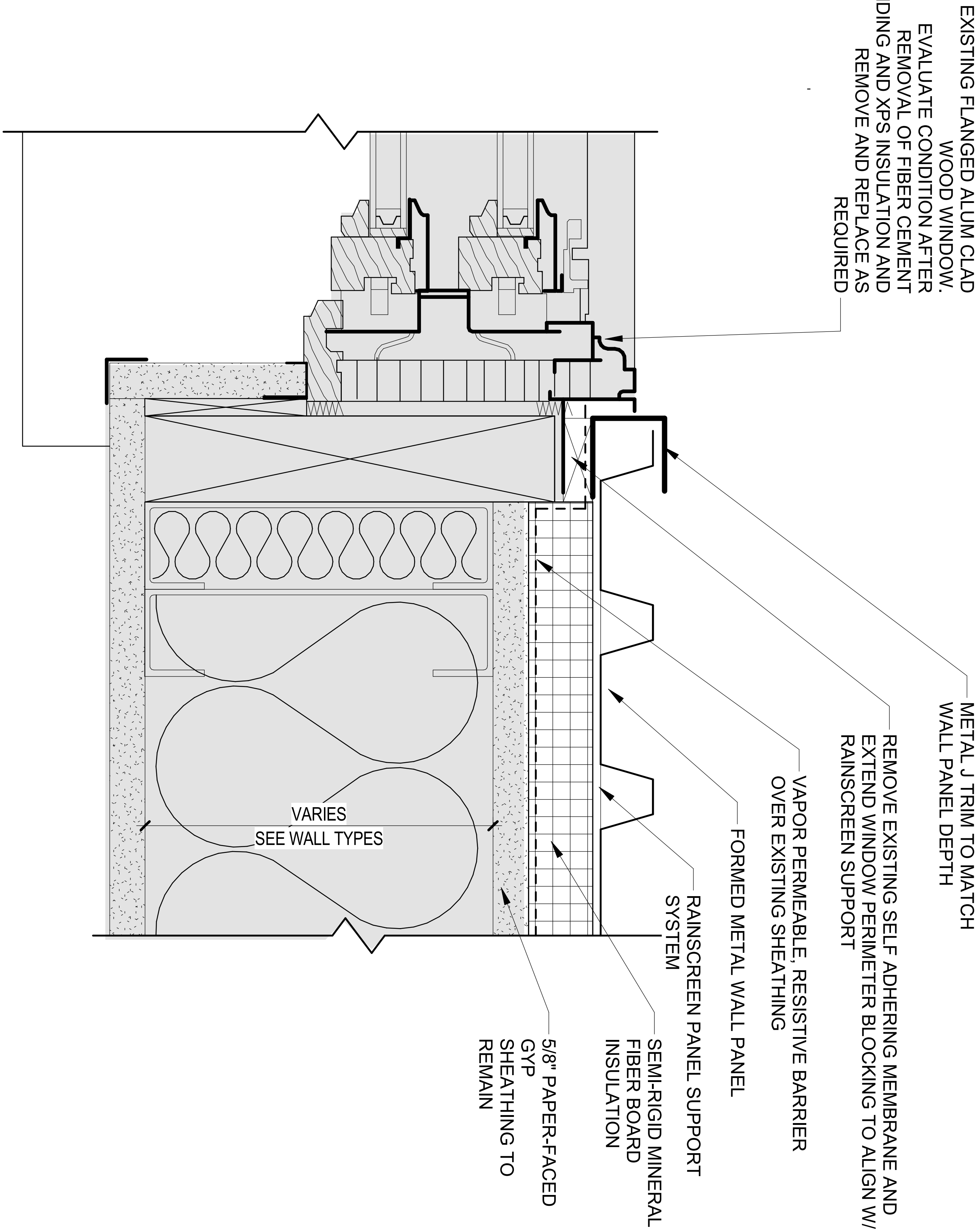
ARCHITECTURE
INTERIOR DESIGN
PLANNING

49 DARTMOUTH STREET
PORTLAND, MAINE 04101
www.chaarchitecture.com

MIDDLE SCHOOL ENEVLOPE

50 REPUBLIC AVENUE TOPSHAM, ME 04086

TITLE	HEAD PROPOSED
JOB #	067221
DATE	06/01/21
SCALE	3" = 1'-0"
SHEET	3.1-A



CHA ARCHITECTURE

ARCHITECTURE
INTERIOR DESIGN
PLANNING

