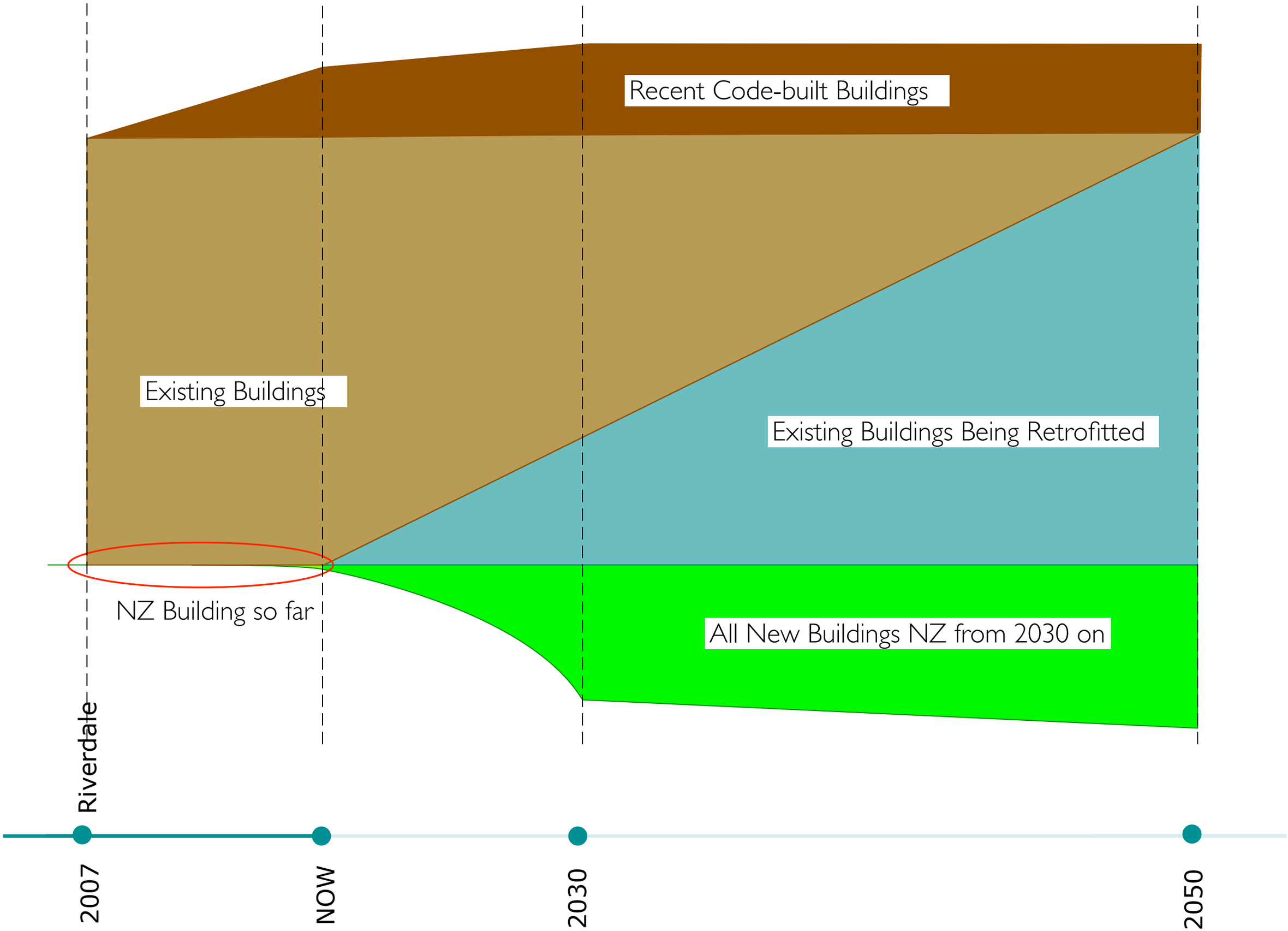
2050


Recent Code-built Buildings
Existing Buildings
Existing Buildings Being Retrofitted
NZ Building so far
All New Buildings NZ from 2030 on
Riverdale
2007
NOW
2030
2050

Ritchie Deep Energy Retrofit

http://renubuildingscience.com/wartime-in-ritchie/

Connors Hill Deep Energy Retrofit


ZIPsystem
30 YEAR SYSTEM LIMITED


ALPHA


ZIPsystem


ZIPsystem


Sundance Housing Cooperative
87 St NW
87 St NW
87 St NW
87 St NW
87 St NW

EnergieSprong

Unit #22

Similar to Unit #15, Unit #22 has a history of occupant complaints due to cold rooms and wall surfaces. We undertook a similar thermal imaging review of this unit, with findings summarized in Figure 8 and 9. Similarly, we found minor areas with raised surface temperature, mostly around the front patio wall to ceiling connection. This area could certainly lead to a localized cold spot on the interior of the unit, however, we'd suggest that a proper volume of heating air supply should maintain internal comfort. The main wall areas show a relatively uniform surface temperature, which suggests current insulation levels are quite consistent. We'd suggest that if thermal comfort continues to be an issue in this unit, then a service contractor could be brought into assess the airflow balance of the furnace.

Figure 8: Infrared Thermal Images of Sundance Unit #15, taken just after sunrise on November 15, 2017. IR images shown on the left, with corresponding regular image shown to the right. The color legend represents the range in temperature present in the image; note that glass temperature is not accurately reflected in these images.

Figure 9: Infrared Thermal Images of Sundance Unit #15, taken just after sunrise on November 15, 2017. IR images shown on the left, with corresponding regular image shown to the right. The color legend represents the range in temperature present in the image; note that glass temperature is not accurately reflected in these images.

Figure 4: Screen capture of IES<VE> energy model representing the Sundance Housing Cooperative, plan view.

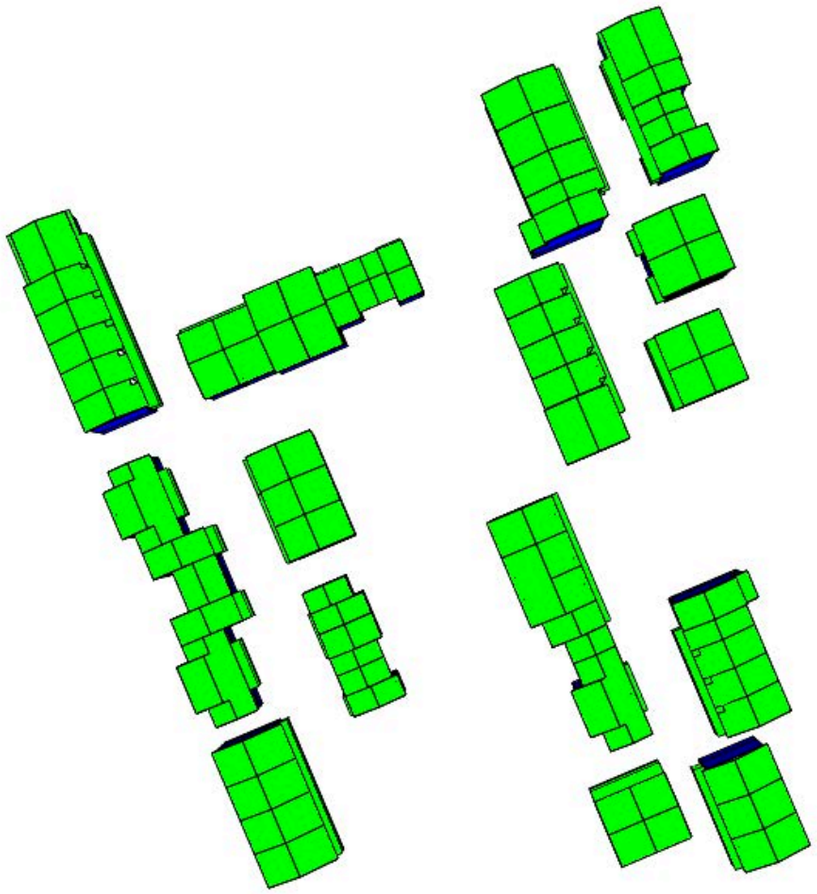


Table 1: Thermal description of the building envelope scenarios modelled as part of this Sundance BCA.

Sundance Housing Cooperative Building Envelope Scenarios				
Envelope Elements	Scenario #1	Scenario #2	Scenario #3B	Scenario #3A
Roof	R20	R60	R68	R68
Walls Above Grade	R13.6	R17.5	R42	R42
Foundation Walls	R1 + Contact	R1 + Contact	R1 + Contact	R20
Slab	R1 + Contact	R1 + Contact	R1 + Contact	R10
Exposed Floor	R12	R28.5	R28.5	R28.5
Windows	R2, SHGC:0.24	R2, SHGC: 0.24	R8, SHGC: 0.24	R8, SHGC: 0.24
Door	R1.2	R1.2	R7.5	R7.5
Airtightness (ACH@50Pa)	3.0	2.0	0.5	0.5
ERV Efficiency (%)	No HRV	No HRV	90%	90%

Our energy modelling has produced estimated peak heating and cooling load data for the Sundance site, shown in Table 2, as well as annual heating and cooling energy demand, shown in Table 3.

