Passive House Object Documentation

Project ID 4398
Two-family residence in Saanich, BC Canada
www.bernhardtpassive.com

Project Architect: Greg Damant, Cascadia Architects Inc
www.cascadiaarchitects.ca
Passive House consultant: Rob Bernhardt, Bernhardt Contracting Ltd.

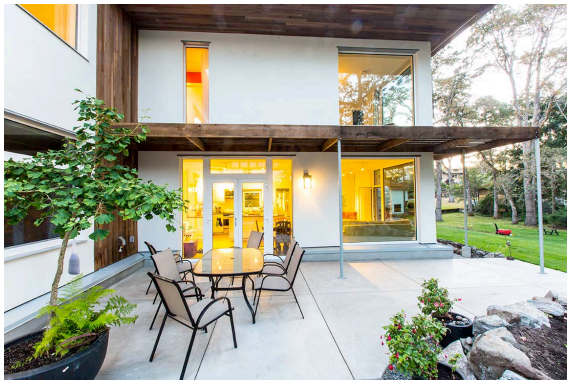
This two family home was built for the builders' extended family in Saanich, BC Canada. The building is wood frame construction with concrete slab and foundation walls. The building is constructed into a slope with the lower level facing east at grade to the yard. One family lives on the upper level fronting to the west & the road and another occupies a suite on the lower level facing the yard. Construction was completed in June 2013 with the residence occupied by the owners since that date.

U-value of exterior wall	0.135W/(m^2K)	PHPP Annual heating demand:	15kWh/(m^2a)
U-value of basement floor slab	0.093W/(m^2K)	PHPP primary energy demand:	106kWh(m^2a)
U-value of roof	0.100W/(m^2K)	Pressure test n_{50}	0.5h^{-1}
U- value of window	0.74 W/(m^2k)		
Heat recovery	82.9%		

1. Description of construction task:

The rock slope was excavated and EPS geofoam used to insulate the floor slab/footings & foundation walls. The structural wood frame walls are 2' X 8" studs with advanced balloon framing. Plywood sheathing was used on the exterior for structural support and OSB was installed on the interior as an air & vapour barrier. Cellulose insulation was blown into the stud cavities and the OSB taped for air tightness. A Service cavity was insulated with rock wool bats. The flat truss roof is insulated with rock wool bats. A water resistant barrier, strapping and ventilated rain screen cladding consisting of cedar siding or stucco was applied to the exterior.

