



A bridge linking housing research and practice

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Is a Concept Home in Your Future?

For the past decade, the Partnership for Advancing Technology in Housing (PATH) has promoted the development and use of materials and technologies that improve the quality, energy efficiency, and affordability of housing in the United States. The completion last year of the first PATH Concept Home in Omaha, Nebraska marks another stride in PATH's ongoing journey toward market transformation.

"With the PATH Concept Home, HUD has created a blueprint for the future of the American Dream by using innovative housing technologies that support our goals of sustainability, efficiency, and flexibility in an affordable home," said HUD Assistant Secretary Darlene Williams at the project's completion in June 2007.

Perhaps the most striking feature of the 2,000-square-foot Craftsman-style home in north Omaha is the central mechanical core, which keeps most of the heating, ventilation, and air conditioning (HVAC); plumbing; and vent stacks in a single location.



Front view of the PATH Concept Home, Omaha, Nebraska.

In addition to providing easy access for repair or replacement, the central core enabled designers to create moveable interior walls, allowing homeowners to reconfigure the living space to reflect lifestyle changes, without the expense or difficulty of moving a load-bearing wall. The concept home can also accommodate later installation of an elevator, if needed.

The Omaha Concept Home incorporates various green elements, including:

- Low-e, double-paned windows filled with argon gas that reduce heat loss in winter and prevent heat gain in summer;
- A right-sized HVAC system with ductwork sealed with mastic (rather than tape) to ensure a complete seal;
- A semibalanced ventilation system that brings in fresh outside air to maintain good indoor air quality;

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- Soy-based foam insulation;
- ENERGY STAR®-rated appliances;
- A tankless hot water heater that provides hot water on demand;
- Clapboard-style vinyl siding with thermal insulation; and
- A metal roof.

The home also features a greywater recycling system in which water from showers and baths is treated and reused in the washing machine, toilets, and exterior water faucets.

First-time homebuyers Marcella and Howard Dial, who qualified for financial assistance through the city of Omaha, HUD's HOME program, and the Nebraska Affordable Housing Trust Fund, purchased the Omaha Concept Home.

Concept Home Principles

Six basic principles that meet both homebuyer and homebuilder needs guided the design and development of the Concept Home:

- **Flexible floor plans.** Flexible houses can adapt to accommodate the addition of children or an elderly relative moving in, or enable a longtime homeowner to age in place. Most houses are difficult to expand or modify without great expense.
- **Organized and accessible systems.** Because HVAC, plumbing, and electrical systems are usually intertwined with the floorplan and structure of houses, expansion or remodeling is often a complex, expensive process. Consolidating all systems into a mechanical "core" provides easy access to these systems and simplifies any subsequent expansion.
- **Improved production processes.** Using innovative or improved production processes can minimize construction delays, reduce material waste, streamline the building schedule, and improve home quality and sustainability.
- **Alternative basic materials.** Materials adapted from other fields can help reduce costs, increase flexibility, and improve sustainability and energy efficiency. Structural insulated panels, low-e glass, and engineered wood products are just a few of the products that came to housing construction from other industries.

- **Standardized measurements and component interfaces.** Although the homebuilding industry has standardized many measurements (such as lumber sizes, duct sizes, countertop heights, and doorway widths), standardizing additional areas such as panel and foundation systems can simplify installation, improve efficiency, and reduce costs.
- **Integrated functions.** Combining household systems can reduce equipment needs, increase efficiency, and promote flexible design.

What's Next?

PATH is already working on its next project, Concept Home Charleston, to be built at Poplar Grove, a 6,000-acre planned community northwest of Charleston, South Carolina. A design charrette in October 2007 identified several design options that will be revised and fine-tuned before the groundbreaking in spring 2008.

Once again, all utilities will be located within a central core for ease of access, repair, and replacement. In addition to demonstrating the same sustainability, flexibility, and construction efficiency found in the Omaha Concept Home, the Charleston home will also focus on durability and the ability to withstand hurricane-force winds, termites, flooding, and year-round humidity that can cause mold and moisture problems—all of which are common in the Charleston area and throughout the Atlantic and Gulf Coast regions of the United States. The Charleston Concept Home is scheduled for completion by fall 2008.

The PATH Concept Homes, with their innovative materials and building techniques, energy-efficient features, and sustainable design elements, portend an exciting future for affordable housing. As homebuilders continue to adopt Concept Home features and materials, your next home may incorporate many of these cost-saving, adaptable, and efficient features.

Visit the PATH website at www.pathnet.org, where you can take a virtual tour of the Omaha Concept Home (www.pathnet.org/concepthomedemo/) and learn about the products and technologies (www.pathnet.org/sp.asp?id=21965#HVAC) used in its construction. **H.I**

The Energy Independence and Security Act of 2007, signed into law in December 2007, contains provisions designed to cut energy consumption in the United States. Initiatives inspired by this legislation will benefit from the work that the Partnership for Advancing Technology in Housing (PATH) has done to identify lighting and appliance technologies that conserve energy, thus reducing utility costs and energy consumption.

PATH-Identified Efficient Lighting

Lighting a home with traditional incandescent bulbs is costly in terms of both environmental impact and consumer expense. PATH recommends two energy-efficient alternatives: compact fluorescent lamps (CFLs) and light-emitting diodes (LEDs). The CFL is an established technology that uses 50 to 80 percent less energy than an incandescent bulb and lasts up to 10 times longer. According to PATH's *Top 10 Ways to Make Your Home Green*, replacing a home's five most frequently used incandescent light bulbs with ENERGY STAR®-rated CFLs will save \$100 annually. LEDs, an emerging alternative to incandescent bulbs, provide more light per watt than traditional bulbs. Although LEDs have higher initial costs (\$25 to \$60 for bulbs retrofitted for traditional night lights and small lamps), they last markedly longer than both incandescent and fluorescent bulbs.

Both PATH-identified alternative lighting options use significantly less energy—a key provision of the new legislation, which phases out most incandescent light bulbs by 2014. The Alliance to Save Energy (ASE) explains that this phase-out will decrease energy

use from light bulbs by at least 60 percent by 2020 and yield \$13 billion per year in consumer savings. ASE expects the energy savings from this measure to exceed 140 billion kilowatt hours annually—more than was consumed by all the homes in Texas in 2006.¹

PATH-Identified Appliance Efficiencies

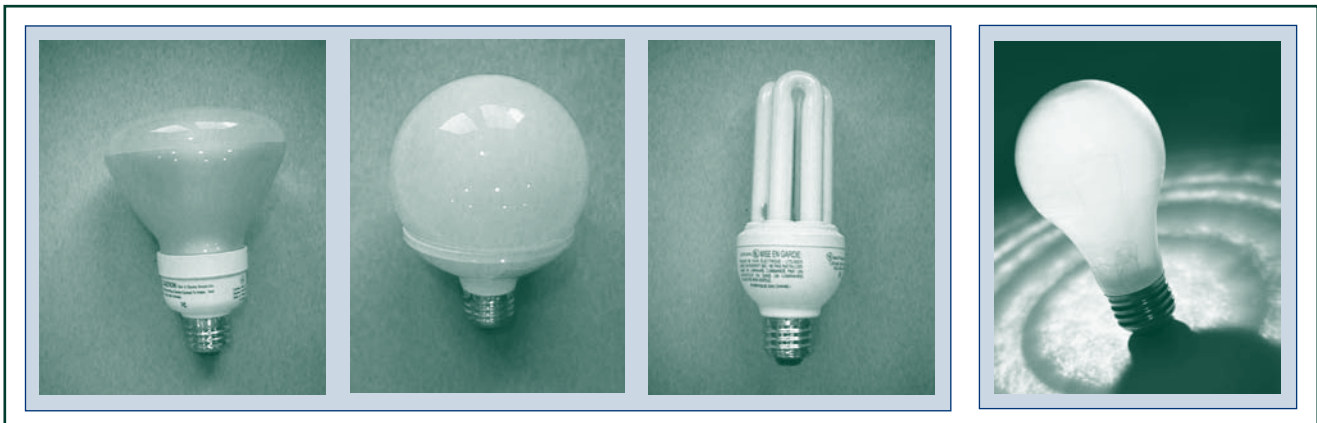
In addition to addressing lighting efficiencies, the new energy legislation also aims to reduce energy consumption and utility expenditures by updating energy standards and setting water efficiency standards for home appliances. ASE expects that these provisions will comprise 20 percent of the overall savings from the legislation.

To promote energy efficiency in homes, PATH encourages homeowners to purchase household appliances rated by ENERGY STAR. Like the energy-efficient lighting alternatives, these appliances have higher initial costs, but they substantially reduce operating costs over time, making them economically viable. A new ENERGY STAR-rated clothes washer, for example, saves 140 kilowatt hours per year—a savings of 56 percent over a new, nonqualified washer. Similarly, a new dishwasher rated by ENERGY STAR uses 24 percent less energy than its unrated counterpart.²

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1. "HR 6 Summary of Efficiency Provisions," Alliance to Save Energy. See www.ase.org/content/article/detail/4155.

2. "28th Annual Portrait of the U.S. Appliance Industry," *Appliance Magazine*; cited in Partnerships for Home Energy, *2006 Annual Report*, p. 6, www.energystar.gov/ia/news/downloads/PHEE2006AnnualReport.pdf.



The first three compact fluorescent lamps use 50 to 80 percent less energy than the incandescent bulb (far right).

Subprime Mortgage Woes May Spur Changes in AHS Data

The rising rate of delinquencies and foreclosures among subprime mortgage holders has been making headlines in both the mainstream media and the financial press for more than two years. These events have sparked interest in the capacity of the American Housing Survey (AHS), a social-statistics research collaboration between HUD and the U.S. Census Bureau, to better support the study of trends in the use of nontraditional mortgages.

Could the survey's questions on mortgage finance capture information on the evolving mix of nontraditional mortgages? A new study, *The American Housing Survey and Non-Traditional Mortgage Products*, explores this question and offers specific recommendations for change. The analysis draws on consultations with housing analysts and previous research to evaluate the survey's usefulness in examining research and policy issues in housing finance. In addition, the study provides a line-by-line critique of the AHS with suggestions for improvement.

Initiated in 1973 and conducted in odd-numbered years, the AHS compiles a record of the physical characteristics, quality, financing mechanisms, and condition of the nation's housing stock, as well as various household characteristics. Separate AHS surveys also periodically examine these features in the housing stock of 21 major metropolitan areas. Although the AHS collects extensive information on mortgages, it is not widely used for research on housing finance.

Recent Volume of Nontraditional Mortgages (dollars in billions)

	2004	2005	2006	1 st Qtr 2007
Total Originations	\$2,920.0	\$3,120.0	\$2,980.0	\$680.0
Nontraditional products	\$365.0	\$866.0	\$958.0	\$239.0
All Interest-only	\$60.0	\$481.0	\$526.0	\$149.0
Interest-only fixed rates	\$55.0	\$418.0	\$387.0	\$100.0
Interest-only ARMs	\$5.0	\$63.0	\$139.0	\$49.0
Option ARMS	\$145.0	\$280.0	\$255.0	\$43.0
40-Year balloon	\$0.0	\$10.0	\$90.0	\$22.0
Other Alt-A	\$160.0	\$95.0	\$87.0	\$25.0
Nontraditional share of all originations	12.5%	27.8%	32.1%	35.1%

"Alternative Mortgage Products Still Play A Huge Role in Early 2007 Originations," *Inside Mortgage Finance*, Vol. 24, no. 4; cited in *The American Housing Survey and Non-Traditional Mortgage Products*, p. 13.

The AHS is a housing unit survey with large sample sizes and high response rates. The quality of the mortgage information it collects depends on the ability of borrowers to understand, remember, and accurately relate the details of their financing arrangements. This reliance becomes problematic when the respondents have nontraditional mortgages with complex features, such as adjustable rate mortgages (ARMs), no-equity loans, lines of credit, reverse mortgages, and interest-only loans.

Either a mortgage can be nontraditional because of these features or because of the way it is underwritten (for example, "low-doc [umentation]" and "no-doc" loans). Whether fully understood by borrowers or not, nontraditional mortgages have grown in popularity in recent years. According to the trade journal *Inside Mortgage Finance*, nontraditional mortgages accounted for about one-third of all mortgage originations in 2006. In a traditional mortgage, the first payment the borrower makes is the same amount as all subsequent payments. By contrast, in nontraditional mortgages, the study explains, "the borrower faces two payment regimes: an initial regime with low payments and a second regime where payments increase to fully amortize the loan and to compensate the lender for the cost of capital and riskiness of the loan."

The long rise in housing values that began in 1992 cushioned nontraditional borrowers for more than a decade, allowing them to refinance to avoid "payment shock" when the initial payment regime came to an end. However, when housing-price appreciation slowed or fell off after 2004, an increasing number of mortgage holders found themselves trapped.

As a result, among subprime mortgages with adjustable interest rates, the number of serious delinquencies (mortgages in foreclosure or with payments overdue by 90 days or more) "rose sharply during 2006 and recently stood at about 11 percent," according to observations made by Federal Reserve Chairman Ben S. Bernanke in May 2007. In the fourth quarter of 2006, about 310,000 foreclosures were initiated, compared with an average of just 230,000 per quarter in the preceding two years, Bernanke added.

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Home Lighting and Appliance Efficiencies *continued from page 3*

PATH also identifies specific types of household appliances that conserve energy. For example, PATH includes three energy-efficient laundry appliance options in its Technology Inventory—the horizontal-axis washer/dryer combo, horizontal-axis washer, and vertical-axis washer—all of which use 30 to 50 percent less water than traditional clothes washers. A field evaluation of 103 clothes washers in Bern, Kansas (www.toolbase.org/PDF/CaseStudies/bernwasherstudy.pdf) shows that having to heat less water yields significant energy savings. In the study, the horizontal-axis (front-loading) washers used 38 percent less water and 56 percent less energy than traditional washers.

Other energy-saving household appliances identified by PATH are the induction cooktop and high-efficiency refrigerator. According to the Technology Inventory, an induction cooktop is 90 percent efficient, meaning that only 10 percent of the heat produced is lost; i.e., not used to warm the pot. In comparison, gas and electric cooktops are approximately 55 and 60 percent efficient, respectively. The induction cooktop's increased efficiency and shorter cooking times make it a good energy-saving alternative to traditional cooktops. Similarly, PATH explains that a homeowner who replaces a 10-year old refrigerator with a high-efficiency model, which can use as little as 450



This high-efficiency refrigerator consumes fewer kilowatt hours than its predecessor.



This horizontal-axis washer uses less water and energy than a top-loading model.

kilowatt hours annually, will save \$100 per year in energy costs (at 8.4 cents per kilowatt hour). In a field study by Asdal Builders in Henderson, Nevada (www.toolbase.org/Field-Evaluations/Asdal-Builders), a home was retrofitted throughout with energy-efficient features, including a new high-efficiency refrigerator. Although the new refrigerator is larger than the old one, it consumes 368 fewer kilowatt hours each year.

PATH also identifies the geothermal heat pump as an energy-efficient technology. This ground-source heat pump uses the natural heat storage capacity of the earth or water to heat and cool a home. According to the Environmental Protection Agency, it costs 30 to 70 percent less to heat a home with a geothermal heat pump than with a conventional system. A geothermal heat pump will also reduce homeowners' cooling costs by 20 to 50 percent.

Adopting these technologies will reduce energy use and help American homeowners embrace the new energy-efficiency standards for lighting and appliances. Information on the energy-saving technologies discussed above is available through PATH's Technology Inventory at www.toolbase.org/TechInventory/ViewAll.aspx. PATH's *Top 10 Ways to Make Your Home Green* is available at www.pathnet.org/sp.asp?id=18438. The Energy Independence and Security Act of 2007 can be read in full at http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=110_cong_bills&docid=f:h6enr.txt.pdf. **EE**

r **Measuring Overcrowding in Housing**

Overcrowding in housing threatens public health and safety, strains public infrastructure, and points to an increasing need for affordable housing. The Centers for Disease Control and Prevention (CDC) says housing is safe and healthy only when it meets the basic physical and psychological needs of its inhabitants, which include sufficient living space to minimize the spread of contagious illnesses and meet the need for privacy. The *Healthy Housing Reference Manual*, developed by CDC and HUD, states:

Ideally, everyone would have their own rooms, or, if that were not possible, would share a bedroom with only one person of the same sex, excepting married couples and small children. Psychiatrists consider it important for children older than 2 years to have bedrooms separate from their parents. In addition, bedrooms and bathrooms should be accessible directly from halls or living rooms and not through other bedrooms. In addition to the psychological value of privacy, repeated studies have shown that lack of space and quiet due to crowding can lead to poor school performance in children.

The amount of living space required to meet health and safety standards is not consistently specified; measurable standards for overcrowding vary. The most widely used measure assumes that a home becomes unhealthy and unsafe when there are more than 1, or sometimes 1.5, household members per room (PPR). Another frequently used measure is the number of individuals per bedroom, with a standard of no more than 2 persons per bedroom (PPB). Assisted housing programs usually apply this standard. Yet another method measures unit square footage per person (USFPP), which quantifies the amount of personal space available to each inhabitant.

Measures Compared

Measuring Overcrowding in Housing, recently released by HUD's Office of Policy Development and Research, is part of a broader exploration of the many ways in which the biennial American Housing Survey (AHS) can serve the housing research community. This study uses AHS data from 1985 to 2005 to compare outcomes when different measures of overcrowding are applied to the same data.

The AHS defines a room as an enclosed space used for living purposes, such as a bedroom, living or



Measures using AHS data indicate a decline in overcrowding between 1985 and 2005.

dining room, kitchen, recreation room, or another finished room suitable for year-round use. Excluded are bathrooms, laundry rooms, utility rooms, pantries, and unfinished areas. Room size is generally determined by custom and building codes. Under the PPR standard of more than one person per room, the AHS data indicate a low level of overcrowding, with the rate falling from 2.8 percent of American households in 1985 to 2.4 percent in 2005. The PPB standard also fell but showed a slightly higher level of overcrowding; the incidence rate of more than 2 persons per bedroom was 3.25 percent in 1985 and 2.65 percent in 2005. Principles of health and privacy might make this the measure of choice, due to the effects of human proximity on infection, airborne disease, and personal privacy. When a USFPP minimum standard of 165 square feet was applied, overcrowding declined from 3 percent in 1985 to 2.4 percent in 2005. This measure is also an indicator of the amount of personal space available and is useful in illustrating how the average house size changes over time.

In a demographic analysis of AHS data, investigators looked for differences and trends in overcrowding among demographic groups, segmented by ethnicity and race, citizenship, income, owner or renter status, region, and metropolitan area. This analysis suggests that overcrowding may be somewhat under- or overestimated among subpopulations, depending on the measure applied. Although the results varied slightly, all three measures pointed to higher rates of overcrowding among Hispanics, renters, foreign-born noncitizens, Westerners, lower-income families, and central city dwellers.

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Subprime Mortgage Woes May Spur Changes in AHS Data *continued from page 4*

To make the AHS a better instrument for studying nontraditional mortgages, the study recommends that HUD and the U.S. Census Bureau:

- Consider ways of highlighting mortgage data in the AHS, thus making it more flexible and easier to use;
- Revise the questions on mortgage products to identify the most current forms of nontraditional mortgages and downplay or omit mention of certain mortgage products that are no longer common;
- Consider broader revisions to the survey's entire mortgage segment;
- Make a greater effort to have respondents provide information directly from their own mortgage statements and make greater use of "dependent interviewing," using the household's answers in previous years as a basis for current questions; and
- Consider adding questions on additional topics, such as closing costs and the search for mortgage finance.

With this report in hand, HUD and the U.S. Census Bureau will review the proposed changes in light of factors such as "costs, change in respondent burden, likelihood that the questions will generate useful



In recent years, nontraditional mortgages have increased in popularity.

results, and the extent to which new questions could increase respondent refusals," said HUD Senior Economist David A. Vandembroucke. New questions would have to "go through cognitive testing and OMB [Office of Management and Budget] clearance." According to Vandembroucke, once these hurdles are passed, budget permitting, selected changes could be implemented with the 2011 American Housing Survey.

The American Housing Survey and Non-Traditional Mortgage Products is available as a free download from HUD USER at www.huduser.org/publications/hsgfin/mortgage_prod.html. **HU**

Measuring Overcrowding in Housing *continued from page 6*

Discussion

A number of factors may contribute to the overall decrease in the incidence of overcrowding in the past two decades. As living standards improved and mortgage financing became more accessible, more Americans were able to buy or upgrade their homes. In addition, as homeownership rates rose, the average home size expanded while the average household



Adequate living space meets basic physical and psychological needs of the inhabitants.

size grew smaller. One explanation might be that contemporary homebuyers are planning further into the future, buying more space now that will accommodate a growing family later. Another influence is the sizeable cohort of aging Americans who are still healthy and active. Many remain in the "empty nests" in which their families grew up, essentially becoming overhoused. Finally, researchers note, perceptions of the function of a particular room may have evolved, requiring additional living space.

By raising these questions, *Measuring Overcrowding in Housing* (available at www.huduser.org/publications/polleg/overcrowding_hsg.html) demonstrates an interesting application of the AHS while revealing several research opportunities that can be applied to the planning and development of safe, healthy, and affordable homes. Interested readers may also want to refer to the *Healthy Housing Reference Manual* (available at www.cdc.gov/nceh/publications/books/housing/housing.htm). **HU**

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In the Next Issue of... ^{research} **works**

- In compliance with the Legacy Act of 2003, HUD and the Bureau of the Census have estimated the number of families raising children and headed by a grandparent or relative other than a parent. HUD's Office of Policy Development and Research makes this information available, along with data on the housing where these families live, in a report prepared for Congress titled *Intergenerational Housing Needs and HUD Program Options*. We'll discuss the characteristics of this population segment, the housing and other challenges faced by these families, and identify some of the resources available to them.
- We'll review the findings of a recent study that examines the regulatory (and resulting cost) barriers associated with the development of single-family homes in the United States. While previous analyses have focused on small geographical areas, this inquiry looks at selected jurisdictions from around the nation and develops a national cost estimate of excessive regulations that can drive up home prices and restrict development.
- The Department of Energy's Pacific Northwest National Laboratory has completed research designed to learn how homeowners would react if equipped with the tools needed to actively participate in managing their home's energy use. We'll discuss the impact of providing homeowners with real-time information about their home's energy consumption, the associated costs, and the technology that allows residents to adjust and control the use of energy down to the appliance level.
- HUD's Office of University Partnerships (OUP) encourages its higher education grantees to use grant funds for initiatives that will not only strengthen their communities today, but will also build leaders and capacities for the future. Over a year ago, OUP set out to discover if efforts to instill leadership skills and build capacity in community-based organizations (CBOs) were paying off in particular local communities. *ResearchWorks* will report on OUP's findings after a year of research and interviews with grantees, community residents, and leaders of CBOs.

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