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**The Pennsylvania Housing Research Center**

# **Project Plan**

## **July 2016 – June 2017**

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# Table of Contents

<b>I. Preface .....</b>	<b>1</b>
<b>II. Training, Technical Assistance &amp; Outreach.....</b>	<b>2</b>
A. Program Development .....	2
1. Existing Program Maintenance .....	2
2. HVAC Design and Installation (continuation).....	2
3. IRC Framing Design & Code Compliance .....	2
4. Online training strategy .....	3
B. PHRC Training Program Delivery .....	3
C. Web-Based Training .....	5
D. Builder Briefs.....	5
E. Technical Assistance, Technology Transfer & Outreach .....	5
<b>III. Applied Research .....</b>	<b>8</b>
1. Laboratory Testing and Analytical Evaluation of Residential Wall R-value for Several Conventional Wall Systems .....	8
<b>IV. Applied Projects .....</b>	<b>9</b>
1. Deck Design Spreadsheet .....	9
2. Exterior Plaster Assemblies in Pennsylvania (continuation) .....	9
3. Update to the PA Alternative.....	9
4. Evolution of the Building Enclosure in PA .....	10
<b>V. Projected Budget by Project Categories.....</b>	<b>11</b>

# I. 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.

The PHRC Industry Advisory Council (IAC) has the responsibility to prioritize activities and project topics. This housing industry-based body consists of builders, developers, manufacturers, suppliers, remodelers, design professionals, industry associations as well as building code organizations and state agencies.

On April 14, 2016 the IAC met to discuss potential projects for the PHRC to pursue. After a thorough discourse, the members of the IAC voted on projects that they felt were the highest priority for the industry. This voting resulted in a prioritization of projects. The high-priority projects are included in this plan.

Unless otherwise noted, the projects contained in this plan are anticipated to start July 1, 2016, and be completed on or before June 30, 2017.

The list of projects that follows identifies only those projects that are to receive funds provided to the PHRC by the Commonwealth of Pennsylvania through the Act 157 of 2006 permit fee. The PHRC attempts to use permit fee monies to leverage outside support. It should also be recognized that the PHRC undertakes 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, the current plan only considers funds in-hand, funds collected from July 2015 to March 2016 with the final quarter from April 2016-June 2016 being estimated based on the previous quarter.

The PHRC plans projects and allocates 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.

At the time of development of this Project Plan for 2016-2017 in June 2016, the contract for the Pennsylvania Construction Codes Academy (PCCA) training program has not yet been awarded. The PHRC needs to have flexibility in the projects planned for the coming year to adjust

schedules as needed to accommodate potentially working with a new organization and/or to provide the needed training to code officials if the awarding of the contract is delayed. The final completion of one or more projects may extend into the next fiscal/project year if time needs to be allocated to support of the PCCA programs.

## II. 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 from the PHRC's Industry Advisory Council and reflect the current needs within the housing industry.

### A. Program Development

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

#### 1. Existing Program Maintenance

**Description:** There is a need to make minor updates to existing programs to address the 2015 code changes and also incorporate course material updates based on instructor feedback through the use of "Program Change Forms." We will also work to update and improve the photos in programs, incorporate more photos or videos as appropriate, and expand active learning exercises to increase learner participation and knowledge retention.

**Manager/PI:** K. Blansett

#### 2. HVAC Design and Installation (continuation)

**Description:** As new home construction introduces tighter and more efficient wall assemblies, the need for design and installation of efficient HVAC equipment is essential. With this flexible program, we will work with industry HVAC experts in creating a full day HVAC design and installation class which can also be delivered in two, half-day sessions, or one full-day session. This will be a second of a two-year project. Outside content experts will be consulted for assistance in development and final program review.

**Manager/PI:** C. Hine

#### 3. IRC Framing Design & Code Compliance

**Description:** The design and implementation of many framing and structural details in residential construction is often taken for granted as experienced framers are relied upon to

provide a code compliant light-frame structure. However, as trends continue to call for complicated floor plans and open concepts, components such as connections and the use of new engineered wood products require more attention and detailing. This full day workshop will take a look at the structural requirements of the IRC including connections, fasteners, hangers, wall bracing, as well as some fundamental light-frame design theory.

