PIECE IT TOGETHER

Rebuildable Homes for Post-Disaster Resilience

by
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AUTHOR DECLARATION

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

ABSTRACT

In an era marked by intensifying natural disasters, no one is immune to the risks of displacement and loss. Climate change is exacerbating extreme weather events, leading to more frequent and intense disasters that affect millions globally, with an average of 25.3 million displacements per year from sudden-onset disasters alone. While government-led disaster recovery efforts aim to restore stability, they often rely on short-term shelter solutions that leave individuals with little control over their futures. These shelters, intended as temporary, frequently become long-term residences, as seen in Haiti and Florida, where FEMA housing remained in use for over a decade. As the climate crisis increases the frequency of such events, the question is no longer if but when, and what happens next.

This thesis addresses the critical challenge of how to transition from shelter to home. It responds to two core problems: the disposability of temporary housing and the disempowerment of those who live in them. The research proposes self-build, incrementally adaptable housing systems that give displaced individuals agency over their environments. These structures can be assembled in emergency conditions and later deconstructed to support the rebuilding of permanent homes - turning what was once a temporary fix into a meaningful foundation for recovery.

By leveraging Design for Disassembly (DfD) principles and flat-pack strategies, the project offers a system that is not only responsive to immediate needs but also materially and socially regenerative. Unlike standard modular pods, which are costly to store or reuse, these homes are designed as kits of parts that evolve with their users. CNC digital fabrication is used not to mass-produce standardized units, but to enable localized, rapidly deployable systems that support self-building and reduce dependency on centralized supply chains.

The thesis employs iterative prototyping, drawing on literature review as a theoretical foundation, to develop a timber-based modular housing system suited to North American climates.Applying the design in post disaster scenario of Jasper Wild Fire and Florida Hurrican to evaluate how the prototypes perform under these recovery conditions - assessing adaptability, reusability, and user empowerment across both interim and long-term use phases.

This research reclaims post-disaster housing as a space of autonomy, love, and growth - one where people rebuild not just structures, but lives. In doing so, it legitimizes the nonlinear, personal, and often prolonged process of healing after disaster, proposing a housing framework that is adaptable, enduring, and deeply human.

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To my parents, thank you for shaping me into the person I am today. Your love, sacrifices, and the values you instilled in me have been my greatest inheritance. Every step of this journey has been guided by the strength, perseverance, and compassion I learned from you. You taught me to work hard, to stay grounded, and to never lose faith, no matter how difficult the path. This achievement is a reflection of your unwavering dedication and the foundation of love and integrity you built for me.

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DEDICATION

To my Bhaiyuu,
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LIST OF ABBREVIATIONS

ABC – American Broadcasting Company

AEMA – Alberta Emergency Management Agency

BBM – BBM Architects

CBS – Columbia Broadcasting System

CNC – Computer Numerical Control

CORE – Central Operations for Rapid Expansion (or define in context –

here it's the RAPIDO core unit)

DFAA – Disaster Financial Assistance Arrangements

DFD - Design for Dissasembly

DFMA - Design for Manufactured Assembly

ELEMENTAL – Chilean architecture firm

EMCR – Ministry of Emergency Management and Climate Readiness

FEMA – Federal Emergency Management Agency

IDMC – Internal Displacement Monitoring Centre

LCA – Life Cycle Assessment

MIT – Massachusetts Institute of Technology

NPR – National Public Radio

POLITICO – U.S. political journalism outlet

RAPIDO – Rapid Disaster Recovery Housing Program (Building

Community Workshop)

RUSS – Rural Urban Synthesis Society

RV – Recreational Vehicle

SAR – Support/Infill Architecture (John Habraken's system)

UN – United Nations

US – United States

WFTS – ABC Action News Tampa Bay

INTRODUCTION

Natural and climate-induced disasters are no longer isolated crises. They have become a recurring condition that displaces and exhausts vast populations, creating precarity for the most vulnerable. In 2024, climate disasters caused $182.7 billion in damage across the U.S.,[5] While Canada recorded its worst year on record, with 25,000 people displaced in Alberta alone.[6] The crisis was not sudden. It was scheduled. Yet we respond as if these are anomalies, not the new normal. Each time, the shelter arrives late. It is pre-scripted, inflexible, and unfit for the complexity of recovery. The temporary housing units deployed in these contexts are in the form of FEMA trailers, mobile pods, and standardised containers. These are designed for rapid deployment but not for life. They are not built to be modified or extended. Their logistical efficiency conceals spatial, material, and political rigidities. Time and again, temporary structures remain in place far longer than intended. Sometimes more than five years, evolving into de facto permanent housing without ever gaining the capacity for permanence. [7] They are unyielding to the everyday rhythms of family, community, or repair. Once the urgency of disaster fades from public view, these architectures remain, suspended in legal and spatial limbo, with users locked into housing that neither supports their autonomy nor allows them to grow.

This condition is not an unfortunate side effect; it is embedded in the logic of how architecture approaches disaster: as a problem to be solved through standardised products, delivered from above and withdrawn once 'normalcy' resumes. But there is no normal to return to. The very premise of return is flawed. This thesis begins with the proposition that displacement cannot be addressed with architectures of containment. It requires spatial systems of transition, adaptability, and care.

This research interrogates the assumptions that govern post-disaster housing systems in North America: fixity, authorship, and temporal closure. In contrast to models that treat housing as a finished object, this project advocates for architectural frameworks that remain open, incomplete, and able to evolve across time, use, and location. Drawing from both historical and contemporary precedents in participatory housing design, the thesis proposes a modular, self-build housing system grounded in design-for-disassembly principles and digitally fabricated construction.

At its core, the system consists of flat-pack, CNC-milled components that can be assembled by residents on site using basic tools and minimal training. CNC (Computer Numerical Control) technology enables precise cutting of standardized panels joints, typically produced in local or neighboring workshops equipped with CNC routers and milling machines. In some cases, these pre-cut components will be delivered directly to the post-disaster site,

5 Smith, "U.S. Billion-Dollar Weather and Climate Disasters, 1980 - Present (NCEI Accession 0209268)."***direct losses ($***

6 "Canadian Insured Losses from 2024 Weather Events Reach Record C$8.5 Billion | Reuters."

7 FEMA, "Disaster Housing Strategy."

depending on the situation and its demands. In other cases, a small on-site assembly shed, with a mobile CNC unit, could support localised production. While the latter requires more technical capacity, it is viable given the scale of post-disaster rebuilding. This approach grounds the housing system in flexible modes of fabrication. It can be either a decentralised workshop supply chain system or a temporary site-based production system.

With the virtue of this digital fabrication and a flexible design logic, the conceived units are not closed forms but adaptable frameworks. They can be extended, subdivided, clustered, or dismantled as needed. They are designed to be erected quickly in temporary housing sites but are not bound to those sites. When leases expire or conditions change, the homes can be taken apart and relocated, returned to original plots, attached to salvaged structures, or even sold to others in need. This mobility is not an afterthought but a primary design logic. By prioritising reversibility in connection details and adaptability in spatial planning, the architecture resists obsolescence. It proposes a circular material logic that keeps housing components in use across changing contexts, rather than discarding them at each threshold.

Just as importantly, it repositions the displaced not as passive recipients of housing aid, but as agents in the building and rebuilding of their own homes and futures. Crucially, when residents build their own homes, by investing time, labor, and care. They gain more than shelter; they gain ownership. Through the sweat equity invested in the assembly process, they forge both a personal and material stake in the outcome. Housing becomes a framework for agency, not a commodity handed down.

Rather than offering a one-size-fits-all solution. The thesis develops a situated design framework tested through two scenarios: wildfire recovery in Jasper and hurricane relief in Port Charlotte, Florida.. These contexts are intentionally distinct in terms of climate, topography, regulation, and social infrastructure, but both share the condition of long-term displacement exacerbated by inadequate temporary housing solutions. The design process considers the operational constraints of each site, from site access and lease duration to service integration and local construction cultures, ensuring the system is both technically feasible and contextually responsive. In Jasper, the modular homes are deployed in clusters on Parks Canada land where residents participate in phased construction, gradually extending the core unit. In Port Charlotte, Florida., the housing units are tested against flood-prone terrain and relocation scenarios, where homes are lifted, disassembled, and re-sited on higher ground or integrated into future rebuilding phases. These scenarios are not speculative exercises, but design tools used to simulate what the system must accommodate: delays, mismatched timelines, uneven policies, and evolving user needs. In both cases, the architecture supports not only habitation but transformation, where dwelling is understood as an ongoing process of making, modifying, and negotiating space.

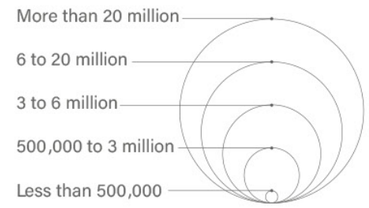


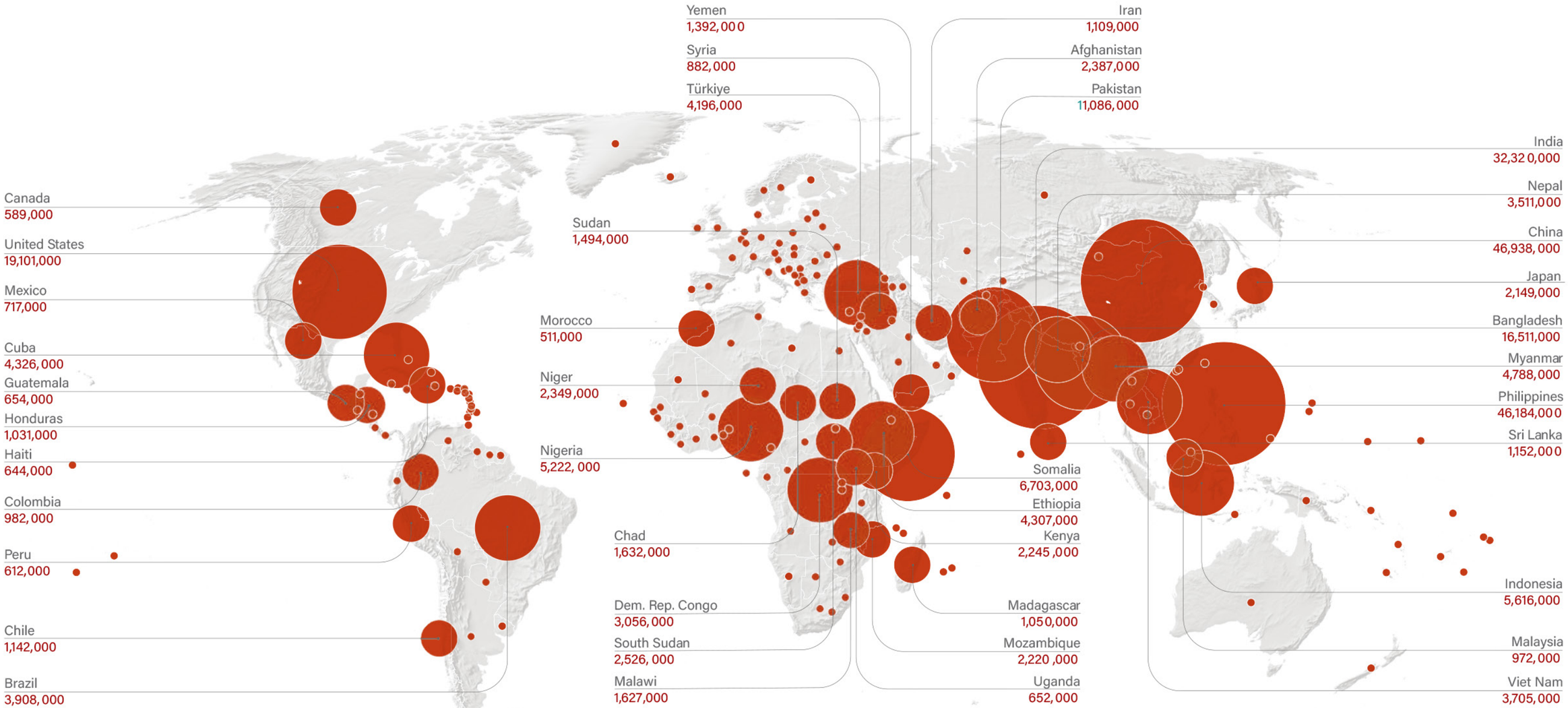
Figure INT.1 A third of Jasper, Alberta lies in ruins after the 2024 wildfires, leaving thousands displaced in Canada's most devastating fire season on record.



Figure INT.2 Hurricane-force winds tear through coastal Florida in 2024, collapsing homes and leaving entire communities in sudden displacement

No country is immune to disaster displacement





This thesis adopts a design-led methodology that combines precedent analysis, material exploration, and contextual scenario testing to develop an architectural response to post-disaster housing. The research is grounded in the belief that architecture should not simply provide shelter, but enable agency, care, and adaptability, particularly in conditions of displacement.

The process begins with a critical review of existing post-disaster housing systems and participatory design frameworks. Case studies such as RAPIDO, Make-It-Rain, and Hsieh Ying-Chun's community-led reconstruction efforts, as well as modular open-source platforms like WikiHouse and U-Build, were analysed to identify strategies for adaptability, ease of assembly, and long-term integration. These precedents were not used as direct templates, but as critical reference points to understand both the potential and limitations of current design approaches. The review is situated within broader theoretical discourses on the design-for-disassembly (DfD), and the politics of relief, allowing the work to address not only technical but also social and spatial dimensions of recovery.

Building on these foundations, the project developed a modular, self-built housing system using CNC-fabricated timber components. Core aspects of the system are investigated through digital modelling and mock-ups to explore structural logic, joinery, and modular coordination. The aim is not to finalise a singular design but to develop a flexible system. One that can be assembled with basic tools, adapted incrementally, and dismantled without significant material loss. Attention is given to reversible connections and repeatable parts, enabling reconfiguration over time and across sites.

To evaluate the system's adaptability, two distinct contextual scenarios are developed: wildfire recovery in Jasper, Alberta, and hurricane displacement in Port Charlotte, Florida.. These sites were chosen for their contrasting climatic and regulatory environments, yet both represent conditions where temporary housing often lingers and recovery remains stalled. The scenarios were used as speculative but grounded tools to simulate how the housing system would respond to real-world challenges, including lease constraints, service integration, and diverse user needs. Rather than designing toward an ideal outcome, the scenarios allowed the framework to be tested against complexity, delay, and change.

By framing design as a relational and temporal practice, this thesis proposes an architectural methodology that resists permanence in favour of flexibility, and shifts the focus from product to process. It contributes to a growing body of work advocating for socially embedded, materially regenerative, and user-driven approaches to rebuilding in the face of the climate crisis.



Figure INT.3 FEMA trailer in use years after deployment , Hurricane Katrina

This thesis unfolds in six chapters. Each chapter traces a different facet of the post-disaster housing problem and the spatial strategies necessary for its transformation. The structure moves from critique to proposition. Diagnosing systemic failures, extracting principles from precedents, and proposing a new architectural framework capable of adapting across time, use, and location.

Chapter 1: From Disaster to Dispossession introduces the thesis by establishing the central paradox of post-disaster architecture: while intended to provide safety and care, emergency housing systems often initiate new cycles of displacement. The chapter situates climate-induced disasters as recurring structural events which are not isolated shocks but predictable outcomes within uneven geographies of risk. By investigating the new normal and the distinction between mitigation and relief, it critiques how existing systems prioritise short-term fixes over long-term spatial justice. The chapter tracks how deployment logics, centralized, wasteful, and deterministic. This reinforces a technocratic mode of recovery, displacing communities under the guise of aid. It concludes by examining the architecture of disaster relief as a spatial apparatus of containment and deferral.

Chapter 2: Condition of Post-Disaster Housing maps the timeline, typologies, and conditions of post-disaster housing systems in North America. It analyses the physical forms and institutional processes through which "emergency shelter" transitions, often unintentionally, into permanent infrastructure. Drawing from cases of FEMA housing in the US and Housing provided by the Alberta Emergency Management Agency (AEMA) in Canada. The chapter shows how post-occupancy conditions of disaster homes are shaped not just by material degradation but by regulatory neglect and political stasis. It foregrounds how shelter, in practice, rarely performs as a temporal placeholder. Instead, it solidifies into permanence, unable to be improved, dismantled, or moved. This chapter provides the comparative groundwork for challenging normative recovery models.

Chapter 3: Way Out – Other Approaches to Post-Disaster Housing turns toward alternative housing systems proposed by architects, collectives, and NGOs that resist the default logics of standardization. It critically examines nine post-disaster housing case studies that offer materially, socially, or spatially distinct approaches to recovery. These are not presented as ready-made solutions, but as experimental gestures that challenge the conventions of top-down aid. The chapter then transitions into an investigation of self-built systems. With the help of eight projects that redistribute authorship and labour across the displaced communities. These cases lay the foundation for shifting the architectural question from "What should we build for others?" to "How can we build together?"

Chapter 4: Democratizing Disaster Relief reframes the design problem by questioning architecture's habitual response to crisis. It proposes that participatory and modular housing systems offer a more just and durable alternative to the prescription-based models currently in use. The chapter traces the development of a design methodology that centers autonomy, not prescription. Based on an approach informed by precedents in participatory practice, including La Mémé, and Segal's Method experiments. From these, it distils a conceptual framework for democratic architecture rooted in open systems, material simplicity, and procedural adaptability. This chapter outlines the ethical and spatial implications of designing not finished products, but shared processes.

Chapter 5: Design Synthesis details the architectural system developed through this thesis in the form of a flat-pack housing kit fabricated using CNC milling and assembled with minimal labor or expertise. It begins by identifying core design objectives: reframing rebuilding as an iterative, user-driven process rather than a turnkey solution. The chapter breaks down the system into its kit-of-parts logic, material strategies, and programmatic elements, including how space is allocated and can expand. It demonstrates typological flexibility across different household sizes and sites, and addresses governance mechanisms for ownership and relocation. This chapter positions the framework not just as a housing solution, but as an infrastructural response to systemic gaps in state-led recovery.

Chapter 6: Beyond the Emergency explores the long-term trajectory of the housing system once its initial role as emergency shelter concludes. It follows the life of the structure beyond the expiration of temporary land leases, examining how the home can be dismantled, transported, and reassembled as an accessory dwelling unit, a permanent structure, or modular inventory for future recovery. This chapter challenges the linear thinking of deployment and disposal, proposing instead a circular architectural logic of reuse and redistribution. It reframes endings as spatial beginnings. With possibilities for continued adaptation, transfer, or ownership by offering an alternative to the cycle of abandonment that defines most post-disaster housing today.

01 : FROM DISASTER TO DISPOSSESSION

Disaster reveals what the city normally hides: inequality, neglect, the failure of the state. The architect's role is not simply to rebuild what was lost but to imagine what could be. In the aftermath of catastrophe, the worst thing we can do is to reproduce the same systems that produced vulnerability in the first place.

– Michal Sorkin

1.1 The New Normal

We are living in the golden age of catastrophe, where disaster is no longer an interruption but the new baseline condition. In 1950, there were fewer than 50 reported disasters. Since then, that number had multiplied eightfold. A neat graph with a sharp incline, a warning long ignored. Today, 394 major disasters in a single decade have displaced over 268 million people[8], which is the equivalent of a city the size of Paris, erased every month, for ten years. Yet, we pretend disaster to be an exception.

This will be more exacerbated by our current predicament. According to UN-Habitat, by 2050 we may see up to 200 million people[9] displaced by climate change. That's not a crisis; it's a civilization in migration. But rather than rethinking housing, territory, or even shelter itself, we continue to ship in shipping containers or distribute plastic tarps, mistaking logistics for care.

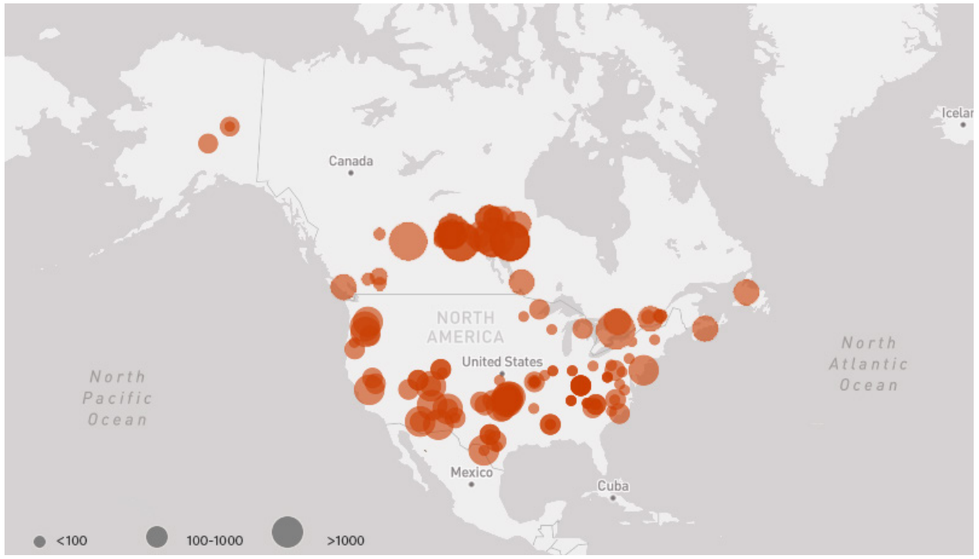
The evidence is no longer distant or abstract. From typhoons in Asia to wildfires in California, floods in Brazil to tornadoes in Saskatchewan, disaster now strikes everywhere, all at once. In the United States, Hurricane Helene (2024) severely impacted Florida, displacing tens of thousands, many were forced to sleep in their cars while waiting for assistance[10], while others couldn't even get through, FEMA failed to answer nearly half of the disaster aid calls it received[11]. The crisis exposed deep, systemic flaws in FEMA's short-term shelter solutions.

In early 2025, wildfires in Southern California alone displaced over 200,000 people, while Canada's 2024 wildfire season was unprecedented, more than 33,000 people were forced to evacuate nationwide as fires raged across provinces[12]. In Jasper, Alberta, over 25,000 residents and park visitors were evacuated due to a rapidly spreading wildfire that destroyed a third of the town's structures[13].

As entire communities are uprooted, architecture continues to trail behind, arriving long after the doctors, the rescue teams, the volunteers, and the first

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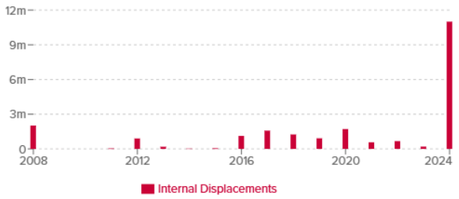
8 Guha-Sapir et al., ***Annual Disaster Statistical Review 2010***.
9 Un-Habitat, ***Cities and Climate Change***, 85.
10 Williams, "Families Left Homeless after Hurricanes Still Waiting for FEMA Assistance."
11 POLITICO, "FEMA Didn't Answer Almost Half the Calls It Received for Disaster Aid."
12 "Canada Wildfires Spread, Forcing More than 33,000 to Evacuate as Smoke Impacts U.S. and Reaches Europe - CBS News."
13 Cecco, "Canada Wildfires."



Displacement in U.S.

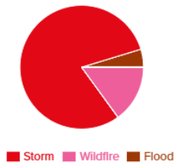
22.3m

Internal Displacements (2008 - 2024)



1,394

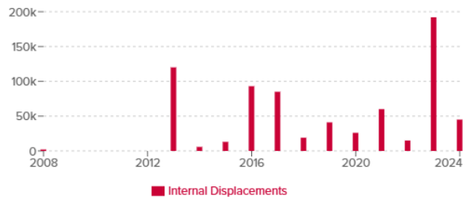
Disaster Events Reported (2008 - 2024)



Displacement in Canada

717,000

Internal Displacements (2008 - 2024)



284

Disaster Events Reported (2008 - 2024)

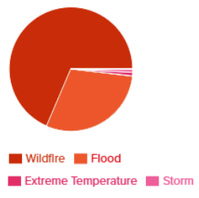


Figure 1.1 Disaster-related displacements in North America, 2008–2024.
Over 22m in the U.S. and 717k in Canada.

responders. Too often, it remains preoccupied with serving the privileged, absent when needed most. But even in disaster, people need dignity. They need more than a roof; they need comfort, privacy, and respect. As Shigeru Ban - who has dedicated much of his career to working in disaster-prone regions, argues, "the responsibility of architecture is not suspended in crisis; it is most urgently needed there."[14]

Homes vanish overnight, cities drown, forests burn and still, our collective responses remain improvised, delayed, and depressingly familiar. We continue to build as if it won't happen again, refusing to accept what is now painfully clear: the future is not post-disaster, it is continuous disaster.

1.2 Mitigation vs. Relief

If we understand that Natural disasters are not isolated incidents, they are part of an increasingly complex, climate-exacerbated systems that affect not just landscapes but the built environment, governance, and social equity. Then we can realise that within this context, the role of the architecture and building industry becomes twofold: first, to support mitigation efforts that reduce future risk, and second, to deliver effective relief when disasters inevitably strike. While mitigation looks ahead to avoid or reduce impact, relief begins in the aftermath, often under conditions of urgency and emotional devastation.

Disaster mitigation refers to all structural and non-structural strategies aimed at minimizing the physical, social, and economic impacts of hazards. This includes changes and constant updating of zoning policies, retrofitting existing structures, using fire- or flood-resistant materials, and planning buffer zones and defensible space. The goal is simple: reduce exposure and save lives, resources, and time. Economically, it's efficient - every $1 spent on mitigation saves an estimated $6 in recovery costs.[15]

However, mitigation is not equally accessible. As seen in the recent 2025 Palisades wildfire in a fire-prone Californian neighborhoods, homes designed to meet or exceed wildfire codes, with sealed envelopes, flame-resistant cladding, and cleared defensible zones may survive while almost all of surrounding houses are lost.[16] These choices, while effective, are expensive and often unaffordable for most families. Retrofitting entire communities is difficult, and political resistance to displacing residents from hazard-prone areas limits proactive action. Even the best mitigation measures cannot fully prevent disaster. Fires spread, floods rise, storms breach levees. That is when relief becomes necessary.

Disaster Relief encompasses the immediate phase which is focused on providing safety, shelter, and survival. Relief housing, including emergency shelters or transitional units, is meant to offer a temporary reprieve, which is

14 Charlesworth, ***Humanitarian Architecture***, 7.
15 National Institute of Building Sciences, U.S., ***Natural Hazard Mitigation Saves 2019 Report***, 40.
16 Los Angeles Times, "California Should Expedite Rules That Could Have Helped Mitigate L.A. Fires, Lawmakers Say."



Figure 1.2 FEMA's trailer auction - Some of about 7,200 mobile homes and travel trailers owned by the Federal Emergency Management Agency sit at the Hope Municipal Airport near Hope, Ark. Twister victims to receive FEMA trailers. (n.d.). Retrieved June 26, 2025, from https://www.nbcnews.com/id/wbna23131072



Figure 1.3 More than 50% of Jasper destroyed after the Wildfires, 358 of the 1,113 structures in town had been destroyed by the fire.

part of post-disaster housing effort.

Post-disaster homes are, in theory, designed to provide safe, temporary shelter while families recover and transition back to permanent housing. In practice, however, these structures often remain in use far beyond their intended lifespan. For example, FEMA trailers deployed after Hurricane Katrina housed survivors for at least 2.5 to 3 years[17] and Hurricane Irma survivors for 5 years[18]. In some cases, such as South Florida following Hurricane Andrew, so-called 'temporary' housing remained in use for over thirteen years.[19] After the Lac-Mégantic rail disaster in Québec (2013), some displaced residents were housed in temporary units for more than two years while funding, planning, and jurisdictional approvals delayed reconstruction. In these cases, housing becomes a form of long-term emergency not because it's adequate, but because it's all that's available. Highlighting the long-term dependency that frequently arises from short-term emergency solutions.

1.3 Slow, Wasteful, Deterministic deployment

Post-disaster housing is meant to arrive swiftly and support recovery. In practice, it is anything but fast. In the U.S., FEMA trailers after Hurricane Katrina took months to reach affected communities, often arriving without adequate infrastructure or oversight. By 2006, over 11,000 units sat unused in a field in Arkansas, deteriorating in storage while housing needs remained urgent elsewhere. [20] Canada has fared no better. Following the 2016 Fort McMurray wildfires which destroyed nearly 2,400 homes many evacuees waited over a year for safe, rebuildable shelter.[21] Modular lodging costs soared, driven by contractor markups and material shortages, while permanent reconstruction remained underfunded and delayed. In both contexts, what is labeled "temporary" too often becomes permanent expensive to deploy, inefficient to manage, and ultimately discarded or sold off. Designed to deliver relief, the system stalls instead, replicating failure with each new disaster.

When temporary housing outstays its intended lifespan, it often deteriorates into neglected, socially fragmented environments. Lacking community planning, green space, or access to essential services, these sites become isolated zones on the margins. Reports following Hurricanes Katrina and Irma documented alarming rises in depression, domestic conflict, and social isolation within trailer settlements.[22] In Fort McMurray, concerns over cultural mismatch and displacement were especially acute among Indigenous evacuees, underscoring how one-size-fits-all solutions often

17 Verderber, "Emergency Housing in the Aftermath of Hurricane Katrina."
18 "5 Years Later."
19 Verderber, "Emergency Housing in the Aftermath of Hurricane Katrina," 379.
20 Allen, "Congress, FEMA Try to Free Up Stockpile of Trailers."
21 "Fort McMurray Wildfire: 1 Year Later, Delayed Rebuild Underway | Globalnews.Ca."
22 International Medical Corps, "Suicide, Violence, and Depression Widespread in FEMA Travel Trailer Parks."

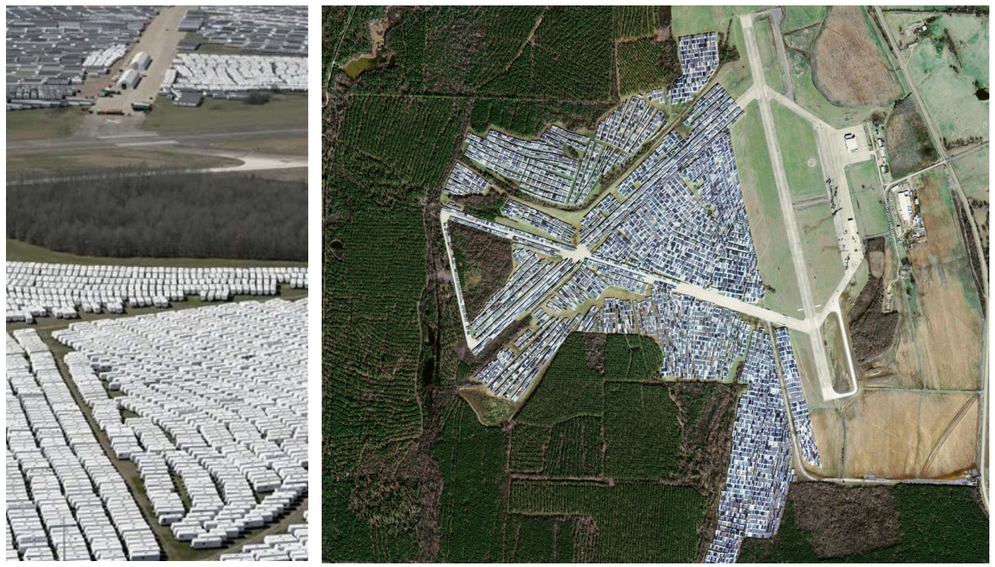


Figure 1.4 This photo shows an aerial view of damaged property after Hurricane Ian in Fort Myers Beach, Fla., Dec. 2, 2022.

deepen existing inequalities.[23]

The deterministic nature of disaster housing, its top-down imposition of order, only compounds these failures. In most scenarios, housing is planned by government agencies, engineered by outside consultants, and delivered en masse with minimal input from the people expected to live in it. After the 2021 floods in British Columbia, evacuees were placed in hotel rooms or RV parks, severed from their communities, schools, and healthcare access. Their futures were shaped by policies drafted far from their communities, often without regard for local circumstances. Even the most well-intentioned interventions became part of a system that prioritized efficiency over empathy, uniformity over adaptability.

1.4 Disaster relief system

Disaster relief functions as a fragmented but systematized response, typically unfolding across three sequential phases: emergency shelter, temporary housing, and permanent reconstruction. This process is managed by a patchwork of actors - government agencies, international NGOs, and volunteer organizations such as the Red Cross, each with overlapping roles and varying capacities.

The Federal Emergency Management Agency (FEMA) is the major agency in the US that handles disaster response and recovery. FEMA helps deliver housing to people directly. This includes temporary trailers, support with rent, and funds to help them rebuild. It takes care of all the logistics for disasters, from emergency shelters to long-term recovery. It has been established to make sure that the federal response is coordinated.

Canada doesn't have a FEMA equivalent. Different layers of government oversee housing following a disaster. **Public Safety Canada** oversees national emergency management at the federal level. It also gives money to provinces through the Disaster Financial Assistance Arrangements (DFAA). Indigenous Services Canada helps First Nations communities directly. But provinces and territories are in charge of distributing housing through local disaster recovery programs. They cooperate with cities and towns to provide shelters, help with evacuations, and help with rebuilding. City governments run evacuation centers and take care of local zoning and permits. The Canadian Red Cross and other non-profit organizations are equally significant. They give people a somewhere to stay for a short time, money, and emotional support. This system makes a response that is broken up yet organized allowing them to provide a more localised response.

