Larsen Truss Retrofit Assembly

See ***Appendix A: Larsen Truss Retrofit Assembly Construction Details*** for plans and construction details.

Description & Overview

This assembly was approached the same as the Fire-Resistant Retrofit, as if there was only an exterior retrofit being performed on an existing home from the mid twentieth century. All the structural components were staying as-is and an exterior high-performance retrofit was going to take place. To determine what material to include in the physical mock-up that would represent the existing construction, GBTAC staff previous experience in renovations guided the selection. The existing assembly from exterior to interior contains:

- 3/8 plywood structural sheathing
- 2x4 stud wall with R-12 fibreglass batt insulation
- Polyethylene sheet VB

To determine what the high-performance retrofit additions would include, GBTAC staff utilized information from previously completed retrofit projects, industry feedback, and staff knowledge. The final decision was to display the addition of mineral wool to the exterior of the existing structure with a new airtight WRB and window replacement. The exterior retrofit addition, from exterior to interior contains:

- Exterior cladding
- 1 ½” Rainscreen strapping
- Airtight WRB
- 8” Larsen Truss with dense pack cellulose cavity insulation

The roof and foundation were decided to be the same as with the Fire-Resistant Retrofit Assembly.

The window installed in the mock-up was a representation of a flangeless high-performance European style tilt and turn window with a wooden frame. It is installed in line with where the exterior edge of the existing wall is. The sill of the Larsen truss is sloped so as to drain moisture away, which restricts putting the window farther towards the exterior.

Materials

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

- **Rainscreen Strapping**
  - 2x4 SPF lumber
- **Airtight WRB**
  - Membrane – Typar Building Wrap – mechanically fastened
  - Sealing tape – Siga Wigluv in varying sizes.
  - Sill Pan Flashing and window R.O air sealing – Soprema Sopraseal Liquid Flashing & Soprema Sopraseal Stick Flashpro
- **Larsen Truss**
  - Framing - 2x2 SPF lumber studs spaced 8” apart
  - Structural Gussets – 16” x 8” x ¾” Plywood connecting the interior and exterior Larsen Truss 2x2s. Layout as per designer/engineer specifications
- **Larsen Truss Cavity Insulation**
  - Sopra-Cellulose packed to the required density
- **Existing Structural Wall**
  - 3/8” Plywood structural sheathing
  - 2x4 SPF lumber

- **Cavity Insulation**
  - Owens Corning R-12 Pink Next gen Fiberglass Insulation
- **Vapour Barrier**
  - Existing polyethylene plastic sheeting
- **Assembly Effective Thermal Performance**
  - RSI-6.52 or R-37.03

Construction

The majority of the other assemblies for this project can be somewhat closely compared to each other in terms of construction. This assembly construction was vastly different than any of the others. In terms of difficulty, it was fairly straightforward. GBTAC has seen this assembly, or some other variation of this assembly, used in a majority of deep energy retrofits in the past 2 years in the Calgary area.

Construction of the Larsen Truss consisted of a 2x2 framing member installed at the exterior of the existing structural sheathing, fastened into the structural framing member. 16" x 8" x ¾" plywood gussets are then fastened to the side of that 2x2 member spaced out as per designed or engineered requirements. A 2x2 framing member is then attached to the exterior edge of the plywood gusset. The result of this is a site made truss. A ¾" plywood cap was installed along the perimeter of the underside of the truss as well as ¾" plywood window bucks around the window R.O.'s. The sill buck of the window was sloped downward to allow any moisture to drain away. 2x4 material was used for the rainscreen on this assembly as the bulging of the dense pack cellulose would interfere with the installation of the cladding if only ¾" material was used.

The air control layer for this assembly was the Typar Building Wrap WRB. Maintaining a continuous air control layer was achieved with this membrane along with the following materials and methods:

- Taping to seal all joints and openings in the WRB.
- Installation of a strip of WRB and tape at the top of the Larsen Truss at the Rafters. Closed Cell spray foam connecting this layer to the ceiling VB.
- Taping electrical wire penetrations.
- Liquid applied membrane of the window bucks. Alternately, an adhered sheet waterproofing membrane can also be utilized in this assembly.
- Taping WRB to mechanical penetrations
- Foam backer rod and caulking to connect the window frame to the liquid applied membrane.

Assembly Advantages

- Wrapping the exterior of the wall assembly with insulation reduces the amount of thermal bridging through the wood structural framing members.
- Retrofitting an existing home saves waste and new construction costs.
- Utilizing the WRB as the air control layer allows for less detailing, and a reduced chance of errors at junctions when the air control layer is to the interior of the assembly.
- Use of a liquid applied membrane to prep and seal the window buck saved a lot of installation time compared to multiple layers of an adhered sheet waterproofing membrane.
- Using a more affordable WRB/Air control membrane resulted in cost savings.
- Most materials were able to be found at a common hardware or building supply store.
- The Larsen Truss can be as thin or thick as needed, allowing for more, or less insulation.

- According to currently available industry Life Cycle Assessment data, cellulose insulation has a lower embodied carbon than the fiberglass, foam, and mineral wool insulation utilized for the other mockups.

Assembly Disadvantages

- Dense pack cellulose requires installation by a certified installer.
- Installing the flangeless window was more difficult for the purposes of this mockup, than the flanged windows for the other assemblies.
- Utilizing a liquid applied membrane required a drying time before the next steps could be completed.
- 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.
- There may be difficulty finding trades that can or are willing to install this type of assembly in a residential setting.
- Air sealing of the attic poly VB is encouraged to be completed as part of a whole building retrofit, which can be a very difficult and arduous task to complete.

Cost Analysis

The cost analysis revealed that completing a retrofit with this assembly for the model home would cost roughly 7% less compared to constructing the home with the Tier 1 2x6 Assembly.

Of the two retrofit examples, this assembly was the more affordable of the two. Construction to complete this assembly over the other retrofit assembly came out to roughly 14% less overall.

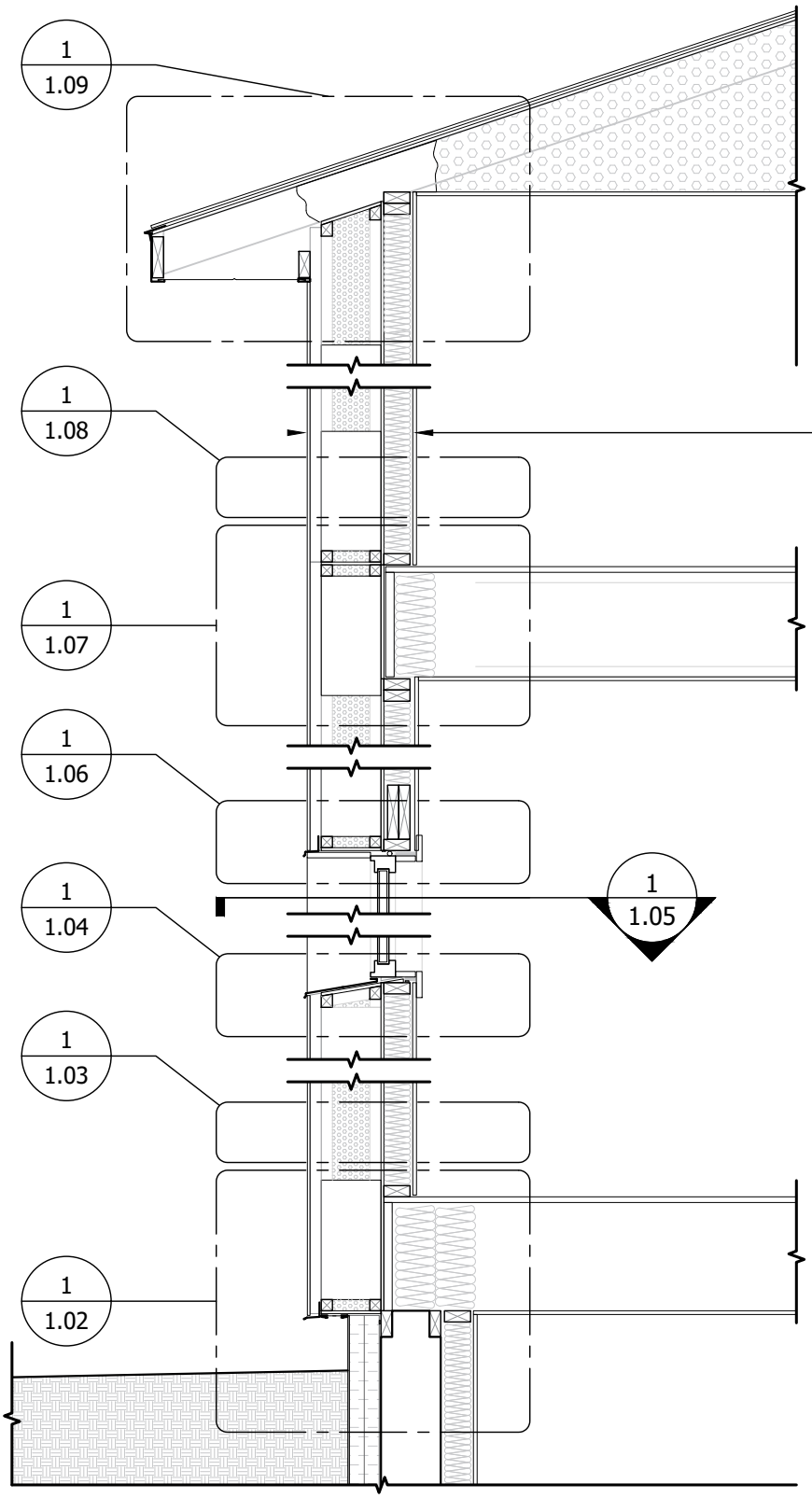
Future Research/Additional Exploration

While GBTAC feels the project shows a good comparison and showcasing of six different assemblies, we have identified areas for future improvements and more accurate comparisons:

- Cost comparisons between the different assemblies when they use all the same materials for the WRB, VB, and sealing tapes.

Appendix A:

Larsen Truss Retrofit Assembly Construction Details



1 ENVELOPE SECTION

1/2" = 1'-0"

LT[1] RETROFIT ASSEMBLY

EFFECTIVE RSI = 6.52; R-VALUE = 37.03

- EXTERIOR CLADDING
- 1 ½ " RAINSCREEN STRAPPING
- AIRTIGHT WATER RESISTANT BARRIER, SHEET APPLIED MEMBRANE, VAPOUR OPEN
- LARSEN TRUSS - 2X2 STUD w/ DENSE PACK CELLULOSE INSULATION[1]
- LARSEN TRUSS - 5" DENSE PACK CELLULOSE INSULATION
- LARSEN TRUSS - 2X2 STUD w/ DENSE PACK CELLULOSE INSULATION[2]
- EXISTING ⅜" EXTERIOR SHEATHING
- EXISTING 2X4 STUD w/ BATT FIBREGLASS BATT INSULATION
- EXISTING VAPOUR BARRIER
- EXISTING ½" GYPSUM BOARD
- EXISTING INTERIOR FINISHING

NOTE

1. LT = LARSEN TRUSS
2. 16" X 8" X ¾" PLYWOOD GUSSETS CONNECTING INTERIOR AND EXTERIOR 2 X 2 OF LARSEN TRUSS

[redacted]

