



CLOSED-CELL SPRAY POLYURETHANE FOAM

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THE USE OF CLOSED-CELL SPRAY POLYURETHANE FOAM (ccSPF) TO ENHANCE THE STRUCTURAL PROPERTIES OF ROOF ASSEMBLIES.

This article discusses research and testing that document the ability of closed-cell spray polyurethane foam - FOAM-LOK FL 2000 to add structural strength to roof assemblies.

It has been known for many years that a ccSPF roofing system can enhance the wind uplift resistance of a roof covering. Field observations of ccSPF performance after Hurricane Hugo and Andrew led to Spray Foam Alliance (SPFA) sponsoring wind uplift testing of SPF roof systems by Underwriters Laboratories (UL) and Factory Mutual Corporation.

Lapolla Industries recently conducted wind uplift testing at Certified Testing Laboratories CTL in Orlando Florida. CTL is an independent test facility certified by Florida State and Miami Dade County. The purpose of the test was to determine the wind uplift capabilities of wood deck assemblies related to the roof system by applying our FOAM-LOK FL 2000 ccSPF to the underside of the wood deck assemblies.

Description of Test:

In accordance with the test protocol, the test was conducted in two phases –

1. Uniform Structural Load Test – Static Test or Vacuum
2. Fatigue Loading Test – Cycle Load – the differential in static air pressure, creating an inward and outward loading, for which the specimen is to be tested under **repeated** conditions.

This test method is a standard procedure for determining structural performance under uniform static air pressure difference. This typically is intended to represent wind loads on exterior buildings elements and is accepted by the State of Florida and Miami Dade County for high wind resistance.

Test Specimens: (3 samples)

48" x 96" x 1/2" thick plywood panels with five (5) 2"x6" wood rafters one at each end and spaced at 24" OC. FOAM-LOK FL 2000 ccSPF was applied as a fillet on both sides of the rafter connection to the plywood panel. The FOAM-LOK was actually used to fasten the plywood sheathing to the 2"x6" rafters. **Note: No fasteners were utilized to secure the plywood to the rafters.** See drawing attached.

Results:

1. **Uniform Structural Load Test** – Static or Vacuum (negative pressure/ wind uplift)

Sample # 1- App. a max. test load of 270 pounds per s.f. = design pressure of – 135 psf

Sample # 2- App. a max. test load of 280 pounds per s.f. = design pressure of - 140 psf

Sample # 3- App. a max. test load of 240 pounds per s.f. = design pressure of - 120 psf

Note: A 50% safety factor is applied to the maximum test load.

Failure:

No adhesive failure occurred between the foam and the plywood sheathing. Failure only occurred when the rafters broke and pulled away from the perimeter framing.

2. Fatigue Loading Test – Cyclic Test

A maximum of 671 cycles were conducted on 3 additional samples and deflection was measured at center mid span.

