

NAHB BUILDING WALL TEST

National Association of Home Builders

SPRAY FOAM INSULATION ADDS UP TO 300% SHEAR STRENGTH TO THE STRUCTURE

Introduction

The NAHB Building Wall Test was initiated by the Polyurethane Foam Structural Quality Assessment Committee of The Society of the Plastics Industry, Inc. in March 1992. The objective was to establish the structural value of spray in place polyurethane foam used in wood frame wall constructions. The original plan called for three phases. The first was a paper review of all available data, the second was laboratory evaluation and the third was full model testing.

Objectives

The original plan intended to quantify the structural value quality of the sprayed polyurethane foam (SPF). The tests were to show that the sprayed polyurethane foam could replace building components such as studs, sheathing and corner bracing. The National Assn. Of Home Builder's Research Center was selected to carry out the plan. It was determined that tests would be performed for racking (shear) resistance and also for compressive (axial) resistance. A total of 45 panels would be built using different configurations.

Racking (Shear)

This test evaluates the resistance of the wall construction to wind forces on the wall. Conventional construction of walls requires bracing using panels or diagonal bracing straps. Thirty racking panels were constructed. Eighteen of these were filled with sprayed polyurethane foam (SPF). For comparison, twelve control panels were constructed without SPF. These panels were built using 2x 4" and were 8 ft. high by 8 ft. wide. Half inch, 4 ft. x 8 ft. sheet rock was installed horizontally on the panel with the seam taped and finished. The conventional panels used half inch fiberboard sheathing or half-inch plywood on the exterior walls. As compared to the panels without foam or sheathing: the foam filled panels were 300% higher in pounds of resistance for the wood siding (T1-11) and 200% higher for the vinyl panels. This clearly proves that sprayed polyurethane foam adds racking strength to wall panels.

Compressive (Axial)

The second test that was performed is designed to determine if the PF would add any strength to the compressive capabilities of the wall construction. The axial test measures the resistance of panels to a compressive load as would be imposed by the dead or live loads of overhead floors or roofs carried by the walls. The wall strength in this test comes from the stud spacing and the sheathing materials. Adhesion of all the construction elements is important to the overall strength of these test panels. Again both wood and vinyl siding were used without sheathing for the sprayed polyurethane foam. The test was

for 16" on center and also 24" on center studs. Each stud spacing variation was done with the vinyl and wood siding.

The values of the wood siding with sprayfoam were very similar for the 16" and 24" on center studs. This shows importance of adhesion for the strength values. The 16" vs. 24" on center stud values for vinyl were not as close. The increase stud spacing showed lower strength values. This can probably be attributed to the building paper (felt) that was used between the foam and the vinyl siding.

Summary

The test has positively shown that the sprayed polyurethane foam adds strength to the wood frame wall panel. The racking test shows that the foam/wood siding material can be as strong or stronger than the conventional plywood panel/fiberboard sheathing construction technique. Special bracing for wind resistance would not be required for strength purposed when using sprayed polyurethane foam in the wall. The 16" o.c. stud spacing using SPF in the walls without sheathing comes very close to the values of conventional panels when tested for compressive (axial) strength. The use of sprayed polyurethane foam can become a major factor in reducing the cost of wood frame construction by allowing 2 x 6 replacement with 2 x 4's.



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