



The Pennsylvania Housing Research Center

PHRC Year in Review

July 2025 – June 2026

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Table of Contents

<i>I. Introduction</i>	2
A. PHRC Organizational Chart	3
B. PHRC Staff Changes	3
<i>II. Training, Technical Assistance, & Outreach</i>	4
A. Code Update Training	4
B. Externally Hosted Training	6
C. PHRC Hosted Training	9
D. Publications & Content Creation	13
E. Technical Assistance, Technology Transfer, & Outreach	14
<i>III. Applied Research</i>	18
<i>IV. Act 157 Funds</i>	20

I. Introduction

The purpose of this document is to provide a summary of activities the Pennsylvania Housing Research Center has pursued and products that have been delivered between July 1, 2025, and June 30, 2026.

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

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

The projects undertaken were developed with input and assistance from the PHRC's Industry Advisory Council (IAC). This body consists of builders, developers, design professionals, code officials, manufacturers, suppliers, remodelers, and industry associations, as well as state and federal agencies. After a thorough discourse at the spring IAC meeting in April 2025, the members of the IAC voted on projects they felt were the highest priority for the industry.

The result of this input was the *"PHRC Project Plan, July 2025 – June 2026,"* which outlined projects that the PHRC would undertake during this period. The plan included only those projects that were to receive funds provided to the PHRC by the Commonwealth of Pennsylvania through Uniform Construction Code (UCC) permit fees. When appropriate, the PHRC attempts to use UCC permit fee funding to leverage outside support. It should also be noted that the PHRC undertook an array of additional projects that did not receive any UCC permit fee funds. Some of these projects are included in this report but are identified as having no support from the UCC permit fee funds.

Through the memorandum of understanding that Penn State has with the Department of Community and Economic Development (Contract #27-872-0001), the PHRC is required to submit to DCED an annual work plan and an annual report summarizing the activities for the previous year with respect to the fee. This "Year in Review, 2025-2026" is submitted to meet the requirement of an annual report.

A. PHRC Organizational Chart

Figure 1 shows the current PHRC organizational chart.

