BUILDINGENERGY BOSTON

# Just Do This!
# Proven Details and Strategies for Simple High Performance Homes

Stephen DeMetrick, DeMetrick Housewrights

*Curated by Asher Greenberg*

Northeast Sustainable Energy Association (NESEA) | March 21, 2025

# DEMETRICK HOUSEWRIGHTS

• EST | 1995 •

Building a Sustainable Future

Learning Objectives:

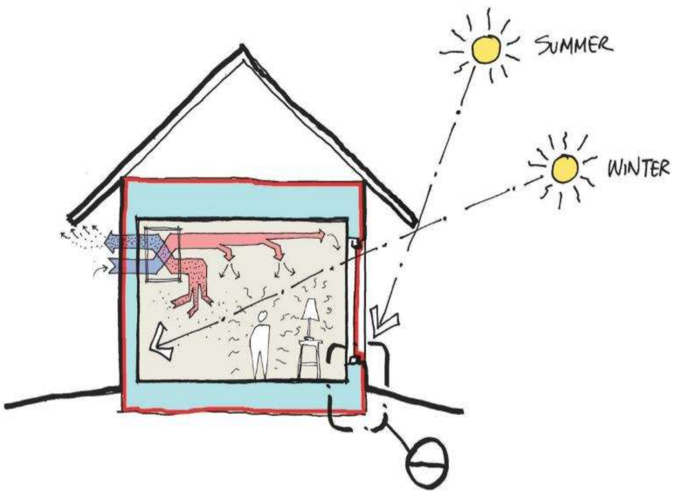
•Prioritize among the myriad of options to improve the building envelope

•Lower construction costs with more organized and relevantly detailed

•Design and select details that work for the tradespeople doing the physical

•Demonstrate how building science problems can be solved with design and

# In the beginning…



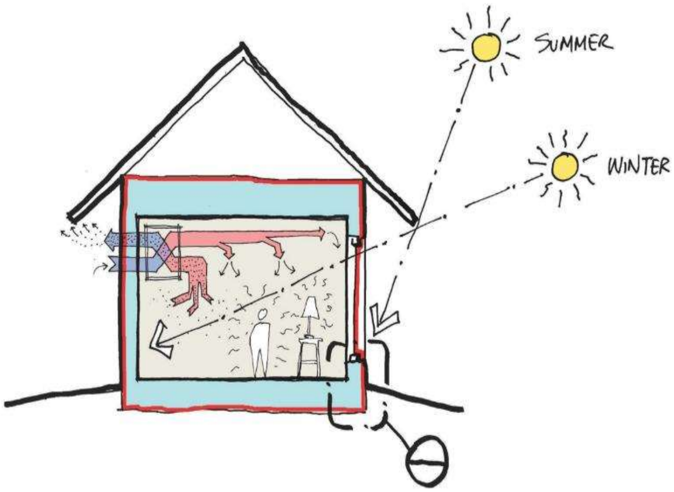

Courtesy JB Clancy, Albert, Righter & Tittmann Architects

## What was our focus 10 years ago?

- Air sealing – this seemed an impossible metric!
- thermal bridging – I think the early WUFI models generated more questions than answers!
- How do we install these European windows?
- is 12″ of foam under the slab going to be enough?
- What about the subcontractors? Will the cable guy blow up my blower door number?

# Today with a renewed and refined perspective:

## What is our focus now?




Courtesy JB Clancy, Albert, Righter & Tittmann Architects

- Health - Ventilation for Indoor air quality and health
- Comfort - Engineering our HVAC with a focus on humidity before temperature
- Durability - Detailing our assemblies for long term durability and low maintenance – vapor open assemblies
- Sustainability - healthy low carbon materials
- Practicality – we need to simplify this work to pave the way for the next generation to make a

# A familiar formula with a new ratio

1 **Design**

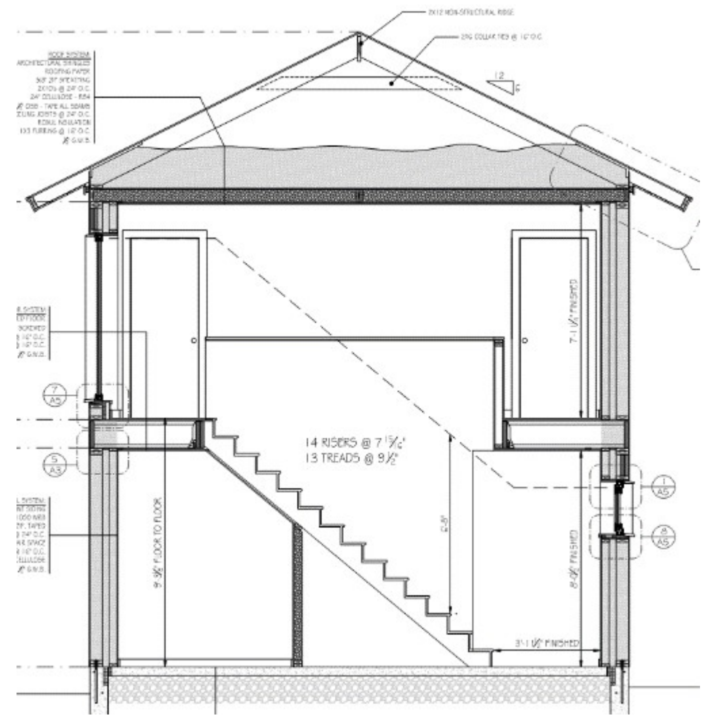
- This is where 95 - 100% of the planning and construction details happen

2 **Build –**

- 0-5% of design happens here. This should now be the easy part, but there are too many humans involved

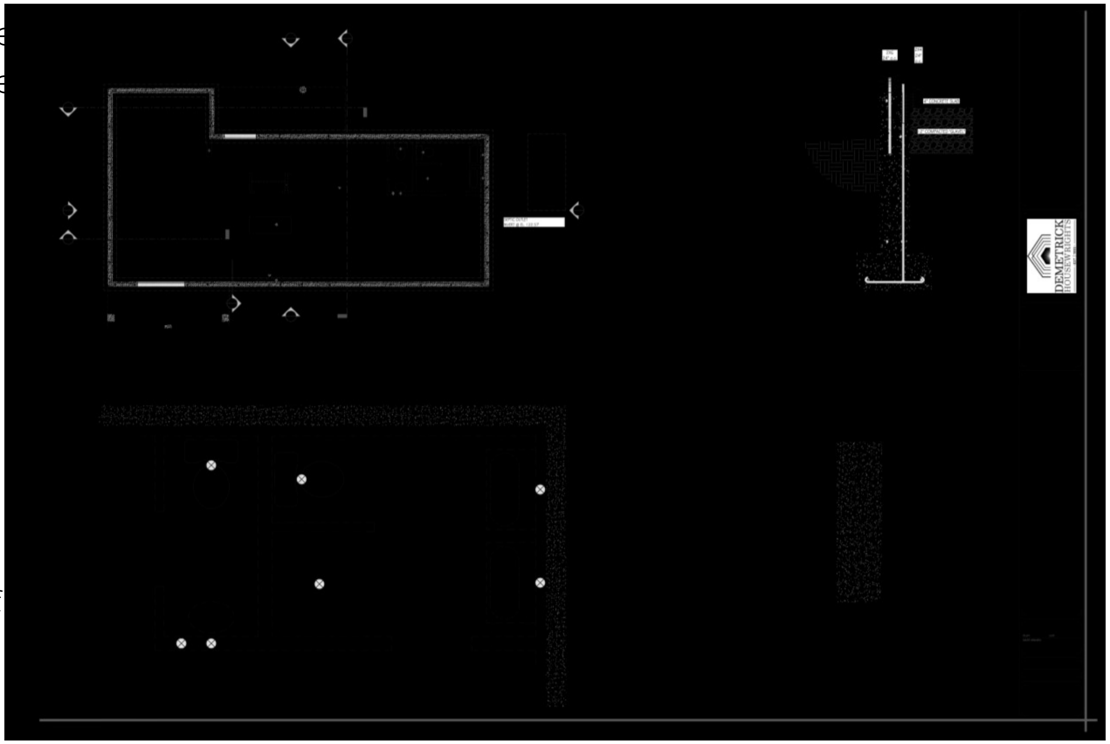
# Design – These are our guiding principles

- Simple shapes, follow the dimensions of existing building products
- Select materials that are familiar to the trades and less difficult to install, healthy to work with and live with
- HVAC – keep it simple and…
    - *Design the HVAC into the space*
    - *Engineer the HVAC - this is critical*
- Provide critical detail drawings
    - *Organize the planset for the people following them in the field*
    - *Don’t leave crucial decisions to be made in the field*
- Problem solve with design choices
    - *Layout locate the water heater, kitchens and bathrooms to shorten hot water piping runs*
    - *Choose an air barrier system and building shapes that don’t rely on spray foam*
    - *Balance priorities – air sealing and ventilation trump r-values*



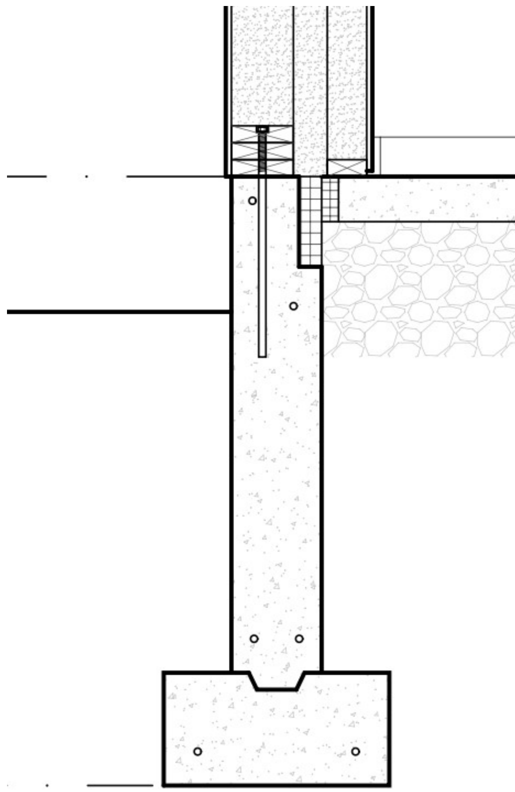
# Foundations

Detail the plans for the people that are doing the work to make their job easier



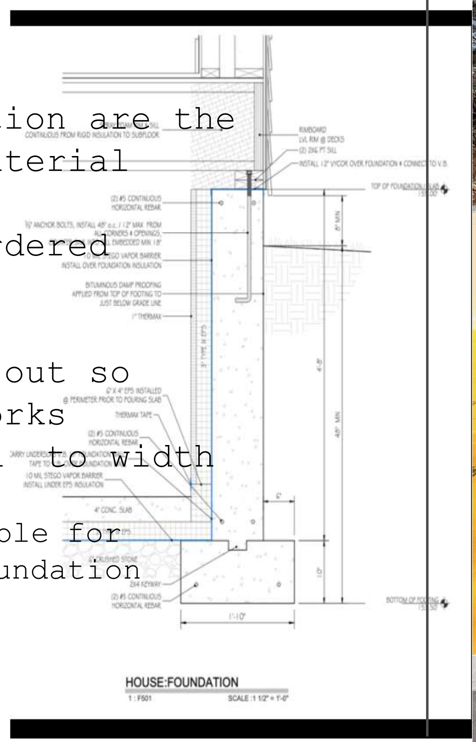
- Organize all the information that the foundation contractor needs on the same few pages – not spread out over a 40 page plan
- List elevations for relevant points only
  - No – top of subfloor dimensions
  - Bottom of footing and top of foundation are the two main numbers needed
- Provide diagonals on the drawings
- Coordinate bolt locations with floor framing plan
- Put the site elevation benchmark on the plan

EPS can be cast in place in the foundation for th



## **Details are thought through for efficiency in the field**

- wall and floor insulation are the same thickness and material
- block at bottom is ordered presized
- Wall height is layed out so 4’ wide EPS sheet works without being ripped to width
- This layout made it possible for 2 people to prep this foundation in a morning




# Framing – framing is framing, this is really about ex

How are we doing this?