Though, in the wake of disaster, displaced populations become subject to biopolitical governance in both cases, a regime in which life is managed, measured, and regulated through institutional provisions. As Michel Foucault described, biopolitics is the power to "make live and let die."[24]

23 Canada, "Rapid Review."
24 Foucault, ***Society Must Be Defended***.

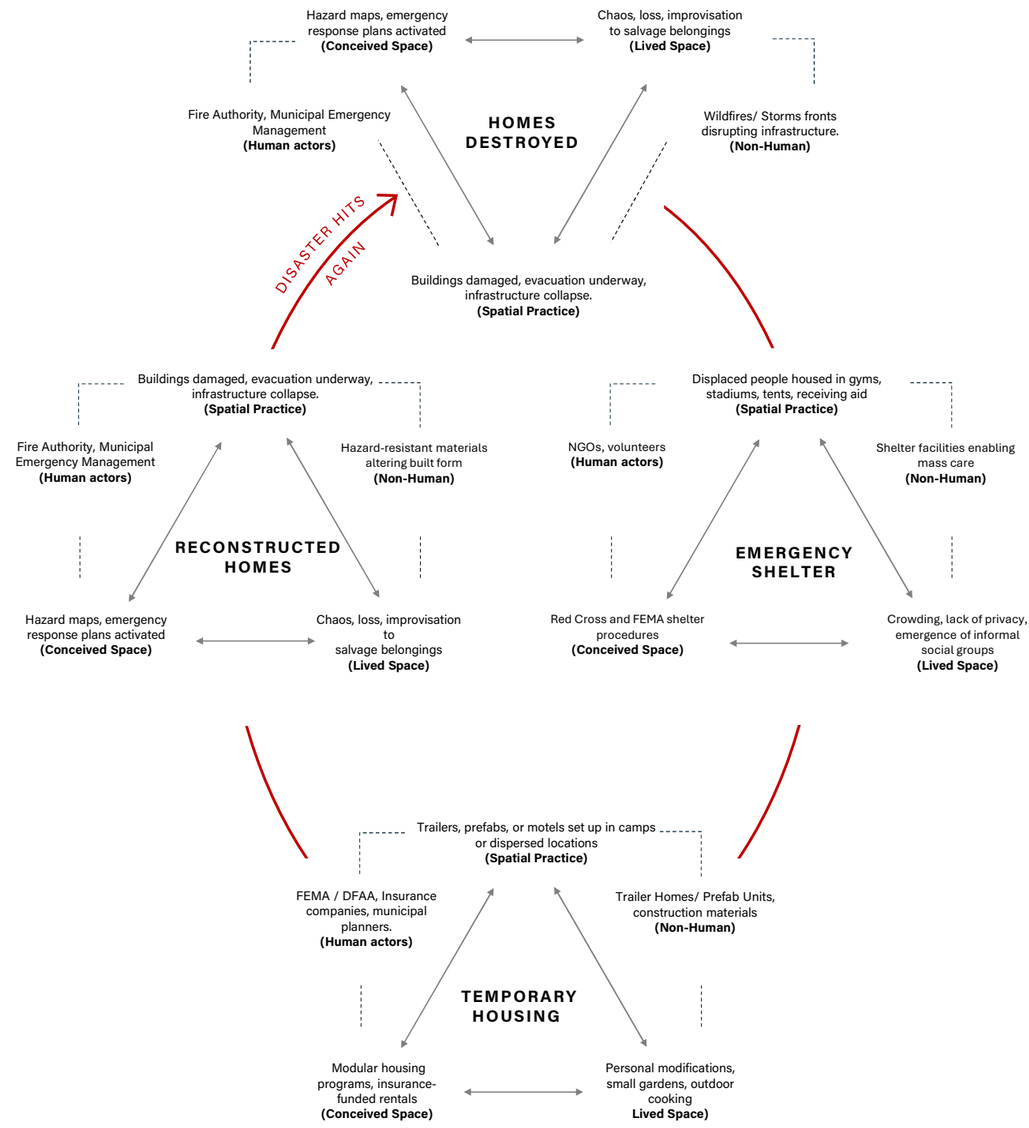


Figure 1.5 Cyclical Production of Post-Disaster Space, integrating Lefebvre's spatial triad with Bruno Latour's Actor–Network Theory to map human and non-human influences across recurring recovery phases

Here, survival is determined not by community voice, but by eligibility criteria, aid distribution algorithms, and the logistical calculus of temporary housing allocation. Risk is quantified, resources are optimized, and needs are flattened into data.

Within this model, residents are disempowered, treated not as participants, but as managed populations. They are handed keys but denied a voice. Decisions about form, layout, materials, and timelines are made for them, not with them. The result is not only physical displacement, but social and political disempowerment. The architecture of disaster relief becomes less a platform for recovery than a mechanism of control, standardized, rigid, and blind to lived experience.

True recovery demands more than shelter. It requires housing systems that are flexible, co-designed, and rooted in long-term planning. Rather than an afterthought, this process must begin long before disaster strikes. This is the through the following:

Principle of Precovery – It is the act of planning as well as taking physical steps for recovery. In the form of a proactive, integrated component towards not just risk reduction but also user participation considerably before the disaster strikes. Precovery anticipates not only the physical needs of rebuilding but the social, cultural, and psychological conditions that support meaningful recovery. If we don't chang our ways, we will keep repeating the same cycle. The wrong thing, too late, for too long and still call it relief.



Figure 1.6 FEMA trailer park beside the University of New Orleans, August 2006 — a standardized landscape of relief where keys were handed over without voice, and 'temporary' shelter became a prolonged state of control.

02 : CONDITION OF POST-DISASTER HOUSING

2.1 Post-Disaster Housing Across the World

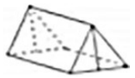
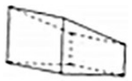
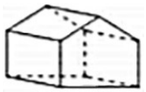
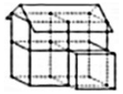
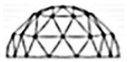
Disaster housing sits at the intersection of urgency, politics, and survival, emerging in moments of rupture when normal timelines, budgets, and design processes collapse under the pressure of immediate need. These systems reveal more than technical fixes. They expose whose lives are prioritised, what counts as 'adequate shelter' and how long aid is given. While governments and support agencies intend shelter to be temporary, history shows they often persist for years or even decades. This transforms these stopgaps into long-term living conditions. Across contexts, similar contradictions reappear prefabricated solutions that resist modification, and standardised units that fail to adapt.

This chapter examines the evolution of post-disaster housing, its forms, failures, and unintended legacies. It traces how tents, prefabricated boxes, and container shelters came to dominate the global imagination of relief, while also exploring their limits as architecture of containment rather than care. These models are situated within a timeline from immediate emergency shelters to long-term housing. This chapter builds a critical understanding of why disaster housing so often fails and what lessons can be drawn for more adaptive approaches.

Historically, post-disaster housing solutions have evolved significantly throughout the 20th and 21st centuries, moving from basic canvas and pole structures to more advanced modular steel and synthetic composite designs. Underlying these typological shifts is a consistent logistical imperative: the efficient deployment and management of resources. Relief efforts often commence with repetitive, standardized structures, such as military-grade tents laid out in urban grids, as seen in the tent cities of 1986 Kalamata, Greece, the scattered barracks after the 1999 Izmit earthquake in Turkey or the roadside camps following the 2008 Wenchuan earthquake in China.

Then came the prefabricated turn: an era of panelized construction. From the FEMA trailers of post-Katrina Louisiana to the plywood boxes of post-Kobe Japan, industrial systems attempted to stabilize disaster. Some, like the Turkish government's 1999 duplexes, were efficient and mass-produced; others, like Mexico's iron-sheeted compounds or Greece's leaking containers, were exercises in failure, misfitted climatically, socially, and spatially. The prefabricated trailer home now an infamous symbol of disaster relief in North America, embodies the contradictions of emergency housing.

There have also been a lot of interest in using shipping containers to make rapidly deployable emergency shelters. With a push by the global design community, there have been several designs. They come with their merits and demerits. One of the most notable example is Future Shack by Australian architect Sean Godsell's, a rapidly deployable shelter that turns

Typology	Scheme	Structure	Materials	Prefabricated	Reusable
Tent		Posts halted by tensioned cables	Posts, textiles, plastic canvas, cables, anchors, bamboo	Yes, it can also be created with site elements	Yes
House with sloping roof		Posts that support the roof, girders, load walls	Galvanized steel, plastic sheets, zinc sheets, wood, concrete, plastic canvas, recycled tires, aluminium foils	Some of its elements can be prefabricated	Recycled materials are used
Gable roof		Posts, load-bearing walls, girders	Wood, galvanized steel, zinc sheets, plastic tarpaulin, metal profiles, polymer panels, paper tubes, plastic bags, beer boxes	Some of its elements can be prefabricated	Yes
Roof with four sloping sides		Posts, concrete foundations	Paper tubes, cardboard panels, textiles, bamboo, wood, concrete, waterproof corrugated cardboard, palm leaf	No	Yes
Compound inclined roofs		Posts, load-bearing walls, foundations, girders	Wood	Some of its elements can be prefabricated	No
Porch		Posts, load-bearing walls, foundations, girders	Wood, galvanized steel, zinc sheet, plastic canvas	Some of its elements can be prefabricated	No
Formal house		Posts, load-bearing walls, foundations, girders	Wood, steel, glass	Some of its elements can be prefabricated	No
Circular plant, geodesic roof		Geodesic	Corrugated polypropylene	Yes	Yes
Half sphere		Steel structure	Concrete and steel	No	No
Circular plant		Cylinder	Corrugated steel, lined with plaster and fiberglass insulation. Bamboo, branches of rice	Yes	Yes
Barrel vault		Steel structure of vault shape	Steel and plastic canvas	Yes, it can also be created with site elements	Yes
Container		Posts, crossbars and side spars	Aluminium, corrugated steel, fiberglass and plastic	Yes	It is its second use
Hexagonal shape		Loading walls	Polypropylene	Yes	Yes
Frames		Steel structure	Steel, plastic canvas	Yes	Yes
Union of triangles		Wood structure with metal joints	Wood, steel, textiles	Yes	Yes

















shipping containers into independent living quarters. It was made to be quickly assembled and deployed remotely claiming to take just 24 hours. It was outfitted with telescoping legs, solar panels, water tanks, and modular ablution facilities. While the parasol roof provides some thermal comfort and a sense of home, the of shipping container typology faced limitations most notably, the finite availability of repurposable containers. The compact interior can strain family use and flexibility, and the steel frame, while robust, it poses significant thermal and condensation challenges, along with practical difficulties in modifying the steel shell to accommodate windows and doors.

2.2 Typologies and Timeline of relief

Post-disaster housing typically follows a multi-staged continuum from immediate emergency shelter to temporary housing, and finally to permanent housing. The nature of this process is significantly shaped by governmental policies, market mechanisms, and the involvement of non-governmental organizations (NGOs), alongside various socio-demographic and socio-economic factor. [25]

Emergency Shelters (0–1 Month): These are initial, rapid solutions, often utilizing large communal buildings like schools or established temporary camps.[26] They are typically intended for very short durations, usually days or weeks. They also come in the form of Mega-shelters, utilizing entire stadiums or convention centers housing thousands. Where evacuees may remain for several months awaiting a more permanent solution. This sometimes might even take up to a whole year to be put in place. The transition out of emergency shelters takes time, as process of establish eligibility, identifying interim housing options, and mobilizing resources is carried out.

Temporary Housing (2-18 Month): Designed to bridge the gap until permanent housing is secured, these units aim to provide victims with a private and secure place to regain some sense of normalcy. While intended for a defined, short period, they frequently become semi-permanent or even de facto permanent residences, sometimes lasting months or even years. For example, FEMA housing Florida has remained in use for over a decade.[27] This extended use can lead to issues such as illegal occupancy and social dysfunction in unplanned settlements[28]

- Prefabricated units: After the 1999 Turkey earthquakes, 40,000 prefabricated temporary housing units, typically 30m² duplexes, were constructed taking a time of 6 months. In Japan after the 1995 Kobe earthquake, prefabricated units measuring 26.4m² were provided with an intended stay length of two years. Similarly, after the 2011 Great East Japan earthquake and tsunami, approximately 53,000 temporary houses were constructed.[29]
- "Mediaguas": These are basic prefabricated timber panel structures, notably used after the 1999 Armenia, Colombia earthquake of 24m² usable area [30], and in Chile and Peru following the 2010 earthquake with 18m² usable area.[31]
- "Katrina Cottages": Introduced after Hurricane Katrina in 2005, these modular houses, initially 27.8m², were designed with the ability for some future extensions.[32]

Permanent housing (2+ years): This is the ultimate aim of post-disaster recovery, but it is rarely swift. FEMA estimates suggest that meeting permanent housing needs can take up to five years, a delay that forces families into prolonged limbo. In the meantime, many are trapped in a cycle of rebuilding in known hazard zones, enabled by a flawed flood insurance system. Repetitive-loss properties with homes that flood again and again, continue receiving payouts, some as many as 40 times. The program's structure, which rewards private insurers for processing claims while passing all risk onto taxpayers, perversely profits from larger disasters. In one case, a single home valued at $56,000 received $430,000 in claims.[33] People living in flood-prone areas like Houston or Florida are often stuck, not because they choose to stay, but because their homes are uninsurable, unsellable, or awaiting a years-long government buyout. Movable housing solutions could provide an alternative: resilient, non-permanent dwellings that allow communities to retreat from repeated risk.



Figure 2.1 The Katrina Cottage, designed by Marianne Cusato as a dignified alternative to FEMA trailers, fell short of the projected 3,500 units. Key obstacles included local resistance, where smaller homes were perceived as reducing property values, stigma around prefabricated homes, and opposition from planning boards and elected officials.

25 "Post-Disaster Sheltering, Temporary Housing and Permanent Housing Recovery."
26 Wagemann, "Need for Adaptation."
27 Verderber, "Emergency Housing in the Aftermath of Hurricane Katrina," 379.
28 Wagemann, "Need for Adaptation."
29 Yang et al., "Developing Energy-Efficient Temporary Houses for Sustainable Urban Regeneration."
30 Johnson et al., "A Systems View of Temporary Housing Projects in Post- disaster Reconstruction."***hurricanes and so forth***
31 Wagemann, "Need for Adaptation."
32 Gunawardena et al., "Time-Efficient Post-Disaster Housing Reconstruction with Prefabricated Modular Structures."
33 Bradley, "John Oliver and a Talking Seagull Explain America's Broken Flood Insurance Program."

2.3 Post-Occupancy conditions of disaster homes

Post-disaster housing is often praised at ribbon-cuttings modular feats, delivered on time, under budget. But the real architecture begins when the cameras leave. FEMA trailers, symbols of “immediate relief,” reveal their defects not in their delivery but in their duration. They are designed for wind speeds lower than the storms that summon them. Meant to last 18 months, they linger for years. Their interiors are unyielding inside the thin metal unibody: no walls can be moved, no space adapted. “Temporary” becomes a euphemism for architectural amnesia. Structures not designed to accommodate change, growth, or even life.

These homes look like vehicles because they are. Trailers with wheels stripped, parked in rows, always suggesting departure, never arrival. Their architecture signals transience, not shelter. Residents, left for years in units designed for months, adapt in visible, improvised ways: broken windows are curtained with sheets, insulation is reinforced with cardboard, and storage spills into the gravel lots outside bicycles, crates, coolers, clotheslines strung between awnings. The threshold between inside and outside blurs, not by design, but by necessity. Without enough room, families cook outside, host visitors under carports, and build makeshift porches out of palettes. Over time, FEMA trailer parks begin to resemble informal settlements, not by choice but by endurance. These are not homes as vessels of care, but containers of containment. A parking lot becomes a neighborhood by force of time, not intention. And in every gesture, tarp over a leaky roof, satellite dish tied to a rusted railing the inadequacy of the unit is made painfully visible.



Figure 2.2 Four years after Katrina, a FEMA trailer still holds a family of nine in Port Sulphur, Louisiana, a space meant for months stretched into years.



Figure 2.3 When FEMA’s trailer eviction deadline loomed in Louisiana, thousands of children face lasting harm from formaldehyde exposure, leaving families sick, uncertain, and on the brink of losing the only shelter they’ve known for years.



Figure 2.4 After Katrina, boarded windows and overgrown lots mark the collapse of Brad Pitt’s ‘Make It Right’ promise, a $26.8M vision for sustainable, affordable housing now reduced to a handful of shodyy homes, and many deemed unsafe.

REAL WORLD DISASTER SCINARIO & POINTS OF BREAKDOWN

STAKEHOLDER & INFRASTRUCTURE

ALTERNATE SYSTEM OF DFD



WHAT MITIGATION MEASURES CAN WE ADOPT?

Early-warning System

Placement of aural alerts enable old town inhabitants, local and visiting, to evacuate the heritage centre prior to inundation.

Pulley System

Mechanical systems allow householders to elevate and secure furniture and belongings to higher levels of house to prevent flood damage to property.

Two-story Construction

Existence of second floor enables inhabitants of old town to dwell on upper floor during floods in order to maintain physical security.

Masonry Construction

Choice of this material over timber mitigates rotting due to flooding and provide a more easily replaced means of construction.

HOUSING SUPPORT POST DISASTER

IMMEDIATE (EMERGENCY RESPONSE) → TEMPORARY HOUSING → INTERIM HOUSING → HOME REPAIR AND RECONSTRUCTION → COMMUNITY DEVELOPMENT

Public Shelter + Basic Services — 1 MONTH

Transitional Sheltering Assistance/AirBnb — 2 - 6 MONTH

Mobile / Modular units — 6 MONTH - 4 YEARS

Financial Aids and Loans — LONG TERM RECOVERY

Affordable Housing Projects — POLICY AND PROJECTS

RESULT - HOME WHEN? WHO?
A MOBILE HOME WITH NO AGENCY





WHERE ARE THEY PLACED?

Muncipal Land / Open Parks
Unused Commercial Lots
Campgrounds and Seasonal Lodges



WHERE DOES NEW MATERIAL COME FROM?

DISASTER TIMELINE 1 : HURRICANE IN FLORIDA

MITIGATION → PREPAREDNESS → DISASTER RESPONSE → IMMEDIATE → LONG TERM

DISASTER IMAPCT

DISASTER TIME LINE 2 FOREST FIRE IN JASPER

MITIGATION → PREPAREDNESS → DISASTER RESPONSE → IMMEDIATE → LONG TERM

WHY DOES IT END UP HERE?

Inefficient resource management leads to waste—despite the fact that nearly 80% of post-disaster materials are potentially reusable



Often, they end up in landfills—wasting valuable resources that could otherwise be reused or repurposed.





WHAT HAPPENS TO EXISTING HOUSING MATERIAL POST DISASTER ?





PEOPLE/ ACTORS INVOLVED LIKE FEMA

Red Cross , FEMA and State Bodies

Lands Leased hence the recovery effort dependant
Alternative - Partnerships for Land Access: Co-ops, land trusts, sweat equity programs

WHO GIVES THE LAND? WHO ELSE CAN GIVE THE LAND?

ALTERNATE PATH

ALTERNATE HOUSING SUPPORT

IMMEDIATE (EMERGENCY RESPONSE) → TEMPORARY HOUSING → INTERIM HOUSING → HOME REPAIR AND RECONSTRUCTION

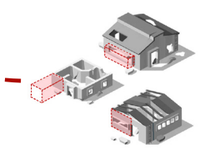
Public Shelter + Basic Services — 1 MONTH

Self-Build Starter Kits (flat-pack units with tools + instructions) — 1 - 4 MONTH

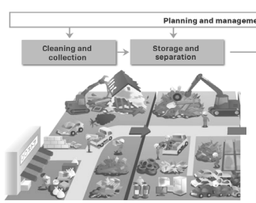
Expandable Units using salvaged or provided materials — 6 MONTH - 4 YEARS

Modules relocated to permanent plots or reconfigured into homes — LONG TERM RECOVERY

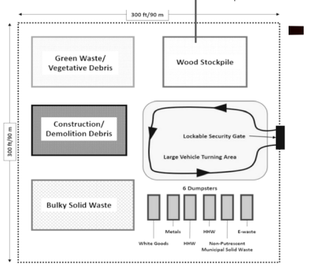
Could something else happen to this material ex. Reuse of ruined materials like creative windows



Rebuilding Homes with the Disaster Pod

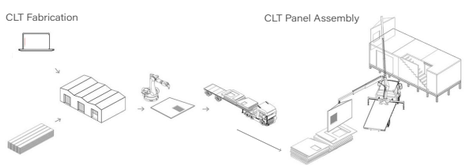


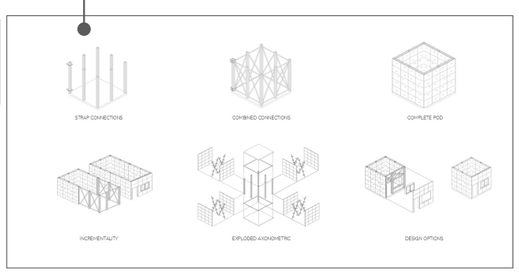
Segregation of materials to retain reusable components for rebuilding homes after disasters - transforming debris into valuable resources and reducing reliance on new material extraction.

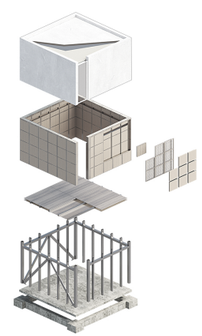


How does the process looks like with modular, adaptive system in place.

WHAT KIND OF PLACES/ INFRASTRUCTURE DO WE REQUIRE FOR IT? CNC FACTORY?







WHAT IS THE ALTERNATE?

Sometimes, problems can persist far beyond their expected life. Deployed en masse after Hurricane Katrina, these mobile units quickly became toxic containers of stagnation. Poor ventilation and the off-gassing of formaldehyde turned them into incubators of illness.[34] With substandard insulation, they were unbearably hot in summer and freezing in winter, amplifying the physical toll on already vulnerable residents. The trailers caused widespread respiratory issues, headaches, and sleep disorders, not by accident, but through a cascade of design neglect and systemic oversight.[35]

Trailer parks are spatialized denial, tucked into the edges of towns, often on the very floodplains where disaster first struck, as seen in British Columbia's 2021 floods in communities like Merritt and Princeton, on brownfields, or in the seams of industrial zones. Chosen less for suitability than for invisibility, they are at once refuge and rejection. Host communities contest their arrival. Zoning fights erupt. Emergency ordinances override local resistance. Their siting reflects political convenience, not human need. Stigma clings to these places. Research after Katrina shows how FEMA parks quickly became racialized and criminalized, spaces of containment rather than care. The "Not In My Backyard" reflex ensured they were placed far from schools, clinics, and the public eye. Out of sight, and therefore out of empathy.[36]

Rarely are they integrated into the city. At Renaissance Village in Baker, Louisiana, row upon row of sterile white units sat in a treeless expanse. No shops, no sidewalks, no thresholds. Only repetition, like a camp without a plan. It was not a neighborhood, but a holding zone which was designed to shelter bodies, not lives through an architecture of abandonment.

In this way, the architecture of relief is rarely about architecture at all. It is a field condition, a system of supply chains, land policies, bureaucratic improvisations, and aesthetic compromises. It is a building without authorship; a spatial outcome negotiated between urgency and regulation. What persists across cases is the same structural paradox: the temporary that becomes permanent, the modular that resists flexibility, the humane that often excludes humanity.

34 E-Flux, "Sick Architecture - Nicholas Shapiro - Manufactured Home Syndrome."
35 Nicholas Shapiro, "Manufacturing Home."
36 Lee et al., "THE FEMA TRAILER PARKS."



Figure 2.5 Along the Gulf Coast, rows of FEMA trailers promised refuge but delivered risk, hot in summer, freezing in winter, and laced with formaldehyde, they became symbols of neglect where shelter blurred into sickness.



Figure 2.6 Seventeen months after Katrina, tornado winds rip through New Orleans, splintering homes, churches, and FEMA trailers in neighborhoods still struggling to rebuild from the last disaster

03 : MODELS OF REBUILDING

3.1 Post-Disaster housing case studies

Across geographies and disaster contexts, a growing body of research work has emerged in response to the inadequacies of conventional shelter systems. These case studies offer not just housing units, but systems of care, speed and regeneration. Ranging from Shigeru Ban's cardboard tube shelters to Yasutaka Yoshimura's ex-container modules. Some are deeply embedded in local material cultures; others test the limits of deployability. Together, they expand the narrow idea of what disaster response can be, proposing architectures that work with uncertainty rather than against it.

Despite their ingenuity, some of these models often reproduce systemic limitations. Many models are overly dependent on materials or technologies that lie far outside the reach of those who lost their homes. Also, failing to offer any pathway for upskilling or self-reliance. Support is delivered either as a final solution or a uniform unit, leaving little room for adaptation to social or cultural contexts. Projects driven by high-tech innovation can appear efficient, yet they remain detached from local capacities and therefore difficult to scale or sustain once external actors withdraw. Even when outcomes are physically robust, they confront the persistent challenge of land availability. Displaced populations are rarely guaranteed access to safe, alternate sites. Models that are fully optimised to a particular location often cannot be shifted elsewhere, while those designed purely for rapid deployment tend to ignore the long-term and spatial realities of resettlement. This tension leaves many projects suspended between site-specificity and portability, without adequately addressing either. Finally, too few models are designed with climate-appropriate materials and assemblies, resulting in shelters that meet immediate needs but fail to respond to long-term environmental realities.

Cardboard Houses - Shigeru Ban

Shigeru Ban's Paper Log houses were developed as a rapid response to global crisis from Rwanda's genocide to earthquakes in Kobe and Haiti. These shelters use simple materials. Like cardboard tubes, tarpaulin, and timber to create a comparatively dignified, low-cost structures. Proposed designs can be built quickly with minimal tools. Ban's architecture critiques the spectacle of high-tech disaster solutions. He offers instead, a human-scale, participatory responses. His work marks an early precedent for moving towards democratizing emergency shelter through local labor and material simplicity.

Yet, while compelling, the model raises questions about production and long-term viability. Cardboard tubes are lightweight and recyclable, but shipping them in bulk consumes significant volume, making large-scale deployment costly and inefficient. Ban often partnered with local manufacturers to produce the tubes closer to the site, but this required industrial facilities which is not always available in disaster-affected regions. Their durability also depended heavily on climate, robust in dry conditions, but they are vulnerable to rain and humidity without protective coatings. These shelters, while temporary, illustrate both the promise and limits of simple, tool-free assembly. Costing as little as $2000 and built within hours. They prioritised speed and access over permanence. Offering immediacy without disempowerment, but they could not easily transition to long-term housing solutions.

Nepal Post-Disaster Housing - Shigeru Ban

In the aftermath of the 2015 Nepal earthquake, Ban's office developed shelters using rubble, local timber, and cardboard tubes, responding to both logistical constraints and cultural expectations. Unlike airlifted prefab boxes, these homes valorized what remained on the ground: broken brick, fractured stone, displaced people. The project challenged the idea that recovery requires imported expertise or materials. Instead, it aligned with vernacular logic and community-led construction.

Though not modular in the conventional sense, these homes demonstrate adaptive reuse and site-specific resilience. Their hybrid frame blends engineered components with debris and anticipates a thesis proposition: turning waste into structure. Residents were trained in the process, embedding knowledge within the rebuilding. The result was a materially grounded, socially attuned recovery model that values slowness, participation, and transformation over replication.



Figure 3.1 Shigeru Ban's Paper Log House uses paper tubes and rubble for rapid, sustainable shelter construction. Built in 13 hours with community involvement, it prioritizes speed, adaptability, and minimal environmental impact.



Figure 3.2 Shigeru Ban's Nepalese emergency shelter prototype features modular wooden frames (90 cm x 210 cm) infilled with salvaged rubble bricks, promoting local material reuse. Supported by lightweight paper tube trusses, this design enables communities to rebuild quickly.

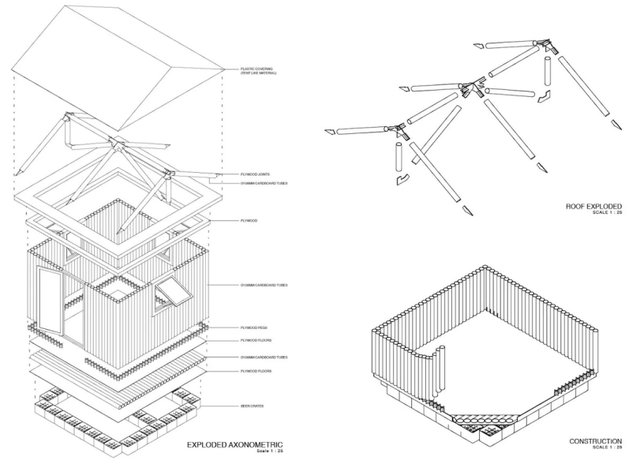


Figure 3.3 Shigeru Ban's original (1995) Paper Log House reveals its pragmatic, recyclable assembly: a sandbag–weighted milk-crate foundation; vertically arranged, polyurethane-treated cardboard tubes forming insulated walls; a plywood floor and canvas roof membrane; and minimally joined framing.

RAPIDO Recovery Housing - Building Community Workshop

Emerging from the failures of FEMA's long-term trailer camps in Texas, RAPIDO reimagines disaster housing as a phased system. Starting with a fast-deployed "CORE" and evolving through co-designed, family-specific additions. This model merges emergency shelter and permanent housing into a single process, rather than treating them as sequential phases. Its pilot deployments after Hurricanes Dolly and Harvey emphasized local labor and dignified reintegration.

RAPIDO embodies the thesis's call for incrementality as design logic transforming temporary shelter into permanent infrastructure. At ~$30–40K, it matches FEMA's cost while radically improving outcomes. It also institutionalizes participation, as homeowners directly co-author their recovery. The project affirms that state-led housing need not erase local knowledge and that long-term resilience begins with early-phase flexibility.

NYC Urban Interim Housing Prototype

Designed in response to Hurricane Sandy, NYC's Urban Interim Housing Prototype proposed a stackale, modular apartment system deployment on infill lots across the city. Though it aimed to keep displaced residents close to their homes. The model was never implemented at scale. While the design addressed urban density, it lacked incremental adaptability and did not offer a role any resident participation. Its high cost and slow deployment highlight the limits of the prefabricated system the prioritized just efficiency over agency. Reinforcing the need for housing solutions that evolve with their users.

The NYC Urban Interim Housing Prototype also reflected broader tensions within post-disaster housing policy in high-density cities. By prioritizing speed and efficiency through industrialized prefabrication, it overlooked the social and spatial complexities of long-term recovery. Its fixed, uniform unit layouts could not easily respond to varying household sizes, cultural practices, or changing needs over time, effectively freezing communities into a single spatial solution. Deployment relied heavily on municipal coordination, specialized contractors, and significant upfront investment, making it vulnerable to political shifts and budget constraints. While visually and technically compelling, the prototype embodied an infrastructural logic more akin to centralized disaster management than to neighborhood-led recovery. In doing so, it missed an opportunity to embed participatory design processes, local labor integration, or material reuse strategies that could have fostered both agency and resilience among displaced residents.

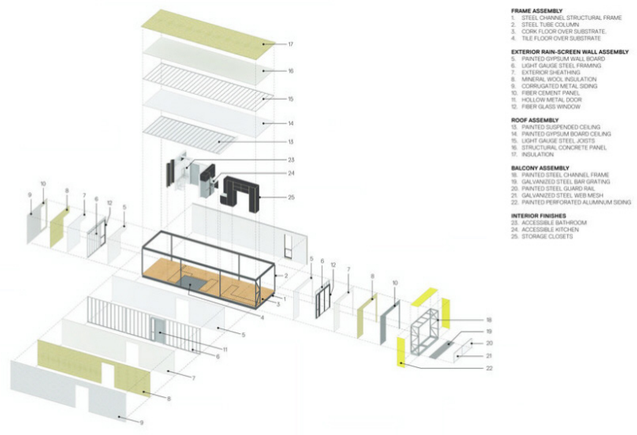
Figure 3.4 A Rapido Recovery home mid-construction, showing its Phase I to Phase II transition, where a temporary core expands into a permanent dwelling. This system reduces reconstruction timelines from the FEMA average of 3–5 years to as little as 6–12 months, integrating local labor and incremental building to lower costs and maintain community continuity.



Figure 3.5 The Urban Post-Disaster Housing Prototype combinesFactory-built steel modules stacked on-site enable dense, rapid-deploy housing, reducing installation time to days. However, high costs and limited adaptability constrain scalability and resident participation.



Figure 3.6 Exploded axonometric of the Urban Post-Disaster Housing Prototype showing its prefabricated steel frame, insulated wall panels, modular floor and roof assemblies, and pre-fitted interiors. The layered component logic enables rapid on-site stacking but remains fixed and non-adaptable.



Ex-Container House - Yasutaka Yoshimura Architects

Following the 2011 Great East Japan Earthquake, Yoshimura's firm converted shipping containers into compact, insulated living units. These structures were designed for quick deployment on tight urban lots and offered complete interiors, bedroom, bathroom, kitchen. Initially used as housing for evacuees, many were later repurposed as pop-up hotels. The project examined the logistical efficiencies of reuse and the limitations of container-based form.

Their strength lies in deployability and density, yet their weakness is their rigidity. While they are stackable and prefab, they do not support incremental adaptation or meaningful user agency. Built in factories and placed in communities, they reflect a top-down logic of emergency response. In the thesis, they act as a counterpoint to participatory models. Raising questions about what kinds of flexibility matter most.



Figure 3.7 The Ex-Container Project repurposes shipping containers into prefabricated housing units, craned for rapid post-disaster deployment. This plug-in system minimizes on-site construction time while providing immediate, weather-tight shelter.

Hsieh Ying-Chun's Adaptive Construction System

Hsieh Ying-Chun's disaster response system helps communities to rebuild their homes utilizing bamboo, steel connectors, and local lumber, creating modular frameworks erected by the residents themselves. The methodology, conceived in response to earthquakes in rural Taiwan and China, emphasises both social and structural dimensions, promoting communal authorship and resilience. Hsieh's work exhibits post-disaster recovery as a culturally contextualized, user-centric process characterized by low cost, high adaptability, and integrated engagement. It supports the thesis's focus on incremental, participatory housing that evolves organically rather than being externally imposed.

Figure 3.8 Model of the Ex-Container Project illustrating its modular, prefabricated units designed for horizontal linking or vertical stacking. This configuration allows flexible site adaptation, creating single homes or multi-story clusters while maintaining rapid deployment and minimal site preparation.

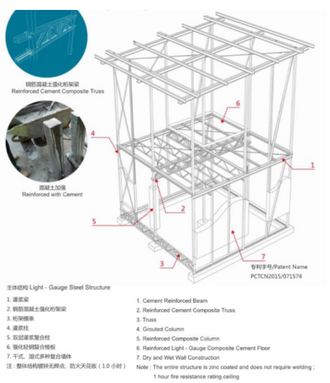


Figure 3.9 The Ex-Container Project's prefabricated modules measure 2.4 m wide, 12 m long, and 2.9 m high, sized for transport on standard flatbed trailers. Arriving fully fitted with interiors, they can be rapidly deployed, relocated, or stacked, enabling flexible post-disaster housing that adapts to shifting site conditions.



Figure 3.10 Exploded axonometric of the Urban Post-Disaster Housing Prototype showing its prefabricated steel frame, insulated wall panels, modular floor and roof assemblies, and pre-fitted interiors. The layered component logic enables rapid on-site stacking but remains fixed and non-adaptable.





Essential Homes - Norman Foster and Holcim

Essential Homes, a collaboration between the Norman Foster Foundation and Holcim. It presents a prototype for long-term refugee housing using low-carbon concrete shells alongside textile reinforcement. The shelter is engineered for durability and climate resilience, being prefabricated and quickly deployable; however, it lacks any participatory elements. While the proposal provides materially viable concepts, it lacks adaptability and autonomy. This project serves as a conceptual alternative, indicating that even well-meaning prototypes can perpetuate the extractive logic inherent in top-down humanitarian design.



