

# HRC NEWS



Vol. 4, No. 1, Fall 1995

The Housing  
Research Center



A Publication of the Housing Research Center at the Pennsylvania State University

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## HRC LEADERSHIP CHANGES

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This is a year of significant change in the leadership of the Housing Research Center. On August 31, 1995, our Director, Dr. Jack H. Willenbrock retired after 27 years of dedicated service to Penn State. After an extensive search, Dr. Eric Burnett, currently a Professor of Civil Engineering at the University of Waterloo, was selected as the next HRC Director. Dr. Burnett will accept the full responsibilities of this position on January 1, 1996. In the interim period, Dr. Harvey Manbeck, a supporter of the HRC since its inception, is serving as the Acting Director of the HRC. This issue contains messages from the past and current Directors as well as an introduction to our incoming Director.

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### A MESSAGE FROM OUR PAST DIRECTOR, DR. JACK H. WILLENBROCK

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My teaching and research career at Penn State began in June 1968 with the directive to start a program in Construction Engineering and Management in the College of Engineering. My focus shifted to the homebuilding industry in 1980 when Bernard Hankin established a Professorship in Residential Construction. That career came to a close on August 31, 1995, when I retired from Penn State as the Bernard and Henrietta Hankin Chair of Residential Building Construction and Director of the Housing Research Center (HRC).

I feel extremely fortunate to have been the beneficiary of so many successes, and only a few failures, during that career. The successes were due to the support and encouragement which I received from a number of people and organizations as I tried to transform "Bernie's Dream" into a reality. Thanks must be extended to J. Roger Glunt, President of Glunt Building Company, and David F. Sheppard, Jr., of the Pennsylvania Builders Association, for their continuous support of the homebuilding program at Penn State. Carl Flohr, Ken Zook and Don DeLess, all of whom served as Chairman of the Advisory Council of the HRC, as well as Robert Buddenbohn of PBA and Walt Freidhoff and Ed Carr provided valuable guidance throughout the various maturation stages of the HRC since its beginning in June 1988.

I also consider myself fortunate to have worked with and mentored Matt Syal, Steve Taylor, and Stacy Worley as they served in the position of Assistant Director of Operations of the HRC while pursuing their Ph.D. programs. In addition to their support a number

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### A MESSAGE FROM OUR INTERIM DIRECTOR, DR. HARVEY B. MANBECK

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Jack Willenbrock who served as the Director of the HRC since its inception in 1980, retired on August 31, 1995. The HRC is a viable research and technology center for residential housing because of his dedication and untiring efforts. He will be missed, but he has left us with a strong organization with support from the housing industry, suppliers, and Penn State faculty from several departments. Perhaps his lasting legacy is that he nurtured the HRC to the point that it has the strength to endure until the new director is on board and to grow to new heights after the new director, Dr. Eric Burnett, takes over the reins on January 1, 1996.

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### INTRODUCING OUR FUTURE DIRECTOR, DR. ERIC BURNETT

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Dr. Willenbrock's successor as the Bernard and Henrietta Hankin Chair of Residential Building Construction and Director of the HRC is Dr. Eric Burnett, who will take up these appointments on January 1, 1996. Dr. Burnett is a structural engineer with special competence in building science and technology, building performance, and structural concrete. He has extensive experience in the building industry, having been involved in the design and construction of buildings on three continents. He is a fellow of the American Concrete Institute and of the Canadian Society for Civil Engineering.

His early education was received in Southern Africa. He completed his graduate studies (M.Sc., D.I.C., Ph.D.) at Imperial College, University of London. Both

*continued on page 3*

***J. H. Willenbrock continued***

of other graduate students and faculty members who "cast their lot" with the HRC deserve a word of appreciation.

A special word of thanks must also be given to the many members of PBA and the homebuilding industry who have provided financial support to the HRC at the leadership, supporting, and patron member levels over the years. On a similar note, thanks must also be extended to John Werner and Robert Booz of the Ben Franklin Technology Center of Central and Northern Pennsylvania who had enough confidence in the industry/academic partnership to provide over \$250,000 of matching support from the Department of Commerce of the Commonwealth of Pennsylvania over a four year period.

