176 NWA

ADDITION & RENOVATION

Arthur Chukhman, AIA, CPHD- Duncan Wisniewski Architecture

Ace McArleton- New Frameworks

Jacob Racusin, CPHC -New Frameworks

Chris West, CPHC- EcohomesVT LLC

Low Carbon

Urban Infill

PHIUS

N.Z.E.

GOALS FOR THIS PRESENTATION:

- Demonstrate proof-of-concept: Low-climate-impact building

- High performance detailing: How it affects the form and expression of architecture.

KEY PLAYERS:

Arthur Chukhman- Architect and GC and client

New Frameworks- Enclosure Contractor, Design & Project Consultant

Chris West- Eco Houses of VT, Energy Modeling for PHIUS

Taylor Richey- Finish carpenter, Siding, Flooring, Timber framing, Porches.

Neighborhood Context

MODERN ADDTION TO OLD BUILDINGS, CORRUGATED METAL PRECEDENT

LARGE SCALE AND SMALL SCALE MULTI-FAMILY

MIX OF FLAT AND GABLE ROOFS

VARIETY OF HEIGHT AND SCALE

Existing Building

VIEW FROM NORTH WINOOSKI AVE

VIEW OF SOUTH WEST ELEVATION FROM DRIVE WAY

VIEW FROM NORTH WEST

VIEW FROM NEIGHBORS TO THE NORTH

VIEW OF BUILDING FROM BACK YARD

VIEW FROM NORTH WEST

VT Gas Retrofit Program Including:

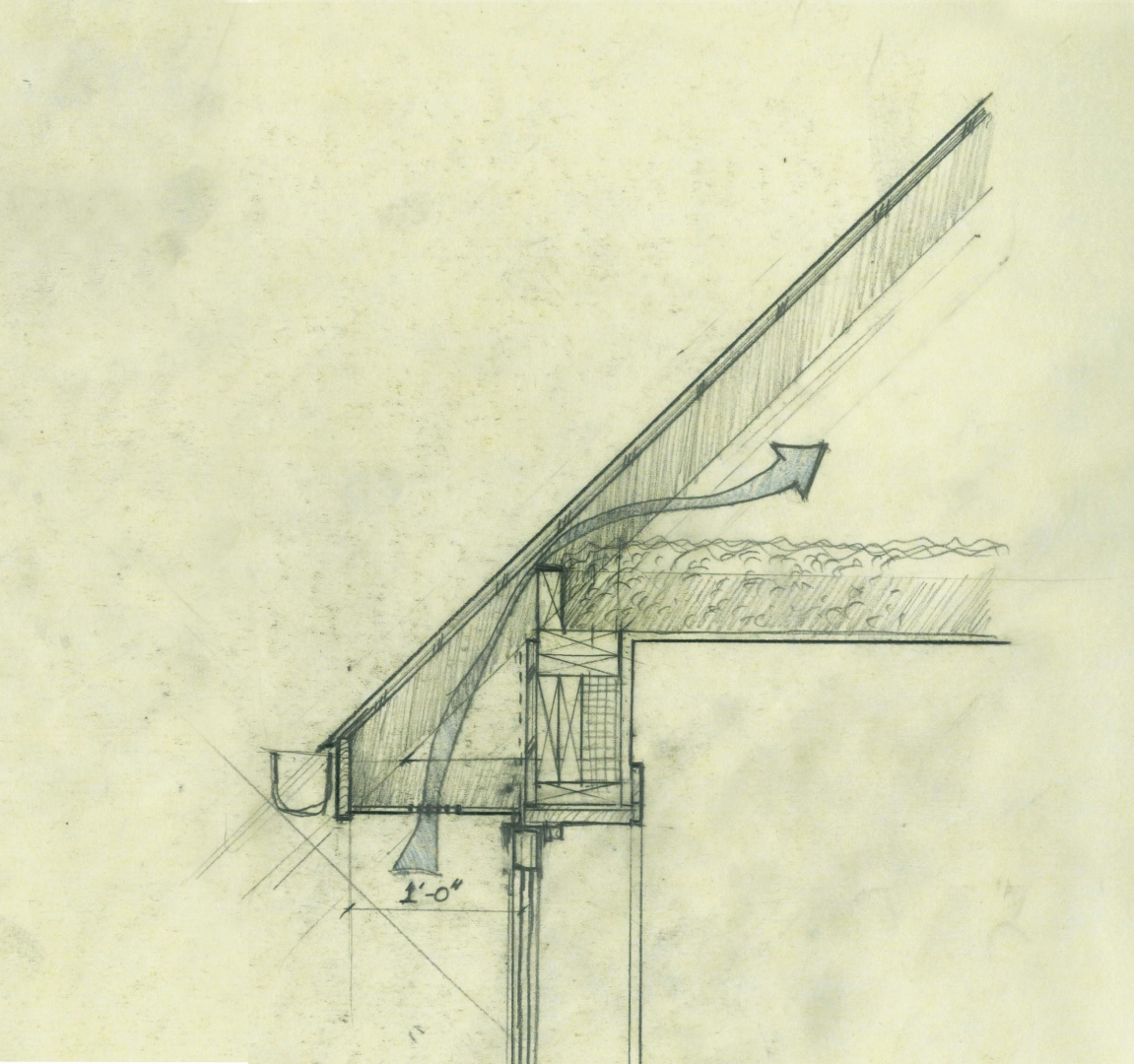
1. Dense pack 2x3 walls
2. Loose Fill attic R-60
3. Spray foam basement walls R-15
4. Basic air-sealing

EUI Calculation	
Building Area (sf)	**1550**
Ave EUI Before VTGas Retrofit	**95.7**
Ave EUI After VTGas Retrofit	**62.6**
EUI Reduction %	**35%**

Project Goals

1. Certify Passive House (PHIUS) for all new construction
2. Renovate existing duplex and not raise rent per bedroom.
3. Make the new unit Net Zero Operation Energy
4. Optimize for low carbon construction
5. Maximize the common backyard for social gathering.
6. Minimize car parking, Maximize covered bike parking (1/bedroom).
7. Capture rainwater for gardening.

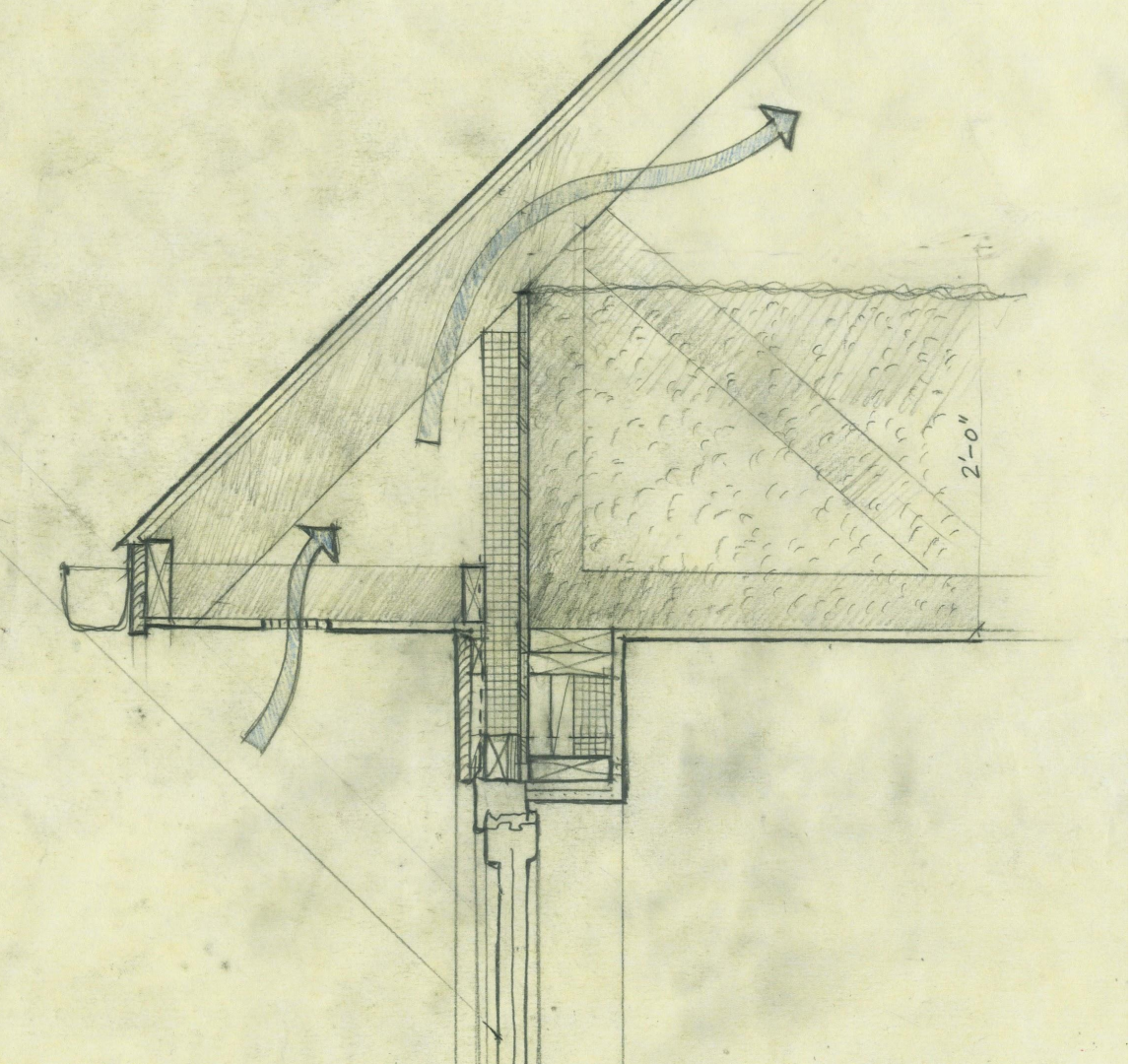
- Passive House goal identified early on in process
- Interest in embodied carbon, talk at BBD in 2018 solidified the necessity to prioritize
    - Role of education and research and trades groups in moving industry forward
        - Building Science Group
- Collaboration & Integrated Process