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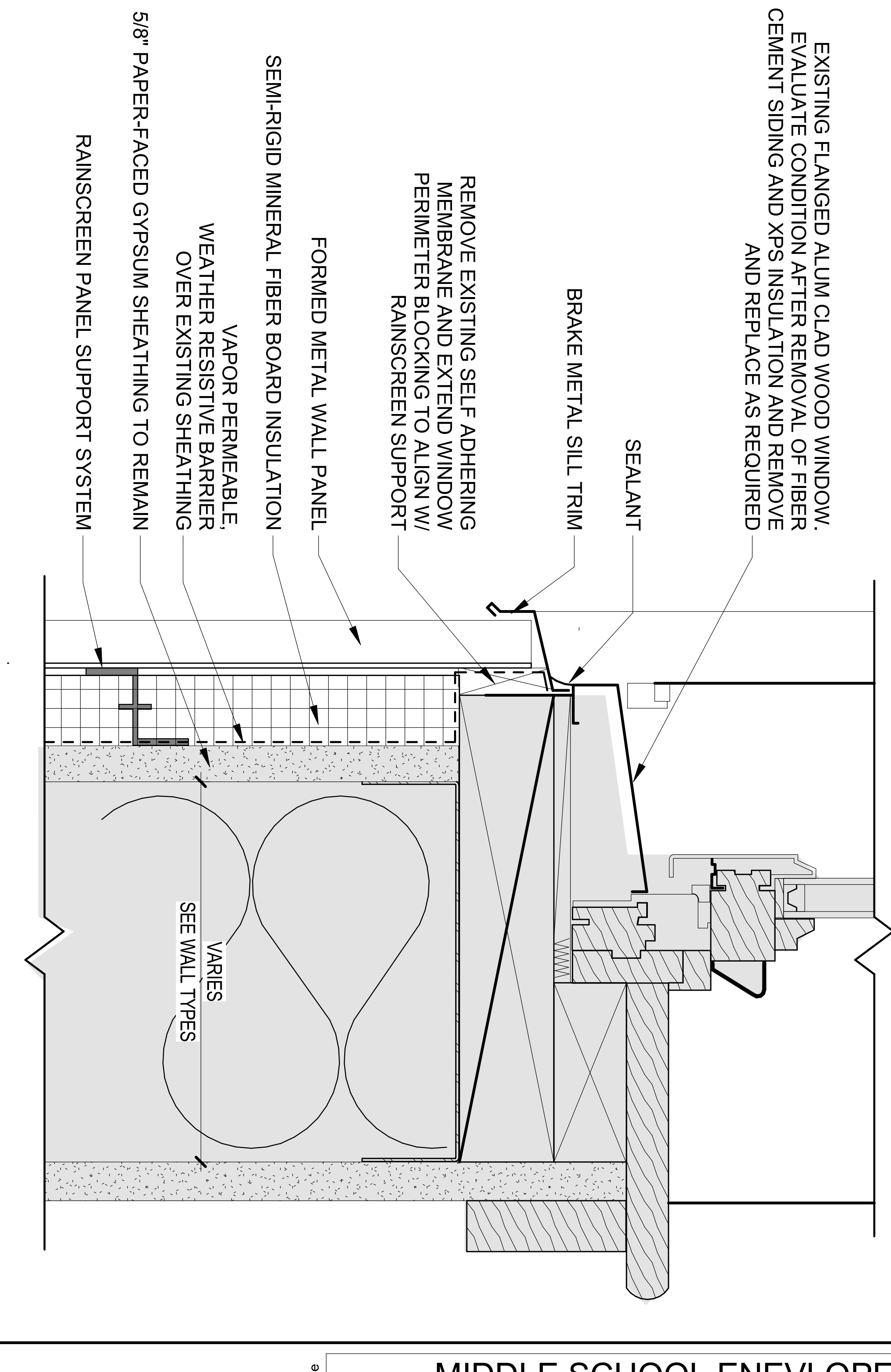
MIDDLE SCHOOL ENEVLOPE

50 REPUBLIC AVENUE TOPSHAM, ME 04086

TITLE JAMB PROPOSED	JOB # 067221	DATE 06/01/21	SCALE 3" = 1'-0"

SHEET 3.1-B



CHA ARCHITECTURE

ARCHITECTURE
INTERIOR DESIGN
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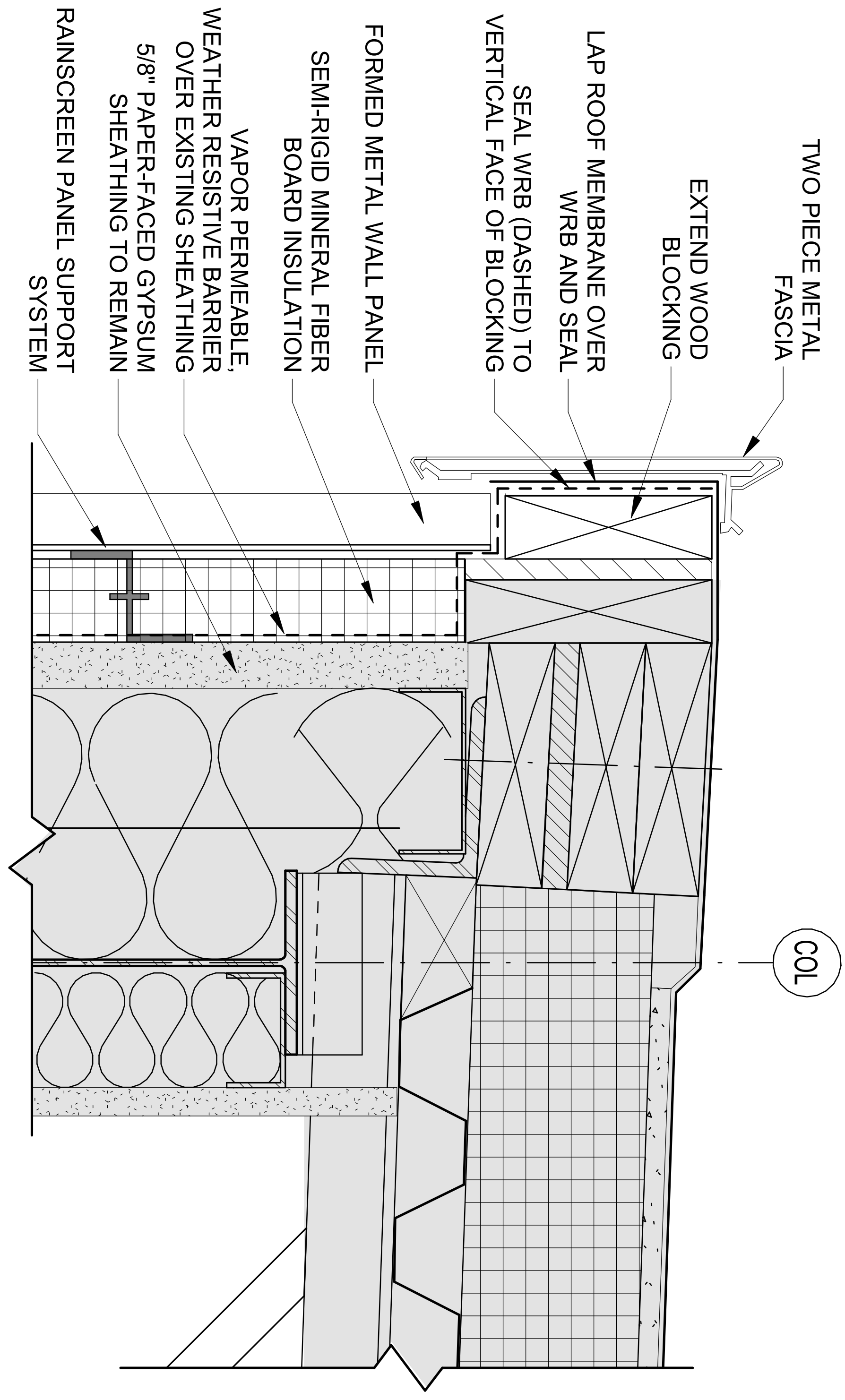
MIDDLE SCHOOL ENEVLOPE

