



The Pennsylvania Housing Research/Resource Center

Project Plan

July 2009 – June 2010

Pennsylvania Housing Research/Resource Center
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Preface

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

- meet the residential construction industry needs and the needs of 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 sections of the industry.

This PHRC work plan is the result of input and assistance from numerous groups and individuals. The PHRC Industry Advisory Council (IAC) and the Operations Committee, in particular, have responsibility for the final choice of activities. These housing industry-based bodies consist of manufacturers, suppliers, builders, remodelers, industry associations as well as building code organizations and state agencies. On April 24, 2009 the IAC met to identify and discuss over 50 potential projects for the PHRC to pursue. After a thorough discourse, the members of the IAC voted on projects they felt were the highest priority for the industry.

This voting resulted in a prioritization of projects into three groups. The first group was high-priority projects that are included in this plan. The second group included medium-priority projects. Many of these are included in the contingency projects that may be pursued if resources become available. The third group was low-priority projects. These projects are not included in this plan. The projects are anticipated to start July 1, 2009 and be completed on or before June 30, 2010.

The list of projects that follows identifies only those projects that are 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 undertakes a wide area of additional projects that do not receive any of these funds and are therefore not listed in this plan.

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 only considers funds on hand. Any remaining funds will be carried over for future projects. We plan to continue with our previous initiatives in the areas of training and education, modular housing, manufactured housing, and applied research.

We plan projects and allocate funds at the start of each year. However, there is a real need for the PHRC to be able to take on special projects during the year. These projects typically fall into two categories: the first includes short term and limited scope projects that are time sensitive, while the second requires the ability to allocate some funds to leverage additional outside funds in response to requests for proposals.

PART 1 - 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.

A. Program Development

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

1. **Residential Mechanical Code Compliance Program** – 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 will provide new and experienced building code officials, mechanical installers, and job supervisors the background they need to effectively administer and enforce the mechanical requirements in the IRC.

Manager/PI: Turns

Deliverables: This program was initiated in the previous fiscal year. The mechanical program development will be completed with a pilot program to be held with representatives from both the HVAC industry and building code officials. Based on the industry input from the pilot, the program will be updated and put in final form.

2. **Two-Family Dwellings and Townhouses Program** – There are specific requirements for multi-family structures built under the IRC that require special attention by the building code official. The program will highlight such issues as fire separation requirements and accessibility. This program will focus on effective plan review and inspection practices and provide an understanding of fire rated assemblies.

Manager/PI: Fortney

Deliverables: This program was initiated in the previous fiscal year. The multi-family program will be put in final form. One of the final components that will be developed is the virtual inspection for a townhouse development.

3. **2009 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 will highlight the most significant changes between the 2006 and 2009 IRC, and identify potential impacts to builders, designers and building code officials. The result of this will be a new training program to be offered to builders and code official organizations.

Manager/PI: Fortney

Deliverables: This program was initiated in the previous fiscal year. The program will be put in final form and made ready for delivery in the fall.

4. **Blueprint Reading Program** - This one-day workshop is designed to familiarize people with little or no construction experience with the technical components of blueprint reading. This program is intended to provide people who want to become residential inspectors or inspectors with this essential skill.

Manager/PI: Fortney

Deliverables: This program will be developed during the fall and will be made available in late February 2010.

5. **Wall Bracing: Prescriptive Design and Plan Reviews** - This one-day workshop is designed to provide an overview of the 2009 IRC wall bracing requirements. The program will provide a general understanding of structural principals of wood frame buildings as well as wind and seismic loading. The program will also provide an emphasis on prescriptive design using the IRC, when a building is exceeding the limits of this approach and a design professional is required, and how to conduct wall bracing plan reviews.

Manager/PI: Fortney, Kasal

Deliverables: This program will be developed by PHRC staff and an outside engineer who has served on ICC's technical committee to develop the new wall bracing requirements. The development will also involve up to two additional instructors who have an engineering or strong technical background.

6. **Updating Existing Programs to the 2009 IRC** – The PHRC will update eight of its existing residential training programs to the 2009 IRC. This will require a re-drafting of many of the programs. Additionally programs a, b, c and d will be expanded and changed to reflect greater need for more basic information and to present the material at a slower pace and in a more detailed fashion.

a. Comprehensive International Residential Code (IRC) Program	2 day
b. Pennsylvania's Residential Energy Code Requirements	2 day
c. Overview of the IRC's Plumbing Requirements	2 day
d. Overview of the IRC's Mechanical Requirements	2 day
e. Residential Mechanical Plan Reviews and Inspections	1 day
f. Commercial Building Provisions of the IECC	2 day
g. Performing Residential Building Inspections	2 day
h. Residential Deck Design Construction and Inspection	1 day

Manager/PI: Fortney, Turns

Deliverables: All of the above programs will be updated. This will include new presentations, manuals, examples, slides, examinations and presenters manual.

