

PENNSYLVANIA HOUSING RESEARCH CENTER NEWSLETTER

FALL 2016



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MARK YOUR CALENDARS FOR THE:

25th Reunion!

ANNUAL HOUSING & LAND DEVELOPMENT CONFERENCE

MARCH 1ST-2ND, 2017



WEBSITE UPDATES

Check out our new and improved website! The new site provides better service for mobile devices and clear organization for those we serve in the housing industry. Click the "Industry" tab for more on our workshops, webinars, and applied projects, or the "About Us" tab for membership to sign up for our mailing list, at PHRC.psu.edu.



ICC PREFERRED PROVIDER STATUS



PREFERRED EDUCATION PROVIDER

The PHRC is now an International Code Council (ICC) Preferred Education Provider! Check the program description to see if it's been approved for ICC credit. All webinars for the 2016-2017 season are eligible for ICC credit.

STAY CONNECTED WITH THE PHRC



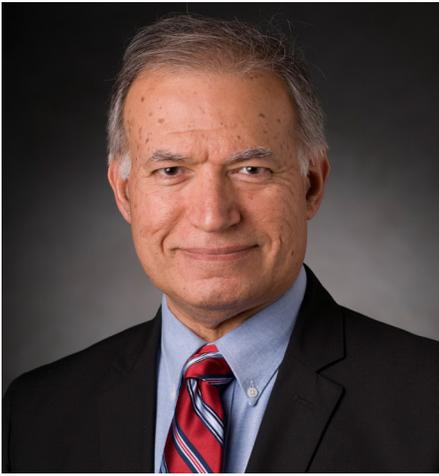
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Dr. Ali Memari, Hankin Chair

The Residential Construction Program at Penn State is continuing its success in education, research, and outreach. With top undergraduate programs in the country in Architectural Engineering (AE) and Civil and Environmental Engineering (CEE), the Residential Construction Program **enhances student opportunities to gain a deeper understanding of the residential construction industry.** In addition to offering courses in Residential Building Design and Construction, Sustainable Residential Subdivision Design, Construction Management of Residential Building Projects, and Building Enclosure Science and Design,

the program offers a **new 22-credit Residential Construction Minor** and a 12-credit Housing Certificate. These formal offerings will not only attract more students to the study of Residential Construction but also increase the chances of students finding employment opportunities in the industry. The Program also supports the **NAHB Student Chapter Residential Construction Management Competition** and **DOE Race to Zero Student Design Competition.** The benefits of such student competitions are numerous, but a very important result is the experience that our students gain in working on real life types of Residential Construction projects, which help them along their career paths.

In graduate education the Program is quite successful in **attracting and recruiting some of the best AE and CEE graduate students** to study and conduct research in topics that support advancement of technologies, means, and methods for improved engineering design and construction of residential buildings. The results of the work of graduate students, as well as visiting scholars, are reflected in theses, technical conferences, and/or scholarly journals.

The Residential Construction Program at Penn State benefits from **highly advanced laboratories** with facilities that allow testing the most critical architectural and structural components of single-family and multi-family

dwelling for acceptable performance under various environmental conditions and natural hazard overload situations, as well as serviceability, durability, and energy efficiency. In particular, the lab facilities provide opportunities for research on different types of building envelope and architectural components besides the structural systems. With some internal and external funding (industry and government), the Program is also able to engage graduate students as well as some undergraduate students on advanced R&D projects.

Finally please read more about the success of our **3rd Residential Building Design and Construction Conference** below. We look forward to continue serving the residential construction industry for many years to come.



NAHB Student Chapter Residential Construction Management Competition team at the International Builders Show

3RD RESIDENTIAL BUILDING DESIGN & CONSTRUCTION CONFERENCE

The 3rd Residential Building Design and Construction Conference (RBDCC), held concurrently with the 24th Annual Housing and Land Development Conference on March 2-3, 2016 in State College, PA, was a great success and attracted attendees from six different countries. This conference provides a forum for researchers and design professionals to discuss the state of the art in residential building and included lab tours, two receptions, and a graduate student poster presentation.

Sessions at the conference covered a broad range of topics including: building envelope sustainability and retrofit, cross-laminated timber, energy audits, energy efficiency and high performance buildings, fire safety,

hygrothermal modeling, indoor air quality and natural ventilation, modular construction, passive house design, phase-change materials, post-disaster housing, resilient design and retrofit, senior living, and wind loading effects on roofs.