Taped sheathing

Air tight drywall

Interior membranes – intello,
Siga Majrex

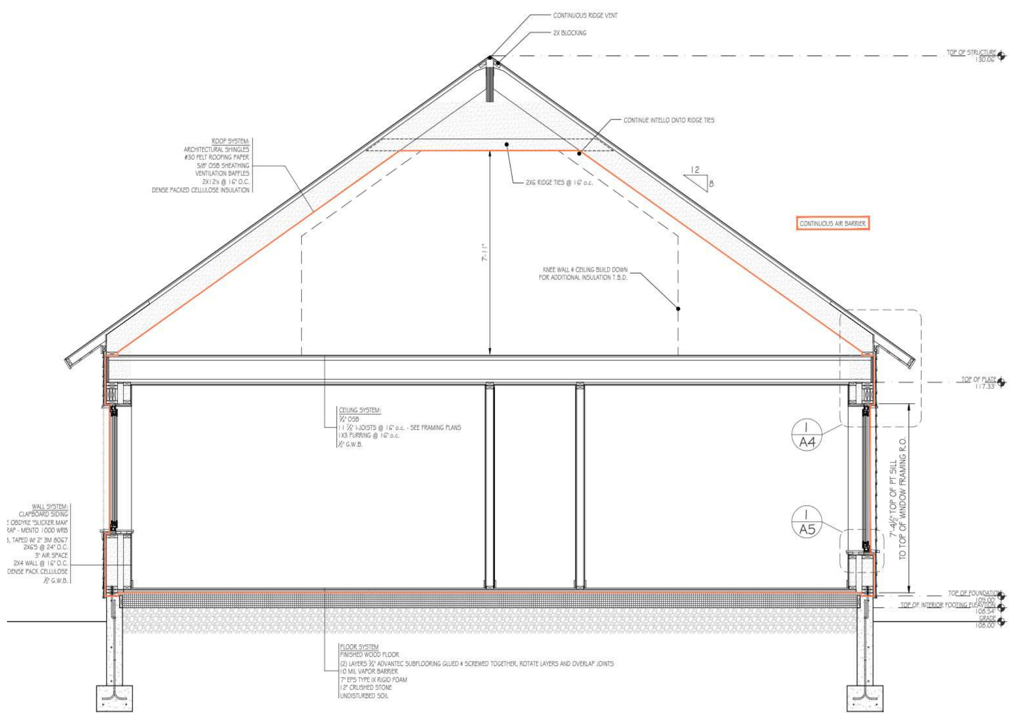
Exterior membranes – Mento, typar/Tyvek,
Self adhered WRBs

Fluid/liquid applied products

Tapes

Caulks

Aerosols – ie.




Canned spray foam

Liquid gaskets

Silicone gaskets

Rubber gaskets

Sill seal

Spray foam

Cream cheese

Concrete – yes, co

Maybe add pictures of the products instead of the details
Don’t use detail drawings to show a concept

# Before you start you need to ask a few questions:

1. Where does the air barrier go?

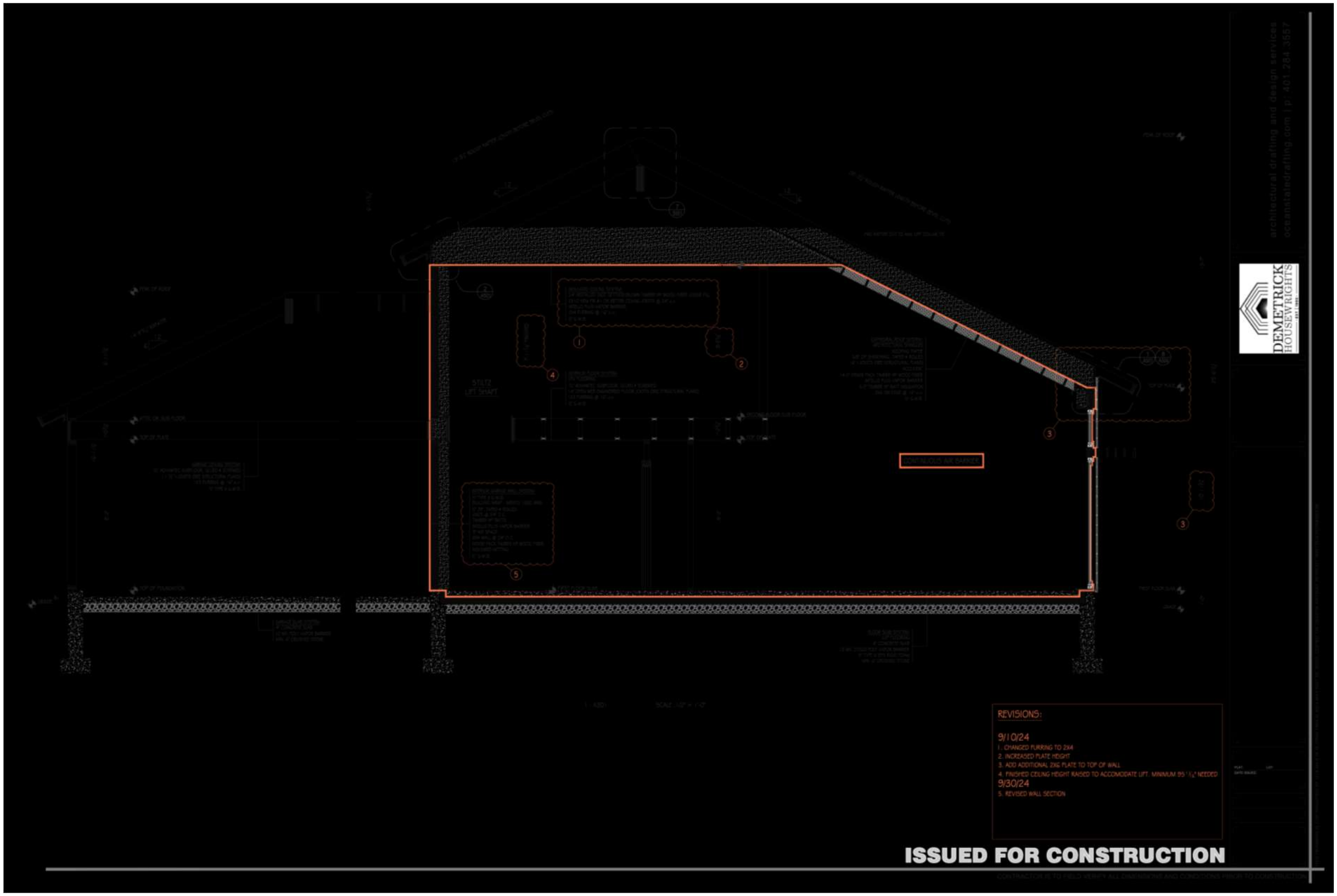
Exterior – Sheathing
Interior – membrane or sheetrock
Mid wall – this sounds like torture

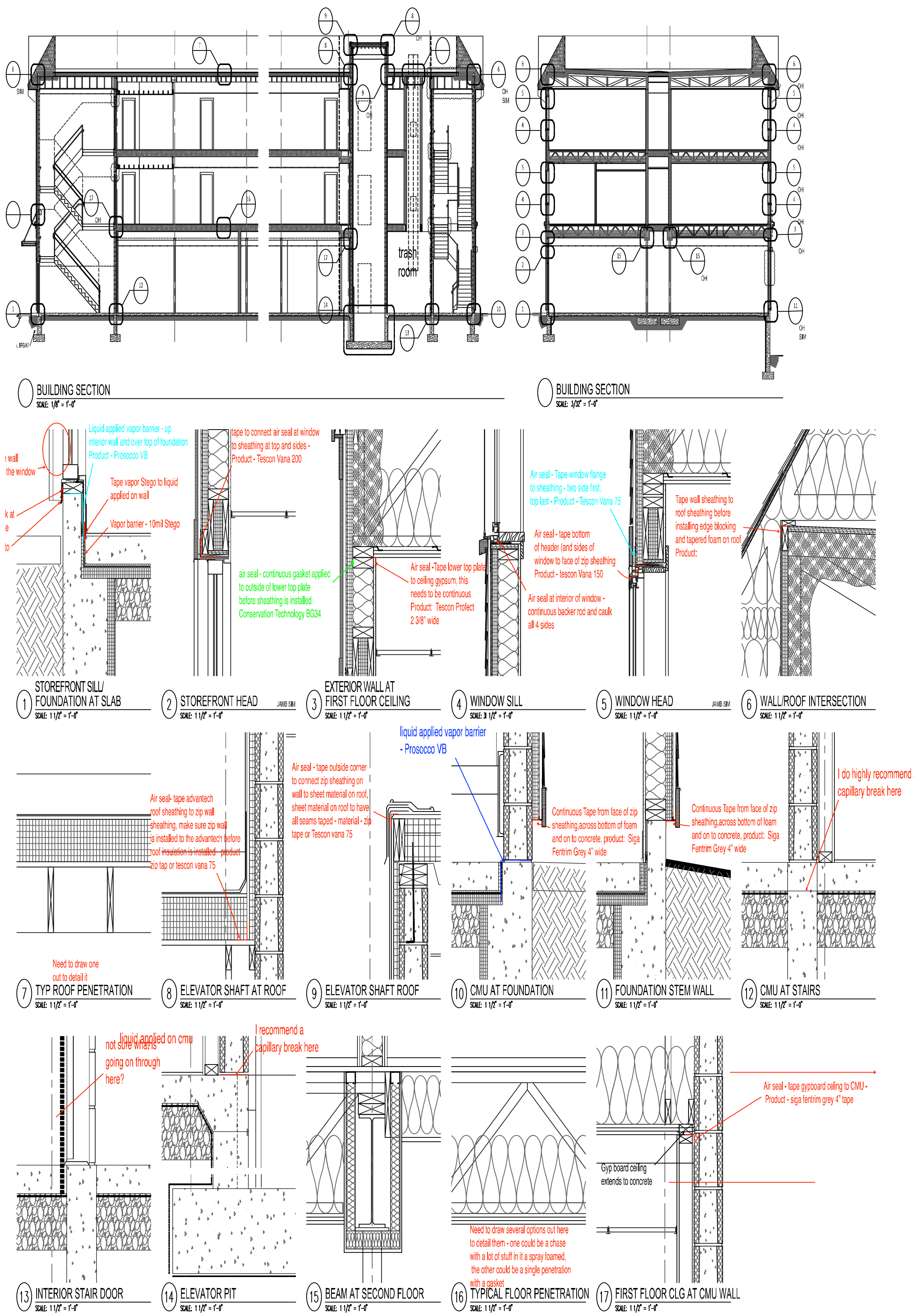
2. What needs to be sealed?