**Manager/PI:** C. Hine & B. Wolfgang

#### 4. Online training strategy

**Description:** The PHRC has developed a new online training strategy in the 2015-16 project year that is based on the successful webinar model. This new online strategy will allow for the delivery of longer workshops (up to 6 hours of instruction) over the course of a few weeks to a month. This strategy will break down traditional workshop material into smaller webinar-style sessions that will be delivered as a series. In 2015-16, “Moisture Management in Residential Construction” was developed in this format and will be offered in late 2016.

Based on the success of the pilot of Moisture Management, other programs will be investigated for either development or modification to this format.

**Manager/PI:** B. Wolfgang

### B. PHRC Training Program Delivery

**Description:** The PHRC has developed and maintains a wide array of training for many sectors of the construction industry with a focus on residential construction. These programs are intended to address technical issues facing the industry. The intended audience for these programs includes builders, remodelers, trade contractors, design professionals, teachers, and building code officials. Additionally, the PHRC can customize programs to better meet the needs of an industry partner.

The PHRC seeks to partner with relevant outside organizations whenever possible. These industry partners 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).

Current PHRC training program offerings are listed below. These are broken into three categories: (1) Residential Building Scholar/ Residential Code Scholar/Code Refresher, (2) Focused Topics, and (3) Academy Programs.

(1) **Residential Building Scholar (RBS)/Residential Code Scholar (RCS)/Code Refresher** programs are intended for those wishing to attain the RBS or RCS designation. These 1-day programs are a shorter alternative to the multi-day academies and are also well-suited for anyone interested in an introduction to building codes, or information to make inspections go more smoothly. The RBS program was established as part of the 2012-2013 project plan.

a. IRC Building

1 day

- |                             |       |
|-----------------------------|-------|
| b. IRC Plumbing             | 1 day |
| c. IRC Mechanical           | 1 day |
| d. IRC Electrical           | 1 day |
| e. Residential Energy Codes | 1 day |

(2) **Focused Topics** programs are designed to immerse the attendee more deeply into a particular aspect of construction. These programs are ideal for meeting continuing education requirements for certified code officials. As appropriate, AIA Learning Units (LUs) for architects and Professional Development Hours (PDHs) for engineers are offered.

- |   |              |
|---|--------------|
| a. Advanced Framing – Increasing Performance & Reducing Costs                                     | ½ day        |
| b. Blueprint Reading  | 1 day        |
| c. Building with Exterior Rigid Foam  | ½ day        |
| d. International Residential Code Inspections   | 2 day        |
| e. Photovoltaic Installation and Inspection   | 1 day        |
| f. Residential Fire Sprinklers  | 1, 2 day     |
| g. Solar Hot Water Installation and Inspection  | 1 day        |
| h. Special Issues with Two-Family Dwellings and Townhouses  | 1 day        |
| i. Fundamentals of Exterior Plaster and Thin Stone Veneer Assemblies                              | 1 day        |
| j. Energy Plan Review and Inspection  | 1 day        |
| k. Achieving Compliance with the International Energy Conservation Code in Commercial Occupancies | online       |
| l. Land Development Process   | 2 hour       |
| m. Stormwater 101   | 2 hour       |
| n. Building Envelope Design and IECC Code Compliance  | 1 day        |
| o. Building Code Plan Review and Inspection   | 1 day        |
| p. Residential Deck Design and Construction   | 1 day        |
| q. Building with Exterior Rigid Foam  | 1 day        |
| r. Stormwater Regulations for Municipal Officials   | 1 hr – ½ day |
| s. Moisture Considerations for Residential Building Enclosures                                    | online       |

(3) **Academy Programs** are typically offered twice per year through the Pennsylvania Construction Codes Academy (PCCA). These programs are geared toward beginning code officials seeking to pass their certification exams, or anyone interested in a comprehensive overview of residential building codes.

- |   |       |
|---|-------|
| a. International Residential Code – Building Essentials           | 4 day |
| b. International Residential Code – Plumbing Essentials           | 4 day |
| c. International Residential Code – Mechanical Essentials         | 4 day |
| d. International Residential Code – Electrical Essentials         | 4 day |
| e. Residential Energy Code Essentials                             | 2 day |
| f. International Energy Conservation Code Essentials – Commercial | 2 day |

For program descriptions, visit <http://www.phrc.psu.edu/Outreach/PHRC-Training-Programs/Workshops/Available-Workshops>.