Two Keynote Speakers were invited for the conference: Tedd Benson, President of Bensonwood, and Dr. John Straube, Principal at RDH Building Science and RDH Building Science Labs and Associate Professor in the Faculty of Engineering at the University of Waterloo. Tedd Benson focused on the next generation of homebuilding in his presentation, *"The 21st Century Craft of Sustainable Homebuilding: Culture, Technology, and Methods Toward a Better Way to Design & Build."* Dr. John Straube focused

on the importance of building science in his presentation, *"Building Science: The Foundation of Future Residential Building Design and Practice."*

For the full conference proceedings and videos of the keynote presentations, please click on the "Publications" tab on our website.



Attendees at the Research Night laboratory tours



RBDCC attendees listening to keynote presentation by Dr. John Straube

SAVE THE DATE - 2016 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 9TH, 2016 - 4:00 PM**

SPEAKER: **SAM RASHKIN, CHIEF ARCHITECT AT THE DEPARTMENT OF ENERGY**

TITLE: **THE PATH TO A SUSTAINABLE FUTURE BEGINS WITH POWER WORDS**

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

2016-2017 WEBINAR SCHEDULE



Join us every **second Tuesday of the month** from **1pm to 2pm** for our monthly webinars! All of this year's webinars are approved for **ICC, L&I, NARI, and PDH** continuing education credit, and most for **AIA**. Webinars are **free to view** and \$20 for a continuing education certificate. Recordings of all of our webinars since 2011 are available on our website under "Industry".

SEPTEMBER (9/13)

Rainscreen Gaps in Exterior Walls

Building enclosure design typically addresses the need for an exterior wall to be able to drain and dry moisture that is present throughout the year. Depending on the cladding system, this may be difficult to achieve using current practices, and may warrant the decision to include a designed drainage space, or a rainscreen, in the wall assembly. This webinar will discuss the benefits of rainscreen systems, the products available to create this designed space, and the best practices for integrating rainscreens into the overall assembly.

OCTOBER (10/11)

Durability of Insulated Rim Joists

Throughout the building enclosure there are various assemblies that are deemed critical to the long-term energy efficiency and durability of a building. When best practices are followed, these critical areas contribute to a sustainable enclosure. When one or more components are incorrectly designed or installed, moisture accumulation, rot, or mold growth may occur. In this webinar we will look at the rim joist portion of the enclosure. Many scenarios come into play such as insulation materials, whether the basement is conditioned and what types of cladding or materials are applied to the exterior of the assembly. We will review these scenarios and work through the risks associated with them.

NOVEMBER (11/8)

HERS Ratings in PA - Why, What, & How?

Nearly a quarter of all homes built in Pennsylvania receive HERS Ratings and the number is growing each year. Many builders say they build energy efficient homes, but with the Home Energy Rating System (HERS) a builder can prove it. A skilled energy

professional performs software analysis, insulation and air barrier inspections, and blower door and duct leakage testing that combine to yield a HERS Index score. This score gives homebuyers critical information about a home's energy performance that's easy to understand. At the same time, builders receive expert consulting and quality assurance services from a certified HERS Rater, and may even be eligible for utility rebates.

DECEMBER (12/13)

Residential Concrete 101

Concrete is one of the most commonly used building materials in residential construction, but is often overlooked. In this webinar we will review the components of concrete and explain how each of them play a critical role in creating a long lasting and durable finished product for placement. We will also review current code requirements along with guidelines set by the American Concrete Institute.

JANUARY (1/17)

Design & Construction of Downspout Disconnections (*AIA NOT available)

Sumping of gutter downspouts is a common stormwater management technique to allow the rainwater that falls on a roof to infiltrate and one of the most frequently used BMPs by builders of single homes that aren't part of a larger subdivision plan. The DEP has provided design guidance in the BMP manual on the sizing of these dry wells, but the material can be difficult to find and is targeted to an engineering audience. The PHRC developed a Builder Brief that summarizes the details on the sizing and construction of downspout sumps into an easy-to-use guide for homebuilders. This webinar will present design details, sizing explanation and equations, and example calculations of dry wells. Maintenance information that needs to be shared with the homeowner will also be covered.

FEBRUARY (2/14)

Frost Protected Shallow Foundations in PA

Frost protected shallow foundations are an economically feasible alternative to traditional foundation construction in Pennsylvania, yet they require special attention to structural and insulation detailing. This webinar will explore what a frost-protected shallow foundation looks like in PA, discuss the code requirements that allow for the construction of these foundation systems, and will examine the design considerations that drive the design and construction of these systems.

