

PHRC

The Pennsylvania Housing Research Center

PHRC Year in Review July 2008 – June 2009

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August 2009

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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, 2008 and June 30, 2009. Additionally, the document is intended to provide the reader an understanding of the amount and source of funds the PHRC has received during the reporting period.

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 2008 – June 2009*" 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 committee.

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.

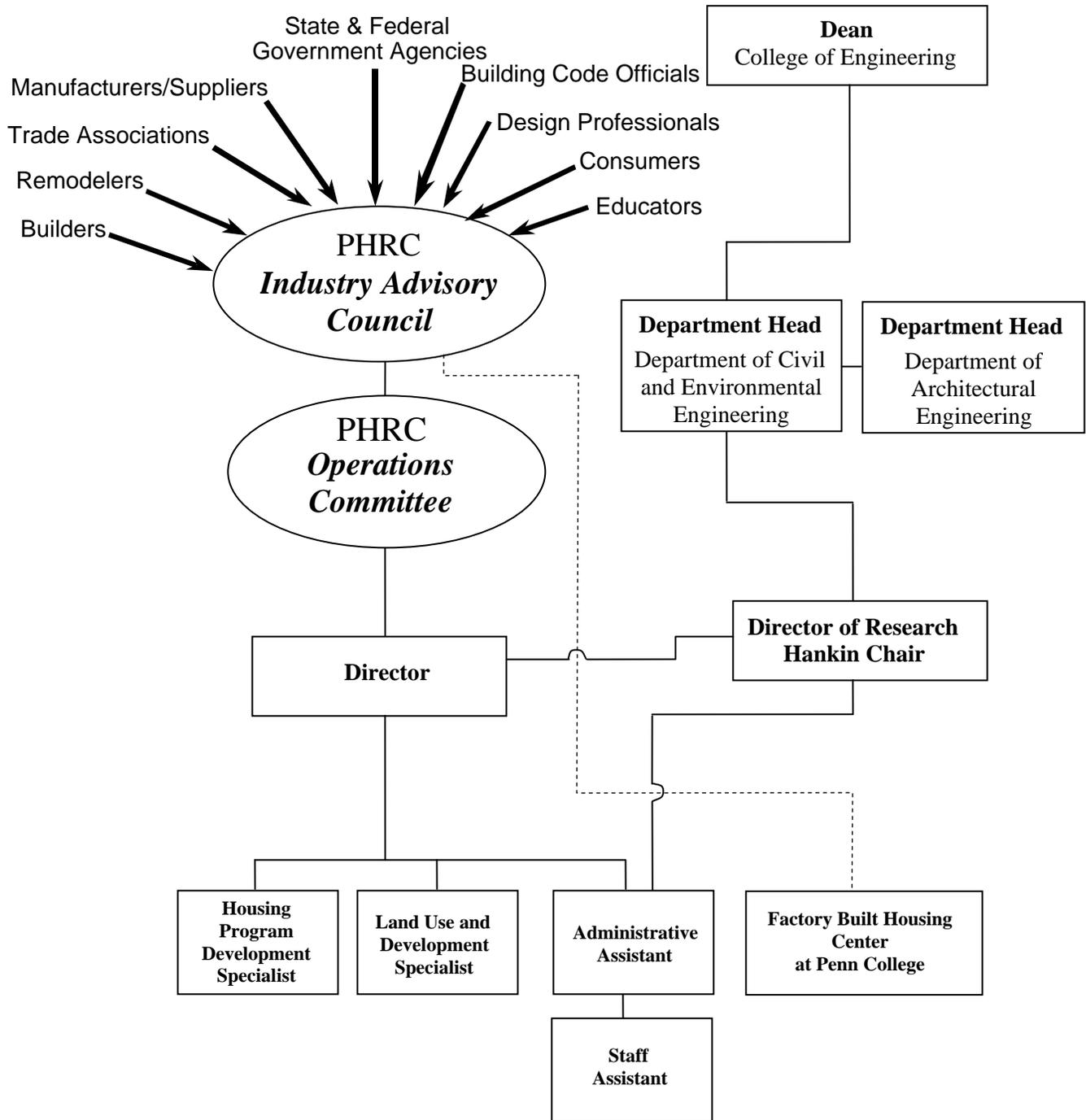


Figure 1: PHRC Organizational Chart

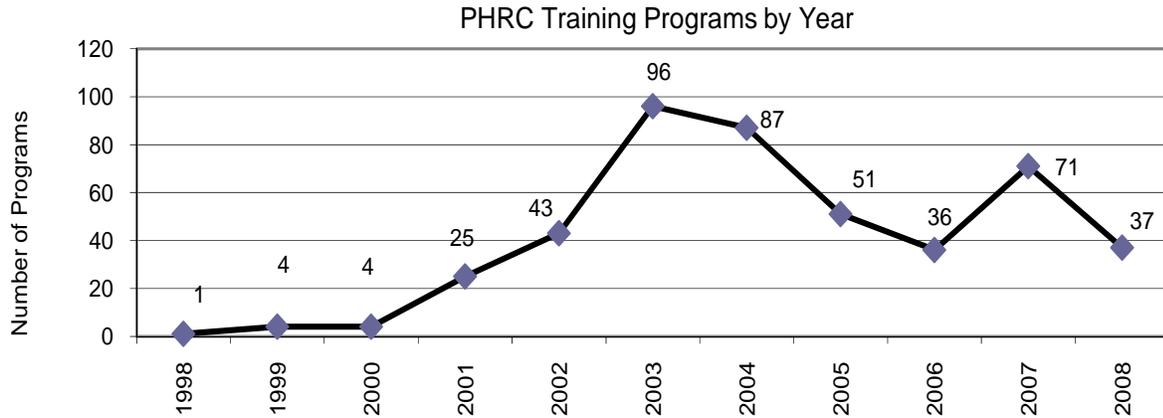
2. Training, Education and Outreach Activities

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 3,675 individuals during this reporting period.

Workshops and Training – The PHRC delivered 37 technical workshops to 2,142 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, 2008 – June 30, 2009

PHRC Training Programs Delivered			
PROGRAM		Activities for 2008	
		# of Programs	# of Attendees
Comprehensive IRC Program	CO1	3	60
International Residential Code Inspection Essentials	CO2	2	52
IRC's Plumbing Requirements	CO3	1	32
IRC's Mechanical Requirements	CO4	1	18
Commercial Building Provisions of the IECC	CO5C	3	74
Residential Energy Essentials	CO5R	1	29
2006 IRC Update Program	CO6	0	0
Storm water programs	SW	0	0
Custom Programs	CP	3	73
Residential Deck	D1	10	278
NDS Wood Design	ND1	1	6
Webinars	W1	12	1,520
Total Programs Held		37	2,142



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 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 local associations, professional associations, building code associations, as well as the Pennsylvania Construction Code Academy (PCCA).

General Audience Programs

- | | |
|---|---------|
| 1. Comprehensive International Residential Code (IRC) Program | 2 day |
| 2. Pennsylvania’s Residential Energy Code Requirements | 2 day |
| 3. Overview of the IRC’s Plumbing Requirements | 2 day |
| 4. Overview of the IRC’s Mechanical Requirements | 2 day |
| 5. Residential Mechanical Plan Reviews and Inspections | 1 day |
| 6. Commercial Building Provisions of the IECC | 2 day |
| 7. Performing Residential Building Inspections | 2 day |