Everything that is in alignment and penetrating through your air barrier
- windows, doors, exterior plumbing/electrical/hvac penetrations, etc.

3. Is it intentional?

It should be!!! If you are not designing the air barrier into your building plans then you will have problems


CONTINUOUS AIR BARRIER
DEMETRICK HOUSEWRIGHTS
REVISIONS:
9/10/24
1. CHANGED FURRING TO 2X4
2. INCREASED PLATE HEIGHT
3. ADD ADDITIONAL 2X6 PLATE TO TOP OF WALL
4. FINISHED CEILING HEIGHT RAISED TO ACCOMODATE LIFT. MINIMUM 95 1/2" NEEDED
9/30/24
5. REVISED WALL SECTION
ISSUED FOR CONSTRUCTION



BUILDING SECTION
SCALE: 1/8" = 1'-0"
trash room
BUILDING SECTION
SCALE: 3/32" = 1'-0"
Liquid applied vapor barrier - up interior wall and over top of foundation Product - Proscoco VB
Tape vapor Stego to liquid applied on wall
Vapor barrier - 10mil Stego
tape to connect air seal at window to sheathing at top and sides - Product - Tescon Vana 200
air seal - continuous gasket applied to outside of lower top plate before sheathing is installed Conservation Technology BG34
Air seal - Tape lower top plate to ceiling gypsum, this needs to be continuous Product: Tescon Profect 2 3/8" wide
Air seal - Tape window flange to sheathing - two side first, top last - Product - Tescon Vana 75
Air seal - tape bottom of header (and sides of window to face of zip sheathing Product - tescon Vana 150
Air seal at interior of window - continuous backer rod and caulk all 4 sides
Tape wall sheathing to roof sheathing before installing edge blocking and tapered foam on roof Product:
1 STOREFRONT SILL/ FOUNDATION AT SLAB
SCALE: 1 1/2" = 1'-0"
2 STOREFRONT HEAD
SCALE: 1 1/2" = 1'-0"
JAMB SIM
3 EXTERIOR WALL AT FIRST FLOOR CEILING
SCALE: 1 1/2" = 1'-0"
4 WINDOW SILL
SCALE: 3 1/2" = 1'-0"
5 WINDOW HEAD
SCALE: 1 1/2" = 1'-0"
JAMB SIM
6 WALL/ROOF INTERSECTION
SCALE: 1 1/2" = 1'-0"
liquid applied vapor barrier - Proscoco VB
Air seal- tape advantech roof sheathing to zip wall sheathing, make sure zip wall is installed to the advantech before roof insulation is installed - product zip tap or tescon vana 75
Air seal - tape outside corner to connect zip sheathing on wall to sheet material on roof, sheet material on roof to have all seams taped - material - zip tape or Tescon vana 75
Continuous Tape from face of zip sheathing,across bottom of foam and on to concrete, product: Siga Fentrim Grey 4" wide
Continuous Tape from face of zip sheathing,across bottom of foam and on to concrete, product: Siga Fentrim Grey 4" wide
I do highly recommend a capillary break here
Need to draw one out to detail it
7 TYP ROOF PENETRATION
SCALE: 1 1/2" = 1'-0"
8 ELEVATOR SHAFT AT ROOF
SCALE: 1 1/2" = 1'-0"
9 ELEVATOR SHAFT ROOF
SCALE: 1 1/2" = 1'-0"
10 CMU AT FOUNDATION
SCALE: 1 1/2" = 1'-0"
11 FOUNDATION STEM WALL
SCALE: 1 1/2" = 1'-0"
12 CMU AT STAIRS
SCALE: 1 1/2" = 1'-0"
liquid applied on cmu
not sure whats going on through here?
I recommend a capillary break here
Air seal - tape gypboard ceiling to CMU - Product - siga fentrim grey 4" tape
Gyp board ceiling extends to concrete
Need to draw several options out here to detail them - one could be a chase with a lot of stuff in it a spray foamed, the other could be a single penetration with a gasket
13 INTERIOR STAIR DOOR
SCALE: 1 1/2" = 1'-0"
14 ELEVATOR PIT
SCALE: 1 1/2" = 1'-0"
15 BEAM AT SECOND FLOOR
SCALE: 1 1/2" = 1'-0"
16 TYPICAL FLOOR PENETRATION
SCALE: 1 1/2" = 1'-0"
17 FIRST FLOOR CLG AT CMU WALL
SCALE: 1 1/2" = 1'-0"


Text

Text


# The sheathing is ~~our primary~~ air barrier

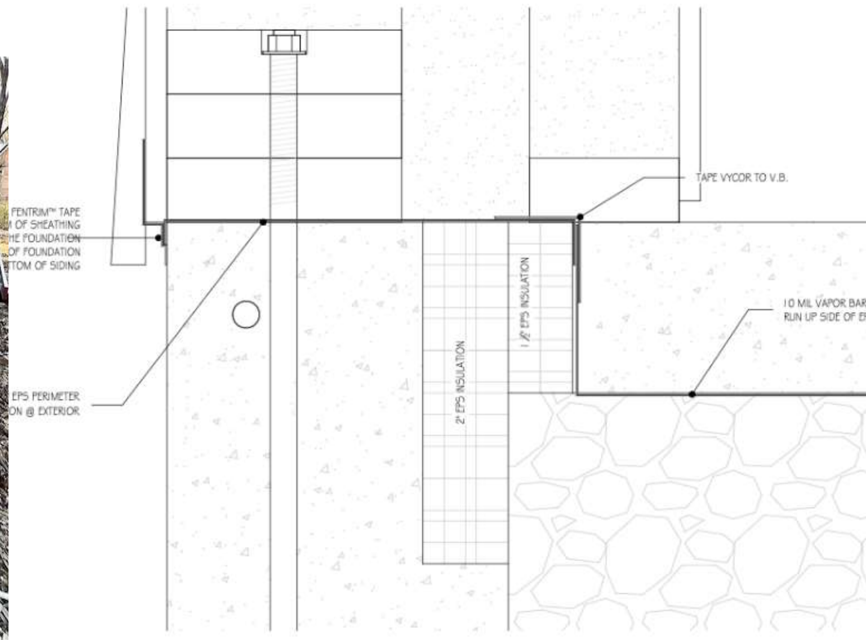
(don't try to tape less expensive OSB, it won't stick without a primer)

3 for 1!

- -Structural
- -nail base for siding
- -air barrier

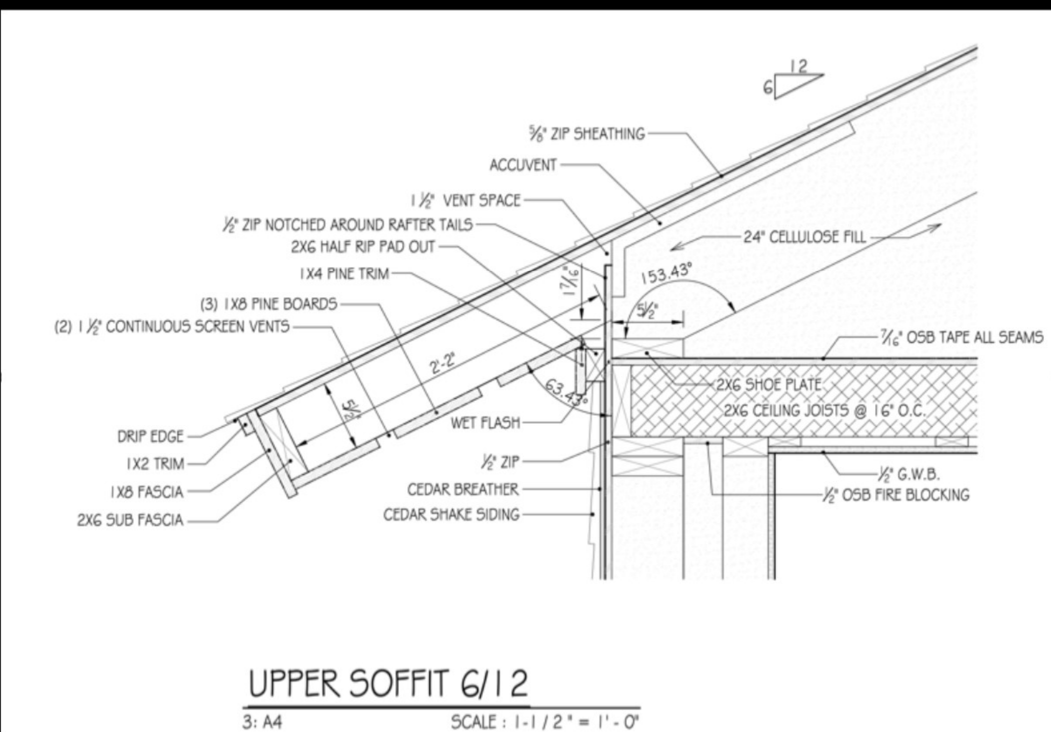
This is also why:

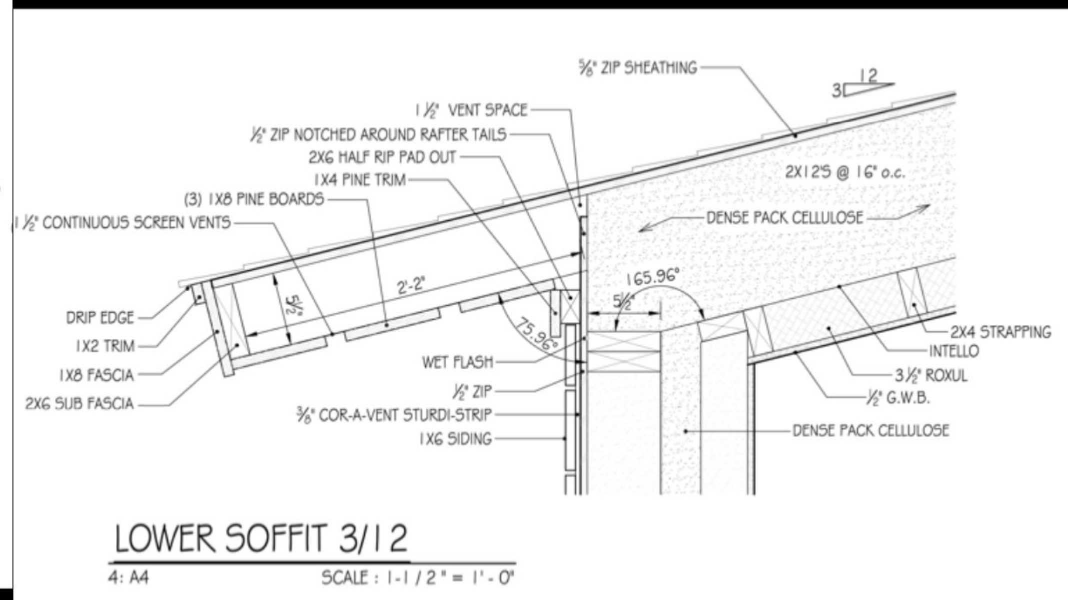

FLASHING TAPE


FENTRIM™ TAPE
I OF SHEATHING
HE FOUNDATION
OF FOUNDATION
TTOM OF SIDING
EPS PERIMETER
ON @ EXTERIOR
TAPE VYCOR TO V.B.
2" EPS INSULATION
1 1/2" EPS INSULATION
10 MIL VAPOR BARR
RUN UP SIDE OF EPS


STEGO WRAP
STEGO WRAP

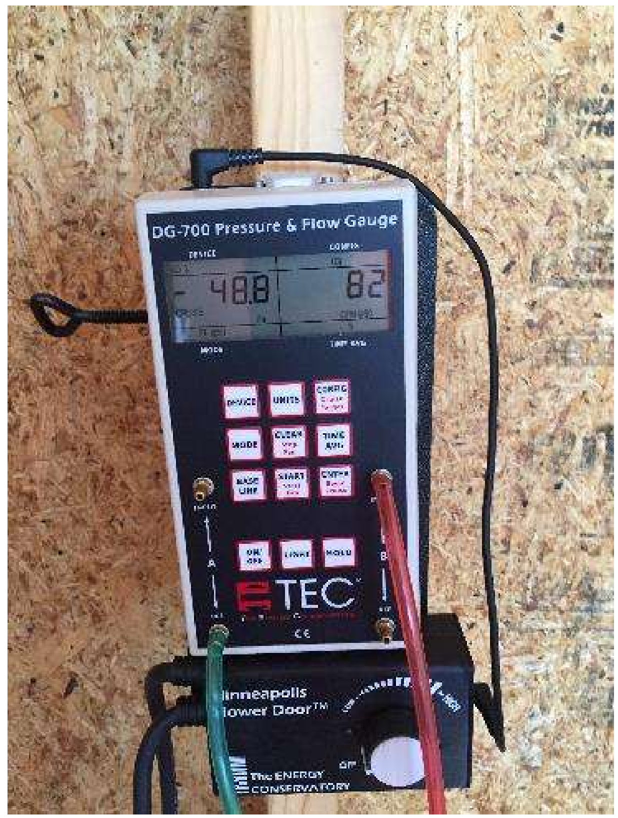
# Connect the walls to the ceiling air barrier

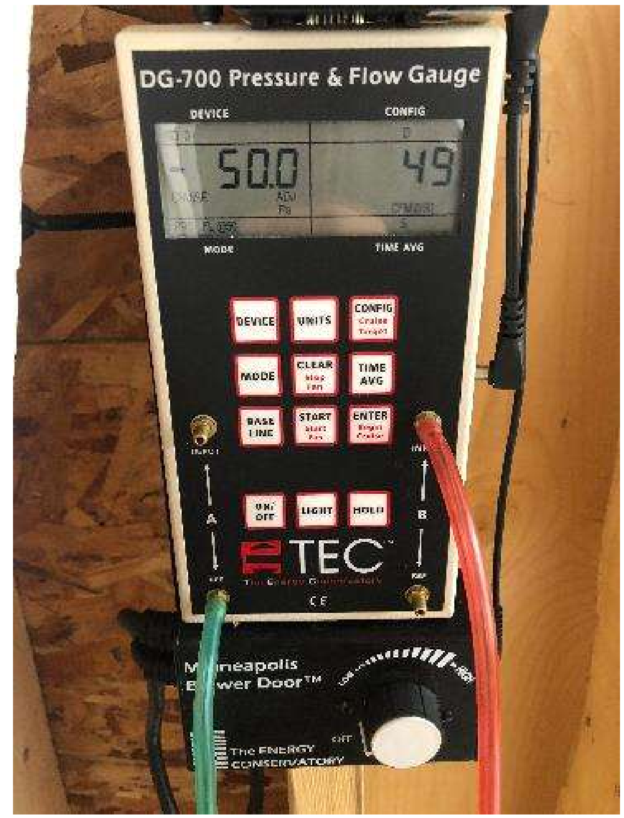


# The last detail in action - it actually looks like the plan!


- 57.1
35
Pa
CFM@50
PR: FL@50
MODE
TIME AVG
DEVICE
UNITS
CONFIG
Cruise
Target
MODE
CLEAR
Stop
Fan
TIME
AVG


DG-700 Pressure & Flow Gauge
48.8
82
TEC
The ENERGY
CONSERVATORY


DG-700 Pressure & Flow Gauge
DEVICE
CONFIG
50.0
49
MODE
TIME AVG
DEVICE
UNITS
CONFIG
MODE
CLEAR
TIME
AVG
BASE
LINE
START
ENTER
ON/
OFF
LIGHT
HOLD
TEC
The ENERGY
CONSERVATORY

# Foundation insulation - Glavel if we can get it in ti

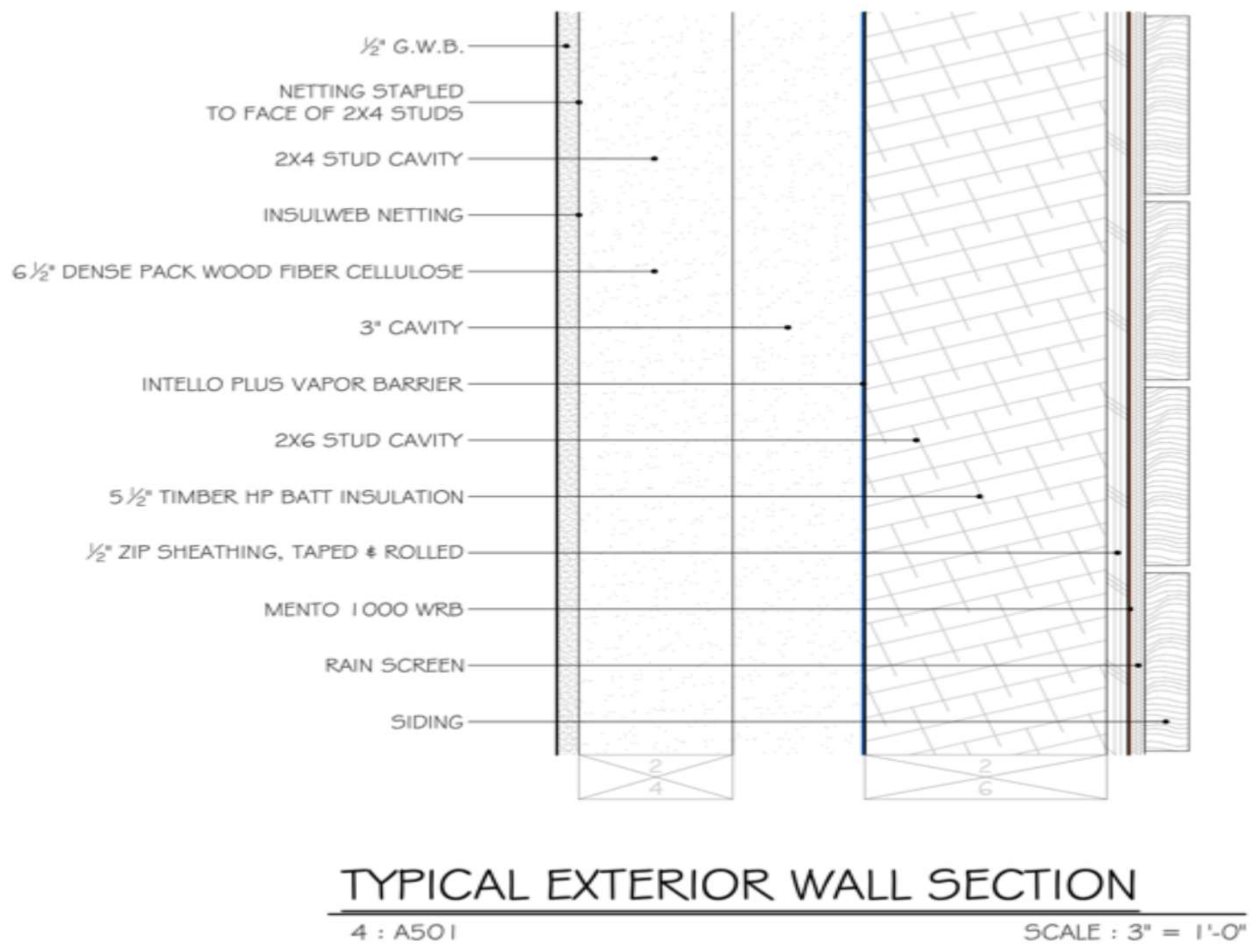


STRUCTURAL

Dense pack cellulose or wood fiber is our standard

Another [redacted]e PHIUS standa

[redacted]

