

PHRC

The Pennsylvania Housing Research Center

PHRC Year in Review July 2011 – June 2012

219 Sackett Building
University Park, PA 16802
Telephone: (814) 865-2341
Facsimile: (814) 863-7304
E-mail: phrc@psu.edu
URL: www.engr.psu.edu/phrc



July 2012

Disclaimer:

The Pennsylvania Housing Research Center (PHRC) exists to be of service to the housing community, especially in Pennsylvania. The PHRC conducts technical projects—research, development, demonstration, and technology transfer—under the sponsorship and with the support of numerous agencies, associations, companies and individuals. Neither the PHRC, nor any of its sponsors, makes any warranty, expressed or implied, as to the accuracy or validity of the information contained in this report. Similarly, neither the PHRC, nor its sponsors, assumes any liability for the use of the information and procedures provided in this report. Opinions, when expressed, are those of the authors and do not necessarily reflect the views of either the PHRC or anyone of its sponsors. It would be appreciated, however, if any errors, of fact or interpretation or otherwise, could be promptly brought to our attention. If additional information is required, please contact:

Mike Turns
Associate Director
PHRC

Ali Memari
Director
PHRC

PHRC

The Pennsylvania Housing Research Center

PHRC Year in Review July 2011 – June 2012

219 Sackett Building
University Park, PA 16802
Telephone: (814) 865-2341
Facsimile: (814) 863-7304
E-mail: phrc@psu.edu
URL: www.engr.psu.edu/phrc



July 2012

Table of Contents

Table of Contents	i
1. Introduction	2
2. Training, Education and Outreach Activities	4
3. Publications	11
4. Research Activities	12
5. Funding	16
6. Proposals	19
7. Appendix 1	20

Tables

Table 1: PHRC Training Programs Held July 1, 2011 through June 30, 2012	4
Table 2: PHRC Expenses July 1, 2011 through June 30, 2012	17
Table 3: Summary of Act 157 Funds - July 1, 2011 through June 30, 2012	18

Figure

Figure 1: PHRC Organizational Chart	3
Figure 2: Distribution of the Number of Programs	5
Figure 3: Summary of Funding: July 1, 2011 through June 30, 2012	16

1. Introduction

The purpose of this document is to provide a summary of activities the Pennsylvania Housing Research Center has pursued and products that have been delivered between July 1, 2011 and June 30, 2012. Additionally, the document is intended to provide the reader an understanding of the major activities of PHRC and the amount and source of funds the PHRC has received during the reporting period. The organizational chart of PHRC is shown in Figure 1.

Each year, the Pennsylvania Housing Research Center (PHRC) seeks to conduct a series of projects that collectively satisfy the following criteria. Projects should:

- meet the needs of the residential construction industry and the housing consumer in Pennsylvania;
- be consistent with the mission and goals of the PHRC;
- be affordable and feasible, given the resources available and the prevailing constraints on time, expertise and facilities; and
- be a balanced program of projects that address both the long- and the short-term needs of all segments of the industry.

The projects undertaken were developed with input and assistance from the PHRC's Industry Advisory Council (IAC) and the Operations Committee. These bodies consist of manufacturers, suppliers, builders, remodelers, and industry associations as well as building code organizations and state agencies. After a thorough discourse at the spring IAC meeting, the members of the IAC voted on projects they felt were the highest priority for the industry.

The result of this input was the "*PHRC Project Plan, July 2011 – June 2012*", which outlined projects that the PHRC would undertake during this time period. The plan included only those projects that were to receive funds provided to the PHRC by the Commonwealth of Pennsylvania. In most cases, we have attempted to use state funding to leverage outside support; in other cases the work is considered important enough to warrant full state support. It should also be recognized that the PHRC undertook a wide array of additional projects that did not receive any state funds. Those projects are included in this report but are identified as having no support from the Commonwealth of Pennsylvania.

The PHRC receives funds from multiple sources including funds collected under Act 157 of 2006 which established a two dollar fee collected for each building permit to support the activities at the PHRC. To assure that programs funded in whole or part with Act 157 monies meet the needs of the construction industry, Act 157 requires that education, training and other activities provided by the PHRC be approved by its Industry Advisory Council.

Please note that with the collection of monies under Act 157 of 2006, there is not an accurate estimate of the exact amounts of funding available during this period. Because of this, this plan is somewhat conservative in that it only considers funds on hand. Any remaining funds will be carried over for future projects. If there is less funding collected than expected, the project plan will need to be abridged. We plan to continue with our previous initiatives in the areas of training and education, modular housing, manufactured housing, and applied research.

