

PHIUSCON - 2021

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Put a Lid on It

Roofs on our Passive Buildings

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Image: Artisans Group





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Passive Mandates:

→ Super-insulated

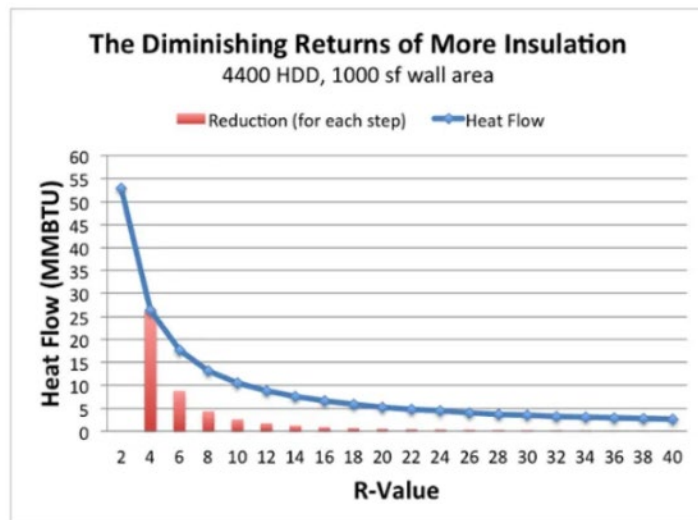
→ Air Tight

→ Durable



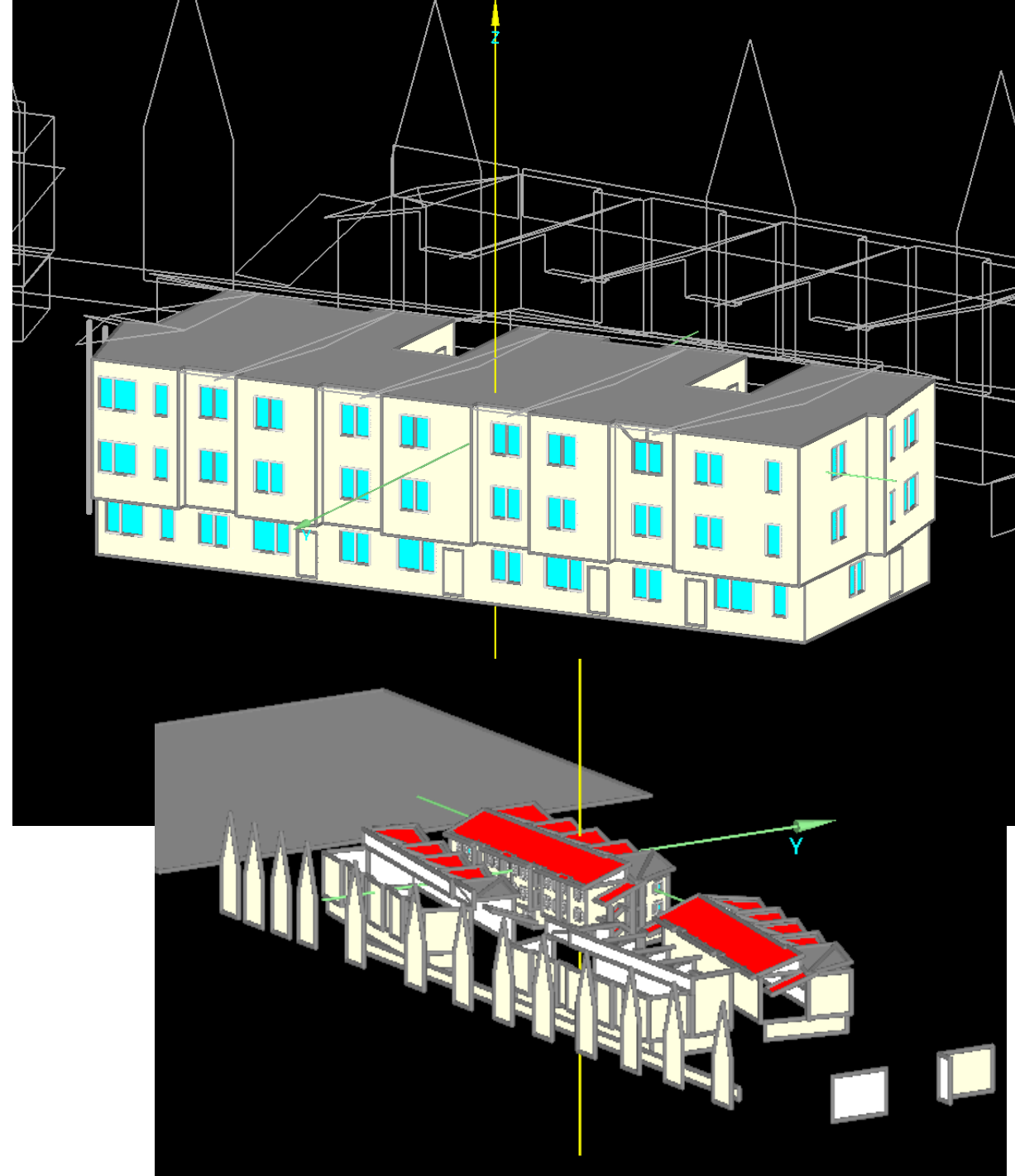
Super-insulated

- Do we need ~R-80 in our passive buildings?
- It's sometimes easy
- And it is effective, to a degree