50 REPUBLIC AVENUE TOPSHAM, ME 04086

TITLE	SILL PROPOSED
JOB #	067221
DATE	06/01/21
SCALE	3" = 1'-0"
SHEET	3.1-C



CHA ARCHITECTURE

ARCHITECTURE
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PORTLAND, MAINE 04101
www.chaarchitecture.com

MIDDLE SCHOOL ENEVLOPE

50 REPUBLIC AVENUE TOPSHAM, ME 04086

TITLE ROOF EDGE PROPOSED	JOB # 067221		SHEET 3.1-D
	DATE 06/01/21		
	SCALE 3" = 1'-0"		

COST ESTIMATES

MSAD #75 - Mount Ararat Middle School
Façade Repairs
66 Republic Avenue
Topsham, ME 04086

June 7, 2021

Budget Estimate

CHA Project Number: 067221.001

Annotations by Kathy Cogan 6/21/2021

Architect:
CHA Architecture
49 Dartmouth Street
Portland, ME 04101
(207) 775-1059

Cost Estimator
CHA Consulting Inc
1 Faneuil Hall Marketplace
South Market Bldg, Suite 4195
Boston, MA 02109
(617) 451-2717

INTRODUCTION

Project Description:

This Project includes exterior façade replacement of an existing school located in Topsham, ME
Work Consisting of:
Partial exterior façade envelope systems replacement including demolition, insulation systems, and façade materials due to water infiltration and deterioration of existing materials

Project Particulars:

Schematic Design Drawings and Specifications dated April 2021, received from CHA Architecture (CHA)
Design Team clarifications and supplemental information during estimating production period
Detailed quantity takeoffs where possible from design documents and reports
CHA Companies' experience with similar projects of this nature.
Discussion and review with CHA and their Consultant Design Team
Anticipated Bid Date: September 1, 2021
Estimated Construction Start Date: June 15, 2022
Estimated Construction Finish Date: August 15, 2023
Construction Duration: 15 Months

Assume 4.5% escalation for construction start June 15, 2023

Project Assumptions:

Project will be procured by General Contractor bid
Our costs assume that there will be at least three subcontractors submitting unrestricted bids in each trade bid category
Direct trade unit rates include escalation to mid-point of construction duration and prevailing wage labor rates. These unit rates continue to be updated during the design period
Operation during normal working hours
Temporary electrical and water site utility connections will be available. General Conditions value includes utility connections and consumption costs
Subcontractor's markups are included in each unit rate. These markups cover field and home office overhead and subcontractor's profit
Design and Pricing Contingency markup is an allowance for unforeseen design issues, design detail development and specification clarifications during the design period
Staffing, Project and General Requirements value have been carried in the Main Summary for on-site supervision staff, site office, temporary utilities, project requirements, overheads
Escalation allowance from now to middle of construction has been carried in the Main Summary. This allowance is adjusted, and typically reduces during the design period, to more accurately reflect the current bidding climate

INTRODUCTION

Construction Cost Estimate Exclusions:

Work beyond the boundary of the site
Pre-construction services
Site or existing condition surveys and investigations
Architectural/Engineering; Designer and other professional fees, testing, printing, surveying
Owner's administration; legal fees, advertising, permitting, Owner's insurance, administration, interest expense
Project costs; utility company back charges prior to construction, construction of swing space and temporary facilities, program related phasing, relocation
Owner furnished and installed products; computer networking, desks, chairs, furnishings, equipment, artwork, loose case goods and other similar items
Utility company back charges during construction
Third Party testing and commissioning
Police details and street/sidewalk permits
Building permit fees

MAIN SUMMARY

ELEMENT		Renovation Building
Direct Trade Details		
Building Demolition		$132,700
Hazardous Material Abatement		$0
Building Construction		$3,258,264
Direct Trade Details Subtotal		**$3,390,964**
Design and Pricing Contingency	5.00%	$169,548
Direct Trade Details Subtotal		**$3,560,512**
General Conditions and Requirements	6.50%	$231,433
General Liability Insurance	2.70%	$96,134
Performance and Payment Bonds	0.73%	$25,992
Fee	3.00%	$117,422
Estimated Construction Cost Total		**$4,031,493**
Escalation Contingency	6.00%	$241,890
Construction Contingency	5.00%	$201,575
Estimated Construction Cost Total		**$4,474,957**
Alternates		
Alternate #1 - Added Insulation	ADD	**$503,982**
Alternate #2 - Replacement Windows	ADD	**$718,917**
Alternate #3 - Phasing Base Work, Recladding	ADD	**$469,935**

DIRECT TRADE COST SUMMARY

ELEMENT	Renovation Construction	Total
02-EXISTING CONDITIONS	$132,700	$132,700
06-WOODS, PLASTICS, AND COMPOSITES	$140,244	$140,244
07-THERMAL AND MOISTURE PROTECTION	$2,984,020	$2,984,020
09-FINISHES	$112,400	$112,400
26-ELECTRICAL	$21,600	$21,600
Direct Trade Details Subtotal	**$3,390,964**	**$3,390,964**

