



THE ADHESIVE AND SEALANT COUNCIL, INC.

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Office of Policy Development and Research, Room 8134  
451 Seventh Street, SW  
Washington, DC 20410

SUBJECT: Progress Report – March 2007

Contract No. H-21521CA, Investigation of Adhesive Applications for Strong and More Disaster-Resistant Roof Assemblies – Phase 1

Period of Performance: 4/7/06 – 10/7/07

Contractor: The Adhesive and Sealant Council, Inc.  
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Email Attachments which Accompany this Report:

- None

## **SECTION I – INTRODUCTION**

The HUD Office of Policy Development and Research has been extensively involved in supporting research and development on building technology innovations, construction systems, products, standards, regulations, and code issues which affect the affordability, safety and livability of the nation's housing. As the interrelationships of these topics become more complex, the continued need to conduct research and demonstrations becomes even more critical.

In addition to the research and demonstration efforts administered directly by the Office of Policy Development and Research, HUD administers the Partnership for Advancing Technology in Housing (PATH) program. PATH provides private and public sectors for the U.S. housing industry an unprecedented opportunity to advance state of the art practices in the design and construction of affordable housing for the public by accelerating the process of developing and introducing new and innovative technologies and new materials through demonstrations and pilot projects throughout the nation.

This cooperative agreement with the PATH program will investigate and characterize the use of adhesives to fasten roof sheathing materials to underlying roof structures in residential buildings.

This application of adhesives holds the potential for improvements in roof system durability and disaster resistance, and applies to both new and existing construction.

## **SECTION II – PROGRESS AND SCHEDULE**

Phase 1 of this project consists of 4 tasks. The status of each task is presented below.

This monthly report reflects a period of performance of 18 months as noted in the previous monthly report. Dates for several task deliverables now reflect this period of performance.

### **Task 1. Assess Performance Requirements and Develop Criteria for Adhesive Consideration**

Start Date: 04/15/06

Deliverable & Due Date: Summary of adhesive-based roofing attachment systems, relevant building code, relevant product standards, and related research programs. Submitted to GTR 8/22/06.

Progress and Deliverables:

Task 1 called for ASC and its subcontractor Newport Partners (NP) to better understand the performance requirements needed from adhesives used in roof assemblies by a) canvassing building code and product standards, and b) investigating related research and product testing. Together ASC and NP have completed this task by engaging dozens of industry stakeholders, including ASC members and non-member adhesive manufacturers, researchers from academia and private firms, industry associations, building code bodies, and international groups involved in research and testing. Findings can be grouped into the following categories:

- Similar research and product development efforts
- Findings on the most suitable applications for similar systems (e.g. retrofit of existing roofs)
- Relevant building code issues that affect the application (e.g. issues with fire blocking for foam plastics)
- Relevant building performance and installation issues which have been raised (e.g. restricting ability of sheathing panels to expand/contract with ambient humidity changes)

The results of these research efforts are presented in the Task 1 summary report submitted to HUD in August 2006.

### **Task 2: Assessment of Industry and Market Factors**

Complete by March 1, 2007

The objectives of this task are to:

- Conduct assessment of jobsite factors which are involved when using adhesive-based systems (especially in new construction). More information is needed on these issues to understand the magnitude of potential barriers.
- Investigate and characterize insurance industry programs focused on encouraging improved water resistance and uplift resistance for roof systems (new and existing) to mitigate future damages. This will improve our understanding of industry interest in applications involving adhesives.
- Determine the most feasible application(s) moving forward based on performance, building code, “constructability”, and market factors. This effort involved a roundtable discussion of adhesive manufacturers at the ASC Fall Convention to get their input.