Sample # 1 = 0.125” maximum deflection

Sample # 2 = 0.1875” maximum deflection

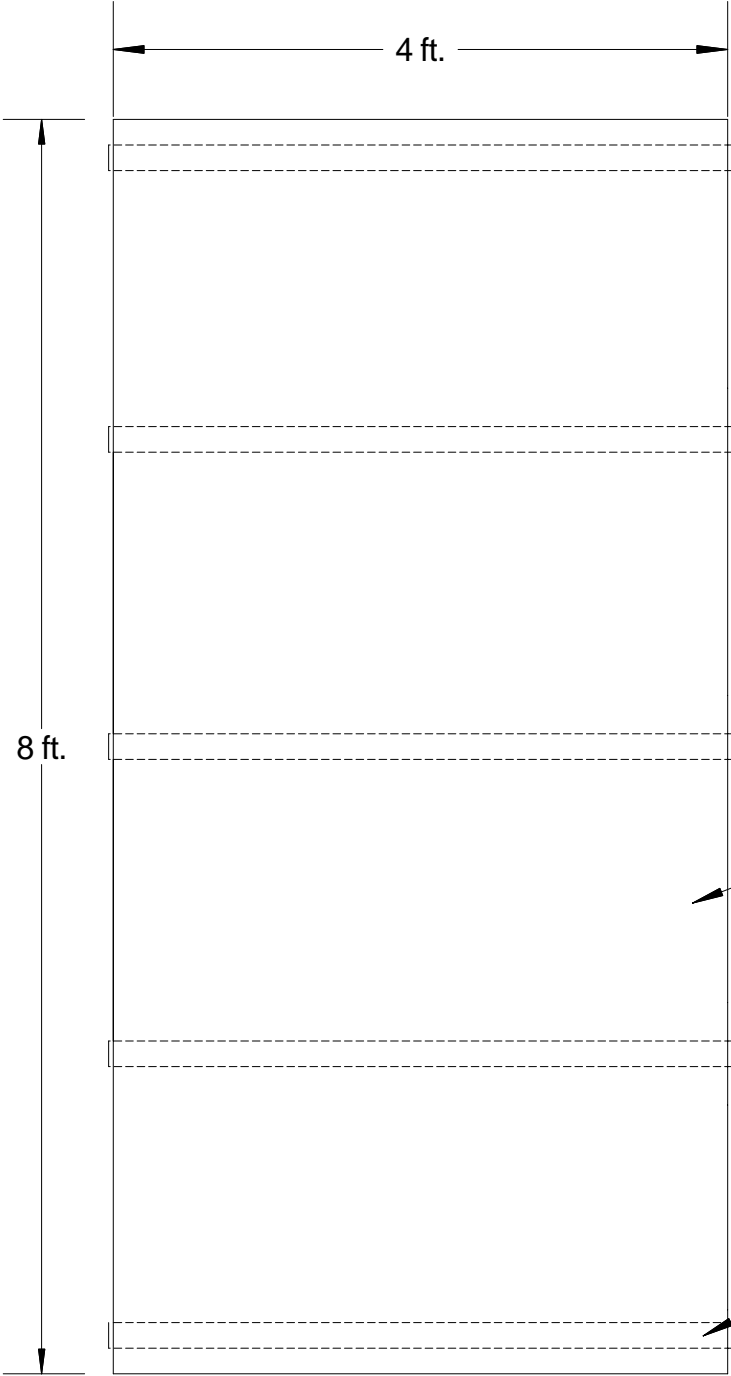
Sample # 3 = 0.125” maximum deflection

The specimens showed no resultant failure after cyclic test was conducted

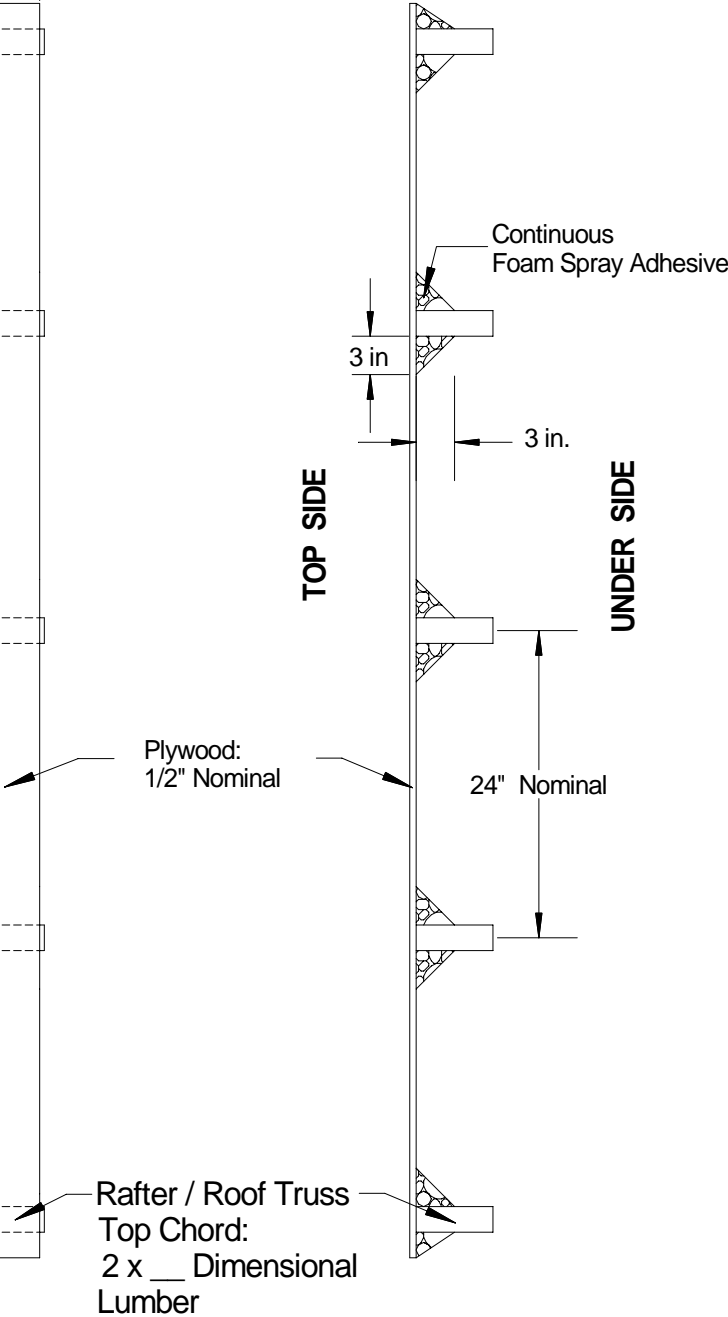
Conclusion:

The results of the test demonstrate that ccSPF can help increase the racking strength of roof assemblies. During a design racking event such as a hurricane, there would be less permanent deformation of roof elements and possibly less damage to a structure that was braced with ccSPF. It must also be noted that in standard construction, the plywood sheathing is mechanically attached to the rafters with nails at 4” and 6” on centers. With the addition of the ccSPF to the underside of the deck the uplift of the roof and sheathing system can be doubled based on the results of the test.

TEST BED SAMPLE



PLAN VIEW
FROM TOP SIDE



SECTION VIEW