RENOVATION BUILDING DIRECT TRADE COST DETAILS

ELEMENT	QUANTITY	UNIT	UNIT RATE	COST
02-EXISTING CONDITIONS				
Remove existing exterior façade for replacement	**40,200**	SF	$3.00	$120,600
Protect existing elements to remain	**1**	LS	$12,100.00	$12,100
02-Existing Conditions Total				**$132,700**
06-WOODS, PLASTICS, AND COMPOSITES				
Rough Carpentry				
Exterior wall, blocking for replacement windows/doors openings	**40,200**	SF	$1.50	$60,300
Exterior wall, replaced damaged sheating boards, partial	**6,030**	SF	$4.50	$27,135
Exterior wall, replaced exterior studs, partial	**6,030**	SF	$4.30	$25,929
Remove and replace exterior door units, single, metal frame/metal door	**5**	EA	$1,800.00	$9,000
Remove and replace exterior door units, double, metal frame/metal door	**6**	EA	$2,980.00	$17,880
06-Woods, Plastics, And Composites Total				**$140,244**
07-THERMAL AND MOISTURE PROTECTION				
Insulation Systems				
Replacement insulation	**40,200**	SF	$5.00	$201,000
Girts, standoffs.stud framing for new insulation install	**40,200**	SF	$4.50	$180,900
Vapor Barrier Systems				
Replacement vapor barrier	**40,200**	GSF	$6.60	$265,320
Exterior cladding material				
Exterior metal panel system	**40,200**	GSF	$50.00	$2,010,000
Flashing and trim at extg window and door openings	**1**	LS	$252,000.00	$252,000
Roofing				
Replace fascia and trim for new siding materals install	**1**	LS	$30,000.00	$30,000
Joint Protection				
Interior sealant, dissimilar materials	**1**	LS	$13,300.00	$13,300
Exterior sealants, dissimilar materials	**1**	LS	$31,500.00	$31,500
07-Thermal And Moisture Protection Total				**$2,984,020**
09-FINISHES				
Gypsum Board				
Repair extg exterior wall GWB from water infiltration	**30**	DY	$1,600.00	$48,000
GWB ceilings				
Repair extg exterior wall ceiling/soffits from water infiltration **these allowances can be deleted**	**15**	DY	$1,600.00	~~$24,000~~
Acoustical Ceilings				
Replace extg ACT ceilings from water infiltration	**5,000**	SF	$4.00	~~$20,000~~
Painting				
Patch paint exterior walls as req'd from water infiltration	**20**	DY	$1,020.00	$20,400
09-Finishes Total				**$112,400**
26-ELECTRICAL				

RENOVATION BUILDING DIRECT TRADE COST DETAILS

	ELEMENT	QUANTITY	UNIT	UNIT RATE	COST
59	Electrical				
60	Remove and reinstall bldg mounted light fixtures and devices for new work	**1**	LS	$21,600.00	$21,600
61	**26-Electrical Total**				**$21,600**
62					

ALTERNATES

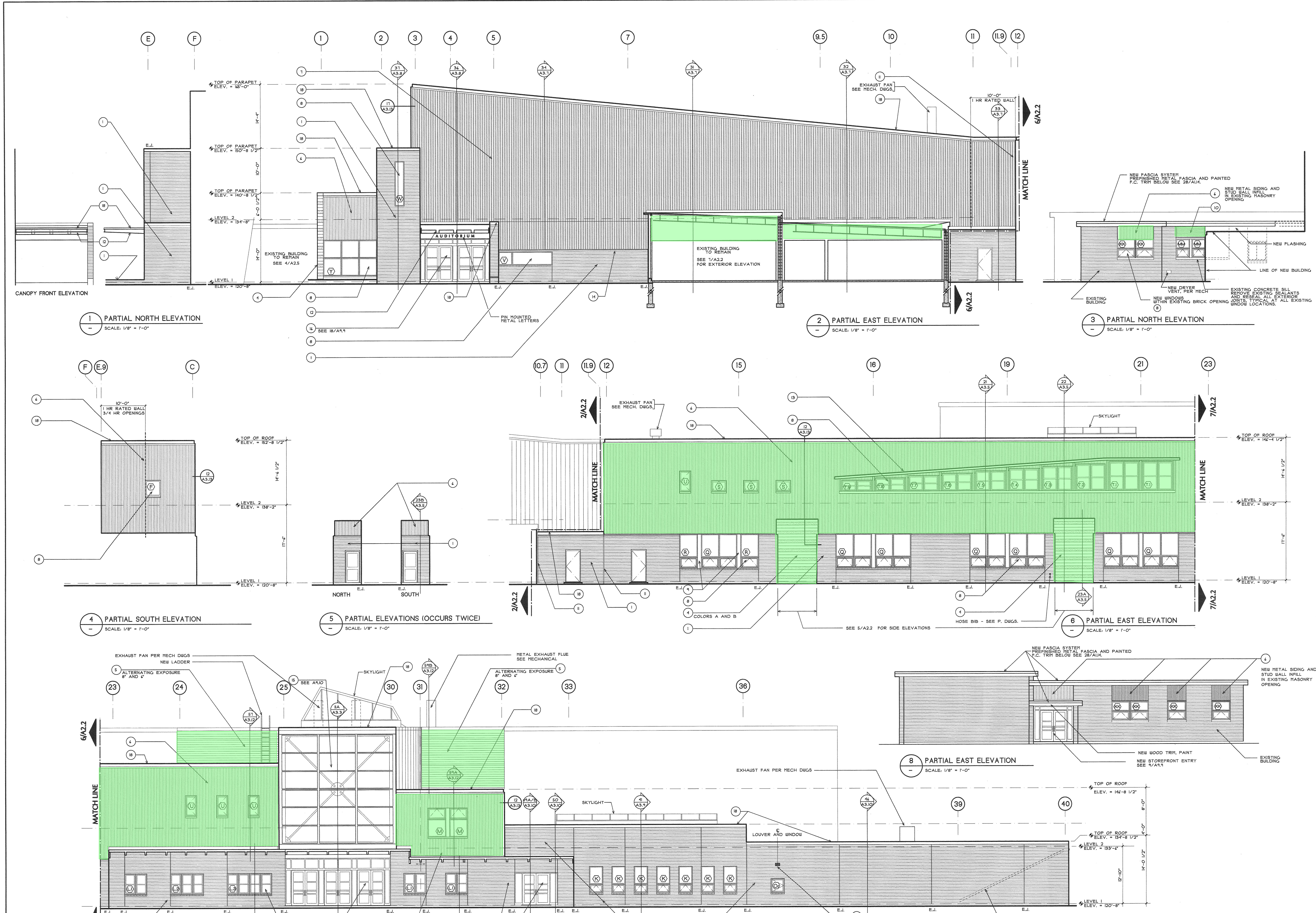
ELEMENT	QUANTITY	UNIT	UNIT RATE	COST
Alternate #1 - Added Insulation				
Insulation Ssytems				
Replacement insulation	**40,200**	SF	$5.00	$201,000
Gurts and framing for new insulation install	**40,200**	SF	$4.50	$180,900
Subtotal for Trade Work:				**$381,900**
Mark-Ups and Contingencies			31.97%	$122,082
Alternate #1 - Added Insulation Total			**ADD**	**$503,982**
Alternate #2 - Replacement Windows				
Replacement windows				
Replacement windows	**7,607**	SF	$60.00	$456,420
Replacement window blocking	**3,800**	LF	$6.00	$22,800
Replacement window sills, interior	**950**	LF	$41.00	$38,950
Caulking and sealants at new windows	**7,607**	SF	$3.50	$26,600
Subtotal for Trade Work:				**$544,770**
Mark-Ups and Contingencies			31.97%	$174,147
Alternate #2 - Replacement Windows Total			**ADD**	**$718,917**
Alternate #3 - Phasing Base Work, Recladding				
Phasing				
Base Scope Work Value	**1**	LS	$3,390,964.00	
Phasing, premium	**10.50**	%		$356,100
Subtotal for Trade Work:				**$356,100**
Mark-Ups and Contingencies			31.97%	$113,835
Alternate #3 - Phasing Base Work, Recladding Total			**ADD**	**$469,935**

