

Effective Floor Cavity and Knee Wall Construction Techniques in Two-Story Homes in Hot Climates

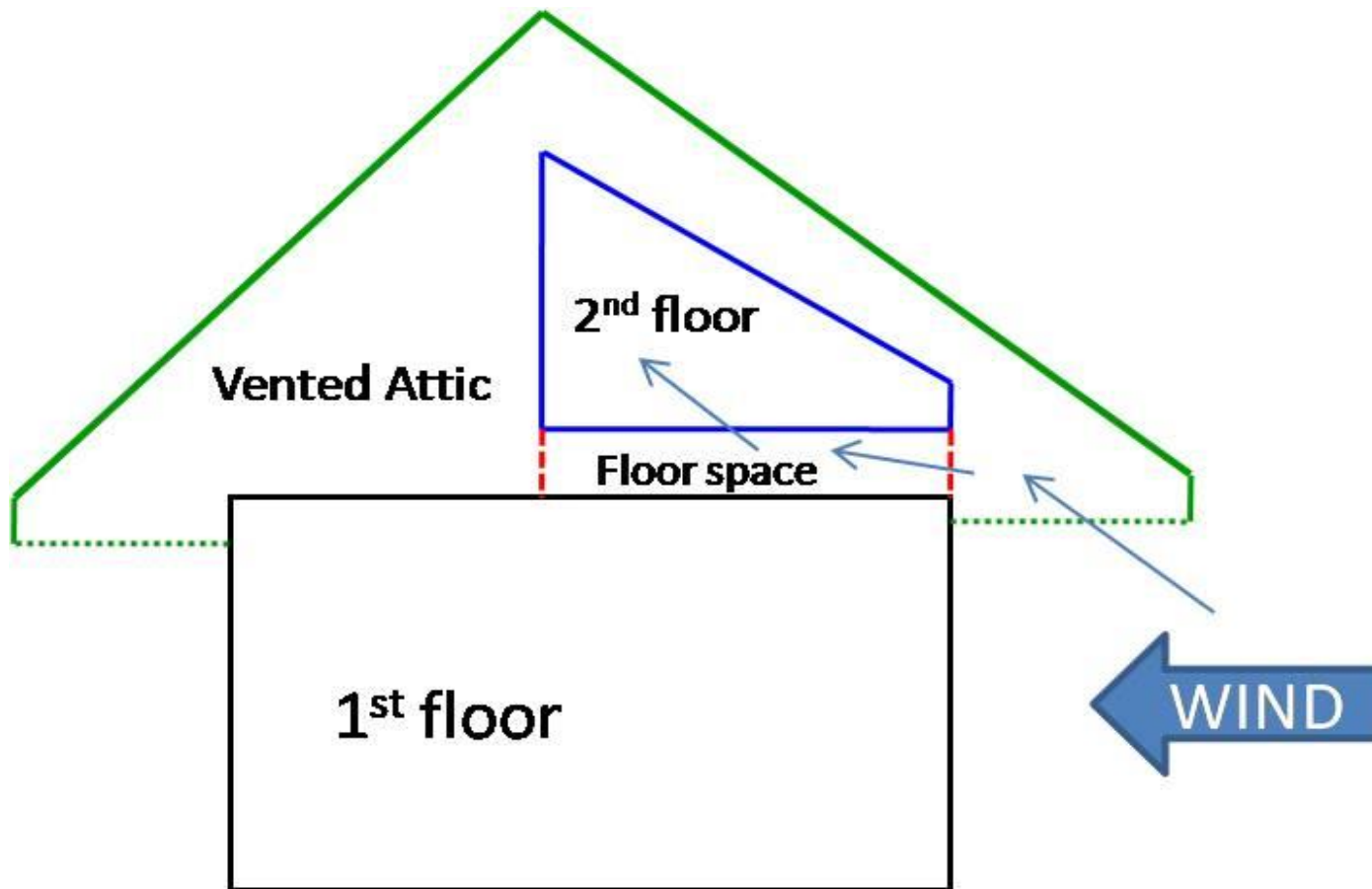
Buildings XIII Conference, Clearwater, FL
Session 6 Practices - 3:30 PM-5:00 PM
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The Concept

Air movement around or through a thermal barrier results in diminished thermal energy and moisture control.



