Double Stud Walls

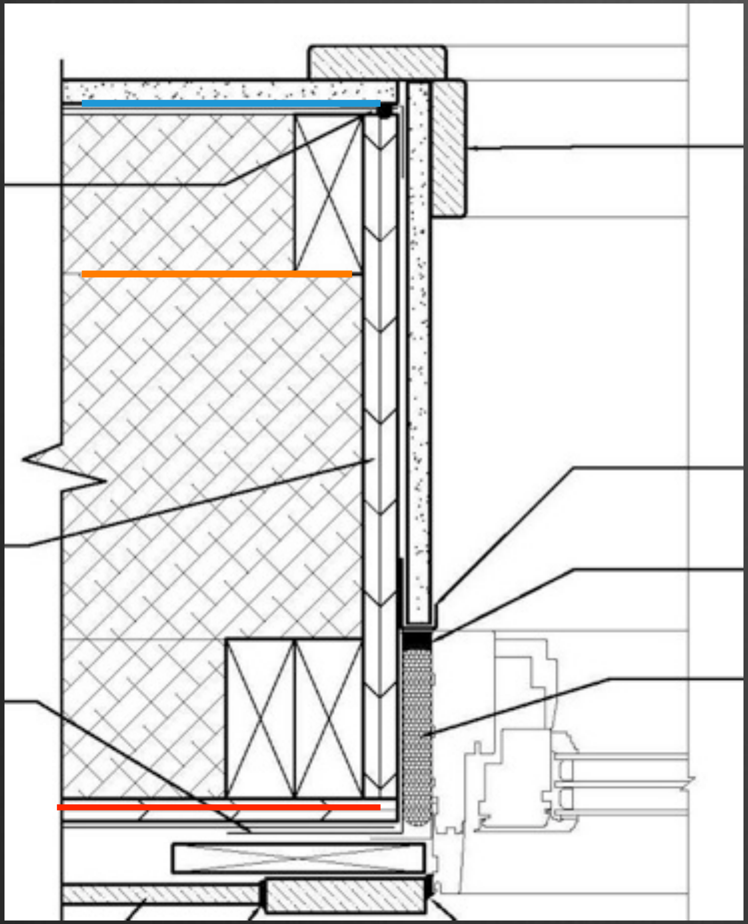
Familiar assemblies, common materials

Blown in insulation – can be cellulose, fiberglass, or open cell spray foam.

Double stud – key issues

- Locating the air barrier and keeping it robust.
- Because the sheathing will be colder in winter, wall should be able to dry to the outside.
- Plywood and structural fiberboard are a better sheathing choice than OSB.
- A gap between sheathing and siding is ideal.
- Fire blocking is required by code.
- Window and door openings need special attention inside and out.

Air and Moisture Management



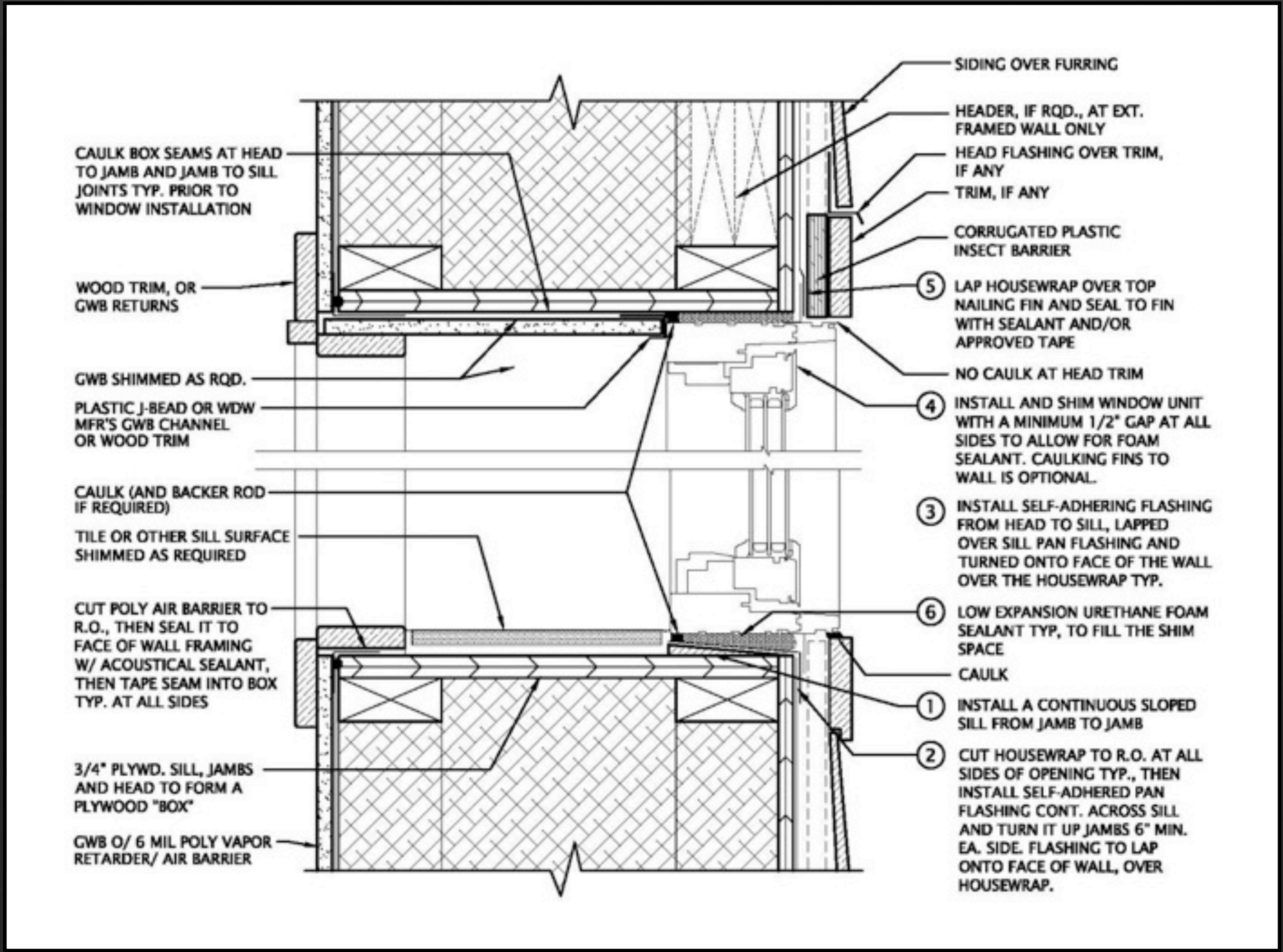
OPTIONS

- Interior sheet polyamide
- Interior OSB
- Exterior Sheathing taped
- Use of Spray Foam
- Interior “cavity” wall
- Larsen truss outboard

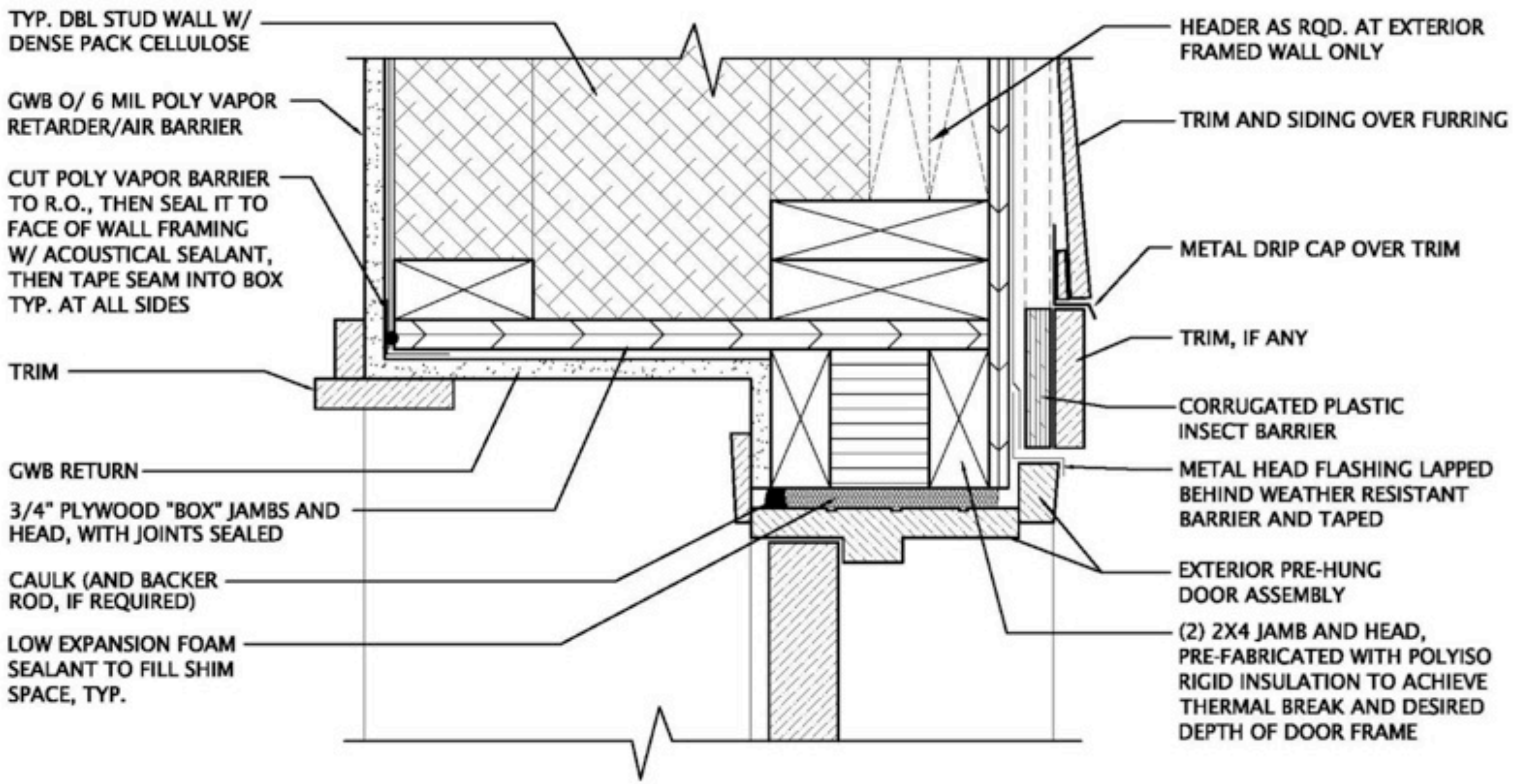
Window and door framing

Openings require special framing details, not complicated if thought out in advance and drawn.