Table 2: Summary of estimated Sundance retrofit peak heating and cooling loads, using ASHREAE Heat Balance Method. Heating setpoint of 22°C, Cooling setpoint of 24°C.

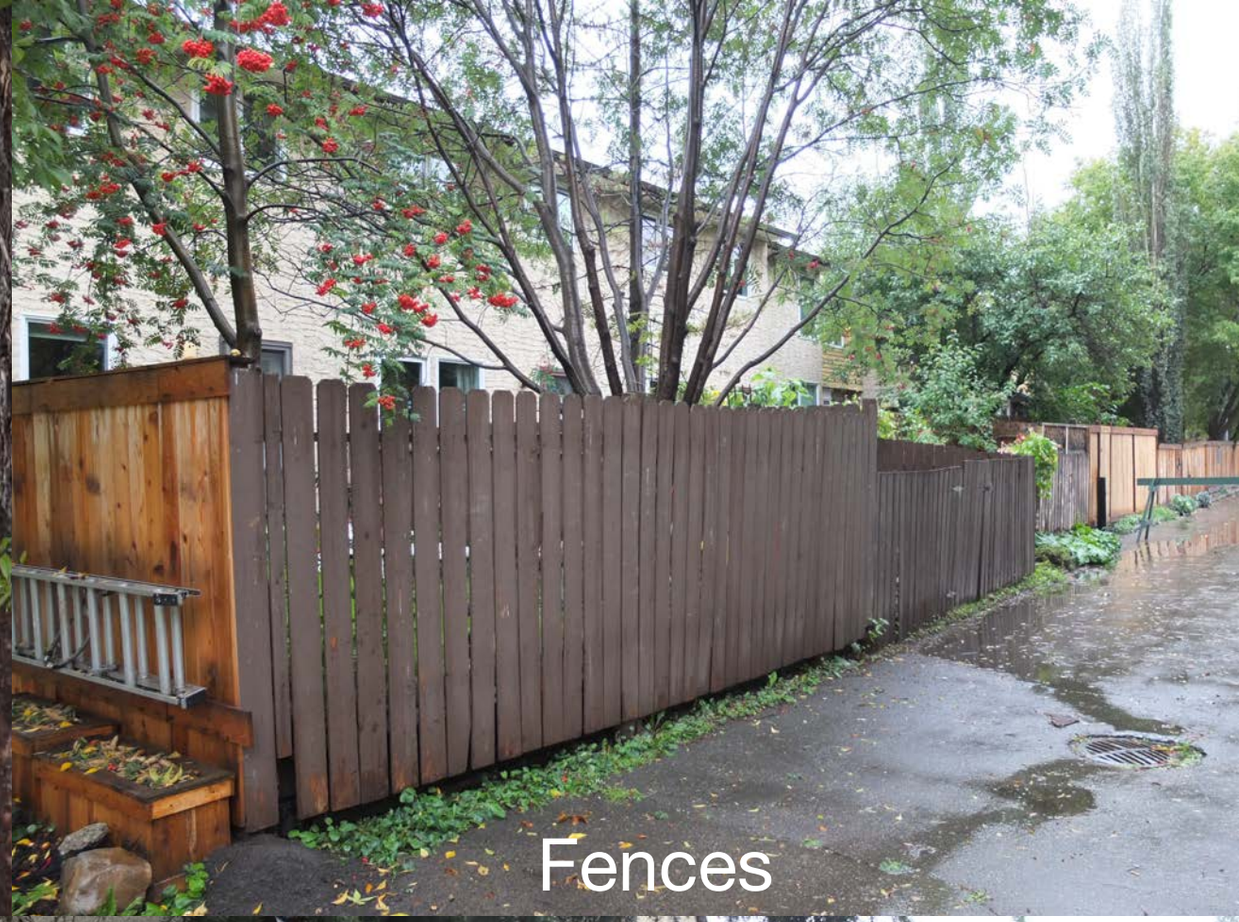
Sundance - Avg Retrofit Heating & Cooling Load				
Scenario	Peak Load (BTU/h)		% Decrease in Peak Load	
	Heating	Cooling	Heating	Cooling
Scenario #1	37769	8141	-	-
Scenario #2	33618	7311	11%	10%
Scenario #3B	24399	5818	35%	29%
Scenario #3A	16309	5067	57%	38%

Table 3: Summary of estimated Sundance retrofit annual heating and cooling energy demand, from IES energy modelling. Heating setpoint of 22°C, Cooling setpoint of 24°C.

Annual Heating and Cooling Demand for Each Scenario				
Scenario	Ann. Demand (kWh)		% Decrease in Ann Demand	
	Heating	Cooling	Heating	Cooling
Scenario #1	1719108	12259	-	-
Scenario #2	1497241	10192	13%	17%
Scenario #3B	690119	8744	60%	29%
Scenario #3A	304354	9648	82%	21%

Our team has worked with Butterwick Construction and NüEnergy Systems to produce detailed capital cost estimates for the three proposed building envelope retrofit scenarios. This data is summarized in Table 4.

