

PENNSYLVANIA HOUSING RESEARCH CENTER NEWSLETTER

FALL 2015



INSIDE THIS ISSUE

- I NEWSLETTER HIGHLIGHTS
- 2 2016 PHRC INDUSTRY EDUCATION WEEK
- 3 UPDATE FROM THE HANKIN CHAIR
- 3 NEW! MINOR IN RESIDENTIAL CONSTRUCTION AT PENN STATE
- 4 UPCOMING WORKSHOPS
- 4 2015 HANKIN DISTINGUISHED LECTURE
- 5 2015-2016 WEBINAR SCHEDULE
- 6 **FIRST PLACE!** NAHB RCMC COMPETITION
- 7 US DOE RACE TO ZERO COMPETITION
- 8 NEW PHRC WORKSHOPS
- 8 RECENTLY COMPLETED PROJECTS
- 10 CURRENT APPLIED RESEARCH PROJECTS
- II 2016 PHRC MEMBERSHIP
- II 2015 PHRC MEMBERS



FROM THE ASSOCIATE DIRECTOR

We've had a very productive summer, including the publication of four Builder Briefs and a research report. Check out the newsletter for an update on these and other projects, and find out more about what's coming up in the next project year. Don't forget to mark your calendars for the PHRC Industry Education week, including our annual Housing & Land Development Conference! As always, please feel free to contact us for more information via our website at www.PHRC.psu.edu.

-- Katie Blansett, Ph.D., P.E.

PHRC INDUSTRY EDUCATION WEEK



Mark your calendars for the PHRC's **Industry Education Week!** Held **March 1st-3rd, 2016**, the Industry Education Week will include two conferences, laboratory tours, training, and much more.

PAGE 2

MARCH 1ST-3RD, 2016



PHRC MEMBERSHIP

Learn more about becoming a PHRC Member! PHRC Members enjoy year-round discounts on our annual conference, workshops, speaker services, and other valuable industry resources.

PAGE 11

NEW WORKSHOPS

The PHRC develops and delivers new workshops each year on current topics facing the housing industry.

PAGE 8



KEEP UP TO DATE WITH US AT

facebook /PHRC.PSU



MARCH 1ST-3RD, 2016

MARK YOUR CALENDARS!

Join the Pennsylvania Housing Research Center for the **2016 Industry Education Week** from March 1st - March 3rd, 2016! Check out the details below for two conferences and additional opportunities for virtually all members of the residential building industry.

- * **Early Bird Registration starts in November '15**
- * Standard Registration starts in January '16
- * **PHRC & PBA Members receive a discount!**

EVENT SPONSORSHIPS AVAILABLE SOON!

24TH ANNUAL HOUSING & LAND DEVELOPMENT CONFERENCE

This two-day event provides information and updates on issues of interest to the residential construction industry. Wednesday, March 2nd focuses on issues related to housing structures and their systems via three tracks: Design, Construction, & Codes (PCCA Symposium). Thursday, March 3rd focuses on land development, water management, & site design.

WHAT: REGULATION & BEST PRACTICE
FORMAT: INVITED SPEAKERS

MARCH 2ND - HOUSING DAY

FOR WHOM:
BUILDERS, REMODELERS,
CODE OFFICIALS,
DESIGN PROFESSIONALS,
EDUCATORS, &
FACTORY-BUILT HOUSING
MANUFACTURERS

MARCH 3RD - LAND DEVELOPMENT DAY

FOR WHOM:
ENGINEERS, BUILDERS,
DESIGN PROFESSIONALS,
DEVELOPERS,
PLANNERS,
& REGULATORY OFFICIALS

3RD BIENNIAL RESIDENTIAL BUILDING DESIGN & CONSTRUCTION CONFERENCE

MARCH 2ND AND 3RD

This event provides a forum to discuss the latest findings, innovations, and projects related to residential buildings. Conference presentations are based on submitted abstracts and peer reviewed papers.