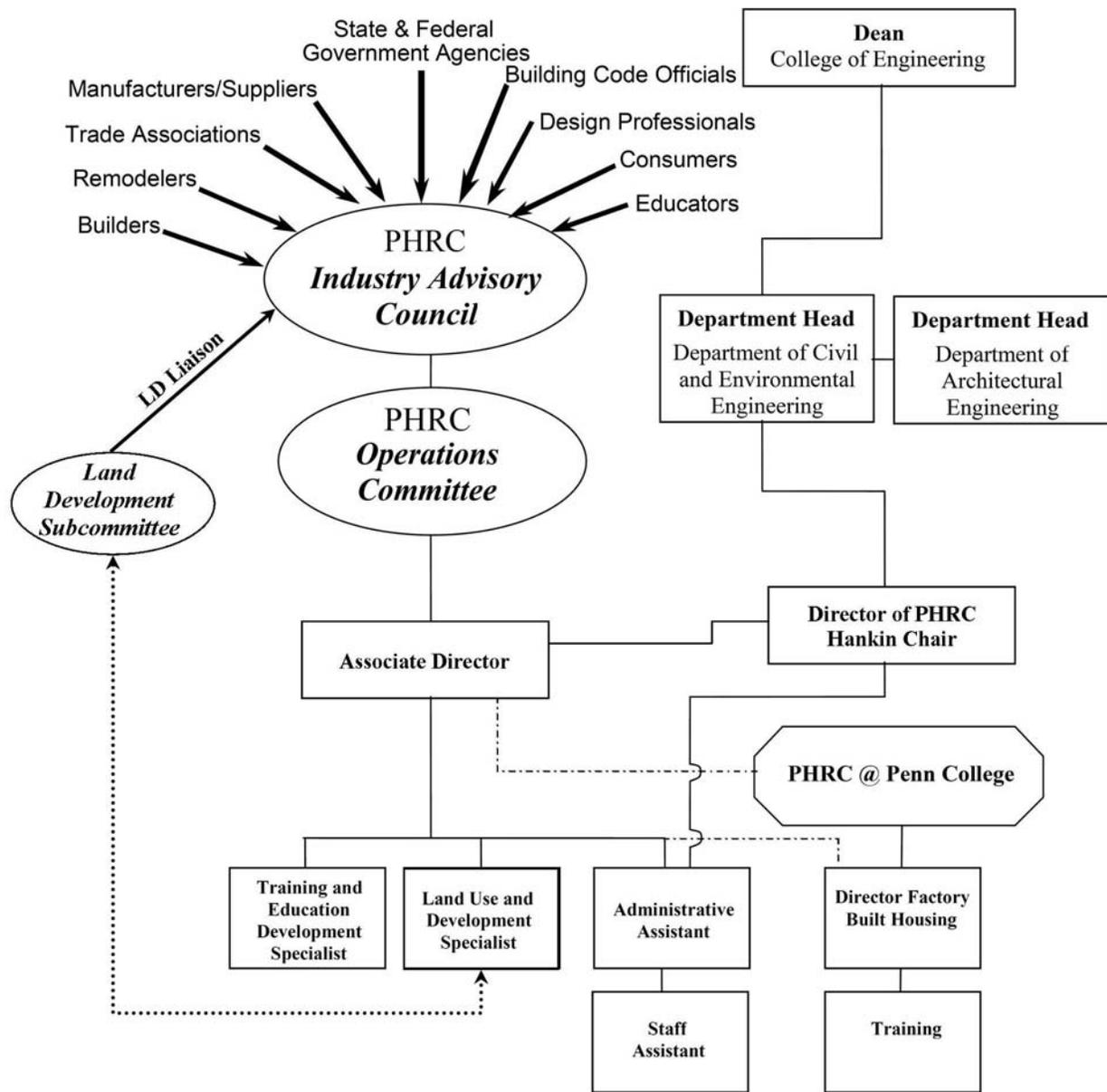


Figure 1: PHRC Organizational Chart

2. Training, Education and Outreach Activities

The PHRC offers a wide array of activities to educate and transfer appropriate technologies to the construction industry. Counting the training and less formal speaker service and presentations at conferences, the PHRC has provided educational services to over 2,246 individuals during this reporting period.

Workshops and Training – The PHRC delivered 54 technical workshops to 2,050 builders, remodelers, educators, code officials, design professionals, and planners during this reporting period (please see Table 1 below for detail).

Table 1: PHRC Training Programs Held July 1, 2011 through June 30, 2012

PHRC Training Programs Delivered			
PROGRAM		Activities for 2011-2012	
		# of Programs	# of Attendees
Advanced Framing	AF1	4	121
Blueprint Reading Program	BP1	3	49
IRC Building Essentials Academy	CO1A	2	25
International Residential Code Inspection Essentials	CO2	5	141
IRC Plumbing Academy	CO3A	1	15
IRC Mechanical Academy	CO4A	1	6
Commercial Energy Provisions (IECC)	CO5C	2	45
Residential Energy Essentials	CO5R	2	16
Electrical Essentials Academy	EE1A	1	9
Exterior Plaster Finish Systems	EP1	3	82
The 2009 International Energy Conservation Code	IECC	6	248
Solar Domestic Hot Water System Inspection/Installation	SHW1	8	195
2012 IRC Sneak Peak	SNP1	7	222
Webinars	W1	10	898
Total Programs Held		55	2072

The distribution of the number of programs over the past 14 years is plotted in Figure 1. The number of programs during the 2011-2012 period is 55, which is very close to the average number of programs over the prior 10 years (58) and also prior five years (60).

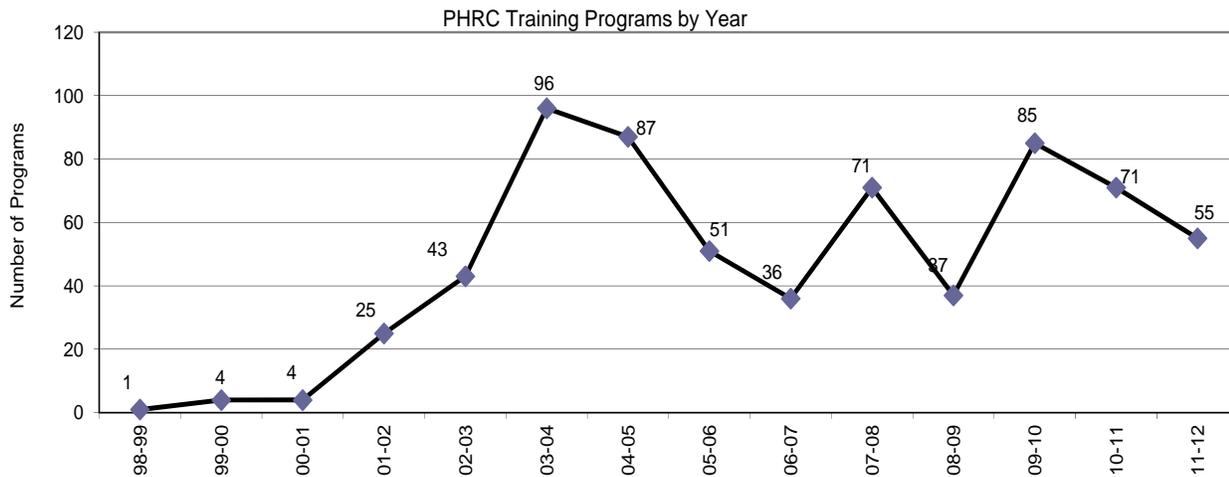


Figure 2: Distribution of the Number of Programs

The following is a description of new programs that were developed or held during this reporting period:

Training, Technical Assistance & Outreach: The PHRC has a mandate to transfer knowledge by providing the necessary training and education to the wide variety of groups that make up the housing industry. The projects that are described below are in response to the recommendations that flow out of the PHRC’s Industry Advisory Council and reflect the current needs within the housing industry.