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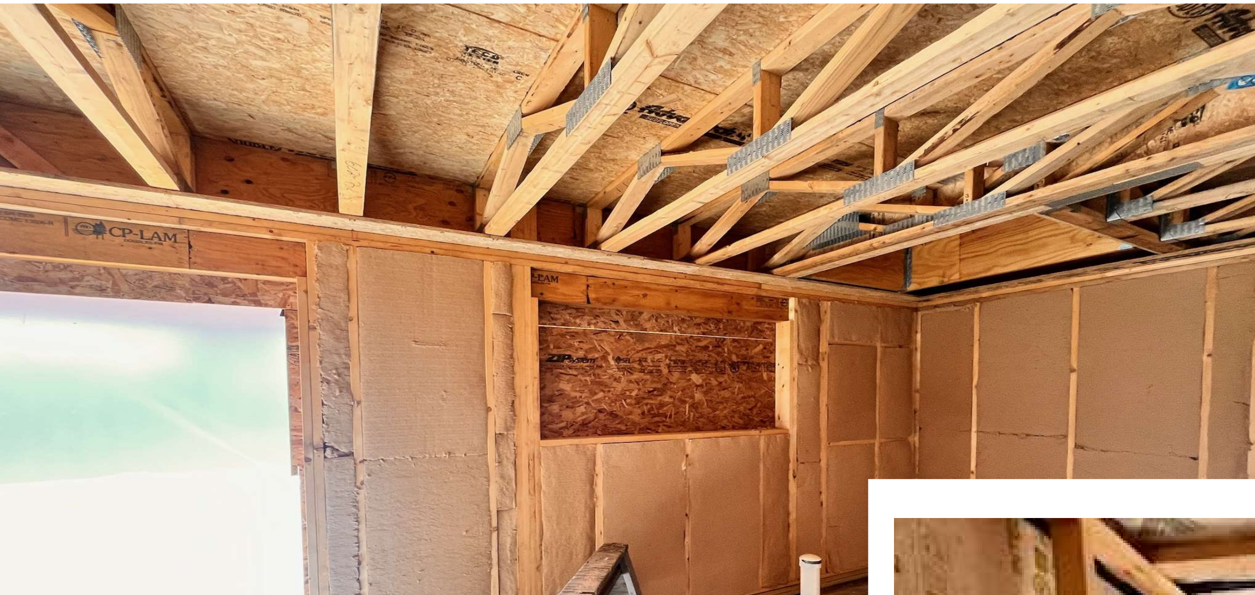
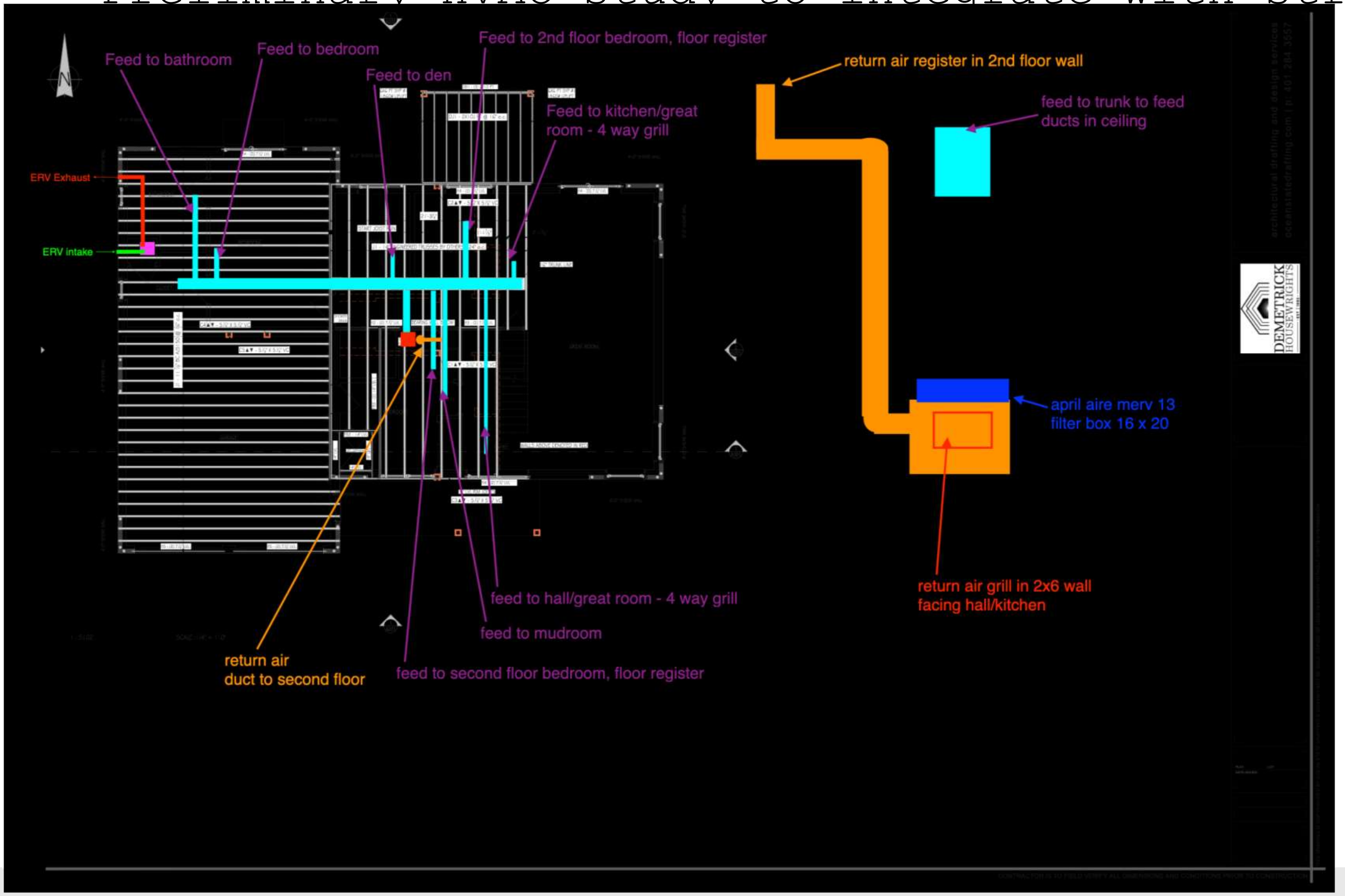
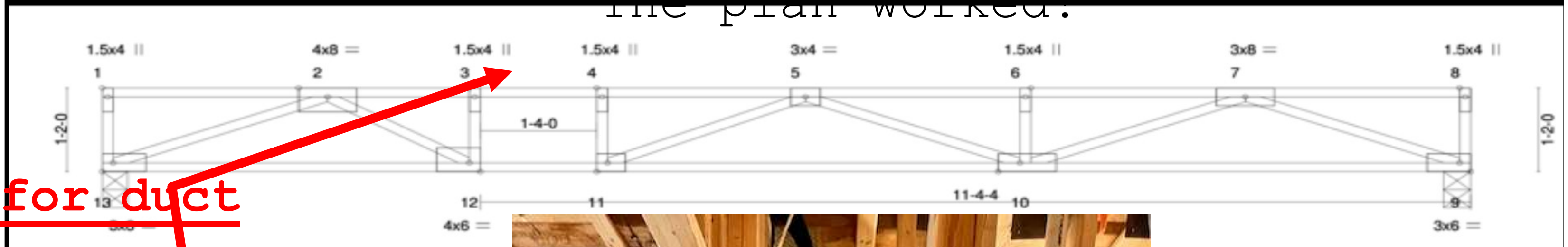

CP-LAM

# Preliminary HVAC study to integrate with structural pl

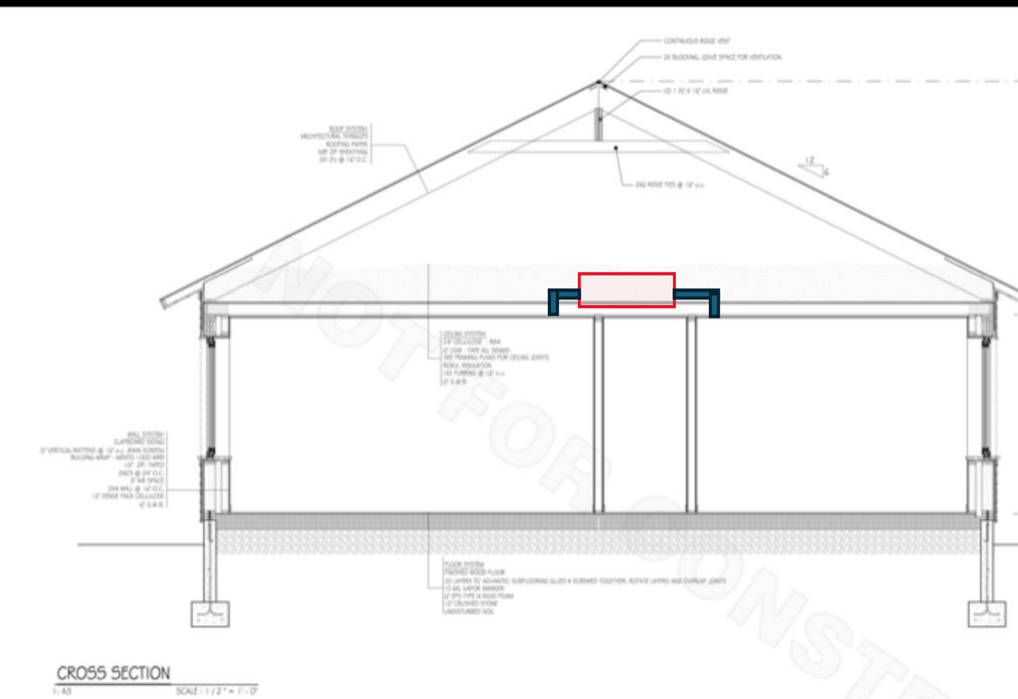


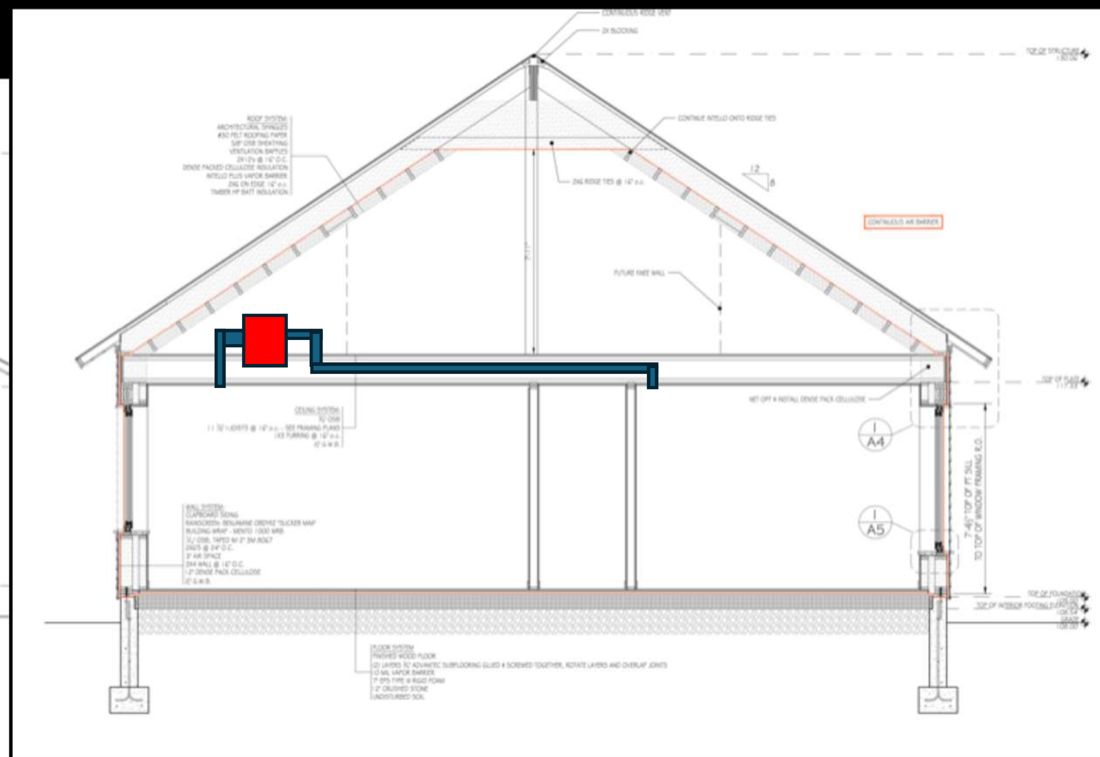
# The plan worked.