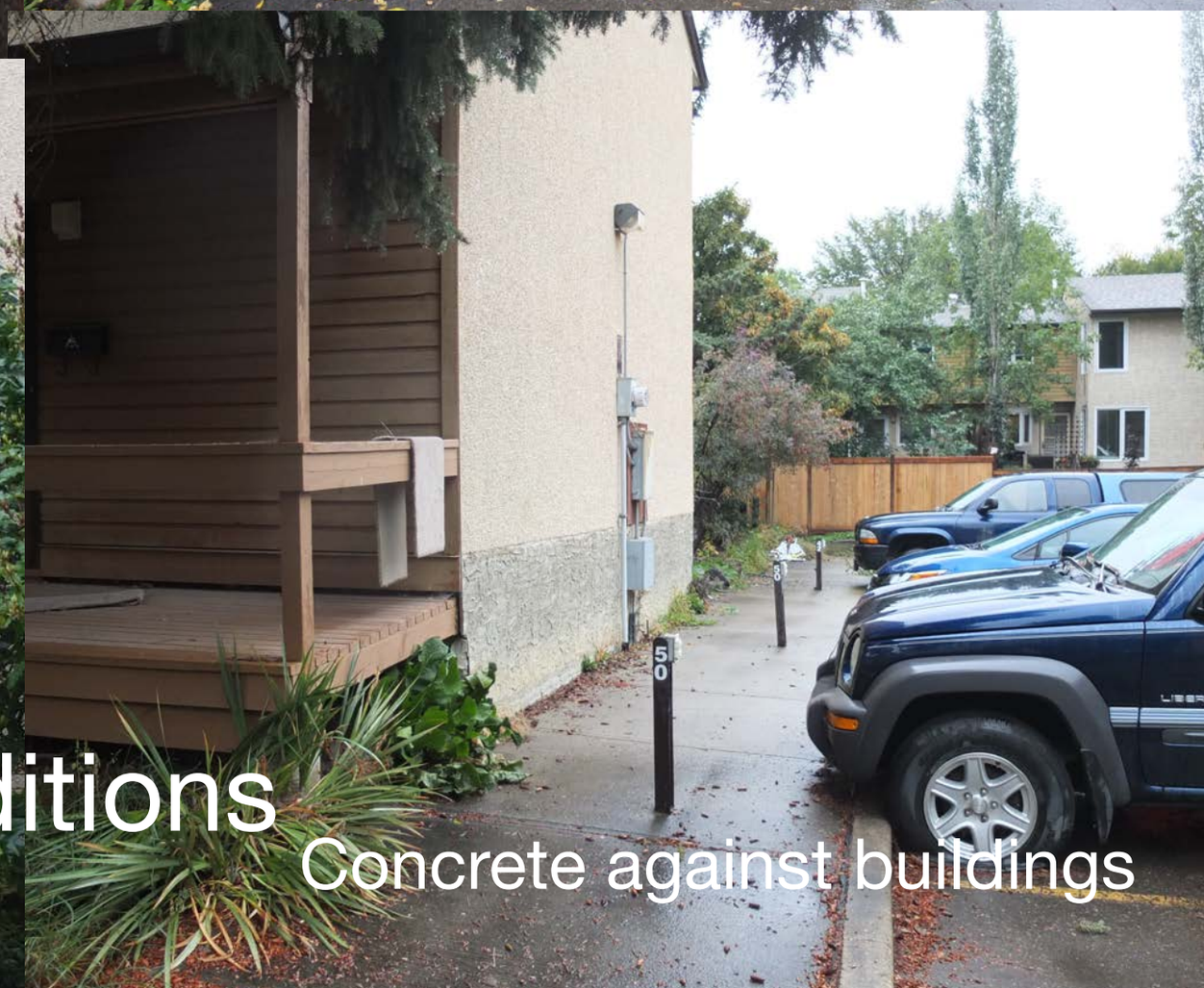
Mature Landscaping



Fences

Sheds

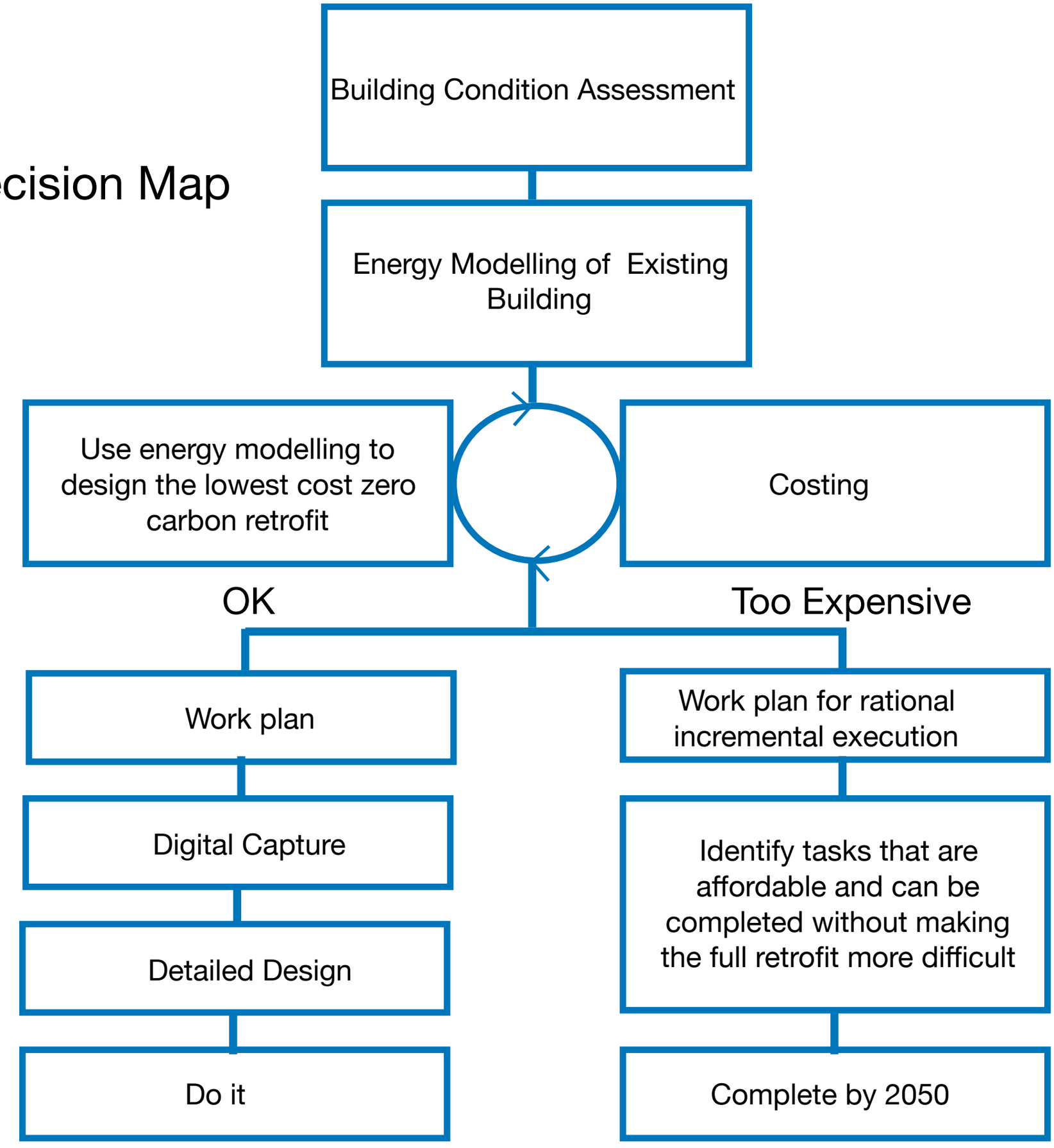
Site Conditions



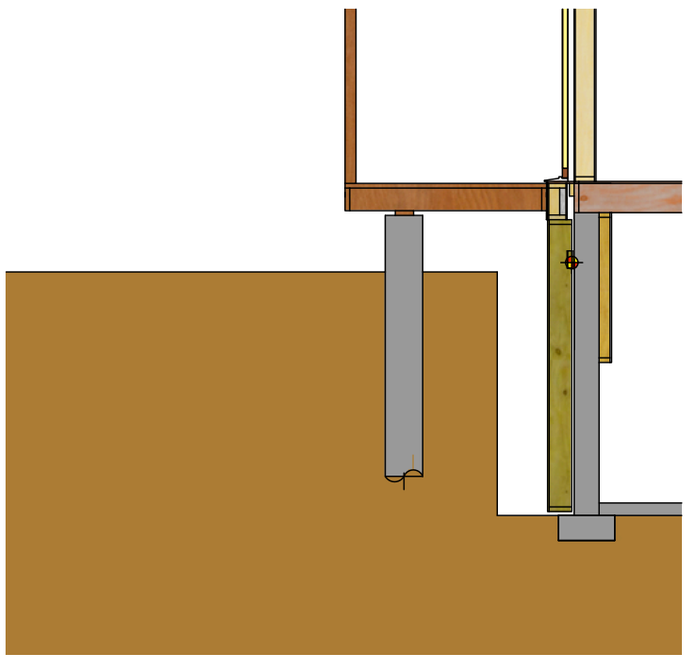
Concrete against buildings

Site Conditions

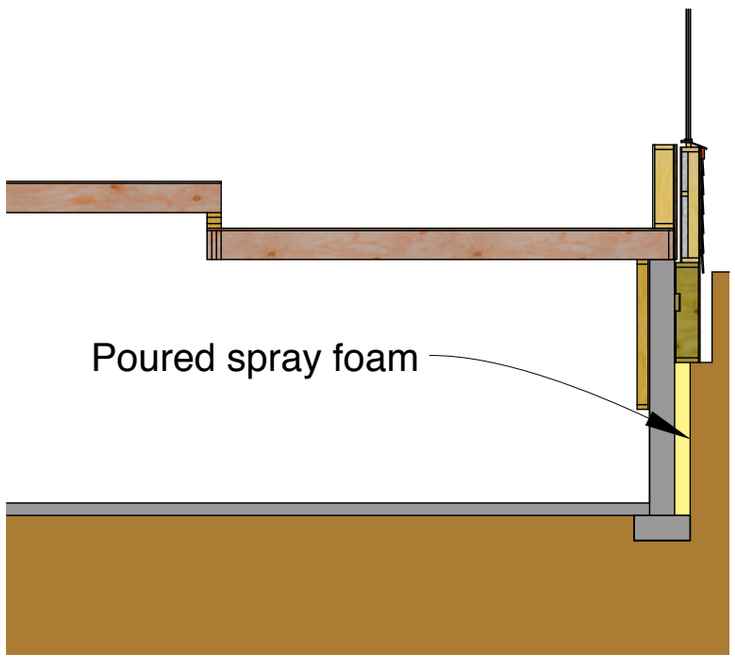
Retrofit Decision Map



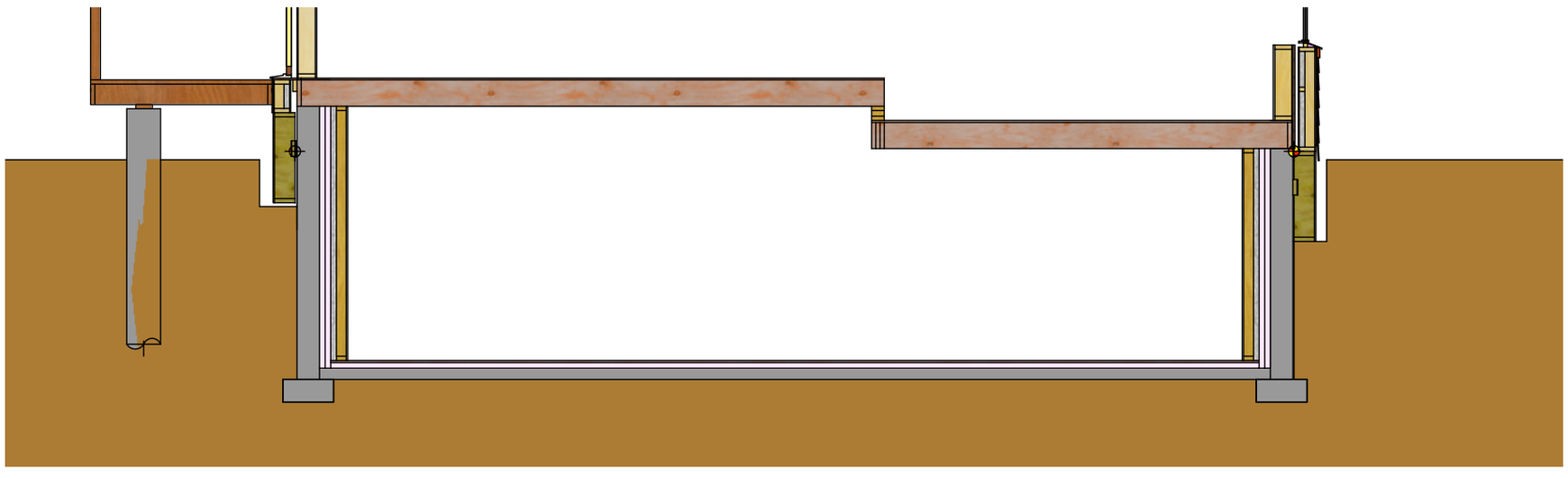
Foundation Options



Full Height 2x8 PFW Exterior Wall



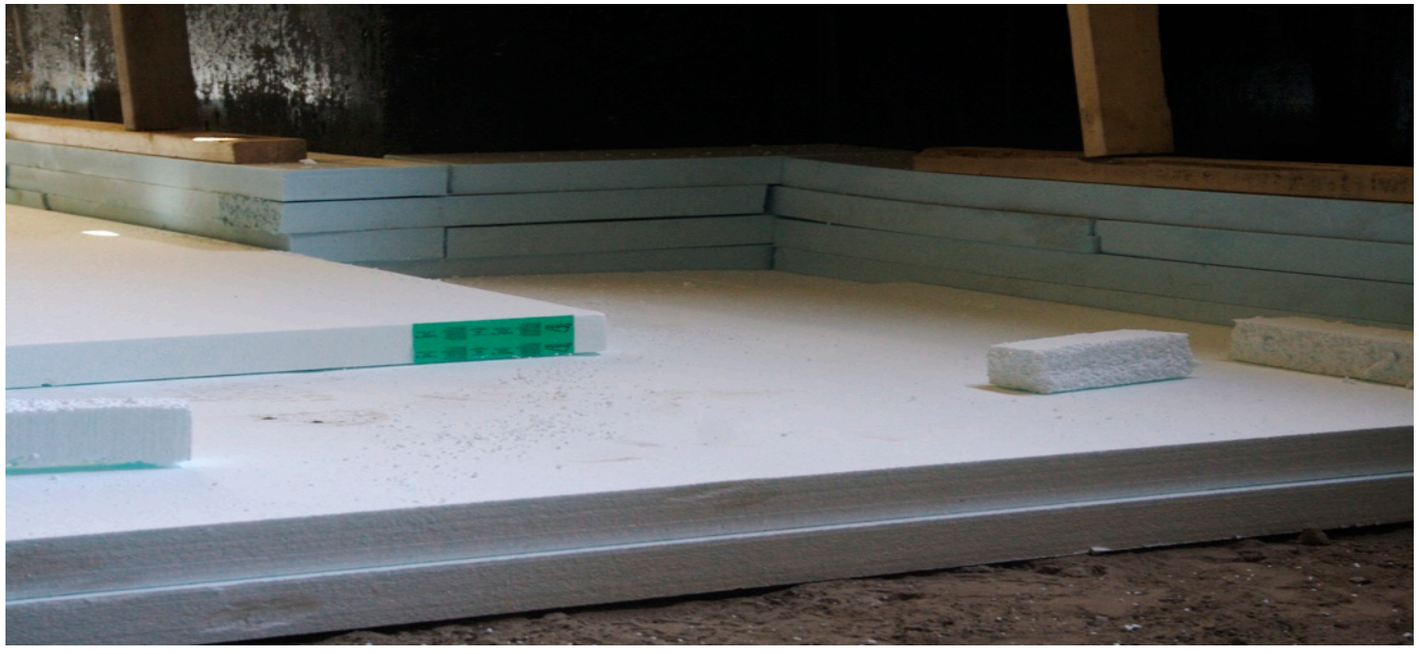
Partial 2x8 PFW Exterior Wall
w/ Poured Spray foam Below



Inside R 35 Frostwall with R 10 Basement Floor Insulation

Cost of Church Underslab Insulation Increments

SLAB INSULATION	R16	R16 - R24	R24 - R40	R40 - R56	R56 - R64	R16 - R64
Heat loss -kWh/m²/A *	28	24.8	22.1	20.6	20.1	20.1
Energy Saving of Increment kWh/A	0*	1672.32	1411.02	783.9	261.3	4128
Cost of Increment		$3,210.00	$6,420.00	$6,420.00	$3,210.00	$19260
Cost/kWh/A of Increment		$1.92	$4.55	$8.19	$12.28	$4.67



* From PHPP9 using the ‘Variants’ function

** Based on Edmonton Climate ~ 9000°F HDD

Cost Benefit Using Modelling Results*

Entire Retrofit

	Annual Heating Demand (kWh/a)	Cost
As built	1719108	
Scenario 3B from BCA #2	690119	$4,878,508.00
Reduction from 3B measures	1028989	
Cost per annual kWh saved		$4.74

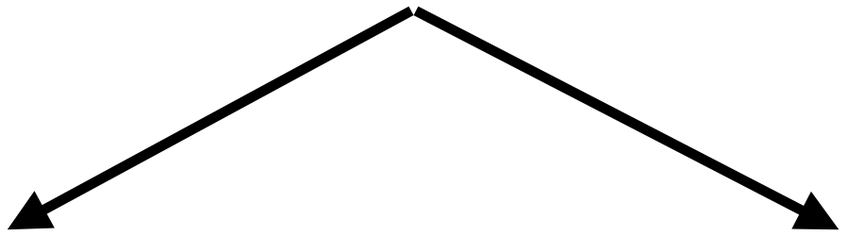
Foundation Options

Scenario	Description	Annual Heating (kWh/a) Demand	Reduction from Scenario #2
1	As built	9557	