PHRC Training Provided through Industry Partnerships

Description: The PHRC has developed and maintains a wide array of training for all sectors of the construction industry with a focus on residential construction. These programs are intended to address mainly technical issues facing the industry. Additionally the PHRC will customize programs to better meet a need of an industry partner. Each program is developed with a particular audience, which may include builders, remodelers, trade contractors, design professionals, teachers, building code officials, etc.

These programs are intended to be offered through our industry partners, which may include trade associations such as the Pennsylvania Builders Association or their 42 local associations, professional associations, building code associations, as well as the Pennsylvania Construction Codes Academy (PCCA).

General Audience Programs

- | | |
|---|-------|
| 1. International Residential Code Essentials | 2 day |
| 2. Residential Energy Essentials | 2 day |
| 3. IRC Plumbing Essentials | 2 day |
| 4. IRC Mechanical Essentials | 2 day |
| 5. Residential Mechanical Compliance | 1 day |
| 6. International Energy Conservation Code Essentials (Commercial) | 2 day |
| 7. International Residential Code Inspection Essentials | 2 day |
| 8. Two-family-dwellings and Townhouses | 1 day |
| 9. IRC 2012 Sneak Peek | ½ day |

- | | |
|--|-------------|
| 10. Residential Deck Design, Construction & Inspection | 1 day |
| 11. Blueprint Reading | 1 day |
| 12. Advanced Framing – increasing performance and reducing costs | ½ day |
| 13. Residential Fire Sprinklers | 1 day/2 day |

Available Only through the Pennsylvania Construction Codes Academy

- | | |
|---|-------|
| 1. International Residential Codes Academy | 4 day |
| 2. IRC Plumbing Academy | 4 day |
| 3. IRC Mechanical Academy | 4 day |
| 4. Electrical Essentials Academy | 4 day |
| 5. Photovoltaic Inspections/Installation Training | 1 day |

New Program Development

Description: The PHRC developed the following new training programs. These programs address issues challenging the residential construction industry (builders, remodelers, building code officials, materials suppliers, etc.) During this period the following programs were developed:

1. **Training Light** — Many of the PHRC’s existing programs are one- to four-day programs. This can create a barrier to participation, as many people are reluctant to spend that much time out of the office or field, or pay the associated travel and/or hotel costs. This project identified sections of existing PHRC programs to be presented as standalone, primarily half-day or whole-day programs. Programs include: Deck Construction; Residential Fire Sprinklers, Fire blocking, Clearances to Combustibles, and Combustion Air; and Understanding the Three Energy Code Compliance Paths. The four programs listed above were created by modifying existing program content, and licensed to the Pennsylvania Builders Association for delivery.

2. **2012 IRC Sneak Peek** –Since the implementation of the UCC in 2004, many significant changes have occurred in each triennial code cycle. Some examples of major past code changes (several of which have been eliminated legislatively) include anchorage bolt spacing, wall bracing, fire sprinklers, electrical receptacles, and energy requirements. This has kept builders, design professionals and code officials scrambling to keep up. The 2012 IRC was published in May of 2011. This program was developed to help builders, code officials, municipal officials, state government officials and various organizations formulate and present their viewpoints at public hearings of the UCC Review and Advisory council (or other venues). This program would have also aided stakeholders in preparing for coming code changes if they had been adopted. This program was completed and has been delivered four times to full houses in the following locations: Concordville, Harrisburg, Pittsburgh, and Lackawanna County. No further programs were delivered as a result of the decision by the Review and Advisory Council not to recommend adoption of any new code provisions.

3. **Solar Hot Water System Inspection/Installation:** Consumer demand, helped along by state and federal incentives, has spurred the growth of

residential renewable energy systems like solar hot water (SHW) systems. This one-day program provides an overview of SHW systems, including solar collector types, plumbing requirements, roof integration, and structural loading considerations.

This program was initially expected to be funded by the Pennsylvania Department of Environmental Protection, but with the change in administration the money was reallocated. Despite this, the program has been completed through a partnership with the PHRC and the Pennsylvania Construction Codes Academy. The PHRC identified three new instructors with extensive experience in the solar industry to teach the program and aid in program development. Some material was obtained from the Florida Solar Energy Center. Eight programs were held across the Commonwealth for a total audience of 195 people.

4. **Building with Exterior Rigid Foam** - The use of foam sheathing achieved a degree of popularity beginning with the oil embargo of the late 1970s. Today, increasing stringency in energy codes along with heightened consumer expectations regarding energy efficiency and comfort are causing more builders and remodelers to consider using exterior rigid foam. While the use of foam sheathing can result in a more efficient building enclosure, it is not without its practical hurdles. Window and door jamb extensions, flashing details, surface burning characteristics, consumer perceptions, siding attachment, wall bracing, and material selection are all potential hurdles to the effective use of exterior rigid foam. The PHRC delivered a pilot program in Pittsburgh and is presently offering this new program.
5. **Exterior Plaster Finish Systems: Meeting Code and Avoiding Moisture-Related Failures** - In his 2008 article, *The Perfect Storm*, internationally renowned building scientist, Joseph Lstiburek called eastern Pennsylvania the “stucco failure capital of the United States.” Improper installation of exterior plaster finish systems, like hardcoat stucco and adhered stone veneer, can lead to severe moisture problems and cracking. Many installations do not meet code and result in the need for costly remedial work. This program covers relevant code requirements, proper flashing and drainage, treatment of joints between dissimilar materials, rainscreen installation, and lath requirements.
6. **International Energy Conservation Code – Achieving 90 Percent Compliance (Residential)** – To be eligible for Recovery Act funding, Governor Rendell signed a letter addressed to the US Department of Energy (DOE) Secretary stating that Pennsylvania would achieve 90 percent compliance with the energy code by 2017. The PHRC was approached by the Pennsylvania Department of Environmental Protection to develop a training program in support of the US DOE’s 90 percent energy code compliance effort. This program is intended to assist municipalities in achieving and documenting 90 percent compliance. The PHRC completed a one-day training presentation, which was delivered six times across the Commonwealth. PCCA provided logistical support to the PHRC for these programs.