1301-16 AVENUE NW CALGARY AB, T2M 0L4

Drawing Title

LARSEN TRUSS RETROFIT

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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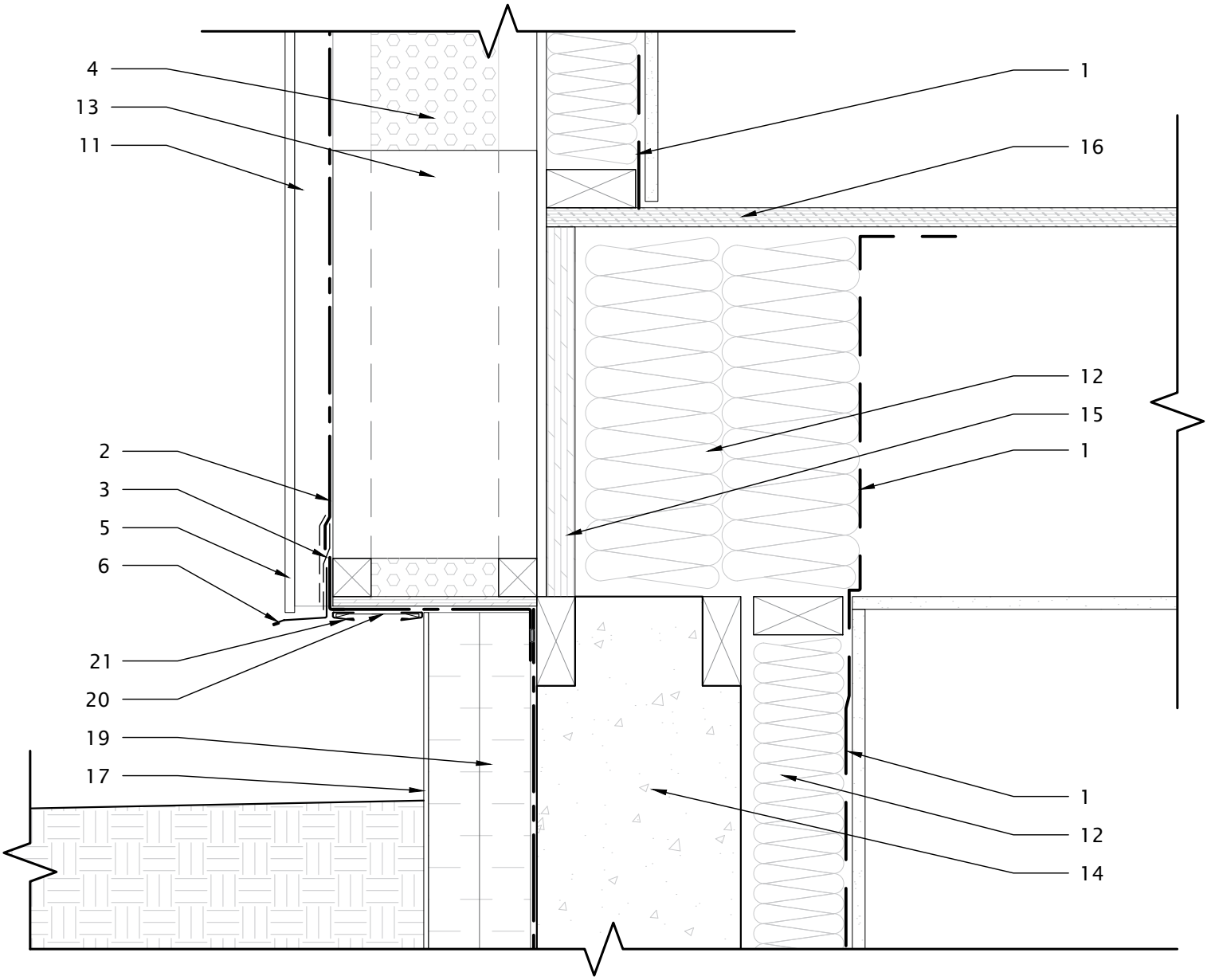

1 FOUNDATION TRANSITION SECTION DETAIL

2" = 1'-0"

1 VAPOUR BARRIER
2 AIRTIGHT WATER RESISTANT BARRIER
3 SELF ADHERED MEMBRANE
4 DENSE PACK CELLULOSE INSULATION
5 CLADDING
6 FLASHING
7 SEALANT
8 NON-HARDENING SEALANT
9 COMPRESSED FOAM ROD
10 EXPANDING POLYURETHANE SPRAY FOAM
11 RAINSCREEN STRAPPING
12 FIBREGLASS BATT INSULATION
13 PLYWOOD GUSSET
14 CONCRETE FOUNDATION WALL
15 RIM BOARD
16 SUBFLOOR
17 PARGING
18 DAMPPROOFING
19 XPS RIGID INSULATION
20 SOFFIT
21 J-CHANNEL

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

Drawing Title

LARSEN TRUSS RETROFIT

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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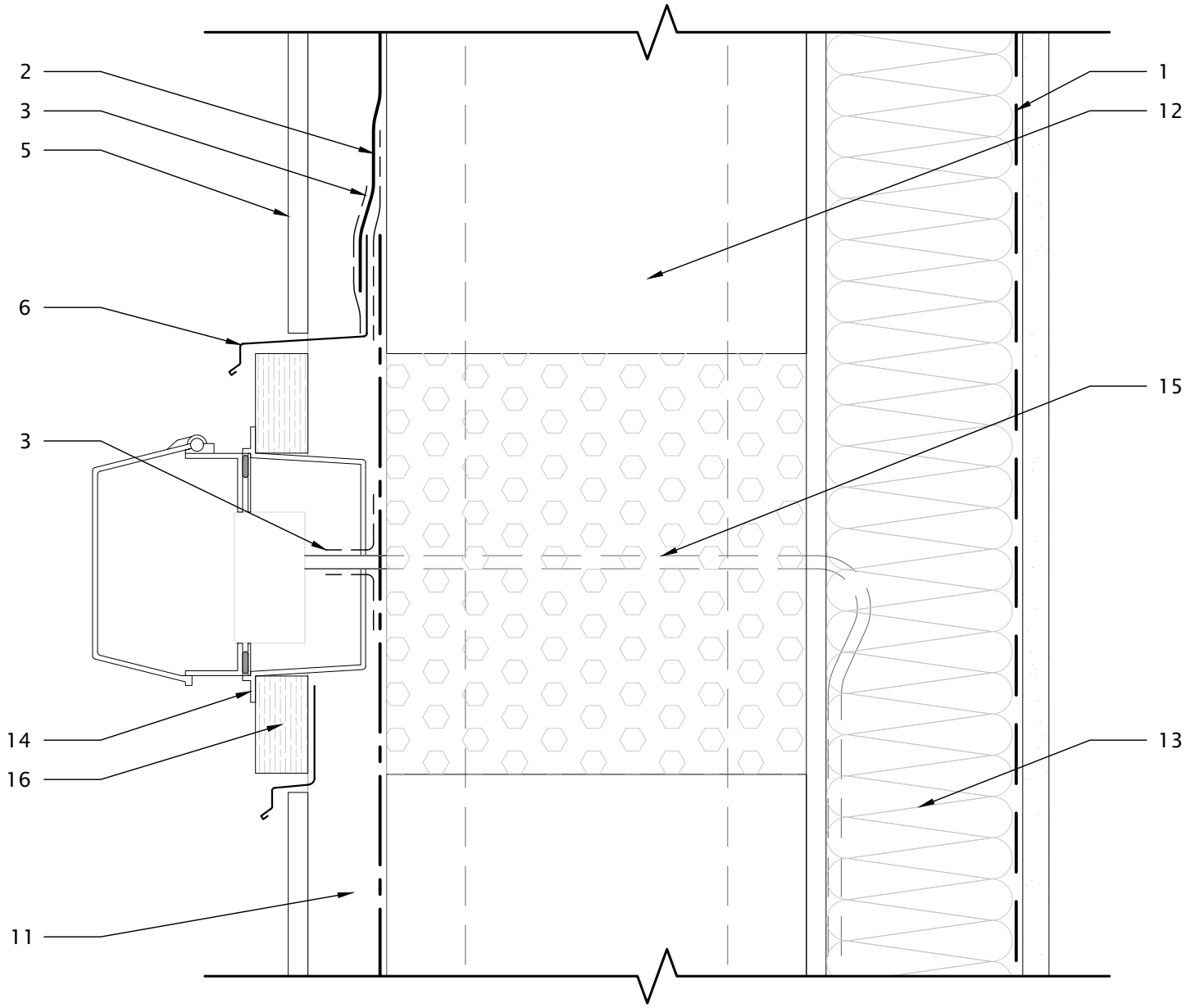

1 RECEPTACLE SECTION DETAIL

4" = 1'-0"

1 VAPOUR BARRIER
2 AIRTIGHT WATER RESISTANT BARRIER
3 SELF ADHERED MEMBRANE
4 DENSE PACK CELLULOSE INSULATION
5 CLADDING
6 FLASHING
7 SEALANT
8 NON-HARDENING SEALANT
9 COMPRESSED FOAM ROD
10 EXPANDING POLYURETHANE SPRAY FOAM
11 RAINSCREEN STRAPPING
12 PLYWOOD GUSSET
13 FIBREGLASS BATT INSULATION
14 IN USE RECEPTACLE ASSEMBLY
15 ELECTRICAL WIRE
16 BATTEN

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

Drawing Title

LARSEN TRUSS RETROFIT

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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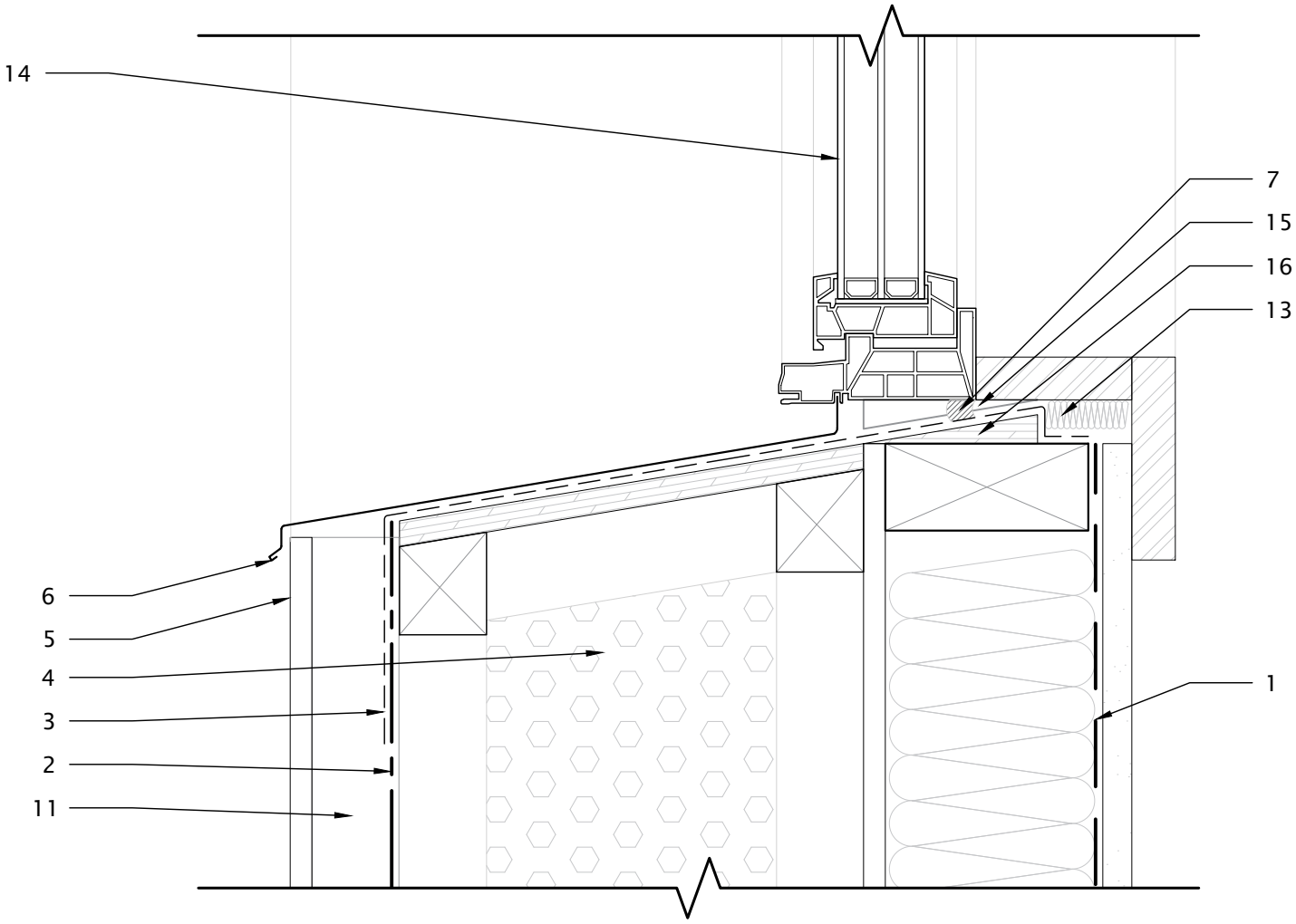

