Exterior Foam Net Zero Assembly

See ***Appendix A: Exterior Foam Net Zero Assembly Construction Details*** for plans and construction details.

Description & Overview

This assembly followed the same principles as the Exterior Mineral Wool Tier 3 Assembly in that it is a structural 2x6 wall with insulation to the exterior of structural sheathing and incorporates an airtight WRB. The difference being that this wall assembly utilized 6" of vapour closed XPS. This meant a VB membrane did not need to be installed interior of the structural framing. The XPS extends from the underside of the truss top chord overhang, down the face of the above grade walls, and down the face of the foundation as well. The wall assembly from exterior to interior contains:

- Exterior Cladding
- ¾" rainscreen strapping
- 6" Vapour closed XPS insulation
    - Connected with ¾" rainscreen strapping and screws as per manufacturers/engineering specifications
- Airtight WRB
- Structural sheathing
- 2x6 stud wall @ 24" O.C.
- ½" gypsum board
- Interior finish

The roof for drafting and details is the same as with the Tier1 2x6 Assembly. The foundation was drawn as an ICF foundation with 4" of XPS insulation installed to the exterior.

The window installed in the mock-up was the same window as the Tier 1 2x6 Assembly. It was installed to the exterior of the structural sheathing behind the XPS insulation.

The decision to select this assembly was partially influenced by the NRCAN LEEP NZE Wall Guides and the fact that this is a common method of commercial construction. Other influencing factors are that many people in the industry consider this a very sound wall from a building science perspective. Placing the majority or all (when no insulation is installed in the framing cavity) of the insulation to the exterior of the wooden structure helps keep the dew point to the exterior of the structural sheathing and WRB, minimizing the possibility of condensing moisture related damage.

Materials

Materials used for mock-up wall construction are as follows:

- **Rainscreen Strapping**
  - 1x4 SPF lumber & ¾" Plywood
  - Fasteners – 10" Simpson Strong-Tie SDWS Exterior Grade Structural Screws – installed per manufacturers guidelines
  - Bug screen
- **6" XPS Insulation – Vapour Barrier**
  - 3 – 2" layers of Owens Corning Foamular NGX Insulation
- **Airtight WRB**
  - Membrane – Soprema Sopraseal Stick VP – Self Adhering Membrane
  - Sill Pan Flashing – Soprema Sopraseal Stick Flashpro
- **Structural Wall**
  - 3/8" plywood structural sheathing
  - 2x6 SPF lumber
- **Assembly Effective Thermal Performance**
  - With a R-22 fibreglass batt insulated framing cavity
    - RSI-8.21 or R-46.62
  - With an uninsulated framing cavity
    - RSI-5.76 or R-32.70

Construction

Of all the assemblies selected, GBTAC staff found this was the most difficult one to construct. Framing of the structural wall was very straightforward as it is the same process as with the Tier 1 2x6 Assembly. The stud cavity was left uninsulated for the physical mockup but could have been insulated as the amount of exterior XPS insulation utilized maintained an acceptable ratio of insulation to the interior of the VB in Alberta climates as required by the National Building Code - 2023 Alberta Edition.

The air control layer for this assembly was the Soprema self-adhered vapour permeable membrane. Maintaining a continuous air control layer was achieved with this membrane along with the following materials and methods:

- Installation of a strip of WRB on top of the cap plate of the wall at the truss connection, draping to the exterior and interior. Taping the ceiling VB to this membrane
- Expanding spray foam at electrical and mechanical penetrations.
- Adhering WRB to window frame on the sides and the top.
- Foam backer rod and caulking to connect the window frame sill to the WRB at the sill.

Using a self-adhering membrane eliminated needing to staple or nail the membrane in place or tape the joints of the WRB. This made the installation of the air control layer slightly faster compared to the Tier 3 assembly.

The most difficult process of constructing the physical mock-up was installation of the 6" of XPS, the rainscreen strapping, and ensuring proper through flashing installation. GBTAC utilized both metal and WRB membrane through wall flashing. When using metal for the through wall flashing, custom pieces had to be made. The length of the screws resulted in more screws wandering out of line while installing them, missing the structural framing member they were intended to hit. One key consideration is that removing a misaligned screw can result in an air leakage path through the WRB and XPS insulation. Misaligned screw penetrations can be found and sealed on the interior side of the structural sheathing.

Custom cap flashing needed to be constructed to finish the top of the XPS insulation at the sill of window. A custom engineered wood window trim return was made for the exterior trim of the window.

Assembly Advantages

- Wrapping the exterior of the wall assembly with insulation reduces the amount of thermal bridging through the assembly.
- Using a vapour closed insulation allowed for the elimination of a VB membrane on the interior of the wall assembly. This saved time on detailing junctions and penetrations.
- Other rigid insulation types could be used if needed such as mineral wool or EPS.
- The structural framing is very similar to how most homes are currently being built (Tier 1 2x6 Assembly).
- Utilizing the WRB as the air control layer allowed for less challenging detailing, and a reduced chance of errors at junctions and penetrations compared to locating the air control layer to the interior of the assembly.
- Attaching the insulation with ¾" strapping material created a rainscreen for the assembly.
- This assembly is widely considered a safe assembly from a building science perspective by many industry professionals.
- WRB membrane can be utilized as through flashing, helping to reduce thermal bridging that would be caused by using metal through flashing.
- This assembly had the highest calculated effective thermal resistance across all of the selected assemblies for this project when the 2x6 wall cavity was insulated. It had the highest calculated effective thermal resistance of the new build assemblies regardless of whether the 2x6 cavity was insulated or not.
- Any punctures of the air control layer due to misaligned screws from attaching the strapping could be seen and sealed from the inside of the assembly.

Assembly Disadvantages

- High quality membranes, and XPS insulation added a significant cost.
- The self-adhered membranes could be difficult to work with. GBTAC found that a minimum of two installers made installing the membrane go smoothly.
- Once the self-adhered membrane was applied it was very difficult to remove or adjust if needed.
- Some materials could not be found at a common hardware or building supply store and needed to be custom ordered.
- Structural fasteners required for rainscreen and insulation installation were very costly.
- Not all cladding systems can be accommodated with this exact assembly. For example, if stucco was to be installed, there would need to be a sheathing layer to the exterior of the rainscreen or other accommodations made.
- Considerable forethought, planning and organization was required, as missed steps caused considerable delays and extra work.
- There may be difficulty finding trades that can or are willing to install this type of assembly in a residential setting.

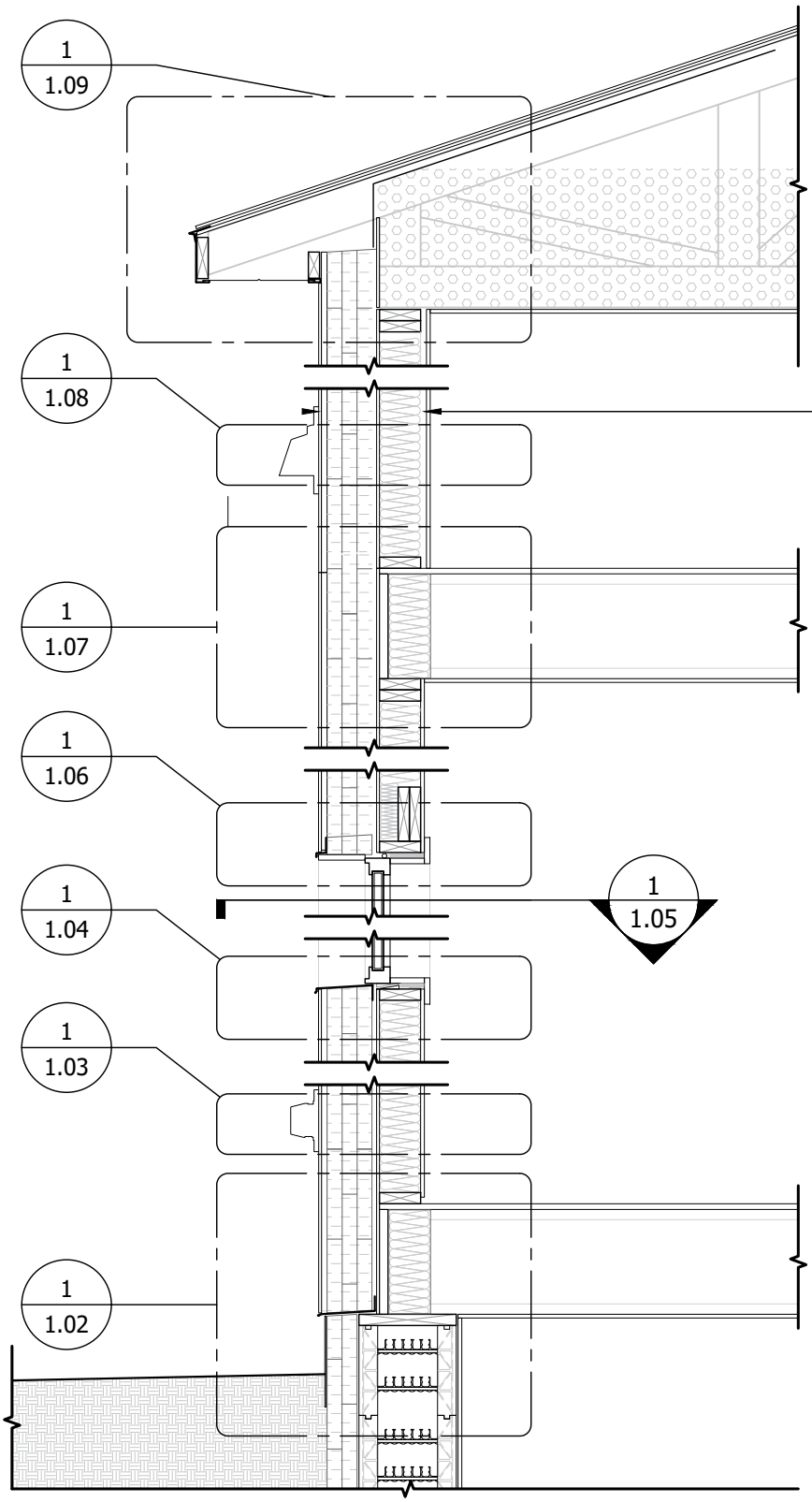
Cost Analysis

Upon completing a cost analysis of this assembly compared to the Tier 1 2x6 Assembly, the cost to construct this assembly for the model home came out to roughly 160% more.

Of the new build assemblies that were selected, this assembly was the costliest compared to the Tier 1 2x6 Assembly.

Appendix A:

Exterior Foam Net Zero Assembly Construction Details



EXT. FOAM NZ ASSEMBLY

EFFECTIVE RSI = 8.21; R-VALUE = 46.62

- EXTERIOR CLADDING
- ¾" RAINSCREEN STRAPPING
- 6" XPS INSULATION - VAPOUR BARRIER
- AIRTIGHT WATER RESISTANT BARRIER, SHEET APPLIED MEMBRANE, VAPOUR IMPERMEABLE
- ⅜" EXTERIOR SHEATHING
- 2X6 WOOD STUDS w/ FIBREGLASS BATT INSULATION
- ½" GYPSUM BOARD
- INTERIOR FINISHING

NOTES

- EXT. = EXTERIOR
- NZ = NET ZERO

1 ENVELOPE SECTION

1/2" = 1'-0"

[redacted]

1301-16 AVENUE NW CALGARY AB, T2M 0L4

Drawing Title

EXT. FOAM NZ

Project Number	2024-009	Project Name	HIGH PERFORMANCE WALL ASSEMBLY				
Drawn by	LL	Checked by	BH, NM	Date	2025-04-30	Scale	1/2" = 1'- 0"
Project Address	N/A						
Issued For	ALBERTA ECOTRUST FOUNDATION						

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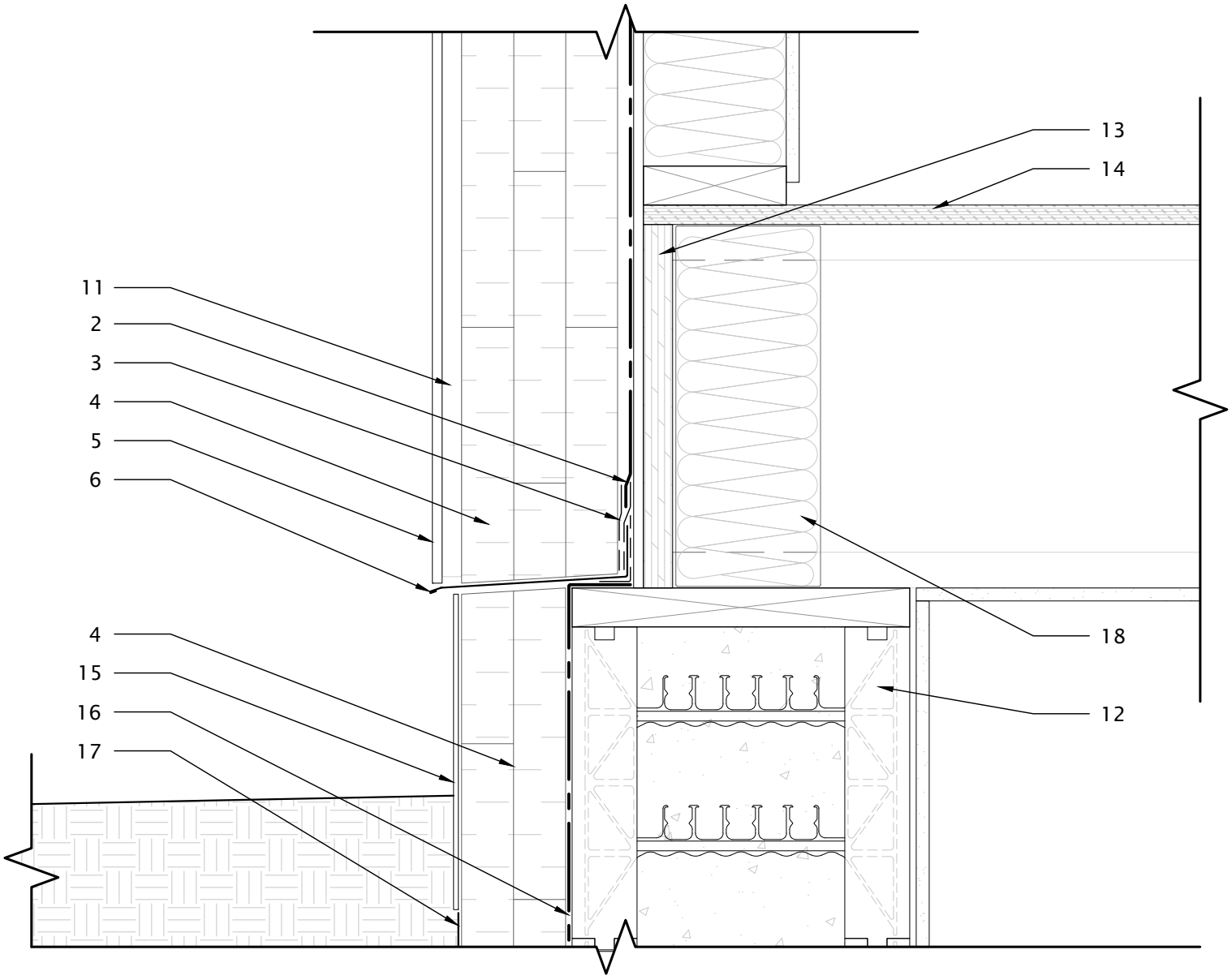