Window to the outside with box frame



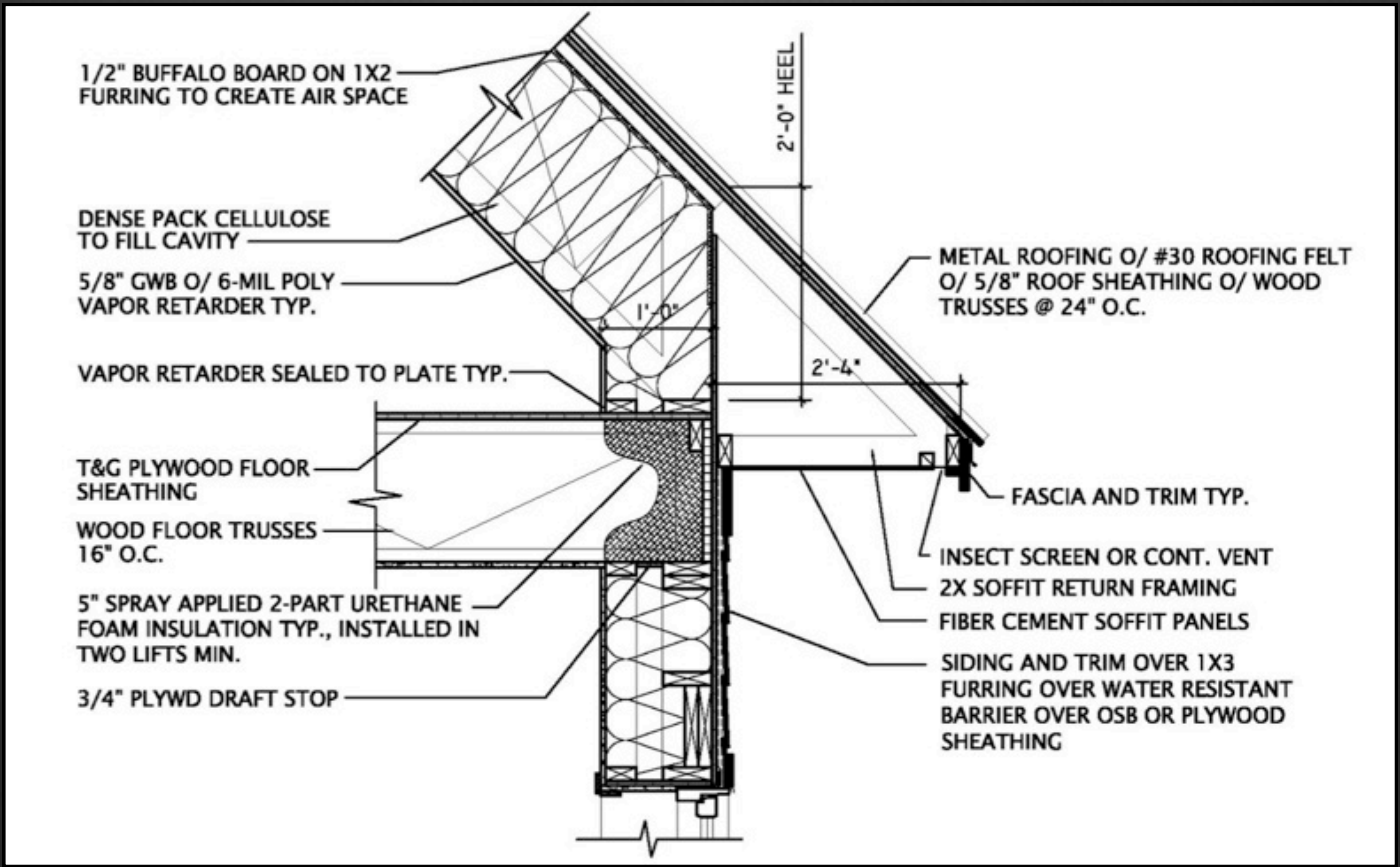
Door at the Outer Wall
for best water management



Double Stud Wall w/ Furred Siding: Door Head Detail

The results can be dramatic

Double Stud wall to floor to roof

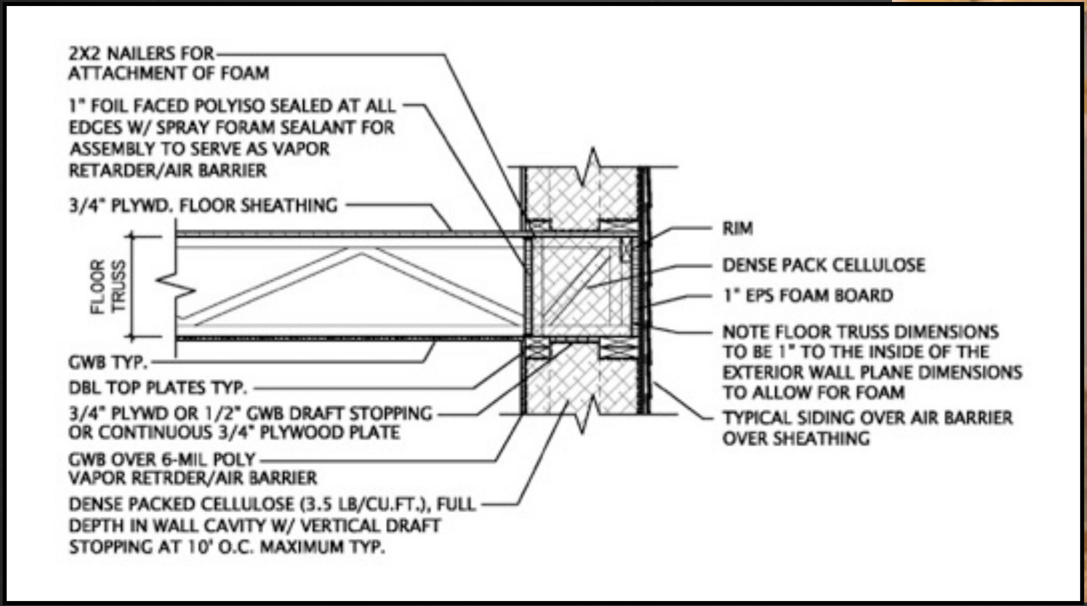


Alternate super-insulated Rim Assembly

Insulating the rim with cellulose was easier than we imagined

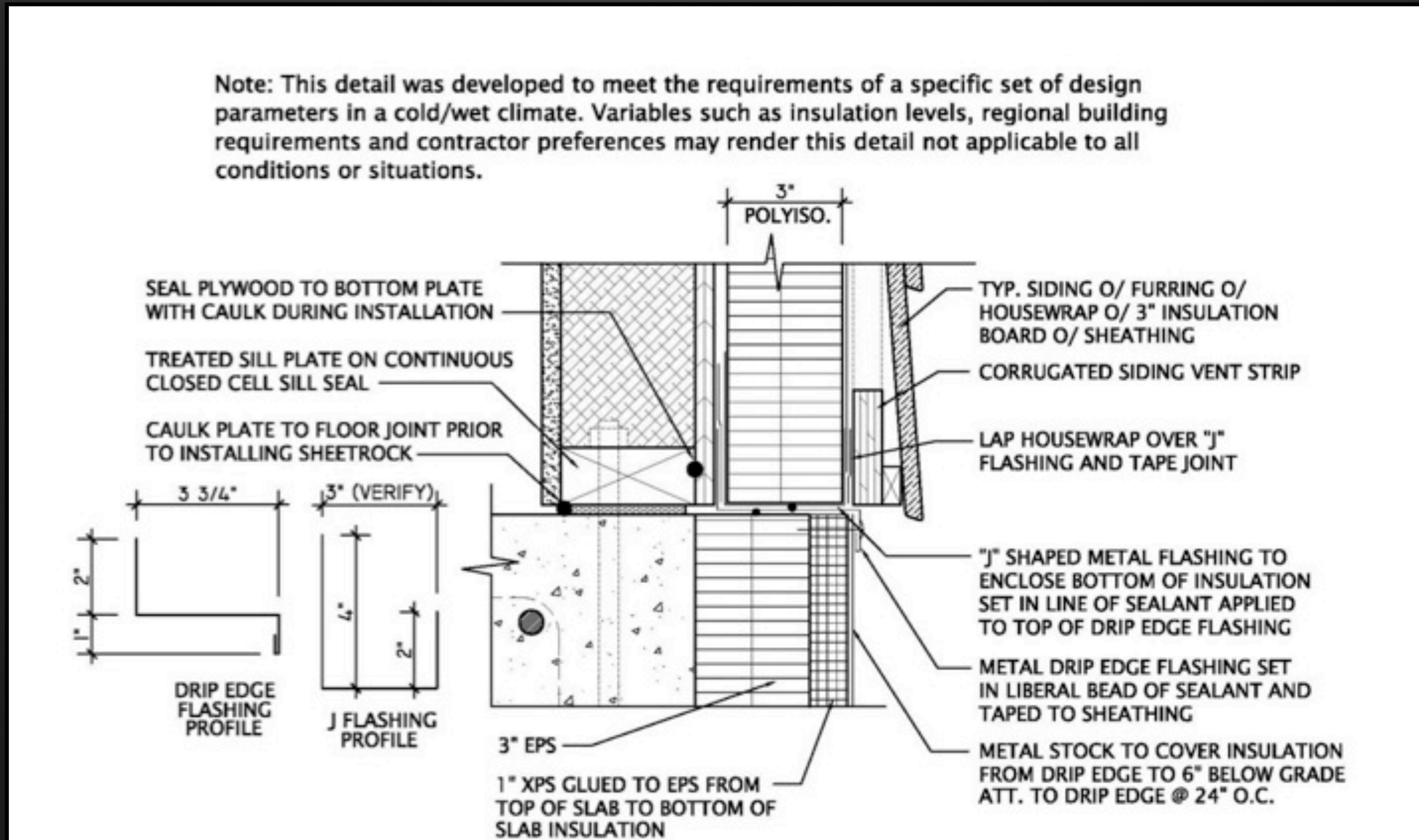
But usually we use 2-3 applications of 2-part closed cell urethane spray foam

This detail was labor intensive in order to maintain the air barrier



Single Stud Walls with Exterior Foam Sheathing

- Especially good for retrofit application
- Good for simple building forms
- 1” foam is not enough in our climate
- Siding typically requires furring



Integrates well with vertical slab edge insulation

Can frame with 2 x 6 or 2 x 4 stud walls.

Board sheathing can be the air barrier, eliminating poly

Wall sheathing as the air barrier offers durability

www.diychatroom.com

Plywood or OSB seams are sealed with caulk, tape, or liquid.