B. PHRC Workshops

Description: Every year the PHRC provides workshops for builders, remodelers, design professionals, educators, trade contractors and building code officials. These programs will be administered directly by the PHRC. Some of the topics that are being considered for this year's programs include the following:

1. **Residential Deck Design Construction and Inspection** - Decks are considered simple structures, yet deck-related failures are responsible for a substantial number of injuries and deaths each year. This program will discuss the root causes of these problems and offer real world solutions.

This one-day program will provide an overview of IRC code requirements for residential decks and a detailed review of the proper installation of commonly used connectors, fasteners and some commonly used proprietary products. The afternoon will focus on hands-on examples including designing a simple residential deck, performing a detailed deck plan review to check for code compliance, and a virtual inspection of a residential deck.

This course is designed for builders, remodelers, deck contractors, building code officials (plan reviewers and inspectors), design professionals, home inspectors, and manufacturers and suppliers of deck-related construction materials.

2. **Residential Mechanical Code Compliance Program** –This program will focus on mechanical installers and job supervisors as well as new building code officials to provide a 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. This program will provide new and experienced building code officials and mechanical installers and job supervisors the background they need to effectively administer and enforce the mechanical requirements in the IRC.
3. **Wall Bracing: Prescriptive Design and Plan Reviews** - This one-day workshop is designed to provide an overview of the 2009 IRC wall bracing requirements. The program will provide a general understanding of structural principals of wood frame buildings and wind and seismic loading. The program will also provide an emphasis on prescriptive design using the IRC, when a building is exceeding the limits of this approach and a design professional is required and how to conduct wall bracing plan reviews.

Manager/PI: Fortney, Turns, Kasal

Deliverable: The PHRC will administer and deliver at least four technical workshops to be held at various locations across the state.

C. 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 42 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. IRC 2009 Update Program	1 day
10. Residential Deck Design Construction and Inspection	1 day
11. Blueprint Reading	1 day
12. Wall Bracing – IRC 2009 Prescriptive Design and Plan Reviews	1 day
13. Design and Construction of Wood Frame Buildings	2 day

Manager/PI: Fortney, Turns

Deliverable: The PHRC will deliver at least 15 workshops to be held through various industry partners across the Commonwealth. The PHRC will also deliver custom programs upon request.

D. Web-Based Training

Description: 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 will seek to develop interactive web-based training that can be available both live and archived for future viewing.

The following are some of the topics that are being considered for web-based training:

- ❖ Factory Built Structures Series; A Primer for Code Officials
 - Part 1 – Manufactured Housing (HUD Code Homes)
 - Part 2 – Modular of Industrialized Housing
 - Part 3 – Commercial Structures (Depending on Pending Legislation)
- ❖ Tall Wall Framing Based on the 2009 IRC
- ❖ Zero Energy Homes in PA
- ❖ Introduction to Wall Bracing in the 2009 IRC
- ❖ Overview of Mold for Remodelers
- ❖ Building Code Basics for Energy Improvements
- ❖ Building No-Step Entrances for Single Family Homes
- ❖ Basement Insulation Strategies
- ❖ Introduction to Green Building
- ❖ Residential Duct Testing
- ❖ Air Sealing Techniques
- ❖ Conducting a Blower Door Test
- ❖ Radiant Floor Heat - Insulation Requirements and Installation Challenges

- ❖ Habitable Attics
- ❖ Live - Work Units
- ❖ Wood - Plastic Composites (Standard Plus Installation Issues)
- ❖ Vinyl Siding and Soffit - Common Installation Errors
- ❖ Combustion Air Requirements
- ❖ Entrapment Protection - Residential Pools

Manager/PI: Fortney, Turns

Deliverable: The PHRC will work with the PBA, PMHA PCCA and other industry and trade organizations to identify the most relevant topic(s) and develop and deliver at least eight (8) programs. Additional programs may be added to address emerging issues as they arise.

E. Builder Briefs

Description: Continuation of the series of short technical documents - two to four pages in length - that address specific issues that have been identified by builders or remodelers. These documents are intended to be quick to read with much information presented graphically or pictorially. Potential topics include:

1. Energy Code Enforcement – Lessons from the Field
2. Design Pressures for Windows and Doors
3. In-floor Radiant Heat
4. Basement Wall Insulation Strategies

Manager/PI: Turns, Fortney, Kasal, etc.

Deliverable: At least one builder brief will be researched, written, printed and distributed.

F. Technology Transfer & Outreach

Description: Continuation or expansion of activities to get information and publications to builders, remodelers, design professionals, building code officials and others involved in the residential construction industry.