1 WINDOW SILL SECTION DETAIL

4" = 1'-0"

1 VAPOUR BARRIER
2 AIRTIGHT WATER RESISTANT BARRIER
3 SELF ADHERED MEMBRANE
4 DENSE PACK CELLULOSE INSULATION
5 CLADDING
6 FLASHING
7 SEALANT
8 NON-HARDENING SEALANT
9 COMPRESSED FOAM ROD
10 EXPANDING POLYURETHANE SPRAY FOAM
11 RAINSCREEN STRAPPING
12 PLYWOOD GUSSET
13 FIBREGLASS BATT INSULATION
14 GLAZING UNIT
15 WINDOW SUPPORT SHIM
16 BEVELED SIDING SLOPED DAM

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

Drawing Title

LARSEN TRUSS RETROFIT

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"				
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Issued For	ALBERTA ECOTRUST FOUNDATION				

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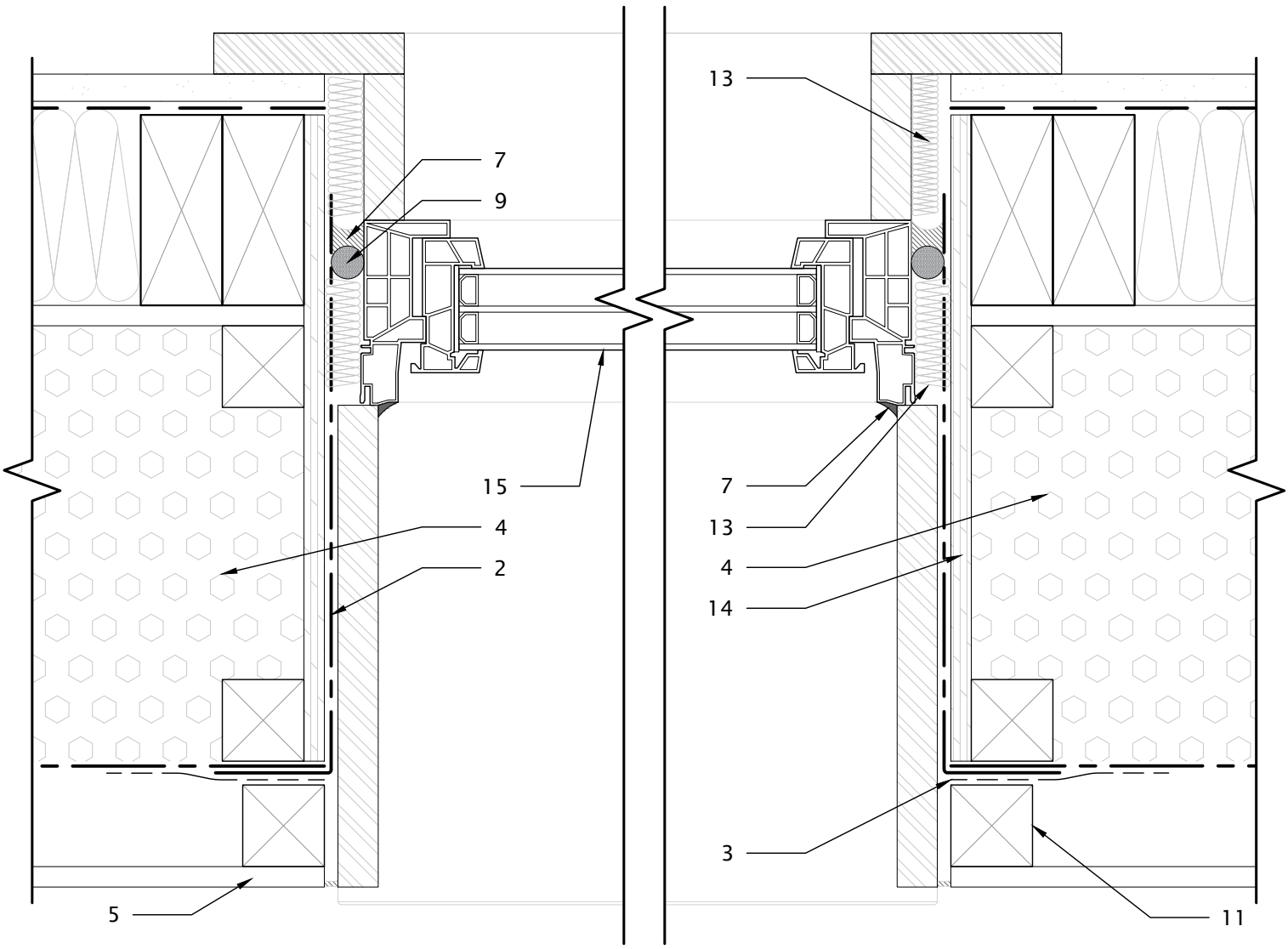

1 WINDOW JAMB PLAN DETAIL

4" = 1'-0"

1 VAPOUR BARRIER
2 AIRTIGHT WATER RESISTANT BARRIER
3 SELF ADHERED MEMBRANE
4 DENSE PACK CELLULOSE INSULATION
5 CLADDING
6 FLASHING
7 SEALANT
8 NON-HARDENING SEALANT
9 COMPRESSED FOAM ROD
10 EXPANDING POLYURETHANE SPRAY FOAM
11 RAINSCREEN STRAPPING
12 PLYWOOD GUSSET
13 FIBREGLASS BATT INSULATION
14 - ¾ PLYWOOD BUCK
15 GLAZING UNIT

[redacted]

1301-16 AVENUE NW CALGARY AB, T2M 0L4

Drawing Title

LARSEN TRUSS RETROFIT

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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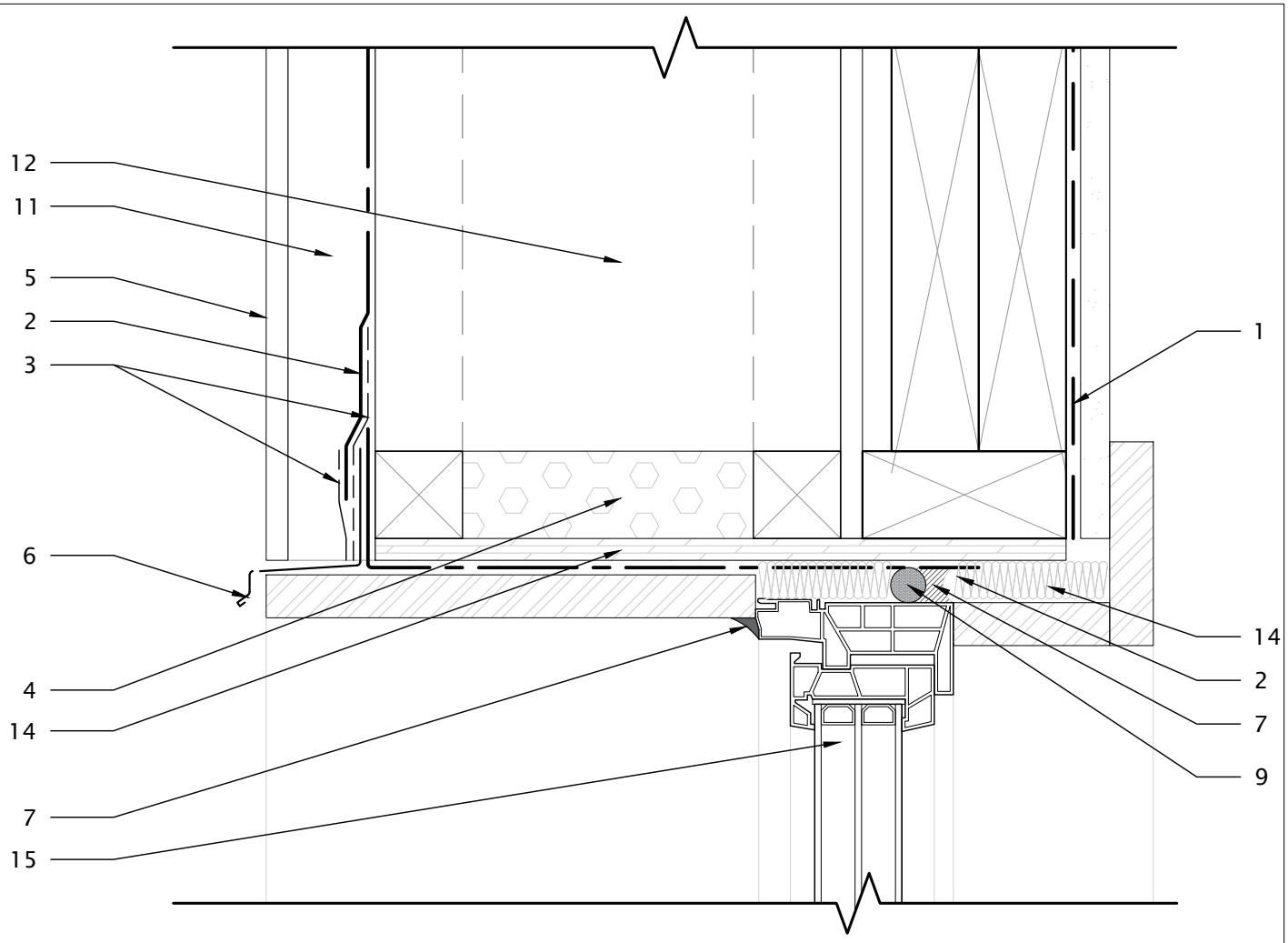

1 WINDOW HEAD SECTION DETAIL

4" = 1'-0"

1 VAPOUR BARRIER
2 AIRTIGHT WATER RESISTANT BARRIER
3 SELF ADHERED MEMBRANE
4 DENSE PACK CELLULOSE INSULATION
5 CLADDING
6 FLASHING
7 SEALANT
8 NON-HARDENING SEALANT
9 COMPRESSED FOAM ROD
10 EXPANDING POLYURETHANE SPRAY FOAM
11 RAINSCREEN STRAPPING
12 PLYWOOD GUSSET
13 FIBREGLASS BATT INSULATION
14 - ¾" PLYWOOD BUCK
15 GLAZING UNIT

[redacted]