2. Pictures of the Bernhardt Passive House:



South elevation

East Elevation

West Elevation

North Elevation

3. Sample pictures of interior:

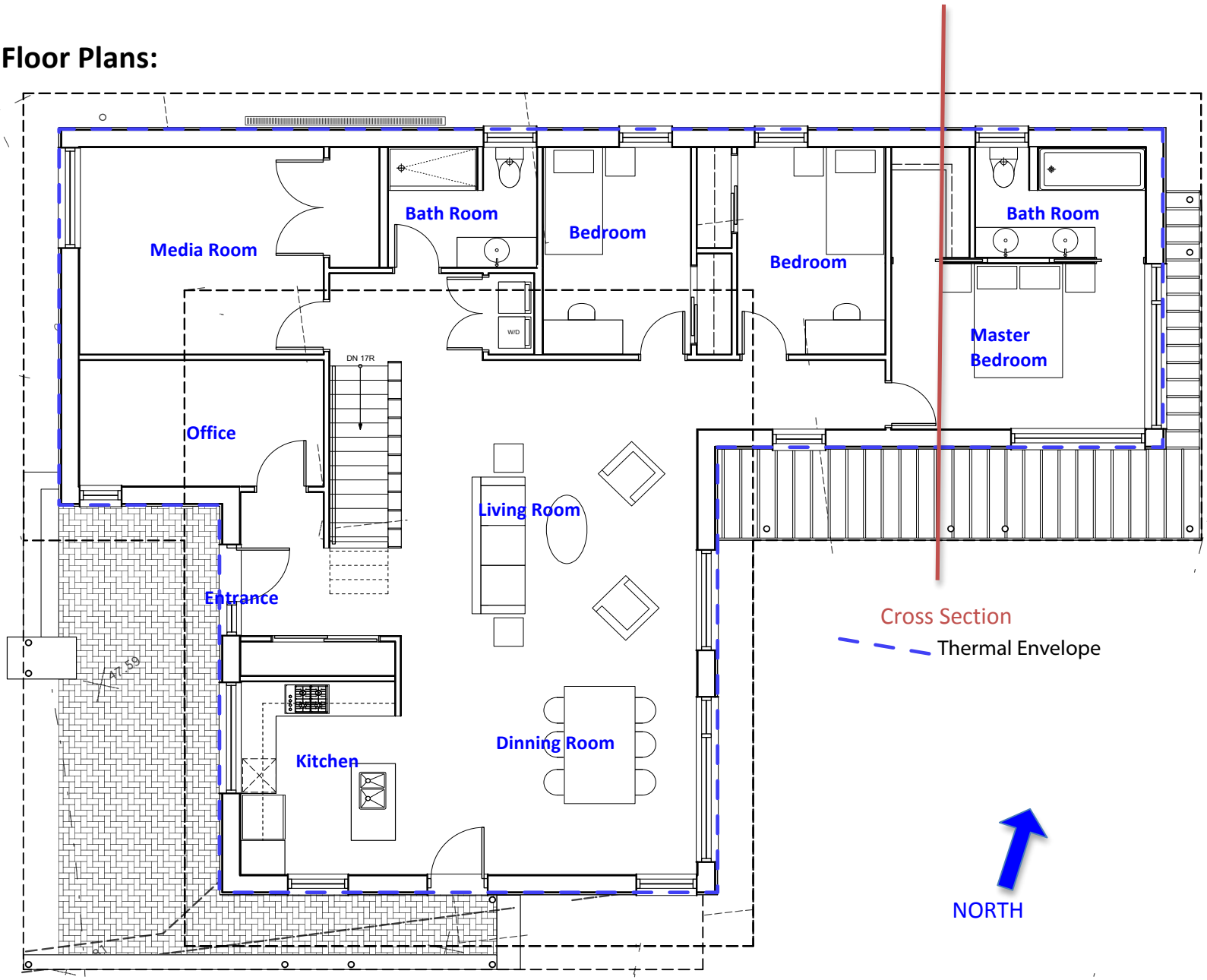
Upstairs dining room

Lower suite living room

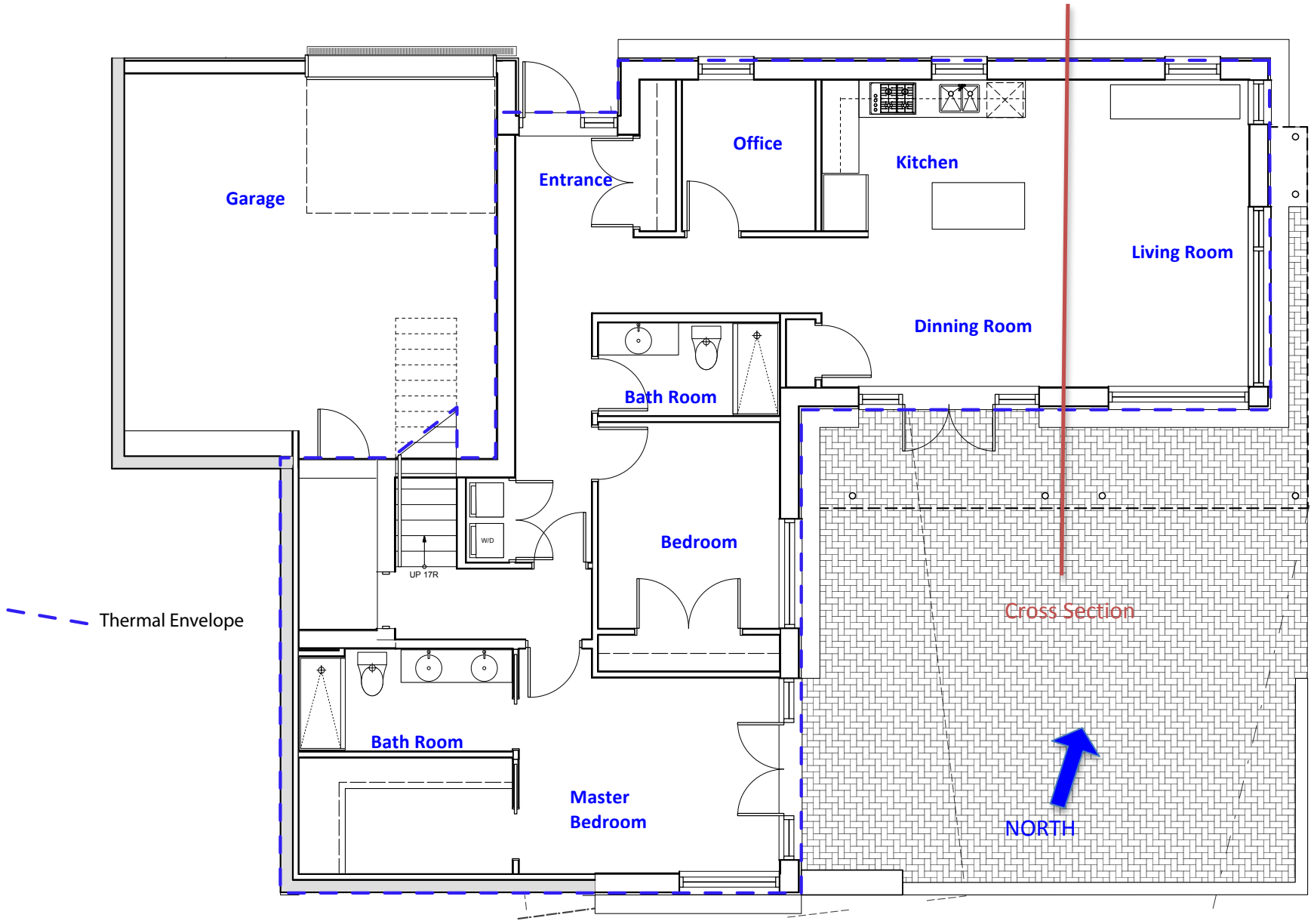
Upstairs hallway

Upstairs master bedroom

4. Floor Plans:

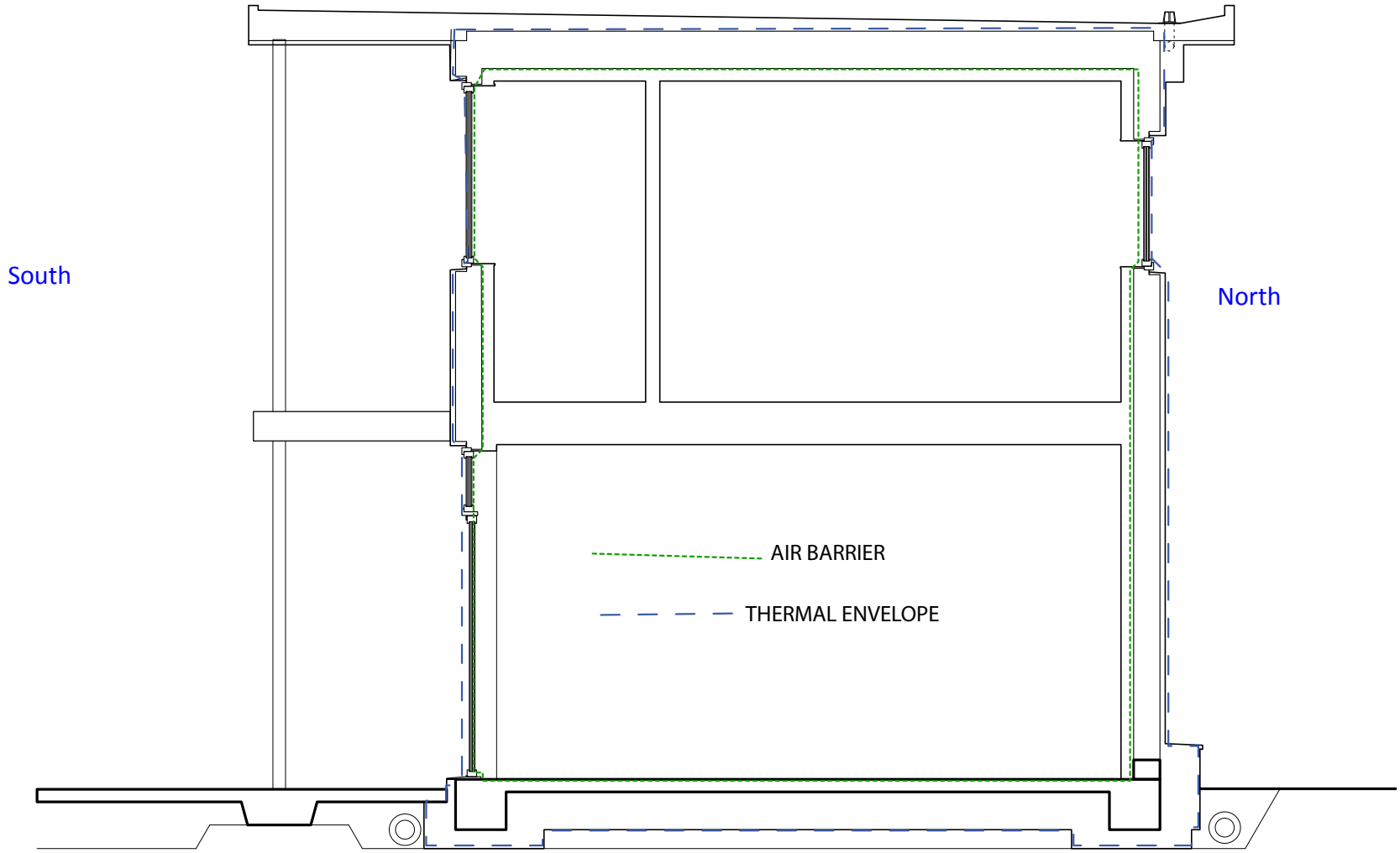


Main Floor

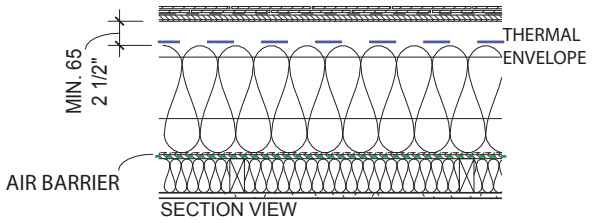


Garden Level

5. Cross Section

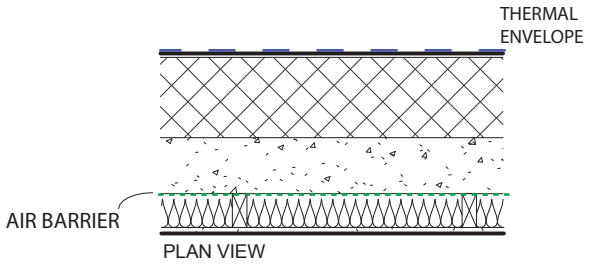


6. Construction details of envelope & services:



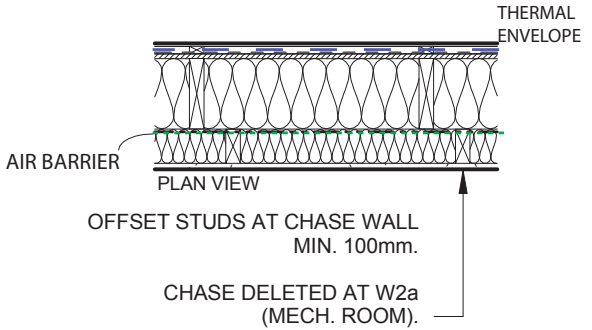
ROOF
INSULATED TRUSS ROOF ASSEMBLY

ASPHALT TORCH ON ROOF
16mm D.FIR ROOF SHEATHING
