

# 490: Modular Housing in Hawai'i

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**ABSTRACT:** This paper is jointly presented by a faculty member, a practicing architect, and selected students enrolled in a Spring 2013 undergraduate professional practice elective course to examine learning results of professional practice design processes coupled with academic research.

In Hawai'i, fair market rent for a two bedroom apartment is \$1,671—the highest in the nation. To afford this level of rent (without paying more than 30% of income on housing—the threshold for “affordable” housing), a household must earn \$66,853 annually.

Statistics such as the above cited by Hawaii Appleseed Center for Law and Economic Justice in their paper “Barriers to Affordable Housing and New Models” inspired students to research modular housing options applicable to their own age group.

The collaborative teaching sought to provide a genuine understanding of how architecture can affect each student's lifestyle and future job viability while also instilling the realization that architecture students can provide creative proposals for real life solutions. Student learning activities included

- Team investigation and reporting
- Regularly scheduled discussions with a practicing architect
- RFQ/RFP document development
- Case study research on modular housing
- Interaction with invited reviewers, panelists and lecturers, a development company engineer, the Building Industry Association of Hawai'i president, a housing construction Real Estate Consultant, Hawaiian Home Lands representative, local architects and interns.

The debate will include assessment of student learning successes relative to the emphasis on superior performance and goals to exceed the imagination and relevancy of normal architecture education through interaction with community leaders.

A highlight of the discussion will be one student team's modular unit design. The ultimate goal is to discover how academic design research that includes interdisciplinary collaborations beyond traditional architecture practice education modes can result in inspired student proposals for innovative paradigms that respond effectively to changing societal needs.

**KEYWORDS:** Methods, Changing Paradigm, Interdisciplinary Collaboration

## INTRODUCTION

Collaborative partnerships between students and professionals were made possible through an elective seminar course. Professional participants were primarily board members of Housing Hawaii, a non-profit corporation created “to advocate for affordable rental and for sale housing in Hawai'i.” The group, founded in 2005, includes representatives from the non-profit development community, private developers, government officials, housing and homeless service providers, self-help housing developers, labor and business leaders. Since then Housing Hawai'i has sponsored several conferences to increase public awareness of the housing crisis which resulted in formation of an Affordable Housing Regulatory Barriers Task Force” to identify barriers that lead to increasing costs of developing housing in Hawai'i.

Architecture 490 students were tasked with researching and presenting alternative modular housing designs in search of a new paradigm to reduce housing development costs. This paper includes one team's design described in detail in section 2.0.

### **1.0. The Hawaii Affordable Housing Crisis: The Architect's Reflections**

Lack of available affordable housing significantly impacts students and others in their income level negatively. The average median home price in Hawaii is \$600,000. This places the majority of homes out of reach of the entry level salaries in the architectural profession. Per Hawaii Appleseed Center for Law and Economic Justice, "Additional symptoms of a crisis for lower income residents include:

- 73% of extremely low income people (under 30% of area median income) pay more than half of their income in shelter costs.
- Hawaii has the highest rate of homelessness among the states, with almost 14,000 people receiving homeless services annually.
- We need 13,000 units by 2016 for households earning less than 50% of the area median income. "

This shortage of affordable homes for students contributes to young professionals moving away from Hawai'i causing a "Brain Drain" condition in Hawai'i.

For those young professionals choosing to remain, it is extremely difficult to sustain a good quality of life. They typically spend more than half of their income on housing rental costs and must share their living space with others with the same dilemma. This condition can be an opportunity for architects to use their creative minds to offer a new approach for housing design.

#### **1.0.1. Arch 490 Modular Housing**

The design and planning initiative for this class was to research how innovative modular construction technology used for housing can become a partial solution to lowering housing construction costs thereby lowering housing costs.