1301-16 AVENUE NW CALGARY AB, T2M 0L4

Drawing Title

LARSEN TRUSS RETROFIT

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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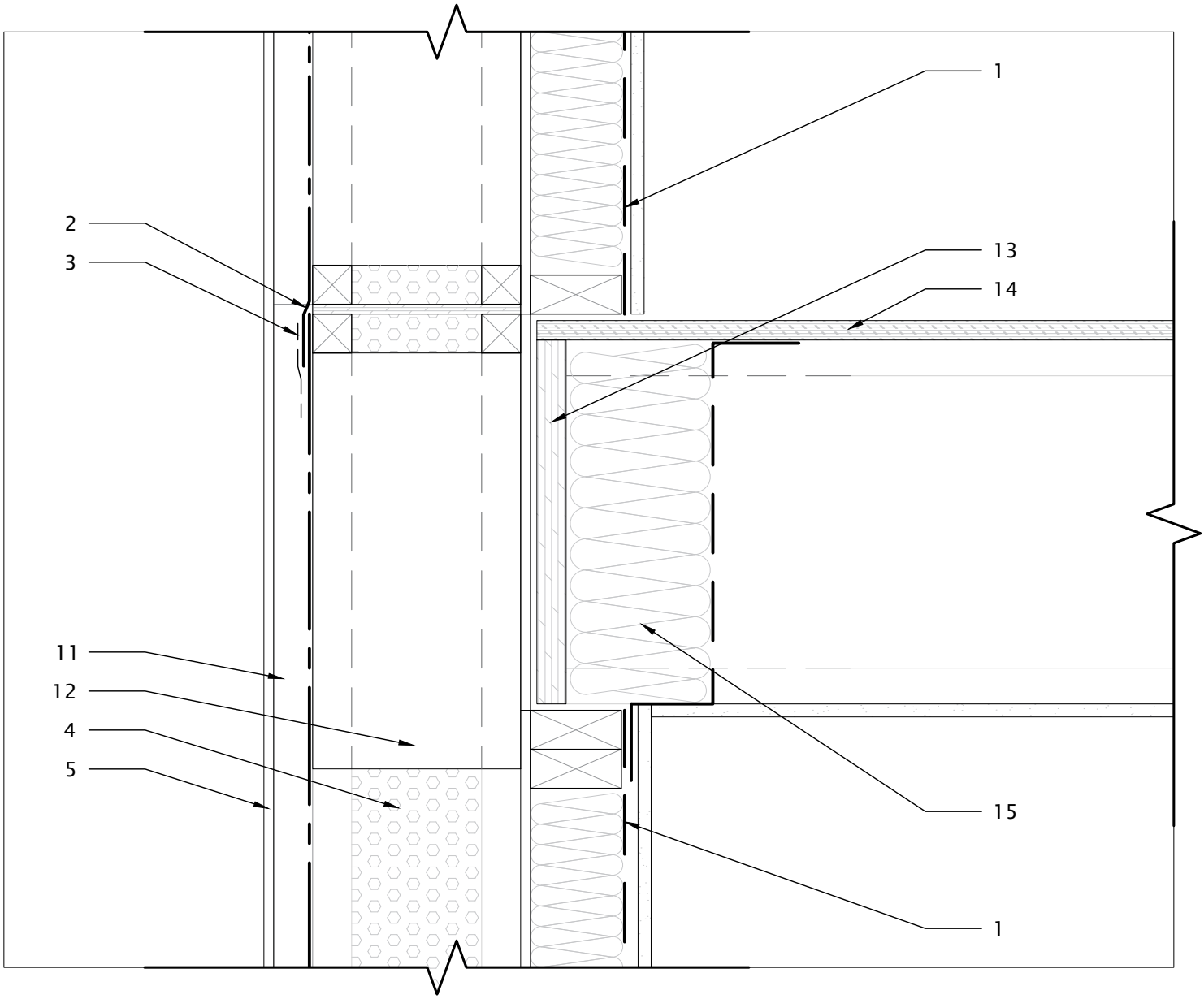

1 FLOOR TO FLOOR TRANSITION SETION DETAIL

2" = 1'-0"

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

[redacted]

1301-16 AVENUE NW CALGARY AB, T2M 0L4

Drawing Title

LARSEN TRUSS RETROFIT

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"
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Issued For	ALBERTA ECOTRUST FOUNDATION						

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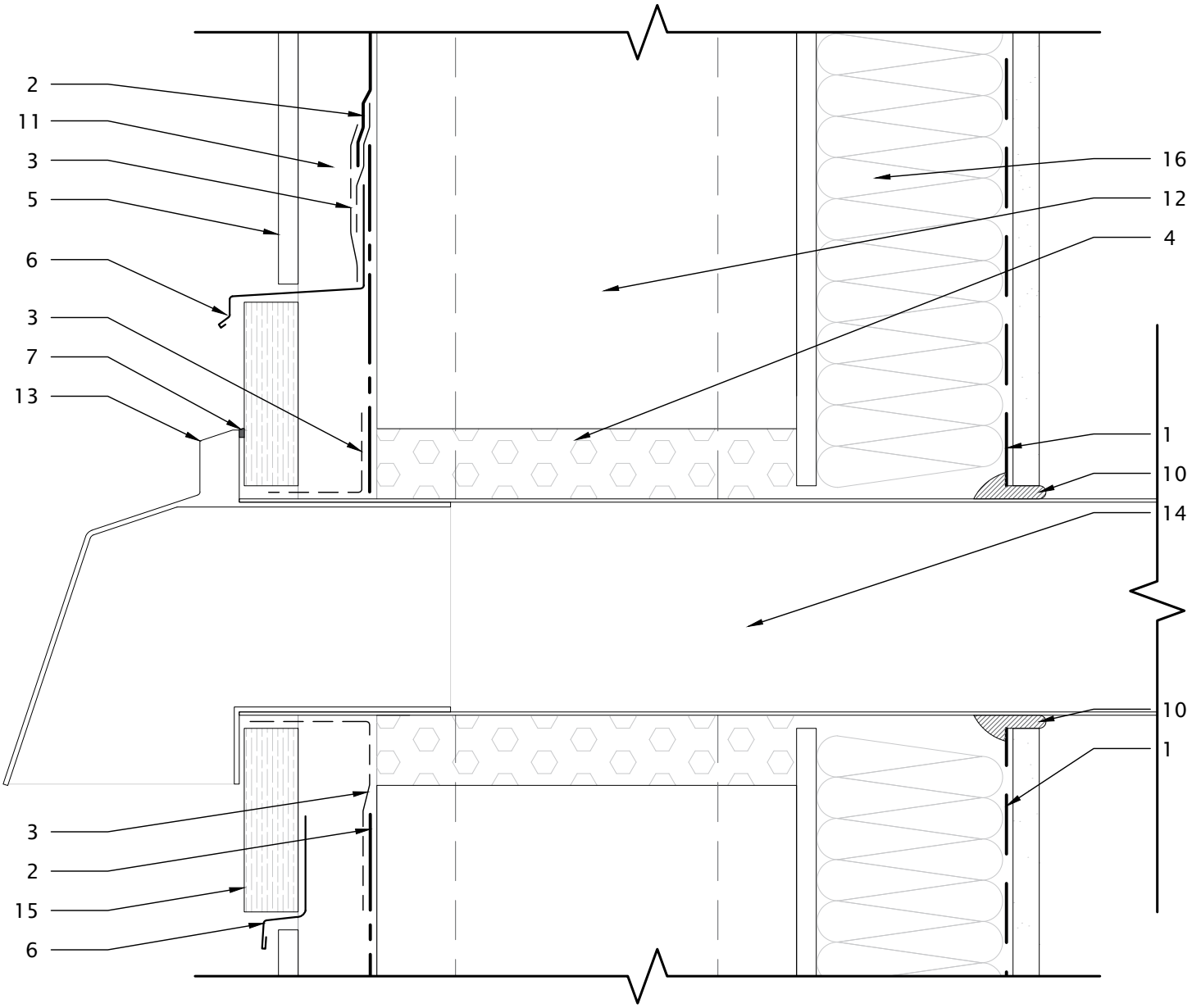

1 DUCT OPENING SECTION DETAIL

4" = 1'-0"

1 VAPOUR BARRIER
2 AIRTIGHT WATER RESISTANT BARRIER
3 SELF ADHERED MEMBRANE
4 DENSE PACK CELLULOSE INSULATION
5 CLADDING
6 FLASHING
7 SEALANT
8 NON-HARDENING SEALANT
9 COMPRESSED FOAM ROD
10 EXPANDING POLYURETHANE SPRAY FOAM
11 RAINSCREEN STRAPPING
12 PLYWOOD GUSSET
13 DUCT HOOD
14 DUCT
15 BATTEN OSB CAP
16 FIBREGLASS BATT INSULATION

[redacted]

1301-16 AVENUE NW CALGARY AB, T2M 0L4

Drawing Title

LARSEN TRUSS RETROFIT

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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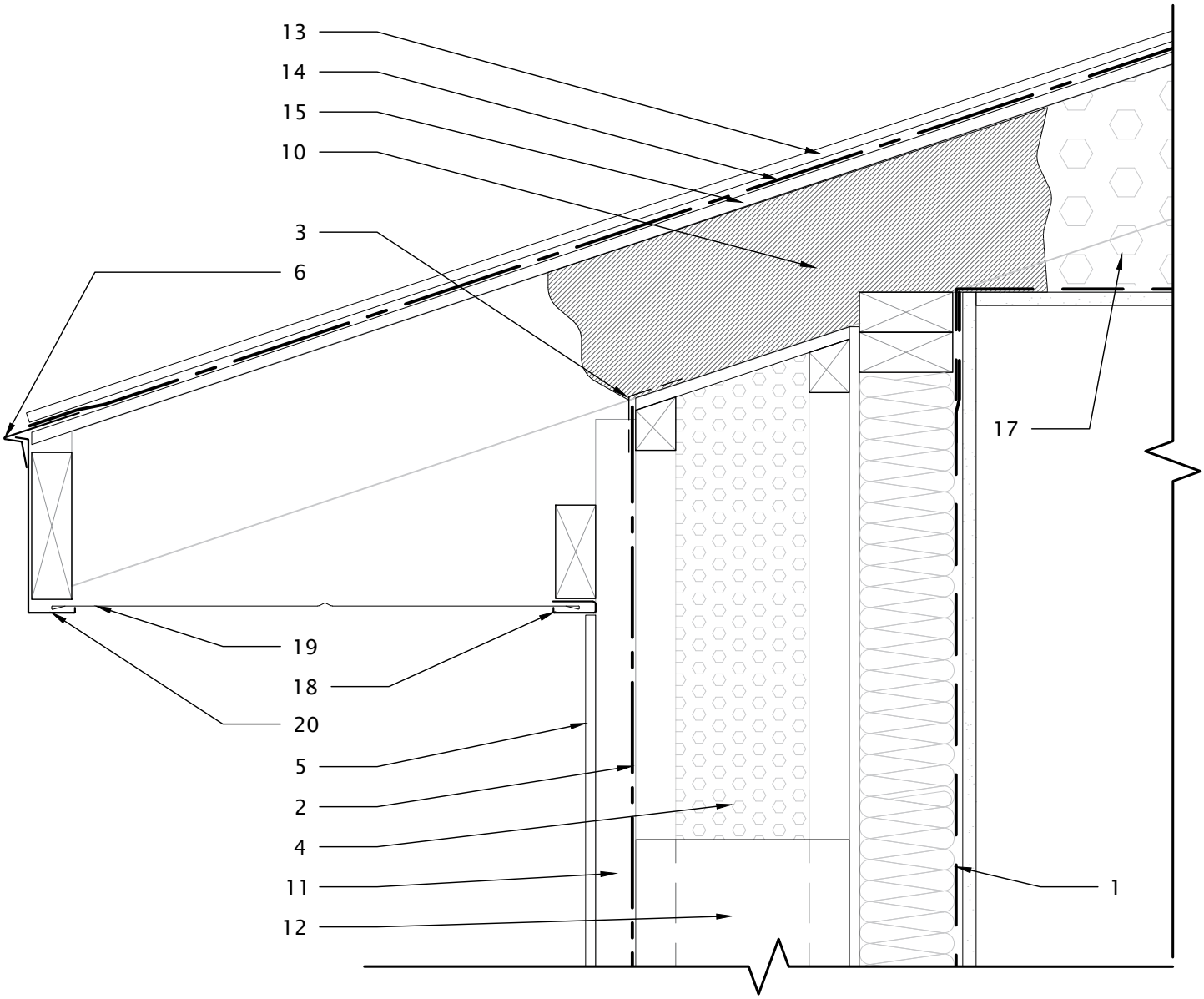