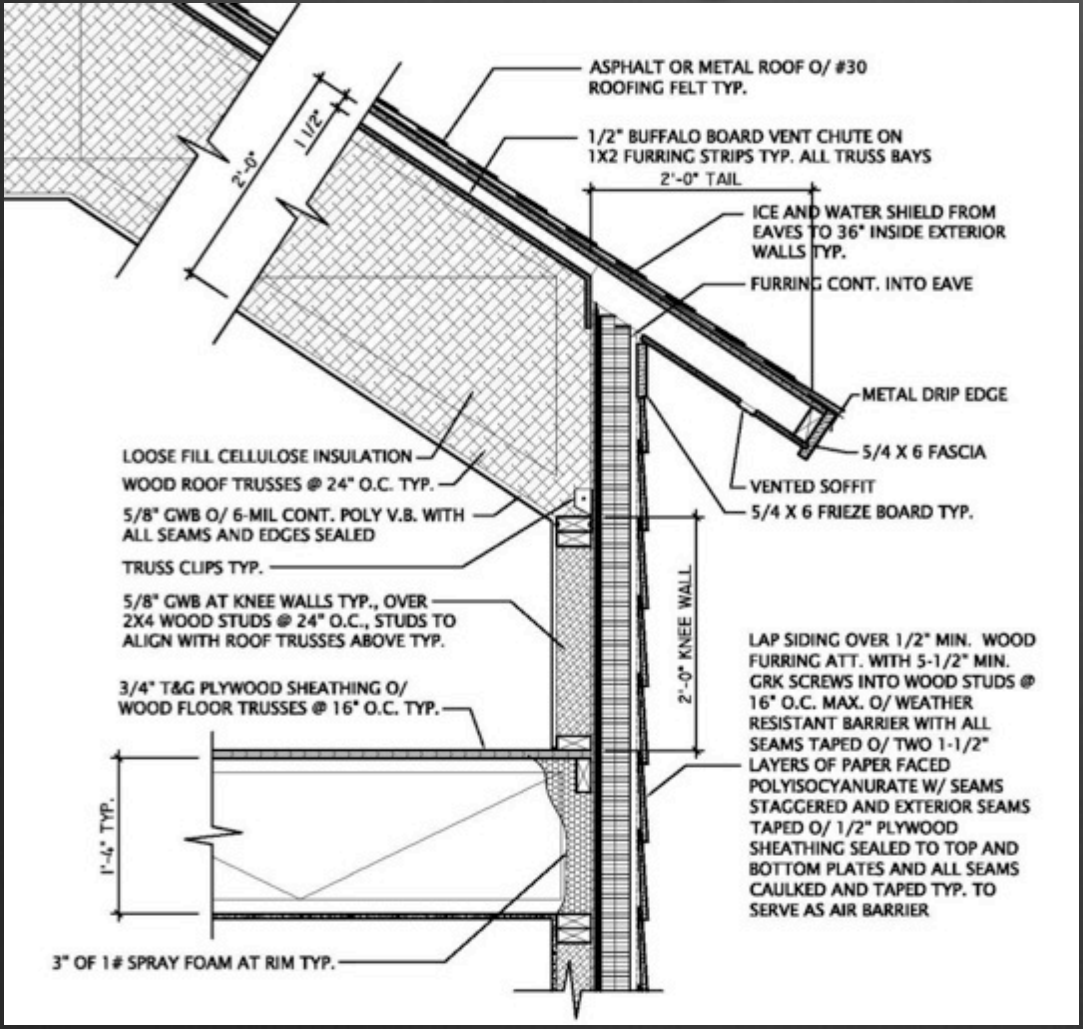
Sheathing is sealed to framing members:

studs, plates, trusses, box frames for windows and doors

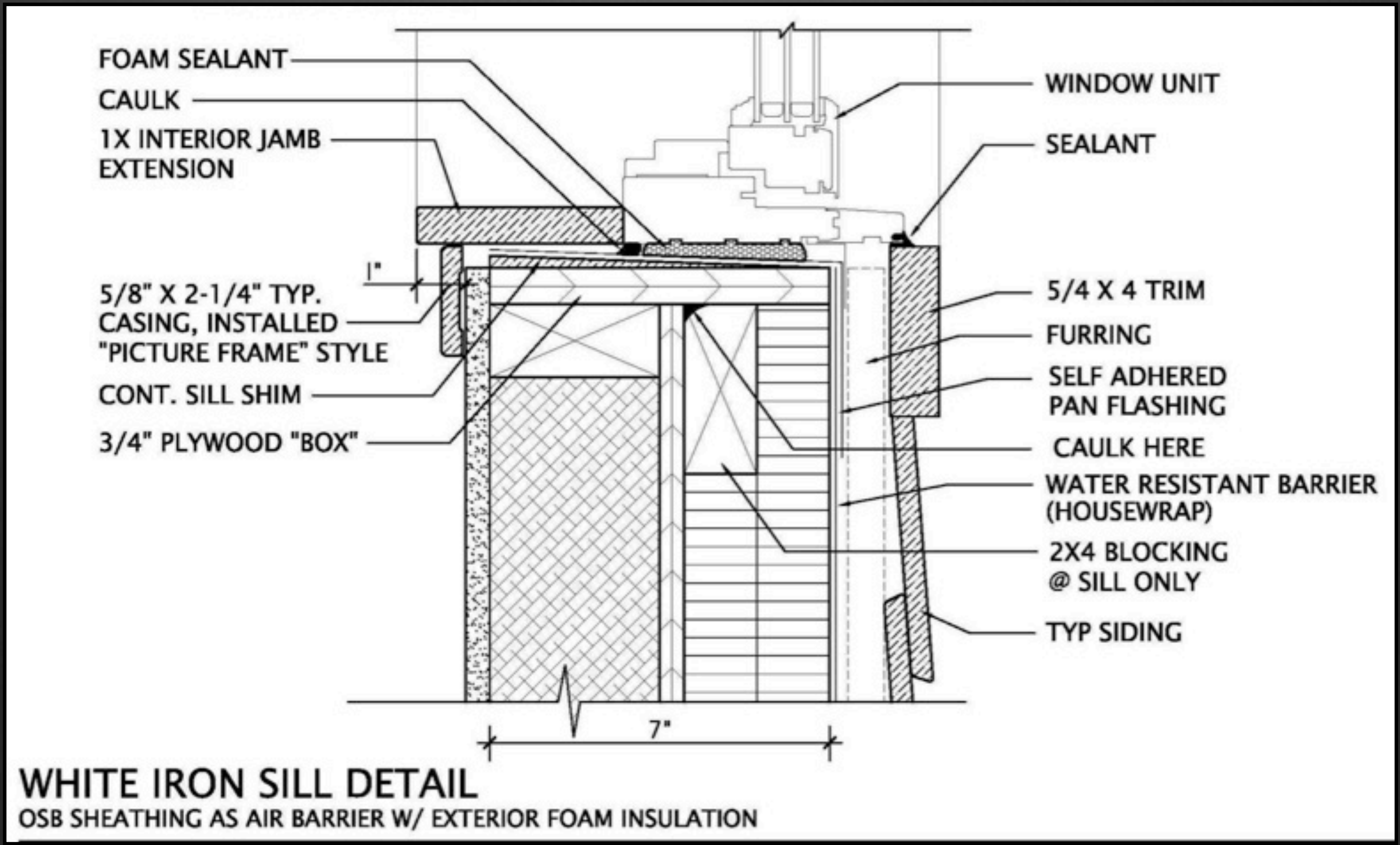
Use enough foam sheathing to keep the board sheathing warm, eliminate poly

Zone	Class III vapor retarders permitted for:
Marine 4	Vented cladding over OSB Vented cladding over plywood Vented cladding over fiberboard Vented cladding over gypsum Insulated sheathing with R-value >= 2.5 over 2x4 wall Insulated sheathing with R-value >= 3.75 over 2x6 wall
5	Vented cladding over OSB Vented cladding over plywood Vented cladding over fiberboard Vented cladding over gypsum Insulated sheathing with R-value >= 5 over 2x4 wall Insulated sheathing with R-value >= 7.5 over 2x6 wall
6	Vented cladding over fiberboard Vented cladding over gypsum Insulated sheathing with R-value >= 7.5 over 2x4 wall Insulated sheathing with R-value >= 11.25 over 2x6 wall
7 and 8	Insulated sheathing with R-value >= 10 over 2x4 wall Insulated sheathing with R-value >= 15 over 2x6 wall

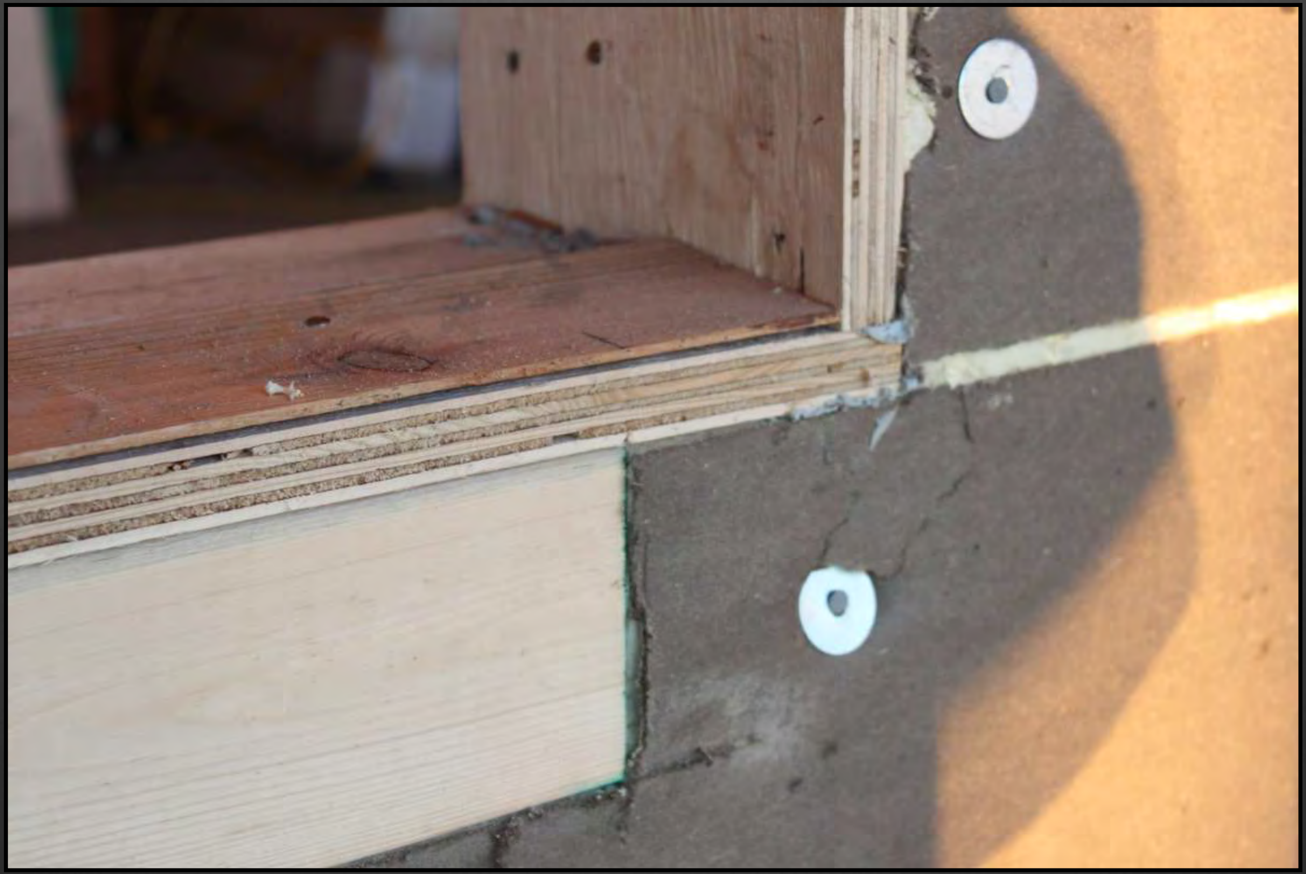
Certain things need attention



- Long screws to fasten siding through furring
- Extra planning at corners to find solid fastening
- Deck attachment details can get tricky