Traditional Eave

1. Large overhang- protect wall from weather
2. Large overhang- to shade the south windows from summer sun
3. Gutter to protect wall from water and to divert or collect the water
4. Soffit vent to vent the attic

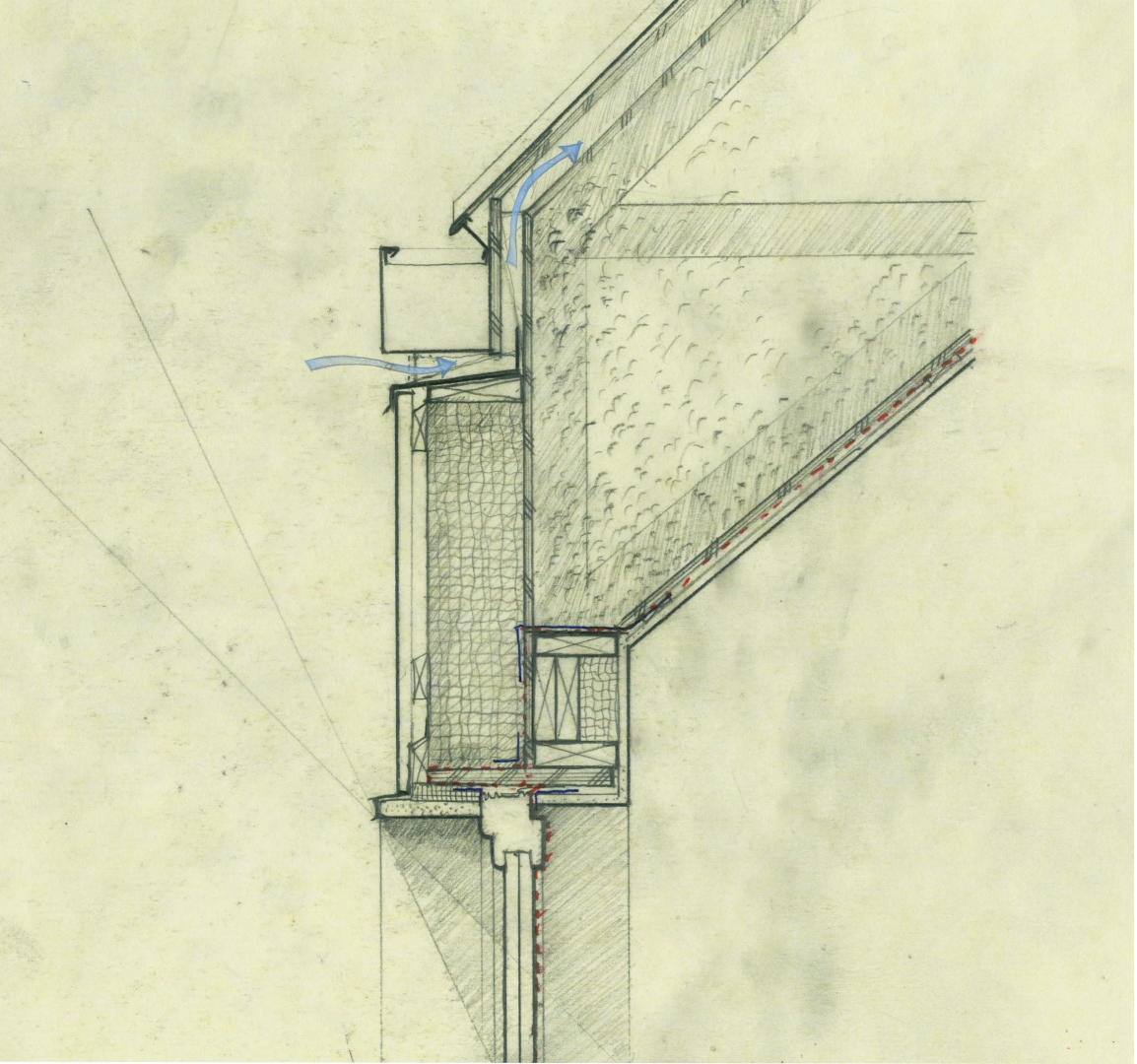
Eave Detail



Modified for high performance

1. We still have a large overhang to protect the wall from weather
2. Added heal in the truss moves the overhang up higher, so larger overhang is needed for the same amount of shading.
3. We still have a traditional gutter
4. We still have a soffit vent

Eave Detail



Modified for this project

1. Corrugated metal siding so not worried about protect siding from weather
2. Windows are in the middle of a thick wall, so the head trim provides some shading to the windows.
3. Gutter is recessed into the corner of the roof to wall intersection, where insulation is the least effective.
4. We are venting the attic through a gap under and behind the gutter