1 FOUNDATION TRANSITION SECTION DETAIL

2" = 1'-0"

1 VAPOUR IMPERMEABLE BARRIER
2 AIRTIGHT WATER RESISTANT BARRIER
3 SELF ADHERED MEMBRANE
4 XPS INSULATED BOARD
5 CLADDING
6 FLASHING
7 SEALANT
8 NON-HARDENING SEALANT
9 COMPRESSED FOAM ROD
10 EXPANDING POLYURETHANE SPRAY FOAM
11 RAINSCREEN STRAPPING
12 ICF BLOCK
13 RIM BOARD
14 SUBFLOOR
15 PARGING
16 DAMPPROOFING
17 DIMPLE WRAP
18 BATT INSULATION

[redacted]
1301-16 AVENUE NW CALGARY AB, T2M 0L4

Drawing Title

EXT. FOAM NZ

Project Number	2024-009	Project Name	HIGH PERFORMANCE WALL ASSEMBLY				
Drawn by	LL	Checked by	BH, NM	Date	2025-04-30	Scale	2" = 1'- 0"
Project Address	N/A						
Issued For	ALBERTA ECOTRUST FOUNDATION						

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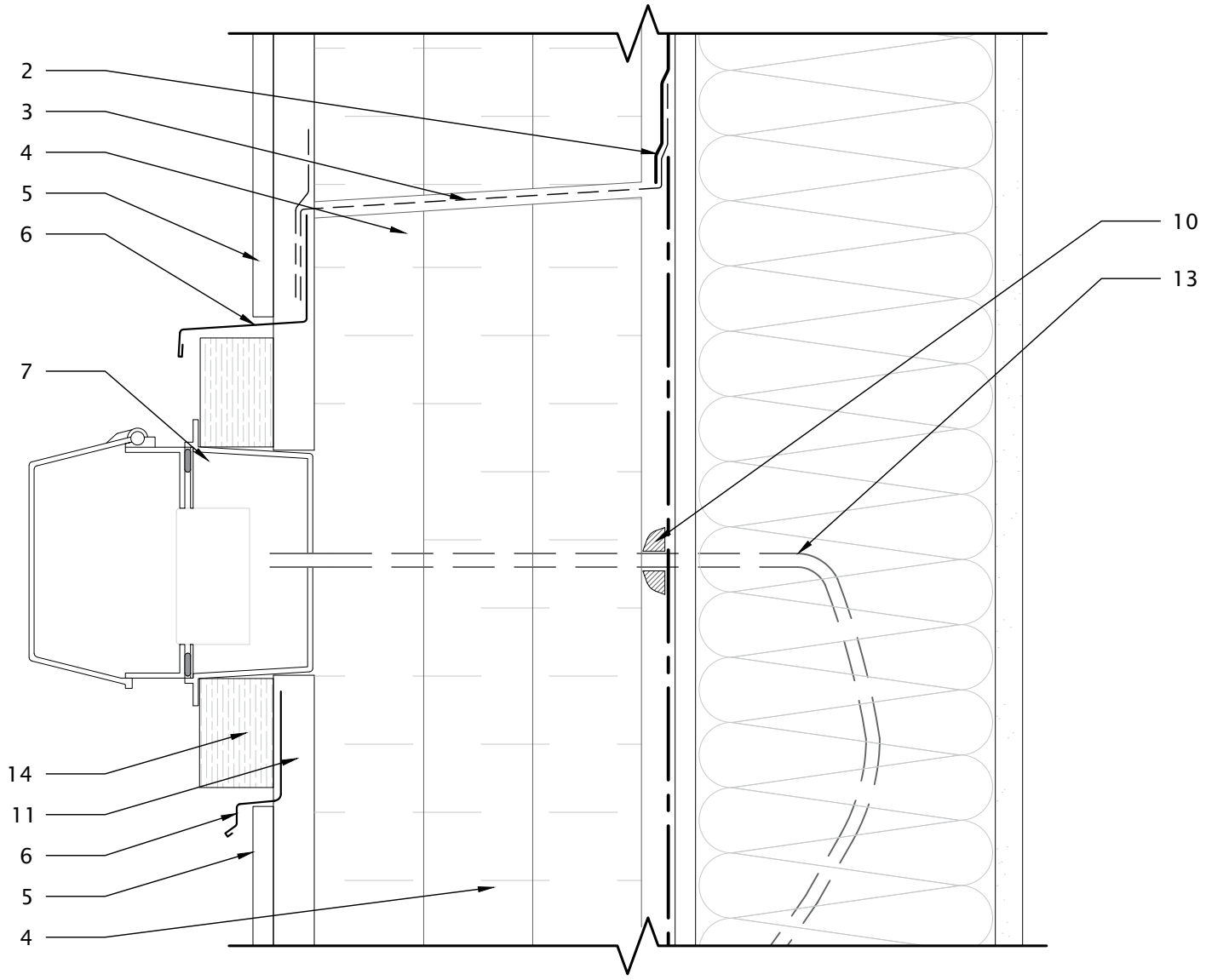

1 RECEPTACLE SECTION DETAIL

4" = 1'-0"

1 VAPOUR BARRIER
2 AIRTIGHT WATER RESISTANT BARRIER
3 SELF ADHERED MEMBRANE
4 XPS INSULATED BOARD
5 CLADDING
6 FLASHING
7 SEALANT
8 NON-HARDENING SEALANT
9 COMPRESSED FOAM ROD
10 EXPANDING POLYURETHANE SPRAY FOAM
11 RAINSCREEN STRAPPING
12 IN USE RECEPTACLE ASSEMBLY
13 ELECTRICAL WIRE
14 BATTEN

[redacted]
1301-16 AVENUE NW CALGARY AB, T2M 0L4

Drawing Title

EXT. FOAM NZ

Project Number	2024-009	Project Name	HIGH PERFORMANCE WALL ASSEMBLY				
Drawn by	LL	Checked by	BH, NM	Date	2025-04-30	Scale	4" = 1'- 0"
Project Address	N/A						
Issued For	ALBERTA ECOTRUST FOUNDATION						

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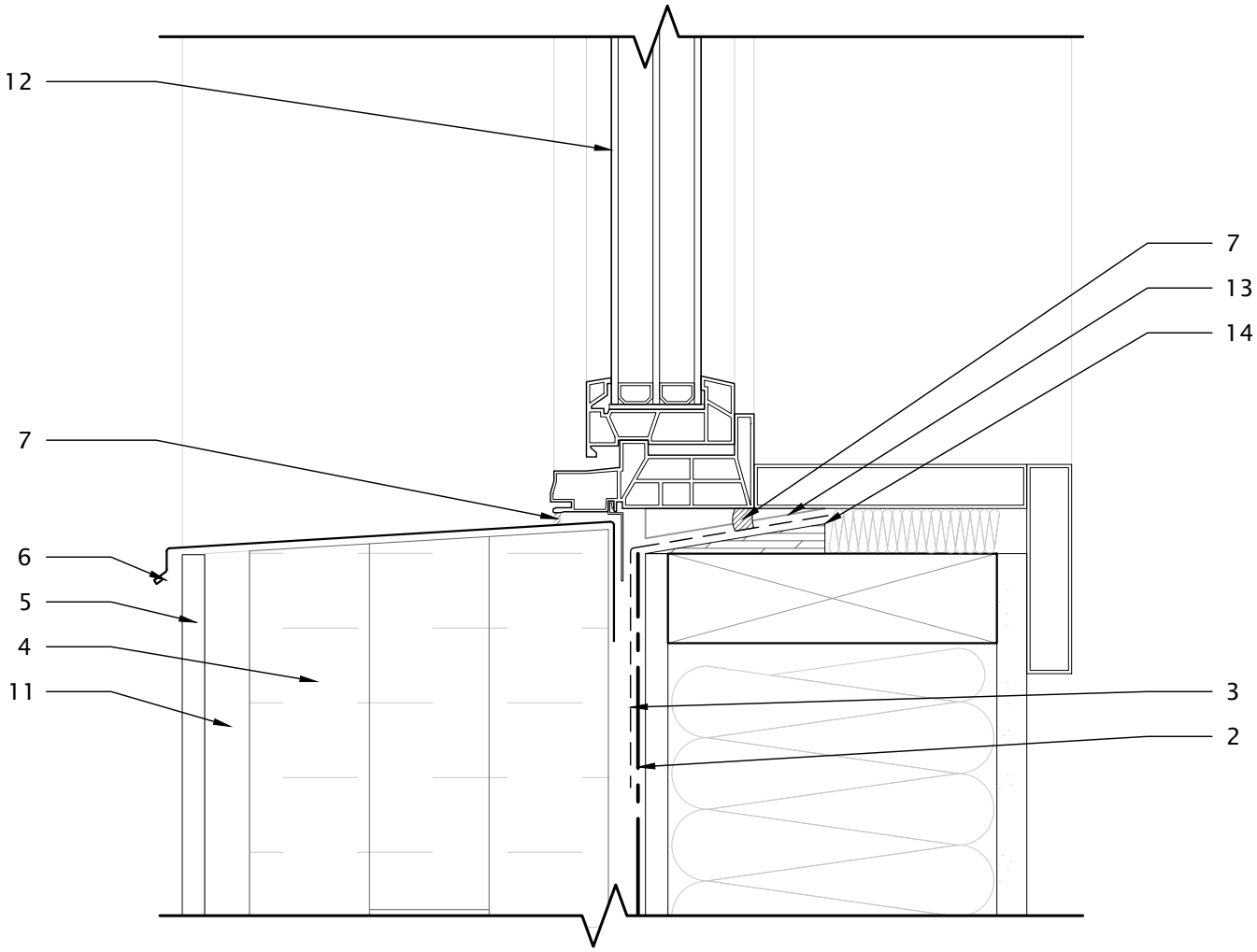

1 WINDOW SILL SECTION DETAIL

4" = 1'-0"

1 VAPOUR BARRIER
2 AIRTIGHT WATER RESISTANT BARRIER
3 SELF ADHERED MEMBRANE
4 XPS INSULATED BOARD
5 CLADDING
6 FLASHING
7 SEALANT
8 NON-HARDENING SEALANT
9 COMPRESSED FOAM ROD
10 EXPANDING POLYURETHANE SPRAY FOAM
11 RAINSCREEN STRAPPING
12 GLAZING UNIT
13 WINDOW SUPPORT SHIM
14 BEVELED SLIDING SLOPED DAM

[redacted]
1301-16 AVENUE NW CALGARY AB, T2M 0L4

Drawing Title

EXT. FOAM NZ

Project Number	2024-009	Project Name	HIGH PERFORMANCE WALL ASSEMBLY				
Drawn by	LL	Checked by	BH, NM	Date	2025-04-30	Scale	4" = 1'- 0"
Project Address	N/A						
Issued For	ALBERTA ECOTRUST FOUNDATION						

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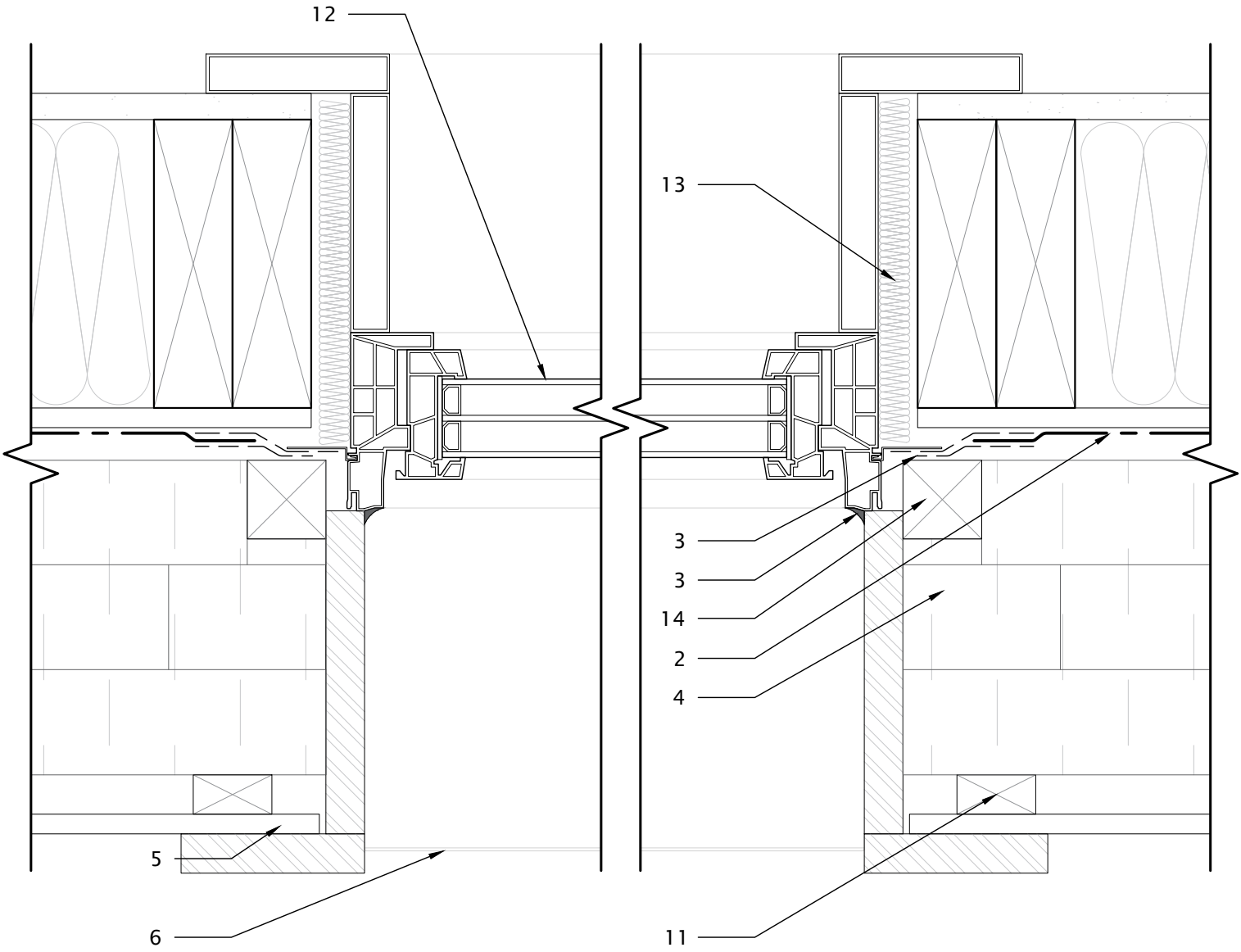