1 WALL TO ROOF TRANSITION SECTION DETAIL

2" = 1'-0"

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

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

Drawing Title

LARSEN TRUSS RETROFIT

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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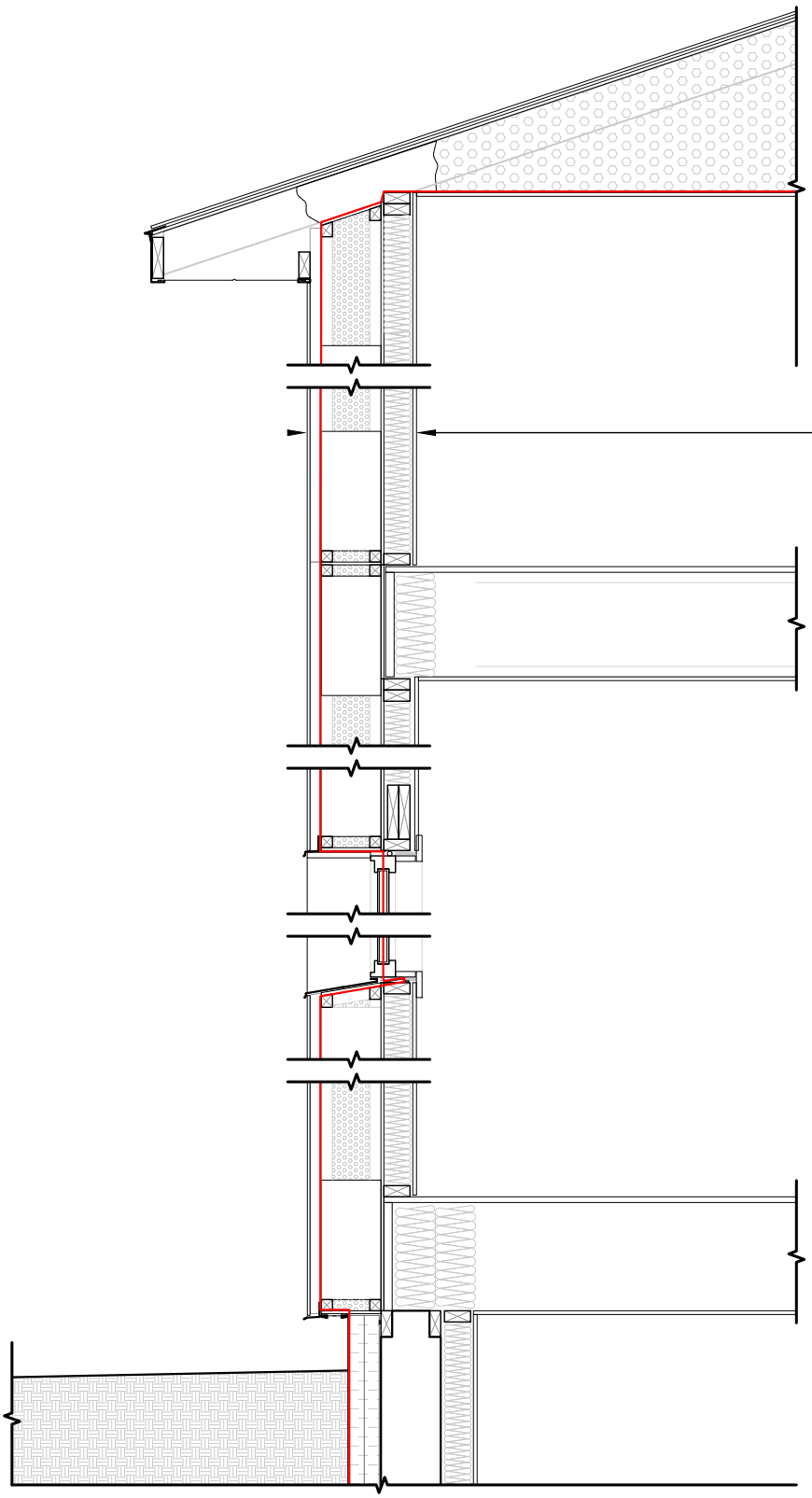

LT[1] RETROFIT ASSEMBLY

EFFECTIVE RSI = 6.52; R-VALUE = 37.03

- EXTERIOR CLADDING
- 1 ½ " RAINSCREEN STRAPPING
- AIRTIGHT WATER RESISTANT BARRIER, SHEET APPLIED MEMBRANE, VAPOUR OPEN
- LARSEN TRUSS - 2X2 STUD w/ DENSE PACK CELLULOSE INSULATION[1]
- LARSEN TRUSS - 5" DENSE PACK CELLULOSE INSULATION
- LARSEN TRUSS - 2X2 STUD w/ DENSE PACK CELLULOSE INSULATION[2]
- EXISTING ⅜" EXTERIOR SHEATHING
- EXISTING 2X4 STUD w/ BATT FIBREGLASS BATT INSULATION
- EXISTING VAPOUR BARRIER
- EXISTING ½" GYPSUM BOARD
- EXISTING INTERIOR FINISHING

NOTE

1. LT = LARSEN TRUSS
2. 16" X 8" PLYWOOD GUSSETS ACROSS THE TWO 2X2 STUDS

LEGEND

AIR BARRIER

1 AIR BARRIER CONTINUITY

1/2" = 1'-0"

[redacted]

1301-16 AVENUE NW CALGARY AB, T2M 0L4

Drawing Title

LARSEN TRUSS RETROFIT

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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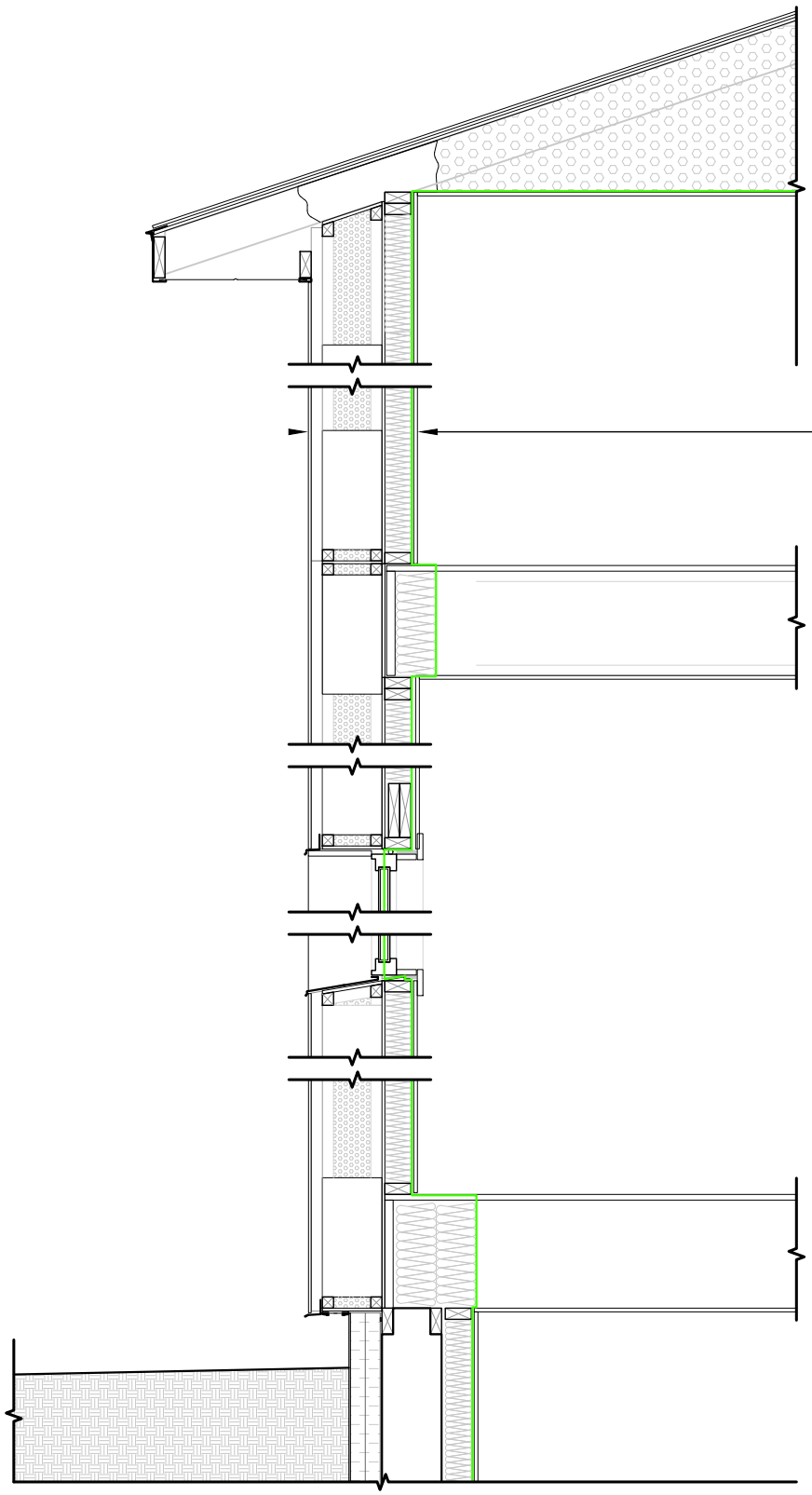

LT[1] RETROFIT ASSEMBLY

EFFECTIVE RSI = 6.52; R-VALUE = 37.03

- EXTERIOR CLADDING
- 1 ½ " RAINSCREEN STRAPPING
- AIRTIGHT WATER RESISTANT BARRIER, SHEET APPLIED MEMBRANE, VAPOUR OPEN
- LARSEN TRUSS - 2X2 STUD w/ DENSE PACK CELLULOSE INSULATION[1]
- LARSEN TRUSS - 5" DENSE PACK CELLULOSE INSULATION
- LARSEN TRUSS - 2X2 STUD w/ DENSE PACK CELLULOSE INSULATION[2]
- EXISTING ⅜" EXTERIOR SHEATHING
- EXISTING 2X4 STUD w/ BATT FIBREGLASS BATT INSULATION
- EXISTING VAPOUR BARRIER
- EXISTING ½" GYPSUM BOARD
- EXISTING INTERIOR FINISHING

NOTE

1. LT = LARSEN TRUSS
2. 16" X 8" PLYWOOD GUSSETS ACROSS THE TWO 2X2 STUDS

LEGEND

VAPOUR BARRIER

1 VAPOUR BARRIER CONTINUITY

1/2" = 1'-0"

[redacted]