Eave Detail

Eave Detail

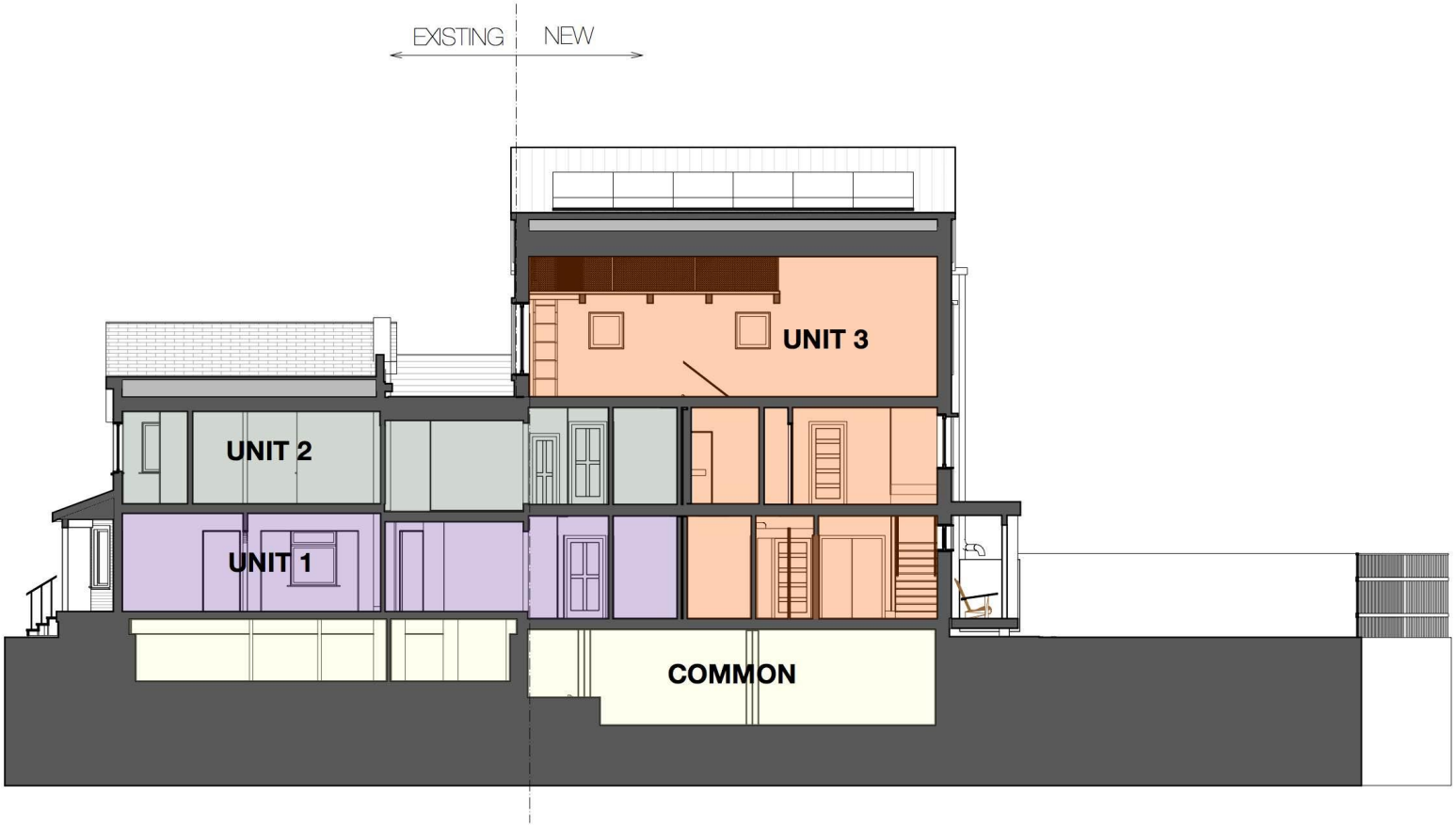
Front - Before

Front - After

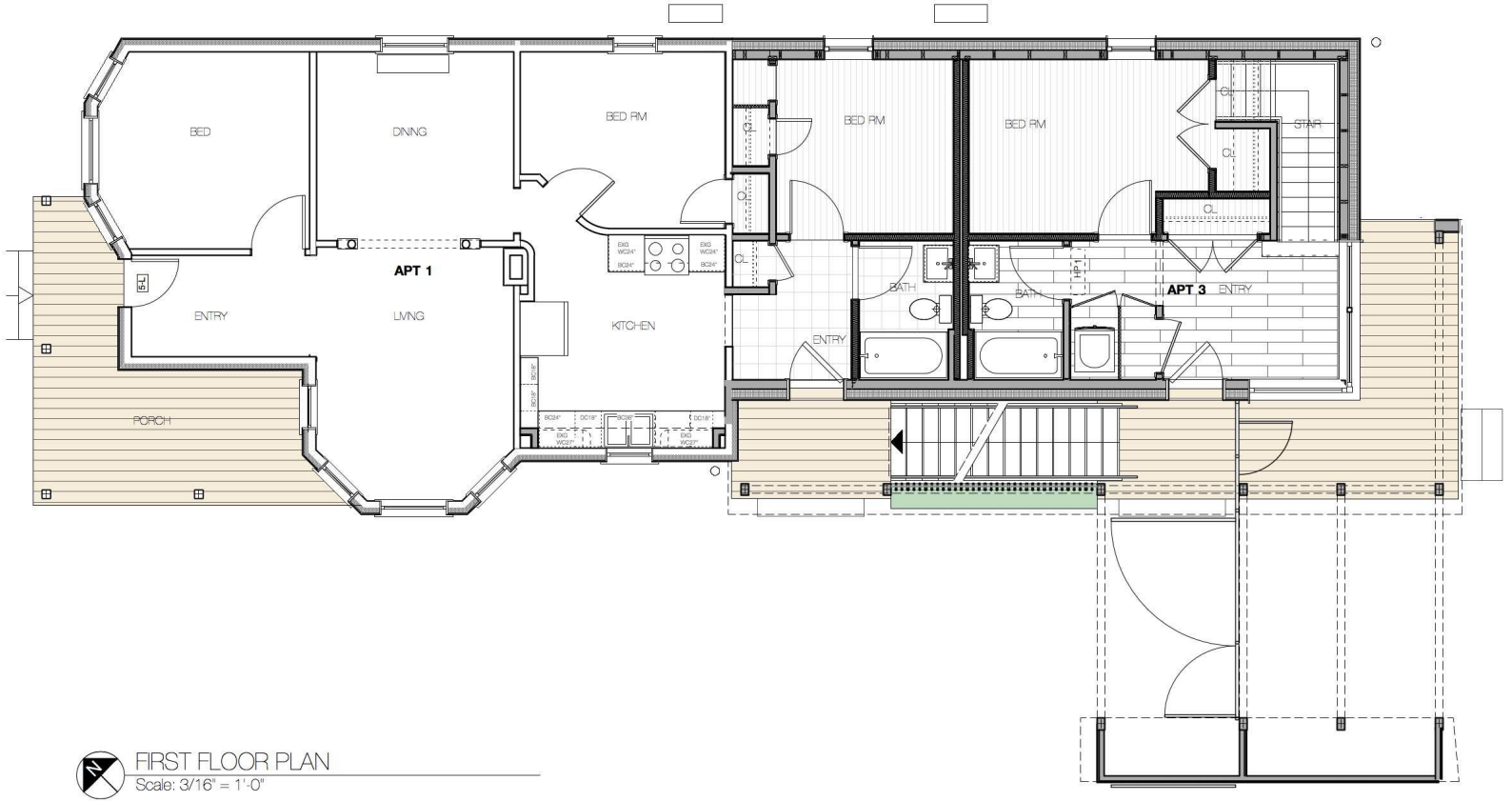
Back - Before

Back - Rendering

Back After



Section Diagram



FIRST FLOOR PLAN
Scale: 3/16" = 1'-0"

176 NWA

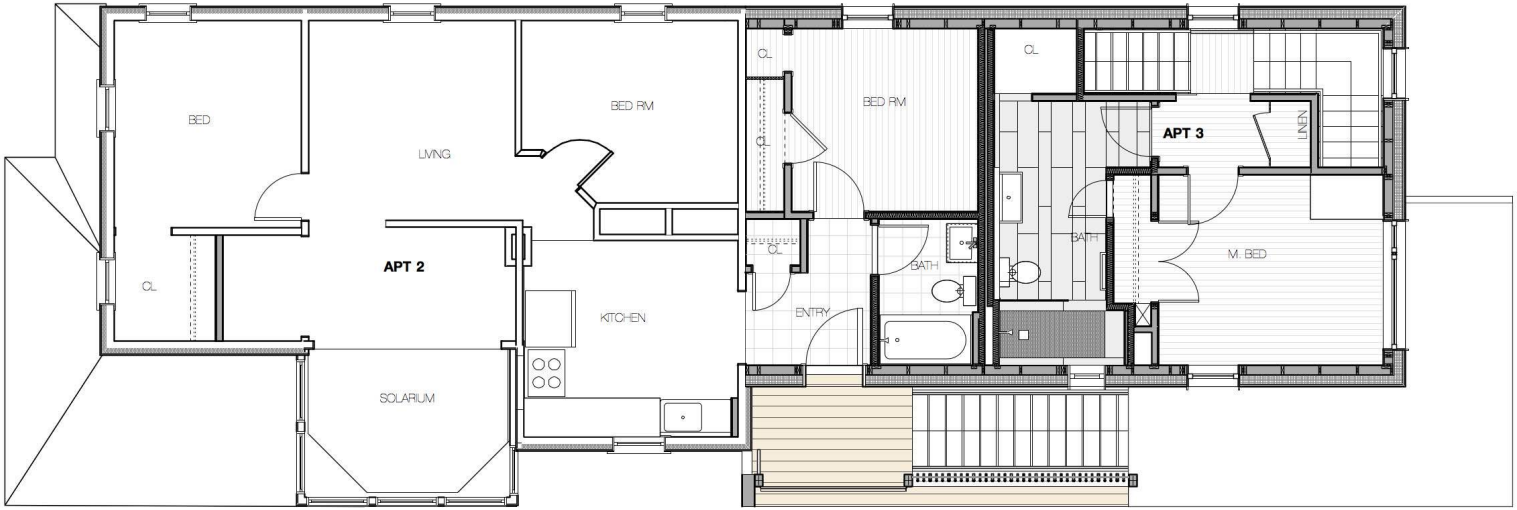
176 N. WINOOSKI AVE

CONSTRUCITON DOCUMENTS

Duncan Wisniewski
ARCHITECTURE
255 SOUTH CHAMPLAIN STREET
BURLINGTON, VERMONT 05401
T: 802.864.6693

DATE: 09.16.19

First Floor Plan



SECOND FLOOR PLAN
Scale: 3/16" = 1'-0"

Second Floor Plan

176 NWA
176 N. WINOOSKI AVE

CONSTRUCITON DOCUMENTS

Duncan Wisniewski ARCHITECTURE
255 SOUTH CHAMPLAIN STREET
BURLINGTON, VERMONT 05401
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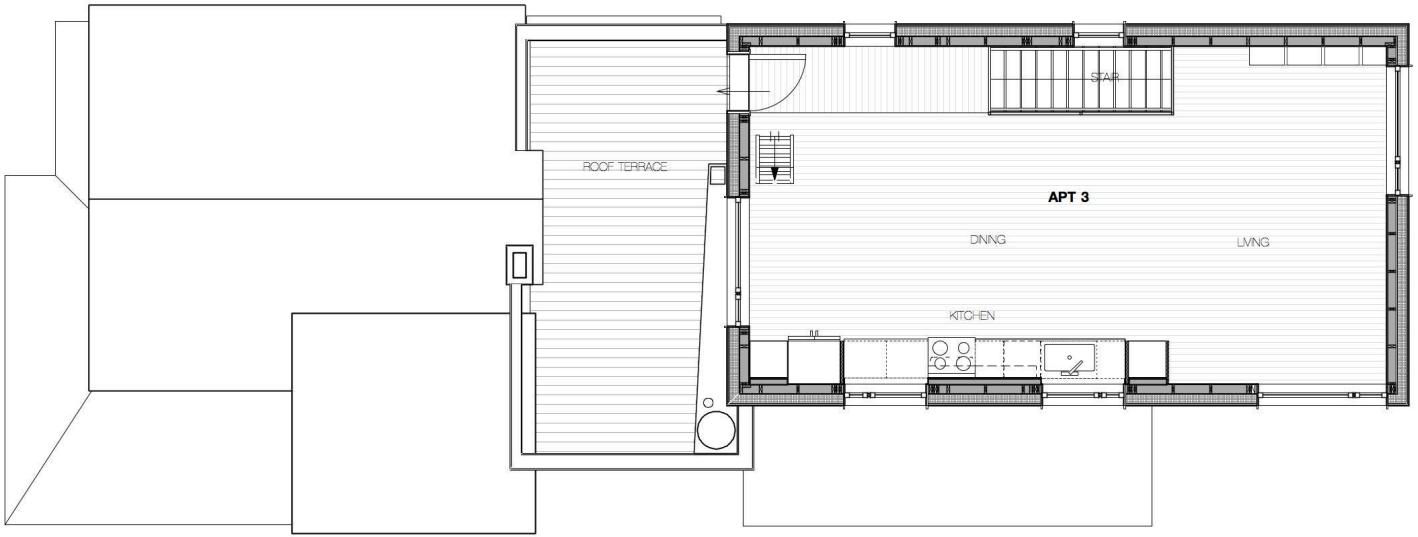
DATE: 09.16.19