#### **1.0.2. Agents of Change Approach**

Architects are trained to be problem solvers. This aspect of creative design should be maximized in architecture curricula and utilized as a tool to shift the paradigm of minimum housing standards to one of efficient space/materials use. In addition, effective civic leadership skills are critical aspects that the profession should utilize to impact perceptions of space needs for the community at large. Civic leadership is currently not taught in architecture programs. Students should be inspired to become "agents of change" who consistently push the boundaries of design creativity as leaders to achieve affordable housing innovations by educating the public and producing innovative housing designs.

#### **1.0.3. A Collaborative Teaching Process**

Students were exposed to practice methods and resources to expand student awareness of the realities of professional practice. Responsibilities emphasized were: 1) Architecture Can Affect Lifestyle, 2) Architecture Can Affect Future Job Viability, 3) Architecture Students Can Provide Creative Real Life Solutions.

#### **1.0.4. Research and the Case Study Method**

Research via web, library, and periodical searches was essential to explore existing examples of modular construction used in the development of housing. Case studies of modular designs were prepared by student teams to provide detailed understanding of the realities of housing design cost including real-life design challenges and viewpoints of housing industry experts and client expectations. Examples of the research include:

- 1.0.4.1 Portland SRO Housing: "Freedom Center Project" (Portland) 150 units; and "Apodments" (Seattle) 60 units: examples of small studio and 1 bedroom units that average between 100 to 230 SF. While built as market housing these units offer a shift to micro units that include modular construction at lower construction costs. Both Pacific Northwest projects are located in the urban core.
- 1.0.4.2 Container Housing: (20 ft. x 40 ft. modules) reuses normal shipping containers as the basic module to construct multi-family structures. These have been marketed as effective examples of adaptive re-use to create small multi-family housing buildings that can be stacked and retrofitted with housing finishes and fixtures. While in Hawai'i containers are commonly used as temporary construction field offices or classrooms they can be expanded easily as options for inexpensive housing. The design challenge is the livability of the housing to minimize the industrial character of the modules.
- 1.0.4.3 *My Micro NY*, a housing project by design firm *n ARCHITECTS*, was the winning program of New York Mayor Bloomberg's New Housing Marketplace Plan competition, adAPT NYC. The design of *n ARCHITECTS* followed many of the objectives that one team's project aimed to fulfill, providing a marketable and desirable residence that would also meet affordable housing needs. As requested in the RFP by the New York City Department of Housing Preservation and Development (HPD), the apartment is a mixed-use building that provides innovative design that "facilitates the development of functional and affordable Micro-units." The NYC project is built with prefabricated building modules, each unit only 270 to 350 square feet. The space is broken down into two elements – the "toolbox" and the "canvas". The "toolbox" contains a tenant's needs for living, including a kitchen, bathroom, and storage. The "canvas" provides the resident an open space for personalization. The apartment building also included a 1,200 square feet "flexible creative space" on the ground floor as an outlet for residents to be used for rehearsals, performances, or cultural activities. The space activated the pedestrian street" to create a connection with the local community.
- My Micro NY* is an example of an affordable housing micro-unit development that could be integrated into a dense living environment. Concurrently, the case study also is a model of an architectural *program* rather than an architectural project. Issues of community development, creative flexibility, and affordable living became the foundation for one team's investigation into the role and influence of affordable housing.

### 1.0.5 Networking

Perhaps the most valued activity for the students was the opportunity to network and learn from relevant private industry experts in housing development. Subject matter experts were invited every two weeks to conduct lectures and provide feedback on the modular affordable housing strategies pursued by the student teams. Housing Industry Experts included but were not limited to:

- 1.0.5.1 Real Estate Consultant who provided market advice of how the consumers would view market level modular housing. The discussion with the Consultant included advice on the key housing features that are deemed most desirable by potential homeowners.
- 1.0.5.2 Affordable and Rental Housing Developers provided background information on the challenges the housing industry faces with reduced subsidies for affordable units. In addition sharing the economic funding complexity of development of affordable housing projects gave students insights into the reality of regulatory restrictions and funding aspects not available through textbook assignments.
- 1.0.5.3 Hawaiian Homelands Representative and Architects with the School of Architecture provided their approach to a modular housing development prototype that achieves a sustainable modular home. The intent of the project design to provide a culturally relevant home for a local market while maximizing modular structural components provided a "real time" example for students.

