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Unvented Roof Research:

The “Ridge Rot” Accelerator

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Net-Zero NORTH AMERICAN LEADERSHIP SUMMIT

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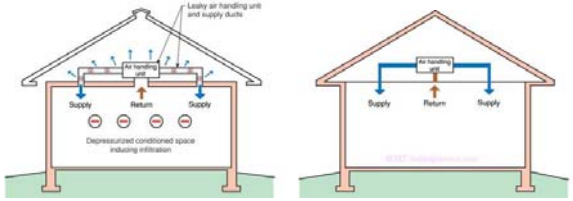
MARCH 3-5, 2015 AT THE SEAPORT WORLD TRADE CENTER

Supporting Zero Energy Ready Homes



- Ducts in unconditioned attic = huge energy losses
- Solution: bring ducts into conditioned space
  - Builders reluctant to move ducts out of attic
- Unvented/conditioned attic—keeps ductwork in conditioned space, duct leak issues eliminated

Why this Project?

- Dense pack insulation of unvented roofs common in cold-climate retrofits
  - Moisture risks (see BSI-043 “Don't Be Dense—Cellulose and Dense-Pack Insulation”)
  - Violates I-codes (see IRC § R806.4)
  - “Ridge rot”—localized problems (SIPS same problem)

Why this Project?

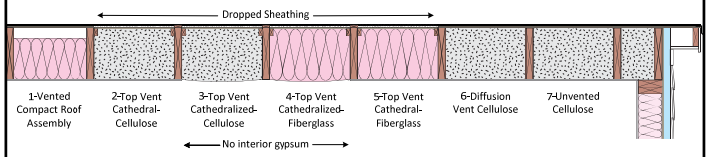
- Unvented roofs without spray/board foams could reduce costs and increase market penetration… IF moisture damage risks are addressed
- Retrofit opportunities (existing uninsulated living space at roof line, without removing finishes)

Experimental Setup

Experimental Design

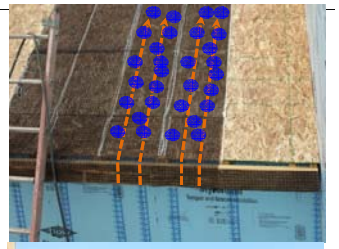
- Seven roof bays (east-west pairs) in test garage attic in Chicago, IL (5A) area
- **72 F/50% RH interior** conditions through winter: stressing assemblies to failure

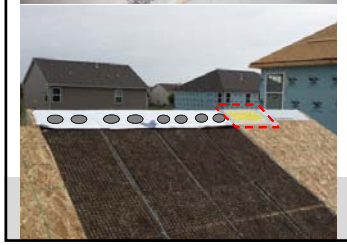
Experimental Design

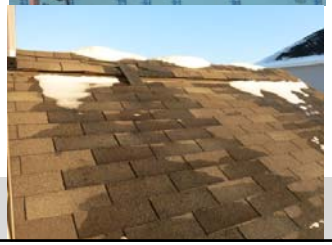


#	Name	Venting	Insulation	Interior
1	Vented	Vent space (2")	Fiberglass	Gypsum Bd
2	Top Vent Cathedral-Cellulose	Cedar Breather (~½")	Cellulose	Gypsum Bd
3	Top Vent Cathedralized-Cellulose	Cedar Breather (~½")	Cellulose	Open
4	Top Vent Cathedralized-FG	Cedar Breather (~½")	Fiberglass	Open
5	Top Vent Cathedral-FG	Cedar Breather (~½")	Fiberglass	Gypsum Bd
6	Diffusion Vent Cellulose	Diffusion Vent	Cellulose	Gypsum Bd
7	Unvented Cellulose	None	Cellulose	Gypsum Bd

Top Vent Details







Instrumentation, Insulation, Finishes…



Results

Full Report Pending

- For the full story…
- Report 118 pages… and growing
- To be submitted for review