WHAT: RESEARCH, INNOVATION, & THE STATE-OF-THE-ART

FORMAT: SUBMITTED PAPERS & PRESENTATIONS

FOR WHOM: RESEARCHERS, DESIGN PROFESSIONALS, MANUFACTURERS, & BUILDERS

KEYNOTE SPEAKERS: JOHN STRAUBE
TEDD BENSON

ADDITIONAL OPPORTUNITIES

MARCH 1ST

PENN STATE LABORATORY TOURS

MARCH 2ND

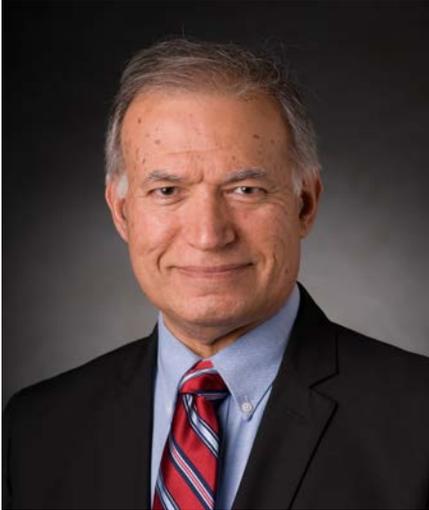
PCCA SYMPOSIUM CENTRAL
MIX & MINGLE RECEPTION

MARCH 3RD

WORKSHOPS

FIND OUT MORE ABOUT THE 2016 INDUSTRY EDUCATION WEEK AT WWW.PHRC.PSU.EDU/CONFERENCES

AN UPDATE FROM THE HANKIN CHAIR



Dr. Ali Memari, Hankin Chair

Thanks to the truly dedicated PHRC staff in helping to bring about a very successful year for our Residential Construction program! We are very pleased to see great interest by our undergraduate and graduate students in Residential Construction-related courses and research.

The most notable accomplishment this past year is the 1st place winning of NAHB Students Chapter Residential Construction Management Competition. Besides this significant win by our NAHB team, our DOE Race to Zero Student Competition team won awards for Design Excellence and Systems Integration Excellence. Such significant accomplishments would not have been possible without great contributions by PHRC staff in teaching some of the courses and being engaged along with the support of industry advisors in mentoring students for the competitions.

A significant milestone reached this year was the approval of our Residential Construction Minor, which has started to attract students beginning Fall Semester 2015.

Our testing laboratory facilities offer unique capabilities to perform standard and custom testing on residential and commercial building products and systems, including envelope/enclosure, foundation, walls, floors, and roof systems. We function as a resource and offer expertise to the residential building

industry in developing and advancing new products, conducting engineering analysis and evaluation of component/system performance, and formulating guidelines.

Our efforts to create a national forum for exchange of research ideas and sharing latest innovations related to residential construction is seeing good results as well. The 3rd Residential Building Design and Construction conference that is planned for March 2-3, 2016 has been embraced with over 50 abstracts submitted. The initiation of the Special Section on Housing and Residential Building Construction, as part of the ASCE Journal of Architectural Engineering, has now seen publication of two full issues of the journal in December 2014 (Vol. 20, No. 4) and June 2015 (Vol. 21, No. 2) with a total of 10 journal papers on the most active research areas in residential building construction.

We are proud of having had the opportunity to serve the Residential Construction industry and look forward to contributing further in the coming years.

NEW! MINOR IN RESIDENTIAL CONSTRUCTION AT PENN STATE



Strengthen your career prospects and stand out in your major in:

- Design & Construction of Residential Buildings
- Sustainable Residential Subdivision Design
- Construction Management of Residential Projects

Choose your track:

- Architecture
- Architectural Engineering
- Civil Engineering
- All Other Majors

10 required credits - AE 470, AE 471, ARCH 412, and CE 411 - for all four tracks

12 additional track-specific credits in Architecture, Architectural Engineering, Civil Engineering, Finance, and Risk Management

For More Information:

- PHRC.psu.edu/Education/Residential-Construction-Program
- Bulletins.psu.edu/undergrad/programs/minors/R/RCNEN