Chase for duct

# Energy modeling is an essential design step

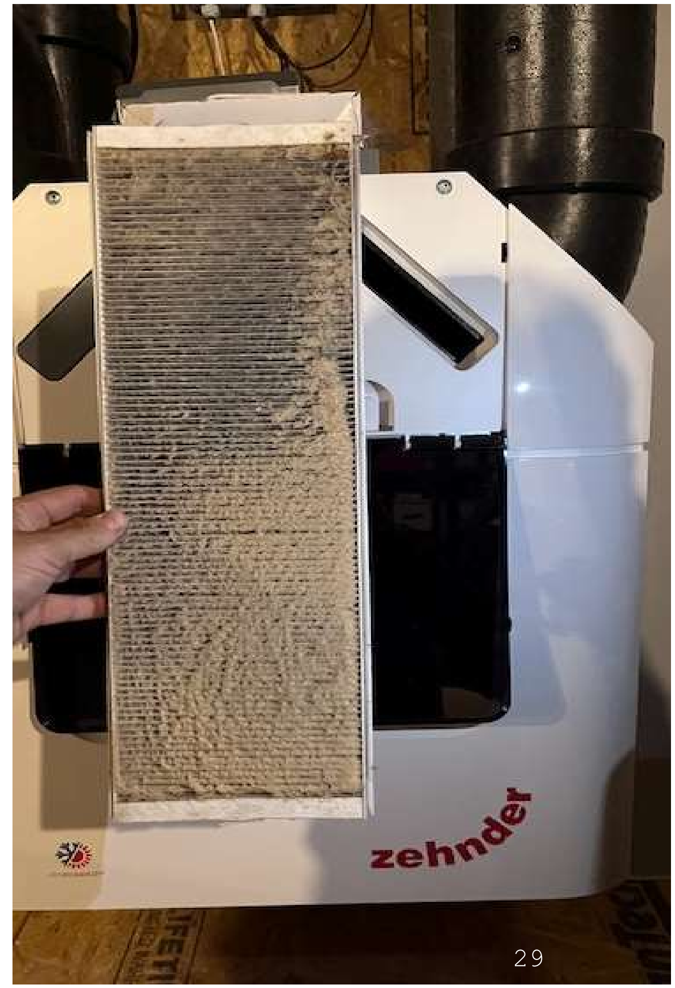


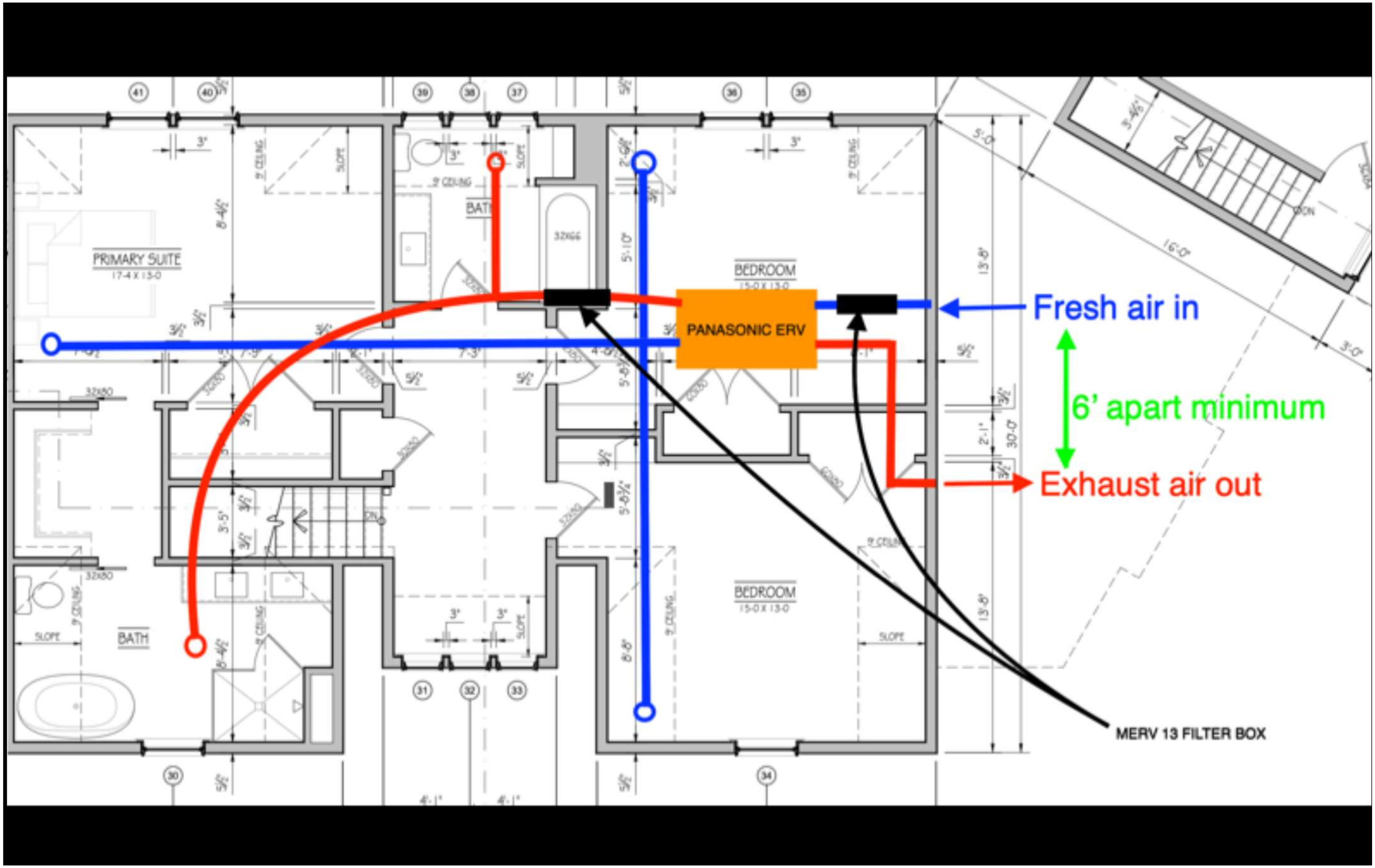




***Adding 2nd floor didn't change the HVAC system!***

# Ventilation is the most important feature of our home





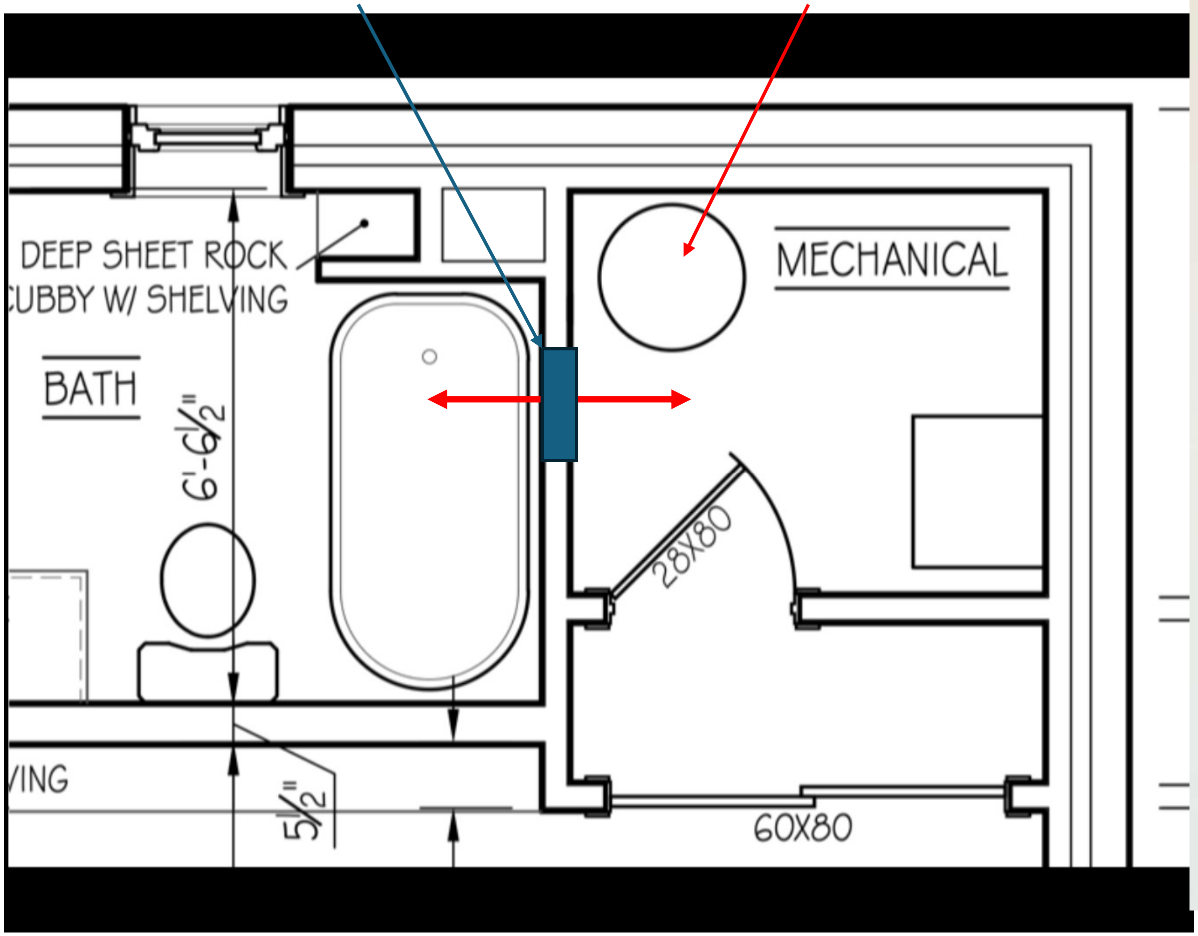


PRIMARY SUITE
17-4 X 13-0
BATH
BEDROOM
15-0 X 13-0
BEDROOM
15-0 X 13-0
BATH
PANASONIC ERV
Fresh air in
6' apart minimum
Exhaust air out
MERV 13 FILTER BOX