1 WINDOW JAMB PLAN DETAIL

4" = 1'-0"

1 VAPOUR BARRIER
2 AIRTIGHT WATER RESISTANT BARRIER
3 SELF ADHERED MEMBRANE
4 XPS INSULATED BOARD
5 CLADDING
6 FLASHING
7 SEALANT
8 NON-HARDENING SEALANT
9 COMPRESSED FOAM ROD
10 EXPANDING POLYURETHANE SPRAY FOAM
11 RAINSCREEN STRAPPING
12 GLAZING UNIT
13 FIBREGLASSBATT INSULATION
14 2X2 BLOCK
15 BATTEN

[redacted]
1301-16 AVENUE NW CALGARY AB, T2M 0L4

Drawing Title

EXT. FOAM NZ

Project Number	2024-009	Project Name	HIGH PERFORMANCE WALL ASSEMBLY				
Drawn by	LL	Checked by	BH, NM	Date	2025-04-30	Scale	4" = 1'- 0"
Project Address	N/A						
Issued For	ALBERTA ECOTRUST FOUNDATION						

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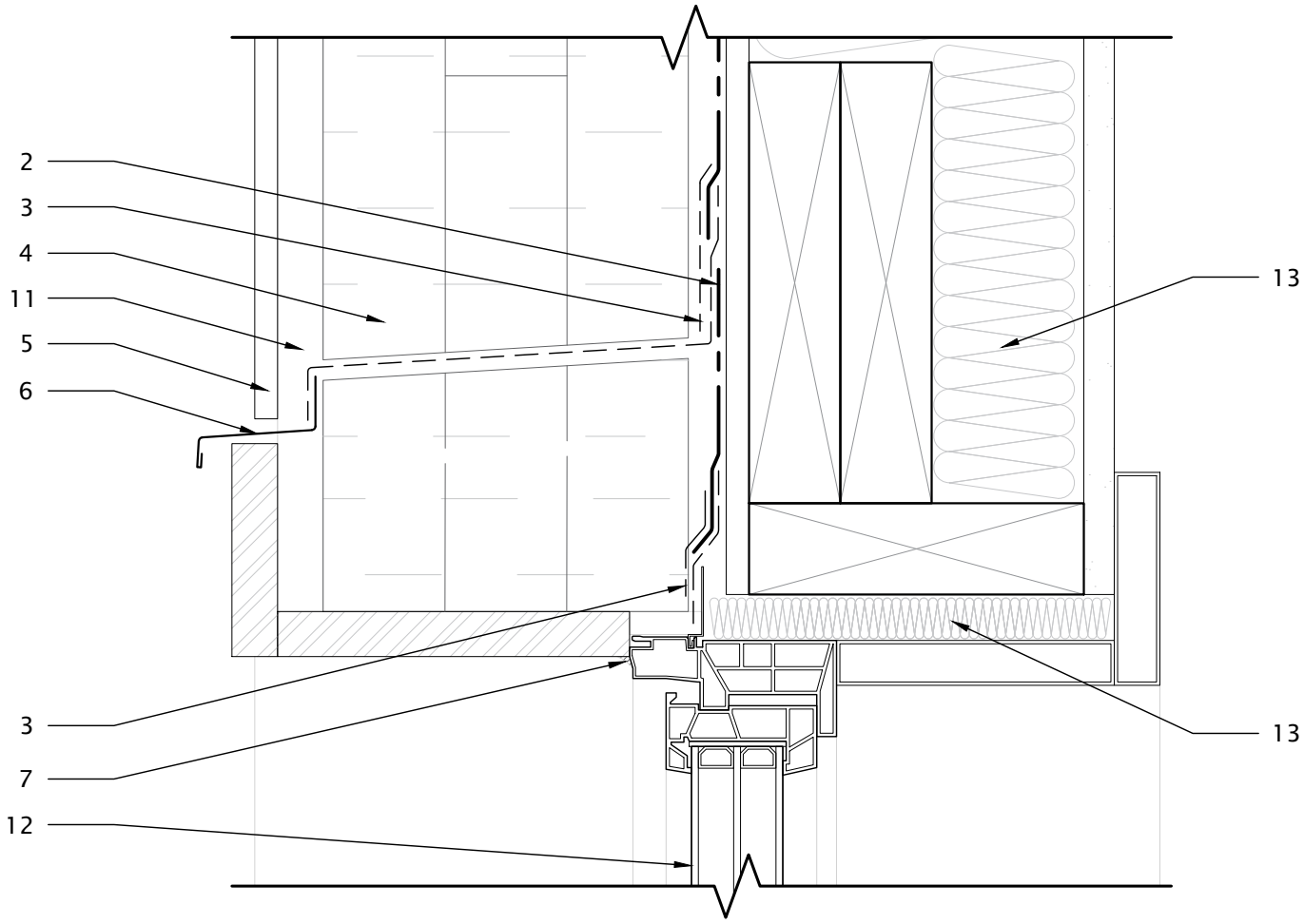

1 WINDOW HEAD SECTION DETAIL

4" = 1'-0"

1 VAPOUR BARRIER
2 AIRTIGHT WATER RESISTANT BARRIER
3 SELF ADHERED MEMBRANE
4 XPS INSULATED BOARD
5 CLADDING
6 FLASHING
7 SEALANT
8 NON-HARDENING SEALANT
9 COMPRESSED FOAM ROD
10 EXPANDING POLYURETHANE SPRAY FOAM
11 RAINSCREEN STRAPPING
12 GLAZING UNIT
13 FIBREGLASS BATT INSULATION

[redacted]
1301-16 AVENUE NW CALGARY AB, T2M 0L4

Drawing Title

EXT. FOAM NZ

Project Number	2024-009	Project Name	HIGH PERFORMANCE WALL ASSEMBLY				
Drawn by	LL	Checked by	BH, NM	Date	2025-04-30	Scale	4" = 1'- 0"
Project Address	N/A						
Issued For	ALBERTA ECOTRUST FOUNDATION						

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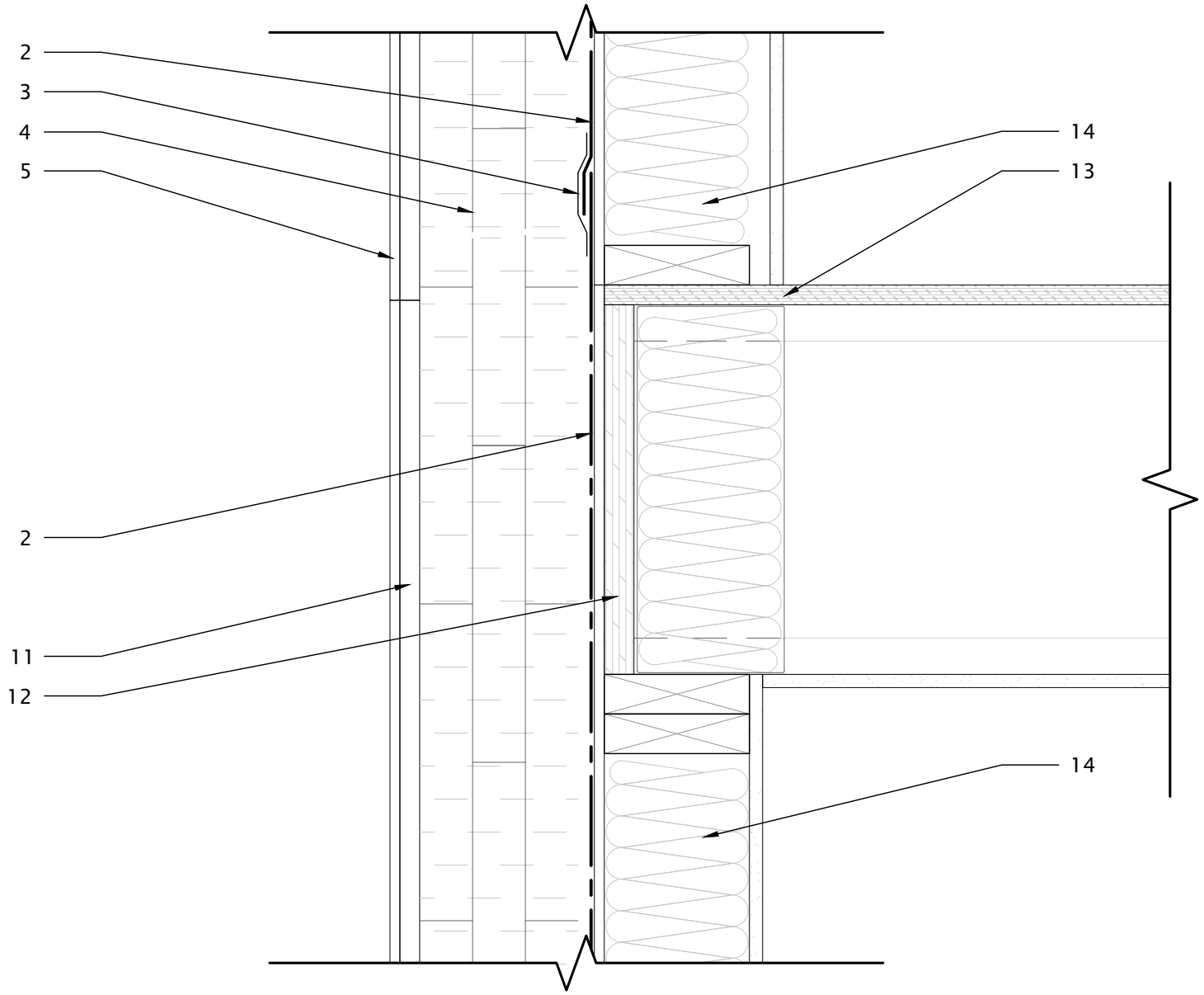

1 FLOOR TO FLOOR TRANSITION SETION DETAIL

2" = 1'-0"

1 VAPOUR BARRIER
2 AIRTIGHT WATER RESISTANT BARRIER
3 SELF ADHERED MEMBRANE
4 XPS INSULATED BOARD
5 CLADDING
6 FLASHING
7 SEALANT
8 NON-HARDENING SEALANT
9 COMPRESSED FOAM ROD
10 EXPANDING POLYURETHANE SPRAY FOAM
11 RAINSCREEN STRAPPING
12 RIM BOARD
13 SUBFLOOR
14 FIBREGLASS BATT INSULATION

[redacted]
1301-16 AVENUE NW CALGARY AB, T2M 0L4

Drawing Title

EXT. FOAM NZ

Project Number	2024-009	Project Name	HIGH PERFORMANCE WALL ASSEMBLY				
Drawn by	LL	Checked by	BH, NM	Date	2025-04-30	Scale	2" = 1'- 0"
Project Address	N/A						
Issued For	ALBERTA ECOTRUST FOUNDATION						

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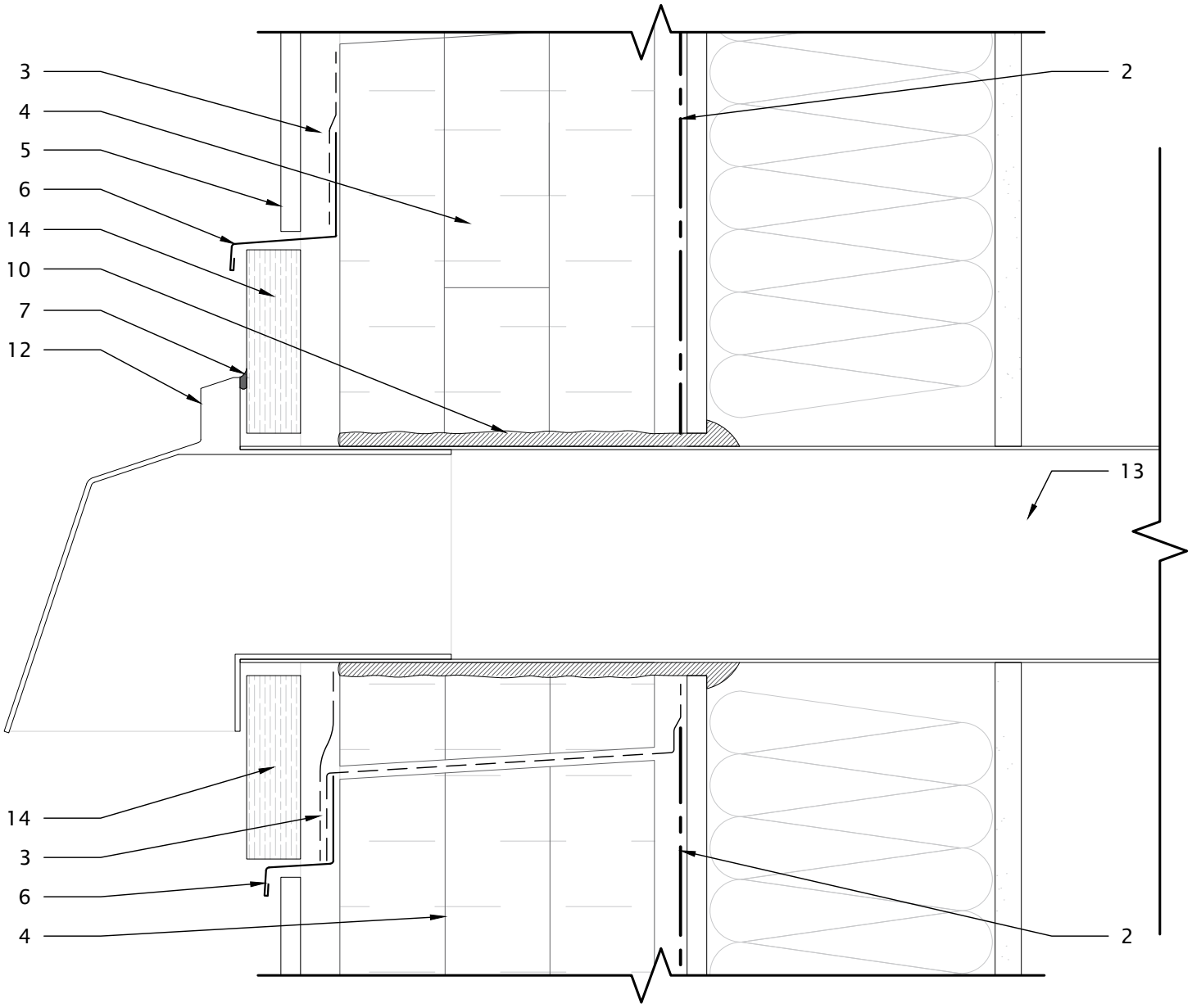