ENGINEERED ROOF TRUSSES W/ 280mm MINERAL BATT INFILL
16mm OSB SHEATHING AIR / VAPOUR BARRIER, JOINTS TAPED AS SPECIFIED
38x89mm WOOD FRAMING CHASE @600mm O.C. W/ MINERAL BATT TO FILL CAVITY
16mm TYPE 'X' GYPSUM WALL BOARD FINISH, PAINTED



FOUNDATION WALL
EXTERIOR WALL ASSEMBLY - INSULATED CONCRETE

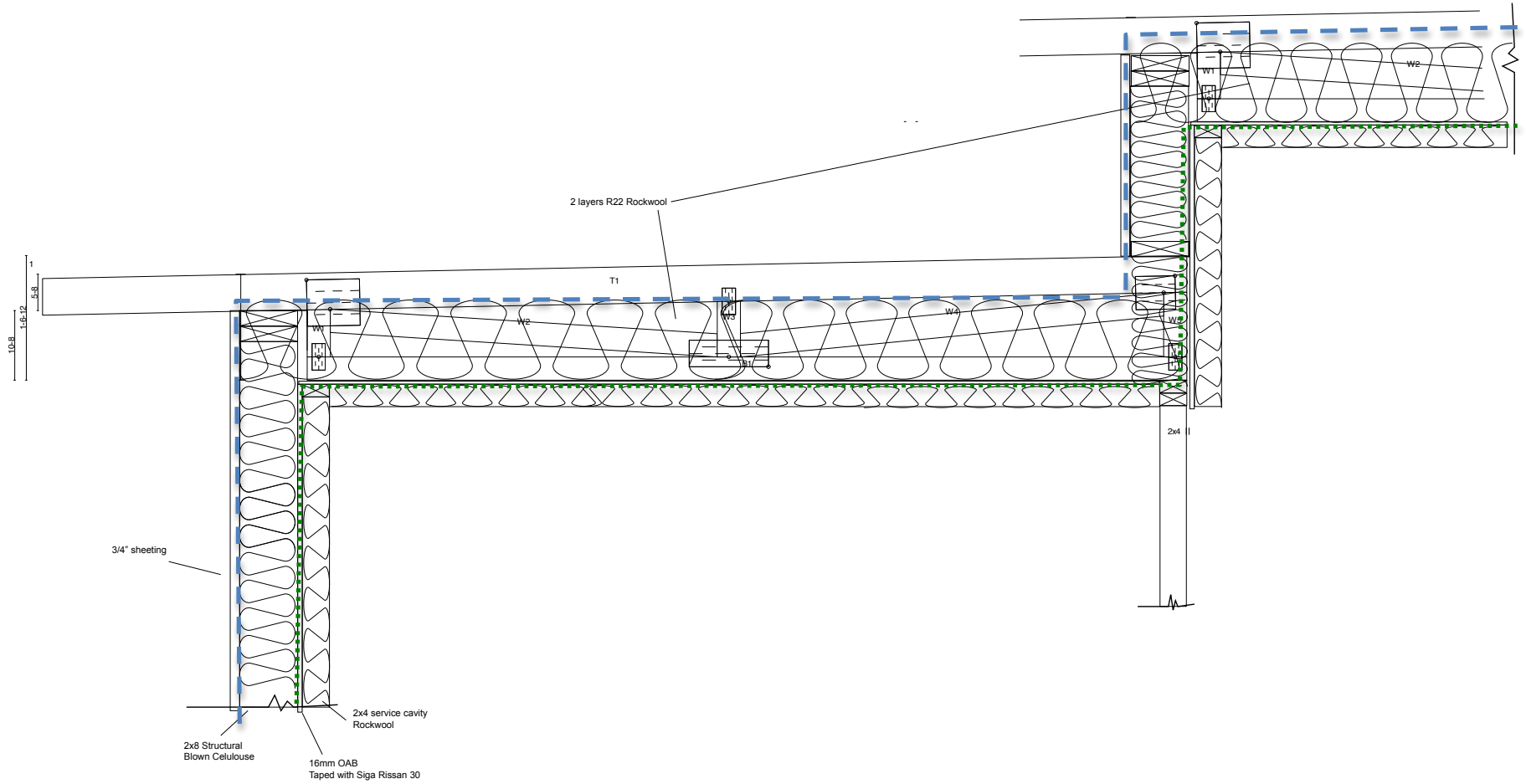
CEMENT PARGING TO 75mm BELOW GRADE, DRAINAGE MAT W/ FILTER CLOTH
NON-BITUMINOUS SHEET WATERPROOFING TO TOP OF ICF WALL
304mm EPS INSULATION PANEL
203mm DEEP REINFORCED CAST-IN-PLACE CONCRETE FOUNDATION WALL
38x89mm WOOD FURRING 600mm O.C.
W/ MINERAL BATT INSULATION TO FILL CAVITY
16mm TYPE 'X' GYPSUM BOARD FINISH, PAINTED

