



The Pennsylvania Housing Research Center

Project Plan

July 2017 – June 2018

Pennsylvania Housing Research Center
Penn State University
219 Sackett Building
University Park, PA 16802
Telephone: (814) 865-2341
Facsimile: (814) 863-7304
E-mail: phrc@engr.psu.edu
Web Site: www.phrc.psu.edu

Table of Contents

- I. Preface 1**
- II. Training, Technical Assistance & Outreach..... 2**
 - A. Program Development2
 - 1. Existing Program Maintenance2
 - 2. Online Residential Deck Program2
 - B. PHRC Training Program Delivery3
 - D. Builder Briefs5
 - E. Technical Assistance, Technology Transfer & Outreach5
- III. Applied Research 8**
 - 1. Comparative Energy Analysis and Life Cycle Assessment of Innovative Residential Wall Systems.....8
- IV. Applied Projects 9**
 - 1. Summary of the PA Uniform Construction Code9
 - 2. Exterior Plaster in Pennsylvania (continuation).....9
 - 3. Residential Ventilation Systems in PA10
 - 4. PA Community Land Trusts (CLT): Quality and Energy Affordability of Homes in Non-Profit Affordable Housing Models10
- V. Projected Budget by Project Categories..... 11**

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 27, 2017 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, 2017, and be completed on or before June 30, 2018.

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 2016 to March 2017 with the final quarter from April 2017-June 2017 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.

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 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: C. Hine

2. Online Residential Deck Program

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. The Online Residential Deck Program will take the current full day deck program and place it into a 4-module online class. This online class will run once per week for a month. Each session will be 1 ½ hours and the total amount of instruction will be 6 hours.

Manager/PI: C. Hine

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 Code Academy (PCCA).

Current PHRC training program offerings are listed below. These are broken into four categories: (1) Code Refresher, (2) Code Essentials, (3) Academy Programs, and (4) 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.

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|----------------------------------|-------|
| 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) Code Essentials programs are 2-day programs that offer a shorter alternative to the multi-day academies but provide greater depth than the Refresher programs.

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|--|--------|
| a. International Residential Code Essentials | 2 days |
| b. IRC Plumbing Essentials | 2 days |
| c. IRC Mechanical Essentials | 2 days |
| d. IRC Electrical Essentials | 2 days |
| e. Residential Energy Essentials | 2 days |
| f. Commercial Energy Essentials | 2 days |

(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.

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|--|--------|
| 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 |

(4) **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.

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

For program descriptions, visit <http://phrc.psu.edu/Industry-Education/PHRC-Training-Programs/Workshops/Available%20Workshops.aspx>.

Manager/PI: B. Wolfgang

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, 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 2017-2018 series are:

- Hot Water Fundamentals
- Revisit Visitability – Design & Constructability Issues
- Radiant Floor Heating Systems

- Land Development TBD (Topic will be identified during summer land development conference steering committee meetings)
- Future Proof Home Design
- Residential Makeup Air Systems
- Modular Construction Basics
- GREENBUILD: Zero Energy Ready Duplex Design & Construction in State College, PA

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

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:

- Summary of the PA UCC
- Residential Ventilation Systems

Manager/PI: B. Wolfgang

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: B. Wolfgang

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

1. **Annual PHRC Housing Conference:** The PHRC will continue to organize, promote and hold the annual conference. This conference has been held since 1992 and has established a reputation of being the premier technical program focusing on technical issues of housing and land development in PA. 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 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:
 - Fire Protection of Lightweight Floor Systems
 - Exterior Water Management
 - PA Alternative Residential Energy Provisions
 - Foundation Systems for Relocated Manufactured Housing
 - 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
5. **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 newsletter, 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 Newsletter –** The PHRC Annual Newsletter 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 2017-2018 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 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.
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 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. Comparative Energy Analysis and Life Cycle Assessment of Innovative Residential Wall Systems

Description: In an effort to develop a better understanding of energy efficient wall system options available to home builders, innovative wall systems such as advanced 2x6 framing and double stud systems (with cellulose, fiberglass, or spray foam insulation, and with or without exterior rigid insulation), SIPs, ICF, EIFS, and other innovative (including some proprietary) systems need to be evaluated further. While there is significant amount of thermal performance data available on conventional 2x4 wood-frame systems, a better understanding of newer systems as well as emerging ones is needed not only with respect to annual operational energy performance where the insulation system significantly impacts, but also from the life-cycle assessment (LCA) perspective that informs one of the embodied energy and carbon footprint from the materials manufacturing stage to completion of the construction and end of life demolition, i.e., cradle-to-grave analysis. This project intends to provide a side by side comparison of various types of residential wall systems assumed to be used to construct a model home for operational annual energy performance using software such as THERM and BEOPT and to carry out LCA using software such as ATHENA. In order to develop a better understanding of the thermal properties of the wall systems, efforts will be made to test selected systems in the BeTL lab climate chamber as well. In particular, some prefabricated wall panel manufacturers will be invited to contribute to the project if they wish their wall system to be tested.

