



---

**The Pennsylvania Housing Research Center**

# **Project Plan**

**July 2020 – June 2021**

**Pennsylvania Housing Research Center**

Pennsylvania State University

206B Sackett Building

University Park, PA 16802

Telephone: (814) 865-2341

Facsimile: (814) 863-7304

E-mail: [phrc@psu.edu](mailto:phrc@psu.edu)

Web Site: [www.phrc.psu.edu](http://www.phrc.psu.edu)

# Table of Contents

<b>I. Preface .....</b>	<b>1</b>
A. COVID-19 Impacts.....	2
<b>II. Training, Technical Assistance, &amp; Outreach.....</b>	<b>3</b>
A. Program Development .....	3
1. Existing Program Updates and Maintenance.....	3
2. Training for Blower Door and Duct Tightness Testing .....	3
3. PHRC Continuing Education On-Demand .....	3
4. Virtual Workshop Transition and Development .....	4
B. PHRC Training Program Delivery .....	4
C. Web-Based Training.....	5
D. Builder Briefs & Other Publications.....	6
E. Technical Assistance, Technology Transfer, & Outreach .....	6
<b>III. Applied Research .....</b>	<b>9</b>
<b>IV. Applied Projects.....</b>	<b>10</b>
1. Training for Secondary and CTC Instructors .....	10
2. A Deeper Dive into Mechanical Ventilation.....	10
3. Energy Retrofits .....	10
4. Deck Flashing Lab Testing .....	11
5. Slab-on-Grade Insulation Details .....	11
6. Advanced Air Sealing Details .....	11
<b>V. Projected Budget .....</b>	<b>12</b>

# 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 16, 2020, the IAC met virtually to discuss potential projects for the PHRC to pursue. After a thorough discourse, IAC representatives 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.

The PHRC utilizes permit fee revenue on a one-year delay (funds collected during the fiscal year spanning July 2019-June 2020 will be budgeted for the July 2020-June 2021 fiscal year). These permit fee funds are distributed quarterly by the Department of Community and Economic Development (DCED).

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, 2020 and to be completed on or before June 30, 2021.

## A. COVID-19 Impacts

The COVID-19 pandemic has had a profound impact on the global economy. The residential construction industry in Pennsylvania has not been spared from the abrupt economic downturn. Since construction activity has a direct impact on PHRC permit fee revenue, it is anticipated that the COVID-19 crisis will impact PHRC operations in the following ways:

1. Fourth quarter revenue (April 2020-June 2020) is significantly lower than historical averages.
2. Staff time has been and will continue to be diverted to respond to industry needs as the construction industry continues to adapt to the COVID-19 crisis. This may delay the delivery of some projects.
3. It is still unknown how in-person events will be planned and received by potential attendees over the coming months and even years. Many traditional PHRC activities rely on in-person delivery. As these impacts become clear, the PHRC team will adapt event planning and delivery.

Despite these challenges, the PHRC continues to be well-positioned to serve the needs of the residential construction industry in Pennsylvania and is able to pivot to adapt to changes as necessary.

## 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:** For many PHRC workshops, there is a need to make minor course material updates based on instructor feedback throughout the year. Also, the PHRC 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

#### 2. 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 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 the National Sustainable Structures Center (NSSC) at the Pennsylvania College of Technology. The collaboration will focus on bringing blower door and other relevant training to PA to provide the regional industry an opportunity to build blower door and duct testing capacity. Note: this project began in the 2019-2020 project year and is ongoing.

**Manager/PI:** B. Wolfgang, S.K. Lowe, & C. Hine

**Deliverables:** This project will result in the development of a blower door and duct tightness testing training program in partnership with the National Sustainable Structures Center (NSSC).

#### 3. 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. The PHRC team is now working with the Office for Digital Learning within the Penn State College of Engineering to utilize newly available software platforms for on-demand education. Note: this project began in the 2019-2020 project year and is ongoing.

**Manager/PI:** B. Wolfgang & R. Fawcett

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

#### 4. Virtual Workshop Transition and Development

**Description:** As the PHRC team continues to adapt to the changes brought about during the COVID-19 pandemic, there will be a need to develop new and adapt existing content for virtual deployment. PCCA has indicated that most of their activities will be conducted virtually in the coming fiscal year which will also support this initiative. Many of these courses will be delivered in a half-day (3.5 hours) live virtual format using video conferencing software.

**Manager/PI:** B. Wolfgang & R. Fawcett

**Deliverables:** This project will result in the transition of existing content and the development of new content as needed for virtual workshop delivery.

## 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).

Note: the types and format of programs that will be offered in the 2020-2021 project year will depend on the feasibility of in-person instruction. Many workshops will be forced to adapt to virtual deployment.

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 (6 hours) 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. Topics include but are not limited to:

- a. Blueprint Reading Program
- b. Fundamentals of Exterior Plaster and Thin Stone Veneer Assemblies
- c. Building Envelope Design and IECC Code Compliance
- d. Residential Deck Design and Construction
- e. Building with Exterior Rigid Foam
- f. Residential Moisture Management: The 4D's
- g. HVAC Design & Installation

**Manager/PI:** B. Wolfgang

## C. Web-Based Training

**Description:** The PHRC will continue its successful 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 2020-2021 series may include:

- Healthy Homes – New Construction
- Slab-on-Grade Insulation
- Rainscreens
- Residential Decks
- Flexible Spaces in Home Design
- Stormwater Special Topics
- Mechanical Ventilation Systems
- Protection of Lightweight Floor Systems
- Control Layers – Vapor Transmission

- Structural Insulated Panels
- Healthy Homes – Existing Construction
- HVAC – ENERGYSTAR
- Advanced Air Sealing Strategies

**Manager/PI:** B. Wolfgang

**Deliverable:** The PHRC will develop and deliver at least eight webinars with a goal of increasing webinar frequency in 2020-2021. Additional programs may be added to address emerging issues as they arise.