Task 2 Deliverables:

- Summary report of jobsite factors, including assessments of different application strategies
- Summary report on insurance industry initiatives which could impact adoption of adhesive-based systems

Task 2 Progress:

In March we continued monitoring developments in state regulations requiring insurers to provide wind mitigation incentives. Notable findings:

- The state of Florida now requires private insurers to provide homeowners with actual premium reduction amounts that would result from them applying certain mitigation measures. Discounts are applied only to the wind portion of the homeowner’s premium, which is roughly 15 and 70% of the total premium depending on location.
- The state of Mississippi passed legislation which will require insurers in the state to offer homeowners premium discounts for applying wind damage mitigation measures. This sets the groundwork for a program similar to Florida’s.

The groups we are engaging in this research include:

- the Texas Department of Insurance (TDI), which oversees regulation of insurers in the state of Texas and works with the Texas Windstorm Insurance Association (TWIA)
- Institute for Business and Home Safety (IBHS)
- Florida Department of Community Affairs
- A US DOE contractor engaged on a project to work with states and the insurance industry on establishing wind damage mitigation programs.

In March we submitted a summary report of insurance industry incentives. While the summary report on insurance incentives is now complete, it is very likely we will continue work under this area as the project moves forward and we continue to work with stakeholder groups.

As a second part of this task, we have assessed jobsite factors which need to be considered for the successful use of adhesives in both new and retrofit applications. These items are considerations for this application which may affect the installation of adhesive or related materials, as well as long-term performance and maintenance. A summary of jobsite factors is presented below, along with potential approaches for addressing the issue. Two relevant standards are referenced in the table below, as these material standards have been referenced in prior testing of adhesives used in roof systems: AFG-01 Adhesives for Field-Gluing Plywood to Wood and ASTM C557-03: Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing. In some instances noted below, the material properties required in these standards may not adequately address the installation and use of adhesives in a residential roof system.

**Table 1: Summary of Jobsite Factors**

<b>Jobsite Factor</b>	<b>Potential Approaches</b>
<p>Application conditions: cleanliness of surfaces to be bonded and their smoothness</p> <p>This applies to both new construction and retrofit applications.</p>	<p>Surfaces should be clean and meet specifications for the chosen adhesive. Nails will be needed to set the decking into the adhesive in new construction, because sheets of OSB or plywood are often warped and will not sit flat without nails. ASTM C-557 also states that mechanical fasteners should be used in addition to adhesives for framing to drywall connections.</p> <p>For material smoothness, AFG-01 requires that adhesives shall be capable of maintaining a bond between the framing and plywood which are separated by a 1/16” gap. This gap specification should suffice in most new construction for establishing a bond between the top face of a truss/rafter and the OSB or plywood that sits on top of this member.</p> <p>However if an adhesive <u>tape</u> is being used, material smoothness will need to be closely assessed as the ability of the tape to bond to surfaces is a function of material smoothness.</p>
<p>Application and service conditions: ambient temperature and relative humidity</p>	<p>Per AFG-01, an adhesive shall be a ready-mixed, gap-filling construction adhesive which sets at temperatures above 32F. If adhesives will be applied at field temperatures less than 32F, the properties of the specific adhesive should be confirmed.</p> <p>AFG-01 shear strength properties are measured following wetting of samples and drying at high temperatures. However it is not clear how this testing protocol translates to the long-term performance of the adhesive bond in this application, given the temperature and RH</p>