©2015 The Pennsylvania State University. All Rights Reserved. This publication is available in alternative media on request. Penn State is committed to affirmative action, equal opportunity, and the diversity of its workforce. U. Ed. ENG 16-28



PennState
College of Engineering

ADDITIONAL EDUCATIONAL OPPORTUNITIES

UPCOMING WORKSHOPS

Below are our currently scheduled workshops for 2015-2016. New workshop dates are scheduled regularly, with the up-to-date list on our website under "Outreach". If your organization is interested in scheduling or hosting a workshop, please contact Tracy Dorman at tdorman@enr.psu.edu or 814-865-2341.

SEPTEMBER

FUNDAMENTALS OF EXTERIOR
PLASTER & THIN STONE VENEER
9/29/2015 | Harrisburg |
HBA of Metro Harrisburg

OCTOBER

RESIDENTIAL BUILDING ACADEMY
10/5-10/8/2015 | Enola |
PSATS Educational Center

NOVEMBER

FUNDAMENTALS OF EXTERIOR
PLASTER & THIN STONE VENEER
11/5/2015 | Philadelphia |
CBEI at the Navy Yard

DECEMBER

RESIDENTIAL ELECTRICAL ACADEMY
12/14-12/17/2015 | Enola |
PSATS Educational Center

JANUARY

RESIDENTIAL MECHANICAL ACADEMY
1/11-1/24/2016 | Enola |
PSATS Educational Center

FEBRUARY

INTERNATIONAL ENERGY
CONSERVATION CODE ESSENTIALS
2/9-2/10/2016 | Bethlehem |
Best Western Lehigh Valley

RESIDENTIAL PLUMBING ACADEMY
2/22-2/25/2016 | Enola |
PSATS Educational Center

APRIL

RESIDENTIAL ENERGY ACADEMY
4/27-4/28/2016 | Enola |
PSATS Educational Center



Roof-Wall Intersection mockup for the *Building Envelope in 3D: Design, Details, & Demonstration* Workshop

SAVE THE DATE - 2015 HANKIN DISTINGUISHED LECTURE

The Hankin Distinguished Lecture Series invites world-class speakers to the Pennsylvania State University to address students, faculty, staff, and industry professionals. The lecture is **free** and **open to the public**. The lecture series was established in 2006 **in honor of the late Bernard Hankin and his family** for their continuous and dedicated support of the residential building construction program at Penn State.



DATE: **NOVEMBER 11TH, 2015 | 4:00 PM**

SPEAKER: **DANIEL S. FULTON**, FORMER CEO OF WEYERHAEUSER

TITLE: **BEEN DOWN SO LONG, IT LOOKS LIKE UP TO ME:**
WAITING FOR THE BREAKOUT OF HOUSEHOLD FORMATION THAT'S
NEEDED TO DRIVE A SUSTAINABLE HOUSING RECOVERY

LOCATION: **NITTANY LION INN**, PENN STATE UNIVERSITY PARK



VIEW PAST HANKIN LECTURES AT PHRC.PSU.EDU UNDER **OUTREACH**

Join us every **second Tuesday of the month** from **1pm to 2pm** for our monthly webinars! In case you miss one, or if you would like to hear one again, recordings of all of our webinars (since 2011) are available on our website under "Webinars".

SEPTEMBER (9/8)

Challenges, Considerations, & Concerns of Indoor Air Quality

In the efforts to build higher performing homes, more stringent guidelines require a tighter building envelope. Tighter envelopes have advantages regarding air leakage and overall energy consumption but have made maintaining good indoor air quality increasingly complicated. This webinar will educate participants on the topic of indoor air quality by explaining the key considerations for health and safety issues related to indoor air quality, strategies for controlling pollutants, as well as product selection and installation.