1 DUCT OPENING SECTION DETAIL

4" = 1'-0"

1 VAPOUR BARRIER
2 AIRTIGHT WATER RESISTANT BARRIER
3 SELF ADHERED MEMBRANE
4 XPS INSULATED BOARD
5 CLADDING
6 FLASHING
7 SEALANT
8 NON-HARDENING SEALANT
9 COMPRESSED FOAM ROD
10 EXPANDING POLYURETHANE SPRAY FOAM
11 RAINSCREEN STRAPPING
12 DUCT HOOD
13 DUCT
14 BATTEN

[redacted]
1301-16 AVENUE NW CALGARY AB, T2M 0L4

Drawing Title

EXT. FOAM NZ

Project Number 2024-009
Project Name HIGH PERFORMANCE WALL ASSEMBLY
Drawn by LL
Checked by BH, NM
Date 2025-04-30
Scale 4" = 1'- 0"
Project Address N/A
Issued For ALBERTA ECOTRUST FOUNDATION

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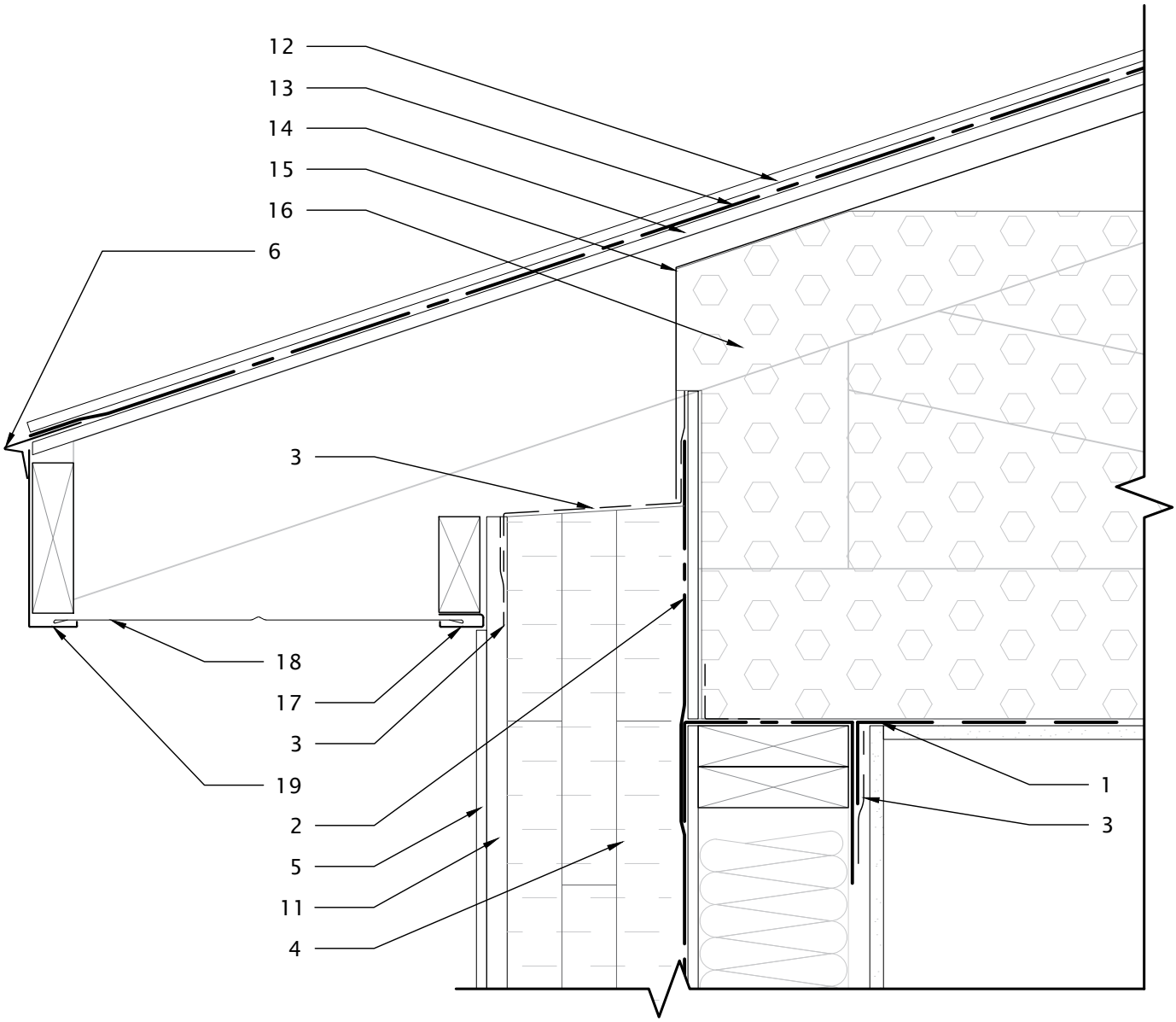

1 WALL TO ROOF TRANSITION SECTION DETAIL

2" = 1'-0"

1 VAPOUR BARRIER
2 AIRTIGHT WATER RESISTANT BARRIER
3 SELF ADHERED MEMBRANE
4 XPS INSULATED BOARD
5 CLADDING
6 FLASHING
7 SEALANT
8 NON-HARDENING SEALANT
9 COMPRESSED FOAM ROD
10 EXPANDING POLYURETHANE SPRAY FOAM
11 RAINSCREEN STRAPPING
12 ROOFING SHINGLE
13 ROOFING UNDERLAYMENT MEMBRANE
14 ROOFING SHEATHING
15 INSULATION STOP
16 BLOWN INSULATION
17 J-CHANNEL
18 SOFFIT
19 FASCIA

[redacted]

1301-16 AVENUE NW CALGARY AB, T2M 0L4

Drawing Title

EXT. FOAM NZ

Project Number	2024-009	Project Name	HIGH PERFORMANCE WALL ASSEMBLY				
Drawn by	LL	Checked by	BH, NM	Date	2025-04-30	Scale	2" = 1'- 0"
Project Address	N/A						
Issued For	ALBERTA ECOTRUST FOUNDATION						

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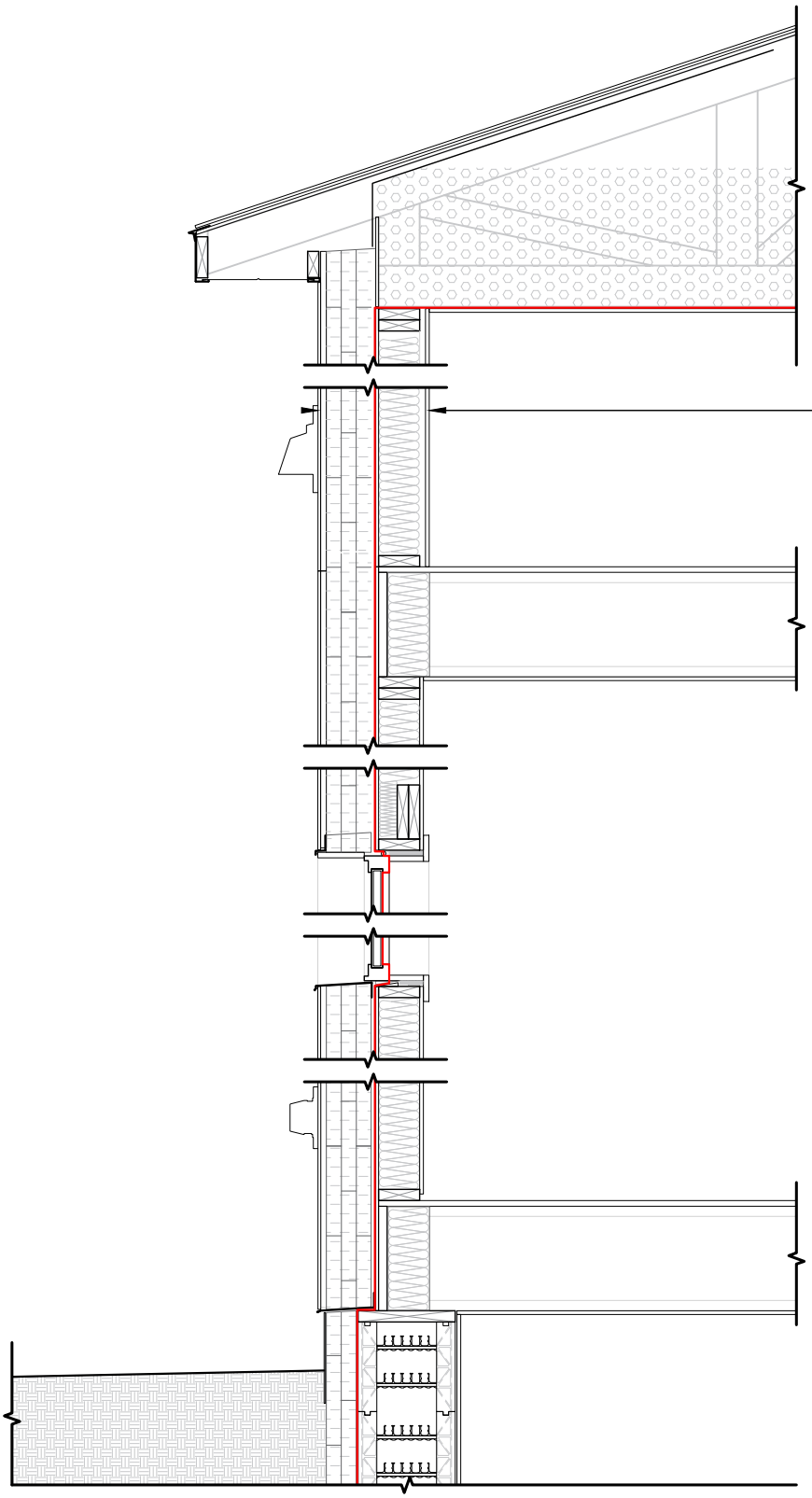

EXT. FOAM NZ ASSEMBLY

EFFECTIVE RSI = 8.21; R-VALUE = 46.62

- EXTERIOR CLADDING
- ¾" RAINSCREEN STRAPPING
- 6" XPS INSULATION - VAPOUR BARRIER
- AIRTIGHT WATER RESISTANT BARRIER, SHEET APPLIED MEMBRANE, VAPOUR IMPERMEABLE
- ⅜" EXTERIOR SHEATHING
- 2X6 WOOD STUDS w/ FIBREGLASS BATT INSULATION
- ½" GYPSUM BOARD
- INTERIOR FINISHING

LEGEND

AIR BARRIER

1 AIR BARRIER CONTINUITY

1/2" = 1'-0"

[redacted]

1301-16 AVENUE NW CALGARY AB, T2M 0L4

Drawing Title

EXT. FOAM NZ

Project Number	2024-009	Project Name	HIGH PERFORMANCE WALL ASSEMBLY				
Drawn by	LL	Checked by	BH, NM	Date	2025-04-30	Scale	1/2" = 1'- 0"
Project Address	N/A						
Issued For	ALBERTA ECOTRUST FOUNDATION						

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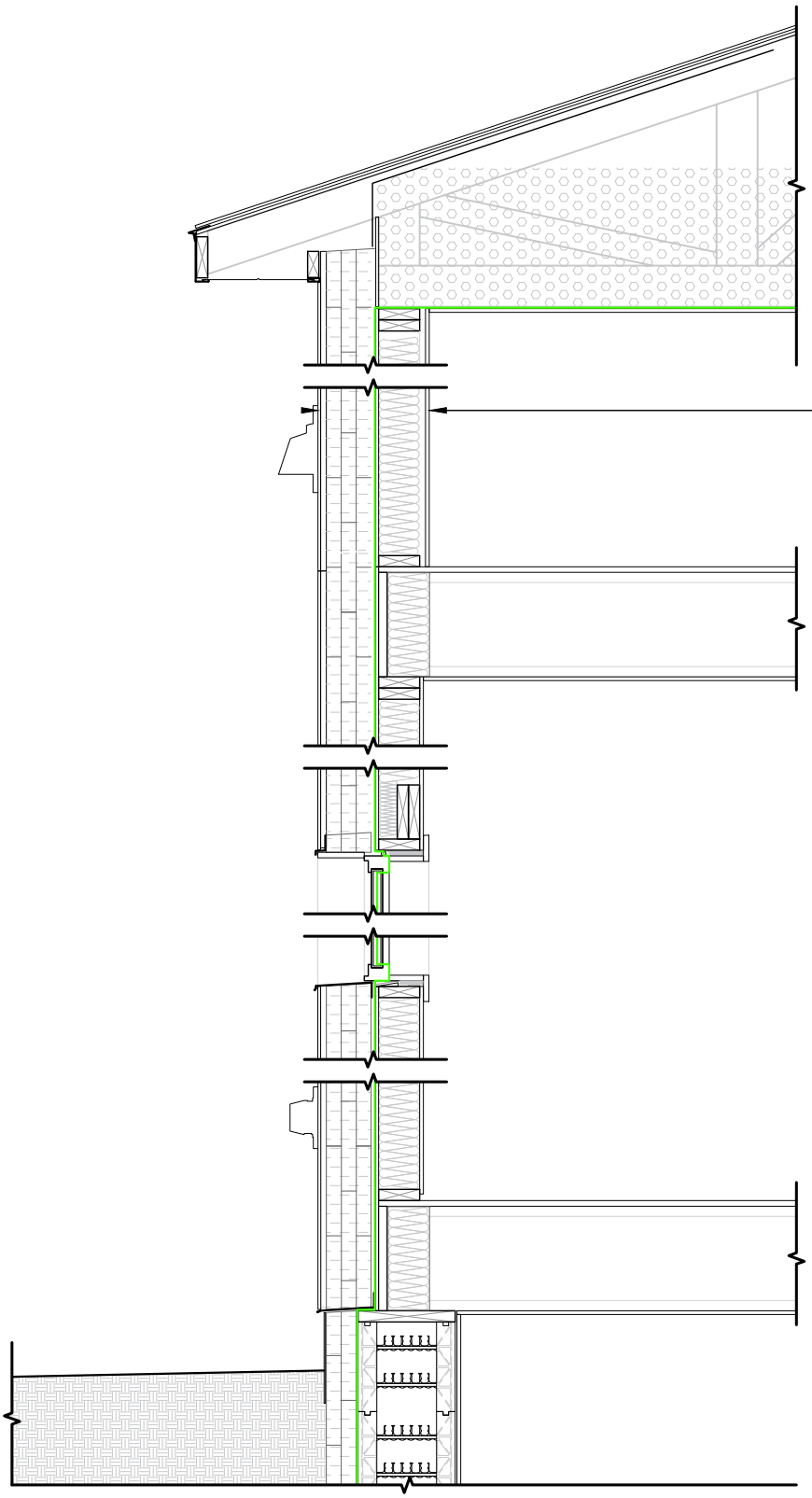