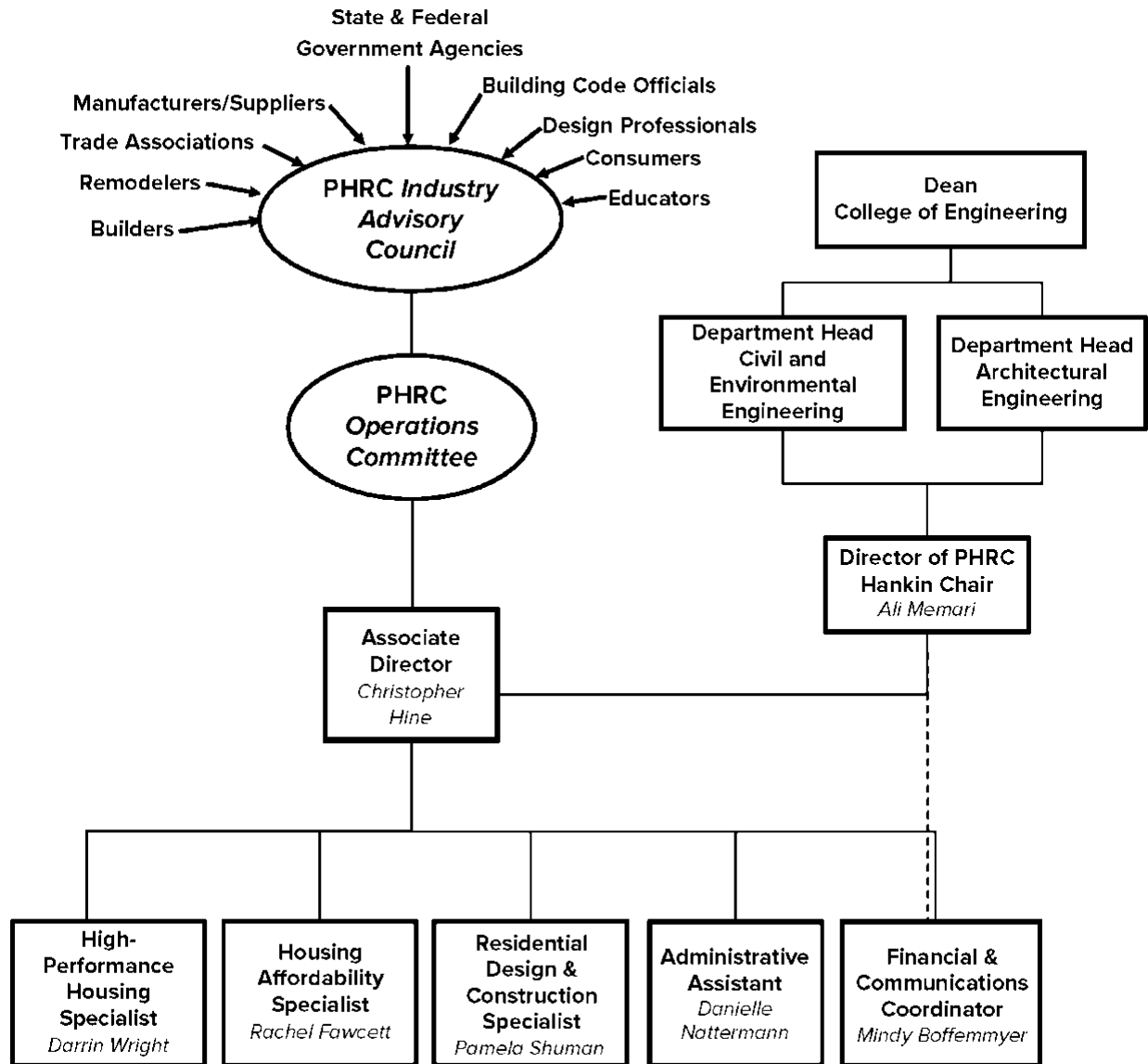


Figure 1. PHRC Organizational Chart

B. PHRC Staff Changes

- There were no PHRC staff changes in project plan 2025-2026.

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 initiatives that are described below are in response to the recommendations of the PHRC's IAC and reflect the current needs within the industry.

Counting speaking engagements, workshops, the PHRC Housing Conference, webinars, and on-demand courses, the PHRC provided 40 educational programs to 1,882 individuals during this reporting period (see Table 1).

Table 1. Summary of PHRC Training Programs for the 2025-26 Project Year

PROGRAM	Activities for 2025-26	
	# of Events	# of Attendees
Speaking Engagements & Conference Sessions	13	508
Workshops	7	88
PHRC Housing Conference	Day 1	150
	Day 2	130
Webinars	10	1,002
On-Demand Courses	8	4
TOTAL	40	1,882

A. Code Update Training

Description: The Pennsylvania Uniform Construction Code will update to the 2021 codes with potential modifications in mid-2025. The provisions impacted by these changes will be summarized through a variety of training methods and modalities. The PHRC will develop several one-hour modules that the team will be equipped to present in-person and online. These modules will be utilized in all code update trainings.

Due to Pennsylvania's upcoming code change, the PHRC will employ a multi-prong approach to educate the Commonwealth about any updates that affect the residential construction industry. The offered program categories are defined below:

- 1. Webinars:** Webinars are delivered live for continuing education credit, and they are archived for on-demand viewing without continuing education credit. Two general code update webinars are planned. Any changes that need to be expanded upon will be held in additional webinars.
- 2. On-Demand Courses:** These on-demand courses will provide code update information and offer continuing education credits. This format utilizes knowledge checks and a final quiz to satisfy continuing education requirements and provides a certificate of continuing education

upon completion for a fee. The PHRC team will utilize recorded webinars to transition into this format and meet accessibility requirements from Penn State.

3. **Speaking Engagements:** The PHRC defines speaking engagements as externally hosted training programs that are up to three hours or less in length without offering continuing education. These programs will be offered from the set list of modules regarding the code update. The PHRC will continue to offer one speaking engagement annually at no cost to organizations within Pennsylvania. Subsequent speaking engagements involve an additional fee.
4. **Workshops:** Utilizing the module structure, organizations will be able to schedule code update training sessions that exceed two hours for an additional fee.
5. **Supplemental Resources:** The PHRC will develop supplemental resources related to the code update as needed and relevant, which may include short videos, handouts, etc.
6. **Support of Standards:** With the Pennsylvania Uniform Construction Code update planned for July 2025, the PHRC will need to address the necessary changes to the PA Alternative. This process may include formation of a subcommittee of the PHRC Industry Advisory Council, solicitation of public comment, modeling of proposed changes to the PA Alternative, and publication of a revised version of the standard. This project will also include an update to the PA Alternative Residential Energy Provisions worksheet.

Report: Further information about each item can be found within the subsequent sections of this report. The PHRC continues to offer training opportunities and resources for the upcoming code change in Pennsylvania.

B. Externally Hosted Training

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. As appropriate, AIA Learning Units (LUs) for architects, PA Labor & Industry contact hours and International Code Council (ICC) credit hours for code officials, NARI credits for remodelers, and Professional Development Hours (PDHs) for Pennsylvania engineers are offered.

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). For externally hosted training, these partner groups and organizations request specific topics to be covered in a program that may vary in length from 30 minutes to full-day offerings.

To further differentiate between the types of externally hosted training that the PHRC offers, each program is classified as either a speaking engagement or a workshop. Both types of programs may be delivered in-person or online. These program categories are defined below:

7. Speaking Engagements & Conference Sessions: The PHRC defines speaking engagements & conference sessions as externally hosted training programs that are three hours or less in length typically without offering continuing education. These programs are generally based on existing content that can be modified slightly to meet the needs of the host organization. The PHRC will continue to offer one speaking engagement at no cost to groups and organizations within Pennsylvania during each calendar year. Subsequent speaking engagements typically involve an additional negotiated fee.