OCTOBER (10/13)

Where to Draw the Line with Thermal Boundaries

A Thermal Boundary is a term used to describe when heat flow is restricted or slowed via insulation and a continuous air barrier. This webinar will start off by discussing the definition of a thermal boundary in regards to residential construction. Next, a brief plan review will be completed showing key elements and requirements of the thermal boundary along with applying the "pen test" on a house cross section, followed by reviewing code and above code check lists to ensure the thermal boundary is compliant at both the plan review stage and during construction. At the end of this webinar, one will know how to identify, inspect and properly construct a durable and effective thermal boundary.

NOVEMBER (11/10)

Moisture Considerations for Insulated Building Assemblies

One critical design consideration in residential construction is the interaction of the home and its building enclosure with moisture. Recently a project was carried out at the PHRC that analyzed insulation

durability as it relates to moisture in various building assemblies. This webinar will bring the results of the project to a one hour format in order to discuss the implications of building codes, material development, and best practices on the durability of insulated assemblies throughout various Pennsylvania climates. By taking these moisture-related issues into consideration during design, builders and homeowners can experience greater durability and sustainability throughout the life of the home.

DECEMBER (12/8)

Technology in the Connected Home

A "Smart Home" refers to a home that has particular objects, products, controls, and systems that are interconnected and identifiable through a series of digital networks, providing home owners with comfort, security, energy efficiency, reduced operating costs, and convenience at all times, regardless of whether anyone is home. This webinar aims to provide participants with the information to understand appropriate "Smart Home" products and technologies, taking into consideration budget, occupant needs, and desired client outcomes.

JANUARY (1/12)

Defining Failures in Residential Construction

The word "failure" is one of the more subjective terms in the field of residential construction and design, yet this term appears in a multitude of design guides, best practice documents, and other literature. This webinar will take a step back to look at what the term failure may mean in different settings. The viewpoints of various construction industry stakeholders will be used to understand the differences in perspective and how they determine the applicability and severity of building failures. Case studies will be used to understand this concept further, and each will analyze the role of building codes in the overall situation.

FEBRUARY (2/9)

Affordable Housing Initiatives in Pennsylvania

Affordable housing options in the Commonwealth of Pennsylvania are in short supply, forcing various housing authorities and affordable housing advocacy groups to get creative to meet the demand from Pennsylvania citizens. This webinar will explore some of the creative solutions, including case studies, that are being successfully implemented in today's housing market and will analyze the applicability of these solutions on a broad scale throughout the state.

APRIL (4/12)

Shedding Light on Glazing Safety and Performance

Understanding glazing concepts can help determine how well a product will keep a home cool in the summer and warm in the winter. By recognizing proper fenestration design principles, industry professionals and consumers can reliably compare products and make informed decisions about the windows and doors they purchase, install, and inspect. This webinar will explore glazing characteristics such as U-Factor, Solar Heat Gain Coefficient (SHGC), Visible Transmittance (VT), Air Leakage (AL), and how they relate to the overall assembly performance, as well as the impact that provisions of the 2009 IRC dealing with safety have on glazing selection and installation.

MAY (5/10)

Residential Deck Design and Detailing

Residential deck construction has been second nature for several years. In this webinar we will review the current 2009 IRC code requirements for deck attachment for lateral loads as referenced in Section R502.2.2. Along with the IRC requirements, we will review the Prescriptive Residential Wood Deck Construction Guide (DCA6) for joist, beam and railing design. This webinar will also review several connection and design details.



STUDENT DESIGN COMPETITIONS

FIRST PLACE WIN! NAHB RESIDENTIAL CONSTRUCTION MANAGEMENT COMPETITION



NAHB RCMC Team with their First Place trophy in Las Vegas, NV

The Penn State NAHB Student Chapter came in **First Place!** in the **Residential Construction Management Competition (RCMC) at the 2015 International Builders Show in Las Vegas, NV.**

The competition gives students the opportunity to apply skills learned in the classroom to a real construction project by carrying out a management project/proposal complete with a construction estimate/budget; construction schedule; cash flow projections; project management and organization; marketing and risk analysis; project site plan and land development plan; and green building initiatives. This year's project focused on a 40 acre site located in Lebanon, Tennessee, which is Middle Tennessee's first Transit-Oriented Development.