1301-16 AVENUE NW CALGARY AB, T2M 0L4

Drawing Title

LARSEN TRUSS RETROFIT

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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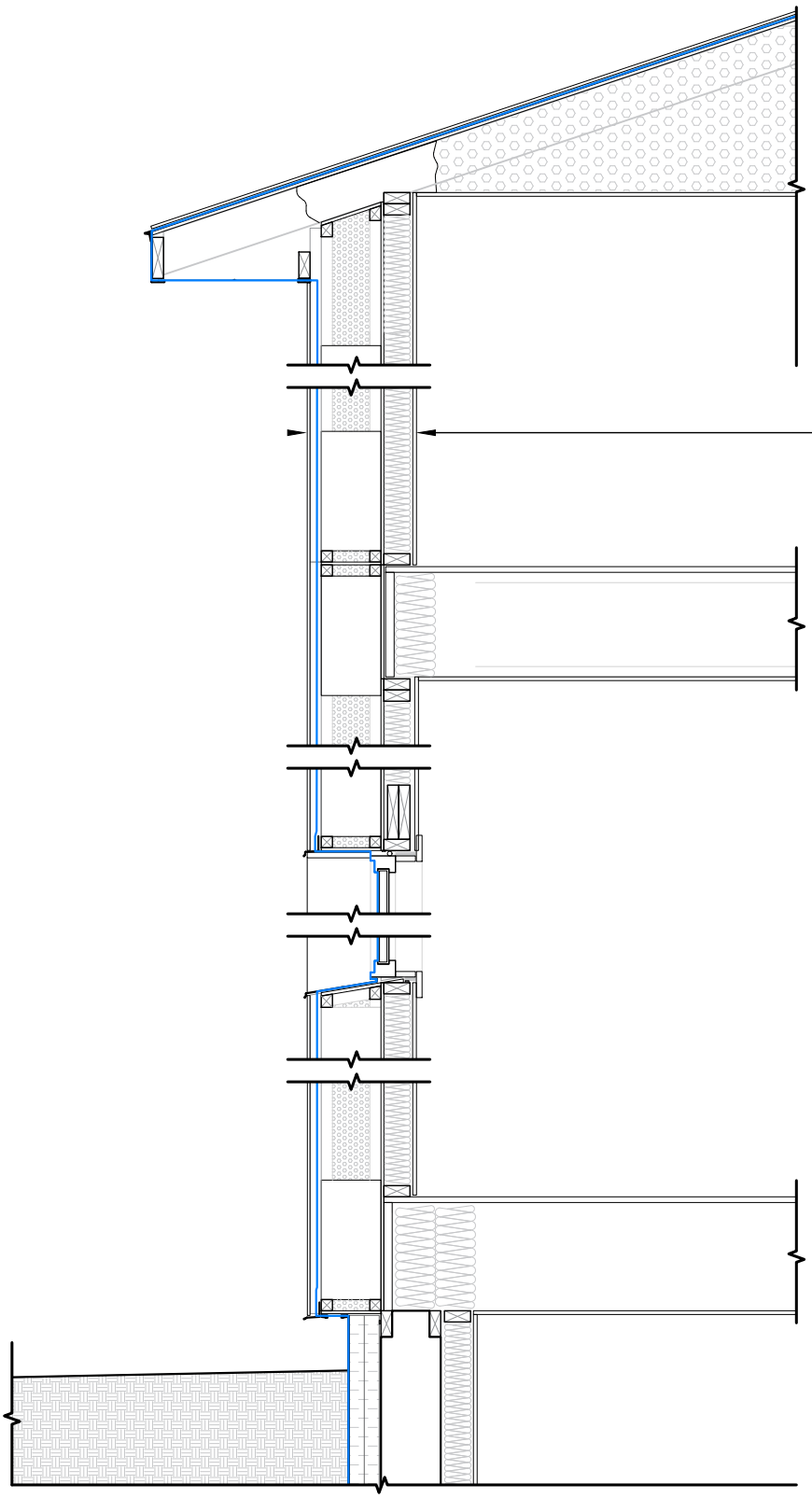


LT[1] RETROFIT ASSEMBLY

EFFECTIVE RSI = 7.69; R-VALUE = 44

- EXTERIOR CLADDING
- 1 ½ " RAINSCREEN STRAPPING
- AIRTIGHT WATER RESISTANT BARRIER, SHEET APPLIED MEMBRANE, VAPOUR OPEN
- LARSEN TRUSS - 2X2 STUD w/ DENSE PACK CELLULOSE INSULATION[1]
- LARSEN TRUSS - 5" DENSE PACK CELLULOSE INSULATION
- LARSEN TRUSS - 2X2 STUD w/ DENSE PACK CELLULOSE INSULATION[2]
- EXISTING ⅜" EXTERIOR SHEATHING
- EXISTING 2X4 STUD w/ BATT FIBREGLASS BATT INSULATION
- EXISTING VAPOUR BARRIER
- EXISTING ½" GYPSUM BOARD
- EXISTING INTERIOR FINISHING

NOTE

1. LT = LARSEN TRUSS
2. 16" X 8" PLYWOOD GUSSETS ACROSS THE TWO 2X2 STUDS

LEGEND

WATER BARRIER

1 WATER BARRIER CONTINUITY

1/2" = 1'-0"

[redacted]

1301-16 AVENUE NW CALGARY AB, T2M 0L4

Drawing Title

LARSEN TRUSS RETROFIT

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: **Larsen Truss Retrofit Wall Assembly**

Materials in Assembly					RSI, (m^2*K)/W	R-Value
Outside Air Film					0.03	0.17
Rainscreen (38mm x 0.0085 RSI/mm)	RSI_F =	0.323	% area of framing =	23	$RSI_{Parallel}$=	
Rainscreen Air Cavity (38mm)	RSI_C =	0.18	% area of cavity =	77	0.20	1.14
Building Paper					0.00	0.00
Exterior Larsen Truss Framing (38mm x 0.0085 RSI/mm)	RSI_F =	0.323	% area of framing =	23	$RSI_{Parallel}$=	
Exterior Larsen Truss Cavity Dense Pack Cellulose (38mm)	RSI_C =	0.95	% area of cavity =	77	0.66	3.75
Larsen Truss Cavity Dense Pack Cellulose (127mm)					3.18	18.06
Interior Larsen Truss Framing (38mm x 0.0085 RSI/mm)	RSI_F =	0.323	% area of framing =	23	$RSI_{Parallel}$=	
Interior Larsen Truss Cavity Dense Pack Cellulose (38mm)	RSI_C =	0.95	% area of cavity =	77	0.66	3.75
OSB Sheathing (9.5mm)					0.0930	0.53
Stud @ 406mm O.C (89mm x 0.0085 RSI/mm)	RSI_F =	0.76	% area of framing =	23	$RSI_{Parallel}$=	
Batt Insulation (R12)	RSI_C =	2.11	% area of cavity =	77	1.50	8.51
Gypsum (12.7mm)		0.8			0.08	0.45
Interior Air Film		57.6			0.12	0.68
			Calculated RSI_{EFF}=		**6.52**	**37.03**
			9.36 Prescriptive RSI Required =		3.08	17.49
			W/HRV		2.97	16.86

Parallel Path Flow Calculations

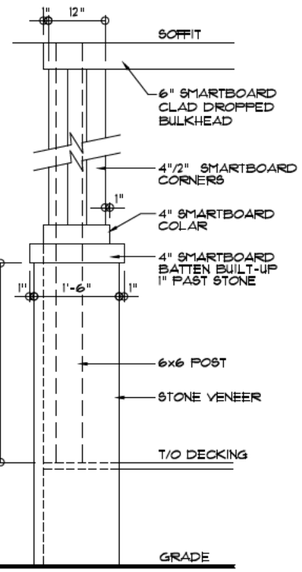
89mm stud with 89mm Batt Insulation (R12)

$$RSI_{Parallel} = \frac{100}{\frac{23}{0.76} + \frac{77}{2.11}} = 1.50 \quad (m2*K)/W$$

Appendix C:

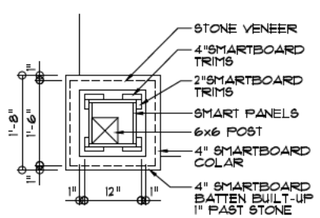
Cost Analysis Model Home

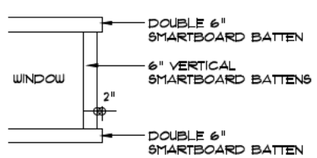
[redacted]



COLUMN DETAIL

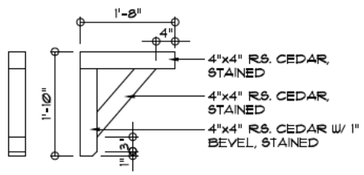
SCALE: 3/8" = 1'-0"





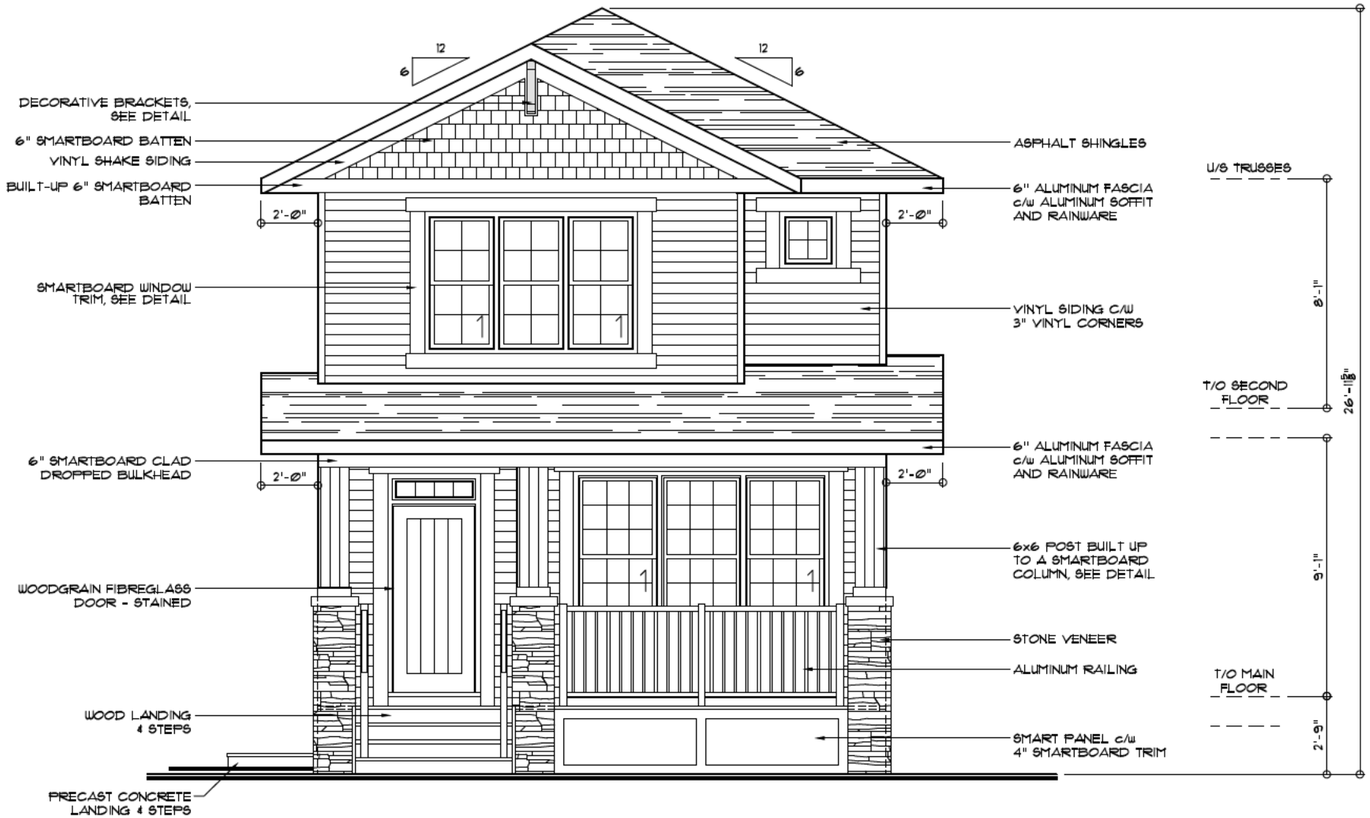
WINDOW TRIM DETAIL

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



BRACKET DETAIL

SCALE: 3/8" = 1'-0"



FRONT ELEVATION

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

[redacted]