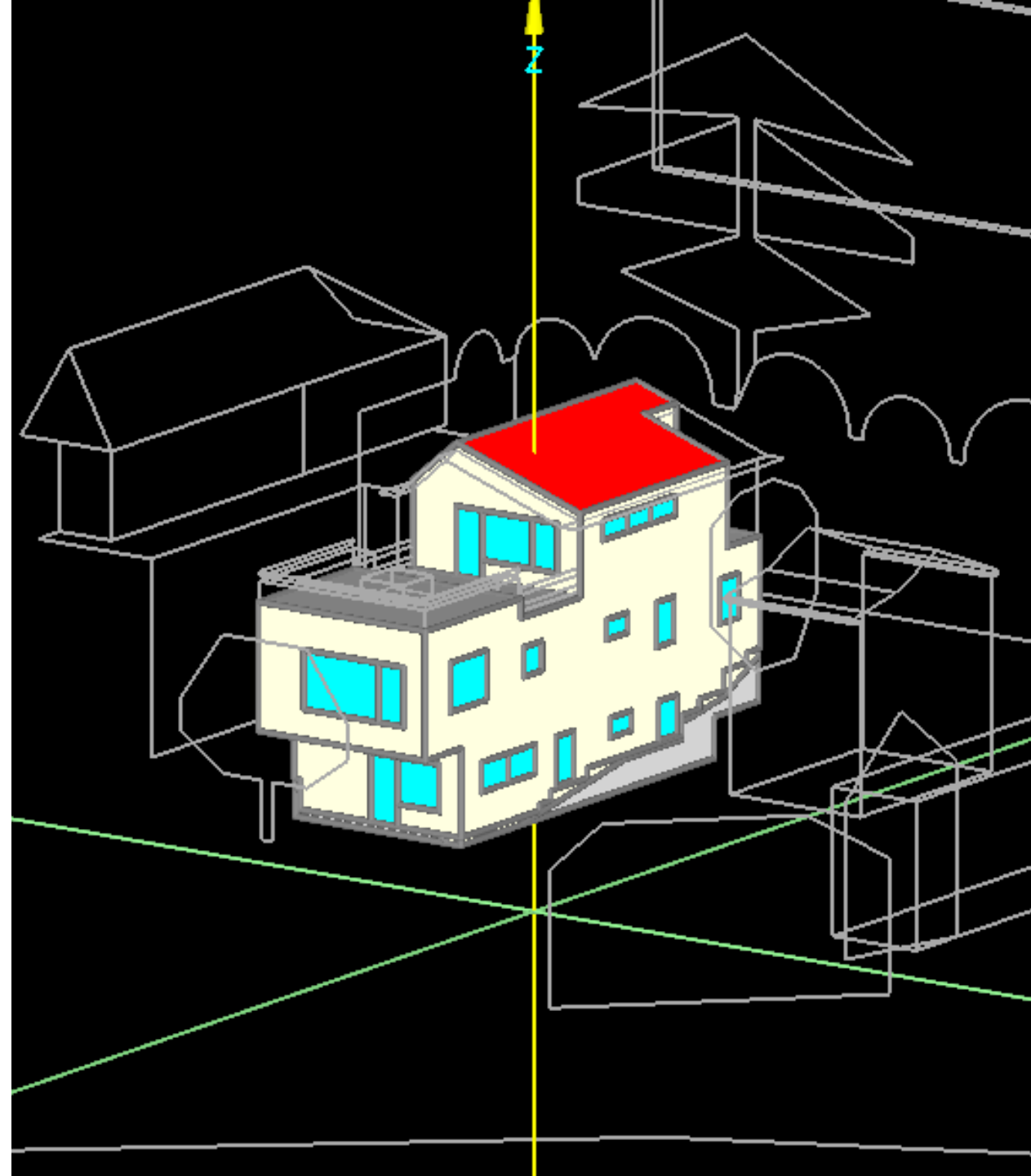
Roof to Enclosure Ratio

- Small multi-family
- 3-storey
- 14,060 iCFA
- Enclosure area: 23,900 ft²
- Roof Area: 5,140 ft²
- **Ratio: ~ 1 to 4.6**
- Performance: Effective **R-70**
 - **It's easy: fill it up w/ cellulose**



