DRAFT

Impact of Spray Foam Insulation on Durability of Plywood and OSB Roof Decks

Presented to the

Florida Building Commission
State of Florida Department of Business and Professional Regulation

by

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1. Issues

- The practice of spraying foam to the underside of a roof deck has a 20-30 year history with no recorded systemic failures issues.
  Spray foam insulations have been used with increasing frequency in Florida residential constructions in both new and existing residential buildings.
- Premature deterioration of wood roof decks (plywood and oriented strand board sheathing) occurs as a consequence of long-term, high moisture load in the wood. Impermeable layers may contribute to this drying potential issue in the roof system.
- Moisture as liquid or moisture vapor may enter the wood either from above (through defects in the roof cover or flashing) of from the underside (by diffusion of moisture vapor from the air in the attic or occupied space).
- Spray foam insulations can create a barrier that reduces the drying rates of wood roof decks, which may result in an unfavorable build up of moisture in the wood. Different insulation formulations have differing effects (hygrothermal properties) on wood drying rates and moisture retention.
- Damage investigations of spray foam-insulated wood roof decks in Florida have found instances where deterioration of a wood deck has occurred due to water intrusion. The role that spray foam insulation may have played is subject of conjecture in the general literature; http://bit.ly/1tqMi9y; and in news media stories; http://bit.ly/1tqJN7f.
- Test reports and studies have documented several beneficial properties of using SPF insulation in the hot humid Florida climate. In addition to thermal insulation, some spray foam insulations are used a secondary water barriers and as a structural retrofit.
- Testing at the University of Florida has shown closed-cell foam additionally act as a secondary water barrier and provide substantially improved wind uplift resistance to wood roofs, Prevatt et al. (2010) http://bit.ly/1qasUsl. The UF testing did identify under abnormally high water leakage that water was retained by the wood sheathing that had closed cell spray foam onto it. The wind uplift resistance was not significantly affected Prevatt et al. (2014) http://bit.ly/1pwoj21.
- The FBC 2013 has approved the use of some SPF products (from five manufacturers) as a secondary water barrier, insulation and as structural retrofits in residential construction.

2. Relevant Sections of the Code (and Related Documents)

- R806.4 – Florida Building Code – Residential Buildings
- 611.7.1.2 – Florida Building Code – Existing Building
- 606.3 – Florida Building Code – Existing Building
- TAS 110 Testing Application Standard – Florida Building Code
- ICC-ES AC 377 – Acceptance Criteria for Spray Polyurethane Foam
- ASTM C1029

3. Statement of Work

- The scope of work primarily will address water accumulation from leaks through defective roofing and flashing materials.
- Form a Working Advisory Panel that consists of all stakeholders; Spray foam manufacturers, wood product manufacturers, roofing and general contractors, installers and consulting engineers (structural and mechanical) and homeowners. Advisory Panel will review and approve Experimental Research Plans before implementation.
- Solicit from the Advisory Panel and from the public domain all available literature and conduct a state-of-the-art review on the properties and field performance of spray applied foam insulations (open cell and closed cell foams), and related causes of water leakage and deterioration of wood roof decks.
- Develop experimental research plans for the a) inspection of existing houses and b) experimental testing of wood roof deck configurations to determine relative drying characteristics of the systems.
    - Design and fabricate a device to measure the comparative evaporation rates through roof cross-sections. Conduct testing to evaluate and compare the drying rates of traditional roofs, against roofs insulated with spray-applied foam insulation of various permeabilities. This first phase proof of concept (controlled temperature and humidity) is advisable before more extensive comparison.
    - Survey the roof constructions having installed SPF insulations to evaluate the relative moisture content in the wood sheathing and SPF layers. Conduct interviews with the homeowner/occupant as to the comfort and thermal efficiency and risk perception of the installations. Install temperature and humidity dta loggers in the roof attics to provide long-term record of temperature fluctuations adjacent to the installed SPF insulation in the roof.
    - Conduct numerical hygrothermal model of two representative wood roof systems with installed SPF insulation to compare with physical data from the test homes.
- Interpret results, and determine if any Code changes are warranted.
- Recommend follow-up testing if necessary to evaluate the impact of moisture from within the attic space and/or conditioned space within the house.
- Produce a report that explains the results and implications for the Code.

4. Budget

Travel costs are included to visit five homes, assuming they are located in Miami, FL. Actual travel budget may vary from this estimate depending on the location:

1. Fuel for transport of personnel. Assuming 5 trips (1 trip per house) originating from Gainesville to Miami, 300 miles x 2 to drive to house, cost of diesel is $4.25/gallon, 8 miles/gallon = 600 / 8 x $4.25 * 5 = $1,594
2. Per Diem and Shelter:

a. 2 people x 5 days x $46/day per diem = $460
b. Faculty/staff x 5 nights * $145/night = $725
c. 1 student x 5 nights * $145/night = $725

3. Salary for personnel (see budget)

Table 1. Budget

Budget	Amount
Salaries	$41,412
Fringe Benefits	$8,066
Equipment	$0
Utilities	$0
Travel	$3,504
Misc. (M&S, Tuition)	$28,920
Indirect Cost/Overhead	$8,190
TOTAL	$90,092

The miscellaneous cost includes $12,208 for graduate student tuition, $1,020 for temperature and relative humidity sensors/data loggers to be installed at two homes, $9,000 to build specimens and a small environmental chamber and $8,000 for approximately 50 hours consulting engineer time to develop a WUFI long-term hygrothermal model of attic and roof conditions. Research personnel time will be reported and certified using a "loaded" rate computed from the following table. Note that the indirect cost shown in Table 1 is computed from the indirect cost in Table 2 + the indirect cost associated with the travel and miscellaneous categories.

Table 2. Breakdown of the hourly compensation rate

Person	Hours	Hourly Rate	Fringe	Tuition	IDC	Total
F. Masters	15	$73.18	$20	$0.00	$9	$1,543
D. Prevatt	170	$63.47	$18	$0.00	$8	$15,168
K. Gurley	15	$65.93	$18	$0.00	$8	$1,390
Lab Staff*	160	$29.19	$9	$0.00	$4	$6,770
Admin Asst	20	$23.30	$11	$0.00	$3	$746
Grad. Students	1,000	$21.00	$3	$10.90	$2	$37,026
Undergrad. Students	240	$10.00	$0	$0.00	$1	$2,682

*Multiple lab staff may be used. Maximum anticipated hourly rate shown

5. Deliverables

- A report providing technical information on the problem background, results and implications to the Code submitted to the Program Manager by June 1, 2015.
- A breakdown of the number of hours or partial hours, in increments of fifteen (15) minutes, of work performed and a brief description of the work performed. The Contractor agrees to provide any additional documentation requested by the Department to satisfy audit requirements.