I am leaving the HRC under the able leadership of Dr. Harvey Manbeck of the Department of Agricultural and Biological Engineering who will serve as the interim Director of the HRC until January 1996. At that time my successor, Dr. Eric Burnett of the University of Waterloo will assume the position of the Hankin Chaired Professor and the Director of the HRC.

The 1995/1996 operating year is a crucial one for the HRC. One of the major challenges this year is to try to stabilize the funding process and to provide a mechanism for "up-front" funding of research projects. I ask each of you to provide both technical and continued financial support to the HRC during its annual fund raising campaign which begins on October 1, 1995. A strong showing of financial support will encourage the leadership of PBA to initiate a drive in 1995/1996 to establish a line item in the state budget to support the HRC in its role as the technology transfer and research arm of PBA and the homebuilding industry.

Thanks for all your support in the past, and please continue to support my successors. I hope to continue to work with you in the future as I begin my "next career" as a consultant to the homebuilding industry. Please contact me if you can use my services.

Dr. Jack H. Willenbrock, Ph.D., P.E.  
Residential Industry Consultant  
1601 Elizabeth Road  
State College, PA. 16801  
(814) 238-7253

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***H.B. Manbeck continued***

I will be serving as the Acting Director of the HRC from September 1 to December 31, 1995. In this role I will seek the advice and counsel of Jack Willenbrock and will be in touch with Dr. Burnett on a regular basis. Dr. Burnett and I will certainly confer on any issues of major importance during this time. Indeed, Dr. Burnett has arranged his schedule so that joined us in State

College for the October 10, 1995, planning meeting for the March 1996, Fourth Annual Pennsylvania Housing Conference, for the Annual Hankin Chair Advisory Committee Meetings and the NAHB Student Scholarship Banquet on November 17, 1995 and for the Fall Advisory Council Meeting on December 7, 1995. Thus, we are postured to make the transition from the Willenbrock to the Burnett directorship a smooth one.

Dr. Willenbrock and I met with the Operations Committee on August 31. The Operations Committee approved the budgets for operations, for four research projects and for the technology transfer efforts for 1995-1996. The total budget for 1995-96 is \$105,000: \$59,000 for research, \$11,000 for technology transfer, and \$35,000 for operations. Sources of funds for 1995-96 activities are \$25,000 from the Ben Franklin Partnership and \$80,000 from industry contributions. Of the \$80,000, \$32,500 has been pledged to the HRC by the Pennsylvania Builder's Association (PBA); the remaining \$47,500 is to be contributed by local builder associations (HBAs), from individual builders, and from other industry supporters during our annual fund raising campaign.

Our fund raising campaign will begin in mid October. Many of you will receive a campaign letter with a request for you to again make a financial contribution to the HRC. Collectively, your response to the fund raising campaigns in the past has been exceptionally good. We have always been able to raise the funds necessary to carry out the HRC research and technology transfer goals. With your continued support during the 1995-96 fund raising campaign, the HRC will have another successful year in 1995-96.

Finally, a word about the troops at the HRC. Without their help, my task as Acting Director would be very difficult, if not impossible. Stacy Worley continues to serve as Assistant Director of the HRC; Charles McIntyre is teaching the Residential Subdivision Design and Construction class this fall and serves as advisor to the Penn State Student NAHB organization; Brennan Glantz is helping with the HRC Newsletters; Jack Julo continues to assist in several operations activities; and an old friend of the HRC, Steve Taylor, will be helping me with a variety of activities during the fall. These young men are dedicated, hard working students who balance their schedules between their HRC responsibilities and being graduate student scholars. I am grateful for their support. Together, we will keep the HRC ship afloat and moving forward until Dr. Burnett is on board.

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### ***E. Burnett continued***

as an educator and a researcher, he has been associated with the University of Waterloo for more than 25 years. The University of Waterloo is one of the largest engineering schools in Canada and is considered to be Canada's most innovative university. Dr. Burnett is currently the Director of the Building Engineering Group, as well as a Professor of Civil Engineering. Recent research interests include system performance (roofing, window, and wall systems), building repair and rehabilitation, and product development.