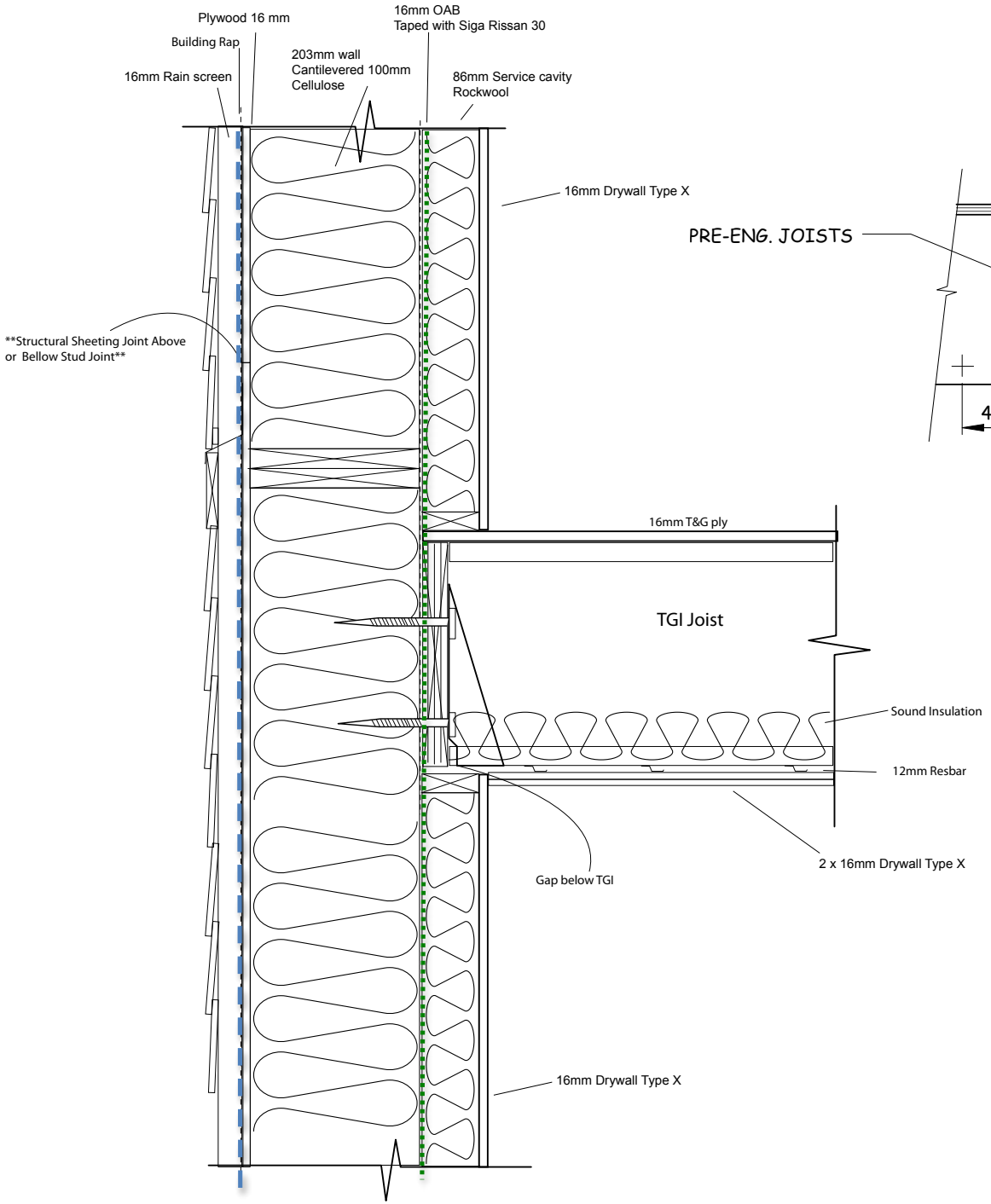


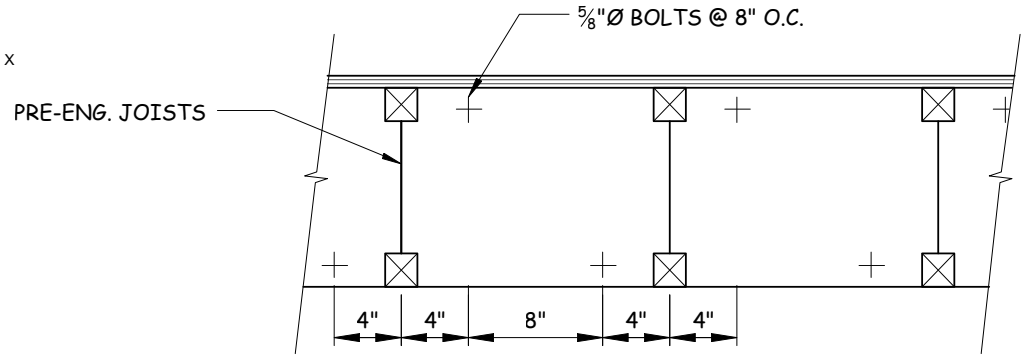
MAIN EXTERIOR WALLS
EXTERIOR WALL ASSEMBLY - TYPICAL ABOVE GRADE

EXTERIOR CLADDING - SEE ELEVATIONS FOR TYPE & LOCATIONS
19x38mm PRESERVATIVE TREATED VERTICAL WOOD STRAPPING 600mm O.C.
BUILDING WRAP MOISTURE BARRIER
19mm EXTERIOR PLYWOOD SHEATHING
38x184mm WOOD STUDS 600mm OC W/ BLOWN DENSE PACK CELLULOSE FILL
13mm OSB AIR BARRIER
38x89mm WOOD STUDS 600mm OC (OFFSET FROM STRUCTURAL STUDS MIN. 100mm)
W/ MINERAL BATT INSULATION TO FILL CAVITY
16mm TYPE 'X' GYPSUM BOARD FINISH, PAINTED