"After three years of competing in the RCMC project I couldn't be more pleased with the results of this year's competition", said **Alec Galanti**, senior in Finance, a team project manager. "The project was tough, but given the diversity of students on the team I never had my doubts that we would put together a strong proposal."

"I credit the NAHB Residential Construction Management Competition as being one of the best parts of my Penn State experience," said **Chris Guyan**, senior in Civil Engineering. "It has expanded on what I have learned in the classroom through a challenging, real world project. I have learned many valuable skills that will benefit me in my career, including collaboration and management."

"The competition has been one of the most worthwhile, real world experiences that I have had an opportunity to be a part of at Penn State," echoed **Galanti**. "I'm glad I chose to get involved as a sophomore and highly recommend the competition to any individual that wants a great experience in the building industry."

The students received travel and scholarship funds from the Pennsylvania Builders Association, the Builders Association of Central Pennsylvania, Henrietta Hankin, the National Housing Endowment, the Samuel A. Shuman Endowment, the Hankin Endowment Committee, and industry sponsors R. Clem Malot and Curtis Schneck.



NAHB RCMC Team presenting their project progress to industry professionals at the annual NAHB Student Chapter Banquet



NAHB RCMC Team receiving travel funds from PBA, NHE, and Penn State



Race to Zero awards ceremony with DOE Architect Sam Rashkin; Lisa Iulo, Associate Professor of Architecture; Chauntel Duriez, Student Marketing Coordinator; & Kyle Macht, Student Team Leader



Full Race to Zero team, faculty advisors, and industry advisors

Penn State's H4: Heritage Homes Team, composed of more than 25 Architecture and Engineering students, won awards in two of the three excellence award categories: Design Excellence and Systems Integration Excellence. The competition was held April 18-20, 2015 at the National Renewable Energy Laboratory in Golden, CO.

33 teams from 27 schools across the United States and Canada competed in the 2015 competition. Student Team Leader, **Kyle Macht** (first-year M.Arch; B.A.E./M.A.E.) and Student Marketing Coordinator, **Chauntel Duriez** (fifth-year student pursuing an integrated Masters in Architecture) represented the Penn State team.

"The competition was fantastic. We did really well, and many people – students, industry partners, and jurors – were really impressed with the project," said **Macht**. **"It was incredible to meet some of the best building scientists in the country and for them to be impressed with us. The entire competition was inspirational, giving me the motivation to make a difference in housing industry."**

The team collaborated with the State College Community Land Trust (SCCLT) to develop a net-zero energy duplex that will be constructed within close proximity to Penn State's University Park campus. The resulting design was a two-story, 3-bedroom, 2-bath, 1,440 ft² per living unit net-zero energy

duplex that incorporates Visitability features, adaptable floor plan, and solar photovoltaic systems that produce 100% of each home's energy onsite, significantly reducing the resident's annual utility bills.

The team worked closely with the SCCLT throughout the design process through design charrettes and visual preference surveys. Additionally the team engaged with more than 14 industry mentors to receive real world insight on buildability, cost estimates, HVAC design, solar photovoltaic system design, and marketability. **"I was extremely impressed with the knowledge the students brought to the discussion,"** said **SCCLT Board Member Ron Filippelli**. **"They were well informed and very professional."**



Race to Zero Design Charette with the State College Community Land Trust (SCCLT)



Exterior rendering of the final design

1. Building Envelope in 3D: Design, Details, & Demonstration

The PHRC has been developing training Mock-ups to be included in our one hour speaking engagements. Recently, all four of the training Mock-ups have been pulled together for a 4-hour workshop titled "Building Envelope in 3D: Design, Details & Demonstration". This workshop will look at key building envelope areas that include air infiltration, insulation, window / door flashing and exterior water management at the roof and wall intersection.