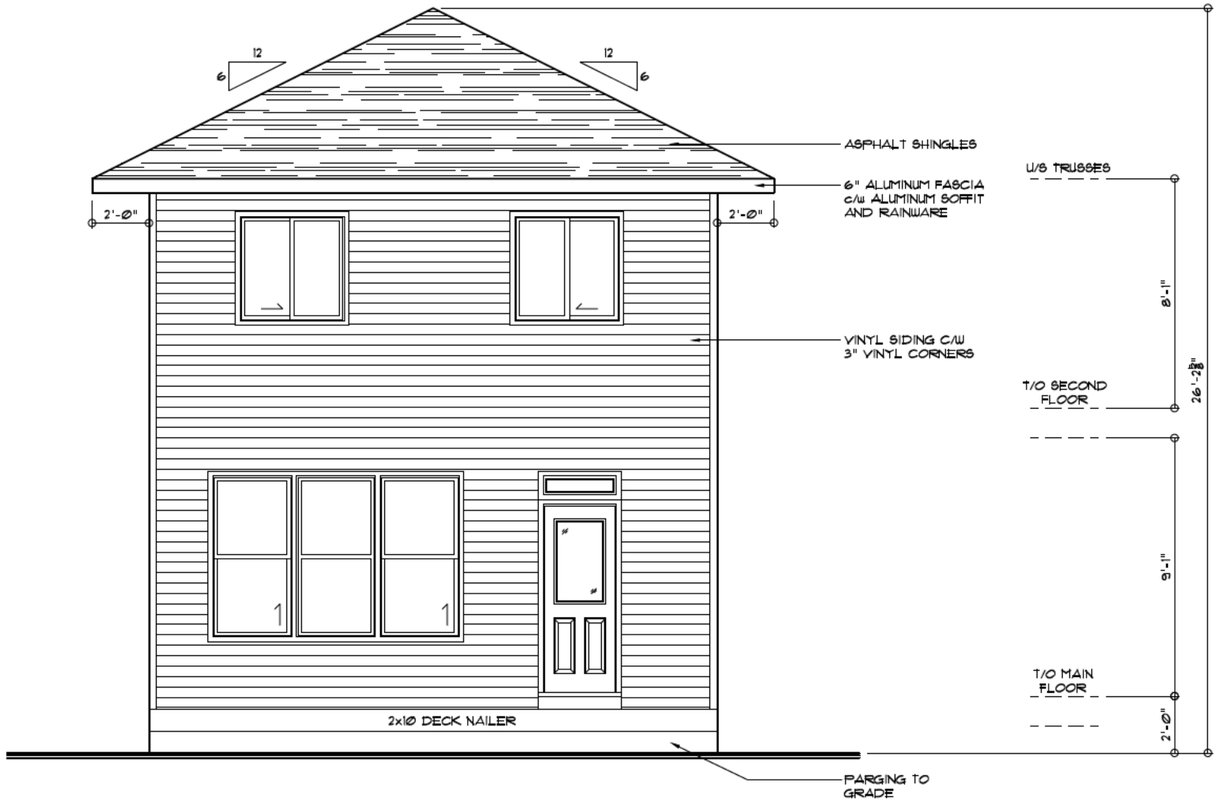
ADDRESS: [redacted]

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



[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.

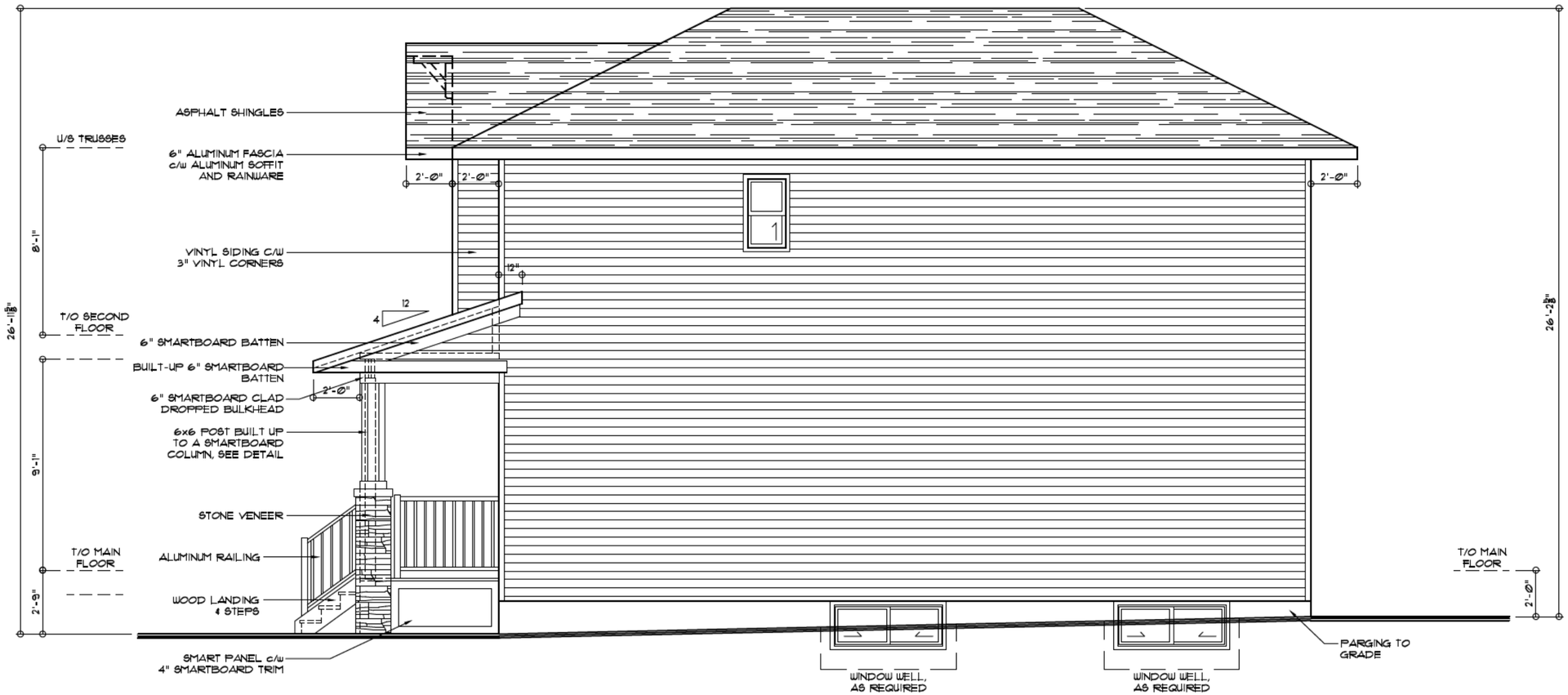
REVISIONS:

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]

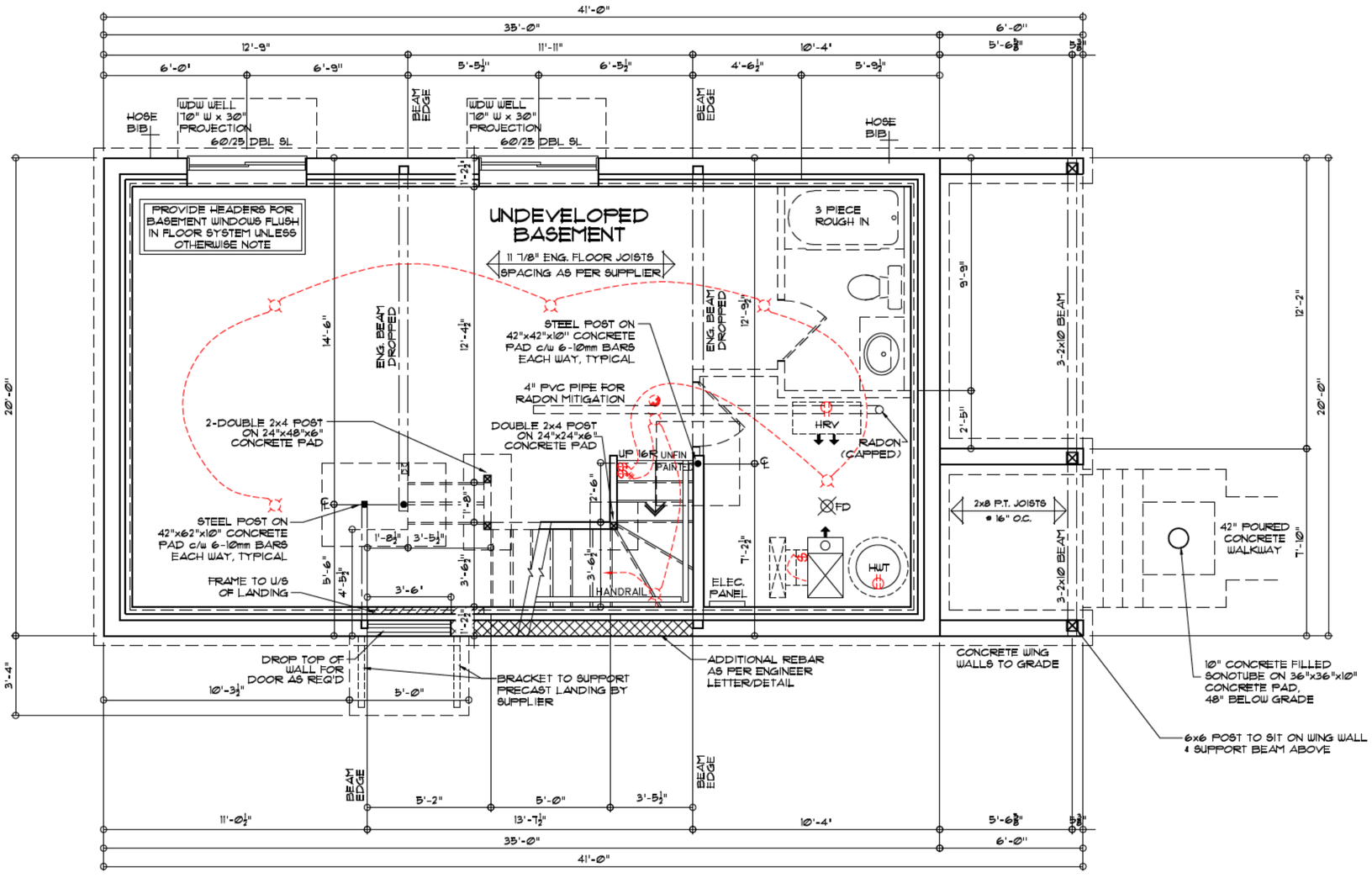
ADDRESS: [redacted]

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'-Ø"

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

[redacted]

ADDRESS: [redacted]