### 1.0.6. Expert Critics

A culmination for the class was the opportunity to present their case study findings and design proposals to a panel of the industry experts who were involved throughout the semester. Summary comments and learning highlights Included

- 1.0.6.1 Initial steps toward identifying opportunities for Hawai'i to implement the innovative modular housing design ideas as a means to reduce housing costs.
- 1.0.6.2 Students' expressed some knowledge of and fresh appreciation for the challenges of the regulatory barriers obstructing housing development,
- 1.0.6.3 Students' changing views regarding negative perception of affordable housing, high construction cost and high cost land development.
- 1.0.6.4 The students gained valuable personal perspective on the real problem of the housing crisis in Hawaii in addition to gaining a perspective of the challenges for affordable housing developments.

### 2.0. One Student Team's Proposal

Shipping containers, or *inter-model steel building units (ISBU)*, were chosen as the core construction material for Team *690 builds'* housing project. Traditionally used as storage units, ISBUs are made of Corten steel, a weathered material highly resistant to atmospheric corrosion, making it ideal for Hawai'i living conditions. Once their value has been exhausted as storage units, they can be reused for housing. A predominant trait of ISBUs is their prefabrication. Since containers are already built, the construction of residential units is completed quickly with fewer materials and savings in labor costs. Containers are also adaptive and can reflect the needs of residences due to their dimension proportions making new additions to existing housing complexes simple. In the case that building height restrictions change due to edits made to zoning codes, containers may be easily added to a building to create more stories. Containers are designed with a simple skeleton-and-skin system to make modification effortless.

One of the challenges addressed was the marketability of shipping containers due to their relative newness to the residential market. Developers express concerns regarding aesthetics and comfort. Customization and contemporary aesthetics proved to be quick solutions to these concerns but challenges with image remain.

When does housing become more than just housing? *690 build* became our rhetorical architecture proposal to meet affordable housing needs as well as acting as an economic catalyst for Hawai'i. Paralleling the intentions of the New York City HPD, *690 build* was designed to tackle *affordability, marketability, and social activism*.

Parameters for the modular design project were established early on:

- High land values in Hawai'i equate to high housing costs.
- Units are not restricted to residential use only. Versatility in modular units would allow options for private and public use.
- Connectors used to attach units should follow a similar modular design to keep production time and costs low.
- Units should be transportable if components are to be prefabricated.
- Redundancy in unit design needs to be addressed to keep project desirable to prospective tenants.

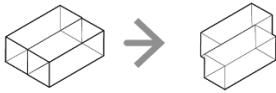


Figure 1: Offset

Each unit of *690 build* is intended to be flexible in program - as a residential unit, an office, a bicycle storage facility, or an event space – in order to fit the needs of the developer and the community. A single unit is constructed out of two prefabricated ISBUs that are offset in order to provide additional living space and compensate for furring of interior walls (Figure 1). All exterior surfaces are exposed and left untouched for additions, such as green walls or retractable partitions. The skeletal steel framing of each container replaces any need for support posts and beams due to its short width and offset design.

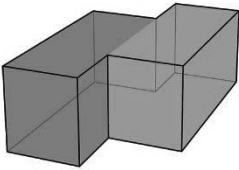


Figure 2: Residential unit

The residential unit is a two-part program: living/dining and bathroom/kitchen (Figure 2). The living/dining area includes sleeping quarters and entertainment space. The bathroom/kitchen area contains plumbing infrastructure. Units are to be organized in order to optimize outdoor spaces in order to compensate for small interiors (Figure 4). Figure 5 shows an example of what *690 build* could look like.



Figure 3: Modular furniture

The challenge of micro-housing designs is the utilization of small spaces. Furniture proposed for these units will be modular, multi-purposed, and built-in, in order to make the most of interior spaces. Figure 3 shows how one space can contain a bed, a sofa, and a desk.

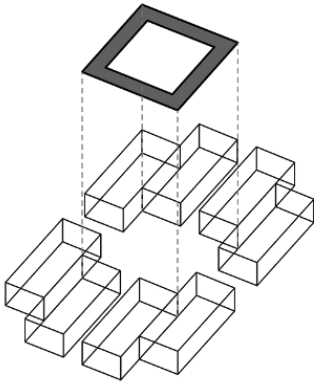


Figure 4: Courtyard



Figure 5: Concept rendering

Units are organized to optimize outdoor spaces which compensate for small interiors (Figure 4). Figure 5 shows an example of what *690 build* could look like.

### 2.0.2. Affordability

With every opportunity for a new paradigm comes expected responsibility. The current construction field is simmering with a lackluster job market for builders and architects. *690 build* provides an opportunity for work, directly and indirectly. The student team's goal is to have their proposal become a catalyst for various project types beyond residences. Aside from the accessibility of materials and smart use of technology and construction methods, *690 build* could be new paradigm for architecture practice.

### 2.0.3. Marketability

Affordable housing has traditionally been associated with construction projects that have never been attractive or welcoming, in areas that were not necessarily places that encouraged community. Housing creates a synergetic relationship between its users and the immediate areas – community reflects housing and housing reflects community. If *690 build* is able to transform the way “affordable housing” is perceived to the public this type of housing program can be a model for creative housing projects and fill the critical need for housing in Hawai'i.

### 2.0.4. Social Activism

A residence cannot exist without a community. The people living in these homes are not just consumers, they are citizens with jobs, families, and goals. When is housing more than housing? *690 build* provides opportunities for its residences to meet and connect, and also to give back to their community. When an individual becomes responsible for things beyond their home, a sense of pride is attained and pride can last beyond the lifespan of a residence.

### 2.0.5 Policies

Alongside the *690 Build* project was a proposal for policies to be implemented in residential projects. These policies have been produced in an effort to (1) keep costs consistent, (2) create a socially resilient class of residents, and (3) keep communality a priority.

#### 2.0.5.1 Residential Eligibility

Eligibility requirements are intended to keep housing affordable. *690 build* is intended to be short-term housing and provide professional opportunity for residences. Prospective residents must meet the following requirements:

- a. Be 20 - 40 years old.
- b. Be currently employed (self-employment allowed).
- c. Fall into a salary bracket of less than \$50,000 annually.
- d. Work within a 5 mile radius of housing site.

#### 2.0.5.2 Types of Units

*690 build* is comprised of one unit type with a flexible interior that can be customized to create a personalized home or a business space that meets its owner's needs. The interior will consist of modular units available to the owner. Units used for "business" will be restricted to availability. One business unit will be available for every three residential units.

#### 2.0.5.3 Pricing

In an effort to keep housing costs low, they will be subsidized by the leasing of business units. Residences of the *690 build* community will have priority rights for these units but they will not cost the same as the residential units. Keeping these leasing costs high allows for internal community cash flow to keep housing prices low.

The costs of these units will be targeted specifically for local residences. Prices are to be lowered by 30% for *690 build* residences. Other businesses whose owners do not live in the *690 build* community will be required to pay full price.

#### 2.0.5.4 Co-operative Living

A co-operative living program is to be implemented and enforced by federal aid. Residents of the *690 build* community are to join small co-operative groups that contribute to the housing development. For example, within the *690 build* community, there will be a bicycle storage facility available, free for residences. Residences who are a part of the bicycle co-op will be responsible for maintaining the bicycle facilities, a requirement for all residents.

### 2.0.6. Student Reflections on the Course

Modular housing as a solution to rising living costs and dwindling housing options surpasses aesthetic innovation and requires a comprehensive understanding of Hawai'i's socio-economic community with an interdisciplinary approach. As opposed to a traditional architectural design course, the organization of *490 Modular Housing* helped decipher the complicated process required to produce a successful housing program as a response to said concerns. Case studies, construction systems, material research, Request for Proposal (RFP)/Request for Qualifications (RFQ) writing, business strategy and marketing/branding, housing policy, and land-use were topics included in the development of an affordable housing program. These categories contribute to a complicated network of architectural problem solving that mimics a real-life scenario. Student practice and production in the course extended into the professional realm and provided opportunity for personal growth in skills such as presentation, speaking, and writing.

The weekly class was divided into sessions where every couple of weeks, students would present their RFP/RFQ and housing program to a new panel of professionals. This weekly reiteration was an opportunity to practice skills in presentation and make necessary edits as needed, identified by the professionals. As students of architecture, the project began with a formal design approach to solving housing concerns. By exposing the project to people of multiple disciplinary fields of work, the housing proposal was able to develop in a manner that could tackle problems that may have been originally overlooked. Reviews helped mold the housing program as a solution for affordable housing and exposed students to realistic complications associated with the project.

As the course progressed and more professionals reviewed the project, the data and research conducted became tangible and probable. The statistics found regarding housing availability and average incomes for young adults was, realistically, a reflection of students' future and the housing situation they would soon encounter. It no longer became a study of housing availability, but rather, a case of Hawai'i's real estate market, job economy, and community values.

### **2.0.7. Role of the Student and the Professional**

The 490 Modular Housing course provided what many other courses normally are unable to offer: exposure. The interaction between students and professionals provided exposure to new perspectives of a design challenge. Our role as students provide us the liberty of distancing ourselves from the difficulties of construction and related legalities; and in doing so, an architectural project can be transformed into an innovative reconfiguration of social and societal needs. Working with interdisciplinary professionals from different fields provided insight into the varying facets of the design project that eventually transformed what the project originally intended to be. It was no longer a post-and-lintel project but rather a public program.

Students are able to provide insight into urban solutions because they are able to dismiss context. In the case of 490 Modular Housing, the course began with an open-ended proposal in an effort to resolve housing concerns without restriction or expectation, other than it being a form of modular design in Hawai'i. Early project designs, evidently, began as unfeasible and premature but were new and innovative. The advice and review of professionals acted as guidelines to narrow down these design solutions that otherwise may have strayed away from conceivable application. With the help of these professionals, students were able to take big ideas and turn them into plausible solutions. It became important not only for the students to produce appropriate, detailed background research into the housing market and other related topics, but that they also develop a camaraderie with said professionals to fully utilize their expertise and improve communicative relationships during the little time shared between both parties.

### **3.0. SUMMARY**

The Arch 490 Modular Housing course is one of a series of professional practice courses specifically developed to provide students with out of the box learning opportunities by challenging them to apply innovative thinking to real world problems. Positive discoveries are encouraged by professionals who are leaders in their fields eager to interact with and nurture young minds.

Key to the success of such interaction is the relationship between the practicing professional and the teaching faculty which is founded on multiple amenities such as:

- The culture of collaboration instilled as a responsibility to serve family, community, and environment with aloha
- The UHM School of Architecture as the only architecture school in the region is **the** source of design knowledge dissemination attracting students from the Asia Pacific region
- The culture and climate of Hawai'i appealing to a majority of the graduates to practice within the islands
- The University of Hawai'i at Mānoa's aspirations and commitment to provide global leadership

The resultant network strength and diversity of partnerships within all sectors-business, professional, and government makes courses such as Arch 490 not only possible but essential to provide exceptional design solutions for challenges like the affordable housing crisis. The largest resultant costs are the multiple volunteer hours provided by the professional participants and the jeopardy that the energy expended by all will be filed away, never to be pursued as credible solutions. It is the architect-educator's responsibility to seek funding to implement the creative ideas uncovered.

## ACKNOWLEDGEMENTS

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