Dr. Burnett has worked with and consulted to a number of research and development agencies in the U.S., Canada, and elsewhere. He spent a year conducting research at the Portland Cement Association in Skokie, Illinois, and a year at the Center for Building Technology at NBS (now NIST) in Gaithersburg, Maryland. He also spent two years in Ottawa, Canada's federal capital city, serving as the first Manager, Building Research, for the Canada Mortgage and Housing Corporation in Ottawa. (CMHC is in many respects the Canadian equivalent of HUD.) For a number of years he was a member of the Technical Research Committee of the Canadian Home Builders Association.

As a senior consultant, Dr. Burnett has been associated with a large, Ontario-based firm of consulting engineers for more than ten years and has served as the firm's Technical Director for Building Science and Rehabilitation. He has been involved in the development and conformance testing of a number of building systems and products. He has directed numerous investigations into the failure or inadequate performance of buildings, especially enclosure and material failure. He has served as a consultant in major Canadian legal cases.

Dr. Burnett intends to build on Jack Willenbrock's achievements and is excited by the challenges and opportunities offered by the Hankin Chair and the HRC. He is looking forward to joining the faculty of an institution as well known and dynamic as Penn State.

#### **Current Contact Information:**

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## **J. ROGER GLUNT FELLOWSHIP RECIPIENT ANNOUNCED**

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The Pennsylvania Builders Association has established the J. Roger Glunt Graduate Fellowship in Residential Construction in Penn State's College of Engineering with a \$60,000 gift raised by individual members and local affiliated associations.

Recently, Mr. Brennan Glantz was named by Penn State and J. Roger Glunt, the immediate past president of the National Association of Homebuilders, to be the first recipient of the Fellowship.

Mr. Glantz joins the HRC from the estimating and engineering staff of the structures department of HRI, Inc., a heavy/highway and bridge contracting company, headquartered in State College, Pennsylvania. He received a bachelor's degree in Civil Engineering from Penn State and will be working for the HRC while pursuing a master's degree in Civil Engineering.

The fellowship will be used to partially support Mr. Glantz as he works on various HRC projects and strives to be an example of J. Roger Glunt's initiative and commitment to Penn State and the entire home building industry.

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## **NAHB STUDENT CHAPTER**

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As part of Penn State's commitment to the residential building industry, the National Association of Home Builders granted a charter to the Student Chapter in 1981. The Student Chapter currently has 35 members and is active in many local and national activities.

Current plans for this fall include: volunteer work with the Habitat for Humanity program, monthly meetings with guest speakers from the industry, and participation in NAHB's Construction Management Marathon. In addition, chapter members are encouraged to apply for the "Residential Building Construction Industry Scholarship Program" and the "Residential Building Construction Industry Essay Contest." The scholarship program awards grants to students in need of financial aid. The essay contest awards students an all expense paid trip to the NAHB National Convention that will be held in Houston, TX in January 1996.

If you would like to receive more information concerning the Student Chapter, or if you would like to contribute to the scholarship program or the essay contest, please contact:

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University Park, PA 16802  
Tel: (814) 865-2341  
e-mail: CMHRC@aol.com

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## HRC RESEARCH PROJECTS

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### CREEP BEHAVIOR OF COMPOSITE STRUCTURAL INSULATED PANELS (SIPS)

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HRC Report Number A41 has been completed and is ready for distribution. Because this is an ongoing project to be completed in the spring of 1996, the progress report reflects the research results gathered to date and is subtitled "The prediction of the creep behavior of SIPS using an empirical power law model."

The progress and initial modeling results of research investigating the physical testing and modeling of the flexural creep behavior of composite wood-faced, foam-core SIPS are presented. The overall experimental plan includes laboratory creep testing of one hundred and four panel specimens for study of the effects of core thickness, core material (rigid urethane and expanded polystyrene (EPS)), load duration, environmental conditions and stress level on the time dependent flexural behavior.

This report discusses the application of an empirical power law used to describe the primary and secondary flexural creep deflection of 24, 41/2 inch thick, urethane and EPS SIPS under three load levels. Model prediction of the actual fractional (relative) deflection is satisfactory with correlation coefficients ranging from 0.827 to 0.933. An isochrone technique demonstrated that the respective urethane and EPS panels are linearly viscoelastic at low levels of both time and core shear stress. Non-linear viscoelastic empirical equations, as well as general rheological constitutive equations, are discussed. The report also lists a time line for completion of the remaining work in the next six months. The final report for this research project will be published in the spring of 1996.