**Manager/PI:** K. Blansett

## C. Web-Based Training

**Description:** In today's economic climate, there is a need for educational programs without travel costs. The PHRC will continue its successful monthly webinar series. Webinars are delivered live, and are also archived for on-demand viewing. Proposed topics are listed below. One certification maintenance credit is offered for each webinar for PA code officials. As appropriate, AIA Learning Units (LUs) for architects and professional development hour (PDHs) for engineers and land surveyors will be offered.

The webinar topics for the 2016-2017 series are:

- Residential Concrete 101
- Design & Construction of Downspout Disconnections
- Durability of Insulated Rim Joists
- Rainscreen Systems
- Frost-Protected Shallow Foundations
- HERS Ratings in PA
- What is Net-Zero Energy?
- Permit Notice of Termination (NOT) Process Overview

**Manager/PI:** K. Blansett

**Deliverable:** The PHRC will develop and deliver at least eight webinars. Additional programs may be added to address emerging issues as they arise.

## D. Builder Briefs

**Description:** The PHRC will continue its series of short technical documents called Builder Briefs that address specific issues that have been identified by builders or remodelers. These documents are intended to be quick to read with a lot of the information presented graphically or pictorially. Potential topics include:

- Evolution of the Building Enclosure in PA
- Adhered Manufactured Stone Masonry Veneer Assemblies

**Manager/PI:** K. Blansett

**Deliverable:** Builder Briefs will be researched, written, printed and distributed.

## E. Technical Assistance, Technology Transfer & Outreach

**Description:** This initiative is a continuation or expansion of activities to get technical information, resources, and publications to builders, remodelers, design professionals, building code officials and others involved in the residential construction industry.

**Manager/PI:** K. Blansett

**Deliverables:** The PHRC will continue to offer the following activities:

1. **Annual Pennsylvania Housing and Land Development Conference:** For 24 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 Housing Day of the conference focuses primarily on the house itself, while the Land Development Day serves as an annual forum that addresses emerging planning, design, and regulatory issues affecting the land development industry in Pennsylvania.
2. **PCCA Symposium:** The PHRC will work with the PCCA to develop and deliver 3 one-day programs (one in the central region of the Commonwealth in conjunction with the PHRC Annual Housing and Land Development Conference, one in the eastern part of the Commonwealth, and one in the western part). This annual event is intended to address technical issues being faced by building code officials.
3. **Speaking Engagements:** The PHRC will hold and/or participate in talks, seminars, and conferences directed at the housing and land development industries. This may include trade and professional association functions and regional meetings, local association meetings, or regional, state, or national conferences. Speaking engagement topics include:
  - Floor Fire Protection
  - Exterior Water Management
  - PA Alternative Residential Energy Provisions
  - Foundation Systems for Relocated Manufactured Housing
  - Subdivision and Land Development Guidelines
  - Stormwater 101
  - Intro to WQ Calculations
  - Land Development Process
  - Stormwater Management Concerns in Karst Regions
  - Insulation: Is this “stuff” right?
  - Code Compliant Air Barriers: It’s All About Continuity
  - Green Infrastructure as a Tool for Stormwater Management
  - Why Decks Fail – Design and New PA UCC Requirements to Improve Safety
  - Stormwater Regulations for Municipal Officials
  - Fundamentals of Exterior Plaster and Manufactured Stone Veneer
4. **General Outreach Activities:** Through our general outreach initiative, the PHRC pursues activities to keep industry professional up-to-date on technical issues, as well as, informed on the services and publications the PHRC provides. These activities may include the PHRC newsletters, mailings, promotional pamphlets, articles in trade journals, phone calls, and the PHRC’s website.



Our general outreach also involves attending relevant industry meetings, such as the Department of Community and Economic Development (DCED) Pennsylvania Housing Advisory Committee, DECD Industrialized Housing/Building Advisory Group, Pennsylvania Department of Environmental Protection (DEP) meetings (Water Resources Advisory Council, Sewage Advisory Council); participating in technical committees such as the Pennsylvania Stormwater Technical Workgroup; and serving as a technical resource to legislative committees as needed

