# The Use of Housewrap in Walls: Installation, Performance and Implications

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Date: December 1998

## Preface and Acknowledgments

This project on Housewrap was initiated in an attempt to develop answers to concerns that had been expressed by a wide variety of people; builders, consumers, home owners and remodelers. If housewrap is replacing building paper, what's wrong with the building paper? Why is housewrap better? What does it do? Does it actually do all the things that it is supposed to do? Quite frankly we could not provide substantive answers to most of these questions. There was clearly a need that the PHRC was in a position to address.

Financial support was provided by:

· The Pennsylvania Department of Community and Economic Development (DCED);

· The Pennsylvania Builders Association (PBA);

· The Hankin Endowment;

· The individuals, associations, and corporations that are members of the PHRC; and

· The Pennsylvania State University.

Valuable assistance, such as the donation of housewrap material and product literature, was provided by the manufacturers of housewrap. Each manufacturer that was contacted gave willingly of their time and we are grateful for their cooperation. Ms. Theresa Weston of DuPont Nonwovens was particularly helpful.

Special thanks are extended to J. Roger Glunt for taking time from his busy schedule to assist in the field survey of housewrap use in Western Pennsylvania. The J. Roger Glunt Graduate Fellowship in Residential Construction provides financial support on a yearly basis to a graduate student interested in housing. Ed Bosack, one of the authors of this report, was the recipient of this fellowship for the 1997-1998 and 1998-1999 school years. Mr. Glunt's willingness to be involved and his knowledge of the housing industry was very helpful in the conduct of the survey.

The assistance of Michelle McMullen and Angela Burnett in producing the final version of the report is appreciated.

The PHRC is responsible for producing this report. We welcome questions or other feedback.

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Director

## Executive Summary

Housewrap is a thin, lightweight, fabric-like material that is used to cover the exterior sheathing of an exterior wall prior to the installation of the cladding system. Currently there are at least 10 different housewrap products being sold. Each of these products is advertised as providing a weather barrier and an air barrier without providing much additional resistance to water vapor diffusion.

This study was initiated for the following reasons:

- Conflicting opinions in builder/trade publications. There is little technical information as to the merits of using housewrap in the exterior walls of buildings.

- The absence of non-proprietary performance testing of enclosure systems incorporating housewrap.

The primary objective was to investigate the in-service performance of housewrap.

Each manufacturer provides information about the properties of their housewrap product. Data for five representative housewraps; e.g., strength, tear resistance, resistance to air movement, resistance to liquid water penetration, water vapor diffusion, etc., was compiled. Mechanical and physical properties are largely derived from standard test procedures but manufacturers do not always use the same test. Comparison is sometimes difficult if not impossible. A more important issue is that the standardized tests do not actually model the in-place housewrap.

A variety of methods are promoted to attach housewrap to the outer face of the exterior sheathing. Horizontal and vertical joints are overlapped and taped or otherwise sealed in order to stop the infiltration/exfiltration of air and to prevent the inward movement of any water. Window and door openings require proper flashing details that incorporate taping and/or sealing. Manufacturers of housewrap provide guidelines for the installation of their product. These guidelines were reviewed and summarized to develop a consensus view as to how housewrap should be installed.

A survey was then conducted by visiting building sites across Pennsylvania to determine how housewrap is actually being used. The results of the survey revealed that in many instances the housewrap was not being installed as specified by the manufacturer. In fact, 93 percent of the installations surveyed did not tape or otherwise seal joint locations. In addition, 73 percent did not tape or render the window/housewrap joint air or water tight by some means of sealing or taping. Housewrap can be attached to the sheathing using staples, large head nails or plastic cap nails according to the manufacturers' installation guidelines. 70 percent of the installations surveyed used staples. Many of these installations using staples had tears or holes because of overly robust installation techniques. The presence of holes and sloppy installation techniques raised concerns as to the actual effectiveness of the installed housewrap.

Having reviewed what housewrap is supposed to do and how it is actually installed in Pennsylvania, a series of experimental investigations were conducted to determine how housewrap works largely with respect to controlling air movement. A series of laboratory tests were conducted at the Building Enclosure Test Laboratory (BeTL) at Penn State University. These tests showed that the various housewrap products provide varying degrees of resistance to air movement. Under positive pressure, the housewrap was found to contribute to the control of air movement but rarely as well as advertised. Under suction, the performance of the housewrap can be very different. If the wall is airtight and this air tightness does not involve the

housewrap then, especially if a contact cladding such as horizontal siding is used, the housewrap performs satisfactorily¾largely because it is not engaged in resisting airflow. If however the wall is not otherwise airtight and the housewrap is engaged in contributing to resisting an air pressure differential, then stapled housewrap can hardly be considered to constitute an effective air barrier. Under suction pressures, the housewrap was found to balloon away from the sheathing. In some instances, the housewrap tore at fastener locations at pressure levels below service wind loads suggested by the BOCA code. Additionally, the contribution to air resistance of other building materials that make up the wall was quantified.

Housewraps use on new housing appeared to be predominant across Pennsylvania as seen in the survey. The following general conclusions were made:

- The installation guidelines provided by the manufacturers are adequate. However, as observed in the field survey, few installers seem to follow them.

- Laboratory tests clearly demonstrated that each of the proprietary housewraps has very different in-place characteristics especially with regard to controlling air movement.

- The type of fastener used for installation is important using staples can lead to tearing and stretching of the housewrap at the fastener location. The type of cladding chosen and its attachment will also have an influence on housewrap performance.