

## 2004 Annual Report

### A. Overview

Since July 1988, the PHRC has served the housing industry in Pennsylvania by carrying out applied research and delivering education, training and technology transfer. The PHRC is located both at the Pennsylvania State University in State College and at the Pennsylvania College of Technology in Williamsport, thus fostering a synergistic combination of research, application and training capabilities. Through its access to faculty, staff, students and external consultants, the PHRC addresses many issues related to housing.

The PHRC operates with extensive industry input and involvement. Projects are selected with input and approval from the PHRC's Industry Advisory Council and its Operations Committee. Members include trade associations, product manufacturers and suppliers, government agencies, developers and individual builders and remodelers. This level of industry involvement, particularly the interest and support of the Pennsylvania Builders Association, ensures that projects and services meet the needs of the housing industry.

In addition to support from Penn State and the College of Engineering, the PHRC receives direct funding from the Pennsylvania Builders Association (PBA), the Home Building Industry, and the Commonwealth of Pennsylvania through the Department of Economic and Community Development. Contract funds are also received from sponsors of specific projects. The Hankin Endowment also contributes support.

### B. Personnel

Dr. Eric F. P. Burnett – Director of Research, Hankin Chair, Penn State  
Mr. Mark Fortney – Director at Penn State University  
Mr. Scott Brown – Land Use and Development Specialist, Penn State  
Mr. Ken Sagan – Training and Education Development Specialist, Penn State  
Mr. Rick Terry – Director, Factory Built Housing Center, PHRC at Penn College  
Ms. Michelle McMullen - Administrative Assistant  
Ms. Tracy DeSoto - Staff Assistant

## C. Training, Education and Outreach

The PHRC provided a wide array of training, education and technology transfer services to over 2,600 individuals at 87 workshops, seminars and other outreach activities in 2004.

Workshops and Training – See table below.

<b>PHRC Training Programs Delivered</b>			
<b>PROGRAM</b>		<b>Activities for 1/1/04 – 12/31/04</b>	
		<b># of Programs</b>	<b># of Attendees</b>
Comprehensive IRC Program for Code Officials	CO1	7	126
Overview of the IRC's Plumbing Requirements for Code Officials	CO3	5	90
Overview of the IRC's Mechanical Requirements for Code Officials	CO4	6	72
PA's New Energy Requirements for Code Officials	CO5	9	179
Comprehensive IRC Program	GA1	28	1106
Overview of the IRC's Plumbing Requirements	GA3	3	81
Overview of the IRC's Mechanical Requirements	GA4	8	285
PA's New Energy Requirements	GA5	8	247
IRC Update Program	GA6	1	26
Comprehensive IRC-Masonry Related Requirements	MA1	6	223
Other		6	217
<b>Total Programs Held</b>		<b>87</b>	<b>2,652</b>

### Conferences:

**12<sup>th</sup> Annual PA Housing Conference** – The PHRC held its Annual Housing Conference in two locations in February 2004. At the Valley Forge, PA location, there were 169 attendees. The Monroeville, PA location had 174 attendees. The morning program consisted of three primary sessions: Update on the PA State Building Code; Basements; and Non-vented Crawlspace. The afternoon programs were split into two tracks. The Land Development track consisted of these three sessions: PA's New Stormwater Policy, Infiltration Facilities, and Legal Issues. The Housing Technology Track consisted of these two sessions: Common Code Violations and Common Building Failures.