THIRD FLOOR PLAN
Scale: 3/16" = 1'-0"

Third Floor Plan

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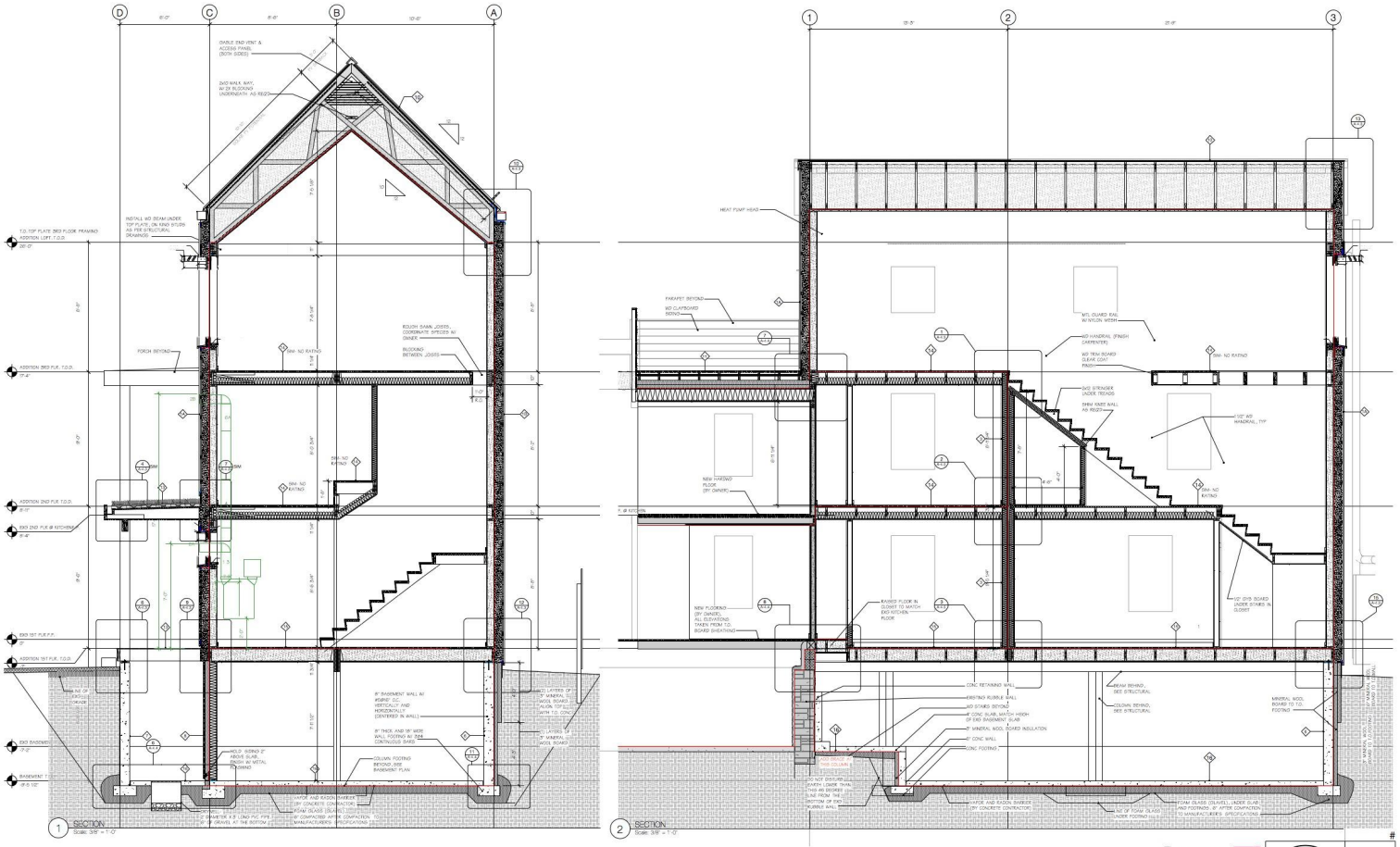

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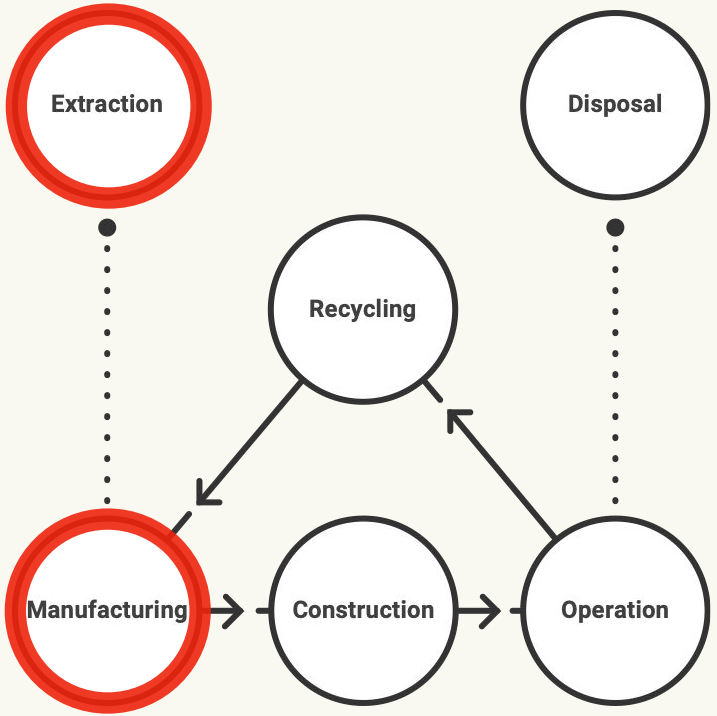
A-3.0

Sections

What is

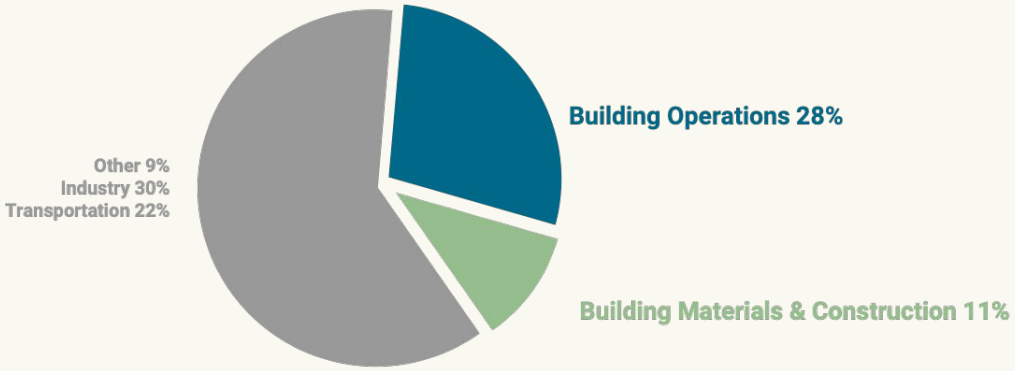
embodied carbon?

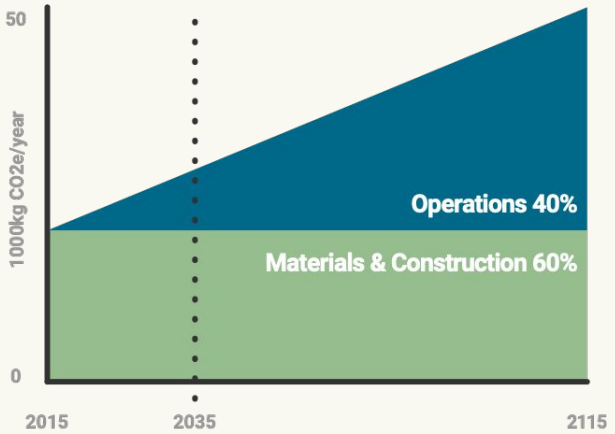
The amount of CO_2 and other Greenhouse Gases (GHGs) released into the atmosphere as a result of the extraction and manufacturing of building materials.



Global C02 Emission by Sector

Data Source: Architecture 2030





We cannot “net zero energy”
our way out of the climate crisis.