## 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:

- Slab-on-Grade Insulation
- Advanced Air Sealing Strategies

**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. The 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 three 1-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:
  - Air Sealing for 5ACH50
  - Blower Doors for Builders
  - Code Compliant Whole House Mechanical Ventilation
  - Crawlspace Design & Construction
  - Energy Codes in PA
  - GreenBuild: Zero Energy Ready Home Case Study
  - High Performance Walls
  - Intro to the Passive House Standard
  - Manufactured Stone Veneer
  - Reducing Thermal Bridging with Continuous Exterior Insulation
  - Residential Deck Design and Construction
  - Residential Energy Auditing
  - Residential Moisture Management – the 4D’s
  - Solar PV in PA
  - Visitability
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 2020-2021 project year, the PHRC intends to continue to have it delivered in the 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. The PHRC also prioritizes gender equity in the residential construction industry through involvement with the NAHB Professional Women in Building (PWB) activities and initiatives. 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 include trying to increase participation of vocational students and instructors in the PHRC Housing 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 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.

#### 1. Cross Laminated Timber Home Design

**Description:** There is a growing interest in the use of Cross Laminated Timber for multistory building construction. According to a 2018 Zion Market Research report, the demand for CLT in 2017 was \$130M and the overall growth is estimated to be 15% per year until 2024. Besides all advantages of prefabrication (e.g., factory environment quality, quick job site assembly), CLT is also favored because of being a low carbon, renewable, and cost effective construction material that can be produced in the USA, helping job growth in rural timber rich areas. Aside from such advantages, CLT has proven to perform well under fire (acceptable fire resistance rating) due to 1) its panel nature and compartmentalization, which reduces the risk of fire spread (separating function) and 2) the formation of char that allows the major part of the member to continue carry loads. This makes CLT suitable for single-family home building as well as the currently favored multi-family construction. However, at this time, there is a shortage of design examples for single-family CLT homes. This project will undertake a complete structural design (e.g., gravity, snow, wind) of a CLT home for PA as well as developing practical wall and roof details for acceptable energy performance and moisture management. The project will also provide a cost comparison with a conventionally designed wood-frame example. The results will be presented as a conference paper and/or a more extended report.

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

**Deliverables:** The result will be presented in a complete research report and a conference 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. Note: this project began in the 2019-2020 project year and is ongoing.

**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. Note: this project began in the 2019-2020 project year and is ongoing.

**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 focuses on studying the potential impacts and challenges associated with energy retrofits through local case studies. Data extracted through this project will lead to future webinars and conference presentations. Note: this project began in the 2019-2020 project year and is ongoing.

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

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

#### 4. Deck Flashing Lab Testing

**Description:** The vision for the deck flashing project takes us into the labs. The goal is to use the spray rack which will apply water to different deck ledger installations. We will then monitor moisture accumulation in various materials and address how each configuration performed.

**Manager/PI:** C. Hine

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

#### 5. Slab-on-Grade Insulation Details

**Description:** Slab on grade foundation systems present unique challenges when designing the building envelope and the thermal control layer. Insulation detailing at the slab edge can present design and constructability challenges that extend beyond minimum code.

**Manager/PI:** B. Wolfgang

**Deliverables:** Based on the accompanying webinar, the details developed will be published independently and included in the Details that Work guide.

#### 6. Advanced Air Sealing Details

**Description:** This project would be developed in conjunction with the air sealing webinar. Details developed for the webinar will be compiled and added into the Details that Work guide.

**Manager/PI:** C. Hine

**Deliverables:** Based on the accompanying webinar, the details developed will be published independently and included in the Details that Work guide.

## V. Projected Budget

The budget for 2020-2021 project year is based on the Act 157 Funds collected during the 2019-2020 fiscal year. Table 1 shows the quarterly check values. The Act 157 Funds available for the 2020-2021 year are approximately \$466,059.78.

Due to the economic disruptions associated with the COVID-19 pandemic, the 2020 Q4 total was significantly less than average, but the rest of 2019-2020 was a productive year, which served to balance this lower amount out. Also, DCED has changed their fee collection process as of April 2020 to no longer accept physical checks as payment for UCC permit fees. All payments are now made online by credit card or check. As a result, DCED is able to close out the quarter earlier than in previous years so it is expected that PHRC will know the Q4 check in subsequent years prior to publishing this plan.

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 \$270,547.70 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 2019-2020 FY (2020-2021 Project Year)**

Quarter	Check Value
Q1: July 2019 - Sept 2019	\$114,084.09
Q2: Oct 2019 - Dec 2019	\$174,422.51
Q3: Jan 2020 - Mar 2020	\$133,211.32
Q4: April 2020 - June 2020	\$44,341.86
<b>Total</b>	<b>\$466,059.78</b>