Manager/PI: Fortney

Deliverables: The PHRC will work with the PBA and other industry and trade organizations by means of the following activities:

1. **Annual Pennsylvania Housing and Land Development Conference:** For over 17 years this conference has been the premier technical conference for housing and land development issues in Pennsylvania. This two-day conference provides the latest information on emerging technologies and how to resolve problems facing the housing industry. The conference is intended for all sections of the housing industry including builders, remodelers, code officials, educators, design professionals and modular and HUD-code builders. The second day of the conference serves as an annual forum that addresses emerging planning, design, and regulatory issues affecting the land development industry in Pennsylvania. This day is intended for anyone involved in land

development activities including builders, developers, design professionals, planners and regulatory officials.

2. **Speaker Service:** The PHRC will hold and/or participate in talks and seminars directed at the housing industry. This may include trade and professional association functions and regional meetings, local association meetings, or state or national conferences.
3. **Outreach Activities:** This includes activities to let builders know about the PHRC and the services and publications it provides. These activities may include the PHRC newsletters, mailings, promotional pamphlets, advertisements in trade journals, phone calls, and the PHRC's Web site.

PART 2 - Applied Research: A very important function of the PHRC is to undertake or stimulate research and development on materials, products, procedures, etc. These efforts may have a longer-term and/or a more fundamental focus than other projects. The projects that are listed below foster partnerships and draw on the expertise and strengths of the persons, groups and facilities available at both the Pennsylvania State University and the Pennsylvania College of Technology.

A. Guidelines for Efficient Basement Insulation

Description: This project will build on two previous projects conducted by the PHRC involving sophisticated testing of the performance of basement wall systems. This project will synthesize the results of previous work to develop simplified guidelines for energy-efficient and healthy basement insulation based on the latest knowledge. Typical basement insulation details will be developed and their positive and negative attributes will be assessed. The target audience for this document will be builders, design professionals as well as building code officials.

Manager/PI: Kasal

Deliverable: Guidelines for basement insulation (new and existing buildings) including typical suggested details and description of their advantages and drawbacks. The guidelines will include suggestions for insulation strategies for new buildings and for basement retrofit (existing buildings). The following will be covered:

- basement evaluation
- suggested insulation including sketches and drawings

The basement evaluation pertains to existing buildings and will consist of rules and steps necessary to evaluate the physics of the space and surrounding environment (soils) in order to design the most appropriate insulation strategy and list suggested solutions based on evaluation parameters (soil type, drainage, basement orientation, foundation wall composition, access to exterior wall surface, etc.)

PART 3 - 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 program and tasks have been identified by builders and the PHRC Operations Committee as a high priority project for Pennsylvania's home building industry. It should be noted that the Land Development Specialist position at the PHRC is currently vacant. Once this position is filled additional activities will be included as contingency projects. The following tasks will be undertaken:

A. Pennsylvania Standards for Residential Site Development

Description: 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.

Manager / PI: Fortney

Deliverable: Presentations will be made to land development design professionals and local government groups. These efforts will be coordinated with PSATS, Local Chapters of ASCE, PBA's Developers Council and other professional associations.

PART 4 - 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.

A. Enforcement Practices and Impact of the UCC on Municipalities

Description: This project, partially funded by the Center for Rural Pennsylvania, will seek to provide a clearer picture of the UCC's impact on rural municipalities. This will include a determination of which municipalities are enforcing the UCC, and more importantly, how they are enforcing it. Analyses of building permit fees will be performed to determine whether there is a correlation between fee amounts and enforcement approach, as well as differences in fees between rural and urban municipalities. This will be accomplished by the integration of several pre-existing data sets: one maintained by the Department of Labor and Industry (DLI); one maintained by the Department of Community and Economic Development (DCED). The PHRC will augment these data sets conducting a mail survey of all municipalities in Pennsylvania.

Manager/PI: Turns

Deliverable: A public report discussing the current code enforcement practices and building permit fees.

B. MHTI & MHRC Support

Description: Two programs focusing on training for the factory-built housing industries have been developed. The first is the Modular Housing Training Institute (MHTI) and the second is the Manufactured Housing Resource Center (MHRC). The MHTI program currently provides a two-day training program that focuses on the on-site completion of modular houses. The program is intended for builders, installation crews, code officials, as well as industry representatives. The MHRC currently provides training for the on-site completion of manufactured or HUD Code housing. The program is intended for retailers, installers, manufacturers, as well as building code officials. In recognition of the importance of factory-built housing to PA, a Ben Franklin award has been made to enable employment of a full-time Director of MHTI and MHRC.

Manager/PI: Pennsylvania College of Technology

Deliverable: Promotion of the programs by providing presentations at trade association meetings, direct marketing to manufacturers, community owners and retailers, etc.

C. Support of Standards

Description: 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.