Can This Be Sealed Effectively Using Batts?

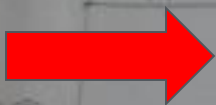


Home with High Wind Washing Potential

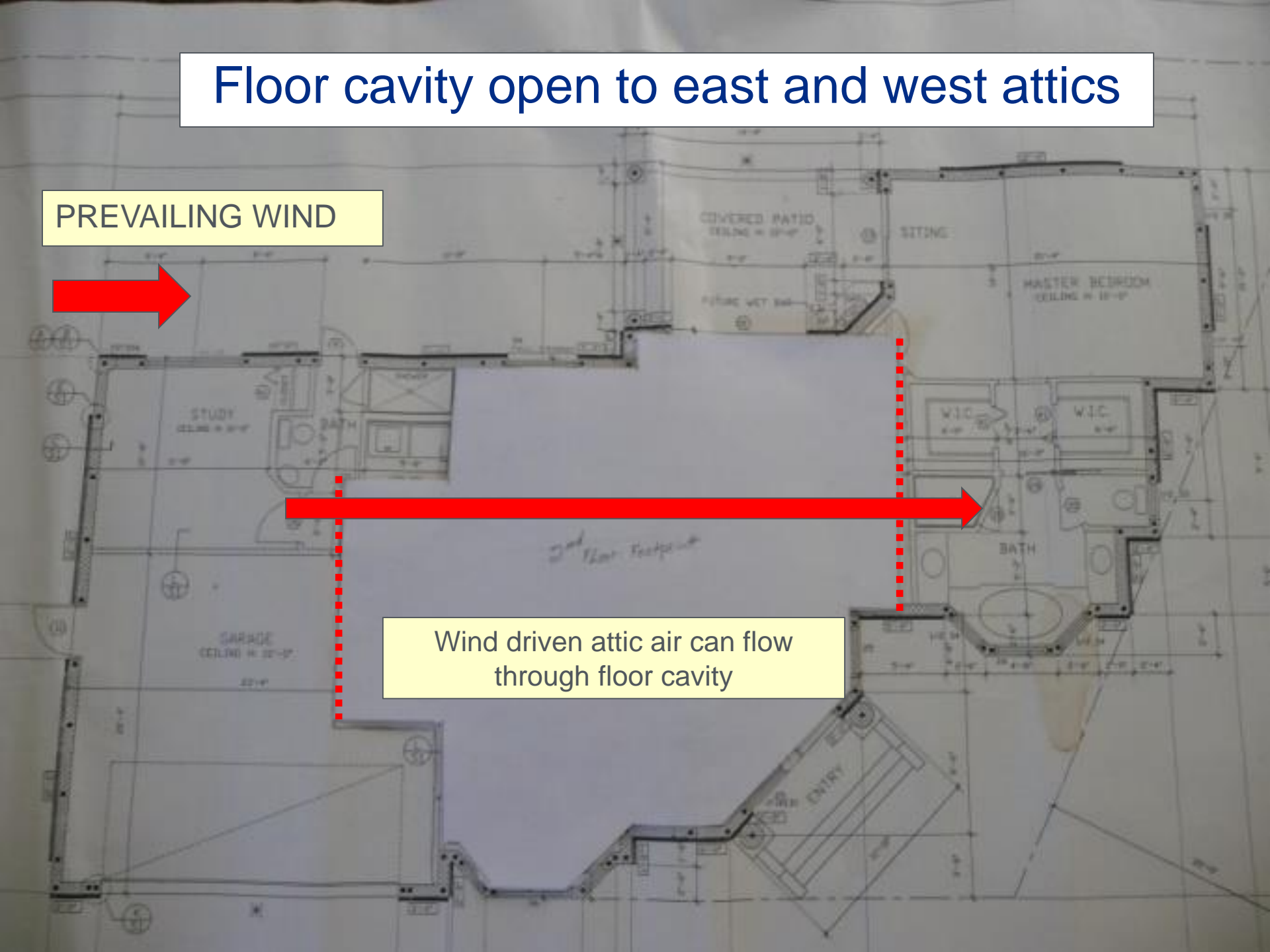


Floor cavity open to east and west attics

PREVAILING WIND



