



Annual Report to the NAHB Housing Research Center
Consortium

January 1996

I. OVERVIEW

The Housing Research Center (HRC) at Penn State has been active since July 1988 in providing education, research, and technology transfer services to the residential building industry. Within the Commonwealth of Pennsylvania, most of the HRC's activities have been carried out in conjunction with the Pennsylvania Builders Association (PBA). Additional joint programs have also been developed with the Pennsylvania Electric Association, the Pennsylvania Energy Office, and the member firms within the Mid-Atlantic Building Systems Council. The HRC at Penn State was also an active member of the Pennsylvania Advanced Technology Housing Consortium (PATHC), which was funded by the PA Department of Commerce through the Ben Franklin Partnership Program between 1989 and 1991.

At the national level, the HRC at Penn State has played a leadership role in the National Consortium of Housing Research Centers, which includes NAHB's Research Center and 16 other university-based HRCs. Strong relationships have also been developed by the HRC at Penn State with the Building Systems Councils of NAHB.

II. COMMITMENT TO THE RESIDENTIAL BUILDING INDUSTRY

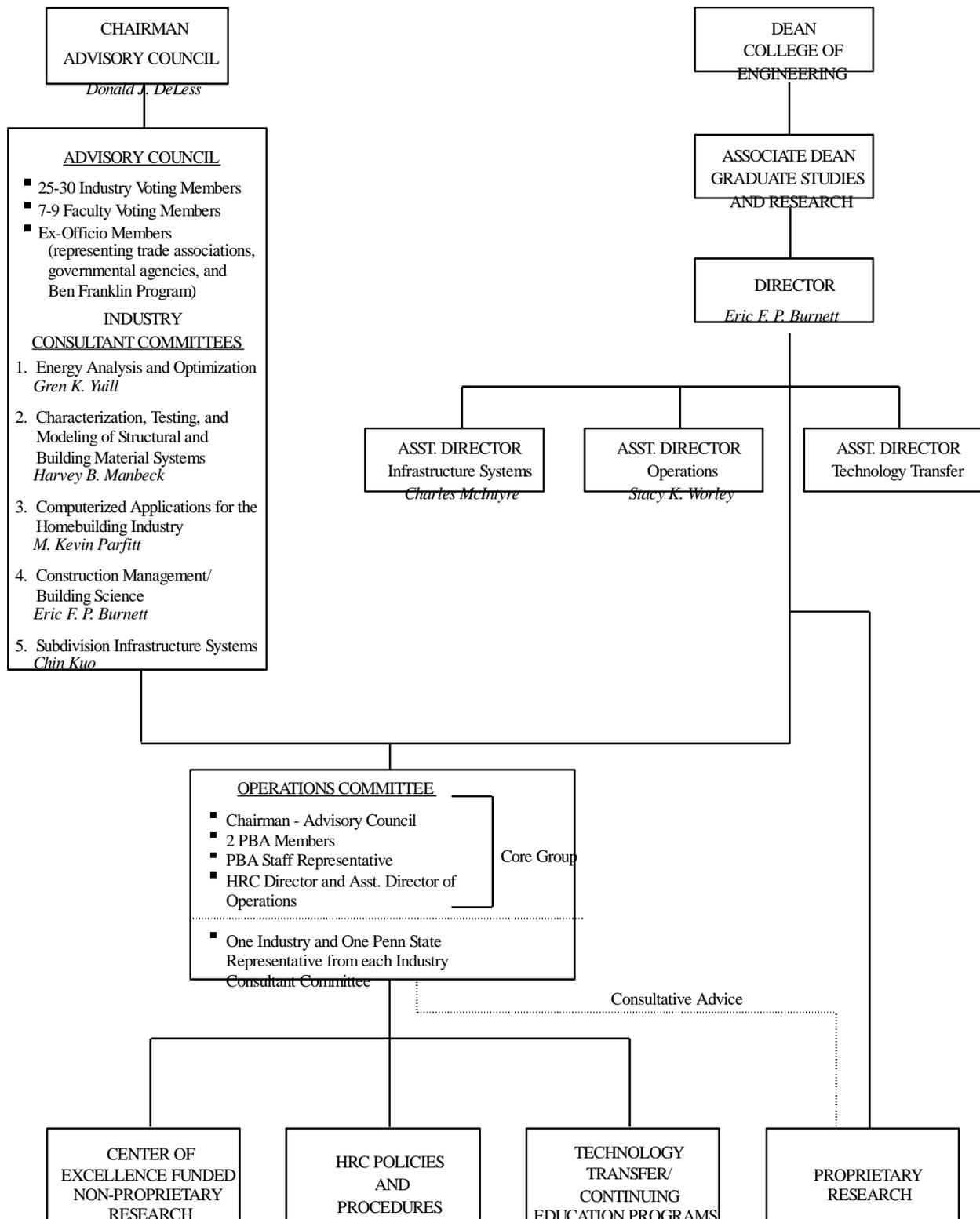
The HRC at Penn State is the research and technology transfer component of Penn State's overall commitment to the residential building industry. A program in Residential and Light Building Construction was established in 1980 at The Pennsylvania State University under the auspices of the Departments of Architectural Engineering and Civil Engineering. This program -- because of the outstanding support which has been received from the Home Builders Association of Central Pennsylvania, the Pennsylvania Builders Association (PBA), the National Association of Home Builders (NAHB), and the late Mr. Bernard Hankin (President of The Hankin Group, who provided the original encouragement and financial support for the program) -- currently includes the following endeavors:

1. Two residential courses at the senior undergraduate/graduate level entitled:
 - a. CE 433 - Residential Subdivision Design and Construction
 - b. AE 470 - Residential Building Design and ConstructionThese two courses are an integral part of the CEM (Construction Engineering and Management) program which has been in existence in the College of Engineering since the late 1960s.
2. An active student chapter of the National Association of Home Builders, which received its charter from NAHB in 1981 and averages about 35 student members each year.
3. An active graduate-level research program. Since 1983, a number of the research studies generated in the CEM program have focused directly on various aspects of the residential building industry.

4. The establishment of (1) the Bernard Hankin Construction Engineering and Management Laboratory, (2) the Residential Construction/Surveying CADD (Computer Aided Drafting and Design) Laboratory in the Department of Civil and Environmental Engineering and the utilization of the Structural Materials Testing Laboratory in the Department of Agricultural and Biological Engineering.
5. The establishment of a Housing Research Center (HRC) at Penn State on July 1, 1988. The HRC, which is situated in the Department of Civil Engineering, is located in 125 Sackett Building.
6. An ongoing Technology Transfer program for builder members of the Pennsylvania Builders Association which began in 1985 with courses that were a part of NAHB's Graduate Builder Institute format. With the establishment of the HRC at Penn State, this program has been expanded to include annual housing conferences, workshops, and short courses related to current and future issues affecting homebuilders.
7. The establishment of the HRC Research Series.
8. The establishment of the Bernard Hankin Professorship in Residential Building Construction in 1979. Dr. Jack H. Willenbrock, Director of the HRC at the time, was appointed as the first holder of the Professorship in August 1984 and served in that position until July 1990.
9. The Professorship noted in (8) above was converted into the Bernard and Henrietta Hankin Chair in Residential Building Construction in 1989. Dr. Willenbrock was appointed as the first holder of the Chair in August 1990.
10. The establishment of a \$60,000 endowment for the J. Roger Glunt Graduate Level Scholarship in Residential Construction at Penn State in January 1994.
11. Dr. Willenbrock retired from the Hankin Chair in August 1995. Dr. Eric Burnett, of the University of Waterloo, assumed the Chair in January 1996.

III. ORGANIZATIONAL STRUCTURE

The Director is jointly appointed in both the Department of Civil and Environmental Engineering and Architectural Engineering. Physically the HRC is located within Civil Engineering. The organization structure is shown in the attached figure.