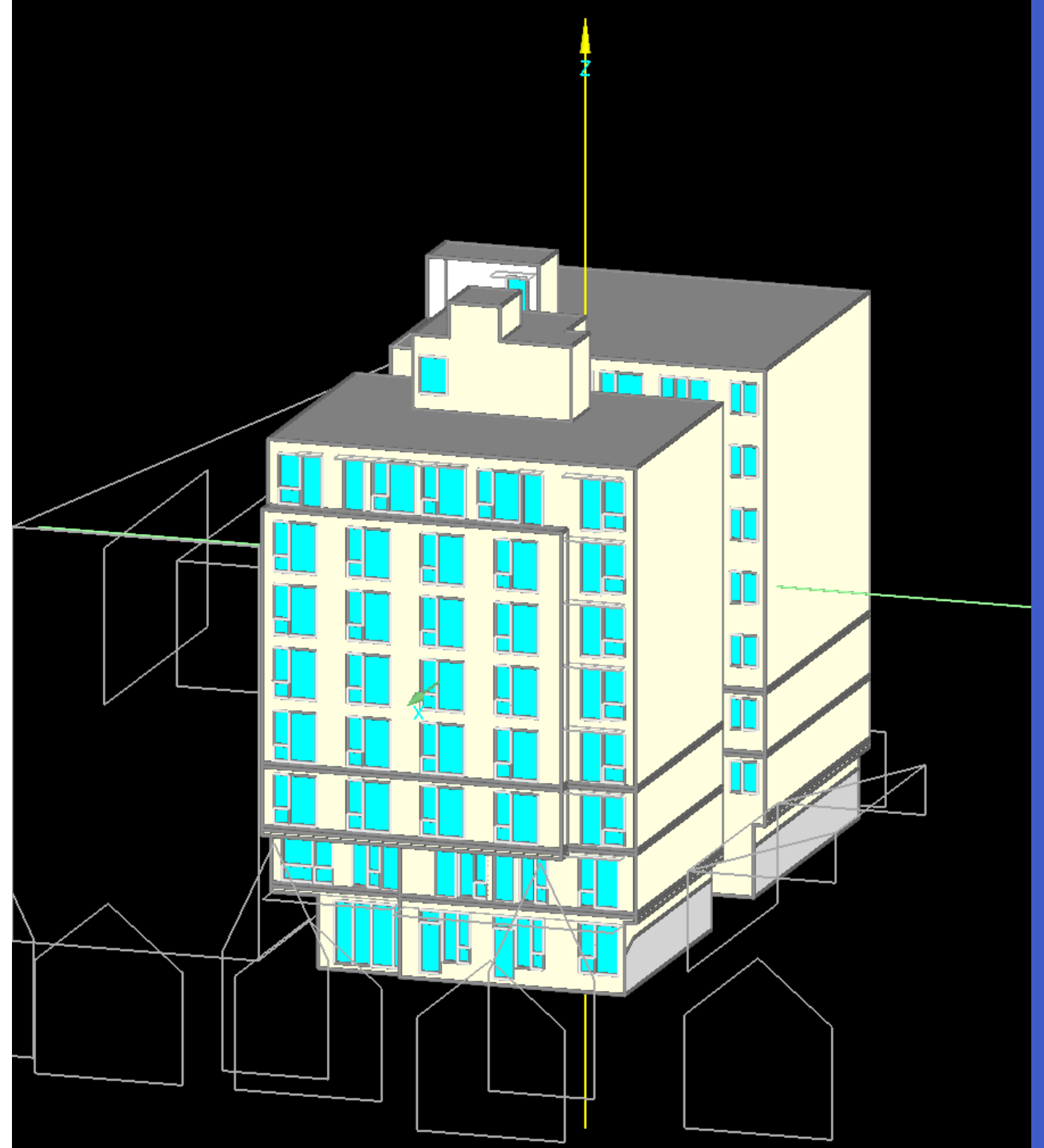
Roof to Enclosure Ratio

- Single-family
- 2 & 1/2-storey
- ~2,400 iCFA
- Enclosure area: 6,490 ft²
- Roof Area: 1,190 ft²
- **Ratio: ~ 1 to 5.5**
- Performance: **R-52**
 - **It's challenging: Vaulted or low slope below amenity spaces**



Roof to Enclosure Ratio

- Multi-family
- 8-storey
- 43,700 iCFA
- Enclosure area: 51,400 ft²
- Roof Area: 6,450 ft²
- **Ratio: ~ 1 to 8**
- Performance: ~**R-45**
 - **Code minimum**



Air Tight

- Critical at roofs
 - Buoyant air
 - Higher interior pressure
 - Warmer
 - More moisture capacity
 - Exposure of roof to cold environment



Air Tight

- Buried air barrier details
- Drying in ASAP
- Incomplete for mechanical systems



Air Tight

- Challenging at roofs
 - Connection to walls
 - Penetrations
 - Mechanical systems
 - Skylights
 - Architectural features