Occasionally, the PHRC team is invited to speak at conferences and symposia throughout the Commonwealth. These types of presentations are still considered speaking engagements, although they may involve additional content creation based on the specific event.

Report: During the 2025-26 project year, the PHRC team delivered 13 speaking engagements & conference sessions to 508 attendees. Table 2 shows a summary of these speaking engagements.

Table 2. Speaking Engagements & Conference Sessions during the 2025-26 Project Year

Organization	Topic(s)	Date	Attendees
Franklin County HBA	2021 PA UCC Residential Code Update: Part 1 (Modified)	7/8/25	16
BACP	PA UCC Residential Code Update Part 1 & 2	7/23/25	35
Pennsylvania College of Technology	PA UCC Residential Code Update Part 1 & 2	8/13/25	19

AZEK	Deck Design and Inspection for Residential Use	8/22/25	2
Central Susquehanna Builders Association	PA UCC Residential Code Update Part 1 & 2	9/10/25	23
PENNBOK Region 6 & Code.sys	2021 PA UCC Residential Code Update, Energy Code Compliance Options in PA & Deck Design and Inspection for Residential Use	10/10/25	50
Penn State CE100S	Residential Construction at Penn State & Beyond	10/29/25	28
MRD Lumber	Energy Code Compliance Options in PA	1/22/26	62
CBO Annual Code Conference	PA UCC Residential Code Update Part 1 & 2 and Decked Out: A Dive into the Updated 2021 IRC Deck Code Provisions	9/12/25	84
York Builders Association	Energy Code Compliance Options in PA	10/8/25	22
2026 PHRC Housing Conference	Energy Code Compliance Options Update in Pennsylvania	3/18/26	68
Builders Association of Metro Pittsburgh	Energy Code Compliance Options Update in Pennsylvania	3/31/26	32
CBO Quarterly Meeting	Energy Code Compliance Options Update in Pennsylvania	6/18/26	67
Total		13	508

8. **Workshops:** The PHRC defines workshops as externally hosted training programs that are greater than two hours in length, up to a full day and typically offers continuing education. These programs may be based on existing training content but often involve extensive content creation. Workshops typically involve a negotiated fee based on travel, accommodations, and the extent of content creation needed to prepare for the program.

Report: During the 2025-26 project year, the PHRC team delivered 5 workshops in partnership with the Pennsylvania Construction Codes Academy. Each workshop was delivered online via Zoom. The PHRC also delivered 2 in person workshops in partnership with the Penn College Workforce Development (formally known as the Clean Energy Center). Table 3 shows a summary of these workshops.

Table 3. Workshops during the 2025-26 Project Year

Organization	Topic(s)	Date	Attendees
Pennsylvania Construction Codes Academy (PCCA)	Basics of Residential Construction Drawings	9/18/25	5

Community Action Agency of Delaware County	Seal the Deal: Intro to Weatherization & Business Opportunities	9/24/25	24
Philadelphia Housing Development Corporation	Seal the Deal: Intro to Weatherization & Business Opportunities	10/22/25	32
Pennsylvania Construction Codes Academy (PCCA)	Foundation Insulation: From Slabs to Walls	11/13/25	3
Pennsylvania Construction Codes Academy (PCCA) & Pittsburgh Permits, Licenses & Inspections	Energy Code Compliance Options in PA	2/23/26	10
Pennsylvania Construction Codes Academy (PCCA)	Heating up Efficiency: Exploring Heat Pump Options in PA	5/6/26	4
Pennsylvania Construction Codes Academy (PCCA)	Advanced Framing Techniques for High-Performance Homes	5/13/26	10
Total		7	88

C. PHRC Hosted Training

Description: The PHRC hosts a variety of training activities, including online webinars, on-demand platforms for education, and in-person conferences. The scope of effort for these programs varies depending on the year as some programs are only offered every other year. In addition, external factors, such as changes to the Pennsylvania Uniform Construction Code, may increase activity in specific areas.

1. **PHRC Webinar Series:** The PHRC will continue its successful webinar series. Webinars are delivered live for continuing education credit, and they are archived for on-demand viewing without continuing education credit. Proposed topics are listed below. One PA Labor & Industry contact hour is offered for each webinar for PA code officials. As appropriate, AIA LUs for architects, ICC credit hours for code officials, NARI credits for remodelers, and PA PDHs for engineers are offered.

Report: During the 2025-26 project year, the PHRC team delivered 10 webinars to a total of 1,002 attendees. Table 4 shows a summary of the 2025-26 webinar season.