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### EVALUATION OF DUCT SEALING EFFECTIVENESS

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A project was carried out to study the energy savings resulting from sealing leaks in the ducts of the hot air distribution system in five central Pennsylvania houses. All of these houses were heated with forced air electric heat pump systems. During the winter of 1995, the heat pump energy consumption, supply air temperature, and thermostat temperature were monitored continuously for approximately two months prior to the duct retrofit. A test was performed to measure the leakiness of the ductwork. The ducts were sealed, concentrating on duct leakage to unconditioned spaces. After the duct sealing process was complete, an identical test was performed to determine the changes in duct leakages characteristics. Finally, the heat pump energy consumption was monitored for another month. Energy consumption was then corrected for weather changes and compared for the two monitoring periods to deter-

mine the energy impact of the duct sealing retrofit. Based on the energy consumed during the two monitoring periods, the retrofit had a significant impact on energy consumption in only one of the houses. Results are reported in HRC Report Number A40.

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### 1995/96 RESEARCH PROJECTS

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On August 31, 1995, the Operating Committee of the HRC Advisory Council approved funding for operations, technology transfer programs, and four research projects. Funding was allocated to two continuing projects: *CAD Systems in Land Development* -- \$11,000 (M.K. Parfitt/C. McIntyre) and *A Builder's Guide to Modular Housing* -- \$11,000 (J. Willenbrock /J. Julo). Funding was also allocated for two new research efforts: *System Performance and Optimization of Floors Utilizing Alternative Building Materials* -- \$15,000 (H.B. Manbeck/S. Worley) and *Parametric Study of Ground Source Heat Exchanger Performance* -- \$22,000 (G. Yuill). A brief summary of the new structural project is included below.

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### PERFORMANCE AND OPTIMIZATION OF LIGHT-FRAME FLOOR SYSTEMS UTILIZING ALTERNATIVE MATERIALS

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Current methods of structural design and construction are not optimized for the efficient use of structural materials. More efficient utilization of building materials could result in significant savings for builders, contractors, and housing consumers. The HRC's current project in the Structural and Building Materials Systems focus area will examine and model the system performance of floor systems which utilize several joist materials (solid-sawn lumber, engineered wood I-beams, and light gauge structural steel), plywood and OSB sheathing, and both glued and nailed connections between joist and sheathing. Results of this research effort will be the basis of a subsequent research effort to optimize the utilization of floor framing materials in residential

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Contributions and news items are  
welcome. The deadline for spring  
submissions is February 1, 1996

housing.

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## **TECHNOLOGY TRANSFER PROGRAMS**

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### *Computer Aided Design*

The HRC is currently involved in a research project that is investigating the use of Computer-Aided Design (CAD) for the analysis of residential land development projects. Of particular interest to builders is a component of the *technology transfer program* that is part of this research effort. A "CAD Workshop for Residential Builders" which offers workshop participants a hands-on approach for learning CAD has been developed. Several CAD programs, all of which have been developed specifically for the residential building industry, are included in the workshop.

Development of the workshop is being funded by both the HRC at Penn State and the Penn State Continuing and Distance Education Program. A series of workshops will be held at various Commonwealth Campus locations during the spring semester of 1996. Local HBA's are encouraged to participate in the planning and scheduling of the workshops. If you would like additional information, or if your local HBA would like to sponsor a workshop session, please contact Charlie McIntyre at the HRC Office.

### *Residential Courses at Penn State*

Two courses in residential construction are offered each year at the University Park campus. In the fall, CE 433 - Residential Subdivision Design and Construction focuses on the design of a residential land development project. An actual site is selected for the projects. The

### **IMPORTANT DATES IN 1995**

PBA Board of Directors Meeting	Nov. 10-11
NAHB Student Chapter Banquet	Nov. 16
Fall Advisory Council Meeting	Dec. 7
NAHB National Convention	Jan. 26-29
Fourth Annual Pennsylvania Housing Conference	Mar. 27-28
Spring Advisory Council Meeting	Mar. 29

class walks the site with the local township engineer and must comply with all local regulations and ordinances for their projects. The students attend a local township meeting to prepare for their oral presentations and defense of their design projects. Students are involved in all design aspects of the subdivision process including: site analysis, road and lot layout, water distribution, sanitary sewer, storm water management, and an engineering cost estimate. The use of Computer-Aided Design (CAD) is heavily emphasized in the course.