2	Energiesprong roof, wall upgrade including windows, 1.25ACH 50, No foundation insulation (kWh/a)	4146	5411
3	2 plus inside inside - wall only, 1.0 ACH50 (kWh/a)	2446	1700
4	2 plus outside insulation- wall only, 1.0 ACH50 (kWh/a)	2190	1956
6	Inside Wall Insulation R35 , Slab at R10 , No Thermal bridge (kWh/a)	1812	2334
	Annual Heating demand reduction to insulate the floor (kWh/a) (Scenario 4- Scenario 6)		378
	Cost difference to Insulate the floor (from BCA#2)		$5,250.00
	Cost per Annual kWh saved		$13.89

*From HOT2000 and IES>VE

Sundance Project Plan

- Choose and master Digital Capture tool
- Retrofit the first two-unit building using site-built panels
- Monitor the first building, evaluate details and work flow
- Market like crazy and evaluate the business case for a small panel factory



Plan A

- Outfit a small panel factory
- Finish the other 57 Sundance Units
- Jump into the DER business with both feet.

Plan B

- Finish the Sundance Retrofit with site built panels
- Keep doing DER’s the hard way until we can build the market needed to start a panel factory
- Jump into the DER business with both feet.


PULTRUM
Milieu Express
Milieu Express
P
SPELT

block M
block J
block K
block L
block F
block G
block A
block B
block H
block I
block C
block D
block E
Fire Road
87 street

CONSTRUCTION

Larrie Taylor Architect Ltd.

Sundance Housing Cooperative, Edmonton

drawing title: Site Plan

date: 11·4·78 | scale: 1"=20'

drawn by: b.g.