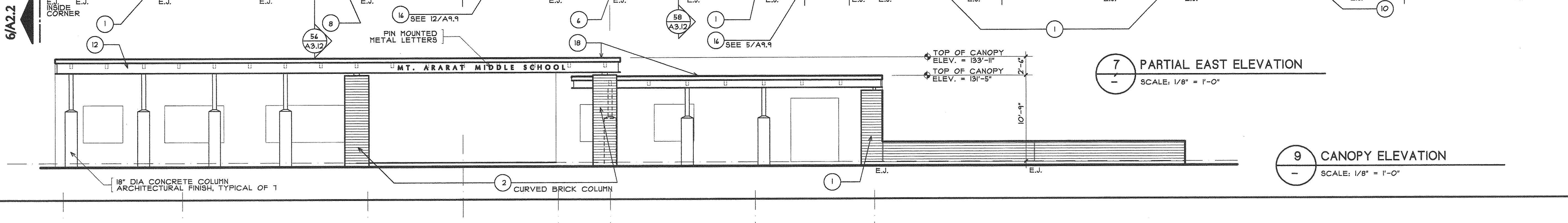
NOTES:

1. Base cost estimate assumes the bulk of the work will be completed over two summers. Some interior work or discrete window / door replacement could take place over additional school breaks (February or April vacation.)

2. Alternate #3 allows for additional mobilizations and assumes work will be phased over three years. It includes escalation costs for two additional years beyond the base cost estimate. This was figured in the event the District decides to phase the work using capital improvement funds rather than bonding a single project.

APPENDIX





BRACING - SEE STRUCTURAL DWGS.

ELEVATION KEY NOTES

1. BRICK VENEER TYPE 1
2. BRICK VENEER TYPE 2 (CURVED)
3. CMU VENEER TYPE 1
4. CMU VENEER TYPE 2 2 COLOR MIX
5. FIBER-CEMENT SIDING, PAINT
6. PREFORMED METAL SIDING TYPE 1
7. PREFORMED METAL SIDING TYPE 2
8. ALUMINUM CLAD WINDOW
9. ALUMINUM TRIM SHAPE, PREFINISHED, BY WINDOW MANUFACTURER
10. METAL LOUVER, SEE MECHANICAL
11. BUILDING EXPANSION JOINT
12. STEEL CANOPY PER STRUCTURAL, PAINT
13. METAL SUNSCREEN
14. METAL TRIM, PAINTED, BY METAL SIDING MANUFACTURER
15. ALUMINUM CURTAINWALL SYSTEM
16. ALUMINUM STOREFRONT SYSTEM
17. EXTERIOR LIGHT FIXTURE, SEE ELECTRICAL
18. METAL FASCIA SYSTEM
19. BRAKE METAL FLASHING AND TRIM, BY F.C. SIDING MANUFACTURER
20. BRICK VENEER: REUSE EXISTING BRICK FROM PREVIOUSLY DEMOLISHED AREAS

