Strengthening Residential Roof Assemblies:
Adhesive Tape Field Trial

THE ADHESIVE AND SEALANT COUNCIL, INC.

Submitted by:

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Introduction

Home owners, insurance industry groups, and the federal, state, and local governments are all evaluating methods to increase a home's ability to withstand hurricane forces winds and reduce property damage/loss. This case study is part of a two-part series on field trials which gathered information on the process of roofing a new home using liquid adhesives and adhesive tape (in additional to traditional nailing) to fortify the roof assembly. Information on the application process, constructability issues, impacts on other building systems, and stakeholder perceptions were gathered by documenting the construction process and conducting pre- and post-interviews with each construction crew.

The field trials and case study development were supported by the Adhesive and Sealant Council and the U.S. Department of Housing and Urban Development's Partnership for Advancing Technology in Housing (PATH) program. The Adhesive and Sealant Council is a trade association representing manufacturers and suppliers in the adhesive and sealant industry. The PATH program is a public-private partnership of leading-edge home builders, manufacturers, researchers, professional groups, and federal agencies concerned with housing. By working together, PATH partners improve the quality and affordability of today's new and existing homes, and help to create the next generation of housing for America's families.

This particular case study focuses on the use of an acrylic adhesion tape to bond roof sheathing to roof framing members in a new residential roof assembly. The field observations were conducted by Newport Partners LLC, a research firm specializing in construction technologies, codes, and market research.

Special thanks go to Wise Choice Construction and Chad Garner, for allowing us to document their work, and 3M, for supplying the adhesive tape used in the field trial.

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Adhesive Tape Field Trial

Newport Partners conducted a field trial in which roofers applied an adhesive tape on the roof assembly of a new addition. The adhesive was attached to the rafters and then the roof sheathing panels were applied and fastened to the underlying rafters. The objective of this trial was to document constructability issues and gather insights from the roofing crew on applying adhesive tape on roof assemblies. This report summarizes the findings.

Overview

This was an 18' by 24' addition to an existing home. The roof line was shed-style, with two smaller sloping sides. The design and size of this addition are typical of the type of additions commonly added to American homes.

The roof framing members were wood 2x10s, spaced at 16" on-center and sheathed with 7/16" OSB panels. A stack of panels was lifted to the roof level using an all-terrain Bobcat with a forklift attachment. The crew worked directly from this stack, including cutting/sawing sheathing panels on the elevated stack.

The observed addition was constructed on a home located in southern Maryland's Chesapeake Bay region.

Adhesive Tape

The adhesive tape used in this field trial was supplied by 3M. Although, no performance or strength testing was conducted during this observation, the following describes the tape's characteristics.

The tape was a Beta Tape, an acrylic sealing and adhesion tape. (Pictures 1 and 2). This tape was selected because it can bond with many substrates without any primer, including wood framing members, plywood, and chip board. This tape also compares favorably with conventional butyl tape in terms of initial adhesion, heat resistance, and durability. The tape is 0.787" in width and comes on a roll that is 98.4' in length. The tape has a thickness of approximately 1mm before application.

This was a double-sided tape, one side was covered with a protective paper film.

Picture 1: 3M tape used in the field trial.

Picture 2: The white protective paper on the tape.

Construction Sequence

Once the rafters and fascia boards were completely installed and the roof frame was ready to apply decking, the crew began to attach the adhesive tape. At first a roofer attached the tape at the top of the roof and section by section he unrolled the tape down the rafter. This process was repeated for roughly four rafters (Picture 3).

Picture 3: Unrolling the tape with one person.

The crew employed a different strategy when two crew members applied the tape. One roofer would hold the roll of tape and stand at the bottom edge of the roof. Then the other roofer would walk up the rafters holding the end of the tape. Once he reached the top, the roofers would lay the tape down on the rafter in one long piece (Picture 4).

Picture 4: Applying the tape with two people.

As the roofer backed down the rafter to start the application process over again, he would run his hand over the recently applied tape to smooth it out and help the tape bond with the framing member.

Once the tape was applied to the rafters, the roofers began to set up for sheathing the roof. A stack of panels was lifted to the roof level using an all-terrain Bobcat with a forklift attachment. The crew worked directly from this sheathing stack, including cutting/sawing sheathing panels on the elevated stack.

When installing the first sheathing panel, the crew only peeled back 4' of the protective paper from the tape (Picture 5). The sheathing panel was placed onto the tape and secured in place using hand-driven nails.

Once the first sheathing panel was in place, the roofing crew removed the tape's protective paper from every taped rafter. When removing the protective paper, a roofer would walk up to the top of a rafter and peel back the paper off of one rafter. Gradually, the roofers began removing two protective paper coverings at a time (2 rafters at a time), and finally ending with removing the protective paper on three rafters at the same time.

When removing the protective paper, the last one or two inches of the tape would lift off the rafter along with the protective paper. A crew member would then need to reposition the tape back onto the rafter. This problem only occurred at the end of the tape, not in the middle.