Air Tight

- Solutions for roofs
 - Minimize penetrations and features
 - KISS

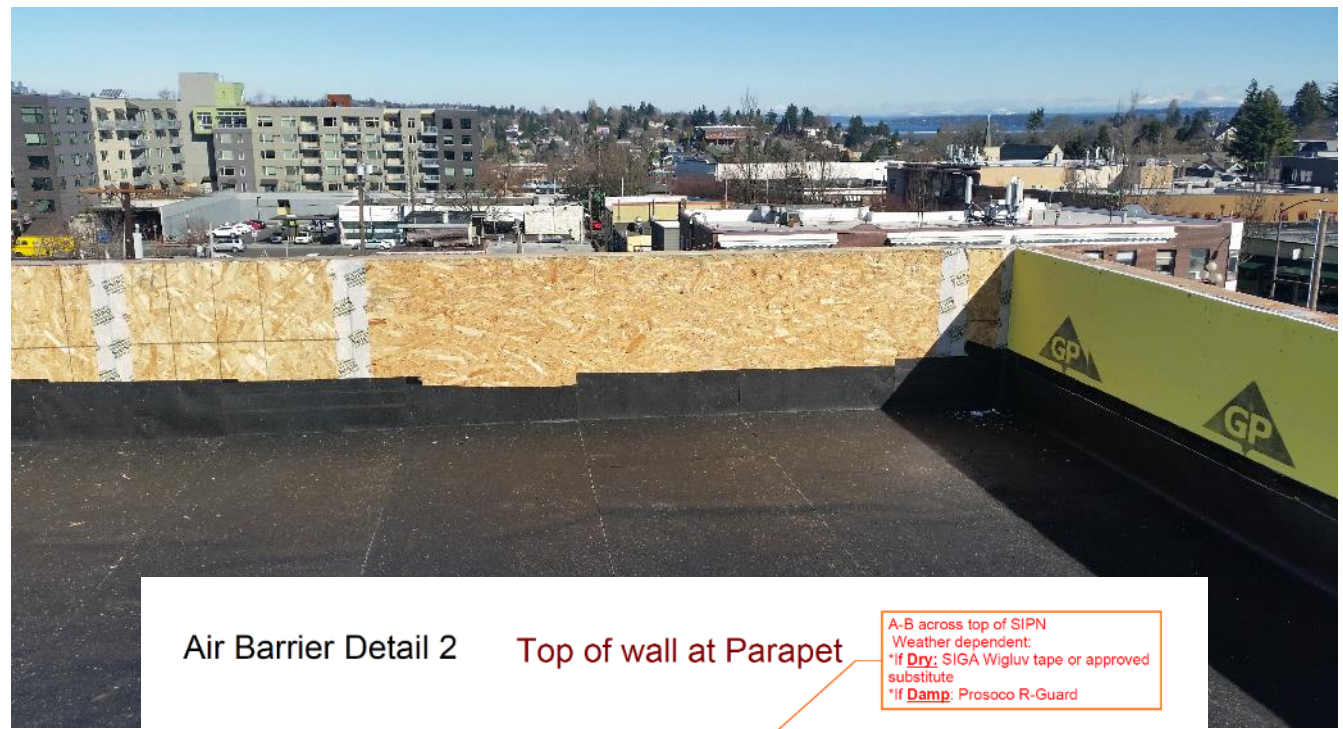


Air Tight

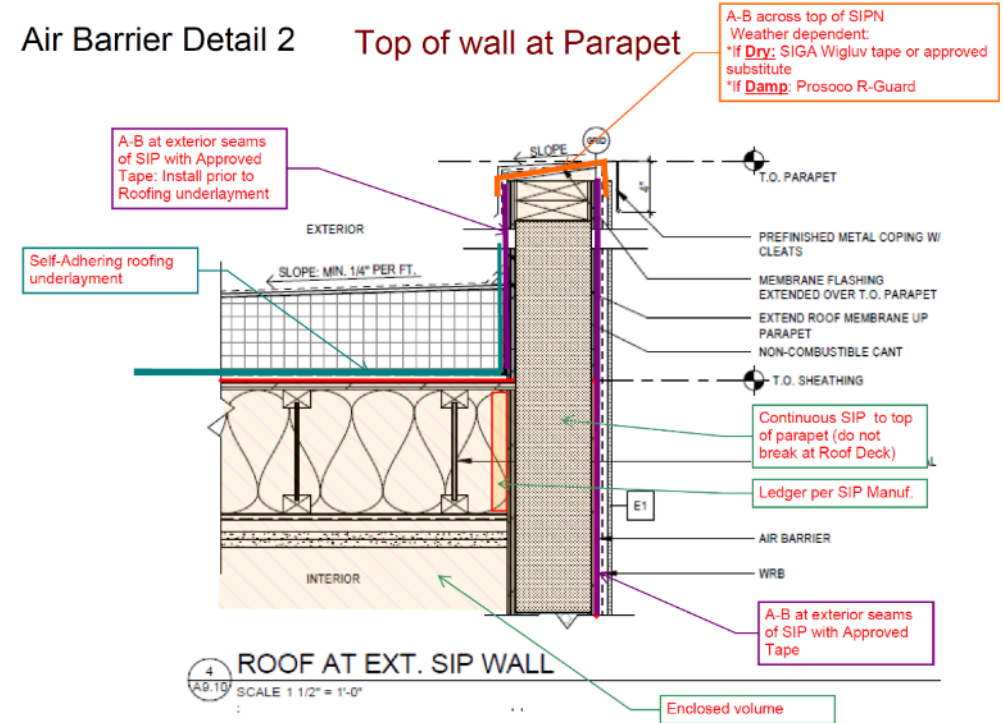
→ Unvented Roof Solutions:

→ PPPPP

→ Esp. at parapets



Air Barrier Detail 2 Top of wall at Parapet



Air Tight

→ Vented Roof Solutions:

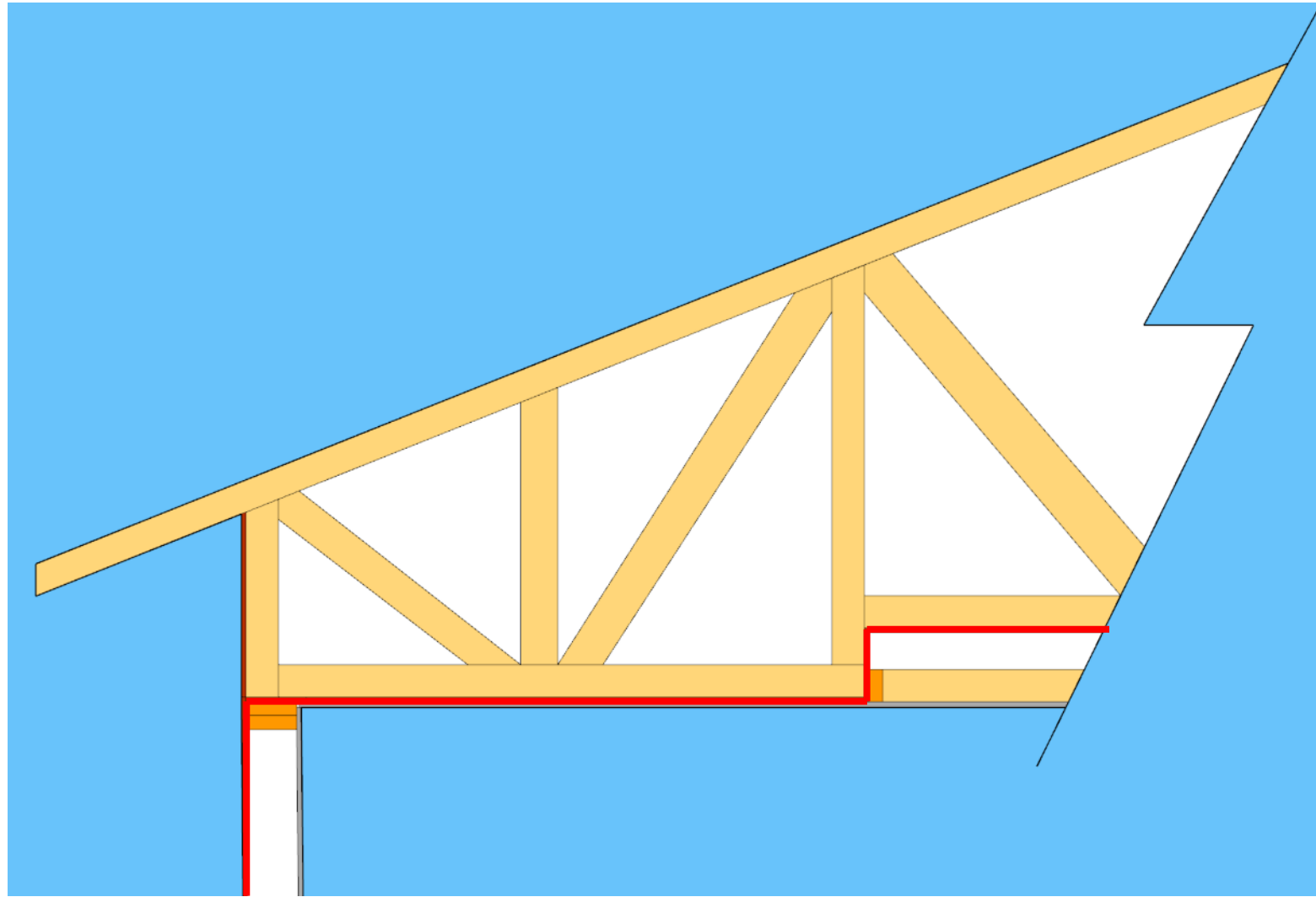
→ Most common: Air Barrier near ceiling



Air Tight

→ Vented Roof
Solutions:

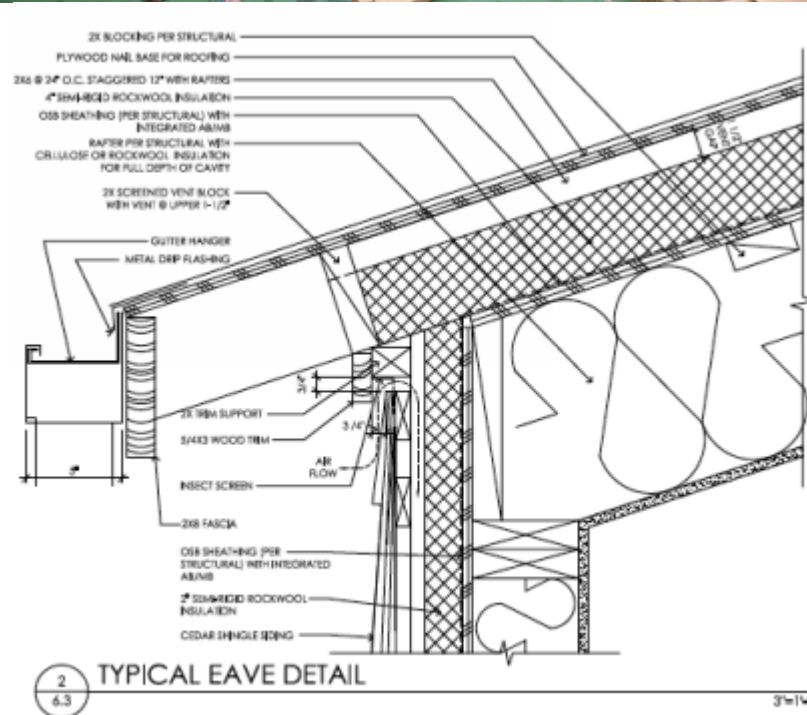
→ Most common: Air
Barrier near ceiling



Air Tight

→ Vented Roof Solutions:

→ Alternate: Air Barrier above structure, below 2nd insulation layer



Images: Josh Salinger, Birdsmouth Design Build

See: *Fine Homebuilding*, June 2021

To vent or not to vent, that is the question...

-What are we venting in mixed and heating dominated climates?