The PHRC delivered presentations at the following conferences:

- Straube, J.F., VanStraaten, R. and Burnett, E.F.P., "Field Studies of Ventilation Drying" *Presented at Buildings IX, Clearwater Beach, December, 2004.*
- Pinon, J.P., Davidovich, D., Shi, X., Burnett, E.F.P., "The Airflow Characteristics of Ventilated Cavities in Screen-type Enclosure Wall Systems." *Presentation at Buildings IX, Clearwater Beach, December, 2004.*
- Sagan, K., "Instructional Facility Operators Guide to the UCC," *Penn State Facility Management Conference, University Park, PA, October, 2004.*

- Sagan, K., “Mechanical Requirements of the UCC,” *Pennsylvania Petroleum Marketers and Convenience Store Operators, Annual Conference*, Hershey, PA, September, 2004.
- Sagan, K., “Builders and Code Officials, Bridging the Gap Through Training,” *International Code Council – Code Forum*, Salt Lake City, UT, September, 2004.
- Sagan, K. Two sessions were presented on “Uniform Pennsylvania Building Code” and “How the New Uniform Code will impact your business”. *Lancaster Realtors Association* Lancaster, September, 2004.
- Fortney, M., “Innovative Energy Code Implementation Strategies,” *State Energy Code Conference, U.S. Department of Energy*, July, 2004.
- Shi, X., Burnett, E.F.P., “Mechanics of 2D Flexible Membranes.” *Proceedings of the Second International Mechanics Conference*, Cape Town, July, 2004.
- Shi, X., Burnett, E.F.P., “Mechanics of 2D Flexible Membranes.” *Presentation at Second International Mechanics Conference*, Cape Town, July, 2004.
- Fortney, M., “Tips for Entering New Statewide Building Codes,” *2004 National Workshop on State Building Energy Codes*, Philadelphia, PA, July, 2004.
- Weston T., and Burnett E.F.P., “Membranes in Enclosure Wall Systems.” *Proceedings and Program Handbook of the BETEC 2004 Spring Symposium*, Arlington, Va., 10-11 June, 2004.
- Burnett, E F P, “The Membranes in Above-grade Enclosure Wall Systems,” *Proceedings of the BETEC Spring Symposium*, Arlington, Va., June 10-11, 2004.
- Fortney, M., “Making Houses Truly Affordable through Energy Efficiency Conference,” *Energy Coordinating Agency of Philadelphia*. Philadelphia, PA, May, 2004.
- Sagan, K., “Overview of IRC’s Plumbing Requirements for the Modular Housing Industry,” *PFS – Annual Conference*, Madison, WI, May, 2004.
- Fortney, M., Griebler J., and Tooley, J., “When Building Science & Codes Conflict” *Presentation at the Affordable Comfort Conference*, St. Paul, MN, April 28, 2004.
- Brown, S., “Barriers to Better Stormwater Management,” *Presented at the Pennsylvania State Association of Township Supervisors 82<sup>nd</sup> Annual State Convention*, Hershey, PA, April, 2004.
- Brown, S., “Stormwater Management from a Home Builders Perspective,” Presented at the Pennsylvania College of Technology, April, 2004.
- Brown, S., “Understanding Hydrologic and Infiltration Processes as they relate to the Construction of Infiltration Practices National Green Building Conference, Austin, TX, March, 2004.
- Burnett, E.F.P., “Ventilation Drying in Enclosure Wall Systems.” *Presented at NSF Housing Workshop in Orlando*, February, 2004.
- Brown, S. “Low Impact Development – Understanding Stormwater Impacts and Mitigation” *Presented at PA Housing Conference*, February, 2004.

- Eric F. P. Burnett, “Below-grade Enclosure Construction: Characterization and Categorization”, *Proceedings of the Ninth Canadian Conference on Building Science and Technology*, Vancouver, British Columbia, February 27 and 28, 2003, pp 238-249.
- Brown, S., “Low Impact Development – Are we Really Mitigating the Stormwater Impact?” Presented at the National Association of Home Builders, Las Vegas, NV, January, 2004.
- Burnett, E.F.P., Invited Presentation – “Whose Needs, Expectations and Performance?” *Submission to the Global Policy Summit on the Role of Performance-Based Regulations in addressing Societal Expectations, International Policy and Local Needs*, Washington, D.C., November 3-5, 2003.
- Eric F. P Burnett, “Roofing Systems Categorization”, *2003 Building Envelope Technology Symposium*, Roofing Consultants Institute, Dallas, 6-7 November, 2003, 22 pages.