	<p>extremes and cycles found in an attic environment.</p> <p>AFG-01 also has requirements for oxidation (aging) resistance: the adhesive's ability to resist becoming brittle and deteriorating is tested in an environment with pure oxygen and elevated temperature and pressure. A free film of dried adhesive shall not break when bent 180 degrees around a ¼" diameter mandrel, after 500 hours of exposure in an oxygen pure atmosphere as described in the standard. Again, this specification provides some measure of aging testing, but the correlation to service life in an attic environment is not clear.</p>
<p>Open Time for the Adhesive – how long do installers have after applying the adhesive to roof framing to then set the deck panel on top of it. This is a new construction issue primarily.</p>	<p>Per ASTM C-557-03, the adhesive shall have an open assembly time of between 10 to 20 min to give the user sufficient time to apply and, if necessary, reposition the gypsum wall board at ambient temperatures, ranging from 40 to 100°F (4 to 38°C). Shear strength testing in AFG-01 is performed for an open assembly time of 10 minutes.</p> <p>Based on limited field trials in new construction, an open time of 10 minutes is reasonable. Installers should apply only as much adhesive on framing as they expect to cover with decking in a 10 minute period.</p>
<p>Removal of Damaged Sheathing - Adhesive bonded sheets of sheathing may need to be replaced at some point if they are damaged. Removal of such sheets could be quite difficult due to the bond created at the perimeter of the sheet.</p>	<p>This issue would apply more to new construction. In retrofit applications it may be possible to cut away the adhesive which is applied at the 90 angle between the underside of the roof deck and the side of the truss/rafter.</p>
<p>Access to Roof Area Out by the Eaves – In existing homes where the adhesive is applied from within a closed-in attic, gaining access to the underside of the roof deck out by the eaves can be very difficult when the roof slope is low. This is an important section of the roof to strengthen as wind uplift forces are greater here than other sections of the roof.</p>	<p>One solution that has been used in a simple extension for a caulk gun that can be fabricated using common materials and tools. The extension allows an applicator to reach the edge of the roof while standing several feet away.</p> <p>This issue does not apply to new construction, as access from above is still available.</p>

Additional factor affecting the use of adhesive in new or retrofit applications will be added as appropriate.

### **Task 3: Code Evaluation and Preliminary Tests**

Complete by June 1, 2007

The objectives of this task are to:

- Explore solutions to code issues for the chosen applications: including the fire protection issue and the pathway for meeting performance-based suction load requirements.
- Conduct preliminary testing (in conjunction with ASC members or other manufacturers) to evaluate system performance and assess potential solutions to constructability issues. For example, testing of mocked-up new construction roof systems might employ a pre-applied adhesive tape applied to the top surface of the truss.

Task 3 Deliverables:

- Summary of relevant code issues and strategies for compliance
- Summary of preliminary testing – including test design, findings, and recommendations

During April we will develop a strategy for testing and demonstrating this application. While preliminary lab testing may be difficult to conduct under this phase of the project, we have developed a thorough set of research needs for follow-up work.

Also under this task, the chief code issue which will be documented will be thermal protection of foam plastics. This issue has been cited by at least one commercial vendor of adhesive systems for roof systems as a major code difficulty.

### **Task 4 : Analysis and Outreach**

Complete by October 30, 2007

The objectives of this task are to:

- Summarize, based on results of Task 3, current “gaps” in adhesive-based roof sheathing attachment systems in three core areas: 1) performance testing, 2) codes, and 3) solutions to constructability issues.
- Develop a primer on using adhesives to strengthen roof systems. Guidance document would be aimed at the appropriate audience, e.g. if the application is new construction the audience would be builders and contractors; for retrofit applications the audience would be contractors, roofers, and DIY homeowners. The short (~ 2 page) primer will explain the benefits of using an adhesive-based system, the intended application, and recommendations for materials.

Deliverables:

- Report on findings and remaining information gaps
- Primer on using adhesives to strengthen roof systems

Task 4 Progress:

Also, we will be presenting the project and its current findings at the ASC Spring Convention on April 15-18 in Savannah, Georgia. During March we prepared an overall project briefing for this presentation, which is being submitted along with this monthly report.

This effort will increase the visibility of the project within the adhesives industry and potentially enhance the contributions of manufacturers to the research.

### **SECTION III – KEY STAFF CHANGES**

None to report.

### **SECTION IV – PLANNED EFFORT**

Activity for April 2007 will focus on continued dialogue to learn of insurance industry opportunities for this application and developing a plan for testing and demonstration. We will also present on the project and its progress to adhesive industry stakeholders at the ASC Spring Convention.