In the spring, AE 470 - Residential Building Design and Construction focuses on the design of the residential structure. Through the use of various CAD programs, students design floor plans, structural framing, a site plan, and all interior systems. The design includes electrical, HVAC, and plumbing. A material cost estimate and proposed schedule is required. If you would like to receive more information regarding the residential courses, please contact Charles McIntyre at the HRC.

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## **HRC HITS THE INFORMATION SUPER-HIGHWAY**

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The HRC Faculty and Staff are easier to contact than ever. We can be reached by e-mail on the Internet in addition to the more traditional phone, fax, and mail:

### **CONTACT INFORMATION**

HRC Office

Voice: (814)863-0623

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## FALL ADVISORY COUNCIL MEETING

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The Fall meeting of the HRC Advisory Council will be held on December 7, 1995, at the Days Inn in State College, PA. The purpose of this meeting is to provide the Advisory Council Members with reports on the projects completed in the 1994/95 operating year, on the progress of current and continuing research progress, and on the current status of HRC Operations. We will also begin the planning process which leads to the selection of research projects for the 1996/97 operating year.

Many thanks to the individuals who have actively participated in the Advisory Council meeting. Your participation is critical in relating the research needs of the residential construction industry. Detailed information will soon be provided to all Advisory Council Members. Anyone who would like information regarding Advisory Council membership requirements and privileges, please contact Stacy Worley at the HRC Office. We look forward to seeing everyone in December!

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## FOURTH ANNUAL PENNSYLVANIA HOUSING CONFERENCE

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The Fourth Annual Housing Conference will be held on March 27-28, 1996, at the Penn State Scanticon Conference Center Hotel. The Annual Housing Conference is the focus of the HRC's technology transfer effort. Last year's conference provided twelve seminar sessions, two short courses, and a guided tour of a modular housing manufacturing facility to approximately 125 representatives from all facets of the residential housing industry. Attendees included builders, contractors, developers, design professionals, utility company representatives, realtors, government and code officials, mortgage lenders, researchers, and educators. This conference is co-sponsored by the Pennsylvania Builders Association and the Pennsylvania Electric Association. Members of these associations receive a discounted registration to the conference. Keep up with the latest trends and technologies in the residential housing industry by attending the Fourth Annual Housing Conference! The following page provides a brief outline of the housing conference. The conference brochure, which will be distributed in early January, will detail the program content and provide registration information. For more information, contact Stacy Worley at the HRC Office.

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## NEW FEATURES

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Two new features will debut in the next issue of the *HRC News: Tips and Tricks* and *The HRC Responds*. *Tips and Tricks* will provide brief solutions to problems and helpful hits spanning a variety of topics which could include: tips for improving specific construction methods or techniques, "hot" new products for the residential builder, relevant news and information resources on the information super-highway, or computer hardware and software. *The HRC Responds* will provide a forum for the discussion of solutions to specific problems or questions posed by the readers.

Both these new features are intended to provide a forum for increased interaction between the HRC faculty and staff and members of all aspects of the residential construction industry. **Each issue will address topics selected from reader submissions. Your input is critical to the success of these features. Submissions for the Spring 1996 issue should be submitted prior to February 1, 1996. Submissions should be sent to:**

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212 Sackett Building  
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e-mail: [skw4@psu.edu](mailto:skw4@psu.edu)**

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## EDITOR'S NOTE

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The HRC is pleased to announce the publication of a second newsletter entitled *HRC Industrialized Housing News*. This newsletter was developed specifically to inform the housing community of the HRC's work related to industrialized housing. Individuals interested in receiving this newsletter should contact Jack Julio at the HRC Office.

The HRC is also pleased to announce that some HRC publications (such as this newsletter or the Research Fact Sheets) can be transmitted electronically. Anyone interested in receiving HRC Documents via e-mail should contact the editor and provide the appropriate e-mail address.





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