Wind driven attic air can flow through floor cavity



2nd Story Floor Space Open to Vented Attic



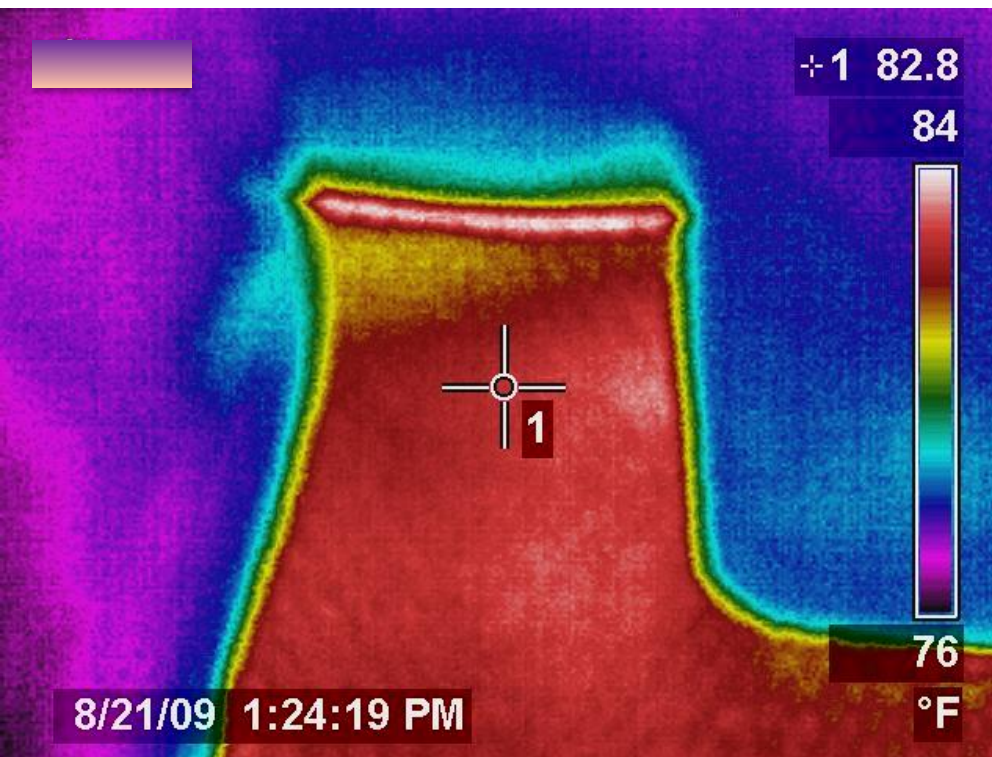
East side attic view

West side attic view

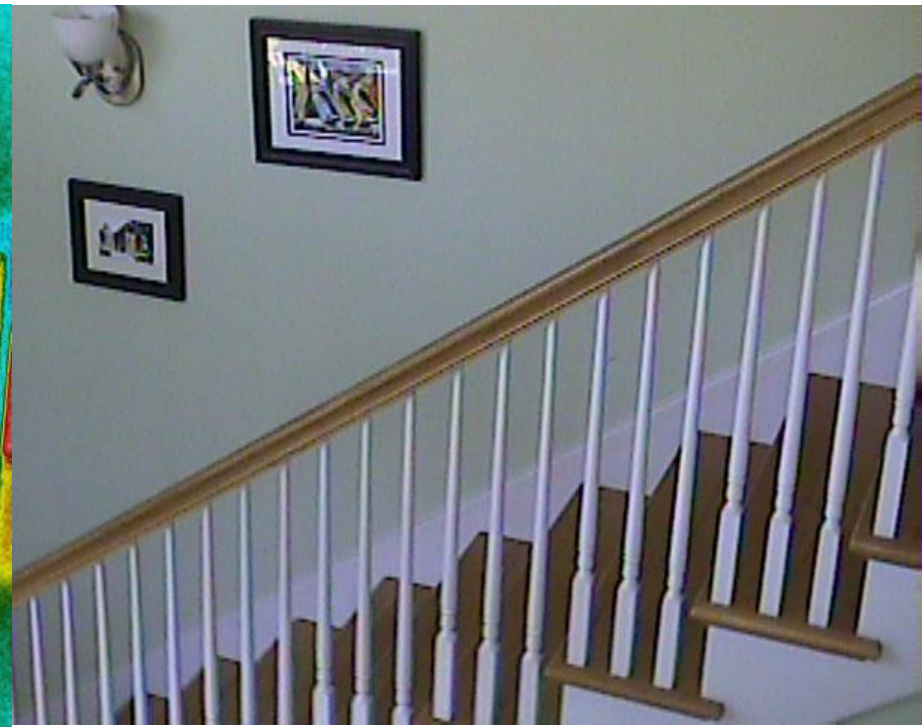