Table 4. Webinars during the 2025-26 Project Year

Organization	Date	Attendees
Energy Code Compliance Options in PA	9/10/25	150
Advanced Framing Techniques for High-Performance Homes	10/14/25	123
Heating Up Efficiency: Exploring Heat Pump Options in PA	10/30/25	99
Best Practices for High Performance Hot Water Systems	11/11/25	57
Putting the Pieces Together: Levels of Offsite Construction	12/9/25	69
Advancing Indoor Air Quality Strategies in Residential Building Design	1/13/26	96
A Blueprint for Compliance: Understanding Chapter 102 Regulations & the 2024 PAG-02 General NPDES Permit	2/10/26	104
Inside the Envelope: Modern Ductwork Strategies for Energy Efficient PA Homes	4/14/26	117
Harnessing AI to Transform Residential Design & Construction	4/30/26	94
Designing for All Ages: Aging in Place & Intergenerational Homes	5/12/26	93
Total	10	1,002

2. **PHRC On-Demand Courses for Continuing Education:** The PHRC now partners solely with the Penn State College of Engineering's Office of Digital Learning (ODL) to offer recorded webinars in

an on-demand format. This format utilizes knowledge checks and a final quiz to satisfy continuing education requirements and provides a certificate of continuing education upon completion for a fee. The PHRC team will continue to deploy webinars that are developed and delivered internally through this on-demand platform.

Report: The PHRC team continues to improve their understanding of accessibility guidelines from Penn State. Due to Penn State technology changes, on-demand courses transitioned platforms to now be hosted on Penn State College of Engineering's Canvas platform, which required courses to be rebuilt and reviewed in the new platform. Those seeking ICC Contact Hours and PA Labor & Industry Contact Hours are the primary audience completing the courses. On average, registrants completed about two courses per year. During the 2025-26 project year, there were 8 course completions by 4 participants.

3. **Annual PHRC Housing Conference:** The PHRC will continue to organize, promote, and hold the industry-focused 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), regulators (planners, building code officials, township engineers, DEP and conservation district staff, etc.), and others involved in the residential construction industry.

Report: The 2026 PHRC Housing Conference was held on March 18-19, 2026, at the Penn Stater Hotel & Conference Center in State College, Pennsylvania. Both days included exhibitors during breaks to highlight products and services relevant to attendees.

Day 1: Day 1 of the PHRC Housing Conference started off with a keynote from Sarah Billington, Stanford University, entitled "From Concept to Community: Design Strategies for Sustainable Affordable Housing."

The following tracks and sessions were offered:

- Construction Materials & Methods
 - "The Future Is Panelized: Building Better with Precision, Performance and Efficiency in Mind" (Matt Cleary, CertainTeed/Saint-Gobain)
 - "Structural Engineering Considerations for Residential Construction" (Glyn Boone, P.E., Myer Hill Engineering)
 - "Residential Housing Value by Design: Cost-Saving Materials, Methods, and Detailing" (Bryan Kehm, Kehm Design & Consulting)
- Residential Code
 - "Energy Code Compliance Options in PA" (Chris Hine, PHRC)
 - "Preparing for Pennsylvania's Updated Energy Code: From Design to Field Verification" (Jimmy Stecik & Christopher Quin, PEG LLC, & Eric Winter, Ekotrope)
 - "2026 PA UCC Update & RAC Process" (Walter Schneider, Centre Region Code Administration)
- Land Development & Planning
 - "Development Review and You: The Road to Improving Municipal Applications" (Anthony Ascoilla, Cathy Fletcher, Michael Simonson, Alyssa Hanecek)

- "Zoning Do's and Don'ts for Data Centers, Solar Farms, Affordable Housing and Other Hot Land Uses" (John Trant, Strategic Solutions LLC)
- "Regulating Accessory Dwelling Units: Emerging Trends in Pennsylvania" (Isaac Wakefield & Idan Ghazanfari, Salzmann Hughes, P.C.)
- The PHRC held a networking event titled "Networking on the Exhibit Floor" in the evening of March 18. This reception included conference speakers, attendees from both the PHRC Housing Conference and the RBDCC, and PHRC Staff to discuss the day's sessions and network with industry exhibitors.

Day 2: Day 2 of the PHRC Housing Conference started with a keynote from Georg Reichard, Georgia Institute of Technology, entitled "The 7 Habits of Successful Builders of High-Performance Homes."

- Retrofits & Existing Construction
 - "Additions & Retrofits 101: How to Begin?" (Jennifer Yourey, Sasha McCarthy, Erin Stiffler, and Jere McCarthy, State College Design and Construction)
 - "HVAC Considerations for Retrofit Application and New Construction" (Aaron Martin, Mitsubishi Electric Heating and Air Conditioning)
 - "Residential Additions Building Up or Building Out?" (Jim Royer, Centre Region Code Administration)
- High-Performance Housing
 - "Practical Next Steps for Carbon and Electrification in Homes" (Andrew Poerschke & Brian Wolfgang, IBACOS)
 - "Ventilation That Works: Principles, Verification, and Practice under the 2021 IECC" (Michael Arblaster, Harmony Home Energy, and Joseph Hillenmeyer, AprilAire)
 - "Optimizing Assemblies for Cost and Performance" (Corey Murphy, 475 High-Performance Building Supply)

Table 5. Attendees at the 2026 PHRC Housing Conference

Event	Attendees
Day 1 (March 18)	150
Day 2 (March 19)	130
Networking on the Exhibit Floor Reception	150

- 4. Residential Building Design & Construction Conference (RBDCC):** The PHRC will organize, promote, and hold the research-focused RBDCC 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 or poster 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 a conference proceedings.