drawing no.: A1

Digital Capture

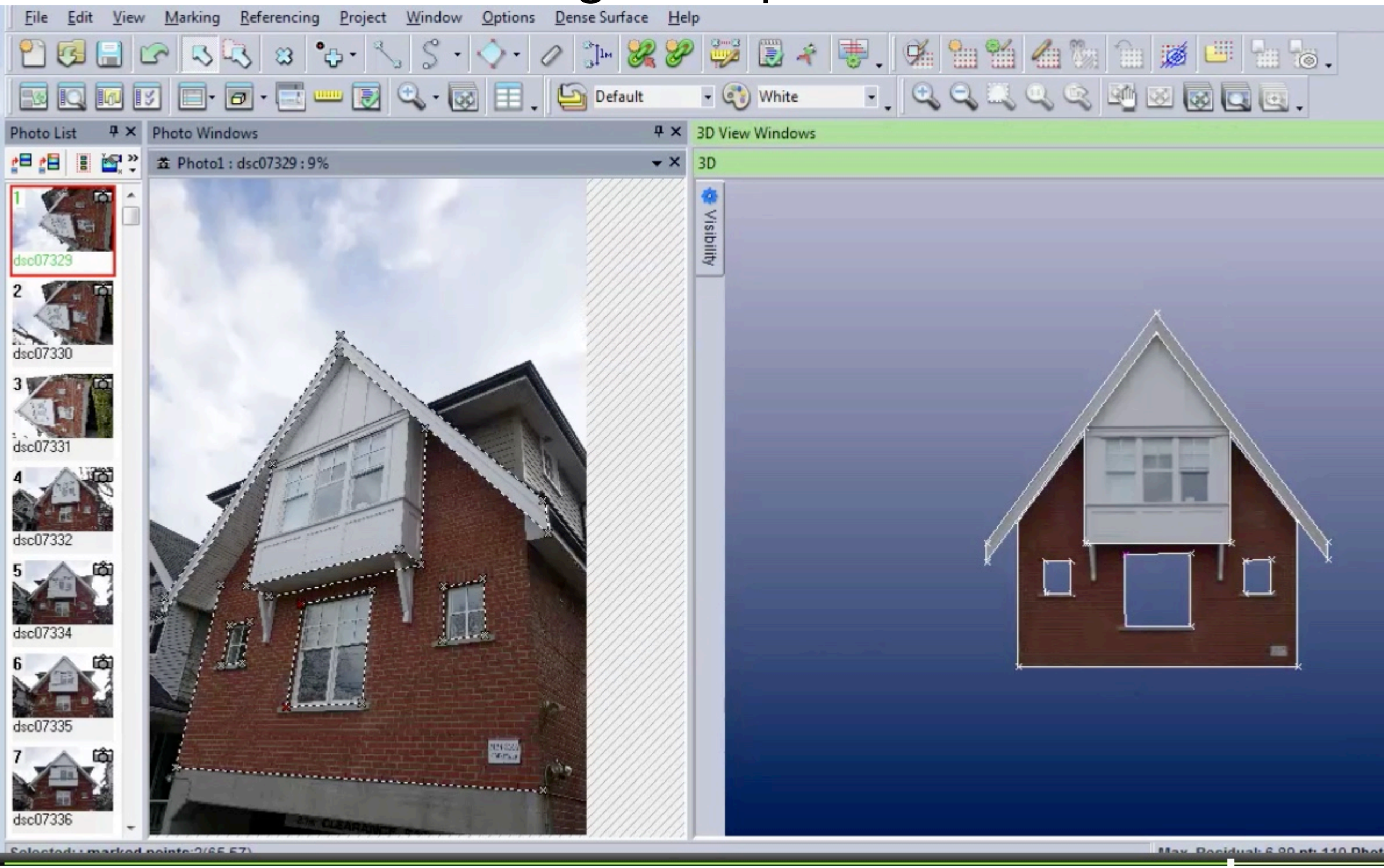
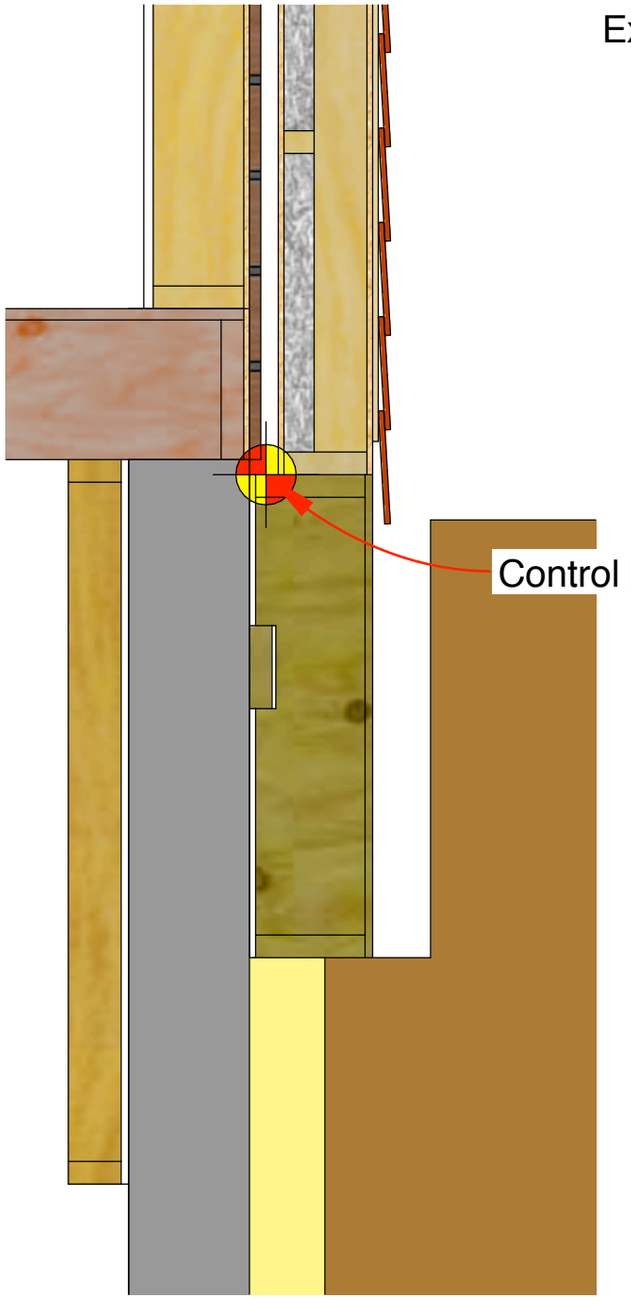
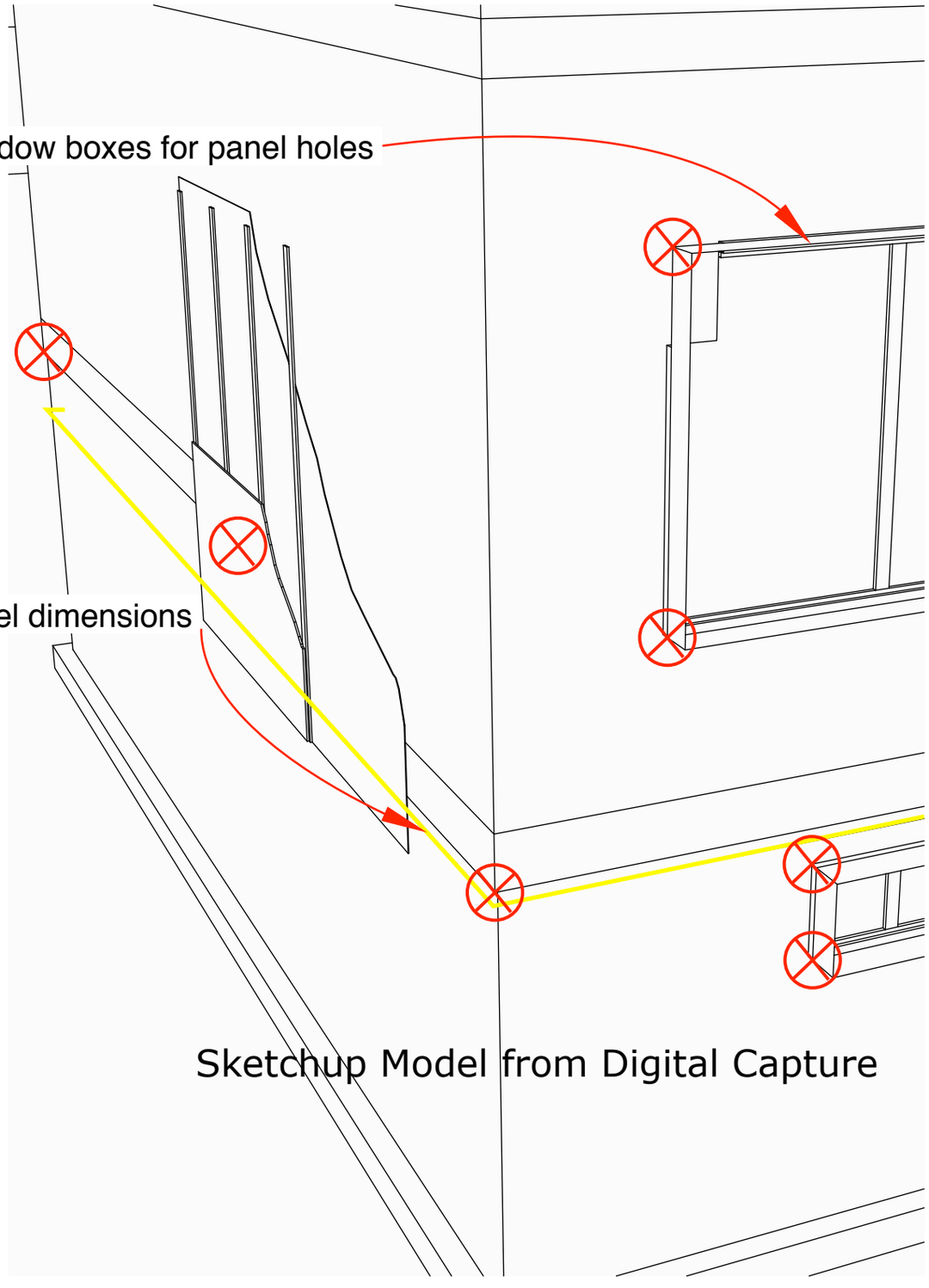