EXT. FOAM NZ ASSEMBLY

EFFECTIVE RSI = 8.21; R-VALUE = 46.62

- EXTERIOR CLADDING
- ¾" RAINSCREEN STRAPPING
- 6" XPS INSULATION - VAPOUR BARRIER
- AIRTIGHT WATER RESISTANT BARRIER, SHEET APPLIED MEMBRANE, VAPOUR IMPERMEABLE
- ⅜" EXTERIOR SHEATHING
- 2X6 WOOD STUDS w/ FIBREGLASS BATT INSULATION
- ½" GYPSUM BOARD
- INTERIOR FINISHING

LEGEND

VAPOUR BARRIER

1 VAPOUR BARRIER CONTINUITY

1/2" = 1'-0"

[redacted]

1301-16 AVENUE NW CALGARY AB, T2M 0L4

Drawing Title

EXT. FOAM NZ

Project Number	2024-009	Project Name	HIGH PERFORMANCE WALL ASSEMBLY				
Drawn by	LL	Checked by	BH, NM	Date	2025-04-30	Scale	1/2" = 1'- 0"
Project Address	N/A						
Issued For	ALBERTA ECOTRUST FOUNDATION						

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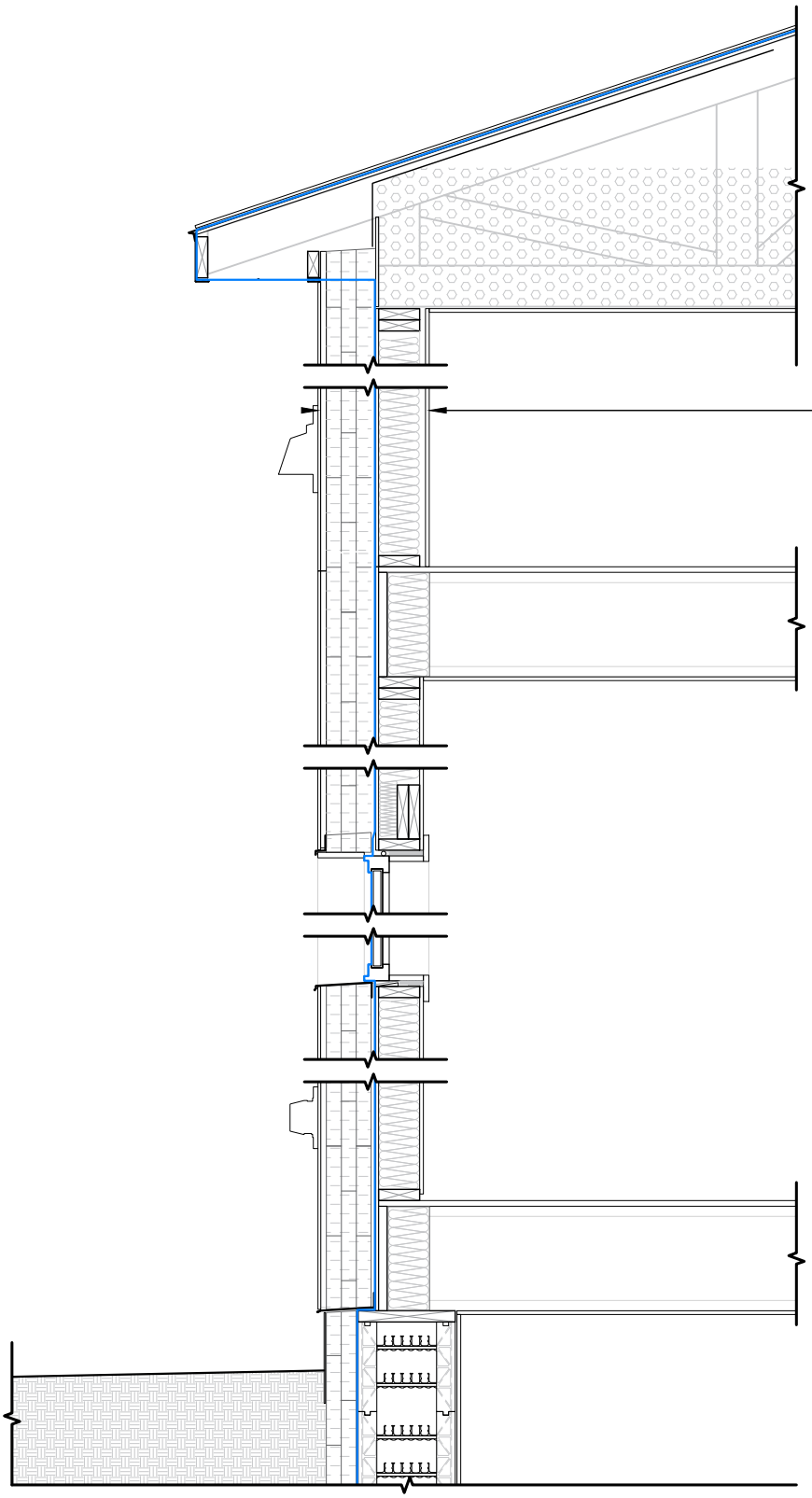


EXT. FOAM NZ ASSEMBLY

EFFECTIVE RSI = 8.21; R-VALUE = 46.62

- EXTERIOR CLADDING
- ¾" RAINSCREEN STRAPPING
- 6" XPS INSULATION - VAPOUR BARRIER
- AIRTIGHT WATER RESISTANT BARRIER, SHEET APPLIED MEMBRANE, VAPOUR IMPERMEABLE
- ⅜" EXTERIOR SHEATHING
- 2X6 WOOD STUDS w/ FIBREGLASS BATT INSULATION
- ½" GYPSUM BOARD
- INTERIOR FINISHING

LEGEND

WATER BARRIER

1 WATER BARRIER CONTINUITY

1/2" = 1'-0"

[redacted]

1301-16 AVENUE NW CALGARY AB, T2M 0L4

Drawing Title

EXT. FOAM NZ

Project Number	2024-009	Project Name	HIGH PERFORMANCE WALL ASSEMBLY				
Drawn by	LL	Checked by	BH, NM	Date	2025-04-30	Scale	1/2" = 1'- 0"
Project Address	N/A						
Issued For	ALBERTA ECOTRUST FOUNDATION						

1.12

Appendix B:

Wall Assembly Effective Thermal Resistance Calculations

Project Name: **High-Performance Wall Assembly Project**

Project Address:

Assembly Name: **Exterior Foam Net Zero Wall Assembly**

Fibreglass Batt Insulation filled 2x6 Cavity

Materials in Assembly					RSI, $(m^2*K)/W$	R-Value
Outside Air Film					0.03	0.17
Rainscreen Framing (20mm x 0.0085 RSI/mm)	RSI_F =	0.17	% area of framing =	20	$RSI_{Parallel}$=	
Rainscreen Air Cavity (20mm)	RSI_C =	0.18	% area of cavity =	80	0.18	1.02
Exterior XPS (152mm)					5.04	28.62
Building Paper					0.00	0.00
OSB Sheathing (9.5mm)					0.0930	0.53
Stud @ 610 (140mm x 0.0085 RSI/mm)	RSI_F =	1.19	% area of framing =	20	$RSI_{Parallel}$=	
Batt Insulation (R22)	RSI_C =	3.87	% area of cavity =	80	2.67	15.15
Gypsum (12.7mm)		0.8			0.08	0.45
Interior Air Film		57.6			0.12	0.68
			Calculated RSI_{EFF}=		**8.21**	**46.62**
			9.36 Prescriptive RSI Required =		3.08	17.49
			W/HRV		2.97	16.86

Parallel Path Flow Calculations

140mm stud with 140mm Batt Insulation (R22)

$$RSI_{Parallel} = \frac{100}{\frac{20}{1.19} + \frac{80}{3.87}} = 2.67 \text{ (m2*K)/W}$$

Project Name: **High-Performance Wall Assembly Project**

Project Address:

Assembly Name: **Exterior Foam Net Zero Wall Assembly** Uninsulated 2x6 Cavity

Materials in Assembly					RSI, $(m^2*K)/W$	R-Value
Outside Air Film					0.03	0.17
Rainscreen Framing (20mm x 0.0085 RSI/mm)	RSI_F =	0.17	% area of framing =	20	$RSI_{Parallel}$=	
Rainscreen Air Cavity (20mm)	RSI_C =	0.18	% area of cavity =	80	0.18	1.02
Exterior XPS (152mm)					5.04	28.62
Building Paper					0.00	0.00
OSB Sheathing (9.5mm)					0.0930	0.53
Stud @ 610 (140mm x 0.0085 RSI/mm)	RSI_F =	1.19	% area of framing =	20	$RSI_{Parallel}$=	
Air Cavity (140mm)	RSI_C =	0.18	% area of cavity =	80	0.22	1.23
Gypsum (12.7mm)		0.8			0.08	0.45
Interior Air Film		57.6			0.12	0.68
			Calculated RSI_{EFF}=		**5.76**	**32.70**
			9.36 Prescriptive RSI Required =		3.08	17.49
			W/HRV		2.97	16.86

Parallel Path Flow Calculations

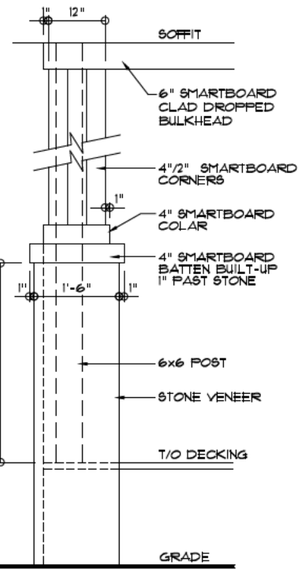
140mm stud with 140mm Air Space

$$RSI_{Parallel} = \frac{100}{\frac{20}{1.19} + \frac{80}{0.18}} = 0.22 \quad (m2*K)/W$$

Appendix C:

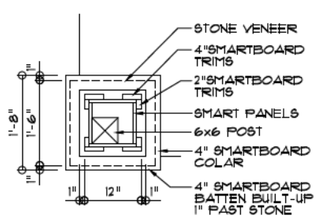
Cost Analysis Model Home

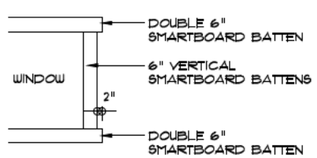
[redacted]



COLUMN DETAIL

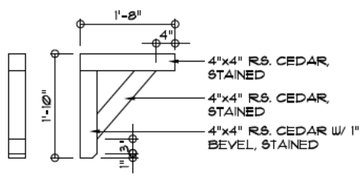
SCALE: 3/8" = 1'-Ø"





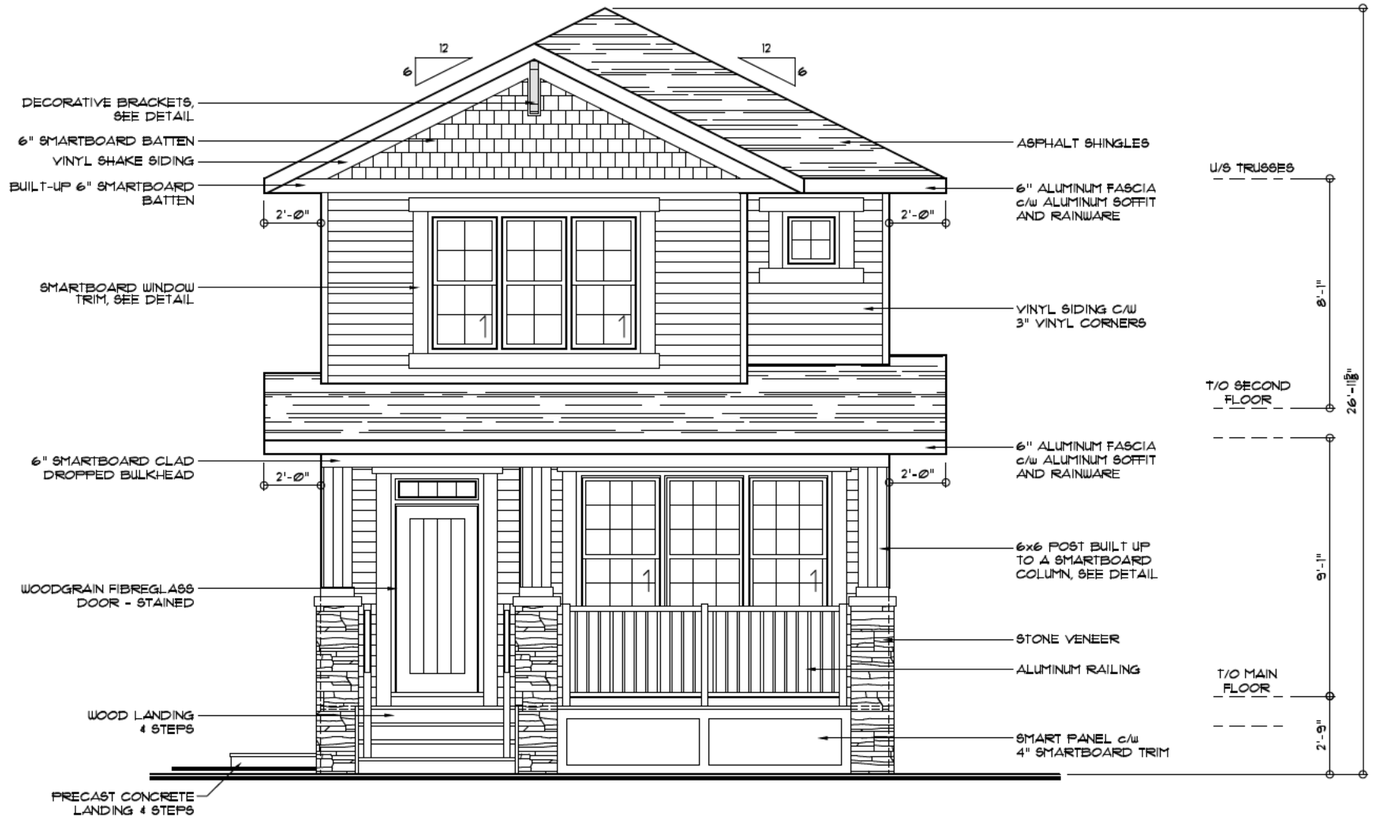
WINDOW TRIM DETAIL

SCALE: 3/16" = 1'-Ø"