| 8. Special Issues for 2-Family Dwellings and Townhouses | 1 day |
| 9. 2003 to 2006 IRC Update Program | 1 day |
| 10. Residential Deck Design Construction and Inspection | 1 day |
| 11. Design and Construction of Wood Frame Buildings | 2 day |
| 12. A new Era of Storm Water Management | 2.5 day |

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

1. **Residential Mechanical Plan Reviews and Inspections** – The need for this program is two-fold. The first is the need of new building code officials to have more in-depth knowledge of mechanical systems since, many of them come into code enforcement from other areas of the construction industry and are not familiar with mechanical requirements and proper installation issues. Additionally, a recent DOE funded study conducted by the PHRC found generally poor performing HVAC systems across the Commonwealth. This was generally attributed to poorly constructed ducts. This program provided new and experienced building code officials the background they need to effectively administer and enforce the mechanical requirements in the IRC.
2. **Multi-Family Program** – There are specific requirements for multi-family structures built under the IRC that require special attention by the building code official. The program highlights such issues as fire separation requirements and accessibility. This program focused on effective plan review and inspection practices and provided an understanding of fire-rated assemblies.
3. **Residential Green Building** - The interest in green building has increased at an impressive rate. However, the industry is finding it challenging to find a good source of unbiased information on innovative construction technologies and methodologies. This program, or series of programs, helps builders understand how to build green and how to have their development and homes certified by major voluntary green building programs.
4. **IRC Update Program** - Every three years the UCC updates its building code to the most recent version of the ICC's International Residential Code (IRC). This program highlighted the most significant changes between the 2006 and 2009 IRC, and identified potential impacts to builders, designers and building code officials. This program was developed and five instructors were trained.