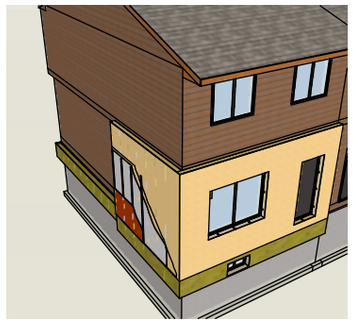
Image from PhotoModeler Video

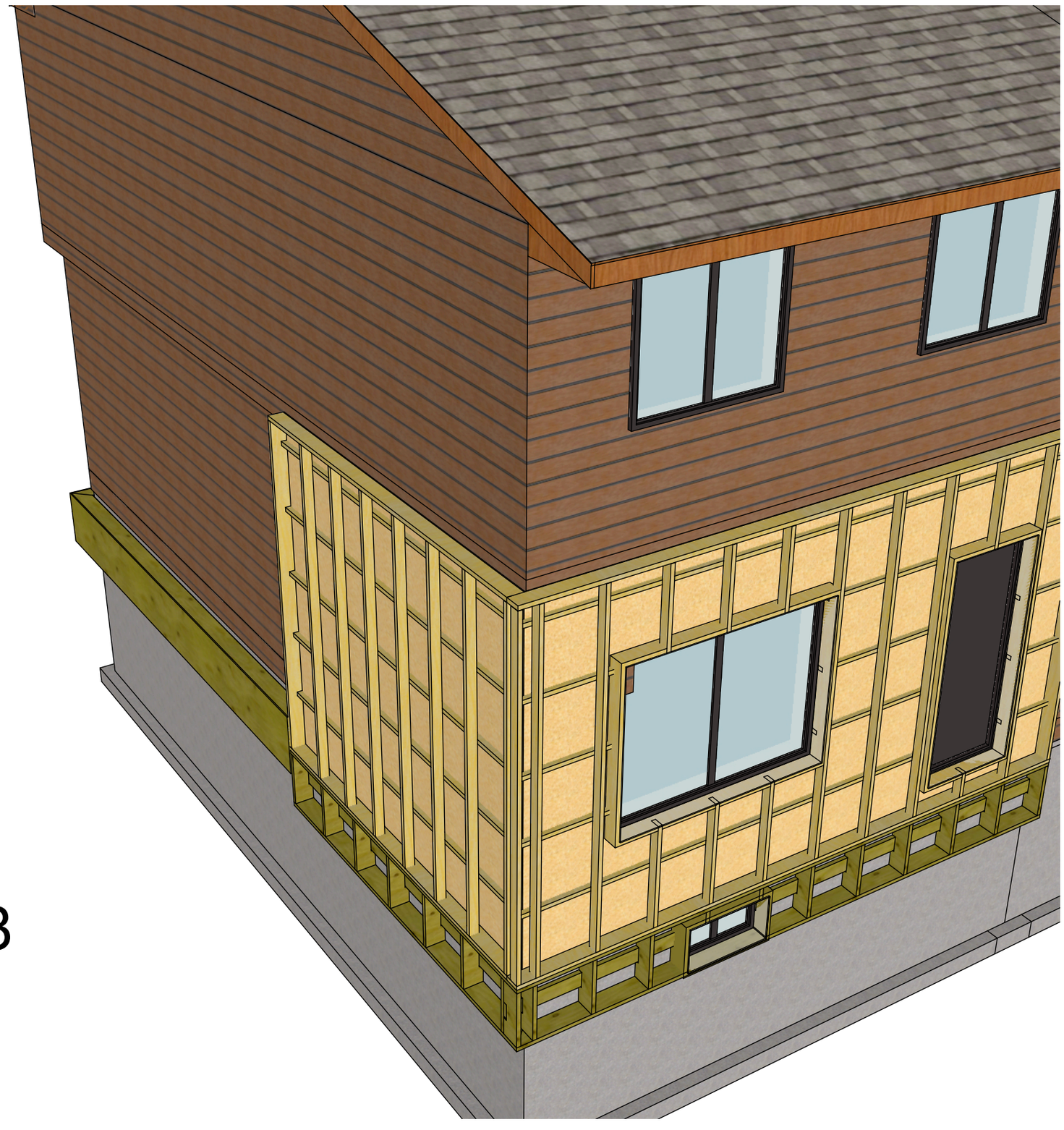
Digital Capture





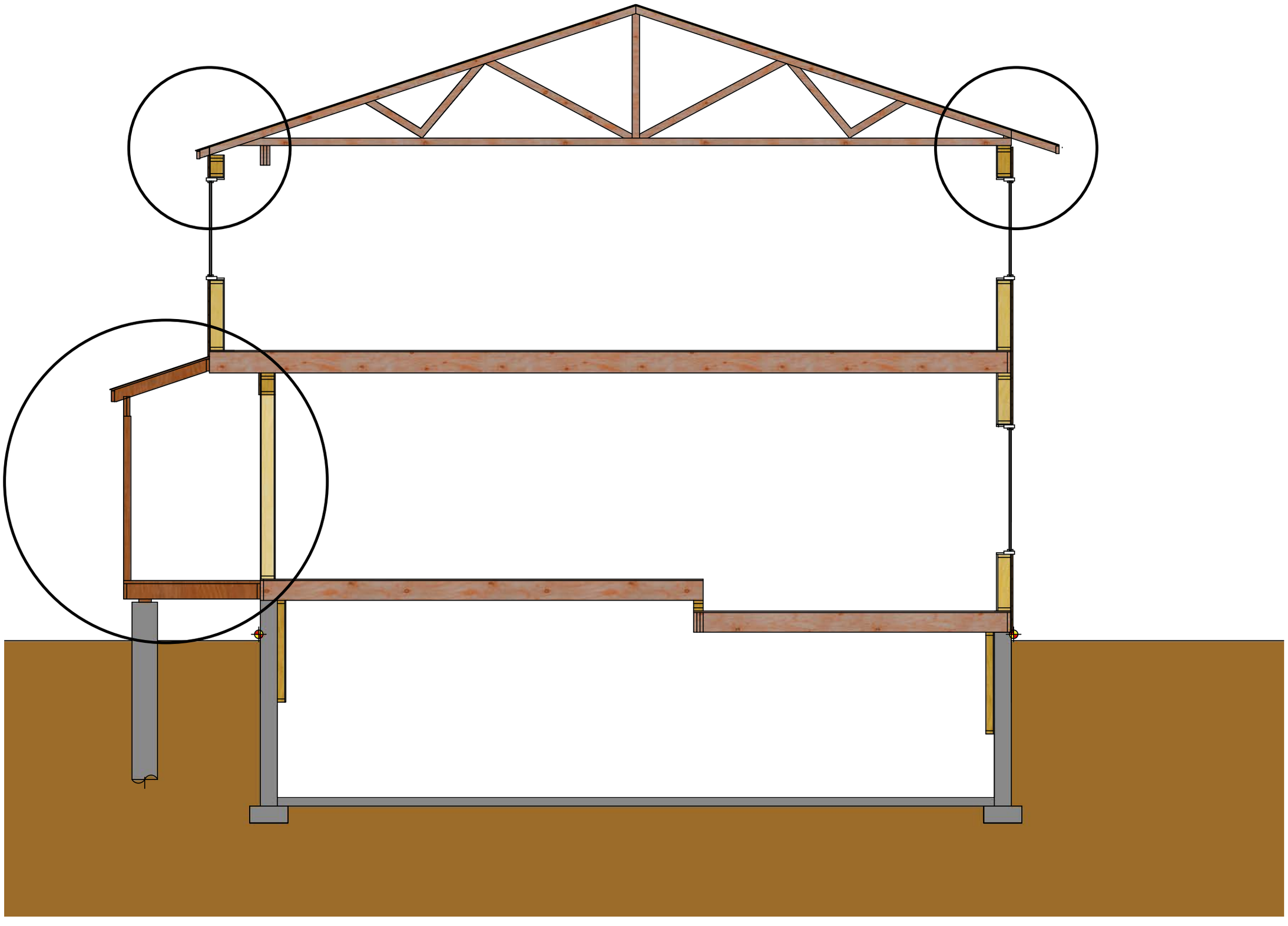
Panel drawing





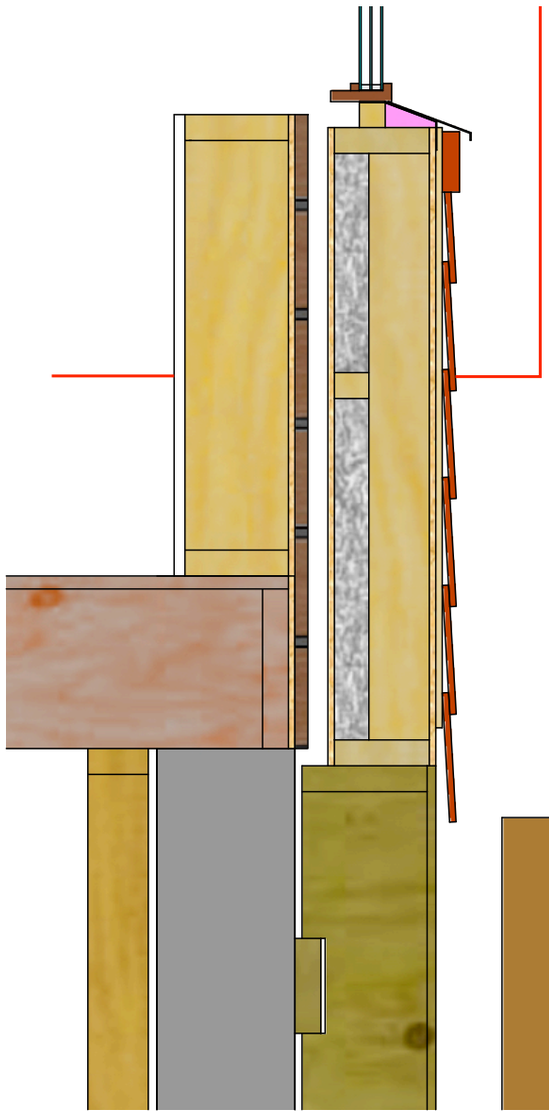
Profile Builder 3