The process to prepare for the biennial RBDC Conference is a two-year effort that is led by Ali Memari and Mindy Boffemmyer. This process includes, but is not limited to, the following tasks:

- Coordinating and negotiating event space
- Announcing, promoting, and accepting abstract submissions along with subsequent review
- Communicating reviews and deadlines to RBDCC authors
- Accepting paper, presentation, and poster submissions
- Coordinating sessions with speakers and moderators
- General event logistics and planning

Report: The program has held eight conferences in the RBDCC series so far. The eighth RBDCC, which was held March 18–19, was another success, with 38 presentations and 53 papers published in the proceedings. The papers submitted to the conference go through a peer review process followed by revision by the authors and in-house editing prior to publication in the proceedings. The proceedings of the past eight RBDC conferences are available on PHRC's website (www.phrc.psu.edu/Publications/Past-Conference-Proceedings.aspx) and provide a collection of contributions related to various topics related to issues of interest in residential building materials, architecture, engineering design, construction technology innovation, sustainability, affordability, health, social aspects, renewable energy, energy efficiency, building science, and hazard mitigation, among others.

D. Publications & Content Creation

Description: The PHRC will leverage the technical expertise of staff members along with the expertise of strategic external partners to continue to produce content for publication and future PHRC training programs. This initiative also includes the development and maintenance of online delivery platforms for article and video publication.

1. **Written Content:** The PHRC will produce written publications as appropriate, including both internally and externally published work. Examples of internal publications include Builder Briefs, research reports, technical flyers, and future online articles. Examples of external publications include scholarly journal articles, conference proceedings, magazine and trade publication articles, and other general interest articles upon request.

This initiative includes the ongoing development and maintenance of the PHRC online article database that can be accessed through the PHRC website. This database allows for the PHRC team to publish a range of types of written work, including general industry announcements and technical articles.

Report: The PHRC News site requires ongoing maintenance and upkeep with the latest information. This site, otherwise referred to as the online article database, was launched in September 2023 and contains technical articles, PHRC announcements, and general industry news.

2. **Video Content:** The PHRC will continue to increase internal capacity to develop video content from demonstrations, site visits, and other live events. This content will be captured, edited, and published in a manner that supports broader PHRC initiatives and future training programs. Example deliverables related to video creation include the publication of short “toolbox talks” for the building community, recording of presentations for secondary programs, and capturing construction processes through live demonstration.

This initiative includes the future development and maintenance of a PHRC YouTube channel. This platform will allow for greater engagement and sharing of PHRC video content.

Report: To increase our audience, the PHRC has created a YouTube channel for easy delivery of on-demand videos. These videos will be housed on this platform and then shared through other social media platforms.

- a. The PHRC team continued to increase the use of video capture and sharing for online and in-person content delivery. Some examples of videos created include promotional or time-sensitive content, webinar previews, and recorded webinars. This adds an additional layer engagement for the attendees. Table 6 below provides the channel’s analytics.

Table 6. PHRC YouTube Channel Analytics during the 2025-26 Project Year

Number of New Videos Posted (2025-2026)	16
Number of New Subscribers (2025-2026)	167
Total Views (2025-2026)	6,184
Total Watch Time in Hours (2025-2026)	930.4

E. Technical Assistance, Technology Transfer, & Outreach

Description: The PHRC continues to work to get technical information, resources, and publications to builders, remodelers, design professionals, building code officials, and others involved in the residential construction industry in new and innovative ways. This often involves leveraging existing and developing new relationships with other organizations in the residential construction industry.

- a. General Outreach Activities:** Through our general outreach initiatives, 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 email and social media campaigns, 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.

Report: The PHRC team continued to engage with the industry on various fronts, including through attendance at various organizations' meetings and participation in a multitude of boards, councils, and committees in service to the residential construction industry. In addition, the lists below outline a portion of the scholarly efforts related to the residential construction industry through the guidance of the Hankin Chair and director of the PHRC.

a. Journal Papers

- i. Park, K., Memari, A. M., Hojati, M., Duarte, J. P., Nazarian, S., Radlinska, A., and Bilen, S. G., (2026). "3D Concrete Printing, Finite Element Modeling, and Testing Validation of a Sub-scale Concrete Dome Structure," *Frontiers in Built Environment*, published 06/29/26; Vol. 12 – 2026, 1854031, 18p., <https://dot.org/10.3389/fbuil.2026.1854031>.
- ii. Abdelwahab, K. and Memari, A. M., (2026). "Seismic Fragility Functions for Light-Frame Wood Walls and Pressure Sensitive Adhesive Air Barrier Systems used in Building Envelopes," Taylor & Francis, *Urban Resilience and Earthquake Engineering*, Published 06/24/26, 17p., <https://doi.org/10.1080/30656680.2026.2685657>.
- iii. Cheng, H., Duarte, J. P., Memari, A. M., Bilén, S. G., and Radlińska, A., (2026). "Recycled cork aggregate for 3D concrete printing: rheology, pore-driven anisotropy mitigation, and low-carbon thermal buffering," Elsevier, *Construction and Building Materials*, Vol. 517, March 28, 2026. 145789. <https://doi.org/10.1016/j.conbuildmat.2026.145789>.