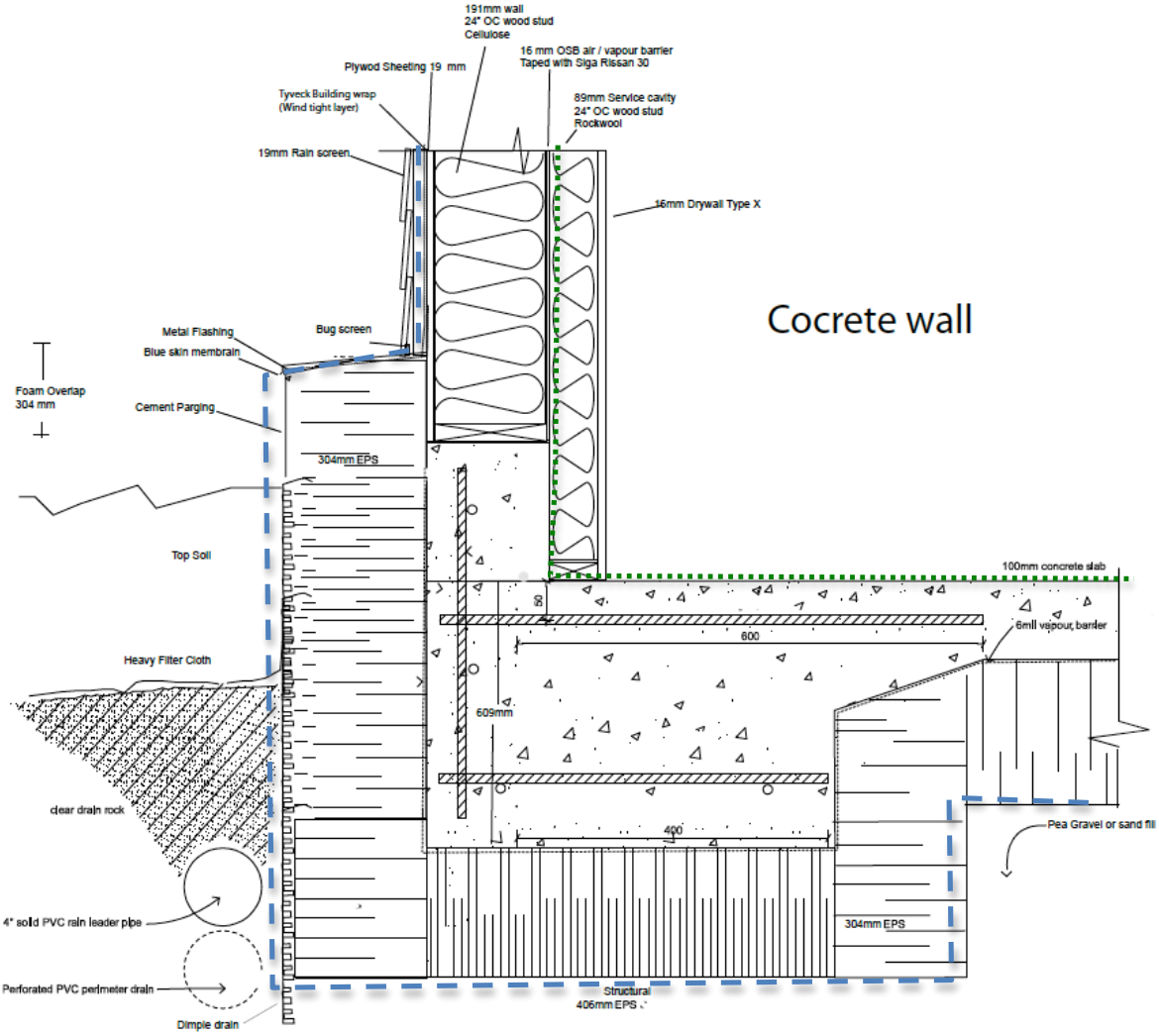
North Wall/Living Room/Roof Junction

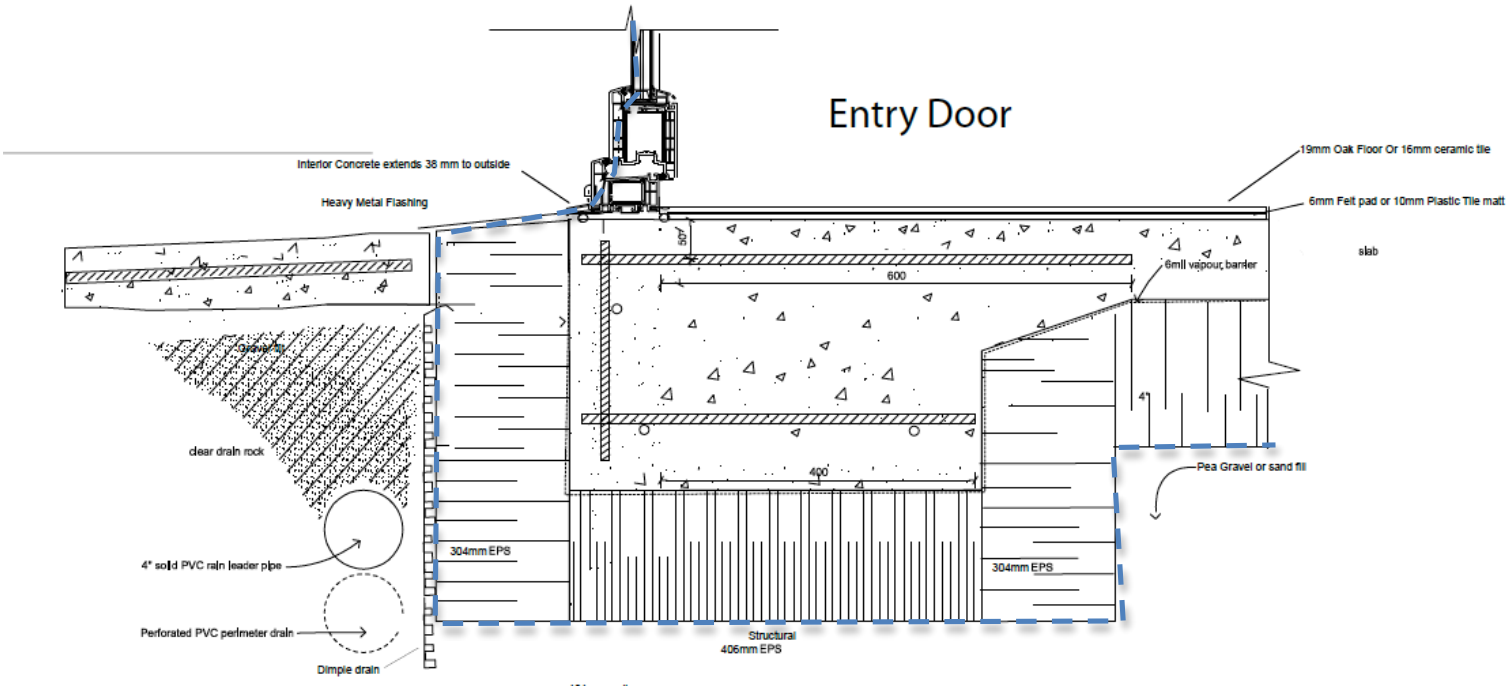






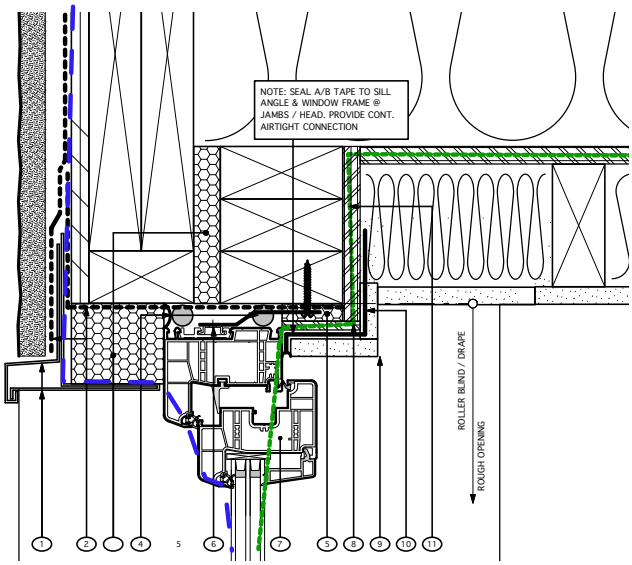
Floor / Wall Interface

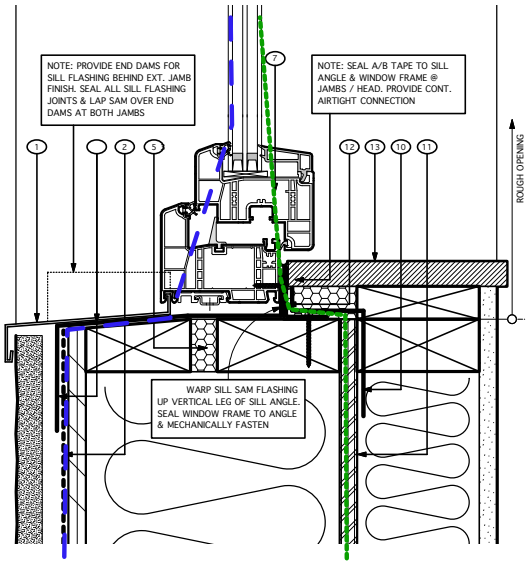

Cocrete wall
191mm wall
24" OC wood stud
Cellulose
Plywod Sheeting 19 mm
16 mm OSB air / vapour barrier
Taped with Siga Rissan 30
Tyveck Building wrap
(Wind tight layer)
89mm Service cavity
24" OC wood stud
Rockwool
19mm Rain screen
16mm Drywall Type X
Metal Flashing
Bug screen
Blue skin membrain
Foam Overlap
304 mm
Cement Parging
304mm EPS
Top Soil
100mm concrete slab
6mil vapour barrier
600
Heavy Filter Cloth
609mm
clear drain rock
400
Pea Gravel or sand fil
4" solid PVC rain leader pipe
304mm EPS
Perforated PVC perimeter drain
Structural
406mm EPS
Dimple drain


Entry Door
Interior Concrete extends 38 mm to outside
Heavy Metal Flashing
19mm Oak Floor Or 16mm ceramic tile
6mm Felt pad or 10mm Plastic Tile matt
slab
6mil vapour barrier
600
Gravel fill
clear drain rock
400
Pea Gravel or sand fil
4" solid PVC rain leader pipe
304mm EPS
304mm EPS
Perforated PVC perimeter drain
Structural
406mm EPS
Dimple drain

7. Window Installation

The windows and doors are installed in the centre of the wall assembly. The windows & doors are EuroLine 4700 series Thermo Plus using a certified Rehau frame and Cardinal 180 glazing having a U_g-Value of 0.74 and a g-Value of 0.58. The airtight layer is sealed to the window frame interior and the window heads and jambs are over insulated on the exterior with XPS foam. The over insulation is protected by the stucco or clear cedar rain screen assembly. The window frames have a U value of 0.79 and a glazing edge Ψ value of 0.03. The installation Ψ values are 0.015 for the over insulated jambs and heads and 0.035 for the sills.