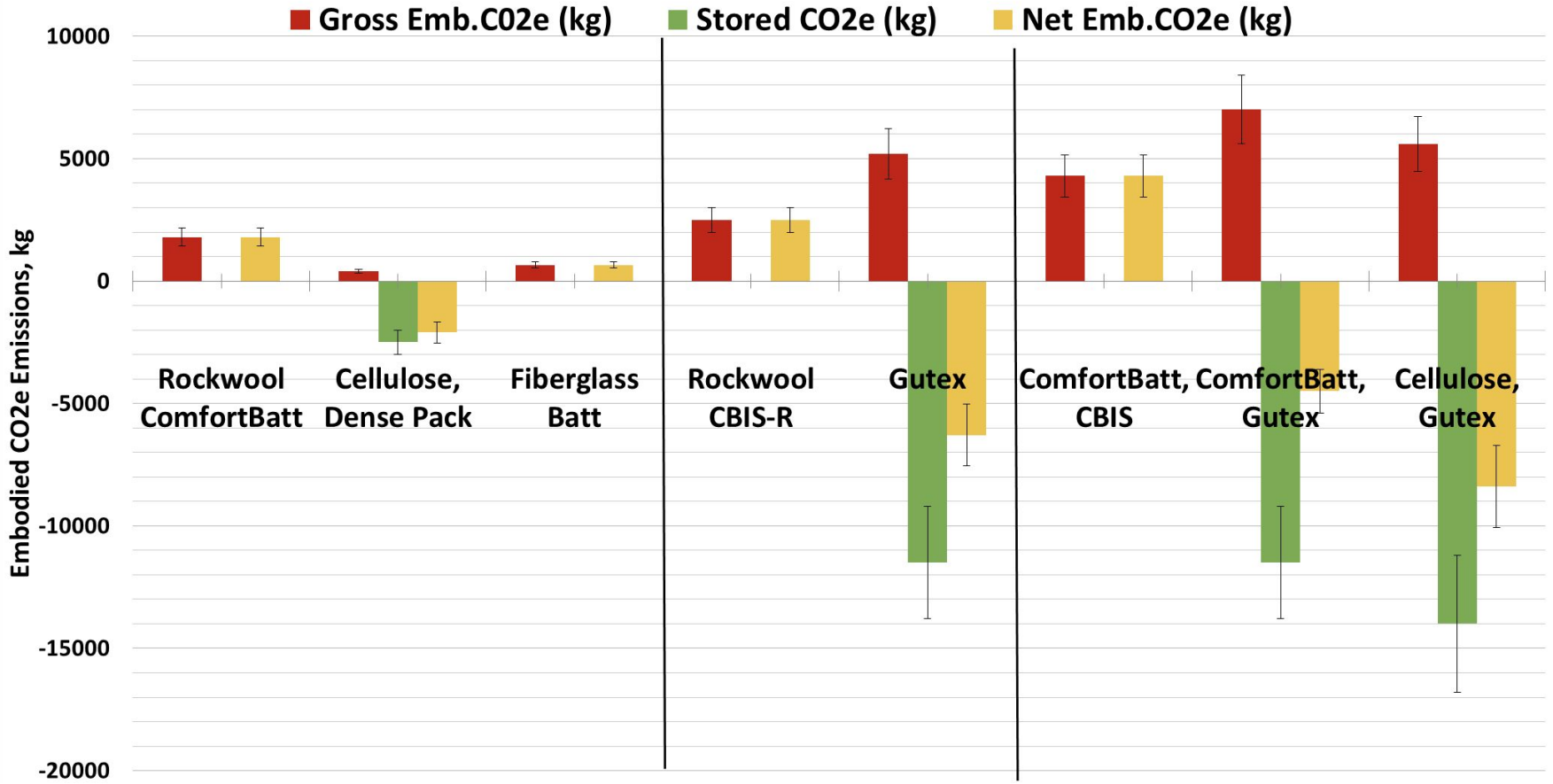
Embodied Emissions +
Operational Emissions

= Overall Climate Impact

Wall Assembly Summary

WALL ASSEMBLY SUMMARY						
WALL ASSEMBLY	R-Value	Thickness	R-Value/in	Cost/Sf	Project Cost	% Diff
CODE WALL	26.06	8	3.26	$37.58	112,761	
MINERAL WOOL WRAP & BATT	45.71	14	3.26	$41.82	$125,462	8.6%
FIBERBOARD WRAP w DP	45.93	14.25	3.22	$39.28	$117,827	5.1%
TJI WALL	49.07	15.5	3.21	$40.90	$122,707	8.1%
DOUBLE STUD WALL	50.94	18	2.83	$41.22	$123,688	8.8%

Burlington PH Insulation Embodied CO2e Analysis

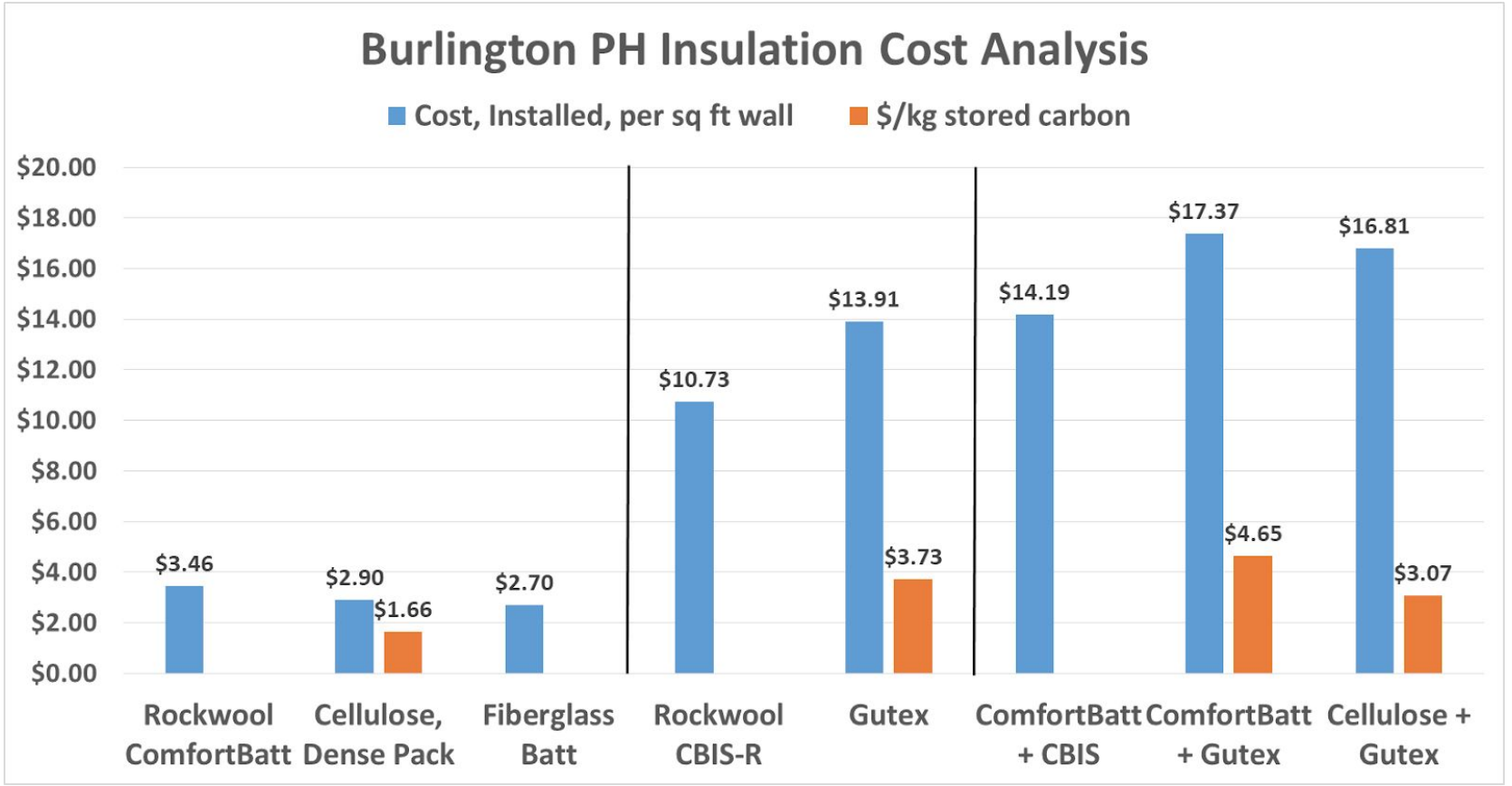


Saved Embodied CO2e in walls = 15+ Years Operating CO2e!