BRACKET DETAIL

SCALE: 3/8" = 1'-Ø"



FRONT ELEVATION

SCALE: 3/16" = 1'-Ø"

[redacted]

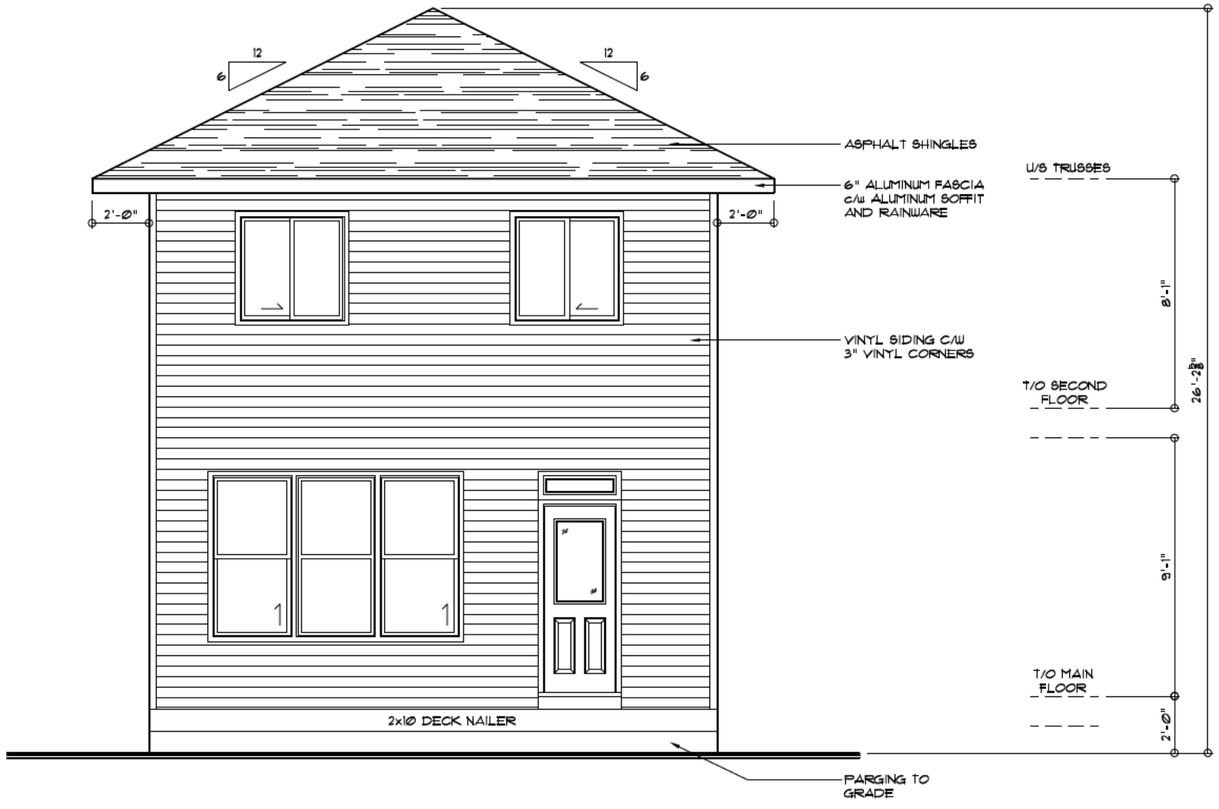
ADDRESS: [redacted]

TOTAL AREA:	1440	sq.ft.
MAIN FLOOR:	700	sq.ft.
UPPER FLOOR:	740	sq.ft.
GARAGE:	N/A	sq.ft.
BSMNT DEV:	N/A	sq.ft.
DECK:	N/A	sq.ft.

REVISIONS:

MODEL: 2 STOREY

ELEVATION: CRAFTSMAN



[redacted]

ADDRESS: [redacted]

TOTAL AREA:	1440	sq.ft.
MAIN FLOOR:	700	sq.ft.
UPPER FLOOR:	740	sq.ft.
GARAGE:	N/A	sq.ft.
BSMNT DEV:	N/A	sq.ft.
DECK:	N/A	sq.ft.

REVISIONS:

MODEL: 2 STOREY

ELEVATION: CRAFTSMAN

UNPROTECTED OPENINGS

LIMITING DISTANCE:	3.08 m
ALLOWABLE OPENINGS:	9.00 %
EXPOSED BUILDING FACE:	743.33 sq.ft.
UNPROTECTED OPENINGS:	46.84 sq.ft.
ACTUAL OPENINGS:	6.30%

[redacted]

ADDRESS: [redacted]

TOTAL AREA:	1440	sq.ft.
MAIN FLOOR:	700	sq.ft.
UPPER FLOOR:	740	sq.ft.
GARAGE:	N/A	sq.ft.
BSMNT DEV:	N/A	sq.ft.
DECK:	N/A	sq.ft.

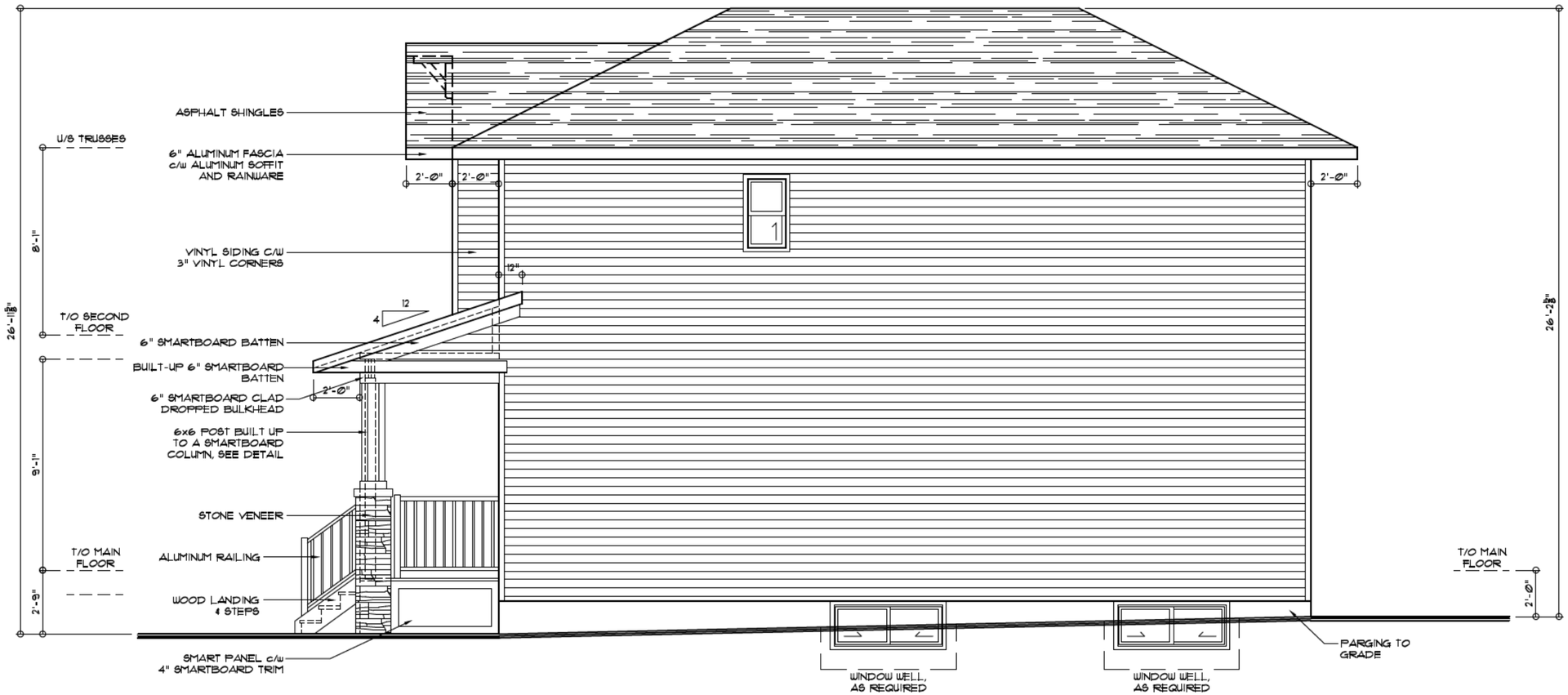
REVISIONS:

MODEL: 2 STOREY

ELEVATION: CRAFTSMAN

UNPROTECTED OPENINGS

LIMITING DISTANCE:	1.22 m
ALLOWABLE OPENINGS:	7.00 %
EXPOSED BUILDING FACE:	739.05 sq.ft.
UNPROTECTED OPENINGS:	27.50 sq.ft.
ACTUAL OPENINGS:	3.72%



RIGHT ELEVATION

SCALE: 3/16" = 1'-0"

[redacted]

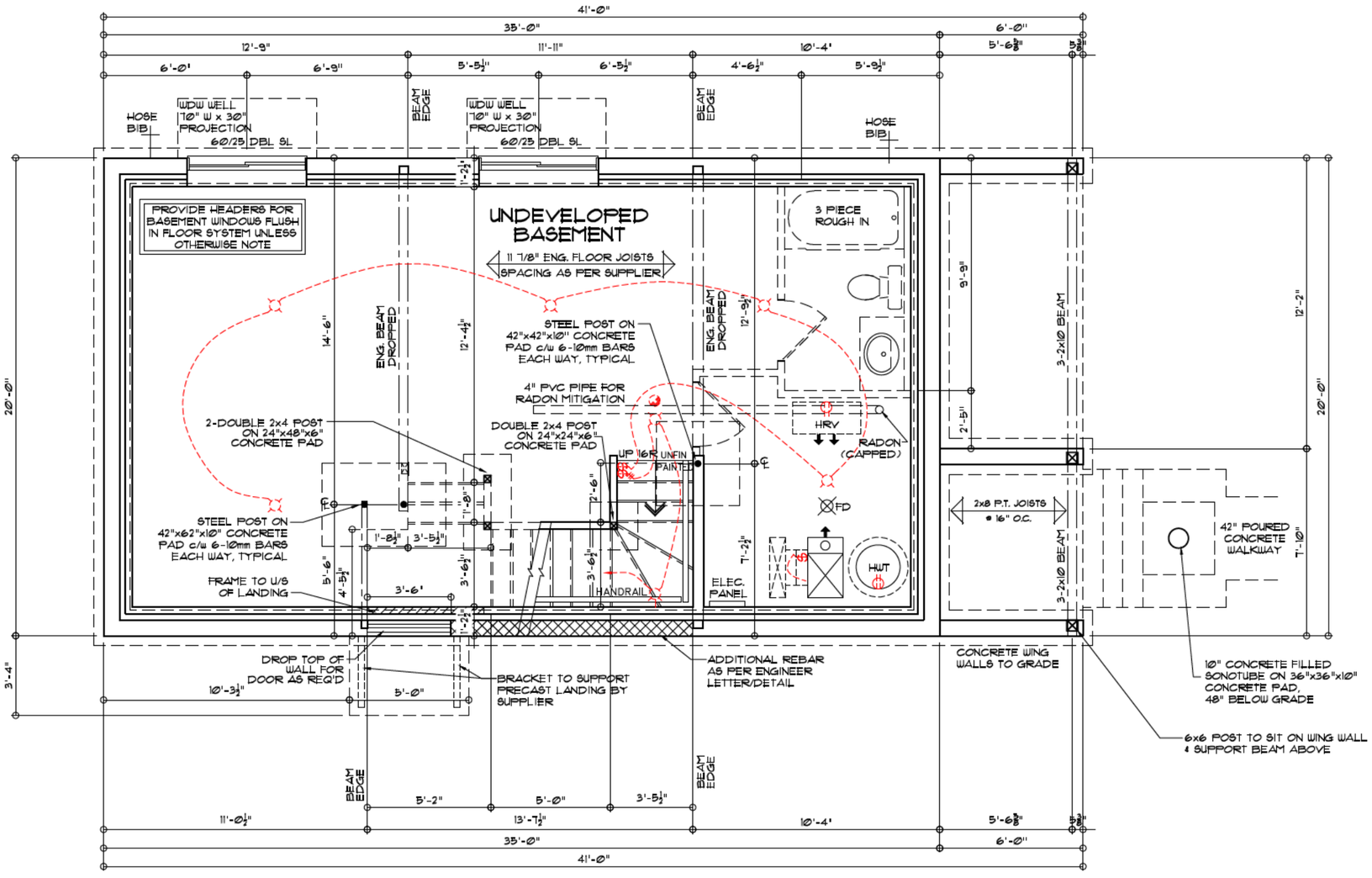
ADDRESS: [redacted]

TOTAL AREA:	1440	sq.ft.
MAIN FLOOR:	700	sq.ft.
UPPER FLOOR:	740	sq.ft.
GARAGE:	N/A	sq.ft.
BSMNT DEV:	N/A	sq.ft.
DECK:	N/A	sq.ft.