APRIL (4/11)

Permit Notice of Termination (NOT) Process Overview (*AIA NOT available)

The version of the Notice of Termination (NOT) for a General or Individual NPDES Permit for Stormwater Discharges Associated with Construction Activities or an Erosion and Sediment Control Permit that went into effect in August 2015 (3150-PM-BWEW0229b Rev. 9/2015) is very different that previous version and has new requirements that some permittees are not meeting, which is leading to rejection. This webinar will discuss the NOT process and provide tips on how to achieve permit closeout with the first submission.

MAY (5/9)

What does Net-Zero Energy Mean in PA?

The residential construction industry has been advancing in terms of energy efficiency for decades. The concept of achieving Net-Zero Energy is now a reality. But what does Net-Zero Energy actually look and feel like in Pennsylvania? This webinar will explore the basics of energy consumption in residential settings, as well as the history of energy efficient techniques, systems, and building codes in Pennsylvania. The discussion will focus on the specifics of Pennsylvania's climate, construction industry, and economy.

STUDENT DESIGN COMPETITIONS

TOP TEN FINISH! NAHB RESIDENTIAL CONSTRUCTION MANAGEMENT COMPETITION



left: NAHB Student Chapter Residential Construction Management (RCMC) Team right: NAHB RCMC Team with team sponsors Valerie Steinke (left) and Rob Parahus (right) of Toll Brothers

The Penn State Student Chapter of the National Association of Home Builders (NAHB) took **sixth place** in the Residential Construction Management Competition, held during the NAHB International Builders Show on January 19-21, 2016 in Las Vegas.

A total of 34 four-year schools participated in the competition, which gives students the opportunity to apply skills learned in the classroom to a real development scenario by completing a construction management project/proposal.

This year's project consisted of a 147 acre site in Frederick, MD. Named Tallyn Ridge, the site

was designed as a residential development composed of 441 residential units. Penn State's proposal consisted of a total of six different units throughout the community to meet the needs of their target market. Penn State offered two different types of townhome units and a variety of single-family homes which target many growing or established families and older couples who are looking to live in a family-friendly community outside of the city.

The team included Eric Catalan, a junior in Energy, Business, and Finance; Jack Dalton, a senior in Finance; Emma Dickson, a junior in Civil Engineering (CE) & Economics; David Good, a senior in CE John Hauser, a senior in CE,

Nate Kiliany, a senior in CE, Eric McCall, a senior in CE; and Austin Will, a junior in Corporate Innovation & Entrepreneurship. They were advised by several members of the PHRC staff, including Katie Blansett, Bryan Heitzmann, Chris Hine and Brian Wolfgang, as well as Tom Skibinski, instructor in CEE.

Team travel support was generously provided by:

- Toll Brothers IBS Travel Grant
- PBA Women in Building Travel Award
- The National Housing Endowment (NHE) IBS Travel Award
- Samuel A. Shuman Endowment
- University Park Allocation Committee (UPAC)

US DEPARTMENT OF ENERGY RACE TO ZERO COMPETITION



left: students, faculty, and industry mentors during a design charrette; center: exterior rendering of the Smart Start home; right: Race to Zero team members sketching design ideas

The PHRC supported the "SMART START Homes" student design team to compete in the 2016 US Department of Energy (DOE) Race to Zero Student Design Competition. 31 teams from 25 schools across the United States and Canada competed in the 2016 competition, which was held April 16-17, 2016 at the National Renewable Energy Laboratory in Golden, CO.

The competition challenges and inspires students to design an affordable, net zero energy home that meets DOE's Zero Energy Ready Home guidelines. This year's design concept was created in collaboration with the Union County Housing Authority to develop

designs for owner-occupied, high performance townhomes for the Authority's Penn Commons development in Lewisburg, PA.

The resulting design was a two story, 3 bedroom, 2 bath, 1,400 ft² per living unit net zero energy townhome design, and included innovative features such as an "Airbnb" space to help residents offset their mortgage payments. Each townhome also has a solar photovoltaic system that produces 100% of each home's energy onsite, significantly reducing the residents' annual utility bills.

This year's team was led by Chris Hazel (Masters of Architecture) and system project managers: Cansu Tari (Masters of Architecture), Jean

Laurent (M.S. Architectural Engineering), Reza Foroughi (PhD Architectural Engineering), Ehsan Kamel (PhD Civil Engineering), Niloofar Nikookar (Masters of Architecture), Selby Niumataiwalu (Bachelors of Architecture), and Shunran Liao (Masters of Architecture).

The team received mentoring from industry partners Chad Owens of Timber Rock Homes and Jordan Robb of Envinity, Inc., and faculty members Professor Lisa lulo (Associate Professor of Architecture, Professor Andy Lau (Associate Professor of Engineering Design), Dr. Somayeh Asadi (Assistant Professor of Architectural Engineering), and Dr. Jiro Yoshida (Assistant Professor of Business).