E.J. = MASONRY EXPANSION JOINT

MT. ARARAT MIDDLE SCHOOL
M.S.A.D. 75
Topsham, Maine

Revisions

KEY PLAN

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REGISTERED ARCHITECT STEPHEN J. BLATT No. 858 STATE OF MAINE

Consultants

Civil Engineer
DeLuca-Hoffman Associates

Landscape Architect
Carroll Associates

Structural Engineer
Pinkham & Greer

Mechanical Engineer
Whitney Engineering

Electrical Engineer
Bartlett Design

Kitchen Design
TJM Consulting

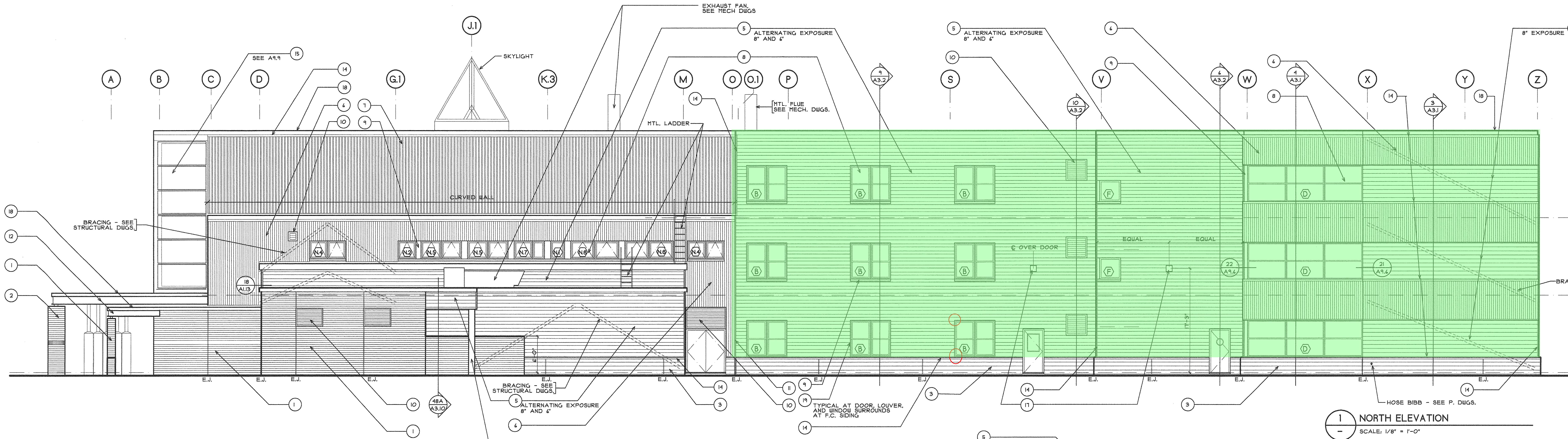
Theater Design
J&M Associates

Acoustic Engineer
Cavanaugh Tocci, Associates

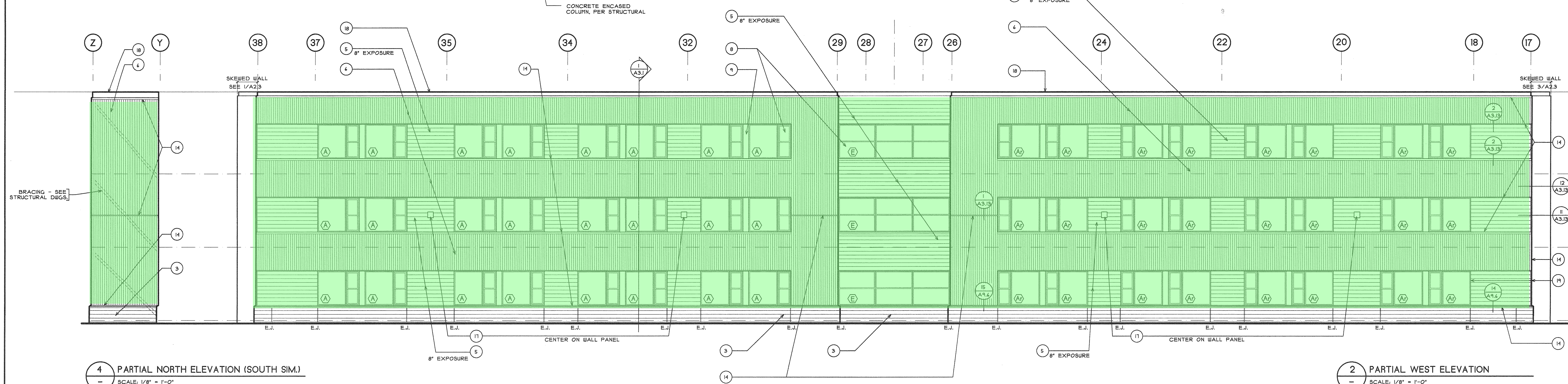
Job No.:	9705
Date:	April 20, 1999
Scale:	1/8" = 1'-0"
Drawn by:	DPB SD
Checked by:	DPB

Drawing Title:
EXTERIOR ELEVATIONS

A2.2

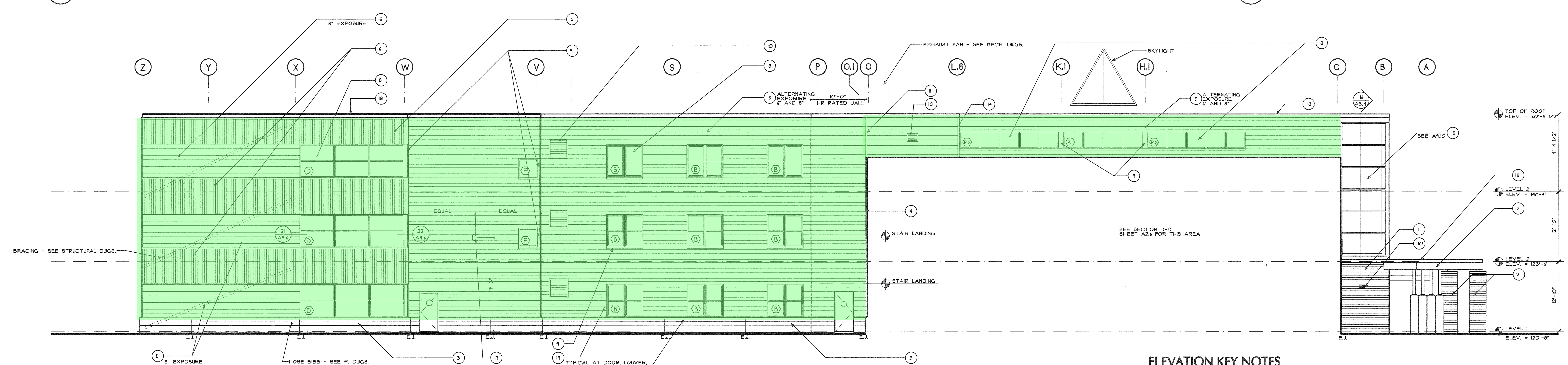


1 NORTH ELEVATION
SCALE: 1/8" = 1'-0"



4 PARTIAL NORTH ELEVATION (SOUTH SIM.)
SCALE: 1/8" = 1'-0"

2 PARTIAL WEST ELEVATION
SCALE: 1/8" = 1'-0"



3 PARTIAL SOUTH ELEVATION
SCALE: 1/8" = 1'-0"

ELEVATION KEY NOTES

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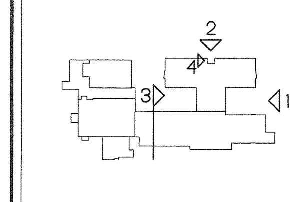