-Moisture via air flow



Requirements: Vented

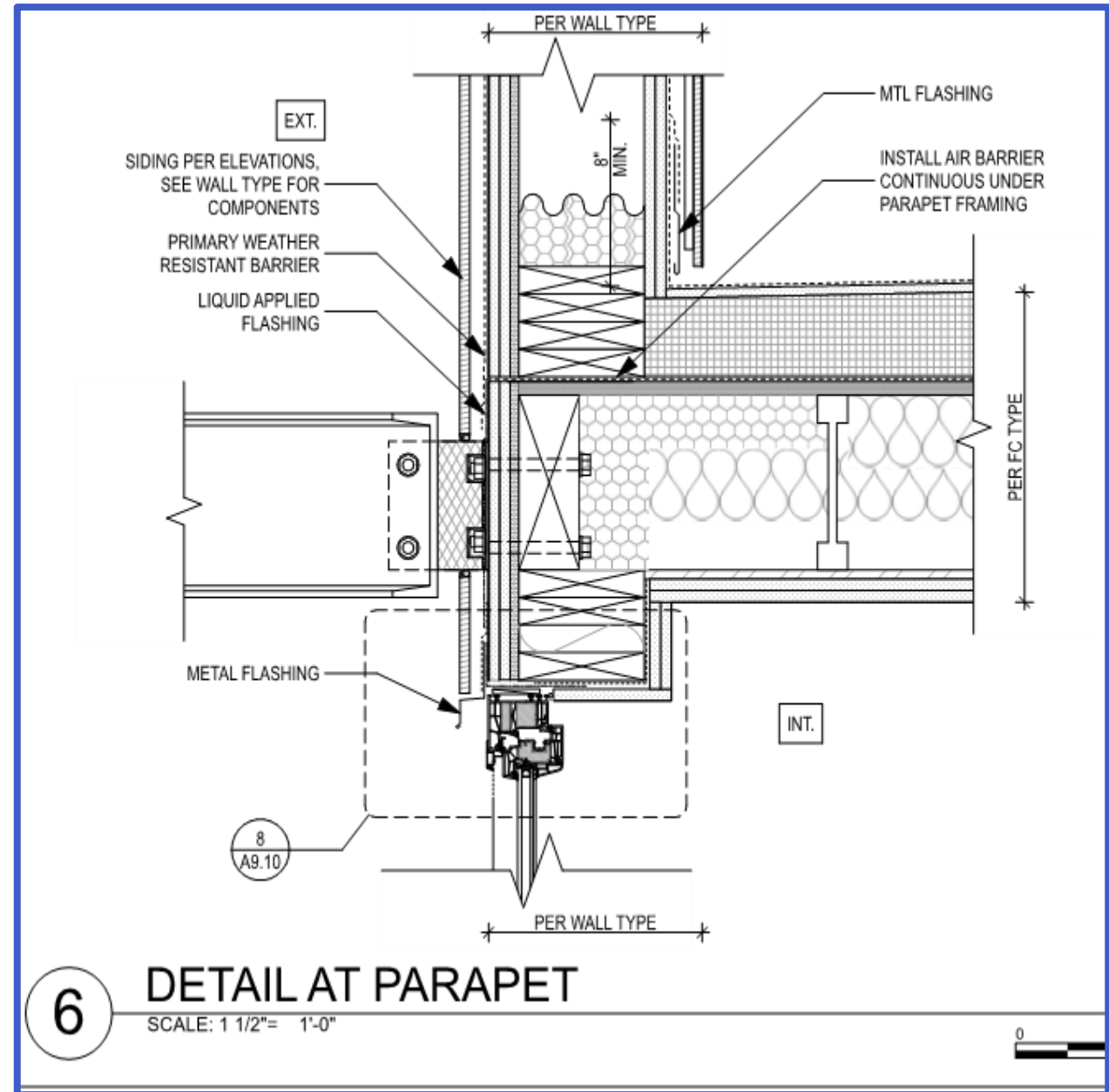
- Between inlet and outlet
 - Pressure difference
 - Continuous path
 - Per Phius: 1.5"
 - Passive air flow
 - Active???
- Low-moisture content at inlet





Requirements: Unvented

- Assess your interior loads
- Manage the vapor
 - Entering the assembly via the ceiling
 - Control temperatures at *vapor control layer* with insulation above
 - Use appropriate materials