17th PA Housing and Land Development Conference – For the past 17 years, the conference has served as a forum to discuss and resolve challenges facing the various sectors of the residential construction industry. This year it was held February 11 and 12 in Scranton, PA. The first day of the conference focused on technical issues related to the delivery of houses and the latest information on emerging technologies and how to resolve problems facing the industry. It was attended by 135 individuals. Some of the topics included:

- Legislative Update
- 2009 IRC Code Changes
- Green Building Programs in PA
- Window Technology – Separating Reality from Sales Myths
- Home Improvement Contractor Registration Law
- Green Building Case Studies – What’s Worked and What Hasn’t
- Improving Energy Performance of Existing Homes
- Changes in IRC 2009 Wall Bracing (Part 1)
- On-site Energy Generation
- Trusses
- Changes in Wall Bracing IRC (Part 2)

The second day of the program focused on emerging planning, design, and regulatory issues affecting the land development industry in Pennsylvania and was attended by 94 individuals. Some of the land development topics included:

- Thermal Treatment of Stormwater Discharge
- Green Building Programs and Land Development
- What’s Behind the Rise in Costs of Housing?
- Performance of Stormwater Infiltration Facilities in Cold Climates
- Evolving Technologies for Infiltration Design
- Innovations in Erosion and Sediment Control Strategies

Some quotes from the conference evaluations:

- *Very informative and educational, presenters were excellent*
- *Great information at a proper time in the market*
- *Topics were very useful in everyday business*
- *Met other building industry members and learned about new code changes that fit my needs*

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. These webinars are interactive web-based training that can be available live and recorded for future viewing. During this reporting period, twelve programs were held:

- Turns, M., - *Introduction to Green Building*, August 12, 2008 (~52 attendees)
- Turns, M., - *Ducts I – Inspecting Residential Duct Systems: Making the Connections*, September 9, 2008 (~72 attendees)

- Conte, M., - *Special Edition: Federal Manufactured Housing Installation Program*, October 8, 2008 (~96 attendees)
- Turns, M., - *Ducts II - Inspecting Residential Duct Systems: Obtaining Adequate Air Flow*, October 14, 2008 (~71 attendees)
- Fortney, M., - *Inspecting Attached Decks: Ledger Board Flashing Details*, November 12, 2008 (~99 attendees)
- Fortney, M., - *Foundation Systems for Relocated Manufactured Housing*, December 9, 2008 (~80 attendees)
- Lau, A., - *Intro to Residential Solar Technologies: Resources and Solutions*, January 13, 2009 (~156 attendees)
- Fortney, M., - *Alternatives to Traditional Foundations: Shallow Frost-Protected Foundations*, March 10, 2009 (~73 attendees)
- Neale, R., - *Residential Sprinkler Systems - an Introduction to NFPA 13-D*, March 31, 2009 (~261 attendees)
- Fortney, M., Buddenbohn, R., - *Sneak Peek: Critical Changes in the 2009 IRC*, April 14, 2009 (~220 attendees)
- Turns, M., - *Tax Credits, Rebates and Grants for the Residential Construction Industry*, May 12, 2009 (~82 attendees)
- Buddenbohn, R., Meshaw, D., - *Special Webinar – Municipal Rights & Responsibilities Under the Home Improvement Consumer Protection Act*, June 4, 2009 (~258 attendees)

Speaker Service – As a service to the home building and remodeling industry in Pennsylvania, the PHRC provides a speaker service to 20 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., *Introduction to Green Building*, Building Industry Association of Northeastern Pennsylvania, Kingston, PA, July 15, 2008 (~10 attendees)
- Turns, M., *Introduction to Green Building*, York County Builders Association, York, PA, August 14, 2008 (~35 attendees)
- Turns, M., *Introduction to Green Building*, Lawrence County Builders Association, New Castle, PA, September 11, 2008 (~25 attendees)
- Turns, M., *Concepts in Sustainable Design and Green Building*, AE470: Residential Building Design and Construction, October 1, 2008 (~20 attendees)
- Turns, M., *Introduction to Green Building*, Huntingdon County Builders Association, Huntingdon, PA, October 2, 2008 (~20 attendees)
- Turns, M., *Overview of Pennsylvania's Alternative Energy Provisions*, York County Builders Association, York, PA, October 9, 2008 (~35 attendees)
- Turns, M., *Case Study: Energy Efficient House Design and Construction*, AE470: Residential Building Design and Construction, October 13, 2008 (~30 attendees)
- Fortney, M., *Frost Protected Shallow Foundations*, Builders Association of Metro Pittsburgh, October 21, 2008 (~30 attendees)
- Fortney, M., *Basement Insulation Strategies*, Builders Association of Metro Pittsburgh, October 21, 2008, (~45 attendees)