Figure 3.11 The Essential Homes prototype by the Norman Foster Foundation and Holcim features a 3D-printed concrete shell with natural insulation, forming a durable, low-carbon dwelling. Measuring approximately 54 m2, the arched structure is designed for rapid assembly, long-term use, and resilience, offering a dignified alternative to conventional emergency shelters.

Future Shack - Sean Godsell

Future Shack repurposes shipping containers as off-grid emergency shelters, equipped with integrated solar panels, water tanks, and prefabricated interiors. While rapidly deployable and secure, its inflexible steel structure hinders any modification by users. It reflects an industrial logic of control rather than care, one that excludes residents from shaping their recovery. Future Shack highlights the risks of excessive crisis overdesign due to elevated costs and restricted replication, emphasising that genuine resilience necessitates spatial openness and social interaction rather than merely logistical efficiency.

Villa Verde - ELEMENTAL

Villa Verde, developed by ELEMENTAL following Chile's 2010 earthquake, implemented a core-and-expand approach in which families were provided with a partially constructed house, enabling them to gradually complete and customize the rest. The architects claim the model is informed by community feedback and rooted in local context. But the local architects and residents argue it is only a partial solution and is misaligned with real needs. It reveals how architecture can become complicit in offering half-measures, allowing the state to sidestep its responsibilities under the guise of participation.



Figure 3.12 The Essential Homes settlement arranges arched units in parallel rows, with shaded corridors, market areas, and gardens integrated between. Following the article's vision, the layout creates a self-sufficient community where homes, food production, and social spaces coexist, promoting walkability, passive cooling, and strong social interaction.



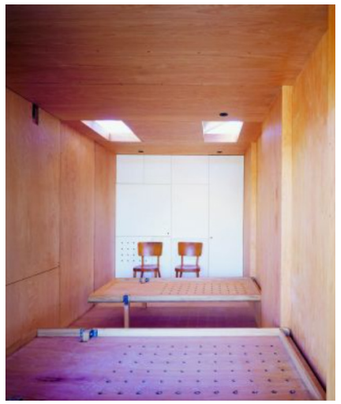


Figure 3.13 The Ex-Container Project's prefabricated modules measure 2.4 m wide, 12 m long, and 2.9 m high, sized for transport on standard flatbed trailers. Arriving fully fitted with interiors, they can be rapidly deployed, relocated, or stacked, enabling flexible post-disaster housing that adapts to shifting site conditions.



Figure 3.14 Exploded axonometric of the Urban Post-Disaster Housing Prototype showing its prefabricated steel frame, insulated wall panels, modular floor and roof assemblies, and pre-fitted interiors. The layered component logic enables rapid on-site stacking but remains fixed and non-adaptable.

Taken together, these post-disaster models demonstrate the urgency and ingenuity of rebuilding in a time of crisis. Yet, these case studies also reveal deep structural limitations. Some succeed in offering speed, dignity, or phased recovery, with others falling short due to the burden of high-tech dependence, land scarcity, or rigid standardisation. Too often, the displaced are given units rather than agency, and temporary shelters fail to evolve into lasting homes. The lesson is that resilience cannot rest on logistics or effiency alone. It must be rooted in adaptability and material strategies that align with both climate and culture. These precedents expand the vocabulary of what recovery can look like, but also underscore the need for housing systems not just to be offloaded onto the communities. They need to be built with them, capable of evolving across the uncertain terrain of disaster and displacement.

PROJECT	MATERIAL USED	SPACES OFFERED	SIZE	COST	INCREMENTALITY	ADAPTABILITY	BUILD TIME / ASSEMBLY	DEPLOYMENT TIME	PARTICIPATORY?	DURATION USED		SUCCESS / FAILURE
										INTENDED	ACTUAL	
CARDBOARD HOUSES (SHIGERU BAN)	Cardboard tubes, tarpaulin, wooden floor panels	Basic shelter: sleeping, minimal storage	~16–20 m²	US $2,000 for 52 m² unit	✗	Moderate – not designed to grow			✓ built with community			✓ Innovative, low-cost, but very temporary
NEPAL POST-DISASTER HOUSING (SHIGERU BAN)	Local rubble + timber + cardboard tubes	One-room shelters	~15–20 m²	US $2,000 for 52 m² unit	✗	Medium – adapted to local materials			✓ trained locals to build			✓ Context-specific reuse of material
EX-CONTAINER HOUSE (YASUTAKA YOSHIMURA)	Shipping containers with insulation panels	Kitchen, bedroom, bath	25–30 m² (single unit)	Low-cost - specific figures not found	✗	Medium – stackable, prefab			✗ factory built, minimal user input			✓ but limited by container supply and cost
RAPIDO RECOVERY HOUSING	Prefab "CORE" panelized unit (12×36 ft / ~40 m²), plus local materials for expansion	Kitchen, living, bathroom, sleeping core + family-customized additions	~37 m² core	Same as FEMA trailer (~US $30K–40K)	✓	✓ Modular core + customizable additions			✓ Homeowners work with designers & local builders			✓ Proven in multiple pilot communities
NYC URBAN INTERIM HOUSING	Steel frame, SIPS, prefab panels	Full apartment (kitchen, bath, sleeping)	40–50 m²	Very high (NYC average emergency cost ~$383/night)	✗	✓ – Stackable, reusable units			✗ top-down design			✗ Too slow to deploy, expensive
HSIEH YING-CHUN ADAPTIVE SYSTEM	Bamboo, local wood, steel connectors	Cluster housing, shared kitchens/toilets	Varies – 30–50 m² typical	NT$200-400 k (~US $6,250–12,500)	✓	✓ – Modular frames			✓ Highly participatory			✓ Empowering + scalable
ESSENTIAL HOMES (NORMAN FOSTER + HOLCIM)	Low-carbon concrete + textile shell	1–2 rooms + bathroom	~25–35 m²	Prototype — cost data unavailable	✗	✓ durable, designed for longevity			✗ Prototype phase, no full participatory process			✗ Too early to tell
FUTURE SHACK (SEAN GODSELL)	Shipping containers + solar + prefab panels	Kitchen, bathroom, sleeping, water tank	~30 m²	> US $30,000	✗	Low – container rigidity			✗			✗ High concept, low replication
VILLA VERDE / ELEMENTAL	Concrete frame, open-ended for user addition	Core home + room for expansion	40–50 m² (expandable to 70+)	~US $7,500 incl. land/services	✓	✓ completely designed to grow			✓ Designed with community			✓ Benchmark in incremental housing

Post-Disaster housing case studies

DAYS - 12 WEEKS | 3 MONTHS - YEAR | YEAR TO PERMANENT

Figure 3.15 Comparative table of post-disaster housing case studies, outlining materials, cost, adaptability, build speed, participation, and long-term outcomes to reveal trade-offs between rapid deployment, growth potential, and community involvement. (Author)

3.2 Transition to Self Build Housing Systems

Where many post-disaster projects offer frameworks for better delivery, growing experimentation in self-build systems reconfigures the very role of the user within the housing process. Here, displaced individuals are no longer treated as passive recipients of aid, but active participants in design, assembly and long-term inhabitation. These cases often emerge from activists, experimental or community-led efforts. Challenging traditional hierarchies of expertise and control. The act of building becomes both a technical and political act, reclaiming autonomy. At their best, self build models embed knowledge within communities and cultivate solidarity through collective labor. They also adapt to cultural and climate specificities in ways that top-down housing rarely can. Foregrounding issues of dignity, autonomy and care.

While self-build strategies reclaim agency and embedded knowledge, they also expose important challenges. Participatory processes when dealing with disenfranchised users cannot assume that residents arrive with the technical expertise. Systems must balance empowerment with clarity, offering simple, legible options for layout, room configuration, and climate-appropriate adaptation. Site planning presents another layer of complexity, as individuals may not have the skills to address issues of orientation, infrastructure, or natural disaster risk like flooding. These are roles that often require translation by local facilitators along with community leaders. Land availability remains a persistent obstacle. Many areas, especially in the case of disasters, are also zones of poverty and marginalization with scarce relocation options. Material choices carry their own contradictions, while timber and earth align with low-carbon and vernacular traditions. Steel frame and heavily machinery driven approaches risk replicating same technological inaccessibility and carbon intensity that undermines true resilience. These critiques point to the need for hybrid models, where the lessons of precedents discussed below are carried forward. Exampeles such as Rapido and RUSS's pedagogical participation are carried forward, but tempered by critical awareness of scalability, equity and environmental impact.

WikiHouse - Open Systems Lab

WikiHouse is a digitally fabricated, which is proposed as an open-source housing system that allows anyone to download, cut, and assemble home components using CNC-milled plywood. Designed for zero-wet trades and minimal skill requirements. It is promoted as a “platform” which allows for the decentralisation of construction and control. Its modular language is flexible, and non-loadbearing interior walls allow for customisation within the layout. However, the reliance on digital tools and access to fabrication infrastructure like a CNC machine is something that limits its reach in many low-resource regions. Despite these constraints, Wiki House presents a compelling shift from provision to participation. It invites communities to become designers, fabricators, and builders of their environments.

U-Build - Studio Bark

U-Build is a system which is reinterprets architecture as block-based assembly system. Where each room is made from interlocking timber boxes. The system allows for full prefabrication, rapid deployment, and interior reuse of each block as storage or furniture. It claims to be easy to disassemble and move, which would support incremental growth and even relocation. While adaptable in principle, spatial flexibility is limited by the grid-based dimensions and visual uniformity of the blocks. Moreover, the structures are designed to be Garden suits; hence, the resolution of services is not completely resolved. Still, U-Build offers an affordable, low-tech strategy that democratises access to building by making each component legible, portable, and manageable by non-experts.

Rural Studio / 20K Home – Auburn University

The 20K Home initiative, led by Auburn University’s Rural Studio, is a pedagogical experiment in dignified rural housing that can be built for $20,000. It emphasises affordability, climate sensitivity, and incremental inhabitation using methods like pole barn shells and prefabricated wall panels. Certain iterations permit users to start with a covered structure and progressively incorporate infill walls, facilitating a gradual yet continuous evolution from shelter to home. Some are completely constructed and less flexible, exposing inherent conflicts between exploration and replicability. The homes are typically student-built, hence the focus is on learning more than end-user participation. What emerges is a long-term, iterative design effort that challenges the aesthetics of poverty without falling into the trap of overdesign.

Figure 3.16 WikiHouse construction uses CNC-cut plywood components that slot and lock together without heavy machinery, achieving self-supporting spans of up to 6 meters. Started by Alastair Parvin of the Open Systems Lab, the open-source system enables non-specialists to assemble customizable, modular structures quickly, supporting adaptable layouts and community-led building with minimal tools.



Figure 3.17 The U-Build system by Studio Bark uses CNC-cut plywood panels assembled with simple tools, allowing non-specialists to build without heavy machinery. Flat-pack components are screwed together in modular box units that can be added, removed, or reconfigured, enabling adaptable layouts and easy disassembly for reuse.





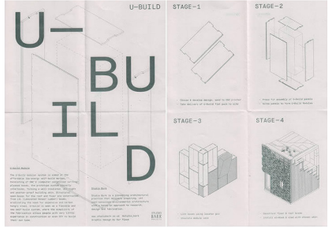


Figure 3.18 The Rural Studio 20K House under construction, showing its simple timber-frame structure designed for affordability, ease of assembly, and adaptability. Built by Student and local labor and materials, the model aims to deliver dignified, low-cost housing for rural communities while supporting incremental improvements over time.



Treehouse, Clapham - Will Anderson

Amateur Studio, designed by Invisible Studio and built with volunteers, is a 55 m² stilted workspace accessed by a bridge, conceived as a system that could be assembled by unskilled labour. Costing £15,000 including materials and labour, the project relied entirely on site-sourced or hand-carried materials, with all timber milled from the surrounding woodland during a two-day hire of a mobile saw. Lightly architect-designed with minimal drawings, the build embraced improvisation, led by an architect but constructed collectively by neighbours and friends with no prior experience. Concrete footings were hand-mixed, and an untreated, unseasoned timber frame—erected in two weeks—was self-scaffolded with timber later reused in the bridge and flooring. OSB-clad walls were painted black and partially overlaid with timber boards, leaving striped sections exposed due to limited milling time. Interiors remained raw, exposing stud-work and insulation, while windows were salvaged from a skip. Heated by waste wood and harvesting roof water to feed an adjacent attenuation pond, the studio demonstrates a low-cost, resourceful approach to construction, foregrounding collective labour and site-based material cycles over polished architectural finish.

Ladywell Hub - RUSS

The Ladywell Hub was built as a training and assembly space for the RUSS cooperative in London. It is designed using participatory design and natural building methods like hempcrete, cob, and straw. Framed using the Segal method, the building acts as a teaching platform where residents and volunteers learn how to construct their own homes. Its value lies in the embedded architectural knowledge within the communities. This makes construction a shared and open-ended process rather than a system of sealed delivery. Though the process is slow and labour-intensive. This hands-on method fosters social cohesion and collective authorship. It is embedded both in pedagogy as well as form. Homes are planned to be designed and built by residents over time. This project refuses speed in favour of collective learning. It prioritises empowerment over efficiency.

Hedgehog Housing Coop - Brighton

Built by future residents over two and a half years, the Hedgehog Housing Coop reflects long-term cooperative commitment to low-cost housing in Brighton. It uses a post-beam timber frame based on the Segal method, combined with recycled cellulose insulation and softwood cladding. While some interior flexibility exists, the frame does not support future structural additions. The project critiques developer-led housing not through opposition, but through lived alternatives: slow, collective, and materially conscious. Residents contribute labor and design input, forging strong communal ties in the process. Yet the time investment required is steep, making it difficult to replicate at scale. Hedgehog exemplifies how slow building can nurture belonging, but only when time and community alignment are present.



Figure 3.19 Amateur Studio by Invisible Studio, a 55 m² stilted workspace built collectively by volunteers using site-sourced timber, OSB cladding, and salvaged windows, demonstrating low-cost, resourceful construction embedded in its woodland setting.



Figure 3.20 Ladywell Self-Build Community Hub by RUSS under construction, with volunteers assembling its Segal-inspired timber frame and testing natural wall systems. Built by over 90 participants, the project serves as both a community space and a training ground for sustainable, cooperative building.





Figure 3.21 Exploded axonometric of the Urban Post-Disaster Housing Prototype showing its prefabricated steel frame, insulated wall panels, modular floor and roof assemblies, and pre-fitted interiors. The layered component logic enables rapid on-site stacking but remains fixed and non-adaptable.

Irish Vernacular

This project revisits rural Irish self-build practices using low-cost, locally available materials like timber, black onduline, and off-shelf fasteners. Its strength lies in its terrain-sensitive timber cross-frame system, which can be expanded module by module. The build process is slow and deeply personal. 50 days spread over two years, but intentionally so. It empowers individuals to create homes at their own pace, suited to their land and financial constraints. Every joint and panel is legible and replaceable, encouraging a sense of stewardship over the home. While architecturally modest, it demonstrates how vernacular building techniques can be systematized without becoming standardized. This is architecture as craft and care, not product.

Taken together, these self-build experiments highlight both the potential and the limits of participatory housing. They show that when systems are simple, legible and adaptable, residents can meaningfully shape their environments and embed long-term stewardship into the act of building. The collective building process cultivates a feeling of solidarity, turning the construction process into a social as well as technical project. The lesson learned moving forward is not to idealise self-build, but to pursue hybrid models that combine the urgency of post-disaster response with the empowerment and adaptability of the participatory construction. In this way, housing can shift from being a finished product to a flexible framework for autonomy, recovery, and care.



Figure 3.22 The completed Irish Vernacular prototype by Dominic Stephens, a low-cost, open-source self-build home clad in black corrugated onduline for passive solar gain, designed to be constructed with minimal tools, unskilled labour, and locally available materials.

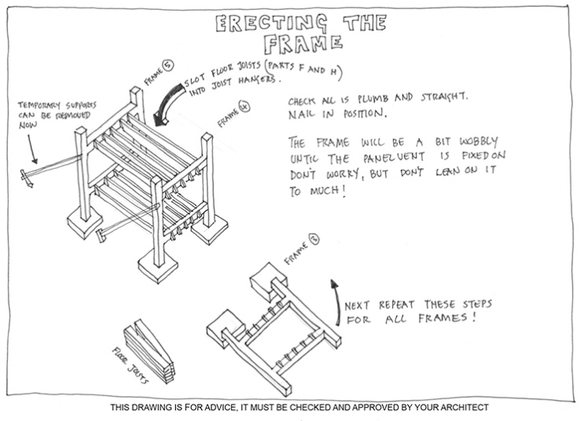


Figure 3.23 Hand-drawn construction guide from Dominic Stephens' Irish Vernacular project, illustrating the step-by-step process of erecting the timber frame using standard sections, joist hangers, and minimal tools, embodying the project's open-source, self-build ethos

PROJECT	MATERIAL USED	SPACES OFFERED	SIZE	COST	INCREMENTALITY	ADAPTABILITY	BUILD TIME	CONSTRUCTION					
								FOUNDATION	STRUCTURAL FRAME	WALLS	ROOF	SERVICES	JOINERIES
WIKIHOUSE	CNC plywood	Living, sleeping, kitchen, WC (flexible modular plan)	Customizable	~$20K–$50K (frame only)	✔ Yes – modules added via digital tools	✔ Yes – non-loadbearing walls, plans modifiable		Flat-pack, no wet trades	Snap-fit CNC plywood	Custom cladding	Custom plywood deck	Off-grid potential	Snap-fit wedges
U-BUILD	CNC timber	Sleeping pod, kitchen, WC, living (box-grid)	16+ m²	~£6,100 for 16m² (frame only)	✔ Yes – boxes added/removed	✔ Partly – fixed dimensions, layout flexible		Flat-pack kit, screw-fixed	Hollow timber boxes	Box-formed insulated walls	Custom / variable	Passive, low-energy	Mallet, screws
RURAL STUDIO / 20K HOME	Timber, SIPs, pole barn	1–2 bed, kitchen, bath, porch	40–60 m²	~$20K (target)	✔ Yes – adaptable pole barn sequence	✔ Partly – layout flexibility varies by model		Pole barn: posts then roof, slab or pier	Timber or SIP panels	Insulated panel or ply	Metal or truss	Solar PV, off-grid optional	Mixed, basic timber joinery
TREEHOUSE, CLAPHAM	Timber, slate, concrete	3 bed, 2 bath, kitchen, living, study	3 storeys	£180,000 (2006)	✘ No – fixed architect design	✘ No – complex, not adaptable		Concrete piles and slab	Timber + steel frame	White render, cedar boards	PV roof with slate	GSHP, solar hot water, rainwater tank	Mortise-tenon + steel
LADYWELL HUB (RUSS)	Rammed earth, cob, straw, hemp, timber	Hub: kitchen, toilets, workshop. Flats: 1–3 bed, kitchen, bath	Varied	£82,000 (hub)	✔ Yes – phased, educational build	✔ Yes – mixed materials, off-grid systems		Screw piles, reclaimed fill	Segal-style timber frame	Earth, hemp-lime, straw bale	Green roof with wildflowers	Compost toilets, rainwater, solar	Mixed methods
HEDGEHOG HOUSING COOP	Softwood, recycled larch, cellulose	2–3 bed, kitchen, bath, WC, shared outdoor spaces	~10 homes	~£60K–80K per home	✔ Partly – adaptable layout, not structure	✔ Partly – minor layout tweaks, no expansion		Concrete pads, paving slab foundation	Post-beam timber frame (Segal method)	Larch cladding, cellulose insulation	Sedum green roof	Gas combi boiler, solar gain windows	Bolted timber joints
IRISH VERNACULAR	Timber, black onduline sheet	1 bed, kitchen, WC, living (expandable modules)	Small footprint	€ 25,000	✔ Yes – built to expand, site-adapted	✔ Yes – custom fit, off-shelf fasteners		Concrete pad foundations	Timber cross-frames sized to terrain	Timber batten + sheet	Pitched roof, timber beams	Electric heater, 225mm insulation	Pegs, brackets, screws
WASTE HOUSE (BRIGHTON)	90% reused materials (jeans, tiles, etc.)	Lab, WC, kitchen, research space	163 m²	£140,000 + in-kind	✘ No – fixed research model	✔ Partly – cassette walls permit some change		Low-carbon concrete + reclaimed aggregates	Timber & ply cassette structure	Reused materials in ply cassettes	Vaulted timber truss	PV, reused appliances, LED, HRV	Ply boxes, taped joints
20K HOME	Timber, metal roof, SIPs	1–2 bed, kitchen, WC, porch, living	~45–60 m²	$20,000 USD	✔ Partly – flexible roof-first logic	✔ Partly – improved with each model		Pole barn (roof erected first)	Post-frame + infill walls	Insulated panels	Metal or wood deck roof	Solar PV, off-grid	Mixed – nails, screws

Figure 3.24 Comparative table of self-build housing case studies, detailing materials, spatial configurations, costs, adaptability, construction speed, foundation and frame systems, and service integration, to highlight variations in design flexibility, scalability, and community participation. (Author)



04 : DEMOCRATIZING DISASTER RELIEF

In the face of contingency, the role of architecture shifts from providing fixed, static solutions to becoming a more dynamic, responsive process of "sense-making." This reorientation is essential for genuinely participatory approaches, which must allow for flexibility and adaptation over time, rather than clinging to a predetermined ideal.

– J. Forester

4.1 Reframing the problem

Top-down approaches to disaster relief housing have repeatedly shown their limits. Shelters are often delivered as standardised solutions that overlook cultural practices, social networks, and the evolving needs of displaced communities. Rather than supporting recovery, they can impose rigid forms that leave residents with little agency over their environments. This problem has not gone unnoticed. Since the 1960s and 70s, several architectural and planning theorists have critiqued the modernist legacy of 'total design' and argued for participatory processes that allow people to shape their own environments.[37] Their ideas, though not directly tied to disaster contexts, offer insight into how housing could move beyond disposability and exclusion toward frameworks that adapt with their users.

Jeremy Till argues that for much of history, architecture has defined itself as a "problem-solving" lens, seeking optimal solutions to clearly defined issues. This approach, according to him, inherently restricts architecture's ability to engage with uncertainty, unpredictability and the richness of lived experience. [38] This technical fixation on how rather than why, inherited from the modernist project, continues to shape contemporary building practices. Often reinforces systems of political and economic control rather than empowering people. In contrast, this thesis reclaims technical methods such as flat-packing, CNC-milled assemblies, not as ends in themselves, but as tools to support adaptability, user agency and incremental rebuilding.

Yona Friedman similarly critiqued that modern architecture lacks the 'bandwidth' to accommodate human complexity and relies instead on a fictional average user. This narrow process of translating input into fixed output, results in rigid, idealized environment that resist adaptation.[39] The two diagrams on the left reinforce the central argument of this thesis: that disaster housing must move away from designing for a fictitious "average user" and instead create frameworks that empower real, diverse communities. Yona Friedman's sketch of the 'broken circuit' exposes the flaw of conventional architecture. Where the architect translates imagined needs into fixed forms, leaving future users with little agency or representation. His call for users to design their own environments anticipates the participatory

37 Till, ***Architecture and Participation***, 22.
38 Till, ***Architecture and Participation***, 23.
39 Friedman, ***Toward a Scientific Architecture***.

ethos of this project, where housing is understood as a toolkit for recovery rather than a finished product. These diagrams shift the frame from a one-time delivery to housing as an adaptable, systematic process.

By failing to incorporate participatory systems, architecture turns people into passive occupants rather than active co-creators of the spaces they inhabit. Similarly, Sherry Anstein, a policy theorist wrote on citizen participation. Distinguished between genuine involvement and what she called "placation" and "pseudo-participation," where community input is sought for legitimacy, but decisions remain predetermined. These perspectives highlight how expertise, when left unchallenged, can silence lived realities under the guise of inclusion.[40]

In a post-disaster context, community input is frequently solicited for legitimacy, yet the decisions are pre-scripted. This leaves those displaced with little to no control over shaping their recovery. In contrast, genuine participatory structures are rarely smooth or harmonious; they embrace contradiction, failure, and improvisation. Rather than erasing difference, authentic participation engages with complexity, creating space for multiple ways of seeing, using, and transforming the built environment.[41] It is based on the understanding that architecture inevitably engages with power, and its refusal to acknowledge this renders it complicit in what Giancarlo De Carlo called structures of dispossession.[42]

This thesis draws on these theoretical positions as a foundation for rethinking post-disaster housing. While issues like land availability and direct collection of user feedback are acknowledged as critical to meaningful participation, they fall outside the scope of this work. Instead, the focus here is on material systems and construction frameworks. In the form of methods that can be flat-packed, assembled, and incrementally adapted by users themselves. By reframing housing as a toolkit rather than a fixed product, the project takes up the challenge of creating participatory structures that restore autonomy.

4.2 Designing for autonomy, not prescription

Scholars such as Madden and Marcuse argue that housing has shifted from being a basic human need to being treated primarily as a commodity. This framing, they explain, reduces homes to economic assets, disempowering residents and reinforcing systems of inequality.[43] Michel Foucault's writings on biopolitics also critique this, showing how architecture and planning can become instruments of "catastrophic governance," where space is mobilised to regulate populations rather than to support them.[44] These dynamics are especially visible in post-disaster contexts, where temporary housing is distributed through frameworks of insurance, aid, and recovery that often

40 Arnstein, "A Ladder Of Citizen Participation."
41 Doina Petrescu, "Losing Control, Keeping Desire."
42 Giancarlo De Carlo, "Architecture's Public."
43 David J. Madden and Peter Marcuse, ***In Defense of Housing: The Politics of Crisis***.
44 Foucault, ***Society Must Be Defended***.

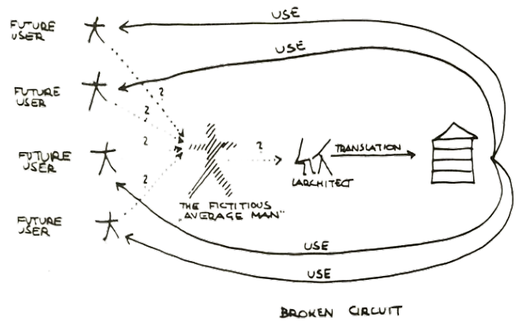


Figure 4.1 Yona Friedman's diagram illustrating the "broken circuit" of architectural design, critiquing the concept of the fictitious "average man" and arguing that designing for this non-existent user alienates actual inhabitants. Friedman advocates for a process in which future users design their own homes, with architects acting as guides rather than sole authors.

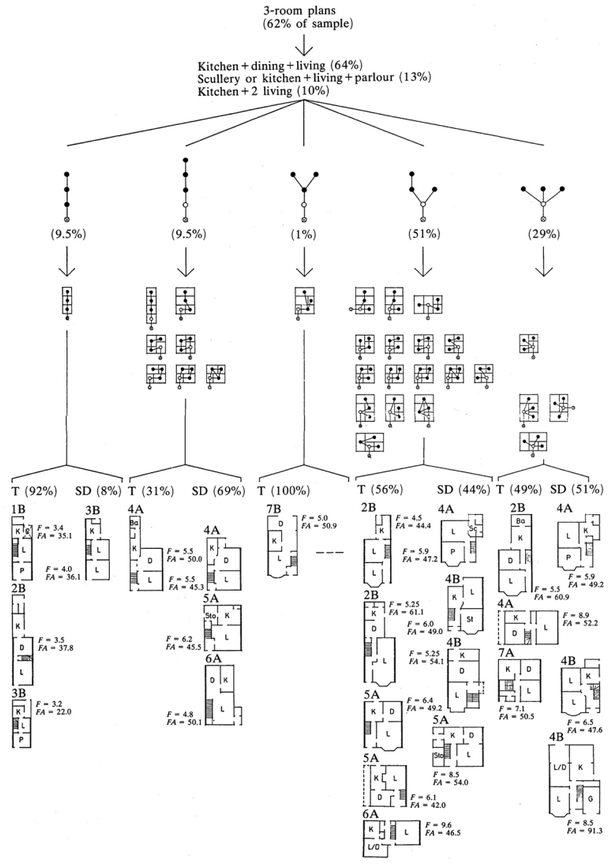


Figure 4.2 This diagram, from research in architectural morphology and configurational studies, classifies real three-room house plans by their underlying spatial "skeletons" rather than dimensions. Using graph theory, plans are grouped by patterns of room connections, allowing systematic comparison of built examples to the full range of possible configurations.

treat shelter as a financial liability to be managed rather than a social right to be secured. In places like Hawai'i, wildfire survivors unable to rebuild on their land face displacement as private equity speculation swallows damaged properties, turning disaster into an engine of dispossession.

This thesis responds to those dynamics by reimagining post-disaster housing not as a commodity to be managed, but as a framework for recovery that restores autonomy. These frameworks are conceived as flexible scaffolds that accommodate change. Weather transience of human existence, shifting environmental conditions, or cultural specificities. Rather than delivering closed, prescriptive units, they are composed of straightforward, legible components in the form of geometric primitives and shared protocols that invite reinterpretation. Designed for non-experts, they can be flat-packed, assembled with local materials and learned skills and incrementally modified, repaired, or expanded over time. In this way, the system indexes multiple possibilities rather than prescribing a single result, resisting the cycle of dispossession and transforming temporary shelter into a foundation for long-term rebuilding.

4.3 Investigating participatory practice

To understand how disaster response can move beyond structural flexibility into truly participatory. It is critical to analyse the work of Lucien Kroll. He was one of the pioneers of the participation movements of the 1970s. Kroll emerged at a time of time of widespread student protests and social upheaval across Europe. Based out of Belgium, he became renowned for his student housing project La Meme' (Maison Medicale). A project commissioned in response to student dissatisfaction with monotonous institutional dormitories. Invited directly by the students, Kroll developed a design that placed user agency and co-authorship at its core.

Even today, La Meme' remains as one of the most radical, built examples of participatory architecture. An architectural act of resistance against the homogeneity, hierarchy and top-down control of modernism. It was Designed between 1960's for the Catholic University of Louvain in Belgium. As mentioned above, it was not commissioned by the institution, but by students dissatisfied with rigid planning and the school administration. In the beginning, the administration was sceptical of Kroll, but as a student protest grew, the administration had to give in to the demand of letting them hire Kroll as the architect for student residence. This launched a rare instance of bottom-up commissioning that would define the building's participatory DNA. From the outset, he rejected the role of sole author, instead framing his work as a facilitator of collective expression.

La Meme exemplifies participatory architecture through its structural and social pluralism. Combining a rectilinear concrete wing with a balloon-framed, irregular side to accommodate diverse spatial preferences. Students were deeply involved in shaping the building by making models as artifacts

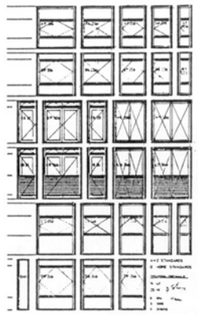
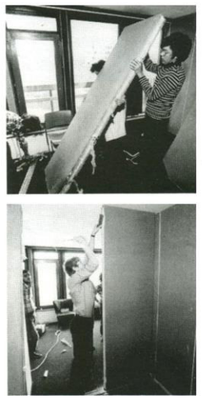




Figure 4.3 Drawings from La Mémé showing the flexible grid-based floor plan, modular façade components, and catalogue of interchangeable panels. This system enabled residents to personalize layouts and exterior expressions, making the building an evolving record of its occupants' choices.



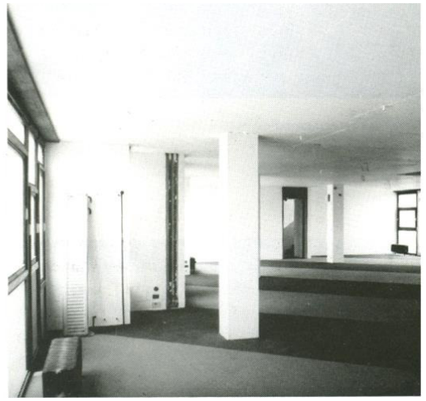


Figure 4.4 Interior views of La Mémé's adaptable framework, where occupants install modular wall panels and fittings to customize spaces. This participatory approach allowed users to shape both the interior layout and, by extension, the building's ever-changing façade.



Figure 4.5 Lucien Kroll's La Mémé (Maison Médicale) in Brussels, a landmark of participatory architecture, featuring an eclectic façade of varied window types, materials, and scales. Designed in collaboration with medical students in the 1970s, the building resists uniformity, reflecting the collective input and individuality of its future users.

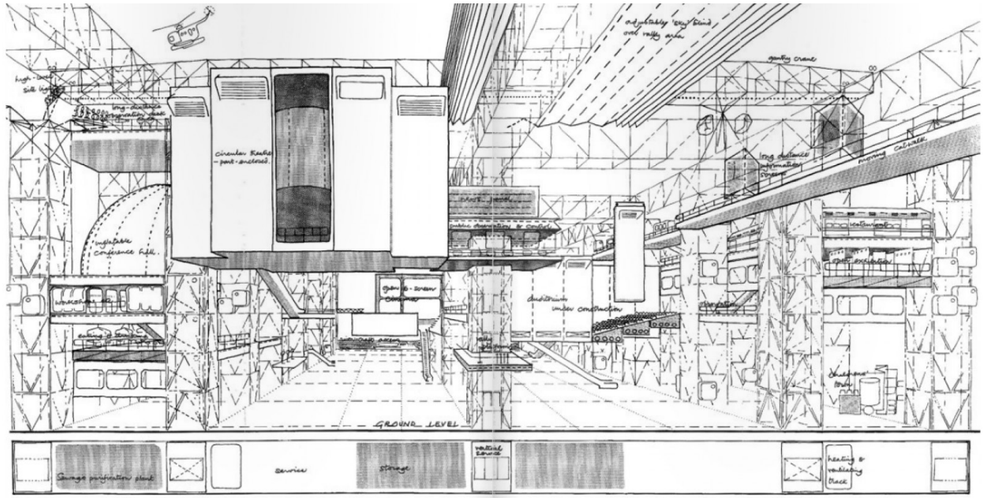
of the participatory process. Constructing gardens and co-authoring the façade. Making the architecture of the building a reflection of collective agency rather than institutional control. SAR (Support/Infill architecture) system, developed by John Habraken, was used in the design of the building. It proposes a separation between support (permanent structural framework of a building) and infills (changeable elements like walls, partitions, windows and interior fittings). Kroll created a modular, reconfigurable framework that treated architecture as a living toolkit rather than a fixed solution. Though, this attempt at participation was short lived, just before the completion of the building, Kroll was fired and blacklisted within the architectural community for his radicle ideas. Once conceived as a building that would continually evolve, it now stands frozen as a heritage site. In post-disaster contexts, Kroll's approaches can be especially relevant. Offering a model for rebuilding that empowers survivors not just to recover but rather to participate in shaping the environment of growth and autonomy.