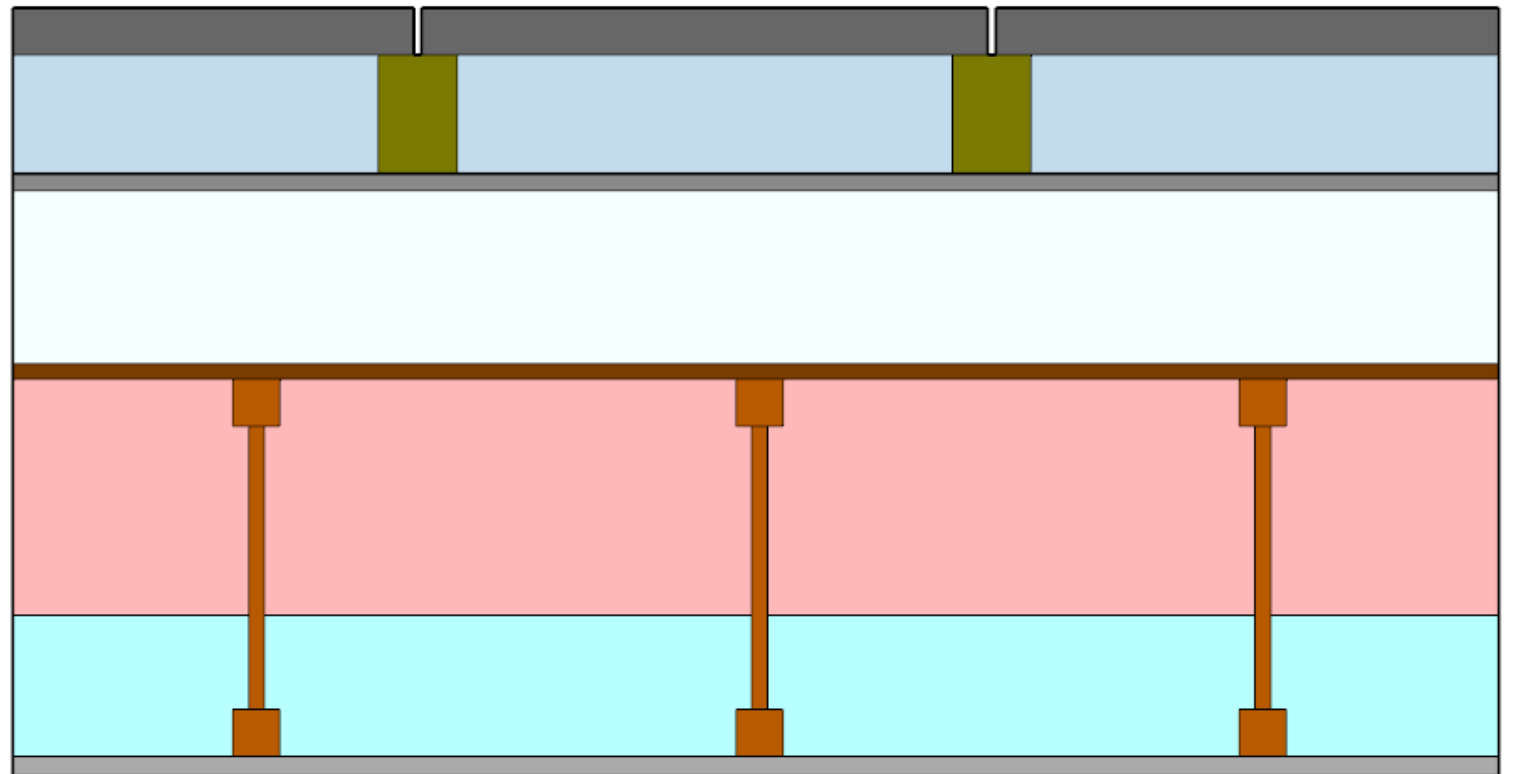
Images: Skyler Swinford



Unvented roofs:

- Foam-free?
- Low embodied energy components?

- What's the risk?
- What's the tolerance for risks?