#### D. NAHB Student Chapter

There are 22 student members; four were awarded scholarships and one student was awarded a travel grant to attend the NAHB Convention in Orlando, FL. These funds were provided by home builders.

#### E. Certificate Program in Housing

With the encouragement of the Hankin Advisory Committee, I developed a proposal to establish a six-course Minor in Housing within the College of Engineering. Penn State’s Senate Committee on Curricular Affairs approved the proposal on October 5, 2004. The certificate was available for the Fall 2004 semester at Penn State.

#### **Committees:**

PA Department of Environmental Protection—Stormwater Management Manual Oversight Committee

- Pennsylvania Builders Association (PBA):
  - Training and Education Committee
  - Editorial Review Board
  - Housing Finance Committee
  - Land Development Task Force
  - PHRC Committee

Pennsylvania Concrete Masonry Association, Code Committee

Advisory Council for the Modular Housing Training Institute (MHTI)

Advisory Council for the Manufactured Housing Resource Center (MHRC)

Dr. Burnett is Chair of the Building Environment and Thermal Envelope Council (BETEC) and an ex-officio member of the Board of NIBS (National Institute for the Building Sciences). He is also a member of to the Consultative Council for NIBS.

#### **DevelopmentEnergy Code:**

In early 2004, the legislation for a new state-wide building code was finally realized. The passage of the Uniform Construction Code (Act 45 of 1999) required the Pennsylvania

Department of Labor and Industry (DLI) to promulgate regulations for prescriptive methods to implement energy requirements. The PHRC was asked to provide a document that is simpler, more flexible, and focused on and better suited to Pennsylvania. Pennsylvania's Alternative Residential Energy Provisions were developed as an alternative to Chapter 11 in the IRC 2003.

**Code Training Consortium** – The Consortium consists of interested organizations, associations and state agencies that either provide building code training or represent groups that need access to training. Interest in membership in the Consortium is increasing as the group comes together. The CTC held a meeting on July 13<sup>th</sup> and October 8<sup>th</sup> in Harrisburg, PA.

**Subdivision Design Guidelines** – The PHRC has developed draft Subdivision Design Guidelines. These guidelines were developed at the request of the Pennsylvania Builders Association. The goal of this initiative is to develop a set of guidelines that could be adopted by municipalities to regulate land development activities for residential subdivision. The standards will address street parking (cartway widths, curbs, shoulders, sidewalks, grades, pavement, etc.), construction standards, water supply (systems, capacity, placement, fire hydrants, etc.), sanitary sewer, and stormwater management.

**PA Stormwater Management Policy** – The PHRC submitted formal comments critiquing DEP's proposed stormwater management policy.

## F. Applied Projects on-going or completed in 2004:

### Research

**Ventilation Drying of Walls** - The PHRC is involved in two interrelated R and D projects. One is funded by ASHRAE and the other by the NSF. Both relate to the contribution of ventilation drying to the performance of wall systems with screen type cladding, e.g., siding, masonry veneer, etc. One objective is to develop and publish guidelines for design and construction. This work will have a bearing on the choice and installation of sheathing membranes (housewraps and/or building paper), the sizing of drainage and ventilation capabilities, choice of cladding and the provision of weeps and vents. This program of work is being conducted in partnership with ORNL in Tennessee and the University of Waterloo in Canada.

In **BeTL**, we now have the following equipment in the lab:

- A large Climate Chamber to simulate enclosure elements (portions of a wall or roof, or windows or sections of materials) under indoor and outdoor environmental conditions including real time solar effects.
- An airflow chamber to model ventilation in representative wall enclosure systems
- A ventilation drying chamber to model the drying or wetting capabilities of the outside air for representative wall enclosure systems.
- A general purpose enclosure test facility that enables us to test the performance of materials and enclosures under air pressure differentials, rain and temperature variations.