Organizational Structure of the HRC at Penn State

IV. 1995 ACHIEVEMENTS

RESEARCH SERIES DOCUMENTS

- Report No. A39: A Progress Report on HRC Activities Related to the Modular Manufacturing Industry. August 1995. J. Julo, P. Gowda, and J.H. Willenbrock.
- Report No. A40: Evaluation of Duct Sealing Effectiveness. July 1995. G. Yuill and A. Musser.
- Report No. A41: Creep Behavior of Composite Structural Insulated Panels. September 1995. S.B. Taylor and H.B. Manbeck.
- Report No. A42: The Framework for an Integrated CAD-Based Information Management System for the Residential Land Development Industry. September 1995. C. McIntyre and M.K. Parfitt.
- Report No. A43: The Energy Cost Optimized Modular House. August 1995. G. Yuill and J. Rioux.

TECHNICAL SUPPORT SERIES DOCUMENTS

- Document No. 5: A Comparative Analysis of State Mandated Contractor Licensing Examinations. October 1994. J. Julo and J. H. Willenbrock.
- Document No. 6: Site Selection and Evaluation Techniques Concerning a Proposed Residential Subdivision Within the Centre Region. C. McIntyre and J.H. Willenbrock. (this report is contained in Report No. A42)
- Document No. 7: Test Item Development for the PBA Certified Residential Contractor Program. July 1995. J. Julo and J.H. Willenbrock.

THE THIRD ANNUAL HOUSING CONFERENCE

The Housing Research Center at Penn State held its third annual housing conference *What the Builder Needs to Know -- What the Builder Wants to Know* on March 29-30, 1995, at the Penn State Scanticon Conference Center Hotel. Approximately 125 representatives of the residential construction industry attended twelve sessions covering a broad range of current topics. Featured presentations included the NAHB Research Center / U.S. Steel sponsored steel construction workshop and the Structural Insulated Panel Association sponsored structural

insulated panel construction workshop. Attendees were offered a Mid-Atlantic Building Systems Council sponsored tour of a modular manufacturing facility and model home. Representatives from several vendors were also on hand to demonstrate their products and answer questions regarding new residential building techniques and technologies.

1994-95 RESEARCH PROJECTS

Two 1994-95 HRC projects were expanded with the award of competitive research grants from the U.S. Departments of Agriculture and Energy. *The Analysis of Time Dependent Behavior of Structural Insulated Panels* was selected for support by USDA. This project involves the study of the creep performance of SIPs. An understanding of time-dependent behavior is necessary to ensure that serviceability requirements are met in residential applications of SIPs. One of the objectives is the development of a model of time-dependent panel behavior that can be applied to a broad range of materials and techniques common to SIP manufacture. *The Design, Construction, and Testing of a Super-Insulated Modular Home Without an HVAC System* was selected for funding by the DOE. The experimental design of a modular home that is sufficiently insulated to maintain a comfortable environment without an HVAC system has been completed and construction of the modules is scheduled for June 1995. Once construction is completed, the home will be occupied and energy consumption will be monitored to provide data for a life-cycle cost analysis.

Research is continuing in the land development area. The current project, *Framework for a CAD-Based Information Management System for the Residential Land Development Industry*, focuses on the collection and interpretation of project information specific to a residential subdivision. The results of this project will be applied to an actual case-study residential subdivision.

Finally, a cooperative effort between the HRC and the Pennsylvania Builders Association to develop a Builder Competency Exam is nearing completion. This project is a key component of PBA's Certified Contractor Program. The development of the exam and a knowledge base for examinee's use in preparing for the exam is under way.

CURRENT RESEARCH PROJECTS (1995-96)

1. The Framework for an Integrated CAD-Based Information Management System for the Residential Building Industry
2. Modeling and Optimization of Floor Systems Utilizing Alternative Materials
3. A Builder's Guide to Modular Housing (Completed January 1995)
4. Ground Source Heat Pumps