b. Conference Proceedings

- i. Asadi, H., Aminian Toosi, F., JafarLavasani, K., Memari, A. M., and Yee, H. M., (2026). "From Shelter to Smart Housing: Integrating Textile Architecture into Contemporary Dwellings," *Proceedings of the 8th Residential Building Design and Construction Conference*, Editors: Ali M. Memari and Mindy Boffemmyer, The Pennsylvania Housing Research Center, Penn State University, University Park, PA, March 18-19, 2026, pp. 517-529, Published June 2026, ISBN 978-1-62307-011-3;

- <https://www.phrc.psu.edu/assets/docs/Publications/2026RBDCCPapers/2026-RBDCC-Proceedings.pdf>
- ii. Monfaredi, P. and Memari, A. M., (2026). "Mechanical and Structural Evaluation of Carbon Geocrete as an Alternative to Portland Cement Concrete," *Proceedings of the 8th Residential Building Design and Construction Conference*, Editors: Ali M. Memari and Mindy Boffemmyer, The Pennsylvania Housing Research Center, Penn State University, University Park, PA, March 18-19, 2026, pp. 377-391, Published June 2026, ISBN 978-1-62307-011-3; <https://www.phrc.psu.edu/assets/docs/Publications/2026RBDCCPapers/2026-RBDCC-Proceedings.pdf>.
 - iii. Asghari, N. and Memari, A. M., (2026). "Impact of Pozzolanic Materials and Mix Design Parameters on Compressive Strength of Hempcrete." *Proceedings of the 8th Residential Building Design and Construction Conference*, Editors: Ali M. Memari and Mindy Boffemmyer, The Pennsylvania Housing Research Center, Penn State University, University Park, PA, March 18-19, 2026, pp. 354-365, Published June 2026, ISBN 978-1-62307-011-3; <https://www.phrc.psu.edu/assets/docs/Publications/2026RBDCCPapers/2026-RBDCC-Proceedings.pdf>.
 - iv. Abdelwahab, K. and Memari, A. M., (2026). "Framework to Simulate the Delamination Failure of Air Barrier Systems Installed in Building Envelopes," *Proceedings of the 8th Residential Building Design and Construction Conference*, Editors: Ali M. Memari and Mindy Boffemmyer, The Pennsylvania Housing Research Center, Penn State University, University Park, PA, March 18-19, 2026, pp. 146-157, Published June 2026, ISBN 978-1-62307-011-3; <https://www.phrc.psu.edu/assets/docs/Publications/2026RBDCCPapers/2026-RBDCC-Proceedings.pdf>.
 - v. Aminpour, N. and Memari, A. M., (2026). "Analytical and Numerical Evaluation of 3DCP structures," *Proceedings of the 8th Residential Building Design and Construction Conference*, Editors: Ali M. Memari and Mindy Boffemmyer, The Pennsylvania Housing Research Center, Penn State University, University Park, PA, March 18-19, 2026, pp. 28-44, Published June 2026, ISBN 978-1-62307-011-3; <https://www.phrc.psu.edu/assets/docs/Publications/2026RBDCCPapers/2026-RBDCC-Proceedings.pdf>.
 - vi. Binega, E. and Memari, A. M., (2026). "Advancing Sustainable Construction: Robotic 3D Printing and Failure Analysis of Clay-Hemp Composite Structural Walls," *Proceedings of the 8th Residential Building Design and Construction Conference*, Editors: Ali M. Memari and Mindy Boffemmyer, The Pennsylvania Housing Research Center, Penn State University, University Park, PA, March 18-19, 2026, pp. 15-27, Published June 2026, ISBN 978-1-62307-011-3; <https://www.phrc.psu.edu/assets/docs/Publications/2026RBDCCPapers/2026-RBDCC-Proceedings.pdf>.

c. Patents

- i. Title: *Reinforced Composite Materials, and Methods of Making the Same*
U.S. Patent No 17/353,626; Date Patent Issued: July 7, 2026

Inventors: Ali Memari, Maryam Hojati, Jose Duarte, Shadi Nazarian, Aleksandra Radlinska, Sven Bilen, and Nicholas Meisel

<https://thepatentplace.com/iplibrary/patent-grant/12674320/>

- ii. Title: *Process for Cold Sintering of Calcium Carbonate for Precast Construction Materials*

U.S. Patent No. US 12,623,969 B2; Date Patent Issued: May 12, 2026

Inventors: Aly Said, Mehrzad Zahabi, and Ali Memari

<https://thepatentplace.com/iplibrary/patent-pdf/12623969/>

- b. **PCCA Symposium & Other Events:** The PHRC will work upon request with the PCCA to plan, develop, and deliver online and in-person events in support of PCCA initiatives.