7. **Online Training** - With tight budgets and near record-high gasoline prices, the need for web-based training is greater than ever. This project will identify an online service that would serve as the delivery mechanism for online training programs. Next, a pilot program will be developed out of existing PHRC workshop material, and adapted to fit the online format. Turnkey services to convert existing content into an online format were deemed to be too expensive and not provide a sustainable solution for providing online training. The PHRC has formed an informal partnership with Penn State's Center for Sustainability (CFS) to use their recording facilities and Learning Management System. Recordings are currently being edited and uploaded to the Learning Management System along with brief introductions and "Test Your Knowledge" questions.
8. **Train the Trainer** - This item does not involve the development of a new training program, but an effort to increase the PHRC training program presenter infrastructure with a focus on grooming presenters with real-world construction or construction management experience. The PHRC has identified several new instructors for the solar thermal program, as well as one new instructor for the exterior plaster finish systems program. In the future, the PHRC will begin to market its training programs more aggressively to contractors and will seek new instructors if necessary.

Research and Builder Briefs

Description: Continuation of the series of short technical documents that address specific issues resulting from some research projects or that were identified by builders or remodelers. These documents are intended to be quick to read with much information presented graphically or pictorially. The following research and builder briefs were published during this period:

Kitchen Ventilation Systems – Part I: Evaluating the 2009 IRC Requirement for Makeup Air, March 2012;

Kitchen Ventilation Systems – Part II: Evaluating the 2009 IRC Requirement for Makeup Air, April 2012.

20th Annual PA Housing and Land Development Conference – This year the PHRC celebrated its 20th annual Housing & Land Development Conference, which was held on February 22 and 23rd, 2012 in State College, PA. This two-day conference provided the latest information on emerging technologies and how to resolve problems facing the housing industry. The conference was intended for all sections of the housing and land development industries including builders, remodelers, code officials, educators, design professionals, developers, engineers, regulators, and modular and HUD-code builders. The land development day of the conference served as an annual forum that addresses emerging planning, design, and regulatory issues affecting the land development industry in Pennsylvania. The PHRC also held training sessions related to the housing industry in conjunction with this conference. The Land Development Conference was held on Day 1 and the Housing Conference was held on Day 2, to better coordinate with the PBA Board meeting, which was held in the same facility February 24 and 25. The conference had 66 attendees for the Land Development Conference, 66 attendees for the training programs and 67 attendees for the Housing Conference.

Land Development (Day 1) – The topics presented were:

- The Good, the Bad and the Ugly – A Panel Discussion on Stormwater BMPs
- Implementation of Ch 102
- Update of the PA Stormwater Technical Workgroup and efforts to revise the BMP Manual
- NAHB Green Land Development Standards
- LEED Neighborhood Development Program
- Life Cycle Assessment of Stormwater Best Management Practices
- Market Research and Analysis
- PHRC Standards for Residential Site Design

Training Sessions (Day 1) – Below is a list of programs held:

- Advanced Framing (16 attendees)
- Exterior Plaster (18 attendees)
- Solar Hot Water Inspection and Installation (32 attendees)

Housing (Day 2) – The topics presented were:

- The Supply Side of the Housing Boom
- Finishing a Basement: Insulation and Moisture Control
- 2006 IRC Wall Bracing
- Air Sealing and the International Energy Conservation Code
- Deck Design Construction and Code Compliance
- Uniform Construction Code Q&A
- Makeup Air for Exhaust Systems in Tight Houses
- Universal Design and Aging in Place
- Flashing Details: Are Your Subs Getting It Right?
- Sealing Ducts to Meet Code

Webinars – The PHRC’s Industry Advisory Council has requested the development and deployment of web-based training. There is a need for technical programs with a lower cost delivery mechanism than a formal classroom setting. This initiative is intended to develop interactive web-based training that can be available live and archived for future viewing. These programs are scheduled on the second Tuesday of most months. The ten programs that were held this year are listed below. PHRC webinars are recorded and available on the PHRC website for on-demand viewing. For a list of all recorded webinars, and the number of times they have been accessed, see Appendix 1.

- Turns, M. – *Fire Protection of Lightweight Floor Systems* – August 9, 2011 (~125 attendees)
- Fortney, M. – *Spray Foam – Thermal Barriers, Ignition Barriers and Specific Approval* – September 13, 2011 (~101 attendees)
- Lau, A. – *Solar Energy Economics in Pennsylvania* – October 11, 2011 (~55 attendees)
- Turns, M. – *Key Changes in the 2012 IRC – Overview of the UCC Adoption Process* – November 4, 2012 (~144 attendees)
- Turns, M. – *Manufactured Stone Veneer: Avoiding Moisture-Related Failures* – November 8, 2011 (~50 attendees)
- Turns, M. – *Building with Exterior Rigid Foam* – December 3, 2011 (~102 attendees)
- Heitzmann, B. – *Individual Lot Preparation: Considerations for Residential* – January 10, 2012 (~90 attendees)
- Heitzmann, B. – *Radiant Barriers: Do They Make Sense in PA?* – March 13, 2012 (~71 attendees)
- Turns, M. – *How to Properly Insulate a Slab* – April 10, 2012 (~85 attendees)
- Jellen, A. – *Make-Up Air and Large Kitchen Exhaust Systems* – May 8, 2012 (~75 attendees)

Speaker Service and Conference Presentations – As a service to the home building and remodeling industry in Pennsylvania, the PHRC offers a speaker service to local and regional associations. This service is provided at no charge to the local builders associations and other interested groups. The PHRC offers short (20 to 45 minute) sessions, often technical, that address some of the issues or problems that builders and remodelers may be facing. Since July, the following presentations have been made by the PHRC:

- Turns, M. – *Intro to Green Building*, Somerset Builders Association, Berlin, PA – August 9, 2011 (24 people)
- Blansett, K. – National Low Impact Development Symposium – *A Model Ordinance as a Tool to Support LID in Pennsylvania*, Sept 25-28, 2011 (~80 people)
- Blansett, K. – National Low Impact Development Symposium – Poster entitled *SWMM Parameterization for Five Urban Karst Watersheds: a Case Study in State College, PA* Sept 25-28, 2011 (+700 attendees)
- Blansett, K. – *Pennsylvania Standards for Residential Site Development*, Pennsylvania State Association of Township Supervisors Fall Engineer’s Workshop. October 5, 2011 (~60 attendees)
- Turns, M. – *Understanding Pennsylvania’s Alternative Residential Energy Provisions*, PennBOC Conference, Grantville, PA, October 13, 2011 (~16 attendees)
- Blansett, K. – *Pennsylvania Standards for Residential Site Development*, to PA Municipal Planners Education Institute (PMPEI), State College, PA, November 5, 2011 (~13 attendees)
- Blansett, K. – *Flow, Water Quality, and SWMM Model Analysis for Five Urban Karst Watersheds*, Agricultural and Biological Engineering Seminar, State College, PA, November 29, 2011 (~35 attendees)
- Turns, M. – *Understanding the Energy Code*, Centre County Housing Cabinet, Bellefonte, PA, January 4, 2012 (~11 attendees)
- Turns, M. – *2012 IECC Update*, PFS Seminar, State College, PA, January 20, 2012 (~45 attendees)
- Turns, M. – *2006 IRC Wall Bracing*, PA Housing Conference, State College, PA, February 23, 2012 (~10 attendees)
- Blansett, K. – *Low Impact Development and Community Responsibility*, Managing Stormwater as a Resource for State Parks, Bald Eagle, PA, February 29, 2012 (29 attendees)
- Blansett, K. – PSATS Planners Seminar. May 8, 2012. Hershey, PA (~25 attendees)
- Blansett, K. – PSATS Annual Conference Workshop. May 8, 2012. Hershey, PA (~20 attendees)
- Blansett, K. – Penns Valley Regional Planning Commission. May 21, 2012. Spring Mills, PA (~12 attendees)

Web Site – The PHRC maintains a web site (www.engr.psu.edu/phrc) to help disseminate information. An executive summary from each of the reports as well as builder, research and technical briefs are available on-line.

Pennsylvania Focus Committees:

- Pennsylvania Industrialized Housing Advisory Group (DCED)
- Pennsylvania Builders Association (PBA)—PHRC Committee
- Pennsylvania Builders Association (PBA) – Appraisal Coalition
- PA Stormwater Technical Workgroup – Executive Board Member, Chapter 5 Stormwater Design Committee – Committee Chair, Chapter 4 Land Development Process Committee
- American Society of Civil Engineers – Central PA Chapter
- Pennsylvania Society of Professional Engineers

National and International Focus Committees:

- National Consortium of Housing Research Centers
- American Concrete Institute Technical Committees on Cracking, Safety, and Deflection Control

3. Publications

The PHRC produces a wide array of publications to provide technical information to the construction industry and to disseminate results of research projects.

Builder Briefs:

Jellen, A., Wolfgang, B., and Turns, M., *Kitchen Ventilation Systems – Part I: Evaluating the 2009 IRC Requirement for Makeup Air*, March 2012.

Jellen, A., Wolfgang, B., and Turns, M., *Kitchen Ventilation Systems – Part II: Evaluating the 2009 IRC Requirement for Makeup Air*, April 2012.

Blansett, K. *Summary of the Typical Residential Land Development Process in Pennsylvania*, August 2012.

Blansett, K. *Summary of the International Stormwater BMP Database for Application in Pennsylvania*, August 2012.

4. Research Activities

Applied Projects

These groups of projects are application oriented and have a direct need by the residential construction industry. This includes the development and support of standards, and longer term initiatives.

Sustainability of Residential Concrete Construction – Concrete is extensively used in residential construction for basements, slabs on grade, above grade construction, driveways, parking areas, and sidewalks. Sustainability is a high priority issue within institutions such as the American Concrete Institute (ACI). Current research topics include replacement of Portland cement with waste products such as fly ash etc., recycling waste products such as glass as for aggregates, and other means to reduce the carbon footprint associated with concrete construction. Use of pervious concrete in residential construction was also investigated.

REPORT: A draft report has been prepared to outline the current state of the art. After the report has been finalized, a builder's brief will be prepared to provide guidance to home builders on sustainability issues related to concrete construction.

Concrete Quality in Residential Construction – A great deal of information is available on concrete quality from institutions such as the American Concrete Institute, Portland Cement Association and others. Achieving quality concrete requires attention to all phases of concrete production from proper specifications to finishing and curing. Unfortunately concrete for residential construction is often ordered based only on a specified concrete compressive strength or number of bags of cement per cubic yard. Water content is often not carefully controlled during initial proportioning and additional water is often added on site. These and other factors can lead to a poor quality product requiring remedial action.

REPORT: A draft report has been prepared outlining the issues involved and identifying actions that can be taken to produce high quality concrete for residential construction. Information from the final report will be used to prepare a builder's brief for use by home builders.

House Depressurization from Exhaust Systems: Case Studies and Analysis of Risks – The 2009 IRC requires makeup air for range hoods with flow rates in excess of 400 cfm, and house depressurization can result in the dangerous backdrafting of atmospherically drafted combustion appliances and non-direct-vent fireplaces. This project would measure the actual amounts of house depressurization in several new homes to determine the risk of backdrafting if open combustion appliances were installed. Blower door tests will also be performed to measure building envelope tightness, which is a key aspect in whether dangerous house depressurization will occur.

REPORT: The PHRC completed two builder briefs on this topic. Interestingly, research performed for the first brief confirmed the IRC's 400 cfm threshold for requiring makeup air. A house of code-level tightness (when selecting the blower door option) is estimated to reach depressurization levels from a 400 cfm exhaust fan that may result in a risk of backdrafting a fireplace. Increased house tightness and/or exhaust rates (both of which are common) will result in backdrafting risk for all combustion appliances with the exception of two-pipe direct-vent systems.