Though La Mémé emerged from a very different context, student protests in 1970s Belgium, rather than the urgency of disaster recovery. It still offers valuable lessons. In a situation of displacement, people's priorities are survival and stability, not resistance to authority, and options must therefore be simple, legible, and limited enough to support clear decision-making under stress. What Kroll's work demonstrates is the possibility of frameworks that accommodate user inputs without requiring expert knowledge or unlimited choices. His approach reframes that architect's role from prescriber to facilitator, offering a model of participation that, if adapted, can inform post-disaster housing. The relevance lies not in reproducing La Mémé, but in carrying forward its ethos of collective authorship, translating it into systems that allow survivors to shape their recovery in practical, incremental, and culturally meaningful ways.

4.4 Framework for Democratic Architecture

The image of Kroll's design became synonymous with a new type of architecture, influencing others of the period to experiment with participatory techniques in their own work. This was a distinct period in history, symbolic of a broader shift in the architectural design process away from modernism. Architects and designers of that time were exploring and investigating how systems, construction methods and spatial frameworks could operationalise democratic values in the built environment. This thesis draws on a mode of thinking that took shape in the 1960s and 70s, a period when avant-garde architects from institutions like Architectural Association in London were reimagining architectural discourse through participation and radical experimentation. With architects such as Cedric Price and Walter Segal, who rejected the rigid notions of the modernist total design practice in favour of adaptable, open-ended and user-driven practices.

Potteries Thinkbelt, an unbuilt project by Cedric Price from 1966, was formed around reimaging a declining industrial region in North Staffordshire.



Il Fun Palace

ARRIVATE E RIPARTITE in treno, bus monorotaia, hovercraft, auto, metrò o a piedi in qualunque momento VOI desideriate – o date semplicemente un'occhiata passando. Gli schermi informativi vi mostreranno ciò che sta accadendo. Non occorre cercare un ingresso – potete entrare a piedi da qualunque punto. Niente porte, atri d'ingresso, code o custodi: sta a voi decidere come usarlo. Guardatevi intorno – prendete un ascensore, una scala mobile per andare ovunque o verso qualunque cosa appaia interessante.

SCEGLIETE cosa volete fare – o guardate qualcun altro mentre lo fa. Imparate a maneggiare utensili, vernici, bambini, macchine, o ascoltate semplicemente la vostra canzone preferita. Ballate, parlate o fatevi sollevare in alto per vedere come gli altri fanno funzionare le cose. Sedetevi con un drink in mano a guardare lo spazio e sintonizzatevi su ciò che accade da qualche altra parte in città. Cercate di scatenare un putiferio o cominciate un quadro – o semplicemente stendetevi a terra a guardare il cielo.

CHE ORE SONO? Qualunque ora del giorno o della notte, inverno o estate – in realtà non importa. Se piove, quel tetto fermerà la pioggia ma non la luce. La nuvola artificiale vi terrà al fresco o disegnerà arcobaleni per voi. I vostri piedi saranno al caldo mentre guardate le stelle – l'atmosfera tersa mentre vi unite al coro. Perché non gustare il vostro piatto preferito lassù dove potrete ammirare il temporale?

PERCHÉ TUTTO QUESTO? "Se c'è una nazione che sarà perduta o salvata dal carattere delle sue grandi città, quella nazione è la nostra." Robert Vaughn 1843.

Stiamo costruendo un giocattolo a breve scadenza nel quale tutti noi possiamo realizzare le possibilità e i piaceri che un ambiente urbano del ventesimo secolo ci deve. Deve durare non più a lungo di quanto ci occorra.

Figure 4.6 Drawing of Cedric Price's Fun Palace (1961–64), a radical, unbuilt proposal for a adaptable space framed by an open steel structure, gantry cranes, and modular service units. Conceived as an "anti-building," it allowed users to reconfigure spaces for cultural, educational, and leisure activities, embodying vision of architecture as a flexible framework for changing needs rather than a fixed monument.



Figure 4.7 Model of Yona Friedman's Villa Spatiale, an exploration of adaptable, elevated housing frameworks that allow residents to design and modify their own living spaces. Using a lightweight structural grid raised above ground, the concept emphasizes user participation, flexibility, and minimal land impact, embodying Friedman's vision of architecture as an open system rather than a fixed form.

It was framed as infrastructure that could be adapted over time, rather than as a static piece of architecture. Built on a rail networks, with mobile classrooms, and communications systems arranged in a looping dynamic system of learning and living. Price rethought the role of architecture not to impose order but rather to enable change. Building not spaces but rather what he called "platforms of transformation". [45] His work questioned our preconceptions of permanence within architecture and instead proposed a model that incorporates transience, based on the emerging needs of the users. Though most of his work was unbuilt apart from the Aviary at London Zoo, as his paper architecture was quite radical for its time.

Within in his Think belt projects, instead of prescribing buildings, he envisioned a ***spatial and material scaffold***: a mobile, reconfigurable network of rail-based units and service pods which responded to the changing needs over time. Central within his design was a ***rule-based design*** approach influenced by information theory and cybernetics, where the overall design operated through protocols and relationships rather than finalized forms. This enabled different programmatic elements to plug in and plug out, rearrange and evolve with time. These concepts offer valuable strategies for the post-disaster rebuilding conditions. Where rapid deployment, flexibility and reconfigurable systems is urgent.

Another radicle thinker, Walter Segal developed a radically simplified building methods that was based on the idea of returning spatial agency to ordinary people. Tired by the prescriptive building methods promoted by the modernist project, he built a prototype first for his own family in Walters way, Lewisham London. Segal's method employed ***lightweight timber frame*** and pad foundations, eliminating the need for wet trades along with heavy equipment. [46]He developed a system using standard timber sizes with a 2.4-meter modular grid, allowing families with no prior construction experience, to build their own home with the use of simple tools and local materials of the area. Each house argued for ***spatial autonomy*** and the structural lines over a 0.6 meter grid had flexibility ingrained within it, internal partitions could be reconfigured while keeping envelop.[47] He emphasized that the method should be comprehensible by users allowing families, including women, children and elderly to build their own home collaboratively. [48] Though, a step in the right direction, the method struggled to scale up due its ad-hawk approach which did not was out of the systems of bureaucratic risk and control. It also faced a hard time due to professional dismissal of self build as marginal and it failed in comparison to market driven housing systems which favoured fast-paced, standardized, financeable development over participatory user-led alternatives.

45 Rattenbury and Hardingham, ***Cedric Price***.
46 Scope of Work, "Anyone Can Build a House."
47 Walter Segal, "Learning From The Self-Builders."
48 Grahame and McKean, ***Walter Segal***.

Figure 4.8 Structural and modular grids used in the Segal Method, where a regular framework governs both the primary structure and the placement of internal partitions, enabling flexible room arrangements and future alterations.

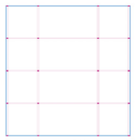


Figure 14. Structural Grid

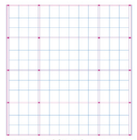


Figure 15. Modular Grid

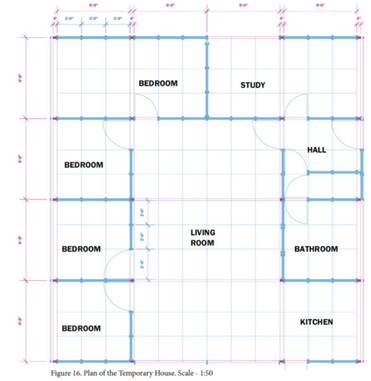


Figure 16. Plan of the Temporary House. Scale - 1:50

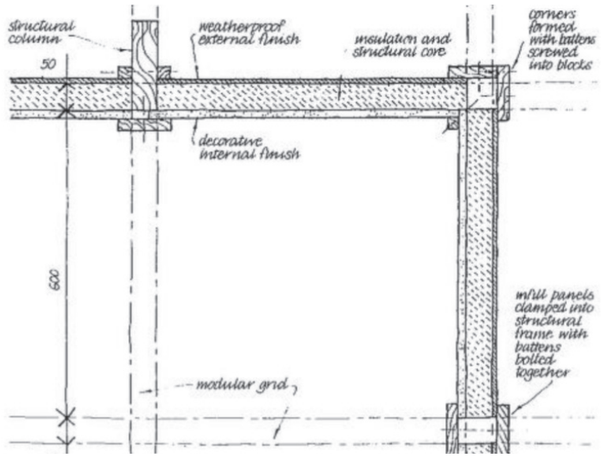
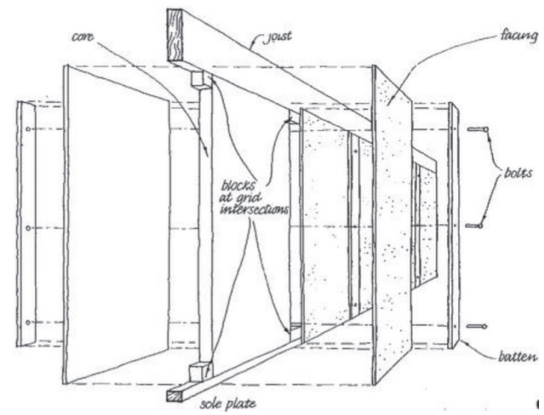


Figure 4.9 Wall construction details from the Segal Method, illustrating how insulated multi-panels are clamped and bolted into a timber structural frame with battens, allowing components to be assembled, removed, and reused without damage.



05 : DESIGN SYNTHESIS

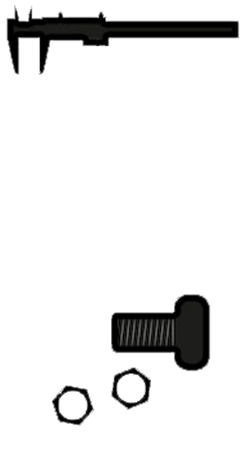
5.1 Framework for Post-disaster Housing

Until this point, the thesis has traced the historical, material and procedural failures of conventional post-disaster housing systems. Where urgency is wrapped in bureaucracy, and promises of hope are too often broken. Through undemocratic and rushed rebuilding efforts. Rather than liberating, these interventions frequently become units of confinement. These are rooted in rigidity, one-directional authorship, which is why they offer shelter but little dignity or control. The inadequacy of the temporary shelters, such as FEMA trailers or mass-standardised modular pods, stems not from material scarcity alone. Rather, from a deeper epistemic disconnect. They are conceived as static objects rather than as evolving processes. In response, the design proposed here attempts to reposition housing not as a singular architectural product but as a participatory framework shaped by user agency and local feedback loops.

Across case studies, it was clear that there is value in radical alternatives to the rigid systems of control. Through projects like Rapido and the work Hseih Ying-Chun, we saw approaches to counter the disempowering logics of top-down aid. However, these cases still deal with the problem on the surface. Prioritising the provision of housing without meaningfully supporting communities in rebuilding their lives collectively. Instead, there is a need to provide them with the tools that would enable them to rebuild on their terms and at their own pace. Which is why I investigated participatory modes of architecture. With transformative thinkers like Walter Segal and Lucien Kroll, who proposed participation not just as a construction method but as a form of healing. Where Sweat equity, collective agency and spatial flexibility combine to extend usability, reduce the risk of long-term displacement. These homes, unlike disposable shelters, often remain in use years after disaster because they evolve with their occupants.

What emerges is a critical insight: recovery is not just about immediate relief but a pathway to sustained inhabitation. Shelter must not only protect but also be able to empower. The design proposed in this thesis builds on these insights. It envisions a housing system that allows displaced users to build, adapt and carry their homes forward. Beyond the expiration dates of temporary aid. It challenges the containerised logic of disaster housing and instead offers a framework of reconstruction.









5.2 Design objectives: Rebuilding as process, not product

1. Start with core, expand over time
   - 1.1. Design begins with a compact core unit for immediate post-disaster shelter
   - 1.2. Supports phased, modular expansion based on household needs and available resources.

2. Empower through building
   - 2.1. Construction is viewed as a form of recovery and agency
   - 2.2. Components are legible, tool-assisted and buildable and assemblable with minimal training.

3. Embed incrementality in Form and services
   - 3.1. Modular grid and distributed service cores enable staged construction
   - 3.2. Units dock, detach, and grow without major retrofit.

4. Prioritise reversibility and repair
   - 4.1. Use reversible connections with screws and wedges.
   - 4.2. Standardised parts support long-term adaptability and multiple lifecycles.

5. Accommodate various user engagement
   - 5.1. System supports full self-built, assisted assembly or guided co-design.
   - 5.2. Residents can participate as occupants, builders or collaborators

6. Support Collective life through shared infrastructure
   - 6.1. Design includes optional shared elements like courtyards or communal decks
   - 6.2. Encourages cooperative labour, governance, and daily interaction.

7. Standardise for simplicity, not uniformity
   - 7.1. Based on standardised off-the-shelf materials for efficiency.
   - 7.2. Allows diverse layouts, orientations and spatial combinations within the system.

8. Link to broader recovery system
   - 8.1. Integrates with local governance and aid frameworks
   - 8.2. Architecture complements, rather than replaces, social infrastructure.

5.3 Design Iterations

The design iterations tested multiple approaches to structural connection, assembly logic, and modular adaptability within a consistent 3x4 and 3x3 module framework. The first 3x4 module trial focused on material reuse, prioritising reclaimed timber and sheet goods to reduce embodied carbon while testing tolerance limits with irregular stock. This was followed by the jigsaw slot iteration, using interlocking CNC-cut joints to simplify alignment and reduce reliance on metal fasteners. A further 3x4 key connections kit-of-parts iteration explored an integrated catalogue of joint types, matching connection logic to specific material properties and structural roles. Parallel 3x3 module trials examined strap connections, leveraging flexible lite timber straps for rapid assembly and tolerance adjustment, and a combined connections approach, blending jigsaw slots, screws, and straps for structural redundancy and repairability. The final 3x3 combined connections iteration synthesised these learnings into a refined assembly sequence, optimising speed, tool accessibility, and material efficiency. Together, these experiments established the assembly grammar that underpins the project's flexibility and disassembly potential.



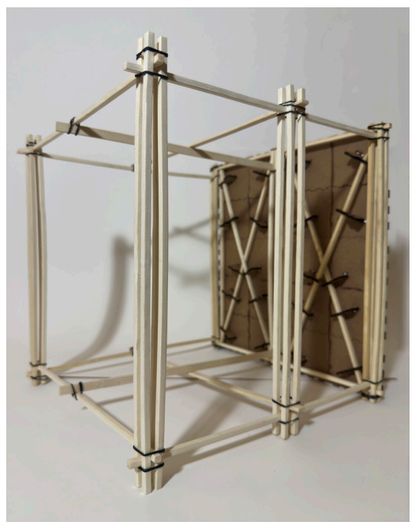
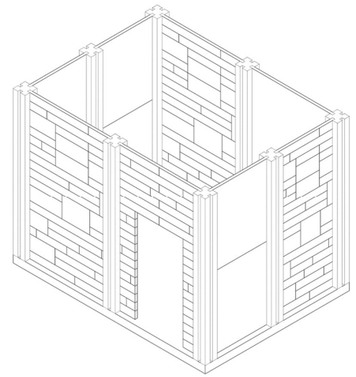


Figure 5.1 Protoype building Iteration 3 - X frame Structure



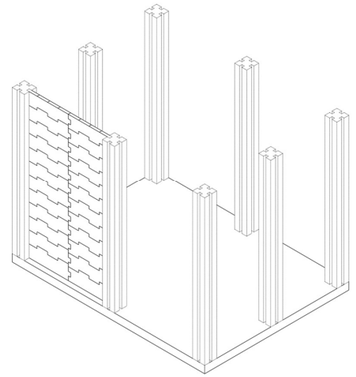
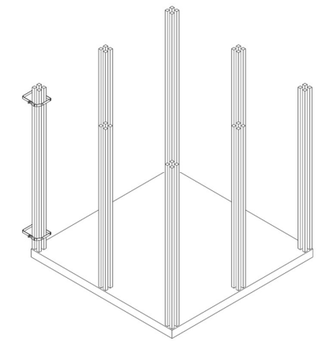


Figure 5.2 Iteration 1 explored reclaimed materials for low-impact construction, while Iteration 2 introduced CNC-cut jigsaw slots for precise, fastener-free assembly.



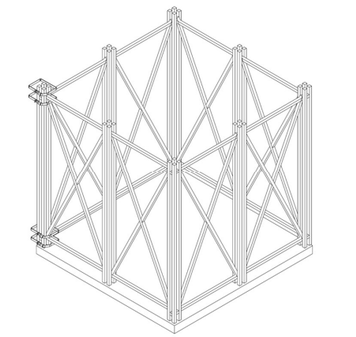
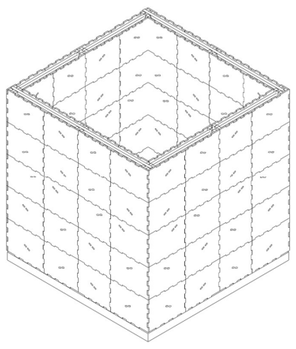


Figure 5.3 Iteration 3, Strap and Brace Connection Uses light timber strapping and bracing to form strong, adjustable joints for rapid, low-tool assembly.



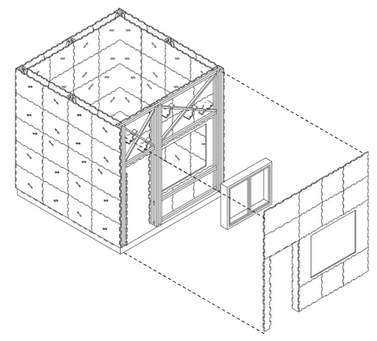
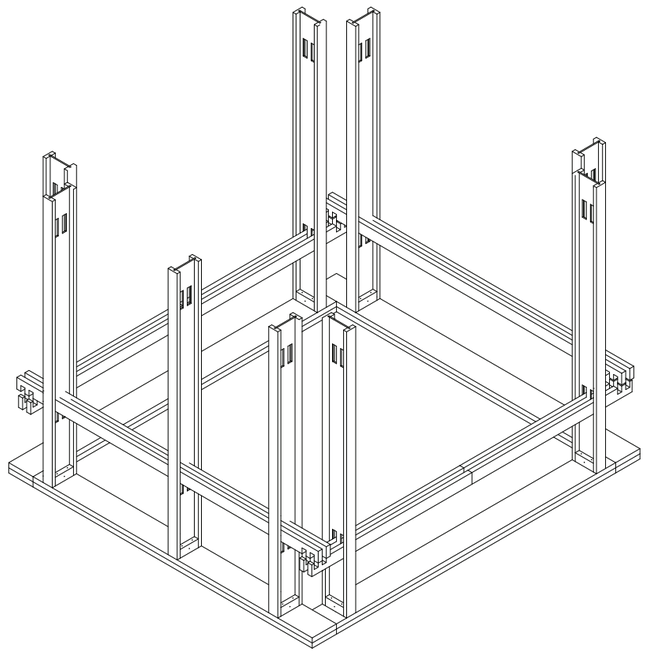
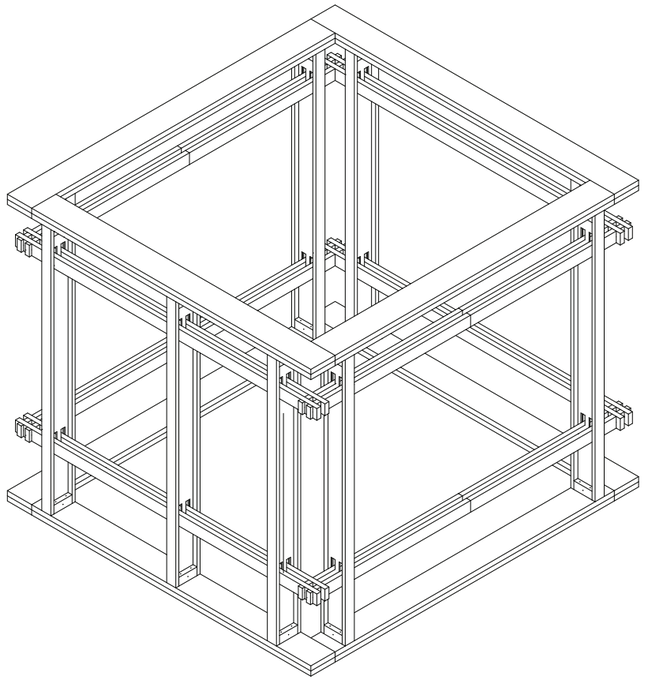
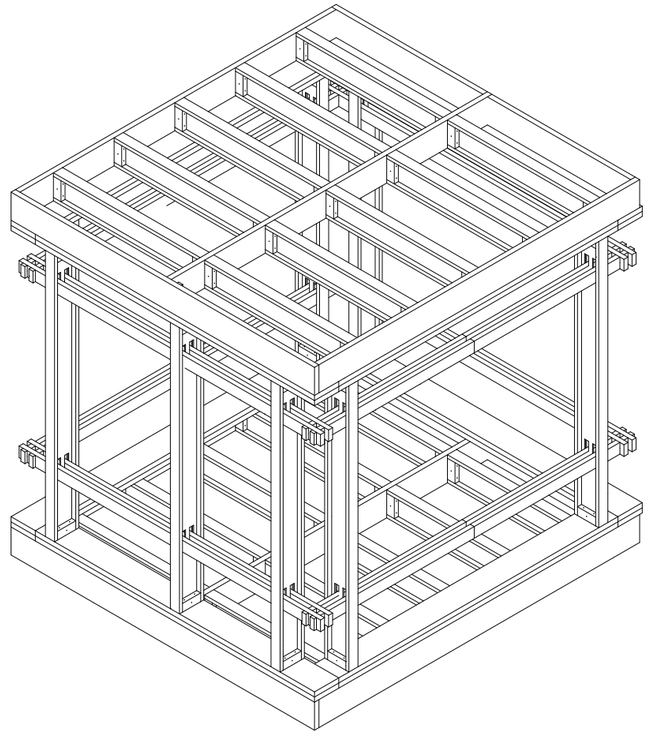
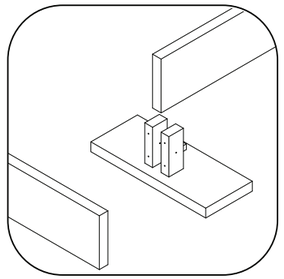


Figure 5.4 Iteration 3, Taking the X-frame structure and enclosing it with CNC-cut interlocking board panels, creating a precise, tool-light assembly with integrated rigidity.

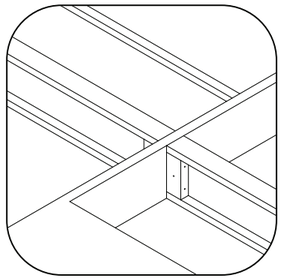




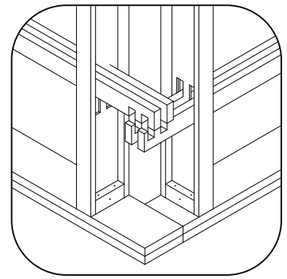




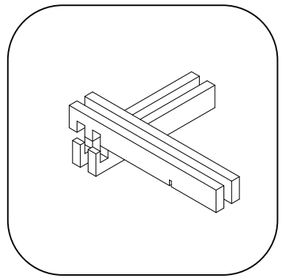
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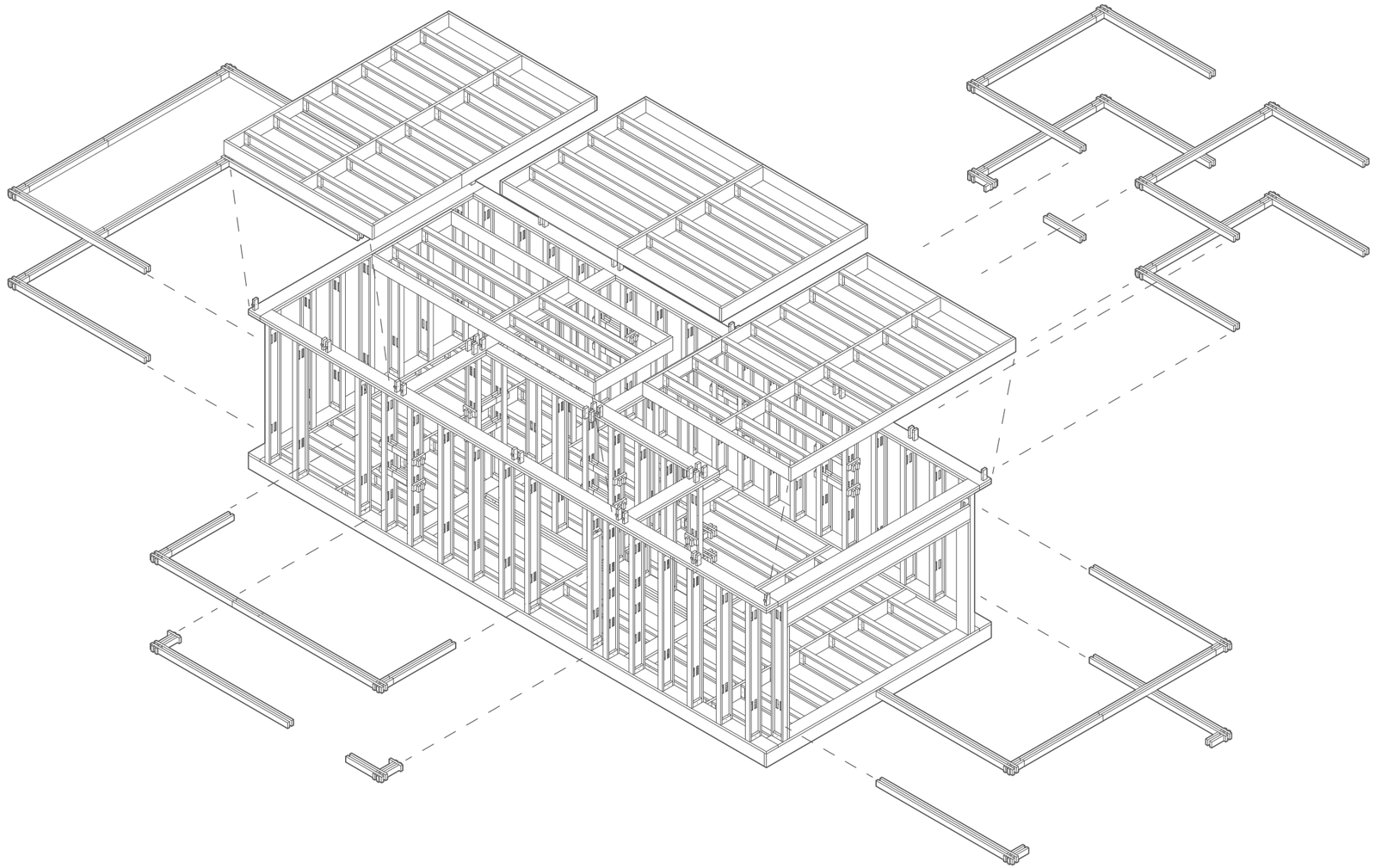
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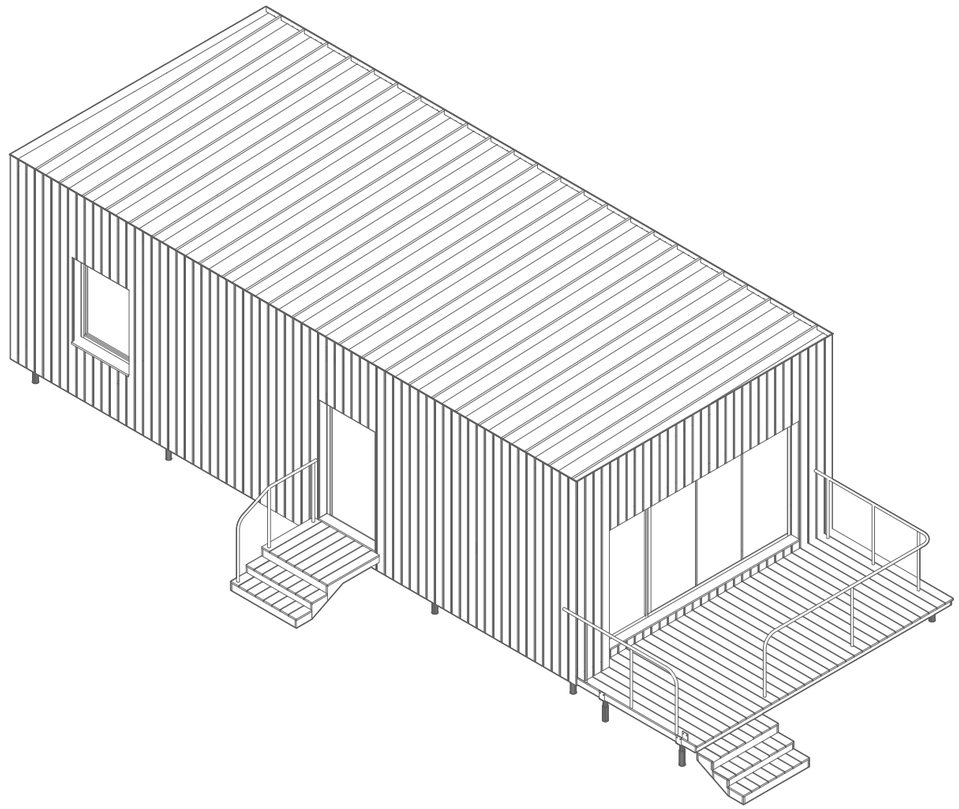
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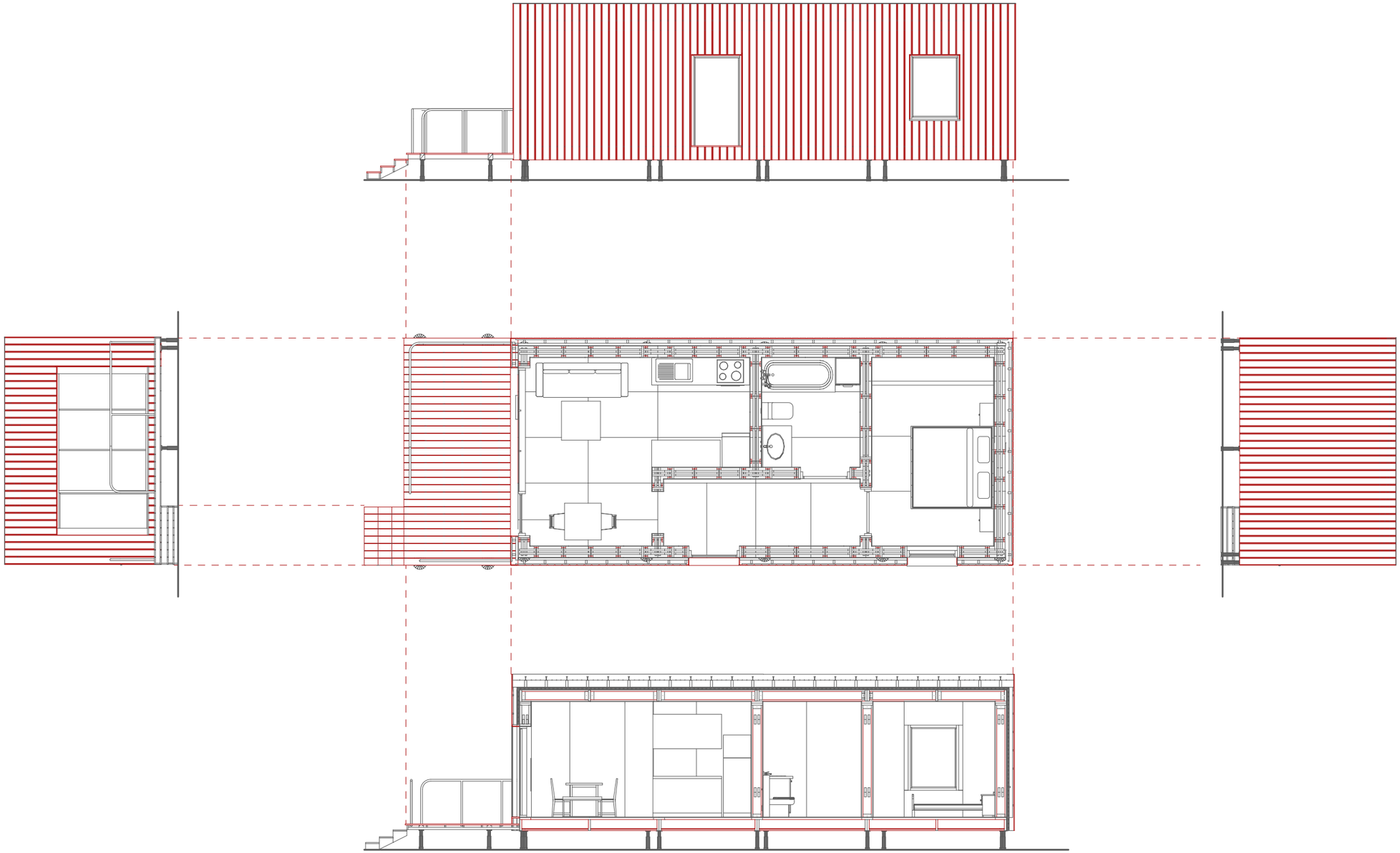
DETAIL 'D'



FINAL DESIGN ITERATION



PROTOTYPE UNIT



PROTOTYPE UNIT

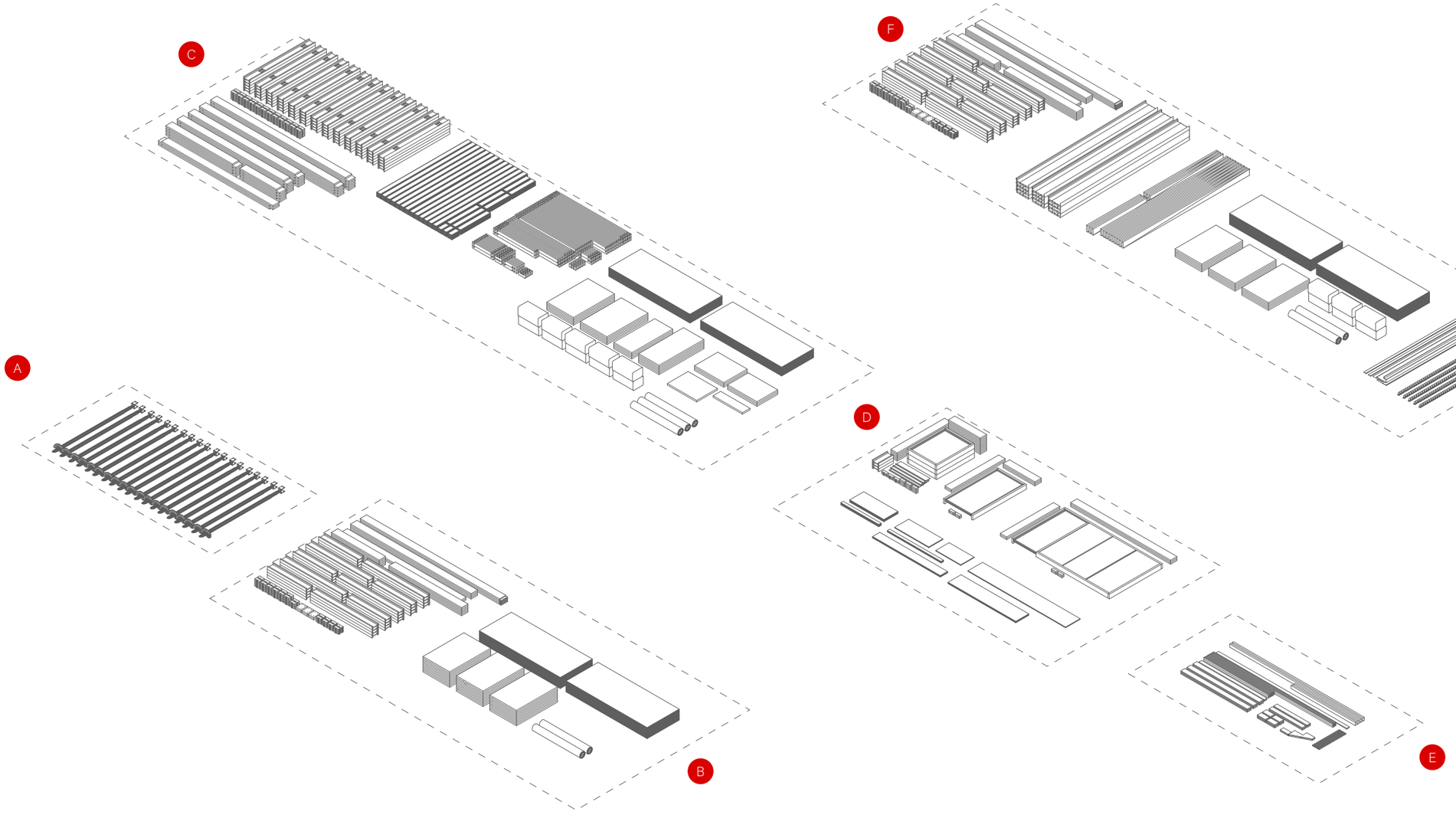
5.4 Kit of Parts: Material logics and assembly

At its core, this design operates through material intelligence. The system is built around a single repeatable module and its variations. A CNC-cut panel, derived from the standard sheet. This modular logic ensures minimal waste, predictable tolerances and ease of transport. This panelised system is supported by a structure of I-joists, forming a connected grid with integrated horizontal members. Mechanical fasteners with screws and wedges replace hard-to-replace nails. Enabling dry assembly and disassembly without skilled labour. The wall and floor assemblies include integrated insulation cavities and predesignated holes in the structure for running services. It is equipped with a clip-on cladding and weatherproofing based on rainscreen principles, creating an easily repairable, perfect wall enclosure. This design is not a blueprint for a singular house, but a grammar of parts. It is a set of components and spatial strategies that translates standardisation into flexibility.