**Properties of wood composite materials and structural response of wood I-joists:** We have submitted five journal article manuscripts based on the work conducted by Dan Hindman for his Ph.D. program. The manuscripts report on the shear properties of composite wood products, the torsional rigidity of composite wood products and preliminary investigations of the lateral buckling behavior of composite wood rectangular and I-joist beams. Four of these manuscripts have been approved for publication and will appear in Wood and Fiber Science and in the Forest Products Journal in 2005. The fifth manuscript is under review. Dr. Hindman is now assistant professor of Wood Science and Engineering at Virginia Tech University. Graduate student, Mr. Jesse Burow, has completed his laboratory work and is currently writing his Master of Science thesis on his investigation of the allowable lateral buckling loads for composite wood I-joists. His research goal is to clarify issues with and improve the design specifications for the lateral buckling load for wood I-joists. His work is scheduled for completion in spring, 2005 and his work should be published in late 2005 or early 2006.

**Moment Capacity of Metal Truss Plate Connectors** – We have completed the research project to measure the moment capacity for a wide range of metal truss plate connected truss joints. We submitted, and the sponsor Truss Plate Institute) has accepted, the final report of our findings. We are preparing a manuscript for submission to an engineering journal for publication of the results.

**Creep response of wood I-joist floor systems** – We have published two articles based on earlier research efforts to measure the long term deflection of wood I-joist floor systems under dead plus sustained live loads. One article was published in the June/July issue of Structural Building Components; the other is scheduled for publication in the Transactions of ASAE in early 2005.

**Visitability** – The PHRC is participating in a project to review the costs and benefits of visitability guidelines in Pennsylvania. The PHFA funded project is a partnership between Life and Independence for Today and the PHRC. The PHRC has assisted in the identification of six to eight builders across Pennsylvania. Over the next 18 months the PHRC will develop a series of reports on the advantages, disadvantages, technical considerations, as well as costs and benefits.

## G. Publications

### **Technical Reports:**

Products of a major ASHRAE project be published in 2004 are:

#### **Review of Literature and Theory, (BEG/UW, Task 0)**

J. Straube, R. VanStraaten, E. Burnett, C. Schumacher

#### **Hygrothermal Properties of Selected Materials, (BTC/ORNL, Task 1)**

A. Karagiozis, K. Wilkes

#### **Ventilation Drying in Screen-type Wall Systems: a Physical Demonstration,**

(PHRC/PSU, Task 5a) X. Shi, C. Schumacher, E. Burnett, J. Straube

**Laboratory Study of Airflows Behind Vinyl Siding, (BEG/UW, Task 3a)**

R. VanStraaten, J. Straube, E. Burnett

**Characterization of Ventilation Airflow in Screen-type Wall Systems, (PHRC/PSU, Task**

3b) J. Piñon, D. Davidovic, E. Burnett, J. Srebric

**Field Study of Airflows Behind Brick Veneers, (BEG/UW, Task 4)**

R. VanStraaten, J. Straube J. Piñon, E. Burnett

**Ventilation Drying under Simulated Climate Conditions, (PHRC/PSU, Task 5b)**

X. Shi, C. Schumacher, E. Burnett, J. Straube

**Field Drying Study of Wood Framed Walls, (BEGUW, Task 6)**

R. VanStraaten, J. Straube, C. Schumacher, E. Burnett

**Synthesis Report and Guidelines, (PHRC/PSU, Task 8a)**

E. Burnett, J. Straube, A. Karagiozis

**Continued Publications:**

Worley, S. K. "Frequency-Domain Analyses of the Dynamic Behavior of an Engineered Wood I-Joist Floor System." Ph.D Dissertation. *The Pennsylvania State University*, University Park, PA. 348 pp. 2004.

Roeder, R.W., Jr., Manbeck, H. B., and Osterberger, T. "Creep Response of I-Joist Floor Systems." *Structural Building Components*. June/July, 2004. Pgs. 56-58, 60.

Masser, J. E. and H. B. Manbeck. "Moment Capacity of Metal-Truss-Plate Connectors." *Final report submitted to the Truss Plate Institute for the TPI Harnden Scholarship Grant*. Madison, WI. June 30, 2004.

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