REVISIONS:

MODEL: 2 STOREY

ELEVATION: CRAFTSMAN



FOUNDATION PLAN

SCALE: 3/16" = 1'-0"

STANDARD WALL SCONCE HEIGHT AT LANDING OR RISERS: 6'-8"

[redacted]

ADDRESS: [redacted]

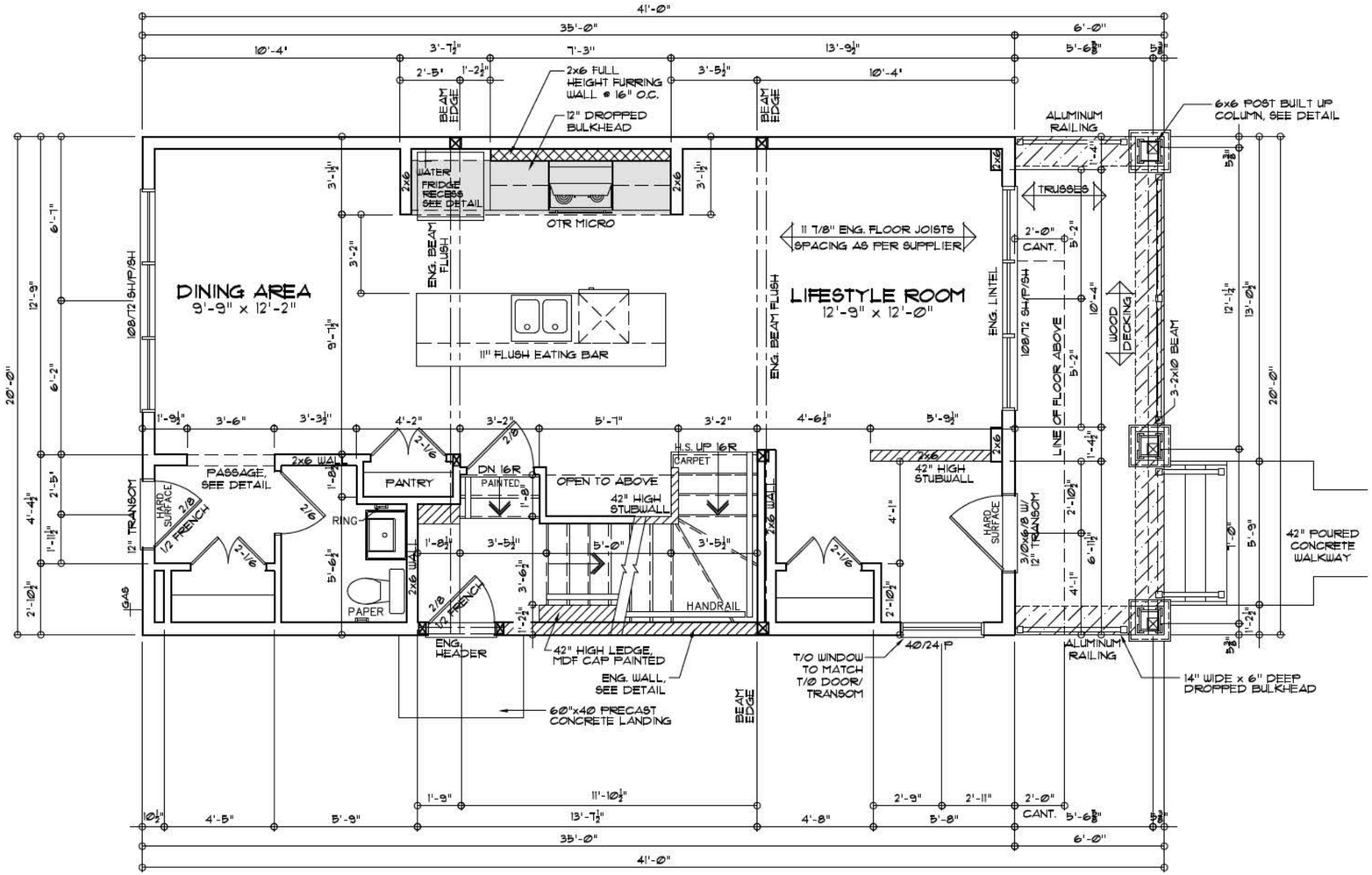
TOTAL AREA:	1440	sq.ft.
MAIN FLOOR:	700	sq.ft.
UPPER FLOOR:	740	sq.ft.
GARAGE:	N/A	sq.ft.
BSMNT DEV:	N/A	sq.ft.
DECK:	N/A	sq.ft.

REVISIONS:

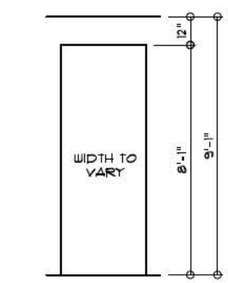
MODEL: 2 STOREY

ELEVATION: CRAFTSMAN

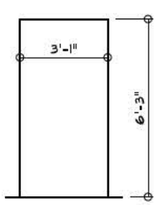
NOTE:
MAIN FLOOR WINDOWS
TO BE 7'-11" HIGH UNLESS
OTHERWISE NOTED



MAIN FLOOR PLAN
SCALE: 3/16" = 1'-0"



PASSAGE DETAIL
MAIN
SCALE: 3/16" = 1'-0"



NOTE:
DIMENSIONS ARE
TO FINISHED MATERIAL

FRIDGE
RECESS DETAIL
SCALE: 3/16" = 1'-0"

[redacted]

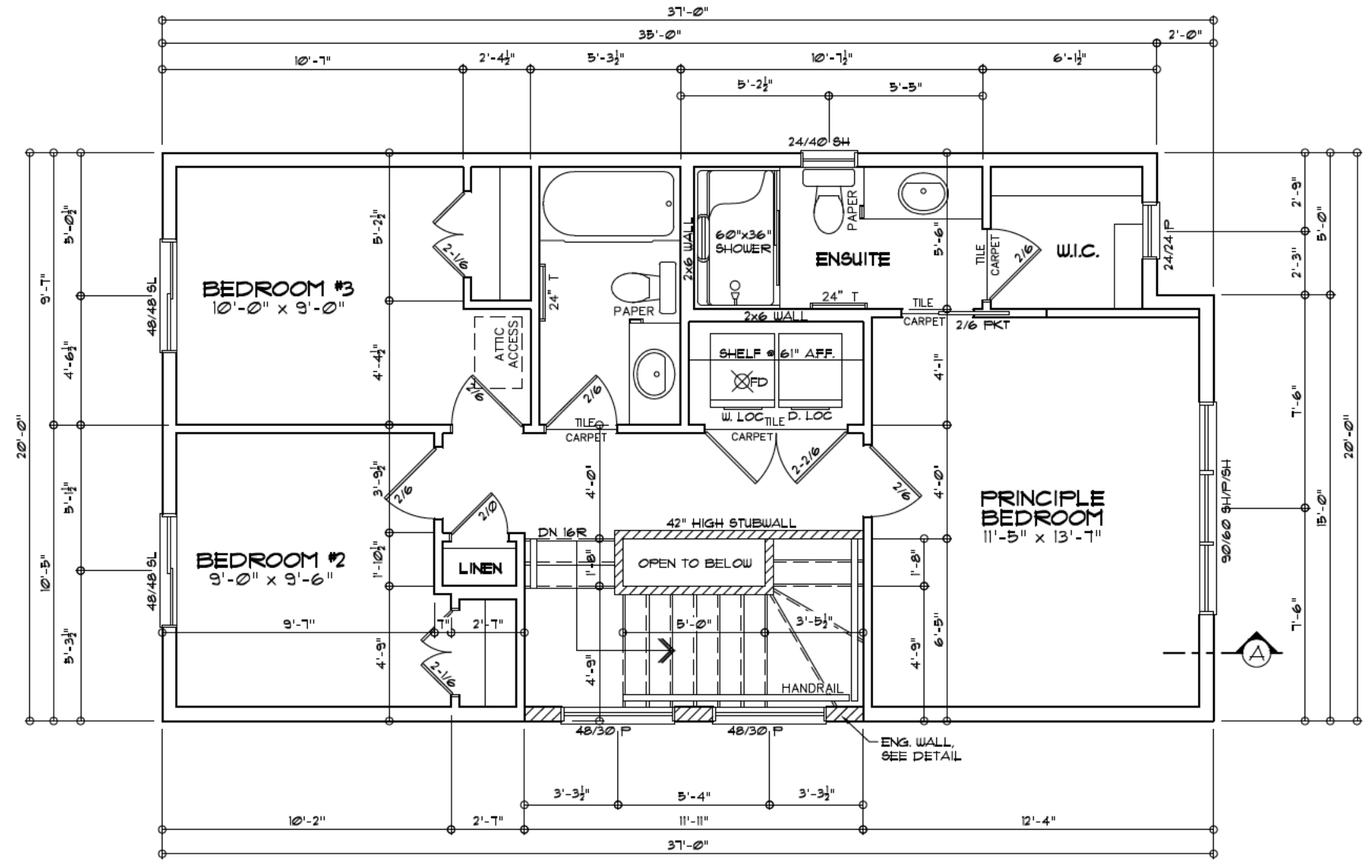
ADDRESS: [redacted]

TOTAL AREA:	1440	sq.ft.
MAIN FLOOR:	700	sq.ft.
UPPER FLOOR:	740	sq.ft.
GARAGE:	N/A	sq.ft.
BSMNT DEV:	N/A	sq.ft.
DECK:	N/A	sq.ft.

REVISIONS:

MODEL: 2 STOREY
ELEVATION:
CRAFTSMAN

NOTE:
UPPER FLOOR WINDOWS
TO BE 6'-11" HIGH



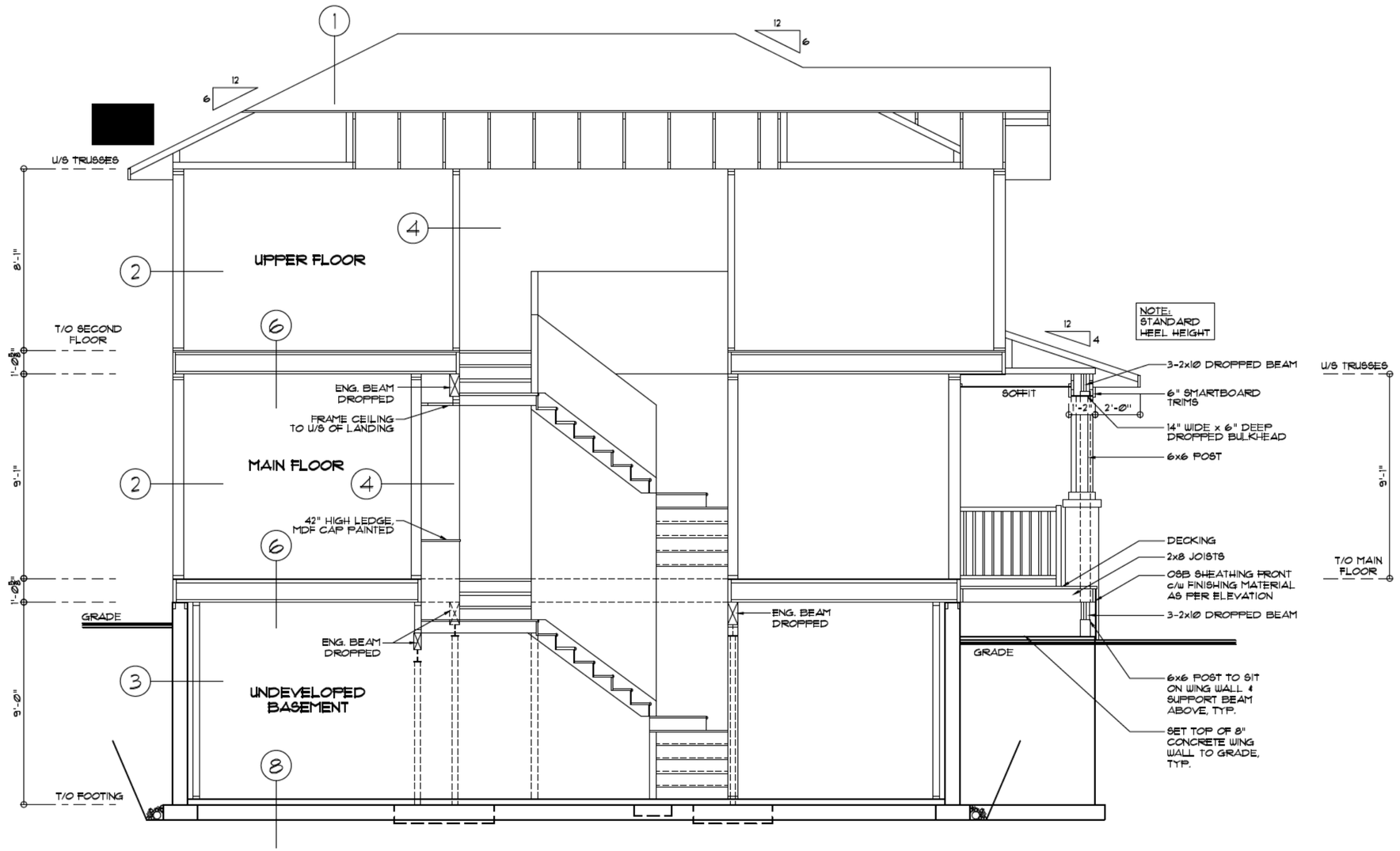
UPPER FLOOR PLAN

SCALE: 3/16" = 1'-0"

[redacted]	ADDRESS: [redacted]		
	TOTAL AREA: 1440 sq.ft. MAIN FLOOR: 700 sq.ft. UPPER FLOOR: 740 sq.ft. GARAGE: N/A sq.ft. BSMNT DEV: N/A sq.ft. DECK: N/A sq.ft.	REVISIONS:	MODEL: 2 STOREY ELEVATION: CRAFTSMAN PAGE 7 OF 10

NOTE:
MAIN FLOOR WINDOWS TO BE 7'-11" HIGH UNLESS OTHERWISE NOTED

UPPER FLOOR WINDOWS TO BE 6'-11" HIGH UNLESS OTHERWISE NOTED



CROSS SECTION A

SCALE: 3/16" = 1'-0"

GENERAL NOTES

-ALL CONSTRUCTION TO CONFORM TO CURRENT A.B.C., FIRE CODES AND 9.36 PERFORMANCE ENERGY MODEL DETAILS
-SPECIFICATIONS, CHANGE REQUESTS SHALL OVERRIDE PLANS
-FINAL GRADING AND SITE CONDITIONS MAY VARY EXTERIOR APPEARANCE
-SECTION NOTES ARE GENERAL AND MAY VARY OR NOT APPLY TO ALL PLANS
-ALUMINUM FASCIA AND EAVESTROUGH AS NOTED
-ALUMINUM VENTED SOFFIT ON FRONT AND REAR ELEVATIONS ONLY.
-NON-VENTED ALUMINUM SOFFIT ON SIDE ELEVATIONS
-TRUSS MANUFACTURER TO VERIFY ALL ROOF SLOPES AND TRUSS DESIGN PRIOR TO FABRICATION

LINTEL NOTES:
-ALL EXTERIOR LINTELS TO BE 2-2x10 SPF UNLESS NOTED
-ALL LINTELS OVER 6'-0" MUST HAVE A DOUBLE CRIPPLE
-INSULATE & DRYWALL WALLS WITHIN 4'0" OF FURNACE & HWT
-INSULATE & DRYWALL WALLS ADJACENT TO STAIRS AND LANDING
-INSULATE AND DRYWALL WALLS AT BASEMENT LAUNDRY WHEN APPLICABLE
-ANY DISCREPANCIES TO BE REPORTED TO THE DESIGNER PRIOR TO CONSTRUCTION

[redacted]

ADDRESS: [redacted]

TOTAL AREA:	1440 sq.ft.
MAIN FLOOR:	700 sq.ft.
UPPER FLOOR:	740 sq.ft.
GARAGE:	N/A sq.ft.
BSMNT DEV:	N/A sq.ft.
DECK:	N/A sq.ft.