Picture 5: Crew installing the first sheathing panel.

Picture 6: Some rafters with tape still protected and others with the protective paper already removed.

Once all of the protective paper was removed from the adhesive tape, the crew installed the remaining sheathing panels. The adhesive tape did prevent the crew from sliding the sheathing panels on the rafters, as the crew typically does when positioning sheathing panels. For the first row, the crew paid particular attention to making sure the edge of the sheathing panel was completely even with the fascia board on the first try (so no re-positioning was necessary).

Picture 7: H-clips with sheathing panels installed.

After the first row of sheathing panels was installed, the crew attached the required H-clips to the panels to allow for expansion but the clips also helped guide the placement of the subsequent rows (Picture 7). Under normal circumstance the crew would set sheathing panels on the rafters and slide the panels downward into the clips. Because the adhesive tape prevented the panel from sliding once it was laid on the rafters, the crew gradually lowered the sheathing panels onto the rafters while simultaneously inserting the panels into the H-clips. Occasionally, a crew member would tap the sheathing panel with a hammer to firmly set the panel into the H-clip.

The crew temporarily attached the sheathing to the rafters with hand-driven nails, a pneumatic nail gun was used later to permanently fasten the panels to the framing members.

Observations

The adhesive tape field trial produced a series of insights provided through observation and interviews with the roofing installers. The companion document to this field trial, *Strengthening Residential Roof Assemblies: Liquid Adhesive Field Trial* has additional insights that could be of interest.

- The application of adhesive tape provided no major construction issues that would hamper its integration into the roofing construction sequence.
- This roofing crew, quickly introduced efficiencies into the construction sequence, including applying the tape on a rafter in one long strip and removing the protective paper from multiple rafters at one time.
- Initially, the crew was concerned about not being able to adjust or slide the sheathing panel once it was set on the rafters. The crew needed to insert the sheathing panel into the H-clip while they lowered the sheathing panel because they couldn't move the panel once it was on the rafters (Picture 8). Setting the panels in this manner did take slightly more time than using the traditional method.

Picture 8: The crew inserting the sheathing panel into the H-clip as they lower it to the rafters.

- After the protective tape was removed the crew did walk on the exposed tape. They did not note any issues related to walking on either the exposed or protected tape; and in fact the tape did not stick to their shoes or pull off the rafters. However the crew tried to minimize stepping on the exposed tape, which helped prevent the adhesive face from getting too dirty.
- The protective paper covering created a fair amount of waste. Once removed, the protective paper was hard to keep in the yard, especially when a breeze would come. Additionally, the protective paper did create a nuisance for the crew, because the strips were 20' long and would get wrapped around power tool cords.
- The crew noticed no difference in hand-driving and pneumatically-driving nails through the sheathing and tape into the framing members.
- Nail "misses" occur pretty frequently, which offers credibility to the value of a back-up attachment method.
- The plywood sheets definitely need to be nailed down immediately to the truss even when adhesive tape is applied, because this connection helps set the sheathing into the adhesive tape, and almost every panel of roof sheathing had some warp to it and would not sit flat without being nailed down to the framing.

- Pre-applying the adhesive tape to the rafters, while the rafters are on the ground, could save time and reduce safety issues. Potentially, a tape product of this type could even be pre-applied in a truss shop prior to jobsite delivery. Although, factors related to the tape's ability to handle exposure to the weather and normal jobsite handling procedures would need to be investigated.
- The crew suggested using heat activated adhesives, similar to the type found on shingles. This would reduce, and possibly eliminate, the application time needed to apply the adhesives.

Conclusion

The application of adhesive tapes onto new roof assemblies to supplement traditional fasteners was not difficult. The observed framing crew easily incorporated the application of adhesive tapes into their construction sequence, and even showed application efficiencies. As roofing crews become more experienced in applying adhesives to roof assemblies, application errors should be reduced.

This preliminary field trial demonstrated that the application of adhesive tapes does not appear to present major difficulties in terms of constructability. However builders, and to some extent homeowners, need to see clear value to the dual strategy of adhesives supplementing nails, since applying the tape will be viewed as an additional step.

The potential value gained from using adhesives on roof assemblies can be shown in multiple ways:

- Adhesives add strength to roof assemblies which is especially important in high wind zones
- Adhesives provide a margin of error for fasteners which are the wrong type, not spaced correctly, or miss the framing member

Additional research which can help to further characterize the benefits of using adhesive tapes would include:

- Uplift strength testing of sample assemblies using adhesive tapes plus nails
- Alternative methods for application of adhesives to framing members
- Develop minimum standards for the use of adhesive tapes in roof assemblies
- Long-term uplift testing of nails-only and nails plus adhesive tape assemblies in a simulated attic environment.

These research needs are discussed further in the final summary report for this project, title "Research Overview and Gap Analysis."