5. **Annual Newsletter** – The PHRC Annual Newsletter will be sent to PHRC members to keep them up-to-date on recent PHRC activities and promote upcoming events. For the 2016-2017 project year, the PHRC intends to continue with the schedule change made last year to have it delivered in the late summer or early fall to provide more timely updating of the audience with the outcome of the previous year’s projects and what to expect in the coming year.
6. **Educating the Next Generation of Tradespeople** - Educating the “next generation” of residential trade contractors is essential for the future of residential construction. With the support of the IAC, the PHRC will consider the education of the next generation of tradespeople as an ongoing project. The ultimate goal is to increase the detailed knowledge of future industry tradespeople through this general outreach and provide students with professional development opportunities within the residential construction industry. This project includes relationship building, sharing of resources, speaking at school events, leveraging resources and contacts to bring opportunities to students, and getting feedback from instructors and administrators to better address their needs. Other outreach activities includes trying to increase participation of vocational students and instructors in the PHRC conference, PCCA Symposia, and PHRC webinars. A scholarship program was established for the 2015 Annual PHRC Housing and Land Development Conference and this program will continue to provide an opportunity for students to attend the conference at no charge.
7. **Support of the UCC RAC** - The PHRC will to support the RAC and the public by serving as a general technical resource upon request.
8. **Support of Standards** - The PHRC has developed three standards to respond to industry demand. Each of these standards requires training and timely technical assistance for local governments, builders/developers, design professionals, and contractors. All of these standards are available electronically for free. Education on these standards will continue to be provided through various training programs as requested and technical assistance will be provided through telephone and email support by the PHRC. The PHRC standards include
  - Pennsylvania’s Alternative Residential Energy Provisions - 2009
  - Guidelines for Subdivision and Land Development in Pennsylvania (formerly the Pennsylvania Standards for Residential Site Development Standards
  - Foundation Systems for Relocated Manufactured Housing

### III. Applied Research

A very important function of the PHRC is to undertake or stimulate research and development on materials, products, procedures, and processes. These efforts may have a longer-term or a more fundamental focus than other projects. Projects in this category foster partnerships and draw on the expertise and strengths of the people and facilities available at the Pennsylvania State University.

#### 1. Laboratory Testing and Analytical Evaluation of Residential Wall R-value for Several Conventional Wall Systems

**Description:** As more innovative and alternative wall systems to conventional wood-frame systems are becoming available to builders offering additional choices, more accurate thermal evaluation of these systems becomes essential. Designers and manufactures of newer wall configurations would certainly like to market such products for higher R-values of a finished wall system, which may include insulation, sheathing, vapor retarder, air barrier, and interior and exterior finish layers.

The two available analytical approaches for determining R-values, Parallel Path Method and Isothermal Method, yield significantly different results. Although each method has its strength for certain type of configuration (e.g., stud wall vs. CMU wall), many new wall systems may have features that makes it difficult to say which method is more appropriate. Numerical methods for whole-wall R-value or clear-wall R-value based on computer simulation can provide a calculation of a wall R-value, but values determined through real-model testing is needing to calibrate and validate the simulation. The objective of this proposed project is to test a selected subset of most commonly used wall systems at the Building Enclosure Testing Laboratory (BeTL) using the climate chamber as a hot-box for determination of clear wall R-values to compare the selected wall types. The result of the study will also provide a basis for comparison of other walls that may be tested at the lab at a future time, hopefully by support from the industry. Both analytical and numerical approaches will also be used to compare with test results. The project will develop a thorough review of past studies.

**Manager/PI:** Dr. Ali Memari

**Deliverables:** The project will lead to a full research report; a webinar and/or Builder Brief; a paper at the 4th PHRC RBDC Conference; and possibly a journal paper.

## IV. Applied Projects

The Applied Project category refers to projects that are application-oriented and have a direct need by the residential construction industry. This may also include longer term initiatives.

### 1. Deck Design Spreadsheet

**Description:** The portions of the 2015 IRC related to decks that have been incorporated into the PA UCC provide design guidance and a prescriptive path for deck design. The final goal of this project is to create a working spreadsheet that will allow the user to plug in overall deck dimensions for standard decks and have results that show the required design criteria.

**Manager/PI:** C. Hine

**Deliverables:** This project will result in a downloadable spreadsheet.

### 2. Exterior Plaster Assemblies in Pennsylvania (continuation)

**Description:** Exterior plaster continues to be a hot topic in Pennsylvania as efforts to improve best practice are ongoing. This project would include activities such as providing technical support, construction detail development, and assistance in the development of general outreach to builders, design professionals, code officials, and home inspectors.

**Manager/PI:** B. Wolfgang

**Deliverables:** This project will result in continued technical support of trade groups in Pennsylvania who are addressing the ongoing needs of exterior plaster wall assemblies. This includes speaking engagements, participation in committees and focus groups, and the development and publication of technical papers, including Builder Briefs.

