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**The Pennsylvania Housing Research Center**

# **Project Plan**

## **July 2019 – June 2020**

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# I. Preface

Annually, 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, building code organizations, and state agencies.

On April 18, 2019, 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.

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 (later amended by Act 36 of 2017). 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 (i.e. funds collected from July 2018 to March 2019 with the final quarter from April 2019-June 2019 being estimated based on historical data).

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.

Unless otherwise noted, the projects contained in this plan are anticipated to start July 1, 2019 and be completed on or before June 30, 2020.

## 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.

#### 1. Existing Program Updates and Maintenance

**Description:** On May 1, 2018, the PA Uniform Construction Code (PA UCC) Review and Advisory Council (RAC) submitted their report to the Department of Labor and Industry adopting the majority of code provisions contained in the 2015 International Code Council (ICC) Model Codes. These new code provisions took effect on October 1, 2018. Many core workshops have already been updated but some focused-topic workshops still need to be addressed. Additionally, there is a need to make minor course material updates based on instructor feedback. Also, we will continue 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:** C. Hine & B. Wolfgang

#### 2. Solar PV Program

**Description:** In 2011, a one-day solar photovoltaic system installation and inspection training program was developed by the PHRC in conjunction with several industry professionals. This project would update this program with the latest code provisions, as well as explore how or if to upgrade or enhance the program to meet the needs of solar photovoltaic installers, inspectors, and educators across Pennsylvania.

**Manager/PI:** S. Klinetob Lowe

#### 3. Training for Blower Door and Duct Tightness Testing

**Description:** With envelope air leakage (blower door) testing now required by the PA Uniform Construction Code, the industry is attempting to respond to the need for more third parties to conduct this test. Many consultants and other subcontractors have an interest in building this capacity in order to offer blower door testing as a service but are not sure where to turn for training. This project would allow the PHRC to partner with other organizations in the state that have a similar goal of helping the residential construction industry adapt to these code changes. This collaboration would focus on

bringing blower door and other relevant training to PA in order to provide the regional industry an opportunity to build blower door and duct testing capacity.

**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, educators, 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 Codes Academy (PCCA).

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

**(1) Code Refresher** programs are 1-day programs that offer 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.

- |                                  |       |
|----------------------------------|-------|
| a. IRC Building Code Refresher   | 1 day |
| b. IRC Plumbing Code Refresher   | 1 day |
| c. IRC Mechanical Code Refresher | 1 day |
| d. IRC Electrical Code Refresher | 1 day |
| e. IRC Energy Code Refresher     | 1 day |

**(2) Academy Programs** are typically offered 1-2 times 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 Codes Academy | 4 days |
| b. IRC Plumbing Academy                    | 4 days |
| c. IRC Mechanical Academy                  | 4 days |
| d. IRC Electrical Academy                  | 4 days |
| e. IRC Energy Academy                      | 2 days |

**(3) 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, ICC credits and ICC contact hours for code officials, NARI credits for remodelers, and Professional Development Hours (PDHs) for engineers are offered.

a. Blueprint Reading Program	1 day
b. Residential Sprinkler Inspection/Installation	1 day
c. Fundamentals of Exterior Plaster and Thin Stone Veneer Assemblies	1 day
d. Building Envelope Design and IECC Code Compliance	1 day
e. Building Code Plan Review and Inspection	1 day
f. Residential Deck Design and Construction	1 day
g. Building with Exterior Rigid Foam	1 day
h. Residential Moisture Management: The 4D's	online
i. IRC Framing Design & Code Compliance	1 day
j. Commercial Energy	2 days
k. HVAC Design & Installation	1 day
l. IRC Multifamily	1 day

**Manager/PI:** B. Wolfgang

### C. Web-Based Training

**Description:** The PHRC will continue its successful monthly webinar series. Webinars are delivered live, and they are archived for on-demand viewing. Proposed topics are listed below. One PA Labor & Industry contact hour is offered for each webinar for PA code officials. As appropriate, AIA Learning Units (LUs) for architects, ICC credits and ICC contact hours for code officials, NARI credits for remodelers, and Professional Development Hours (PDHs) for engineers are offered.

The webinar topics for the 2019-2020 series are:

- Thermal Bridging & Exterior Continuous Insulation
- Challenges with Infill Housing/Lots
- Wall Bracing in the UCC
- High Performance Wall Systems
- Buried Ducts
- Individual On-Lot Stormwater Systems
- Crawlspace Revisited
- ENERGY STAR

**Manager/PI:** B. Wolfgang

**Deliverable:** The PHRC will develop and deliver at least eight webinars. Additional programs may be added to address emerging issues as they arise, including programs addressing significant changes to the PA UCC.

