Economic Assessment of Basement Insulation for Pennsylvania

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Preface and acknowledgments

This report is the product of one of four projects on basements recently conducted by the Pennsylvania Housing Research Center (PHRC). The four reports together represent a comprehensive effort to address basement-related issues with reference to Pennsylvania in particular, and the north-east in general.

Financial support has been provided by:

- The Pennsylvania Department of Community and Economic Development (DCED),
- The Pennsylvania Builders Association (PBA),
- The individuals, associations, and corporations that are members of the PHRC,
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- The Pennsylvania State University.

*Economic Assessment of Basement Insulation for Pennsylvania*will be of interest not only to builders and developers but also to the regulatory community. The cost and the contribution of the basement to space-conditioning energy is often relatively small. Quantifying the energy-related performance of the below-grade area presents problems such as the following:

- A reasonably accurate analytical procedure is required.
- It is difficult to model the actual ground conditions.
- Use of the basement space and the degree of finish are highly variable.

This study seeks to address each of these concerns and arrive at insulation strategies that are both economic and practical.

The study was conducted by Dr. William Bahnfleth, Ms. Cindy Cogil, and Dr. Grenville Yuill. Valuable assistance was given by the following individuals and corporations and associations:

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

E. F. P. Burnett

Director

Executive summary

This study was undertaken to investigate the effectiveness of foundation insulation for both conditioned and unconditioned basements. A foundation heat-loss model of a representative basement was developed specifically for this purpose. Foundation assemblies considered include conventional cast-in-place concrete, cast-in-place concrete with insulating forms, and precast insulated concrete panels.

Parametric studies compared the effects of insulation location and R-values from zero to R-20 for basement exterior walls and from zero to R-30 for basement ceilings for three locations representing the range of Pennsylvania climates and two common residential heating and cooling plants.

It was found that some level of insulation can be economically justified for most conditioned basements in Pennsylvania. The optimal amount of insulation, however, is sensitive to the type of heating system, cost of heating energy, climate, and the economic life over which the added cost of insulation is recovered. Interior insulation was most cost-effective from the perspective of installed cost, and the largest R-values were justified for homes with electric heating.

Insulation requirements found in other sources were reviewed and compared with results of this study. Previously published guidelines for energy-conscious, cost-effective basement insulation vary widely in published codes, standards, and design guides. In general, these sources recommend lower levels of insulation than the findings of the present investigation.