- Fortney, M., Common deck failures and how to avoid them, Builders Association of Metro Pittsburgh, October 21, 2008 (~44 attendees)
- Turns, M., *Overview of Green Building Programs*, Builders Association of Metro Pittsburgh, Pittsburgh, PA, October 21, 2008 (~40 attendees)
- Turns, M., *Anatomy of a Green Home*, Builders Association of Metro Pittsburgh, Pittsburgh, PA, October 21, 2008 (~40 attendees)
- Turns, M., *Energy Code Compliance Tips*, Builders Association of Metro Pittsburgh, Pittsburgh, PA, October 21, 2008 (~20 attendees)
- Turns, M., *Introduction to Green Building*, Lebanon County Builders Association, Lebanon, PA, October 29, 2008 (~50 attendees)
- Turns, M., *Introduction to Green Building*, Lackawanna County Builders Association, Dunmore, PA, October 30, 2008 (~50 attendees)
- Fortney, M., Basement Insulation Strategies, HBA of Huntingdon County, February 5, 2009, (~15 attendees)
- Turns, M., *Green Building Programs and Land Development*, co-presenter, PA Land Development Conference February 12, 2009 (~100 attendees)
- Fortney, M., Overview of the changes in the 2009 IRC, Wayne Co. BA, March 17, 2009, (~30 attendees)
- Fortney, M., Overview of the changes in the 2009 IRC, PA Manufactured Housing Association, Harrisburg, PA, March 18, 2009, (~25 attendees)
- Fortney, M., Mold for Building Operators, PA County Commissioners Association - Loss Prevention Group, Harrisburg, PA, April 7, 2009, (~40 attendees)

Conference Presentations:

- Turns, M., *Status of Energy Codes in PA*, US DOE's Energy Codes 2008. Saint Paul, MN, July 24, 2008 (~150 attendees)
- Kasal, B., *North American Technologies in Housing – Can They Help in Solving Housing Shortages on 21st Century?* Invited Lecture. China Planning Network. Beijing, China. July 2008 (~100 attendees)
- Kasal, B., *In Situ Evaluation of Timber Structures– State-of-the-Art and Future Directions*. Keynote Lecture. SACOMATIS. RILEM International Conference. Varenna. Italy. September 2008 (~80 attendees)
- Kasal, B., *Application of Digital Radiography in Evaluation of Components of Existing Structures*. SACOMATIS. RILEM International Conference. Varenna. Italy. September 2008 (~30 attendees)
- Kasal, B., *Holz und Verbundwerkstoffe –neue Möglichkeiten im Bauingenieurwesen* [in German]. Invited lecture. TU Braunschweig, Germany. September 2008 (~60 attendees)
- Kasal, B., *Reinforcement of Wood with Composite Materials*. US Delegate to US-South America Workshop on Innovative Materials for Civil Infrastructure, Research & Education. Universidad Catolica de Chile. Santiago, Chile, October 13-15, 2008 (~50 attendees)
- Kasal, B., *Structural Repair and Reinforcement of Wood with Composite Materials*. Structural Faults & Repair-2008. Royal Society of Edinburgh, Edinburgh, UK. 2008 (~40 attendees)
- Kasal, B., *In-situ Assessment of Structural Timber*: RILEM technical committee 215 AST. Structural Faults & Repair-2008. Royal Society of Edinburgh, Edinburgh, UK. 2008 (~40 attendees)
- Turns, M., *Green Building Case Studies: What's Worked, What Hasn't*, (panel moderator) PHFA's PA Housing Conference, February 11, 2009 (~50 attendees)