### 3. Update to the PA Alternative

**Description:** Over the years, the PHRC has developed several standards to respond to industry demand. Each of these standards includes a consensus process to determine content and requires training and timely technical assistance for local governments, builders/developers, design professionals, and contractors. All of these standards are available electronically for free on our website.

The most recent version of the PA Alternative Residential Energy Provisions is the 2009 edition. Since new code provisions from the 2015 IRC/IECC were adopted in PA and became enforceable in January 2016, it is time to revisit the Alternative Provisions. It is important that this document remain relevant throughout the PA residential construction industry. Updating this document would involve the identification of stakeholders and the formation of an advisory committee, similar to previous update processes. Through the guidance of this committee, new code provisions that have been adopted in PA would be analyzed and considered for inclusion in an updated version of the PA Alternative.

Additionally, other provisions that would provide alternative means of compliance (yet equivalent code stringency) could be considered.

The time period for this project is currently open ended and must respond to both the consensus process for content development, and pending legislation that may change what provisions of the energy codes are applicable in PA.

**Manager/PI:** B. Wolfgang

**Deliverables:** The deliverables of this project are currently open ended and will be determined by the steering committee. If the committee sees fit to move forward with an updated version of the PA Alternative Residential Energy Provisions then a 2015 edition will be developed and published. Training materials on the new edition will also be need to be developed. There will a marketing component to this project to help industry professionals know that an updated version of the document is available.

#### 4. Evolution of the Building Enclosure in PA

**Description:** The forces that determine the design and specification of building enclosures in residential construction include energy code requirements, consumer expectations, and broad environmental goals. Each of these forces has led to a distinct evolution of how the building enclosure is designed and constructed. This project would take a closer look at the timeline for these changes, the current state of practice in the Pennsylvania construction industry, and where the industry may go in the future. This project would take a “lessons learned” approach with an emphasis on building airtightness.

**Manager/PI:** B. Wolfgang

**Deliverables:** This project will result in a Builder Brief, trade journal article, and likely both a speaking engagement topic and a webinar.

**\*Note:** As previously noted, at the time of development of this Project Plan for the 2016-2017 fiscal/project year, the contract for the Pennsylvania Construction Codes Academy (PCCA) training program has not yet been awarded. The Evolution of the Building Enclosure in PA project will be the one most likely delayed or dropped if resources/time need to be redirected to support the PCCA programs.

## V. Projected Budget by Project Categories

The budget for 2016-2017 project year is based on the Act 157 Funds collected during the 2015-2016 fiscal year. Table 1 shows the quarterly check values. To be conservative in the budget, the lowest value of the year is assumed for the final check that won't be received until late-July 2016. The Act 157 Funds available for the 2016-2017 year are approximately \$382,586<sup>1</sup>. There was a carryover of \$41,105 from the 2015-2016 year bringing the total Act 157 funds for 2016-2017 to approximately \$423,691. Table 2 shows the budgeted distribution of funds across project types and sources, and also includes outside grant monies for outreach projects and indirect support from Penn State.

Table 1. Quarterly check values from the 2015-2016 FY (2016-2017 Project Year). The fourth quarter check will not be received until late July so to be conservative in the budget, the lowest value for the year has been assume.

Quarter	Check Value
July 2015-Sept 2015	\$96,921.50
Oct 2015-Dec 2015	\$116,514.85
Jan 2016-Mar 2016	\$84,574.60
Assumed April 2016-June 2016	\$84,574.60
<b>Total</b>	<b>\$382,585.55</b>

Table 2. Budgeted distribution by project type for Act 157 funds along with outside grant monies and indirect support from Penn State.

Project	Act 157 Funds <sup>1</sup>	Outside <sup>2</sup>	PSU Support	Total
Training, Technical Assistance and Outreach	\$314,477	\$147,912	\$179,881	\$654,269
Applied Research	\$16,571	\$3,514	\$9,478	\$29,564
Applied Projects	\$90,677	\$18,065	\$51,867	\$160,609
<b>Total</b>	<b>\$421,724</b>	<b>\$169,491</b>	<b>\$241,226</b>	<b>\$832,442</b>

1. The final quarter funds for the 2016-2017 project year are not yet known at the time of publication of this plan. The expected budget is an estimate and, to be conservative, the fourth quarter value used in this calculation is lowest of the previous three quarters.
2. Outside funding is received from a variety of sources including fees for services, in-kind contributions, industry contributions, grants and contracts.