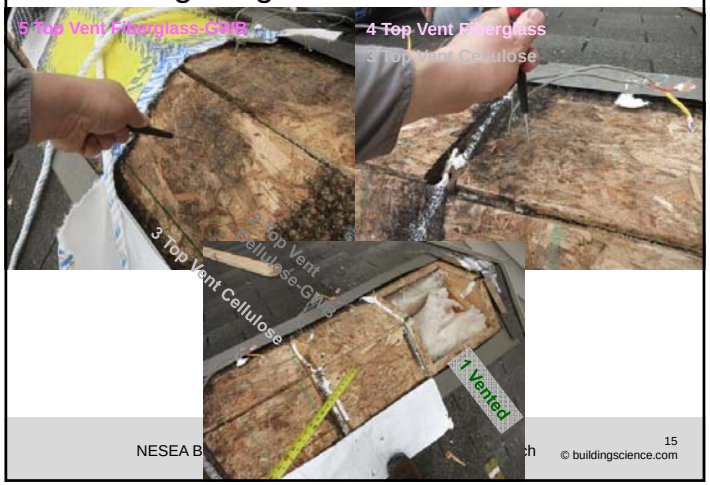
Monitoring Result Takeaways

- Vented roof=great performance—even @50% RH!
- Unvented cellulose assembly driven to failure (high RHs, high sheathing MCs)
- Cellulose + diffusion vent helps, but not enough
- Top venting not enough to save roofs in:
  - Zone 5A climate, 50% RH interior
  - With a small (~1/2" vent space)
  - With OSB sheathing
- In top vent roofs, fiberglass roof much worse than cellulose

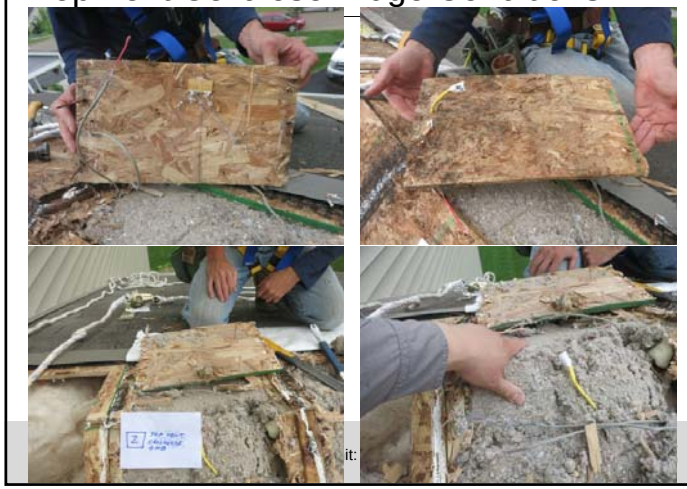
Disassembly

Sheathing Ridge Condition

Sheathing Ridge Condition

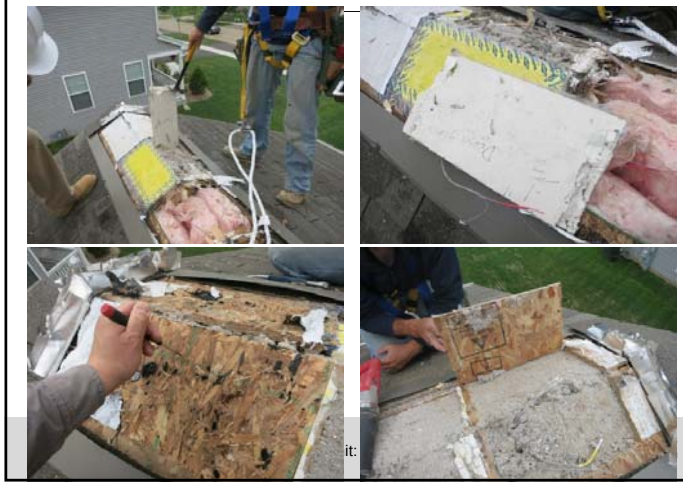


Top Vent Cellulose Ridge Conditions



Top Vent Fiberglass Ridge Conditions

Diffusion Vent & Unvented



Sheathing Further from Ridge-East

Disassembly Takeaways

- Results consistent with monitoring data
- Sheathing stained but not punky/structural damage
- Damage concentrated/severe at ridge
- Fiberglass sheathing & framing: extensive damage & staining, possible mold growth
- Cellulose sheathing: some delamination, adhesions, and rusty fasteners—not as bad
- Cellulose did not settle over one winter
- Fiberglass batts leave lots of air leakage paths

Conclusions

Experimental Conclusions

- No roof except for “control” vented roof showed “safe” performance in Zone 5A @ 50% RH
- Cellulose roofs generally showed lower MCs than fiberglass roofs, less damage to structure
- “Top vent” configuration not effective
  - OSB too restrictive for diffusion drying, even with outward thermal gradient? (part of the time)
  - Ventilation space too small?
- Diffusion vent allowed greater drying than conventional unvented, but still higher MCs than generally considered safe

Questions?

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