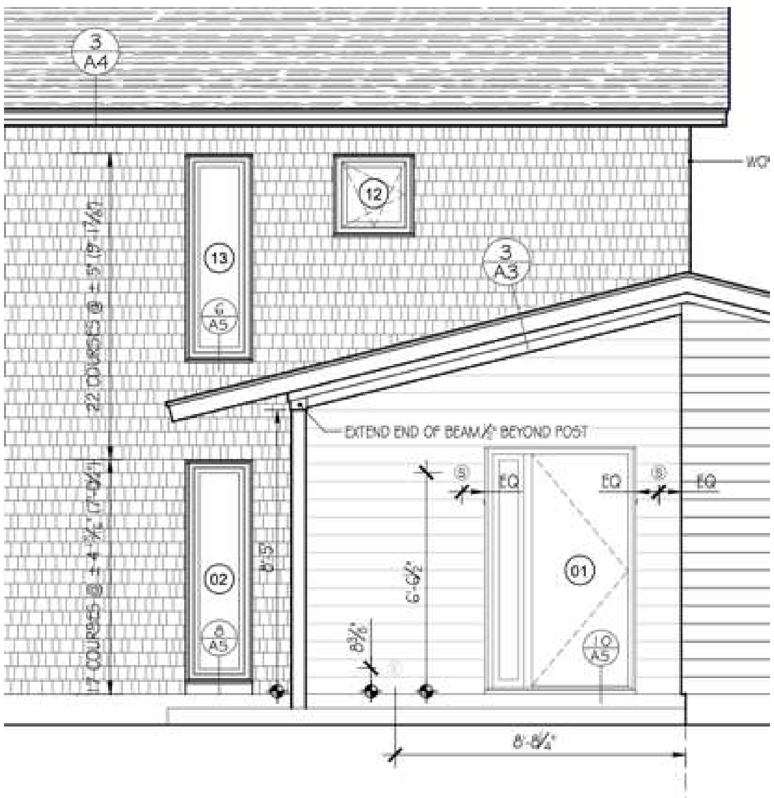
# Make up air system

Grill to provide
Air volume for
Water heater

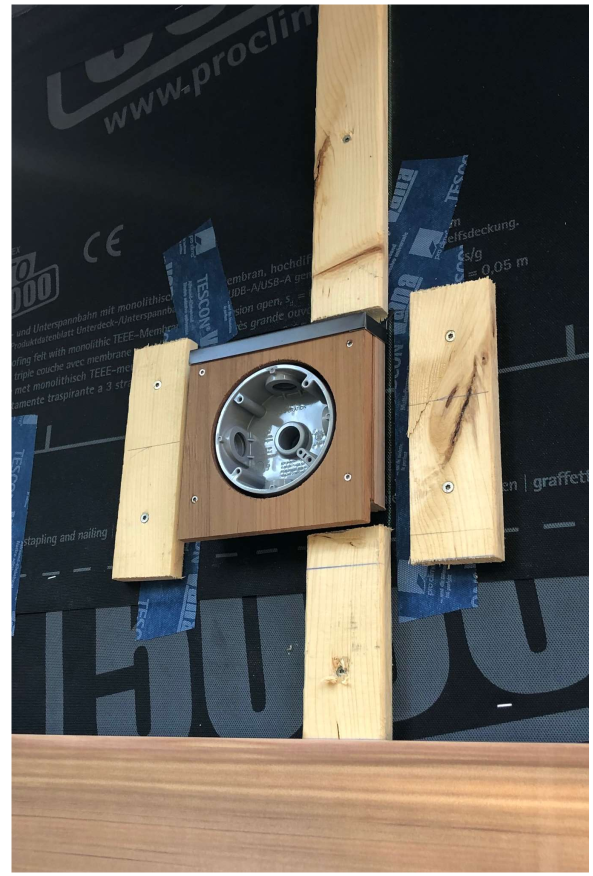
Heat pump water
Heater in a closet




# Details - elevations and layout is done in autocad




All siding is spaced off the WRB with provision for dr




Natural materials are less expensive and last longer when they are installed proper

# Two other options for rainscre

Cedar breather  behind shingles

Cedar vent battens by DCI products
Behind vertical board and batten


ZIP system

# Detailing penetrations

*Flashing these penetrations is extremely important stuff for long term durability*


TESCON

# Charlestown, Rhode Island

*1,797 sqft.*

# Annual Heating Consumption

Charlestown, RI - *1,797 sqft.*

| | |
|---|---|
| **RI SBC Minimum** | ***77,000,000*** ***Btu/yr*** |
| **As-Built** | − ***5,200,000*** ***Btu/yr*** |
| | ***71,800,000*** ***Btu/yr*** |

**94%**

reduction

| **HEATING** *(1,797 sqft)* | | |
|---|---|---|
| *Design Load (kBtu/hr)* | *Annual Load (Btu/yr)* | *Annual Consumption (Btu/yr)* |
| 50,300 | 72,700,000 | 77,000,000 |

| | |
|---|---|
| Slab | *R10U, 2'* |
| Walls | *R21* |
| Windows | *U.35,* |
| Ceiling | *R38* |
| Airtightness | *5.00 $ACH_{50}$* |
| Ductwork | *8% (outside)* |
| Hot | *95% instant* |
| Heating | *96% furnace* |
| Ventilat | *Bath fan* |
| Appliances | *Energy Star* |

| ***TOTAL*** *Consumption* |
|---|
| 103,900,000 |

| **HEATING** *(1,797 sqft)* | | |
|---|---|---|
| *Design Load (kBtu/hr)* | *Annual Load (Btu/yr)* | *Annual Consumption (Btu/yr)* |
| 50,300 | 72,700,000 | 77,000,000 |
| ***43,900*** | ***55,800,000*** | ***59,300,000*** |

| | |
|---|---|
| Slab | *R10U, 2'* |
| Walls | *R21* |
| Windows | *U.35,* |
| Ceiling | *R38* |
| Airtightness | *5.00 $ACH_{50}$* |
| Ductwork | *8% (outside)* |
| Hot | *95% instant* |
| Heating | *96% furnace* |
| Ventilat | *Bath fan* |
| Appliances | *Energy Star* |

→ ***R20U all, R15P***


| ***TOTAL*** *Consumption* |
|---|
| 103,900,000 |
| ***86,900,000*** |

| **HEATING** *(1,797 sqft)* | | |
|---|---|---|
| *Design Load (kBtu/hr)* | *Annual Load (Btu/yr)* | *Annual Consumption (Btu/yr)* |
| 50,300 | 72,700,000 | 77,000,000 |
| ***40,100*** | ***46,100,000*** | ***49,100,000*** |

| | |
|---|---|
| Slab | *R10U, 2'* |
| Walls | *R21* |
| Windows | *U.35,* |
| Ceiling | *R38* |
| Airtightness | *5.00 $ACH_{50}$* |
| Ductwork | *8% (outside)* |
| Hot | *95% instant* |
| Heating | *96% furnace* |
| Ventilat | *Bath fan* |
| Appliances | *Energy Star* |

| |
|---|
| ***R20U all,*** |
| ***R43 dbl stud*** |


| ***TOTAL*** *Consumption* |
|---|
| 103,900,000 |
| ***76,800,000*** |

| **HEATING** *(1,797 sqft)* | | |
|---|---|---|
| *Design Load (kBtu/hr)* | *Annual Load (Btu/yr)* | *Annual Consumption (Btu/yr)* |
| 50,300 | 72,700,000 | 77,000,000 |
| ***36,800*** | ***33,300,000*** | ***35,600,000*** |

| | | | |
|---|---|---|---|
| Slab | *R10U, 2’* | → | ***R20U all,*** |
| Walls | *R21* | → | ***R43 dbl stud*** |
| Windows | *U.35,* | → | ***U.17, SHGC.54*** |
| Ceiling | *R38* | | |
| Airtightness | *5.00 $ACH_{50}$* | | |

| | |
|---|---|
| Ductwork | *8% (outside)* |
| Hot | *95% instant* |
| Heating | *96% furnace* |
| Ventilat | *Bath fan* |
| Appliances | *Energy Star* |

| ***TOTAL*** *Consumption* |
|---|
| 103,900,000 |
| ***65,300,000*** |

| **HEATING** *(1,797 sqft)* | | |
|---|---|---|
| *Design Load (kBtu/hr)* | *Annual Load (Btu/yr)* | *Annual Consumption (Btu/yr)* |
| 50,300 | 72,700,000 | 77,000,000 |
| ***35,500*** | ***29,400,000*** | ***31,500,000*** |

| | | |
|---|---|---|
| Slab | *R10U, 2'* | ***R20U all,*** |
| Walls | *R21* | ***R43 dbl stud*** |
| Windows | *U.35,* | ***U.17,*** |
| Ceiling | *R38* | ***R93*** |
| Airtightness | *5.00 $ACH_{50}$* | |
| Ductwork | *8% (outside)* | |
| Hot | *95% instant* | |
| Heating | *96% furnace* | |
| Ventilat | *Bath fan* | |
| Appliances | *Energy Star* | |

| ***TOTAL** Consumption* |
|---|
| 103,900,000 |
| ***61,300,000*** |

# **HEATING** *(1,797 sqft)*

| *Design Load (kBtu/hr)* | *Annual Load (Btu/yr)* | *Annual Consumption (Btu/yr)* |
|---|---|---|
| 50,300 | 72,700,000 | 77,000,000 |
| ***24,300*** | ***22,200,000*** | ***23,800,000*** |

| | | | |
|---|---|---|---|
| Slab | *R10U, 2'* | → | ***R20U all,*** |
| Walls | *R21* | → | ***R43 dbl stud*** |
| Windows | *U.35,* | → | ***U.17,*** |
| Ceiling | *R38* | → | ***R93*** |
| Airtightness | *5.00 $ACH_{50}$* | → | ***0.30 $ACH_{50}$*** |