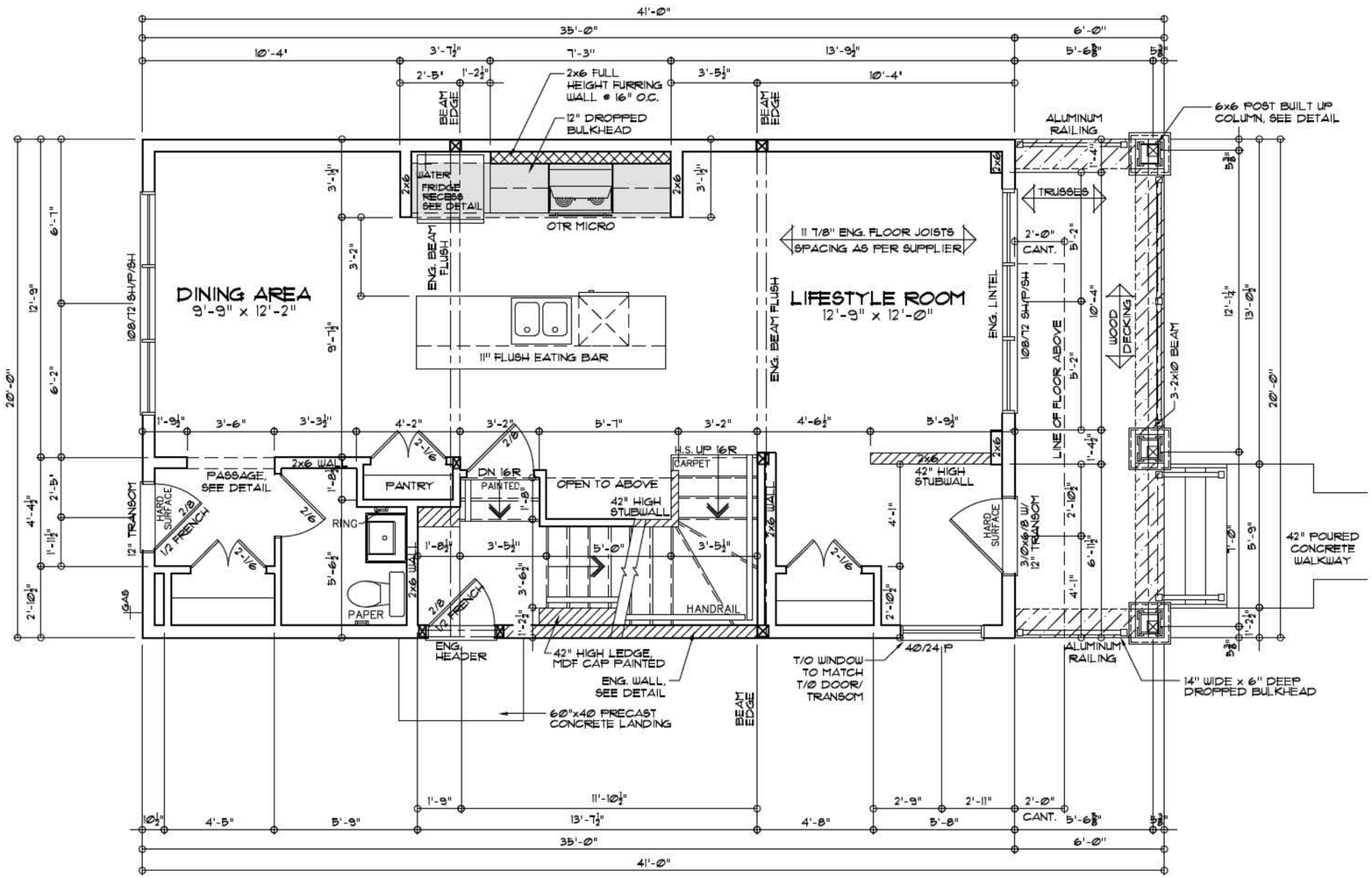
TOTAL AREA:	1440	sq.ft.
MAIN FLOOR:	700	sq.ft.
UPPER FLOOR:	740	sq.ft.
GARAGE:	N/A	sq.ft.
BSMNT DEV:	N/A	sq.ft.
DECK:	N/A	sq.ft.

REVISIONS:

MODEL: 2 STOREY

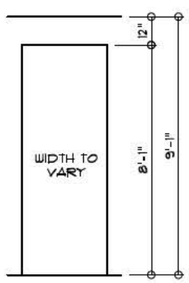
ELEVATION: CRAFTSMAN

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



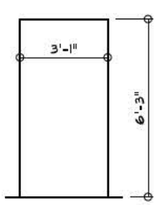
MAIN FLOOR PLAN

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]

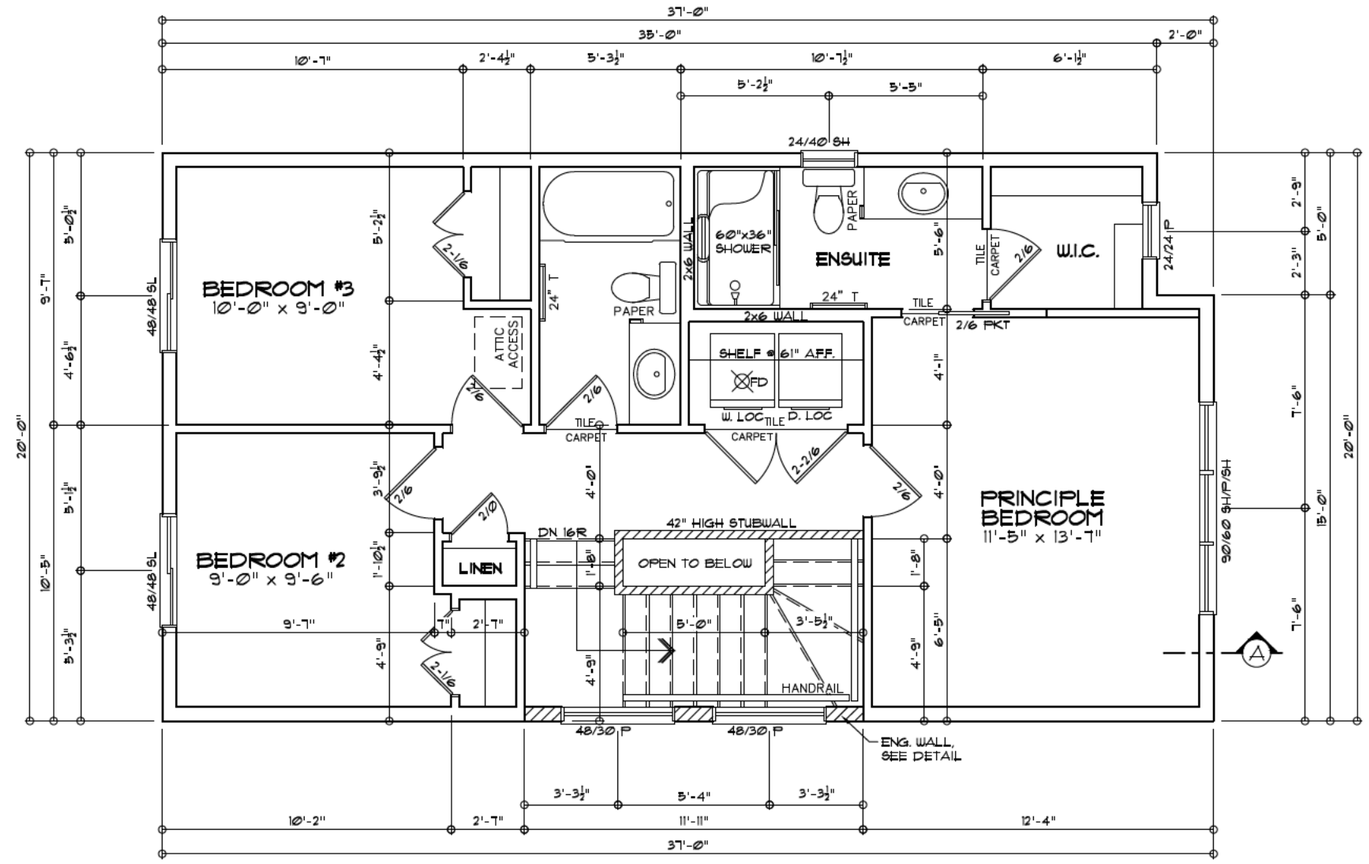
ADDRESS: [redacted]

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



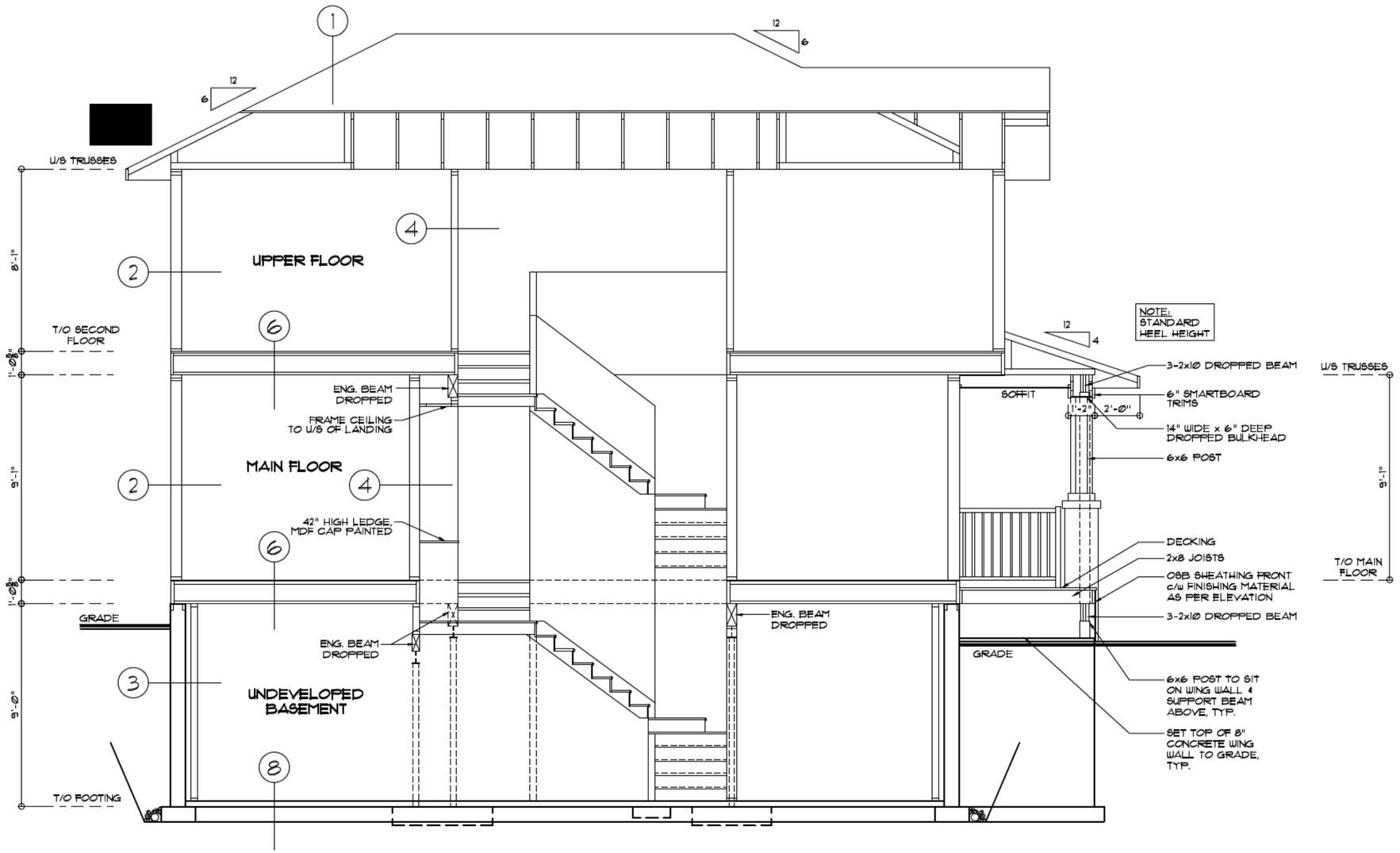
UPPER FLOOR PLAN

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

Larsen Truss Retrofit Assembly


DELTA
DELTA


Caution
Do NOT climb or stand on the Wall displays
Beware of SHARP Edges and Splinters
These are real examples of walls and have all the pointy bits associated
Thank you
enbj
LARSEN
TRUSS


Caution
Do NOT climb or stand on the Wall displays
Beware of SHARP Edges and Splinters
These are real examples of walls and have all the pointy bits associated
Thank you
enbi
FIRE RATED
RETARDANT


PREMIER
Garant


SOPREMA
SOPRASEAL
SOPRASEAL STICK VASHPRO


SOPREMA
SOPRASEAL STICK FLASHPRO
GRAINGER
DELTA
FLASHING


DELTA