Echoing precedents like Walter Segal's timber framing, the design resists permanent ground attachment. The structure is raised on adjustable legs, reducing site disturbance, accommodating terrain. This underscores the mobility and adaptability at the core of the proposal. Services are consolidated into a core unit, with pre-routed panels for plumbing, power, and ventilation. Openings for doors and windows are dimensioned to the grid and flexibly inserted within façade units. Each element is designed for human-scaled handling and installation using simple power tools like a drill. The frame is conceived as post and beam, with all infill demountable and replaceable. Services run in the wall cavities for ease of access. Rather than a permanent blueprint, the architecture offers a grammar of linkages. A kitchen can clip to a bath core, and two sleeping modules may share a deck or be separated by a breezeway. These spatial elements are assembled, service-prepped and expandable. Like the rest of the system, their strength lies in their ability to respond, not just to the evolving needs. But also, to the collective act of dwelling.

What distinguishes this system, then, is not only its technical efficiency but the underlying theory embedded within its material logic. Each component is designed to be handled, understood, and adapted by non-experts, making the act of assembly a participatory process rather than a delivery of a finished object. Building becomes a form of recovery. A way for displaced residents to regain agency, learn through doing, and collectively author their environments. The modularity and reversibility of the kit are not simple practical solutions, but expressions of a design philosophy that embraces change, contingency, and growth over time. In this way, the kit-of-parts extends beyond construction. It operates as a social and spatial framework that treats self-build not only as a method of housing production, but as a means of healing, empowerment, and long-term resilience.

Standard kit of parts



FOUNDATION

1. Screw Piles

FLOOR

1. Plywood
2. Insulation
3. WRP Roll
4. Floor TJI
5. LVL Beam
6. Sole Plate
7. Drop in Gypsum
8. TJI - LVL Connector
9. TJI - Sole Plate Connector
10. Screws

WALL

1. Plywood
2. Insulation
3. WRP Roll
4. Wall TJI
5. Top Plate
6. TJI - TJI Connector
7. TJI - Top Plate Connector
8. Pod Connector
9. Furring Strip
10. Wall Facade
11. Screws

DOOR + WINDOWS

1. Door Frame
2. Window Frame
3. Sill Plate
4. Header Plate
5. Trimmer
6. Packing Plates
7. TJI quarter Height

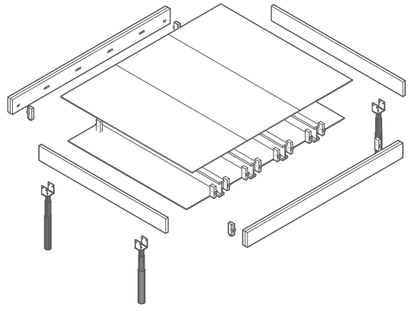
DECK + STAIRS

1. Deck Boards
2. Beams
3. Facsia Boards
4. Stringers and Treads
5. Handrail
6. Post

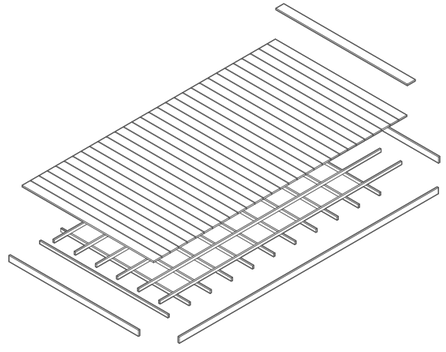
ROOF

1. Plywood
2. Insulation
3. WRP Roll
4. Roof TJI
5. LVL Beam
6. Top Plate
7. TJI - LVL Connector
8. TJI - Top Plate Connector
9. Sleepers
10. Clip
11. Gutter
12. Standing Seam Roofing Sheet

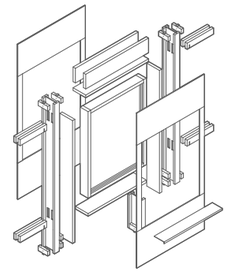
Syntax of Kit



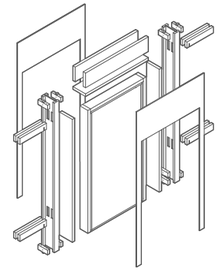
FLOOR ASSEMBLY



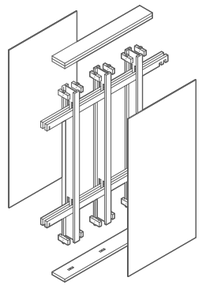
DECK ASSEMBLY



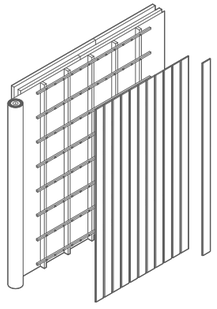
WINDOW ASSEMBLY



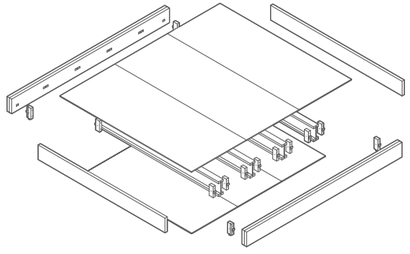
DOOR ASSEMBLY



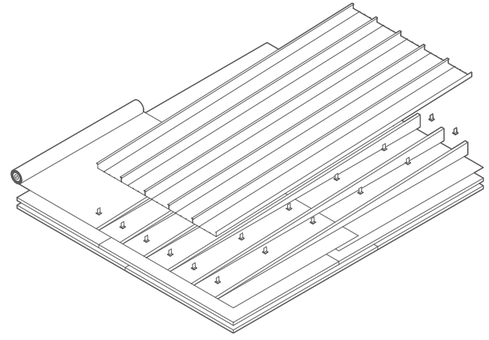
WALL ASSEMBLY



FACADE ASSEMBLY



CEILING ASSEMBLY

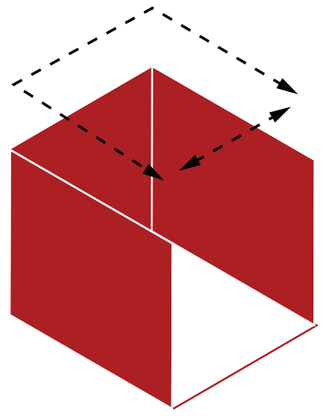


ROOF ASSEMBLY

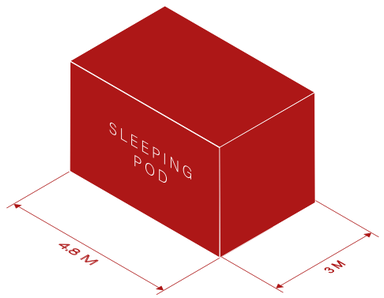
5.5 Programmatic Components

Beyond structural logic and panelized assemblies, the system's real flexibility emerges through its programmatic modules. In the form of pre-dimensioned units developed out of the proposed grid. To make components such as kitchen pods, bathroom cores, sleeping units, and storage bays. These are designed not to be prescriptive but rather as starting points for future reconfiguration. Each pod is organised with repeatable components. Allowing for each to dock, cluster or disperse across different sites and user preferences.

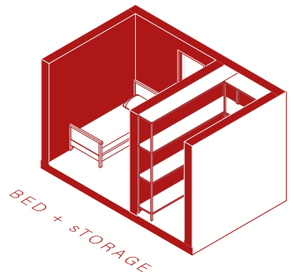
The critical design feature is that each pod is built with one open longitudinal face. A strategic void within the 3-quadrant wall system. This retains the structural stability while the pods are being connected and disconnected. Along with providing connection and continuity with the rest of the system. This open edge permits seamless addition or subtraction of units. Rather than treating a "unit" as a closed box, the pod operates as an open frame. Which can receive extensions, bridge other parts or dissolve into shared space. This allows the architecture to remain flexible by design. Not incomplete but receptive to user improvisation, accommodating incremental construction, and enabling diverse living arrangements.



Programmatic
componets

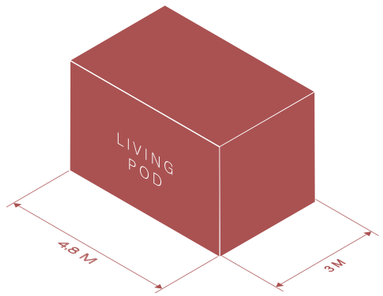




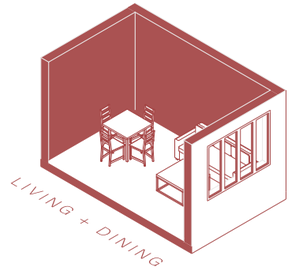


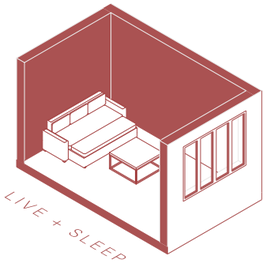


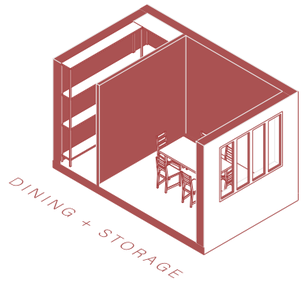


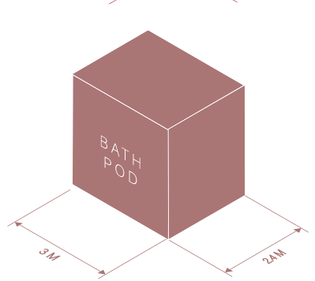


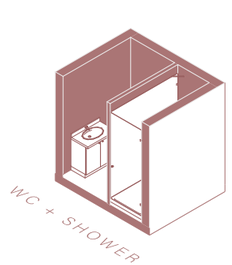


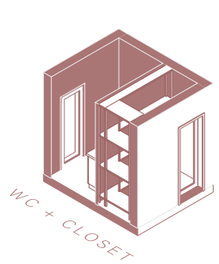


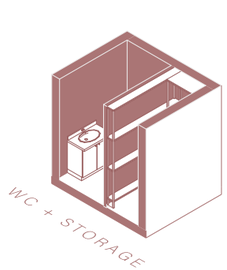




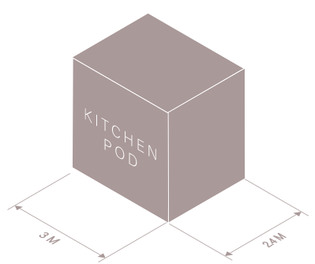


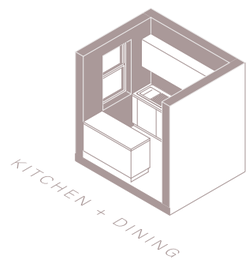


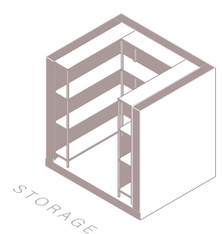


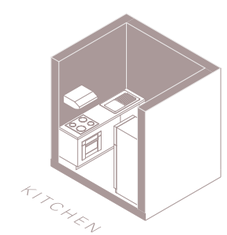












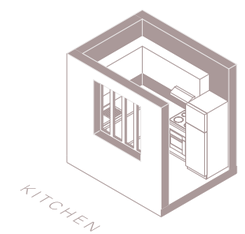


Figure 5.5 Programmatic Components showing 3 Quadrant Wall System with Pre-dimensioned pods, kitchens, bathrooms, sleeping units, and storage bays, built with an open longitudinal face within the 3-quadrant wall system. This open edge maintains stability while allowing pods to dock, bridge, or detach, enabling flexible layouts and user-driven reconfiguration.

5.6 Typological flexibility

In most disaster housing responses, typology is treated as a constrain into standard layouts that reduce life to a list of functions. But domestic needs are rarely standard. Family structures shift, spatial customs vary, and priorities like cooking together, privacy for elders, or space for children demand architectural flexibility. This proposal treats typology not as a finished plan, but as a scaffold for variation, customisation, and future transformation.

Each unit begins as a configuration of interoperable components. Sleeping pods, bath cores, storage walls, and communal decks, that can plug into a common spatial grid. The system accommodates one, two and three-bedroom variations for emergency deployment, but these aren't rigid templates. They are permutations within a broader architectural grammar.

Rooms can be resized, merged, or reoriented, a large living space might be made by combining one full pod with another. Or by connecting two sleeping zones with a central shared core. The placement of kitchens and bathrooms is intentionally flexible, on cultural norms or desired adjacencies. A bathroom can be positioned at the end of a dwelling for privacy, or closer to shared areas for access. The point is not to choose the "correct" arrangement, but to enable a spectrum of choices within one coherent system.

Spatial variation is also accommodated within the details of the framework. Along with that, Furniture is also not built-in, made with flexible kit parts and modular panels that operate like pegboards – removable and interchangeable. Shelving, storage, and work surfaces can be clipped, removed, or repositioned, allowing each room to be turned to the daily rhythms of its users. These are not generic boxes; instead, spaces to be inhabited, altered, and owned.

What distinguishes this system is how flexibility seeds the future of these dwelling units. These early configurations, however minimal, are not ends in themselves but beginnings. When residents move the pod to their original plot of land, the same logic of assembly allows new rooms to be added without a complete retrofit. A back wall becomes a new threshold. A bathroom pod is detached and connected to a larger frame. Sleeping modules extend literally or stack vertically. The grid can remain constant or be completely retrofitted, but ultimately, the entire dwelling evolves.

This flexibility is not a stylistic a form of agency. As Jeremy Till notes, contingency is not a flaw in architecture; it is its reality. Designing with contingency means accepting that buildings will change, and the users, not designers, must be able to author that change. Here, typological flexibility is the architectural manifestation of this belief. It empowers households not just to live, but to shape how they live, both now and in the future.

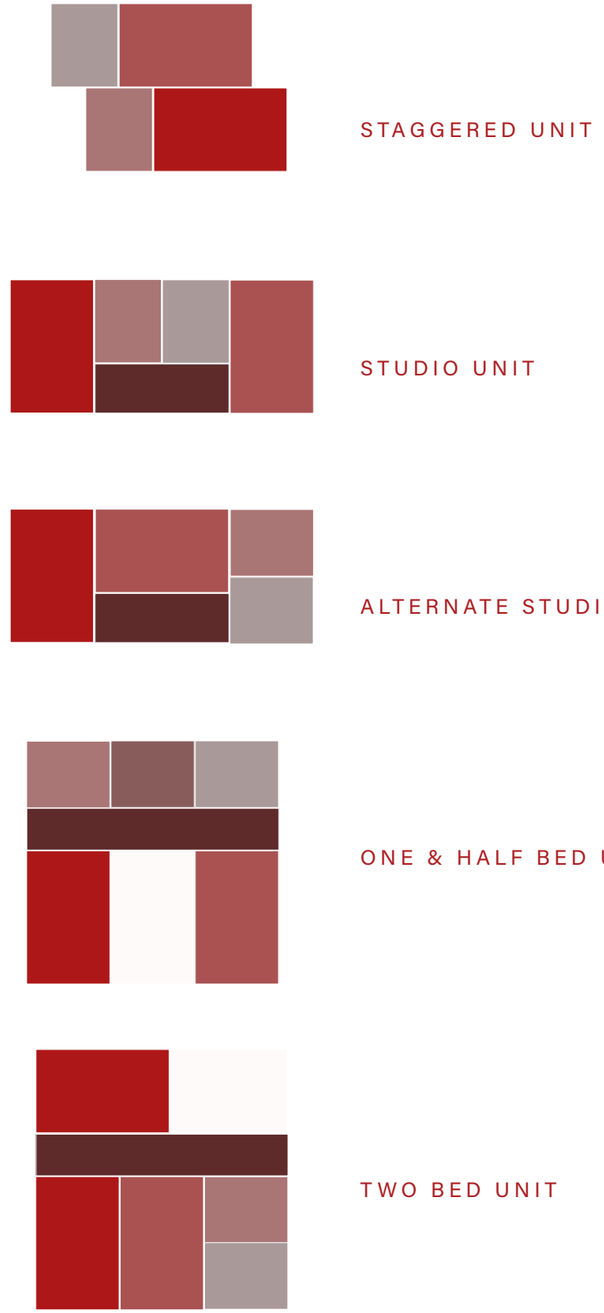


Figure 5.6 Typological Flexibility as shared grid supports interchangeable modules, kitchens, washrooms, living, and sleeping spaces, that can be reconfigured, resized, or expanded. This transforms typology from a fixed plan into a flexible framework for cultural variation, incremental growth, and resident-led adaptation.

Axonometric

Floor Plan

Typological Flexibility

U-System Diagram

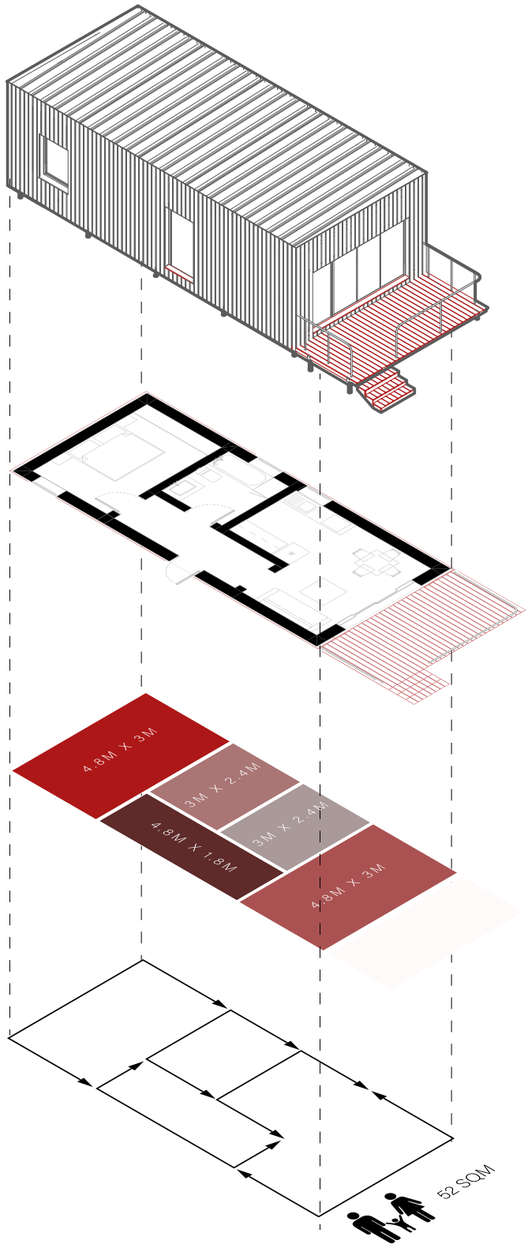


Figure 5.7 Studio Pod Type 1 Highlight in the pod flexibility arrangement and the U- system



Axonometric

Floor Plan

Typological Flexibility

U-System Diagram

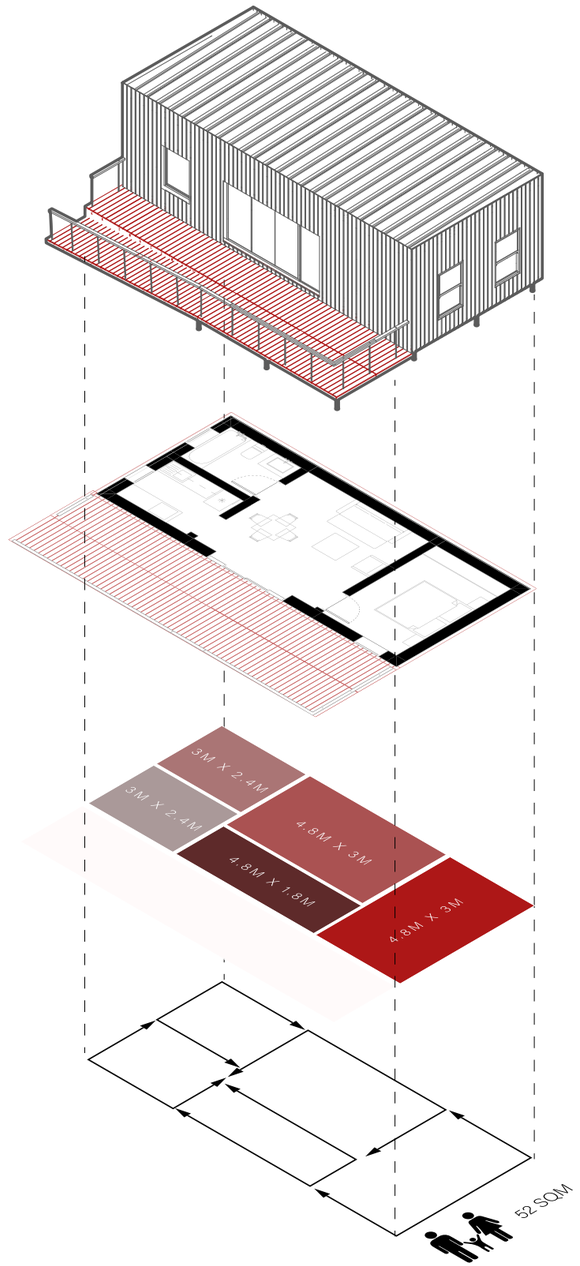


Figure 5.8 Studio Pod Type 2 Highlight in the pod flexibility arrangement and the U- system



Axonometric

Floor Plan

Typological Flexibility

U-System Diagram

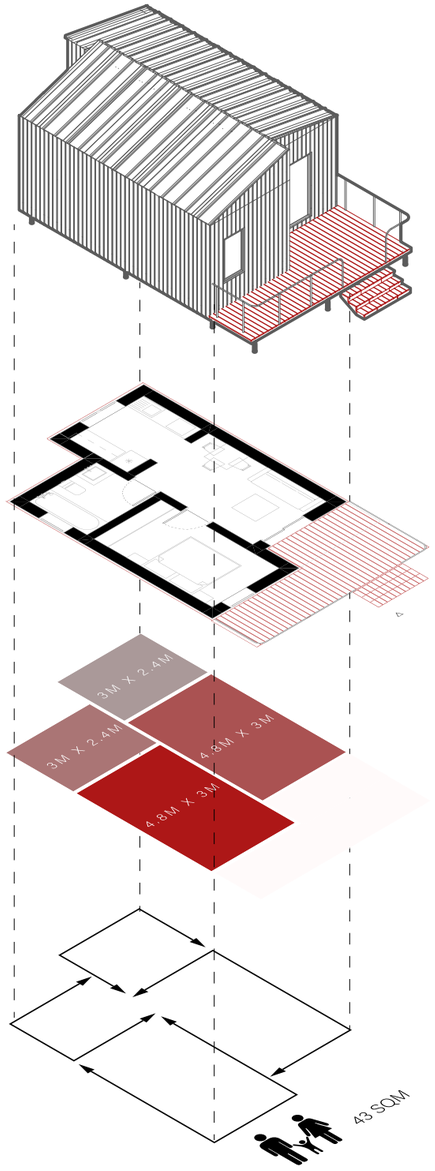


Figure 5.9 Studio Pod Type 3 Highlight in the pod flexibility arrangement and the U- system



Axonometric

Floor Plan

Typological Flexibility

U-System Diagram

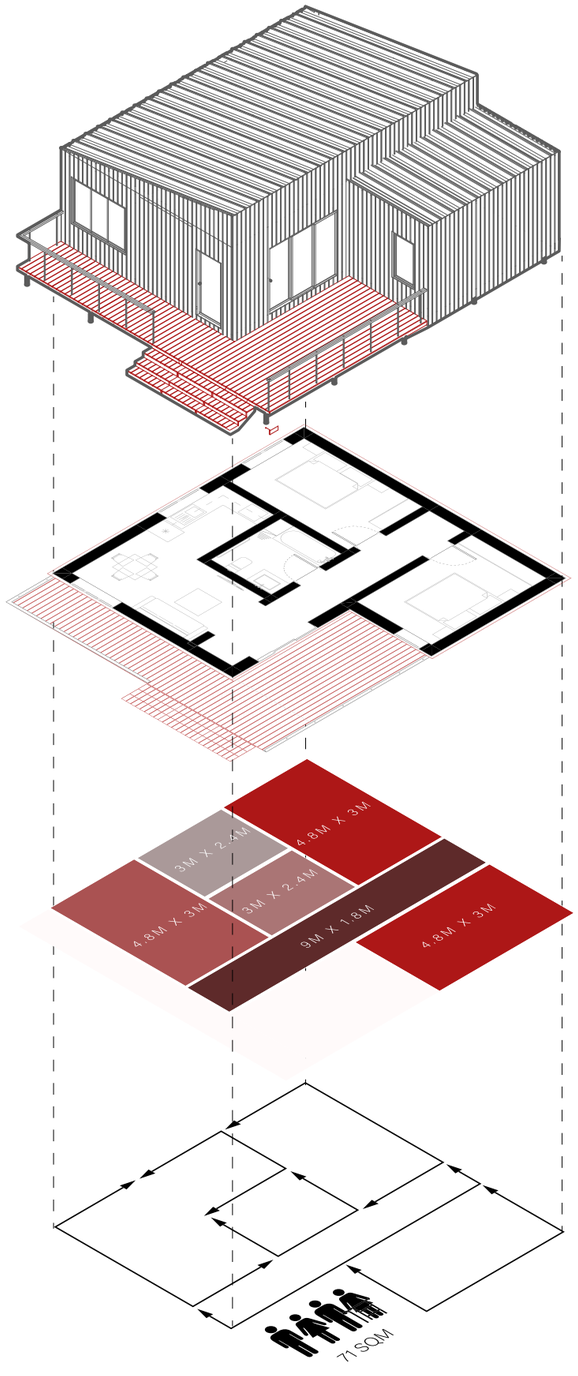


Figure 5.10 One and a Half Bedroom Pod Highlight in the pod flexibility arrangement and the U- system



Axonometric

Floor Plan

Typological Flexibility

U-System Diagram

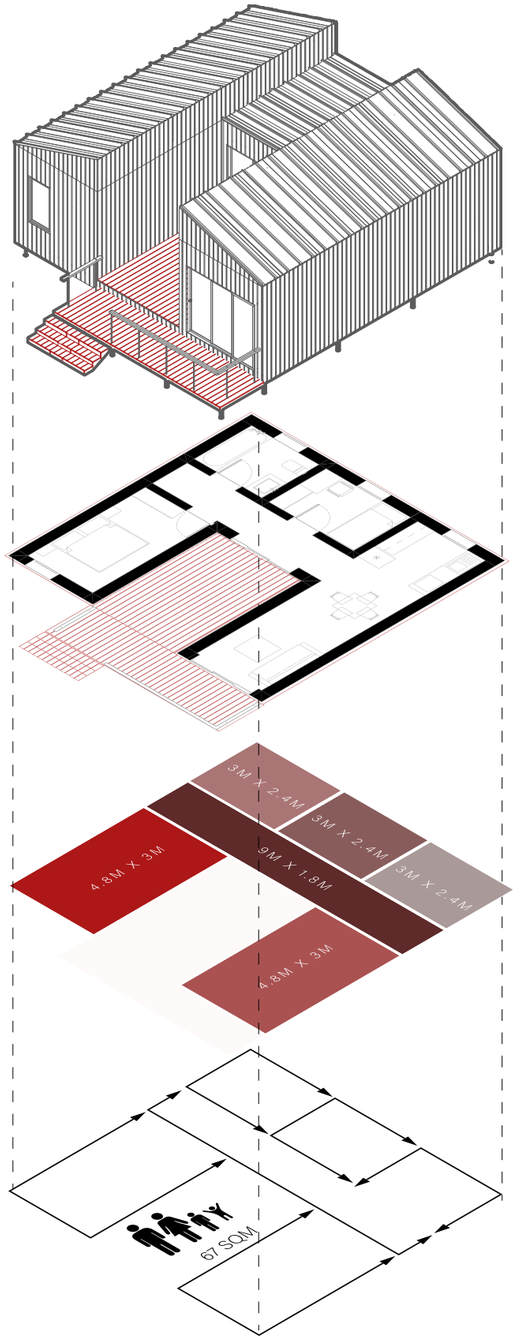


Figure 5.11 Two Bedroom Pod Highlight in the pod flexibility arrangement and the U- system



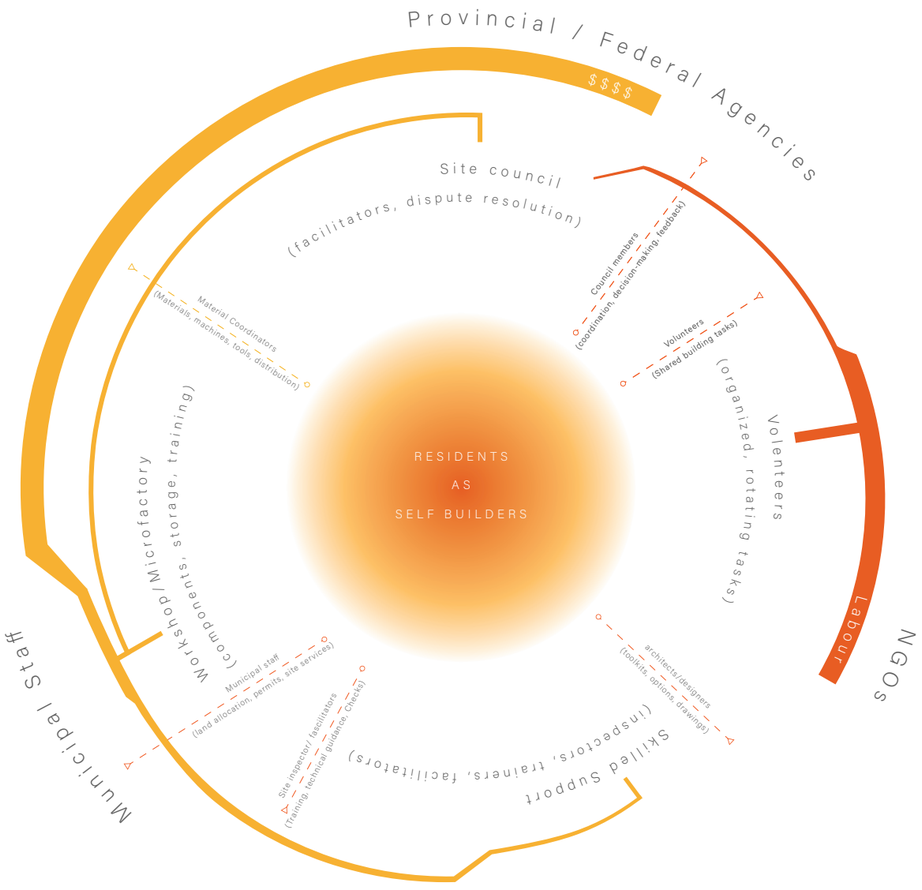
5.7 Governance for recovery

Post disaster recovery depends not just on materials, but on the frameworks that distribute authority, coordinate labor, and embed accountability. This governance model operates through a polycentric structure that integrates local agencies, NGOs, and grassroots organizations into a pre-established recovery network. These actors form a rotating site council that oversees logistics, land allocation, and communication. To ensure that decisions are transparent, needs-responsive, and culturally grounded.