Quantifier Pro

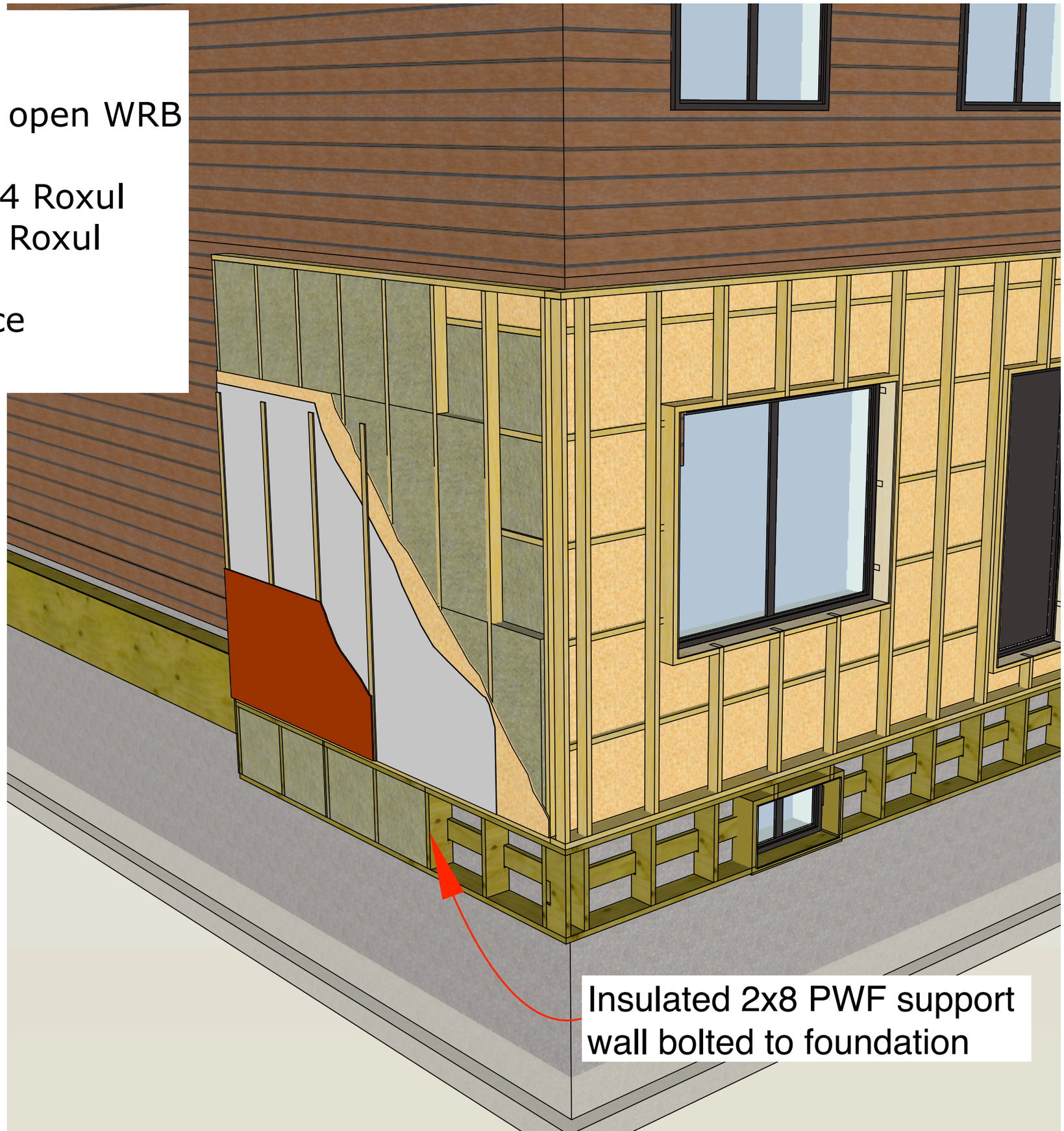
Original Section



Panel Details

-Cladding
-3/8” Rain screen
-Air tight, vapour open WRB
- 7/16” OSB
- 2x4 spruce, R 14 Roxul
-2x2 spruce, R10 Roxul
-3/8” OSB
- Gap for tolerance
- Original wall