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Drawn by:	DPB SD
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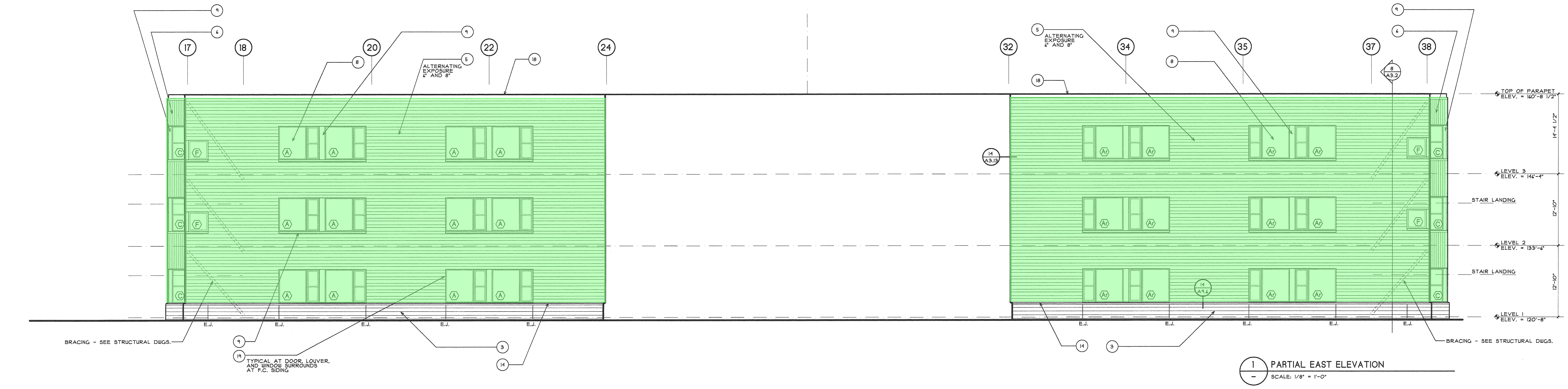
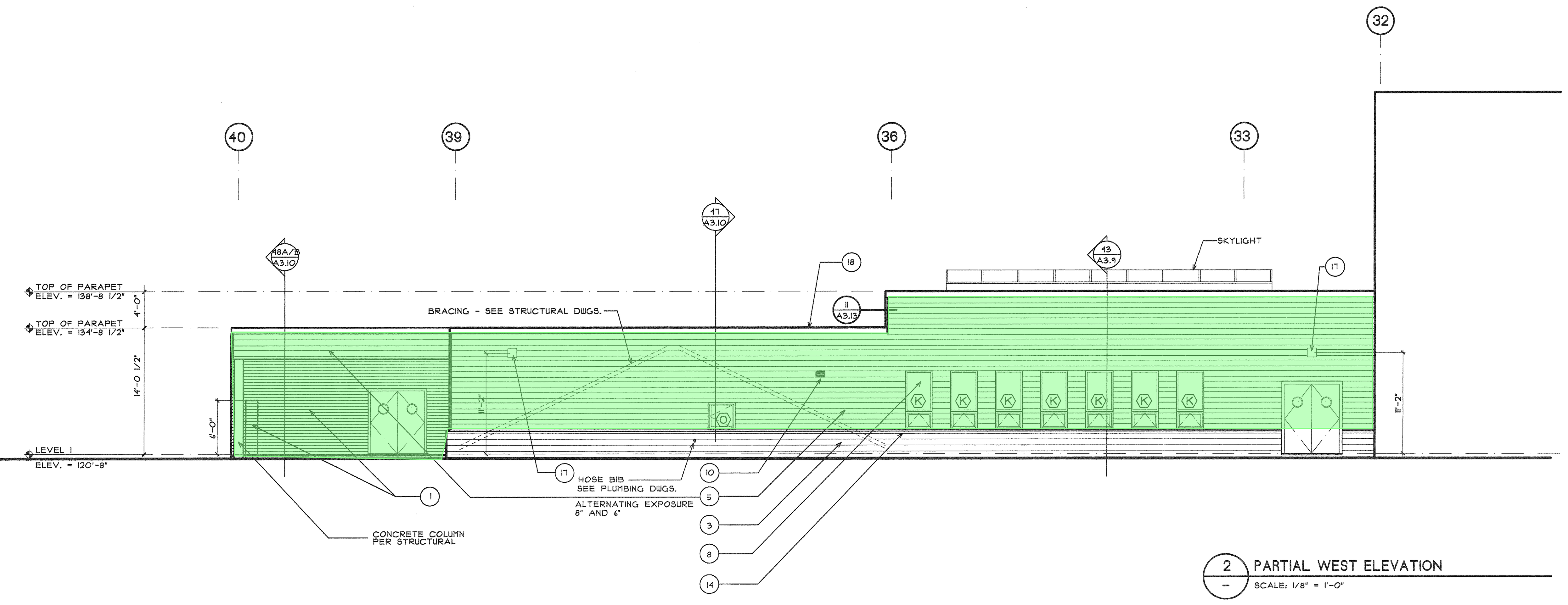
Drawing Title:
EXTERIOR ELEVATIONS