To avoid dependence and delay, governance protocols are pre-negotiated as part of a "precovery" framework.[49] These include memorandums of understanding, training modules, and mutual aid agreements that can be activated rapidly. Each recovery site runs on a clear flexible governance charter, adapted to local context and shape dialogue with residents. This local level support is not to replace federal or provincial organizations like FEMA in US, Ministry of Emergency Management and Climate Readiness (EMCR) in B.C. or Alberta Emergency Management Agency (AEMA), but to supplement them. So, that the local responses are tailored and manpower along with local knowledge is mobilized.

The material systems are paid for and supported by the federal and provincial organizations. The response, towards the disaster recovery is coordinated across various material and labour flows. Connecting community supply chains, technical assistance and feedback loops. Dispute resolution, labour coordination, and safety standards are managed through site-level assemblies following the predetermined procedure. External actors help build capacity but do not dictate outcomes. Governance is designed to be procedurally practiced, yet adaptable. It creates space for self-organization, grounded in belief that when communities are given the tools and information to act, they will build more resilient futures.

49 Pacific Risk Management 'Ohana, ***Weaving a Path to "Precovery" in American Samoa***.



5.8 Pre-positioning for rebuilding

Assembly begins with a shift in how support is delivered. Rather than placing residents in prefabricated units or temporary shelters, the government distributes and funds these kit of parts housing systems directly to those affected. In disaster-prone regions, this system is pre-positioned and made accessible as part of the broader recovery infrastructure. When a home is destroyed and the household is insured, the payout is redirected to supplement or secure access to these kits. This ensures that financial and material resources arrive in tandem. Unlike standardized trailer housing, these kits are composed of flexible, prefabricated components. These components allow for variation, expansion, and adaptation over time. They are not imposed as finished solutions but offered as open frameworks for reassembly. Which are responsive to the needs and aspirations of each household. Assembly, then, is not just technical task but a spatial negotiation. A way for individuals and communities to reimagine home, using common tools to build in uncommon ways.

Though flat packing and CNC technology underpin the proposed system, enabling precise cutting of standardised joints and panels that can be fabricated in local on-site or surrounding workshops. In some cases, pre-cut components would be transported directly to the site. In others, on-site assembly sheds equipped with mobile CNC units could support localised production. These sheds are paired with open spaces for unloading, fabrication, and training, turning recovery into a visible and collective process. Once construction winds down, the sheds and adjacent yards do not disappear. They can be adapted into clinics, food hubs, or community kitchens while the open spaces transition into gardens or gathering spaces. In this way, the fabrication infrastructure itself becomes a part of the long-term social recovery, extending its role beyond construction into everyday resilience.

In many post-disaster scenarios, survivors with insurance payouts still struggle to secure stable house. The reasons are systemic: timelines rarely align, and families are often unsure if and when will they ever receive aid. After months of waiting, what many receive is only a temporary solution. They are offered trailer, structures with a ticking clock. These units must either be returned to federal or provincial agencies (Such as FEMA or its Canadian equivalents) or purchased or renter from the government. They were never intended to serve as permanent homes.

This proposal takes a different approach. Instead of providing stopgap shelters, the government supplies residents with a kit-of parts housing system. That allows them to begin rebuilding immediately. These kits are not reclaimed or loaned, they become the property of people assembling them. A portion of the cost may be covered through insurance payouts as explained above. But the act of construction, the time and labor invested by residents themselves, secures ownership. It affirms the home as theirs, not something to be taken back.

This shift addresses three chronic failures:

1. It speeds up recovery by enabling faster deployment,
2. Replaces dependency with participation, and
3. Ensures that insurance funds are translated into lasting, inhabitable structures not bureaucratic limbo.

The logic behind this model lies in rethinking prefabrication of disaster housing. Not as the production of entire homes, but as the production of adaptable components that can be stored, deployed, and assembled efficiently. One of the biggest constraints in post-disaster housing is time. In conventional prefabricated systems, production only begins after disaster strikes. This delays everything: first the unit has to be manufactured, then assembled and only then transported. Because fully prefabricated homes take up significant space, developers as well as agencies often lack the capacity to stockpile them in advance. That volume constraint becomes a bottleneck. Not only limiting how many units can be stored, but also slowing down response when disaster hits. By contrast, a component-based system drastically reduces storage volumes. Panels, connectors, and structural elements can be flat-packed and nested, making it possible to per-position far greater quantities within existing warehousing infrastructure. Along with this, because these components are being manufactured from CNC and machine tools, this further reduces the timelines. This approach transforms preparedness into action. Housing is not a distant promise but a material reality, staged and ready to be generated and assembled as soon as it is needed.

Building on this premise, the proposed model removes assembly time from the post-disaster equation altogether. Components are manufactured quickly and ahead of time, stored in compact, stackable form, deployed immediately when needed. The timeline is reorganised into three streamlined stages:

Production - rapidly done using CNC and completed before the disaster,

Deployment - rapid delivery of components to the site,

Assembly - carried out by or with the household, using guided instructions.

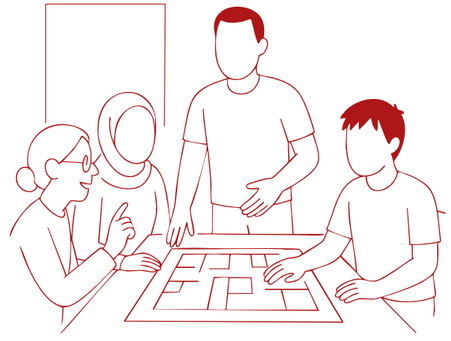
This shift means more homes can be delivered to more people in less time. It's a system built for scale and speed, without sacrificing adaptability or dignity. Storing components, rather than whole units, also opens up logistical possibilities. In future, distribution could be supported by existing warehouse networks, through partnerships with hardware chains like Home Depot, or through regional hubs that stock these kits as off-the-shelf recovery resources. Rather than being caught in reactive production cycles, this system embraces preparedness as infrastructure.



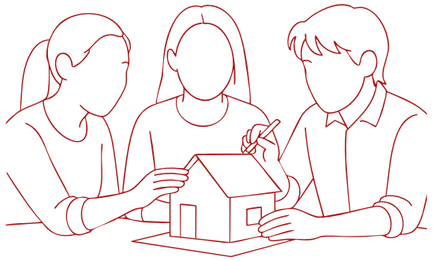
INFORMATION SESSION



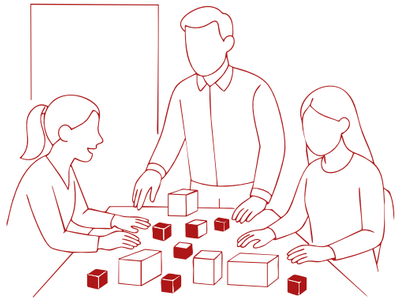
SIGNING OF PARTNERSHIP



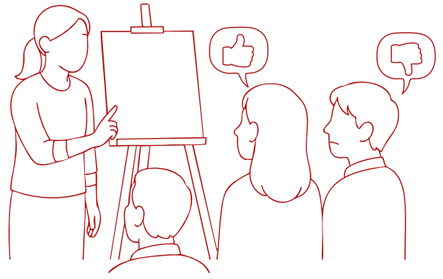
COMMUNITY CO-DESIGN SESSION



MODEL MAKING



DESIGN CHARRETTES



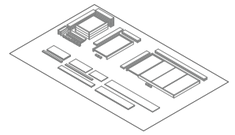
FEEDBACK SESSION

PRECOVERY

PRECOVERY

Users
Emergency Management Representative
Local Govt. Representative
Insurance Lenders
N.G.Os/ Volunteers
Architect, Designers
Local Construction workers
Local/ Regional workshops

Demand anticipated
Precovery Funding Release
Engagement & Community informed
Partnerships established between all stakeholders
Co-design performed
Documents prepared
Kit of parts refined and tested
Kits pre-printed and packaged
Essential materials kit pre-positioned



Disaster Strikes

IMMEDIATE RESPONSE

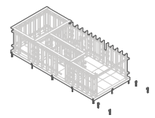
Firefighters
Emergency Medical services
Local Law Enforcement
Volunteer & Rescue teams
Municipal Emergency Management Staff
Federal Emergency response agency

Evacuation & Relocation
Debris Clearance begins
Temporary housing demand/ other needs
Funding Release

SITE SETUP & MOBILIZATION

Municipal Staff
Material Coordianator
Municipal Contractors
Local Workshop/ Regional Workshops

Temporary housing site selected
Pre-positioned kits mobilized
On-site workshops established if needed
Additional kits printed



RECOVERY

PARALLEL WORKFLOWS

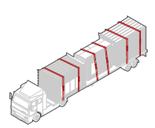
Municipal Contractors
Site Council
Community / Volunteers
Local Contractor/ Expert Volunteers
Site inspector/ Cordinator

Site services (electrical, water, sewer lines, roads)
Excavation and foundation works
Volunteer outreach, Task division
Off-site tutorial/ Meetings
Dispute resolution/ Assembly Coordination
Kit arrives on site
Structural systems assembled
Walls + partitions installed
Services integrated (electrical, plumbing)
Moisture barriers + insulation added
Doors, windows
Roof installed
Interior finishing + furnishing
Final Inspection
On-site tutorial
Regular Inspection

Typology is assembled

Users
Emergency response Agency

Partial Dissembly and transport to orignal lot
No Dissembly structure transported to orignal lot / sold
Complete Dissembly and transport to Storage (if sold by users)



POST RECOVERY

5.9 Assembly

Assembly has the potential to be more than just the construction of the shelter. To be sharing of knowledge, building of relationships and sharing a sense of place. It begins not with cranes or uniformed crews, but with training, collaboration and iterative learning. The housing system proposed here is designed for intuitive execution, using a flat-pack logic that prioritizes simplicity, adaptability and flexibility. Components arrive pre-cut, labelled, and bundled according to the stages of construction. But the real infrastructure is not in the kit, it is in the hands of those who assemble it.

The process opens with a site-based orientation: a training module that teaches residents to read diagrams, use basic tools, and understand the sequence of the build. These sessions are participatory, inviting everyone to share what they bring, beyond simply being told what to do. Residents are not reduced to labourers; they are trained to be builders. Once familiar with the system, households can choose between two paths. Either assembling their own home entirely or contributing by rotating through specific tasks - such as frame bolting, panel placement, insulation, or sealing, across multiple homes on site. This rotation reduces the need to master every trade, distributes labour fairly. Allows participants to learn through repetition and collaboration.

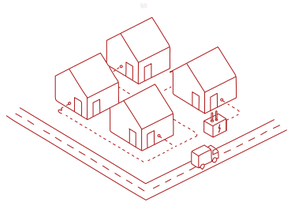
Inspections are embedded into the process. Construction professionals who are trained in specific trades, instead of building all the houses, will be the inspectors and teachers and in exchange, given equitable compensation for their services. They will circulate to verify technical components at key milestones. This creates a distributed quality assurance system without centralizing control. Tradespeople who already possess prior certification, or experience can directly begin work within their domain, enabling a multi-scalar labour network. Some learn by doing, some contribute by guiding.

In a few contexts, especially remote areas or post-disaster sites where transporting finished panels is inefficient, the systems allow for localised fabrication. Mobile CNC machines or low-tech jigs can be deployed on-site to mill components from standard ply and lumber. This turns the post-disaster housing site into a mini-factory, enabling real-time adaptation to site conditions, last-minute changes, or bespoke component needs. Here, fabrication and assembly bleed into one another, reducing delays and decentralising production.

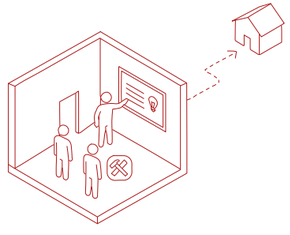
Construction flows sequentially: it begins with survey teams making out the grid using colour-coded templates, Structural frames are assembled horizontally, safe and accessible to new builders. Then raised and braced into place. Infill panels follow, then floor assemblies, façade components and finally utility cores. Visual guides with exploded axonometric diagrams, colour-coded steps, and pictorial instructions, replace language-heavy manuals, supporting accessibility across literacy levels.

Build time will have to calculated by constructing a full-scale prototype. Though an educated guess, based on case study says, that the core dwelling shell can typically completed within three to five days. Optional upgrades like solar panels, greywater tanks, or other cosmetic features can be added incrementally. The speed is not dictated by external contractors, but by the cadence of collective action. Some build fast, other slower, but all build together.

This participatory construction process becomes a form of situated learning. When tools, methods, and outcomes are shared and openly transmitted, building becomes a for of common knowledge. It is not hoarded but circulated. Residents leave the process not only with shelter, but with new capacities. A dwelling is not just something received, it is authored, negotiated and remembered.



SITE-LEVEL SERVICES



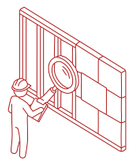
TEACHING WORKSHOPS (OFF-SITE)



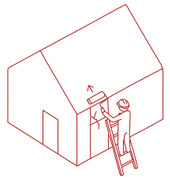
TEACHING WORKSHOPS (ON-SITE)



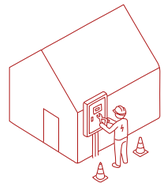
PROBLEM SOLVING



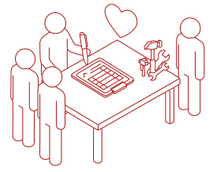
INSPECTION



MAINTAINING

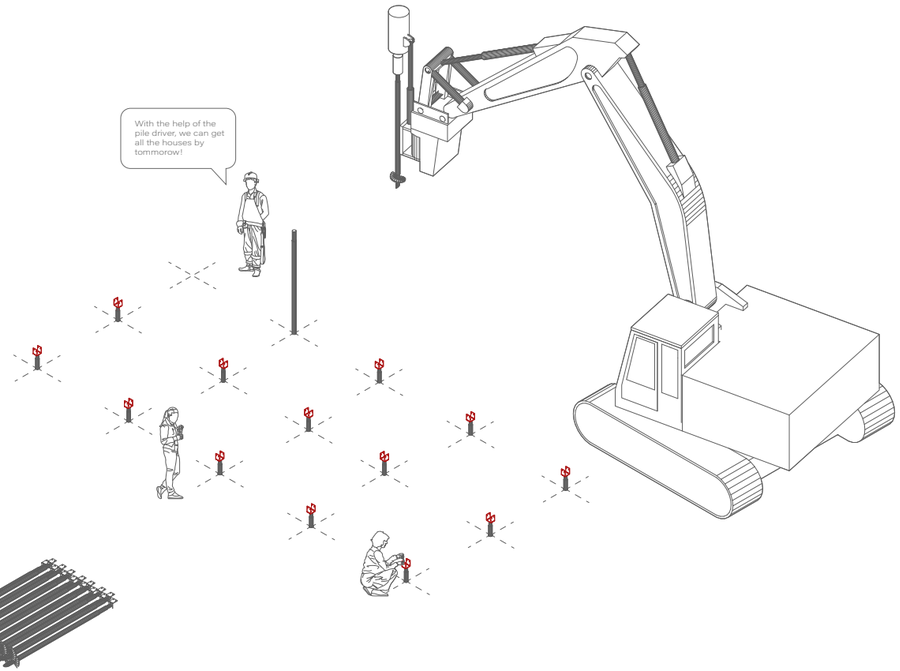


EXPERT WORK



VOLUNTEER WORK-SIGN UP

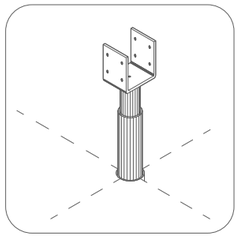
	PREPARATION	STRUCTURE + WALLS	SERVICES	ENVELOPE	FURNISHINGS	FUTURE ADAPTATIONS
TIME	2 Days	1 Week	2 Days	1 Week	2 Days	1 Year later
USERS	How much space do I need? My family size is.... / I will need help, who can I reach out to?	Pre-cut members, what a life saver!	Might need an experts help.....	Whats the right way to put the waterproofing? Lets ask for guidance.	Finally a place to call home. Even if for just a while.	Back home! Now we can grow in our own piece of land!!
	Choose your house from options.	Place ledger	Assemble wet wall	Install windows/ doors	Light fixtures	Disassembly Reassembly
	Drill Screw piles	Assemble floor	Connect plumbing	Waterproof + External insulation	Move in furniture	Incremental increase
	Recieve Kit of parts	Put TJI & sheath walls	Wire electrical	Install roof sheet over sleepers	Move in appliance	
		Put Beams & sheath ceiling	screw wood covers			
FRONTSTAGE	2 Days	2 - 4 people	2 people	2 - 4 people	2 people	2 people
	Provide advice	Inspector/ supervisor	Service contractor	Inspector/ supervisor		Truck flat bed
	Prepare documents	Observing work		Guidance/ Help		
	Set up delivery of kit	Training				
BACKSTAGE	Material sourcing	Training Manuals				
	CNC fabrication					

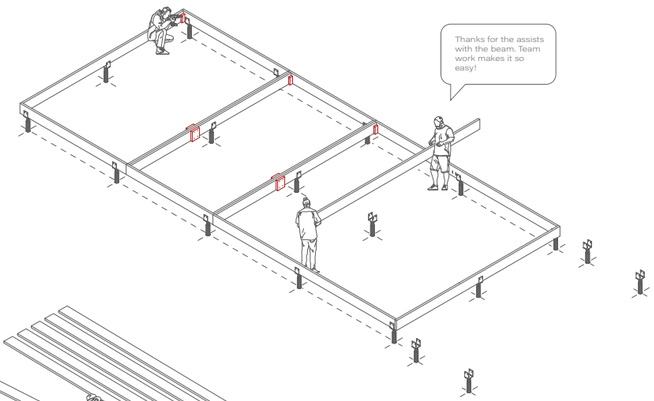


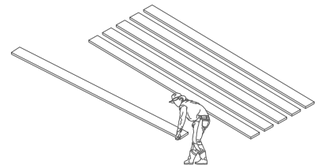
BUILD FOUNDATION

Notes:

Ground screw piles to be installed with saddle-brackets, maintaining a vertical tolerance of ± 2mm.
Minimum depth to be determined by engineer based on frost line, geotechnical conditions and structural load requirements.



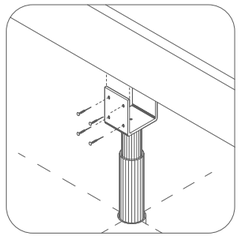


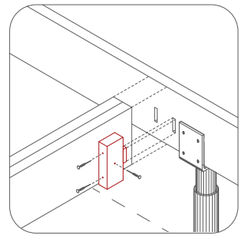


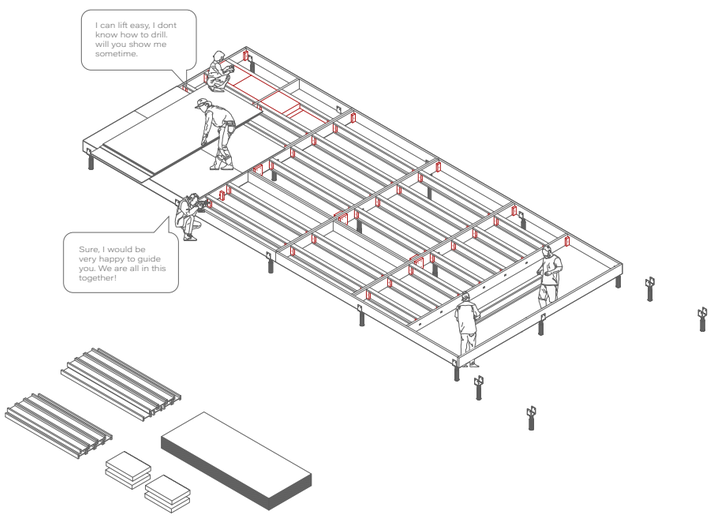
PLACE LEDGER BEAMS

Notes:

Timber LVL ledger beams lapped and jointed at corners. Size here is 250mm by 44mm (1 3/4"), should be based as per structural engineer.
Check LVL ledger is installed accuratelty and with precise level within 2mm tolerance, vertically over the U saddle.



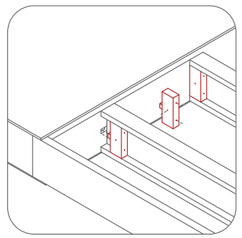


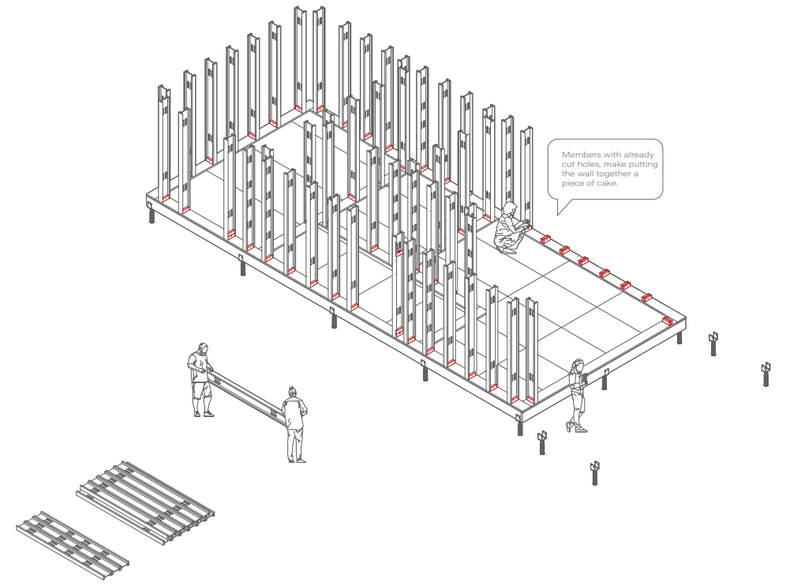


FLOOR ASSEMBLY

Notes:

Connect TJI floor joists to LVL beams using CNC-cut LVL connectors, fixed with screws; two connectors per joist. Tie secondary beams to primary beams with the same connectors. At pod edges, double LVL beams joined with square plates screwed into both members to allow later disassembly. Drop in gypsum panels over aluminium soffit panels for crawl space protection. Screw floor sheathing flat on completed structure.

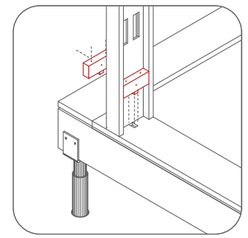


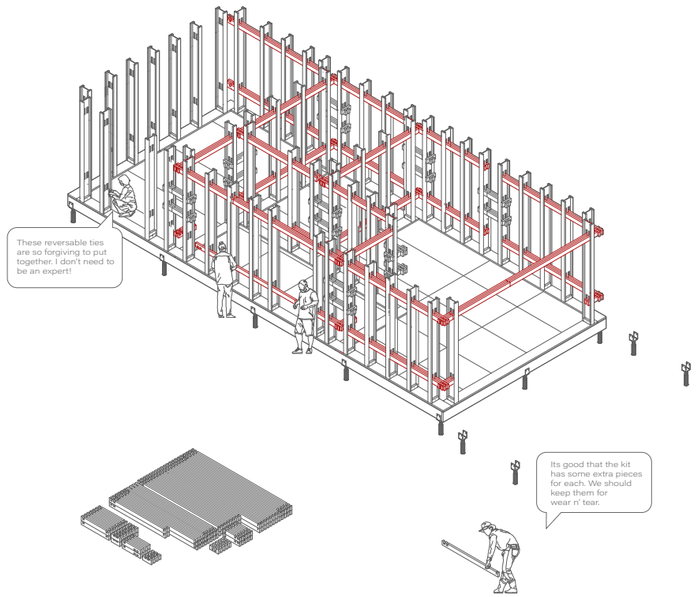


STUDS

Notes:

Install TJI studs onto LVL sole plate using CNC-cut LVL connectors. Fix connectors to both members with screws; two connectors per stud. Slot connectors into precut openings in sole plate to achieve friction fit and secure alignment.

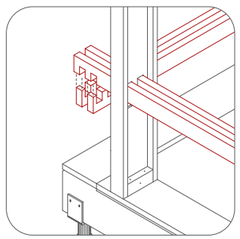


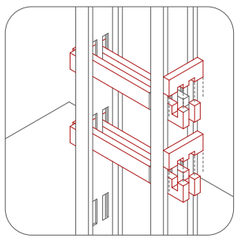


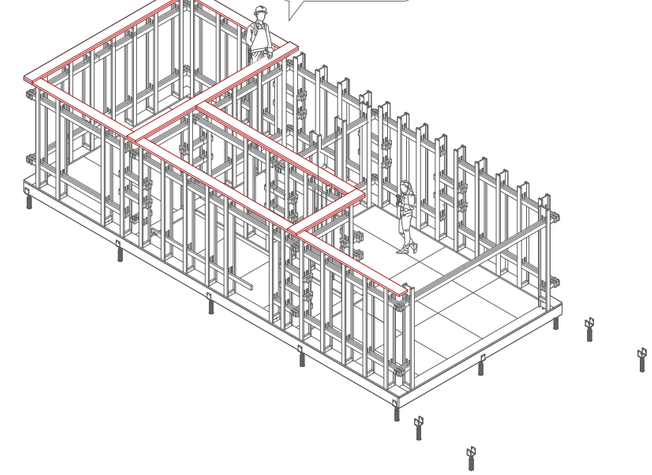
INSERT REVERSABLE TIES

Notes:

Insert long reversible ties into pre-cut holes in TJI wall studs to act as nogging and provide structural bracing. At pod connection points, install smaller reversible ties to allow later disassembly or incremental expansion of the structure.



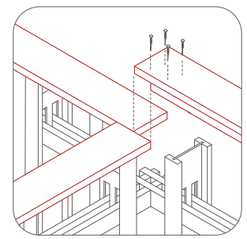


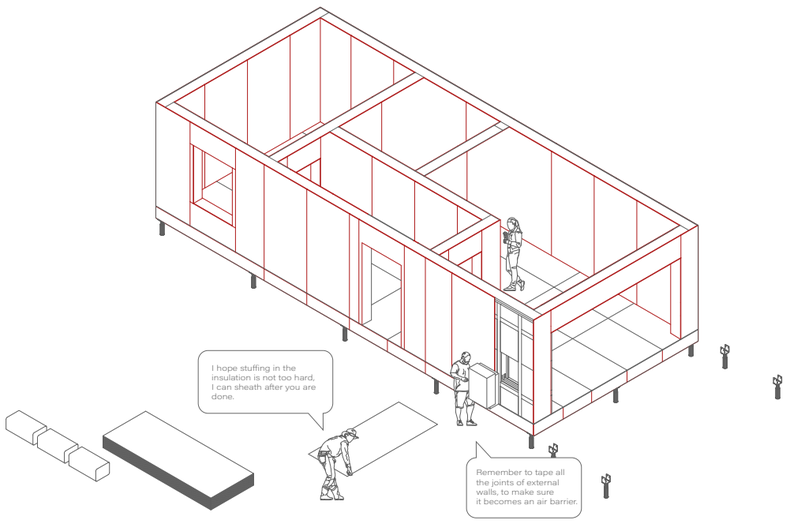


TOP PLATE

Notes:

Install LVL top plates over TJI studs using CNC-cut LVL connectors, fixed with screws to both members, as with sole plate assembly. Form double top plate by lapping connections to provide continuity and stability. Secure lapped joints with structural screws to ensure rigidity and load transfer.

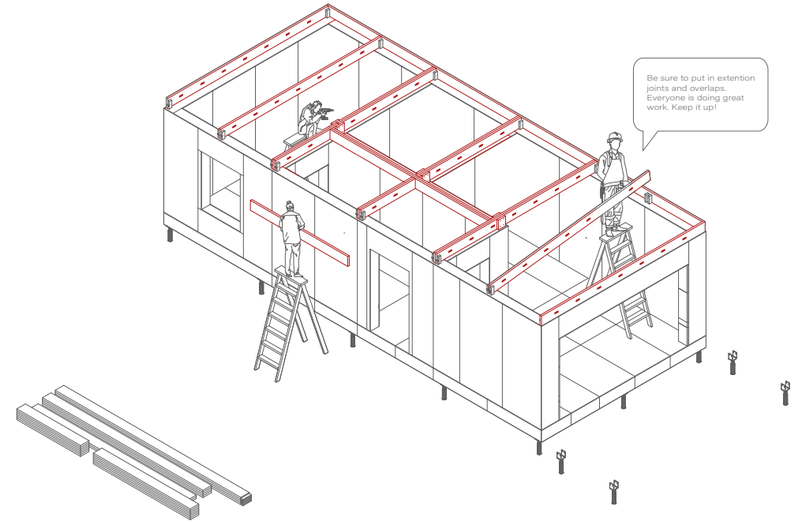




SHEATHING WALLS

Notes:

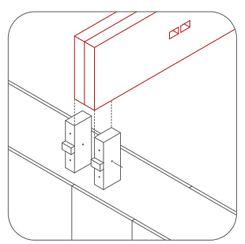
Fix external and internal sheathing panels to TJI wall studs with appropriate fasteners, ensuring tight joints. Tape external sheathing joints to create a continuous air barrier. Install internal insulation batts between studs, fitted flush without gaps. Use mineral wool or glass wool batts as specified.

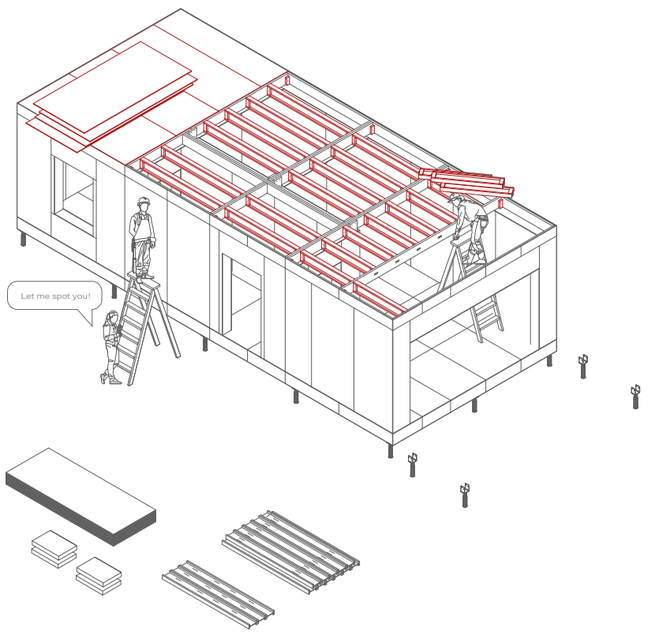


BEAMS OVER TOP PLATES

Notes:

Drop primary LVL beams onto double top plate and connect using CNC-cut LVL connectors, fixed with screws as per stud assembly. At internal pod edges, use double LVL beams joined with square plates screwed into both members to allow later disassembly.

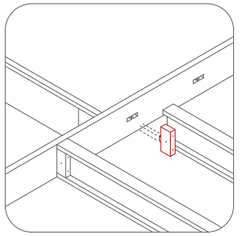


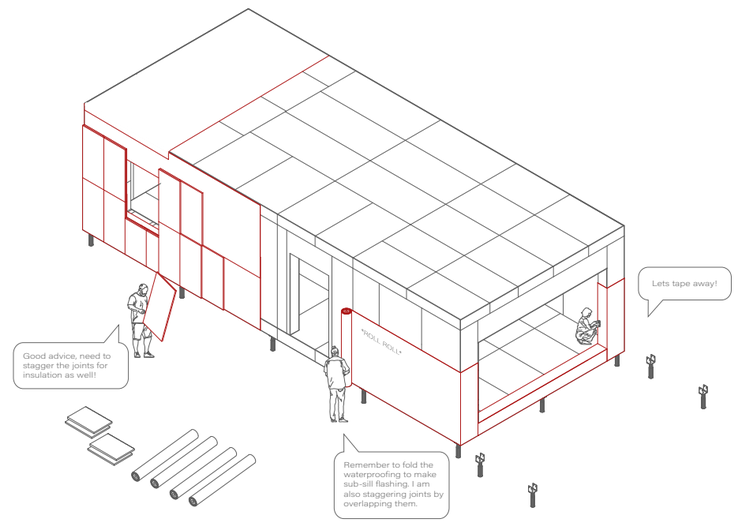


CEILING

Notes:

Connect TJI ceiling joists to LVL beams using CNC-cut LVL connectors, fixed with screws; two connectors per joist. Tie secondary beams to primary beams with the same connectors. Install mineral wool or glass wool insulation in batt form between joists. Lay ceiling sheathing flat over the completed structure.

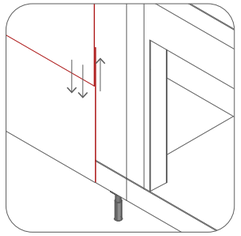


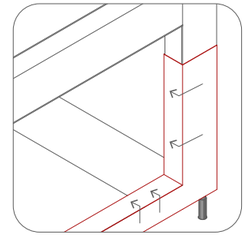


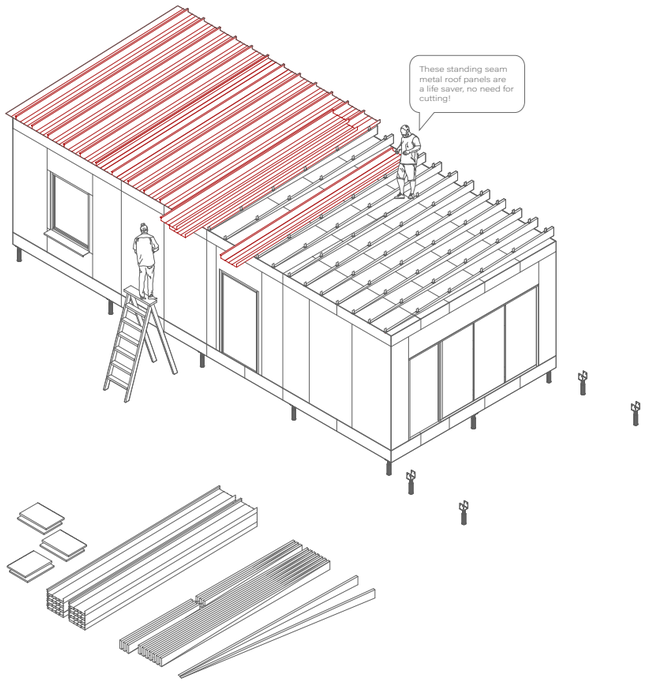
WATERPROOFING AND INSULATION

Notes:

Apply roll waterproofing membrane over roof sheathing and lap joints for continuity. Lap membrane across pod edge lines visible at roof sheathing edges. Seal all joints with waterproofing tape. Fix external insulation panels over sheathing; stagger panel joints for thermal performance. Use mineral wool rigid insulation (as in Jasper) or foil-faced polyiso insulation (as in Florida), as per project requirements.



