Association of Collegiate Schools of Architecture/
Fannie Mae Foundation

# Affordable Design:
## Convening the Conversation

## Final Report

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AFFORDABLE DESIGN: CONVENING THE CONVERSATION
FINAL REPORT

CONTENTS






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Design, designers, and design thinking clearly demonstrate the potential to make a significant contribution to the production and long-term success of affordable and mixed-income housing. Affordable Design: Convening the Conversation, sponsored by the Fannie Mae Foundation, brought together academics, practitioners, and advocates to discuss ways to reach this potential. The project extended over 12 months, with the high point a June 7–8, 2006, forum that focused on strategies for employing design collaboratively to increase the economic and social performance of affordable housing. This final report presents the outcomes from the project, including outcomes from the forum itself and from the many discussions that occurred in developing the forum and disseminating the results.

The project identified some of the most promising work in the affordable housing field: useful resources, areas where additional research is required, and barriers to the implementation of design solutions. In discussions among project participants and in the materials gathered through the project, many design success stories emerged. One example is the use of railings designed by artist Seitu Jones at the pond overlook of a HOPE VI project in Minneapolis. These elegantly designed railings feature important icons from local history and the environment. Yet, the cost of this installation was less than that of the ubiquitous standard DOT barrier. The community treasures the grace of these sculptural elements, and management has adopted the design as a feature element in marketing materials.

As described further below, design successes can also be broadly scaled to benefit communities. An efficient model home designed by the Affordable Homes Program at McGill University, led by Avi Friedman, has resulted in the production of 10,000 unsubsidized units of housing that are affordable to families with incomes as low as that of the poverty level in Canada.

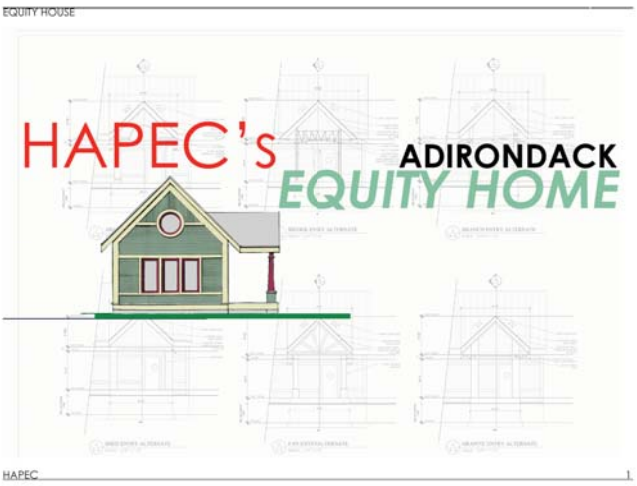
Such successes come about when design is used to meet the needs of the various stakeholders in the envisioning, financing, construction, and occupation of affordable housing. One key element singled out repeatedly during the project was the value of design thinking to critically evaluate and solve problems when several competing opinions and options are at play. As detailed in *The Art of Innovation* by Tom Kelly[1] and as is being explored in Stanford University's new "d.-school," design thinking can be employed to analyze and solve problems in new ways. With this in mind, Convening the Conversation brought together some of the most accomplished designers and analysts of affordable and mixed-income housing with leaders in the production and financing of such housing to gain greater insight into possible strategies for improving outcomes in affordable housing.

This artist designed railing cost less than the standard DOT barrier.


The widow who occupies this home is struggling against deterioration and air infiltration as the unit fails to provide her in her old age with the secure housing envisioned by her and her husband when they purchased it 30 years ago.

[1]Tom Kelly, *The Art of Innovation* (New York: Doubleday, 2001).

This project was initially conceived by the ACSA Housing Committee as the first step in a 10-year Affordable Housing Design Initiative to advance the knowledge of design strategies that increase the availability and sustainability of high-quality affordable and mixed-income housing. Among the ideas developed by the committee is a "Design Toolbox." Originally envisioned as a portal to information about designing affordable and mixed-income housing, this online resource would be intended for use by those involved in the development, finance, management, and advocacy of affordable housing. Summaries of research findings, case studies, literature reviews, training tools, and data resources were all identified for inclusion in the toolbox. Since the initial development of this idea the ACSA Housing Committee has begun collaborating with the Affordable Housing Design Advisor website (www.designadvisor.org) to explore ways in which this concept could be realized. A key outcome from Convening the Conversation is the creation of materials to continune this work by including them on the Design Advisor website and/or, at Fannie Mae Foundation's discretion, KnowledgePlex®.




As the result of a design study funded by the New York State Council on the Arts a local Community Development Corporation the Housing Assistance Program of Essex County (HAPEC) will replace this depreciating asset with one that will provide long-term value for the pwner and the community.

To accomplish the goals of Convening the Conversation, ACSA and project leader Kathy Dorgan, AIA, worked with the Fannie Mae Foundation to identify an advisory board to help generate discussion topics for the forum and ensure that work on "design's contributions" stayed suitably in touch with the various other sectors of the affordable and mixed income housing industry. The advisory group, whose profiles are included in section 4, met in the winter and early spring of 2006 to inform work to prepare the conversation that would take place at the forum held in June. The advisory group included:

Thomas Barrie, North Carolina State University
Connie Chung, County of Los Angeles
Kathy Dorgan, Dorgan Architecture & Planning
Diane Georgopulos, MassHousing
Bradford C. Grant, Hampton University
Lynette Jung Lee, East Bay Asian Local Development Corporation
Rick Lowe, Project Row Houses
Michael Monti, ACSA
Kevin Nelson, U.S. Environmental Protection Agency
David Perkes, Mississippi State University
J. Michael Pitchford, Community Preservation and Development Corporation
Victor Rubin, PolicyLink
Kate Schwennsen, American Institute of Architects

## PEPARING THE CONVERSATION

### Calls for Submissions

The project began with preparations for the background materials for the forum. A call for abstracts and posters was published to academics and practitioners alike.The response to this invitation demonstrated a strong interest particularly among faculty and students in teaching and researching affordable and mixed-income housing design. The abstracts received were for papers documenting strategices for employing design to dramatically increase the economic and social performance of housing. The 67 abstracts for papers covered a great range of topics including:

- Ideas for technological improvements to the production of affordable housing
- Strategies for improved site and unit planning
- Analyses of social reactions to affordable housing and related policies
- Arguments for the importance of community engagement in the design process
- Reviews of ongoing and completed projects and competitions
- Arguments for the social value of affordable housing
- Proposals for new models of design practice, and
- Outlines of the philosophical and historical background of affordable housing.

Of the 67 submissions, 55 came from faculty in fields related to affordable housing, 7 came from architects in private practice, and 5 came from students. In addition to abstracts from the United States, submissions were received from Canada, Nigeria, Israel, New Zealand, Iran, Chile, and Turkey. The submissions from within the United States came from 22 states and Puerto Rico. The following seven 7 were chosen to be developed into full papers.[2]

More than Just Looking Good: Towards Evidence-Based Design in Affordable Housing
Sherry Ahrentzen, Ph.D.

Residencial Serra Verde: participative design process and self-management of low-income housing construction in Belo Horizonte, Brazil
Ana Paula Baltazar Dos Santos and Maria Lucia Malard

Employing Architectural Flexibility to Achieve Affordability in Housing
Avi Friedman

Innovations in the Development of Industrially Designed and Manufactured Modular Concepts for Low-Energy, Multi-Story, High-Density, Prefabricated Affordable Housing
Harry Giles and Fernando Lara

Affordable Housing for the Puerto Rican Community
John B. Hertz, AIA

Muffled Conversations: The City, the Citizens, & Affordable Housing Design
Carlos Martín, Ph.D.

Cultural Sustainability and Neighborhood Rehabilitation: A case study in design in Charlottesville, Virginia
Kathryn Rogers Merlino and Katie Swenson

The accepted abstracts were then submitted as papers to be published in the background material provided to the forum participants.

Ahrentzen's paper, which outlined a framework for evidence-based design practice in affordable and mixed income housing design, was employed as a framework for the discussion and subsequent analysis. An outgrowth of evidence-based practices of medicine, evidence-based practice in architecture recognizes the value of information from multiple sources and applies these resources within the time constraints of real-world practice. This approach is already employed in the design of medical facilities. In addition, adherents of evidence-based practice are actively engaged in the extraction of knowledge from their professional practice and in advocating for institution of policies, procedures, and structures that elevate practice.

The other six papers contributed to developing the framework for research presented in this analysis. The papers by Baltazar & Malard, Hertz, and Merlino & Swenson presented examples of the ways in which practice-based knowledge, including both community participation and professional experience, contributed to successful affordable housing developments. The papers by Friedman and Giles & Lara offered ideas about how architects might take on issue-based research—both in technical terms of improving the physical structure and in social terms of how to allow for user flexibility. Baltazar & Malard also speak to the issue of user flexibility and how communicating parameters to residents can be best facilitated through visualization technology. Martín presents the need for translational research, in particular the need to develop a better understanding among architects and developers of the design and cost implications of policy.As part of the forum planning process, a call for posters

[2] Text of the papers are included in appendix 2.

was also published. Most of the 25 submissions were from students, although several came from practitioners and faculty members. The poster submissions included proposals for new models of affordable housing, presentations of built projects, and two outlines of methods for teaching affordable housing in design programs. Sustainable construction practices, modular housing production, building in environmentally sensitive areas, and culturally specific design criteria were themes common to the proposals for affordable housing production. The built projects included units in Venezuela, Mexico, and Canada as well as in California, Louisiana, North Carolina, and New York. Nineteen posters were invited for presentation.[3]

Reviewers of the abstracts and posters were pleased by the depth of interest in affordable and mixed-income housing design evidenced by the number and quality of submissions. It was observed that the interest in the project is an indication of the sea change going on design schools, where there is growing interest in affordable and mixed-income housing. It was also observed that a preponderance of the submissions described a specific studio or project. In fact, the similarity of the case study inquiries, apart from their locales, made selection of proposals in the areas of unit design and community design especially challenging.

Given the quantity of the work in this area it was also disappointing to the review committee that few of the authors situated their explorations in the history of similar inquiry, compared their results to that of others, or extracted specific lessons applicable to future projects. Also noted was the apparent lack of a common vocabulary, set of references, framing structures or citations. This area of inquiry is still clearly in the developmental stage. Absent from the submissions were proposals to study a specific design issue, comparisons of design initiatives, reviews of research in a topic area, user preference analysis or postoccupancy studies.

Friedman's paper, "Employing Architectural Flexibility to Achieve Affordability in Housing," demonstrates the potential of the academy for generating and implementing design solutions to real-world housing problems. The author describes a demonstration project by the Affordable Homes Program at McGill University. The Grow Home is a space-efficient model for townhomes based on a narrow lot width (18 feet), a layout amenable to low-cost build-out options, and owner participation in finishing work. Implementation of the project required changes in lot requirements in some jurisdictions. Units can be site-built or ordered premanufactured from Canadiana Homes. Unsubsidized homes sell for about one third of the cost of a typical suburban home and are affordable even to some households with incomes below the official poverty line. The Affordable Homes Program initiative led to the construction of over 10,000 affordable housing units in Canada.

*Grow Homes* designed by the Affordable Homes Program at McGill house over 10,000 households

Extending ideas developed in Grow Home is the Next Home project. This model allows families or individuals to occupy only as much space as the need, while maintaining the cost effectiveness of a larger envelope and standardized construction. Each three-story building, according to Friedman, can be configured as a single three-level unit, a two-story unit and a flat, or as three flats. This flexibility allows owners to expand or contract their living spaces at various stages of their life or to only buy as much housing as they require. The units are also designed to lower heating bills. The design of *Next Home* was not only informed by the prior project, but also by research into contemporary demographics and historic housing models—particularly

[3] Eight posters presented are printed as appendix 3.

the way that people creatively modified structures in the 1940s during a critical housing shortage. These models are contributing to affordable housing solutions in the Montreal area.Reviewers, advisory committee members, and other participants agreed that Friedman's work exemplifies the level of engagement between designers and the various stakeholders involved in developing and constructing affordable housing. A high level of collaboration and buy-in from all parties from the beginning is necessary, as are clear communication and flexibility. Discussions during the forum often reached similar conclusions, particularly in sessions where presenters highlighted specific factors affecting the performance of housing beyond flexibility of space and cost for example, introduction of sustainable materials that cost more for construction but lead to lower energy and other costs for residents. Such presentations often involved discussions of the potential barriers or competing considerations and highlighted the need for strong and accessible information documenting the various options.

## THE CONVERSATION

### The Value of Good Design to Affordable Housing

ACSA sponsored the two-day forum in Los Angeles to further explore the issues raised by the papers and the project's initial charge. Scheduled in conjunction with the AIA annual convention and the Association for Community Design's annual meeting, the event brought creative thinkers together to brainstorm about the potential of design as a tool in the production and maintenance of affordable and mixed-income housing. Presentations were given over two days by practitioners engaged in design, teaching, community engagement, lending, development, and policy analysis. The topics ranged from identifying the challenges we currently face in affordable housing to potential production methods to proposals for future action. However, several consistent themes and issues emerged. These issues are discussed below within the framework of 'how we know,' 'things we know,' 'things we need to know,' and 'next steps to knowing.' Following the summary is a list of key points from each of the presentations.

### How We Know: Research Framework

For the purpose of this discussion knowledge acquisition is described within three types of inquiry—practice-based, performance evaluation, and translational. The state of each type of research with regard to informing way to increase the availability and sustainability of high-quality affordable housing will be briefly discussed. In the Next Steps To Knowing section, particular agendas for research are presented.

The first source of information is *practice-based research*. This information is gathered through the experience of professionals, clients, and other stakeholders. Professionals regularly employ intuition and creativity informed by experience. Many also employ processes that catalog knowledge held by others familiar with community conditions, material performance, or user requirements. For example, a fundamental tenet of the community design movement is incorporation of participatory methods in the design process. This is undertaken to obtain knowledge held by the future residents and stakeholders in the surrounding community. There are many skilled practitioners with extensive knowledge about many aspects of affordable and mixed-income housing design. Some of this insight is included in the book *Affordable Family Housing*, by Jones, Pettus and Pyatok,[4] and its sister website the *Design Advisor.* However, there are gaps in information about areas such as efficient unit design, siting strategies, construction management, and bidding.

The second source of knowledge is *performance evaluation research*. This type of research is usually undertaken over long periods of time, or at least takes into account information that has been collected over a significant duration. These techniques have been most effective in analyzing energy performance of different types of materials and construction assemblies and subsequently providing information about these topics in a format that is useful to a designer or developer. Similar information about the performance of other materials and building systems as well as information about maintenance costs and longevity would be of enormous value to the profession. Case studies such as *Hilberseimer/ Mies Van der Rohe Lafayette Park Detroit* edited by Charles Waldheim, which examines almost a half-century of performance of this mixed-income development, are an important source of information. The evaluation would be even more robust if a mechanism had been in place to collect additional performance data and to compare the project laterally to other developments.

[4] Tom Jones, William Pettus, Michael Pyatok, Affordable Family Housing (New York: McGraw Hill, 1995).

There has been minimal analysis of successful projects such as this duplex developed by the Winchester Housing Authority forty years ago

Often performance evaluation research is undertaken in fields such as social work that are tangential to the everyday practices of architecture; this by no means implies that the work done in these fields isn't crucial to successful affordable and mixed- income housing design. These studies examine the performance of affordable housing in terms of its social, economic, and political contexts. Unfortunately, an insufficient number of these studies take design into account. The relationship between specific aspects of design, operating costs, and long-term success remains largely unexplored. Information collected by lenders and project managers that could be of use in such studies are largely untapped. The recent study *Cost and Benefits of Green Affordable Housing Study,* by New Ecology, Inc. of Cambridge, Massachusetts, compares the costs of 'greening' 16 affordable housing units to the economic operating benefits. It provides an example of analysis that is directly useful to developers, designers, and policymakers. More and deeper explorations of this type are required.

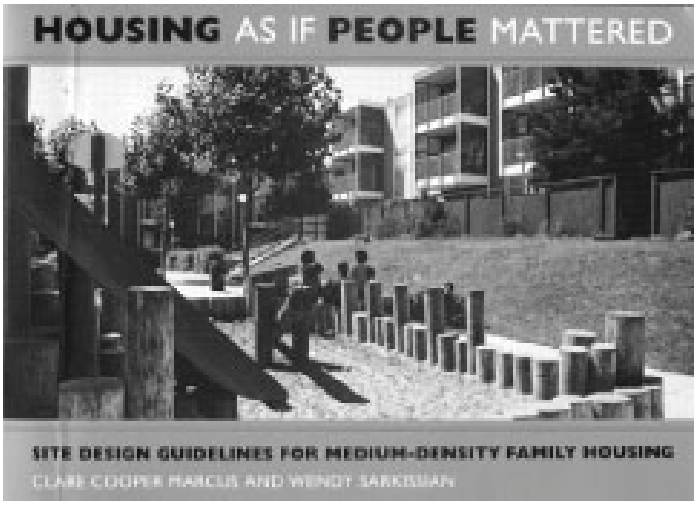
The last form of knowledge production, and the one that Ahrentzen specifically refers to in her essay, is *translated knowledge*. Many of the studies done within architecture and in other fields, while useful for design, development, and policy writing, are written for researchers and not immediately accessible to individuals who work on affordable housing. The language can be different, the references can be unfamiliar, and the results are rarely stated in terms of design or in a manner that answers a specific question for a specific project. Also, few if any of these studies get distributed in places that architects and others involved in affordable housing production tend to look. These challenges to using performance evaluation research can be overcome by undertaking translational research. These initiatives extract information from studies, develop strategies for applying the lessons to practice, and extract further knowledge from implementation projects. The United Kingdom has established the Commission for Architecture and the Built Environment (CABE, http://www.cabe.org.uk/) to improve quality of life through good design and undertake translational initiatives for a variety of building types including housing. The initiative conducts outreach through publications such as *The Cost of Bad Design*, establishes national standards for housing and neighborhoods, evaluates built projects, funds activities that encourage good design, and supports advocacy initiatives such as the Campaign for More and Better Homes. A more modest voluntary translative initiative in the United States led by a coalition of housing intermediaries and hosted by the New Jersey Institute of Technology is The Campaign for Excellence in Affordable Housing Design (http://www.designadvisor.org/updates/).


Home Depot foundation has used translated research to prepare this brochure describing the benefits of planting trees.

**Things We Know: Context for the Conversation**

Design matters. The design quality of homes and neighborhoods has been demonstrated to have a direct impact on many aspects of individual and community lives. The way communities are configured impacts health, safety, and social capital, which in turn impact many other aspects of quality of life. For example, members of homogeneous communities are less active and less connected, especially in high income areas. The way you enter your unit, the lack of a private outdoor area, and even living in a post 1940s home have been linked with depression. A study by Herbert Childress attributed shallowness and alienation in adolescents to community design. Three primary

sources for evidence about the ways in which design impacts quality of life are *Understanding the Relationship Between Public Health and the Built Environment*,[5] prepared by Design, Community & Environment et al. for the LEED Neighborhood Core Committee in 2006; *Housing as if People Mattered* by Clare Cooper Marcus and Wendy Sarkissian,[6] published in 1986; and Oscar Newman's 1972 book *Defensible Space: Crime Prevention through Urban Design*.[7]




*Housing as if People Mattered* by Clare Cooper Marcus and Wendy Sarkissian

Participants in the forum discussed their understanding of the role of design in providing solutions to the housing affordability crisis. Among the items mentioned in the open discussions were the following:

**Challenges to Design Solutions**

- The production of affordable housing is not solely a matter of design, a matter of funding, a matter of legislation, or a matter of social vision. Problems defy simple categorization within disciplinary boundaries; the current situation calls for interdisciplinary solutions by interdisciplinary teams.

Designers and developers have insufficient resources to evaluate the longevity of materials as evidenced by the decay of this 17 year-old affordable infill housing.

- Housing affordability is not simply about initial construction cost. Analysis of affordability should also take into account the impact that inhabiting a particular house has on other budgetary concerns from energy costs to transportation to child care to mental health services. However, the resources available to conduct this type of analysis are limited.
- We are working in a context in which affordable housing is accompanied by both real and perceived failures. A narrative that encompasses but does not distinguish between the real and perceived failures has become tied to particular design solutions.
- There is a difference between changing the paradigm of affordable housing production and working to improve the quality and increase the quantity of affordable housing within the current paradigm. While we shouldn't abandon the former, perhaps our immediate efforts may be best put toward the latter.
- Numerous models and many persistent programs successfully include participatory design and community engagement in the pedagogy of design. However, these models and programs often rely on the commitment of one or a small number of committed professors and rarely become institutionalized or broadly disseminated.

[5]Available at https://www.usgbc.org/ShowFile.aspx?DocumentID=148.
[6]Clare Cooper Marcus & Wendy Sarkissian, Housing As If People Mattered: Site Design Guidelines for the Planning of Medium-Density Family Housing (Berkeley: University of California Press, 1986).
[7]Oscar New Main, Defensible Space: Crime Prevention through Urban Design (New York: Macmillan, 1973).

**Barriers to Design Solutions**

- Zoning and building regulations and lending requirements usually require housing to be configured as fixed space with fixed occupancy. This paradigm precludes some of the flexible solutions imagined by designers that would allow homes to grow and contract as a household needs and resources change over time. Swing rooms that move from one unit to another, shared guest rooms and mobile home offices are among the opportunities that could be accommodated with more flexible regulation. Savings from this type of approach would include reduced costs for relocation, vacancy, and utilities as well as reduce the overall requirement for built space. In addition changing units rather than moving people could contribute to social capital and educational achievement by reducing the average number of moves undertaken by a household. A model for this type of initiative is the recent progress in supporting accessory units in several locales.
- Likewise, rooms within units are generally envisioned within the regulatory framework and development requirements to have a single use. Providing building elements that allow for more flexible use over time has substantial benefits. For example, fold-out desks in the dining area could support children's educational achievement as well as provide opportunities for supplementary income. Another example is that households often utilize the dining areas as an additional bedroom; yet, these spaces are rarely configured to accommodate this inevitability.
- Costs of financing, taxes, and utilities can be substantially reduced by an incremental approach to construction and rehabilitation. This strategy also often supports reductions in labor costs through use of sweat equity or the employment of smaller contractors with lower overhead costs. However, the financing tools for this type of project are difficult to employ, leading many to high-interest credit card financing. Regulatory barriers also discourage this type of initiative. This is a particular challenge in weak-market communities, where equity gaps may preclude conventional development strategies.

Case studies could explore how this attractive campus of the village for Families & Children Inc. in Hartford, Connecticut has successfully provided housing and services since 1925.

- Changes in underwriting criteria have reduced the viability of two to four family projects in owner-occupied loan programs, and the transaction costs generally preclude small projects in multi-family financing programs. Small multiple family developments could provide an important resource for the field if viable financing was available. Such projects could take advantage of sites that may be a detriment to the community. Smaller projects could also offer an entry point to development for a more diverse group, thereby increasing the field's capacity to deliver housing. In addition, smaller projects are more appropriate to test new ideas that may encounter initial market resistance. Loft style housing is an example of a housing type that has developed unused resources into a viable market solution.
- Under the current housing production system most of the benefits of good design are long-term and therefore do not accrue to the developer who makes the design decisions.

**Opportunities for Design Solutions**

- The recent growth of PhD programs in architecture schools is increasing the number of individuals doing research in the field. Reaching out to this constituency could impact the volume and quality of research about design issues and affordable housing. A minimal investment in research support could result in substantial payback in terms of research with direct applicability to advancing practice.

- Designers excel in the use of visual imagery and spatial models that demonstrate options for the built environment. This skill could be effectively employed to study the impact of design parameters such as density on resident or neighborhood quality of life. Encouraging design studios, public commentators, reviewers, and others to employ this tool could result in more creative solutions to housing challenges.
- As housing becomes further out of the financial reach of ever-larger segments of society, the public is becoming more aware of the challenge and more accepting of affordable housing.
- Materials cataloged online on the *Design Advisor, Design Matters* and *Affordable Housing: Designing and American Asset* are an accessible resource for exploring successful models for affordable housing design.
- Architects often employ creative solutions to solving their own family's housing quandaries. There is probably value in analyzing these approaches to identify lessons that can be applied to general practice.

**Things We Need to Know: Gaps in our Understanding**

Despite general knowledge about the value of good design there is insufficient comprehensive research about specific questions of interest to designers and their clients. There are even fewer resources that assist practitioners to achieve design success or measure the benefit of specific elements of a project. Although promising case studies and model projects exist, there hasn't been sufficient analysis and dissemination of the findings from these investigations. However, through Convening the Conversation we were able to identify excellent examples of initiatives necessary to connect research to questions with direct applicability to the needs of practitioners and successful widespread application:

- ASSIST, a community design center in Salt Lake City, Utah, has undertaken a comprehensive initiative to provide accessibility in single-family homes owned by low-income households. They review literature; analyze the needs of specific individuals; design, test and refine building solutions; develop a system for effectively delivering services statewide; reflect on their work; publish a guide to accessible solutions that is intelligible to homeowners and their builders; and participate in developing and implementing policies that support realization of accessible and visitable units.
- Green Communities, a program of Enterprise Community Partners and the National Resources Defense Council, began by establishing principles that define their design goals. In addition they are analyzing and packaging information from research in a way that is accessible to community members, providing training programs for neighborhood developers, supporting construction that meets program goals, supporting additional research, and collaborating with local governments to establish policy that supports their mission. The program continues to reach out to establish additional partners and initiatives to support the established design goals.

Participants suggested that similar initiatives focused on the specific questions related to mixed-income and mixed-use development as well as design that increases capital in all its forms are required. Additional issues raised during the conversation include:

- Few studies explore how affordable housing, particularly mixed-income housing, impacts residents in the long-term. Studies that take design issues into account are even scarcer.
- Many fields intersect with the design disciplines in the area of affordable housing, such as social work, but those of us in the design disciplines do not have this work readily at hand. In particular there are bodies of knowledge in the areas of defensible design, environmental psychology, energy conservation, and social environments that could be more effectively incorporated in practice if research summaries and implementation tools were available.
- Studies that compare the quality of life impacts of particular design-related regulations associated with the various affordable housing funding programs would be useful.
- Quantitative data that demonstrates what we know about the design of environments for inhabitation is necessary if we are to achieve large-scale policy and funding change in favor of higher design quality in affordable housing.
- Successful affordable housing projects are rarely disseminated in any real depth for 5–10 years after they have been built, and ironically they are often still represented as they stood when they opened and accompanied by little if any analysis of performance.
- Similarly, the successful projects are rarely disseminated with enough documentation to allow for them to be useful as either precedent for practice or demonstrations for teaching the many issues that are incorporated in affordable housing design.
- One important possibility for change would be to have more architects engaged in funding and policy.

**Next Steps to Knowing:**
**Recommendations for a Research and Action Agenda**
Participants discussed a wide variety of needs. The following items were identified as achievable midterm objectives most inline with the capacity and priorities of ACSA.

***Pedagogy***
Recommendation: Form an ACSA committee to further pedagogy in affordable and mixed-income housing. Among the initial activities that might be undertaken by such a committee are:

1. Inventory of teaching methods for affordable and mixed-income housing within North American schools of architecture.
2. Recognition programs for excellence in teaching and student work in affordable and mixed income housing within North American schools of architecture.
3. Partnerships with national organizations that will facilitate engaged learning in affordable and mixed-income housing design.
4. Transdisciplinary engagement—through a summer affordable housing institute.

***Outreach***
Recommendations: Establish a more formal Design Toolbox as a website to share material collected as part of this initiative. This site should be linked closely or jointly hosted with the Design Advisor and/or Knowledgeplex.

***Research***
Recommendations: Priorities for encouraging and supporting research activities should include the following:

1. Profiles—fill the gaps in the type of project information available to practitioners by collecting information on the following topics that are not adequately addressed by existing directories of exemplary projects:
    a. Design for reuse—innovative strategies that have allowed buildings to be economically reused to provide high-quality environments.
    b. Flexible design—strategies that allow innovations such as multiple uses of space, incremental construction, self-help construction, and swing space.

- Case studies develop a robust case-study methodology and system for postoccupancy evaluations that could be employed by researchers in multiple locations, including in course work in schools of architecture. Such a methodology could build from the AIA Case Study Starter Kit and the ACSA Case Studies in Landscape Architecture Initiative. It would provide a database for longitudinal analysis of design approaches.
- Translational research—encourage efforts to gather and interpret primary research and other information from the field of architecture and other disciplines to inform design of affordable and mixed-income housing practice in areas such as: income mix and life-cycle costing
- Data sets—work with housing finance agencies and others to identify and secure access to data bases that could be applied to studies of design success that might include measures such as long-term sustainability and its many components.
- Experimentation program—work with the National Association of Homebuilders (NAHB) and others to develop a program to test design ideas and materials within the context of a large development.

***Vision***
Continue the working group that has advised the project. A working session, perhaps a Wingspread conference, which takes on this issue and brings in individuals from across the spectrum of affordable housing production may be one of the best avenues for maintaining the initiative.

> *Architecture and urban design may not determine human behaviour, but bad design can numb the human spirit.*
> –Jane Jacobs

## SUMMARY OF ISSUES FROM FORUM PRESENTATIONS

## APPENDIX 1.

### SUMMARY OF ISSUES FROM FORUM PRESENTATIONS

Below are key issues taken from the presentations and discussions during the forum sessions. Please refer to appendix 2 for a detailed schedule and description of the sessions.

Keynote Panel: Pyatok
What We Know
- Corporate and business groups are beginning to understand that without affordable housing they cannot maintain an affordable workforce.

What We Need to Know
- What the real impacts are of particular unaffordable housing practices on families.

Keynote Panel: Schwennsen
What We Know
- Affordable housing needs to be a national priority.

What We Need to Know
- How can we best use design as an advocacy tool?

Keynote Panel: Huh
What We Know
- It isn't enough to build a good unit or home; we need to create communities that attract workforce and families that want to stay for longer terms.

What We Need to Know
- What policies and practices best support community development?

Keynote Panel: Issues Brought up During Q & A
- If affordable housing is built in the service of maintaining an affordable workforce, how does the practitioner represent the occupants?
- What are the implications of significantly different dwelling densities for what is designated affordable housing and what is market rate?
- Are we making unsustainable practices last just a little longer; is there a need for national or regional growth policies?
- Who has the authority to make decisions and how to me make sure that not only the powerful are represented?
-

**The Challenge: Martín**
What We Know
- Regulations can be separated into those that are building based and those that are place-based.

What We Need to Know
- Actual impacts of particular policies including those which architects and affordable housing advocates have been successful in changing.

**The Challenge: Bizios & Barrie**
What We Know
- The production of affordable housing occurs within a negative legacy of both perceived and real failures, which leads to NIMBYism, typological bias, and social stigma.

What We Need to Know
- How to make affordable housing more than episodically or periodically connected to architectural education.

**The Challenge: Research Issues Brought up During Q & A:**
- Can additional data—such as zillow.com—be used to discourage segregation, etc?
- What data sets would be salient for our work, and where would they be most visible?
- Which regulations are beneficial, which are not, which are beneficial but need to be offset?
- How can the investment community be brought onto the solution side of the discussion?
- How can students be directly and effectively engaged with meaningful research?

**User's Perspective: Feldman**

What We Know

- Many residents of affordable housing start businesses, take on child-care, share spaces, share responsibilities, etc., which would be better served by other housing models; live/work spaces would be a benefit.
- Children are often left out of design/programming considerations for housing.

What We Need to Know

- Studies that can be used to influence funding and policy directives so that housing can support a wider set of choices for affordable housing residents.

**Lunch working session: led by Evans**

What We Know

- Goal seems to be finding "strategies for employing design to dramatically increase the economic and social performance of affordable housing."
- Perhaps it is beneficial to narrow the conversation
  - Role of design in improving vs. transforming affordable housing paradigms.
  - Can do relatively more of the former directly and relatively less of the latter except as a support role.
- Congress respects the AIA intellectually, but it doesn't have any clout because not a voting block for any one member of Congress.
- Perspectives: design, regulation, policy, research, education, organizational action.
- Innovation in affordable housing may be able to improve market rate housing.

What We Need to Know

- How to communicate and apply what we know about design to effect change in regulation, policy, funding, and accepted 'minimum-expectation' practices.
- How to impact regulation beyond the local.
- Data to back up what we know anecdotally or how to present anecdotal knowledge we have in ways that can affect policy, regulation, and funding.
- How to apply evidence-based design to affordable housing.
- How to institutionalize and galvanize the teaching of participatory design, so that it lasts beyond commitments of individual professors.
- What role the organizations can have and are willing to take.
-

**Site Selection: Jones**

What We Know

- How to teach students skill sets which allow them to go beyond traditional practice, for instance how to illustrate return on investment.
- Community building is part of affordable housing design.

What We Need to Know

- How to consistently include interdisciplinary project education in architecture schools, with construction managers, engineers, business degrees, etc.

**Site Planning: Pyatok**

What We Know

- Unit planning is not separate from the rest of the process, has a reciprocal relationship with site planning, appearance, and building organization.

What We Need to Know

- How to consistently bring unit planning issues into site planning and site selection processes which typically happen without input from design professionals.

Value of Interdisciplinary Teams: Bronet

What We Know

- If the focus of architectural education were shifted to emphasize that architects should always be working with the community, there would be a different group of people choosing architecture as a profession

What We Need to Know

- Ways to improve the goals of the academy.

**Value of Interdisciplinary Teams: Grant**

What We Know

- Disability can be used as a tool to begin getting students and institutions to understand what it is to be 'the other.'

What We Need to Know

- Perspective of diverse populations when we ourselves are not diverse.

**Identifying Issues/Resources/Gaps: Kerslake/Evans**

What We Know

- Not only do we need a focus that would drive the research, but also need a strategy for making research more available.

What We Need to Know

- Successes of others, if design is disseminated at all it is 5-10 years later in a book and in presentation drawings that don't show how problem was solved.

## APPENDIX 1.

**Poster Presentation: Baltazar**
What We Know
- 3D visualization models are more helpful than plans and drawings to communicate design to populations that aren't used to engaging architectural work.

What We Need to Know
- What levels of visualization are most effective.

**Putting the Project Together: Mallory**
What We Know
- That we are currently trading first costs for long-term durability and environmental degradation (e.g., in using vinyl).

What We Need to Know
- Strategies to change funding structure to build durability and intelligent approach to environmental issues into decision making during design.

**Putting the Project Together: Georgopulos**
What We Know
- It is meaningless to deal with affordable housing as a social issue without dealing with the cost of transit.

What We Need to Know
- Need a broader group within those concerned with affordable housing who are capable of sophisticated financial analysis.

**Preparing for the Future: Pride-Wells**
What We Know
- That the academy is a potential resource for significant engagement in affordable housing through research, experiential learning and service learning.

What We Need to Know
- How have activities in design schools affected affordable housing production to date?

**Preparing for the future: Ahrentzen**
What We Know
- Model of evidence-based design is being successfully implemented in the area of health care design.

What We Need to Know
- Can evidence-based design be applied to affordable housing?

**Designing the future: Perkes**
What We Know
- In a post-disaster situation, the civil society model works at a minimal level, but does not have resources to address complexity or scope of the problem

What We Need to Know
- How as architects to work with civil society in a productive way.

**Designing the Future: Rubin**
What We Know
- Social justice arguments are trending toward regional equity.

What We Need to Know
- How to get social scientists and architects to communicate and get along.

## FORUM BACKGROUND MATERIALS

**WEDNESDAY, JUNE 7TH, 2006**

8:00AM **REGISTRATION**

9:00AM **KEYNOTE PANEL**
*Speaker 1: Michael Pyatok*
*Speaker 2: Jim Carr*
*Respondent 1: Kate Schwennsen*
*Moderator: Bradford Grant*

10:30AM **BREAK**

**PANEL 4B**

11:00AM **Convening the Conversation Kick-off**

11:10AM **The Challenge**
*Speaker 1: Thomas Barrie & George Bizios*
*Speaker 2: Carlos Martin*
*Respondent 1: Lynette Jung Lee*
*Moderator: Jody Beck*

*Barrie & Bizios: Statistical evidence indicates a shocking lack of affordable housing globally and in the United States. In this presentation, we will provide a snapshot of current challenges facing architects and architectural educators working to provide affordable housing in the U.S. We will focus on the social, physical, and historical context, the financing, and the production of affordable housing. Our review indicates that the issues regarding affordable housing have been and continue to be complex and challenging. In this adverse environment, architectural education has the opportunity and obligation to play a significant role in preparing future architects to successfully create affordable housing. Additionally, architects and the profession share this opportunity and obligation to make significant contributions to the design of the next generation of affordable housing. It is our intent to provide a shared foundation that will guide us into a productive discussion over the next two days.*

12:00PM **Users' Perspective**
*Speaker 1: Roberta Feldman*
*Respondent 1: Rick Lowe*
*Moderator: Daria Mallin*

*Roberta Feldman: The architecture of public housing is being reconsidered in light of its apparent failure, although government reports indicate that other factors including its underlying segregationists' intent, under-funding, mismanagement, and restrictions on resident income mix -- were equally if not more responsible. Professionals and policy makers now call for a new architectural approach, but public housing residents do not have a meaningful role in the design, development nor management of Chicago's redeveloped public housing. Using observations from working with Chicago public housing residents for over two decades, I describe the mismatch between public housing policy and practices and the values and ways of life of public housing residents. Several issues of import to public housing residents are addressed: communal life, household life, accommodating children, and integrating uses. Examples are drawn from other subsidized housing projects from across the U.S. to illustrate alter native design solutions that better address these issues than those currently evident in Chicago's redeveloped mixed income projects.*

**WEDNESDAY, JUNE 7TH, 2006**

12:30PM

## LUNCH

Lunch working groups
Identifying the Issues, Resources and Gaps
*Moderator: Kathy Dorgan*

2:00PM

## PANEL 5B

**Holistic Approaches to Site Selection and Development**
*Speaker 1: R. Thomas Jones*
*Speaker 2: Mike Pyatok*
*Respondent 1: Kevin Nelson*
*Moderator: Eric Ellis*

*Tom Jones: The process of planning and constructing residential or mixed-use facilities is different for nonprofit or social-benefit sponsors than for for-profit sponsors. This panel is a discussion of skill sets needed for site selection and feasability study processes as well as programming, financing, and zoning issues.*

*Mike Pyatok: Building design and how it relates to site planning*

3:00PM

**The Value of Interdisciplinary Teams**
*Speaker 1: Frances Bronet*
*Respondent 1: Bradford Grant*
*Respondent 2: Connie Chung*
*Moderator: Stephen Goldsmith*

*Frances Bronet: Discussion of the advantages of working across disciplinary boundries with problem solving.*
*Brad Grant: Cultural Perspectives on Design*

3:30PM

## BREAK

3:45PM

## PANEL 6B

**Group Discussion**
Identifying the Issues, Resources and Gaps
*Speaker 1: Jennifer Kerslake*
*Speaker 2: Deane Evans*

*Deane Evans: Discussion of "the good, the bad, and the ugly" in terms of design for affordable housing: why good design is not merely an amenity or an "extra" and what are barriers to using design for its advantages.*

4:30PM

## Poster Presentations

*Speaker 1: Ana Paula Baltazar*

5:30PM

## Reception

## THURSDAY, JUNE 8TH, 2006

| | |
|---|---|
| 8:00AM | **REGISTRATION** |
| 9:00AM | **PANEL 7**<br>Putting the Project Together<br>*Speaker 1: Sandra Mallory*<br>*Speaker 2: Diane Georgopulos*<br>*Respondent 1: J. Michael Pitchford*<br>*Moderator: Kil Huh*<br><br>*Sandra Mallory: Discussion of opportunities for sustainable design in affordable housing that are both available but not implemented.* |
| 10:15AM | **BREAK** |
| 10:30AM | **PANEL 8**<br>**Preparing for the Future**<br>*Speaker 1: Michael Pride-Wells*<br>*Speaker 2: Sherri Ahrenson (invited)*<br>*Moderator: Katie Wakeford*<br><br>*Michael Pride-Wells: How affordable housing is taught through case studies as a method of teaching.* |
| 11:15AM | **Group Discussion**<br>Identifying the solutions |
| 12:00PM | **LUNCH**<br>Lunch working groups<br>Identifying the solutions |
| 1:30PM | **PANEL 9**<br>**Designing the Future**<br>*Speaker 1: David Perkes*<br>*Respondent 1: Victor Rubin*<br>*Respondent 2: Jim Carr*<br>*Moderator: Michael Monti* |
| 2:30PM | **Closing Remarks**<br>*Speaker 1: Kathy Dorgan* |
| 3:00PM | **End** |

## ADVISORY BOARD

**DIANE GEORGOPULOS, FAIA,** has for 20 years worked at MassHousing, the country's leading affordable housing finance lender. She has for the past 10 years worked on the architectural and construction coordination of the $275 million U. S. Department of Housing and Urban Development Demonstration Disposition Program, the largest single investment made in the history of that agency. Using an expansive resident participation process, the 11 developments in the program, which included 167 buildings, were substantially rehabilitated or newly constructed to produce 1850 units of family housing in three distressed Boston neighborhoods. In her new assignment, she conducts design reviews of Transit Oriented Development proposals that come to MassHousing for financing. She is also writing Design Standards for Massachusetts Smart Growth Overlay Districts, an innovative new zoning approach to advance higher density development in areas served by transit.

Ms. Georgopulos developed the design guidelines for the Elder Choice Program; a first model for state financed rental assisted living programs designed to deliver services to frail elders in a residential setting. Her work was recognized in1995 by Ford Foundation's Innovations in American Government Award and also by the National Council of State Housing Finance Agencies.

In 2005, Ms. Georgopulos won the American Institute of Architects Thomas Jefferson Award for Public Architecture. She is the immediate past co-chair of the AIA Center for Communities by Design, which actively pursues opportunities for advancing the profession's engagement in elevating awareness that design quality is a necessity for a sustainable future. In 2002 she served as chair of the national AIA Housing Committee. She recently collaborated with her colleagues at the Boston Society of Architects to host the First and Second national Conferences on Density, exploring the issues to creating sustainable vibrant 21st century neighborhoods.

Ms. Georgopulos graduated magna cum laude from the State University of New York at Buffalo, School of Environmental Design and earned her Master of Architecture from MIT. She is a member of the Phi Beta Kappa honors society.

**BRADFORD C. GRANT, AIA, NOMA,** is the Chairperson and Endowed University Professor of Architecture in the Department of Architecture at Hampton University, Hampton, VA. He received his Master's degree in Architecture with a focus on social and cultural factors from the University of California at Berkeley (1981). A registered architect, Grant has extensive experience in housing and community design through his research, teaching and architecture practice as principal of the architecture firm Arctronics: Grant Walden Architects, Hampton, VA. His research on cultural environmental design practice can be found in his work titled "Accommodation, Resistance and Appropriation in African American Building", in Craig Barton's Sites of Memory (Princeton Press, 2000) and in the Directory of African American Architects/Survey of African American Architects, co authored by Dennis Mann (University Cincinnati, 3rd edition released as web site http://Blackarch.uc.edu).

Grant is the Director of Hampton University Department of Architecture's Urban Institute, the community design center and a service learning arm of the University. As part of the Urban Institute, Grant has conducted many urban and community design studies including the North King Street Urban Corridor, Hampton, VA., the Monticello Street Corridor, Norfolk, VA., the Ponidexter Street Commercial Corridor, Chesapeake, VA. along with architecture design assistance work with the City of Virginia Beach's office of Housing and Community Service. His community design work has earned him the Hampton Clean City Commission Award, a Proclamation of Appreciation from the City of Hampton, the Universal Design Education Award from Adaptive Environments, Boston and Award of Merit from the Virginia Downtown Development Association.

Professor Grant has served as President of the Association of Collegiate Schools of Architecture (ACSA 2001-04) and is a member of the Board of the Hermitage Foundation, Museum and Slone Collections, Norfolk, VA. He is involved in research, practice and teaching of architecture accessibility and Universal Design, Fair Housing and cultural issues in architecture. He is currently working on or has completed several commissioned projects and planning assignments including the addition the Guiding Light Church, Portsmouth, VA, the Blair Middle School addition, Norfolk, VA and Arbor Music, a site specific environmental sculpture for the Botanical Gardens, Norfolk, VA.

**VICTOR RUBIN** is Director of Research at PolicyLink, a national non-profit research, advocacy and communications organization. A member of the senior management team, he coordinates a wide range of knowledge-building activities linked to action, from literature reviews and surveys of practitioners to analyses of policy initiatives. His current research includes projects on public financing for housing and infrastructure, community factors in health disparities, and methods for evaluation of grass-roots community building and policy change.

He joined PolicyLink in 2000 after serving as director of the U.S. Department of Housing and Urban Development's Office of University Partnerships, where he was responsible for the development of new programs, initiatives, and publications. There he administered a $23 million annual budget for grants to institutions of higher education

for local partnerships and support of students in community development fields. Under his direction, the Office's grants expanded and diversified to include more community colleges and Hispanic-serving institutions, as well as more research about how to improve the effectiveness of the partnerships. He has written and spoken extensively about university-community partnerships in both academic and community settings.

Before joining HUD, Rubin served for 13 years as Director of Research and Community Programs of the University-Oakland Metropolitan Forum, a partnership based at the University of California, Berkeley's Institute of Urban and Regional Development. He was responsible for the design and supervision of research, planning and technical assistance on economic development, employment and training, neighborhood revitalization, urban design, and education, working with faculty, students, community-based organizations and local government.

Rubin has served for five years as a principal analyst in the firm of Berkeley Planning Associates, providing policy research and program evaluation in the areas of child care, youth development, and employment training, through numerous contracts with state, federal and local agencies. He has also been a lecturer at three Bay Area universities, most recently Adjunct Associate Professor in City and Regional Planning at the University of California, Berkeley.

Rubin earned a Ph.D. in 1986, from the Department of City and Regional Planning at the University of California, Berkeley, and a M.C.P. eleven years prior. His Bachelor of Arts degree was in Public Affairs at the University of Chicago.

He is the author of articles in numerous journals for scholars and practitioners, including the Journal of Planning Education and Research, the Urban and Social Change Review and the Children's Advocate. A book co-authored with Nan L. Maxwell, High School Career Academies: A Pathway to Educational Reform in Urban School Districts?, was released by the W. E. Upjohn Institute for Employment Research in November 2000.

**KATE SCHWENNSEN, FAIA,** is associate dean for academic programs at the Iowa State University College of Design and an associate professor of architecture. As an administrator, she oversees budgeting, strategic planning, and academic programs for this 1,900-student, comprehensive design college.

Kate teaches professional practice and architectural design courses. Her scholarly research and writing focus is on the evolution of the profession and its image and the relationship between practice and education. Her papers have been published in ACSA Proceedings, Iowa Architect, AIArchitect, and Architectural Record. She has been a lecturer, moderator, and panelist at various AIA, ACSA, and NCARB education sessions and university meetings.

Before returning to her alma mater (BA, 1978; MArch, 1980) to teach, Kate had broad experience as manager of a nationally recognized architecture office and as a project manager. She practiced full time for 10 years in professionally critical areas, including personnel, marketing, and design on projects that included continuing care retirement communities in a dozen states, custom and speculative housing projects, and retail projects.

Kate served as an Institute vice president (2002–2003) after completing a three-year term as a Central States regional director (1999–2002). She chaired juries for the AIA/ACSA Topaz Medallion for Excellence in Architectural Education (2002) and the AIA Education Honors Awards (2002). She was a member of the AAF Board of Regents (2001–2004), the AIAS Studio Culture Task Force (2001–2002), the AIA Mentorship Task Force (2001–2002), and Architectural Record's Editorial Advisory

Committee (2000–2003). Kate has been a member, AIA Gold Medal/ Firm Award Advisory Jury (1998); chair, Advisory Group for Educators and Practitioners Network (1997–1998); member, NAAB Task Force to Revise Accreditation Criteria (1997); and member, PIA Council (1996–1998). Kate has also served as chair of the NCARB Education Committee (2002) and the NCARB Certification Task Force (2001).

At the state level, Kate was president of AIA Iowa (1997), chair of the Iowa Architectural Foundation (2000), member of the Iowa Board of Architectural Examiners (1994–2002), and IDP educator coordinator (1993–2001). At the community level, she chaired the Architectural Advisory Committee for the City of Des Moines (1993–1994) and served on a city Plan and Zoning Commission Task Force. Kate was elevated to the AIA College of Fellows in 2002 and, in the same year, received the NCARB Presidential Medal for Distinguished Service. In 2003, she was recognized with the AIA Iowa Medal of Honor.

**ADDITIONAL ADVISORY BOARD MEMBERS**

**THOMAS BARRIE**
**LYNETTE JUNG LEE**
**RICK LOWE**
**CONNIE CHUNG**
**DAVID PERKES**
**J. MICHAEL PITCHFORD**
**KEVIN NELSON**

## INVITED SPEAKERS

**GEORGIA BIZIOS** joined the architecture faculty at NC State University in 1986, having begun her academic career at Tulane University where she taught architecture for 12 years. Her teaching and research interests include architectural design, site and sustainability issues, user involvement in design, theories of placemaking and principles of architectural design. Bizios' administrative experience includes serving as associate dean at Tulane and at NC State University. In 2004, she became the founding director of the Home Environments Design Initiative at NC State's College of Design. Its mission is to initiate, facilitate and coordinate scholarship, research and outreach services in the area of quality design for home environments. In this endeavor, the Home Environments Design Initiative provides a forum for the discussion of housing design issues among academics, professionals and the public.

Professor Bizios has practiced architecture as a consultant to architectural firms and individual clients. Her professional experience includes residential, commercial and planning projects. In 1990 she established her firm, Bizios Architect, with a focus on residential architecture.
Professor Bizios holds a Master of Architecture from the University of Oregon, a Bachelor of Architecture from the University of Minnesota, and a Bachelor of Arts from Colby College, Maine. She is a registered architect in Louisiana, Virginia, Tennessee, and North Carolina and is NCARB Certified.

**JAMES H. CARR** is Senior Vice President of Financial Innovation, Planning and Research for the Fannie Mae Foundation and a visiting professor of urban planning at Columbia University. Prior to his appointment to the Foundation, Jim served as Vice President for Housing Research at Fannie Mae, Assistant Director for Tax Policy with the U.S. Senate Budget Committee, and Research Associate at the Center for Urban Policy Research at Rutgers University. Jim has served on research or policy advisory boards at numerous colleges and universities including Harvard University, University of California-Berkeley, University of Pennsylvania, University of Arizona, and University of Southern California. Jim is an Advisory Committee member of the Federal Reserve Bank of San Francisco Center for Community Development Investments, Research Advisory Committee member for the National Low-Income Housing Coalition, and a certified instructor for the Texas Real Estate Commission's Mandatory Continuing Education Program. Jim has served as an expert advisor to the Organization for Economic Cooperation and Development (OECD) Urban Affairs Project Group in Paris, France, Board member of the American Real Estate Society, member of the Corporate Advisory Board of the Urban Financial Services Coalition, and frequent instructor for the Neighborhood Reinvestment Training Institute. Jim has served as an international advisor on financial modernization and housing finance to China, Mexico, Turkey, and Colombia. He has also served on Congressional delegations on economic development to South Africa and Ghana.

Jim has published and lectured extensively on housing and urban policy, housing finance, community reinvestment, personal financial services, and state and local finance. He has written and presented papers on technological innovation and workforce diversity. And, he is particularly recognized for his knowledge about and leadership on development of innovative financial instruments and strategies to promote affordable lending, inner-city development and wealth creation for lower-income households. Jim is editor of the scholarly journal Housing Policy Debate, which received the 1996 Award of Excellence from Washington EdPress for editorial excellence and was rated number one for impact on the field of urban studies by the Institute for Scientific Information Journal of Citation Reports in 2004. He also served for more than a decade as editor of the peer-reviewed publication Journal of Housing Research. His books include Replicating Microfinance in the United States, 2003.

Jim's speeches have been awarded top honors, including the "Best of the Best" award, the "Award of Excellence", and the "Award of Merit" by the International Association of Business Communicators. He has been published in Vital Speeches of the Day. Jim is a 2003 Aspen Institute Scholar and the recipient of the 2003 Community Impact Award from the National Organization of Black County Officials. He has also received a Distinguished Service Award from Texas Southern University, the Presidential Award by the National Association of Urban Bankers, and an Outstanding Achievement Award by the Neighborhood Reinvestment Training Institute.

Jim's research, and that of Fannie Mae Foundation research team he manages, has been cited and reported in various major newspapers and media outlets throughout the country including the Washington Post, USA Today, New York Times, Wall Street Journal, Los Angeles Times, Dallas Morning News, Associated Press and Reuters and dozens of other print outlets. He has made several radio appearances including Newsweek on Air, Bloomberg Radio, and National Public Radio. Jim has earned numerous academic honors and awards, including Who's Who in American Colleges and Universities, Alpha Rho Chi Bronze Leadership Medal, American Society of Planning Officials Fellowship, and William Fontaine Fellowship. He holds a Bachelor of Architecture degree with honors from Hampton University, a Master of Urban Planning degree from Columbia University, and a Master of City and Regional Planning from the University of Pennsylvania.

**DEANE M. EVANS, FAIA,** is a registered architect and a Fellow of the American Institute of Architects. From January to December 1998, Mr. Evans served as the founding Director of the Partnership for Advancing Technology in Housing (PATH) – a public/private partnership housed at HUD. Before accepting the PATH Directorship, Mr. Evans was the Vice President for Research at the American Institute of Architects. Prior to joining the AIA, Mr. Evans was a Principal at Steven Winter Associates, Inc., an architecture/engineering firm in New York City, where he concentrated on applying innovative technologies and systems to buildings, particularly housing.

In January 1999, Mr. Evans left the Federal government and returned to private practice, where his principal area of concentration was high performance, sustainable buildings, particularly housing and schools. During this period he created the Affordable Housing Design Advisor, a unique, electronic tool that provides step-by-step guidance for affordable housing developers and community leaders on how to create better designed affordable housing.

On October 1, 2001, Mr. Evans left private practice and accepted appointment as a Executive Director of the Center for Architecture and Building Science Research at NJIT. Among other duties at the Center, he maintains the Design Advisor web site, coordinates the nationwide "Campaign for Excellence in Affordable Housing Design," and supervises the national "Show Your Green" affordable housing design recognition program in cooperation with the American Institute of Architects. He also recently authored Good Design: The Best Kept Secret in Community Development for the Local Initiatives Support Corporation. Mr. Evans has a B.A. from Yale University and a Masters in Architecture from Columbia.

**TOM JONES** is currently the Dean of the College of Architecture and Environmental Design at California Polytechnic State University in San Luis Obispo. He has 36 years of experience in architecture, planning, housing development, public policy and education. Prior to his appointment at Cal Poly in 2003, he was Executive Director of the California Futures Network, a statewide smart growth coalition of 91 environmental, business, labor, social justice, housing, transportation and open-space organizations that worked with representatives of the California Legislature and Governor's Office.

From 1998-2000 he served as a HUD Community Builder directly serving Secretary's Representative Art Agnos in the Region 9 California State Office. From 1983 to 1988 and again from 1992 to 1998, Tom worked at San Francisco's Asian Neighborhood Design organization, first as Director of Architecture, and later as Director of Community Planning and Development. While there he designed or developed over 800 units of affordable housing and received several regional and national awards for his community planning, architecture, and public education efforts. He also served as Special Projects Director for the Mayors Office of Housing in San Francisco from 1988-1992, where he authored their first Comprehensive Affordable Housing Strategy.

Tom holds a bachelor's degree in architecture from Cornell University and has taught at the University of Oregon and UC Berkeley. He co-authored the NEA funded book "Good Neighbors: Affordable Family Housing". Currently he serves on the Board of the Central Coast Chapter of the AIA and the Board of the San Luis Obispo County Housing Trust Fund. He is also a Regent for the California Architectural Foundation.In 1998 San Francisco Magazine named him Architect of the Year. In 2005, Design Intelligence Magazine ranked him among the 30 most respected educators in the US based on a national poll of practicing architects, for leadership in "bridging the practice of architecture with higher education."

**LYNETTE JUNG LEE** has served as the executive director of the East Bay Asian Local Development Corporation (EBALDC), a nonprofit community development corporation located in Oakland, California, for 24 years. During that time she has helped to grow EBALDC to develop over 1000 units of affordable rental and homeownership housing and 200,000 sf of neighborhood retail and community facility space. EBALDC also operates 1) an Individual Development Account program which has helped over 500 families reach their savings goals, 2) a Mainstreet program in Oakland's Eastlake district, and 3) neighborhood planning and organizing activities. Current board member of National Coalition of Asian/Pacific Americans in Community Development and Development Training Institute. Received the James A. Johnson Community Fellows Award from Fannie Mae Foundation in 2000.

**SANDRA MALLORY** is a Project Architect at Environmental Works Community Design Center (EW) in Seattle where, in addition to her design work, she works to expand and promote the organization's green building capacity. She spearheaded the LEED process for Traugott Terrace, located in downtown Seattle, the first LEED certified affordable housing project in the country. Currently, she is Project Architect on Chestnut Street Housing, a mixed-use affordable housing project under construction in Bellingham, WA designed to achieve a LEED silver rating.

Sandra manages EW's Sustaining Affordable Communities initiative which is aimed at providing sustainable design assistance and education to EW's non-profit clients. As part of that initiative, Sandra is conducting Post Occupancy Evaluations of both Traugott Terrace and the EW designed sustainable childcare at The Evergreen State College. She has worked as a trainer with the BetterBricks program of the Northwest Energy Efficiency Alliance, teaches a one-day energy unit for Seattle's Sustainable Building Advisor Program and has taught the Environmental Principles course at the University of Washington Department of Architecture. Previous to moving to Seattle in 2000, she taught all aspects of environmentally responsible design for three years in the interdisciplinary graduate Sustainable Systems Program at Slippery Rock University. Sandra is a LEED Accredited Professional with the U.S. Green Building Council, recently completed a two-year term as Secretary/Treasurer of the Society of Building Science Educators and is a member of the American Solar Energy Society.

**MICHAELE PRIDE-WELLS, AIA, NOMA,** is the Director of the School of Architecture and Interior Design at the University of Cincinnati's College of Design, Architecture, Art, and Planning. She holds a B Arch from Arizona State University and earned the Master of Architecture in Urban Design from Harvard University Graduate School of Design. Michaele joined the UC faculty in September 2003. Her research focuses on the social and political implications of housing and urban design. She is also known for her community-based design work in the months and years following the 1992 Los Angeles riots, helping to coordinate participatory processes and leading the volunteer efforts of the design community through the Design Professionals Coalition. Michaele has received awards for design, planning, and community advocacy from the LA Cultural Affairs Commission, the National Organization of Minority Architects, American Planning Association, and the American Institute of Architects.

**ADDITIONAL SPEAKERS**

**DEANE M. EVANS**
**MICHAEL PYATOK**
**FRANCES BRONET**
**ROBERTA FELDMAN**
**BRADFORD C. GRANT**
**THOMAS BARRIE**
**KATIE WAKEFORD**
**WENDY LEGERTON**

# More than Just Looking Good: Toward an Evidence-Based Design Practice in Affordable Housing

Sherry Ahrentzen, PhD

The problem is not so much what we don't know; it's what we think we know that just ain't so.
(Attributed to Mark Twain)

In today's political and economic climate, providing more affordable housing often means building at higher densities and incorporating a broader mix of resident incomes and generations, resulting in more financially feasible projects. In facing NIMBYism, architects design the massing, layout, and façade of such housing to be more accepting to the higher economic context of the neighborhood. But when asked how design can enhance the economic and social performance of affordable housing, architects may resort to hunches or dated generalizations. As Mark Twain suggests, relying on the certainty of our anecdotes may come back to haunt us—and the residents for whom we build.

As the conference conveners maintain: "Affordable housing design practice (with notable exceptions) has changed very little and has not kept up with advancements in building technologies, materials science, environmental design research, and other factors which affect affordable housing. Architects do not have access to reliable information about successful models and approaches to affordable housing and strategies for comprehensive approaches to community design, and there are limited ways for experienced practitioners to share their methodologies and hard-won experiences in the field…. Those charged with managing funding, policy, or development have even less access to information on design."

There is no established agenda for organizing, disseminating, and advancing the state of knowledge of how good design is best employed to create long-term economic and social value in affordable housing. There are examples of "best practices"—but with little empirical evidence or explanation of what makes them "best" or who sets the criteria for defining and measuring "success" (if such even exists). With an amalgamation of design practices and housing examples that seem to work well, the Affordable Housing Design Advisor reflects accumulated tacit knowledge of professionals. But assessment of the return on investment (ROI) of such practices—in health, social and human capital, usability, stress, etc.—is not broached. Then there are those countless research articles with relevance to affordable housing policy and design but usually only accessible and comprehensible to those willing to cull though countless academic journals. To date, there are only isolated efforts to synthesize, evaluate, organize, and present this massive information in a wide-spread, useful manner for and with practitioners.
To set a direction for ACSA's initiative to redefine and reposition affordable housing in practice and education, this paper advocates a professional approach toward the production and preservation of affordable housing that incorporates evidence-based design practice in fostering healthy, livable environments that reflect long-term economic and social value, for residents and the communities in which they live. Evidence-based design practices within the healthcare industry have made significant strides in the last decade, developing and implementing strategies for successfully bridging research and design practices, and resulting in better informed design decisions that ultimately affect the health of patients and staff. To what extent could similar evidence-based efforts be situated within the affordable housing design practice? How might this best be implemented? And what benefits and costs would practitioners, residents, and communities derive from such?

This paper speaks to these questions by first briefly profiling the evidence-based practice of healthcare design, and deriving a general framework for the development of such evidence-based practice within the affordable housing arena. It then describes two initiatives at Arizona State University's Stardust Center for Affordable Homes and the Family that reflect components of this evidence-based design orientation. And it concludes by recommending further efforts to foster an evidence-seeking design culture within affordable housing design practice.

## WHAT IS EVIDENCE-BASED DESIGN PRACTICE?

Evidence-based medicine emerged as a movement in the mid-1990s, spearheaded by the York-based Cochrane Centre, to bring a more scientific approach to seemingly random differences in surgical techniques and clinical practice in hospitals. Today, the evidenced-based medicine movement has evolved into a more inclusive evidence-based health practice, involving health and behavioral health, social work, even child welfare services.[1] Evidence-based health practice means integrating the best available clinical evidence from systematic research with individual clinical expertise. Expertise is reflected in many ways, but especially in more effective and efficient diagnosis and in the more thoughtful identification and compassionate use of individual patients' predicaments, situations, and preferences in making clinical decisions about their care. Indeed it is such expertise that determines whether the external evidence should be applied to the individual patient at all and if so how it should be integrated into a clinical decision.[2]

Similarly, an evidence-based design practice would involve designers working with clients to make decisions based on the best information available from research and project evaluations. The practitioners' critical thinking, experience, and creativity would continue to play a central role in the design process since the solution must be targeted to the specifics of client, program, and site, and within contexts of continuous flux, such as changing demographic, economic, cultural, technological, and political conditions.

But the wholesale transfer of this model into design practice is a complicated matter. The processes that operate on communities, households, and organizations—occupants of the built landscape—are more complex and less understood than those that operate within the human body. And rigorous, controlled experiments, considered hallmarks of quality research, are much more difficult to conduct in the designed and lived landscape than in controlled medical experiments. Clearly evidence-based design operates within architectural practice when we consider designing for the operational viability and safety outcomes of particular structures, materials, and environmental systems. "Evidence" is portrayed in codes and specifications, resulting from systematic research and evaluation. But when addressing the more human dimensions of our design decisions—economic, social, behavioral, emotive, health—evidence is usually sporadic, sometimes idiosyncratic, and at times completely neglected. But this may be changing. Designers and researchers within the healthcare industry are promoting evidence-based design practice and are convincing healthcare administrators to invest the time and money to build better buildings.[3]

A leading proponent of evidence-based practice, architect Kirk Hamilton details four levels of such a practice, each level representing an increasingly rigorous level of commitment and methods of using research on behalf of clients (see Image 1).[4] At level one, practitioners familiarize themselves with the research literature of the field and try to incorporate relevant evidence into their work. Level-two practitioners hypothesize the expected outcomes of design interventions and subsequently measure the results. At level three, they begin to share their results publicly in the trade and popular press. And level-four practitioners perform the same tasks as those at the other levels but also publish in quality journals that are peer reviewed. They may also collaborate with social scientists in academic settings who contribute to the formal literature.

Hamilton also warns of "level-zero practitioners"—those who acknowledge that there is research that demonstrates that the designed environment has an effect on people. But they cut corners. They take a single research article or conference presentation, make a personal interpretation that fits their design bias, and claim the subsequent design is evidence-based. They rarely read the original research, do not understand how to draw valid inferences from narrow and precise studies, and misapply important principles.

There is also an implicit assumption in Hamilton's model that the most basic activity—reading the material to stay current on emerging research—is the easiest. But actually it can be the most challenging for many practitioners whether they are designers, policymakers, developers, or others involved in day-to-day placemaking. Research can offer complex and sometimes contradictory insights, demanding comparison, criticism, evaluative judgment, and synthesis beyond simply reading a series of articles. Hamilton suggests that "the dark side" of this trend is the appearance of practitioners who would like to be associated with evidence-based design but who do not do the hard work required to become current.

Thus an evidence-based design practice is one that is a team practice. It has to be—one can hardly keep abreast of new research developments. Even within medicine, a profession with a strong research foundation, clinicians face difficulties in keeping abreast of all the medical advances reported in primary journals. For example, one study showed that to keep up to date with the reading for general medicine would require examining 19 articles per day, 365 days per year. Yet British medical consultants claim that the time available for such reading is well under an hour a week.[5] There are almost endless sources of potentially useful information, and there is a need to reach valid conclusions about the design implications of highly specialized and narrow studies.

Yet given these complexities, collaborative efforts within the healthcare design profession and industry are promising. The AIA College of Fellows awarded its 2005 Latrobe Fellowship of $100,000 to Chong Partners Architecture, Kaiser Permanente, and the University of California at Berkeley for a research study that incorporates techniques from psychology, sociology, and neuroscience. The research involves a collaboration of architect, client, and university to determine how hospital design affects the recovery and healing for people of different cultures. It combines traditional research with new applications to develop a model that architects and designers can apply to address cultural diversity in the design of any public building.

| | ACTIVITY | LEVEL 1 | LEVEL 2 | LEVEL 3 | LEVEL 4 |
|---|---|---|---|---|---|
| Interpret the Evidence | Read material to stay current on emerging research. | ★ | ★ | ★ | ★ |
| | Use critical thinking to interpret implications of research on current project. | ★ | ★ | ★ | ★ |
| | Collect success stories and historical data on completed projects. | ★ | ★ | ★ | ★ |
| Hypothesize and Measure | Perform applied research as a practitioner on real projects. | | ★ | ★ | ★ |
| | Hypothesize intended results of design interventions. | | ★ | ★ | ★ |
| | Measure the results associated with design interventions. | | ★ | ★ | ★ |
| Share Results Publicly | Report unbiased project results in the public arena, writing and speaking. | | | ★ | ★ |
| | Perform independent 3rd-party postoccupancy evaluations. | | | ★ | ★ |
| | Improve understanding of research methods through advanced education. | | | ★ | ★ |
| Meet Academic Standards | Collaborate with credible academic researchers and social scientists. | | | | ★ |
| | Publish research results in peer-reviewed journals. | | | | ★ |
| | Write academic thesis or dissertation on evidence-based design topic. | | | | ★ |

1. Four Levels of Evidence-Based Design Practice, Proposal by Kirk Hamilton [19]

Another important collaborative example is the Pebbles Project under the auspices of The Center for Health Design.[6] This project, which is now five years old, provides researched and documented examples of healthcare facilities whose design has made a difference in the quality of care and financial performance of the institution. Currently there are 37 active provider partners and three corporate partners. Each partner pays an annual fee of $30,000 for a three-year membership. In return, they receive prompt access to research information and expertise to questions they have. Twice a year the partners meet with the Center's board and research committee, and other industry experts who offer learning opportunities. High-level consulting and technical assistance to facilitate the partner's research is also provided, as well as a proprietary research design methodology template. Most partners are healthcare facilities with one or more facilities being designed or extensively renovated.

Undertaken thoughtfully, evidence-based design practice allows the client and architect to capitalize on the return on investment, not simply financially but socially, environmentally, and healthful as well.

## COULD IT OPERATE IN AFFORDABLE HOUSING PRACTICE?

It is perhaps not surprising that evidence-based design has found a foothold in the healthcare design profession. Members of the healthcare industry—whether medical administrators, hospitals, physicians, etc.—have historically held scientific results to be the basis of decision-making. They also work within established industry borders: health facilities, for the most part, are institutionally based.

This is a different animal from the housing industry. The latter is rarely institutional (prisons being one exception). Desired outcomes are less agreed upon, more diffuse, and sometimes minimally measurable. The historical base of the industry is geared toward profit making and efficient, expedient construction rather than the care mission that underlies the healthcare industry. Evidence-based design appeals to the scientific minds of physicians and other clinicians who are trying to practice on the basis of medical evidence. This may be a harder sell among housing developers and others in the housing industry. But evidence-based design also appeals to business-minded administrative leaders. It offers them the prospect of reduced costs and improved organizational performance, and can provide justification for some of the costly decisions made on their building projects.

Within housing and community design, the transferability of the evidence-based design approach is also exacerbated by context. Every city is different, and every community and neighborhood within a city is different. As Stoner and Stutz note, while each individual differs in some way from all others, the vital systems of all humans—respiratory, circulatory, digestive—are laid out similarly and work in the same way.[7]

But there are clearly lessons to learn and strategies to adapt. A glance at the healthcare facilities of the Pebbles' partners demonstrates that evidence-based design does not result in some type of monolithic or standardized design. Second, as demonstrated in Hamilton's model (Image 1), there are numerous ways to practice evidence-based design, depending on context, stage of development, resources, and other factors. Third, as in most industries, return on investment is foremost in the minds of these healthcare CEOs, and to date practitioners have been able to convince these CEOs not only of the health and social value of the design decisions, but the business case as well.

Fourth, social, behavioral, and health outcomes can be meaningfully measured—the "measured outcomes" that investors and CEOs like to see. Critics often point out the difficulty of measuring outcomes that are often subjective intangibles like "satisfaction," "preference," and the like. In the Fannie Mae Foundation–supported Campaign for Excellence in Affordable Housing Design, four noble yet vague outcomes are claimed: adds assets to a community; improves quality of life; integrates communities; and creates long-term value.[8] To a researcher, these are too broad to reliably measure and validate. To an investor or developer, they are unconvincing in such immeasurable form. But in recent years housing researchers have been moving toward tangible measures that are particularly salient to health outcomes and highly relevant social and behavioral outcomes, such as educational performance, stress, or parenting behaviors. For example, in a longitudinal study of housing affordability (in cost, not design, terms), housing policy researchers Joseph Harkness and Sandra Newman at Johns Hopkins University have identified outcomes that reflect the Campaign's goals but in a more tangible, measurable, and potentially convincing fashion: modeling how housing costs impact nutrition, residential mobility, parental stress, which in turn impacts parenting/nurturing, which results in specific health outcomes and cognitive development of children.[9] While this study focuses on housing affordability, it is not a stretch to see how design factors—for example, size and layout of the dwelling unit and residential development; nature, layout and amount of common interior pathways and corridors; the degree of segregation or integration of affordable, moderate and market-rate units in a mixed-income development—might result in similar health and social outcomes. And in recent years a number of behavioral economists have targeted their research to demonstrate how health and human capital outcomes can be translated into convincing ROI arguments (e.g., see Nobel Laureate James Heckman's compelling economic models and ROI arguments for investing in early childhood learning).[10]

To date, evidence-based design has not reached the affordable housing field. This is not for lack of research or housing/design researchers. Rather research is often conveyed in journal articles and reports that are written for researchers, not for designers. And architects have little time to "translate" these or to stay abreast of current research. Further, finding germane research may require one to cull through several databases and irrelevant articles. While many affordable housing developers and designers wish to make informed decisions based on valid, relevant evidence, they may be stymied in their efforts to

find synthesized, well-grounded, and concise accounts that are targeted to issues and questions of their concern. There are good, solid "databases" of housing-relevant research reports: examples include KnowledgePlex, and those within HUD's Office of Policy Development and Research (e.g., PATH, Regulatory Barriers Clearinghouse). Yet these databases consist of reports, with minimal attempt at synthesis and briefing of research across research studies.

Further complicating the matter is the complexity and non-institutional nature of the affordable housing design practice (AHDP), that is all those participating in the design and development of affordable housing whether they be in the architect's or developer's office, the State House or White House, the planning board or the community meeting. Three main constituents are major players in the design/development process: architects and builders; policymakers and public officials; housing developers, residents, and neighbors. Different constituents are confronted with different dimensions of affordable housing dilemmas; and an evidence-based AHDP must strive to address this diversity.

Yet, there are some challenges all these constituents face in implementing evidence-based affordable housing design. All operate in arenas where time is tight and responses must be quick; so research spread must accommodate these parameters. For an architect, for example, dissemination must be shaped to address pressing questions a practitioner faces during a project. For a non-profit developer, answers might be sought when she is confronted by a neighborhood group that contends the development will result in a drop in surrounding property values. Planners and government staff officials may have more luxury of time when establishing or revising long-term policy and regulations; but even among these constituents, succinct, visual, compelling, and pointed evidence is useful when trying to expeditiously convey the importance of the policy development to harried elected officials. Today, with electronic resources much more accessible and user friendly, research evidence can be expressed and transmitted in visual and concise formats that can be retrieved quickly. Admittedly, there are those who still prefer and gain enormously from face-to-face dialogue in identifying and assessing research evidence for a project. Again, with telecommunications, opportunities for this are more available than even a decade ago.

In any case, research spread—that is, how research information is disseminated and digested—is critical to understand. But such challenges are being confronted and strategies invented within the healthcare design practice. The ADHP could build on these (see Image 2).

**HOW WOULD WE PROCEED?**

Once convinced of its value, how could we foster an evidence-seeking design culture within the ADHP? First, such a cultural change must strive to value outcomes beyond structural quality and financial feasibility (as essential as these are), to also encompass outcomes central to long-term economic and social value of the residents and community, such as: safety and security, health and resilience; social and human capital, social interaction and privacy, livability and utility, and economic betterment of household and neighborhood (or asset-building).

**Challenges In Implementing Evidence-Based Affordable Housing Practice**

| Challenge | Solution |
|---|---|
| The size and complexity of the research | Translational research and research synthesis undertaken by design, social, behavioral economic, and/or policy researchers |
| Difficulties in developing evidence based practice | Produce guidelines, workshops, and process case studies for how to develop evidence based practice<br><br>Develop incentives to encourage effective EBP<br><br>Show success stories of such implementation |
| Stunted spread (i.e. poor access to evidence when needed) | Produce structures – electronic, printed, and face-to-face or phone visits -- so that guidelines/information can be accessed at strategic points of the pre-design, programming and design process |
| Organizational barriers to implementation | Develop more effective strategies to encourage clients/residents to insist on EBP<br><br>With behavioral economists, establish return on investment figures for completed projects using evidence-based design |

2. Challenges in Implementing Evidence-Based Affordable Housing Design Practice

In practice questions are posed, answers are sought (or guessed), generally targeted to a project in progress. A survey of architects found that the manner in which they most "learned" or accessed research was through vendors—getting answers to specific questions they had on a particular project.[11] An evidence-seeking design culture in ADHP would continuously pose design questions central to long-term social and economic concerns. The nature of questions posed will differ by ADHP constituents (although some overlap). But "the posing of the questions" can be the basis for organizing an evidence-based process. (Indeed, posing of the question is the first step in the research process!)

The Stardust Center for Affordable Homes and the Family is a newly created community design and research center at Arizona State University whose mission is to serve the needs of organizations, neighborhoods, and professionals for quality homes and vibrant, sustainable communities. The Stardust Center provides research, educational outreach, advocacy and design innovation services for developers and builders, city councils and elected officials, planning commissioners, lenders and donors, service agencies and service providers, American Indian tribes, and neighborhood groups seeking to preserve or enhance the social, cultural, and environmental quality of a community. Currently the Center is developing an accessible web-based strategy to help foster evidence-based design among stakeholders involved in affordable housing and mixed-income developments. The aim is to organize existing research information and produce new research in a manner that is accessible, useful, and sufficiently flexible to incorporate various practice contexts (e.g., local planning boards, com-

munity development corporations). Efforts to simplify do not mean efforts to be simplistic—but rather developing innovative, relevant, and useful methods to convey complex, seemingly contradictory, research information in a manner that is comprehensible, in which practitioners can build on and incorporate.

Spread of research evidence is not the end product. It is left to the expertise and judgment of practitioners to determine the extent to which the stringency and amount of research evidence plays a role in design decisions. For example, in those situations where physical and mental health is paramount, or where a prototype is being developed for future large-scale development, research evidence may play a more prominent role.

In evaluating the strength of evidence, various strategies have been tried in evidence-based healthcare design. Most use a star system—whether derived from Christopher Alexander's rating system in Pattern Language, or simply cultural tendencies of rating movies, restaurants, and the like.[12] In any case, a method for not simply summarizing research findings but also designating the strength of evidence produces more useful, informed guides for making decisions.

The remainder of this paper describes in-progress efforts at the ASU Stardust Center that illustrate two strategies for fostering evidence-based design. These two efforts reflect Hamilton's first level of evidence-based practice—of developing strategies for collecting, evaluating, synthesizing, and spreading (i.e., disseminating) research evidence in a manner that can be used by practitioners. The dissemination of information reflects quick-response spread, in part capitalizing on online resources. The two developments are (a) translational research, and (b) evidence-based best practices.

**Translational Research**

Research is often conveyed in journal articles and reports that are written for researchers, not for public officials, architects or housing developers. Practitioners have little time to "translate" these, or to stay abreast of current research. Further, finding research targeted to a specific issue may not be easy, requiring one to cull through several databases and irrelevant articles. Sometimes reports may be driven from a particular point of view, even neglecting to address all sides of an issue or evaluating the rigor and applicability of the research. While many developers, public officials, and others wish to make informed decisions based on valid, relevant evidence, they may be hindered in their efforts to find synthesized, well-grounded, and concise reports that are targeted to issues of their concern.

Translational research is becoming more prominent in many scientific fields, but especially in healthcare and health policy arenas. In medical parlance, translational research is the process of applying research-generated insights and discoveries to the treatment or prevention of human disease. In other words, translational research is the bridge between research studies and day-to-day applications.

One type of bridge being developed is Research Synthesis. Both the Robert Woods Johnson Foundation (RWJF) and the National Institutes of Health have major initiatives in research synthesis. For example, RWJF is producing concise briefs and reports that translate research findings on perennial health policy questions. The project pairs researchers with policy analysts to produce these synthesis reports and briefs. Short, skimmable, and policy-focused, the synthesis projects are structured around policy questions, rather than research issues; they distill and weigh the strength of research evidence in rigorous and objective manners; and they underscore the policy implications of findings.

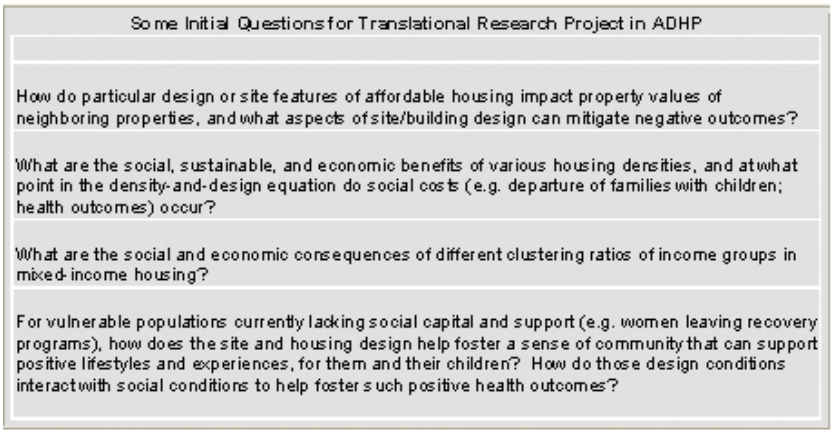
The Stardust Center has begun a similar process of translational research to result in both concise, germane briefs that synthesize and translate research findings on critical housing issues pertaining to affordable housing, and FAQ-oriented summary statements. By weighing the strength of evidence and synthesizing those research findings that are valid and reliable, these briefs provide affordable housing design practitioners with convincing, dependable information and new perspectives to inform policy, design, and development decisions. Similar to the RWJF process in determining the issues to be covered in these briefs (see Image 3), a panel of public officials, architects, developers, service providers, health practitioners, and others involved in the housing/community development process will identify those salient and critical issues and questions pertinent to the design and development of affordable housing.[13]

It is important that this be an inclusive group. For example, a county public health official approached me a few months ago to inquire how affordable housing and community design factors might affect prenatal care among women in low-income neighborhoods. This was an issue I had never considered before, but one she invited me to pursue with her public health colleagues. Those outside the direct circle of housing design and production can also provide insight into important dimensions that need to be addressed within our designed


3. Steps in the Research Synthesis Project, Robert Woods Johnson Foundation [20]

communities. Some issues that have been brought to the Center's attention already by those in the community include (see Image 4):

A methodology has been developed, based on the RWJF process, to derive, validate and produce these evidence-based briefs and FAQ statements. After soliciting and identifying topics, research studies are identified; these are then analyzed and critiqued. Valid and promising findings are synthesized, and briefs are developed. From those briefs, FAQ statements are developed. A panel of experts reviews the briefs and FAQs. Once corrected, the briefs and FAQs will be available on the Center's Web page. This Web resource is currently being developed, with an expected online inauguration of October 2006.




4. Some Initial AHDP Questions for Translational Research Project

**Evidence-Based Best Practices**

The term "best practice" is used so pervasively today that it seems little more than a reflection of the Lake Wobegan community—strong, good looking and above average. From an evidence-based standpoint, the "practice" of best practices is fraught with ambiguity, since in many instances the benchmarking is vague or unknown, and empirical investigation minimal or even absent. There are exceptions, of course, such as the well-documented Rudy Bruner Awards Program and the Business Week/Architectural Record Awards (e.g., the latter has the client articulate their objectives, and awards are given to the client/architect team based on the extent to which the design and constructed building best achieves those objectives).

One advancement would be to encourage case-study research within ADHP. Within evaluation and applied research disciplines, case-study research is a well-respected domain of research methodologies.[14] The American Institute of Architects has developed a case study starter kit, but its focus is on the processes of design development; no delineation is given to evaluating outcomes of a development. Sponsored by the Landscape Architecture Foundation, Mark Francis's efforts in developing a case study methodology for landscape architecture is exemplary in the design professions.[15] As he contends "case studies often serve to make concrete what are often generalizations or purely anecdotal information about projects and processes" (15). In short, "[a] case study is a well-documented and systematic examination of the process, decision-making and outcomes of a project, which is undertaken for the purpose of informing future practices, policy, theory, and/or education" (16). In advocating empirical and critical analysis as well as the use of systematic methodology for case studies, Francis has provided a framework and format that case-study research could follow. He contends that case studies are a useful way for practitioners to evaluate the success and failure of projects, although few practitioners routinely do this. Yet, designers and public officials continuously point to precedents and best practices. If case-study research could be "simplified" to a more evidence-based best practice, than practitioners could build on existing cases by understanding aspects of a project unique to a given context while gleaning principles useful in similar projects. Francis's own monograph of Village Homes in Davis, California, encompasses more than a decade of study, a number of surveys, and post–occupancy evaluations, and brings a critical, long-standing lens to this exemplary and early sustainable housing development.[16]

Case studies are one venue for building an evidence-seeking design culture, albeit a time-consuming one (although such are good candidates for graduate students' theses and dissertations). Another approach is not to replace the best practices nomenclature but to build upon it, by advocating and advancing a process whereby best practices are identified and publicized based on evidence that substantiates their claims. Most instances of "best practices" reflect an all-or-none approach: a project or practice receives that label or does not. However, evidence-based best practices could be identified and judged by the quality of the evidence provided in supporting the program's objectives or social/economic goals. Adapting the three-part best practice typology developed by the Institute of Medicine (IOM), we might consider establishing a range of best practices:[17]

> *Evidence-based best practice: exemplary affordable housing policy, program, or design whose outcomes are supported by comprehensive, valid and compelling research evidence (e.g., post–occupancy evaluation; use of evidence-based guidelines or programming) that substantiates how design reflects/fosters positive social, sustainable, and economic outcomes;*
>
> *Emerging best practices: affordable housing policy, program, or design that shows potential but whose outcomes are only modestly documented by research;*
>
> *Promising practices: affordable housing policy, program or design that has not yet been documented but is identified as promising by experts in demonstrating potential positive outcomes.*

Following a pattern established by Business Week/Architectural Record, in the submission narratives practitioners would describe how

their designs respond to the needs of residents or the community at large, and provide concrete data on how the design facilitated better outcomes according to a variety of criteria, some mentioned previously. Panels of judges assess submissions according to the above criteria.

## CONCLUSIONS

Today's evidence-based design practice recalls efforts of the 1970s and 1980s to integrate research and design.[18] Those efforts, which continue today, have now taken on new maturity within the healthcare design field, in part because of the growing sophistication and maturity of the research as well as an informed clientele seeking substantive evidence for decision making that will produce better building outcomes.

The proposals presented here for enhancing an evidence-seeking design culture within ADHP are only a small start. Evidence-based design practices can and should be much more encompassing than these two that the Stardust Center is embarking on. These two represent unidirectional strategies that a practitioner uses in conjunction with other strategies and in the context of political and economic realities. Multidirectional strategies are necessary as well, and will only further embed this process within the culture of ADHP. Collaboration and dialogue among Pebbles Project partners and research experts as they develop their projects, for example, are invaluable forms of tacit knowledge building and action.

What I have tried to demonstrate in this paper is that in, ACSA's effort to redefine and reposition affordable housing design in practice and education, we have much to learn from fellow design communities. Adapting the strategies of the healthcare design practice can enhance and capitalize on an approach that values sustained social and health outcomes as a foundation for designing better homes for all households. The Pebbles Project is aptly named—throw a pebble into the lake and watch the ripples ensue outward—a ripple that perhaps does not stay within the healthcare design industry, but across the spectrum of design education and practice as well.

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# RSV - Residential Serra Verde: Participative Design Process and Self-Management of Low-Income Housing Construction in Belo Horizonte, Brazil — A Model for Future Government Loan Programs

Ana Paula Baltazar Dos Santos and Maria Lucia Malard

**ABSTRACT**
This paper describes the work of a team of architects, engineers, economists, sociologists, social workers, the city council and an association of homeless people, joining forces to create a pilot housing project as a model for the new loan system for housing in Brazil. The Ministry of Science and Technology of Brazil funded this applied research project with the intention to develop strategies of design, self-management, and sustainability for low-income housing. It describes the interdisciplinary approach of the research project and the participative design process developed for Residencial Serra Verde (RSV).

## 1. INTRODUCTION: THE SOLIDARITY CREDIT AS AN ALTERNATIVE HOUSING LOAN PROGRAM

In Brazil, until the 1980s, popular dwellings subsidized by the Government were built by private enterprise, totally excluding the participation of dwellers, as pointed by Lícia Valadares, Ermínia Maricato, Nabil Bonduki, Alfio Conti, and other authors.[1] This exclusion has in a way given incentive to popular movements demanding better living conditions and new forms of management in order to implement these conditions. According to Bonduki the proposed housing self-management—seen as a work of construction and management carried out by the future dwellers—appears in Brazil in the beginning of the 1980s lead by the popular movements in the fight for better living conditions. The proposals articulated by these movements were as follows:

- The creation of entities that represented the organized community, in charge of promoting and managing all stages of the housing enterprise (self-management);
- The attainment of land with the governments, at zero cost;
- Attainment of financing compatible with a household income of around a minimum wage, in order to buy construction material for a house of about 40 m2;
- The construction of houses incorporating the work force of the community, organized in the so-called mutirão (constructing bees);
- The attainment of subsidy for the execution of infrastructure; and
- The hiring of technical teams trusted by the community, to help it in the elaboration of projects, in the planning, control, and organization of the work and of the contracts with public organs.

In the beginning, one of the biggest difficulties found in this self-management idea was to legally form an autonomous co-op of the public government. This difficulty persisted until 2005, when the government, through the Ministry of Cities, created the Common-Interest Credit Program, to be operated by the Caixa Econômica Federal (Federal Economy Bank), whose objective is to "attend the housing needs of low income citizens by financing the final beneficiaries, organized in co-operatives or housing association".[2] The beneficiary families—with an income of three combined minimum wages or less—must join in an associative manner to obtain credit. Families with an income above three combined minimum wages are admitted, but no more than 20% per enterprise. The Common-interest Credit Program admits the self-building regime of the beneficiaries themselves, self-help or constructing bees, or direct management, with the hiring of professionals or firms to execute the specialized services.

This program is the result of a long and intense struggle of popular movements and can bring significant improvements in solving the qualitative and quantitative deficit of popular housing in Brazil, as long as it is carried out properly.

## 2. RSV: THE CONSTRUCTION OF A SELF-MANAGMENT MODEL

Since 1996 the School of Architecture of the Universidade Federal de Minas Gerais—EAUFMG—has developed research using advanced graphic computing resources to give support to the participation of the community in the planning and housing production for the low-income population.

Because of this accumulated experience the Financiadora de Estudos e Projetos—FINEP (technology innovation agency of the Ministry of Science and Technology)—hired with the Projects Department of EAUFMG the elaboration of a model to enable the construction of housing of social interest in the self-management regime, incorporating principles of the common-interest economy, of community participation, digital inclusion and environmental, social, and economic sustainability (through job and income creation). This model is not abstract, since it is an applied research aiming to actually build housing for 76 homeless families, as a pilot experiment of the Common-Interest Credit Program.

The project groups professors, researchers, and undergraduate and graduate students of the Universidade Federal de Minas Gerais, the Pontifícia Universidade Católica de Minas Gerais (PUCMINAS), as well as Belo Horizonte City Hall technicians and leaders of the Associação dos Sem-Casa de Belo Horizonte (Homeless Association of Belo Horizonte)—ASCA/BH. Its main goal is to link technical and scientific knowledge developed at the UFMG and PUCMINAS with the current housing policy of the Brazilian government in attention to social movements for housing and urban reform. Its main result should be 76 dwelling units with 50 m2 each and a report with recommen-

dations for further development and improvement of the Common-Interest Credit Program.

The self-management housing model resulting from the project should be reemployed in similar enterprises, in order to consolidate the self-management process and the public policies of social development, with an aim to overcome the poor social and economic conditions of a large part of the country's population.

In order to develop strategies that not only cover the design of housing, but also enable common interest economy and a certain degree of sustainability, two simultaneous research studies are of fundamental importance: first, the survey on community habits and vocation devised by the Department of Economics, and second, the strategic reuse of water and wastes, devised by the Department of Engineering. The survey is set as an interview, containing both structured and semi-structured questions, aiming to trigger in the community a discussion process regarding possible vocations for future work arrangements. These work arrangements range from women groups with handcraft and culinary skills to more professional mixed groups willing to learn and develop skills related to construction techniques or other issues indicated as result of the interviews. As for the reuse of water and wastes, the Department of Engineering has presented to the community some options and their benefits, ranging from traditional solutions of dirty water and waste disposal to combining possible reuse of water and waste showing the labor needed and the possible profit. About 98 percent of the community members seem to be willing to implement the strategies for treating and reusing water and recycling waste. The final project and costs for implementing such a system is now being studied for the final approval of the community.

It must be said that this is the first time we are able to join all discussions, critiques, and techniques developed in previous research, and also to test some as yet unexplored tactics of participation in a real situation of housing development. As far as we have already come, it has proven very successful. It has been legally approved by the city council and by the loan program, and is now in the beginning of the negotiation process of self-management. The community will now decide how to proceed with the building of its housing; whether some of its members will work as self-builders or if they will contract a third party to do it (contracting). The technical team is already working on the best structural solution to guarantee that construction can be done without any heavy instruments and with non-specialist labor. With regards to labor, any contracted labor would need some training, so it is important to give the training opportunity to those members of the community who are unemployed and willing to improve or learn new skills for further jobs, as indicated in the research of the Department of Economics. Section 3.3 describes further the concept of open design applied to the constructive system, employed to make it easier to accommodate different structural systems at the time of construction, considering the huge fluctuation of prices of ordinary building materials in Brazil.

**2.1 The characteristics of a self-management model**

The housing production process in a self-management regime has its peculiarities: the hiring of technical consultants that elaborate the projects and technically manage the work and the mixing of specialized labor with unskilled labor, recruited in the community.

A self-managing model, therefore, involves the following activities:

I. After the partnership between the government (which makes the land available) and the dwellers association for the execution of an enterprise is defined, a package of architectural and complementary projects is provided. This package is elaborated by the technical consultants with the participation of future dwellers.

II. As soon as the architectural project is concluded, the technical assistants take care of its approval and registration with the relevant authorities.

III. Once the complementary projects are concluded and coordinated, budgeting and planning actions are taken with the objective of physically and financially executing the enterprise, with the participation of the community and coordinated by the technical consultants.

**2.2 Preparation of the users to the participation in the project and construction activities**

The evaluations carried out in self-managed housing settlements reveal that the main problems of such a management model are due to the lack of participation of the community in the decisions about the project, planning, and execution of these enterprises.[3] This lack of participation is due to two basic factors. The first is excessive tutelage of the government that subsidizes the enterprise and consequently takes control of the decisions. The second factor is the lack of formal knowledge—technical and administrative—of the beneficiaries, which inhibits and even impedes their full and effective participation in the process, for they are left impotent in front of the supposedly technical arguments that are presented to them. In fact, excessive tutelage takes place exactly because poor communities have little argumentation power when faced with technical elements and find themselves in an extremely fragile political position because of the financial help they get from the government. The tutelage of the government generally gives rise to authoritarian actions, while the community's technical and political frailty results in subservience. Authoritarianism and social frailty make a circle that needs to be broken. Among the actions that can be developed to enable people to make informed decisions and encourage their participative attitudes, breaking this circle, is education. Thus, the process of project and construction of dwellings must constitute an opportunity for learning.

Another question highlighted by previous research is related to the role of independent technical assistance, hired directly by the commu-

nity association. A well-conducted technical assistance was observed to be extremely relevant for the success of a housing program managed by the community. However, the technical assistance must not manipulate the decision-making process.

The technical discourse is intimidating and seductive at the same time. It is seductive because of the mystery it holds: the technician (or specialist) is taken as a person that has the key to access all compartments that normal people do not understand. Projective drawings, for example, are too intricate for a housewife or a man who washes cars that never finished primary education. A cost table is enigmatic for both of them. In a constructing bee both are "consulted" and take part of the decisions that are suggested to them. They do not challenge these decisions because they cannot understand everything about them. They are vulnerable, therefore, to any sort of manipulation. This problem can only be minimized—and even eliminated—if the community has total access to the technical and financial information of the enterprise. To access it fully it will be necessary to know it fully. The role of the technician is to generate the possible alternatives of solution, be they technical or financial. To decide on the alternatives generated, the community needs to understand and evaluate them autonomously. This is the big question to be solved in self-managed enterprises. The evaluative studies available—including the ones we carried out—do not indicate any technical, building, sociological, political, administrative, or legal problem to which the solutions are not known and tried, be they in our or in similar contexts. On the other hand, a little-explored field is that of the interaction between the community and the enterprise, like the practical and democratic action and exercise of citizenship. A high degree of interaction between the participants of the enterprise and the free circulation of information seems to be a fundamental element for the improvement of the cooperative systems of construction, and here we include the constructing bees. The individuals involved in the creation process—architects, engineers, technicians and especially the final users—may, with the support of computers, be asked to participate in a more effective way in the work process.[5]

Thus we arrive at the idea of combining educational action with the development of new participatory processes in the work project and execution, using computer technology.

With this strategy we could enhance cooperative management procedures, enabling a better communication between the work site and the technical backing, and employing effective mechanisms to educate personnel, in which the teaching and learning activities take priority over mere training. Our hypothesis was that the situation itself—the effort of a community to make its own housing—was extremely propitious to the development of innovative actions in the systems of cooperative housing construction. Besides, the incorporation of cutting edge technologies in the computer science field could enable people in the community to move past their lack of technical knowledge and lack of experience.

We are convinced that only the incorporation of new technologies to the self-management process will make it develop technically and administratively, while remaining a participatory process. From a technical perspective the self-management construction regime is a construction like any other. It involves the same operational procedures required by other forms of construction. To generate products of good technologic, architectural, urban, and environmental quality, the constructing bee has to be organized technically and administratively like any other means of production that has these same objectives. In a constructing bee, the execution of a brick wall must obey regular procedures, whether the executor is a professional builder or not, for the wall needs to be a well-built wall. A finished house is a building like any other.

The difference between the cooperative construction system and the construction enterprise (construção empresarial) resides in the involvement of the human resources and in the type of management of these resources. In the construction enterprise (construção empresarial) the human resources are specialists, except in those activities in which unskilled labor may be used (as is the case of transporting the materials from one place in the construction to another). On the other hand, the human resources available for constructing bees are very heterogeneous and vary from case to case. And each case will be unique. However, the involvement of the people with the act of building their own houses is always intense, and that makes the qualitative difference between the cooperative systems and the systems of contracting.

According to Antônia de Pádua, president of the Estate Union for Popular Housing, the appropriation of the housing—dwelling units and collective spaces—is much more successful when community participation happens from the beginning of the design process. The sooner people get involved with the decision process the better becomes their knowledge and understanding of the limitations and possibilities of their housing. Consequently their sense of "belonging" is enriched when appropriating the space, be it during or after construction.

To participate is to decide, and to decide one needs to understand what the object of decision is. The participative design process must include the community in all stages of decision, and at the same time empower its members to understand and negotiate each one of the stages. In the case of RSV, we were able not only to create and test a participative design strategy with some community members, but also to evaluate it critically, correct the errors found, and try again in new workshops.

After this comprehensive explanation of the project we focus on the design strategies used to guarantee low cost and high value of use in housing. This takes into account that the more empowered the community is to make decisions, the better involved the community will be in the whole process, from designing to building and appropriating.

## 3. PARTICIPATIVE DESIGN STRATEGIES

The participative design strategies developed for RSV aim to include the community in all stages of the design process. The design process is developed in three steps: First, the digital inclusion of the community, which aims not only to make community members familiar with computers but also to make them familiar with the basics of architectural representation and to get involved with the design process. The main objective of this digital inclusion is to enable the community to negotiate their spaces among themselves and with the design team. Second, the participative design process of the dwelling units aims to define which features are of collective and individual decisions, and also those that are unacceptable and wished for. The main objective of this process is to define what can be taken as fixed and what can be taken as flexible in order to guarantee low cost and high value of use of all dwelling units. Third, the design of the housing itself takes into account the results of community participation in the previous stages. In the case of RSV, the housing is a vertical building fully accessible, whose units are embryos fixing those features collectively decided and leaving open to dwellers half of the floor area of each dwelling unit, so they can decide individually on their living spaces without making the housing more expensive. It must be said that these stages are not so strictly divided, they happen simultaneously, informing each other. The design team was already working on the building site and studying possible building locations simultaneously with the first workshops for digital inclusion. Nevertheless, we divided the three steps as clearly as possible for purposes of description and further research.

1. Screenshots of the form with digital keyboard with two different fonts and the animation of the digital keyboard into Qwerty keyboard

### 3.1 Digital inclusion

For the digital inclusion of the community—almost all of its members are computer illiterate and some of them completely illiterate—we have criticized and improved the digital-inclusion strategy developed in previous research by Flávia Ballerine and José dos Santos Cabral Filho.[6] We designed a set of interactive digital interfaces, using Macromedia Director, to enable community members to learn the basics of computers with content related to the housing. This educational process is not one-way, as the technical team also learns a lot from the families about their preferences, wishes, and dislikes, which informs the design process. Each of the 76 families has at least one representative taking part in the workshops for digital inclusion.

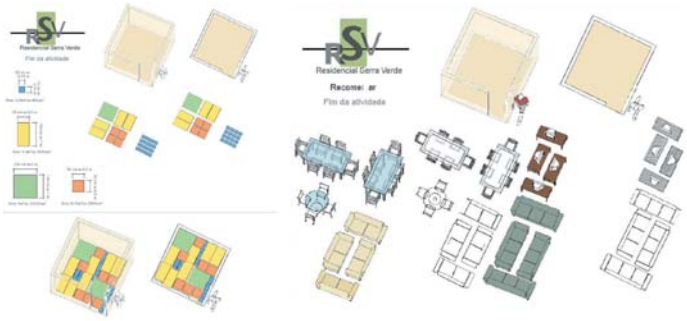
The first digital interface is designed to introduce the use of the mouse, which is a difficult task for most uneducated people. Ballerine had already indicated that one of the greatest barriers to start using the computer was the difficulty to find the letters in the keyboard, which makes people quite uneasy. This first interface is then a simple form (Image 1) with family data to be filled using only the mouse to choose the letters placed in alphabetical order in a digital keyboard. People are required to interact several times with the movement of the mouse, as they need to make the form fields active by clicking on them, and later clicking on the letters to fill in the fields. As the task—filling in the form—is quite important, as this is their official registration to start the participative process of designing and building their homes, they focus on the task, and not on the use of the mouse, which seems to facilitate the use of the mouse.

The second digital interface (Image 2) is set to give continuity to the use of the mouse and to introduce the keyboard, making people more comfortable with the computer. This is used after the animation of the letters from the digital keyboard into Qwerty keyboard, which makes them more at ease with their lack of knowledge of the position of the letters. This interface regards users' environmental preferences, and it is designed to stimulate people not only to repeat the use of the mouse—by clicking and dragging—but also to start thinking about their preferences regarding the place they will live in. Instead of providing a set of images to be chosen, the interface has fields in which users are required to write that which comes to their minds. If the word written matches the range of things we have already thought of, then a symbol of it appears, if the word is misspelled or if it is something we have not programmed, then a generic symbol appears with the word on it. In both cases users are required to drag the symbol and place it in order of their preference in one of the five squares on the bottom of the page. Though this is a very simple interface, it is effective because it not only introduces the use of the keyboard quite naturally, but it also starts a process of participation in which people are not required to choose among predefined things—rather they need to think independently and inform the technical team about their wishes.

2. Screenshots of a sequence of use of the interface of environmental preferences

At this point in the workshop we have a break from the computer, as people have already taken more than an hour with the previous interfaces to get familiar with the use of mouse and keyboard. During this break, we ask them to use a set of cardboard modules measuring 1m x 1m and build a room. We then require them to organize cardboard tiles on the floor and discuss with them notions of area and volume.

After that, they return to the computer to use the next two interfaces, which pertain to architectural representation and require of them a more precise use of the mouse (Image 3). These two interfaces are reproductions of the cardboard room they have created. The first deals with organizing tiles on the floor, so users are required to experiment with the abstraction of the concrete space they had just created to its representation. This deals with scale and notions of area in architectural representation, both plan and perspective. The second has the same room as its basis, but this time users are required to organize a furniture layout. In both cases users can operate in plan and perspective simultaneously, as everything done in one is automatically represented in the other.



3. Screenshots of the interfaces of spatial representation

The use of these interfaces, though basic, triggers a dialogical process between the community and the technical team regarding space. We learn with them what they find to be comfortable, small, unacceptable, etc. They are quite happy to manifest their critiques of the spaces they live in, or those they know and dislike, as also to tell us about things they believe to work quite well in dwelling spaces. This ranges from comments about room size to critiques of a usual solution in Brazil, which is a kitchen in line with the service area, with only one window for both. In their view this is not acceptable, because grease and food odor impregnate their laundry, which they hang from the ceiling in the service area.

At every workshop we noticed something that could be improved, such as our explanations of the tasks or the computer interfaces. The last two interfaces, which deal with spatial representation, were the ones that suffered most changes. Our main findings were that from their use we could not say whether or not people could really understand the space. We could only know that they had a notion of representation, but we were not able to tell for sure if they were merely solving a puzzle or if they were really able to have an idea of the space represented.

Since having people really involved and knowing what they are deciding on is crucial to the success of this work, we needed to find the best way we could possibly use for architectural visualization. We then decided to apply the techniques of "usability test" to check which way would be the most useful to communicate with the community the design of their housing. We redesigned the interfaces of spatial representation as a test with different kinds of architectural representation, ranging from physical to digital models, used in different ways, as we also wanted to check how the community would feel more involved discussing their own spaces.

From a series of six workshops with different groups using different approaches, we noticed that the more successful was the manipulatable three-dimensional digital model, with which people got more involved and seemed more able to visualize as an abstraction of a real space. Our observations made us speculate that perhaps people tend to see physical models and printed drawings as concrete objects, which makes it more difficult to start the abstraction process. With the digital model, due to its lack of fixed scale, people are already working with abstraction from the beginning, and this is perhaps the advantage of this kind of representation. Another point we have observed is that when given a bit of time alone to play with the model each user was able to get much more involved and bring more ideas to the discussion process.

### 3.2 Participative design of dwelling units: collective and individual decisions

The second step of the participative design process is the design of the dwelling units. Though participative design process is not new, we developed a new approach due to recurrent problems. In order to apply for a loan the design needs to be legally approved by the city council, which means that before having the final dwellers defined (approved by the loan agency) it is necessary to have the design. Another problem is that the community has in common only the lack of money, their demands are not the same, which means that more space with lower cost is welcome instead of a fixed space with predefined size and number of rooms. This, among other reasons explained below, made us rethink the ideal of individual participation. Our approach implies a workshop based on the strategy of focus group, with randomly chosen homeless persons in which several design proposals are shown and they are able to criticize and change them in real time according to the group's negotiated demands. From this we are able to define which features are of collective and individual decisions, as well as those that are unacceptable and wished for.

For this participative process our starting point was the idea of "open

design," borrowed from product design, which according to Ronen Kadushin is "based on the principles of the already successful Open Source method that revolutionized the software industry, and gave birth to a social movement that is cooperative, community-minded and seeks legitimate ways of sharing creativity." Both open source and open design are participative processes that enable different degrees of participation.[7]

According to Carole Pateman there are three types of participation: pseudo, full, and partial.[8] Pseudo-participation is the most common in architecture: users are called to participate in the design process only to legitimate the imposed proposals of architects. Pateman says that "pseudo-participation ... covers techniques used to persuade employees to accept decisions that have already been made."[9] This needs to be extinguished from architecture. On the other extreme full participation is defined as "where each individual member of a decision-making body has equal power to determine the outcome of the decisions."[10] This would be the ideal, but due to its very egalitarian definition it is not possible in architecture, as architects would be always in advantage with the power of their technical knowledge, which differentiates them from other participants. So, in architecture we can only think of partial participation, and this can be directed towards pseudo or full participation. Nevertheless, we need to bear in mind that the knowledge of architects is an instrument of power, and this can be regarded not only as a negative attribute, but as a powerful instrument in benefit of participative design; that is, it can be used to help people to understand their lived spaces and to interpret their demands, so the design of spaces can be produced as to meet people's demands without imposing ways of living.

In architecture partial participation is not new. Architects such as Lucien Kroll, Ralph Erskine, Christopher Alexander, Yona Friedman, Walter Segal, Cedric Price, and many others, have already tried it in different ways. Some of them would approach participation as a means to personalize buildings according to their users, as is the case of Kroll's La Meme, and Alexander's Nagoya and Mexicalli housings. The problem with such an approach is that the space is personalized, designed as to accommodate the demands of users in a specific time, becoming as difficult as other buildings to accommodate future changes. An attempt to solve this problem is to use modular systems, such as those developed as SAR (Stichting Architectural Research) and Open Building, working with the idea of support and in-fill, setting the fixed and the flexible parts of the building.[11] Unfortunately, this in Brazil is not easy as our building industry is not developed according to modular coordination, and our building regulations do not help. As an example, it is not possible to have a building approved by the city council and change its facade (nor even change the place of windows in the facade).

Other architects, such as Friedman, bring the user to play the role of architects. Friedman's 'Flatwriter' would enable users to design their own flats. In this case, the architect creates a sort of interface to help users decide on their spaces, but the design is still completely predefined before building and use, making it difficult to accommodate future changes due to different demands of use.[12]

In the cases above, participation is facilitated by letting the user work with the architects or replace the architects. The designs produced, even if with a certain degree of flexibility, are of finished spaces, with little or no change in the traditional design process based on representation, in which the stages of design and construction are completely separate.

The participation processes proposed by Segal and Price differ from the above. Segal developed a self-building system, which includes the user in the actual production of space, and Price proposes value-free spaces, or flexible spaces, in which users are expected to complete the spaces with their appropriation.[13]

The intention of RSV's participative process is to acknowledge the power of architects without reproducing traditional practices, without moving toward pseudo-participation. We are inspired by the idea of support and in-fill, and also by the self-building processes of Segal and the flexible spaces open to users' appropriation proposed by Price. We developed an approach to join these strategies taking into account our local building regulations and the very low budget of the Common-Interest Credit (each dwelling unit needs to be R$ 20.000,00, which is about US$ 10,000.00).

We already knew from previous research that low-income communities in Brazil modify residential spaces much more frequently than the middle classes because their houses tend to be much smaller and they have to extend or adapt them over time due to changes in their family composition.[14] Another point is that their dwelling units are small, so any change needs to be accommodated in the space, which generates refurbishment. With this in mind we started to discuss with the community a series of design proposals for the dwelling unit, ranging from 40 m2 to 50 m2, with different articulations of internal spaces. These proposals were supposed to raise discussions and inform the design team about what can be taken as collective, thus can be fixed in the design solution, and what is taken as individual and so need to be left open in the final design solution. These discussions were done in workshops with the community, sometimes with focus groups (12 to 15 people), sometimes with groups of more than 20 people. At all times we used 3D models. In the smaller groups these models were manipulated in real time by a technician using the software Sketch Up, which provided an easy and quick way for the community to criticize and change the design proposal. In the big groups the models were used to show the community the demanded changes in the design proposal so they could approve them. We also used printed drawings of plans to be modified and criticized individually, in both big and small groups, and also used a combination of strategies—3D models and 2D drawings.

The strategy adopted in the workshops with small groups was to show three different models of the dwelling units for discussion and modification (Image 4). None of these models were intended as the final design, they were only means to raise varied discussions concerning the relationship of the members of the community with their dwelling space. One of the models was a finished two bedroom dwelling unit, with all walls and rooms defined, and with very little possibility for future change, as the bathroom determined the two bedrooms and the living-room. The only possible change people could make in space was to open the kitchen to the living-room. Another dwelling unit presented was an open floor with the kitchen/service-area and bathroom defined. People were able to try and place two or three small bedrooms and the living-room, and also to change the size of the kitchen/service-area. The other alternative to the dwelling unit presented was a three bedroom with little possibility for change.

4. General views of Residencial Serra Verde

After the first discussion groups we were able to understand that the community had equal thoughts regarding the wet areas and one master bedroom. This means that they wish a big kitchen with separate ventilation from the service area, a very tiny toilet, and a master bedroom able to accommodate a double bed, a wardrobe, a drawer and two bedside tables. Most of them also wish they could have some privacy separating the bedrooms and toilet from the living space. There was no consensus regarding the number of bedrooms and the size of bedrooms and living room, nor was there consensus concerning the possibility of keeping the kitchen open as an extension of the living room or closing it. From the discussions with the community, and the changes they made, we learned enough to start working in other dwelling units for future big group discussions (Image 5). So we defined as collective not only that which Habraken calls support, but everything that seems to be consensus, including most of the in-fill (wet areas); and defined as individual the living spaces, that which should be open to each family to decide upon.

The final design of the dwelling units tried to contemplate all these, and at the same time take advantage of the fact that we have a very low budget to build the best space. The community has opted to have a 50 m2 flat even if this implies not having their flat completely finished. We are still trying to sort out a way to enable them to finish their flats according to their different demands for their living spaces. But this is not only a matter of budget, but also of building regulations, as the unit is already approved by the city council and the loan program, and any change needs to be approved again.

The participative process used in RSV borrows from Price the idea of leaving the space undefined for users' appropriation, as half of the space designed is left empty for future divisions when appropriating. The architects work not as authors or advocates of one design or idea, but as observers showing different possibilities for the community and learning from and with them how to interpret their demands. Our interest was always turned to hearing the community and learning from them as much as we could in order to empower them for discussing their demands and spaces. The workshops were always conducted by a group of architects and at least one economist and one engineer. The technical team works more as mechanical hands for the community and less as authors of a finished design. The final design of the dwelling units is a collective product.

Partial participation and open constructive system tend to take to the extreme the possibilities of accommodating different life-styles. This is what we call "open design," which aims to enable partial participation of users in the conception, building, management, and appropriation of the building; always taking into account that in order to produce mass housing we need to open the possibility of participation as much as possible without affecting building costs.

5. The rationality of RSV and the irrationality of H-shaped buildings for different structural systems

### 3.3 The final design of the housing

The third step of participative design is the design of the housing itself. The architects´ team already knew from previous research[15] some requirements of Brazilian low-income communities as far as the housing settlement is concerned. These requirements are:

I. While doing the housework, the mothers must be able to have their kids playing under their possible surveillance;

II. Bedroom windows should not face one another, to ensure pri-vacy;

III. The housing should not have unsafe areas (hidden places), that is, all places should be easily watched by dwellers;

During the workshops other requirements were put forward by future dwellers:

IV. The use of lift should not be compulsory, because of their high operational costs;

V. People should be able to access their houses without ascending more than one or two floors.

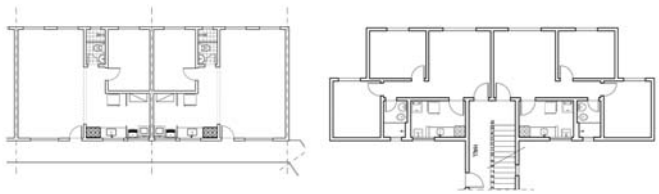

6. Pagination of both families of structural bricks without changing the design

7. Screenshots of the building-site game: the game environment and Zé Palpite taking an object out of place

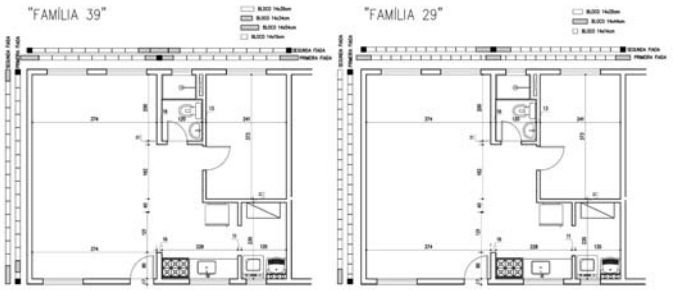
After knowing all these requirements the architects' team was able to develop a housing design and submit it for the community appraisal. First we studied the terrain, which is quite steep (Image 6), and the possibilities available for it. Then we opted to use the declivity to guarantee direct-level access for all pavements to be built. The most adequate solution to attend most of the requirements was a variable high terraced housing, forming a horseshoe, with a large collective area inside it (Image 7). The part higher up in the terrain is composed of two floors. The part lower down in the terrain is composed of five floors. It had already been determined that the housing units would be semi-detached and would have the door and one window facing an area of circulation, and the other windows would be facing the outside. The length and depth of these units, as well as the positioning and articulation of the rooms were then defined in a participative process aiming for open design.

This solution stood up under the community scrutiny; it was very well accepted and approved. A few people seemed to be worried about the circulation in front of their sitting room and would prefer a high sill window there. Nevertheless, the majority opted to have low sill windows with curtains to protect the view from people passing by.
The area of the plot is 6.367 m2. There are 76 dwelling units of 50 m2 each, more 100 m2 destined to a telecenter for the community (funded by the Ministry of Science and Technology), plus an open area (200 m2) we call "pilotis" for legal approval purposes, which will be used by the community for economical purposes (common-interest economy or rental for needed shops). There are 27 parking spaces, as most of the dwellers have no car and also the city legislation only requires one space for each group of three flats.

We have used the open design concept to inform the open structural system. That is, we designed the building to enable distinct possibilities of material and components without losing spatial quality. This is crucial in Brazil, because the prices of products in general are not stable, and so the prices of building material usually fluctuate. For example the price of cement decreased almost 50 percent last year,[16] and the price of iron is more than twice its value a couple of years ago. This makes iron structures almost impossible, as also the use of ferroconcrete. However, the use of concrete is encouraged by its low price. At the moment, the best alternative seems to be concrete structural brick walls. This example only shows that in Brazil we need to have options for the time of construction, and not define the structural option which seems to be the cheapest at the time of the design. Different motivations make the prices of material change and the design must take this fact into account. To enable such a flexible choice of materials and constructive system, the design we propose can be built for example in iron structure, ferroconcrete, or structural brick walls. When using structural brick walls, the design generally is done so as to create indentations that guarantee structural stiffness. H-shaped buildings with small indentations on each face are very common in Brazil, built with structural brick walls. When using iron structure or ferroconcrete, this H shape with indentations turns out to not be very rational, as it demands a lot more structuring than a non-indented building. In the case of RSV (Image 8), we proposed the joint of perpendicular walls as a series of T-shaped structures to avoid the need of indentation and to guarantee flexibility and quality of space, taking advantage of any structural system employed.



8. Pagination of both families of structural bricks without changing the design




9. Pagination of both families of structural bricks without changing the design

Another advantage of the design of RSV is that if built with structural brick walls it can employ bricks of both families available in the Brazilian market. This is another interesting point for research as in Belo Horizonte, and also in other Brazilian cities, brick producers usually make them 39cm x 14cm (39 family), which means that if the pagination of the walls are right we need to use a few bricks measuring 14cm and a few measuring 54cm (which is a bit heavy if the workers are first timers or women for example) in order to create the T-shaped structural system. Nevertheless, recent research[17] has already indicated that it is much easier to paginate and to build walls using smaller bricks (29 family), which are also cheaper to produce, making the final cost of the square meter even cheaper. The problem we have is that on the one hand it is easier to find and buy the 39 family, but on the other hand we should at least try and push the market to change to the 29 family. This can only be done if we have a design to fit both situations (Image 9), as is the case of RSV, so we can test both scenarios and the community can understand the advantages and disadvantages of all cases and decide what to do.

We are now preparing the complementary projects (electrical, hydraulic, and structural) to start the discussions with the community concerning the self-management of the building. The site was already donated by the city council, and the building process will start this year. As already mentioned in section 2, the design was already approved by the city council and by the loan program. However, the families are not yet all approved, and the last notice we have is that only half of them were able to fit the requirements of the Bank. This means that the homeless association needs to replace some of the members applying for this program, or to review their applications.[18] So, we cannot say precisely the demographics of the future residents, but from the 76 families we have up to now we can have an idea of the residents' profile:

- 86 percent of the heads of the families are women and only 14 percent men. According to Antônia de Pádua, president of the Estate Union for Popular Housing, this is due to women's role as mothers and their need to have more stability and fixity than men (this is particularly the case with low-income families). Their family income varies from two to three minimum wages, (the minimum wage in Brazil is R$ 350,00 month, about US$ 160).

- 19.7 percent of the families are composed of two members, 26.3 percent composed of three members, 21 percent of four members, 15.8 percent of five members, 10.5 percent of six members, and 6.6 percent have their composition varying between 7 and 10 members.

- 65 percent of the heads of the families have already lived or worked in rural areas, which characterizes their skills for rural activities such as growing fruits and vegetables, cooking fruit and vegetable conserves, and other related activities.

- The age of the head of the family varies from 22 to 77, and the age of other members ranges from newborn babies to grandmothers and grandfathers in their 80s. We can perceive a predominance of school aged children and teenagers.

- 26.3 percent of the heads of the families are single, 47.4 percent are married or have a stable union with a partner, 14.5 percent are divorced, and 11.8 percent are widows.

## 4. PREPARING FOR THE WORK: THE GAME STRATEGY

In order to increase participation of the community in the discussion of construction questions, we raised a daring hypothesis: the incorporation of cutting edge technology in the computer science field, using the seduction of a video game associated with the didactic and pedagogical approach of Paulo Freire to teach adults.

The idea of the games was a strategy to transform the teaching/learning into a sort of child's play, using electronic games with all their seductive potential. Hans George Gadamer notes that a game is not something serious for those who play it, and that is why one plays it.[19] The seriousness of the game is exactly in that it is taken seriously as a game and not as something serious. The game has its own essence, independently of the players being conscious of it. The players are not the subject of the game; but through the players it is the game itself that is represented. Hence its power of seduction and the force it has to fix learned points.

A series of games is already being developed with three games completed, and another three under way. The games will be used as soon as the community decides on the management strategy, defining who will take part in the construction process. The first game to be played is the building-site game, which is described bellow as an example of the game strategy.

### 4.1 The building-site game

The building site game deals with the organizational aspects of a building site, regardless of the type of enterprise—whether it is self-managed or contracted—but taking into account its size and technological profile. The objective of the game is to allow the discussion

of several important factors in the assembling and organization of a conventional building site, using the video game strategy to commit contents to memory and discuss them. The structuring elements of the building-site game were conceived with reference to a building-site for a popular housing enterprise of medium size in which conventional technologies are employed in the construction, in which supporting and sealing elements are made in loco.

According to the technicians that have already worked in aiding constructing bees, one of the main problems found in the organization of the building sites is to make personnel realize that there is a need to keep the building-site organized and clean. This is surely due to the fact that the conventional construction activity is in itself a generator of dust and debris, giving the impression that disorganization and dirt are inherent aspects of construction. Because of this it was decided that a basic educational message of the building-site game would be that a building-site must be well planned, furnished with all the infrastructure of support to the work, to the storage and distribution of material and tools; and it must be kept organized and clean to enable good production development.

To make the learning of these contents more effective, the game would be played first, and then discussions related to the elements of organization of the building site would be conducted. The contents would be evaluated and the eventual distortion of information would be corrected. Thus a group of the constructing bee would freely play the game and then a technician (of technical assistance) evaluates it. In the instruction about the game a small script is presented that might lead to discussions with members of the bee as an evaluative task. Even if a member of the bee does not become interested by the discussions, she will still have attained certain general concepts from the game, allowing her to understand some matters related to building sites more easily.

*4.1.1. João Expedito organizes the building site*

To fulfill the educational objective of the game, a story was created in which the characters were members of a constructing bee. João Expedito (Expedite John) is a young man who wishes to build his house and joins a bee, at the heart of a homeless association. Zé Palpite (Opinion Joe) is an idle fellow who roams around the building site trying to get in the way of João Expedito's task. The game presupposes that the player will side with João Expedito, trying to protect him from the actions of Zé Palpite.

Initially there is an introduction to the game, which aims to contextualize the story and present the characters. In this introduction João Expedito looks for the technician Teresa (Tetê) and asks her what is necessary to start the bee. Tetê explains that, among other things, it is necessary to build some provisional installations called "building site" where the houses will be located. After that, Tetê observes that the preparation of the site requires four basic places: one in for storing tools, one for material, one for an administration office, and one for a refectory. She adds that electrical installations and water/sewage installations will be necessary, as well as a rain-water drain which protect against possible flooding.

With this information the player takes on the role of João Expedito and goes to a building site were other members of the bee are, among them Zé Palpite. The tasks João Expedito has are: collecting objects that are strewn around the site and putting them in their proper places; turning on the water mains and fixing an electricity post. However, while João Expedito tries to fix the site, Zé Palpite walks around taking things out of their proper place. To every object placed correctly by João Expedito, the player gets a point and the game ends when the player scores ten points. There are ten different levels, through which each element taken by Zé Palpite corresponds to a loss of one point. At higher levels Zé Palpite removes objects more quickly.

The objects chosen to appear in the video game are those that can be easily identified by the people who have little familiarity with building processes: a post-hole digger, a sack of cement, office papers, a plate for food, and a tool box. These objects, after João Expedito stores them, reappear on the building site floor when Zé Palpite goes past in the background; in that case, João Expedito must place them back on the appropriate places so that the player can score points. The post-hole digger must be placed on the tool shed, the sack of cement on the material shed, the papers in the office, and the plate must be placed on the refectory table. João Expedito still has to turn off the water mains and fix the light in a lamppost, but he will need to hear the complaint of a member of the bee who is next to the bathroom, and take the toolbox to fix an improvised wiring.

*4.1.2. A brief technical description of the game*

The game was technically conceived to be executed in a very basic configuration and accessible in community telecenters and public schools. The minimum requirements for the computers are K6 II 300 megahertz, 8 Mb RAM, 10 Mb video card, and a multimedia kit. The game was conceived in Shockwave Flash Macromedia and may be played in a browser (Internet Explorer, Netscape and others) on-line, or it may be downloaded and played. The size of the video game is 1.2 Mb, and its download over the internet takes 5 to 6 minutes at a speed of 46 Kbps. The video game may be played without the web browser and offline, after it is downloaded, using the player standalone of Shockwave Flash Macromedia.


10. Pagination of both families of structural bricks without changing the design

The building-site game asks the player to use the mouse in the introduction and the keyboard in the development. The only element that is controlled by the player is João Expedito, with the use of keys and arrows of the keyboard, which move the character so he can perform his tasks. To move him right, the right arrow (®); to move him left, the left arrow (); to make him jump, the arrow up ().

The original game font allows changes in the following visual components without altering the ActionScript programming (and adapting them easily to the type of bee in which it is applied): the types of objects and their position, exchange of scenery (backgrounds and provisional constructions).

In the several tests we carried out, some bugs were identified. Sometimes, in the development of the game, the character of João Expedito manages to simultaneously carry the sack of cement and the post hole digger (which does not happen all the time) and depending on the computer processor used (if faster or slower) the character may float (which made the game easier) and slow down the Zé Palpite passing by on the background. None of these bugs, however, interferes with the development of the game. A faster processor allows Zé Palpite to pass by more times, because it is a random function that activates his passing (Image 10).

*4.1.3. Step by step on how to win*

The game file comes with step-by-step instructions to allow the instructors to be familiar with the rules and the best sequences for the player to score points and, consequently, the scoring of ten points that are required to complete the building-site organization. On scoring the tenth point the player is saluted and given incentive to play again in order to improve his or her time. The objective is for each player, in competing to improve his or her performance, gets the message (the point the game is trying to teach).

**4.2. Suggestions of discussion after the game**

The conception of the games took into consideration the possibility of errors in the representation of the reality in which the actions take place. Thus, before we started the storyboard of the games about the processes of construction, we were already conscious that we would make mistakes of representation to get our message across. The following were anticipated:

Generalization—It was necessary to set criteria for generalizing images, techniques, and procedures with the intention of holding the players' attention and keeping actions fast paced.
Selection—It was necessary to set criteria for selecting game information, giving priority to the sequences that could be learned coherently and with technical correction.

Distortion—The distortion of images and information should not interfere with the conveying of information. They were studied and designed in relation to their expressive capacity.

To complete the learning process we suggest a discussion script with the players right after the game is played. We suggest that the following questions be raised:

I. Explain the fact that João Expedito is a fictional character who can carry out many simultaneous activities in the game and can also do somersaults and float. In reality it is only possible to develop one activity at a time in a building site, because ordinary people are not capable of doing those pirouettes.

II.Note that men are more commonly present in most building sites (and that is why the characters are both male), but that women take active part in the self-managed processes, and that they lay bricks, work in the hydraulic installations, and perform other tasks usually performed by men.

III. Note that the characters do not wear helmets, but that helmets are indispensable in a real building site. In the games, only Tetê wears a helmet because she only appears in the introduction, outside the fictional action.
IV. Note that there are empty places between the provisional constructions, indicating the space for the construction of houses.

V. Note that rainwater drains are not present, but that these are important to avoid flooding, as recommended by Tetê.

VI. Note that the animations only show essential aspects of each step, and explain in detail what was omitted and what might be interesting for the bee in question.

At last the complementary script can be elaborated from the necessary errors of the game, inferring the idiosyncratic characteristics of each place and community.

**5. CONCLUSION**

So far we can conclude that community participation should start from the beginning of the design process: the more they understand, the more they get involved, the more successful is the next step of participation. It is a cumulative process. As for the best means of visualization and negotiation of space, 3D digital models have been the best instruments so far. People's ability to abstract is much more encouraged with manipulatable 3D digital models than with other media tested such as drawings, physical models, and 3D still images of digital models. With regard to the negotiation process, the 3D manipulatable digital model enables people to quickly change and propose new ideas for their spaces. This facilitates their involvement and consequently also their ability to discuss their opinions concerning the space with others. The discussion process becomes less a matter of speech and leadership, and more a matter of action (people acting on the representation of space).

With regards to the participative process, our approach shows that

instead of personalizing each dwelling unit to the taste of the dweller, bringing the user to the place of the architect, we can work with even more constraints and reach a great degree of satisfaction. This process has proven to enable the design team to learn from the group which features of space are collectively acknowledged by all as necessary, and which features should be regarded as of individual decision, and so appropriated in different ways, even though the dwelling units are the same and cost the same. This will certainly improve value of use.
In unstable economical circumstances, as that of Brazil and other similar countries, designs need to be open not only in terms of use, but also open to different structural systems and materials, while also guaranteeing spatial quality, flexibility and low cost. This can only be done if the design takes advantage of the most usual systems. To achieve low cost and high value of use in housing, all these steps described above should be regarded. However, these steps are not guarantee of low cost and high value. The careful work and enthusiasm of the design team and the involvement of the community members in the design process, from the beginning, are essential for the success of the whole process, including, we believe, the self-management of the housing construction. We can only hope that the self-management will work well after the degree of involvement of the community with the design from the beginning of the participative process.

We also propose the open design as an open source to be freely distributed, used, and adapted by any other low-income development with no cost. Everything we design has no copyright and can be freely appropriated by anyone, from the interfaces for digital inclusion, to the design of the dwelling units, to the training games. This should encourage other similar low-income housing enterprises to take advantage of our pilot research project.

## BIO

Maria Lucia Malard is Professor at the School of Architecture of Federal University of Minas Gerais, Brazil. She is a qualified architect and obtained her Doctorate at the University of Sheffield, UK. Her research has been mainly concerned with the design process and housing design. She has several publications and has held research grants from the Conselho Nacional de Pesquisa (CNPq) and the Financiadora de Estudos e Projetos (FINEP). She has supervised over 20 research students and 60 undergraduate students. She has practised architecture in both the private and public sectors in Brazil.

Ana Paula Baltazar dos Santos is a qualified architect, MArch, and PhD candidate at the Bartlett School of Architecture, University College London. She is currently working as a researcher at the School of Architecture at the Federal University of Minas Gerais, Brazil, developing digital interactive interfaces and immersive environments for participative design processes. She also lectures at the Catholic University in a graduate program of Architecture of Interiors, focusing on design strategies toward user's participation. She has several articles published and has been awarded three research prizes and two design prizes.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## ENDNOTES

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# Employing Architectural Flexibility to Achieve Affordability in Housing

Avi Friedman

**ABSTRACT**
Homes can be designed and marketed to provide homebuyers with choice as to the amount of space purchased and the contents of their home. This choice will enable families with modest means to have a better fit between their dwelling, household composition, lifestyle, and resources. In addition, rather than buying a fully finished unit, their home's flexible design should enable them to house themselves progressively as means become available.

The Next Home, designed based on these strategies, was constructed at McGill University as a demonstration and later adopted by private sector builders. It responded to the fundamental demographic and economic changes that have heightened the need for a new housing paradigm that uses flexibility as a means of reaching affordability. Prospective buyers can purchase one, two or all three of the floors in a three-story structure. It can become a single-family home, a duplex, or a triplex for a cost of $37,000 ($50,000 CAN) per 750 sq. ft. floor area (including land) in Montreal, which is 50 percent of median price per square foot of a new home. Buyers can also choose from a catalogue of interior components to further tailor the design to their budget. Fundamentally, the evolutionary nature of the Next Home—the notion that housing can be designed to evolve not only in configuration and appearance, but also in use—responds to an explicit need to accommodate a wide variety of users with a different range of affordability constraints.

This paper explains the rationale for such an approach, the historic evolution of flexibility in North American housing, the design principles of the Next Home and the application of the concept in the marketplace.

## A NEED FOR A NEW PARADIGM

The Next Home demonstration project was constructed in 1996 by the Affordable Homes Program of Montreal's McGill University as a direct response to contemporary North American households with their diversity of interior design needs and affordability constraints (Figure 1). The principal strategy employed by the author was to offer flexible open spaces in a multi-family 3-story building where users can select only the components that they need and can afford from a catalogue prepared by the builder. The project extends the research undertaken by the author since 1990 on the Grow Home project: an affordable, narrow-front, rowhouse prototype of which over 10,000 units were subsequently built in Canada.[1] A primary consideration in the approach of these prototypes is the economic and demographic changes that have rendered many notions inherent in the traditional design and marketing of housing obsolete.

The evolution in the global economy in the last two decades has taken its toll both on world markets and on the lives of individual citizens.

1. Pagination of both families of structural bricks without changing the design

Government deficit reduction has led to cutbacks in social services and jobs; international trade agreements have created new sectors of employment in some countries and eradicated many jobs in others; and the restructuring of many traditional arenas of commerce has resulted in unemployment for many who thought they were in secure positions.[2] For many, the very style, location, and definition of "work" has changed so dramatically that punching a clock or collecting a biweekly paycheque has become an archaic ritual.

In parallel, old home ownership models are weakening, including the traditional mortgage system which requires the borrower to possess a long-term job – a basic security which many people no longer have. Rising costs for land and urban infrastructure justify the building of houses on smaller plots of land in denser communities, while financial insecurity on the part of the homeowners validates a need to purchase an affordable and compact housing unit and consider other paradigms for housing design and marketing.

For many first time buyers, affordability is a major – if not the only – impediment to homeownership, since the relative cost of housing has doubled in recent decades.[3] In a situation where housing prices rise much more steeply than household earnings, purchasing a compact amount of space at a relatively low cost is a means of coping with the housing affordability crisis.[4]

Under strained conditions—both global and personal—potential homeowners are finding that committing a smaller portion of their earnings to housing is a distinctly desirable, if not unavoidable, option. Therefore, buying unpartitioned and unfinished space, with the intention to upgrade and expand at a later date when finances permit, is another affordability strategy that was used in the past and is currently considered by wary homeowners. A parallel, increasingly popular trend has been the opening of home renovation "supermarkets," where homeowners are able to select from a wide range of tools and products that are easy to use and install. It enables them to

renovate and expand their homes: a trend that directly complements the idea of user involvement in their unit design.

The new economic landscape has similarly led to dramatic demographic responses. Significantly, while the number of families and households in Canada (and similarly in the U.S.) is increasing, the size of these domestic arrangements is decreasing.[5, 6] The effect of these demographics is found in the need for homes that are designed flexibly to reflect the changing nature of a diverse range of occupant groups. At the same time, baby boomers are continuing to have the largest impact on the age structure of the population. Inevitably, fewer numbers of young people will be "supporting" a greater number of older people, a prospect which creates incentives for the elderly to take active measures to safeguard against a precarious future of insufficient or nonexistent government pensions and shortages of suitable institutional care housing.

Furthermore, another household type which has gained in numbers over the years is the household composed of one person. In previous years young, single people were not considered potential homebuyers. Nowadays, there are not only many young male and female singles who purchase homes on their own before marriage, but many who buy homes without the specific intention of marrying.[7, 8] Homebuilders who neglect to market their products to single people (households made of one person) are sacrificing a considerable portion of first-time buyers, as are architects and planners who fail to design housing units and communities with single homebuyer in mind. Flexible design strategies, whereby both traditional and non-traditional households may reside in the very same structure need, therefore, to be considered.

These socio-economic phenomena were the catalysts for the author's quest for a new housing paradigm, one that will foster a better fit between homebuyers and their chosen accommodation. The thrust of the approach was to regard the buying procedure as a process of selection from a menu. The author recognized that this choice and flexibility must be reflected in all aspects of housing design and marketing. It has to be factored into the composition of varied households within a single structure, the component choices available, and the ease of making future modifications based on the occupant's space needs.

This approach stands in stark contrast to current marketing practices of homes, whereby only a small number of options, primarily in interior layouts and finishes, are offered to buyers. Having a variety of single- or multi-family prototypeswithin the same development , enabling buyers to purchase the amount of space that they need and can afford, and permitting them to actively take part in the interior design of their home (e.g. choose kitchen types, locate partitions—) is not common in today's housing market. The Next Home intended to demonstrate that a flexible approach to the design, construction, and marketing of dwellings can contribute to lowering the financial burden that buyers assume at the outset, thus making housing more affordable.

Design for flexibility and for the evolving needs of occupants in dwellings has been attempted before. The return of millions of veterans in North America and the ensuing baby boom of the 1940s and 1950s, coupled with the stagnant state of the housing industry as an aftereffect of the Depression years, created a housing crisis of great magnitude. This crisis stimulated research into innovative design and building technology and resulted in the development of strategies appropriate to small, affordable, and adaptable homes.[9] Prosperity in later years enabled buyers to afford larger homes, and the lack of a continuing pursuit of new technologies and forward-looking design ideas led to the abandonment of flexible building strategies.

Examining and reflecting upon various initiatives, ideas, and projects developed in North America were valuable steps in enabling the author to learn from past successes and errors and introduce strategies relevant to the current housing conditions.

**FLEXIBILITY IN POST-WORLD WAR II NORTH AMERICAN HOUSING**

With the return of Second World War veterans, households that had placed their aspirations on hold during wartime frugality began to search for housing with revitalized optimism and purpose. Homes, however, were nowhere to be found, as demand vastly outweighed supply. The magnitude of this shortage was further exacerbated by the 1946-to-1960 baby boom which played a key role in dictating the market housing type. There was also a severe shortage of supplies and materials for construction, initially brought about by the economic stagnation of the Depression and further aggravated by wartime shortages of skilled labour. A second factor was the predicament of excessive overcrowding and the enforced communal living of family and non-family groups. By 1945, many homes situated in large cities were deemed severely substandard and in critical need of exterior and interior repair. Basic amenities such as communal flush toilets and bathing facilities were significantly deficient.

In that same year, numerous government departments were established in North America as vehicles to alleviate this housing shortage. Radical transformations of the housing industry were undertaken as various levels of government launched economic proposals to quicken the pace of development. Not only did these departments help finance new developments, they also established limits on the price and size of subsidized homes. Furthermore, these limits resulted in conformity to a conservative prototype. Paradoxically, these confining constraints had an implicit effect on design strategies. They compelled architects and builders to experiment with and investigate innovative cost-reduction strategies as well as to attempt to respond to the needs of the occupants with maximum efficiency while building to lower size standards. Essentially, stringent government regulations provided a foundation of affordability that established flexibility and adaptability as a criterion in the efficient planning of these homes.[10]

During the postwar euphoria, both consumer demand and expectations were substantial, borne of rejuvenated optimism. The public consensus placed high hopes on incorporating the latest in technology, planning, building, and labour-saving devices as critical elements of the design program. As a direct result of both the price and design restrictions, architects were obliged to re-orient their practices away from the traditional, ornate dream houses that had preceded the the Second World War, and to satisfy the high demand and flagrant optimism of a new order. This impact was translated into functional, practical, economical, and adaptable solutions appropriate to the dynamic needs of a family home.[11]

**Unpartitioned Spaces**

Several strategies were employed to provide functional houses without compromising livability. These strategies called for a reorganization of traditional house planning and embodied adaptability as a means to accommodate the present and future demands of the inhabitants. The living room was expanded to increase its flexibility as an all-purpose space. While maintaining its traditional functions, the living room acquired the diverse functions of the study, dining room, parlour and play room. The kitchen was no longer relegated to the rear of the house but was integrated into this multi-functional living area. In form, it was transformed into a pragmatic U-shaped work space equipped with practical appliances and gadgets. A low counter was the only division between the kitchen and living area, transforming the kitchen from its traditional service purpose into a practical, adaptable, and efficient utility space that not only accommodated culinary services but enabled clear supervision of children playing and facilitated the serving of meals by being adjacent to the dining area.[12]

The scarcity of interior space and the dynamic needs of the family resulted in the reduction of such fixed features as walls that would instill rigidity in the plan and counteract the notion of adaptability these homes embodied. The objective of maximizing the potential range of uses within restricted interior space was accomplished by presenting an open floor plan which allowed the occupants to define the space according to their specific requirements as opposed to the designer dictating the definition of the space. Rooms could be easily transformed as required with the implementation of innovative features such as sliding walls and moveable partitions, which allowed privacy levels to be modified and rooms to be created or merged at the discretion of the residents[13] (Figure 2).

**Space-Making Devices**

The prime challenge in incorporating diverse functions in a small area was to design with a conscious effort to maintain an ambience of spaciousness and detract from the impression of a small house. An emphasis on relating the house to its immediate surroundings was one such strategy commonly employed to instill the illusion of greater living expanses. Large plate glass windows and patio doors dissolved the confining impression of conventional walls and instead extended


2. In 1950, the architect Haydn Philips designed a flexible plan intended to adapt to changing needs over time. Instead of fixed partitions, modular closets and folding partition walls are provided which can be arranged according to the particular needs of the users. (Architectural Forum, 1950)

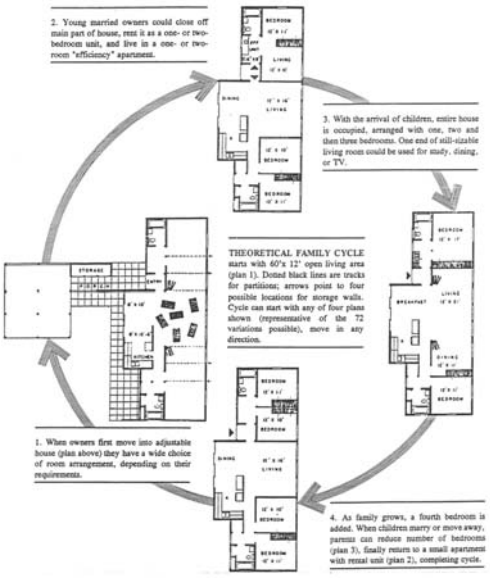
the perceived limits of the internal rooms into the exterior. Another strategy involved using drapery, accordion walls or ceiling-high moveable storage shelves as partitions. Consequently, the finite limits of the rooms were blurred, which cultivated an enhanced milieu of larger internal rooms. However, the development of outdoor living at this time was also the result of the quest for efficiency. The use of well-designed outdoor rooms not only expanded the dimensions of the home, but they were also not subjected to the constraints of government size regulations.[14]

**Adapting Through Expansion**

In order to avoid the high cost of relocating, many families began to examine lower-cost alternatives. In the interest of responding to these requirements, designers developed strategies both to allow for expansion within the original house and to facilitate easy addition. Design for adaptability and expansion represented a considerable departure from the pre-conceived floor plans of traditional design and emerged as an innovative strategy to increase the suitability of a small home to the dynamic of the family by explicitly recognizing the potential for individuals to design and alter the living environment to cater to their evolving needs.[15]

Two types of homes were built across North America during the period: wartime houses and small-lot housing. The wartime house was built during a period when land was cheap and plentiful, and therefore each unit was granted ample outdoor living space. Owners could add extra rooms in the rear of the dwelling without compromising their private outdoor space. Small-lot housing did not share this same adaptability of horizontal expansion; apart from vertical growth, there were very few options in expanding these homes. Furthermore, the

square plan of the wartime home provided far more adaptability in the incorporation of additional rooms
(Figure 3).




3. The focus of the Flexabilt Home in San Antonio, Texas, by Frank Robertson in 1952 was on adding or subtracting rooms within the fixed perimeter of the original house. The single-family house allowed 72 variations on one floor plan, using moveable closets and retractable walls which ran from floor to ceiling and which could be arranged by residents without carpentry. (House and Home, 1952)

The interior layout of the wartime house was modified primarily to accommodate the need for more storage. The kitchen was the area where most renovations were made or desired, followed by the children's bedrooms. The coal shed in the rear was one of the most versatile areas in the wartime house in meeting the changing spatial needs of the household; it was generally adapted for use as additional living space. Storage problems were resolved by employing unused spaces in the home such as the hollow area beneath a staircase.[16]

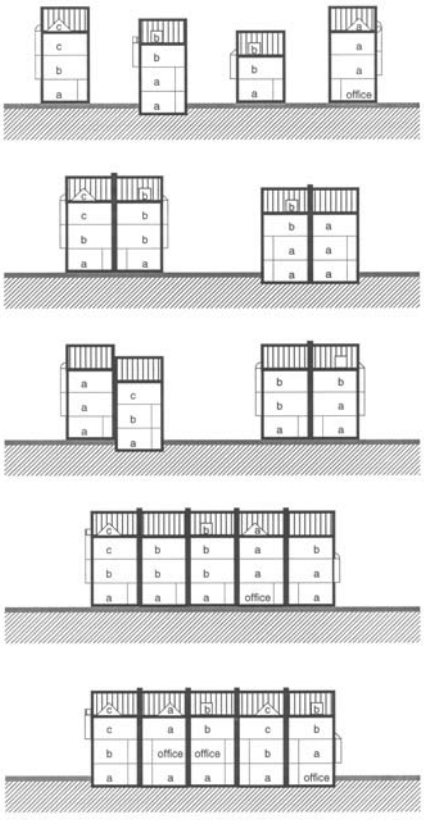
As North America moved away from the immediate postwar era into the prosperous 1950s and 1960s, the need for adaptable and expandable housing strategies subsided. Buyers had the means to afford larger homes, and builders were eager to build them. Gradually, the expansion of lot sizes and housing standards eliminated the need to efficiently utilize small spaces. The building industry fell into a traditional conservative pattern, where a limited acceptable number of house types was the norm and innovative ideas such as adaptability were regarded as unnecessary frills.

In the Next Home research and design, the author reviewed principles and lessons learned in the postwar era and applied them to current practice. A description of the Next Home design process follows.

## THE NEXT HOME—FLEXIBILITY AND COST REDUCTION

One of the fundamental distinguishing features of the Next Home was the option extended to prospective buyers of purchasing the type and "quantity" of house they presently need and can afford. The feasibility of this option was attained by designing a three-story structure which can be built, sold and inhabited as a single-family house, duplex or a triplex at a construction cost of $26 per square foot ($380 CAN per square meter). The interior of the units can also be configured according to the wishes of the occupants. Some, as noted in figure 4, may choose to have a home office as part of their unit.

The dimensions of the Next Home have been chosen by adhering to modular sizes and by balancing the advantages and critical limitations of various unit widths. In order to reduce waste of materials, the framing dimensions were subsequently adjusted to a 2-foot (610mm) module to enable sub-floor material which has been cut to be used elsewhere in the frame. A 20-foot (6.1 meter) width produces spaces of comfortable dimensions and compatibility with municipal regulations while liberating the interior of load-bearing partitions. With diligent planning and material selection the same principle was implemented to accommodate interior finishes such as drywall and floor tiles. Furthermore, cost savings were achieved not only through




4. Subdivision and volume options (letters indicate households).

efficient use of materials but also through reduced labor requirements as a result of less on-site cutting and fitting.[17] The flexible choice of interior components, combined with the efficient design, reduce the cost of each 750 square feet (75 square meters) floor to an average of $37,000 ($50,000 CAN), (including serviced land at a cost of $7.50 per square foot ($108 CAN per square meter), in Montreal (Figure 4).

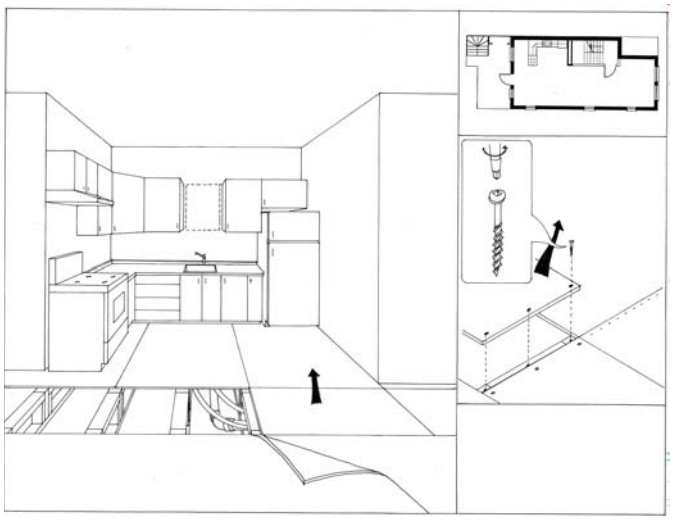
The Next Home was designed to be subdivided and rearranged in both the pre- and post-occupancy stages to accommodate change from one housing type to another with minimal inconvenience and cost. In order to facilitate future transformation of the dwelling units and to maximize the impression of open space, the stairs were placed along the side longitudinal wall in the middle of the unit and adjacent to the front entrance. By positioning the stairs lengthwise against the side wall the available floor space was more efficiently increased (Figure 5).


5. Demonstration unit plans. The stairs were placed along the side wall, leaving the floor space open.

Another characteristic of the dynamic and flexible design was the confining of mechanical systems to a vertical shaft and horizontal chaser. The vertical shaft enclosed the water supply, drainage, venting (including heat recovery ventilator, HRV), as well as electrical, telephone, and cable. The horizontal chaser was installed to run the length of each floor and facilitated future relocation of rooms. Such an arrangement of chasers permits access to the building systems through the floor – not the ceiling or the walls – thus facilitating all changes without disrupting the neighbouring units. Consequently, regardless of the initial configuration of a Next Home design, the household and its evolving nature are accommodated with minimal renovation work and expense (Figure 6).

**Components à La Carte**

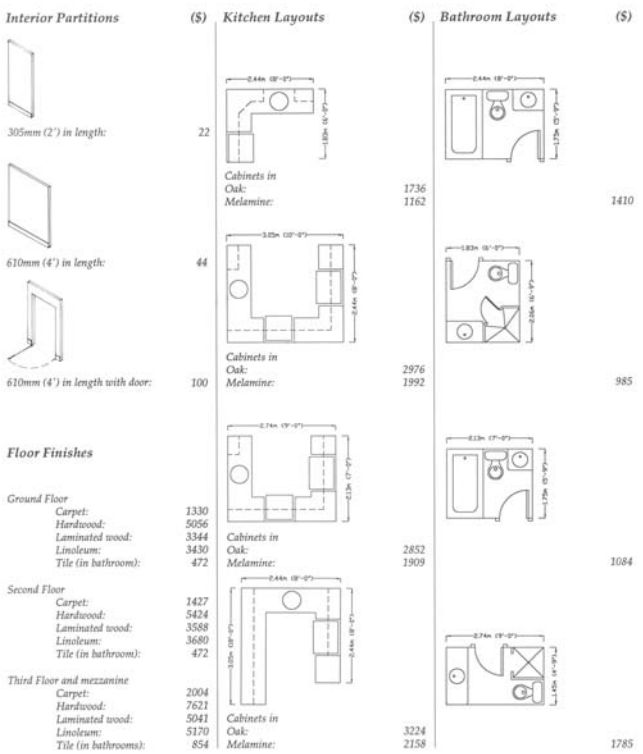
In the interest of responding to today's diverse population and, life-



6. Post-occupancy modifications are facilitated by flexible floor joists.

styles and the economic capabilities of buyers, the Next Home included a menu of pre-occupancy choices. Prospective occupants choose from a catalogue of interior components designed by an architect, determined and made available by the builder (Figure 7). User choice enables occupants to "consume" only the type and quantity of features they currently require or can afford. These options also include a range of components to assist physically challenged occupants to live independently.

Despite the large number of potential lifestyles that the Next Home aims to accommodate, current trends indicate that the average time spent by an adult on productive activities is 7.8 hours per day, compared with 5.7 hours spent on free time.[18] Such reduced leisure time is acknowledged and applied directly to the variety of configurations of Next Home units. For example, the pre-occupancy flexibility and the capacity for post-occupancy modification of the Next Home have inspired the design of a variety of kitchen layouts to suit a wide range of household configurations. These kitchen arrangements cater to desires for increased work surfaces, space economy, and the inclusion of washer, dryer, and recycling facilities within this area.[19] Moreover, due to the prefabricated nature of kitchen cabinetry, builders can offer a




4. Subdivision and volume options (letters indicate households).

wide selection of layouts without significantly increasing the administrative costs that are incurred by allowing these choices.

Similarly, bathroom choices also vary according to the occupants and their individual needs. Living in a small home does not mean being restricted to a single bathroom: if the number of occupants and their schedules justify a second bathroom, one can be included. Consequently, the bathroom options offered by the Next Home builders will range in size from powder rooms to complete bathrooms with shower, bath, toilet, and sink.

An analysis of the layouts of the three units of the Next Home demonstration house, which was displayed on the McGill University campus, illustrates the manner in which various pre-occupancy selections of interior components formed three highly personalized, versatile living spaces. Household scenarios have been created for the three units in order to account for choices made at the pre-occupancy design stage of each unit and to illustrate the potential inherent to such flexibility (Figure 5).

**Flexibility of Building Exterior**

Façades of housing developments with identical units are often repeated for reasons of economy. Using the same size of window openings and the same style of windows gets a builder a volume discount from his framing team and manufacturer. The effect of such a streetscape, primarily one with rowhousing, is frequently unpleasant and sterile. In conversation with builders, the author has found that when a carpenter is alerted in advance (i.e. prior to the construction of the frame), he generally does not mind alterations in façade openings as long as the variations are not radically different from one another. With regard to the opening sizes and to the windows themselves, small numbers can be selected and alternated within the composition.

The principles underlying the design of the Next Home façades are the same as those governing the design of the structure and plan: flexibility, individual identity, and affordability. The three basic formal strategies for the location and treatment of windows (the essential component in the articulation of residential façades) aresystematic repetition, random order, and composition. Systematic repetition accommodates the concept of flexibility by allowing the application of a universal standard of window placement that could accommodate any function, but such a strategy eliminates the potential for personal expression and must therefore be considered unsuitable. The second option, random placement of windows based on user preferences and plan consideration, accommodates a high degree of individual identity but runs the risk of undermining the reading of a single module as a unified whole. The result of absolute random placement of windows would be visual chaos. Some vertical emphasis is required to carry the eye upward and indicate the importance of a single unit over the row. The second strategy has therefore been applied to the Next Home façade in combination with the third strategy—composition—to obtain a balance between flexibility and unit identity. While compositional concerns impose some measure of constraint on the sizing and placement of windows, they impart a sense of stability and recognizability to the façade. The element of personalization in the placement and the specific sizing of windows reduces flexibility in the long term, in the sense that interior modifications could also lead to changes in the façade. While this aspect may be considered as an obstacle to flexibility, the appropriate choice of façade materials (such as stucco) makes such façade changes relatively easy.

**A New Urban Perspective**

The 20-foot by 40-foot (6.1 meter by 12.2 meter) module also allows for flexibility with regard to a variety of building configurations. The Next Home provides planners and builders with the ability to incorporate three housing types within a single community in order to respond to a diverse range of values, incomes, and households. The increased density which results from building in rows contributes to a livelier public realm and a more structured streetscape, amplifying the viability of commercial and office uses of the ground-floor units as well as animated semi-public and public open spaces.[20]

One of the most common drawbacks of rowhouse communities is the homogeneous, repetitive nature of the development, a by-product of economies of scale. Consequently, an essential feature of such a

community is the necessity to avoid monotony and instead provide a diversity of appearances through the buyer's participation, in conjunction with the builder. This concept requires a thoughtfully developed design code angled toward the larger urban scale of the street rather than just the individual module. The value of diversity within the boundaries of an established code is twofold: it satisfies the individual user's personal requirement for identity and self-expression, while counteracting any potential feeling of anonymity resulting from increased density.

The notion of flexibility is further extended to the character of the development by introducing neighborhoods of mixed activities. The segregation of uses common to most postwar suburbs (i.e., housing separated from commercial zones) no longer serves the current needs of city dwellers nor contributes to an integrated urban fabric.[21] New communications technologies that have facilitated the growth of home offices and the desire of most people to shop within walking distance of their residences are strong incentives for mixed-use design. The Next Home concept aims to revive such traditional development models while updating them to comply with contemporary and future needs[22] (Figure 8).

8. A Next Home development including variations of a typical module as detached, semi-detached, and row-housing units

## APPLICATION OF THE NEXT HOME CONCEPT

The Next Home concept was implemented in the design and construction of several communities in the greater Montreal area. The builders' main objective, although different in each site, was to take advantage of the flexibility that the design offers both in the unit and the urban levels. Attracting a variety of households with a range of socio-economic backgrounds was meant to expand the builders' profit opportunities. In collaboration with the author the builders adopted the principles of the demonstration unit to their site as per their specific marketing needs. Affordability through flexibility remained a key factor in all the built projects. The units were sold at an average cost of $48,000 ($65,000 CAN) per 800 sq. ft. of floor area, a price equivalent to 50 percent of the median price in the Montreal area. The sites were all infill and the projects benefited from existing infrastructure and access to civic amenities. Descriptions of three of the projects' main features follow.

### Le Faubourg du Cerf

Le Faubourg du Cerf is a 130-unit project in Longueuil, a suburban town near Montreal. In 1998, the builder, Cleary Construction, sold each floor for $44,000 ($59,900 CAN) in a relatively affluent area of town. The structures faced a communal green space and were built without a basement. The outdoor parking was designed for a ratio of one parking space per unit.

Units of two dimensions were designed in the three-story structure and mezzanine: 20 feet by 37 feet (6.15 meters by 11.6 meters) and 25 feet by 43 feet (7.7 meters by 13.2 meters). It led to the creation of a floor plate with an average footprint of 800 square feet (80 square meters). The developer offered the option to purchase one, two, or all three floors, as was proposed in the original concept. He subsequently commented in a conversation with the author that buyers like the flexibility offered to them, which became a significant draw for clients with smaller means. This was demonstrated by the large number of single-story units sold compared to two- or three-story units, which enabled many young households to become homeowners.

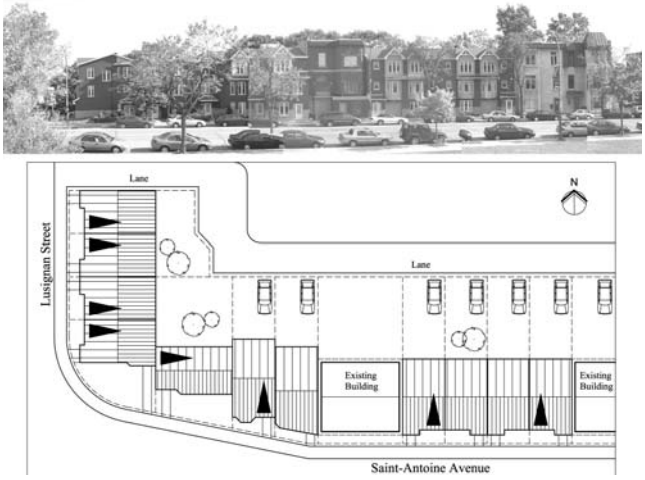
As part of the marketing process, the developer constructed a temporary sales office near the site. In it was a display of drawn floor plans and scale models of possible interior layout options. In addition to pre-conceived designs, the developer permitted buyers who were interested to participate in the design of their chosen floor. His firm's technicians assisted these clients for a modest administrative fee. The offered unit and those designed by the occupants demonstrate a wide variation of interior arrangements. Some of the units have one bedroom and others two. There is also a variety in the interior components (e.g. kitchens, bathrooms) chosen by the occupants and the placement of these components on the floor. The choices made and their location was an outcome of the household's demographic composition, lifestyle and affordability level.

### Le Carre Saint-Antoine and Le Faubourg Saint-Michel

The next two projects were constructed between 1998 and 2000 by the same builder, Anobid Construction, a small firm based in Montreal. They were infill urban projects aimed primarily at attracting those who wished to live in proximity to work and enjoy the amenities of urban living. The developer worked closely with the author, and his approach to the marketing and the design of the units was highly flexible. He referred to the sales process as a "one on one" relationship. Mr. Di Bona, the developer, sat with each homebuyer for several hours. He also maintained that buyers do not mind paying an extra modest administrative cost as long as they are given choices and attention is paid to their special needs. It increases the occupant's overall satisfaction with the project, he commented.

In these two projects the firm's marketing material read like a restaurant menu, with a wide variety of choices, ranging from fireplaces to kitchens and bathroom layouts. The floor arrangement of the 11 structures in the Sainte-Antoine project is an outstanding example of the Next Home principles. Each "slice" of the row was subdivided differently. Single-family units on its three floors were constructed next to a two-family structure and a three-family building. In one of the two-family buildings, a homeowner rented one of two purchased floors to a student. Parking for some of the units is outdoors at the rear, and for others it is indoors on the ground floor. The developer also offered a choice of balcony at the rear yet maintained a fairly consistent front façade (Figure 9).

The Saint-Michel project consisted of 11 structures that were ulti-



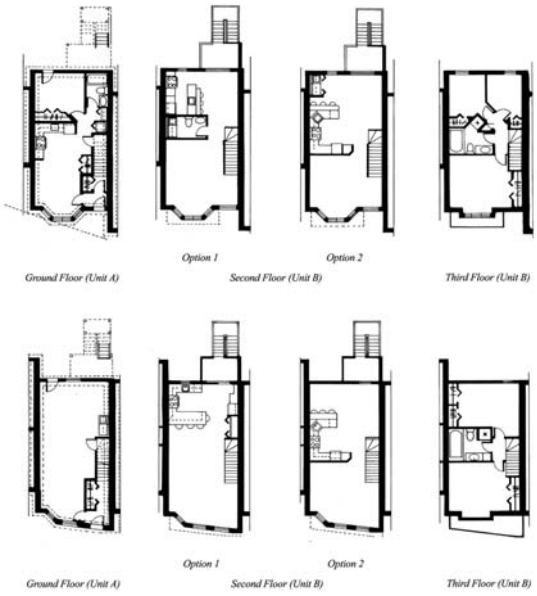

9. Façade of the Le Carré Saint-Antoine project.

mately divided into 25 units of different interior configurations. The width of the structure is 20 feet (2.1 meters) and the length is 40 feet (12 meters). Here, homebuyers had two choices . They could select the number of floors they wished to buy and interior components in them (Figure 10).

As was conceived originally, the clientele was very diverse, and since the houses were constructed only when sold, the buyers were able to adapt them to their space needs, lifestyles, and budgets. The one- or two-story units were sold for between $45,000 and $95,000 ($60,000 and $130,000 CAN), while the cost of the complete building, including a garage on the ground floor, was around $105,000 ($145,000 CAN).

The open plan and flexible space also permitted the developers to respond to specific housing demands. For example, in one of the buildings, the owners of the third floor and the ground floor shared the area of the middle floor.

**Cost Reduction Strategies and their Effects**




10. Plan options in the Le Faubourg Saint-Michel project.

Several strategies contributed to cost reduction. They each led to saving of the overall cost and their calculation is based on a study that was concluded in 1996 as part of the design of the demonstration home. The average construction cost of a typical wood-frame dwelling at the time was $75 per sq. ft. ($800 per sq. m.) (including land and infrastructure). The cost of the Next Home was found to be $36 per sq. ft. ($390 per sq. m.) The difference in cost is a result of the following strategies:

- Simplicity of envelope design and roof contributed to reduction of approximately 10 percent.

- Offering a "loft-style" open space where buyers were able to select items from a catalogue, which eliminated cost of key internal partitions and unnecessary components, reducing the cost by 20 percent.

- Offering modest finishes and allowing the buyers to complete their homes when means became available contributed to reduction of cost compared to a typical home, by 20 percent.

- The narrow width of the unit led to savings in land and infrastructure (that amounted to 30 percent) compared to a single family home on a typical lot.

- The design's multistory typology led to savings of land per unit and avoidance of foundation construction per dwelling, which amounted to 20 percent savings compared to a typical single family home. It is important, however, to state that the above reductions are a result of surveying 4

builders in the Montreal area and may be different in other regions.

**Implementing the Model in Other Settings**

The Next Home was designed and implemented in Montreal. The principles embedded in the design can be employed elsewhere. Several issues need, however, to be kept in mind. The first is to find a site that permits construction of narrow front 20-foot-wide (6-meter-wide) dwellings. Preferably the zoning will also permit townhouses in multi-family configurations. Sites of this nature are usually found in the city's core in proximity to such areas. Working with a builder that will welcome the idea of offering a menu of options is another aspect. The items on the menu need not be exhaustive, and include several kitchen and bathroom types and interior latyouts. The builder representative can assist the buyers in the choice and guide them in interior design. The builder can be from the private sector (as was the case in Montreal) or the public sector. Legally, the projects needs to be sold as condominiums rather than freeholds, an aspect which did not pose a problem in our case.

Since the introduction of the Next Home on campus, several hundred units have been constructed and sold in Montreal. In fact, the design became the least expensive dwelling that one could purchase in the region. Most of the units have been constructed in the heart of small suburban towns around Montreal and a few in proximity to downtown. Also, a prefabricated version of the unit is now being promoted by a local manufacturer and some panelized units have been constructed in the U.K.

## CONCLUSION

Through the Next Home's design principles the author attempted to acknowledge the economic and the demographic pressures currently facing homebuyers. Builders need to consider contemporary households with their diverse interior design needs and affordability constraints. The narrow width, which reduces the amount of valuable serviced land, the efficient design, and the flexible choice of interior components combined to reduce the cost of construction to $26 per square foot ($380 CAN per square meter).

The evolutionary nature of the Next Home – that is, the notion that housing be designed to evolve in layout and use – requires a thoughtfully developed urban design code that balances individual expression with the overall continuity of the street or neighbourhood. Another essential design element is the realization that lifestyle – as one of the defining characteristics of peoples' lives as citizens, consumers, and householders – is a feature that shifts in accordance with a dynamic lifecycle process. A home that can be altered with a minimum of effort and expense at a time of change in the lives of its owners is a home that evolves with the lifecycles of its household rather than becomes restrictive.

The assessment of the application of the Next Home principles in building sites demonstrated stet the two underlying objectives: affordability and flexibility. Although the builders had to invest more time in the marketing process, buyers were willing to pay the small administrative cost in return for having their choices built. It is no doubt a change to current approaches to home building and marketing. The flexible, affordable, and sustainable design principles of the Next Home respond sensitively to the urgent need to accommodate a wide diversity of contemporary users and household types and to extend affordability to a wider portion of the population.

## BIO

Avi Friedman is a Professor of Architecture and Director of the Affordable Homes Graduate Program at McGill School of Architecture in Montreal, Canada.

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# Innovations in the Development of Industrially Designed and Manufactured Modular Concepts for Low-Energy, Multi-story, High-Density, Prefabricated Affordable Housing

Harry Giles and Fernando Lara

## INTRODUCTION

This paper shows how accessibility to and the quality of affordable housing can be achieved through an interdisciplinary strategy that integrates socio-economic considerations and technological imperatives. The ACSA forum is a timely call to debate and expose these kinds of strategies to a wider audience. We demonstrate the urgency of the problem, which fundamentally lies within current design culture and construction that shies away from past stigmas and does not address the benefits of compact housing design. Current practice perpetuates a traditional style and construction ethic that continues to encourage urban sprawl, undermines progress, and blocks opportunities for affordable housing. The authors demonstrate how these issues are being addressed in other counties as well as through their own research in technological innovations in the development of industrially designed modular concepts for low-energy, multi-story, prefabricated, compact affordable housing. This work is being carried out under a substantial grant funded by the Partnership for Advancement of Technology in Housing (PATH)/National Science Foundation (NSF), as part of a national initiative for promoting higher quality and value in housing through the implementation of effective technologies.

A key issue for the housing industry is the fragmentation among various industry stakeholders, with its communication impediments and slow adoption of new housing technologies.[1] Our research group is addressing the problem head-on, by proposing a paradigm shift in how we design for integrating technology in housing, to include spatial arrangements, volumetric configurations and the urban realm, and how this leads to technology realization in manufacture, delivery to site, and erection. Such an approach was suggested in a recent PATH-NSF conference on housing, asking whether a "revolution" is needed in housing construction and what constraints and impediments prevent this from happening.[2] Our thesis for change is supportive of a paradigm shift for manufacturing to be entirely factory based rather than site based; our research demonstrates applications for low-income, higher-density urban social environments, showing how to provide the best solution to positively influence homebuyer demographics and expectations.

We are proposing a methodology for the application of technology to house manufacturing methods that can readily integrate other new technologies related to sustainability and low-energy consumption, which are otherwise "extras" that are eliminated during implementation. We propose new technologies for their social potential. Our research is toward justifying the basis of and the methods for factory-based manufacturing. We are conducting interdisciplinary research and design initiatives, among university units, architectural professionals, community housing associations, house builder associations, and manufacturers, toward the design of whole-life product housing typologies. Our approach proposes a new design paradigm for house building, which leverages local automotive–industry based transfer technologies into manufacturing, with the aim to construct affordable, durable, and aesthetically prefabricated homes for low-cost urban multi-family housing.

The whole-house prefabrication concept integrates building services into the enclosure, similar to the design of automobiles. The enclosure is conceived as an innovative hybrid monocoque (or unibody) metal skin enclosure that is stacked vertically to form multi-story, prefabricated volumetric housing modules. The material components, enclosure, and environmental systems are integrated with hybrid solar and passive energy systems. We are working in the context of the urgent need for good-quality, low-cost, low to medium-rise, high-density housing that seeks to set a new framework, by designing a prototype for modern living. The social focus is to invigorate new interest in repopulating vacant and blighted urban areas. While we focus on Detroit's inner urban area, the principles of our approach will be equally relevant to numerous similar sites throughout the United States[3] and the rest of the world.

We further elaborate on the key issues underpinning our philosophy in the rest of this paper, and in order to address the interdisciplinary nature of the subject under investigation, our paper is divided into two main areas: (1) socio-economic considerations, (2) technological innovations.

We attempt to address these two areas separately, consistent with the objectives of our research project and show the role of each area with a focus on the zones of overlap and their mutual interdependencies. Owing to the vast scope of our project, that involves a large number of complex variables and considering the limited space available in this paper, we will attempt to show only the principal goals of our research, the methods we are adopting, and some of our initial findings that are setting the course of our future investigations.

## RESEARCH METHODOLOGY

We highlight the methodologies associated with our research, which is in the first-year of a three-year project. During this initial phase, our goals are to explore the possibilities of high-density mid-rise housing development using standardized modular prefabricated construction, influenced by the dynamically varying social imperatives that we see in a modern world. As part of this process, we conducted a research-based studio, with diverse faculty who are also part of the research team, to explore the issues we outline later in the paper and to identify aspects that can form the basis of a guiding set of principles for future low income housing designs. The research studio incorporated five multidisciplinary teams of architecture, civil and mechanical engineering students, in order to fully explore the interdisciplinary nature of a "whole-house" design approach. This initial study was carried

out in the form of a design project, based on different sites of varying size, urban context and solar orientation. The project designs were developed within the strict confines of the principles that underpin our philosophy. These were used by the faculty to act as a set of guiding principles, towards creating a success for the affordability and social sustainability of low income housing. We have started to measure success on the basis of feedback from external critics working in the field as practitioners, developers, housing associations and field workers, who reviewed the projects at various stages of development. Based on overwhelmingly positive reactions, we were encouraged to implement the principles we had set for the studio projects as the basis for our ongoing research objectives. It is beyond the scope of this paper to dwell on the detailed sets of goals and outcomes and we do not claim finality through the results of these successes, since we are still in an exploratory mode. However, we are confident in our approach, which is reinforced by our local and international experience, supported by industry leader partnerships. We all recognize the potentials of information and technology transfer, combined with new innovations in designing for diversity that beneficially integrates appropriate technology in a way that we do not see happening in the United States. Much of the technology we are adopting is already in existence, but is not being applied within the realm of our investigations. It is therefore our aim to demonstrate and disseminate this knowledge to the industry through a set of guidelines, including the development of exemplar projects through our industry partnerships. In this paper we set out the principal issues, discuss the potentials for implementation and the consequent achievable benefits already identified through our preliminary studies. We use the results of our research studio, which was set in relation to sites within central Detroit, which were also governed by city ordinances that restrict plot ratios. The results of the designs are intended to provide a quantification of dwelling unit density that can be compared with residential norms, towards the aims for sustainable and safe environments. While the detailed goals and means of implementation of the study are too extensive to discuss here, we make reference later in this paper to important issues that were incorporated or arose in the designs. These issues were enshrined in the study with their consequent positive outcomes, which are also discussed.

We should also point out that the research studio is a fundamental co-component of our own academic research, since the participating faculty are all part of the research team, and as such we do not distinguish between differences in goals and outcomes in comparison to our own academic research. To this end, each student group was required to provide detailed written reports at various stages of the investigation, which were rigorously critiqued and reworked, in order that they directly contribute towards the research activities and documentation. The strength of this approach is based on the fact that a large design study was able to be conducted in a relatively short period of time, which has both pedagogical value (as required by the research grant) and provides a large amount of data that can be compared between the various group investigations and designs. The diversity of group investigations ensured a broad spectrum of study that minimized bias and encouraged a vast horizon of perspectives, since the study group comprised of members from diverse cultural, ethnic, and international backgrounds. The interdisciplinary nature of the studio also ensured that architectural perspectives and concepts were grounded in reality and at the same time technological solutions were made relevant within a unique social and cultural context. The study was not only conducted to establish generalized design solutions related to regulations, but more importantly it encouraged creativity through the integration of the various principles discussed in this paper, which resulted in the number of successes as described above. The authors have achieved past successes in this approach, the details of which are beyond the scope of this paper. Future proposed research is to develop several prototypical designs based on the experience and findings of the research studio towards establishing a set of guiding principles that are encompassed in the different projects. These designs and principles will be further verified in the field and will form the basis on which to construct prototypical pilot projects, working with industry partners that include housing associations, contractors, developers and funders of low income housing. Our intent is to lead by way of example. This has been the demonstrable measure of success in countries like the United Kingdom and Holland and a number of case study references from these countries are discussed in this paper to illustrate this point.

## SOCIO-ECONOMIC CONSIDERATIONS

Many housing developers have been accused of exploiting a short-sighted, least-common-denominator market that maximizes profit at the expense of social and environmental quality. It is striking to note the degree of standardization in spatial arrangements across housing typologies, given that the building industry is so locally based. But instead of implementing the best of industry standards, that could give us flexible solutions adapted for diverse family arrangements, we get the costs of a labor-intensive process together with a low technology that stems from a site-assembly process. In contrast, we are working to elevate the technological knowledge base in housing toward a highly efficient design and manufacturing approach that uncompromisingly integrates environmental and social sustainability issues that will initiate social transformation from depressed low-income groups toward a progressive home-owner society.

We are proposing to provide the housing industry with a new model for housing delivery and a model that quantifies energy savings that not only creates a more sustainable environment, but one that enables a new lifestyle. This is true especially for those less privileged people who would otherwise continue to exist in a depressed environment of less durable construction, in societies that lack connections and meaning. Our approach encourages closer connections between work, life, and play by promoting higher-density urban living, which is far more sustainable than the ever-expanding urban sprawl of suburban housing. As indicated by previous PATH panels, the diffusion of technology throughout the construction industry seems to

be a key obstacle for a more sustainable design that would lead to the attainment of PATH goals.[4] Our research integrates technology with socio-cultural issues that encourages the diffusion flow. While most technological innovations work on the extremes of either basic issues of durability or global issues of ecological sustainability, we believe that issues of social transformation and identity that lie between these two extremes must be addressed to facilitate the possibility of disseminating such technology. We discuss the various social issues and propose concepts for housing that set the basis on which to develop technological innovations as:

1. A new genre of more affordable compact housing concepts

2. Adaptability that allows for more life style choices

3. Design concepts that encourage mixed-use developments and create diverse living arrangements

4. Creating affordability through holistic life-cycle cost optimization

**A new genre of more affordable compact housing concepts**
It would appear that the low income–building sector might be pursuing an unachievable goal of making the suburban detached house affordable for low-income families. For example, in a recent competition aimed to form a future model for Urban Habitats in Charlottesville[5], the sponsors aimed to provide affordable housing with two- to three-bedroom, 1200 sq ft units for low-income families. Given the current market, this translates to a house cost in excess of $150,000 using the most basic of building construction materials in a low-rise single family home. A family would need to be earning in the region of $50,000 per annum to come close to affording a mortgage to purchase such a home and therefore at best this would become a rental or heavily subsidized unit. Therefore it does not appear possible under current market conditions, to build anything of quality and it is also very unlikely that in the near future we will be able to raise the income level of those in the lower 20 percent bracket beyond the current $25,000 per year.

Further, it becomes imperative to realize that those families cannot afford a unit above 900 sq ft without heavy subsidies. For example, in the greater Detroit area, the research team has partnered with a housing association called Venture, which has provided valuable information on the levels of subsidy that is being provided in their area based on HUD funding to the local county, in this case the Oakland County Community and Home Improvement. Subsidies range from 25 percent of market price to flat sums of money in the region of $31,000 for a house regardless of size. Oakland County is also one of the richest counties in the whole of the U.S. Without further available evidence to the contrary we believe that any available subsides within the boundaries of Detroit (just across the border from Oakland County) are most likely to be much lower or near to non existent, based on the state of Detroit's bad financial performance in the recent past. Further research still needs to be conducted in the Detroit area to better quantify the level of available subsides, in working out a whole life cycle cost for affordable housing in Detroit, along the lines that we are proposing. In Oakland County, subsidies are only available on a limited basis for first-time buyers. The houses currently being developed are all single family units based on a standard stylist design (Cape Cod and Colonial) with a floor area averaging about 1200 sq ft. On the contrary, we could do better than promote urban sprawl in this manner and at the same time provide homes that are more accessible to low income groups, by working toward designing good neighborhoods that would provide a better quality of life with greater density, which also means more sustainable cities. This view is supported by Friedman, noting that a telling index of the affordability level of a project is its density.[6] Density indexes reveal several principles that contribute to housing affordability. As net density increases, lot sizes as well as the area allocated to roads decrease. Smaller lot sizes in areas zoned for high density will save on land costs and at the same time the leftover land can be used as more open communal space.

Our proposal is for higher density dwelling with an average Floor to Site Area Ratio (FAR) in the region of two. FAR is defined as the ratio between net usable floor areas on the entire project in relation to the gross site area. Density can also be described as the number of residential units per acre and the relationship between FAR and units-per-acre is discussed later. During our studies, we found that an FAR of two provides a suitable level of compact housing that converts to between 50 and 70 units-per-acre equivalent, depending on the spatial arrangements achieved through the implementation of our guiding principles. This is not a universal conversion factor, since it depends on the size of units and their eventual arrangement on the site. An acceptable level of density of 50 to 80 units-per-acres was established as the limiting quantum by Oscar Newman, in his quest to devise guidelines for "defensible spaces," as described in his earlier works[7], therefore we are adequately within the boundaries of this limit.

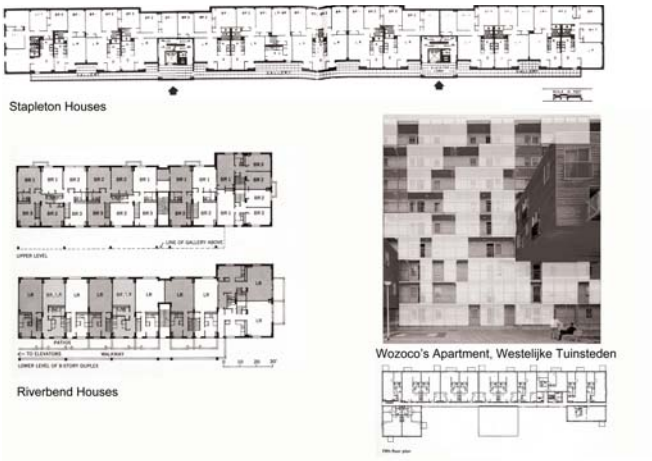
Further affordability is achieved through a combination of limiting the size of the housing unit to say 900 sq ft for a median family of two parents and two children in a high-density multi-family housing development, together with a more economic means of construction using modular prefabrication based on industrialized manufacturing processes, combined with lower energy costs, and at the same time achieving a good-quality product. Considering the case for density, the median house size in Washington, DC was 1860 sq ft in 2001, providing an excessive 700 sq ft per person. At the opposite end of the spectrum a median house size in Tokyo is 420 sq ft. Perhaps a more realistic goal would be to attain the much-admired urban quality of life in many European cities such as London (770 sq ft median) or Madrid (707 sq ft median). It would be reasonable to assume that a low-income family struggling to make ends meet could live for part of their lives in an 800- to 900-sq ft unit that would fit their budget and at the

same time within a higher density urban environment, that contributes toward a more sustainable city. This would be an appropriate entry step into home ownership and facilitate better retirement savings. However, in the United States these kinds of units are not available except in New York, Chicago, Boston, and San Francisco with costs in excess of 10 times that which we are using as a reference baseline. One unfortunate reality of city living is that, on one hand it would be possible to build high-density accommodation at an affordable level based only on construction costs, however market forces drive the cost of even the smallest units to levels that low-income families cannot achieve. Therefore such housing developments will need to remain under the stewardship of housing associations that maintain affordable costs based on actual construction costs and guard against the ravages of extreme market forces. At the same time, this model provides for increased home ownership among the low-income groups, based on its own defined "market forces" that are regulated, however with a resulting improved sense of pride in their environment that will help toward attaining sustainable communities.

There is a pressing need, as unfortunately the nation needs millions of those units. According to the latest report from the Harvard Joint Center for Housing Policy, within the next 10 years some 17 to 19 million new housing units will be needed in the United States alone[8]. For the entire planet the United Nations estimates the need for 350 million housing units based on current demographic predictions[9]. Another UN-based report explains that the wide diversity of typologies throughout the planet is being sharply reduced to only three: the single-family house, the walk-up apartment building, and the high-rise.[10] Despite any advancement on density, automobile dependence or multiple uses, the overwhelming majority of those one million housing units that will be built over the next decade will have a traditional plan. How well will the design of those units fit the needs of the families that will inhabit them? We know that the majority of these families have configurations other than the traditional four-person nuclear family that forms the basis of the median apartment in the last 100 years. As of 2002, 49 percent of United States families have arrangements for a married couple and 32 percent for a single individual. Meanwhile we should remind ourselves that the prevailing two- or three-bedroom apartment unit that is the standard for every low-income housing complex was developed as a typology in Europe during the early 20th century and was translated to the North American context between 1940 and 1960.[11] To expand on how outdated an apartment plan developed right after World War II might be, let's remember that in 1950, some 78 percent of US families had two parents with an average of more than two children while the figure for 2002 is that only 51 percent are comprised of a married couple and the average number of inhabitants per household is 2.5 (Census Bureau, 2005)[12]. Or the fact that in 1960, 41 percent of women married before 19 years of age and an astounding 85 percent were married by age 24.

Another understated issue that connects family arrangements with low-income housing demands is the divorce rate that in the United States nears 50 percent of all marriages. In the event of a divorce, the family is left with the same income or less (given the lack of inexpensive childcare), however they are left with double the housing costs. Moreover, the most common federal Housing and Urban Development grant for housing subsidy applies only to first-time buyers, which is not the case of a large number of families going through a divorce. Besides the need for affordable units, these families have employment needs and childcare needs that challenge the separation between home and work in the current suburban or high-rise model. All these facts alone support the implementation of mixed-use buildings with a denser urban typology.

So how do we cater for these changing needs? As part of our research efforts, we explored the potentials for a more modest 900 sq ft median apartment unit within a high-density housing development with an FAR of two that caters to diversity in family configurations, family sizes, and age groups, along with enhanced commercial facilities and public amenities that are fully integrated within the housing scheme. To this end, our research studio conducted a number of studies on a number of sites in downtown Detroit, and we were able to demonstrate that the smaller units could be well integrated and diversified toward a high-quality environment. Quality in this instance is defined as a developed sense of pride in ones environment which provides safety and fosters community through an ideal arrangement of high-density living arrangements that is affordable. Our view is that this can all be achieved through good design together with the possibility of home ownership. The following figures are examples of schemes that were developed in our research studio, for various inner-city sites in Detroit, the details of which will be expanded on in the following sections (Image 2). In all cases, the main aspect of the apartment has a southerly aspect, taking advantage of good daylight and winter solar gains, where each unit is provided with a private south-facing balcony. These orientations are all driven by solar aspect. It is worth noting therefore that these schemes all include an "external" semi-enclosed access corridor with single-loaded units, located on the northerly side of the building. The single loaded configuration allows for daylight to penetrate both the north and south oriented facades, allows natural ventilation to pass through the unit and as such limits the maximum length of unit to 40 feet. The access corridor is designed more as a second balcony, providing communal access and ownership that avoids the stigmas of wind-swept, anonymous-access spaces that breed crime and are left unattended. This is key to the success of this type of development. We cite successful examples of this type of configuration that incorporates a single loaded corridor that is deemed to be acceptable for residential applications of this type through the studies of Newman[13] on Stapleton Houses, Staten Island, New York and Riverbend Houses, Harlem, New York and as shown in a project Wozoco's Apartment, Westelijke Tuinsteden, Amsterdam, Netherlands, for the elderly[14]. (Image 1) We draw attention to the single loaded corridor arrangements on all these projects that service four to six residential units in relation to the vertical access points. In addition, entrance doors to the residential units are either located




1. Floor plan layouts that successfully incorporate single loaded corridor arrangements in low-income housing, as "defensible spaces" for the projects cited. [13, 14]

within a semi-private entrance space off the main corridor axis or use "piggy back" row house typologies stacked five high to create ten levels of apartments with an outdoor patio space that is connected to the corridor in the New York apartments.

Whereas in the Wozoco's Apartments, the corridor contains a series of screens along the building north perimeter, that both shelter occupants from the weather and provide the necessary ventilation and daylight required of a north facing façade in a double aspect residential unit. Image 1 also demonstrates how such a north side façade can be made to be an exciting component of the architectural elevation, compared to the relentless bands of public balcony witnessed in less successful social housing projects. Images 2, 3 and 5. also show how these principles were incorporated in the studio project examples. Although single loaded corridors are considered to be more expensive than double loaded ones for low income housing, the overall benefits both socially and environmentally outweigh any argument to the contrary. This view is supported by the findings of Newman in the above reference source.[11]

2. High-density housing concept examples in Detroit showing individual balconies and integral solar thermal flues including access corridors with semi private entrance areas, partially enclosed with translucent screens, providing a second "defensible space" communal balcony

**Adaptability that allows for more life style choices**

Contemporary demographics teaches us that the traditional two-child family is declining. Other familiar arrangements such as divorcées with children some days a week, or extended families with grandparents at home, or same-sex partnerships, requires other spatial arrangements. House design is generally something that is immobile and expensive and the possibility of transforming the spatial configuration of the building in order to accommodate changes (instead of selling and buying somewhere else) becomes even more attractive. New materials are lighter, and if they were to be made more durable, could provide better heat and sound insulation so that new partitions can be easily removed or added. This is especially meaningful for aging "Boomers" who may require new spatial conditions as they grow older, which is substantiated by an extensive body of research showing the benefits of aging at home. This is the kind of innovation that crosses many levels of well-being from basic family functioning to connections with the larger community.

Assuming that we design for the median two-parent–two-children arrangement, this would cater to about 50 percent of the population need for low-income families, whereas the other 50 percent have different arrangements. How do we design for those different arrangements? A typical scenario may be a two-level terrace home with a basement that is occupied over an 11-year span, includes an initial family of two parents and a child and later a second child, toward older parents and a single child at home at the end of the 11-year period.[4] A number of changes occur throughout this period, including room alterations, the introduction of a family room and storage space in the basement, additional bathrooms and family rooms converted to additional bedrooms. Other possibilities might include a private bedroom/bath unit for a grandparent, a home office, a playroom, and issues related to differing ages of children with different needs. To provide for maximum flexibility through the lifespan of a family and perhaps multiple lifespans of a dwelling unit, we are best served by designing for these possible changes as an integral part of the design concept.

In the case of a single family home, city ordinances may preclude economic extensions to an existing property. Whereas in a well-designed high-density arrangement, some areas can be used as buffer spaces that are more flexible over the years and allow units to expand and contract according to needs. For example a single-bedroom unit may be expanded into a multiple-bedroom unit by incorporating adjacent dwelling units into a single unit and vice versa, by splitting up a bigger unit into smaller functional units. We studied these possibilities as part of our studio research project, and we were able to develop

modular concepts that allowed full flexibility to accommodate these changes. Images 3 shows how this concept could be developed into a fully functional floor plan and Image 4 shows how a series of different modules can be combined to achieve various functional residential units. These units can also be further combined or separated to cater for diverse potential uses according to family configurations that might only be established at the time of first occupation. This also provides for greater flexibility as demographics within each building block and neighborhood changes with time. For reference purposes, the modules as shown in Image 4 are each approximately 300 sq ft. For example three modules could create a two bedroom 900 sq ft living unit that contains adequate living spaces and bathrooms as shown.

3. Spatial arrangements using three simple modular types to create a diverse mixed floor plan

The research studio groups developed a variety of concepts for different sites. One project concentrated all the plumbing infra structure within one kitchen and one bathroom module as the service unit, with another module made of a larger open space that could be a living, dining, or work space. Other schemes studies how units could function either as two bedrooms or as a general living area. Another arrangement developed a scheme where adjacent units can be altered to achieve additional bedrooms in one, while reducing in the other. As seen in the figures provide, the combination of different modules can allow for innumerable spatial arrangements that are not only more suited to different families but can also accommodate change.

**Design concepts that encourage mixed-use developments and create diverse living arrangements**

The same data that tell us about the need to provide for more diverse family arrangements also show how diversity is a more important factor than ever. Forty years ago Jane Jacobs demonstrated to all of us the importance of a diverse mixed-use environment for a healthy neighborhood. So much has been written since her classic book, but the maladies that afflicted the North American cities in the 1960s are still pervasive: single-use, single income–level, single-background neighborhoods. Working in Detroit, one of the cities most affected by those problems, our research studio explored mixed-use configurations that also encourage people of diverse background and life stages to live together (Image 4). Units with different sizes and spatial organization were designed side by side, together with the requirement that units themselves should be flexible and adaptable to change.


As the U.S. population diversifies, housing solutions should accommo-

4. Prefabricated unit study using six typical prefabricated modules in spatial arrangements that integrates planning and manufacture to form a variety of living units

date such diversity. Demographics also teach us that we should provide for a new immigrant population (Hispanic and Asian), who may also have different spatial needs. If architects and developers cater to those desires instead of insisting on a one-size-fits-all suburban model, there is potential to make significant improvement in our housing environment. We demonstrate how such diversity can be integrated within a rigorous modular approach to design and construction, without creating limitations in catering to such diverse needs. In addition, to catering to social diversity, we integrated functional diversity. Instead of always relying on other commercial developers to create necessary commercial outlets for everyday shopping needs, we integrated many of the base essentials within the housing complex itself. Even when we considered different sites by location and size, there was always room to include shops, utility functions, social gathering spaces, and places to eat. In addition, multiple rooftops are created by staggering the development through different heights, to allow green roofs to be formed, accessible to the occupants, and further providing additional recreational space to the housing development community, for little additional cost. This integration of both function and social mix contributes to reinforcing a social nucleus within the housing development that not only provides a more sustainable city through the means of localized and decentralized facilities, but reduces the need for additional transportation to reach these facilities. It encourages a local community that is also more aware of its surroundings, takes more care of such surroundings, and provides a safer environment in which the entire local community can share. This approach challenges the "gated" mentality that we see pervading new housing developments in Detroit, which work against creating social sustainability and encourage a more insular city at street level—the place where communities used to thrive in the days before modernism. Therefore, by creating higher density on the site through highly efficient modular arrangements, we free up more land space that can be given over

to community activities. We show here, some typical ground-floor arrangements with additional commercial facilities that are integrated within a housing scheme that sits above (Image 5).

**Creating affordability through holistic life-cycle cost optimization**


5. Example of high-density housing that integrates diversity in unit typologies with additional facilities located at ground-floor level

If there is to be any large-scale impact, general design considerations in housing need to include the potential transfer of marketability toward lower-income groups. It is both difficult and risky to envisage that we can design social systems for the future based on simplifying the built environment toward the least common denominator or some unsustainable middle-class goal for the "American Dream." Failures of modernism have provided valuable lessons on the effects of the desires and demands of the middle class. This has required the establishment of a dialogue between design ideas and popular taste, as being an important component of any new housing design. On the other hand we believe that the pervasive homogeneity of the housing market has flattened the field to a point in which the consumer has no choice at all. In contrast, we are proposing an alternative spatial and aesthetic choice, articulated with an environmentally sustainable outcome at optimal life-cycle cost, as one of the goals that we are trying to attain. Again, marketability means fine-tuning people's demands while maximizing the positive contributions of technology and design dissemination toward a more sustainable environment and society. Partnerships with manufacturers are essential, to evaluate new technologies against the constraints of the housing market while at the same time pushing the limits of such constraints.

Better materials and better technology will not only make houses cheaper to maintain, but it should have a substantial impact on the environment. The 2002 International Union of Architects congress in Berlin was devoted to the idea of architecture as a resource. Using data from 150 countries, it was estimated that the built environment (from construction to maintenance and demolition) consumes about 30 percent of the energy resources in the developed world. Any small progress on energy conservation in the housing sector (which comprises at least 70 percent of the built environment) would be substantial.

Maintenance costs are known to be one of the major problems in public housing. This is financial burden that low-income families can least afford, since they will already be struggling to make ends meet on food, health, and education expenses. Low-income multi-family buildings suffer from lack of maintenance as well as from a lack of pride in ownership. The most visible outcome is the devaluation of the property even when damage is superficial (garbage, graffiti, dust), but more serious problems can occur when the lack of regular maintenance affects roof, insulation, or plumbing systems. The damage can be irreversibly expensive after only a few months without maintenance. Developing materials that age better and result in less expensive maintenance will have a positive impact on housing quality. A house that is cheaper to maintain would improve basic sheltering needs and most importantly contribute toward a healthier community with higher self-esteem.

One important characteristic that distinguishes housing from other consumer goods is its durability. A house is generally the most expensive investment one can make. A property's durability not only affects its own price, it also affects the value of surrounding properties; this is called the externality effect. When purchasing a home, the buyer makes a long-term investment in both their property and in the neighborhood. The quality of the homes in the surrounding community plays a part in purchasing decisions, and if a neighborhood contains properties made from low-quality construction materials, the property value in this neighborhood is adversely affected. The durability issue is also important for neighborhood health. As predicated by the neighborhood life-cycle theory, when some properties in a neighborhood start to show signs of dilapidation, the concern about the future decline in property value may motivate some residents to move. As more residents move out of the neighborhood, the properties begin to be sold at a discount and the negative externality effects are magnified. The process becomes self-perpetuating as the neighborhood transforms from a healthy middle-income neighborhood to a declining low-income neighborhood. Clearly, neighborhoods built of low-quality materials are more likely to experience this problem than neighborhoods constituted of durable properties. By contrast, a community where all the properties are built with durable materials, everything else being equal, would be more likely to maintain high property value. This factor alone accounts for a major problem in low-income areas.

It can be demonstrated that affordability is attainable across a broad spectrum of lower income groups. In a U.S. Census Bureau report, the average household income for Michigan is $45,887 whereas the income for Detroit is $27,276.[15] This great divide is represented by most of the low-income households in the city of Detroit, and this is where the greatest need for good affordable housing lies. Most of the

existing housing stock is old and beyond repair without substantial investment. Most of these low-income families are living in properties that are on the market at a rate of less than $50/sq ft, based on a brief survey of available properties listed by a mortgage lender ERA.[16] Although these properties are still circulating through the market, it is depressed, low–quality, and unsustainable. The time has come to begin developing new housing stock for low-income families. However, based on the current low entry level cost of existing housing stock, the solution for new construction is not immediately obvious, since new market rate construction will cost in the region of $120 to $150 per sq ft. As mentioned previously, at the median dwelling size of 900 sq ft, a family would need to have an income of $50,000 per year to afford a mortgage for a simple single-family home. However people still manage to exist on the average of $27,000 income per year in Detroit by recirculation of existing housing stock, as evidenced in the above survey and then the larger existing houses are converted into multifamily units that are still dilapidated and unsustainable in the long term. Therefore it appears that any new development will not be able to fully cater to all low-income households.

However, given current market rates, together with HUD grants offered as subsidies through the counties as described earlier in this paper, our view is that families earning $20,000 or more should be able to purchase a new home. How is this possible?

The answer lies in good design for high-density, modest dwelling unit areas, prefabrication, and low energy consumption. We have demonstrated through a simple "ballpark" calculation that substantial savings can be achieved in the cost of construction through prefabrication (i.e., 30–40 percent savings in construction costs as verified in discussions with existing pre-manufactured housing companies visited in Indiana), together with potential energy savings (i.e., up to 40 percent savings on average energy costs). Affordability is achievable in the $30,000 to $40,000 income range using modular prefab construction in a high-density arrangement without any housing subsidy. Cost reductions can be achieved from low-energy design, using passive energy strategies, in the region of $850 per annum, based on building simulation studies carried out as part of this research project and is described later in this paper. This amounts to a one-month reduction in mortgage payments. Then with the addition of a housing subsidy, it can be shown that the $20,000 annual-income group fall within the realm of possible home ownership, albeit only for a limited number of first time buyers as described earlier in this paper. Therefore, given that first-time home owners will generally be able to afford a home on the basis of the above calculation, and although there is more pressure on second-time buyers to purchase at the higher rate, it demonstrates that the $30,000 median income level is adequate for the kind of dwelling size and configuration (900 sq ft for a four-person family), that we are proposing as a baseline model for low-income housing. This calculation does not even include the effect on property appreciation, which can amount to over $800 per month for this housing model, just less than the cost of the mortgage to purchase a 900 sq ft home according to a lender ERA, who provides a calculator to determine the long term value of a property purchase, considered as an investment.[17] Therefore to encourage homeownership, rather than to simply provide "housing for the poor," this model generates the opportunity for families to create better long-term financial security as a consequence of becoming a home owner—something that provides the kind of social and financial stability needed nationally in the long term.

## TECHNOLOGICAL INNOVATIONS

So how does technology play a role in the above set of social scenarios? We are addressing the housing industry's inefficiencies and fragmentation caused by the slow adoption of new housing technologies, through our ongoing research that promotes a paradigm shift for construction that uses industrialized manufacturing models and technology transfer, in the design and procurement process, through to final climatic and environmental performance. The overarching objective of our research is to embrace best international practice and create a new way of conceptualizing housing design that integrates technological innovation with environmental, economic, and social sustainability. This can be achieved through a primary technological focus that:

1. Creates advantages for construction using factory-based industrial manufacturing methods

2. Innovates a construction concept using entirely pre-manufactured volumetric units; and

3. Integrates low-energy/whole-house design and sustainable technologies.

### Construction advantages through factory-based industrial manufacturing methods

We are proposing to shift the existing paradigm for housing construction, which operates either as minimal standard site-built elements or standardized pre-manufactured modular units, layered in the conventional methods that represent the majority of home building construction techniques seen on the market today. There are some home builders that claim a "modular" product delivery, however this is no more than creating a set of "standard" elements that are molded or pre-manufactured using traditional site built methods, and delivered for assembly on site. All these methods are a far cry from what might be considered as industrialized manufacture. Kieran + Timberlake refer to past histories and the failures to produce successful modular pre-fabricated houses.[18] They refer to Le Corbusier's mass-produced houses of the World War II era, which failed to provide lasting legacies. The failures are identified as the historic attempts to create focus as a prerequisite for success. However, the failures were caused by the various political, programmatic, procedural and stylist agendas that were narrowly defined. This resulted in little widespread, enduring, or self-sustaining applicability.

We are aware that our proposal to shift the paradigm stands in danger of suffering from the same causes; however, our proposal is more open ended, sustainable, and socially relevant. By setting a framework that allows the procurement of low-income multi-family housing to succeed as a product commodity, we believe that this will create a consumer demand, market competition, and the successful delivery for aesthetic, durable, and environmentally sustainable dwellings for the future. We need to be aware that currently off-site production has come to be associated with products in trailer parks. A key element in our favor is that the one most important change from Le Corbusier's vision has been the shift in fabrication from mass production to customized prefabrication. This has become prevalent in a number of industries, and in particular the auto industry—a consumer-led market—as well as sophisticated commercial buildings that contain numerous innovative technological features, successfully realized through industrialized-manufactured assemblies or components. Examples of this are curtain walling, prefabricated services pods, bathroom pods, elevator and services shafts, and components. The applications for technologically innovative modular construction is not new, however its application in a new paradigm for housing is new and it is in this area that we are focusing our research. We have cited below examples in Europe, where this kind of integration is possible, resulting in model developments from which we can all learn and adapt for the U.S. market. To this end we are proposing that prototypical housing, using modular system typologies be developed, that incorporate environmentally sustainable principles and that maximize the benefits of socio-economic integration as technological imperatives in the design process. Our target areas for low-income dwellings are typologies related to multi-story developments that are a combination of low to mid-rise in height, or 3 story walkups to 7 story elevator blocks. (It is worth noting here that Newman[7] identified that 7 stories is the maximum height that building occupants feel comfortable with in terms of using stairs in the event of an emergency, overall safety and proximity to the ground in the event of elevator failure.)

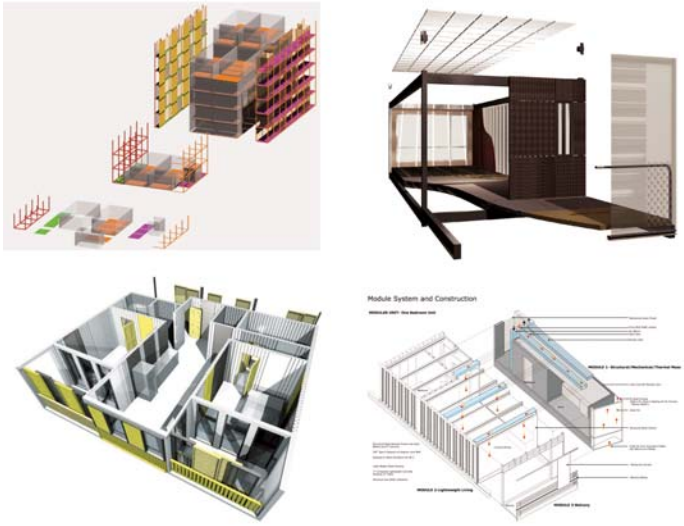
The car industry started by using traditional materials used in transportation at the time (mostly wood based) but very rapidly progressed to a new method for using new materials and the methods of manufacture (steel) that best optimized car design and performance, economics through manufacturing opportunities, and eventual disposal and recycling. The building industry, and in particular the housing industry, is still a century behind. A move away from tradition requires an industry-wide initiative, just like Henry Ford led the way with mass production. With the increasing sophistication and capability that digital technology offers, we are well poised to develop our concepts toward mass customization in house design using a prefabricated approach. Modular production is best suited in an industry that thrives on a "supply chain" process that is condensed so that the best expertise is incorporated with as few parts as possible, which arrive at the point of final assembly in pre-contained modular units. Our approach toward designing a set of modular units, mass customized to the desire of the end user, is consistent with this approach in the automotive industry. We are convinced that by transferring these models for manufacture into the housing market, we can revolutionize the cost and quality base of our housing market. However, this will require a quantum shift in the conceptualization and appreciation of what a house represents in a modern world and begin to move away from traditional styles and methods of construction. So called "pre-manufactured homes" are simply traditional construction methods built under a roof adopting traditional stylistic modeling to entice the single-family home buyer. There is little that is industrialized about the process and even less which is innovative, resulting in a flattened set of "standardized" designs that eventually give the appearance of an on-site built "dream" home, but little else to offer than lower initial cost. These units are designed to cater to the single family home market and continue to propagate the worst kind of urban sprawl. It offers nothing to the low-income housing crisis and is entirely driven by a profit motive with little consideration for long-term quality.

To combat this ethic, we have tailored our research towards the principles of car design and manufacture and are beginning to set the scene for expanding the automotive model into the larger realm of high-density, multi-story housing. We are beginning to weave a tapestry of precedent, social context, and technology, using our existing research that will serve to radically change the way we approach housing design for low-income, urban dwellings. Refer to Image 6 that shows how we managed to sway away from traditional construction and styling, by adopting models for prefabrication in our recent research studio design studies. Part of our current research is investigating how an industrial design base would be implemented to the design of modular housing. The theoretical base for industrial design is understood and the challenge is for us to extend this into an area of production, not yet operating in this way. We are in the process of identifying those parts of traditional building construction that are the main sources that cause problems and are concentrating on advancing technical solutions that will facilitate shifting the paradigm. It is beyond the scope of this paper to describe our processes in detail, but suffice it to say that the process is well underway and shows very positive trends, which will be the subject of future publications.

**Construction using pre-manufactured volumetric units**

Our research is designed to improve affordability and constructability, by developing new typologies for building envelopes and structural systems that use new materials and building products that incorporate multiple functions. In order to emphasize the relevance of our approach, we set out some specific project success stories on the international scene, in order to create a better perspective on our own approach to innovating technology for housing design and construction in the United States (Image 6). We highlight misrepresented concepts in modular housing design and emphasize the need to concern oneself with a whole-life design concept that embraces sustainable environmental and social living. The examples quoted highlight feasible opportunities, since these are real projects that have been suc-

cessfully completed and inhabited. A review of some international examples of modular home construction highlights how a housing association developer, the Peabody Trust, has promoted and constructed a number of good examples of modular stacked housing, that have proved to be a social success.[19] The Peabody Trust owns 19,000 properties housing nearly 50,000 people and they work primarily with local communities, local government, and a wide range of voluntary, private, and public sector partners in the UK. Their mission is to improve the quality of housing and life for its residents, to tackle social exclusion, and to build lasting, sustainable communities. This example aptly underscores how we can create similar sustainable communities in the USA.




6. Modular prefabrication concepts for high-quality, high-density low income housing

A good example of sustainable design is the work by the ZEDfactory, which is leading the way with medium-density house design along advanced sustainability principles. It represents a highly successful model housing development that is community based and integrates the current state of the art in green technology for housing.[20] The group asserts that conventional developers will not build low-energy designed homes because they do not believe there is a market. It is also more expensive to build to high environmental specifications, incorporating gardens, conservatories, and renewable energy features. They also assert that conventional banks are reluctant to lend money to fund the construction of speculative low-energy homes because they believe the sales risks are too high. However they are already recording successes in a recently completed project.

One example of innovation that helps to set the scene for modular housing are a number of Peabody Trust housing schemes based in the United Kingdom, that incorporate a modular housing system.[21, 22] We cite one example pilot project, called the Murray Grove project, which used steel stud volumetric container technology to construct modular pod units that were stacked to achieve five levels of housing (about the maximum height limit for lightweight steel volumetric units). The accommodation was targeted at young single people, couples, and apartment sharers, who might prefer low-rental housing for a few years rather than the greater commitment of a mortgage. See Image 7 which demonstrates the modular concept and construction methodology together with the finished product on two different projects for the same developer, the Peabody Trust previously described.

In order to make this concept financially viable, our focus is on stacked modular volumetric units, where the volumetric unit is the final enclosure, houses all the internal components, provides the means by which to join units, are structurally capable of carrying all the vertical loads and able to withstand lateral forces from extreme events such as seismic and hurricanes. The fact that the units are pre-made for site assembly, poses challenges for jointing and tolerances and consequently durability of the joints. Key benefits constructionally, are that volumetric frames provide significant structural strength for vertical stacking, transportation loading and natural forces, because the enclosure is structurally more robust that conventional stick built systems. This is where a monocoque system is best applied, where the volumetric components work as a stressed skin, resulting in a stiffener hybrid structure. Our ongoing research and development has led us along avenues that optimize on the lightweight and portable nature of a monocoque volumetric system. As has been demonstrated in car and aircraft design, monocoque structural systems are more efficient in terms of strength-to-weight ratio and possess very high stiffness characteristics. This is crucial for a volumetric unit that is proposed to be pre-finished integral with the modular factory-built approach, to ensure that the final finishes within do not suffer during transportation and installation.

We are pursuing a design concept for a monocoque unit that integrates "shell and fill" as a singular product, that can be built and fully tested for durability and that has been fully optimized for both structural and constructional criteria.[23]

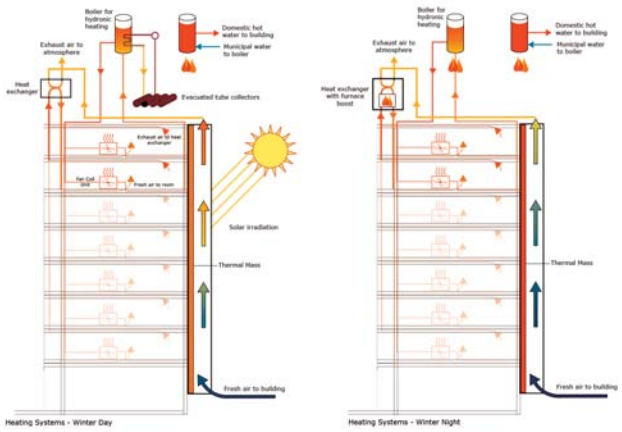
To justify the relative economics and feasibility of complete volumetric monocoque units, we are currently researching key areas related to jointing and tolerances, structural stressed skin monocoque systems, harmonizing of elements and the economics of modular volumetric manufacturing. Our research into appropriate combinations of form, materials, and jointing is balancing cost versus quality. Currently there are a number of modular housing typologies on the market that range from the likes of Redman Homes[24] in the USA to IKEA based products trading under the name BOKLOK[25] in Europe. These products are all essentially wood frame based, cater for the single family market and in our view represent a low quality product that will not stand the test of time. In addition, they are not suitable for stacked units beyond two floors and as such we do not consider these products to be a serious contender for the kind of concept that we are developing. This view was confirmed during a recent visit to the production plant of one the main pre-manufactured housing companies. These companies


7. Case study—Volumetric prefabricated units with durable integral finishes provide high quality housing developments in the UK, Peabody Trust projects, Murray Grove (Cartwright Pickard Architects), and Beaufort Court (Feilden Clegg Architects)[21, 22]

design and build a standardized product, as cheaply as possible to meet the minimum requirements of code, with little regard towards the long term durability of such a product and at the same time they continue to reinforce the single family housing market and promote urban sprawl. In our view this kind of market is not only limited by a short term horizon, but also socially irresponsible. In contrast, our approach is more akin to the case studies described earlier in this section of the paper as exemplified by the Murray Grove and Beaufort Court projects, shown in Image 7 .

**Integration of low-energy/whole-house design and sustainable technologies**

As part of an entire package for prefabricated modular housing, we also address the role of energy consumption and generation in the context of an integrated design approach. This is achieved through the integration of solar energy and air systems that provide additional benefits in reducing energy costs. We have been conducting building energy analyses using eQUEST[26] simulation software both within the research studio and as part of our academic research, that compares a baseline case for a detached single family house with an apartment located in a high density configuration in a mid-rise block (up to say 7 floors) and are able to demonstrate energy savings up to 40 percent, as a consequence of the insulating benefits of stacked construction as wall as from the integration of passive energy strategies, without much additional capital cost to the building. One such passive solar strategy adopted in one of the studio designs teams, uses a solar chimney to gain sensible heat from the power of the sun to save on heating energy costs. It also serves to reinforce the natural ventilation of the units through stack effects. From these various building simulation studies, we were able to demonstrate energy consumption levels as low as 7 kWh/sq ft per annum, compared to state energy code requirements that only require energy levels to be limited to 25 kWh/sq ft per annum. Our goal is to achieve minimum to zero carbon emissions through the integration of building design features within the envelope, passive heating and cooling systems as well as the benefits of using thermal mass internally.




8. Low-energy and passive environmental systems are designed as an integral part of the building design concept—example of using a thermal flue to provide solar air energy during winter months.

A recent example of building for low-energy demands, implemented as an integral part of the building design, is a project for medium-density housing in Holland, near to Amsterdam.[27] The project included 14 units in a low-cost housing development where the solar energy provides approximately 30 percent of the total energy needs of each house. The solar panels are made from thin film silicon wafers, developed in the United States, by depositing a layer of semi-conductor onto glass or a flexible polymer. Since it is the law in Holland to incorporate sustainable elements, architects have a mission to build solar energy projects in an elegant and charming way. In Holland the law also requires that the main living units within a residential dwelling are orientated south in order to take full advantage of good daylighting and winter solar gains. In the United States the sustainability imperative is still exercised voluntarily through LEED certification, (which falls well short of adequately defining life cycle in terms of environmentally sustainability) and then on top of this, it is simply considered to be an additional cost that developers will try to avoid, since it represents a cost risk. Therefore our proposal instigates a radical shift in our thinking, less toward short-term gains and more toward sustaining our long-term future through sound life-cycle analysis and economic principles that take advantage of life-cycle costs. We are intending to invigorate this process through demonstrable projects that are intellectually conceived through innovative technological design, executed under factory-controlled conditions. This is one example of how we can integrate new technologies in ways that were not possible previously.

In our research studio, we explored designs based on a set of target

energy savings as performance criteria, exploring solutions for passive and active systems that integrate construction techniques for the enclosure, including exploring material and energy feature changes and refinements as a consequence of simulation studies. The performance criteria were to design an energy-efficient, tight construction that minimizes infiltration to combat against heat loss and gain and prevent warm, moist air into the space that can cause mildew, mold, and other damage to building materials. One key feature that is integrated in our modular concept is a thermal chimney, which interconnects an air cavity circulation wall and floor system to a south facing winter garden zone or thermal flue as part of a double skin glazing unit. This feature is highlighted in Image 2 and shows how it can be integrated as a part of the building elevations. The cavity and the inner spaces of the building enclosure are connected with a series of opening and closing vents that may be automated to respond variously, depending on the season. This system provides a means by which to tap into natural heating, cooling, and ventilation and thus at the same time provide superior air quality and lower energy consumption. An example of the operation of a thermal flue and its functionality during the winter months is shown in Image 8.

Another dimension that contributes to targeting low energy consumption and sustainability as good for the environment and society, is highlighted in various papers where market forces are beginning to make mortgage lenders look for ways to bring in more customers.[28, 29] Consistent with the beneficial financial opportunities provided from adopting low energy designs, our concept for manufacture from site to factory raises opportunities to integrate advanced-technology with energy-saving concepts more successfully, compared to existing traditional methods of construction. It is contended that design and construction of a new house is one of the most resource-intensive and economically significant decisions made by developers and consumers. Various life-cycle energy and cost analyses have previously demonstrated the opportunities for achieving a dramatic reduction in energy consumption by the residential home sector with only incremental energy-efficiency measures.[16] Given that the technology for building more energy-efficient homes is available, and then together with life-cycle cost analysis we are able to perform a more meaningful evaluation of consumption figures and its life-cycle impact. We are pursuing a "whole house" research agenda, which is defined as the integration of technologies and processes to satisfy current and anticipate future dynamic and flexible housing performance attributes, technically and socially.

In conclusion, we reiterate our own goals, consistent with the objectives of good design as:

1. We have demonstrated that through an understanding of various user demographics, the needs of dwelling occupants can be met using modular design principles within design and construction.

2. Our approach is directly related to the pressing needs for affordable housing. Our focus is on socio-economic demands and opportunities, created through the innovative implementation of appropriate technologies based on a modular prefabricated construction approach that provides an economic and flexible basis on which to build.

3. Our concept will ensure successful neighborhoods through integrating diversity and flexibility in relation to the urban realm achieved through the potential living arrangements that are possible using a modular construction design for both layout within the units and layouts between units. Coupled with this, we are proposing a building product that is more durable and provides an enhanced living environment using improved construction materials and finishes and performance.

4. Modular construction based on industrial design and manufacturing principles will enable an affordable and better-quality product that takes advantage of the economies of mass and customized production procedures. This translates to less maintenance and higher value that appreciates over time and an improved home ownership esteem that forms the basis of a sustainable community.

5. By adopting low energy design strategies, we can further justify affordability with funding agencies and hence secure greater accessibility to good quality housing for low income groups.

The detailed conclusions we draw thus far are summarized below as a set of guiding principles for design, to achieve sustainable solutions for affordable housing:

A. Develop a project site to its full potential. This means a FAR of at least 2.0 and/or setting the number of living units to a density of 50 to 70 per acre.

B. Integrate commercial and market rate apartments into the affordable housing scheme to ensure overall financial viability for the project.

C. Encourage an environment of high self esteem through creating opportunities for home ownership. This will be best served by using higher quality construction that is affordable in the form of a new genre of modular prefabricated construction using volumetric units that are robust.

D. Limit building heights to 7 stories and foster a sense of community by avoiding tall apartment blocks.

E. Design smaller affordable units to the median size of 900 sq ft for a two-parent two-child family

F. Create defensible spaces according the guiding principles according to the work of Newman.

G. Incorporate single loaded horizontal corridors that combine good natural daylight and fresh air, while at the same time gives shelter from inclement weather. (i.e. avoid double loaded corridors at all costs)

H. Together with item G, provide variation in the corridor by creating pockets of patio or foyer spaces off the main circulation access that can be considered as semi private and shared between neighbors.

I. Provide optimal size modular units that allow living spaces to benefit from good daylight from both sides of the living unit.

J. Integrate passive solar strategies with low energy design principles that will include the provision for natural ventilation well insulated walls that are exposed to the exterior, use of winter gardens and thermal flues to tap solar energy with little extra cost to the project.

K. Use whole house design principles based on life cycle cost analysis to justify investment in energy saving features and better quality construction that will last longer.

L. Orientate the building blocks so that main living areas and private balconies are dominantly south facing. Always provide a double lighting aspect to each apartment (north and south). Locate service areas such as kitchens, bathrooms internally to provide the greatest exposure to light from bedrooms and living rooms.

M. Each unit to have a private balcony.

N. Provide as few entry points to a building block as possible and ensure a safe point of entry from street access. Keep access distances short from street edge and relate building block strongly to urban context.

O. Provide opportunities for communal spaces and service facilities by maximizing the inclusion of commercial areas at ground level.

P. Provide an elevation change from ground level to the first level of apartments of at least ½ story.

Q. Create diversity of building heights and function by incorporating a number of elevator blocks and three story apartments. Elevator blocks are best used by the elderly, away from families with children and three story walkup apartments are best suited for families with children in this collection of buildings and social mix.

R. Allow for flexible use of modular units by integrating breakout panels that will allow future modifications without too much inconvenience and extra cost.

S. Limit the number of car parking spaces on the project site and maximize usable ground floor area by locating car parking spaces below ground where possible.

T. Avoid large street setbacks to the building façade and preserve/reinforce the existing urban fabric.

U. Provide building blocks of varying height to optimize on sun penetration into the overall development and create links to accessible roof top gardens as semi private spaces for the residential community to share.

Finally, by combining the above guiding principles within a holistic framework that includes our concept for a new genre of modular prefabricated housing units, we can create greater opportunities towards home ownership in low income communities and secure a sustainable future for all.

## BIO

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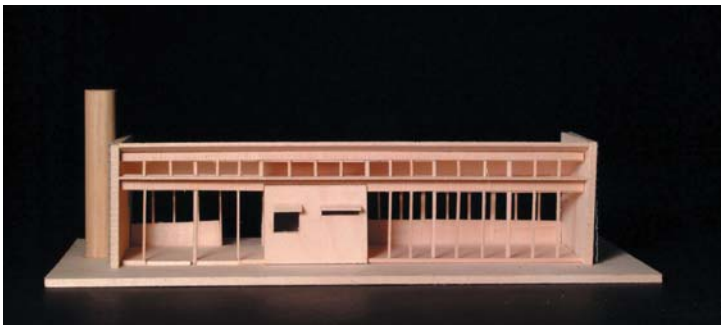
# Affordable Housing for the Puerto Rican Community—A Case Study in Sustainability

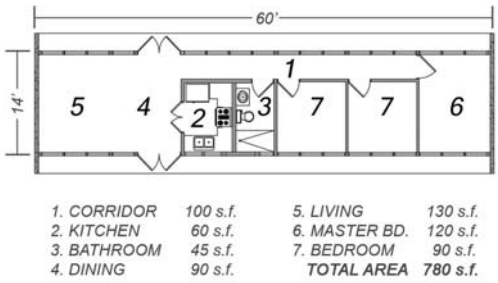
John B. Hertz, AIA

## INTRODUCTION

What is affordable housing? In its most ample sense it is more than just the initial capital costs of land acquisition and building construction. This design project, the result of a competition by the Puerto Rican Housing Department, professional organizations, local lenders, and the Environmental Protection Agency (EPA), addresses the issues that really make housing affordable: controlled construction costs, design strategies, and technology that reduce life cycle-costs, sustainable materials that have low upkeep requirements, flexibility to adapt to changing user needs and demographics, and spaces with architectural qualities that enhance pride of ownership.



1. Project model south view




2. Project plan

Puerto Rico is one of the few political jurisdictions in the US that still has a robust, publicly funded, affordable housing program. Dating back to Operation Bootstrap and the New Deal, the first major projects built on the island were the direct result of a visit by Eleanor Roosevelt in the 1930s. During 2005, the Puerto Rico Department of Housing was responsible for the construction of almost 12,000 units, about half of all housing built on the island, either through directly underwriting projects, through subsidies to developers and builders as tax incentives, or in the form of direct help of some type to low-income home buyers.[1] For historic and political reasons, these structures have been primarily built of concrete and concrete block. Much of the housing is designed by engineering firms, creating functional but aesthetically challenged results. There is a general consensus among both the private and public sector that the quality of this housing type needs to be improved.

This paper, using the competition-generated design project as a case study, will address both product and process in illustrating good design practices applied to affordable single-family housing for Puerto Rico, an island that is 99 percent Hispanic. The competition project resulted in a total rethinking of the construction of affordable residential design and in the development of this 780 sq ft wood frame and concrete house for a minimal 2,500 sq ft lot. The process was underwritten by a grant from the EPA and had as its original goal the cutting of electrical utility costs. Independent certified engineering analysis of the design has demonstrated a minimum reduction of 30 percent in the consumption of energy for its operation. While the original thrust of the competition had a more limited focus, the project designers embraced a much wider vision of energy reduction and affordability to include resource conservation and sustainability, among other issues. The project recently received a building permit and the first units should be under way this summer with a construction cost of $56,000, which includes mechanical systems such as solar hot water heating, photovoltaics, and rainwater harvesting and purification, all supplemented by publicly supplied utilities. Designed with limited interior structural walls, the house facilitates multiple configurations that range from traditional single-income families with dual head of household, to extended families and to non-related co-housing situations, as well as the possibility of an office and business in the home. The project team consists of faculty and students at the School of Architecture at the University of Puerto Rico, led by its dean, and assisted by external professional consultants.

3. Typical affordable housing in the towns of Cabo Rojo, Fajardo and Guyama (from left to right)

## HISTORIC PRECEDENTS

In the spring of 1934, Eleanor Roosevelt, wife of the U.S. president, visited Puerto Rico accompanied by Rexford Tugwell of the Department of Agriculture, who later became the last appointed American Governor of the island and was instrumental in the modernization of Puerto Rico. The trip was designed to demonstrate the federal government's concern with the difficulties the island was facing. She visited schools, factories, and both rural and urban housing areas. In her book, This I Remember, she wrote:

*The conditions in rural homes were unsanitary enough but in the towns they were even more shocking. I remember going down a street, looking in the houses of factory workers. Most of the houses consisted of two rooms; the back room had no light, and practically the only light in the front room came through the doorway. There were no screens and, of course, no plumbing or other modern conveniences in these old brick buildings. Many of the women cooked out of doors, and I wondered how they could produce their meager meals from the little stoves they used.*

*The real slums were actually worse, I thought, in the capital city. Huts were made of tin and scrap iron and wood picked up after the last hurricane and were built out over the water. We walked on duck boards placed precariously over the piling, and the water came in under every house. There was also a slum which clung precariously to the side of the cliff. Here goats and other animals lived under the houses. Again there was no sanitation, and typhoid was common.* [2]

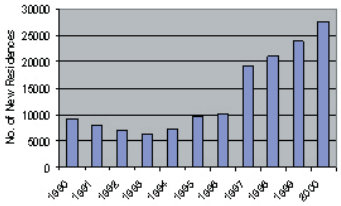
The visit marked the beginning of a sustained commitment to solve the housing problem of low-income families that later became part of an effort by President Roosevelt and Governor Tugwell to create a program of economic reconstruction for Puerto Rico. Mrs. Roosevelt was cognizant of the need to do more than simply provide shelter. She noted that efforts were being made "…to put up some new houses, but the people had to be taught how to use them. They did not know how to live decently even under better physical conditions…" [3]

There had been scattered attempts before the 1930s to address the need for decent affordable housing, including the Homestead Act in the 1920s, to build subsidized, single-family housing in the area of Santurce known as Barrio Obrero (Workers Neighborhood). This location, distant from work opportunities, resulted finally in these homes being later resold at market rate to non-qualified buyers.[4]

While there was an integrated effort to better conditions throughout the island, more energy and resources were canalized to remedy the situation in San Juan, which was suffering from unprecedented growth due to outmigration from rural areas and natural burgeoning of a population with better nutrition and economic progress. By 1935, the Roosevelt administration had founded the Puerto Rican Reconstruction Agency, whose first efforts were the construction of three public housing projects. The first were built of reinforced concrete to include individual apartments and shared community spaces. The projects, especially one located near the dock area, were controversial. There was a great deal of resistance, both from radical labor leaders and the Commissioner of Labor, to the stacking up and concentration of families within the confines of a single project.

A year later, the construction began on a major development of 2,300 units which combined single-family and multi-family housing, as well as a park, school, fire station, community center, and other facilities. Again, the buildings were of reinforced concrete, designed in a modified art-deco style and in a "Hispanic" styled modern architecture. This project and its precedents were the precursors to the creation of the Puerto Rico Housing Authority in 1938, which had the twofold task of erasing endemic slum conditions and creating affordable housing.[5]

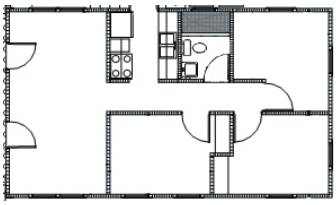
Despite multiple efforts by both the appointed American government and later by successive elected governments of Puerto Rico, the problem of a lack of affordable housing was not resolved, and even today there is a notable deficiency. By the 1970s, increasing density in the San Juan area began to result in high-rise projects as the solution to affordable housing, meanwhile the city and the island began to suffer the effects of rampant suburbanization and sprawl as the middle class and the economically advantaged sought to escape the problems that plagued urban areas. When the construction of dense high-rise housing for low-income residents began to prove as inadequate in Puerto Rico as in the rest of the United States, the government came to adopt the single-family home as the model to solve affordable housing needs. Sheer economics and a lack of vision on the part of the government forced development to remote areas with lower land costs, however they lacked services and were removed from places of employment, requiring automobile ownership and excessive commutes. The reinforced concrete units were small, uninspired, and built in totally denuded landscapes. In spite of all the deficiencies of this development pattern, which has contributed to unsustainable sprawl on the island, it is the model that the government at all levels has adopted as a solution to affordable housing for the Hispanic community. The housing design competition did not address this deficiency either, which was roundly criticized by the invited international jury, in spite of lauding the winning entries.




4. Number of new residences built in Puerto Rico in the last decade

## GREEN BUILDING/SUSTAINABILITY

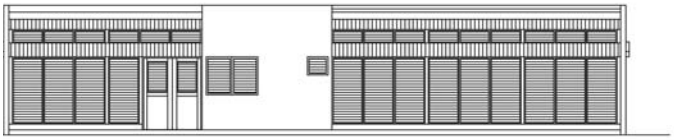
As originally conceived, the competition was to promote energy efficiency in affordable housing. Using Energy Star and other protocols, the requirements were for a demonstrable 30 percent reduction in utility costs for the inhabitants. The EPA mandated independent simulation testing in the development of this project to prove at least that level of efficiency. The original call for proposals was issued in collaboration with the College of Architects (Colegio de Arquitectos y Arquitectos Paisajistas de Puerto Rico—CAAPPR). The CAAPPR is a professional organization for all licensed architects and landscape architects as well as those in training, whose membership is obligatory, and its participation was in response to the Housing Department's de-



5. Typical affordable house plan, concrete construction

sire to generate more habitable and aesthetically pleasing solutions to affordable housing needs on the island given the paucity of these characteristics in the typical affordable home built of concrete.

The winning design team took a much more inclusive view of the need to reduce energy costs, so that it included both life-cycle and capital energy expenditures. This meant looking as well at reducing embodied energy and the environmental footprint of the project, however, without ignoring the primary task of reducing life-cycle energy costs. The importance of reducing utility costs is that it represents a larger percentage of the monthly budget for the less economically advantaged. There were two main strategies used to these ends, those of design and technology.



6. Project south elevation

**Design strategies to reduce utility costs**

*Form and orientation*

Formally, the house manifests two aspects: first, regularity and orthagonality to promote an ease of construction and to reduce cost; and second, the configuration of the roof, which is perhaps the most notable aspect of the project. As well as providing interior shelter from the climate outside, it also serves other needs that are intrinsic to an ecological solution to housing. For example, its inclination is adjusted to the necessity of solar panels and photovoltaic systems (an inclination of 18.5 degrees or a 4/12 pitch) and its north/south alignment permits the maximum entrance of natural light that is reflected by a light-shelf to illuminate the ceiling, which acts as a reflector that bathes the interior spaces with natural illumination. Its inverted form, being higher at the eaves, allows for the natural ventilation of the interior spaces by convective means and the vee-shaped form allows for the easy collection of rainwater for its reuse. An important aspect of the orientation is the organization of the interior spaces with the bedrooms found on the eastern side of the home and the more public spaces to the west. The proposition is to reduce the impact of the afternoon sun on the bedroom area and, as a result, they are cooler at night.

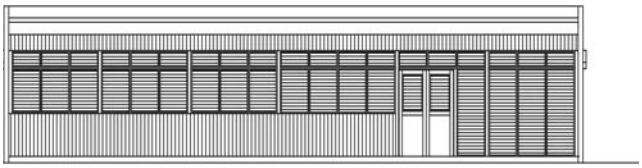
*Proportions*

The house is elongated in an east/west direction, which maximizes the walls to the north and south, reducing exposure to the east and west. The location in the tropics at latitude of 18 degrees, with the sun found predominantly high in the sky, makes controlling the solar radiation on the north and south walls easier. Studies have demonstrated that reducing the solar gain is the most important aspect of climatically responsive architectural design in the hot humid tropics and that it can have a great impact on the sustainability of the project.

*Natural ventilation*

The module of the building is the width of one room, promoting cross-ventilation in all rooms. Again, the roof form promotes convective ventilation when it is hotter inside than out, even during calm periods.

7. Project model northeast view



8. Project north elevation

*Natural light*

Natural light is the most efficient light source, producing the least heat for the amount of luminous energy provided. As such, the controlled use of natural illumination contributes to the sustainability of the design. The project differentiates between openings that provide view and those that admit natural illumination. On the southern side of the house, there is a continuous hyperbolic-shaped light shelf that serves two purposes: first it acts as a sun shade to block the entrance of direct solar radiation through the lower openings, reducing glare and providing a visually comfortable view to the outside. Second, it reflects light up toward the sloped ceiling through high, small openings, allowing this surface to act as a large, glare-free reflector that spreads indirect natural illumination throughout the house interior.

**Technology to reduce utility costs**

*Potable and waste water*

The house has a system of rainwater collection that is stored in a large holding tank at grade. A central channel in the vee of the roof funnels

rainfall to one end where it falls by gravity to the tank after passing through a roof-washer filter to remove impurities and dirt. The water is filtered and purified by an ulta violet system to make it potable and stored in a pressure tank. When rainwater capture is insufficient, the holding tank fills from a pipe served by the Aqueduct and Sewer Authority (Autoridad de Acueductos y Alcantarillados—AAA). The AAA-supplied water is supplemental to the rainwater. Wastewater is disposed of by the AAA sewer system. As sewer charges are predicated on water usage, the use of rainwater reduces both water and sewage bills.

*Photovoltaic and hot water heating systems*

The roof inclination and orientation is optimal for the photovoltaic system that generates electricity for the home and the solar hot water system. The former is supplemented by a connection to the power grid in what is referred to as a parallel or grid-interactive installation. As a capital cost saving measure, the project does not include a battery storage for backup, rather it relies on the Electric Energy Authority (Autoridad de Energía Electrica—AEE). As well, this reduces maintenance needs, as the system consists solely of the photovoltaic array, a dc/ac inverter and a transfer switch to allow for the use of either energy source.

The solar hot water heating system consists of two flat-plate collectors that provide hot water to roof-top mounted, pressurized storage tank, that has an internal electric heating element to supplement the solar collectors when necessary. Again, the concept is that the systems installed in the house are the principal utility source and are only supplemented by traditional public supply streams. This guarantees access to needed services under almost all conditions while radically cutting the monthly cost of their use.

**Analysis of utility cost savings**

As part of the project development, the Department of Housing contracted with the firm Caribbean Thermal Technologies, Inc., to evaluate various alternatives in construction and material selections to determine their capacity to reduce life-cycle costs through energy consumption. Different materials were evaluated in conjunction with the use of natural ventilation, daylighting, solar hot water heating, and air-conditioning. Using dynamic thermal load calculations, the project was compared to a "typical" affordable house. Because the island is not heavily industrialized and given its hot, humid climate, the impact of residential utility cost on total energy consumption is higher here than on the mainland, using some 35 percent of total energy production. The few Puerto Rican energy-conserving buildings from the past have been poorly conceived architectural solutions with ingenious solar technology that has been not well integrated.[6]

In this case, the energy analysis was undertaken as part of the ongoing design process and adjustments were made in material selection to reduce energy consumption especially under simulated air-conditioning situations. This included increasing the amount of building insulation and modifying the solar hot water heating system, among others. As a result, energy analysis demonstrates that the house was able to reduce energy consumption by 30 percent when compared to a typical affordable home built on the Island.

**Reducing embodied energy and the environmental footprint of the building**

Affordable housing, much like almost all residential building in Puerto Rico, has since the 20th century been built from poured-in-place, reinforced concrete. These surfaces then receive a cementatious coating to true-out and finish the interior and exterior walls and ceilings and are finally painted. Most finished surfaces are impervious, as rust of metal components and mold and insect damage to wood are problematic.

The availability of construction materials and building components in Puerto Rico is severely limited because of the small size of the market on the island and the long distance, over 1,000 miles, to the nearest U.S. port. Almost everything is imported. In the case of concrete, the Portland cement and reinforcing are imported, while the sand and gravel are available locally, although the downside is that the island has been plagued by illegal mining of the shoreline.

The geography of the Caribbean makes reducing the embodied energy and the environmental footprint of the building more difficult and less economically viable. As an example, the project specifies flyash as a substitute for Portland cement. This byproduct of coal-fired electrical generation is removed from the waste stream and substitutes virgin material, in this case cement, which has a high embodied energy. The flyash produced in Puerto Rico is unfortunately of such high sulfur content that it cannot be used as a concrete admixture. Currently there is a major court case with the Dominican Republic over flyash from Puerto Rico purported to be illegally dumped on Dominican beaches, as it has proved next to impossible to recycle the waste product on the island. As a result, flyash used in the mix is imported from the mainland, affecting the embodied energy of the material. However, as the Portland cement is also imported, this comes out a wash. The use of flyash does remove the product from the waste stream, which is beneficial. As well, it reduces the amount of water needed to make concrete, which is an additional advantage.

Successive evaluation of other materials used has created a palette of products that have low embodied energy, recycled content, or the ability to be easily recycled, or some combination. The building is basically composed of four materials—concrete, aluminum, wood, and gypsum—with two basic finishes—glazed ceramics and paint—as follows.

*Green concrete structure and polished floor*

Flyash is being used as an aggregate to permit the deviation of this material from the waste stream, reducing the energy necessary to produce the Portland cement that it substitutes. Its use conserves

materials and reduces environmental contamination from concrete production. Flyash can substitute up to 20–35 percent of the Portland cement. Its use increases the plasticity of the concrete, reducing the amount of water needed in the mixture to maintain its workability. As well, it augments the structural resistance of the mixture, lowers the permeability of the finished product, and minimizes corrosion in the rebar and the reaction between the alkaline and the aggregate.

*Wood framing and treatment*
Appropriately grown and harvested, wood is a natural and sustainable product. In contrast with concrete, it has much less embodied energy. It has a much lower impact on global warming, produces less toxicity in the air and water, and generates less waste. As a result, a wood building has less environmental impact. To promote the use of second-growth tress that can be more easily harvested in a sustainable manner, the structure uses the smallest timber members possible. The project requires the use of wood from certified sustainable forests. Wood is used here to frame the north and south walls, as well as interior partitions and the roof structure. In the tropics, wood is traditionally treated by impregnation with toxic materials to protect it from rot and insect destruction. In this project, wood is treated with an inorganic borax salt, which lacks odor and is non-toxic to humans and animals. This treatment has the necessary properties to protect the wood from organisms such as insects, mold, and rot.

*Structural skin*
The structural skin is made of oriented strand board (OSB), a substitute for plywood fabricated out of small wooden pieces that come from small diameter trees, making it a sustainable product. Analyses of earthquakes in California and Japan have demonstrated that buildings of this construction are more resistant than similar metal or concrete buildings. It should be noted that Puerto Rico is very active seismically, although most earthquakes are of low intensity.

*Aluminum roof and siding, hurricane louvers and doors*
This product contains between 25–95 percent recycled, post-consumer content. As well, the materials are themselves easily recyclable. They do not require painting or other treatment. The high reflectivity of their surfaces reduces heat gain, although unfortunately, they are efficient in the conduction of heat. The house has no glazed openings; they are simply screened and protected by solid, horizontal louvers that are crank operated.

*Gypsum panels*
The specified material has 12 percent recycled residue from other gypsum panels. As well it can contain up to 100 percent of gypsum from the waste stream of other manufacturing processes. The paper

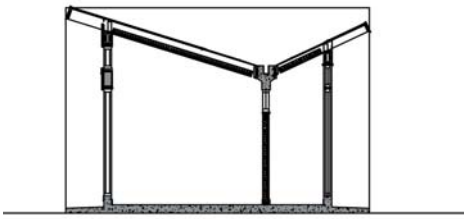
surfacing of the panels is 100 percent recycled from discarded newspapers and cardboard boxes.

*Insulation*
Rockwool insulation is produced from naturally occurring lava stone and is an inert, nontoxic material.

*Paint*
The paint is nontoxic, with zero VOC (volatile organic compounds) emissions. The VOCs of typical paint can cause irritation in the eyes and skin, respiration problems, nausea, headache, and damage to the kidneys and liver. Even though dry, typical paints continue emitting VOCs for a prolonged period.

*Tile*
The specified ceramic tile is made of 70 percent recycled, post-industrial and post-consumer glass. This comes principally from auto and airplane windshields as well as mirrors. The fabrication process has no negative environmental effects and is not toxic. The mastic used to attach the tiles to the substrate is formulated to have no VOCs, and only requires water for cleanup. The mortar has the same characteristics.

*Cabinets*
The cabinet material comes from certified sustainable forests. The veneered panels use glue that contains no formaldehyde. The panel core is made of recycled paper and is nontoxic.



9. Project cross section through bedroom and corridor

**Sustainable construction methods**
A smaller environmental footprint not only depends on material selections but on sustainable construction technology. The building specifications of the project detail all aspects of the creation of the building, trying to reduce its impact. This includes issues such as noise and light pollution that result from construction activity. One of the concerns is the control of waste materials that the construction generates, including reducing the packaging of materials and equipment that arrive on the site as well as waste separation for recycling. Also, it promotes construction means and methods that result in the least cutting possible. Puerto Rico produces more than five pounds of waste per person per day, of which almost half is construction waste. Of that, 40–50 percent is concrete and debris, the rest made up of wood, plastics, metal, drywall, and cardboard/paper. In Puerto Rico, promoting the recycling of construction materials in this project is a pioneering issue, in that the island has not even reached a 1 percent recycling rate (the equivalent of taking a year to recycle the solid waste produced in 4

1/2 hours). This is in stark contrast with the 35 percent recycling rate mandated by law.7

**Reducing maintenance costs**

Material selection has looked toward the impact that the cost of maintenance has on the families of limited resources who would occupy this affordable housing. Surfaces are durable, such as the polished concrete floors and ceramic tile used in the bathroom and kitchen area. The louvered windows and doors require no painting and neither do the exterior panels. The only exterior surfaces requiring painting are the eaves of the roof structure and the only interior surfaces that require repainting are the ceiling and interior walls.

## CONTROLLING BUILDING COSTS

**Design strategies to control building costs**

One of the principal strategies is the simplicity of the rectangular form as seen in the layout of the house and the repetitive nature of the construction. The number of door and window types has been severely limited. Interior finishes are few in number. The qualities of the spaces are the result of architectural form and use of natural light, rather than expensive finish materials. As well, the project has a "wet core" which places all water and waste plumbing in proximity to a single wall, reducing the need for extensive piping. The same efficiency of layout has been applied to the interior lighting, which is all grouped along a central structural beam that runs from one end of the house to the other.

**Appropriate materials and technology**

Even though the design focuses on sustainability, the materials and construction technology used are not exotic and are readily available in the market in Puerto Rico. The market limitations found on a small island 1,000 miles from the mainland has affected the "greenness" of the project to some degree.

## BARRIERS TO DESIGN SOLUTIONS

There have been a number of problems in getting the first units of this project built. The principal problem is a regulatory one, as there is a tacit discrimination against the use of wood as a structural material in Puerto Rico. As a result, "mixed use" construction of concrete and wood is subject to almost three times the typical insurance cost if any is available at all. As a result, lending institutions have been unwilling to provide financing for buyers. The designers, working with the Housing Department, have been successful in getting the Office of the Insurance Commissioner (Oficina del Comisionado de Seguros) to collaborate in the possible creation of a new rate category for this project, one more in line with a typical concrete structure. This possibility is based on two marked differences between this proposal and the typical frame house found in Puerto Rico: first, that the kitchen, the major source of fires, is built within a fire-proof concrete structure separated from the framed part of the house; and second, because the roof framing is engineered to withstand hurricane winds and its shape more resistant to wind uplift.

The second issue is one of the protocols used by the EPA to evaluate the energy efficiency of the house and certify it as producing a 30 percent reduction in consumption. As these protocols are designed for the U.S. market, they assume that all housing is air-conditioned and heated. The conditions in the tropics are otherwise, as there is no need for heating and this project in particular is designed to be naturally ventilated and cooled. However, the only way to satisfy the EPA was to assume a fully glazed condition with air-conditioning and show its efficiency compared to the "typical" affordable housing produced on the island. The Housing Department has requested that the EPA consider the creation of local protocols.

A third issue is that Puerto Rico is not forward thinking regarding energy conservation. It does not require that the AEE purchase excessive energy generated by the photovoltaic system at market rate. This affects the payback period of the capital investment required for the purchase of the system. As well, there are very limited tax advantages in installing energy saving equipment, including photovoltaic and solar hot water heating systems. There are none for the rainwater harvesting system, in spite of Puerto Rico having severe water problems.

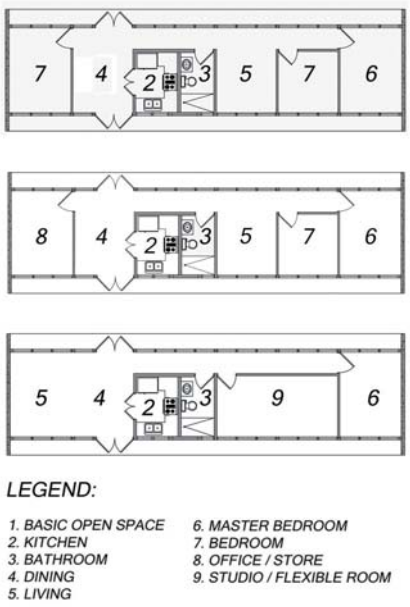
## USER NEEDS AND DEMOGRAPHICS

Puerto Rico is notable for its high percentage of homeowners, as almost 73 percent of all housing is individually owned, which compares favorably to Hispanic home ownership in the United States, which is slightly less than 50 percent. This underscores the need to produce units for sale rather than for rent. Of all households in Puerto Rico, some 54 percent are composed of married couples, with more than half having children under 18 in residence. Twenty-five percent of the households are extended families, with half having children under 18 living at home. About 21 percent are female head of household, with half having children under 18 at home. There are approximately 20 percent of households that are non-family, almost all composed of individuals who live alone. These figures are not meant to be cumulative and do not add up to 100 percent, as some overlap categories.8 What is apparent from these statistics is that the family composition is varied and that almost half of the households are not the traditional nuclear family.

**Strategies for changing demographics**

This affordable housing project is designed to permit various configurations of the living spaces to accommodate different household types and needs. The competition requirements only visualized a three-bedroom, one-bath home with living and dining areas. The project proposal not only permits that type of spatial organization, it also allows for separating or joining the master bedroom to the other two bedrooms, allowing for a greater or lesser degree of privacy. As the interior walls are non–load bearing, their exact location is not dictated, allowing for a variety of spatial organizations and number of bedrooms. As well, there is flexibility in the location of public spaces. Finally, the project allows for the creation of office areas and small commercial spaces that can be independently entered. This allows for

families to have a means of generating income that is based on the informal economy, a prominent sector in Puerto Rico.




10. Project alternate floor plans

**Strategies for flexibility in user needs**

The basic living unit of this project allows for any number of possible interior arrangements. This is the result of using non–load bearing interior walls, which can be built in accordance with the inhabitants' needs. The house also is easier to remodel than one built of concrete. Given the tendency of Puerto Rican families to move less frequently than their counterparts in the United States, this other concept of flexibility is important.

## QUALITY OF LIFE

A fundamental concept of the housing competition that generated this project was the desire, both on the part of the profession and the Department of Housing to see a marked improvement in the design quality of the affordable housing built on the island. To that end, an international jury for the competition consisting of four architects and a developer was selected to evaluate the proposals. Two of the members were from Puerto Rico, Norma Fúster, architect and planner, and Cesar Vasquez, Esq., developer and builder. They were joined by three well-known practitioners from the Americas: Javier Sanchez Corral, a Mexican architect whose work has been awarded medals and honorable mentions in various Mexican Biennials and published in Arquine, Enlace, and Praxis Journal among others; the Colombian architect, Germán Samper, who began his professional career in the offices of Le Corbusier in 1948–1954, and has gone on to become one of his country's best know practitioners, with works that include the famous Museo del Oro (Gold Museum); and René Davids, Chilean by birth, who actually practices in California with the firm Davids Killory and whose projects have won several AIA National Awards, PA Awards, and Presidential Design Awards from the NEA.

While perhaps the cost of an affordable housing unit is much less than the average housing unit on the market, it represents a significant investment for the purchaser, and there is a need to demonstrate a high worth for the dollars spent. This is reflected in this project with the creation of architecturally interesting spaces that result in a pride of ownership. The project emphasizes luminous qualities, thermal comfort, and a sense of security.

**Luminous qualities**

While lighting levels in residential buildings are low and energy savings from the use of natural illumination not that significant, the quality of light in a home creates spaces with design interest. To that end, this project uses natural illumination as a form giver. The ceiling acts as a large-scale screen to reflect natural light into the rooms. As well, the narrowness of the building profile permits the penetration of daylight into all spaces.

**Thermal comfort**

*Ventilation*

Fundamental to the design is the creation of thermal comfort through promoting natural ventilation and reducing solar gain. In contrast with the typical affordable home, with its limited fenestration, concrete walls and roof, and deeper width, this project is designed to respond to the two aspects of climate that dominate Puerto Rico: abundant solar radiation and hot-humid conditions. The incentive to create conditions of thermal comfort without depending on a technological fix results from a concern for the economic impact of air-conditioning systems for families of limited economic resources. As Puerto Rico produces almost all its electrical power by burning imported oil, it has one of the highest electrical rates in the United States. The net energy consumption in the residential sector reaches 35 percent of electrical generation.[9]

*Time Lag and Nighttime Cooling*

In the Caribbean, the two vertical surfaces most impacted by solar radiation are the east and west orientations. This is especially important on the west side, where the combination of solar radiation and the higher temperatures that occur in the afternoon can cause great discomfort. The decision was made to construct these walls of concrete, giving them greater thermal inertia, reducing the impact of heat transfer to the building interior. As well, they are shaded by trellises with climbing plant material.

One notable condition of the hot-humid tropics is the lack of a pronounced diurnal temperature shift. Given the limited difference between daytime and nighttime temperatures, a totally massive structure makes little sense. Indigenous housing found in the tropics is little more than a post and beam structure with an immense roof. This lack of massivity permits the interior temperatures to decline at the

same rate as exterior temperatures. This is in direct contrast to the typical affordable housing unit constructed on the island and made entirely of concrete. The total project mass strikes an appropriate balance between limiting interior temperature swings and promoting a more rapid cooling during the nighttime.

*Double Roof/Wall*

The roofing and wall system consists of aluminum corrugated sheeting over a structural substrate. This assembly produces an air space under the ridges of the metal panels, which are ventilated at both ends. This air space also acts as a thermal break to conductive heat transfer, further reducing heat gain from the outside, resulting in greater interior comfort. The same system is used on the framed exterior walls. As a result the roof structure itself is kept cooler.

**Security**

Security needs to take various forms, and in the tropics one of the principal issues is protection from constant hurricanes. The house is designed to resist hurricane winds of up to 125 mph and has the potential to resist winds up to 140 mph. The inverted roof form reduces uplift at the perimeter and makes it more resistant to wind forces. The same need to close up the home tightly under severe weather conditions is also a deterrent to illegal intrusions.

There is another important issue related to hurricanes in Puerto Rico and that is the fragility of the electrical grid. Each major hurricane leaves the island without electricity for days or weeks, and even longer in rural areas when lines and power poles are downed. As the pressurization of the public water system requires electricity for pumping, the island is also left dry. This house, with its photovoltaic, solar hot water heating and rainwater harvesting systems, is designed to provide a minimum level of service under adverse climatic conditions, creating greater security for the inhabitants.

Finally, a basic concept of the house is the "safe room," a reinforced concrete core at the center of the home that houses the kitchen and bath. With its metal doors and windows, the space serves to protect the house from fire originating in the kitchen, and under the most catastrophic weather conditions provides a shelter from the storm.

## DESIGN PROCESS

One special aspect of the project is the involvement of the School of Architecture of the University of Puerto Rico in the design process. The University has a unique program of "Intermural Practice," which promotes the professional work of its professors within the academia. In this case, the author of this article functioned as lead designer and project director, supported by design and technology faculty who provided technical assistance and graduate students who worked on various presentations in graphic and model form. They, as well as several external consultants who worked on the project, were compensated through a contract between the Puerto Rican Department of Housing and the University. Basically, the program allowed setting up an architectural practice within the School. Students and faculty were involved in the project from the first competition proposal thought the generation of contract documents. The graduate students also prepared digital and print format documents that were used for a number of presentations to municipal governments, local HUD offices, and housing officials, to develop greater awareness of the importance of sustainable and energy efficient solutions to affordable housing in Puerto Rico. This project is part of a larger initiative on the part of the School to promote sustainability in architecture on the island and is reflected in design studio content. It is also made manifest in being one of only twenty schools in the U.S., Canada, and Europe, selected to participate in the U.S. Department of Energy sponsored 2007 Solar Decathlon, which is being undertaken by a special sustainability studio.

## CONCLUSION

This example of innovative affordable housing is the first instance in Puerto Rico of applying green building strategies to this housing type. It responds to specific needs of the Hispanic community on the island, addressing the issues that really make housing affordable: controlled construction costs, design strategies and technology that reduce lifecycle costs, sustainable materials that have low upkeep needs, flexibility to adapt to changing user needs and demographics, and spaces with architectural qualities that enhance pride of ownership. What makes this project even more unique is that it is the product of collaboration between the local government, federal agencies, the private banking sector, the architectural profession, and academia.

## ENDNOTES

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# Muffled Conversations: The City, the Citizens, and Affordable Housing Design

Carlos Martín, PhD

## INTRODUCTION

In many ways, this article's title is misleading. Most affordable housing developers and designers know all too well how vociferous and articulate their cities' building departments can be. They have all been harangued in city council hearings while defending large projects, and they have all gotten more than their share of neighborhood opposition verbally, in written form, and otherwise. Affordable housing advocates know that those voices are less than "muffled."

Practitioners and advocates of affordable housing, on the other hand, could certainly claim some sense of feeling silenced. More to the point of this paper, studies or even documentation of these incidents are also muted; though everyone has an anecdote, there have been few attempts to track the patterns of these incidents, the long-term policies that might be enacted to correct them, or, of a more pressing need, the practices that might be employed to overcome them. Many advocates have certainly employed this last group of tactics in their quest to build affordable housing; from voluntary community charrettes to calling on friends in high places, these practices focus more often than not on the conceptual existence of affordable housing units than on any physical or formal traits of the homes themselves. Simply, discussions attended by this observer more often include the statement: "I don't want those people in my neighborhood," more than: "I don't want those designs in my neighborhood." Further, if you heard the latter, it was a likely euphemism for the former.

But, we know that all those arguments have directly impacted not only specific project designs, but also a general strategy for contemporary affordable housing advocacy, and that design choices have altered the terms of those debates in numerous examples. In fact, the NIMBY ("Not-In-My-Back-Yard") syndrome has been proposed as one of the primary reasons for affordable housing providers' recent interest in architectural design. While no empirical studies have explored this, significant evidence does point to the fear of affordable housing and all of its trappings (i.e., poor people) from cities and from certain citizens as a key catalyst for investment in design services, facilitated design guidance, and, ultimately, in good design itself.

This root cause, however, has many manifestations—each of which shapes design differently: antiquated and purposefully restrictive zoning regulations prohibit specific kinds of density increases. Presciptive building codes such as material, hardware, or equipment specifications prohibit alternative constructions that would decrease production costs (and presumably increase affordability) while not reducing occupant safety. Even the newly popular city or community design requirements—including mandates on height and recess variation, exterior finishes, and placement of garages—ultimately add cost and restrict architects' creativity without significantly improving local design values despite their architect–authors' original intent. Perhaps most insidious and certainly most unpredictable has been the use of design as a key debate by neighborhood opponents of affordable housing.

This paper explores the various kinds of regulations and development restrictions that plague contemporary affordable housing and how they shape design considerations. My focus is on categorizing patterns of opposition (in both regulatory and quasi-regulatory forms), and then tracing out design implications for each category with examples of projects that were able to overcome these restrictions almost entirely because of design interventions. Finally, the paper investigates the changed role of professional architects and designers given this broader context for development, as well as implications for affordable housing advocacy.

## THE SILENCE

Despite their tremendous impact on development costs, community development opportunities, and the basic existence of affordable housing, governmental and quasi-governmental regulations over land and building uses have not received the full attention of scholars, practitioners, and advocates. In fact, according to the US Department of Housing and Urban Development's (HUD) 2005 update to the first national review of regulatory effects on affordable housing in 1991, many of the effects persist—and some have worsened.[1] These practices can be found throughout the country; for example, excessive regulations in New Jersey were estimated to raise the final price of a 2000 new home by $40,000 to $80,000 (or approximately 35%), thereby pricing approximately 430,000 households out of the market.[2]

Many of these restrictions apply to the physical nature of housing without providing any commensurate public health, safety, or economic benefits. Building codes and their related mandates (including rehabilitation provisions, energy-efficient or "green" building requisites, and the more recent neighborhood architectural design requirements) shape design and construction directly. It should be noted, though, that they are applicable to all housing within a jurisdiction but, because they add additional costs to developments, indirectly prohibit affordable housing.

Other restrictions disproportionately impact affordable housing options only—like those that limit or prohibit higher density, prevent multifamily or rental properties, ban accessory units (e.g., "granny flats") or manufactured homes in specific communities or segments of communities. By definition and practice, these housing types are affordable. As opposed to structure-related regulations, restrictions on the location of these housing types within municipal or regional jurisdictions are another form of regulation against affordable housing. These are commonly referred to as "exclusionary zoning" prac-

tices. An interesting segment of these practices can be found in those communities where zoning rules may allow affordable housing options, but neighborhood sentiments (i.e., NIMBYism) counter them and, consequently, prohibit affordable housing.

For purposes of clarity and later tracing the effect on designs, it is useful to classify regulations using these two, new categories (structure-based versus location-based regulations) rather than by previous categories founded on other parameters (like cost or income source) because these are the two categories that most determine architectural interventions. There are numerous other regulations, restrictions, and covenants that have no or little bearing on design, such as: the structure and magnitude of impact fees, environmental protection regulations (including growth restrictions), and the general administration of regulations. Without a doubt, these all have definite impacts on the ability to construct affordable housing units but are less relevant to those units' designs or to designers' efforts.[3]

The remaining restrictions have all shaped design either:

- in direct response to the restriction—for example, designers being creative because of the restriction;

- as an anomaly to get the restriction temporarily suspended or a variance permitted—that is, when developers pose such a good design that city or community leaders are willing to waive some regulations on other aspects of the development (the most noted of the design-regulation exchanges);

- by demonstrating potential design opportunities when the restriction either does not exist or is removed. Indeed, many practitioners look to jurisdictions that do not have the same regulatory stringency as models of what could exist in their own communities; or

- a combination of the above.

Because of the varying strengths of regulations and endurances of affordable housing practitioners in different communities, these relationships are inherently complex. Therefore, defining each of the restrictions is called for.

**Building-Based Regulations**

In the first group of restrictions—those that deal with the physical structure of an individual building or development project, there are those restrictions that are common to virtually all communities in the country in some form another as well as restrictions that are somewhat unique to a few jurisdictions. Yet, both ultimately shape the quality and quantity of affordable housing both in those specific jurisdictions as well as the larger regions in which they reside. Again, these regulations prohibit affordability indirectly by increasing the costs of all building projects, thereby becoming difficult for subsidized affordable housing projects to make financial sense as well as those market-rate projects directed at lower-income households.

*Building Codes*

The most pervasive of all regulations on building materials and methods are, of course, building codes. The original intent of building codes is still used to define their central purpose: to safeguard occupant safety and health.[4] Soon after their first enactment in major American cities at the turn of the century, building codes became a hotly contested terrain for industrial interests looking to promote certain materials or practices.[5] The uneven rulings and mandates of occasionally undertrained and often overworked building officials further exacerbated the inability of designers and builders to propose creative, cost-effective solutions to building needs.[6]

In fact, architects and engineers were at the forefront of debates regarding the overall approach of building code language, adoption, and implementation for the good part of the twentieth century.[7] Known as performance codes, these alternative regulations could liberate building codes by letting designers pose a multitude of options provided they meet stated performance standards rather than specify the means of reaching those standards. An example of a performance-based code is one that would state that a wall would have to support a given amount of force, but would not state that the wall would have to be made of a certain material, constructed by certain methods or with certain tools, or that would prohibit it from performing other functions. Currently, most local building codes are a combination of performance- and specification-based codes, though single-family residential codes are largely specification-based.[8] As such, there have been precious few examples of design that varied from extant building codes.

It is difficult to measure the impact of building codes on affordable housing design—and all buildings, for that matter. This is due largely to the fact that there are few, if any, opportunities to modify them as there are to vary from the location-based regulations we will look at shortly; variances or "alternative methods and materials" provisions are allowed by most building departments and in most codes, respectively. But, their effectiveness and even basic usage is unclear and likely questionable.[9] So, building codes have had the effect of chilling many design opportunities, particularly when they include new technological or material experiments. Similarly, architects that have attempted to merge functions within a house or suggest alternative methods of use for spaces have been severely restricted, and with little recourse. It has been suggested that building codes—along with market forces—have limited architectural design options in housing to variations on a basic layout and to the selection of finishes.

In fact, the best examples of how building codes have shaped design are demonstrations of what architects can do when there are no building codes. Most known of these experiments have been those of

Samuel Mockbee and Auburn University's Rural Studio in Hale County, Alabama (Image 1). In fact, Mockbee publicized the fact that he preferred working in this area because there was no code enforcement.[10] As we now know, the consequence was homes and community buildings made of soda bottles, hay bales, car tires, and carpet tiles—not the stuff of contemporary building code provisions.

1. Rural Studio, Bryant "Hay Bale" House, 1993–94; Mason's Bend, Hale County, Alabama. Photograph by Timothy Hursley. Available from the National Building Museum, www.nbm.org/Exhibits/current/Mockbee.html.

To be fair, some components of building code regulation have been beneficial for society at large. We believe that disability and accessibility requirements, for example, are building code requirements whose social benefits outweigh the additions to individual development costs. Historic preservation guidelines are often similarly described. Others, and arguably a majority of contemporary building codes, however, are more of a detriment to affordable housing design.

*Rehabilitation Codes*

One such restriction worthy of particular mention here are rehabilitation provisions—that is, the requirements for bringing homes up to a contemporary standard when undertaking a limited renovation or remodeling project. This disproportionately affects affordable housing opportunities and, in turn, affordable housing design options because in many communities building rehabilitation is such a critical source of affordable housing as well as community revitalization.[11] This dilemma is particularly true of rental properties, where rehabilitation is an ongoing problem for currently rented units as well as essential for preparing new ones for occupancy.

Traditionally, many communities employed what was called the "25/50 Rule" for rehabilitation—a building code based on the cost of expected renovations as a percentage of the value of the property (which, by definition, disproportionately affects lower-income households because property values would be lower for most affordable homes).[12] This rule divides rehabilitation work into three cost-based categories each with its own requirements for bringing the building up to contemporary standards: work planned to be under 25 percent of the physical value of the existing structure would be at the discretion of the code official as to how much of the remaining structure would have to be brought up to meet code; work planned at 25 to 50 percent of value would have to bring all areas of the home slated for rehabilitation into full compliance; while work estimated at over 50 percent of the value would require that the entire structure be brought into compliance (including areas or systems that were unrelated to the rehabilitation). Some jurisdictions had even more restrictive triggers for rehabilitation compliance.

By demonstrating how a more nuanced rehabilitation code could improve design options and reduce construction costs, affordable housing advocates have been able to overturn existing code provisions in numerous jurisdictions. This started with the State of New Jersey, which also provides an exemplary case study demonstrating how an improved code could shape design options and constrain costs (Image 2).[13] Key provisions allowed by the new code saved a remodeler 20 percent of the expected costs of renovation, including:

- overlooking existing foundations without requiring further structural analysis since no additional weight was to be added from the rehabilitation;
- allowing current windows to remain though they did not comply with modern egress restrictions;
- permitting both an existing ceiling height and corridor width that were less than the norm;
- consenting to the existing stair geometries that fell outside of new building requirements but that were not an apparent safety hazard.

2. Existing Corridor Permitted Under New Rehabilitation Code. Chester, New Jersey. From NAHB Research Center, Innovative Rehabilitation Provisions: A Demonstration of the Nationally Applicable Recommended Rehabilitation Provisions (Washington, DC: US Department of Housing and Urban Development, 1999).

By demonstrating how effective design considerations can still satisfy occupant health and safety needs while reducing the costs of remodeling construction considerably, cases like this demonstrate how mundane battles with building departments can lead to long-tem regulatory change.

*Design Reviews*

Though still very limited in geographic spread, design review board and design guidelines for neighborhoods have become increasingly common—and increasingly hinder design options for affordable housing while instituting design with little or unclear community value.[14] These requirements generally pertain only to subdivisions, multifamily projects, and other such large developments, and are carried out through appointed design review boards or city redevelopment staff members. Historic preservation design requirements are similar, yet these have not proven to be a deterrent to affordable housing as much as the design requirements for subsidized and market-rate housing subdivision.[15]

Larger cities have had these regulations for some time, often as a means to abdicate responsibility for new construction away from city councils or agencies. Because of the volume of large-scale projects that they face, large cities have even instituted design guidelines, purportedly not as official code but as voluntary technical assistance to direct potential developers to the boards' concerns and likely red flags that will delay permit issuance. For example, the City of Seattle's design review guidelines describe in specific detail the architectural and landscape options that a designer should consider with the hope that such attention generates a development that will "contribute positively to neighborhoods," "respond better to distinctive character of its surroundings," and, ultimately, create "good communities."[16] The intentions for larger cities' guidelines for multifamily design are largely well founded, yet it is still unclear whether they have reduced the amount of negotiation after design submissions to review boards, whether they are adhered to by the review boards, or, to put it bluntly, whether they have generated good design in the end.

3. Phoenix Streetscape. Carol Johnson, "Single-family Design Review: Quick Fix or Creating Communities?" American Planning Association National Planning Conference Proceedings (1999).

A more troubling recent addition to this group of regulations has been the rise of single-family housing design reviews and design guidelines, particularly in more affluent areas of the US Southwest.[17] In the late 1990s, the City of Phoenix instituted a design review as part of its single-family subdivision reviews to combat the "monotony, garage-scape, and lack of community" of typical developments in the area (Image 3).[18] Armed with seeming benevolence, the city drafted guidelines that included different colors and types of roofing materials, alternating the orientation of roof lines, varying lot widths, staggering front yard setbacks, increasing sideyard setbacks, varying elevations on adjacent properties, and optional street standards.

Ultimately, industry pressures watered down most of the guidelines primarily to surface treatments and the like rather than lot arrangements, street layouts, and other more sensitive design concerns. As such, it is not clear whether the subsequent designs have benefited the community as a whole, or whether they have even reduced design creativity. Despite that, the City of Phoenix expanded the design review of planned housing to include individual lots as well as subdivisions.[19]

In many ways, the advent of design reviews for single-family housing mirrors the debates over pattern languages, new urbanism, and any prescriptive design categorization. While they may be conceptually sound, they certainly serve to increase costs and limit architectural diversity. The bring attention to design concerns, but often do so in ways that overlook the potential economic implications and actual implementation problems that might arise. The most extreme examples of design control—as depicted by the quasi-governmental codes, covenants, and restrictions of homeowners' associations—completely prohibit a diversity in building types. They also serve to segregate and disenfranchise certain segments of the population, like affordable housing recipients.

It is true that few of the current municipal design review guidelines are particularly demanding; in fact, many follow good architectural principles. It is not clear that interpretation by design review boards, however, will match the intent of requirement. There is a strong likelihood that review board members could begin to impose individual stylistic choices. Not only does this have general cost implications for all developers including affordable housing ones, this ambiguity has the potential of being used disproportionately against affordable housing projects. Indeed, many smaller cities that have employed single-family design review boards and guidelines tend to be more affluent communities within large metropolitan areas. For example, the City of Scottsdale's voluntary "Sensitive Design Principles" espouse the generally benign concept of respecting "the unique climate, topography, vegetation and historical context of Scottsdale's Sonoran desert environment."[20] But, the added costs of complying with even the most benign programs (not to mention any additional requirements that might be imposed unfairly to certain projects during the review process), lead affordable housing practitioners to look elsewhere.

*Green Building Programs*

In very similar ways to design reviews, green building programs are sufficiently ambiguous that we might question whether there are sufficient social benefits to individual compliance. Further, green building programs tend to be found in affluent communities located within larger metropolises. Fortunately, most are structured voluntarily and give other development bonuses (such as expedited permit reviews) in exchange for compliance. The incentives in these programs, then, do not necessarily or directly penalize affordable housing developers.[21]

There are two more similarities between green building programs and design reviews, however, that were not discussed previously but that require further exploration. The first is that it is often the design community itself that is looking to create design reviews and green building programs within their cities. While at first glance it might seem in direct conflict with their professional missions of increasing the number of units, many affordable housing designers also see the need to improve the stock of all housing—whether it be low-income or high-end. Unfortunately, architects have not often crafted these initiatives with any eye toward equitable implementation or to potential societal effects.

However, second, many affordable housing finance sources have supported the design community in these endeavors. Green building programs in particular have received much consideration from housing intermediaries (most notably is Enterprise's Green Communitities™ initiative) and housing policy-makers (Image 4). For example, the State of California gives bonuses to proposed developments that incorporate "energy efficiency, resource conservation, or indoor air quality items" as well as projects including "distributive energy technologies" when it disbursed its allotted low-income housing tax credits. So, there is evidence that subsidized affordable housing financiers are supportive of the design community's efforts to regulate design.

4. Azotea Senior Apartments in Alamogordo, New Mexico: Enterprise Green Communities™ case study: www.greencommunitiesonline.org/documents/Azotea2006.pdf.

It is very important to note, though, that while assisted affordable housing developers are sometimes able to acquire sympathetic financing to compensate for incorporating these guidelines and regulations into their projects (including both the design and green requirements), affordable market-rate developers are priced out of the market because they do not have access to gap financing.[22] In turn, designers of assisted projects are given somewhat more flexibility while those working on market-rate, low- to moderate-income housing are essentially forced to compensate in other areas, or simply left without work. This sector, as many designers know, is marked with some of the least desirable design, and is a sector requiring much more study and advocacy by the architectural community.

**Location-Based Regulations**

While the first group of regulations and guidelines focuses exclusively on the physical materials and methods of building affordable housing, the second group includes those that more directly prohibit affordable housing by specifying where or, more often than not, where not to build it. Looking at these regulations' effect on affordable design is in many ways easier because there is more flexibility in their implementation. In turn, there are so many more examples to choose from; indeed, it is rare to find an affordable development (especially a larger subdivision or multifamily project) that was not granted some form of variance or overlay either due to design excellence or requiring design changes as a condition of approval. In fact, planned unit developments (PUDs) were created as official vehicles to deviate from development standards required by zoning in order to provide more design flexibility and, purportedly, greater community assets as a consequence.

In short, a significant portion of the well-designed affordable housing in this country came out of such variances to statutory, location-based regulations, if not the vast majority. Some examples of these individual changes, as well as projects that lead to more comprehensive regulatory reforms based on the quality of affordable housing design, are described below.

*Multifamily, Rental Property, and High Density Exclusions*

The most common form of excluding affordable housing from specific neighborhoods or whole communities has been through zoning. This collection of ordinance include prohibitions on certain housing types that are likely to contain lower-income households (like multifamily properties or rental units), or on the structural characteristics that typify those housing types (like higher density), within certain communities or entire citiess. In so doing, these last practices necessarily prohibit the construction of affordable housing units that could only pan out financially at higher densities. In a vast number of communities across the country, such exclusions persist.

Often, though, improved design has been used as both a vehicle to receive variances to existing zoning, and to call the broader zoning ordinances into question. Affordable housing providers employ the lessons from higher-end market developers by investing in design services early, thereby ensuring higher quality architecture and landscaping at the time of permitting and approvals.

The design strategies commonly used involve:

- adding visible amenities to the development or neighboring community, or both (such as green spaces, swimming pools, playgrounds, recreational facilities, or retail centers);

- decreasing the appearance of density through hidden parking, varying building heights, and recessed facades;[23]

- upgrading finish materials such as exterior paint, window treatments, roof shingles, etc.;

- incorporating the development more into the local context through vernacular details or overall building types; and

- generally improving interior and exterior layouts so as not to mimic stereotypes of either apartment buildings or "projects," such as removing exterior stairwells or varying individual units.

5. Stoney Pine Apartments. Sunnyvale California (2001). Architects: David Baker + Partners, www.dbarchitect.com.

One example of how designs become integral in navigating the treacherous waters of city officials and regulators can be found in Sunnyvale, California. The Stoney Pine Apartments are an affordable housing project for developmentally disabled citizens in the middle of some of the most expensive property values in the nation (Image 5). Lead by Charities Housing Development Corporation with HUD Section 811 funding, the project required extensive regulatory changes. Though the project's site had already been designated as high-density residential, improved design quality along with negotiations with city officials lead to eventual approvals.

Similarly, Sorg and Associates' LeDroit Park development seamlessly incorporated historical elements into the construction of new units to match those units that were being renovated as part of the Washington, DC project.[24] Design strategies such as these have lead to the creation of individual projects as well as to a longer-term reconsideration of the connection between affordable housing design and regulation. For example, when the City of Bainbridge Island, Washington adopted a comprehensive plan for the Winslow neighborhood in 1998 that established a higher density overlay, it also provided design guidelines that would allow such density to be incorporated into the neighborhood without disturbing existing home appearances or local architectural styles. In fact, the ensuing guidelines suggest that the incorporation of these accessory units could even architecturally complement the homes, along with potentially adding financial value.[25]

*Accessory Unit Prohibitions*

Similar to the exclusions on higher density, prohibitions on accessory units where the accessory unit does not necessarily pose a fire or safety hazard are another method of reducing potential affordable housing within specific localities. Usually used as rental units, accessory units can range from rooms rented from within a single-family house, to an apartment attached to a house or taking up an entire floor with a separate entrance and amenities, to a detached smaller structure (i.e., "granny flats") on the same lot as the primary dwelling. Because they are rental properties and often located with surrounding family or friends, these units are used particularly by lower-income households. In many neighborhoods, accessory units are an important community development asset because they provide affordable rental housing at the same time as they provide rental income and economic assets to the landlord household. Different prohibitions exist in different cities, including ones that prohibit even the renting of a room. It has been estimated that as many as 3.8 million units could be added to the nation's rental housing supply through this means alone.[26]

6. Carpenter Village Homes. Cary, North Carolina. Photograph by W&W Partners Inc., www.carpentervillagehomes.com.

Fortunately, again, design provides solutions to circumvent and eventually reduce these barriers. Insuring that accessory units both comply with existing building codes and are visually complementary and pleasing without appearing too crowded, designers have been able

to work with cities and affordable housing developers to develop accessory unit programs. For example, the City of Cary, North Carolina, had existing zoning provisions that allowed for accessory units but required that they be attached to the main dwelling unit and occupied by a relative.

Cary also had an increasing affordability issue as growth from the Research Triangle started straining its housing stock. As part of its affordable housing initiatives, Cary considered removing these restrictions and expanding the number and quality of accesory units. One local development, Carpenter Village, began including "suites" in townhouses that could be converted to such additional rental income units.[27] These units are incorporated into the development's design plans, which include other design amenities like hidden parking, mixed-use buildings, and increased sidewalks and paths (Image 6).

*Manufactured Housing Exclusions*

Another housing type that provides a primary resource to lower-income households that is often prohibited in many communities is manufactured housing.[28] Rather than being a housing type marked by social measures like rental apartments or granny flats, manufactured (or HUD-Code homes) are marked most by the fact that they are constructed completely within a factory and delivered to the house site on a chassis. As such, manufactured homes are a very affordable housing option. However, they have also received unfair consideration by the housing market and by popular opinion. Many communities have consequently zoned out manufactured home communities in particular, and manufactured homes in general.

As a consequence to these stereotypes, many manufacturers have made great strides in developing improved home designs for both traditional manufactured homes as well as possible multi-story homes.[29] Due to the increased production of multi-section manufactured homes, to improved construction standards as defined in the HUD code, and to improved designs, there has been a trend by states during the 1980s and 1990s to limit the authority of local governments to exclude detached manufactured housing or to confine it to specifically designated communities. In fact, California amended existing laws in 1996 to enable the construction of affordable multi-unit housing using manufactured-home technology. Created primarily to facilitate the construction of duplexes on small San Francisco Bay area lots using HUD-code homes, this law has not been significantly tested. However, the quality of manufactured home design has certainly continued to improve.

One example of design improvements that enabled reductions in manufactured housing exclusions, and perhaps the most famous example to date, is Noji Gardens in Seattle, Washington (Image 7). Nonprofit developer, HomeSight, worked regularly with the local neighborhood council system, as well as Seattle's extensive design review boards and the manufacturer and financiers to continuously assure them of the project's solvency—and its design potential. As one document states, "officials were ultimately swayed by the fact that the homes would be two-story Neo-Victorian homes with 8-in-12 pitch roofs that blend in with the surrounding neighborhoods."[30] With numerous public meetings, HomeSight also convinced the neighbors that the homes would look "regular" in addition to being able to revitalize the neighborhood.

7. Noji Gardens. Seattle Washington (2002). Developer: HomeSight, Seattle. Manufacturer: Marlette Homes (Oakwood Homes). From Manufactured Housing Research Alliance, Eliminating Barriers to the Use of HUD-Code Housing in Attached Construction (Washington, DC: US Department of Housing and Urban Development, 2003).

Perhaps just as interesting as the design improvement of manufactured homes themselves has been the attempt by designers and home manufacturers to circumvent manufactured housing exclusions through the creation of modular systems. Like manufactured homes, modular homes are constructed in a factory and shipped to the final site to be finished and completed with interior amenities, finishes, and appliances. Because the homes are built in sections (modules) and set on a permanent foundation, local codes apply rather than the national HUD code and can rise as high as three stories. Design in this housing segment has received tremendous attention as of late, particularly due to the increased interest in prefabricated housing. Architects like Jennifer Siegal, Michelle Kaufmann, Charlie Lazor, Rocío Romero, and Kieran Timberlake have pushed the boundaries of modular housing design (Image 8). Though to date these designs are still fairly far from affordable, they have also taught methods for circumventing existing manufactured home exclusions.

*Infill Disincentives*

Another common barrier to affordable housing has been the inability of developers to overcome the numerous combined regulations that are needed to design and build infill projects in cities. This is a particularly egregious problem for lower-income households, who tend to be located both in existing cites and in the least developed areas of those cities. A combination of antiquated rehabilitation codes, zoning exclusions, and extremely bureaucratic administrative procedures for acquiring lots and receiving permits collude to make such critical work nearly impossible for tight-margin projects.

8. LV Series©. Perryville, Missouri. Rocío Romero LLC, www.rocioromero.com

Design, though another development cost, has often come to the rescue when developers have proposed multiple-lot, affordable housing projects. Good, contextual design not only makes each individual home more amenable to neighbors and city officials, but insuring continuity in design details throughout the homes further cements a sense of community as well as brings many needed additional infrastructure and amenity improvements to the entire neighborhood.

One recent example of such a developmentis the Neighborhoods in Bloom program of the City of Richmond, Virginia.[31] In 1997, the City identified 900 target areas within six urban neighborhoods, half of which were vacant lots and two-thirds of which had blatant code violations. The City then worked with neighborhood groups and nonprofit housing organizations to either encourage existing homeowners to rehabilitate their properties with additional regulatory incentives and funding sources, or took over the properties themselves. In the first two-year trial of the program, 23 properties were completely renovated, 102 were started, and 144 more were planned, while 44 new units were built, 133 had broken ground, and 117 were planned (Image 9). The City has since continuously renewed the program. By using a combination of incentive, regulatory variances, and design assistance, Richmond has revitalized these neighborhoods, provided affordable housing options, and secured local architectural traditions.

9. The Richmond, Virginia Neighborhood of Church Hill Central, One of the Six "Neighborhoods in Bloom" Areas, www.ci.richmond.va.us/departments/communityDev/neighborhoods

*Neighborhood Opposition*

Perhaps the most difficult regulation that design has had to confront is the only one that is not a regulation at all: the opposition of neighbors to an affordable housing development, or NIMBYism. This "regulation" is particularly difficult to address for the very reason that it is mandated and, therefore, unpredictable (with the possible exception of mandatory public hearings for larger developments), yet is the primary motivation for many of the other regulations.

Indeed, the ability to receive variances, alternative materials exemptions, or any regulatory exclusion is usually predicated on neighborhood sentiment—and a neighborhood's voicing of that sentiment. But, again, designers have come to the rescueby putting two particular skills to use: providing good design and facilitating the development of that design.

Numerous examples abound of designers demonstrating how affordable housing design can become an asset to a community. Yet, one recent example is particularly striking: Waterloo Heights in Los Angeles, California. Serving as a special needs housing community, the Hollywood Community Housing Corporation enlisted the premier architecture firm of Koning Eizenberg Architecture to develop striking yet contextual designs for a community that was less than enthusiastic about the development (Image 10). As stated in the National Building Museum's recognition of the project: "Area residents were wary of the development from the onset because of a failed attempt to establish drug and alcohol treatment programs in the area."[32] This concern affected all aspects of the project and design—from site, to density, to visual appearance, down to security technologies. The developers and designers met regularly with the community to come to agreement both about the overall project's purpose and how the design might address that as well as provide a long-term community asset socially and visually. The result was a well-conceived, visually rich project.

10. LV Series©. Perryville, Missouri. Rocío Romero LLC, www.rocioromero.com

Using good design as a means of preempting or diffusing quasi-regulatory dissent has even gone beyond individual project tactics. The

Non-Profit Housing Association of Northern California (NPH) sponsored one of the most successful and publicized affordable housing awareness campaigns, fully using design as a key strategy for describing what affordable housing "is, and is not."[33] Focusing both on the architectural design of developments as well as on occupants' personal stories, the campaign produced two videos ("Good Neighbors: Affordable Housing in the Bay Area" and "Affordable Family Housing: A Bay Area Tour") that received much acclaim and were shown throughout the country.[34] Indeed, from massing to exterior finishes and landscaping, good design has done much to overcome regulatory barriers on individual projects, and to change public sentiments that reduce regulations in the long-term.

Good design alone, however, is not necessarily enough. Communicating that design and listening to neighbors as well as potential occupants has become critical to practitioners' strategies for combating regulatory barriers and local dissent. Popularized by many architects (including Michael Pyatok, Tom Jones, and Kathy Dorgan), "participatory" or "community" design assumes that other parties beyond the developer or client that are affected by a development are also integral to its success; consequently, the design process should communicate with them. The inclusion of potentially opposing parties not only strategically assists that project, but also serves as the beginning of a longer-term education for those neighbors. This, in turn, reduces the likelihood of future community opposition as well as the political bite of regulations.

In all of these examples of design's response to location-based regulations, good design ultimately has perpetuated more affordable housing because it counteracts the notion of what affordable housing is based on old stereotypes. In so doing, design makes cities more amenable to rezoning and other regulatory reductions while making local citizens less fearful of further affordable housing. Indeed, it was conceivable that individual cases posed a poor precedent for affordable housing practitioners because they would perpetuate a pattern in which each project would be required to jump through additional hoops for approvals. But, beyond the one-shot regulatory variances that were common in the 1980s and 1990s, design has actually led to a longer-term reconsideration (if not reduction) of affordable housing restrictions in many communities. From unaffordable urban areas like San José to regions marked by poor quality housing such as rural Alabama, design has been critical to community support for both projects and for policy changes.

## DESIGN SPEAKS

In comparing the building-based regulations versus the location-based ones, it becomes somewhat obvious that examples of design responses abound for the latter. Design, ironically, has done a greater service in combating location-based regulations but has struggled with the ones that are more directly relevant to its skill set and professional service—the regulations of the building's physical materials and construction. This is due to the fact that designers are usually charged with drafting building-based regulations on the local level, but are often excluded from broader planning and policy issues in cities.

Of all potential skills they can employ, designers do design best. This is not surprising, yet I am always surprised by the assumptions that designers make about the policy implications of their work without fully understanding the complexity of contemporary urban politics. Architects often catch themselves in a design determinism quandary, where they believe that a complete and comprehensive good can come from design (and, in particular, their individual designs). This often leads to limited and, in the worst case, flawed policy recommendations for building-related regulations.

I am equally surprised, though, at the lack of scholarship on design, its practices, and its effect. Often, studies are all that city officials, lenders, and community advocates are willing to consider—particularly if they are predisposed against affordable housing or any other development they perceive as foreign, irregular, or deleterious to their existing sense of community. Such scholarship, along with involved practitioners, can only serve as another strategy for opening up options to affordable housing, and for ensuring design's role within that discussion.

To be fair, architects have been on the cutting edge of policy guidance through their very work as designers and design facilitators. HUD's HOPE VI program—the first and largest design and construction funding source for public housing authorities in decades—would not have included key design provisions had it not been for both the advocacy of the design community and the successful examples of past affordable housing designs. There is much evidence that architects and architectural schools have been at the forefront of providing guidance to affordable housing developers with regard to potential pitfalls in their local policies, as well.

In short, design can change policy. As the most mundane of policy vehicles, then, regulations are fair game.

## BIO

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## ENDNOTES

[1] The original report, the Advisory Commission on Regulatory Barriers to Affordable Housing's "Not In My Back Yard": Removing Barriers to Affordable Housing (Washington, DC: US Department of Housing and Urban Development, 1991) was based on the 1990–1991 HUD Commission hearings. The recent update is HUD's "Why Not In Our Community?" Removing Barriers to Affordable Housing—An Update to the Report of the Advisory Commission on Regulatory Barriers to Affordable Housing" (Washington, DC: US Department of Housing and Urban Development, 2005).

[2] Michael Luger and Kenneth Temkin, Red Tape and Housing Costs (New Brunswick, NJ: Rutgers University Center for Urban Policy Research, 2000). Recent studies of other such examples are reviewed in HUD (2005).

[3] One possible exception to this is the possibility that growth restrictions or boundaries (e.g., "smart growth") regulations may be enacted simultaneous to more flexible zoning, like increased density or infill incentives within growth boundaries. For more on this, see the Smart Growth Network Subgroup on Affordable Housing's Affordable Housing and Smart Growth: Making the Connection (Washington, DC: Environmental Protection Agency, 2001) or Stuart Meck, Growing Smart Legislative Guidebook: Model Statutes for Planning and the Management of Change (Washington, DC: American Planning Association, 2002).

[4] Sara Wermiel, The Fireproof Building: Technology and Public Safety in the Nineteenth-Century American City (Baltimore: Johns Hopkins University Press, 2000).

[5] Carlos Martín, "Riveting: Building Codes, Steel Technology, and the Production of Modern Place" (PhD diss., Stanford University Department of Civil and Environmental Engineering, 1999).

[6] Francis Ventre, "Social Control of Technological Innovation: The Regulation of Building Construction" (PhD diss., MIT Department of Urban Studies and Planning, 1973).

[7] The argument was made conceptually for all building types, but it usually played out in large commercial and multifamily projects. See Martín (1999).

[8] Note that most jurisdictions in the United States have now adopted an edition of the International Code Council's code series with some local revisions and with a few notable exceptions (such as those using the National Fire Protection Association)—thereby, providing at least some geographic standardization to codes nationally. Interestingly, many builders and some designers of single-family or lower-density multifamily housing prefer specification-based codes because they limit design options, thereby firming up expected costs early and with little potential for unexpected variations.

[9] International Code Council, "Removing Building Regulatory Barriers: PATH Roundtable on Codes." Monograph prepared for the Partnership for Advancing Technology in Housing (January 2004), http://www.pathnet.org/si.asp?id=1174.

[10] Fred Bernstein, "A Poor County, Rich in Modern Architecture," New York Times, December 25, 2005. Note that, for better or for worse, poor rural and NativeAmerican territories have often been the sites for experimentation by designers.

[11] David Listokin and Barbara Listokin, Barriers to the Rehabilitation of Affordable Housing: (Washington, DC: US Department of Housing and Urban Development, 2001), vol. 1 of 2, Findings and Analysis.

[12] For more background on rehabilitation codes, see Building Technology Inc., Smart Codes in Your Community: A Guide to Building Rehabilitation Codes (Washington, DC: US Department of Housing and Urban Development, 2001).

[13] See NAHB Research Center, Innovative Rehabilitation Provisions: A Demonstration of the Nationally Applicable Recommended Rehabilitation Provisions (Washington, DC: US Department of Housing and Urban Development, 1999).

[14] Carlos Martín, "Response to 'Building Codes and Housing'…" Cityscape 8, no. 1 (2005): 253–59.

[15] This is partially because subsidized housing developers can receive both low-income housing and historic preservation tax credits to finance the additional costs of historic design requirements, and because historic neighborhood provisions generally are not in areas of concentrated lower-income households.

[16] City of Seattle, "Design Review: Guidelines for Multifamily and Commercial Buildings" (November 1998), http://www.cityofseattle.net/dpd/stellent/groups/pan/@pan/@plan/@drp/documents/Web_Informational/cos_005127.pdf.

[17] The Municipal Research and Services Center of Washington lists many relevant resources in this area http://www.mrsc.org/subjects/planning/desrevguideandcode.aspx#singlefam.

[18] Specifically, the monotony of uniform roof pitches, house colors, and elevations, the lack of response to the local climate, the dominance of the garage as a design element, and the size and shape of streets were singled out as target problems. See Carol Johnson, "Single-Family Design Review: Quick Fix or Creating Communities?" American Planning Association National Planning Conference Proceedings (1999), www.asu.edu/caed/proceedings99/JOHNSNC/JOHNSNC.HTM.

[19] See http://phoenix.gov/DEVPRO/sfdrvw.html.

[20] See http://www.ci.scottsdale.az.us/Design/general/SensitiveDesign/.

[21] The US Green Building Council has recently developed a single-family new construction program, LEED for Homes. See http://www.usgbc.org/DisplayPage.aspx?CMSPageID=147.

[22] The most developed local green building programs can be found in Scottsdale, Arizona, and Alameda County, California—both jurisdictions with home sales prices well above the regional (and even national) average.

[23] It should also be noted that several studies suggest that neither density increases nor subsidized housing per se do not necessarily impact local housing prices (see George Calster's literature review in "The Effects of Affordable and Multifamily Housing on Market Values of Nearby Homes" in Anthony Downs [ed.], Growth Management and Affordable Housing—Do They Conflict? (Washington DC: Brookings Institution Press, 2004).

[24] See National Building Museum, Affordable Housing: Designing an American Asset (Washington, DC: Urban Land Institute, 2005).

[25] See http://www.mrsc.org/mc/bainbridge/bainis18/UsfDG.pdf.

[26] See HUD (2005).

[27] Smart Growth Network Subgroup on Affordable Housing, Affordable Housing and Smart Growth: Making the Connection (Washington, DC: Environmental Protection Agency, 2001).

[28] Manufactured Housing Research Alliance, Eliminating Barriers to the Use of HUD-Code Housing in Attached Construction (Washingtonm DC: US Department of Housing and Urban Development, 2003).

[29] NAHB Research Center, Home Builders' Guide to Manufactured Housing (Washington, DC: US Department of Housing and Urban Development, 2000).

[30] Steven Winter Associates, A Community Guide to Factory-Built Housing (Washington, DC: US Department of Housing and Urban Development, 2001).

[31] The Neighborhoods In Bloom project also was that latest recipient of the HUD Secretary–American Planning Association Opportunity and Empowerment Award. See http://www.huduser.org/research/APA06Recipient.html.

[32] National Building Museum (2005): 114.

[33] See NPH's outreach materials "Tool Box": http://www.nonprofithousing.org/action-center/toolbox/index.atomic.

[34] The videos were selected to accompany the traveling exhibit on affordable housing design organized by the National Building Museum documented in National Building Museum (2005). See http://www.nbm.org/Exhibits/online/affordable_housing/ah_index.html

# Neighborhood Rehabilitation and Cultural Sustainability: A case study in design in Charlottesville, Virginia

Kathryn R. Merlino and Katie Swenson

## INTRODUCTION

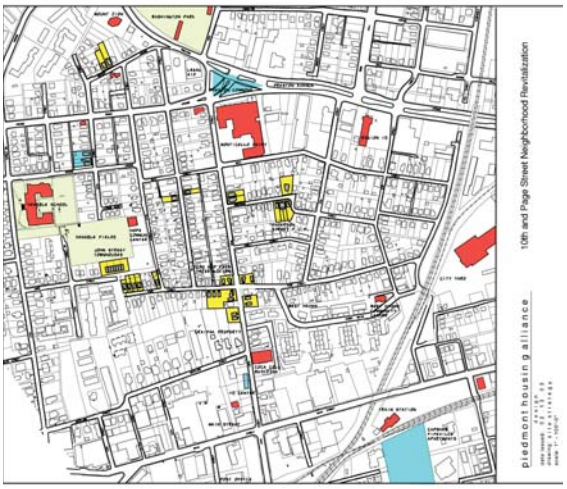
While 'green' building is synonymous with architecture that is environmentally responsible, it does not, alone, create or promote sustainable communities. Environmental building practices must engage in a dialogue with historic preservation and community-driven design processes to become a truly viable means to a more sustainable future. Thus, we argue that sustainable design successfully integrates the use of physical and cultural components, both old and new, to enhance place-making, and build for a sustainable future. A Charlottesville, Virginia, 10th and Page Street Project, provides an successful case study of a neighborhood revitalization project that succeedesin uses a sustainable design strategy that achieved green building, community development, and affordable housing goals. By establishing a dialogue between the past (architectural fabric, urban patterns, infrastructure), and present (green building design and contemporary housing needs), this project protected the continuity of the neighborhood's rich cultural history while shaping the neighborhood's future with sustainable and high-quality affordable housing options.

Building and site design protocols that guide designers for form, space and cultural meaning are particularly critical, yet oftentimes absent, within the context of an existing site. This lack of a framework supporting sustainable design and redevelopment within existing communities makes the successful integration of past and present fabric perhaps the greatest challenge of architecture today.Traditional views of preservation promote the idea that buildings and landscapes immobilize a specific time or event. This rather static view severely limits its design concepts and project outcomes by disregarding the past's more dynamic relationship with the present. A revisited and more functional interpretation of historic preservation requires the consideration of a less rigid view of history, in order to preserve critical areas of existing physical and cultural fabric while meeting current community needs. When this balance is achieved, then historic preservation is inherently sustainable.

In recent years, scholars and designers have become increasingly aware of the relationship between historic preservation and cultural sustainability in the design of successful communities. In his closing plenary talk at the National Trust Annual Conference in Portland Oregon in 2005, Donovan D. Rypkema acknowledged a more holistic view of historic preservation, one that must preserve "cultural history of site and occupants, economic competitiveness, job creation, housing, public partnerships and social cohesion".[1] The National Park Service concurs that designers and preservationists must integrate suitable sustainable practices into the built environment, but caution that it must be done without "sacrificing historic preservation".[2]

Other recent themes in preservation include an awareness and promotion of the fact that the reuse of old buildings comprises a more environmentally sustainable practice than new construction. The re-use of existing building materials reduces waste, while protecting the historic character of the built environment. Re-use also conserves the amount of energy that would have been required to tear down and rebuild, also known as "embodied energy," which can instead be used for the renovation of an existing structure.[3]

One way to implement a new sense of preservation and sustainability is to critically assess architecture within the broader cultural landscape. In the Charlottesville neighborhood of 10th and Page – so named for the main intersection – preservation took place on many levels, with a strong focus on community needs as well as the physical environment. From a traditional perspective, the project may be considered less than a total success because physical artifacts from the neighborhood's past were lost. Nonetheless, the 10th and Page neighborhood has benefited tremendously from new and improved housing, better streets and infrastructure, enhanced safety, and a new community center. Ultimately, the project's negotiation and synthesis of broader planning, community development, and preservation goals laid the foundation for the transformation of one of Charlottesville's most neglected urban neighborhoods into a culturally sustainable and vibrant community.




1. Map of the 10th and Page neighborhood in Charlottesville illustrating boundaries and market housing target dispersion (map courtesy of PHA, 2000).

## THE 10TH AND PAGE STREET REVITALIZATION INITIATIVE

In the year 2000, neighborhood leaders and the City of Charlottesville collaborated on a unique neighborhood project - the 10th and Page Street Revitalization Initiative - and asked the Piedmont Housing Alliance (PHA) to help. PHA is a not-for-profit group and regional organization based in Charlottesville that is dedicated to improving the lives of low and moderate-income families and individuals through

housing and community development opportunities. Katie Swenson, who was lead designer of the project, was then employed with PHA as a Rose Architectural Fellow of Enterprise Community Partners, a program designed to train architectural leaders in the realm of community development and raise the quantity and quality of affordable housing.

The 10th & Page Street Revitalization Initiative was implemented as a scattered-site affordable housing development project within a targeted neighborhood, which supported socio-economic integration, rather than perpetuate socio-economic isolation. The neighborhood had deteriorated both structurally and socially over the past several decades, and suffered from a disproportionately high rate of crime, and slum-lord rental housing that had seen little or no capital reinvestment for many years. By synthesizing community development, historic preservation, and green building methods, the 10th & Page Project achieved its design goals of renewal and sustainability through three critical means of investigation and application. First, a historical and cultural understanding of the neighborhood was developed to understand occupancy patterns and changing demographics so the designers could develop culturally appropriate design models that would speak to a diverse population. This study of existing conditions provided a conceptual framework in which to begin the design phase, as informed by a local understanding of the community and site. Vernacular building forms were used as a language that created continuity and familiarity and stabilized the neighborhood visually.

2. The vernacular language was preferred as it blended more with the architectural landscape and the features are inherently sustainable (photo by author, 2004).

Secondly, the project designers furthered a sense of ownership and trust by facilitating a series of neighborhood meetings and design workshops, which empowered residents to articulate their vision for the neighborhood and develop relationships with the designers. Third, green building principles were incorporated into redevelopment requirements. Green homes not only support a healthier environment, but also sustain more affordable housing with reduced user costs. The long-term affordability of a home is as critical, if not more so, than the initial price point. PHA therefore required all homes be Energy Star certified, and later incorporated the even more stringent goals and design details developed by the EarthCraft Program created by the South Face Energy Institute in Atlanta. The importance of green building principles and the effect on affordability over time was promoted in all aspects of the project.

## PROJECT CHALLENGES & GOALS

In the 2001 Comprehensive Plan, the 10th and Page neighborhood study of Strengths, Weaknesses, Opportunities and Threats (SWOT) illustrated the need for continued housing renovation and home ownership opportunities as central concepts for the neighborhood. Ideas related to housing conditions appear throughout the SWOT study and were prominent in community meetings. Many of the concerns of individual homeowners surrounded the problem of homes in disrepair and/or a state of abandonment, often called the 'broken window syndrome'. Besides discouraging investment, abandoned and dilapidated houses had become centers of criminal activity and the neighborhood had one of the highest crime rates in the City.

Furthermore, while the neighbors understood the benefits of being near University of Virginia grounds, future losses of owner occupied homes converted to student rentals was viewed as problematic for the community's identity and homeownership goals. According to the Comprehensive Plan, homeownership in the 10th and Page Street Neighborhood stood at just 33%, with 67% rental housing. In addition to the goal of improving housing stock and providing additional homeownership opportunities, PHA also sought to address poor road conditions, traffic concerns, substance abuse, and general code enforcement. There was also a strong interest in establishing a community cultural center that would offer programming for a variety of ages, incorporating the arts, community activities, after school care, and other elements.[4]

## UNDERSTANDING CULTURE AND SITE

The neighborhood of 10th and Page was, for many years, a racially diverse neighborhood characterized by a mix of ethnic backgrounds, occupations, and incomes. However, in recent decades, the neighborhood became segregated along the lines of race and income. The median age in the neighborhood is 34 years, versus a median age in the City of 29 years. Many properties are occupied by residents over 65 years of age who still reside in their family home. Except in recent years, 10th and Page has not been able to attract significant numbers of young families, with the exception of a public housing complex in the area.[5]

Concentrated low-income or affordable housing can often limit communities' social capital, segregate households by race or ethnicity and discourage reinvestment, which limits home equity gains. To promote a diverse and viable community, PHA focused on dispersing housing types, and targeted three distinctive economic groups: those earning

under 60% Area Median Income (AMI); those earning 60-80% AMI; and those earning above 80% (who were eligible to buy houses on the open market without subsidy). Although the existing density at 14.80 persons per acre was already more than twice that of the rest of the city (6.99 persons per acre), the project further increased the density with the subdivision of lots from one home to three or four; addition of duplexes,; and in some cases, both of these factors. For example at the intersection of 10th and Page, there are now thirteen houses where eleven once stood, and on Anderson Street, four homes take up the previous location of two.

## ARTICULATING A VISION THROUGH COMMUNITY PARTICIPATION

Community participation at a neighborhood level ensured success in the 10th and Page neighborhood. Community meetings were held from the very beginning of the project in recognition that early design decisions made collaboratively would have a major, positive impact on achieving cost effective, well considered, and sustainable design goals. Community workshops and monthly meetings during the course of the initial construction period of three years identified the goals the community needed and designers envisioned.

2. Community members take place in a design charette (photo by author, 2002).

The neighborhood advisory board started with a goal setting session, carefully prioritizing its wish list. Designers created three dimensional models and drawings to help resident visualize development options. Monthly meetings over the course of the multi-year project had the effect of supervising the development progress against the early goals. Public open houses and ground breaking events were used as opportunities to share the project vision with the broader community.

At the earlier community meetings, it became clear that residents viewed the single-family housing typology as an important cultural resource of the neighborhood. Thus, overall planning strategies of PHA reflected the goal of promoting a mixture of dense single-family houses that kept eyes on the street and encouraged an active pride of ownership. Community meetings also focused on enacting and carrying out neighborhood beautification plans that addressed larger landscape issues to enhance the neighborhood's appeal and build a sense of pride. These plans included landscaping for both safety and ease of maintenance and pedestrian flow through the neighborhood. Residents communicated to designers that infrastructure needed to be updated for greater connectivity within the neighborhood, to ease transportation and to allow pedestrians to safely navigate the neighborhood. This resulted in the construction of a sidewalk on Albemarle Street, along railroad tracks to West Main Street, as well as sidewalk and curbing at the following locations in the neighborhood: 11th Street (West to Page Street, both sides); Anderson Street (at the bend between 10th and 9th Streets); storm sewer on west side of 11th, below West Street; and reopening 11th Street to pedestrian traffic only to encourage access to park and ball fields located at northeast corner of John and 13th Streets.

Residents also wanted vehicular traffic reduced, in favor of improved public transportation options. These community objectives resulted in the development of a traffic-calming plan for 10th Street and expansion of bus routes and schedules beyond 10th street and deeper into the neighborhood to serve elderly residents. Considerations for an "on-demand" service were discussed, as well as the option of installing benches and/or shelters needed by elderly transit users in selected locations.

On the architectural scale, vernacular building forms were used as a language that would create continuity, familiarity and stabilize the neighborhood visually. Vernacular housing in Virginia traditionally incorporated elements that not only were visually pleasing, but responded to the particular regional climate. Raised, deep front porches addressed the issues of water intrusion and rodent protection, heating and cooling efficiency, and allowed for front yard privacy as well as a connection to the street. Vernacular details were incorporated into the building facades and a clean sensibility was maintained. Double hung windows typical of the Virginia home were incorporated with added environmental benefits of air circulation. Yards were planted with indigenous, drought resistant vegetation that blended with the existing landscape. These design decisions eased residents concerns about the changes their neighborhood would undergo, as they established greater continuity between the old and the new.

## IMPLEMENTING A SUSTAINABLE VISION FOR 10TH & PAGE

When PHA purchased residential lots with extant properties, decisions on demolition versus renovation focused on the greater good of the community rather than the individual building. Three houses were renovated to higher standards, and of the thirteen that were demolished in the 10th and Page neighborhood, many had been slated for demolition under the city's Blight Ordinance, and none of the homes were considered 'historic' enough to restore.[6] The houses that were demolished were of a variety of ages, mostly dating from the either the 1920s or 1970s.


3. One of the 10th street slab-on-grade houses. (Photo by PHA, 2000)


4. House slated for demolition showing the site and material conditions (photo by PHA, 2000).

The preservation community was understandably alarmed at the loss of these structures yet there was not a framework in which to evaluate the capacity of these homes to be restored into PHA standards. Since no legislation or ordinances were in place to prevent demolition, the houses were documented and demolished and new ones were constructed.

Decisions to demolish were weighed carefully between structural condition and general site specificity. Many houses were structurally damaged, abandoned and had issues of squatting and crime associated with them. At the 10th and Page intersection, standing water had flooded the basement of four 1970s homes which had issues of rot, mold and failing foundations.

Three houses at the intersection acted in part as a symbol of neighborhood renovation resulting from a double murder that happened on the site and served as a safe haven for drug dealing. Other houses in disrepair represented opportunities for rebuilding denser lots, with a variety of higher-quality and energy efficient housing types. Most demolitions occurred due to a combination of these factors, and no guidelines were set in place for proper evaluations beyond these issues.

5. House on Anderson Street before renovation (Photo by Author, 2000)

6. Anderson Street Home with new residences, creating a denser fabric of street-facing homes. The house in the middle is an image after renovation and construction of the new houses; the older home is located in the middle. (Photo by Will Kerner, 2006)

By the end of three years PHA built over 30 new homes and renovated 3 existing homes. The new homes were scattered around the neighborhood and integrated with the existing older structures that created a continuity of architectural fabric and historical feel within the neighborhood. Density was increased in the neighborhood on these sites, as lots were constructed with duplexes or two single-family units where previously there was only one, such as at the Anderson Street site. Each new or remodeled home was built to unprecedented energy standards.

**(RE)BUILDING SUSTAINABLY**

Rebuilding homes in the 10th and Page neighborhood presented an opportunity to incorporate energy-efficient systems early in the design process, which would impact energy use throughout the life of each home. This would result not only in buildings that cost less to run, but also have a longer life span. In addition to long term cost savings, and enhanced durability, green buildings also have less of an impact on the environment, and improve human comfort and health. For these reasons, PHA committed to building Energy Star houses early in the project. Life cycle cost analyses of energy efficiency measures were used to evaluate whether financial savings generated over time justified higher upfront costs. as well as enhanced durability. Of the 27 houses constructed, at least the last 18 houses are all rated Energy Star, and one was part of the stricter EarthCraft Home Pilot Program in the state of Virginia.

A key element of green building and efficiency is the building envelope. Insulation choices, tightness of the building envelope, and foundation choices all contribute to the efficiency of a structure, and appropriate size of heating, cooling and air conditioning systems. For these reasons, PHA used Optimal Value Engineering (OVE) to reduce framing time, lower construction costs, and conserve lumber, a natural resource (IMAGE NINE). By increasing insulation above the required minimums, homes will be more comfortable and residents will save on energy costs.[7] OVE framing techniques utilized the green construction guidelines and methods below:

- "California" corner construction allows for more insulation to be placed at the corners of the structure and reduces the amount of lumber needed.
- "Ladder" framing at the junction of every interior and exterior wall allows greater insulating area and reuses short pieces of "waste" lumber.
- 2" x 6" window & door headers (instead of 2" x 10") reduces costs and the use of large dimensional lumber.
- The 2" x 6" exterior walls are framed at 24" spacing to reduce lumber use and increase the amount of insulation in contact with the exterior sheathing by an average of 56 square feet per house.
- 16" open-web trusses between the first and second floors allow for a rigid central HVAC trunk-line, and reduce the need for a conventional joist system.

A well-designed, energy-efficient, and comfortable house design uses an integrated design approach to address features that control, move, circulate or retain energy, air, and water. The mechanical system design was incorporated into the schematic design for the house, using streamlined, minimal duct work, well sealed and in the conditioned body of the house. Decisions were made for climate and solar orientation, which influenced the location and number of windows in homes. These interrelated elements were an integral part of sustainable home design. Plus, many of these green architectural features crossover with vernacular design. Thus, sustainable design can be inherently supportive of vernacular architectural traditions and local building traditions.

In Charlottesville's hot and humid summers, high ceilings, deep overhangs, and porches all alleviate heat gain and discomfort with less reliance upon mechanical systems, which lowers utility bills. Tall ceilings were incorporated in three modular units so hot air could rise above average human heights and enlarge the comfort zones. Ceiling fans were installed to increase comfort. Roof overhangs were designed to prevent solar heat gain during the warm summer months, allow heat gain during the winter, and drain water during the wet season. Double-hung windows were considered most efficient for ventilation as cooler air enters through the raised bottom sash while hot air escapes through the lowered upper sash. Conditioned crawlspaces – insulation at the walls instead of under the floor -allowed for the crawlspace to be dry and warm, preventing mold and moisture problems and increasing the efficiency of the house. Finally, the roof, which is one of the greatest sources of potential heat gain during the warmest months, when the path of the midday sun is directly overhead, was constructed with lightly colored and reflective materials to minimize heat gain.

PHA also focused on indoor air quality when designing the new homes, in order to protect human health, ease maintenance requirements, and solve many problems that are inherent of older structures, such as mold growth. The solution for good indoor air quality was to carefully select and compare building materials that affordably avoided volatile organic compounds (VOCs), PVC, formaldehyde, arsenic, chromium and other toxic chemicals.[8] The homes were designed to prevent the growth of toxic molds, which can be nearly impossible to remove once embedded in walls and other building materials.[9] By avoiding toxic materials and preventing mold growth, PHA built houses that are environmentally conscious and people-friendly.

Landscape was another important component of a comprehensive sustainable design plan. Deciduous trees and shrubs were planted, where feasible, on the west, east, southwest, and southeast sides of the home to shade against solar heat gain in the summer and let sunlight in the home during the winter. Shading pavement around houses with small shrubs and groundcover reduces reflected heat and keeps the house cooler. Shade trees also provide comfortable outdoor space for social and community activities.

A tight building envelope, efficient mechanical system, vernacular design features, avoidance of toxic materials, and thoughtful landscaping were all essential elements of the PHA design plan for sustainable and affordable housing that enhanced the neighborhood's health and solidified the community's identity.

**CONCLUSION**

PHA has achieved its goal of providing a variety of housing options that support socio-economic diversity and safety within the 10th and Page neighborhood. The Charlottesville Police Department reports that the rate of narcotic crime has dropped substantially, from 61 incidents in 2000 to just 13 in 2005 [citation?]. As of March 1, 2006, PHA rehabilitated and constructed a total of 27 homes, and four more homes are under construction. Six townhouses on John Street will start construction next year. With 14 funding sources, ranging from public and private foundation grants to low-interest loans,, subsidies have averaged over $40,000 per home on new homes, plus PHA has offered mortgages with interest rates as low as 3.5% fixed for 30 years.[10]

One-third of buyers have afforded market rate homes, and two-thirds of buyers are very low/moderate income earners ($28,000 annual income, or 47% of area median income). The average home sale price of very low/moderate income buyers to-date is $154,000, with their average net-mortgage after PHA assistance at approximately $114,000. 65% of all buyers have been minorities, and primarily, but not exclusively, African-American.[11] This continues the historically integrated settling patterns in the neighborhood. Professions of homebuyers have included, among others: hotel staff, dishwasher, bookstore employee, retiree, firefighter, teacher, plumber, school principal, secretary, service worker, and maintenance technician. Market rate homebuyers have included local teachers, doctors, professors, and former neighborhood residents moving back to the City.

While the initial price-point of PHA's homes has been slightly higher than less durable and efficient homes, the long-term costs to the buyer – monthly bills for heating and cooling, as well as the costs of replacement of systems such as roofs, siding, windows and flooring - are far less. Homebuyers have reported to PHA staff that their electric utility bills average $70 per month, and have not exceeded $100.00 per month during any month of the year.

The 10th and Page project has had the secondary affect of solidifying PHA's mission to develop sustainable housing. PHA was the first community housing development organization to attain EarthCraft Program certification in the Commonwealth of Virginia, and 10th and Page hosts the first Energy Star and EarthCraft homes in the City of Charlottesville. The United States Environmental Protection Agency Energy Star Program recently honored PHA with an award for the development of energy efficient affordable housing. On Wednesday, March 15, 2006, The Daily Progress announced that the Charlottesville Planning Commission honored the 10th and Page Neighborhood as Neighborhood of the Year. The commission cited the neighborhood's revitalization efforts as well as residents "positive ability to adapt to and embrace the changes that are taking place in their community."

Designing for the future requires an aggressive environmental stand not only for long-term energy savings, but also for permanence and performance in the neighborhood landscape. By providing the 10th and Page neighborhood with the tools in which to articulate and maintain a safe, affordable and beautiful environment, the City of Charlottesville, the Piedmont Housing Alliance and neighborhood activists have created a truly culturally sustainable and livable place. With the shared goals of understanding the cultural landscape and improving neighborhood conditions, community members, designers, and developers alike, engaged in an ongoing and productive dialogue.

9. Wall assemblies and HVAC diagrams helped energy efficiency (drawing courtesy of PHA, 2002).

A symbol of community empowerment, the Hope Community Center is currently under construction. Upon completion, the 10th and Page neighborhood will have a green building at the heart of their community, which will bring new cohesion, direction, and safety to all of the residents, home owners and renter alike. Building on the goals of the 2001 Comprehensive Plan, the center will provide opportunities for after school care, programs for youth and elderly, job training and a computer lab. The new building will host an indoor recreation space for basketball and receptions alike. The addition of a new facility and renovation of the existing provides a courtyard that creates a connective path for children in the 10th and Page neighborhood to the local elementary school and access to the fields and playgrounds. Once perceptibly the hidden backyard behind the University, the 10th and Page neighborhood is connected to the city in a holistic and transparent way.

While there have been many successes in the project, there are many opportunities to learn. Five homes incorporated visitability and Universal Design, but all 'sustainable' homes should incorporate lasting accommodations for residents of all ages.

- While the 10th and Page project successfully establishes a dialogue between historic preservation and environmental standards, it lacks a system of evaluating the importance of vernacular buildings. While the project outcome respects the historic fabric of the neighborhood and provides a vital fu-

ture for residents, it suggests that a framework for working with existing vernacular sites must be established. It is our hopes that this article will contribute to the conversation of successful environmental design strategies that incorporate not only a variety of green building practices but a consideration of sustaining the existing culture of both the community and the broader cultural and architectural landscape.

## ENDNOTES

[1] Donovan D. Rypkema, "Economy, Sustainability and Historic Preservation," (Plenary Speech, National Trust for Historic Preservation Conference): Portland, Oregon, 2005.

[2] The National Park Service

[3] 'Embodied energy' in a building is energy worth saving in older buildings; the cost of tearing down and replacing a structure uses more energy and is therefore less sustainable than the cost of rehabilitating it to modern use.

[4] City of Charlottesville, 2001 Comprehensive Plan, Neighborhood, 10th and Page, Demographics. (http://www.charlottesville.org/)

[5] The Frederick P. Rose Architectural Fellowship is designed to promote architectural and community design in low-income neighborhoods. The fellowship fosters productive partnerships between architects and community development organizations, and it encourages architects to become lifelong leaders in public service and community development. Katie Swenson, founder of Charlottesville Community Design Center, was a Rose Fellow for the 10th and Page Project. See www.enterprisefoundation.org.

[6] City of Charlottesville, 2001 Comprehensive Plan, Neighborhood, 10th and Page, SWOT. (http://www.charlottesville.org/)

[7] 2x6 framing increases the R-value in the walls from R-13 to R-19. Roofs were rated to R30. The use of recycled wet-blown cellulose was used as a more efficient insulation and insect control product

[8] Some sources of indoor air pollution are building materials and furnishings that contain chemicals like phthalates, arsenic, and formaldehyde such as insulation, carpets, and cabinetry or furniture made of certain pressed wood products. Other sources like combustion sources such as oil, gas, kerosene, coal, and wood contribute significant amounts of indoor air pollution in homes. Redecorating activities such as use of paint strippers can release pollutants for long periods after installation. Adhesives associated with wall coverings or in particleboard used in kitchen cabinets can release formaldehyde.

[9] While certain health hazards are linked with the production of vinyl products, some alternative flooring materials such as bamboo or oak strip floors that are natural and renewable have demonstrated low-VOC emissions and an environmentally friendly production. Avoid the use of carpet, which can serve as a sink for dust, allergens and other substances that may pose health hazards to susceptible residents.

[10] Piedmont Housing Alliance, 2006.

[11] Piedmont Housing Alliance, 2006.

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Does the idea of not having to cook meals for yourself or family every night, deal with traffic on your block, or worry when your children are out playing in the neighborhood appeal to you? If the answer is yes, you may want to consider exploring cohousing, a concept that originated in Denmark in the early 1970s and has spread throughout Europe. In Cohousing, a number of European cohousing communities are profiled. Although each community is a unique reflection of its members' tastes and desires, there are some common components, such as parking lots on the perimeters of the community for pedestrian safety, a common house where meals can be shared, and recreational facilities housing various community activities and services. With all the responsibilities entailed in managing a home and/or a family, cohousing is a solution for finding sufficient time to relax and spend with the people who are important to us. (The authors have recently started The Cohousing Com pany, a design and development company formed specifically to assist groups interested in planning and implementing cohousing in this country.)

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From a Texas farmhouse to a loft in St. Paul, to a prefab cabin on the Wisconsin prairie, these houses, in which anyone would feel at home, display a wonderful mix of design smarts and budget savvy. "Good House Cheap House is chock full of great ideas and creative solutions for those of us on a budget-but even the less financially-challenged can learn a thing or two about stylish and innovative design."

--Charles Burbridge, designer, HGTV's Design on a Dime

"The cookie-cutter house trend has been around long enough. With its outside-the-box ideas and great resources, Good House Cheap House proves you can build a unique space without emptying your bank account." -Amber Jones, Editor, do! Magazine

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The only how-to guide to community design written from the design professional's perspective. In this groundbreaking guide to the increasingly important discipline of community design, a leading international expert draws upon his own experiences and those of colleagues around the world to provide proven tools and techniques for bringing community members into the design process successfully and productively. The first and only how-to guide on community design developed for design professionals, Community Participation Methods in Design and Plan ning features:

* Fifteen case studies chronicling community design projects around the world
* Coverage of educational facilities, housing, and urban and rural environments
* Design Games-a proven, culture-neutral approach to educating participants in their design options and the consequences of their choices
* Proven techniques for fostering community participation in the design process
* Checklists, worksheets, questionnaires, and other valuable tools

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Fifteen in-depth case studies display the work of some of today's finest architects in locations ranging from California and Connecticut, to Virginia and Oregon. Each project includes lavish photography accompanied by detailed discussion of the economical construction techniques implemented in each house. With an in-depth look at square footage costs, design techniques, and low-cost building materials, Great Houses on a Budget will provide readers with everything they need to plan a great home on even the smallest budget.

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2. Sir Peter Hall, author of Cities in Civilization: Culture, Innovation, and Urban Order : Lawrence Vale's major study throws new and important light on the contradictions and dilemmas of American public housing policy over the past half-century, as they worked themselves out in one of the nation's great cities. It has vital messages both for scholars of public policy, planning, and urban studies, and for urban policy-makers, both in the United States and the wider world. This is a major contribution to the urban literature.

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Mary Jane Brustman, SUNY at Albany Libs. Copyright 1998 Reed Business Information, Inc.

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Why are homes so expensive to buy and to maintain? Construction has emerged as a mainstream political issue. Yet the building trade is one of the world's weakest: it is fragmented, barely globalized and behind other sectors in introducing disruptive innovations to its basic processes. The modest worldwide scale of prefabricated building confirms how construction remains a 19 th -century affair, not a 21 st -cen tury one. Drawing on the latest technologies that have emerged both inside and outside the sector, Why is construction so backward? forms a detailed, practical alternative to the conventional wisdom in building design and urban planning. It is a powerful call for reform, and a sharp attack against architecture as social engineering and environmentalist dogma. 'Very compelling. . . a significant piece of research and thought leadership. Essential. ' Colin Bartle-Tubbs, UK Operations Director, Deloitte 'Welcome and timely. . . takes on an industry that has reveled in complacency for too long. ' Bernhard Blauel, Principal, Blauel Architects 'The authors are prepared to be daring, reframe the question and posit new paradigms. Reflecting effortlessly across the literature of property, business, market research and construction, the book's kaleido scope of ideas, examples and images gives it a refreshing depth of insight and breadth of vision. ' John Worthington, Founder, DEGW 'A tour de force of polemical provocation. This timely work forces one to think about construction in the broadest terms.

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34 out of 35 coastal states have adopted the national coastal management program administered by the National Oceanic and Atmospheric Administration/Office of Ocean and Coastal Resource Management (NOAA/OCRM).
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## **Affordable Housing and Community Design:** PAPERS

Barrios-Paoli, Lilliam and Peter Madonia and William C. Rudin. *Uniting for Solutions Beyond Shelter*. The City of New York. Jun 2004.
“Uniting for Solutions Beyond Shelter is a 10-year action plan that brings together the business, nonprofit, and public sector communities to address the challenging issue of homelessness at its core, rather than manage it at the margins. It reflects my strong belief that every individual and family deserves safe, affordable housing –a goal we can achieve through proactive, coordinated action and investments in cost-effective initiatives thatsolve homelessness.” - Mayor Michael R. Bloomberg

Feldman, Ron. *The Affordable Housing Shortage: Considering the Problem, Causes and Solutions*. Federal Reserve Bank of Minneapolis. Aug 2002.
Abstract: Many observers claim that we are in the midst of an “affordable housing shortage” or, even worse, an “affordable housing crisis.” The primary concern is that too many households live in “unaffordable” rental units. We hope to clarify the current debate by first measuring the size of the problem, then diagnosing its underlying causes and, finally, discussing treatments that policymakers should consider. While our review is hardly exhaustive, we conclude that a shortage of income is largely behind the housing affordability problem despite the current focus on housing. Policymakers should recognize that government financing of new housing units is unlikely to be a cost-effective response to low household income.

Hu, Yucum and Qiping Shen. *Systems Thinking in the Study of Housing Development in Hong Kong New Towns*. The Hong Kong Polytechnic University, Department of Building and Real Estate. 2000.
“In this paper, we have applied system dynamics to analyze housing development in Hong Kong new towns. Because housing development is concerned with many factors such as population growth, employment, personal income, gross domestic product and government policies,

it is a complex social-economic system that demands system thinking for its solution. We have constructed a system dynamics model that attempts to describe housing development in new towns. In this model, the interactions of various factors in urban housing development are taken into consideration. The model has been implemented in a computer simulation package named "I think". The simullation provides a trend of future housing development in Hong Kong new towns. These results can assist decision makers produce more appropriate plans for future housing development. We found that the application of system dynamics into housing development is a new and fruitful attempt."

Katz, Bruce, Margery Turner, Karen Brown, Mary Cunningham and Noah Sawyer. *Rethinking local affordable housing strategies: lessons from 70 years of policy and practice.* The Brookings Institution Center in Urban and Metropolitan Policy and The Urban Institute. Dec 2003.

Efforts to provide affordable housing are occurring at a time of great change. The responsibilities for implementing affordable housing are increasingly shifting to state and local actors. The market and demographic changes in the country are complicating the picture, as sprawling jobs-housing patterns and downtown revivals in some places are creating demand for affordable housing for working families and immigrants in both cities and suburbs. To help state and local leaders design fresh solutions to today's affordable housing challenges, The Brookings Institution Center on Urban and Metropolitan Policy and the Urban Institute joined forces to examine the lessons of seven decades of major policy approaches and what these lessons mean for local reforms. This executive summary of the full report, funded by the John S. and James L. Knight Foundation, finds that past and current efforts to expand rental housing assistance, promote homeownership, and increase affordable housing through land use regulations have been uneven in their effectiveness in promoting stable families and healthy communities. The findings suggest guiding principles for local action, with important cautions to avoid pitfalls.

Pascale, Connie. *The Critical Shortage of Affordable Housing in New Jersey: A Brief Overvie*w. The Legal Services of New Jersey Poverty Research Institute. Jun 2003.

For at least three decades, study after study has documented New Jersey's severe affordable housing shortage. This report from Legal Services of New Jersey's Poverty Research Institute compiles such studies and data to present a current portrait of just how bad the housing shortfall has become. It is intended as a resource for policy makers and the public, to help energize and guide the urgent question of what should be New Jersey's governmental response to this crisis.

The report was prepared primarily by Connie Pascale, Vice President and Assistant General Counsel at Legal Services of New Jersey, with assistance from colleagues Kristin Mateo and Anjali Srivastava. Our hope is that armed with information, at long last New Jersey's leaders will guide the state toward a comprehensive and effective government-wide housing policy.

Pickard, Deena, et. Al. *A Systematic Approach to Service Improvement: Evaluating Systems Thinking in Housing.* The Office of the Deputy Prime Minister: London. Sep 2005.

"This report provides a review of work undertaken to explore the use of systems thinking in a social housing setting. In particular, the research considered the effects on the delivery of housing management services and assessed efficiency gains arising."

Pickard, Deena, et. Al. *Defining a National Housing Research Agenda Construction Management and Production*. The Office of the Deputy Prime Minister: London. Sep 2004.

Soffin, Jeremy. *Housing Crises Threatens Regional Economy.* The Regional Plan Association and Citizens Housing and Planning Council. May 2004.

High housing costs, poor housing quality and long commutes are putting the NY-NJ-CT metropolitan region at a competitive disadvantage in attracting and retaining a talented workforce, according to a regional housing study released today. The report, "Out of Balance: The Housing Crisis from a Regional Perspective," is a collaborative effort of Regional Plan Association (RPA) and Citizens Housing and Planning Council (CHPC) to survey regional housing trends and identify housing problems that pose obstacles to regional development or diminish the quality of life.

Tucker, William. *How Rent Control Drives Out Affordable Housing*. Cato Institute. May 1997. Cato Policy Analysis No. 274 Location: http://www.cato.org/pubs/pas/pa-274.html

White, Lawrence J. *Fannie Mae, Freddie Mac, and Housing Finance: Why True Privatization is Good Public Policy*. Cato Foundation. Aug 2004.

**Affordable Housing and Community Design: SUSTAINABILITY:** ARTICLES

Architype. "Green Credentials: Housing in Brighton." *RIBA Journal.*

Boehland, Jessica. "Greening Affordable Housing," *Environmental Building News*. v14, n3. pp. 1, 11-19. March 2005.

Bone, Eugena. "The House That Max Built." *Metropolis*. v16, n5, p 37-42, Dec 1996.

The Center for Maximum Potential Building Systems (Max's Pot) built the Advanced Green Builder demonstration house on the outskirts of Austin with only local materials. It is the place where founder Pliny Fisk III and his wife "concoct environmentally sound and sustainable building technologies." Both Calcrete and Solar-Tube were conceived there. The house uses Green Forms, an "open-ended" post and beam system as structure. The central concept is that the Green Forms provide the frame for site-specific (and therefore more sustainable) elements and finishes. This approach also leaves plenty of potential for personalization. Local climates are studied as well as attainable materials for cladding, insulation, and other surfaces from the area. Options may include rammed earth, adobe, straw wall, industrial by-products, and Styrofoam. The project also helps to sustain local businesses, distributors, and craftsmen by utilizing their services within their communities. The article also mentions innovative composite materials that can be used in cladding, including mixing leftover wood fiber with plastic from recycled bottles to make hardy wood-like panels. Water sustainability is addressed with composting toilets and wetland integration.
For further energy consumption reduction photovoltaic panels can be added to roofs, radiant heat can be distributed from floor slabs, and a gas-fired water heater can double as the heat source for the floor slabs.
While the house (at time of article publishing) costs about $250,000, the goal is to build for $10 to $12 per square foot. The article includes photos of the house in Austin and images of examples of various site-specific cladding materials. (DM)

Bradshaw, William et. al. The Costs & Benefits of Green Affordable Housing. *New Ecology*. 2005.

Cameron, Kristi."Rebirth: BOASE, Denmark's Model for Sustainable Mass-Produced Housing, On Stilts." *Metropolis*. v23, n5. p 66-69. Jan 2004.

BOASE is an innovative national competition winning concept proposed by a team of students in Denmark. The primary themes of the project are affordable housing, mass production of units, and soil remediation that occurs through phytoremediation while the housing units sit above the petrochemically polluted site in a network of "tree dwellings."
The units stand on stilts, and therefore allow rainwater and sunlight to filter down and nourish the soil-cleaning plant ecology. The provocative notion of developing polluted sites is rooted in the cheapness of land that no one wants to use- polluted land. The plants are expected to clean the top six feet of contaminated soil in a period of ten years, which, by some, may be worthwhile "rather than spending millions hauling the contaminated dirt to a landfill of treatment facility." If the clean-up process does not occur as expected through phytoremediation, not all is lost; "even if the trees don't manage to clean up the soil, they are sucking up water and evaporating it through their leaves… (it) won't leach into groundwater supplies, taking pollutants with it."
Units are manufactured from lightweight fiberglass-reinforced plastic, giving them the advantages of lasting structural strength with minimal weight. In this project, the "home" becomes industrialized, a unit of mass production. The three technologies used in this project are: Gratzel Solar Cells, Fiberline Plastic Composites, and Phytoremediation. (DM)

Clark, Ross. "Everyone Stares at Cornflake Towers." *Mail on Sunday (London)*. Jul 18, 2004. Associated Newspapers, Ltd. 2004.

Beddington Zero (fossil) Energy Development (BedZED) and its appeal.

Couling, Nancy and Klaus Overmeyer (of cet-0). "New From Suburbia: Agro City." *Architectural Design*. v74, n4, p 66-71. Jul/Aug 2004.

Couling and Overmeyer have produced a model for areas outlying urban centers to become neighborhoods surrounding farming-land green spaces, rather than arbitrary parks and green spaces, commonly ordained by local zoning codes. The theory proposes that the residents maintain and work the "farm-land" and it gives back to them, monetarily, as well as enriching a closer-knit community than a typical suburb. The article includes a model for investment and return based in its proposed operations in an area outlying Hamburg- the location of cet-0's Fischbek-Mississippi project. The underlying concept is a "symbiosis of land for farming and land for building…Green areas are a combination of agricultural fields and domesticated plots, leased to an ecofarmer, or to the Mississippi Club, of which the new residents would ideally be members"(Couling p. 69). (DM)

Diamond, Richard C. "Affordable Housing Through Energy Efficiency." *GSD News/ Harvard University*. p 14. Winter/Spring. 1993.

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BedZED is discussed, Sutton's Zero Energy Development housing.

Gates, Charlie. "Consultant on BedZED does U-turn." *Building Design*. Nov 26, 2004. CMP Information Ltd. 2004.

Gifford, H. "Third Street: Can architects and builders work together to produce highly energy-efficient and affordable multifamily housing without any grant support? Two New Yorkers prove that it can be done." *Home Energy*. v22, n5, p 24-29 Energy federation Incorporated. 2005.
Third Street considers the assemblies and methods utilized to create more energy-efficient apartment buildings in New York City. The buildings are located at 299 E. 3rd St. (38-family building) and 228 E. 3rd St. (22-family building) in Manhattan. The project was developed by Mary Spink and the architect is Chris Benedict.
The article denotes specific building assemblies that improve thermal and acoustical insulation. Specific wall sections are shown, as well as efficiency comparisons based on energy consumption and cost.
The article also implies concerns about the negative effect of funding sustainable projects through grants, relating this approach to the concept that one can only do good if funded. Another interesting issue exemplified by these projects is that buildings that may be extremely energy effi cient and "green" to a great extent will never satisfy current LEED criteria because of certain detailing that, in a sense, make them even more sustainable. (DM)

Gregory, Rob. "Wake Up Call." *The Architectural Review*. p 44, Nov 2003.
BedZED is a prototype for sustainable high affordable housing complexes by Bill Dunster Architects. It is an example of high density suburban-urbanization in Sutton, England. Highlights of the project include live-work units, a community hall, south facing spaces and terraces. The one bedroom loft apartments have their own entrances and open onto a sky garden.
The article includes photographs, a site plan, an elevation, sections, and a sun study. (DM)

Koebel, Theodore "Sustaining sustainability: innovation in housing and the built environment." *Journal of Urban Technology.* v6, n3. p 75-94. Dec 1999.
Sustaining Sustainability discusses a wide spectrum of issues related to spreading the desire for, and acceptance of, sustainable housing. The article theorizes the necessity for technological developments to push the viability of sustainability into mainstream construction. Koebel also articulates various circuits within the development and construction industries through which sustainable practices must spread if they are to effectively diffuse within our culture. Included issues are mass production, adaptability, change agents, codes, and policies (and their makers). The general message is that everyone needs the tools and the know-how, as collectively accepted across the industry, to progress in supporting and encouraging sustainable housing.
An interesting theory on the method of diffusion and its characteristics is delineated and discussed. Koebel's research designates certain "characteristics of innovations that influence adoption," (Koebel p.79) including relative advantage, compatibility, complexity, trialability and observability. Koebel goes further into the issue of diffusion by discussing various initiatives in sustainable housing and their overall perfor mance. (DM)

Makovsky, Paul. "Green Space: In the country's first green residential tower, a temporary showcase interior offers lasting ideas." *Metropolis*. vol. 23, no. 3, pp. 118-120, Nov 2003.
Makovsky outlines various sustainable furniture and finishes used at the Solaire in Battery Park City, New York. The Solaire is significant in that it is the country's first high-rise sustainable apartment building. The interior design of the apartments was created by Stedila Design.
The article describes the innovative finishes and furniture and interesting descriptions of their origins and how they are designated as sustain able for this project. Perhaps most helpful are the actual names, manufacturers, and distributors of many pieces.
Sustainable finishes and furniture mentioned include: Uba Tuba granite from Brazil, Urea-free formaldehyde fiberboard cabinets, Non-Urea formaldehyde parquet floors, Reclaimed-recycled lines of carpet and furniture, Abaca fiber instead of plastics, and A "less than 500 miles" philosophy, aiding in cutting embodied energy expenditure (DM)

Martin, Glen and Frank Escher and Andrew Wagner. "Shades of Green: Dwell Home II." *Dwell*. v5, n6, p 114, 116. June 2005.
Dwell Home II was constructed in Topanga Canyon, California as a test home for green design. It's construction in such an isolated area prompted many questions about the true sustainability of remoteness in this modern world, since a car must be used for traveling into town

for commodities. Andrew Wagner facilitated a discussion/ interview with the homeowner Glen Martin and architect Frank Escher, prompted by questions written to Dwell magazine regarding the project.
In the project's defense, the convenience and viability of bus lines and telecommuting are available for use in the remote setting. Aside from those conveniences, Escher maintained that the building, when seen as siteless, is extremely efficient, performing well, and addresses "environmental questions that need to be addressed on any site."
Dwell Home II cools itself, generates its own electrical power, uses a quarter of the water of conventional houses, and treats its own wastewater. The article brings up the interesting notion that "in the 70's, central Europe was going through what we are going through in California now. There were some people who were really interested in more intelligent use of resources and sustainable design…" (Escher p.116). (DM)

Merrick, Jay. "Saving the planet, in style: Tony Blair wants us to lead cleaner, greener lives. Yet just how?" *The Independent (London)* Features. Sep 20, 2004. Newspaper Publishing PLC. 2004.
Discussion of BedZED ("bridge to the future"), its design and pioneer residents.

Shore, William B. "Land-use, transportation and sustainability." *Technology in Society*. v28. p.27-42. 2006.
This article proposes three strategies for recentralizing the dispersed population epidemic in the United States on the grounds that regional planning is a substantial element in reaching a more sustainable lifestyle, and culture. The strategies are: "pricing goods and services to reflect sustainable needs, improving the magnetism of cities, and legislating enforceable regional plans."
The article articulates the history of population dispersal away from cities and the ramifications of this trend. It then discusses the sustainability of a "spread city" in comparison to "traditional centers and community." (DM)

Singh, Yvonne. "BedZED, eco vision of the future." *The Evening Standard* (London). Sep 20, 2006. Associated Newspapers, Ltd. 2004.

Solomon, Nancy B. "The Pick of the Sustainable Crop." *Architectural Record*. v193, n7, p 153-156, 158, 160, Jul 2005.
The Pick of the Sustainable Crop reviews three of the top 10 Green Projects awarded by the AIA Committee on the Environment. The article gives background on the COTE selection process and categories that qualify their concept of sustainable design.
With narrative, photos, diagrams and sections, the innovative design aspects of the three built projects are elaborated.
The Pittsburgh Glass Center, in Pittsburgh Pennsylvania, has an innovative and effective heat recovery system and effective insulation and ventilation systems. It is an industrial building that houses hotshops, offices and exhibition space, designed by DGGP and Bruce Lindsey AIA.
Rinker Hall in Gainesville, Florida is the home of the M.E. Rinker School of Building Construction in the department of the University of Florida's College of Design and Construction. Designed by Croxton Collaborative Architects + Gould Evans Associates, the building utilizes enthalpy wheel technology, passive solar design, and high-performance glazing.
A connection is made between daylighting and occupants' circadian rhythms "connecting… to nature's own circadian rhythm- allows occupants to experience what Croxton describes as `the most primitive, deep-seated aspects of comfort'."
The Austin Resource Center for the Homeless (ARCH) is a 26,800 sf building that houses homeless temporarily and for the long term, while providing support programs in Austin Texas. The building was developed concurrently with Austin's adoption of a new policy that the design of any new municipal building must follow the guidelines put forth by the U.S. Green Building Council for its LEED rating system. The project utilized the method of stack-cast tilt-frame construction, cutting down on the cost of formwork for concrete. Fly-ash was substituted for 45% of the portland cement in the concrete mix. A rain-water collection system was also developed to mediate Austin's serious flooding problems (due to poor topsoil conditions). (DM)

Taylor, Rebecca. "Estate of the Art." *Time Out. The Green Issue: The Good Life.* Mar 8, 2006. Time Out Group. 2006.
"Five years ago an eco housing estate in Sutton was hailed as the community of the future. Rebecca Taylor visits Londoners living the green dream." Discussion of BedZED.

Zhang, Zhihui and Xing Wu, Xiaomin Yang, and Yimin Zhu. "BEPAS- a life cycle building environmental performance assessment model." *Building and Environment.* v41. p 669-675. 2006.
In this journal article, BEPAS (building environmental performance analysis system) is explained and tested in a case study. It has been proposed that the system's methodologies can be utilized on both new and existing buildings, evaluating their facilities (operation phase consumption and pollution), location, and materials. This article seems to have been inspired by the "rapid process of industrialization and urbanization" currently underway in China. It is also in response to the relative subjectiveness of sustainability evaluation checklist-type methods such as LEED. The BEPAS researchers responded to these issues by creating a more objective analytical approach to evaluating building performance, building upon the in-depth model of LCA (life cycle analysis). Results of the article's case study show the test building's environmental impact was 96.6% from the facility operation, and only 5.6% from the building materials.BEPAS attempts to include more variables than other existing analysis models of a similar genre. (DM)

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**Affordable Housing and Community Design: GULF COAST REGION:** ARTICLES


Allais, Lucia. "Building Dwelling, Not Thinking" *Thresholds*. v20. p 50-55. 2000.

Allais theorizes that housing typologies can have underlying social implications that must be recognized, especially when addressing afford able housing for poor predominantly African American populations in certain areas of the country. She specifically addresses the symbolism embodied in the shotgun-style housing that is commonly constructed as affordable infill housing.

The discussion of the possible sociological ramifications of typology arose through a competition for Delray Beach Florida's Redevelopment Agency to design "affordable infill housing" in the predominantly black Mount Olive community.

Allais sites the works of Marylis Nepomechie and Heidegger as current and historical thinkers on the same subject; the architects' argument about the pride of ownership.

The theories, as presented in this article, are very subjective, and tend to make difficult assumptions that sometimes waiver on the verge of being credible. However, the concepts put forth are extremely provoking, and are frequently neglected in design of affordable housing. The relationship between form and meaning can have great impact, and the architect needs to be held responsible for intervening in the best interest of mediating this phenomenon, downplaying the tones of social segregation in affordable housing. (DM)

Associated Press, The. "Nonprofit homes to go up fast for hurricane victims." *State & Local Wire.* Hendersonville, Tenn. Dec 8, 2005.

Derus, Michele. "Will cottages solve post-Katrina housing dilemma?" *Milwaukee Journal Sentinel (Wisconsin)*. May 14, 2006. Journal Sentinel Inc. 2006.

Burby, R. J."Reconstruction/Disaster Planning: United States." *International Encyclopedia of the Social & Behavioral Sciences*. p 12841-12844. 2004.

This encyclopedic entry is a good introduction to the basic elements of procedures and plans typically set up for post-disaster reconstruction in the United States.

The organization of the short article is in five sections: the problem, evolution of planning for resilience, post-disaster and recovery plans, hazard mitigation plans, and conclusion.

One can imagine that these procedures are effected by the magnitude of key disasters in the country's history, and thus do not include the devastation of Hurricanes Katrina and Rita, nor the resultant policies that may have been developed.

The article elaborates the primary elements of plans that address natural hazards, falling in two categories: post-disaster reconstruction and hazard mitigation. (DM)

Joyce, Steve. "James Hardie Sponsors 300 Square Foot 'Katrina Cottage' at Int'l Builders' Show." *New Urban Guild. Business Wire.* Orlando, FL. Jan 11, 2006. www.buildingsonline.com; www.newurbanguild.com

Kroloff, Reed and Kevin Pratt. "A Newer Orleans: Six Proposals." *Artforum*. v44, n7, p 266-283, Mar 2006.

An overview of the current search for inspiration for hope and design for a "newer Orleans" sets the precedent for the summary of 6 design proposals, or "six visions" to invoke a "spirit of possibility." The introduction mentions that the Congress for the New Urbanism (led by Andres Duany) had an extensive design charette to provide design guidance for Mississippi's devastated regions, and it has now "seduced" Louisiana's government as well. Artforum suggests that a fresh, inventive dialogue needs to commence.

These proposals do not situate themselves in the realistic realm of feasibility any time in the near future, but they are refreshing and drastically different takes on how a new city might reshape itself after a disaster of such enormous destruction.

The six teams were proposed by Artforum for proposals to be published, two each (one Dutch and one American team) for three segments: community (MVRDV, Huff + Gooden), urban icon (UN Studio, Morphosis), and landscape (West 8, Hargreaves Associates). The proposals did not address affordable housing within their broad assigned categories.

Recurring themes within the variety of proposals were: public space, connections (both communication and physical), pride and dignity, high density revitalized areas, reinvigoration and symbolism. (DM)

Lewis, Jim. "Battle for Biloxi." *The New York Times.* May 21, 2006. www.nytimes.com/2006/05/21/magazine.

Pierce, Emmet. "Katrina Cottage might be the answer." *Today's Scene*. Orlando, FL. Copley News Service. Feb 17, 2006. Copley News Service. 2006.

Reber, Nichole L. "'Katrina Cottages' proposed as an alternative to the maligned FEMA trailer." *Sarasota Herald-Tribune*. Home & Real Estate. March 25, 2006. Sarasota Herald Tribune Co. FL. 2006.

Shepard, Richard . “Refilling a Neighborhood: West Coconut Grove, Miami.” *Places*. v14, n3, p 44-45, Spring 2002.

Shepard (as director of the Center for Urban and Community Design at the University of Miami School of Architecture) describes a studio project that integrated students and university with a struggling neighborhood whose population, property, and quality of life has drastically declined. The project was for students to design an affordable house after surveying the conditions, lifestyles and policies of its neighborhood and jurisdiction. The project set a precedent of trust between the University and the neighborhood that could potentially lead to similar future collaborations benefiting both parties, the academy and the struggling neighborhood.

The underlying concept driving the development of the project is Shepard’s assertion that “If vacant lots and abandoned buildings could be developed for low-and moderate- income families, the proportion of stakeholders could increase and the community pride of ownership could return“ (Shepard p. 44).

The studio culminated in the actual approval and eventual building of a two-story shotgun house designed by students who saw it take shape before graduating from architecture school. A local developer had become an enthusiast of the studio and funded the project Shepard’s concept and its follow-through becomes an exemplar for students, teachers and developers wondering how they can do more in their “own back yard.” (DM)

Sorkin, Michael. “Will new plans for the Gulf drown it again, this time in nostalgia?” *Architectural Record*. New York, v194, n2, p.47. Feb 2006.

This article critically expresses concerns related to the Congress for the New Urbanism’s (CNU) recent charette and resultant design recommendations for post-hurricane redevelopment of 11 towns examined along the Mississippi Gulf coast. While the report calls for ample transportation (along with a virtual “concrete kimono”), it is also overtly concerned with regulating every facet of architecture in a someone’s aesthetic utopian ideal, it pays little attention to disaster mitigation and future damage precautions, nor sustainable strategies and environmental conscientiousness. (DM)

Thomas, Greg. “Where would you rather live…” *Time- Picayune (New Orleans)*. Mar 18, 2006. Times Picayune Publishing Company. 2006.

“Where would you rather live? In this? Or this? The LRA wants to know why FEMA is spending $75,000 on trailers when these cottages cost less than $60,000.” An article about ‘Katrina Cottages.’

Unknown. “The Katrina Housing Debacle.” *The New York Times.* Nov 24, 2005. Sec A; Col 1; Editorial Desk; pg 32.

Voss Matthews, Sherrie. “Orlando Planners Build Energy-Efficient House.” *Planning.* Chicago. v69, n5. p 40. May 2005.

The house at 2516 East Church St. in Orlando, Florida is not, by most means “affordable” at an appraisal value of $300,000. However, it is an example of the availability of systems, materials and labor available in Florida to conduct sustainable construction. The house includes 9-foot tall ceilings and a floorplan that supports good ventilation through airflow. Since termites are often a problem in Florida, no wood was used in construction. The house is clad, instead with wood fiber cement plank siding over steel frame. Flooring finishes include bamboo (impregnated with borates) and ceramic tile. Energy Star criteria were met for appliances throughout the house, reducing greenhouse emissions. In terms of water conservation, low flow fixtures and toilets were installed. Water is heated with solar heat, and the house has an integrated insulation system. The house, at 2,000 square feet, is “affordable to operate, and runs on $60 per month, for everything.” (DM)

**Affordable Housing and Community Design: GULF COAST REGION:** PAPERS

FEMA/ US Department of Homeland Security. *Home Builder’s Guide to Coastal Construction Technical Sheet Series*. FEMA 499, Aug 2005.

In August of 2005, FEMA produced guidelines for coastal construction in a technical fact sheet series. The series of 31 fact sheets gives guid ance and recommendations for coastal residential buildings. This guide was produced to improve building performance in high winds and flood conditions. The document includes information that incorporates national Flood Insurance Program regulatory requirements. Topics emphasized and illustrated are siting, structural connections, the building envelope, utilities and additional resources on various subjects. (DM)

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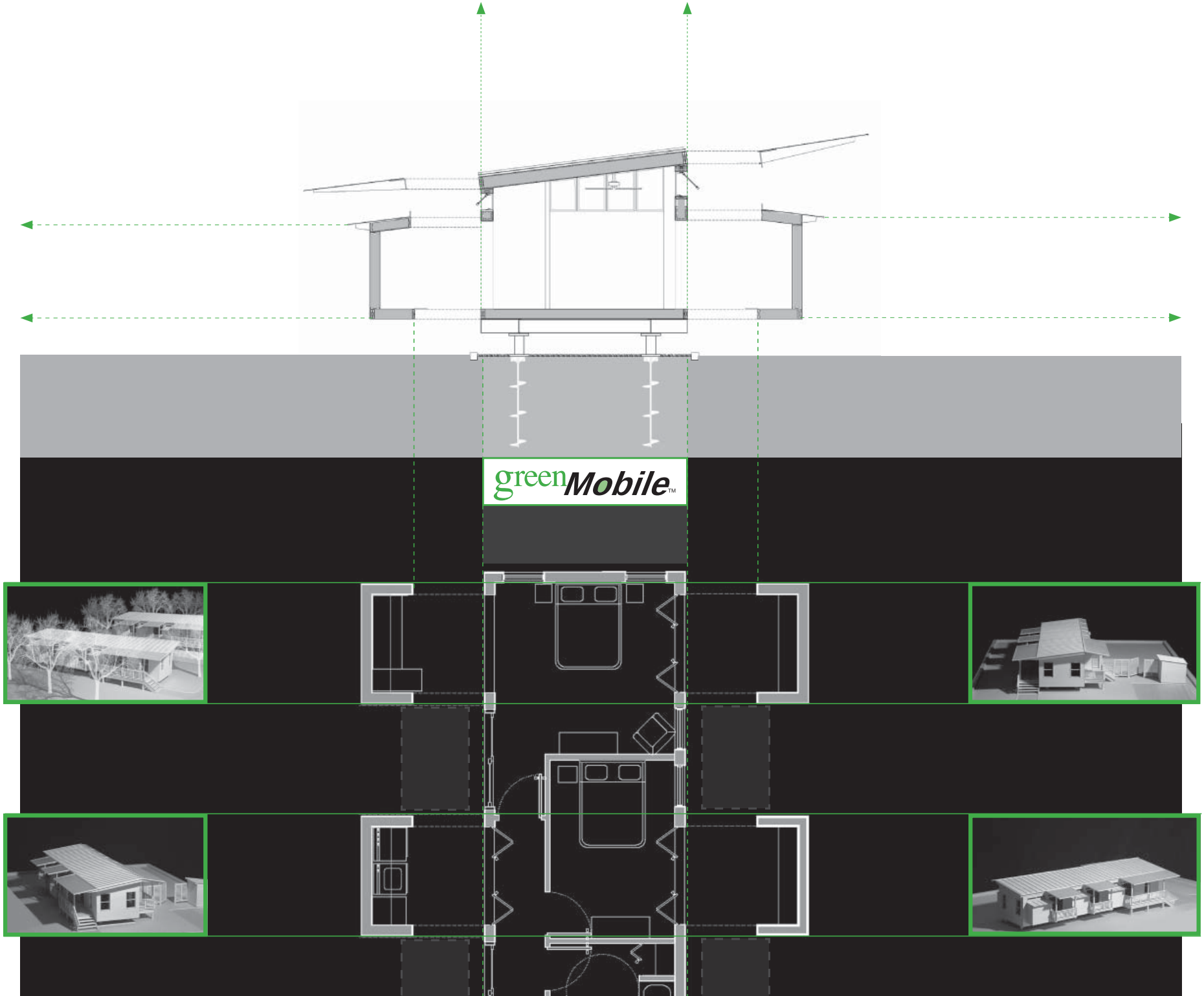
## POSTERS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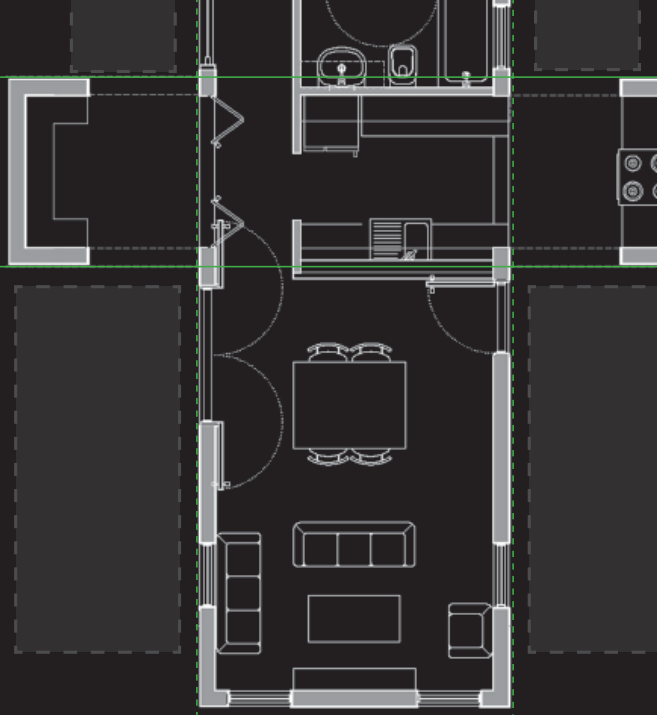

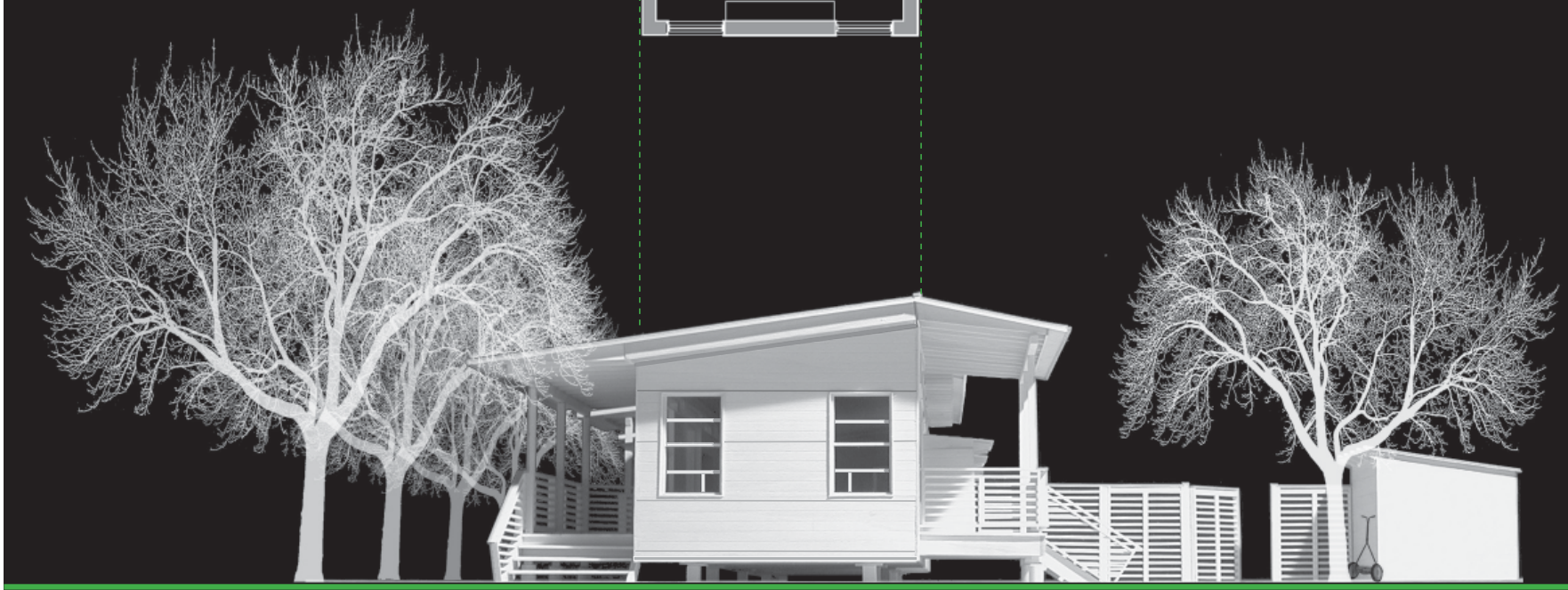


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CARL SMALL TOWN CENTER (CSTC)
JASON PRESSGROVE . MARSHALL GRAVES . JOSEPH HAGERMAN
**LARRY BARROW** AIA DIRECTOR, DRIL


# ULTRA - AFFORDABLE

Low-income and ecological-minded factory-built modular housing units


**MISSISSIPPI STATE UNIVERSITY**
SCHOOL OF ARCHITECTURE
**COLLEGE OF ARCHITECTURE ART + DESIGN**
COLLEGE OF ENGINEERING
FOREST PRODUCTS LAB

# Stardust Center

**for Affordable Homes and the Family at Arizona State University**

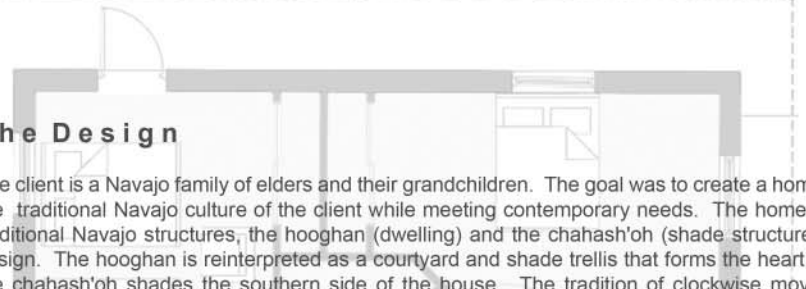
## The Center

*The Stardust Center for Affordable Homes and the Family* is a new initiative by Arizona State University to increase the quantity and quality of affordable housing. Through innovative education, research and design efforts, and technical assistance to housing providers, the Stardust Center promotes affordable housing that is both dignified as well as environmentally and culturally responsive.

## Design Build

As part of ASU's new initiative, the Center engages in design/build efforts each year to create models of affordable, sustainable and culturally appropriate housing. The Center's first design/build project—the Augustine Residence in Nageezi, New Mexico—was completed in July of 2005 for a Navajo elder family on allotted tribal land of the Navajo Nation. Architecture students (of Navajo decent) within the College of Design at ASU sought the center's assistance in creating better housing for their own communities. Subsequently, the project was built through a partnership with ASU, the Navajo Housing Authority and Navajo Flex-Crete. The Augustine Residence represents a new model in design, technology and implementation approach for affordable housing on the Navajo Nation that responds to the climate and traditional culture of the region.

## Summer 2005 Affordable + Sustainable Design/Build Project, Nageezi, NM



## The Design

The client is a Navajo family of elders and their grandchildren. The goal was to create a home which reflected the traditional Navajo culture of the client while meeting contemporary needs. The home incorporates two traditional Navajo structures, the hooghan (dwelling) and the chahash'oh (shade structure), into the house design. The hooghan is reinterpreted as a courtyard and shade trellis that forms the heart of the house and the chahash'oh shades the southern side of the house. The tradition of clockwise movement through a

efficiency climate process de


Mary and Kee Augustine; Owners of the House


Mary and Kee Augustine with the construction and design team


Clerestory windows to allow natural cross ventilation


Material selection is imperative for a good thermal performance. FlexCrete blocks provide both; mass and insulation


This data acquisition unit is collecting information to evaluate energy and thermal performance

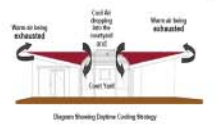
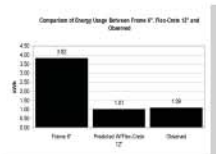
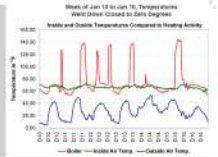
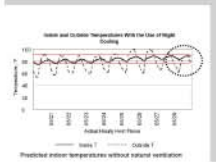
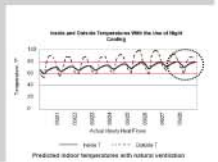


Diagram Showing Daytime Cooling Strategy




hooghan is preserved in the layout of the house with an entry to the east and circulation around the central courtyard.

## Integrated Design Process

The project was designed in a studio process led by the ASU Stardust Center Design Director Daniel Glenn, involving students in the ASU College of Design and built in a design/build process involving dozens of local tribal members of the Navajo Nation and ASU students. Four Navajo students (Adrian Holiday, Christopher Billey, Jason Croxton and Tanya Yellowhair) participated in the design and/or construction of the project, and contributed their intimate knowledge of the culture to the design. Several client meetings were held to develop the design, and the work was presented in the Navajo language by the Navajo students to the clients (one of whom does not speak english) and to the local Navajo Chapter House. Dr. Harvey Bryan and graduate student Ernesto Fonseca in the ASU Energy Performance and Climate Responsive Architecture provided energy analysis with digital modeling from beginning to end of the design process.

## Climate Responsiveness

Specific passive cooling and heating strategies were applied in order to reduce energy consumption and increase thermal comfort. The house does not have an artificial cooling system. Instead all its cooling is predicted to be achieved using day and night natural ventilation. This unit is predicted to use over 60% less energy than a traditional stick frame house. Heating is provided with a radiant floor heating system and complemented with passive heating and 12% of south facing glazing. The thermal conditions in the house are being monitored in 20 points with thermocouples that range from floor temperatures to walls, roof and floors. Outside climatic conditions are being monitored in order to compare these conditions and its impact on inside ambient temperatures and gas consumption for the winter and cooling in the summer. A 1,200 gallon underground tank was installed to harvest rainwater which later will be use for farming, watering animals and gardening.

## Energy Efficiency

The home was designed using Energy 10 and eQUEST simulation and modeling programs. Currently the house is demonstrating reduction in electrical use of 70 %compared to a conventional house primarily through daylighting. In the month of January of this year, a conventional house of this size would use nearly 400,000 btu's/winter month for heating. This house used 182,000 in January, a percentage reduction of 52% in a month with lows exceeding 4 degrees farehnheit. The house is designed to maximized daylighting and natural ventilation through its courtyard design, which provides cross ventilation and two-sided daylight in all the rooms. The home is heated with passive solar supplemented by radiant floor heating. The 12" inch thick exterior walls of aerated concrete block provide both mass and insulation to reduce the need for heating/cooling, reducing the cooling needs on cording to computer simulations to zero when combined with nighttime flushing through automatic, thermostat-controlled ventilation windows, despite summer temperatures that exceed 100 degrees.

A Design for an environmentally sensitive neighborhood of affordable housing. Twelve Oaks is an environmentally sensitive neighborhood designed specifically for the Village of Caledonia, in Southeastern Wisconsin with a sense of the past, stewardship of the environment, and an understanding of what makes people feel part of a place. Twelve Oaks relies on the strength and charm of the traditional neighborhoods of the past and sustainable directions for the future.

Legacy Development
www.legacydc.com
Studio 1032 Architecture Mark and Linda Keane
www.studio1032.com
Yaggy Colby Associates, Inc.
www.yaggy.com

Original Farmstead Home

## Twelve Oaks
## Caledonia, Wisconsin

Twelve Oaks offers traditional neighborhood living for all ages with urban amenities of jobs, culture, nature, and education. Residents choose between varying sizes and styles of housing built within the Midwest regional tradition and can live and work within a 5-minute walk from the necessities of life- commercial, office, retail, civic, recreation, and nature. Streets are pedestrian friendly with homes, shops, offices fronting sidewalks, supported by interior block parking. Key landmark buildings- a school, a church, meeting hall, environmental center, community clubhouse, serve as visual landmarks in the pastoral setting. Adjacent to the shops and offices around Village Green at Trillium Triangle is the 19th century farmstead, meticulously restored into a bed and breakfast and complete with a fruit orchard, farmer's market and equestrian riding center, all celebrating past uses of the land. Open space is provided in the form of public squares, playgrounds , recreation fields, parks and conserved marshes and wetlands.

Typical 28' street with lots ranging from 30'to 60' wide.

Midwestern indigenous housing typologies - the Farmstead, the Four Square, the Bungalow and the Prairie.

Neigborhood public park with access road on four sides.

## Sustainable Building Program

Twelve Oaks will set a new standard for neighborhood design as it embraces the first series of issues set forth by the Leadership in Energy and Environmental Design (LEED) for neighborhoods. These standards will create a strong relationship between the location of buildings, their design and the construction of the neighborhood.

## Building America Initiative

Building America is a US Department of Energy (DOE) initiative to develop energy conservation technologies in partnership with the residential homebuilding industry. New building technologies, innovative building materials, and creative construction systems will result in more energy-efficient, better quality, and more affordable homes. Field support is provided by the National renewable Laboratory (NREL) in Golden, Colorado. BA can save homeowners an average of $500 /yr in consumer energy dollars, reduce construction waste by 20%. Energy -efficient mortgages are also available for BA homes.

## Benefits of Sustainable Building

people, especially elderly and young, gain independence and movement
public greens offer opportunities for neighbors to meet and greet
places to live- single family, multi family, apartments, live/work units
places to work- offices, commercial, retail opportunities, adjacent industrial
places to visit- environmental center, farmer's market, orchard
places to attend- a school, church, senior citizen center
places to relax- a bed and breakfast, spa, riding center, clubhouse
preservation of land with best use practices, wetland views, marshes and oaks
parking shared strategies, on street, and interior parking
roads and pervious surfaces limited
traffic congestion minimized
air pollution reduced

## The Whole House Approach

Teams design houses from the ground up considering the interaction between climate, orientation, landscaping, mechanical systems, building envelope, neighboring houses, etc. Teams are able to incorporate energy saving strategies at little or no extra cost. This systems engineering delivers the following design innovations:

## Advanced Framing Systems

Insulative value of walls is greatly improved by using 2 x 6 studs at 24 inch spacing (as opposed to 2 x 4 construction at 16 inch spacing). Less lumber and less labor are needed for the framing. SIPS-Structural Insulated Panels can be used to create airtight, highly insulative wall construction.

## Integrated Envelope Sealing Package

Lower air infiltration reduces heating and cooling needs and is achieved with taped sheathing systems, air-tight caulking of drywall, and high quality workmanship.

## Energy Efficient Windows

Vinyl framed windows with low emissivity coatings have superior thermal insulation than commonly used aluminum framed clear glass windows.
House orientation and exterior shading are used to control solar heat gain.

## Optimally Sized Mechanical Systems

Heating and cooling systems can be smaller due to reduced heating and cooling loads.

## Improved Ductwork

HVAC Systems are centrally located for shortest supply and return ducts, lowering construction costs and reducing opportunities for air leakage. High quality duct sealings reduces loss of conditioned air.

## Modular Construction

Site delivered Factory made modules reduce construction time and costs and result in tighter building envelopes and less wasted material.

### Benefits for Homeowners

- Lower Utility Bills
- Greater Comfort
- Better Indoor Air Quality
- Energy Efficient Mortgages
- Higher Resale Prices
- Stewardship of the Environment

### Benefits for Builders

- Lower Material and Labor Costs During Construction
- Reduced Purchase Costs of Mechanical Equipment
- Less Construction Waste
- Advanced Energy Systems Integration Including Photovoltaics and Solar Hot Water
- Reduced Callbacks and Warranty Claims
- More Options for Same Sale Price
- Prominence in the Marketplace

### Benefits for the Nation

The energy efficient, healthy and environmentally friendly houses created under Building America contribute to a better quality of life for all citizens.

- Less Reliance on Fossil Fuels
- Reduced Greenhouse Gas Emissions
- More Affordable Homes for First Time Homebuyers

Town square in the center of Trillium Commercial district.

Peterson Boulevard connecting the main street HWY K to the wetlands to the north.

Townhomes with pedestrian access to town center and equestrian grazing areas.

# Nueva Democracia and Nuevo Milenio: Two Topographies of Affordable Housing.

**Pablo La Roche[1], Irma Ramirez[1], Kyle Brown[2], Marina Gonzalez[3], Kristian Whitsett[1], Kim Wehinger[4]**

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## Nueva Democracia

Nueva Democracia is a project made up of 900 dwellings in 25 hectares, in which the Community, the State Government and the Public University get together to solve a housing problem. This project, designed in 1995, promotes social organization of the communities at different scales or levels of interaction represented physically: at the urban level, by the housing complex; the intermediate level, by housing groups between 12 and 30 units around community spaces; and, at a third level by the basic urban cell: the dwelling.
At all levels the project has been designed so that it can be usable and livable with a minimum investment by the government and the people. All services and urban spaces can be developed and evolve with community participation, which will be the main owner of spaces, (61.28% private space, 11.23% semi-private space, and only 14.24% semi-public and 14.87% public) so as to achieve a better quality of life. The initial houses were 30 square meters with multiuse spaces and had all the connections in space to grow up to comfortable two-story 140 square meter dwellings. The rate of growth varied according to the families possibilities and necessities.

## Urban Proposal

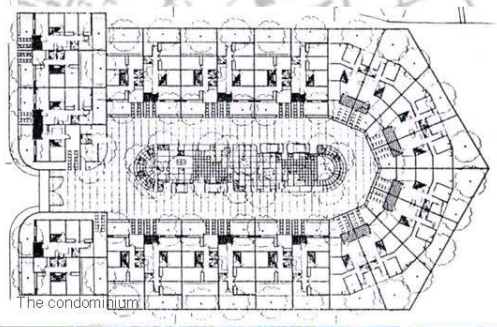
The basic principles that sustain the urban proposal are:
- Rationalization of the occupation and use of the land in order to optimize organization of the infrastructure and reduction of urbanism costs, starting from minimum standards until better standards are achieved.
- Minimization of public and semipublic areas, which are difficult to maintain and control.
- Increase in the physical controls on collective use spaces, through the adequate definition of properties and space uses.
- Structuring, through design of the space and the social organization, of community integration, so that they serve as support to the progressive production of housing and urbanism.
- Support of new forms of participation in dwelling production which are contemplated by the Operation Procedures of the Housing Policy Law.


neighbors


views of different houses

## The Condominium

**The Condominium is an organization of territorial units in horizontal**, specifying the spatial limits that reinforce the ownership sense of the different families to a territory that is their own and recognizable; and their sense of property of what is collective. This motivates the participation of the community in the necessary tasks for the improvement of the residential areas.
The Condominiums, in "New Democracy" increase private and semiprivate spaces over the public and semipublic spaces, in order to establish the responsibilities of the communities, assuring the responsibilities on the conservation and the improvement of these spaces. These areas will be developed by self organization of the families located around the space, in function of their needs, work capacity and income, and not of the local governments. These spaces are owned by the families surrounding them and thus the adequate development of these spaces is their responsibility. The condominiums have been designed as compact units and with a form based on the hexagon; which offers optimization of soil occupation, because remnant spaces that result from plot assembly in orthogonal structures are avoided.

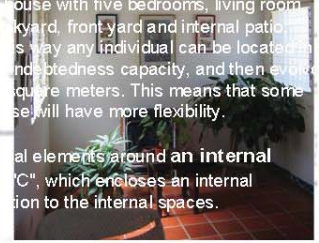

The condominium

## The Dwelling

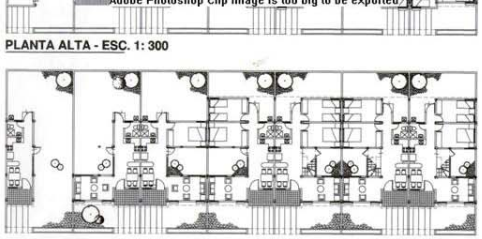
The conception of the dwellings [illegible] with **progressive growth capacity**, is one of the most important concepts envisaged in their design. Houses are designed to grow from [illegible] square meters with a multiple living-


Growth of the house


Houses in the condominium



The house is a succession of geometrical elements around **an internal courtyard**. From an "I" to an "L" to a "C", which encloses an internal courtyard that provides light and ventilation to the internal spaces.




The house has been designed using simple forms and geometric elements, which will be easily recognized and manipulated by its users contributing to individualize the house but maintaining its main design features. The main facade has an important function in this, as an element that socially implies quality and status: simple combinations of finishes and colors are proposed so as to help differentiate and dignify the individual building but assuring an adequate urban unity.

# Sustainable Housing for Tijuana

Most of the measures to improve the environmental performance of buildings in developed countries are directed to improve existing technologies. Societies of less developed countries are open to opportunities for a better quality of life, permitting the introduction of completely different systems which might be more difficult to introduce in more developed societies.

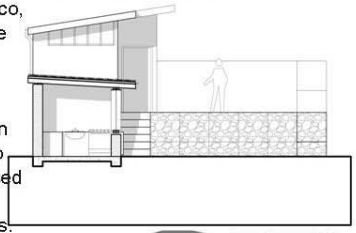
A low cost sustainable housing prototype is being developed by faculty and students of architecture and regenerative studies at Cal Poly Pomona. This prototype will be implemented in Nuevo Milenio, a Colonia in Tijuana, Mexico, emphasizes local materials, technology appropriate for the cultural and economic conditions of the community, strategies that minimize the use of energy, water and materials and adaptation to local topography. Passive heating and cooling technology, affordable food production alternatives for residents, and water and waste systems to protect public health are some of the main issues addressed in the project.

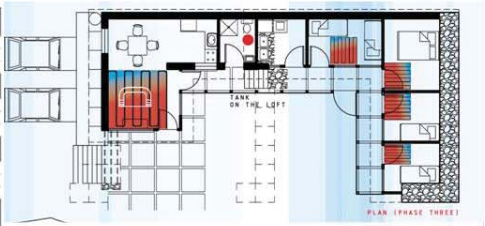
As in Nueva Democracia, the house can be built in phases. Prior to the construction of the buildings, grading, gabion retaining wall construction, drainage swales and earth bag walls can be constructed by the community, with limited outside resources. In addition, the building's slab on grade foundation system can be poured.

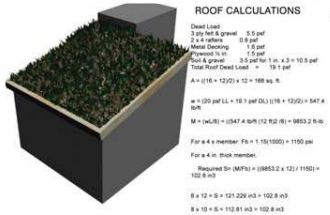
Storm water runoff is a significant challenge in the community and is addressed by the use of rain catchment systems. The rainwater can be collected, stored and directed to the landscape for irrigation via gravity. However, runoff from adjacent properties must be addressed. An "extensive" green roof has been incorporated into the design to assist in mitigation of rainfall runoff while providing improved heating and cooling performance and an increased roof life expectancy due to reduced UV exposure.

A full scale prototype is under construction by architecture and Masters of Science in Regenerative studies students at the Lyle Center for Regenerative Studies at Cal Poly Pomona. The house will serve as a full size experimental setup to test and develop many systems and building components.

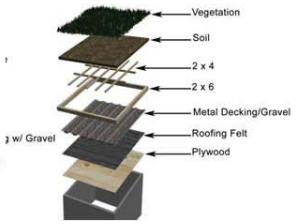
Growth of the Tijuana House

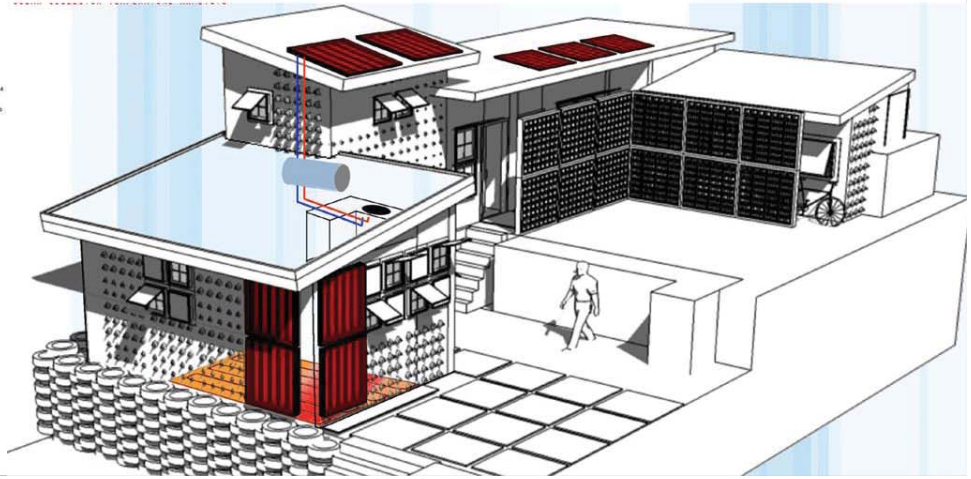





Green Roof



# Affordable Design: Convening the Conversation Forum

## Common Ground Community

Common Ground Community's mission is to solve homelessness through innovative programs that transform people, buildings, and communities. Through environmentally sustainable design, we will create dramatic **energy savings** for our buildings, **better homes** for our tenants, and **healthier communities** for our city.

As program innovators, we address the needs of those who remain homeless the longest, as well as those most at risk of becoming homeless - including youth aging out of foster care, people leaving prisons and jails, veterans, and vulnerable families. In doing so, we knit together service providers, government agencies, landlords, businesses and members of the community to support our prevention and housing initiatives.

To better address the needs of all segments of the homeless population, Common Ground develops new housing models such as the "First Step Housing" program, which combines the traditional lodging house — a historic New York housing typology—with new forms of prefabricated individualized dwelling units. The Andrews House represents the first implementation of that program, which provides housing to those individuals not yet ready or willing to enter into permanent supportive housing programs. Furthermore, green design has been an integral component of our building philosophy, in an effort to create buildings that better serve our residents and the community.

Two of our most innovative projects, by way of building planning and building systems, are highlighted below.

## The Andrews

The Andrews House is one of only three lodging houses that remain on the Bowery in New York City. Since it opened in 1909, it has operated continuously as a lodging house for lower income, transient men. In 2002, Common Ground purchased the Andrews to introduce its First Step Housing program. First Step Housing seeks to update and improve the lodging house concept by offering private, safe, clean and affordable short-term accommodations to homeless and other individuals in need of housing.

In addition, First Step will make available numerous services which will be optional to the residents, including linkages to housing and employment resources, medical help and substance abuse treatment. This approach to engage the service-wary sector of the homeless population was shaped through information gathered in interviews and focus groups with over 200 homeless men and women and many outreach staff working directly on the streets. Based on our research from these interviews and focus groups, it became clear that the real problem with the lodging houses of the Bowery was poor management and poor design. It seemed, however, that the concept of the lodging house – that is, a clean, inexpensive place to spend a night – remained a practical alternative housing model for this population.

Upon completion of renovations, 146 new interior dwelling units will replace the small private cubicles typically found in lodging houses. In addition to short-term housing, the building will contain a clinic to serve the unique health care needs of building residents – creating a cohesive support community. Common Ground plans to replace the Andrews House's existing 213 cubicles, containing 225 beds on five floors, with 146 new First Step units. The project will involve a complete renovation of floors two through six, and the addition of three floors.

### The Competition

To invite the widest range of design solutions for The Andrews House, Common Ground partnered with the Architectural League of New York to seek the ideas and skills of an international group of architects and designers. 180 entries were received to provide solutions for the new Andrews House, and five proposals were selected – 2 of which are shown in prototype. After the "test-drive" of these units during an exhibition by staff and residents of the Andrews, necessary changes will be made to the design and the prototypes will go in production and be installed at the Andrews later this year.

First Step Unit Program and Requirements:
Competitors were asked to design a prototypical prefabricated individualized dwelling unit (the First Step unit) and layout 19 such units on a typical floor of the Andrews House. The designs submitted were not to alter the building's structure, systems, or permanent walls and spaces.

Objectives
Identify design solutions to offer a private, secure, affordable accommodation to existing lodging house residents and those now homeless. Create a cost effective housing unit that is modular and easily replicable through prefabrication and/or a kit of parts approach, and that offers the possibility of individualization by the end user.

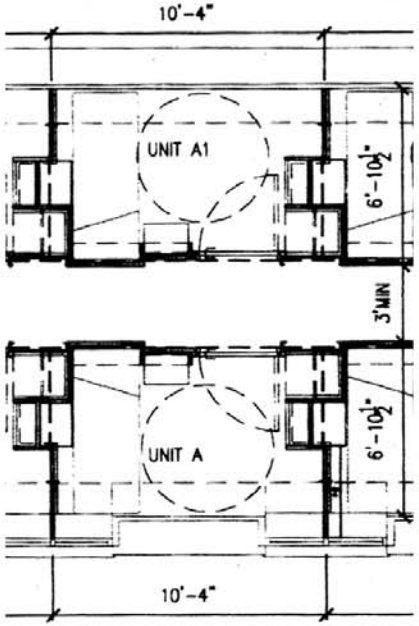
Original Andrews House cubical - 33 SF
Maximum Interior First Step Unit Square Footage - 88 SF

### Selected Prototypes

The Ordering of Things (white unit):
Katherine Change & Aaron Gabriel

Kit of Parts (brown unit):
Rafi Elbaz / Lifeform

COMMON GROUND






# Pitt Street Residence

In December 2004, Common Ground closed on the acquisition of a former Boys' Club building on the corner of Pitt and Houston Streets on Manhattan's Lower East Side.

CGC is in the design stages for a proposed 99,000 SF building on the site. The building will be 12 stories high, with a half-level floor above to provide access to a proposed green roof. The state-of-the art facility will be home to 263 residents, including special needs adults, youth aging out of foster care, homeless adults and low-income working adults from the Lower East Side, an area undergoing rapid gentrification.

Common Ground will develop the project, provide property management services and partner with two service agencies to provide the onsite social services. The Door, an affiliate of University Settlement House, will provide services to the young adults. The Center for Urban Community Services (CUCS) will provide on-site services to the adult population in the building.

To create a healthy building with operational efficiency, the new construction will seek LEED Rating. Sustainable design features will include recycled building materials, energy-efficient lighting fixtures, ozone-friendly HVAC equipment and other systems.

Kiss + Cathcart Architects are designing the building. They are recognized as a world leader in combining solar, or photovoltaic (PV), technology and architectural design. Construction of the new facility is slated to begin in early 2007.

## Sustainability

Building with sustainability in mind will help contain long-term costs. While government agencies supporting the construction of affordable housing understand the benefits of making a building "green" - both for the tenants and for long-term cost efficiency - they still consider these elements nonessential and outside the scope of program funding. Therefore, strategically thinking of ways to pay for these "upgrades" is necessary from the inception of the project.

Key upgrades to a basic affordable housing development include the use of sustainable materials, energy-efficient mechanical systems and pragmatic design strategies.

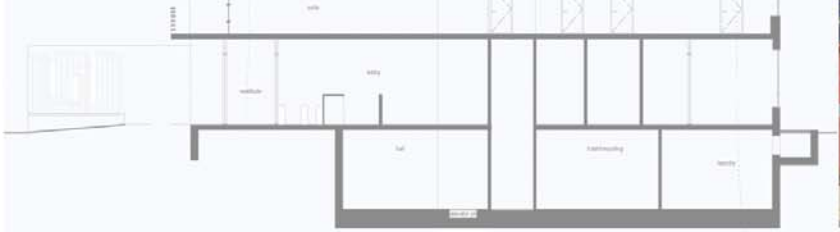
One particularly significant element in an urban affordable housing development is outdoor space. A planted green roof serves both the tenants (as a place of congregation) and the bottom line (as an energy-conserving source of cooling).

Certainly, the life cycle costs of "green" systems and elements are imperative to rating their affordability. Recently in assessing the viability of a geothermal system for Pitt St. Residence, we found that the payback period was just ten years, with an operating savings of over $100,000/year.

Sustainable components in the Pitt Street design include:

- Recycling collection on every floor
- Draft vestibule
- Machine roomless, energy efficient elevators
- Green ready roofs
- Open stairs to encourage walking
- Bike storage
- Energy recovery/occupancy based ventilation
- Occupancy sensor/setback temp
- Geothermal system
- Condensing boiler for domestic hot water
- Corian countertop
- No VOC paints
- Shading devices on west facade
- EIFS
- Light reflectors on North facade will reduce daytime electricity use
- Bi-level l light fixtures in stairways
- Low flow showerheads

To achieve all of these goals - that is, to create smart design, to program appropriately for the chronic homeless population, to work towards long-term viability and to contain the budget - requires coordination with many professionals from the inception. The design team, along with the consultants and contractors, must look at the economic restraints of affordable housing as a challenge. And the developer and design team must involve the funding partners in the process from the early schematic designs, so that short-term costs can be weighed against long-terms savings. A holistic approach will serve well the housing developers and the tenants.



Corner of Pitt & Houston

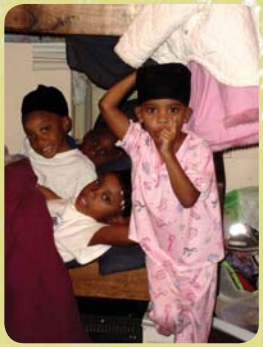
Pitt Street Entrance

# *The Five30 Project:*

*Design/Build Studio, Service Learning, and Greening the Habitat For Humanity Home.*

***Louisiana Tech University***
***School of Architecture***

*Robert Brooks; Assistant Professor*
*Kevin Stevens; Assistant Professor*

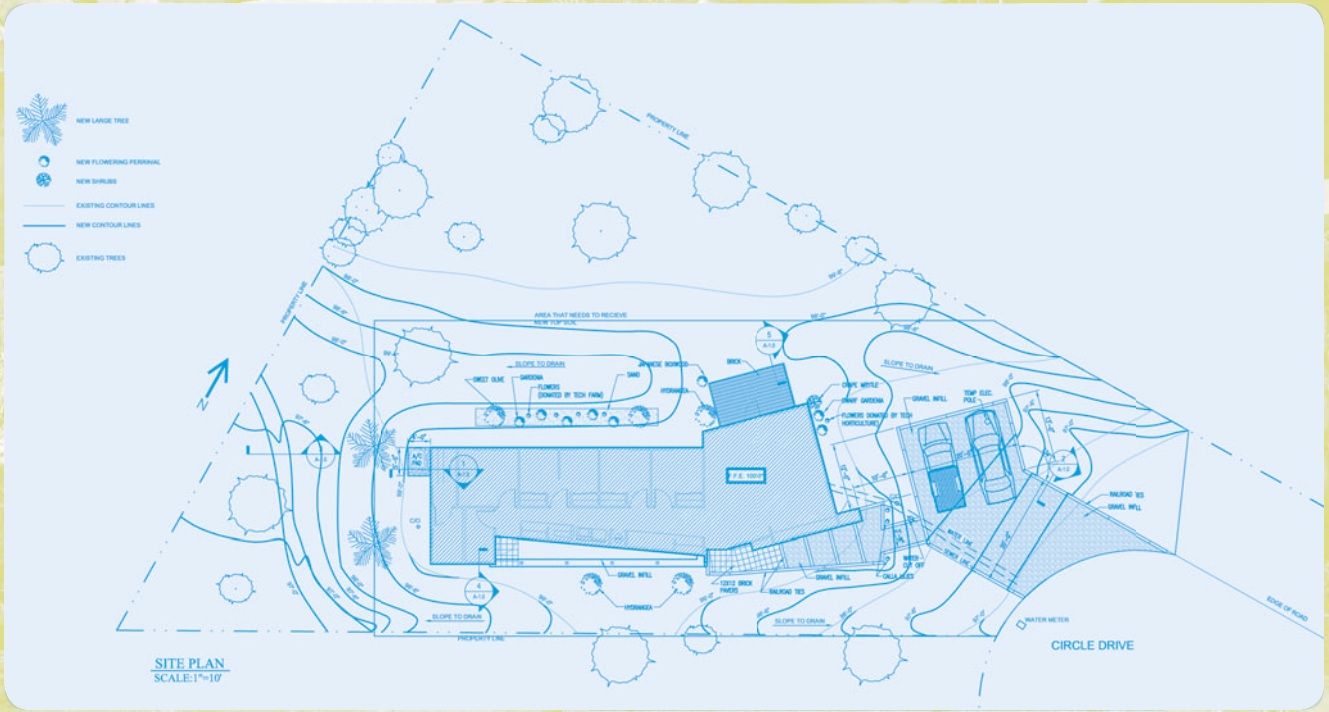


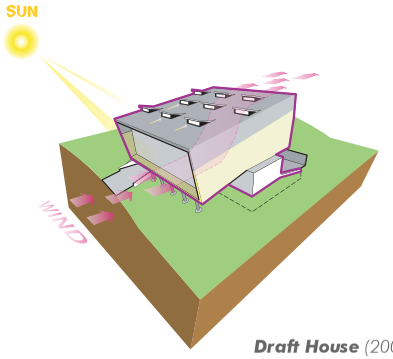
*In conjunction with the North Central Louisiana Chapter of* ***Habitat for Humanity*** *and utilizing generous grants from the Weyerhaeuser Corporation and Working Films, the Fifth Year Studio in the School of Architecture at Louisiana Tech University is currently completing a design/build project that focuses on a* ***1,350 square foot, four-bedroom home*** *for a family of six which also serves as a vehicle for the re-examination of the proto-typical Habitat for Humanity home. This project emphasizes* ***environmental sensitivity****, healthy environments, and sustainable building practices within the context of* ***affordable building strategies****.*

*The studio approached these issues through several filters which served to inform their studies and decision making regarding contemporary building and practice methodologies. Typically, homes built by Habitat are known as being* ***direct in their expression, frank in their provision*** *of programmatic spaces, and resourceful in their financial model. In addition to meeting these demanding realities of the Habitat home as a starting point for their studies, students also identified a series of additional criteria to which they would hold themselves* ***accountable****. Parameters identified by the students, and outlined in their mission statement, are that the project must provide a sustainable and environmentally responsive home that is at once architecturally innovative yet responsive to and* ***empathetic with localized building*** *traditions, regional context and client needs, while ultimately providing Habitat for Humanity with a* ***new working precedent****.*

*Areas focused on within the context of developing this affordable home can be broken down into three prime areas: site development, re-assessment of building* ***typology/configuration****, and materials selection/utilization. Careful site development of the project emphasizes passive energy management strategies informed by historic regional building typologies. These typologies are also overlaid on the* ***typical "nodal hall"*** *development of the Habitat plan type, in which the hall is strictly circulation space, in an effort to search for other options that develop communal/habitable spaces. Among the prime defining environmental/materials factors adopted by the students was a decision to design and construct a house which is, to the largest extent possible,* ***PVC free*** *in an effort to enhance the quality of the interior environment for the family as well as set a standard for environmental stewardship. Other issues addressed with regard to materials and detailing decisions throughout the project were environmental impacts of manufacturing and disposal,* ***lifespan and longevity****, and long-term financial commitments associated with maintenance and repair.*

*The parameters set forth for the project by the studio and the faculty were ambitious, especially within the context of the given timeframe,* ***relative practical experience*** *of the class, and the demanding budget. While many issues were successfully resolved within this project and will serve to provide a continuing avenue for investigation, it is useful to understand and document issues which were not able to be resolved largely due to* ***financial limitations*** *and* ***material availability.*** *It is proposed that had these questions been addressed in a home directed toward a different segment of the population, the task would be perhaps surmountable. The poster submitted for this session addresses both of these areas and, at the same time, serve to establish a* ***point of reference*** *for a design/build studio that is scheduled to begin in the fall of 2006 which will continue to investigate these issues.*

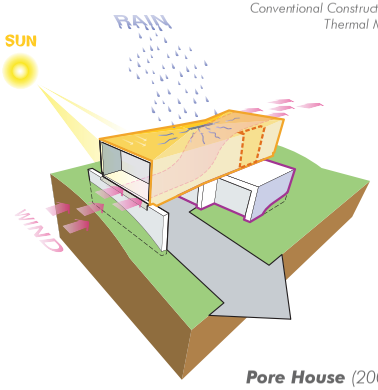



***Draft House*** *(2002)*

***Dumb Box***
*Conventional Construction/*
*Ventilated Box*

***Dumb Box***
*Conventional Construction/*
*Thermal Mass*



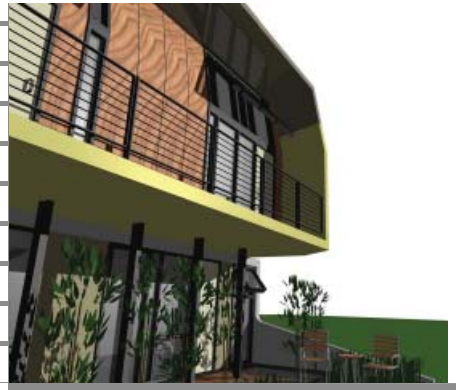

***Pore House*** *(2005)*

***Smart Box***
*Precise fabrication/*
*Performative Skin*

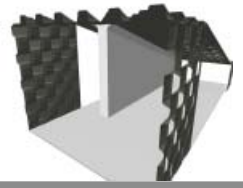
***Dumb Box***
*Conventional Construction/*
*Thermal Mass*

# drape house

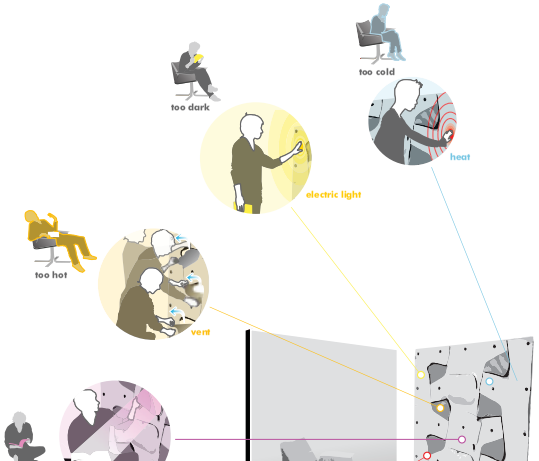
*timeline of project evolution*

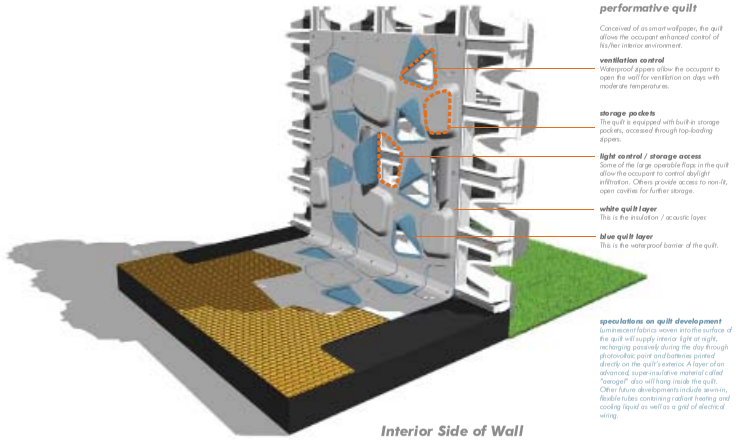


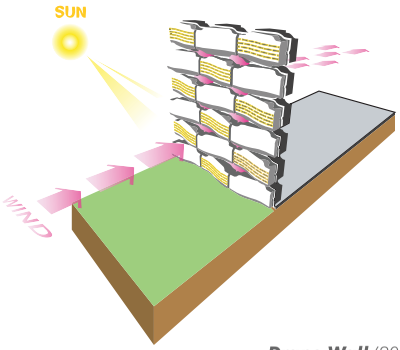
## Draft House



## Pore House



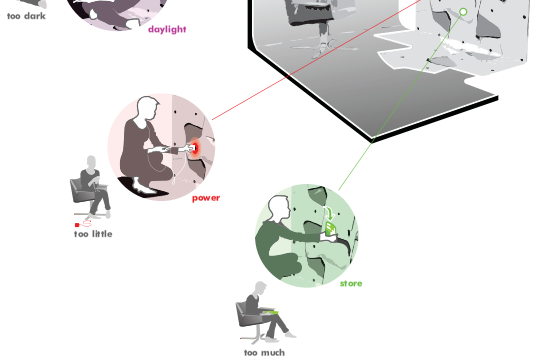



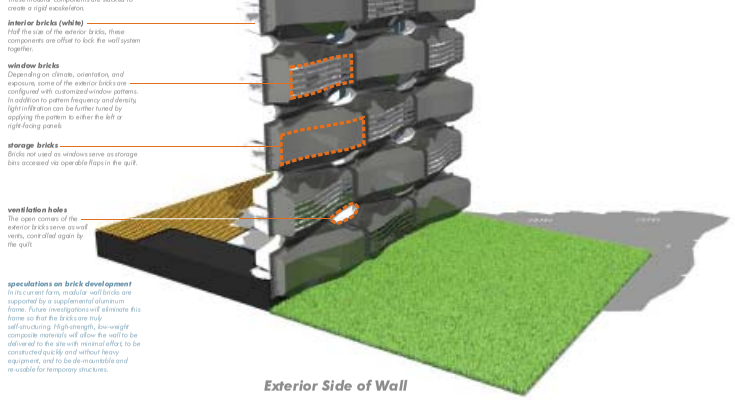



**Drape Wall** (2006)

***Smart Wall***
*Intelligence invested in study of responsive skins*

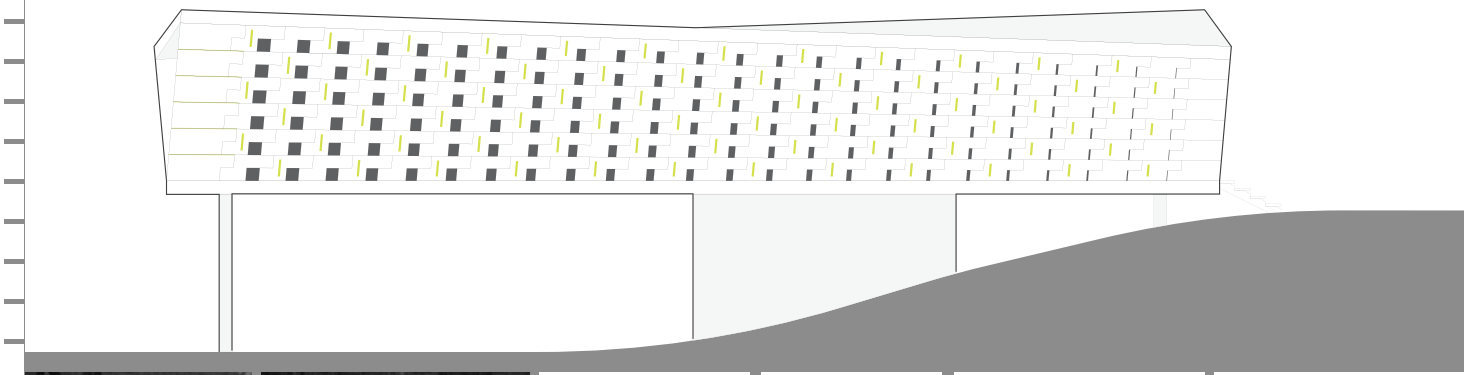
***Production***
*Alternative digital fabrication techniques utilized in fabrication of wall*




*Exterior Side of Wall*

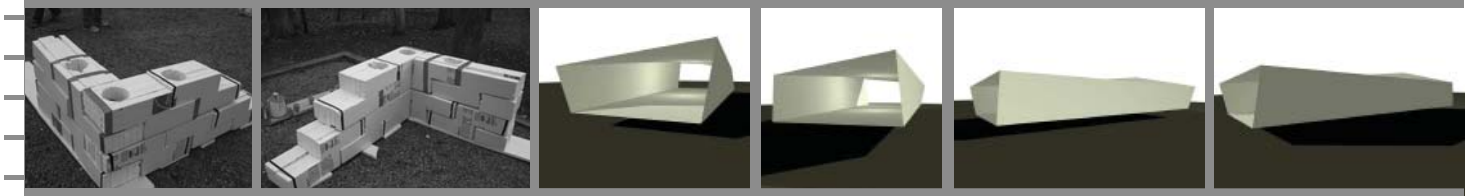
**Drape Wall**



**Drape House** (2006)

*Continued evolution of Drape Wall project back into a fully-developed house - Collaboration with University of Minnesota Engineering Department - Currently under development.*

*Wall is now a self-structuring system made of stackable, interlocking bricks.*



**Drape House**

# GEO NATION

## The rise of affordable private housing in Latin America

**The top affordable housing company in Latin America**

**Featuring 30,000 units a year with profits over $700 USD millions**

GEO has produced more than 230,000 housing units for a million dwellers

Selling prices start at $15,000 USD and are subject to loans and credits

International ARC awards, New York and many national excellence in design prizes

GEO creates efficient self-contained communities integrated to the city

Innovative dwelling concepts such as multiple housing, dwelling and geoblock

Partnership with Prudential Financial investing $455 USD millions

Environmental affordable quality through volume, new technologies and finance

Author: Alfonso Valenzuela aval@MIT.EDU

ACSA
ASSOCIATION OF COLLEGIATE SCHOOLS OF ARCHITECTURE

Fannie Mae
Foundation

cover art DESIGN BY TUMIS