NEW PHRC WORKSHOPS - READY TO BE SCHEDULED!

1. *Updated!* Residential Deck Design & Construction

Based on a 2012 NAHB statistic, 26% of new single family homes are constructed with decks, or roughly 5,000 per year, not including decks constructed after the certificate of occupancy has been issued. It is critical that builders and inspectors remain up-to-date in deck design and construction to protect consumers from deck failures. The PHRC deck program was recently updated to include the sections of the 2015 International Residential Code that have been adopted in PA as part of the UCC, as well as figures from the American Wood Council's Design for Code Acceptance (DCA) 6 – Prescriptive Residential Deck Construction Guide. New examples have also been added to the program.

2. *Online!* Residential Moisture Management: The 4-D's

The performance of the building enclosure in the modern construction industry is critical to the success of a project. Much of this performance has to do with managing moisture in various forms. This new online workshop series will focus on moisture management in four distinct approaches: Deflection, Drainage, Drying, and Durability. By addressing each strategy independently, design and building professionals are able to ensure that the enclosure they are designing and constructing is safe, durable, and sustainable. These sessions will discuss moisture sources, material options, and general strategies for appropriately controlling the impact that moisture has on the built environment.

3. *Updated!* Building with Exterior Rigid Foam

To meet the increasing demand for energy efficient enclosures, builders are turning to the addition of exterior rigid foam to their wall assemblies. Including exterior continuous insulation has many benefits, including reduced thermal bridging, increased whole-wall R-value, and reduced risk of interstitial condensation. This workshop will analyze the building science behind the success of exterior rigid foam as well as the details of installation in order to comply with manufacturers and current code requirements. This workshop will discuss the nuances associated with this fundamental change in the overall wall assembly, including fastening requirements, flashing sequence, and cladding attachment.

4. *Expanded!* Deck Details - Expansion of Mock-up Based Training

Over the past year, the Mockup Training series has been delivered to over 250 people across the state of Pennsylvania through speaker engagements, conference invitations, association board meetings and industry leading corporate meetings. The latest mock-up in the series is on deck connections, and the program includes code compliance requirements along with best practice guidelines from the American Wood Council's document DCA-6 (Design for Code Acceptance, Prescriptive Residential Wood Construction Guide).

5. Stormwater Regulations Training for Municipal Officials

It is very difficult to keep up with the constantly evolving regulations related to stormwater management (SWM), especially when SWM is the not your primary focus, as is the case for many municipal officials. The program provides a concise overview of the Municipal Separate Storm Sewer Systems (MS4s) program, Act 167, and local ordinances, and how all three overlap and tie together. This one- to two-hour program is geared to a non-technical audience, providing a basic introduction to the relevant regulations and permits.

WORKSHOPS IN DEVELOPMENT - COMING SOON!

1. HVAC Design and Installation

As new home construction introduces tighter and more efficient wall assemblies, and building codes push towards higher energy efficiency, achieving occupant comfort is becoming more and more dependent on the proper sizing of HVAC systems. This program will address both design and installation, and is being developed with flexibility as either two half-day sessions or one full-day session. This new workshop is expected to be piloted at the 2017 PHRC Housing and Land Development Conference.

2. IRC Framing Design & Code Compliance

The design and implementation of many framing and structural details in residential construction is often taken for granted as experienced framers are relied upon to provide a code compliant light-frame structure. However, as trends continue to call for complicated floor plans and open concepts, connections and the use of new engineered wood products require more attention and detailing. This full-day workshop will take a look at the structural requirements of the IRC including connections, fasteners, hangers, and wall bracing, as well as some fundamental light-frame design theory.

3. Expanded Online Training Opportunities

The PHRC has developed a new online training strategy that is based on the successful webinar model. This new online strategy will allow for the delivery of longer workshops (up to 6 hours of instruction) over the course of a few weeks to a month. This strategy will break down traditional workshop material into smaller webinar-style sessions that will be delivered as a series. Keep an eye out for information about "Residential Moisture Management: The 4-Ds," which will be offered online in late 2016.



1. Frost Protected Shallow Foundations

Frost protected shallow foundations (FPSF) are an economically feasible alternative to traditional foundation construction in Pennsylvania, yet they require special attention to structural and insulation detailing. A Builder Brief that studied FPSF in the context of code compliance, synergies with current enforceable energy codes, and constructability within Pennsylvania was published and is available on the PHRC website.