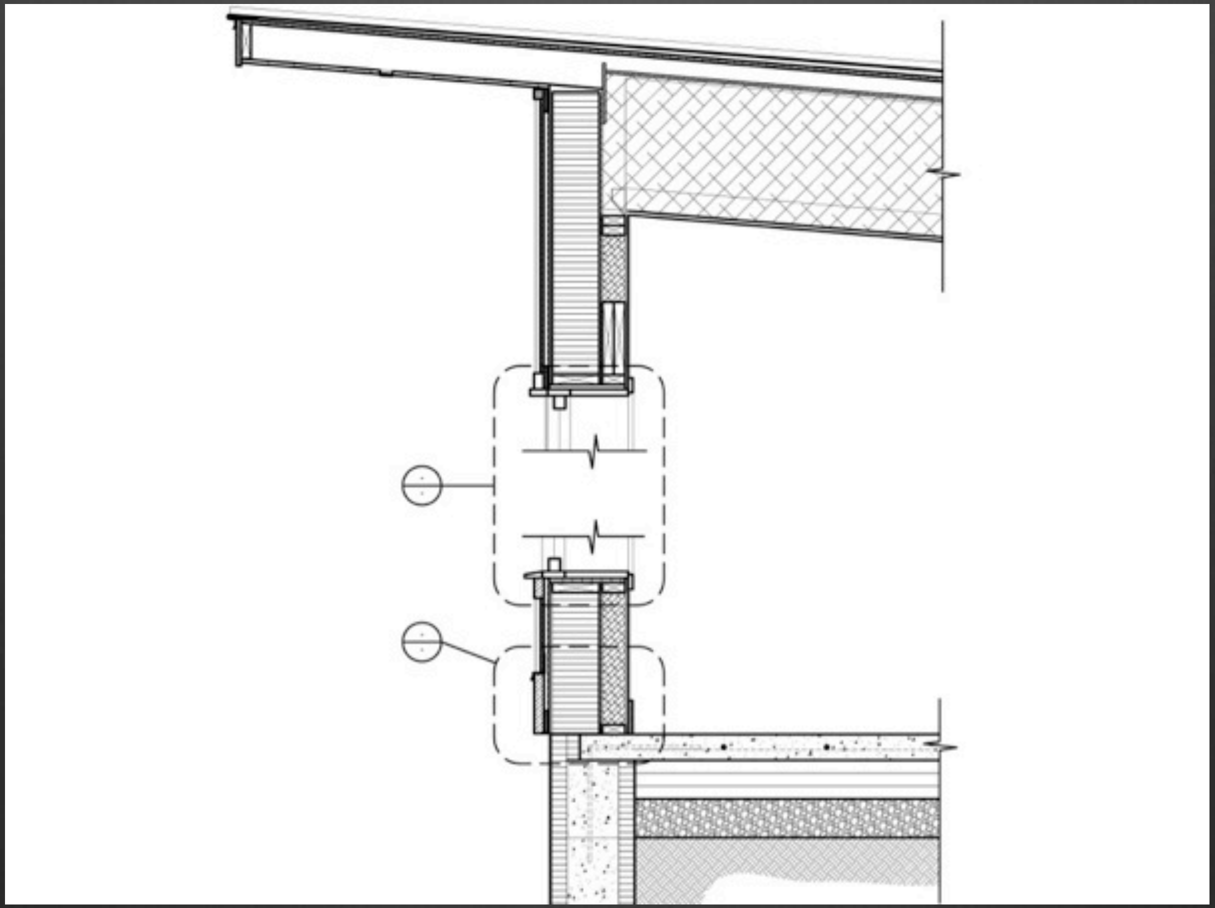


With 3” or more of foam sheathing, may need wood support under windows

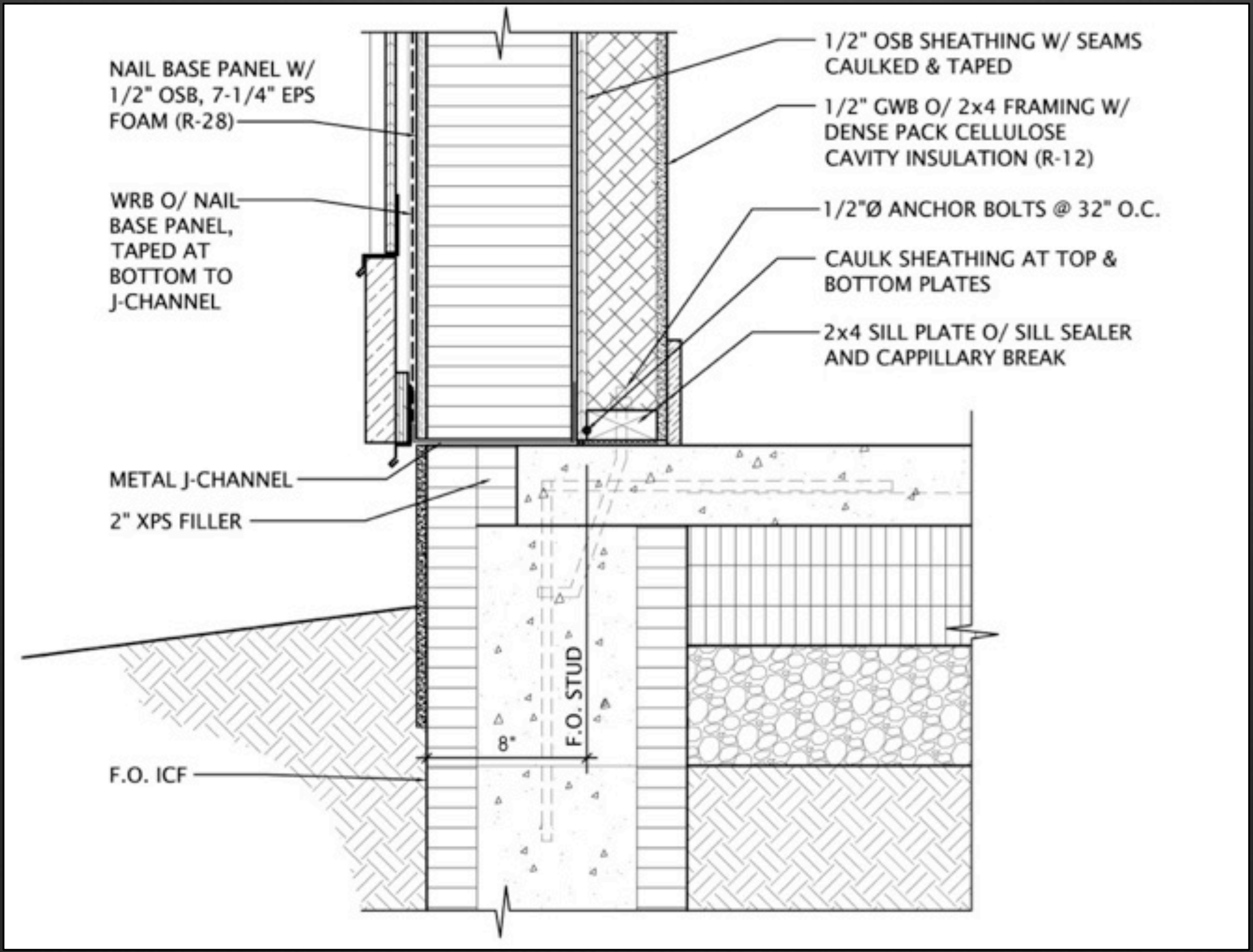


- 2 layers of foam are better than one
- If board sheathing is the air barrier, you don't need to tape foam joints, but large gaps should be foamed

Evolving single stud + foam



(S)IP Hybrid



NAIL BASE PANEL W/ 1/2" OSB, 7-1/4" EPS FOAM (R-28)
WRB O/ NAIL BASE PANEL, TAPED AT BOTTOM TO J-CHANNEL
METAL J-CHANNEL
2" XPS FILLER
F.O. ICF
8"
F.O. STUD
1/2" OSB SHEATHING W/ SEAMS CAULKED & TAPED
1/2" GWB O/ 2x4 FRAMING W/ DENSE PACK CELLULOSE CAVITY INSULATION (R-12)
1/2"Ø ANCHOR BOLTS @ 32" O.C.
CAULK SHEATHING AT TOP & BOTTOM PLATES
2x4 SILL PLATE O/ SILL SEALER AND CAPPILLARY BREAK