2nd Story Floor Cavity Heated By Attic Air

2nd story floor surface is very warm

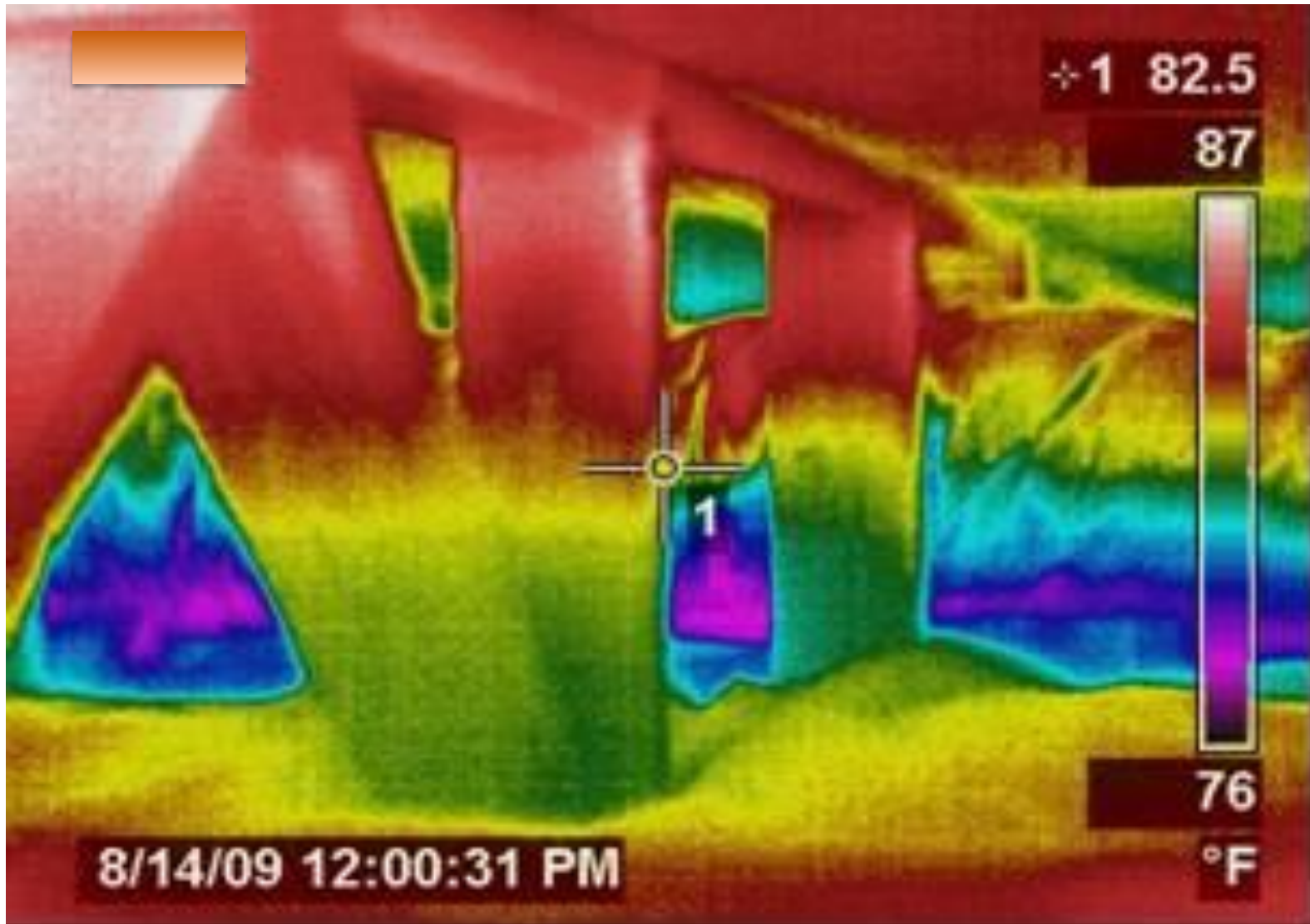


2nd Story Floor Cavity Heated By Attic Air



Floor space on other side of very warm wall section.