Manager/PI: Fortney, Turns

Deliverable:

1. Pennsylvania's Alternative Residential Energy Provisions - 2009: Education will be provided through various building code training programs and technical assistance will be provided through 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 deliver a one-hour training program for building code officials and contractors. After this is held, it will be posted to the PHRC's Web site for open viewing.

D. Analysis of Zero Energy Homes – Technical, Constructability, and Public Policy Challenges

Description: 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? 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.

Manager/PI: Turns, Lau

Deliverable: This project will result in a presentation of the findings at the PA Housing Conference, as well as a webinar. The work will also be summarized in a technical report for use by builders, design professionals and state and federal policy makers.

E. Development of the 2009 Alternative Residential Energy Provisions

Description: In November 1999, the Pennsylvania Legislature passed ACT 45, known as the Uniform Construction Code (UCC), into law mandating a statewide building code across Pennsylvania. Act 45 requires the Pennsylvania Department of Labor and Industry (DLI) to promulgate regulations to implement the requirements of the legislation and, in addition, to consider the development of alternative prescriptive methods for energy conservation that account for the various climatic regions within the Commonwealth. In deriving these energy standards, the DLI was to seek to balance energy savings with initial construction costs.

The PHRC developed the *Pennsylvania Alternative Residential Energy Provisions* (PA-Alt) for consideration by DLI to meet their legislated mandate. The PA-Alt was developed with the intent of being:

- simpler to build to and easier to enforce;
- more rational and flexible;
- focused on Pennsylvania in terms of climatic and other conditions; and,
- equivalent to the provisions of the International Energy Conservation Code (IECC).

The initial version of the PA-Alt was developed in 2000 and was based on the 2000 IECC and IRC. The second version was updated to the 2003 IECC. The third iteration of the PA-Alt is equivalent to the 2006 IECC.

In 2009, the PHRC may need to update this document to be aligned with the new 2009 International Energy Conservation Code (IECC). This typically involves detailed computer analysis to document equivalence of the code and evaluate potential tradeoffs.

Manager/PI: Fortney, Lau

Deliverable: The development and publication of the 2009 provisions.

Contingency Projects: Projects in this group have a high level of interest, but because of limited resources (financial, staff, etc.) the PHRC is not able to undertake them during this period. Other projects in this group are projects in which the PHRC has solicited financial support but are awaiting response from funding agencies. Additionally, the PHRC may take on high priority, short-term projects mid-cycle at the request of the Industry Advisory Council or the Operation Committee.

A. Residential Sprinkler Training

Description: At the time of drafting this plan, the Commonwealth of Pennsylvania is on the verge of mandating sprinklers for one- and two-family dwellings and townhouses. While this technology is common in commercial/industrial construction it is not common practice for residential construction. This project will develop or identify a training program aimed at design professionals and building code officials.

Manager/PI: Fortney

Deliverable: The PHRC will seek to develop and/or deliver technical information and training on the residential sprinklers. This could be through webinars, conference presentations as well as training events.

B. Building Diagnostics

Description: Performance of residential buildings is affected by many factors that include structural and nonstructural elements. Building diagnostics ranges from visual assessment to acoustic emissions, psychometric, noise penetration measurements and x-ray technology. A number of consulting companies specialize in building diagnostics, but no unified guidelines exist that will summarize available technologies, their capabilities, and drawbacks. Within this project, a protocol to evaluate residential structures for structural and nonstructural deficiencies (energy, moisture damage, mold development, air quality, etc.) will be developed and the most appropriate technologies identified. The PHRC is developing the diagnostics capability and is it expected that we will be able to offer assistance in identifying best construction practices and causes of potential building failures.

Manager/PI: Kasal, Srebric

Deliverable: PHRC will have the ability to objectively monitor, measure and evaluate important parameters affecting the performance of houses and other buildings (including commercial). To do this effectively we need a unified protocol that can be followed to evaluate all buildings in a consistent and comparable manner. This includes: infrared thermography, psychometrics, air flow, air quality and noise penetration evaluations. This project will help the industry and consumers (both residential and commercial) to have an independent evaluation entity available. Attaining this capability may evolve in a full time position within the PHRC to serve PA citizens and companies including training.

Attachment 1**Projected Budget by Project Categories**

Project	Act 157 Funds	Outside^{1,2}	PSU Support	Total
Training, Technical Assistance and Outreach	\$279,361	\$191,443	\$125,712	\$596,516
Applied Research	\$45,109		\$20,299	\$65,408
Land Development	\$3,786		\$1,704	\$5,490
Applied Projects	\$56,579	\$39,470	\$25,461	\$121,510
	\$384,835	\$230,913	\$173,176	\$788,924

Notes:

- 1 Outside funding is received from a variety of sources including fees for services, in-kind contributions, industry contributions, grants and contracts.
- 2 These funds are contingent upon industry commitments.