Flood Preparedness of Pennsylvania's Housing Stock: Pennsylvania has more miles of waterways than any other state and is one of the most flood-prone states. This project will review the current state-of-the-art for flood resistive construction and proper procedures for flood recovery. This project will also identify key areas

for future efforts to help Pennsylvania prepare for the recovery of future floods. This project will include involvement from FEMA, PEMA, and others involved in emergency response in the Commonwealth.

REPORT: This project was listed as a contingency project in the PHRC's 2011-2012 Project Plan, and was not pursued.

Voluntary Standards for Relocated Manufactured Housing: Frequently the manufacturer's installation instructions are not present when a manufactured home is relocated. This puts installers, code officials, and sometimes the homeowners in a quandary with regard to how the home should be installed. Often this is a barrier to relocating a manufactured home either to an outright lack of code acceptance, or because homes are held to code requirements that make reinstallation of the home economically infeasible. This project would summarize which codes and standards are applicable to various types and vintages of manufactured homes, along with providing basic standards to ensure the health and safety of the occupants. The PHRC will work closely with the Pennsylvania Department of Community and Economic Development's Housing Standards Division, and the Pennsylvania Manufactured Housing Association. Funding will likely be solicited from the Center for Rural Pennsylvania.

REPORT: This project was listed as a contingency project in the PHRC's 2011-2012 Project Plan, and was not pursued as a result of the passing of Act 40 of 2012, which gave DCED the authority to promulgate regulations regarding relocated manufactured housing. With DCED tasked with regulating relocated manufactured housing, there was no need for a voluntary standard. The PHRC provided a review DCED's draft regulations.

Development of Alternative Residential Deck Lateral Load Connections – Deck failures can have tragic consequences. The 2009 International Residential Code establishes prescriptive option for deck lateral attachment connections is problematic to construct and may not meet the loads imposed. In addition, there has previously been no widely accepted engineering methodology for determining lateral loads for residential decks. This project investigated developing a set of details that will result in safe deck construction with regard to withstanding lateral loading. This was done through structural analysis of the deck systems. Project deliverables were to include a set of guidelines for determining deck lateral loads and options for resisting those loads. A supporting document, or appendix, including a description of how the load resistance values were calculated was also to be created.

REPORT: After taking a closer look at the load resistance numbers that were included in the guidelines along with restrictions on combining resistance methods, it was determined that the proposed alternatives were no more practical than the prescriptive option in the code. Thus, the PHRC decided not to move forward with publishing alternative guidelines for later load resistance. Load resistance from post embedment and knee bracing was so low that an impractical number of posts would have to be installed. Lateral resistance of full-height bracing was somewhat better, but is not likely to be a desirable option for aesthetic reasons. Connection to the house with angle irons and bolts provided sufficient load resistance; however, this method does not get around the need to access the floor joists on the interior, or blocking requirements when floor joists are perpendicular to the deck joists.

A conversation with Dr. Don Bender at Washington State University confirmed that post-embedment and post bracing were not practical solutions to meeting occupant loads. In addition, WSU's testing indicated that occupancy loads can be 8-10 psf, which lends support for the PHRC's assumption of 8 psf design loads taken from the ICC bleacher standard.

Architectural Light Therapy System Prototype Development – The goal of the project is to develop a working prototype of a residential living environment outfitted with a novel architectural lighting system designed to promote health by stimulating the human circadian system while maintaining standards for visual quality. The space will be instrumented with measurement devices to verify light exposure performance and

will serve as a model for future clinical trials and larger-scale residential installations. This project fosters the research/industry partnership that was a founding goal of the center. The PHRC wishes to encourage the relationship between Penn State faculty and its industry partners in order to stay on the cutting edge of housing-related research. The PHRC has provided seed money to fund the first phase of this project.

REPORT: A one-year extension was granted on this project due to personnel difficulties. Postdoctoral scholar, Mike Royer, left unexpectedly for a full time position at Pacific Northwest National Laboratory. PhD candidate Andrea Wilkerson will begin work over the summer with a new completion deadline of June 30, 2013.

Dr. Houser has assumed full responsibility for this project with the announced retirement of Dr. Behr.

Support of the UCC Review and Advisory Council (RAC) This code cycle the PHRC took a more proactive role in supporting the RAC. The primary role of the PHRC was to research differences between the 2009 International Residential Code (IRC) and the 2012 IRC to provide the RAC with an overview of the most significant code changes.

REPORT: PHRC provided the RAC with a notebook summarizing new code provisions in the 2012 IRC. A representative of the PHRC attended both of the RAC hearings and the subsequent meeting that had the result of Pennsylvania not adopting any of the 2012 ICC code provisions (with the exception of accessibility provisions). While it is not expected that the RAC will need assistance from the PHRC in the foreseeable future, we will continue to look for opportunities to assist the Commonwealth as it makes decisions about future code adoption and implementation.

Support of Standards The PHRC has developed three standards to respond to industry demand. These include Pennsylvania's Alternative Residential Energy Provisions, Pennsylvania Standards for Residential Site Development Standards and Foundation Systems for Relocated Manufactured Housing. Each of these standards requires training and timely technical assistance for local governments, builders/developers, design professionals, contractors, etc. All of these standards are available electronically for free and hard copies are available for a fee.

1. Pennsylvania's Alternative Residential Energy Provisions - 2009: Education will be provided by telephone and email support by the PHRC
2. Pennsylvania Standards for Residential Site Development Standards: Please see the Land Development section
3. Foundation Systems for Relocated Manufactured Housing: The PHRC will provide technical assistance through telephone and email support
4. Deck lateral load guidelines: The PHRC will provide speaker service engagement, as well as technical support to builders and code officials

Land Development

The land development process is a key component of providing affordable homes; however, there is no single group looking at land development practices in Pennsylvania. These initiatives are part of the PHRC's long-term effort to provide technical input and guidance and leadership to these issues. The following projects were identified and prioritized by the Land Development Industry Advisory Council Subcommittee.

