FACTORY BUILT HOUSING REPORT

PRESENTED BY

HAWAI'I ISLAND
HOUSING COALITION

A STREAM OF VIBRANT HAWAI'I

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01: SUMMARY

Hawai'i continues to experience a shortage of housing solutions to address the community's fundamental need for shelter. The 2019 Hawa'i Housing Planning Study showed that 30.6% of households in Hawai'i County were shelter burdened (paying over 30% of their monthly household income toward a shelter payment) and Hawai'i County needs 13,300 additional units by 2025.

This report explores Factory Built Housing as a viable option to meet the housing need on Hawai'i Island and provide the reader with evidence of the safety, code compliance, resilience, and quality of Factory Built Housing products.

DEFINITION

Factory Built Housing is a form of housing which is built off-site in components or modules for later assembly on-site in accordance with locally adopted and enforced building codes.

Throughout this paper we will be using the terms Factory Built Housing and Modular Housing (FBH/MH) interchangeably as they both refer to structures built partially or entirely in a factory and are intended to be installed on a foundation.

02: MANUFACTURED HOUSING

FBH/MH should not be confused with Manufactured Homes or Mobile Homes which are distinct in its regulation, design, construction, and installation. Manufactured Housing means a structure as defined by the National Manufactured Housing Construction and Safety Standards Act of 1974 (42 U.S.C.A. §§ 5401-5426.) and is an industry and product regulated under the authority of the Federal Department of Housing and Urban Development (HUD).

The standards and codes governing HUD approved Manufactured Housing differ from and do not contain the most current state and local building code provisions. Manufactured Housing is a product that is built on axles (trailer chasis or set of wheels) with a permanent frame.

While Manufactured Housing is regulated by the federal government (HUD), FBH/MH is regulated by the State and/or local government based on that jurisdiction's preferred or designated code and standards.

In most jurisdictions, FBH/MH products are required to be installed on an approved permanent foundation that meet the jurisdiction's requirements for wind uplift, shear, and seismic conditions, and are not on a permanently affixed trailer chassis.

For further details, refer to respective state and local codes.

03: HISTORY OF FBH/MH

FBH/MH is not a new or novel option, in fact, FBH/MH has been a viable construction method for more than a century, since Sears, Roebuck & Co. began selling their famous pre-fabricated "kit homes" in 1910 and has been supported by the US Housing and Urban Development for decades.

"In 1969, HUD launched Operation BREAKTHROUGH, a $30 million demonstration program to test ways to expand the use of factory-built housing. This experiment producted 2,794 units and tested a number of new industrialization techniques. Modular housing systems can make the construction of single-family homes and multifamily buildings less expensive, make more efficient use of increasingly costly land, and, ultimately, build vibrant neighborhoods." (Jagruti Rekhi and Michael Blanford, HUD Staff: Office of Policy Development and Research, Evidence Matters, Winter/Spring 2020).

BARRIERS TO FBH/MH IN HAWAI'I

Due to the absence of local manufacturers as well as the cost of shipping incurred by mainland based manufacturers, FBH/MH is relatively new to the construction industry in Hawai'i. However, there have been proof of concept projects across the state utilizing utilizing FBH/MH products for single and multi-family residential construction. These proof of concepts have utilized exclusively imported units (those constructed outside the State of Hawai'i).

Other barriers to FBH/MH include lack of government processes to facilitate the manufacturing of FBH/MH, political opposition by special interest groups, and the perpetuation of myths or unsubstantiated allegations that such products are inferior and unsafe for island residents.

04: GOVT OVERSIGHT & REGULATION

In the State of Hawai'i, the Hawai'i State Building Code Council is tasked by state statute to adopt the State Building Codes and establish the foundation or baseline controls for building construction in Hawai'i.

Each of the four Counties is required to adopt the State Building Codes with limited opportunity to incorporate County specific amendments which cannot be less restrictive than the State Building Code provisions.

The Hawai'i Revised Statutes clearly delineates the administrative authority for the Counties with respect to permitting, inspecting, and the enforcement of code compliance.

In 2012, the County of Hawai'i adopted the State Building code which was based on the 2006 International Building Code. One of the County of Hawai'i amendments included the adoption of Appendix L: Factory-Built Housing. However, the processes for a local manufacturer to implement the code had not been formally developed and codified, and is ongoing.

05: CASE STUDY

For the purpose of this paper and to provide context, reference will be made to one Hawai'i Island manufacturer, HPM Building Supply (HPM), and the implementation and utilization of the County of Hawai'i code provisions as it pertains to FBH/MH.

In 2018 as the County of Hawai'i and the residents of Hawai'i Island were being impacted by the volcanic eruption and the subsequent loss of over six hundred (600) structures, many of which were primary residences, the concept of FBH/MH was seen as a viable disaster recovery solution and later as an effective attainable housing solution for island residents.

Over a period of 3-years (2018-2021), HPM designed and obtained plan approvals and permits for the factory construction of (2) prototype structures. These working models provided an opportunity for HPM to improve efficiencies and the County of Hawai'i Building Division to implement some of the developed processes.

The execution of these (2) prototype structures included the application for and acquisition of:

1. "Factory Shell" Building Permits,
2. Framing, Insulation, and Rough-In Plumbing and Electrical Inspections, and,
3. "Move & Set" Building Permits for one of the units to be used as a model home.

Note: The application for the install of the second unit will be submitted for a future project site and use.

Throughout, complete regulatory control was maintained by the County of Hawai'i, and HPM maintained an open door policy affording the County full and unannounced access to the projects.

DESIGN, PLANS, & PERMITTING

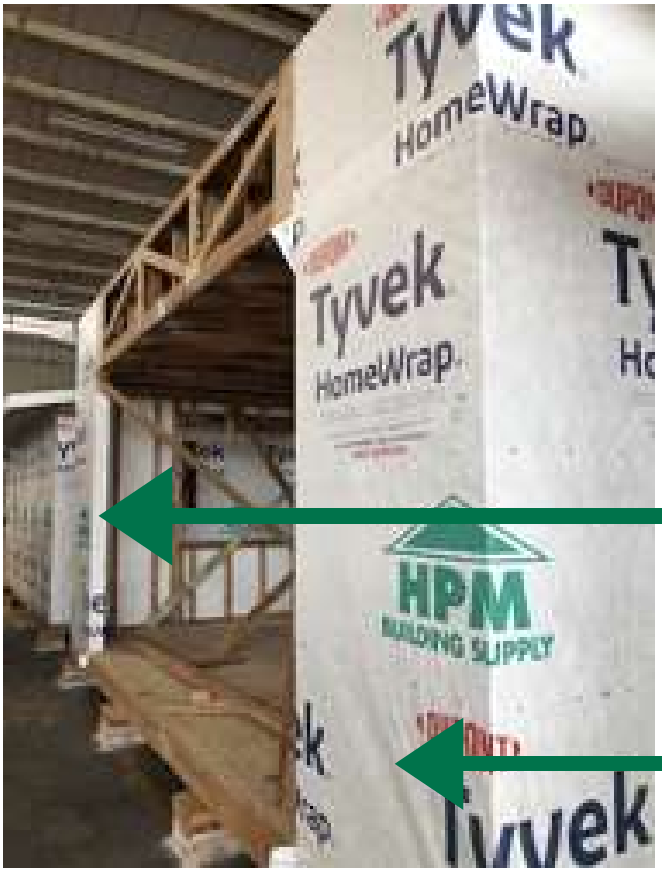
All plans and designs for prospective HPM FBH/MH products have been reviewed and approved by the Building Division Authority Having Jurisdiction (AHJ). It should be noted that those designs submitted for permitting were previously reviewed and approved/stamped by a licensed structural engineer in the State of Hawai'i. As permitted, the plans and designs of the structures were confirmed to have either met or exceeded the design requirements of the current building code.

CONSTRUCTION & INSPECTION

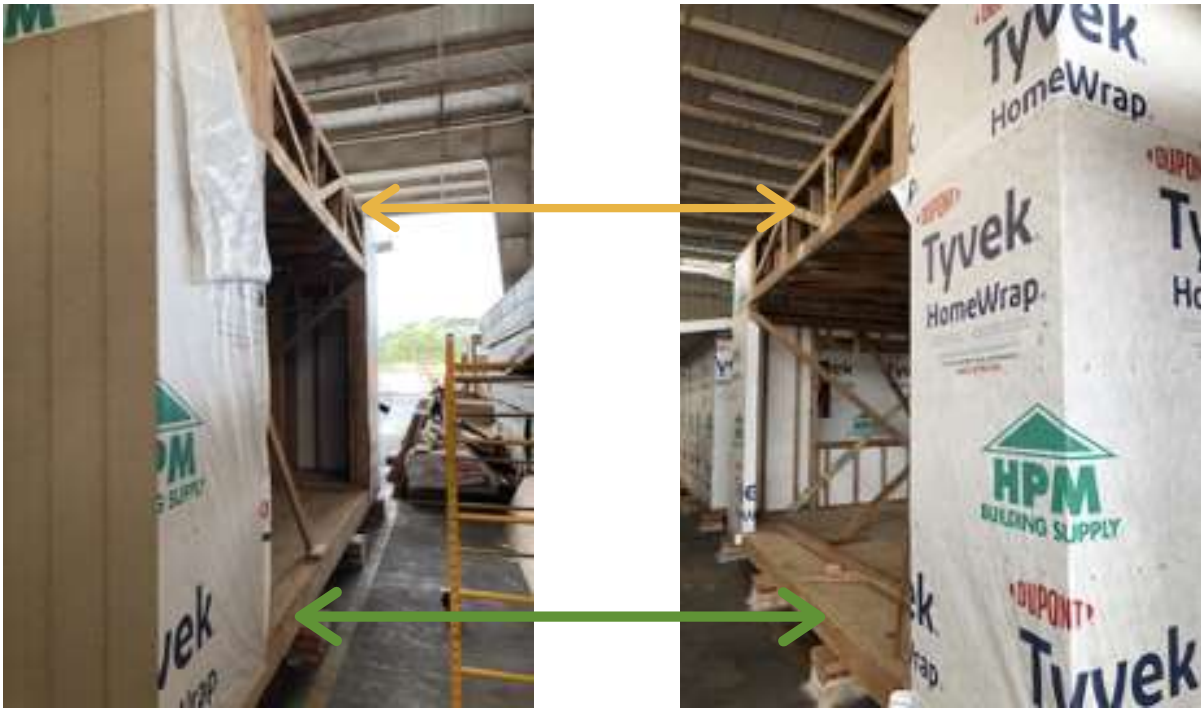
FBH/MH has proven to be a very safe and resilient method of home construction. In addition to utilizing similar building materials and methodology, FBH/MH incorporates additional reinforcement to support its transportability. The photos on the following page show recessed internal shear walls on both the left (Module 1) and right (Module 2) halves of the structure, noted by the green arrows. These walls are at the "marriage point" of the two units, and when joined, form a center structural element that provides significant strength and hardening of the structure above what is provided for in typical site-built construction.

This exact type of increased structural integrity incorporated in FBH/MH was cited in a post impact damage assessment report conducted by FEMA shortly after Hurricane Andrew devastated Florida communities.

"Overall, relatively minimal structural damage was noted in modular housing developments. The module-to-module combination of the units appears to have provided an inherently rigid system that performed much better than conventional residential framing. This was evident in both the transverse and longitudinal directions of the modular buildings." (Building Performance: Hurricane Andrew in Florida, FEMA, 2/93)



Green arrows point to the internal shear walls of Module 1 and Module 2 which are joined together to form a center structural element that provides significant strength and hardening of the structure above what is provided for in typical site-built construction.



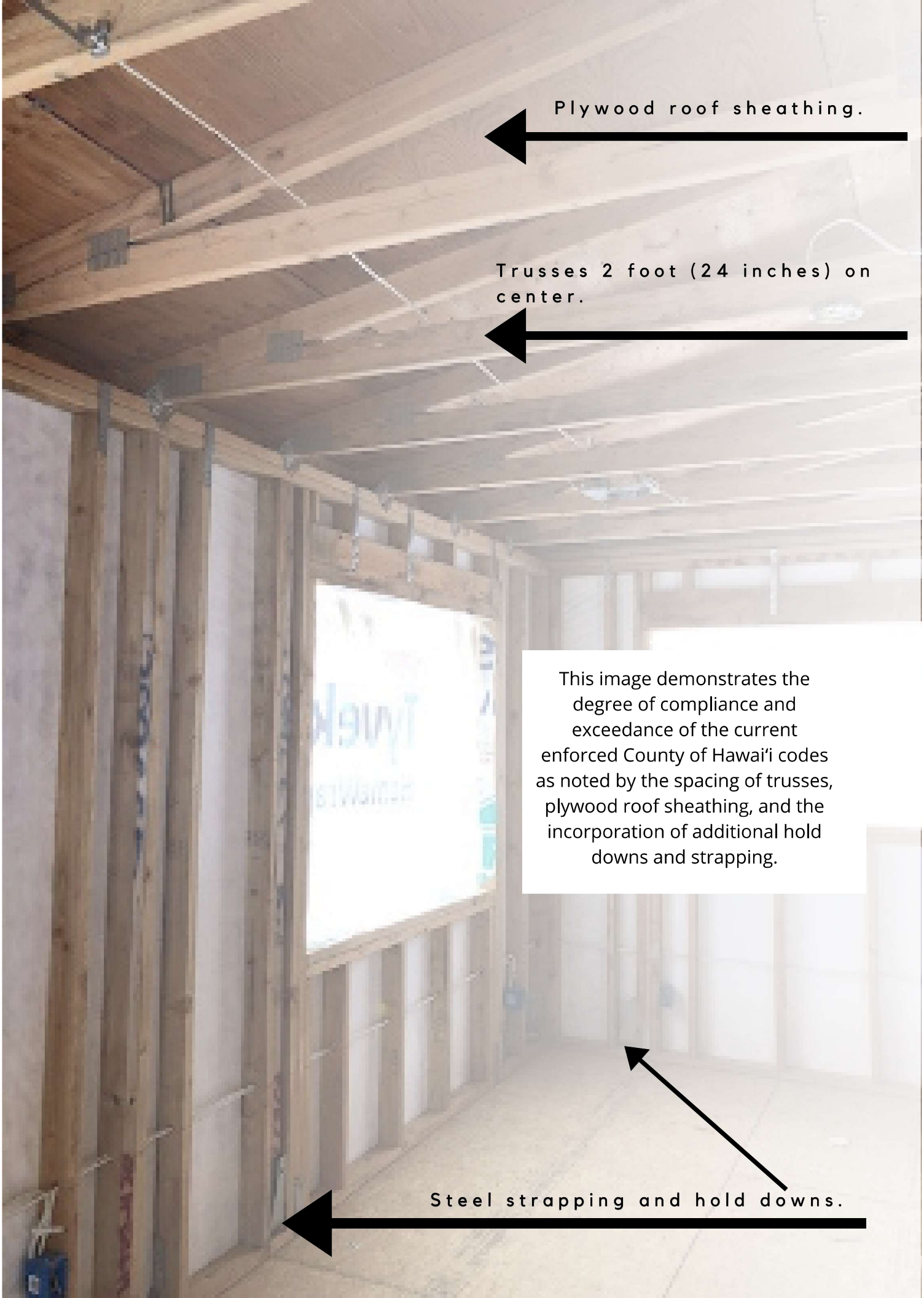
Additional examples of code compliance, structural integrity, and hardening incorporated into the designs and manufacturing of FBH/MH include complimentary connections at the marriage point at the truss level (double bridge truss) and the floor assembly girders (double girders).

Each of these examples result in significant enhanced strength and rigidity beyond traditional site built structures.

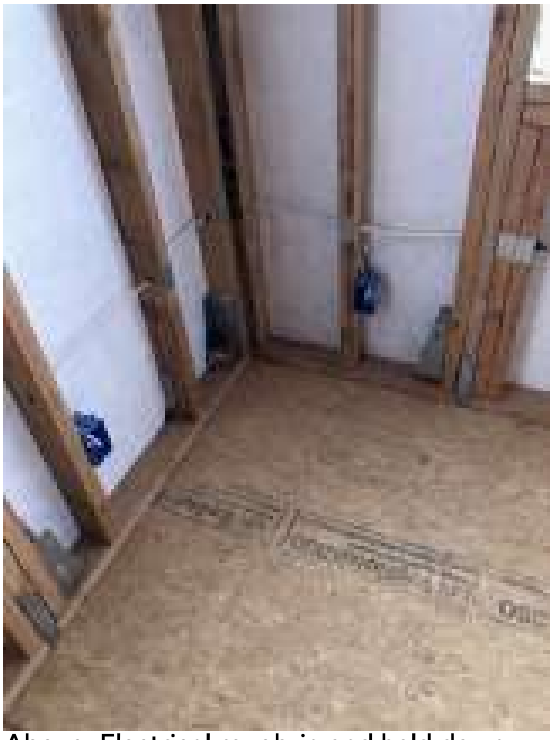
Top Images, Yellow Arrows: Double Bridge Trusses

Top Images, Green Arrows: Double Girders

Bottom Image, Subfloor view of Double Girders



This image demonstrates the degree of compliance and exceedance of the current enforced County of Hawai'i codes as noted by the spacing of trusses, plywood roof sheathing, and the incorporation of additional hold downs and strapping.

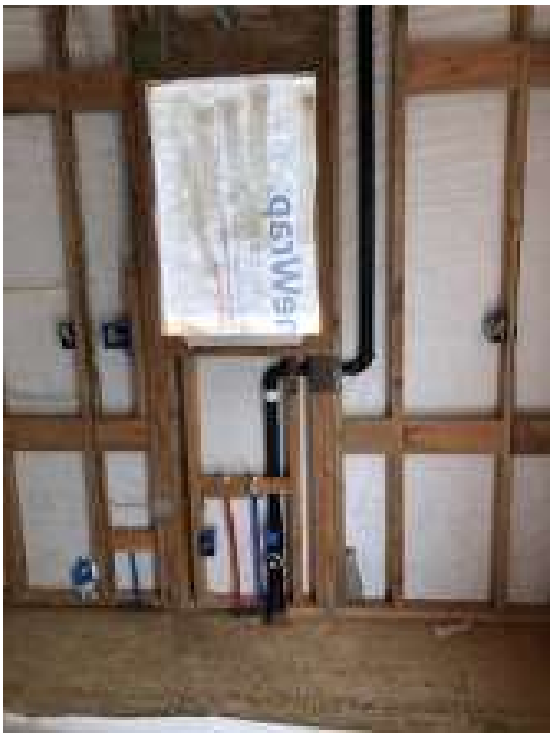


Above: Electrical rough-in and hold downs

FBH/MH structures manufactured in Hawai'i County are inspected for compliance twice: first in the factory, and again at the time of installation on the approved permanent foundation.

These inspections, inclusive of framing, insulation, and rough-in electrical and plumbing is conducted exclusively by the County of Hawai'i Building Officials.

In addition, all of the construction and assembly is performed under the oversight and direction of a licensed general contractor. All sub work (i.e., electrical and plumbing) is performed by licensed electrical and plumbing contractors.



Above: Electrical and plumbing rough-in and hold downs

06: TRANSPORTATION CONCERNS

The expressed concern of an increased risk of structural damage and compromise of the units during transportation (that may present with fire risk and other hazards associated with damaged electrical or gas systems and leaks with plumbing systems) have recently been raised by local opponents of FBH/MH.

The following sources of expertise refute these concerns:

- Karl Aittaniemi, P.E., is the Director of Standards at the International Code Council. He supervises the Standards Department staff in their roles supporting the development and support of ICC's Codes and Standards out of ICC's Central Regional Office in Country Club Hills, IL. Karl has an extensive professional background in fire protection product evaluation and has managed fire protection investigation projects in accordance with nationally and internationally recognized model codes and standards. He has experience as a forensic engineer and is a licensed professional engineer in several states.
- (Ray Bizal, Regional Operations Director of the National Fire Protection Association
- David Tompos, President of the International Code Council NTA
- State Regulatory Offices (California, Colorado, and New Mexico)

Contact was made with these agencies and organizations based on their roles and responsibilities with collecting incident data and identifying trends or issues of safety concerns and making corrective code changes to ensure the safety of building occupants.

All sources were not aware of any data, reports, or incidents attributed to structural compromise with the transportation of FBH/MH.

06: TRANSPORTATION CONCERNS

The closest comparable data available was provided in the most recent report published by the NFPA and examining the fire incident data of Manufactured Homes; the comparative analysis of fire incidents in Manufactured Homes versus other traditional one- and two-family homes showed a rate of 1.6 incidents per 1,000 housing units in Manufactured Homes compared to a 2.1-2.4 per 1,000 units in other one- and two-family housing units. (Manufactured Home Fires, NFPA, 2013).

There is insufficient evidence or data to support inferences that transporting an assembled, wired, and plumbed structure presents with undue risk for compromise and/or potentially hazardous conditions after installation.

Further, the ICC is on track to develop, propose, and release the following by 2021:86

- A standard for the planning, design, fabrication and assembly of off-site construction,
- A standard for the inspection and regulatory compliance of off-site construction, and • A guideline for the transportation of modular components to the construction site.

According to the iccsafe.org website, "The balloting period for committee members to approve the final drafts was completed on June 28, 2021. Both ICC 1200 and ICC 1205 first edition standards were approved by the committee."

07: CONCLUSION

FBH/MH, designed and constructed in accordance with the current building codes and standards, can provide for safe occupancy and residency and should be supported as an option to address the housing shortfall in Hawai'i. Given the history of FBH/MH across the US and its use and installation in wind and seismic environments that are comparable to Hawai'i, FBH/MH has proven to provide safe and resilient housing.

The County of Hawai'i's Building Division has demonstrated its ability to effectively regulate locally manufactured FBH/MH through the implementation of existing codes which provide adequate safeguards to plan and design approvals, permitting, and inspections.

The designs and concepts of FBH/MH have demonstrated to provide superior performance and resiliency with historic wind impact events and disasters, and based on the inherent hardened design and methods of assembly.

"Manufacturing building components off-site provides for more controlled conditions and allows for improved quality and precision in the fabrication of the component." - National Institute of Standards and Technology and the National Research Council

"Homes (built) in a factory setting allows for more consistent quality due to uniform construction processes, training techniques, and inspections. All homes are inspected by an independent, third-party home inspection agency before leaving the factory. Once on site, they are again inspected, this time by a local building inspector. These homes meet and often exceed all requirements of locally adopted building and fire codes." National Association of Home Builders

RESOURCES

Aittaniemi, P.E., K. (2019, April 23). *ICC joins OFF-SITE construction revolution.* ICC. https://www.iccsafe.org/building-safety-journal/bsj-technical/icc-joins-modular-building-revolution/.

APA policy guide on factory built housing. American Planning Association. (n.d.). https://www.planning.org/policy/guides/adopted/factoryhousing.htm.

Chapter 107 Public Improvements. CHAPTER 107. (n.d.). https://www.capitol.hawaii.gov/hrscurrent/Vol02_Ch0046-0115/HRS0107/HRS_0107-.htm.

County of Hawai'i. (n.d.). *Hawai'i County Code Chapter 5A.* Chapter 5A Building Code. https://www.hawaiicounty.gov/home/showdocument?id=302737.

Department of Business, Economic Development & Tourism. (2020). *Hawai'i Housing Planning Study, 2019.* Hawaii Housing Planning Study - Department of Business, Economic Development & Tourism. https://dbedt.hawaii.gov/hhfdc/files/2020/01/FINAL-State_Hawaii-Housing-Planning-Study.pdf.

Effects of Market Forces on the Adoption of Factory-Built Housing, Evidence Matters: Office of Policy Development and Research. Winter/Spring 2020

Federal Emergency Management Agency, Federal Insurance Administration. (1992, December 21). *Building Performance: Hurricane Andrew in Florida.* Homeland Security Digital Library. https://www.hsdl.org/?view&did=721586.

Windle, M., Quraishi, S., & Goentzel, J. (2019, October). *Disaster Housing Construction Challenges In America: Exploring the Role of Factory-Built Housing.* MIT Libraries. https://dspace.mit.edu/bitstream/handle/1721.1/122651/MIT_HSCL_Housing_Report_final_102819.pdf?sequence=3&isAllowed=y.

CONTACT

HAWAI'I ISLAND HOUSING COALITION

Darryl Oliveira, Co-Chair
Kaikea Blakemore, Co-Chair

www.vibranthawaii.org/housing
housing@vibranthawaii.org

ABOUT VIBRANT HAWAI'I

In 2018, informed by the Aloha United Way ALICE (Asset Limited, Income Constrained, Employed) Report, a Small and Mighty (SAM) group of Hawai'i Island community change leaders came together with a common belief that increasing wealth and wellbeing on our island would need each sector, district, and individual's unified commitment. The SAM group invested in developing relationships with over 30 community leaders by participating in network meetings and learning about the unique mission and capacities that each organization held.

A year later, the SAM group invited community representatives (business, philanthropy, government, education, social services, faith communities, and community-based champions) to share their answer to one simple question, "What does a vibrant Hawai'i look like to you?".

Informed by the unified voice of those participants, the vision of a vibrant Hawai'i guides the collective action we prioritize through our Streams of Economy, Education, Financial Resilience, Health and Wellbeing, the Hawai'i Island Housing Coalition, and a network of Resilience Hubs.

The Hawai'i Island Housing Coalition aims to reduce the shelter burden on Hawai'i Island residents and believes that this can be accomplished through community driven and government supported collaborative action and providing our community with a spectrum of affordable housing options.

Learn more about our work at www.vibranthawaii.org