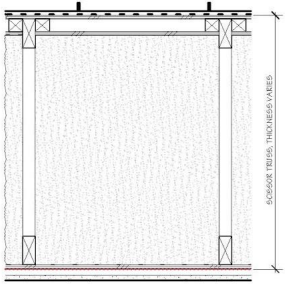
CO2e In Walls Analysis

Making The Budget Work

- Design & Planning process prioritized costs early and often
- Line itemed costs
  - Allows for client choice
  - Helps to prioritize key goals
- Targeted New Frameworks involvement
  - Envelope-only contractor
  - Commitment to outcomes allowed for creative roles and process to make building possible
  - Hourly PM support


Burlington PH Insulation Cost Analysis
Cost, Installed, per sq ft wall
$/kg stored carbon
$20.00
$18.00
$16.00
$14.00
$12.00
$10.00
$8.00
$6.00
$4.00
$2.00
$0.00
$3.46
$2.90
$1.66
$2.70
$10.73
$13.91
$3.73
$14.19
$17.37
$4.65
$16.81
$3.07
Rockwool ComfortBatt
Cellulose, Dense Pack
Fiberglass Batt
Rockwool CBIS-R
Gutex
ComfortBatt + CBIS
ComfortBatt + Gutex
Cellulose + Gutex

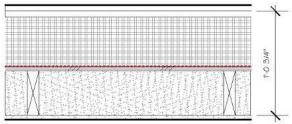
MAIN TRUSS ROOF



[R-110]

- STANDING SEAM MTL ROOF
- ROOF UNDERLAYMENT
- 1/2" PLYWOOD SHEATHING
- 1/2" PLYWOOD BAFFLE OVER 2X BLOCKING BTWN TRUSSES
- WD TRUSS AS PER STRUCTURAL DRAWINGS
- LOOSE FILL CELLULOSE 24"-30"
- 1/2" PLWD SHEATHING FULLY TAPED
- 1X STRAPPING
- 5/8 TYPE X" GWB

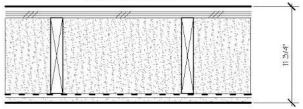
EXTERIOR WALL



[R-43.6]

- SIDING AS PER ELEVATIONS
- 3/4" RAIN SCREEN
- 6 1/4" GUTEX FIBER BOARD
- 1/2" LP FLAME BLOCK FIRE RATED OSB SHEATHING- FULLY TAPED
- 2X6" WD FRAMING 24" O.C.
- 5 1/2" DENSE PACK CELLULOSE
- 5/8" TYPE-X GYPSUM BOARD FINISH

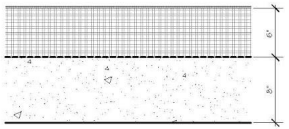
1ST FLOOR



[R-45]

- FINISH FLOOR, SEE FLOOR PLANS FOR LAYOUT
- 3/4" FLOOR SHEATHING FULLY TAPED
- FRAMING AS PER STRUCTURAL DRAWINGS
- LOOSE FILL CELLULOSE INSULATION
- RESILIENT CHANNELS
- (1) LAYERS 5/8" GYP. BD.

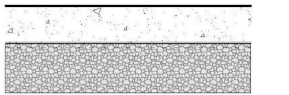
EXTERIOR INSULATED CONCRETE WALL



[R-24/12]

- METAL FLASHING ABOVE GRADE SEE DETAILS
- DRAINAGE BOARD TBD
- (2) LAYERS OF 3" MINERAL WOOL BOARD INSULATION FOR FIRST 3' BELLOW GRADE. THEN 1 LAYER OF 3" MINERAL WOOL BOARD INSULATION TO FOOTING (ENVELOPE CONTRACTOR)
- FLUID APPLIED WATERPROOFING (BY SUBCONTRACTOR)
- REINFORCED CONCRETE, PER STRUCTURAL DRAWINGS (CONCRETE CONTRACTOR)

TYPICAL SLAB

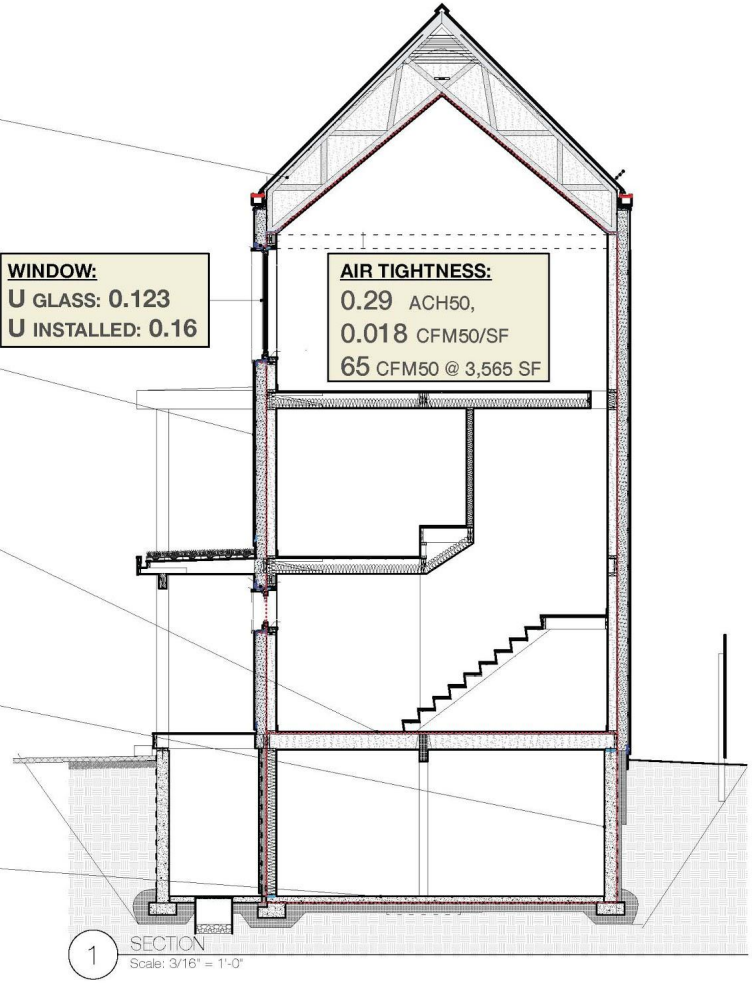


[R-12]

- 4" CONCRETE SLAB (CONCRETE CONTRACTOR)
- VAPOR AND RADON BARRIER (MATERIAL BY OWNE INSTALLED BY ENVELOPE CONTRACTOR)
- 6" GLAVEL INSTALL PER MANUFACTURER'S RECOMMONDATIONS (SITE CONTRACTOR)

WINDOW:
U GLASS: 0.123
U INSTALLED: 0.16

AIR TIGHTNESS:
0.29 ACH50,
0.018 CFM50/SF
65 CFM50 @ 3,565 SF



1 SECTION
Scale: 3/16" = 1'-0"

Envelope

- Cost plus contract
- Estimated contract total: $250,315.35
- Revised contract total w COs: $261,354.73
- Actual total: $255,138.30 ($6216.05 under contract total)
- $113/square foot - 41% of total cost of project

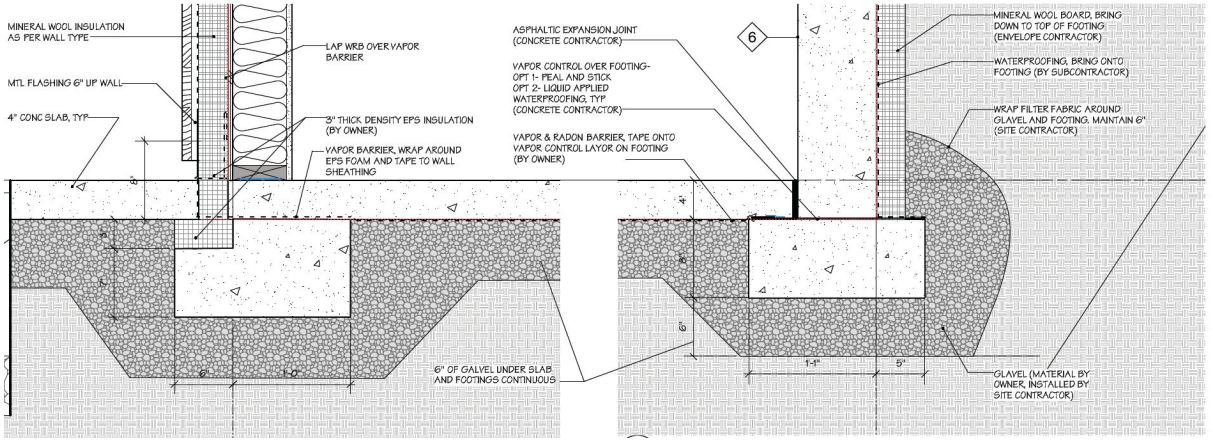
Envelope-only costs

Materials Selection

- Carbon Storing & Low Embodied Carbon materials selection:
  - FSC framing lumber, regionally harvested (Quebec)
  - Gutex-wood fiber board chosen over mineral board
  - Densepack cellulose chosen over mineral batt
  - Glavel-Foam glass sub slab insulation

- $255,140 total cost, $113/square foot, 41% of total cost of project ($275/sf)

Sub slab Insulation-Glavel



Glavel Install

Foundation walls

Thermal Break Detail

Outboard mineral wool boards 6” thick first 4 feet, then 3” thick to footing.

High density XPS Thermal break at walls.