2. Full Day Fundamentals of Exterior Plaster & Thin Stone Veneer

Improper installation of exterior plaster finish systems, like hardcoat stucco and adhered stone veneer, can lead to severe moisture problems and cracking. This workshop explores relevant exterior plaster code requirements, and reviews proper flashing techniques, lath requirements, and treatment of joints between dissimilar materials. Following the completion of this workshop, participants will be able to understand the code requirements that relate to the construction of exterior plaster and thin stone veneer assemblies, relate the effects of improper construction technique to occupant risk and building failure, and detail appropriate flashing components in order to provide cost effective and durable construction solutions.



RECENTLY COMPLETED PROJECTS

1. Crawlspace Design & Construction

During the 2014-2015 project year we took a look at the design and construction of crawlspaces in Pennsylvania. Pairing together code compliance and best practice methods, we developed a webinar, Builder Brief and construction details that will provide a path to reduce the risks associated with crawlspace design and construction. The Builder Brief is available on our website under the "Publications" tab.

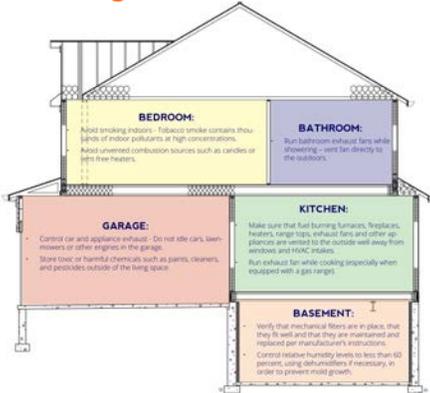
2. Builder Briefs on Moisture-Related Design & Construction

This project took a fundamental look at common building assemblies and materials found throughout Pennsylvania, and was separated into two distinct parts: Roof / Ceiling Assemblies and Wall Assemblies. Two Builder Briefs were developed which outline moisture-related

considerations for designing and constructing insulated wall and roof / ceiling assemblies. These Builder Briefs focused on moisture accumulation and moisture transport principles as they affect the durability of the system over seasonal cycles. The Builder Briefs are available on our website under the "Publications" tab.



3. The Fundamentals of Indoor Air Quality in Residential Buildings



IAQ Considerations by Room

Indoor air quality (IAQ) is a term which refers to the quality of air within and around buildings, especially as it relates to the health and comfort of building occupants. In fact, improving the quality of indoor air is vital for human health. This project summarized the topic of IAQ and the pollutants that affect it, such as: gase, like carbon monoxide or radon; microbial contaminants, like mold or bacteria due to moisture intrusion; improper and inadequate ventilation or make-up air; or any other pollutant or condition that can induce adverse health conditions. This project provides guidance to help recognize common pollutants, understand the potential health impacts of poor indoor air quality, identify sources of indoor pollutants, and recognize methods of improving the air quality within a home.

A Builder Brief titled “The Challenges, Considerations, and Concerns of Indoor Air Quality” is available on our website under the “Publications” tab. A follow-up one hour long webinar was delivered in September, and the archived webinar can be viewed on our website under “Webinars.”

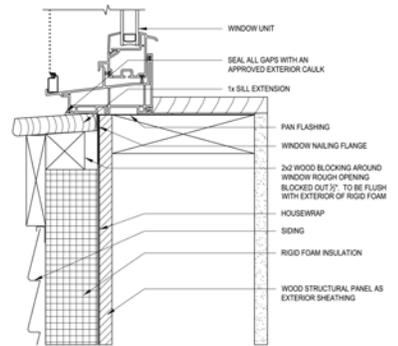
4. Stucco: Code Review and Analysis & State of the Art

“The stucco failure capital of the United States” is how Joseph Lstiburek, internationally renowned building scientist, referred to eastern Pennsylvania in his article *The Perfect Storm*.

Due to this increase in the number of stucco failures, this project studied stucco failure related to moisture infiltration and rot from installations performed in accordance with the code requirements as outlined in the IRC 2000, 2003, 2006, and 2009 model codes. Each publication of the IRC from 2000 – 2009 was reviewed as they related to exterior plaster wall assemblies. Revisions in pertinent sections, including exterior plaster, vapor retarder, and water-resistive barrier requirements, were analyzed.