Report: PHRC Staff continue to work with PCCA staff to develop and offer education sessions needed for code officials in Pennsylvania. This item is further reported upon under II.A.2. in Workshops.

- c. **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. Additionally, it is archived on the PHRC website for public viewing. For the 2025-26 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.

Report: The magazine was sent electronically to PHRC members and stakeholders to keep them updated on recent PHRC activities and to promote upcoming events. For the 2025-26 project year, the PHRC magazine was published in the fall to provide for a timely update with the outcome of the previous year's projects and with what to expect in the coming year.

- d. **Support of Secondary Career & Technology Education (CTE) Programs:** The PHRC will continue to support secondary education and CTE programs through a variety of outreach initiatives. Outreach activities are intentionally flexible based on the needs of these secondary programs but may include participation on occupational advisory committees, guest lectures in secondary program classrooms, development and promotion of video content for secondary students, and other activities as needed.

Report: PHRC staff continue to serve on various occupational advisory committees for local programs. PHRC staff have connected the PBA Endorsed Trade Program with the Penn College Workforce Development (formally known as the Clean Energy Center) and their workforce development.

- e. **Professional Women in Building (PWB):** The PHRC, in alignment with its current strategic plan, prioritizes gender equity in the residential construction industry through involvement with the NAHB Professional Women in Building (PWB) activities and initiatives. This effort 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.

Report: The local PWB council within the Builders Association of Central PA and the statewide PWB Committee have not been active in this project year. PHRC staff contribute as needed with the groups' various efforts.

- f. **Support of the UCC RAC:** The PHRC will continue to support the Uniform Construction Code Review & Advisory Council (RAC) and the public by serving as a general technical resource upon request.

Report: The PHRC continued to be present at RAC meetings and supported the overall effort through promotion of deadlines as well as opportunities to contribute via public comment.

- g. **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 current PHRC standards include:

- 2025 Pennsylvania Alternative Residential Energy Provisions (2025 PA-Alt)
 - Compliance Worksheet for the 2025 Pennsylvania Alternative Residential Energy Provisions
 - Stickers for the 2025 Pennsylvania Alternative Residential Energy Provisions
- Foundation Systems for Relocated Manufactured Housing

Report: The PHRC staff with support from the PA-Alt Subcommittee and external consultants created the 2025 PA-Alt and its associated documents. The 2025 PA-Alt is published on the PHRC website, and it will be available in the *2024 Changes to the Pennsylvania Uniform Construction Code* published by the ICC. The PHRC also continues to provide training on the 2025 Pennsylvania Alternative Residential Energy Provisions through conference sessions and speaking engagements.

- h. **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.

Report: The PHRC continued to experience success from ongoing networking and relationship building with other organizations, manufacturers, and companies. Examples of this ongoing effort included a collaboration between the PHRC and the Penn College Workforce Development (formally known as the Clean Energy Center) at Penn College through weatherization training.

III. Applied Research

An 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, and they are typically completed under the supervision of the PHRC director Ali Memari. Projects in this category foster partnerships and draw on the expertise and strengths of the people and facilities available at Penn State.

1. Development of High Strength Hempcrete for Load Bearing Application in the Form of Blocks and Panels

Description: The use of hempcrete in wall construction has attracted some attention over the past few years due to the benefits of the material with attributes such as high thermal insulation (R-value about 2/in.), high sound insulation, fire resistance, high humidity absorption capacity, insect resistance, carbon sequestration, natural renewable and nontoxic material, and low cost, among others. The 2024 IRC recognizes hempcrete as an insulation material and provides guidelines for its use. Currently, hempcrete, made of hemp hurd, lime and water, is applied/made as spray form, cast in place, or precast. The precast form is mainly in block form. All forms of application are for non-load bearing walls. The compressive capacity is normally less than 1/20th of concrete or between 50-150 psi depending on the mixture, and the weight is around 13 to 60 lb/ft³. Hempcrete walls are generally constructed using studs for gravity carrying load and hempcrete that confines the studs for thermal resistance and walling surfaces, which is then finished with a coat of lime plaster on the interior and exterior. So, a hempcrete wall essentially eliminates drywall, batt/rigid insulation, OSB sheathing, air barrier, and siding, which leads to lower overall cost compared to conventional wood-frame construction. PHRC has been involved in the field measurement of thermal resistance of walls in several hempcrete homes in different states and has developed a unique understanding of the potential for further use of this material in home building. Preliminary studies carried out in the PHRC's BeTL lab have shown that with the use of certain ingredients such as magnesium oxide the strength can be significantly increased. This proposed research will build on the current experience at PHRC and will explore development of higher strength hempcrete for generation of blocks and panels incorporating additional additives and/or innovative configurations for potential load-bearing applications.