## D. Builder Briefs & Other Publications

**Description:** The PHRC will produce publications as appropriate, including 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 publication topics include:

- Mechanical Ventilation
- Residential Decks

**Manager/PI:** B. Wolfgang

**Deliverable:** Builder Briefs and other publications will be researched, written, printed (as appropriate), 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:** B. Wolfgang

**Deliverables:** The PHRC will continue to engage in the following activities:

- 1. Annual PHRC Housing Conference:** The PHRC will continue to organize, promote and hold the conference. This conference has been held annually since 1992 and has established a reputation of being the premier program focusing on technical issues of housing and land development in Pennsylvania. The conference brings together the building community (builders, remodelers, design professionals, educators) with regulators (planners, building code officials, township engineers, DEP and conservation district staff, etc.) and others involved in the residential construction industry.
- 2. Residential Building Design & Construction Conference:** The PHRC will organize, promote, and hold the Residential Building Design and Construction Conference (RBDCC), to be held in even numbered years. The RBDCC provides a unique forum for researchers, design professionals, manufacturers, and builders to keep up-to-date on the latest advancements and discuss their own findings, innovations, and projects related to residential buildings. RBDCC sessions will consist of technical paper presentations on recent research and innovations related to residential buildings. RBDCC is focused on various types of residential buildings including single- and multi-family dwellings, mid-rise and high-rise structures, factory-built housing, dormitories, and hotels/motels. Full papers will be published in the conference proceedings.

3. **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 annual PHRC Housing 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.
4. **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:
  - Residential Code Updates
  - Blower Doors for Builders
  - Fire Protection of Lightweight Floor Systems
  - Exterior Water Management
  - PA Alternative Residential Energy Provisions
  - Insulation: Is this “stuff” right?
  - Code Compliant Air Barriers: It’s All About Continuity
  - Why Decks Fail – Design and New PA UCC Requirements to Improve Safety
  - Fundamentals of Exterior Plaster and Manufactured Stone Veneer
  - Manufactured Stone Veneer
  - Energy Auditing 101
  - HERS and the ERI Path
5. **General Outreach Activities:** Through our general outreach initiative, the PHRC pursues activities to keep industry professionals up-to-date on technical issues, as well as informed on the services and publications the PHRC provides. These activities may include the PHRC magazine, mailings, email and social media campaigns, articles in trade journals, phone calls, and the PHRC’s website.

Our general outreach also involves attending relevant industry meetings and serving as a technical resource to legislative committees as needed.
6. **Annual Magazine:** The PHRC annual magazine will be sent electronically to PHRC members and stakeholders to keep them up-to-date on recent PHRC activities and to promote upcoming events. For the 2019-2020 project year, the PHRC intends to continue to have it delivered in the late summer or early fall to provide timely updating of the audience with the outcome of the previous year’s projects and with what to expect in the coming year.
7. **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 soliciting 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.

8. **Support of the UCC RAC:** The PHRC will continue to support the RAC and the public by serving as a general technical resource upon request.
9. **Support of Standards:** The PHRC has developed 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:
  - 2018 Pennsylvania Alternative Residential Energy Provisions
  - Foundation Systems for Relocated Manufactured Housing
10. **Strategic Partnerships:** The PHRC will continue to seek out new relationships and partnerships with peer organizations with activity in the residential construction industry. These partnerships are leveraged for the benefit of the PHRC audience and stakeholders. PHRC staff time will continue to be allocated in support of this overall initiative.

### 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 Penn State.

#### **Comparative Study of Suitability of Different Types of Wall Systems for Passive House Design Based on Construction System, Energy, Building Science, and Life Cycle Assessment**

**Description:** With growing interest in Passive House (PH) Design approach based on Passive House Institute (PHI) or Passive House Institute United States (PHIUS), home designers and builders are encouraged to explore the possibility of considering such design/construction, but they are faced with the challenge of choosing the appropriate wall system configuration. Besides conventional site-built approach, panelized wall systems and modular construction are now options for construction systems. Additionally, PH can be employed in many climates. As a result, some preliminary comparison of all the options is necessary to help designers and builders see merits of each option. This proposed project will review wall system types that have been used for PH design in the United States and Europe. It will evaluate them side by side based various criteria including thermal resistance, air tightness, moisture permeability, embodied energy (life cycle assessment), overall energy performance, and suitability for site-built stick-frame, panelized construction, and modular construction.