Pennsylvania Standards for Residential Site Development The residential development standards project was finalized in April 2007. These are a set of consensus standards that allow for the most up-to-date design innovations and provide flexibility needed for sustainable land development. The initiatives that will be

undertaken will increase the awareness of the standards and encourage the adoption by municipalities within the Commonwealth.

REPORT: The Standards were presented to and input solicited from several stakeholder groups. These groups include the Pennsylvania Municipal Planners Education Institute (PMPEI, a group of, primarily planners who train municipal planners across the state), Pennsylvania State Association of Township Supervisors (PSATS) Engineers Council, PSATS Planners Council, PSATS general conference session, as well as a national audience at the 2012 Low Impact Development Symposium. Based on the input received, it has been determined that issuing an addendum, as was initially proposed for the 2011-2012 project year, is not the appropriate format to address the update to the document. Instead, a more intensive revision of the document is now underway. The document has been renamed the “Subdivision and Land Development Guidelines for Pennsylvania.” The chapters of the current document have been divided into individual booklets making the document more accessible and manageable for users and easier to update for the PHRC. Content will be updated to address recent regulatory and policy updates. This project will extend into the 2012-2013 project year. Webinars will be presented as booklets are completed.

Stormwater BMP Effectiveness in Real Residential Developments This contingency project was to involve the installation of flow monitoring and sample collection equipment in residential developments to collect data on the characteristics of stormwater runoff from these sites and the effectiveness of BMPs in a typical development.

REPORT: A funding proposal for this project was submitted to the Water Environment Research Foundation but it was not accepted. The project was not pursued during the 2011-2012 project year.

Summarize ASCE BMP Database as Applicable to Pennsylvania The Water Environmental Research Foundation (WERF) and the American Society of Civil Engineers (ASCE) Environmental Water Resources Institute (EWRI) maintain the International Stormwater BMP Database, which is a repository of pollutant removal data from over 400 BMP studies. This database is cumbersome to use, and it is difficult to determine what data or BMPs apply in PA. This project sorted through the data and developed an easy-to-access summary report of the data that is applicable in PA.

REPORT: There are only three BMP sites in PA in the BMP database. One of these is a green roof that collects flow data only and another is a manufactured device in an industrial location. The research BMPs at Villanova University are the only entries in the database directly related to residential applications in PA. Some general statements about types of BMPs that are good at removing particular pollutants have been determined based on the larger data set, but there isn't a large enough data set to make definitive statements that are Pennsylvania specific. A Builder Brief has been completed for the project and a webinar will be delivered in the Fall of 2012.

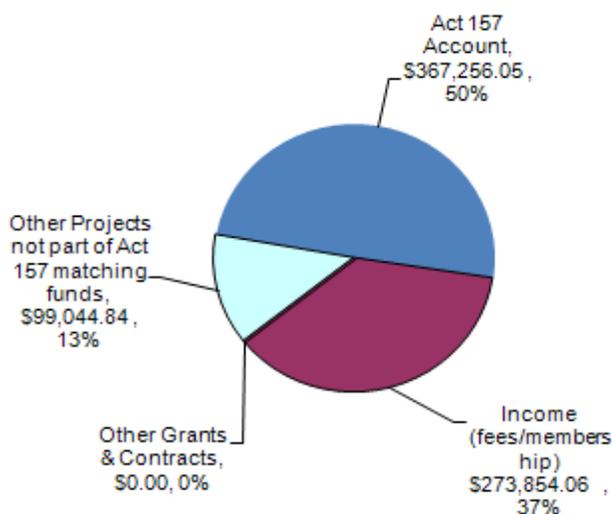
Land Development Process Flow Chart and Comparison of Permit & Approval Process in Pennsylvania to Other States Permitting and approval agencies don't always know the whole process of developing a piece of land, and are not always aware of the other permits or approvals that are needed to complete a project. Acquiring all of the necessary permits and approvals for a land development project in Pennsylvania often takes a year to 18 months, or longer. The goal of this project was to develop a flow chart that integrates the federal and state requirements and provides a template for the local requirements. The flowchart also includes a typical timeline for the various steps based on agency review periods which will allow for easy comparison of the process in Pennsylvania to other states.

REPORT: A Builder Brief including the land development process and a brief narrative describing the process has been completed. The Builder Brief is available on the PHRC website and will be integrated into the revised version of the Subdivision and Land Development Guidelines for Pennsylvania.

5. Funding

The PHRC receives funding from diverse sources including contracts, grants, membership fees, fees for services as well as funds collected under Act 157 of 2006. Additional contributions were made by the Pennsylvania State University through a variety of sources including the Hankin Endowment and in-kind support.

During this reporting period total project costs were \$740,154.95 (Figure 3). Act 157 Construction Training Account accounted for 50% of these funds, we had no other grants and contracts, other projects not part of Act 157 matching funds accounted for 13%, and income from fees and services accounted for 37%.



**Figure 3: Summary of Funding
July 1, 2011 through June 30, 2012**

The funds collected under Act 157 of 2006 stem from a \$2 fee collected for each building permit to support the activities at the PHRC. This legislation took effect in January 2007. As of July 1, 2011, the beginning of this reporting period, the PHRC received one payment of \$154,580.48 in August 2011, \$119,138.61 in November 2011, \$122,235.52 in February 2012, and \$104,607.78 in May from the Department of Community and Economic Development.

Any remaining funds, and disbursements received during this period, will be used for activities in the next fiscal year.

The Act 157 Account incurred expenses of \$367,256.05 during this reporting period. This is a little less than anticipated in the Project Plan in large part due to a proposal not being funded. The PHRC's WERF proposal (see Section 6 below) included PHRC match funding to purchase water quality monitoring equipment. The PHRC did not purchase this equipment because the other aspects of this project were not funded.

The *PHRC Project Plan July 2012 – June 2013* was developed with the remaining funds in the Act 157 Account as of June 30, 2012. This plan has anticipated expenditures of \$521,074.