- Fortney, M., *Ask the Pros* - panel discussion, 2009 PA Home Energy Conference, March 17, 2009 (~300 attendees)
- Fortney, M., *Home Improvement Contractor Registration Act*, March 18, 2009 (~50 attendees)
- Fortney, M., *Overview of changes coming in the 2009 IRC*, March 18, 2009 (~50 attendees)
- Kasal, B., *Residential Structures Under Natural Disasters*. Invited speaker. Inner Mongolia Technical College. June 18, 2009. Hohhot, China (~200 attendees)
- Kasal, B., *Residential Structures Under Natural Disasters*. Invited speaker. Inner Mongolia University of Science & Technology. June 19, 2009. Hohhot, China (~250 attendees)
- Kasal, B., *Modeling of Composite Layered Laminated Arches*. International Conference Computational Modeling and Advanced Simulations, Jun 30 – July 3, 2009 Bratislava, Slovak Republic (~40 attendees)
- Kasal, B., *Composite Materials in Reinforcement of Timber*. University of New Brunswick. December 17, 2009. Fredericton, New Brunswick. Canada (~10 attendees)

WWW 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 Builders Association (PBA)—(Training and Education Committee, Land Development Task Force, Housing Finance Committee, and PHRC Committee)
- Advisory Council for the Modular Housing Training Institute (MHTI)
- Advisory Council for the Manufactured Housing Resource Center (MHRC)
- Builder Association of Central Pennsylvania
- Pennsylvania Concrete Masonry Association, Codes Committee

National and International Focus Committees:

- National Consortium of Housing Research Centers
- RILEM, Technical Committee TC 215 AST Chair
- National Institute for Building Sciences (NIBS)
- International Council for Research and Innovation in Building and Construction – Working Commission W-18 – Timber Structures
- Technical Advisory Committee, SACOMATIS-Structural Assessment of Masonry and Timber Structures, Varenna, 2008
- International Scientific Committee, SHATIS International Conference on Structural Health Assessment of Timber Structures, Lisbon 2011

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.

Reports:

Turns, M., *Energy Code Enforcement and Compliance in Pennsylvania: Lessons from the Field*, PHRC Research Series Report No. 106, July 2008

Kasal, B., Adams, A., Manbeck, H., Memari, A., *Experimental Cyclic Racking Evaluation of Light-frame Wood Stud and Steel Stud Wall Systems*, PHRC Research Series Report No. 107, April 2008

Kasal, B., Myers, T., *Analysis of the Wall Bracing Requirements for Pennsylvania*, PHRC Research Series Report No. 108, May 2009

Research Papers:

The research publications not only disseminate the technical information to the public but increase the state, national and international reputation of the PHRC. As such, they are an important component of our mission.

Memari, A. M., and B. Kasal. 2008. Comparison of In-plane Lateral Load Resistance of Interior Steel Stud and Wood Stud Light-Frame Walls ASCE Structures Congress 2008, Vancouver, Canada, April 24-26, 2008.

Heiduschke, A., B. Kasal, and P. Haller. 2008. Performance and drift levels of tall timber frame buildings under seismic and wind loads. *Structural Engineering International*, Vol. 18, Nr. 2, published by IABSE, pg. 186-191, 2008 (Invited publication).

Kasal, B. and A. Adams. 2008. Radiographic investigation of structural connections. In *Proceedings of World Conference on Timber Engineering*. Myiazaki. Japan. June 2008.

Kasal, B. 2008. Structural repair and reinforcement of wood with composite materials. In *Proceedings of STRUCTURAL FAULTS & REPAIR-2008 - 12th International Conference + Exhibition*, 10th - 12th June 2008. Edinburgh, Scotland.

Saralde, T. C. Jr., P. N. Peralta, I. Peszlen, and B. Kasal. 2008. Mechanical Properties of Lumber From Partially Cad-Deficient Loblolly Pine (*Pinus Taeda.*) *Wood and Fiber Science*. Volume 40, Number 4 / October 2008. 657-672.

Repka, N., and B. Kasal. 2008. Insulated concrete masonry below-grade walls. PHRC Report No.105. Pennsylvania Housing Research Center. 237 p.

Blass, R., and B. Kasal. 2009. Modeling of composite layered laminated arches. In *Proceedings from Computational Modeling and Advanced Simulations*, Jun 30 – July 3, 2009 Bratislava, Slovak Republic. (CD Publication)

Heiduschke, A., B. Kasal, and P. Haller. 2008. Shake table tests of small- and full-scale laminated timber frames with moment connections. *Bulletin of Earthquake Engineering*. Springer Verlag. DOI 10.1007/s10518-008-9075-4.

Heiduschke, A., B. Kasal, and P. Haller. 2008. Performance and drift levels of tall timber frame buildings under seismic and wind loads. *Structural Engineering International*, Vol. 18, Nr. 2, published by IABSE, pg. 186-191, 2008 (Invited publication).

Kasal, B. (Editor/Author) 2008. State-of-the-art in in-situ assessment of timber. RILEM TC AST 215 Special Publication. RILEM Paris (In review).