Deliverables: The result of this work will include a PHRC report and a RBDC conference or journal paper.

Report: Building on preliminary studies carried out in the PHRC's BeTL lab, which had shown that with the use of certain ingredients such as magnesium oxide (MgO), the strength can be significantly increased, this project has explored the effect of different binders and additives on hempcrete's compressive strength. While a full study report with quantitative details is under preparation, this summary explains some of the results. Besides using lime as the main binder, the use of MgO and cement binders, as a partial substitute to lime, was also investigated. Furthermore, a range of supplementary materials and additives, including metakaolin, fly ash, nano-silica, silica fume, and gum arabic, were also incorporated to evaluate their effects on compressive strength. As an example of the results for this part of the study, incorporation of metakaolin and fly ash at approximately 10% of the binder weight increased the compressive strength by 50%. While in general, mixtures would include only one additive to determine the effect of each additive, the study also considered dual-additive combinations, particularly mixtures incorporating metakaolin and silica fume together with other additives. The results show that generally better performance can be obtained in such cases compared to mixtures containing only a single additive. As another major alternative binder, the feasibility of combining conventional hempcrete mixtures with cement binder was also investigated. The results show that while one gains significant increase in compressive strength, the increase in density and reduction in environmental sustainability will be the deciding factors for limiting the percentage of cement binder. Besides the proportions of different binder materials and additives, the density of conventional cast hempcrete was also found to have a significant influence on their compressive strength. For example, increasing the volume compactness of 2 in. cube wet samples of hempcrete by 30% led to increasing the compressive strength by 43%. Another factor studied was the effect of drying and curing time on the compressive strength. Comparison of mixtures tested at 7 and 28 days demonstrated that longer curing periods can improve the measured compressive strength. The results in particular show that a 28-day curing period is more appropriate for evaluating the compressive strength of modified hempcrete mixtures containing supplementary materials. The details of the study are expected to be available as a PHRC report, and later a conference paper or a journal paper will be prepared.

IV. Act 157 Funds

The PHRC receives funding from diverse sources, including contracts, grants, membership fees, fees for services, and the funds collected under Act 157 of 2006 and amended by Act 36 of 2017. To fulfill PHRC's annual mission, the organization must raise additional revenue outside of Act 157 funds to complete its annual project load.

Prior to October 25, 2018, Act 157 of 2006 funds were collected through a \$4 fee on every building permit issued in the Commonwealth and are dispersed through the Department of Community and Economic Development (DCED). PHRC received 50% of the collected permit fees minus a 7.5% administrative fee to DCED.

Beginning on October 25, 2018, Act 36 of 2017 amended building permit fees to be \$4.50 with PHRC being allocated 43.5% of the collected permit fee minus a 3% administrative fee to DCED. As of April 2020, DCED changed their fee collection process to only accept online payments by credit card or check for UCC permit fees, which allows for more expedient reporting to the PHRC.

Funds for the 2025-26 Project Year are based upon funds received from July 2024 through June 2025, which can be seen in Table 7 below.

Table 7. Summary of Act 157 Funds received during the 2024-25 FY (2025-26 PHRC Project Year)

Collection Period	Amount Received
Q1: July 2024 - Sept 2024	\$117,101.25
Q2: Oct 2024 - Dec 2024	\$113,831.56
Q3: Jan 2025 - Mar 2025	\$123,015.94
Q4: April 2025 - June 2025	\$101,423.07
Total	\$455,371.82

Expenses for the Act 157 Account (\$624,489.79) were more than the revenues (\$455,371.82) for the 2025-26 project year. The PHRC strategically overspent this year's revenues due to a surplus created from higher than usual funds received in prior years and staff turnover. Additionally, Ali Memari's applied research projects for project years 2024-25 and 2025-26 were both charged in this project year as well as the external consultant fee for the Pennsylvania Alternative Residential Energy Provisions project, which was completed in project year 2024-25. Also, the PHRC continues to be fiscally conservative in adjusting to an ever-changing housing market by minimizing expenses where possible and has increased strategic investments through various initiatives such as external content development. The PHRC maintains a strong financial position to weather uncertainties in the housing market. Table 8 shows a breakdown of PHRC expenses for the 2025-26 Project Year allocated to the Act 157 Account.

Table 8. PHRC Expenses for the 2025-26 PHRC Project Year

Category	Act 157
Total Salaries	\$400,056.60
Total Wages	\$0.00
Total Student Wages	\$15,150.00
Fringe Benefits	\$162,673.65
Supplies and Materials	\$26.79
Communications Services	\$1,406.09
Travel & Meetings	\$10,326.76
Publications	\$2,187.00
Maintenance	\$0.00
Consulting & Prof Svc	\$28,500.00
Copies and Photographic Services	\$140.00
Computer Services	\$491.40
Purchased Services	\$0.00
Equipment	\$0.00
Computer Equipment	\$0.00
Miscellaneous	\$3,531.50
Total	\$624,489.79