Table 2: PHRC Expenses July 1, 2011 through June 30, 2012

Category	Act 157 Account	Leveraged Funding	Total Expenses
Total Salaries	\$179,959.25	\$182,343.75	\$362,303.00
Fringe Benefits	\$53,483.09	\$54,335.14	\$107,818.23
Supplies and Materials	\$284.77	\$7,811.05	\$8,095.82
Communications Services		\$5,071.31	\$5,071.31
Travel	\$41,137.65	\$68,221.64	\$109,359.29
Publications	\$935.54	\$1,869.44	\$2,804.98
Maintenance		\$918.00	\$918.00
Consulting & Prof Svc	\$75,783.25	\$1,565.20	\$77,348.45
Copies and Photographic Services		\$23,417.02	\$23,417.02
Scholarships			\$0.00
Tuition and Fees	\$14,630.00	\$7,315.00	\$21,945.00
Equipment	\$1,042.50	\$11,581.44	\$12,623.94
Purchased Services		\$582.00	\$582.00
Miscellaneous		\$7,867.91	\$7,867.91
Indirect Costs (Overhead)			\$0.00
Total	\$367,256.05	\$372,898.90	\$740,154.95

Table 3: Summary of Act 157 Funds - July 1, 2011 through June 30, 2012

		Summary of Act 157 Funds		
		Expenses	Deposits	Balance
Fiscal Year 2011-2012	Starting Balance FY 2011-12			\$435,893.05
	Expenditures FY 2011-12	\$364,789.15		\$71,103.90
	August 2011		\$154,580.48	\$225,684.38
	November 2011		\$119,138.61	\$344,822.99
	February 2012		\$122,235.52	\$467,058.51
	May 2012		\$104,607.78	\$571,666.29
	Projected Expenditures FY 2012-13	\$521,074.00		\$50,592.29

6. Proposals

The PHRC continuously seeks to leverage funding from the Commonwealth with funds from other sources. The following is a list of proposals submitted during 2011-12.

Proposals Submitted:

Pennsylvania Department of Environmental Protection – Training to Achieve 90 Percent Compliance with the 2009 International Energy Conservation Code in Residential Occupancies (Funded)

Water Environment Research Foundation (WERF) – Nutrients and Sediment in Stormwater Runoff from Residential Developments in Karst Landscapes (Not Funded)

7. Appendix 1

Live Event Date	Title	Times Accessed FY 2011-2012	Times Accessed All-time
May 8, 2012	Makeup Air for Exhaust Systems in Tight Houses	45	45
April 10, 2012	How to properly insulate a slab	182	182
March 13, 2012	Radiant barriers: Do they make sense in Pennsylvania?	103	103
January 10, 2012	Individual Lot Preparation: Considerations for Residential Construction	172	172
December 13, 2011	Building with exterior rigid foam	133	133
November 8, 2011	Exterior Plaster Finish Systems: avoiding moisture-related failures	147	147
November 4, 2011	Key Changes in the 2012 IRC... and an Overview of the UCC adoption process	332	332
October 11, 2011	Solar energy economics in Pennsylvania	156	156
September 13, 2011	Spray foam - thermal barriers, ignition barriers and specific approval	115	115
August 9, 2011	Act 1 Requirements for Fire Protection of Lightweight Floor Systems – Things to consider	166	166
May 17, 2011	Act 1 of 2011: New Uniform Construction Code Exemptions and Code Adoption Process		358
May 10, 2011	Bringing the ducts inside: <i>unvented attics, conditioned basements and crawl spaces, and avoiding exterior walls</i>		104
April 12, 2011	Chapter 102 Erosion and Sediment Control and Stormwater Management Regulations: Changes you need to know.		134
March 8, 2011	Performing inspections using the IECC insulation and air sealing checklist		132
January 11, 2011	Wall Bracing Overview (2009 IRC)		204
December 14, 2010	Understanding Barriers - <i>vapor, air, water resistive, etc.</i>		135
November 9, 2010	The 2012 International Energy Conservation Code: A Sneak Peak		102
October 12, 2010	Basement Wall Insulation Strategies		172
September 14, 2010	Building Permit Fees in PA - <i>overview of Center for Rural PA study</i>		67
July 22, 2010	Special Webinar - Coordination of the 2009 IRC Energy Requirements with Industrialized Housing Installation		417
May 11, 2010	An Introduction to Advanced Framing: Reducing Costs while Improving Building Performance		302
April 13, 2010	Zero Energy Houses in PA - A technical review		359
March 4, 2010	Performing air tightness testing - a primer for code officials and builders		146

January 12, 2010	Changes in IRC 2009 wall bracing		676
December 15, 2009	Building habitable attics and five floor buildings under the IRC		97
November 5, 2009	Building a durable no step entrance		56
October 20, 2009	Emerging regulation of commercial modular construction		30
September 8, 2009	Verification Required! New Duct Leakage Testing Requirements in the 2009 IRC		142
August 11, 2009	Factory Built Structures, Part 2, Industrialized/Modular Housing		50
July 14, 2009	Factory Built Structures, Part 1, Manufactured Housing		171
June 4, 2009	Special WEBINAR - Municipal Rights & Responsibilities Under the Home Improvement Consumer Protection Act		217
May 12, 2009	Tax Credits, Rebates and Grants for the Residential Construction Industry		89
April 14, 2009	Sneak Peek: Critical Changes in the 2009 IRC		308
March 31, 2009	Residential Sprinkler Systems - <i>an Introduction to NFPA 13-D</i>		506
March 10, 2009	Alternatives to Traditional Foundations: Shallow Frost-Protected Foundations		136
January 13, 2009	Intro to Residential Solar Technologies: Resources and Solutions		180
December 9, 2008	Foundation Systems for Relocated Manufactured Housing		132
November 12, 2008	Inspecting Attached Decks: Ledger Board Flashing Details		275
October 30, 2008	Act 106: UCC Review & Advisory Council (Recorded without audience)		941
October 14, 2008	Ducts II - Inspecting Residential Duct Systems: Obtaining Adequate Air Flow		193
October 8, 2008	Special edition: Federal Manufactured Housing Installation Program		140
September 9, 2008	Ducts I - Inspecting Residential Duct Systems: Making the Connections		409
August 12, 2008	Intro to Residential Green Building		388
TOTAL VIEWS		1,551	9,319