High density EPS thermal break at slab

- Chosen to use all FSC framing lumber
- To optimize cost
- Allowed NFW crew to focus on air barrier transitions, and put our value there
- Pros and cons

Prefab/ Panelized Framing

-Hemlock timber frame porches and exposed interior structure

-White Cedar siding and slats

Local Timber

Continuous Board insulation

Gutex

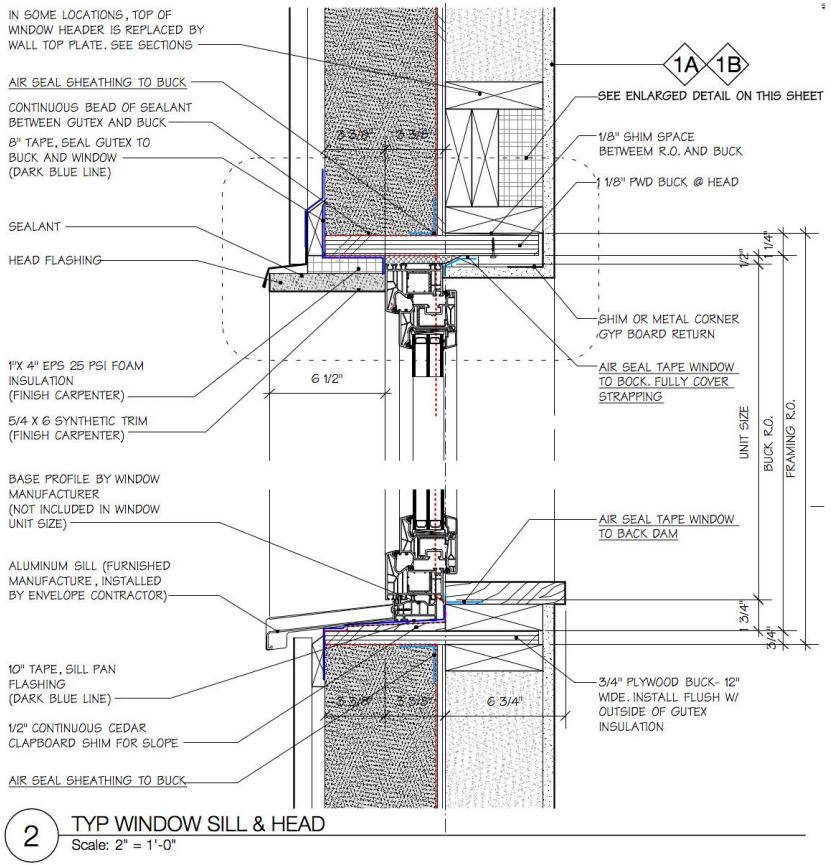
- Carbon Storing
- Tongue and Groove - Waterproof
- vapor open

- 0.29 ACH50,
- 0.018 CFM50/sf of exterior wall,
- 65 CFM50, 3565 sq ft of enclosure:

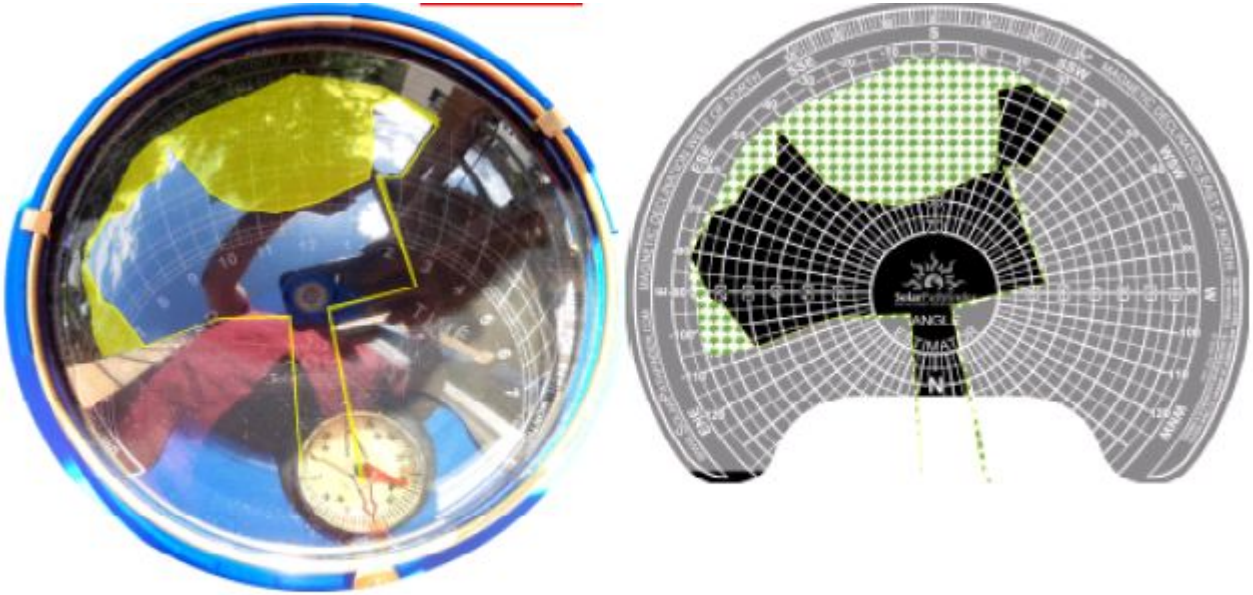
Air Sealing

blower door test reaction

Schuko UPVC - U Glass- 0.123 - U window installed- 0.16



Windows



Solar Pathfinder shows the deciduous trees for summer shading.

This reduces the need for overhangs

Solar Site Analysis Report

Layout Point 1

Image File: 176 N Winooski S E6 2nd fl4June.jpg

Solar Obstruction Data

Month	Unshaded % of Ideal Site Azimuth=180 Tilt=44.5	Deciduous Area(s) Solar Radiation Transparency = 80% kWh/m²/day	Unshaded % of Actual Site Azimuth=210.8 Tilt=90.0	otal Solar esource raction (SRF) (Actual vs deal)	Ideal Site Efficiency Azimuth=90.0 Tilt=90.0
January	65.0%	1.04	64.8%	132.1%	68.3%
February	60.6%	1.19	61.1%	101.9%	69.3%
March	48.5%	0.96	49.2%	68.6%	79.3%
April	47.5%	0.65	49.3%	53.0%	76.1%
May	54.3%	0.00	56.9%	53.9%	70.0%
June	55.4%	0.00	57.9%	50.2%	68.8%
July	54.9%	0.00	56.3%	53.8%	68.2%
August	37.1%	0.00	37.9%	41.7%	62.3%
September	12.5%	0.00	13.2%	17.6%	44.9%
October	59.5%	1.16	60.9%	99.2%	66.6%
November	66.8%	1.01	66.6%	135.6%	63.3%
December	69.3%	0.89	69.7%	162.1%	66.8%
Totals	52.6% Unweighted Yearly Avg	6.90 Effect: 25.6% Sun Hrs: 0.57	52.1% Unweighted Yearly Avg	65.4% Unweighted Yearly Avg	67.4% Unweighted Yearly Avg

Solar Site Analysis Report from Solar Pathfinder Assistant shows Unshaded% giving monthly and annual.

This is input into WUFI Passive for each window.

Solar Site Report

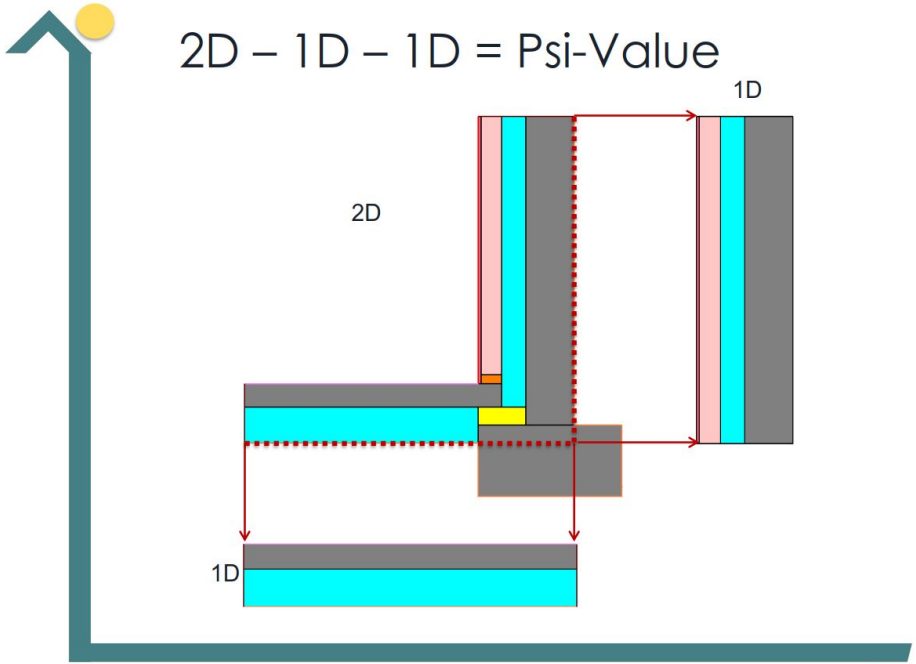
After the windows had been installed we discovered that the window frames were different then what was used in the energy model.