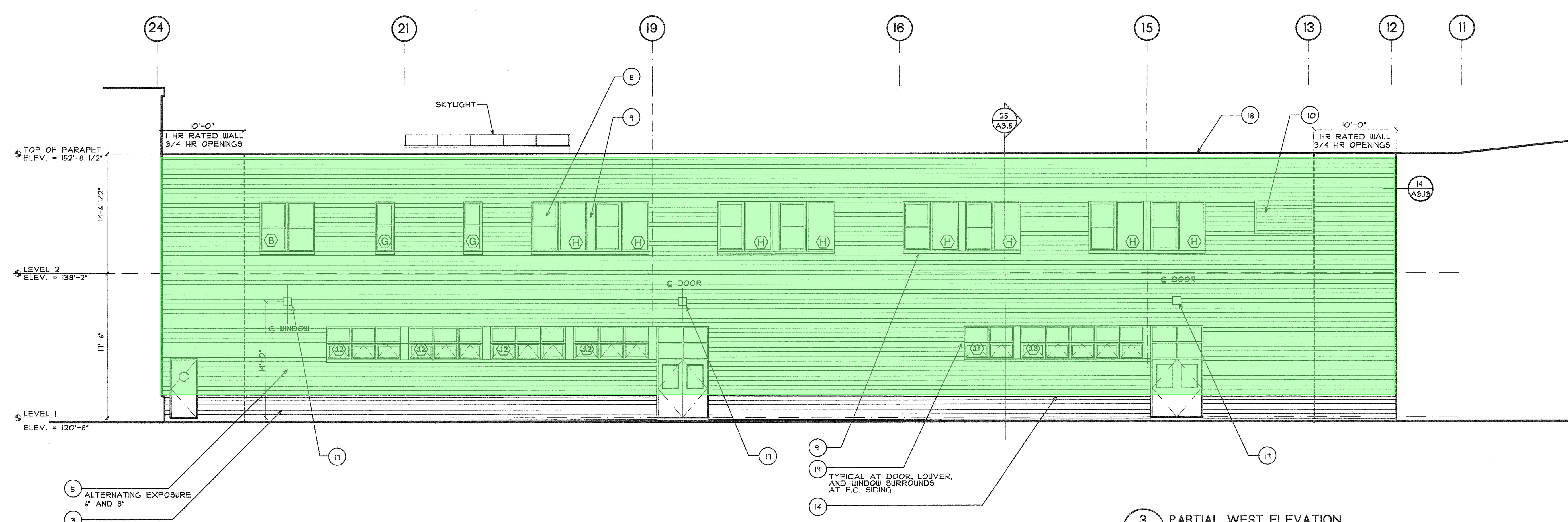
A2.3



1 PARTIAL EAST ELEVATION
SCALE: 1/8" = 1'-0"



2 PARTIAL WEST ELEVATION
SCALE: 1/8" = 1'-0"



3 PARTIAL WEST ELEVATION
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Checked by:	DPB

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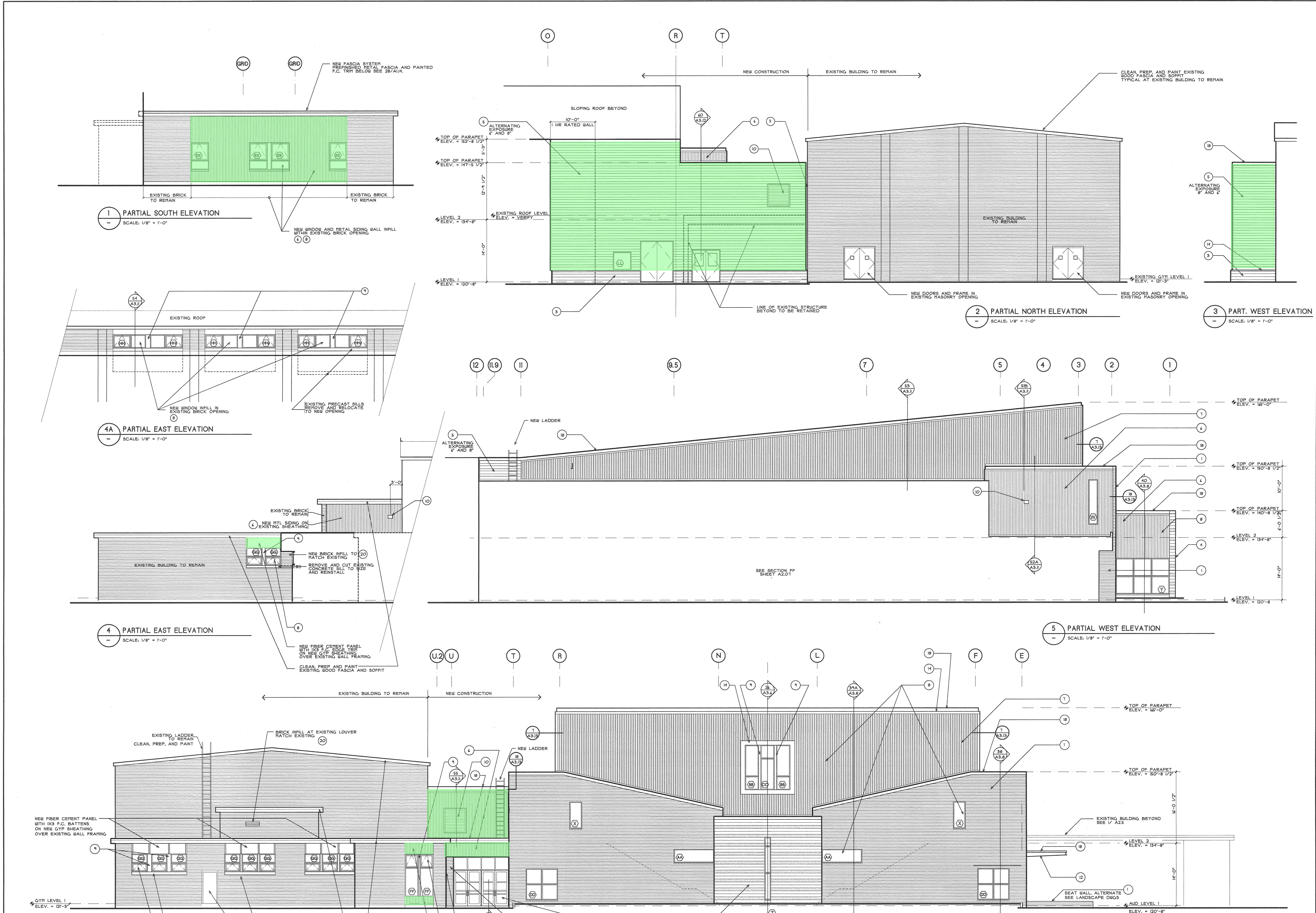
EXTERIOR ELEVATIONS

A2.4



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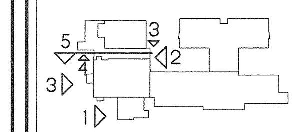

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Drawn by:	DPB SD
Checked by:	DPB

Drawing Title:
EXTERIOR ELEVATIONS

A2.5