Manager/PI: Dr. Ali Memari

Deliverables: The result will be a complete research report, a builder brief, 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. Summary of 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. 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.

Manager/PI: B. Wolfgang

Deliverables: This project will result in a Builder Brief and a one-hour presentation to be used for future speaking engagements.

2. Exterior Plaster in Pennsylvania (continuation)

Description: This project would include activities such as providing technical support and assistance in the development of general outreach to builders, design professionals, code officials, and home inspectors as the housing industry in PA continues to address issues related to stucco and manufactured stone installation.

Manager/PI: B. Wolfgang

Deliverables: This project will include speaking engagements, participation in committees and focus groups, and the development and publication of technical papers, including Builder Briefs.

3. Residential Ventilation Systems in PA

Description: As the building enclosure on residential projects becomes tighter, it becomes increasingly important to consider the ventilation requirements for the project. Current enforceable code requirements in PA allow for the use of operable glazing to satisfy air exchange requirements. However, there are scenarios that warrant consideration of mechanical ventilation through exhaust or balanced systems. Available technology continues to expand, and guidance from industry standards does not always agree. This project would look at the existing requirements, design guidelines, and available ventilation systems in order to provide PA builders with a reference should they consider the installation of a mechanical ventilation system on a project.

Manager/PI: C. Hine

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

4. PA Community Land Trusts (CLT): Quality and Energy Affordability of Homes in Non-Profit Affordable Housing Models

Description: A Community Land Trust (CLT) is a general term for a type of non-profit affordable housing organization that is designed to meet the specific affordable housing needs of its host community. As of 2017 there are ten (10) CLTs in the state of PA, and 316 in the United States. While each have a common mission to provide affordable housing to its host community, each have unique characteristics, including:

- strategies to meet their perpetually affordable housing goals (e.g., dual or shared ownership arrangements, affordable resale requirements, etc.),
- various and unique funding arrangements (e.g. private donations, grant funding, etc.)
- spectrum of client types, including homeowners, renters, or a combination of both,
- focus on utilizing existing housing stock, building new construction, or a combination of both, and
- utilization of single family, attached, and/or multifamily homes.

The purpose of this project is to evaluate the initial and current quality and energy affordability of the homes that the ten (10) CLTs in Pennsylvania are utilizing in their respective programs, and to explore feasible strategies to improve their housing stock in a way that enables them to continue their mission of perpetually affordable housing.

Manager/PI: S. Klinetob Lowe

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

V. Projected Budget by Project Categories

The budget for 2017-2018 project year is based on the Act 157 Funds collected during the 2016-2017 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 2017. The Act 157 Funds available for the 2017-2018 year are approximately \$455,362.70¹. 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 2016-2017 FY (2017-2018 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 2016-Sept 2016	\$124,177.55
Oct 2016-Dec 2016	\$129,512.95
Jan 2017-Mar 2017	\$100,836.10
Assumed April 2017-June 2017	\$100,836.10
Total	\$455,362.70

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 ^{1,2}	Outside ³	PSU F&A Equivalent ⁴	Total
Training, Technical Assistance and Outreach	\$326,583	\$78,476	\$186,805	\$591,863
Applied Research	\$45,699	\$6,217	\$26,140	\$78,056
Applied Projects	\$115,731	\$19,726	\$66,198	\$201,656
Total	\$488,013	\$104,418	\$279,143	\$871,575

1. The final quarter funds for the 2017-2018 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. Remaining budgeted funds for the MHTI Training Program and one (1) Applied Research project from 2016-2017 are being carried over to the 2017-2018 budget, thus the greater reported projected expenditures than projected 2017-2018 income.
3. Outside funding is received from a variety of sources including fees for services, in-kind contributions, industry contributions, grants and contracts.
4. These values are the avoided Penn State F&A charges that have been waived for this contract.