IR Image Inside Floor Cavity Open to Attic



House Repair With Low Density Foam

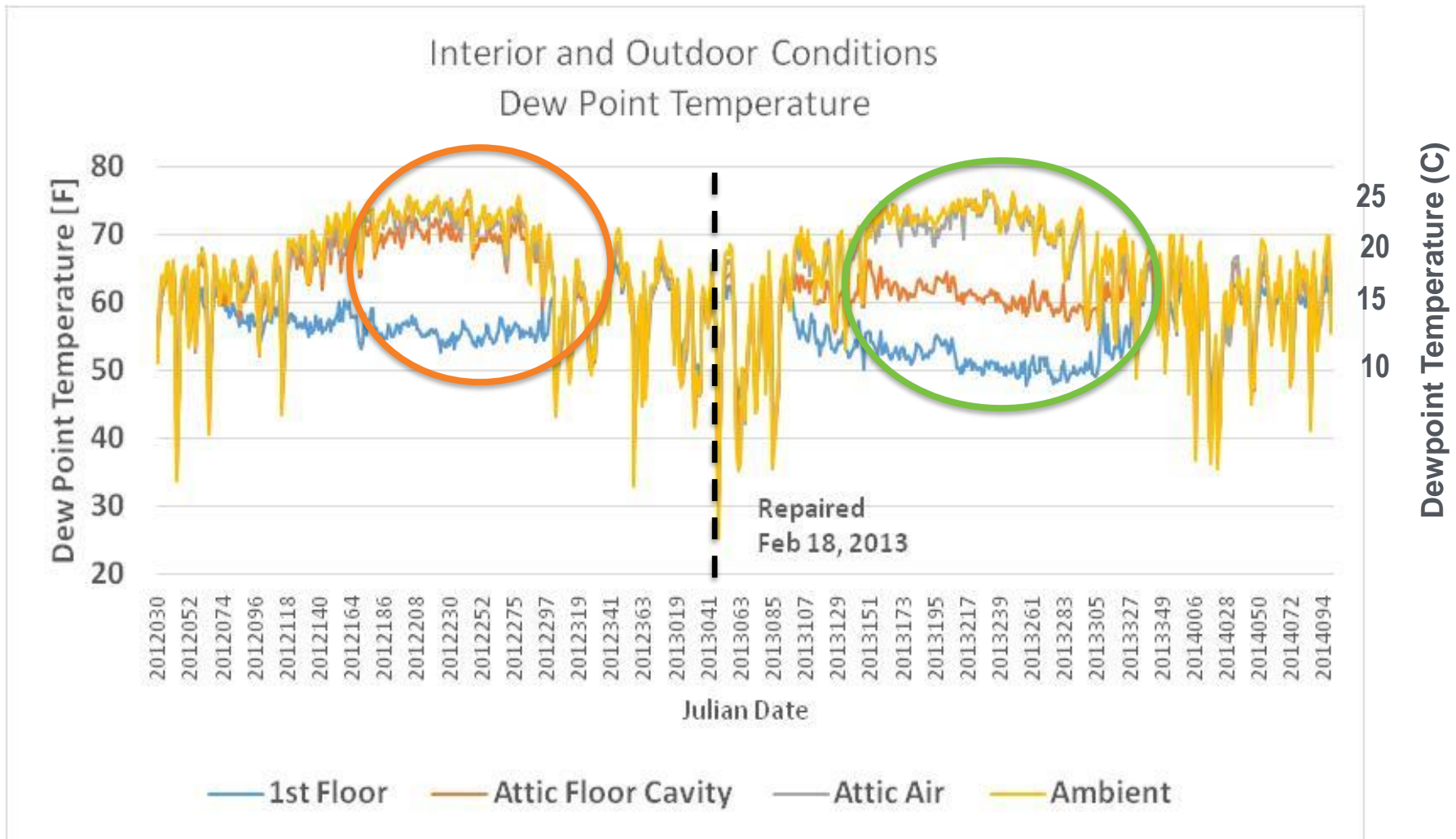


Yes, Foam Can Leak Too



House Floor Cavity Before and After Repair- Summer Impacts

Floor cavity becomes drier; Cooling savings 10.5%



Floor Cavity Repair Using Batt Insulation



Floor Cavity Repair Using Batt Insulation

Open pathways due to dropped ceiling area over kitchen (right) and around utility penetrations (below).