Wehsener, J., and B. Kasal. 2008. Echtzeit-Röntgenuntersuchungen an duktilen stabförmigen Holzverbindungen bei dynamischer Beanspruchung. *Bautechnik* 85. 10/2008. 678-686.

Kasal, B. 2008. RILEM TC 215 AST “In-situ evaluation of structural timber.” SACOMATIS. In *RILEM Proceedings PRO 59*. Binda, L., M. di Prisco, and R. Felicetti (Editors). Volume 2. RILEM Publications. Bagnaux. ISBN 978-2-35158-061-5. 1025-1032.

Kasal, B., A. Adams, and M. F. Drdacky. 2008. Application of digital radiography in evaluation of components of existing structures. SACOMATIS. In *RILEM Proceedings PRO 59*. Binda, L., M. di Prisco, and R. Felicetti (Editors). Volume 1. RILEM Publications. Bagnaux. ISBN 978-2-35158-061-5. 581-592.

4. Research Activities

Wall Bracing Standards for Pennsylvania – The residential structures all over the United States are exposed to high winds year round. We propose to look at the historic wind data for Pennsylvania available through the National Weather Service, and establish critical regions/counties. The assessment of wind loading with these local wind data is possible by using the existing design guidelines. All 3 Phases--Feasibility Study, Regional Wind Mapping, and Developing of Bracing Standards, were finished and a PHRC Report #108, *Analysis of the Wall Bracing Requirements for Pennsylvania*, was published and is available in a PDF format on the PHRC web site. More detailed analysis is available in the thesis, “Analysis of the International Residential Code 2006 Low Rise Wood Frame Building Bracing Requirements for Pennsylvania” by Tanya L. Myers.

Impact of the Uniform Construction Code in Rural Pennsylvania – Little had been known about the mix of enforcement approaches chosen by municipalities, or the fees they charge for enforcement services. This project will use existing data sets and a survey of municipal secretaries to assess building code enforcement approaches and building permit fees in Pennsylvania municipalities. Uniformity of code requirements across the state, housing permit data, and the potential impact of the code on homeowner’s insurance premiums were also analyzed. A new database unifying diverse sources of data was created. The final report was submitted to and approved by the Center for Rural Pennsylvania.

The PHRC implemented a survey to assess the issues described above, and garnered over 1,400 responses representing 60% of opt-in municipalities. Some key findings include the following items. Enforcement by 3rd-party agencies is the dominant method across the Commonwealth, more so in rural than urban municipalities. There was a wide range and high level of variability in the board of appeals and UCC fee data. There were no consistent trends that would lead to the conclusion that one enforcement method results in lower costs than another. UCC fees were significantly (22-37%) higher in urban municipalities than in rural. There was significant disagreement between what municipalities reported and what L&I records indicated regarding the presence of amendments to the UCC. Over 20 percent of rural, and over 50 percent of urban municipalities, claim to enforce an amendment to the UCC. DCED’s cooperation with the U.S. Census Bureau has filled in the gaps in the Census building permit data in Pennsylvania. DCED permits are about 10 percent higher than Census estimates. Overall, municipal ISO ratings have improved dramatically since the implementation of the UCC; however, the impact on homeowner’s insurance premiums is probably not large.

5. Applied Activities

Technical Assistance the Review and Advisory Council – In the fall of 2008 the PA Legislature created the Uniform Construction Code Review and Advisory Council. The RAC consists of 19 members appointed by the Governor from various construction industry trades and professions as well as local government, and is charged with making recommendations to the Governor, the General Assembly and the Department of Labor & Industry regarding proposed changes to Act 45 (The Pennsylvania Construction Code Act) and changes that appear in the International Codes enforceable under this act. Initially, the Council will be involved primarily in deliberations on whether any changes made in the latest triennial version of the International Codes should be excluded from adoption in Pennsylvania.

The PHRC has offered technical assistance to the RAC. This technical assistance was offered in two forms. The first was reviewing the residential provisions of the ICC codes and prioritizing the major changes. This is done in writing, ahead of their meetings. The second was to provide information during the meetings. This has included providing testimony on the background of specific code requirements and technical difficulties in meeting them, as well as answering questions posed by the Council. The RAC recommended no exclusions of new requirements in the 2009 ICC codes to the DLI. In order to provide this service, several projects were delayed to allow the allocation of staff time.

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 - 2006: Education will be provided through various building code training programs. Technical assistance will be provided through telephone and email support by the PHRC.