Windows

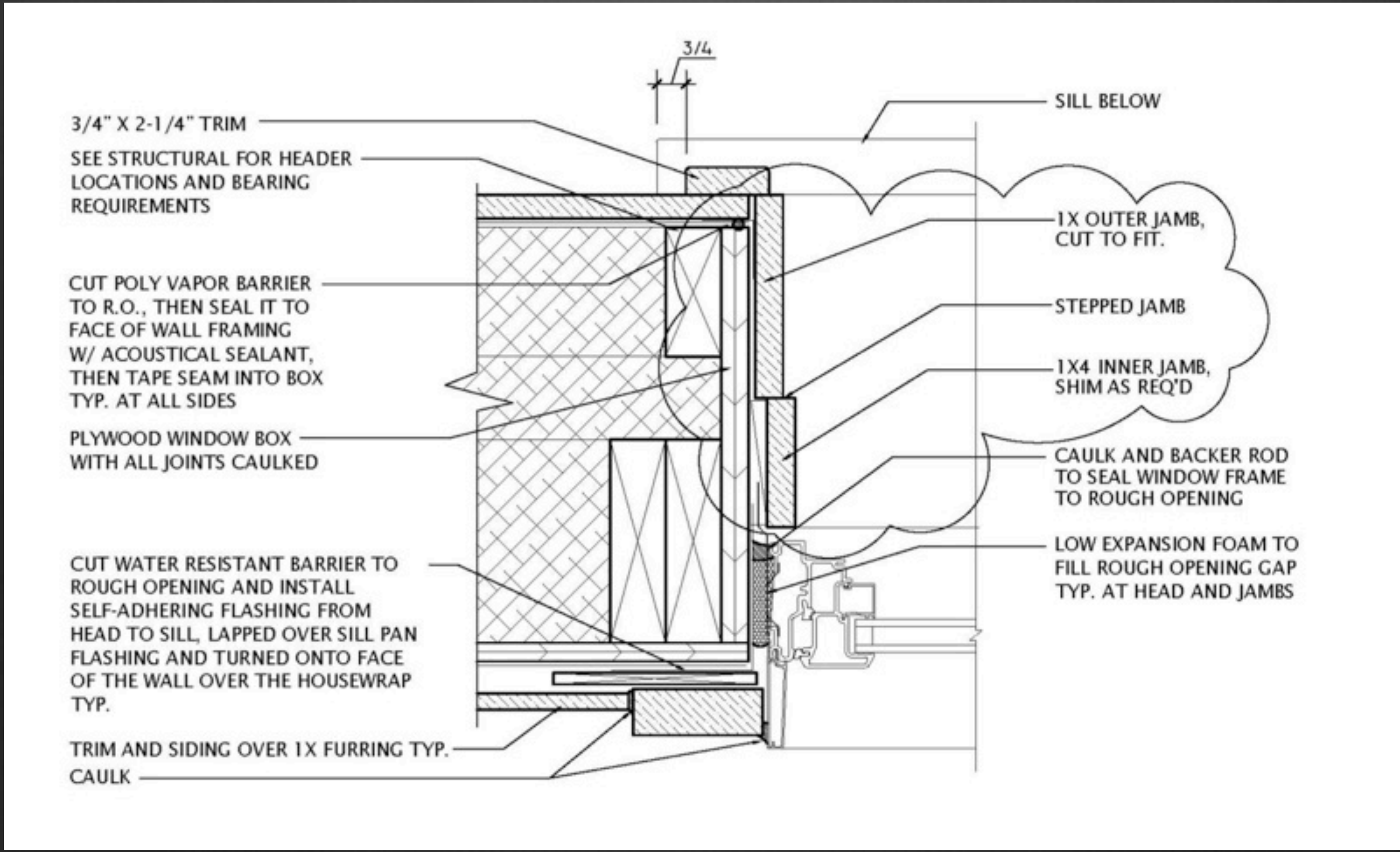
Suggestions for High Performance

- Eliminate sliders
- Eliminate double hung
- Triple-pane glazing
- Insulated frame
- Solar gain low-e on south
- Understand SHGC
- Minimize north and west glass
- U-value < 0.26
- An energy calc helps

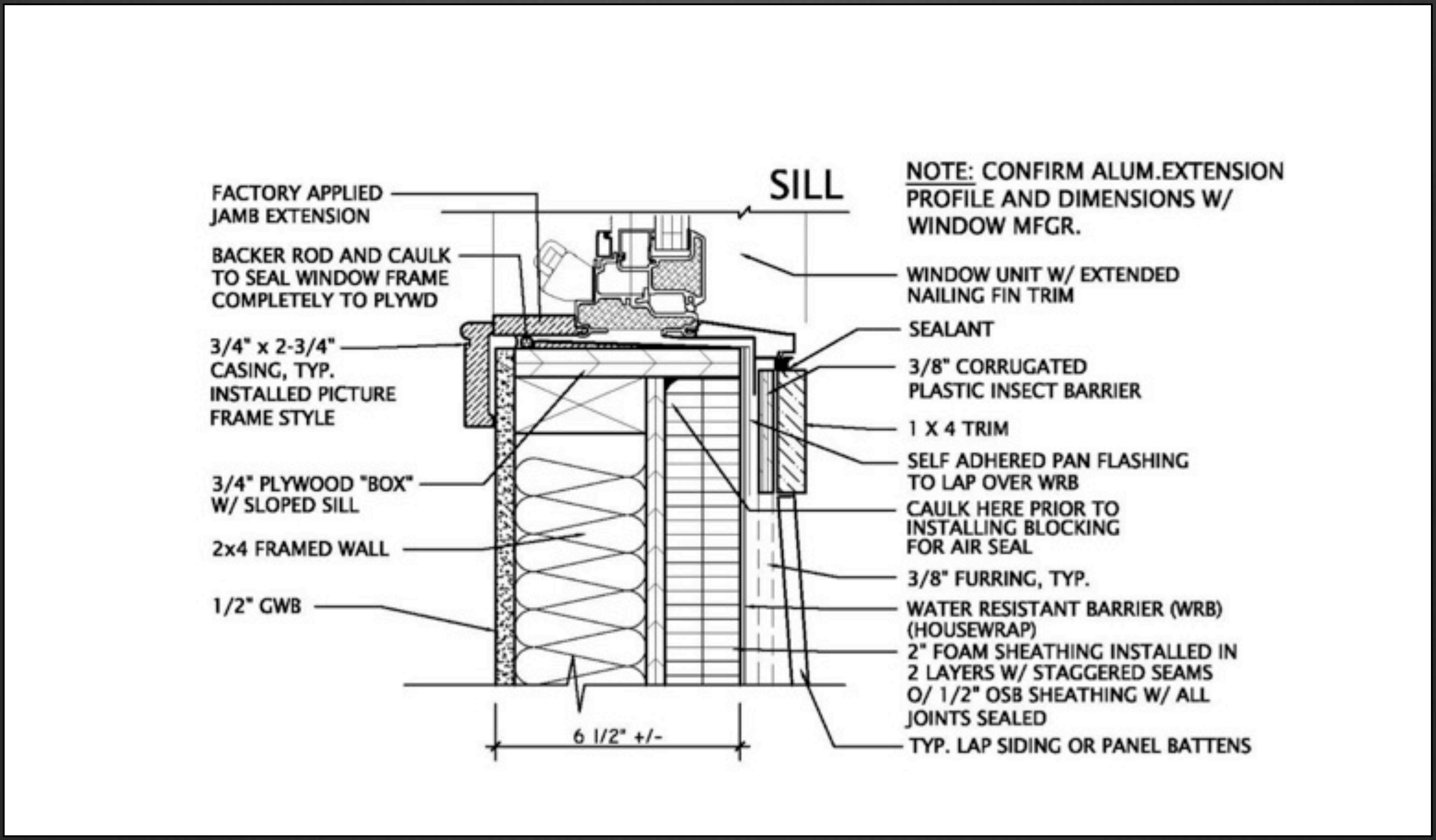
Windows for a cold climate

1. High solar gain
   - Min 0.5 glazing SHGC or
   - 0.4 whole window value
2. High thermal performance
   - MAX. overall U-value of 0.24
   - Don't lose more heat from the house than heat gained from the sun
3. High visible transmittance
   - It's cold and dark for many months
   - I look for min. glazing VT of .6
4. Condensation resistance
   - Frame with some insulating value
   - Warm edge spacers