REVISIONS:

MODEL: 2 STOREY
ELEVATION: CRAFTSMAN

Appendix D:

Wall Assembly Affordability and Constructability Analysis

Cost per sq/ft of Wall Affordability Analysis

Assembly	Cost/sqft of Wall	Notes
Tier 1 2x6	**Baseline Cost**	Assembly built with materials commonly used in current residential construction. These include; • Tyvek WRB. • 6 mil poly vapour barrier.
Exterior Mineral Wool Tier 3	**153%** higher than baseline	Incorporates high-performance building materials at an additional cost. These include; • Siga Majvest WRB (Roughly twice as much per sq/ft coverage of Tyvek). • Siga Majrex vapour barrier (roughly 9x as much per sq/ft coverage of 6 mil poly). • Siga WRB and VB tapes for air sealing. Other Additional Costs: • Exterior mineral wool insulation. • Rainscreen material.
Double Stud Net Zero	**64%** higher than baseline	Incorporates a combination of more commonly used construction materials and high-performance building materials at an additional cost. These include; • Typar WRB (similar in price to Tyvek). • Siga Majrex vapour barrier (roughly 9x as much per sq/ft coverage of 6 mil poly). • Siga VB tapes for air sealing. Other Additional Costs: • Framing of 2 walls. • Additional insulation to fill wall cavity.
Exterior Foam Net Zero	**465%** higher than baseline	Incorpotates high-performance building materials at an additional cost. These include; • Soprema Sopraseal Stick WRB (Roughly 11x as much per sq/ft coverage of Tyvek). •Soprema sill flashing. Other Additional Costs: • Exterior XPS insulation. • Rainscreen material. • Fasteners for screwing through a large amount of insulation.
Fire Resistant Retrofit	**206%** higher than baseline	Incorporates high-performance building materials at an additional cost. These include; • ProClima Mento WRB (Roughly 3x as much per sq/ft coverage of Tyvek. • ProClima tapes for air sealing. Other Additional Costs: • Exterior mineral wool insulation. • Rainscreen material. • Thermal Clips.
Larsen Truss Retrofit	**165%** higher than baseline	Incorporates common building materials similar to the baseline home; • Typar WRB (similar cost as Tyvek). Additional Costs: • Framing material for the Larsen Truss. • Rainscreen material. • WRB tape for air sealing. • Insulation for Larsen Truss cavity. • Soprema liquid applied membrane for window bucks and air sealing.

• No monetary value has been noted as there are many variables that could impact the comparability of these costs.
• This chart is a direct comparison of the cost of the material to construct ***ONLY*** *the wall assembly of the model home.*
• This chart only compares the materials selected for each physical mock-up. It cannot be considered a 1 to 1 comparison as different materials selected have different costs, possibly resulting in inflated prices for certain assemblies.

Constructability Analysis

Assembly	Material Availability	Difficulties/Issues	Constructability Rating (1-5)
Tier 1 2x6	• All material used was available at common hardware/construction material supply stores. • Material was all readily available as this is a commonly built assembly across Alberta.	• Accoustical sealant can be messy and inconsistent.	**1** **Baseline** •Easiest to construct.
Exterior Mineral Wool Tier 3	• Framing and cavity insulation materials were readily available at common hardware/material supply stores. • SIGA WRB, VB and tapes was not readily available and needed to be ordered in. This required a small lead time. • Exterior mineral wool insulation was not readily available and needed to be ordered. This required a significant lead time. • Rainscreen framing material and fasteners were readily available at common stores. • Custom made flashing was required. GBTAC made these on site with the use of a Break. If GBTAC did not have this tool, this material would need to be custom ordered.	• WRB was the air control layer, so ensuring continuous membrane behind flashings and penetrations increased the difficulty of installing the WRB. • Ensuring the screws that hold on the rainscreen strapping properly embed in a structural member of the wall. • Ensuring proper flashing installation and detailing around the window. • Custom exterior window trim detail was required. • Order of operations for the framer. WRB membrane was required to transfer into the interior at the roof so as to transfer the air control layer to the underside of the roof ceiling.	**2.5** • Relatively simple to construct. • Exterior insulation is the major change from the baseline that makes it more difficult
Double Stud Net Zero	• All materials used in this assembly were readily available at common hardware/material supply stores aside from the VB. • VB and tapes was not readily available and needed to be ordered in. This required a small lead time.	• Double walls could be heavy and difficult to move around. • Custom window jambs are required to be made to cover the large window rough opening to the interior of the window. • Order of operation for the framer. VB needs to be wrapped under the plates of the walls before the walls are installed. • Proper installation of the 3 layers of insulation in the cavity to ensure there is no settlement.	**2** • Simple Construction . • Not to dissimilar to the baseline with adding a second wall and extra insulation increasing the difficulty.
Exterior Foam Net Zero	• Framing material readily available at common hardware/material supply stores. • WRB was not readily available and needed to be ordered in. This required a small lead time. • XPS and fasteners were readily available at some material supply stores, but had the possibility to need to be ordered in with a small lead time. • Custom flashing needed to be made. This was made onsite with a break, otherwise this would have been needed to be ordered from a supplier.	• WRB was the air control layer, so ensuring continuous membrane behind flashings and penetrations increased the difficulty of installing the WRB. • Ensuring the screws that hold on the rainscreen strapping properly embed in a structural member of the wall. • Ensuring proper flashing installation and detailing around the window. • Custom exterior window trim detail was required. • Installing through flashing in the correct spot at the wall proved difficult. • Peel and stick membrane required at least 2 workers to install as it was difficult to remove the backing without adhering the membrane to itself.	**5** • Most difficult to construct. • Long screws and the amount of exterior insulation made this assembly difficult to construct.
Fire Resistant Retrofit	• ProClima WRB and tapes wer not readily available and needed to be ordered in. This required a small lead time. • Exterior mineral wool insulation was not readily available and needed to be ordered. This required a significant lead time. • Rainscreen framing material and fasteners were readily available at common stores. • Custom made flashing was required. GBTAC made these on site with the use of a Break. If GBTAC did not have this tool, this material would need to be custom ordered. • Soprema thermal clips had to be ordered in with minimal lead time.	• Attaching the rainscreen strapping to the metal thermal clips proved quite difficult at times.	**3** • Somewhat difficult to construct. • If good screws are used that screw into the metal thermal clips well, the construction would be slightly easier.
Larsen Truss Retrofit	• All framing material and the WRB material was readily available at common hardware/material supply stores. • Dense pack cellulose needed to be installed by a professional installer. Lead time for booking the installer was required. • Liquid applied membrane for window bucks was required to be ordered in with a small lead time.	• Installing the liquid applied membrane could not be done at a lower temperature.	**2.5** • Relatively simple to construct. • Amount of labour and correct installation of the Larsen Truss raises the difficulty.

• Constructability values are based on the previous experience of the GTAC Staff and conversations with industry

Exterior Foam Net Zero Assembly


EXIT
SOPREMA
sopraSEAL
STICK VP


SOPREMA
SOPRASEAL
STICK VP
STICK VP


SOPREMA
SOPRASEAL
STICK VP


SOPREMA
SOPRASEAL
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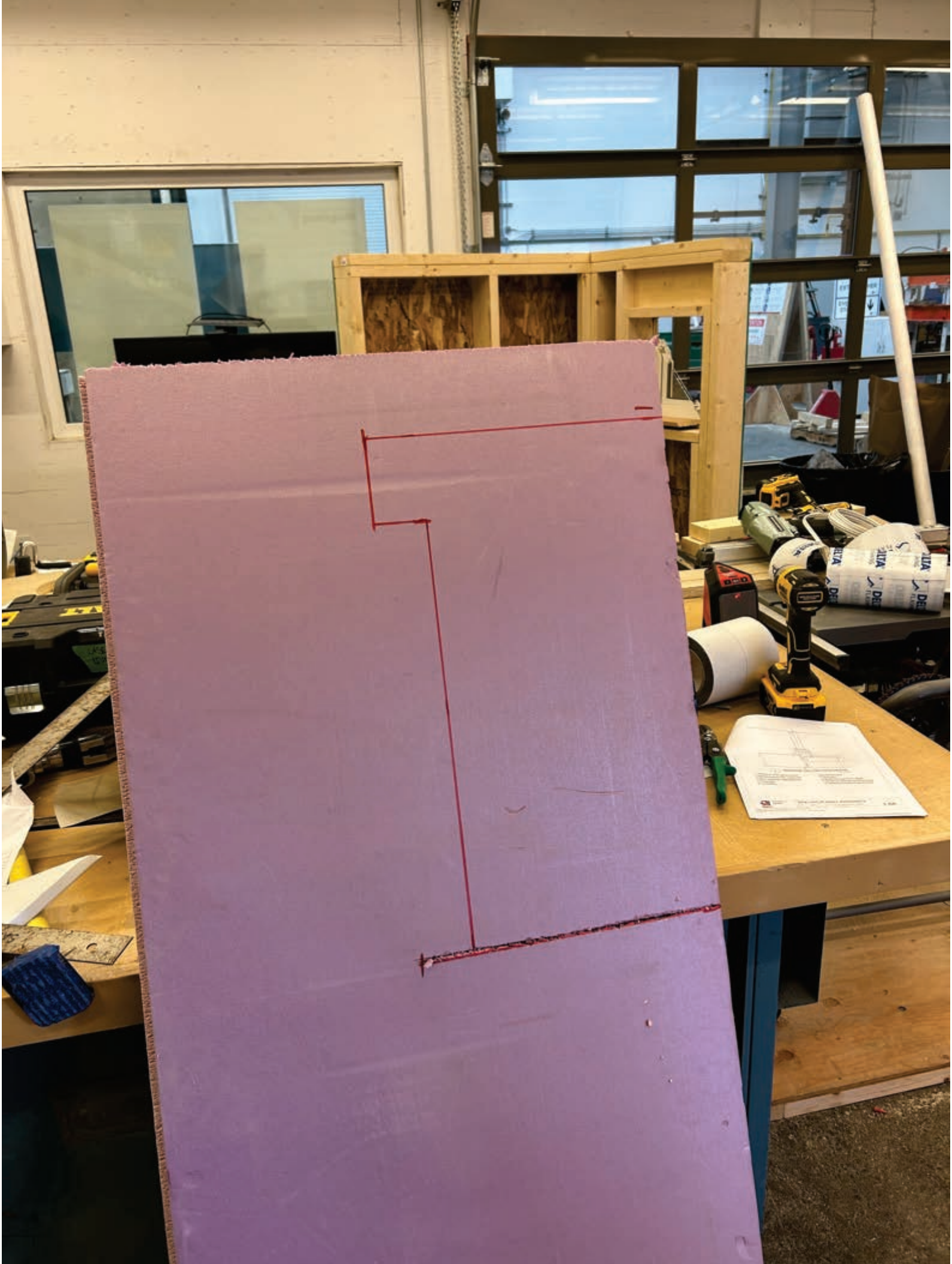
SOPRASEAL
STICK VP


SOPREMA
SOPRASEAL
STICK VP

SOPREMA
sopraSEAL
STICK


SOPREMA
SOPRASEAL STICK VP


EXIT
SOPREMA
sopraSEAL
STICK VP
ek
Wrap




PLASTIC CAP NAILS
3"
CLOUS AVEC RONDELLE DE PLASTIQUE
SOPREMA
STICK VP


L'ISOLANT DE POLYSTYRÈNE EXTRUDÉ FOAMULAR® DE NOUVELLE GÉNÉRATION EST CONF
RÉGLEMENTATIONS FÉDÉRALES ET D'ÉTAT/PROVINCIALES RÉGISSANT LES ÉMISSIONS AU
FOAMULAR® NGX (NEXT GENERATION EXTRUDED POLYSTYRENE) INSULATION MEETS ALL
EMISSION REGULATIONS IN THE USA AND CANADA
2158
OWENS CORNING
FOAMULA
ISOLANT DE POLYSTYRÈNE EXTRUDÉ
HIGH PERFORMANCE XPS INSULAT
2"
FOAMULAR NGX C-200
2"
R-10


FOAMULAR® NGX C-200
ISOLANT DE POLYSTYRÈNE EXTRUDÉ HAUTE PERFORMANCE
HIGH PERFORMANCE XPS INSULATION
2"
THICKNESS
ÉPAISSEUR
R-10
FOAMULAR
NGX C-200
EXIT


FOAMULAR NGX C
R-10
NGX C-200
R-10


FOAMULAR NGX C-200
2" THICKNESS EPAISSEUR
R-10
Tyvek
HomeWrap


2"
FOAMULAR NGX C-200
2"
R-10


2"
FOAMULAR NGX C-200
2"
R-10


DELTA
FLASHING
R-10
2"
aSEAL


2"
R-10
2"
R-10
DELTA
FLASHING
EXIT

FOAMULAR NGX
ISOLANT DE POLYSTYRÈNE EXTRUDÉ RIGIDE HAUTE PERFORMANCE
HIGH PERFORMANCE XPS INSULATION
2"
THICKNESS
EPAISSEUR
R-10
RSI-1.76
DELTA
FLASHING
aSEAL
STICK


FOAMULAR NGX
ISOLANT DE POLYSTYRÈNE EXTRUDÉ RIGIDE HAUTE PERFORMANCE
HIGH PERFORMANCE XPS INSULATION
R-10
RSI-1.76
2"
THICKNESS
ÉPAISSEUR
DELTA
FLASHING
OWENS CORNING
aSEAL
OPEN
STICK


FOAMULAR NGX C-200
2"
R-10
2"
THICKNESS
ÉPAISSEUR


FOAMULAR NGX
R-10
2"
ASEAL
OPEN

DELTA