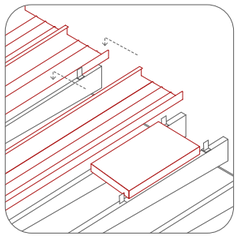


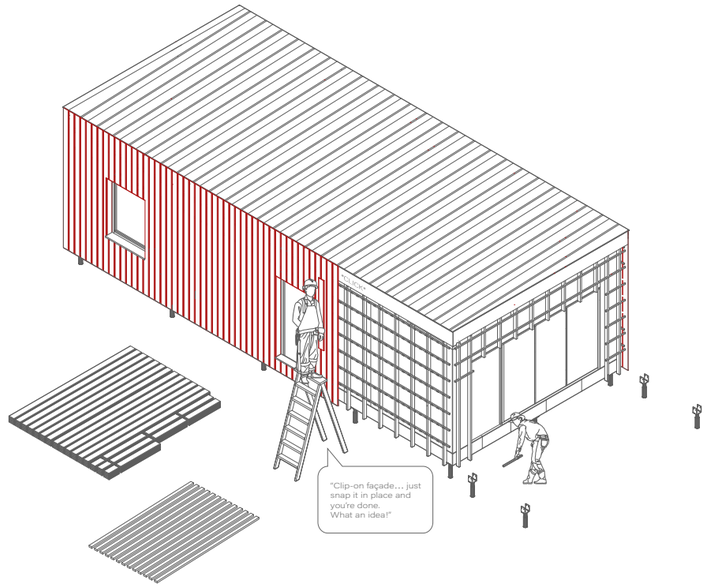


ROOFING

Notes:

Fix sleepers over roof structure to create required single-pitch slope. Install continuous rigid roof insulation panels over sleepers. Apply sealant to the roofing sheet seams. Clip standing seam roofing sheets, pre-cut to size, onto sleepers using insulated-base clips to prevent thermal bridging. Install gutters along the lower roof edge to collect runoff from the single-pitch slope.

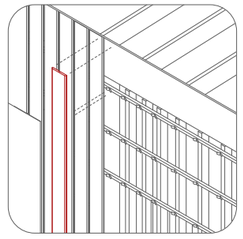


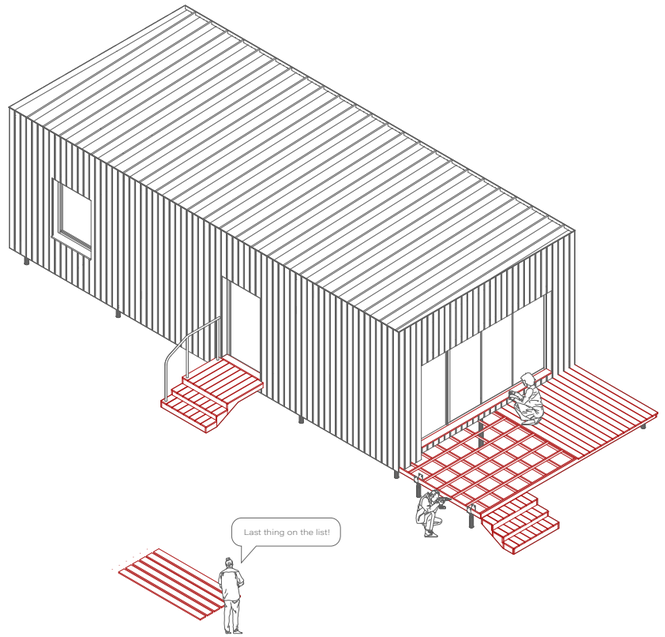


FACADE

Notes:

Fix vertical furring strips to wall studs at 600 mm c/c using long screws. Install horizontal furring strips with click-on system clips to create drainage cavity and enable reversible façade assembly. Click façade panels onto horizontal strips. For Jasper, use fiber cement panels with engineered grooves for click-on system and fire resistance. For Florida, can use timber façade panels.

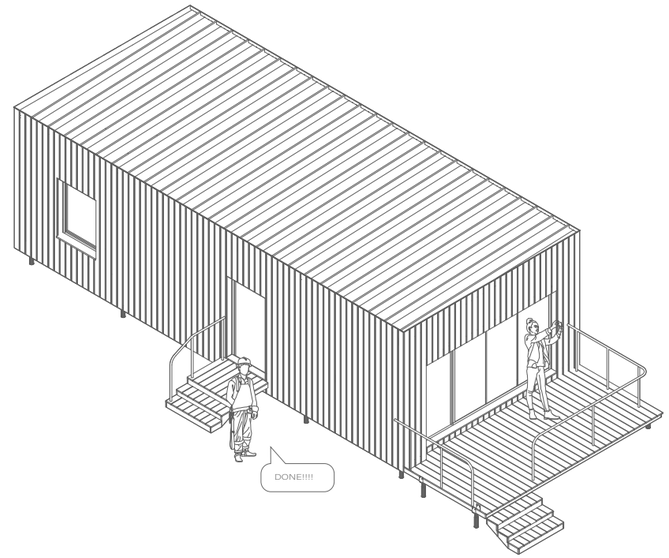




DECKING

Notes:

Lay decking boards over joists with uniform spacing and fix using corrosion-resistant screws or concealed fasteners. Install railing posts securely to structural framing, then attach handrails and balusters as specified. Ensure all connections are plumb, level.



COMPLETE

Notes:

All assemblies completed with structure, insulation, sheathing, façade, roofing, decking, and railings installed as specified. Final verification by site inspector is required prior to occupancy, with attention to overall connections, weatherproofing, and safety.

5.10 Comparative Implementation: Port Charlotte vs. Jasper

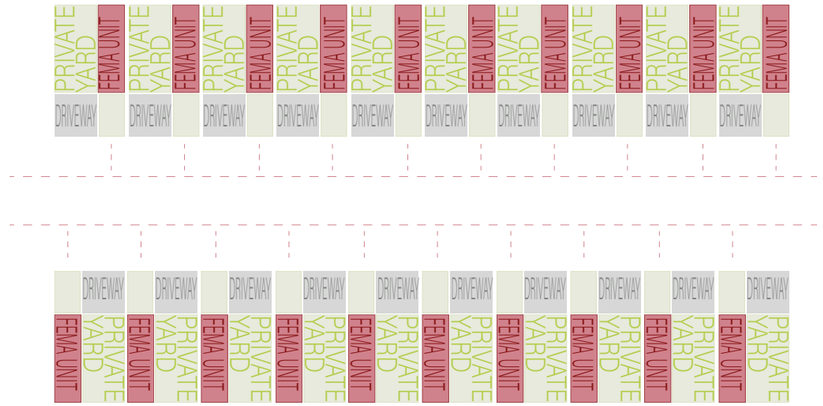
Post-disaster housing is often understood at the scale of the unit, but its success depends equally on how those units meet the ground, orient to climate, and relate to one another. Where FEMA trailers and Canada's Rapid Housing Initiative often default to repetition, in the form of long rows of uniform boxes, arranged in lines. This proposal reimagines site planning as an opportunity to foster community, mitigate climate, and support recovery as a social and spatial process.

The system is tested through two contrasting site conditions: post-hurricane Port Charlotte, Florida and post-wildfire Jasper, Alberta. In both, the same kit-of-parts was deployed, but the spatial configurations and environmental responses are adapted to the specific context.

In Port Charlotte, housing is raised above ground on adjustable piers to manage flood risk and support airflow beneath the structure. Roofs extend to shade decks. Units are clustered around open-air courtyards, with communal decks forming shaded microclimates between dwellings. The emphasis here is on cross-ventilation, shared outdoor life, and modular porosity, each cluster scaled to allow privacy without isolation.

In Jasper, where temperatures drop below -30°C in winter, site planning focuses on heat retention and snow management. Homes are compactly grouped to minimise heat loss and to allow shared snow-cleared paths. Vestibules serve as thermal buffers, and south-facing windows maximise passive solar gain. Windbreaks (like tool sheds or tree clusters) are arranged to protect entries from exposure. Here, site planning becomes a device of thermal resilience, adapting the same kit to vastly different environmental demands.

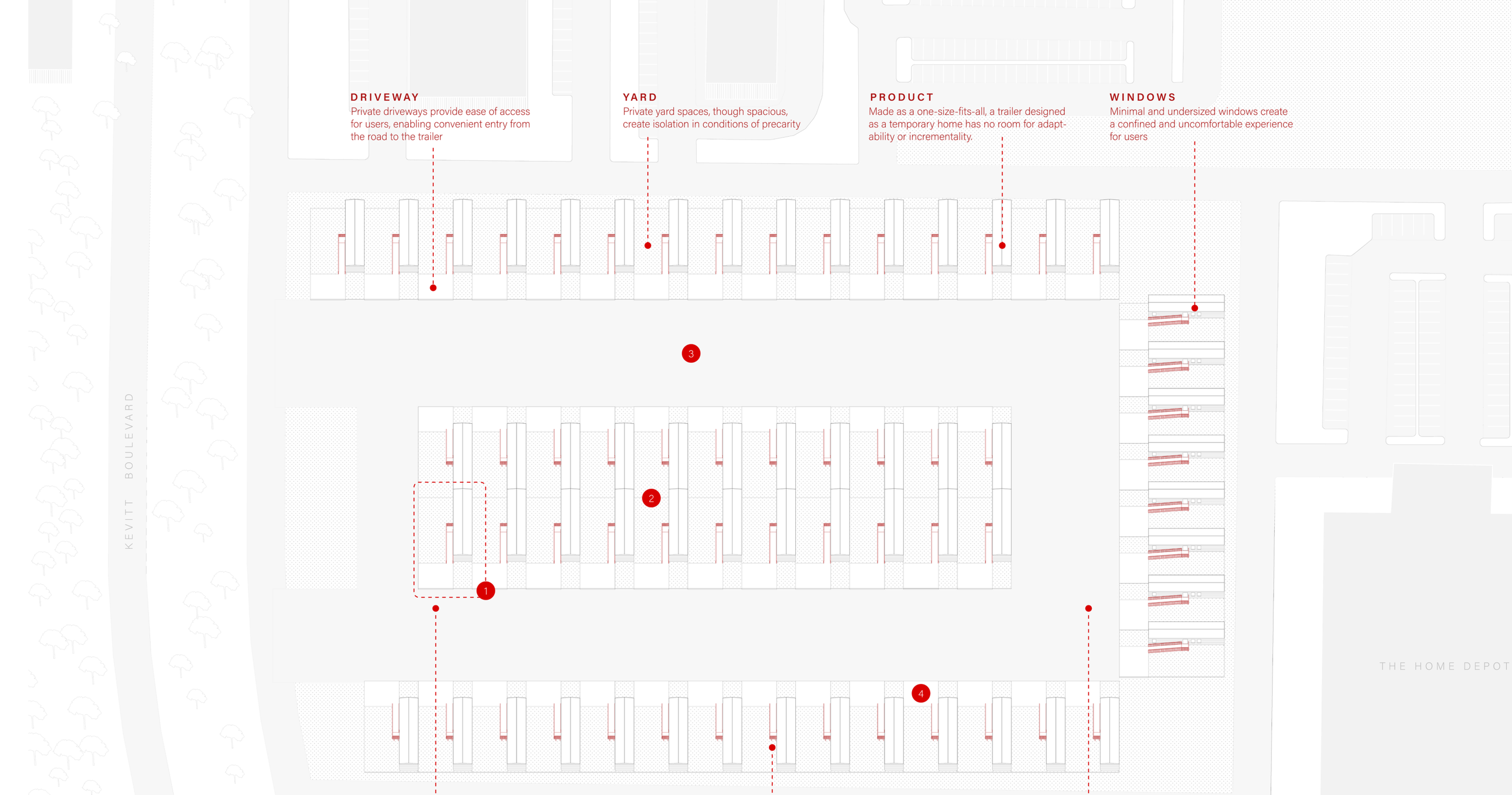
Across both cases, the layout logic moves away from strict linear repetition and toward clustered typologies. Single-occupancy homes are grouped toward one edge of the site for ease and independence. Larger households are placed around shared open spaces, forming loose collectives with overlapping programs like play areas, gardens. These clusters are not decorative; they offer spatial cues for mutual support, enabling households to cook, build, and recover together.



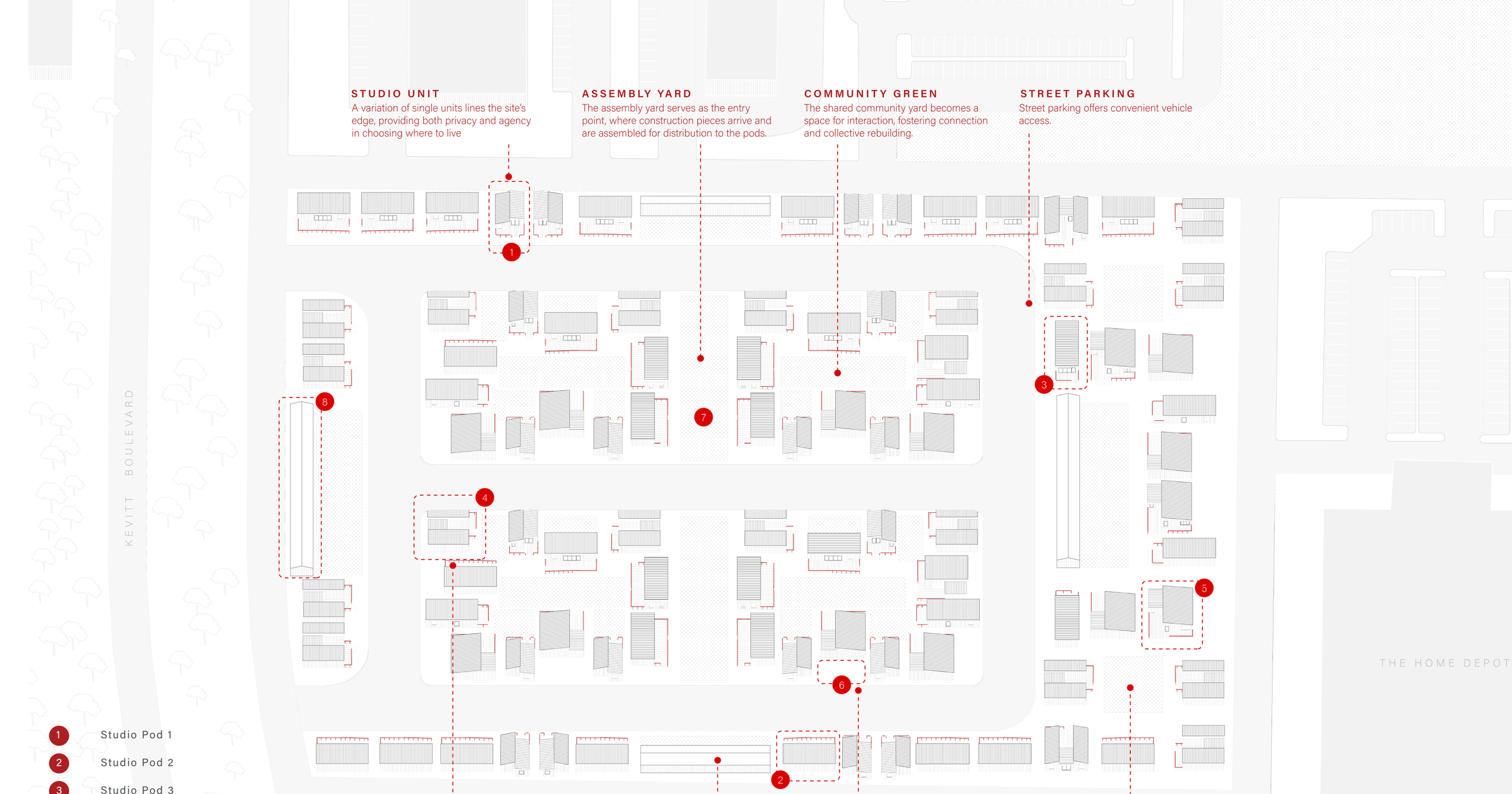
CONVENTIONAL ORGANISATION



PROPOSED ORGANISATION



1 Fema Trailer
2 Yard
3 Road
4 Driveway



STUDIO UNIT
A variation of single units lines the site's edge, providing both privacy and agency in choosing where to live

ASSEMBLY YARD
The assembly yard serves as the entry point, where construction pieces arrive and are assembled for distribution to the pods.

COMMUNITY GREEN
The shared community yard becomes a space for interaction, fostering connection and collective rebuilding.

STREET PARKING
Street parking offers convenient vehicle access.

1. Studio Pod 1
2. Studio Pod 2
3. Studio Pod 3
4. 1.5 Bed Pod
5. 2 Bed Pod
6. Incremental Space
7. Assembly Yard
8. Community Block

FAMILY UNIT
Family units are arranged in a courtyard layout, creating a village-like setting that offers normalcy and helps families cope together

COMMUNITY SPACE
Initially serving as storage for the pod kit during rebuilding, the space is later repurposed as a community space with shared services.

INCREMENTAL SPACE
Space for expansion allows pods to grow with users who remain longer than planned.

SHARED YARD
The shared yard becomes a space for interaction, fostering connection and collective rebuilding.

WILLOW AVE

PINE AVE

CONNAUGHT DR

YARD
Private yard spaces, though spacious, create isolation in conditions of precarity

DRIVEWAY
Private driveways provide ease of access for users, enabling convenient entry from the road to the trailer

PRODUCT
Made as a one-size-fits-all, a trailer designed as a temporary home has no room for adapt-ability or incrementality.

WINDOWS
Minimal and undersized windows create a confined and uncomfortable experience for users



SYSTEM
Standardized repeated system with trailer, yard, and driveway creates a familiar envi-ronment but lacks adaptability.

ACCESS
Ramp provided for ease of acess move-ment to the trailer from the driveway

CIRCULATION
Wide roads result from too few trailer homes placed on the site.

1 Fema Trailer
2 Yard
3 Road
4 Driveway

SLEEPY HOLLOW ROAD

WILLOW AVE

PINE AVE

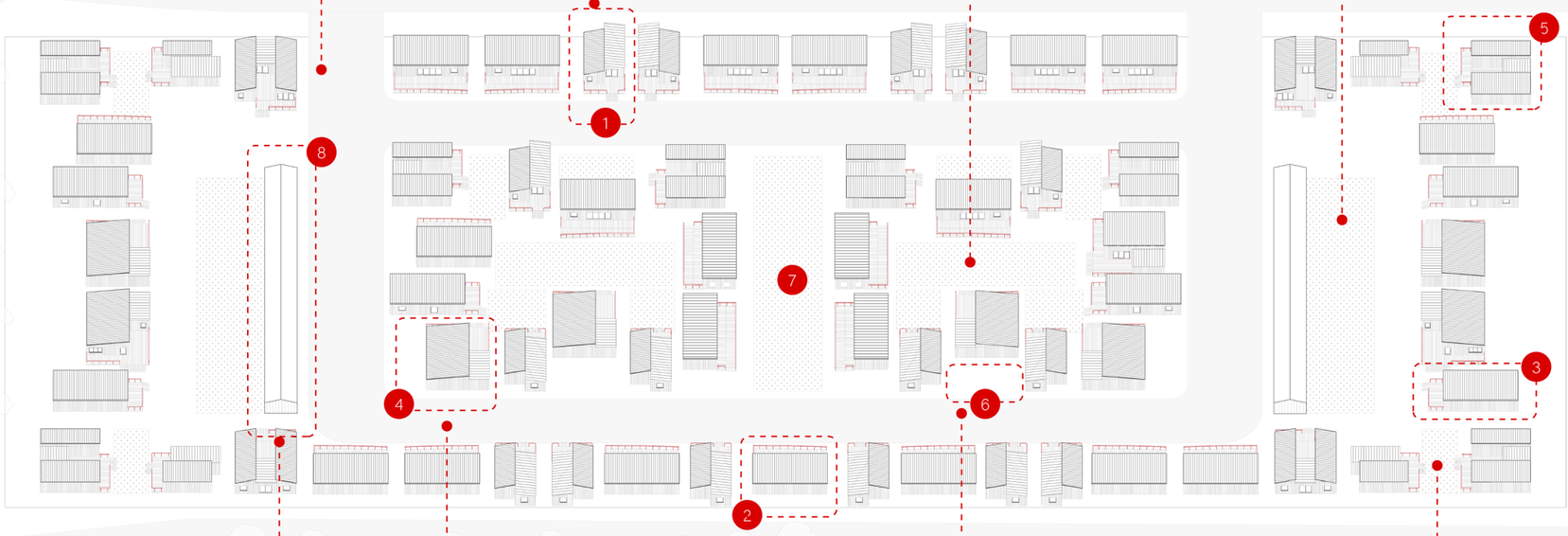
CONNAUGHT DR

STREET PARKING
Street parking offers convenient vehicle access.

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A variation of single units lines the site's edge, providing both privacy and agency in choosing where to live

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The assembly yard serves as the entry point, where construction pieces arrive and are assembled for distribution to the pods.



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Initially serving as storage for the pod kit during rebuilding, the space is later repurposed as a community space with shared services.

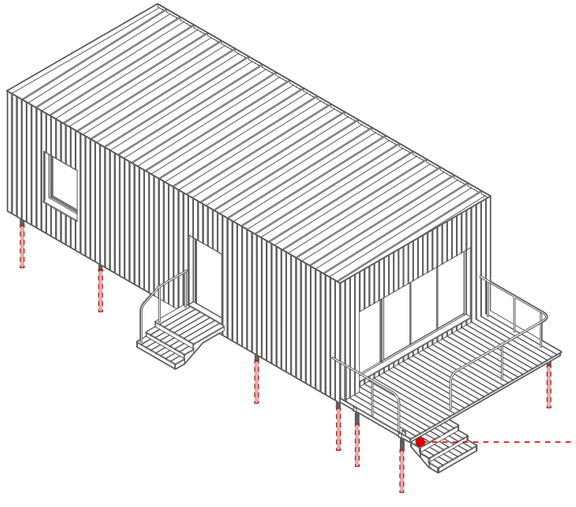
FAMILY UNIT
Family units are arranged in a courtyard layout, creating a village-like setting that offers normalcy and helps families cope together

INCREMENTAL SPACE
Space for expansion allows pods to grow with users who remain longer than planned.

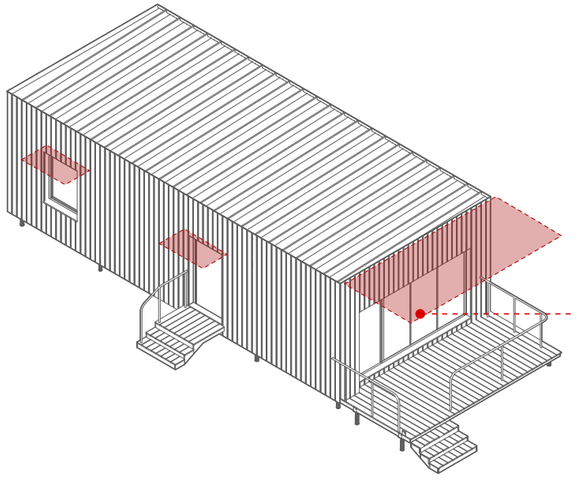
SHARED YARD
The shared yard becomes a space for interaction, fostering connection and collective rebuilding.

SLEEPY HOLLOW ROAD

PORT CHARLOTTE , FLORIDA



ELEVATED FOUNDATION
Elevated foundation which allows the home to be protected from water and wind flow

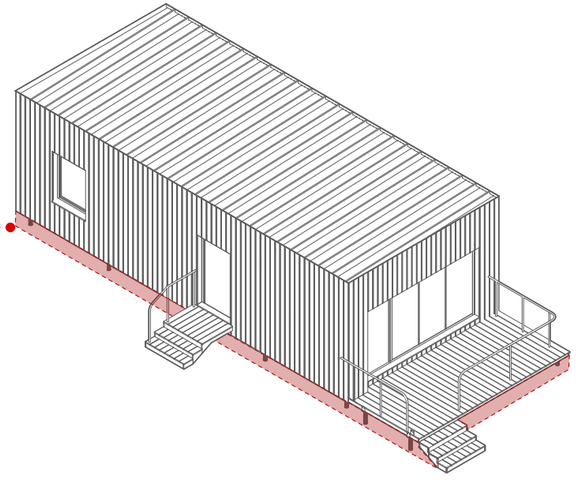


SHADING CANOPY
Shading devices which protect the home from heat and provide a better microclimate

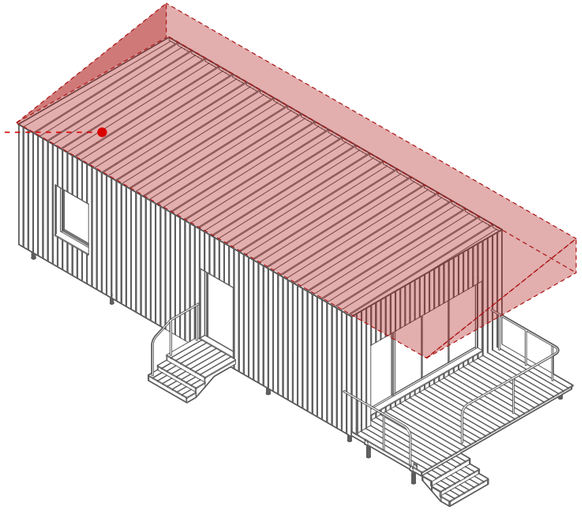
CLIMATE ADAPTATIONS

For the prototype adaptation in Port Charlotte, the pod can be supported by elevated screw piles, providing protection against water and enhancing wind resistance. The shaded canopy addition contributes to a more comfortable microclimate, offering protection from both heat and rain.

JASPER , ALBERTA



FOUNDATION ENCLOSURE
Adding a foundation enclosure to protect it from snow and forest animals during winter



SLOPING ROOF
Sloping roof addition which allows the home to be protected from snowfall

CLIMATE ADAPTATIONS

For the prototype adaptation in Jasper, the pod can incorporate enclosed foundations that provide protection from snow accumulation and prevent intrusion by forest animals. The sloping roof design enables snow to slide off easily, reducing structural load while enhancing thermal insulation and overall energy efficiency.

06 : BEYOND THE EMERGENCY

This chapter addresses the spatial condition that follows the expiration of the temporary land lease. Unlike normative practices, the houses and aid are not taken away from the people. Here, the housing system, conceived from the outset as modular and demountable, is not removed, discarded or left behind. The architecture remains in the possession of those who built and inhabited it.

Each dwelling, composed of a set of interlocking parts, is disassembled by reversing its dry joint connections. The removal of a single wall panel unlocks the structural grid, allowing rooms to separate. Units can be loaded onto a flatbed truck with the help of a small crane and transported to the plots of the users without damage or waste. The system has extended its life beyond the initial emergency. It is not a temporary shelter, but the first phase of a broader sequence of rebuilding the lives of people affected by these disasters.

Upon returning to their plots, users reconfigure the system according to their context and needs. Three primary modes of re-inhabitation are anticipated:

1. As Accessory Dwelling Units (ADUs), placed adjacent to partially salvaged structures.
2. As Additions, integrated directly into the salvaged house.
3. As autonomous starter dwellings expanded incrementally based on future needs.

Each mode assumes continuity in use, not rupture. Spatial hybridity, between the pre-disaster condition and the kit-of-parts system, is not treated as a design problem, but as a condition to be absorbed. The architectural system accommodates this not through flexibility as an aesthetic, but through its internal logic: Deconstructable joints, and a separation between rooms allow for modification without specialist labour.

Services are consolidated within pre-routed cores. These can be connected to municipal infrastructure where available, or operate off-grid, but this is beyond the scope of this thesis. Here, open-endedness is embedded both in the plan and in the section: floor platforms can extend, roofs can shift, and new modules can be attached without altering the original frame.

Incrementality is not presented as a compromise but as a deliberate design strategy. As in Habraken's "Support" theory, permanence is reserved for the system; variation is left to the user.[50] The proposal avoids both monumentality and precarity. Its architecture is neither final nor fragile.

The result is a transitional-permanent typology. It neither erases the conditions of emergency nor fixes them in time. It accepts the long duration of reconstruction as a necessary part of inhabitation. Housing is not delivered in total, but constructed over time. Users determine the rate and

50 Habraken et al., ***Variations***.

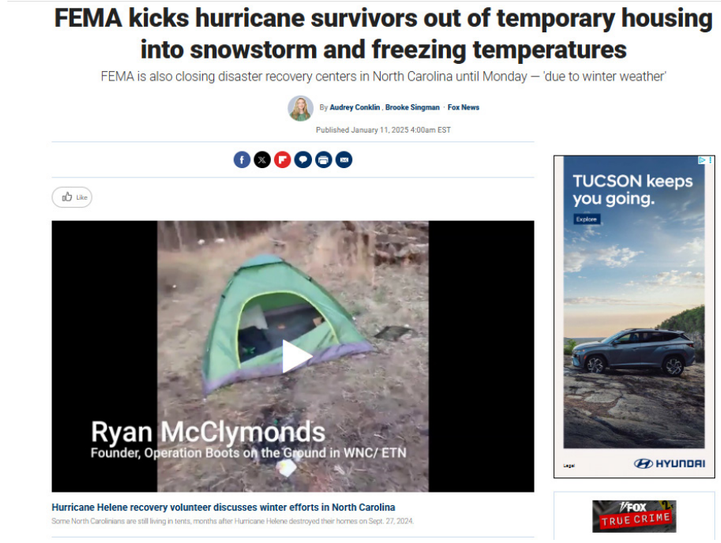


Figure 6.1 Survivors evicted from shelters are left in freezing conditions, some forced back into tents months after the storm.



Figure 6.2 Frustration spills into the streets as survivors protest evictions, demanding secure housing until real reconstruction begins.

direction of growth.

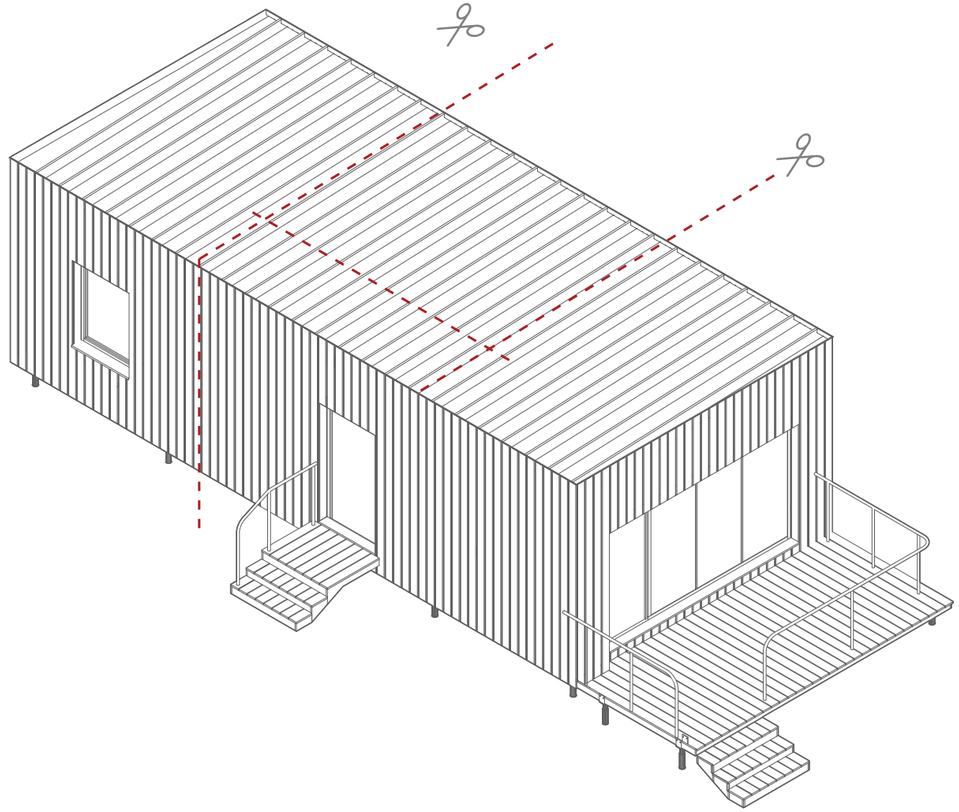
In some cases, the unit remains unchanged. In others, it expands from the base unit. In all cases, the architectural language remains consistent: standard parts, repeatable logic, minimal intervention. Even furniture and interior divisions operate as a system of add-ons, removable, and reconfigurable.

Disassembly and relocation are not exceptional operations. They are designed as normal phases in the use of the system. Where typical post-disaster housing creates waste. This model carries forward, architecturally, economically, and socially. It enables phased permanence without fixed form. This approach avoids the binary of temporary and permanent. It replaces it with a continuous architectural framework: one that prioritises ownership, adaptability, and infrastructural clarity over symbolic completion.

The New Trailer home sitting on the empty site

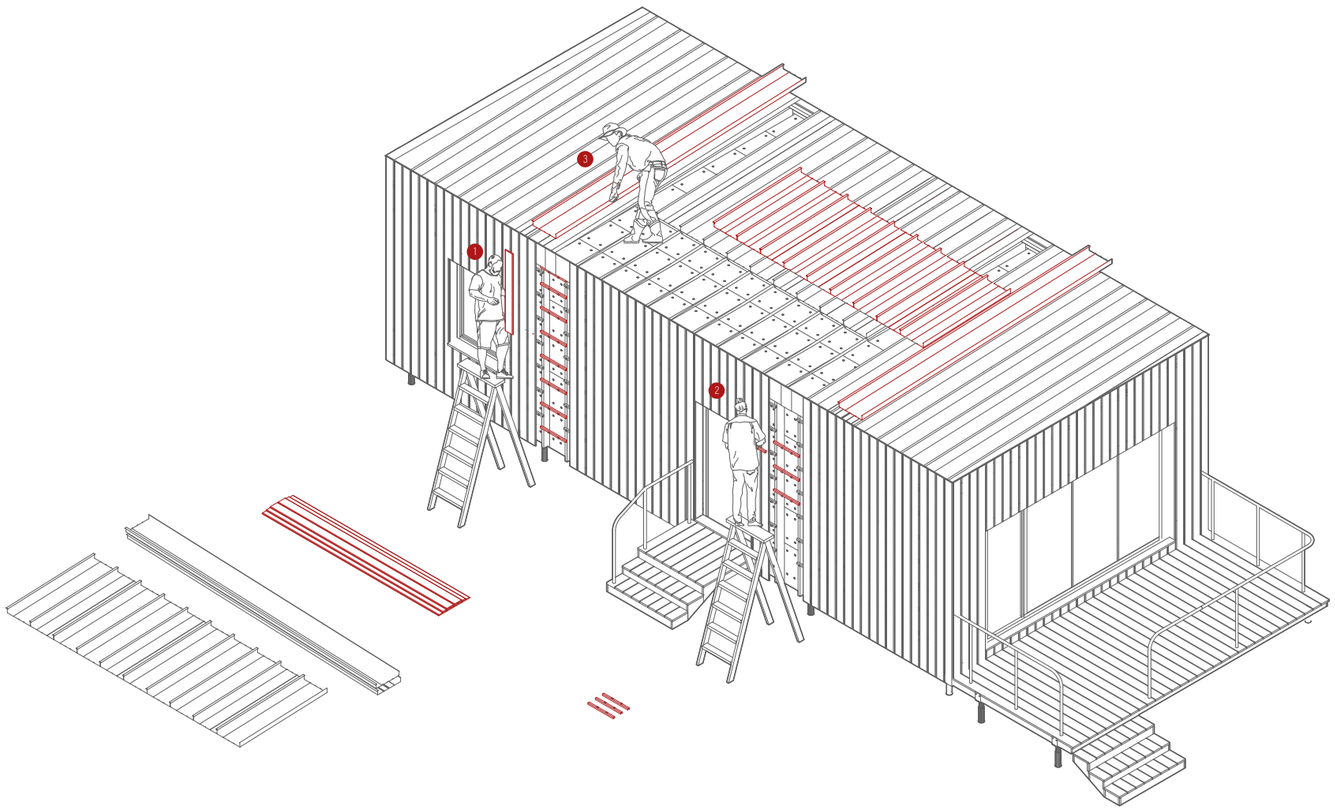
Empty Plot lands which were homes once

Figure 6.3 Altadena neighborhood in California, where people are sleeping in a recreational vehicle and surrounded by empty lots that were once the site of family homes.