The PHRC has reviewed the 2009 IECC and has developed a list of some of the key changes between the 2006 and 2009 IECC. These have been prioritized and the PHRC is in the process of developing a standard that will provide equivalence to the 2009 IECC and provide some flexibility to the provisions. The PHRC is in the process of developing computer models to evaluate equivalence of the various options that are being considered. The final version of the PA-Alt was delivered to DLI in May 2009.

The working group for the PA-Alt development consists of the following individuals:

Andy Bowman (Code Official)
Scott Cannon (Builder)
Ed Carr (Energy Consultant)
Don DeLess (Builder)

Jerry Leach (Builder)
Clem Malot (Code Official)
Tim Palaski (Code Official)
Frank Thompson (Builder)

2. Pennsylvania Standards for Residential Site Development Standards: Please see the Land Development section.
3. Foundation Systems for Relocated Manufactured Housing: The PHRC has developed a one-hour training program for building code officials and contractors. This program was initially held at our December 9th Webinar to over 80 people. A recording of this program is posted on the PHRC's web site for open viewing (www.engr.psu.edu/phrc/Training/Webinars.htm).

Analysis of Zero Energy Homes – Technical, Constructability, and Public Policy Challenges – Politicians are paying increasing attention to issues of global warming, rising fuel prices, and our country's dependence on foreign oil, making the possibility of far-reaching energy legislation in the near future very real. If deep cuts in energy consumption were mandated, how would home builders respond? Could builders take advantage of a greenhouse gas cap-and-trade system? With economic feasibility in mind, this project would look at how far modified designs and off-the-shelf technologies could take a home in cloudy Pennsylvania toward the goal of producing as much energy as it consumes. Cost mitigating factors and relevant policy issues will also be discussed in this research report.

An initial literature search was completed, identifying case studies relating to Zero Energy Homes in Pennsylvania or similar climates. Information has been gathered on related public policy issues, such as Pennsylvania's recently created Alternative Energy Investment Fund. Builders with experience in building near-Zero Energy Homes have been identified as possible resources. Information has also been obtained on Massachusetts Office of Energy and Environmental Affairs Task Force on zero net energy buildings. This project was put on hold due to time constraints caused by the development of the *Home Performance 101* training program, the mechanical training program, and the *Impact of the UCC in Rural Pennsylvania* research project.

Prioritizing Energy Efficiency in Remodeling Projects – Pennsylvania has a very old housing stock; over 80% was built before the Commonwealth established an Energy Code. The potential for reducing energy use and improving comfort of our existing homes is great. Consumers and remodeling contractors usually do not consider energy improvements as part of remodeling project, but when they do, energy savings can be very significant. Many times this is a lost opportunity for the remodeling contractor.

The PHRC has redirected this initiative slightly to leverage funds and program support from the Commonwealth. The PHRC took the lead in the development of a full-day training program and training manual titled, *Home Performance 101: The House as a System*. The program was developed to help remodelers and other contractors understand the interactions between a home's systems and how to prioritize energy upgrades. Residential energy programs and incentives, certifications, business models, building science principles and energy audit protocols are also introduced. The program development was funded by the PA Department of Environmental Protection through the West Penn Power Sustainable Energy Fund.

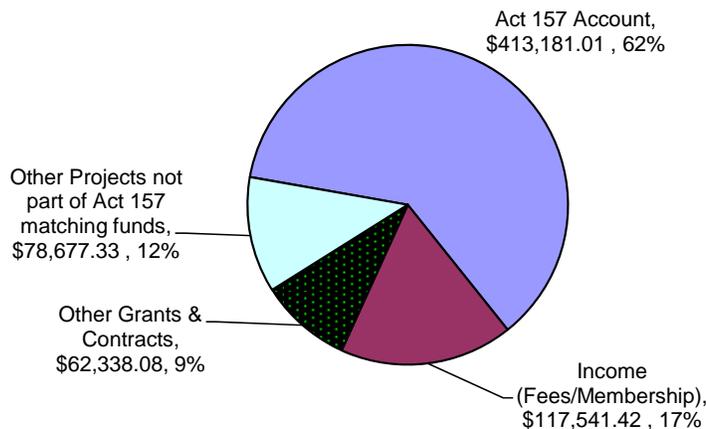
DEP-DOE Grant - Work is complete on a project funded by a grant from the U.S. Department of Energy, in partnership with the Pennsylvania Department of Environmental Protection. This project focused on the implementation of the 2006 IECC, and included the following activities: (1) code official certification training, (2) advanced training of building code officials, (3) 2006 IECC transition programs, (4) train-the-trainer programs, (5) energy code administration and enforcement, (6) evaluation of energy code compliance, (7) coordination and information sharing, and (8) development and distribution of energy code training materials.