Floor Cavity Repair Using Batt Insulation

Faced batts can be used if installed carefully. Cut edges to fit penetrations. Mechanically fasten and seal at perimeter. (Duct tape does neither of these).



Floor Cavity Repair Using Batt Insulation

Faced batts can be used if installed carefully.

Paper face should not be exposed to attic according to building code and manufacturer (fire safety).



Moisture Damage From Wind Washing



Complimentary Pathway Through Floor- East to West

NE corner view



NW corner view

Inspection

Access into west side soffit open to floor space



History of Summer Moisture Related Problems

- Mildew stains and moisture on supply grills
- Condensation on duct in floor space dripping onto first floor ceiling.



- Warped pocket door



Moisture Damaged Stairs, Floors and Ceilings

- Moisture damage before repair on stair risers



Wind Wash Floor Cavity Inspection

- Inside east attic view of open floor space



Insulation in direct contact with cold supply duct resulted in condensation on duct and insulation. Sealing floor space around ducts must be done right.

Floor Cavity Repair Around Cold Supply Ducts

Insulation exterior with class I vapor retarder placed around ducts before spray foam application.



Air Leak Impacts from Floor Cavity Repair



- House tightness-
 - 11% tighter (ACH50)
 - 23% tighter if vented can lights in floor cavity
- Infiltration rate (tracer gas AHUon) decreased 30%
- Duct Leakage
 - Return leakage- 37% decrease
 - Indicated supply duct leakage decreased 38% (Ppan values 1st floor)

(Based on average of 10 houses that had no direct duct repairs made to them.)

Energy Impacts of Floor Cavity Repair in Florida

	Annual Cooling kWh	Summer Peak Hour Cooling kW	Annual Heating kWh	Winter Peak Hour Heating kW
Pre-Repair	9392	3.66	502	1.86
Post-Repair	8483	3.27	378	1.53
Savings	909	0.39	125	0.33
Savings %	9.7%	10.7 %	24.9%	18.7 %

909 kWh/yr @ \$0.115 / kWh = \$105 saved / year

Average annual savings closer to about 1,034 kWh / year may be realized if more heavily weighted for more homes towards south Florida.

Repair Costs

- Project repair costs avg. \$573 per house; 15.7m² (169ft²)
- Predict avg. repair cost about \$350 possible. (\$2.07/ft²)
- Average Payback in about 3-4 years.





New Construction Issues

Floor Cavity is Sealed by Plywood, But Little Clearance Between Roof Truss and Knee Wall.



Interior of This Wall Is Not Good Location for Batts !



Floor Cavity Covered by Plywood With Adequate Clearance Between Roof Truss and Knee Wall For Insulation



2nd Floor System Refrigerant Penetrations Into Floor Cavity Must Be Sealed.



Penetrations from return plenum into leaky floor cavity = return duct leaks



Summary

Floor cavity can be insulated/sealed with variety of materials. Primary considerations are how limited the work space is and sensitivity to cost.

- Generally, using materials readily available at home improvement stores will be less expensive.
 - May not be able to effectively seal some retrofits.
 - Less durable, kraft paper tears easily.

Summary

- Spray foam may be the only practical option when making repairs from within small vented attic spaces or when the area to be sealed has multi-faceted complex geometry.
- Spray foam is more likely to have better air seal.
- Be aware of code issue regarding requirement for fire ignition barrier. (intumescent coating, 1 ½ “ mineral fiber or cellulose, or ¼ “ hardboard or wood structural panel *per IRC 2012 Sect. R316.5.3 Attics*. Not required if foam plastic tested in accordance with Sect. R316.6)

Questions?

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