The revisions and the potential impact of the revisions were summarized in a 24-page report titled “Impact of Building Codes on Exterior Plaster in Pennsylvania.”

5. Details That Work



New construction practices create a need for new and innovative details for contractors and sub-contractors to ensure proper installation. These necessary details encompass a wide range of scenarios starting from the footing level through shingles.

During the 2014-2015 project year we added several more Details to our database. This project year’s Details include:

1. Passive Radon Systems
2. Window Installation and Flashing Details with Exterior Rigid Foam Construction, and
3. Crawlspace Design





Penn State's 2007 Solar Decathlon competition home

1. Learning from the Experience of the Solar Decathlon

The Solar Decathlon program is a very successful Department of Energy (DOE) sponsored competition that challenges national and international colleges and universities to design, construct and operate solar powered homes for energy efficiency, cost-effectiveness and various other criteria such as renewable energy, clean energy, and advanced building technologies. The program has so far been held during 2002, 2005, 2007, 2009, and 2011.

Although the competition will result in one team winning first place, each team uses different features from which much can be learned. In particular, if the target audience will be the builders and developers, there are many useful features that this audience may benefit from for different applications.

The goal of this project is to develop a collection of learning materials from the significant investment and effort that has so far gone into the Solar Decathlon program. In particular, the detailed designs of all past Solar Decathlon homes are being reviewed to identify special features that were used for each home. These features will then be categorized and tabulated with their attributes. Then the features and their impact considering various performance criteria will be compared taking into account the analyses results generated by each team in their projects.

2. Evaluation of Wall Insulation Retrofit Options for Existing Homes

According to the 2011 DOE Building Energy Data Book, walls are the second highest area for energy loss out of a residential building enclosure, with windows being the highest. In addition to traditional fiberglass batt

insulation; various types of loose insulation materials; different rigid insulation boards; foam insulation; sandwich boards of vapor barrier and rigid insulation; and sandwich boards of sheathing and rigid insulation have been developed.

Most of these products are suitable for new construction. However, information and understanding about the suitability and appropriateness of different insulation systems specifically for retrofit purposes is not readily available.

This project is looking into all possible methods and materials/components suitable for retrofitting existing walls to enhance energy efficiency. Each method will be evaluated for energy saving enhancement through computer modeling. The potential condensation issues will also be studied by using software such as WUFI. The study will also develop a cost analysis for each option so that various retrofit methods can be compared for energy consumption as well as retrofit cost and payback period.



Infrared image of building envelope energy loss

3. Passive Cooling Opportunities for Seasonal Energy Savings in Mass-Produced Homes

Over the last several decades construction practices of contemporary residential structures have improved significantly, resulting in good energy performance. While the structures are produced with energy conservation in mind, one major contributor to the final outcome is the home owner or occupant.

An often overlooked opportunity for energy conservation is to expand the period when neither heating nor cooling is used in a home. This project focuses

on the prediction of energy savings utilizing passive strategies that promote specific occupant behaviors/operational strategies to extend the period when the cooling equipment can remain idle.

As this strategy depends on occupant behavior, the question is: can passive design strategies be incorporated into residential structures to promote "better" occupant behavior – that is, will the occupant leave the cooling and heating equipment de-energized for longer periods? There are significant hours within the mid-Atlantic region where passive solar or natural ventilation can provide thermal comfort in residential situation without the aid of mechanical heating and cooling equipment, and not running the equipment would result in 100% energy savings during those times.

4. Shear Wall Opportunities in Residential Construction

Current building codes and standards for residential construction are complex and easily misunderstood when it comes to the requirements pertaining to wood shear walls. Whether they are engineered or prescriptive the design intent has the potential to be lost resulting in improper construction of walls that can lead to poor performance and failure (both aesthetically and structurally).