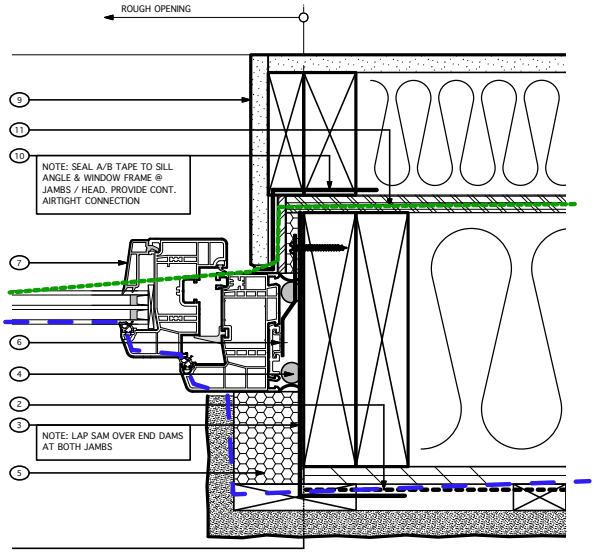




1 / 0 Head detail - Tilt & Turn window
Scale: Half Actual Size

AIR BARRIER

THERMAL ENVELOPE



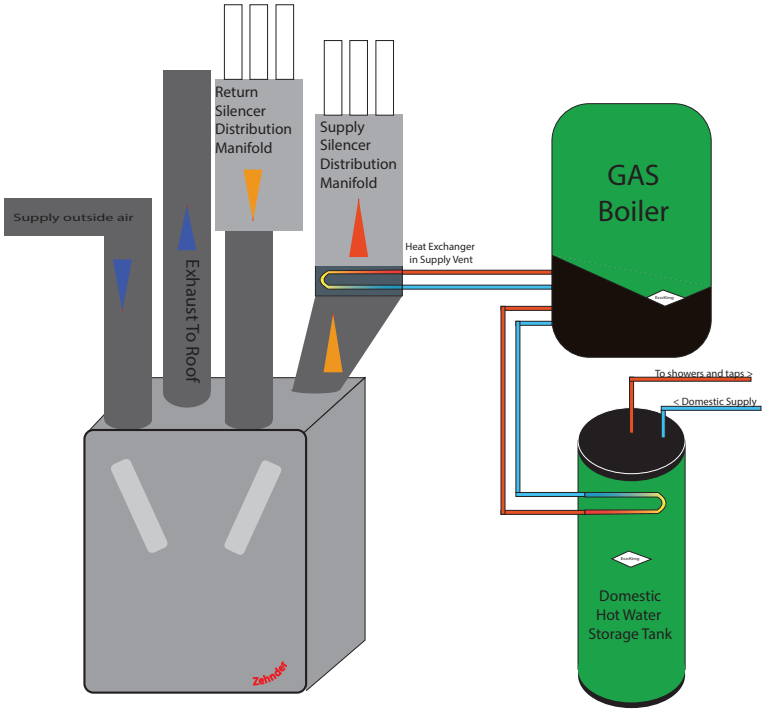
3 / A5 0 Jamb detail - Tilt & Turn window
Scale: Half Actual Size

NOTE LEGEND

1. PRE-FIN. 22ga. METAL FLASHING
2. BUILDING WRAP
3. SELF-ADHERING W/P MEMBRANE (SAM)
4. CONT. FLEXIBLE EXT. GRADE SEALANT & FOAM BACKER ROD - FRONT AND BACK OF WINDOW FRAME
5. RIGID INSULATION
6. WINDOW REBATE FASTENER CLIP
7. WINDOW FRAME & GLAZING TO MEET PPHP PERFORMANCE REQU'TS.
8. CONT. FLEXIBLE EXT. GRADE SEALANT & FOAM BACKER ROD
9. GYPSUM WALLBOARD
10. SELF-ADHERING A/B TAPE & SEALANT - PROVIDE CONT. CONNECTION OF OSB A/B LYR WITH WINDOW FRAME
11. OSB A/B LAYER
12. CONT. 1.5 X1.5 ALUM. SILL INSTALL ANGLE
13. 1 ENG. or SOLID STONE SILL

8. Heat supply:

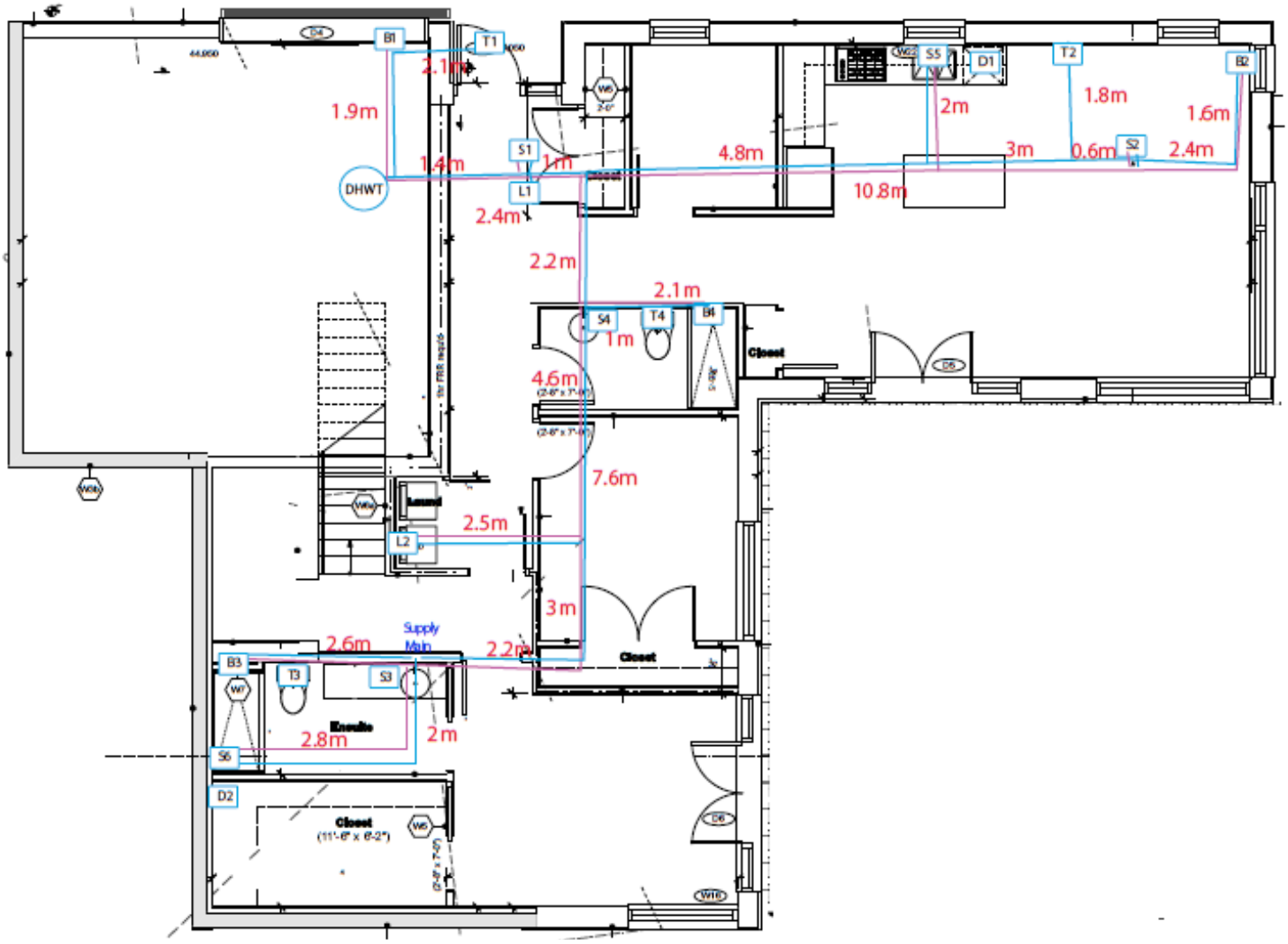
The primary heat for the residence is a hydronic coil installed in the main HRV supply duct, upstream of the manifold. Hot water for the hydronic coil is supplied by the adjacent hot water storage tank, which is heated by a condensing gas boiler. The tiled bathroom floors have electric resistance heat mats under the tiles. There is no mechanical cooling. Exterior shade and a moderate climate make cooling unnecessary.