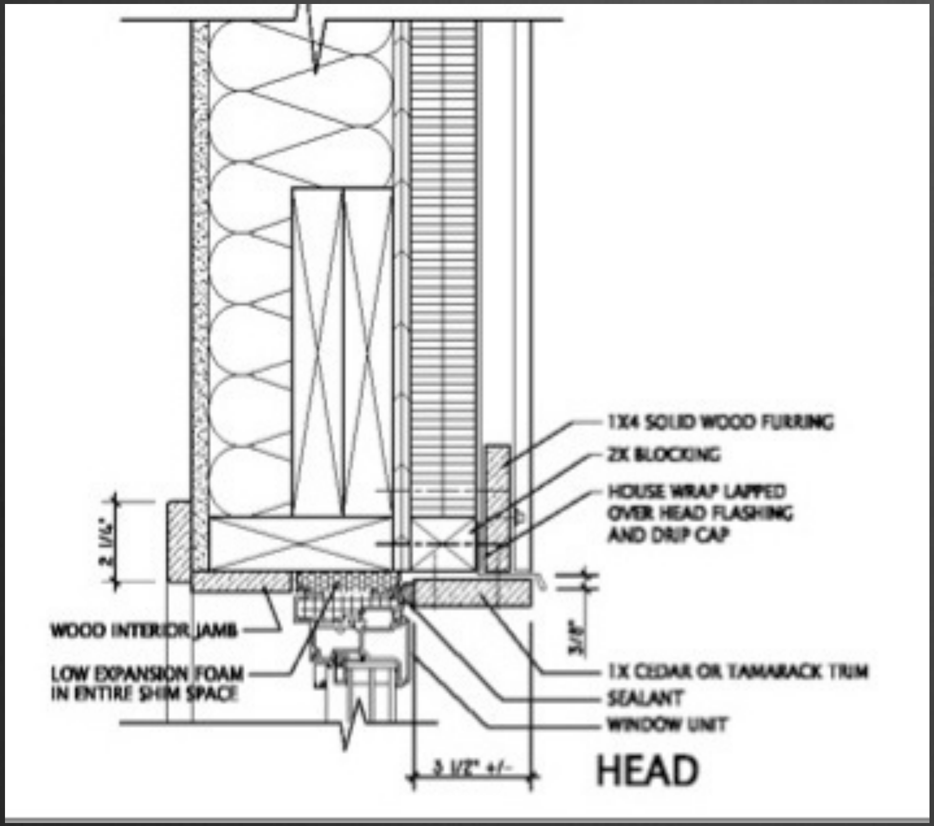
Window Details with Detail



Window inset in wall places window into a thermally preferable place

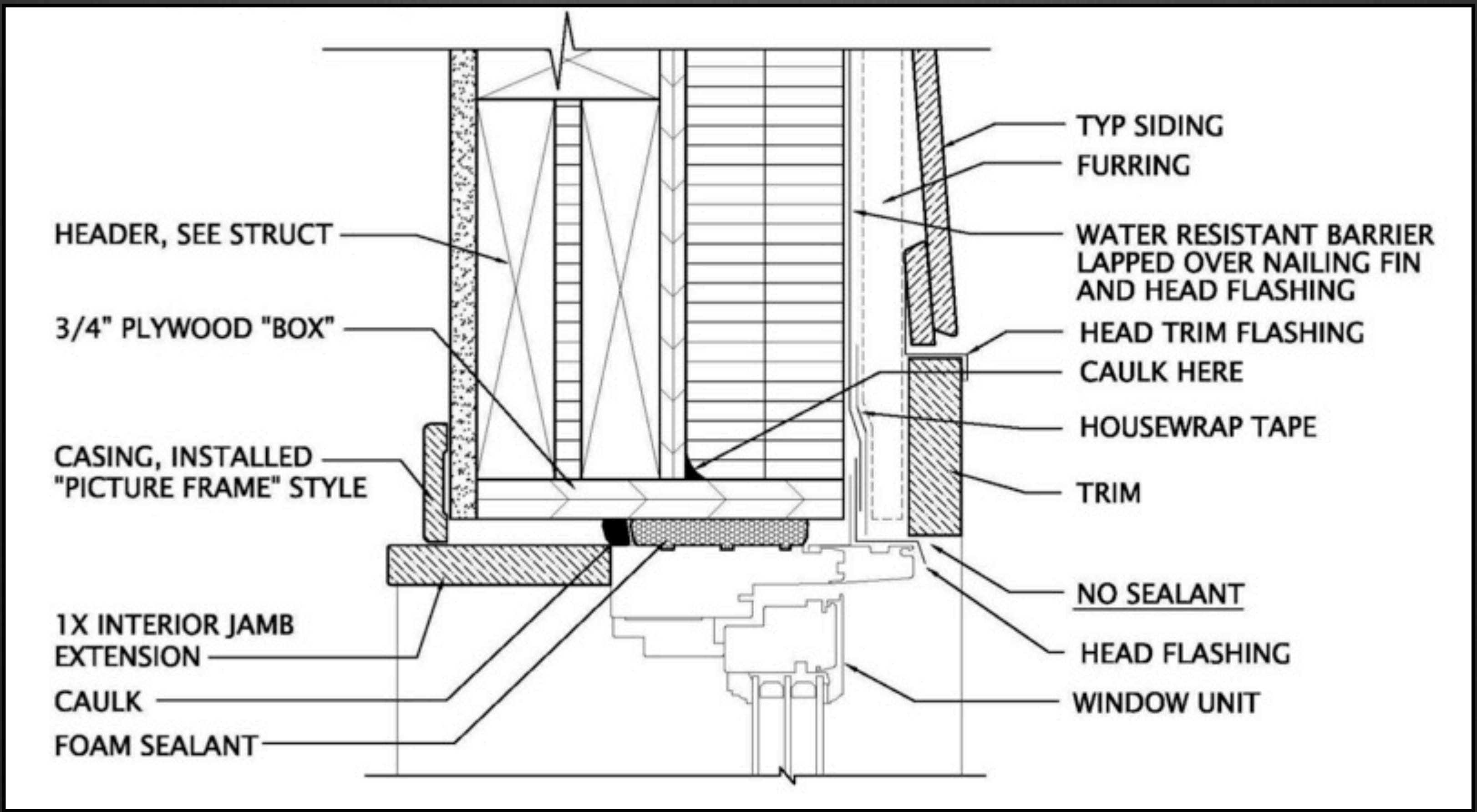


Inset window in wall w/ foam sheathing



Windows and Doors
Part of the air barrier assembly so they need solid, continuous connection

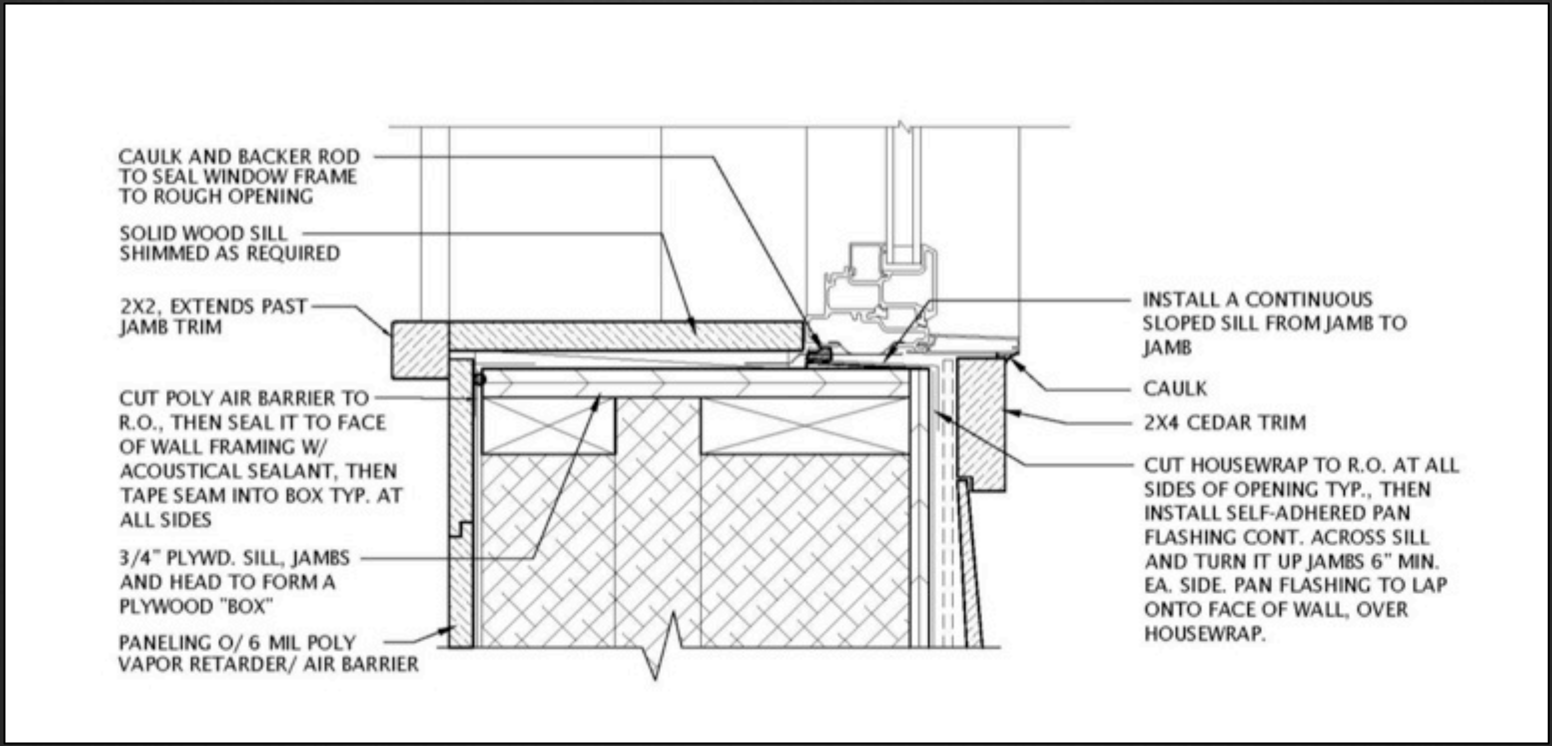
Details and installation require care



Airtight window installation

Foam, sealant and backer rod all attach to something solid.

Water management is critical in assembly design and installation



Layer the assembly so water stays out and drains down

The Roof

Functions:

Protect structure

Shed water and snow

Can also:

Divert rainwater

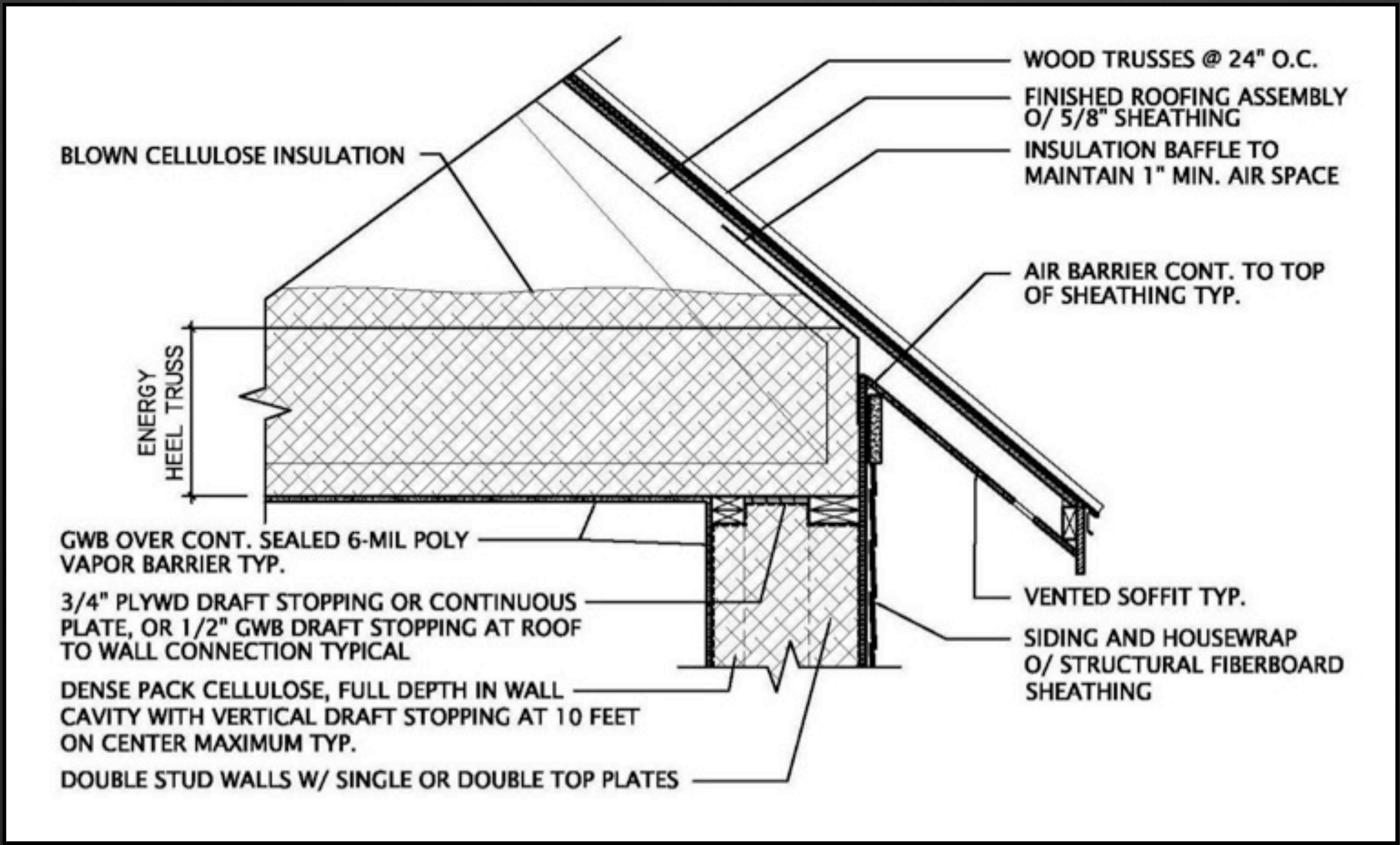
Manage solar gain

Create space

Hold equipment

Roofs – simpler works better

Truss heel makes super-insulation easy

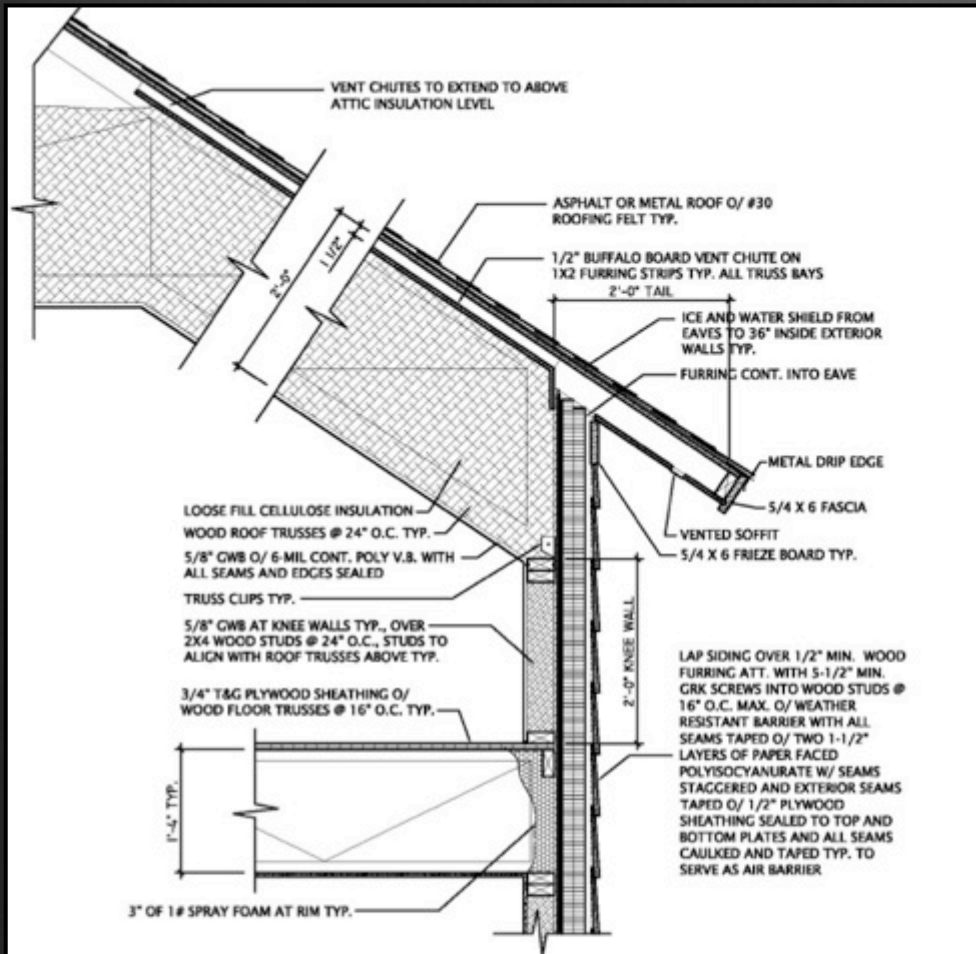


22” BLOWN CELLULOSE = R-80 ATTIC INSULATION

2009 and 2012 IECC requires R-49

Managing Air in Roof Assemblies

- If roof is vented, control the path of ventilation from soffit to ridge.
- Be clear about connecting the air barrier.



I like cellulose, but cellulose should be in a vented roof assembly.
If moisture gets in, it can dry out.

A super-insulated vaulted ceiling

- Frame with roof trusses to minimize thermal bridging
- To vent a vaulted ceiling: use site-built vent chutes to create air space and contain the insulation

Seal Penetrations to the Air Barrier

Solid connections at penetrations maintain the air barrier.

If poly or other membrane is your air barrier at the ceiling (or wall), know what it can and cannot be easily sealed to in order to maintain the air barrier.

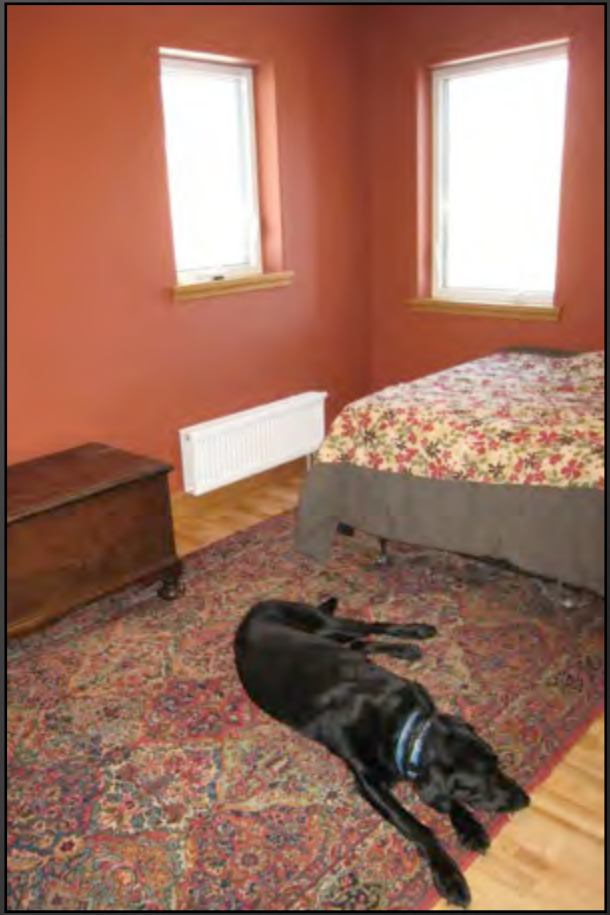
Mechanical, Electrical and Plumbing (MEP) Systems

A Few MEP Guidelines

- Recognize that mechanical equipment is replaced more often than envelope elements
- Things will change over time – build in adaptability
- Create utility cores and/or chases
- Minimize length of hot water distribution piping
- Balanced mechanical ventilation aids indoor air quality
- Also build in good natural ventilation systems

Right sized space conditioning

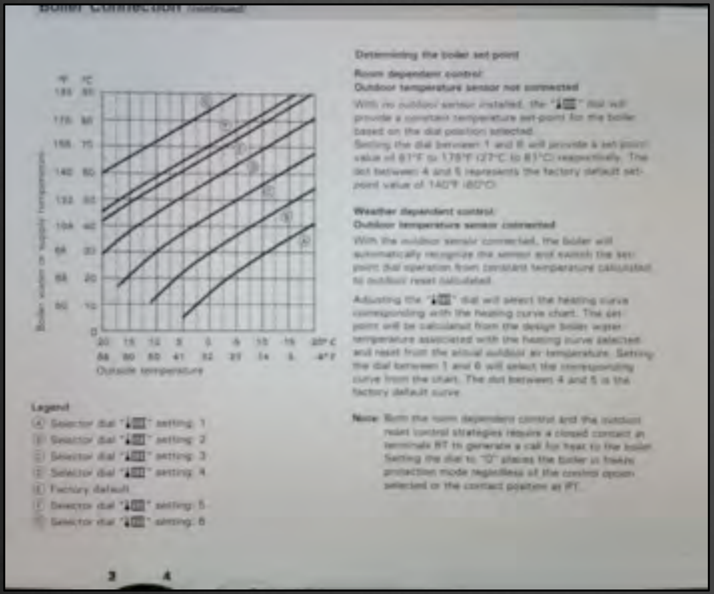
- In a very low energy house, heat or cooling may not need to be delivered to every room
- Accurate energy modeling can help guide decisions about heating and cooling equipment and distribution



Why I like floor trusses

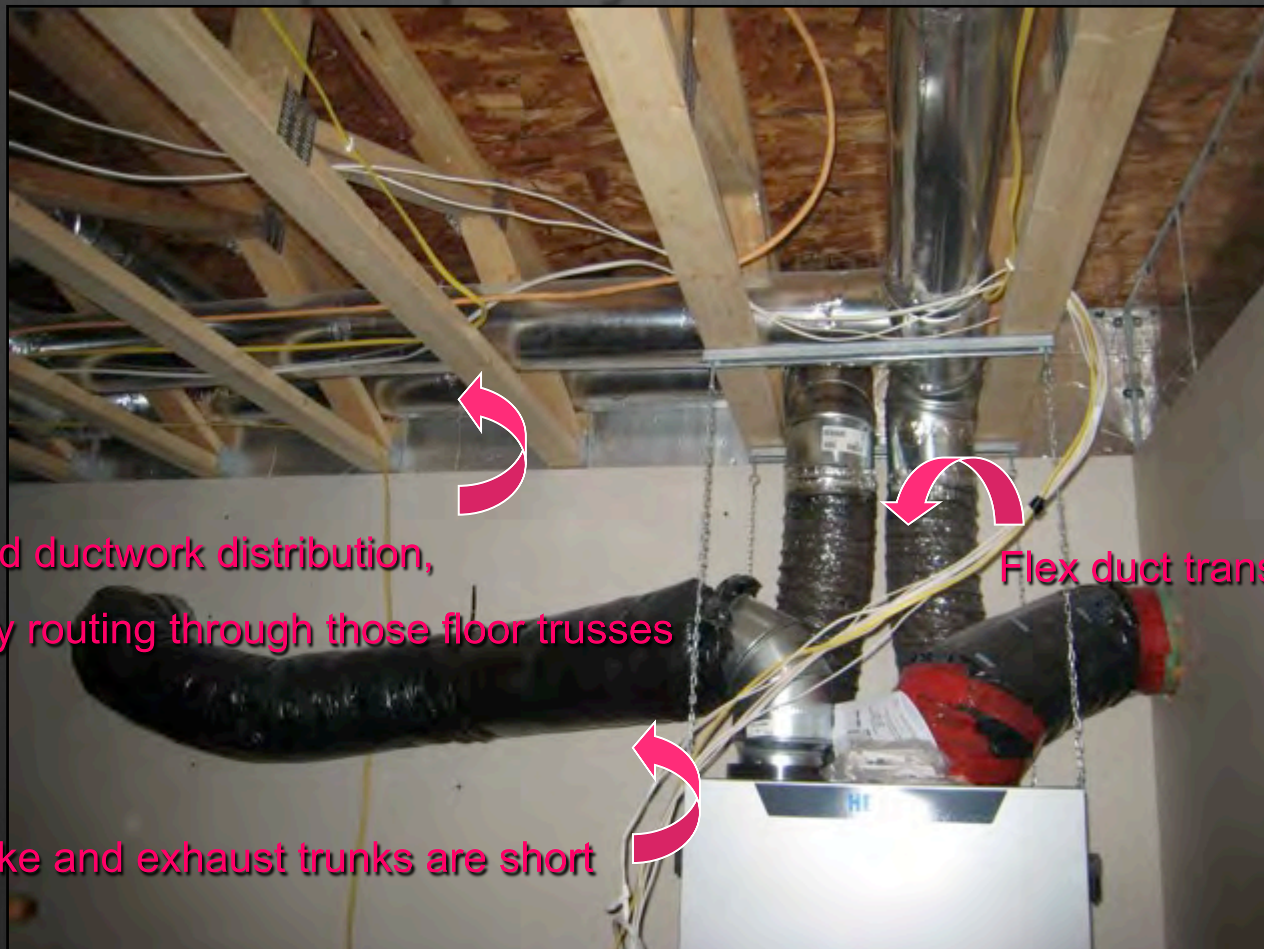
(but subs should cooperate or things can get ugly)

Tuning the Systems



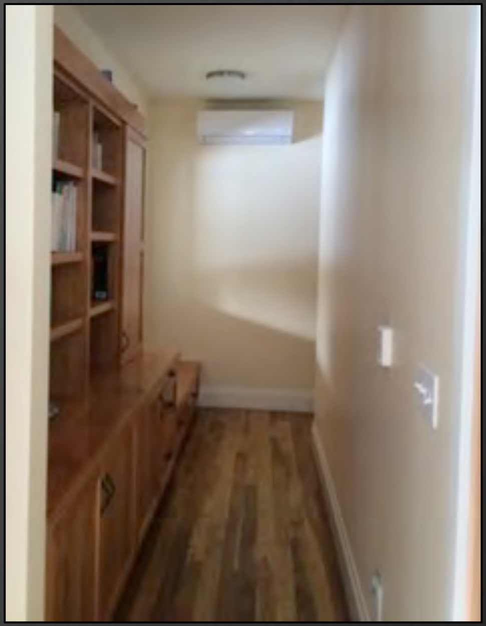
The right equipment doesn’t yield the right result all on its own. Installation matters. Settings matter.