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

**Deliverables:** The result will be presented in a complete research report, a conference paper, and 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. Training for Secondary and CTC Instructors

**Description:** The PHRC has pursued an initiative for the past few years that involved outreach to the “next generation” of the residential construction industry. This outreach included interaction with secondary instructors at Pennsylvania schools and career and technology centers. Some feedback during this outreach was that many of the instructors themselves need training. This project would focus on obtaining approval to provide continuing education to secondary instructors through the PA Department of Education. This would also open the potential to hold a standalone event in future years catered to secondary instructors and their need for professional development.

**Manager/PI:** B. Wolfgang

**Deliverables:** This project will result in PHRC training programs obtaining approval for continuing education credit for Pennsylvania secondary and CTC instructors.

### 2. A Deeper Dive into Mechanical Ventilation

**Description:** This applied project will take whole-house mechanical ventilation a step beyond standard code compliance. We will look at the performance characteristics of each method and look into hybrid, high performance ventilation strategies.

**Manager/PI:** C. Hine

**Deliverables:** This project will result in the development of a speaking engagement presentation and the publication of a builder brief.

### 3. Energy Retrofits

**Description:** Nearly 80% of Pennsylvania’s existing housing stock was built before modern building codes, resulting in higher than necessary energy bills and occupant comfort issues. This project would focus on studying the potential impacts and challenges associated with energy retrofits through local case studies. Data extracted through this project would lead to future webinars and conference presentations.

**Manager/PI:** S. Klinetob Lowe

**Deliverables:** This project will result in a future webinar and white paper.

#### 4. Residential Deck Builder Brief

**Description:** This applied project will take and consolidate the majority of the residential deck provisions along with best practice construction details and assemble them into either a one page “jobsite document” or a multiple page instruction flyer for contractors.

**Manager/PI:** C. Hine

**Deliverables:** This project will result in the publication of a builder brief.

#### 5. PHRC Continuing Education On-Demand

**Description:** PHRC staff have repeatedly been asked when webinars would become available on-demand for continuing education credit. This has been difficult in the past due to ongoing software and infrastructure changes at Penn State. This project will dedicate more resources to making more PHRC content available on-demand, including working with Penn State to obtain software training as appropriate.

**Manager/PI:** B. Wolfgang

**Deliverables:** This project will result in the development of a database of on-demand paid content that can be viewed for continuing education credit.

#### 6. Summary of Changes to the PA Uniform Construction Code

**Description:** The Uniform Construction Code in PA has been in place for over a decade. During that time, it has been altered numerous times through various legislative actions. Similar to the UCC Quick Guide, this project would focus on summarizing the basics of the UCC, including common exemptions, significant amendments, and a summary of the original Act 45 requirements. Most recently, Act 36 of 2017 significantly altered the code review and adoption process. The result of this project would be a short publication in the form of a Builder Brief so that it could be tucked into a code book or similar reference. Note: this project is carried over from the 2018-2019 project plan.

**Manager/PI:** B. Wolfgang

**Deliverables:** This project will result in a Builder Brief or similar concise document.

## V. Projected Budget

The budget for 2019-2020 project year is based on the Act 157 Funds collected during the 2018-2019 fiscal year. Table 1 shows the quarterly check values. The Act 157 Funds available for the 2019-2020 year are estimated to be approximately \$480,355.04 (assuming the 2019 Q4 check matches 2018 Q4). Located in the Department of Civil and Environmental Engineering at Penn State, the PHRC receives the added benefit of Penn State waiving their F&A (facilities & administrative) rate for this research contract. As a result, this means that PHRC retains approximately \$287,540.53 more than it normally would for a research contract. This allows PHRC to maximize any received monies in service of its mission to serve the home building industry and the residents of Pennsylvania by improving the quality and affordability of housing.

Table 1. Quarterly check values from the 2018-2019 FY (2019-2020 Project Year)

Quarter	Check Value
Q1: July 2018-Sept 2018	\$104,764.90
Q2: Oct 2018-Dec 2018	\$168,767.41
Q3: Jan 2019-Mar 2019	\$92,670.01
Q4: Assumed April 2019-June 2019	\$114,152.72*
<b>Total</b>	<b>\$480,355.04**</b>

\*The 2018-2019 fourth quarter value is assumed for the final check that will not be received until late July 2019.

\*\*Estimated total based upon estimated fourth quarter check.