Heating System Diagram

Hot water lines from boiler & storage tank to hydronic coils in HRV

Plumbing layout

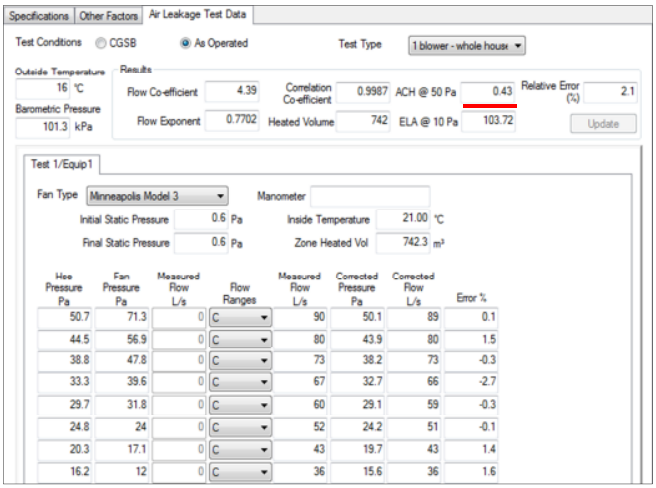


9. Description of airtight envelope & test document

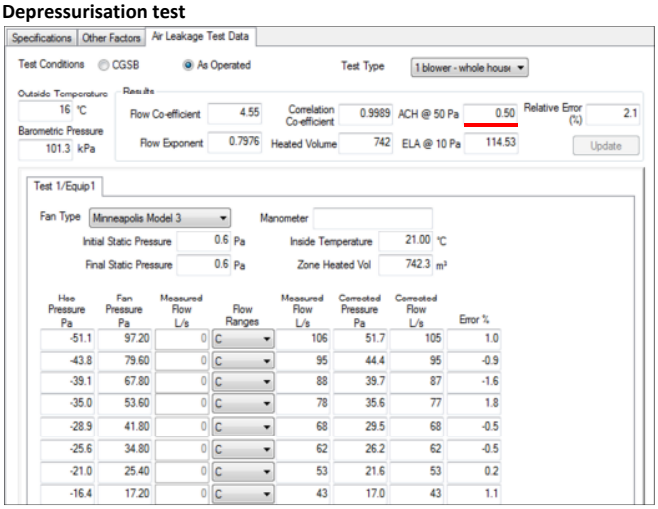
The air-tight layer is the OSB on the inside of the 2 X 8 structural wall, taped at all seams with SIGA tapes. The OSB is continuous from the concrete foundation to the ceiling and then across the ceiling. The ledger on which the upper floor joists are hung is bolted over the OSB. Window & door frames have rod & calk plus air seal tape on the inside from the OSB to the window frame. A service cavity was installed inside the air-tight layer after a mid-construction blower door test. Final blower door test was performed after completion, with the certificate attached below.