2. Exterior Plaster Assemblies in Pennsylvania

Exterior plaster continues to be a hot topic in Pennsylvania as efforts to improve best practice are ongoing. The PHRC continues to maintain involvement throughout the state regarding the topic of exterior plaster. This ongoing project recently included the publication of a Builder Brief on rainscreen systems and their applicability to reservoir cladding systems (including exterior plaster). Check out the Publications tab of the PHRC website to find this and other Builder Briefs.

3. Durability Evaluation of Insulated Rim Joists

Insulated rim joists have traditionally been a weak point in the building envelope. This area not only needs thermal insulation, but also requires air sealing to perform adequately. Insulated rim joists are subjected to moisture damage if not designed properly and often this damage can go undetected for significant periods of time. This project includes the development of exterior wall assembly schematics, which represent common methods for insulating rim joists in PA. Each scenario was analyzed regarding the ability of the assembly to not only insulate against heat loss and gain, but also to prevent condensation and promote drying should the assembly become wet. The result of this project is a Builder Brief, which highlights the building science concepts of condensation prevention and drying potential, as well as a comparison of risk between common assemblies. This project is in support of a NAHB Construction Technology Research Sub-Committee (CTRSC) Research Priority.

4. Guidance of the Downspouts as a BMP for Builders

Sumping of gutter downspouts is a common stormwater management technique to allow the rainwater that falls on a roof to infiltrate. This technique is one of the most frequently used BMPs by builders of single homes that are not part of a larger subdivision plan. The DEP has provided design guidance in the BMP manual on the sizing of these sumps, but the material can be difficult to find and is targeted to an engineering audience. A Builder Brief was published that summarizes the sizing of downspout sumps in an easy-to-use reference for homebuilders. The Brief includes design details, sizing explanation and equations, and example calculations.

1. Deck Design Spreadsheet

The portions of the 2015 IRC related to decks that have been incorporated into the PA UCC provide design guidance and a prescriptive path for deck design. The PHRC is developing an easy to use spreadsheet that will allow the user to plug in overall deck dimensions for standard decks and have results that show the required design criteria based on new 2015 IRC decks material that was adopted in PA.

2. Update to the PA Alternative

Over the years, the PHRC has developed several standards to respond to industry demand. The most recent version of the PA Alternative Residential Energy Provisions is the 2009 edition. Since new code provisions from the 2015 IRC/IECC were adopted in PA and became enforceable in January 2016, it is time to revisit the Alternative Provisions. The Alternative Provisions is referenced in the PA UCC as an alternative to energy code provisions of the IRC, so it is important that this document remain relevant. Updating this document involves the identification of stakeholders and the formation of an advisory committee, similar to previous update processes. Through the guidance of this committee, new code provisions that have been adopted in PA will be analyzed and considered for inclusion in an updated version of the PA Alternative. Additionally, other provisions that would provide alternative means of compliance (yet equivalent code stringency) could be considered.

The time period for this project is currently open ended and must respond to both the consensus process for content development, and pending legislation that may change what provisions of the energy codes are applicable in PA.

The deliverables of this project are currently open ended and will be determined by the steering committee. If the committee sees fit to move forward with an updated version of the PA Alternative Residential Energy Provisions, then a 2015 edition will be developed and published. Training materials on the new edition will also need to be developed. There will be a marketing component to this project to help industry professionals know that an updated version of the document is available.



BECOME A 2017 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.*

CURRENT 2016 PHRC MEMBERS

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DOW Building Solutions



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- S&A Homes
- Weyerhaeuser

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- The Duck Harbor Company
- NTM Engineering, Inc.
- Timber Rock Homes
- UpStreet Architects, Inc.



Session at the 24th Annual Housing & Land Development Conference

INDIVIDUAL MEMBERS

- | | |
|-------------------|----------------------|
| • Jake Arner | • Richard Hotchkiss |
| • Steven Balkey | • Jon Kautz |
| • Mark Bartel | • Paul Laskey |
| • Paul Calvanelli | • Michael Lusaitis |
| • Thomas Crean | • Jeffrey McClintock |
| • George Deller | • Lee Rackus |
| • Lora Dombrowski | • Todd Smeigh |
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| • Mark Grassi | • Cynthia Smith |
| • Alan Hawman | • Robert Smith |
| • Dean Hilliard | • Jon Sukonik |
| | • Joshua Weaber |

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- Builders Association of Northwest PA
- BIA of Philadelphia
- Central Susquehanna Builders Association
- Concrete Reinforcing Steel Institute
- HBA of Berks County
- HBA of Bucks & Montgomery Counties
- Lebanon County Builders Association
- Somerset Builders Association
- Willistown Township
- York Builders Association

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PENNSYLVANIA HOUSING RESEARCH CENTER NEWSLETTER

FALL 2016



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

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