This contract has been closed and all deliverables completed. The PHRC Research Series Report 106, *Energy Code Enforcement and Compliance in Pennsylvania: Lessons from the Field*, continues to be available to the public. Under this contract a total of 37 programs were held by the PHRC with 2,142 individuals trained.

6. 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. The grants and contracts include: the Pennsylvania Department of Community and Economic Development; U.S. Department of Energy through the Pennsylvania Department of Environmental Protection; the U.S. Department of Agriculture in partnership with North Carolina State University; and, DOW Chemical Company. 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 \$413,181.01 (Figure 2). Act 157 Construction Training Account accounted for 62% of these funds, other grants and contracts accounted for 12%, other projects not part of Act 157 matching funds accounted for 9%, and income from fees and services accounted for 17%.



**Figure 2: Summary of Funding
July 1, 2008 through June 30, 2009**

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, 2008, the beginning of this reporting period, the PHRC received one payment of \$159,947.32 in February 2009 and \$102,857.22 in May 2009 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 \$413,181.01 during this reporting period. This is less than anticipated in the Project Plan for a variety of reasons. The salaries were reduced because the Land Development Specialist position was vacant for part of the reporting period. Additionally, the PHRC was able to shift funds initially anticipated to be incurred by Act 157 account to other funding sources

The *PHRC Project Plan July 2009 – June 2010* was developed with the remaining funds in the Act 157 Account as of June 30, 2009. This plan has anticipated expenditures of \$384,835.

Table 2: PHRC Expenses July 1, 2008 through June 30, 2009

Category	Act 157 Account	Leveraged Funding	Total Expenses
Total Salaries	\$273,172.52	\$60,226.25	\$333,398.77
Fringe Benefits	\$74,657.94	\$12,365.93	\$87,023.87
Supplies and Materials	\$212.97	\$7,989.25	\$8,202.22
Communications Services	\$1,683.52	\$4,265.33	\$5,948.85
Travel	\$33,417.38	\$56,894.10	\$90,311.48
Publications	\$2,788.20	\$1,534.07	\$4,322.27
Maintenance		\$631.00	\$631.00
Consulting & Prof Svc	\$21,739.25	\$14,521.14	\$36,260.39
Copies and Photographic Services	\$3,961.51	\$10,731.78	\$14,693.29
Scholarships		\$410.75	\$410.75
Tuition and Fees		\$31,450.00	\$31,450.00
Equipment <\$5000		\$68.00	\$68.00
Equipment >\$5000		\$13,876.16	\$13,876.16
Computer Equipment <\$5000	\$1,163.72	\$2,867.00	\$4,030.72
Purchased Services		\$334.95	\$334.95
Miscellaneous	\$384.00	\$20,963.01	\$21,347.01
Indirect Costs (Overhead)		\$19,428.11	\$19,428.11
Total	\$413,181.01	\$258,556.83	\$671,737.84

Summary of Act 157 Funds				
		Expenses	Deposits	Balance
Fiscal Year 2008-09	Starting Balance FY 2008-09			\$563,970.81
	Expenditures FY 2008-09	\$413,181.01		\$150,789.80
	February 2009		\$159,947.32	\$310,737.12
	May 2009		\$102,857.22	\$413,594.34
	Payment Due August (anticipated amount)		\$76,503.05	\$490,097.39
	Projected Expenditures FY 2009-10	\$384,835.00		\$105,262.39

7. 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 2008-09.

Proposals Submitted:

- Center for Rural Pennsylvania – *Impact of the Uniform Construction Code in Rural Pennsylvania*
- National Science Foundation – *Modeling of Low-Rise Buildings Subjected to Extreme Wind Loads*
- West Penn Power Sustainable Energy Fund – *Development of certification Training for Keystone Help Contractors*
- Integrated Building and Construction Solutions (IBACOS) – *Advanced Residential Energy Training*
- PA Department of Environmental Protection – *Implementing the 2009 IECC in Pennsylvania- Pre-proposal*
- National Cooperative Highway Research Program (NCHRP) – *High Performance Composite Guardrails Based on Sustainable Materials*
- DOW Chemical – *Hygro-Thermal Performance of Imperfectly Protected Below-Grade Walls with Interior Insulation*
- National Housing Endowment, Homebuilding Education Leadership Program (HELP) – *Establish the Instructor-Practitioner Position*