(e) ACH@50PA Calculation

Pressurisation test



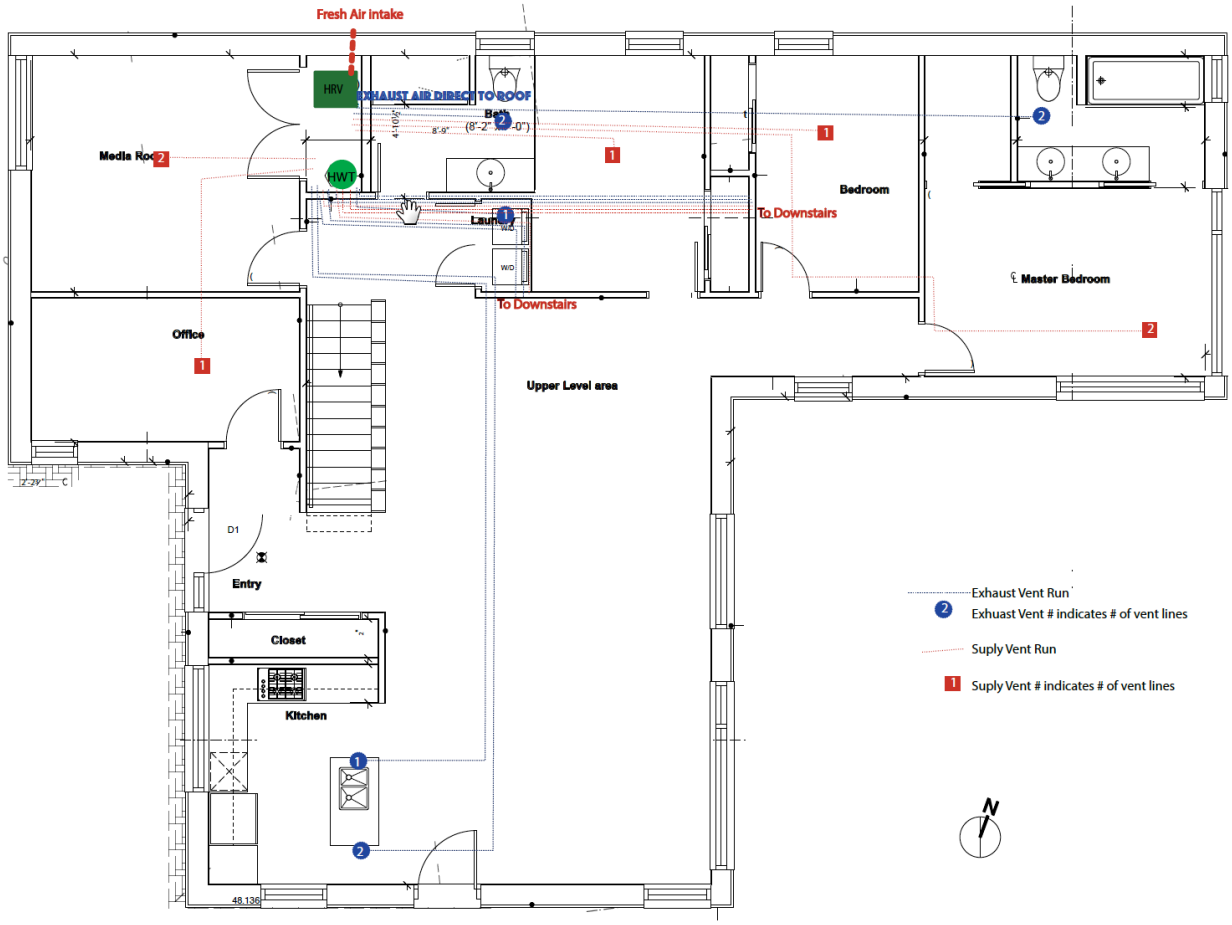
Depressurisation test



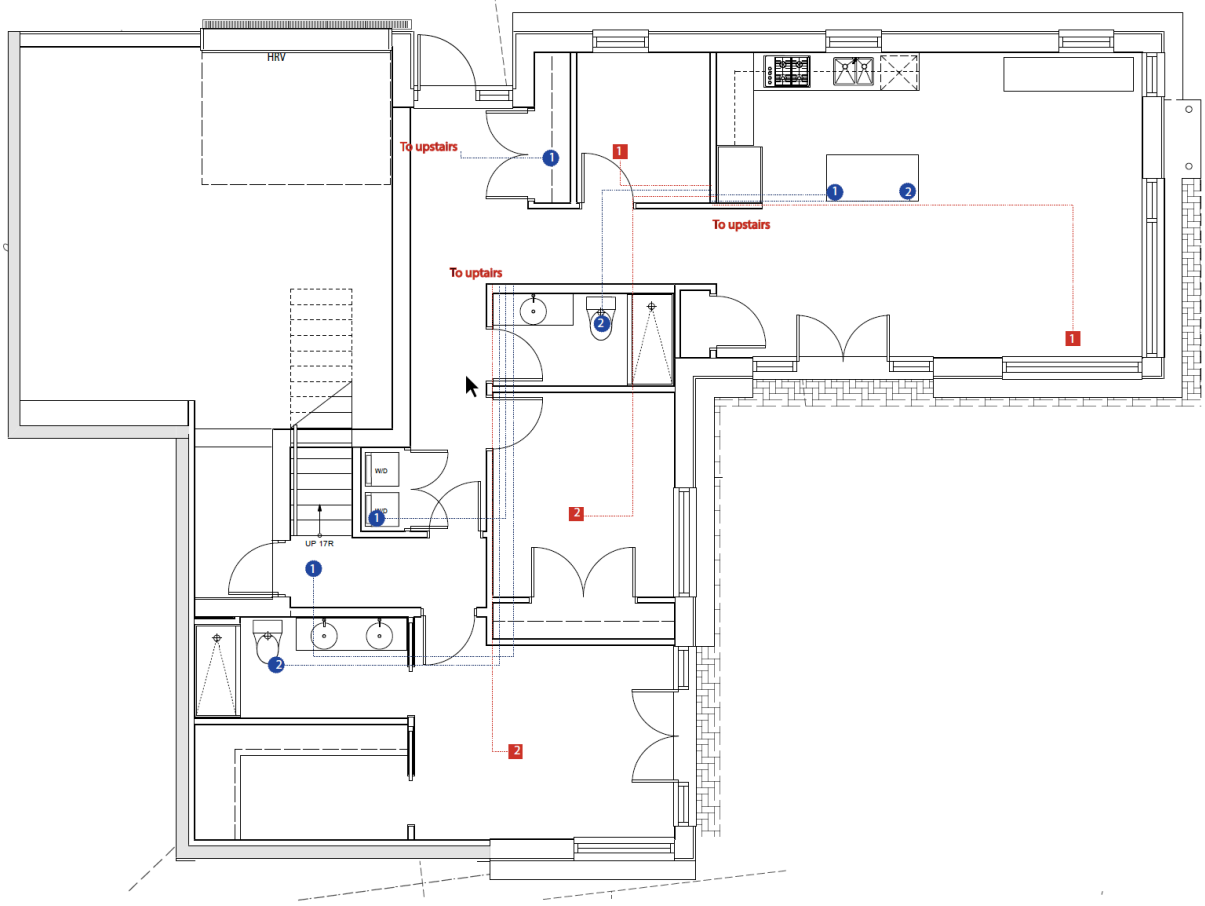
10. Ventilation distribution system:

Ventilation is provided by a Zehnder 550 located in a closet of the upstairs suite, adjacent to the north side of the residence. The ventilation system has an effective heat recovery of 82.9% and an electrical efficiency of 0.31. From the ventilation manifold, comfo tube ducts supply and extract air, with no central ventilation ducting. All comfo tubes run within interior walls, or within the service cavity of the upstairs ceiling. All living rooms, bedrooms, offices and media room are serviced with one or two supply ducts depending on required supply volume. All bathrooms, entry closets, kitchens and laundry areas have exhaust vents, with kitchens having two exhaust vents supplied with two comfo tubes each. The main intake duct on the building exterior has two bug/debris screens.

Main Floor HRV Layout



Garden Level HRV layout



11. PHPP results:

Certification Documentation

Specific building demands with reference to the treated floor area

				Requirements	Fulfilled?*
	Treated floor area	251.0	m²		
Space heating	Heating demand	15.40	kWh/(m²a)	15 kWh/(m²a)	yes
	Heating load	12	W/m²	10 W/m²	-
Space cooling	Overall specif. space cooling demand		kWh/(m²a)	-	-
	Cooling load		W/m²	-	-
	Frequency of overheating (> 25 °C)	1.6	%	-	-
Primary energy	Heating, cooling, dehumidification, DHW, auxiliary electricity, lighting, electrical appliances	106	kWh/(m²a)	120 kWh/(m²a)	yes
	DHW, space heating and auxiliary electricity	54	kWh/(m²a)	-	-
	Specific primary energy reduction through solar electricity		kWh/(m²a)	-	-
Airtightness	Pressurization test result n_{50}	0.5	1/h	0.6 1/h	yes

* empty field: data missing; '-': no requirement

This building has been awarded the

Quality Approved Passive House

certificate by MosArt Ltd.

This certification is based solely on the design data and specifications provided to MosArt Ltd by the client for the purpose of certification. MosArt Ltd has checked and approved the building's energy balances according to these data.

This certification does not cover quality assurance of the construction work or design implementation. MosArt Ltd hereby takes no responsibility for any faults in the above.

12. Construction costs:

CAN $ 740,500 or $2,062/m^2 of gross floor area

13. Total project cost:

CAN $1,255,500 (includes land & other costs)

14. Year of construction: 2013

15. Project architect:

Greg Damant, Cascadia Architects, Victoria, BC

16. Building services planning:

Bernhardt Contracting Ltd., Victoria, BC

17. Building physics:

Rob Bernhardt, Bernhardt Contracting Ltd., Victoria, BC

18. Structural Engineer:

David Anidjar-Romain, P.Eng., Spar Consultants, Victoria, BC

19. Experience:

Experiences, descriptions and photos relating to the project are found on: www.bernhardtpassive.com The building has performed almost exactly as modeled during the first winter. The comfort is amazing, as is the air quality. We currently have a 6 unit condominium Passive House under construction as we believe others will also appreciate the difference Passive House offers.

20. Publications & studies on the project:

As the first Passive House built on Vancouver Island, this project has received extensive media attention and been the subject of numerous presentations to construction industry groups. Some of the material is found on the website cited in the preceding paragraph, on the company website at: www.bernhardtcontracting.com and the project Facebook page under Bernhardt Passive Home.

The project is now one of the projects included in a business case analysis of Passive House construction in Canada. The Canadian Mortgage & Housing Corporation, BC Housing, Vancity, RDH Building Engineering, Bernhardt Contracting, Synergy Sustainability Institute, and others support this research.