| | |
|---|---|
| Ductwork | *8% (outside)* |
| Hot | *95% instant* |
| Heating | *96% furnace* |
| Ventilat | *Bath fan* |
| Appliances | *Energy Star* |

| ***TOTAL*** *Consumption* |
|---|
| 103,900,000 |
| ***53,400,000*** |

| **HEATING** *(1,797 sqft)* | | |
|---|---|---|
| *Design Load (kBtu/hr)* | *Annual Load (Btu/yr)* | *Annual Consumption (Btu/yr)* |
| 50,300 | 72,700,000 | 77,000,000 |
| ***12,500*** | ***17,800,000*** | ***18,900,000*** |

| | | | |
|---|---|---|---|
| Slab | *R10U, 2’* | → | ***R20U all,*** |
| Walls | *R21* | → | ***R43 dbl stud*** |
| Windows | *U.35,* | → | ***U.17,*** |
| Ceiling | *R38* | → | ***R93*** |
| Airtightness | *5.00 $ACH_{50}$* | → | ***0.30 $ACH_{50}$*** |
| Ductwork | *8% (outside)* | → | ***inside*** |
| Hot | *95% instant* | | |
| Heating | *96% furnace* | | |
| Ventilat | *Bath fan* | | |
| Appliances | *Energy Star* | | |

| ***TOTAL*** *Consumption* |
|---|
| 103,900,000 |
| ***47,800,000*** |

| **HEATING** *(1,797 sqft)* | | |
|---|---|---|
| *Design Load (kBtu/hr)* | *Annual Load (Btu/yr)* | *Annual Consumption (Btu/yr)* |
| 50,300 | 72,700,000 | 77,000,000 |
| ***12,500*** | ***19,500,000*** | ***20,600,000*** |

| | | |
|---|---|---|
| Slab | *R10U, 2’* | ***R20U all,*** |
| Walls | *R21* | ***R43 dbl stud*** |
| Windows | *U.35,* | ***U.17,*** |
| Ceiling | *R38* | ***R93*** |
| Airtightness | *5.00 $ACH_{50}$* | ***0.30 $ACH_{50}$*** |
| Ductwork | *8% (outside)* | ***inside*** |
| Hot | *95% instant* | ***HPHW + distrib*** |
| Heating | *96% furnace* | |
| Ventilat | *Bath fan* | |
| Appliances | *Energy Star* | |

| ***TOTAL*** *Consumption* |
|---|
| 103,900,000 |
| ***41,300,000*** |

# **HEATING** *(1,797 sqft)*

| *Design Load (kBtu/hr)* | *Annual Load (Btu/yr)* | *Annual Consumption (Btu/yr)* |
|---|---|---|
| 50,300 | 72,700,000 | 77,000,000 |
| ***12,500*** | ***19,500,000*** | ***6,700,000*** |

| | | | |
|---|---|---|---|
| Slab | *R10U, 2’* | → | ***R20U all,*** |
| Walls | *R21* | → | ***R43 dbl stud*** |
| Windows | *U.35,* | → | ***U.17,*** |
| Ceiling | *R38* | → | ***R93*** |
| Airtightness | *5.00 $ACH_{50}$* | → | ***0.30 $ACH_{50}$*** |
| Ductwork | *8% (outside)* | → | ***inside*** |
| Hot | *95% instant* | → | ***HPHW +*** |
| Heating | *96% furnace* | → | ***ASHP*** |
| Ventilat | *Bath fan* | | |
| Appliances | *Energy Star* | | |

| ***TOTAL*** *Consumption* |
|---|
| 103,900,000 |
| ***26,300,000*** |

# Equipment Efficiencies

| RI SBC Minimum | |
|---|---|
| ***Annual Load*** | ***Annual Consumption*** |
| **72.7** ***MMBtu/yr*** | **77.0** ***MMBtu/yr*** |

96% *AFUE gas furnace*

| As-Built | |
|---|---|
| ***Annual Load*** | ***Annual Consumption*** |
| **15.4** ***MMBtu/yr*** | **5.2** ***MMBtu/yr*** |

| AHRI Efficiency Ratings | |
|---|---|
| SEER (SEER2) / HSPF (HSPF2) / EER (EER2) | |
| COP at 47º F / 17º F | 4.44 / 3.3 |

COP = ratio of useful heating or cooling provided to energy required

| **HEATING** *(1,797 sqft)* | | |
|---|---|---|
| *Design Load (kBtu/hr)* | *Annual Load (Btu/yr)* | *Annual Consumption (Btu/yr)* |
| 50,300 | 72,700,000 | 77,000,000 |
| ***10,000*** | ***15,400,000*** | ***5,200,000*** |

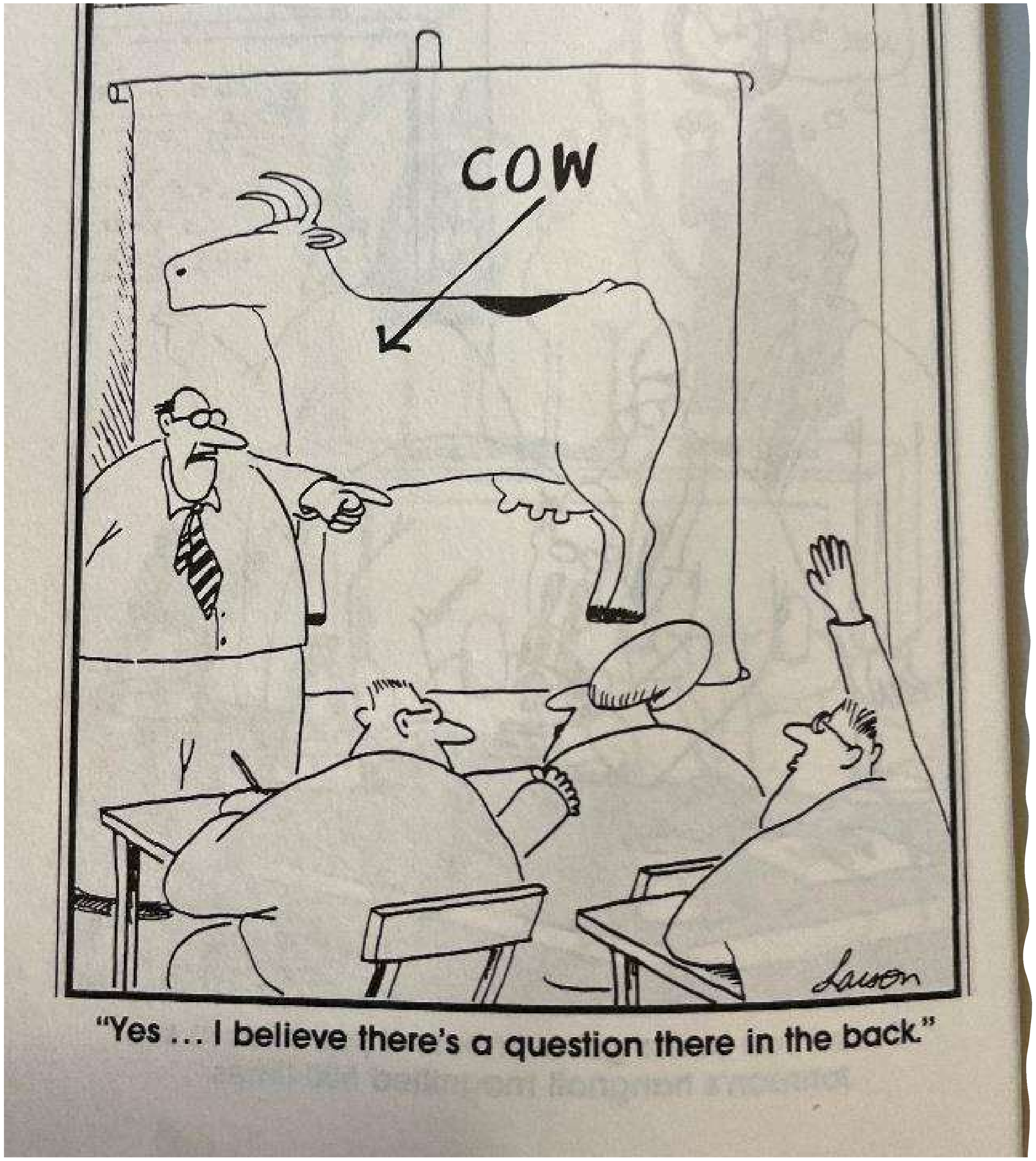
| | | |
|---|---|---|
| Slab | *R10U, 2'* | ***R20U all,*** |
| Walls | *R21* | ***R43 dbl stud*** |
| Windows | *U.35,* | ***U.17,*** |
| Ceiling | *R38* | ***R93*** |
| Airtightness | *5.00 $ACH_{50}$* | ***0.30 $ACH_{50}$*** |
| Ductwork | *8% (outside)* | ***inside*** |
| Hot | *95% instant* | ***HPHW +*** |
| Heating | *96% furnace* | ***ASHP*** |
| Ventilat | *Bath fan* | ***ERV*** |
| Appliances | *Energy Star* | |


| ***TOTAL*** *Consumption* |
|---|
| 103,900,000 |
| ***25,100,000*** |

| HEATING (1,797 sqft) | | |
|---|---|---|
| *Design Load (kBtu/hr)* | *Annual Load (Btu/yr)* | *Annual Consumption (Btu/yr)* |
| 50,300 | 72,700,000 | 77,000,000 |
| ***10,000*** | ***15,400,000*** | ***5,200,000*** |

| | | | |
|---|---|---|---|
| Slab | *R10U, 2'* | → | ***R20U all,*** |
| Walls | *R21* | → | ***R43 dbl stud*** |
| Windows | *U.35,* | → | ***U.17,*** |
| Ceiling | *R38* | → | ***R93*** |
| Airtightness | *5.00 $ACH_{50}$* | → | ***0.30 $ACH_{50}$*** |
| Ductwork | *8% (outside)* | → | ***inside*** |
| Hot | *95% instant* | → | ***HPHW +*** |
| Heating | *96% furnace* | → | ***ASHP*** |
| Ventilat | *Bath fan* | → | ***ERV*** |
| Appliances | *Energy Star* | → | ***HP dryer*** |

| ***TOTAL*** *Consumption* |
|---|
| 103,900,000 |
| ***24,100,000*** |




# Questions?

BUILDINGENERGY BOSTON

# Just Do This!
# Proven Details and Strategies for Simple High Performance Homes

**Stephen DeMetrick, DeMetrick Housewrights**

*Curated by Asher Greenberg*

Northeast Sustainable Energy Association (NESEA) | March 21, 2025