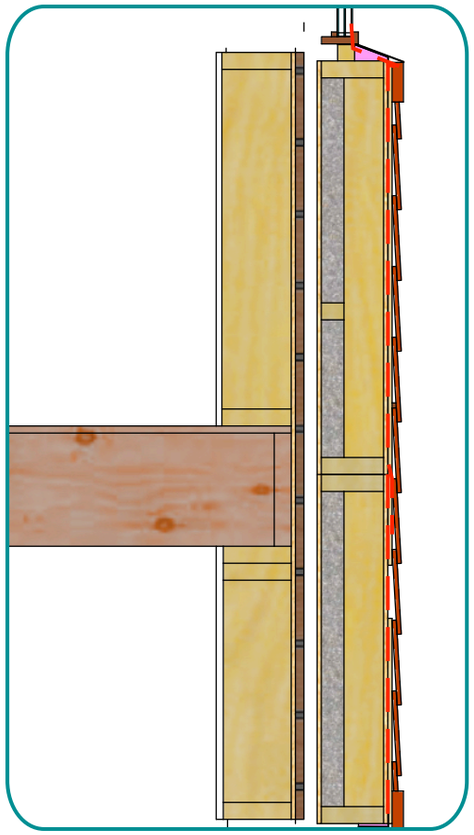


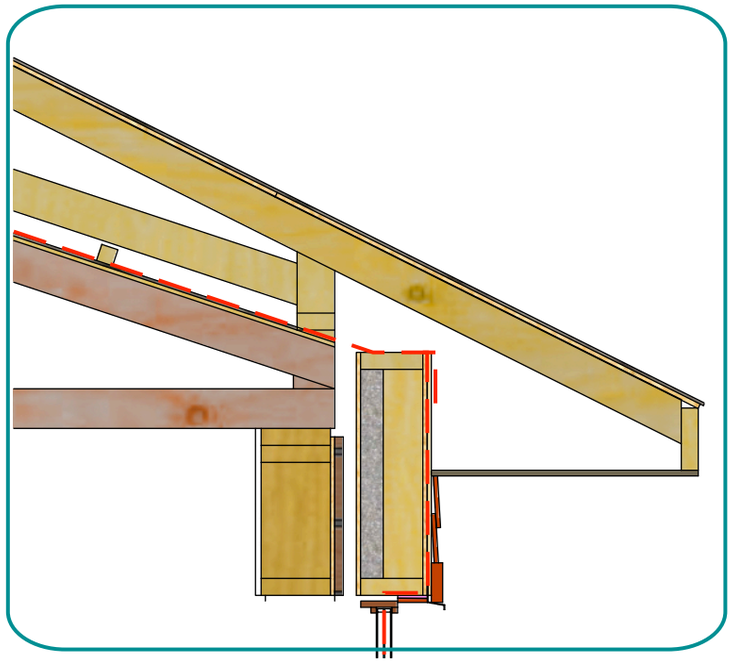


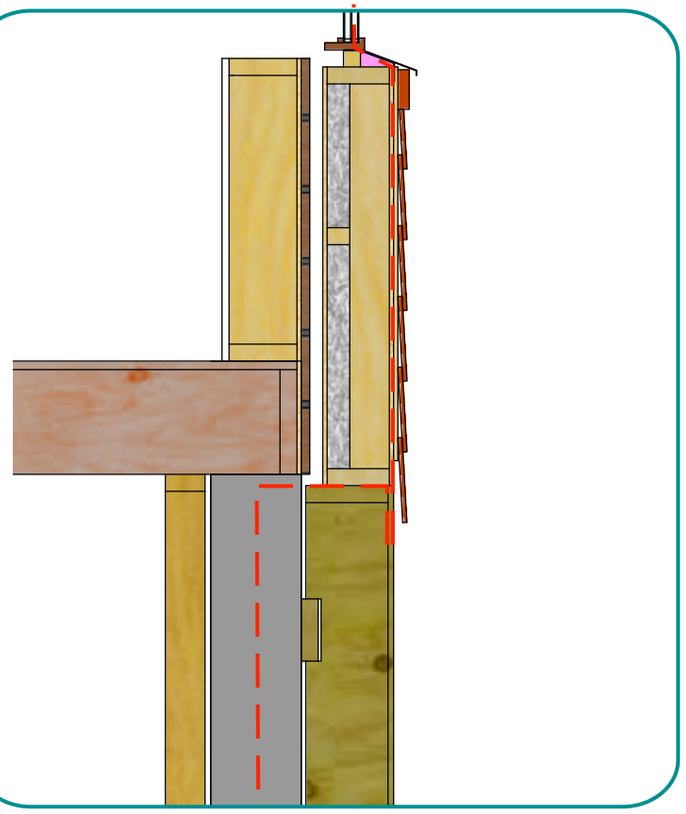
Air and Water Sealing

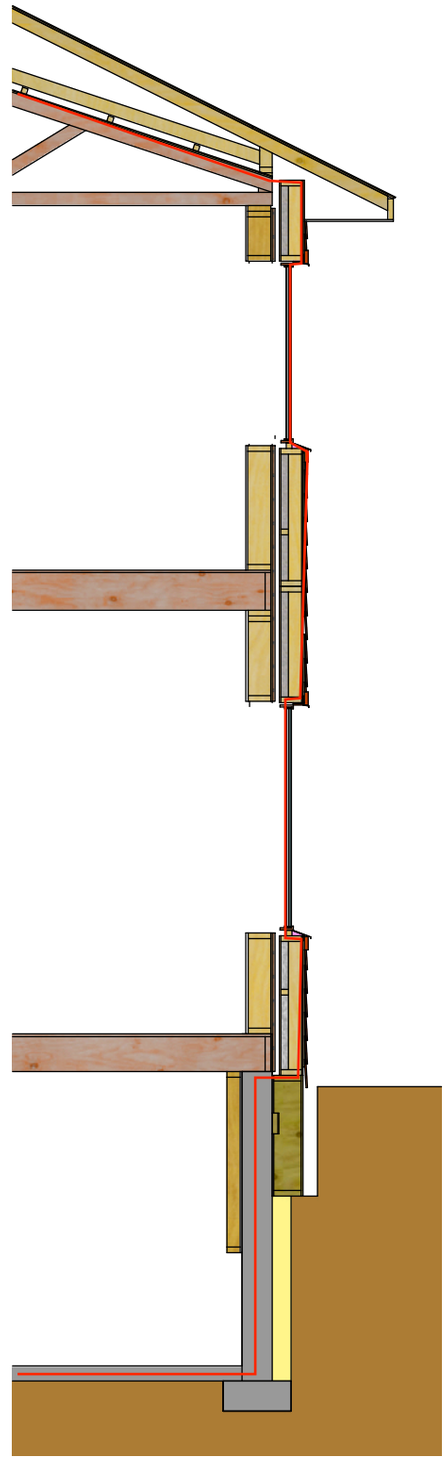
Caulking vs Sealed Flaps

Air and Water Sealing

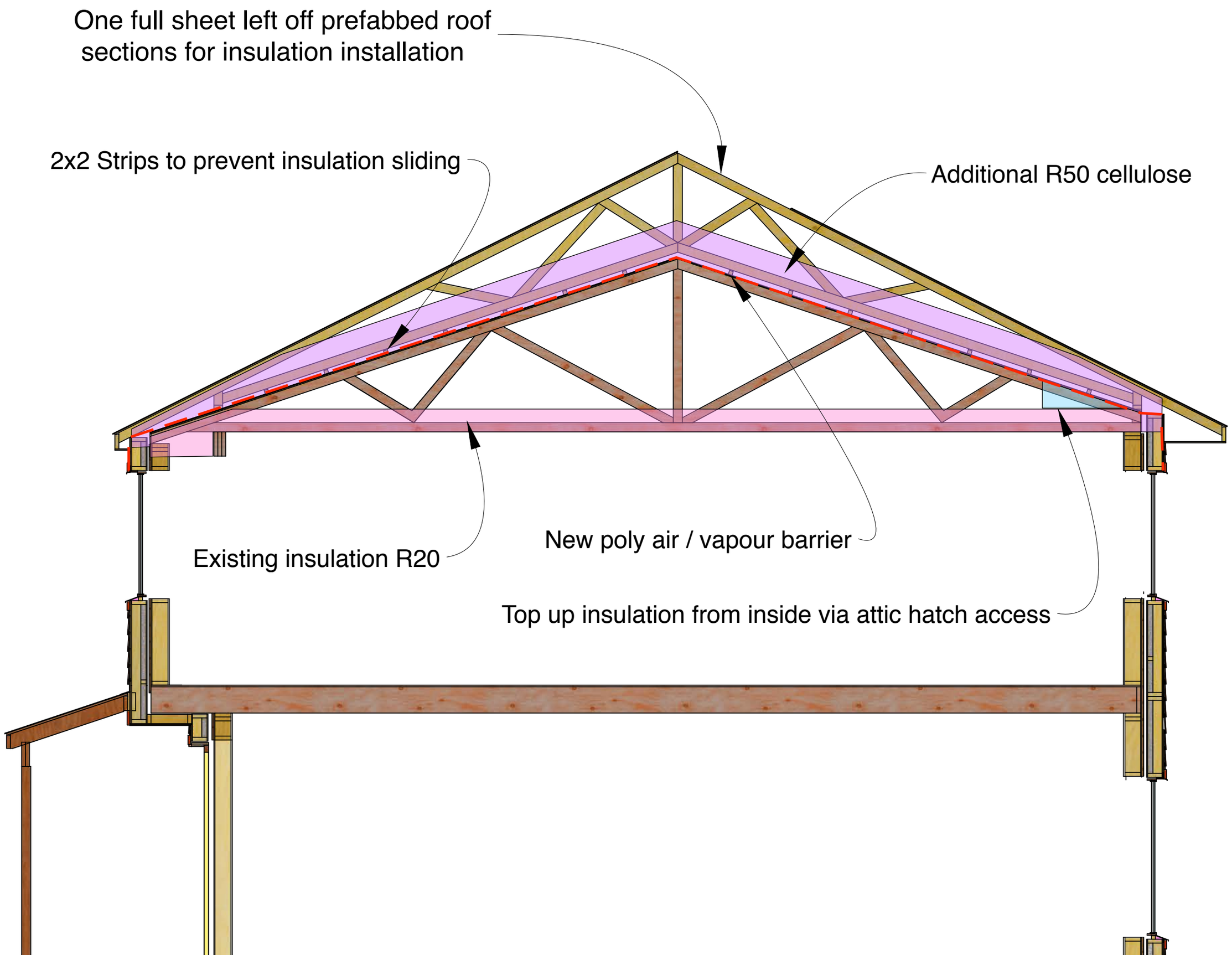




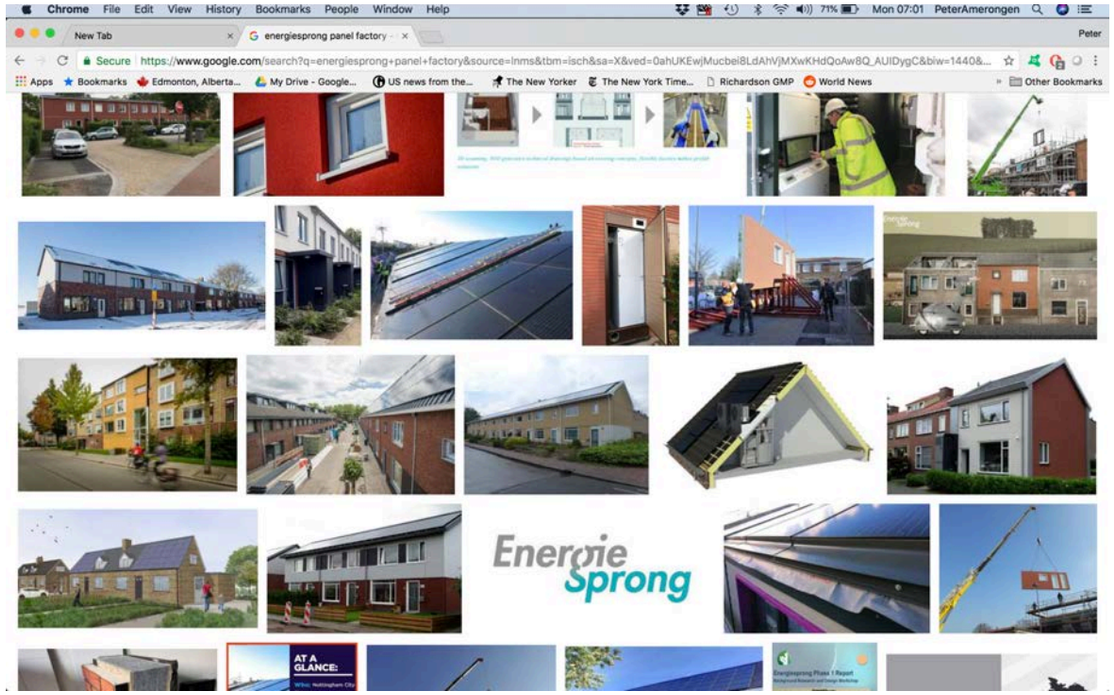




Roof


One full sheet left off prefabbed roof sections for insulation installation
2x2 Strips to prevent insulation sliding
Additional R50 cellulose
Existing insulation R20
New poly air / vapour barrier
Top up insulation from inside via attic hatch access

Starting a Panel Factory



- What can we learn from Europe?
- Can we find enough of a market to support a factory?
- At what volume do the savings from plant production offset the added cost of overhead, transport and lifting?
- What annual volumes are required to support varying levels of capital investments in the plant?

Mechanical Systems

Cladding Options

Cladding Options

- Renewing the building exterior can greatly enhance the retrofit value proposition
- Stocking multiple materials in a small factory can be expensive.

Information?

Thanks

Comments and Questions?