HRV or ERV always, properly installed



Provides reliable required ventilation air with little energy penalty

Hybrid Mechanical Systems



- Fuel flexibility
- Integration of renewable and non-renewable
- In a low load house, renewable systems can provide significant energy without being significant in size.

High Performance, Low Energy in the Field

Gets “twice the mileage” of the average living vehicle

Can run on more than one fuel

Comfortable

Durable

Esko House

Built 2009
3150 ft2
Heat Demand 20.5 MMBtu/yr
(4.87 kBtu/ft2/yr)
Total energy use average 44.3 MMBtu/yr

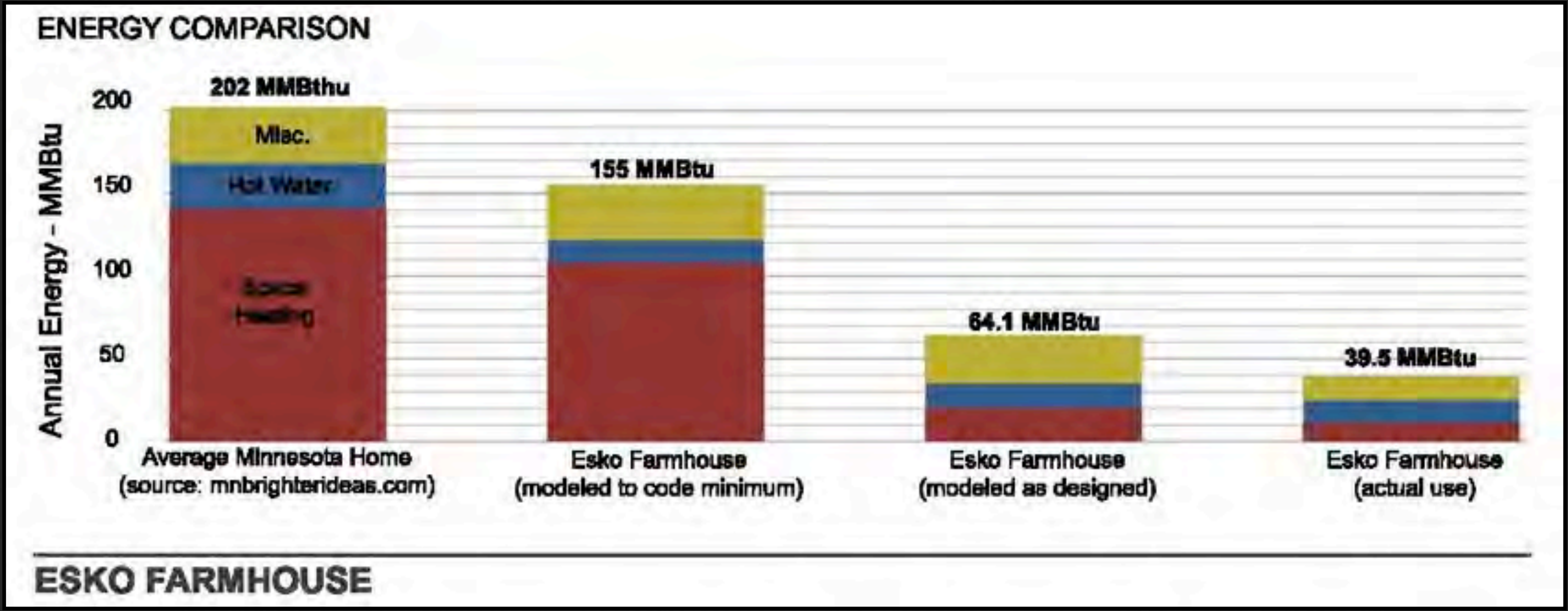
REAL ENERGY USE

Goal: 51.5 MMBtu/yr or 19.8 kBtu/ft2/yr)

Total Energy: 44.3 MMBtu/yr purchased energy (14 kBtu/ft2/yr)

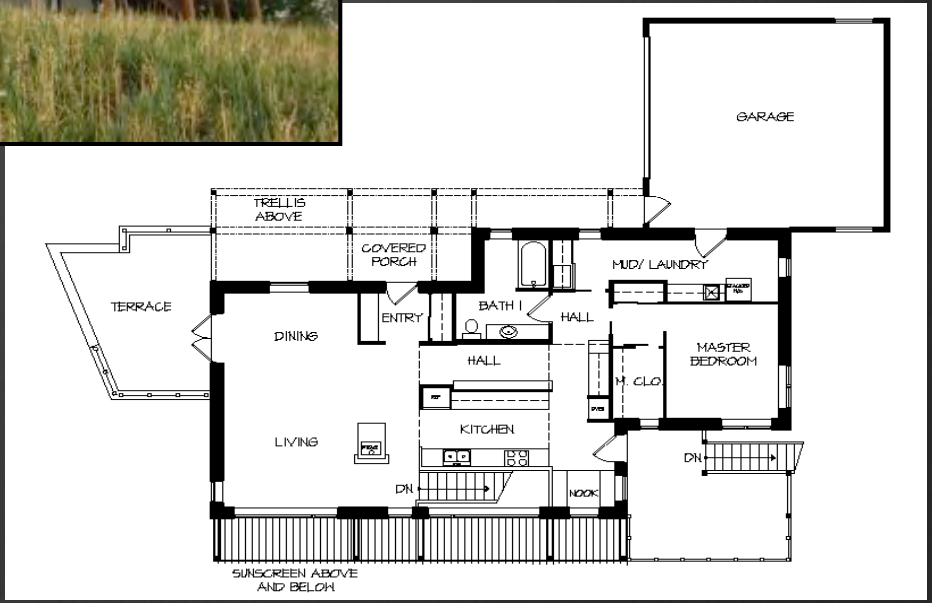
Costs about $300 a year to heat (dual fuel electric rate)

3.5 kBtu/ft2/year in electric heat and 4.6 kBtu/ft2/year in wood.



Skyline House

Built 2008
2950 ft2
Heating Demand 19.4 MMBtu/yr
2009:
used 38.9 MMBtu/yr total
13.2 kBtu/ft2/yr total energy

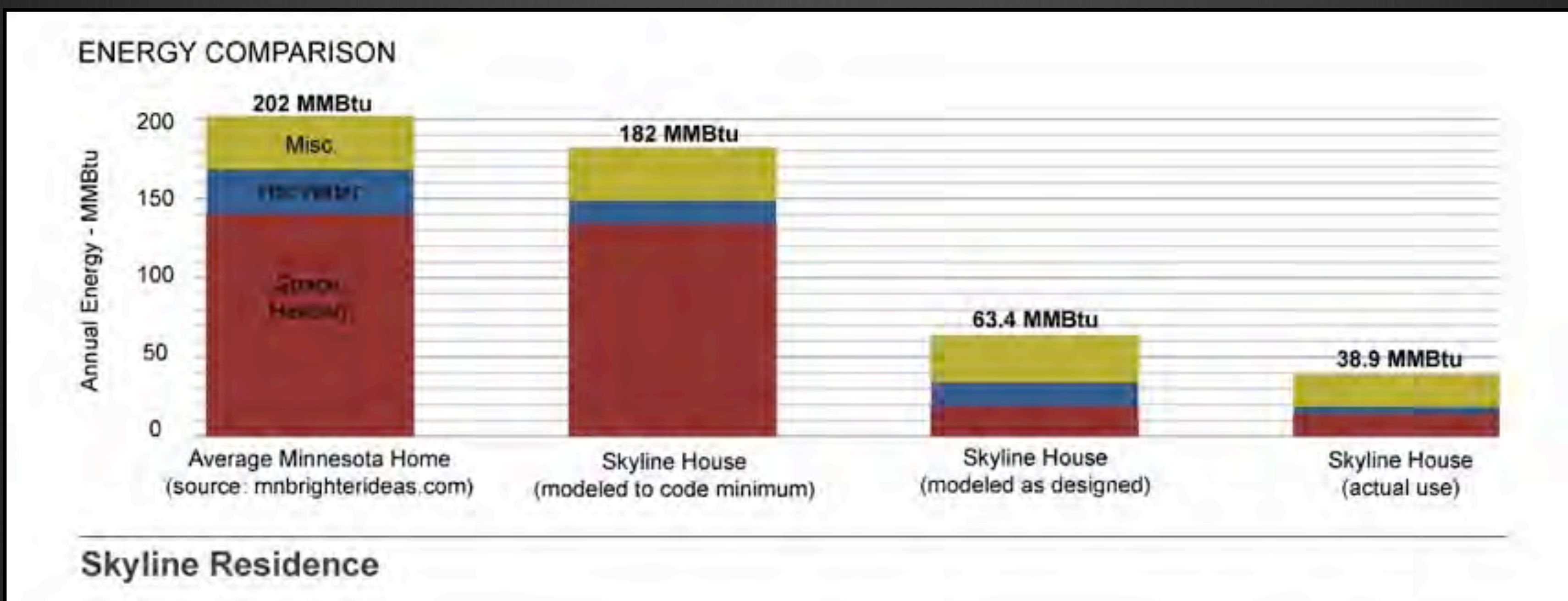


REAL ENERGY USE:

(Goal: 51.5 MMBtu/yr or 19.8 kBtu/ft2/yr)

2009 Total energy: 38.9 MMBtu/yr or 13.2 kBtu/ft2

The house is using about 4.57 kBtu/ft2/year in gas for heating.



Thank you.

Wagner Zaun ARCHITECTURE

17 N Lake Avenue
Duluth, MN 55802

218.733.0690
www.wagnerzaun.com

Some Helpful Resources

www.ecohomeduluth.com

Green Building Advisor

www.greenbuildingadvisor.com

(especially Musings of an Energy Nerd blog)

Building Science Corporation

www.buildingscience.com