This pilot study will cumulate the vast knowledge regarding residential shear walls options, provide comparisons between behavior and design steps, and finally recommend best practices for constructing. The results will give designers and builders a better understanding of the complexity of shear wall code provisions and how to go about designing and constructing shear walls through clarifying code intent.



Wood shear wall construction

BECOME A 2016 PHRC MEMBER!

The Pennsylvania Housing Research Center (PHRC) serves the home building industry and the residents of Pennsylvania by improving the quality and affordability of housing. We conduct applied research, foster the development and commercialization of innovative technologies, and transfer appropriate technologies to the housing community.

PHRC membership fees will be used to support the outreach activities of the Center, Penn State students involved in the NAHB Student Chapter, and graduate students conducting research with the PHRC.

PLATINUM	\$5,000
GOLD	\$2,000
SILVER	\$1,000
BRONZE	\$500
INDIVIDUAL	\$100
ASSOCIATION	\$150

PHRC Members receive many benefits including*:

- ➔ **Annual conference discounts**
- ➔ **PHRC Workshop discounts**
- ➔ **Advertising in annual newsletter, on the PHRC website, and in the annual conference program**
- ➔ **Electronic access to past conference presentations**

**Benefits vary between membership levels.*

2015 PHRC MEMBERS

GOLD



- Hankin Group

SILVER

- Muncy Homes
- Pennsylvania Concrete Masonry Association (PCMA)
- Pennsylvania Manufactured Housing Association (PMHA)
- S&A Homes

BRONZE

- Curtis E. Schneck, Inc.
- UpStreet Architects, Inc.

INDIVIDUAL

- | | | | |
|---|--|---|--|
| <ul style="list-style-type: none"> • Robert Baney • Thomas Dobrzyn • Lora Dombrowski | <ul style="list-style-type: none"> • Anthony Geonnotti • Alan Hawman • Jon Kautz • R. Clem Malot | <ul style="list-style-type: none"> • Craig Martin • Jeffrey W. McClintock • Tim Myers • Michael Queen | <ul style="list-style-type: none"> • Lee Rackus • Todd E. Smeigh • David Sweetland • Donald A. Tracy |
|---|--|---|--|

ASSOCIATION

- | | | | |
|---|---|--|--|
| <ul style="list-style-type: none"> • Adams Township • BIA of Northeast PA | <ul style="list-style-type: none"> • HBA of Chester/Delaware County • HBA of Metro Harrisburg | <ul style="list-style-type: none"> • Lebanon County Builders Association • Somerset Builders Association | <ul style="list-style-type: none"> • Toll Architecture - A Toll Brothers Company • York Builders Association |
|---|---|--|--|

For full details, visit our website: PHRC.psu.edu/About-PHRC-Membership or contact Tracy Dorman: TDorman@engr.psu.edu | (814) 865-2341



Pennsylvania Housing Research Center
Penn State University
219 Sackett Building
University Park, PA 16802

Director of Research **Ali Memari**
Associate Director **Katie Blansett**
Housing Program Development Specialist **Bryan Heitzmann**
Housing and Land Development Specialist **Chris Hine**
Housing Systems Specialist **Brian Wolfgang**
Training and Events Coordinator **Tracy Dorman**
Budgets and Publications Coordinator **Sarah Klinetob Lowe**

(T): (814) 865-2341

(F): (814) 863-7304

www.PHRC.psu.edu

PENNSYLVANIA HOUSING RESEARCH CENTER NEWSLETTER

FALL 2015



The PHRC Team (left to right): Brian Wolfgang, Chris Hine, Sarah K. Lowe, Dr. Ali Memari, Dr. Katie Blansett, Bryan Heitzmann, & Tracy Dorman

THE PENNSYLVANIA HOUSING RESEARCH CENTER

serves the home building industry and the residents of Pennsylvania by improving the quality and affordability of housing. We conduct applied research, foster the development and commercialization of innovative technologies, and transfer appropriate technologies to the housing community. For more information about the PHRC, download any of our free publications, learn about membership, check out our free webinar schedule, or sign up for a training program, check out our webpage at:

PHRC.PSU.EDU