Durability

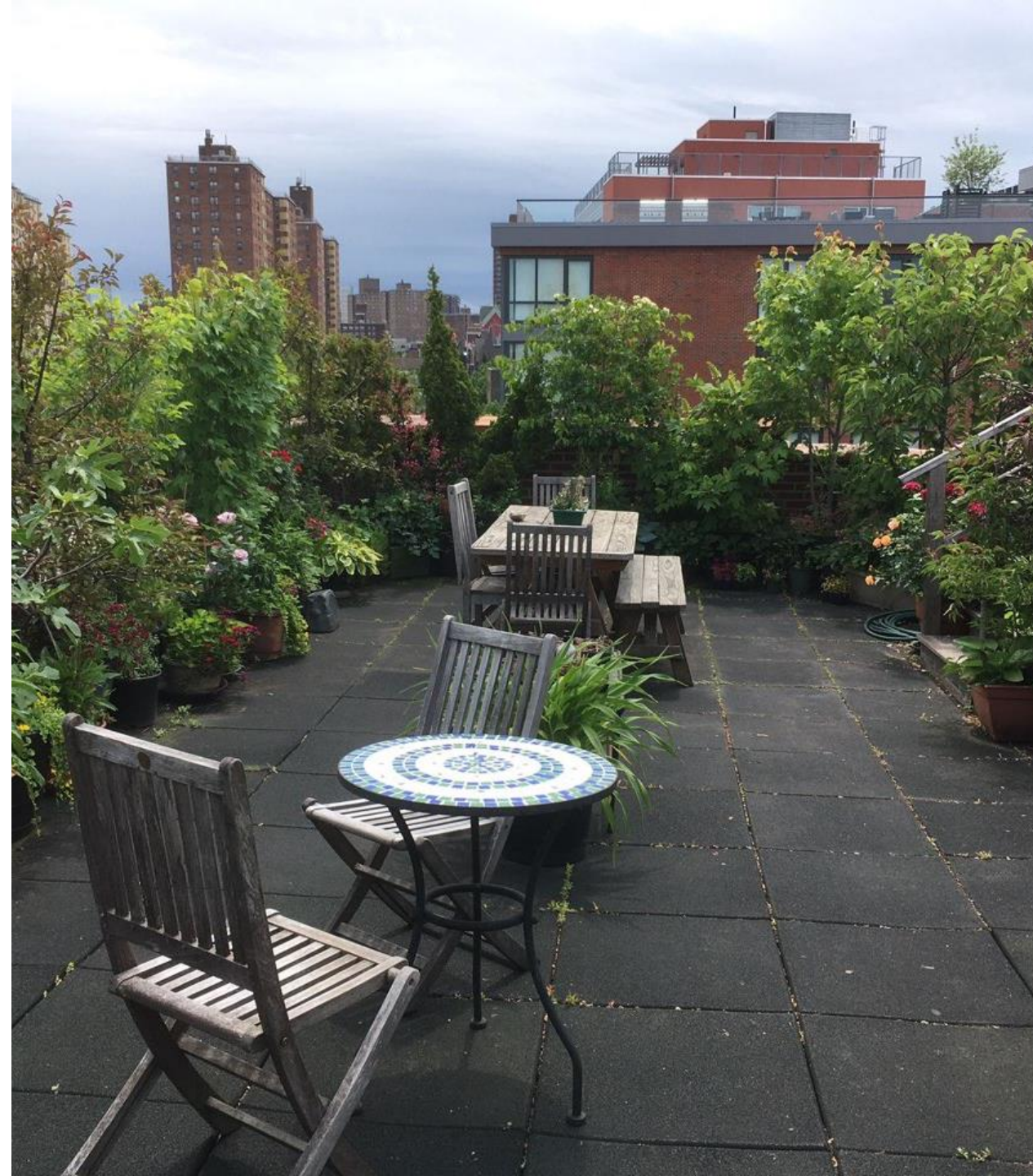
→ Maintenance

→ Design it in



New considerations

- Roof as a building resource
- Amenity spaces



New considerations

→ Platform for energy systems



Durability w/ Overburden

→ Maintenance

1. Increased use/risks
2. Limited access
3. Additional burdens

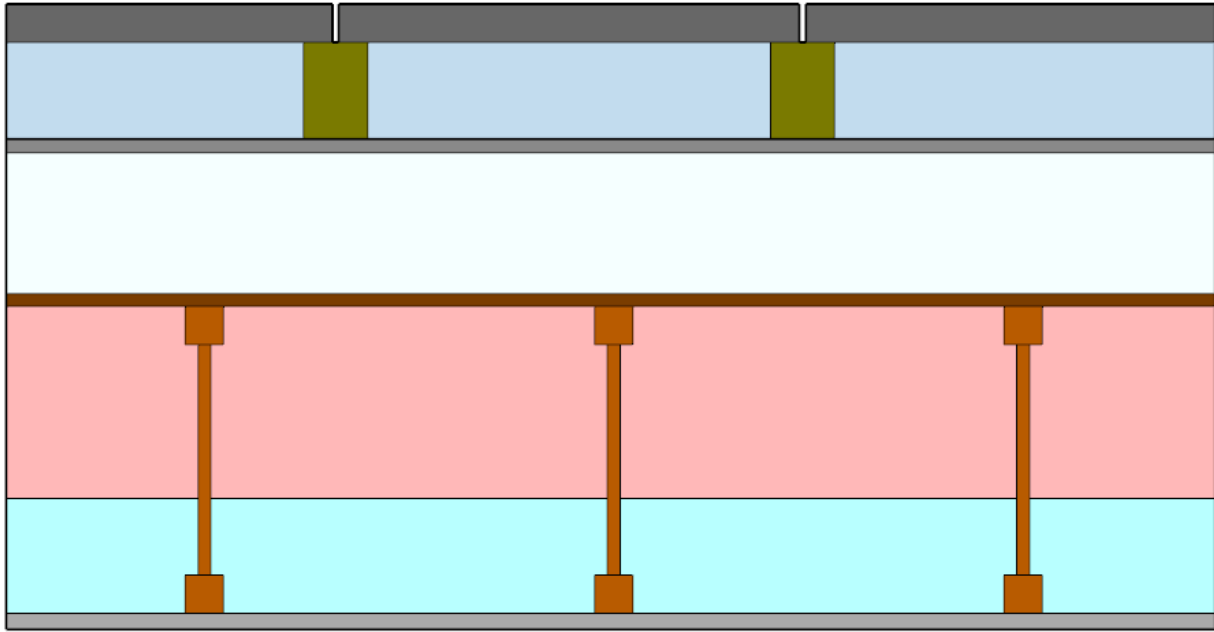
Significant cost
increases



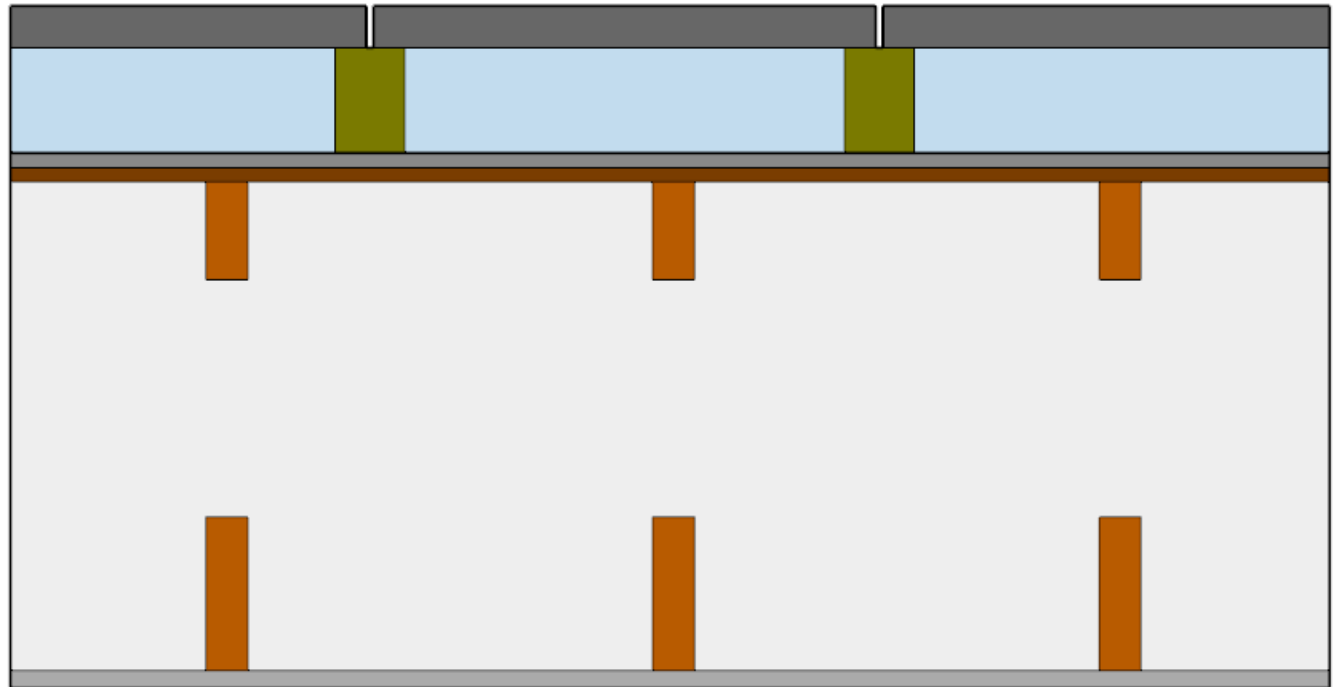
Durability

- Flat structure at roof
- A roofer's recommendation:
 - Prepare for roofing to leak
 - *Install the best underlayment you can*





How do we deliver these assemblies with lower climate impact yet meet durability concerns?



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Discussion + Questions

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Thank You