- Profile system: **SCHUCO Living 82 MD, (previously SI82) uPVC Window/Door System**
- Hardware: **SCHUCO** VarioTec, fully perimeter locking with 2 security closures and safety lock
  SCHUCO Handle, style –standard, color-**white,** hinges-**white**
  Entry Doors 1,2,3 : Handle Color EV1 Interior/Exterior (matte silver color)
  Patio Door 4 : Interior Handle White, Exterior Pull (Black Color)
- Color Finish: **Interior/Exterior: White DOORS: Interior White/Exterior: Color Foil (9002 Siena Noce)**
- Frame: SI 82 (Windows), 6-Chamber Profile System with corresponding Uf-value of 0.190 Btu/(h·ft²·°F)
- Glazing: Triple Glazed Low E Insulated with Warm-Edge Spacer System Ψg-value of 0.018 Btu/(h·ft·°F)
- Accessories: Insect Screens in White, Grey Mesh
  180 mm aluminum sills in white color included. (Aluminum Sill Length Specified as 1" Less than Unit Width)

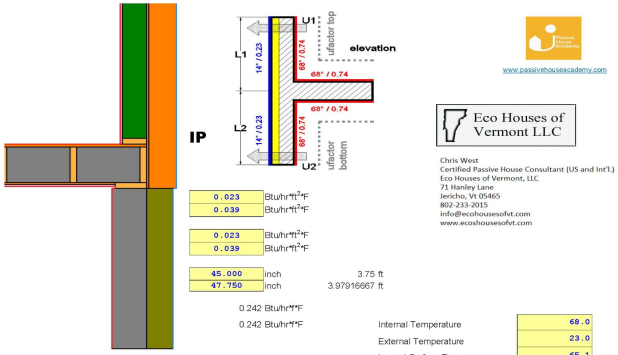
U Frame = 0.19!!!
Not 0.13!

Glazing Type	U-value	SHGC	VT
CLIMATOP XN TRIPLE PANE	0.105	0.54	0.77
CLIMATOP ECLAZ TRIPLE PANE	0.123	0.60	0.74

Thermal bridge free construction to the rescue!



‘Positive’ Thermal Bridging



IP

www.passivehouseacademy.com

Eco Houses of Vermont LLC

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0.023	Btu/hr*ft²*F	
0.039	Btu/hr*ft²*F	
0.023	Btu/hr*ft²*F	
0.039	Btu/hr*ft²*F	
45.000	inch	3.75 ft
47.750	inch	3.97916667 ft

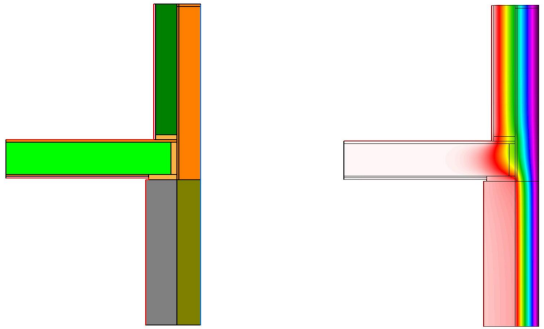
0.242 Btu/hr*F
0.242 Btu/hr*F

Internal Temperature	68.0
External Temperature	23.0
Lowest Surface Temp	65.1

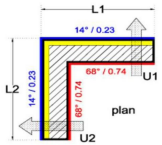
Ψ_e (for PHPP) -0.001 Btu/hr*F

f_{RSI} at 68 °F/ 23 °F 0.94

Images Of Detail 176 N Winooski Ave: Suspended floor over heated bsmt Eave End 30Jan19



PSI XLS IP



plan

1Mar15

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Wall Corner

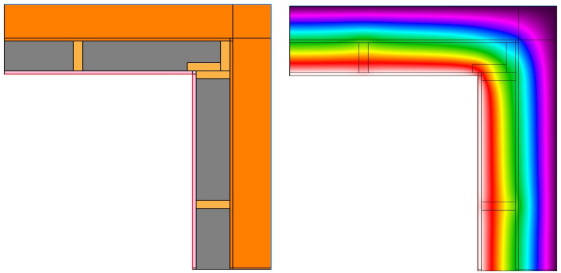
U-value 1 U1	0.023	Btu/hr*ft²*F
U-value 2 U2	0.023	Btu/hr*ft²*F
U factor therm	0.019	Btu/hr*ft²*F
Length L1	43.530	inch 3.6275 ft
Length L2	49.000	inch 4.08333333 ft
Q 1-dim	0.179	Btu/hr*F
Q 2-dim	0.145	Btu/hr*F

Internal Temperature	68.0
External Temperature	23.0
Lowest Surface Temp	68.0

Ψ_e (for PHPP) -0.034 Btu/hr*F

f_{RSI} at 68 °F/ 23 °F 1.00

Images Of Detail 176 N Winooski Ave: Outside Corner Wall to Wall 30Jan19



Thermal Bridge Analysis

Ventilation Closet with Zehnder CA350 ERV

VENTILATION MEASUREMENTS

RETURN AIR	Planned CFM	Measured CFM				
	Medium	Low	Medium	High	Valve Type	Valve Position or ComfoSet Disk 0-4
1. 1-Bathroom	24	17	25	34	Roma	
2. 2-Bathroom	24	17	26	33	Roma	
3. 3-Kitchen	36	22	36	45	STB-2	
SUM:	84	56	87	112		

SUPPLY AIR	Planned CFM	Measured CFM				
	Medium	Low	Medium	High	Valve Type	Valve Position or ComfoSet Disk 0-4
1. 1-Bedroom	24	18	25	33	Luna	
2. 2-Master Bed	24	17	24	32	Roma	
3. 3-Living Room	36	24	37	49	Luna	
SUM:	84	59	86	114		

Trim	Low	Medium	High	Comfort Temperature	0
Ventilator Setting Return Air:	35	55	85	Filter Condition	new
Ventilator Setting Fresh Air:	25	38	50	Weather	clear 60

Heat pump above door in first floor entry

Modeled Demand : 7,000 Btu/hr,

(2) single zone Mitsubishi cold climate heat pumps. 9,000 Btu/hr each.

Needed at least two heads for distribution (first and second floor)

Second floor is has no heat source and stays within 4 degrees on the coldest days if doors are open.

First floor location in alcove is proving to be difficult to hit a set point.

WaterSense is a prerequisite for PHIUS

It requires a maximum of 0.60 gallons of water in the longest run of pipe

176 N. Winooski Ave Plumbing Calc

Kitchen Sink and Dish Washer 3rd flr

Direction	Material	Thickness	Oc/ft	Length (ft)	Volume (ounces)	Gallons
H	copper	0.75	3.22	2	6.44	0.05
V	pex	0.75	3.39	11	37.29	0.29
V	pex	0.5	1.31	9	11.79	0.09
H	pex	0.5	1.31	4	5.24	0.04
V	pex	0.5	1.31	2	2.62	0.02
Total						**0.49**
Max						0.60
Difference						0.11

Master Sink 2rd flr

Direction	Material	Thickness	Oc/ft	Length (ft)	Volume (ounces)	Gallons
H	copper	0.75	3.22	2	6.44	0.05
V	pex	0.75	3.39	11	37.29	0.29
H	pex	0.75	3.39	1	3.39	0.03
H	pex	0.5	1.31	8	10.48	0.08
V	pex	0.5	1.31	4	5.24	0.04
Total						**0.49**
Max						0.60
Difference						0.11

Bathroom Sink 1st flr

Direction	Material	Thickness	Oc/ft	Length (ft)	Volume (ounces)	Gallons
H	copper	0.75	3.22	2	6.44	0.05
V	pex	0.75	3.39	1.5	5.085	0.04
H	pex	0.5	1.31	5	6.55	0.05
V	pex	0.5	1.31	3	3.93	0.03
Total						**0.17**
Max						0.60
Difference						0.43

Master shower 2rd flr

Direction	Material	Thickness	Oc/ft	Length (ft)	Volume (ounces)	Gallons
H	copper	0.75	3.22	2	6.44	0.05
V	pex	0.75	3.39	11	37.29	0.29
H	pex	0.75	3.39	1	3.39	0.03
H	pex	0.5	1.31	4	5.24	0.04
V	pex	0.5	1.31	3.5	4.585	0.04
H	pex	0.5	1.31	5.5	7.205	0.06
V	pex	0.5	1.31	2.5	3.275	0.03
Total						**0.53**
Max						0.60
Difference						0.07

Tub/shower 1st flr

Direction	Material	Thickness	Oc/ft	Length (ft)	Volume (ounces)	Gallons
H	copper	0.75	3.22	2	6.44	0.05
V	pex	0.75	3.39	1.5	5.085	0.04
H	pex	0.5	1.31	6	7.86	0.06
V	pex	0.5	1.31	7	9.17	0.07
Total						**0.22**
Max						0.60
Difference						0.38

Laundry

Direction	Material	Thickness	Oc/ft	Length (ft)	Volume (ounces)	Gallons
H	copper	0.75	3.22	2	6.44	0.05
V	pex	0.75	3.39	1.5	5.085	0.04
H	pex	0.5	1.31	7.5	9.825	0.08
V	pex	0.5	1.31	2	2.62	0.02
Total						**0.19**
Max						0.60
Difference						0.41

Spread carbon competence

Develop more small scale multi-unit projects.

Complete a full analysis on the climate impact of this building.

Where to go from here: