HousingWorksRI
at Roger Williams University

SCHOLAR SERIES
Contemporary Issues in Housing

Beyond Housing Subsidies: Enhancing Affordability Through Design, Construction Technologies, and Land Tenure

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About the Authors

Ryan Ludwig is a licensed architect and an associate professor of architecture at Roger Williams University (RWU). Both his academic and advocacy work are dedicated to promoting equity and ecological resilience in design discourse and practice. He is the author of the book Beyond Sustainable: Architecture's Evolving Environments of Habitation (Routledge, 2021), which reconceptualizes the relationship between humans and their architectural surrounds, challenging how we might better adapt to climate change. Ludwig is also a co-editor of the book The Function of Form, published by Actar Press (2009/2020). His work has been supported by a Centrum Artist Residency (2018), MacDowell Fellowship (2019), Art Omi: Architecture Residency Fellowship (2021), I-Park Foundation Artist Residency (2022), and the Pogue Wheeler DAAP Faculty Travelling Fellowship (2021). He was a member of the 2024 ACSA cohort for the Academy for the Public Scholarship on the Built Environment: CLIMATE ACTION, and is an active member of The Architecture Lobby Green New Deal Working Group. Prior to joining RWU, Ludwig held teaching positions at Syracuse, SUNY Buffalo, the University of Cincinnati, and Cornell.

Toby Arment is a Master of Urban Planning candidate at the Graduate School of Design, where he is focused on solutions to the ongoing affordable housing crisis. Concurrently, he serves as a Municipal Fellow for the City of Cranston, where he leads community engagement processes and develops policies to support the creation of more affordable housing. Prior to this role, Toby was a Research Analyst at HousingWorks RI. He holds an A.B. in Urban Studies and Sociology from Brown University and is a proud native of Wyoming.

Kylee Hong is a Brown|RISD Dual Degree student '26 studying Urban Studies at Brown University and Interior Architecture + Adaptive Reuse at the Rhode Island School of Design. Her interdisciplinary education in urban policy and design—along with experiences in land use, architecture, and municipal government—centers on housing. From the scale of interior spaces and construction details to the broader patterns and policies that shape cities, she seeks to understand how housing and livability can be enhanced for all.

Additional editing and review by Annette Bourne, Patrick Duffy, and James Hardy.

Table of Contents

Foreword

Annette Mann Bourne
Research & Policy Director

The genesis of this paper goes back to 2022, with notes about the myriad facets that drive the costs of residential development. At the time, I was looking primarily at the changing demographics of a variety of households—smaller, aging, urbanist (committed to no car/biking)—who might be inclined to live in smaller spaces. The list included the costs of construction and the savings that could be realized by manufacturing indoors (modular and manufactured homes) and new technologies (3D printing). Work continued on and off with interns, but time intervened, and the paper lay idle.

Fast forward two years, and an invitation from Roger Williams University Associate Professor of Architecture Ryan Ludwig breathed new life into the work. While the work Ryan was doing with his students centered on the dangers presented to residents of mobile home parks and the promise of turning the parks into resident-owned communities, I took the opportunity to ask him if he would be willing to take a look at the work-to-date on what I called "alternative housing structures." Even more promising was the presence of two young colleagues: Toby Arment, newly working as HousingWorks RI's Research Analyst, and Kylee Hong, our summer intern through Brown University's iProv program and a dual degree student at Brown and the Rhode Island School of Design. Both were eager to work with Ryan and produce one of our Scholar Series papers on the topic.

We are pleased now to be presenting the results of this collaborative scholarly effort guided by Professor Ludwig, which combines some of my original interests in how newer construction technologies may enable some cost savings, as well as how those savings could be further enhanced by collective forms of ownership.

Over the period of time from inception to publication, we have been heartened to see more mention of these technologies, particularly in other scholarly research and in reports by states (including our own) to help accelerate the production of homes. The benefits and constraints suggested are not exhaustive and offer some commonalities relative to the nature of any change—perhaps the two most prevalent are getting businesses to scale and training a new workforce.

While the paper is titled "Beyond Housing Subsidies," we are not blind to the fact that some recommendations here require government investment to incentivize new business formation and workforce development. We are making a distinction between a "subsidy" as direct assistance to a developer or renter to defray the cost of development or rent, and a short-term investment in businesses and the labor force that will generate economic development for years to come.

HousingWorks RI continues to strive to offer information to policymakers and the public about the most current trends and research in housing. We hope this paper offers new ideas on the direction of how we can meet our state's need for housing affordability.

Introduction

Rhode Island, like many states across the country, is facing a housing affordability crisis. Research and practice demonstrate that increased housing production is one way to expand affordability.[1] The new state guide plan, *Housing 2030*, has set a goal of permitting 15,000 new units over the next five years. Although building permit data does not provide a flawless assessment of new housing production, it shows a troubling trend in Rhode Island, which regularly ranks among the lowest states in new housing permits per 100,000 residents, ranking last as recently as 2023.[2]

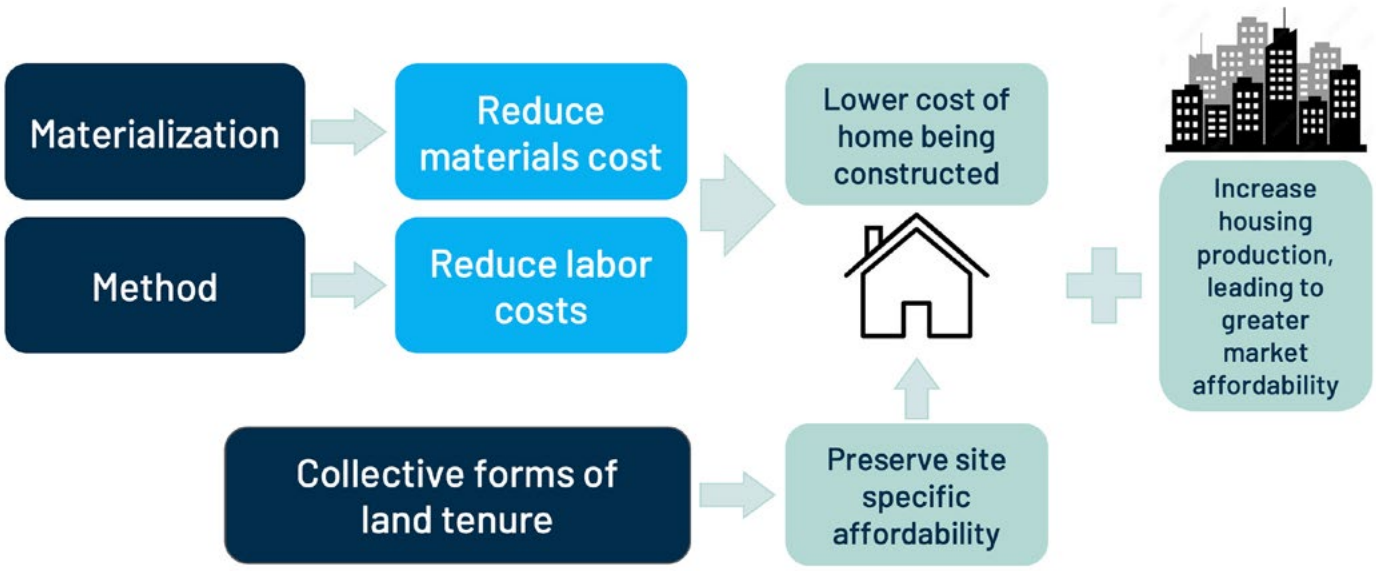
The rate of new residential construction in Rhode Island continues to fall short of meeting the housing needs of a changing demographic of a greater number of smaller households. A comparison of U.S. Decennial Census data from 2000 to 2020 shows a far steeper growth in the number of households (8.04 percent) than population (4.68 percent) with a decrease in household size to 2.49 from 2.57. This shortage of production and supply that matches these new households has great implications for housing affordability in the state. Today, nearly half of Rhode Island renters and more than a quarter of homeowners pay more than 30 percent of their income for housing, making them cost burdened.[3]

Discussions amongst those involved in housing production overwhelmingly identify costs as a significant barrier to producing housing that offers affordable rents or purchase prices.[4] Typical subsidies, like rental assistance and development programs, tend to incentivize specific housing options that reinforce traditional models of design, development, and land tenure that do not always yield substantial cost reductions or sustain those benefits over time. Additionally, compared to other domestic industries, the U.S. construction sector has not seen significant innovation or growth in productivity in the past 50 years.[5] Recently, the COVID-19 pandemic sent shockwaves through

the housing world, posing major disruptions to timelines, supply chains, and labor availability.[6] The public health crisis of COVID-19 also highlighted the prevalence of housing insecurity among Americans, particularly for renters and low-income individuals, underscoring the need for lower housing costs.

As the building industry continues to recover from the effects of the pandemic, we are at a critical moment to reflect on our current construction practices. In setting the goal of increased housing production, *Housing 2030* notes the promise of these innovative models in achieving the economies of scale necessary for faster production. What innovative design and construction techniques might potentially reduce costs and advance wider affordability?

Building on research and national discussions, this Scholar Series explores potential design and construction decisions to improve housing affordability and identify policies that may unlock new opportunities for scalability and impact.



Construction methods and materials have site specific affordability impacts but can also help scale housing production supporting greater market affordability. Collective forms of land tenure help preserve site specific affordability.

Graphic by Patrick Duffy

Chapter 1: DESIGN PRINCIPLES

During the planning or pre-construction phase of any architectural project, strategic design decisions can reduce costs. Three of these approaches have the potential to create savings: increased efficiency in materials and labor, adaptable and efficient space planning, and alternative domestic programming.

1. Enhancing project efficiency through design can be achieved by leveraging economies of scale from standardization. **Decisions that minimize materials, labor, and construction time lead to more efficient project delivery, resulting in cost savings.** This approach reduces building complexity, thereby shortening construction time and labor demands. While not all aspects of a project benefit from the repetition involved in standardization, certain elements—such as dwelling units and structural components—often do. Residential development presents strong opportunities for creating efficiencies through the standardization of unit types while still allowing for unique designs that respond to specific site and project conditions.

2. **Prioritizing space planning that is adaptable and efficient maximizes the potential of existing and new housing.** By designing with several potential uses in mind, housing can evolve to meet changing demographics, family structures, and community needs over time. **This strategy not only applies to the building interior but also to the land the building occupies.** More compact, denser developments and the rehab of existing buildings optimize the use of land and materials; examples include Accessory Dwelling Units (ADUs), infill development, adaptive reuse, and mixed-use projects. These development practices unlock housing opportunities while preserving existing buildings and surrounding environments.

3. **Alternative living arrangements also offer further opportunities for design efficiency.** There is a growing trend toward co-housing or co-living models, where individuals have private rooms but share common areas. This type of housing is particularly efficient for certain populations, such as single adults, as it reduces costs, conserves space, and can provide more desirable living arrangements. Another example is multi-generational housing, which is having multiple generations of family members living together. These alternative layouts provide strategic, flexible solutions that address the diverse needs of modern housing, enhance efficiency in both construction and long-term use, and offer benefits such as shared resources and stronger social bonds.

Chapter 2: BUILDING TECHNIQUES

In addition to design decisions, the materials and construction methods used in a project significantly affect overall cost. Emerging building techniques can support the goals of efficiency, adaptability, and affordability in housing developments. A distinction between building ***materialization*** and building ***method*** has been employed to help clarify the difference.

> ***MATERIALIZATION*** is categorized as including building materials or components, without specifying the form in which they will be applied.
>
> ***METHOD*** encompasses types of construction systems without specifying the specific material components used.

It is possible, in any project, to combine multiple techniques or selectively apply them to specific components. This selection of building techniques is not exhaustive but highlights those with significant potential and growing relevance in contemporary construction.

One emergent theme is the general approach of **off-site construction** through **prefabrication** methods. While off-site construction has been shown to increase efficiency and cut costs, it remains a largely regionally dependent practice in the United States, shaped by local industry conditions. For example, in areas with less developed prefabrication markets, transportation and assembly costs for modular units can offset labor and construction savings, particularly when manufacturers are located too far from the site.[7] In light of this, the availability of these technologies, as currently developed in Rhode Island and more broadly across the Northeast, is discussed.

This chapter examines two new kinds of materialization: Mass Timber and Structural Insulated Panels (SIPs), and four kinds of methods: 3D Printing/Material Extrusion, Panelized, Modular, and Manufactured.

MATERIALIZATION

1 ***Mass timber*** **refers to a family of engineered wood products composed of multiple layers of wood that create strong, load-bearing structural elements.**[8] These innovative, versatile, and increasingly used products are enabling the use of wood as the primary structural system (including columns, floor slabs, and shear walls) in large buildings, replacing steel and concrete. Alongside efforts to reduce the building sector's carbon emissions, emerging sustainable practices are increasingly turning to mass timber as an alternative because it is a renewable, low-carbon material and construction system. Even for low- to mid-rise multi-story buildings, compared to a traditional steel or concrete podium with a light-frame on top, mass timber offers competitive advantages in multifamily residential development.[9]

The most well-known mass timber products are *cross-laminated timber* (CLT) or *glue-laminated timber* (glulam); other products include nail-laminated timber, dowel-laminated timber, laminated strand lumber, and parallel strand lumber.

Benefits and Potentials for Cost Savings

- Lightweight, with equal or greater weight-bearing capacity than steel or cement, reducing the amount of material needed for the structure.
- Wood components (walls, floor plates, and structural supports) can be prefabricated, thereby requiring significantly less labor and time for on-site installation.
- Aesthetically attractive, which may eliminate the need for more expensive or labor-intensive finishings, such as drywall or paint.
- A more sustainable alternative as it sequesters carbon and is composed of fast-growing, smaller trees.

Existing Constraints

- Growing, but still small, domestic mass timber manufacturing.
- Requires more specific expertise in both design and construction.
- Building codes in many cases limit its potential use, especially in larger building applications.

Policy Areas to Grow

- Modification of state and local building codes to permit larger structural CLT buildings and maximize savings.
- Support for growing the domestic mass timber manufacturing industry.
- Support training programs to increase the building industry's expertise in both the design and construction methods of mass timber.

Regional Context

New England forests are a prime location for mass timber manufacturing. There is growing traction, pressure, and excitement among planners and policymakers for mass timber construction in the Northeast. For example, in 2024, the Boston Planning and Development Agency (BPDA) released the final report on the Mass Timber Accelerator program, one of many city initiatives targeted at achieving carbon neutrality.

The regulations for CLT construction in Rhode Island follow the state's building and fire codes, which are based on the International Building Code. This code is prescriptive by nature and establishes certain requirements for CLT structures, such as minimum thickness of exterior walls and maximum allowable floor-to-floor height. The most significant restriction placed on the construction of CLT structures within the Rhode Island building and fire codes is the regulation limiting timber-framed construction to a maximum of five stories.

RISD North Hall | NADAAA | 2019 | Cross-Laminated Timber (CLT) Structure, Steel Frame

2 *Structural Insulated Panels* (SIPs) are a high-performance building system that uses prefabricated building components for walls, floors, and roofs.

They typically consist of insulating foam sandwiched between Oriented Strand Board (OSB) sheathing—an engineered wood panel similar to plywood. Building envelopes constructed using SIPs are airtight (maintain a continuous air and vapor barrier), provide great insulation, and have high strength and load-bearing capacity.

SIPs are manufactured off-site, allowing panels to be fabricated with pre-cut openings for doors, windows, and electrical wiring before delivery to the construction site. While OSB is the most typical sheathing material, alternatives include sheet metal, plywood, and fiber-cement siding. SIPs are used in small to medium-sized residential construction, whereas larger/taller structures require secondary framing made of wood or steel.[10] In recent years, SIP panels have become a popular choice among architects and builders to help achieve high-performance building certifications and meet energy efficiency metrics.

Benefits and Potentials for Cost Savings[11]

- Combine multiple building envelope layers (waterproofing, insulation, thermal barrier) into a single off-site-fabricated panel.
- Streamlined manufacturing process and more efficient on-site assembly as compared to traditional stick-built framing.
- Less carpentry labor is required.
- Less waste is generated during manufacturing and installation.
- Efficiency and precision of a controlled factory environment during production.
- Long-term energy savings due to higher insulation R-values and a more airtight building envelope.

Existing Constraints

- More time is required upfront for the architect, builder, and SIPs manufacturer to coordinate the design, fabrication, and installation of the panels.
- More SIP-specific expertise is required to plan and design.
- Building contractors must be knowledgeable about the SIP installation process.
- Most SIP fabrication relies on rigid insulation materials made of Expanded Polystyrene (EPS) or Polystyrene (PU), derived from petrochemicals, which have relatively high embodied energy.

Policy Areas to Grow

- Provide rebates and incentives for increasing the use of SIPs.
- Support training programs to increase the building industry's expertise in both SIP design and construction methods.
- Support research into more sustainable, non-fossil-based insulation materials.

Regional Context

According to the Structural Insulated Panel Association (SIPA) member directory, there are six SIPs manufacturers/builders and designers based in Rhode Island, with 29 across New England.[12] Currently, the initial estimated cost of construction with SIPs is slightly higher than that of stick-built construction.[13] However, over the building's lifespan, when energy savings are considered, SIPs construction can become a more affordable alternative.[14]

METHODS

1 ***3D-printed houses*** **utilize full-scale on-site 3D printing technology as the primary method of construction. To date, most projects employ a cement-based mix, although there is increasing experimentation with other materials, such as bio-resins, mycelium, and plastics, among other composite and earthen-based materials.** Industrial-sized 3D printers extrude one layer at a time from the ground up in a process called additive manufacturing. After the ribbed bearing walls are completed, the windows, doors, and roofs are installed.

At present, this technology is primarily used for single family homes, but it has the potential to be scaled up for multi-story buildings in the future.[15] While this construction methodology is still in its early stages and remains on the fringes of the building industry, it has been the subject of academic research for some time. Fully reliant on on-site automation, this method introduces a novel approach to construction, offering distinct advantages. These include significantly shorter construction times, reduced labor, minimized material waste, and more consistent execution.

However, the current reliance on cement-based mixes makes it a carbon-intensive construction method. Furthermore, cement rigidity and limited adaptability can restrict design flexibility and future modifications. Ongoing research and development aimed at addressing these issues may enable 3D printing to evolve into a transformative force in construction.

Benefits and Potentials for Cost Savings

- Automated fabrication enables faster construction times and reduces on-site labor needs.
- As an additive technique, it applies material only where needed, reducing offcuts and excess waste compared to traditional building methods.

Existing Constraints

- The technology remains in development, posing challenges for widespread adoption and scalability.
- The technology and its applications are uncommon, leaving most tradespeople without the necessary skills or resources.
- Since the technology remains in development, costs are unpredictable.

- Traditional construction labor is still needed to install roofs, windows, doors, insulation, and finishes.
- Cement and concrete, the primary substrates for 3D printing, have significant carbon footprints, raising life-cycle sustainability issues.

Policy Areas to Grow

- Provide support and incentives for ongoing research and development of 3D printing technologies in the state/region.
- Provide support and incentivize collaboration with regional institutions already pursuing 3D printing technologies.
- Revise the building code to allow 3D printing based on performance standards.
- Support training programs to increase the building industry's expertise in 3D printing design and construction methodologies.

Regional Context

There are currently no 3D-printed houses in Rhode Island, and the only one in New England is located at the University of Maine, with another planned in Manchester, NH.[16] While a handful of startups and more established companies in the United States sell 3D printers for home construction applications, there are currently no builders that utilize this technology locally.

2

***Panelized building systems* employ a factory-built construction method where the building is designed as a series of prefabricated panels that include all the structural components of the home, often with windows already installed, and are delivered to the construction site ready for assembly.** The panels can be stick-built or made of SIPs. Unlike modular construction, panelized components remain as flat panels that can be stacked during transportation and only form three-dimensional structures once assembled at the building site by workers, who may use a crane. While the panels are fabricated off-site in a factory setting, panelized houses must comply with state and federal building code requirements and undergo local inspections.

Benefits and Potentials for Cost Savings

- Efficiency and precision of a controlled factory environment.
- Panels can be placed on smaller flatbed trucks, reducing transportation costs.
- Faster installation that requires less skilled carpentry and on-site labor.
- Produces less construction waste.
- Requires less on-site space for material storage and construction activities, making it ideal for infill developments with limited space.
- Allows for a high degree of customization.
- Lends well to standardization.

Existing Constraints

- More time is needed initially for the architect, builder, and panel manufacturer to coordinate the design, fabrication, and installation of the panels.
- More specific expertise is required to plan and design a panelized project.
- Building contractors and installers must be knowledgeable about proper panel installation.

Policy Areas to Grow

- Provide rebates and incentives for increasing the use of panelized construction methods.
- Support training programs to increase the building industry's expertise in panelized design and construction methods.

Regional Context

Builders FirstSource Truss & Components division in New Bedford, MA, specializes in designing and producing engineered wood products, including roof trusses, wall panels, and custom prefabricated components, all manufactured at its factory. This facility demonstrates the region's existing capacity to support panelized and prefabricated construction, serving as a potential resource for expanding innovative building methods in Rhode Island.

Lookout on Main | HUS Companies | Warren, RI | 2025 | Panelized | Mixed-Income Condominiums

3 ***Modular construction*** **involves one or more prefabricated volumetric "modules" that, when assembled, create the building. They are manufactured almost entirely in a factory before being transported to the construction site for assembly.** Homes built in this manner can vary greatly in design and materials. They may employ more traditional methods like stick-built construction, or alternative approaches like repurposed shipping containers.[17] A modular approach differs from panelized construction in that it fabricates complete three-dimensional portions of a building off-site, which are then transported to the construction site for assembly. These portions may include exterior and interior walls, exterior windows and doors, as well as interior elements such as cabinetry, doors, and finishes. Modular homes differ from manufactured homes in that they are typically fabricated in smaller segments, must comply with state and federal building codes, and undergo local inspections. Once assembled, modular homes appear no different from site-built homes and can be designed to meet any aesthetic or building form. The efficiency of this method is best realized when modular components are produced in large quantities, increasing the benefits of standardization, efficient labor practices, and reduced material waste.[18] There are exciting possibilities for modular construction in a wide range of housing applications. Currently, modular building represents a small but fast-growing segment of the overall industry.[19]

Bowdoin Street Rowhouse | One Neighborhood Builders | Providence, RI | 2022 | Modular Construction | Affordable Multifamily [20]

Benefits and Potentials for Cost Savings

- Modules are mostly prefabricated off-site, which significantly reduces production time as compared to on-site stick-built construction.
- The amount of on-site skilled labor required is less than that of traditional stick-built construction.
- Efficiency and precision of a controlled factory environment.
- Using a standardized module design can boost manufacturing efficiency and reduce production time.

Existing Constraints

- The manufacturing of modules requires high initial investment costs to set up a facility.
- The larger size and shape of modules lead to higher shipping and equipment costs, because trucks and cranes are required, thereby limiting the economically feasible serviceable area around a factory.

Policy Areas to Grow

- Provide rebates and incentives for increasing the use of modular construction methods.
- Support training programs to increase the building industry's expertise in modular design and construction methods.

Regional Context

According to the member directory of the Modular Home Builders Association, there are seven modular construction companies in CT, MA, and RI—and an even greater number in the broader New England area.[21] Modular home builders in the region mainly use stick-built construction methods with a wide range of housing types and floor plans available.

4 ***Manufactured housing*, formerly known as mobile homes, is both a construction method and a specific residential typology employed for a variety of residential arrangements, from single family homes on private lots to neighborhood communities on rented pads.**[22] As a method of construction, it entails a completely off-site process that results in the fabrication of complete housing units (either in one or several parts, depending on the final configuration - single wide, double wide, etc.). Once produced, these units are delivered to the site, where they are assembled and connected to basic building services using minimal labor.

Using a complete factory-built production process allows for the standardization of both building elements and the sequencing of their assembly. This results in a more efficient, streamlined process that shortens the construction timeline and creates substantial cost savings compared with site-built homes.[23] This process also requires less labor and results in less material waste than traditional on-site stick-built construction. While current manufactured housing fabrication processes rely on traditional building materials and heating sources, recent initiatives—such as the ENERGY STAR Certified Manufactured Homes program—aim to improve energy performance and reduce costs for both manufacturers and homeowners.

Beyond the savings that result from the construction method, manufactured homes benefit from a single federal building code—the "Manufactured Home Construction and Safety Standards," commonly referred to as the HUD Code. It came into effect in 1976 and regulates the design and construction of all manufactured units nationwide. The jurisdiction of the HUD Code provides a single set of standards that all manufacturers, regardless of the unit's destination, must meet. While local building codes do not apply to the manufactured units themselves, they do apply to additional elements incorporated after the unit has been installed on-site, such as stairways, ramps, or carports. Some states also have additional regulations regarding the unit's required installation on its foundation. The adoption of a single set of federal regulations allows for a more streamlined and predictable process of design, production, and installation that is easily scalable. Although all the construction methods mentioned offer cost savings, only a manufactured home arrives as a self-contained unit. Once in place, many homes are customized with porches and other amenities that make them nearly indiscernible from a conventional site-built home, especially those that are "double-wide."

The single-section manufactured home, as the smallest HUD Code home, is easy to transport and install on-site. They can range from 14-18 feet in width and 50-80 feet in length.

Benefits and Potentials for Cost Savings

- Completely factory-built, resulting in less on-site construction time and labor.
- Using the HUD Code for manufactured housing allows for a more streamlined and predictable fabrication process—local building regulations still apply to all site constructions, like stairs or ramps.
- Standardization in construction reduces costs.
- Efficient and compact plan design.

Existing Constraints

- Due to the size and complete off-site fabrication of units, there are higher initial investment costs required for the setup of manufacturing facilities.
- Restricted to a limited shipping distance from the manufacturing facility location making it difficult and/or excessively costly to ship longer distances.
- Dimensional limits imposed by conveying units to the site result in reduced design flexibility.
- Local zoning often limits where new manufactured housing can be located.
- Stigmatization of manufactured housing communities remains an obstacle.

Policy Areas to Grow

- Incentivize the manufactured home industry to invest in new production facilities within the region.
- Eliminate exclusionary zoning that restricts where manufactured housing can be located.
- Improve access to traditional mortgage financing for potential manufactured homebuyers.
- Increase eligibility for first-time manufactured homebuyers comparable to programs in place for site-built homes.
- Provide support to manufactured housing communities to address long-standing infrastructure and resiliency planning.

Regional Context

As of 2023, there are no production facilities for manufactured homes in New England.[24] As a result, the primary relevance to the region is as a housing typology rather than a regional industry. Nationally, manufactured housing is the largest segment of housing that is affordable without the use of a subsidy.[25]

Approximately half of manufactured homeowners site their homes on land they've purchased separately from the housing unit. The other half locate their homes in privately owned and managed "parks," paying monthly "pad" or "lot" rent.[26] Nationwide, the industry estimates 4.3 million homesites across 43,000 communities; in Rhode Island, most manufactured homes are in dedicated park communities, with approximately 3,700 manufactured homes spread across 46 parks.[27]

Such parks provide infrastructure connections to essential services, including sewers or septic systems, water, and electricity. Although Rhode Island is one of several states with laws protecting manufactured home residents, it continues to classify these homes as "personal" rather than "real" property. This classification makes it more difficult for potential buyers to obtain traditional financing, such as a 30-year mortgage.[28]

Chapter 3: COLLECTIVE FORMS OF OWNERSHIP

While implementing more efficient design practices and advanced construction techniques can lead to significant project savings during development, there is no guarantee those savings will extend beyond the initial residents. Furthermore, in the traditional market, even affordable homebuyers expect their home's value to appreciate over time, building equity that can be accessed when they decide to sell.

Alternative models of land tenure based on collective ownership help ensure that the benefits created by implementing more efficient design practices and advanced construction techniques are preserved long-term. These models support sustained affordability through mechanisms such as resale formulas for income-eligible households, alternative financing options, and community governance.

The two most common models are based on establishing a membership organization that residents purchase into as shareholders or on separating the ownership of the residential structure from that of the land (land trust). In some cases, such alternative arrangements also offer secondary social and community benefits, such as mutual labor networks, greater social connectivity, shared social programming, and more.

1 Cooperative Ownership

A ***Resident Owned Community*** (ROC), pronounced "rock," is a collective form of land tenure developed to address the longstanding precarity experienced by residents of "mobile home parks," stemming from not owning the land beneath their homes. The ROC model separates the ownership of manufactured homes from the ownership of the land by establishing a cooperative nonprofit organization. This co-op is managed by a board of elected ROC residents and retains ownership of the land and all site infrastructure, including sanitation/septic systems, water distribution systems, electrical hookups, stormwater management, roads, and common areas. Homeowners retain ownership of their units and are responsible for maintaining their lots, as required by the community bylaws/rules.[29] In some cases, the co-op will hold the right of first refusal when a unit is sold and may specify a resale formula to help keep the community affordable over the long-term.[30] Many ROC communities are also age-restricted and serve as affordable, stable, and social housing options for older adults looking to downsize. Often, ROCs offer additional community benefits like social programs (activities, dinners, events, classes, etc.), recreational spaces, community gardens, volunteer labor networks, and green spaces. In Rhode Island, there are two active age-restricted ROCs—Sherwood Valley Housing and Lincoln Mobile Estates—that have received support from ROC USA, a national nonprofit organization that provides guidance, financing, and technical assistance to manufactured housing communities interested in purchasing their land.

Sherwood Valley Housing Coop | Providence, RI | est. 2022 | Resident Owned Community | Manufactured Housing

As a model, **Limited Equity Housing Cooperatives (LEHCs)** are typically used in multi-unit buildings and may include more than one structure. In a LEHC, a co-op corporation is established to manage, govern, and own both (i.e., the development's real estate).[31] The co-op is governed by voting members, all of whom are tenants holding proprietary leases for their respective apartments. They do not own their individual units, but are shareholders in the co-op corporation that owns them. In this model, residents are simultaneously tenants, shareholders, and members of the co-op corporation.[32]

2 Community Land Trusts (CLTs)

As a model for land and housing tenure, community land trusts have evolved since their earliest conception in 1970 in southwest Georgia to grow into a movement of over 300 CLTs stewarding more than 40,000 housing units nationwide.[33] Many CLTs also include elements beyond housing, like urban agricultural projects, commercial spaces serving local communities, social programs, shared labor networks, and land conservation efforts.[34] Like ROCs, CLTs separate the ownership of the individual home from that of the land, which is owned by a private, nonprofit organization. As practiced today, the CLT model of land tenure combines three principal features: (1) collective ownership of the land through a single nonprofit organization that grants a long-term ground lease to individuals who have purchased a house on the land,[35] (2) management of the nonprofit corporation is conducted through a governing board composed of equal parts CLT members (leaseholders), residents of the local municipality, and public stakeholders,[36] (3) a focus on serving those most in need by ensuring permanent housing affordability through a preset resale formula and granting the nonprofit corporation the right of first refusal when a homeowner wants to sell.[37] Today, there are nearly 300 Rhode Island homes held in land trust across 26 municipalities with the bulk overseen by Church Community Housing Corporation, Community Housing Land Trust of Rhode Island, NeighborWorks Blackstone River Valley, and South County Habitat for Humanity.[38]

Conclusion

The building materials and methods—mass timber, SIPs, panelized, modular, and manufactured—outlined in this publication are not new innovations, but they remain underused and have the potential to reduce the costs of residential construction. Even 3D printing, which is still emerging, might help in this effort. The current supply chain delays and labor shortages present difficult but solvable challenges and provide an opportunity for Rhode Island to rethink and reimagine its approach to residential construction. *Housing 2030* envisions both improvements to housing production and a renewed focus on workforce and skills development alongside these innovations.

When materials, labor, and energy are abundant, there is little incentive to innovate. It is during times like these—when facing cost constraints—that we are compelled to reevaluate our practices and develop more efficient, sustainable, and forward-thinking solutions. However, innovation in construction alone is just one tool. Collective forms of land tenure that operate outside the for-profit real estate market help ensure that the cost savings from construction innovation are preserved over time. Such models help stabilize communities by preventing displacement caused by market speculation, empower residents to make decisions that support the community's long-term well-being, and strengthen social bonds. All these factors contribute to creating more resilient and sustainable communities now and in the future.

The implementation of these methods can extend beyond simply providing shelter to also create opportunities that strengthen the local economy through workforce development and the growth of local industries. These innovations could also enhance skills and lead to better-paying jobs. By combining housing solutions with economic development, Rhode Island can position itself as a leader not only in addressing the housing crisis but also in building a more resilient and livable future for its communities.

Policy Recommendations

1. **Modernize building codes to accommodate innovation.** Update codes for alternative materials and methods. Introduce performance-based standards to promote flexibility in materials and design while maintaining safety and compliance.

2. **Encourage innovation in housing construction.** Establish pilot programs and grants to support innovative housing construction methods, demonstrating cost-effectiveness and scalability.

3. **Support cooperative models of land tenure.** Establish funding to support the ongoing operation and establishment of CLTs, ROCs, and LEHCs.

4. **Support workforce development and local industry.** Partner with local organizations to provide Rhode Island workers with specialized training in emerging construction technologies. Create pathways for apprenticeships and upskilling programs to ensure a strong local labor force. Invest in local manufacturing facilities for prefabricated components to strengthen supply chains.

Endnotes

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18 A recent Terner Center study found that modular building cuts project timelines between 10 and 30 percent. This time savings, for an industry that hasn't seen productivity gains for the past 75 years, could be a game changer for housing, especially once the total volume of modular residential projects achieves economies of scale, including more efficient factories, reduced material costs, and more developed and expedited supply chains. See Pullen, Tyler. "Off-Site Construction in Los Angeles County: Unlocking the Benefits of Innovative Approaches to Housing Production," UC Berkeley Terner Center for Housing Innovation (March 2021). Accessible at: https://ternercenter.berkeley.edu/wp-content/uploads/2021/07/Los-Angeles-County-Off-Site-2021.pdf.

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22 The switch in nomenclature largely follows the passage of federal guidelines by the Department of Housing and Urban Development (HUD), "Manufactured Home Construction and Safety Standards" that took effect on June 15th, 1976. These guidelines, commonly referred to as the HUD Code, set federal standards for the construction and safety of such dwellings and adopted the term "manufactured housing" for such dwelling units. For more details, visit: https://www.hud.gov/hud-partners/manufactured-home.

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26 Of this 50% half will own their unit outright and the other half are renters. Herbert, Chris. "The Potential and Challenges of Using Manufactured Housing to Expand Homeownership Opportunities," [Webinar] Joint Center for Housing Studies of Harvard University (February 16, 2024). Accessible at: https://www.jchs.harvard.edu/calendar/potential-and-challenges-using-manufactured-housing-expand-homeownership-opportunities.

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29 ROC USA is the largest national nonprofit organization providing support, resources, and financing to manufactured housing communities interested in becoming resident owned. See ROC USA. "Why Resident Ownership" webpage. Accessible at: https://rocusa.org/why-resident-ownership/.

30 This is not inherent to the ROC model, however, because of the initial savings incurred from the production of the manufactured unit as discussed in this paper, even when resale formulas are not implemented units typically remain a more affordable option than a comparable site built home in the area. Additionally, manufactured units historically will depreciate in value overtime, like a car, because they most often are legally regarded as private property and not real property. However, units that are located within a resident-owned community typically do appreciate in value over time due to the more stable model of land tenure provided by such ownership. See Herbert, Reed, and Shen, *op.cit*.

31 Davis, John Emmeus (ed.). *The Affordable City: Toward a Third Sector Housing Policy* (Philadelphia, PA: Temple University Press, 1994), p. 84.

32 *Ibid*.

33 In an effort to ease the economic difficulties and residential instability of rural African Americans living in the Deep South through a land reform program, the community land trust model of tenure was first established by New Communities, Inc., in southwest Georgia in 1970. The development was structured as a "cooperatively managed farm and planned residential community to be located on land that was leased from a community-controlled non-profit." See John Emmeus Davis, "Origins and Evolution of the Community Land Trust in the United States," in *The Community Land Trust Reader*, ed. John Emmeus Davis (Cambridge, MA: Lincoln Institute of Land Policy, 2010), pp.15-17.

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35 Davis 2010, *op. cit.*, 4.

36 Davis 2010, *op. cit.*, 9-10.

37 Davis 2010, *op. cit.*, 23.

38 For more information, contact The Community Housing Land Trust of Rhode Island at https://housingnetworkri.org/our-work-programs/community-housing-land-trust-of-rhode-island/.