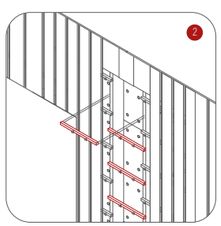
DISASSEMBLY MANUAL

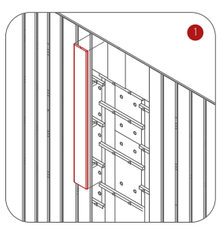
Notes:
This manual begins with a complete view of the prototype, illustrating the assembled system before disassembly.
Subsequent diagrams will break down each stage of removal step by step.

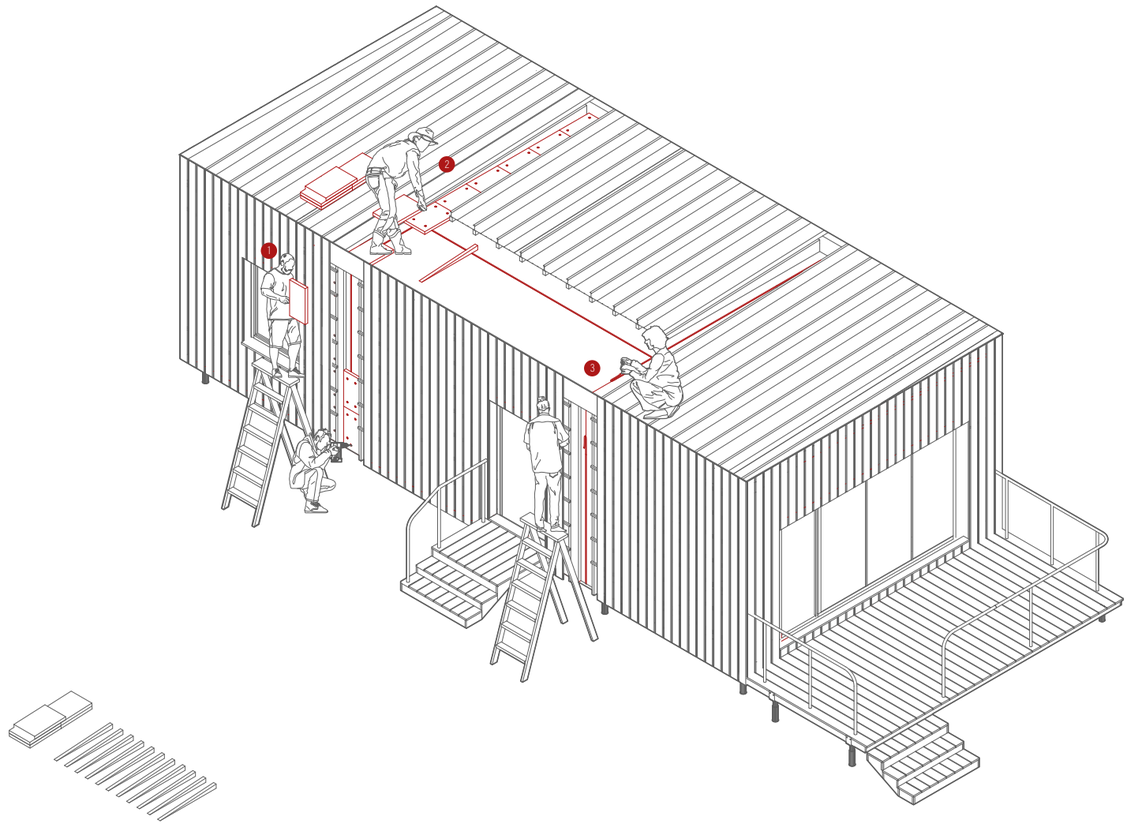


REMOVE CLADDING & ROOFING AT JOINTS

Notes:
1. Remove wood clip-on facade panels; store flat.
2. Detach furring strips at pod joints; extract all fasteners.
3. Unscrew and remove corridor pod roof sheets

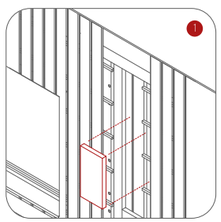


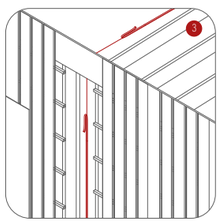


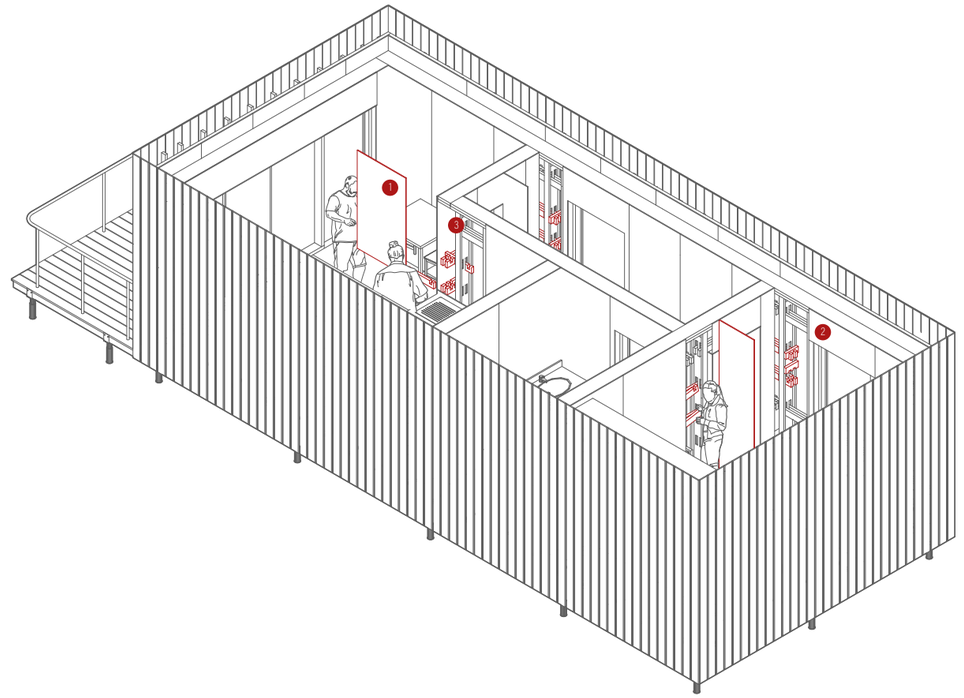


REMOVE INSULATION & CUT WATERPROOFING AT JOINTS

Notes:
1. Remove insulation at facade and roof joints
2. Remove roof insulation and sleepers to expose waterproofing (corridor pod only)
3. Cut tape at waterproofing seams

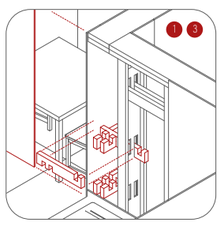


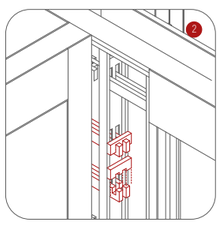


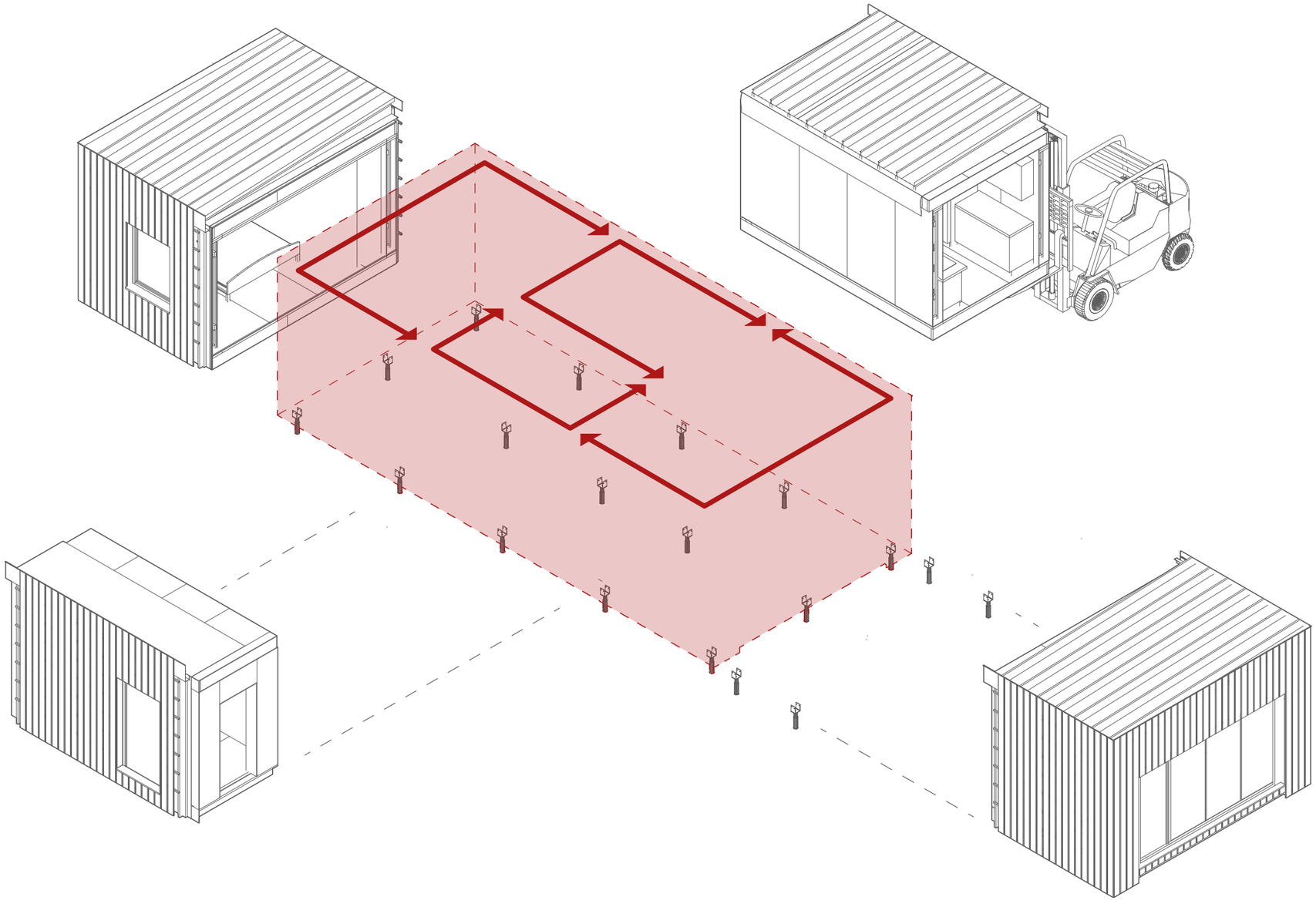


REMOVE SHEATHING & UNHOOK JOINTS

Notes:
1. Remove internal sheathing panels (easy-remove type)
2. Expose two connection joints and remove ties
3. Unhook the connection joints and remove it.

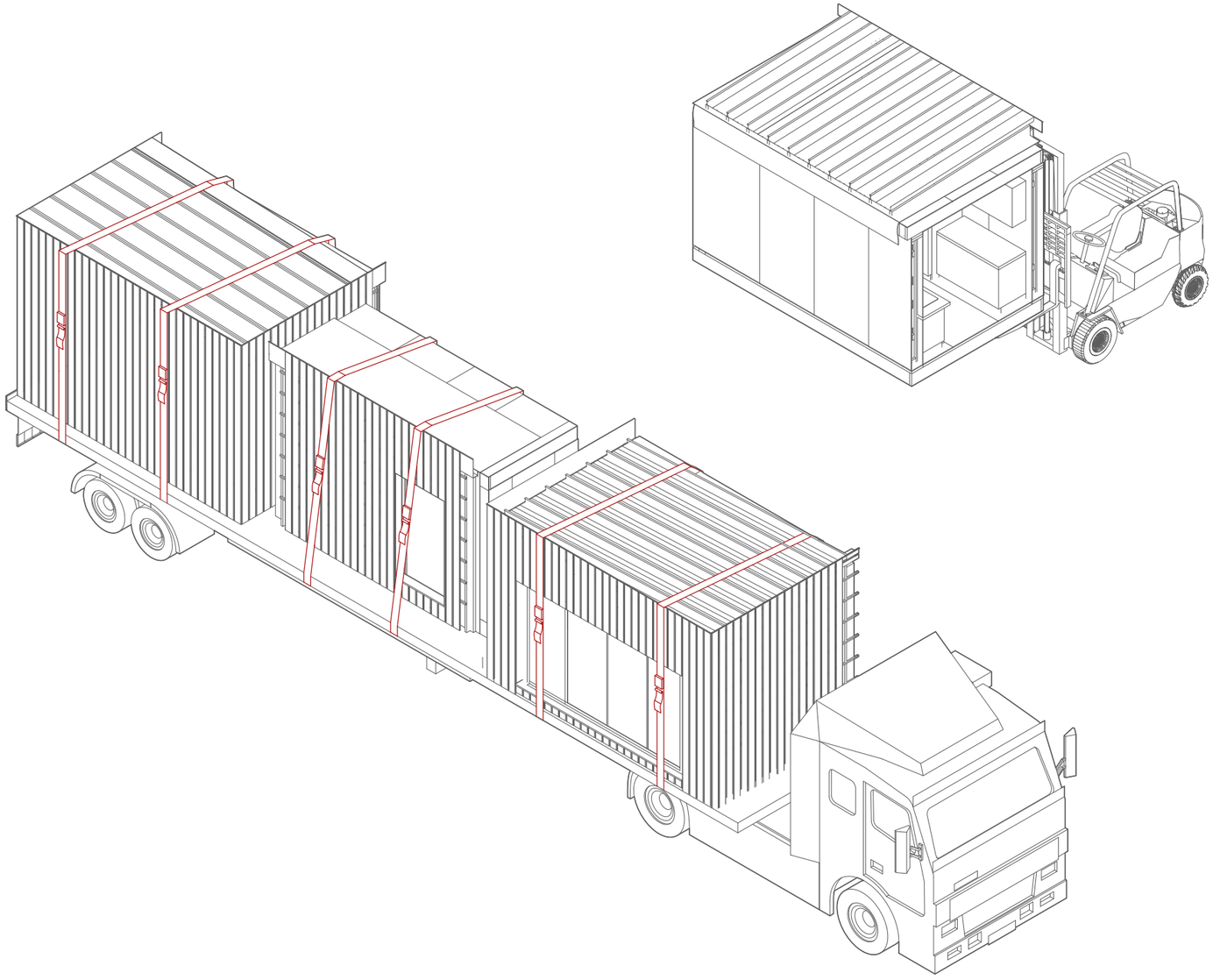






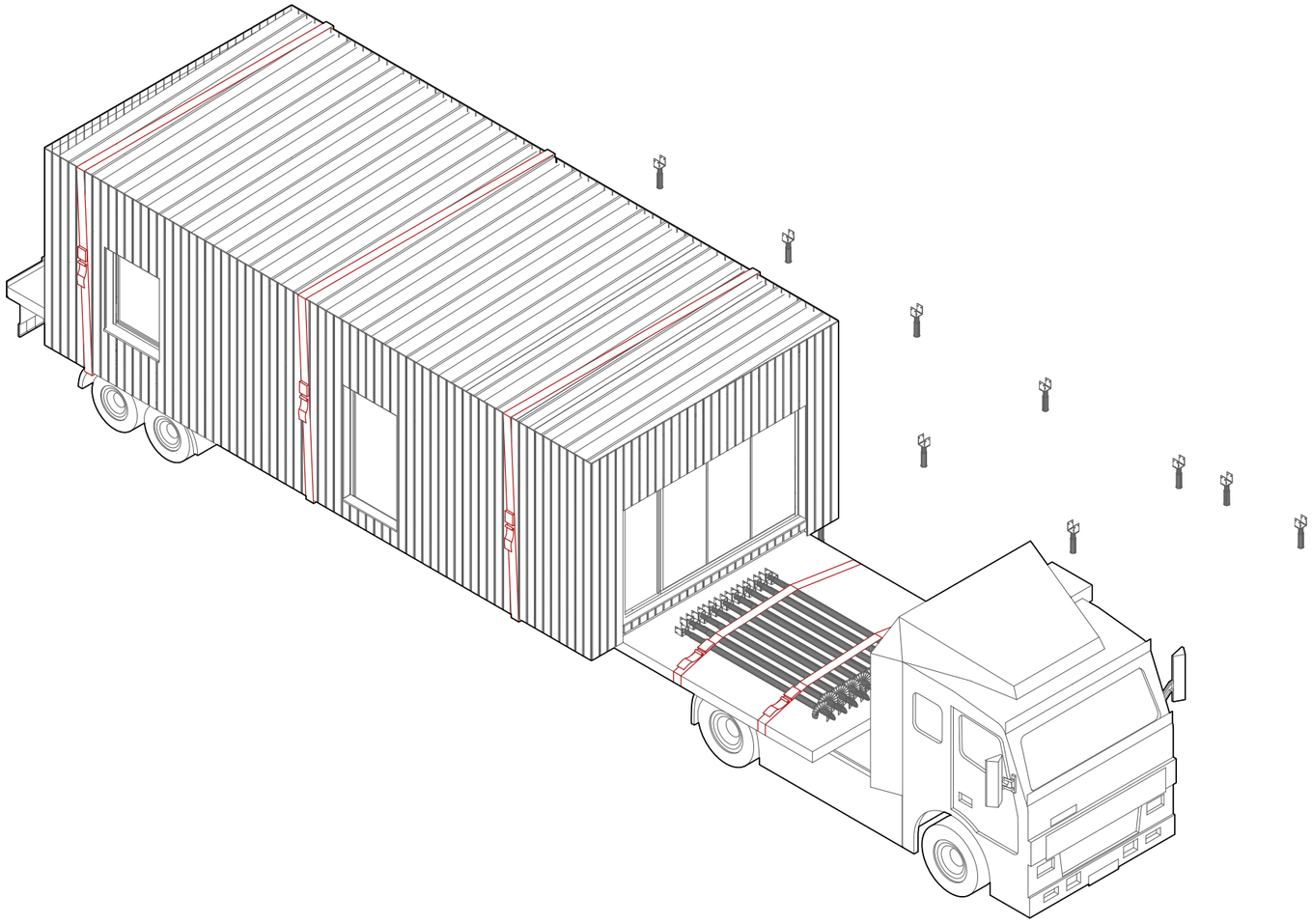
EXPLODED VIEW OF ROOM PODS & CONNECTIONS

Notes:
Pods can be lifted by forklift. Arrowheads indicate shared wall connections.
Each pod has three independent walls, with the fourth wall shared, forming U-shaped connections.



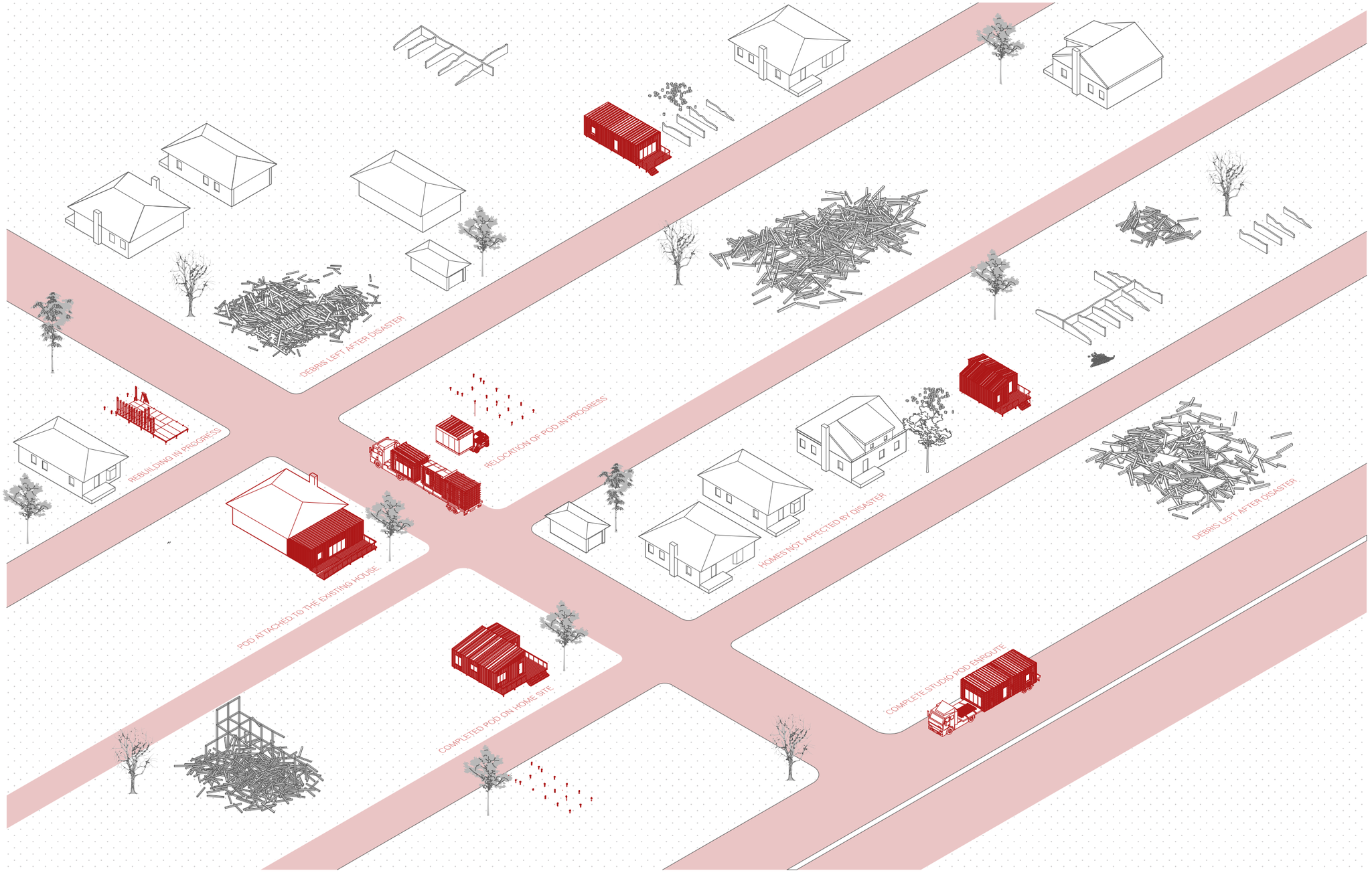
POD TRANSPORT

Notes:
Up to three pods can be loaded onto a standard truck bed. Pods are secured with straps.
The fourth wall may be temporarily sealed with sheathing. Internal furniture can be removed or safely secured inside.



ALTERNATE STUDIO UNIT TRANSPORT

Notes:
Studio unit can be transported in one piece on an oversized truck bed or with extensions on either side.
This method requires special transportation permits and is only applicable to studio units, not larger layouts.



RELOCATING & RECONFIGURATION OF UNITS

Notes:
Units are dismantled by reversing dry joint connections and transported on flatbed trucks.
Reassembly occurs on original plots as ADUs, additions, or autonomous dwellings.

CONCLUSION

This thesis addresses a critical and urgent question: how can post-disaster housing transcend disposability and instead serve as a foundation for long-term recovery? The research traces conventional models of shelter, such as FEMA trailers, prefabricated pods, and container homes. The shortcomings of these models are not solely attributable to technical limitations, but rather to an inherent prioritisation of logistical efficiency over human agency. This paradigm reduces the most affected and vulnerable individuals to passive recipients, rather than enabling them to actively participate in their own recovery.

In pursuit of an alternative, this research investigates participatory modes of architectural production. It draws inspiration from theorists such as Yona Friedman, Kroll, Seigal, and Jeremy Till, all of whom have critiqued the modernist impetus to deliver totalizing, prescriptive solutions. Instead, the argument presented advocates for frameworks that remain adaptable and responsive to user input. Friedman elucidates the limitations inherent in designing for a hypothetical 'average user,' while Till reconceptualises contingency not as a liability but as an architectural reality necessitating adaptability over permanence. Collectively, these perspectives underscore the imperative for disaster housing systems that resist closure, redistribute authorship, and acknowledge the temporal complexities of recovery. Accordingly, this thesis is situated within a lineage of architectural discourse that regards disaster housing not as a deliverable object, but as an ongoing, negotiable process.

Inspired by this, this research proposed a post-disaster housing system that is based on design for disassembly, incremental adaptability, and participatory self-building. Developed through iterative prototyping within the contextual scenarios of Jasper and Port Charlotte the system reframes disaster housing as a process towards recovery. Its CNC-fabricated components and reversible connections transform the housing from a static container into an open framework that has the potential to evolve with its users. The contribution of the thesis lies less in producing a singular design rather in advancing an alternative methodology for post-disaster architecture. By positioning displaced residents as co-builders instead of treating them as mere clients, it redistributes power. It affirms that recovery is not merely technical but also deeply social. Sweat equity, participatory assembly, and incremental inhabitation reframe post-disaster housing as a vehicle for autonomy and care. In this sense, the role of architecture in a crisis is not just to deliver projects, but to provide legible, adaptable systems that empower people to take back control of their lives and shape their own environment.

The design was developed through intensive research into disaster scenarios rooted in the contexts of post-wildfire Jasper and post-hurricane Port

Charlotte, Florida, alongside other cases across North America. This research foregrounded the lived realities that follow disaster. In the form of delays in aid, months-long recovery timelines, and the disorienting uncertainty of displacement. In Jasper, for example, residents could not immediately return after the fires. The town first had to be secured, debris removed, roads reconnected, and safety checks completed. Before reoccupation was even possible. During this interim, agencies such as AEMA provided temporary accommodations through hotels, vouchers, and shelters. While others more fortunate, sought refuge with friends or family in nearby communities. These realities underscored that the immediate problem is not the first few days or weeks, when shelters, hotels, or vouchers are typically provided. Rather, the months and years that follow when families are forced to remain in inadequate temporary housing. Disaster housing cannot remain a stopgap measure in this prolonged phase. It must instead offer continuity between emergency relief and long-term rebuilding. It is from this recognition that the thesis shifts its focus from temporary shelter as containment to housing as a framework for recovery, resilience, and the gradual rebuilding of community.

The design implications then become clear. Housing must be reversible, not disposable; adaptable, not prescriptive. Connections must be detailed for dismantling as much as for assembly. Material logics should support circularity and reuse, extending the life of components across multiple contexts. Without such circularity, disaster housing often ends up like FEMA's trailer auctions, where thousands of units sit abandoned in fields instead of being reintegrated into recovery, wasting both material and opportunity. This is especially critical in conditions where the location of housing cannot be taken as permanent, a reality that grows more pressing with the accelerating pace of climate-driven disasters. Hence, architectural frameworks must recognize displacement as a prolonged and non-linear condition, offering continuity rather than rupture between emergency, temporary, and permanent phases. To achieve this repetitively and holistically in disaster-affected regions, the proposal also supplements housing with simple shed-like structures for support services such as counseling, food banks, and daycare. These flexible spaces not only host essential programs that sustain communities but also serve a dual role in the assembly and disassembly process, providing covered areas where materials can be stored and organized during construction or deconstruction.

Beyond, the interim disaster housing site, these structures are envisioned to return with individual dwellers to their plots of land. Unlike, conventional trailer of pod homes, which are manufactured for quick delivery. These are designed so that they can be better integrated into the building fabric of the neighborhoods affected by natural calamities This thesis therefore moves away from quick, one-size-fits-all pod solutions in favor of an incremental and adaptable architectural system. Such an approach builds upon existing building practices which use conventional materials, supplement them with machine made kits of parts. In doing so, it places the act of rebuilding back

in the hands of the people who have lost so much, rather than leaving them dependent on external technological fixes. This form of collective rebuilding with municipal and design partners also gives an opportunity to build back better. This would allow for more disaster resilient building methods to be implemented in the rebuilding process. In this way, incremental units not only provide immediate shelter but also progressively propagate more resilient building systems, enabling communities to live in empowered conditions rather than remaining vulnerable.

The design also recognizes that climate responses must differ based on place and its context. In cold regions like Jasper, protection from frost and enclosing the underfloor space prevents heat loss. While, in hot or hurricane-prone regions, ventilation gaps and shade structures help dissipate heat. Insulation alone is not enough, localized strategies must supplement the universal system. I moved away from the trailer or prefabricated model because it forces families into confined, sometime unsafe conditions that become long-term despite being designed as temporary. Trailers reduce people's realities to a 'one size fits all' solution that ignores how different households actually live.

At the same time, this thesis also acknowledges its limits. The scenarios explored, including the wildfire recovery in Jasper and hurricane relief in Port Charlotte, are specific test cases, not exhaustive models. Further work is needed to test these assemblies at scale and refine them with more participatory user feedback. Scale models, for instance, could be developed as part of the Precovery framework in disaster-prone areas, where designers and architects collaborate to prototype and evaluate performance. Such testing would be especially important for material behaviour, since wood fibres and other components respond differently under varying conditions of humidity, dryness, and temperature. Nevertheless, what emerges is an optimistic proposition: that post-disaster housing can be more than a stopgap. It can be infrastructure of resilience, a platform for autonomy, and a space of dignity. By shifting the architect's role from prescriber to facilitator, the work affirms that even in conditions of crisis, housing can embody care, adaptability, and human agency.

A further limitation lies in the level of capability of participants. Not every household has the same physical ability, skill, or time to engage in rebuilding. This thesis therefore frames construction as a collective process, where tasks are distributed, skills are shared, and volunteers or contractors can supplement household effort when required. Equally important is the question of site adaptability. Future testing may account for contour conditions, though the screw pile foundation system is easy to adjust to sloped or irregular terrains along with flat, serviced lots. The assembly manual includes the use of a pile driver as one option, acknowledging that large numbers of houses may require piling to be completed efficiently. At the same time, an alternative method, screwing the piles in by hand remains

possible. Though more labor-intensive, this approach can still be achieved through simple lever action, ensuring that foundations are feasible even in contexts with limited access to heavy equipment as in the case of Jasper.

From my conversations with counselors working with survivors at disaster resilience seminars, it became clear that recovery is deeply shaped by trauma. In the aftermath of disaster, people should not be left to rebuild in isolation. Rebuilding together, where households support one another and volunteers step in. This creates a sense of shared purpose that can help people process trauma. The act of collective building is not only about producing shelter, but also about fostering solidarity and dignity in recovery. While not every household has the same skills or capacities, case studies like WikiHouse show that when tools are simplified, people are eager to engage. In many disaster-hit areas, this already happens out of necessity, as families build for themselves when contractors are unaffordable . This culture of DIY and mutual support demonstrates that participatory rebuilding can be both a practical necessity and a pathway to healing.

The future of post-crisis housing is not in ever-faster products and delivery systems, but in open-ended processes that evolve with communities. If embraced, such an approach could transform recovery from an architecture of containment and disposability into one of possibility. One that does not merely shelter life but enables it to grow.

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APPENDICES



Shigeru Ban's cardboard tube shelters in Nepal



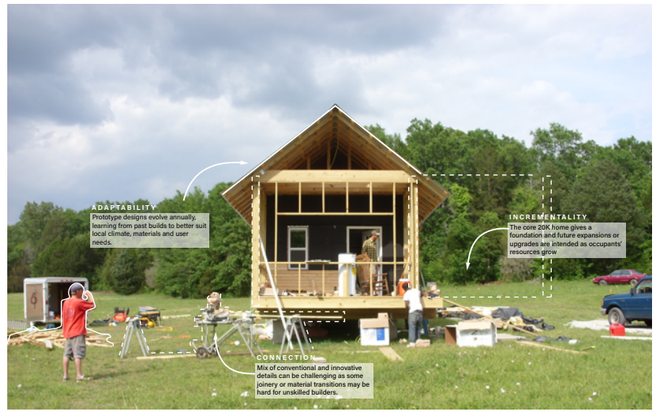
Yasutaka Yoshimura's ex-container housing in Japan



Rapido Recovery in Texas



U - Build



20K House/Rural Studio



Wiki House

DYSTOPIA EMERGES NOT FROM AESTHETICS, BUT FROM THE DENIAL OF CONTROL

ADMINISTRATION OVER AGENCY

DURATION OF USE EXCEEDS DESIGN INTENT, BUT NO PROVISION FOR EVOLUTION EXISTS.

ARCHITECTURE IS DELIVERED, SEALED, AND FIXED.

NO ABILITY TO MODIFY, REPAIR, OR ADAPT

NO ROOM FOR RITUAL, GATHERING, OR INFORMAL USE

NO CAPACITY FOR DISASSEMBLY OR REPAIR

NO PARTICIPATORY SITE PLANNING—PATHS AND RELATIONSHIPS ARE IMPOSED, NOT EVOLVED

MASS DEPLOYMENT OVER MASS DIGNITY

PLANNED FOR STORAGE, NOT FOR LIVING.

PERIMETER LOGIC: CONTAIN, NOT CONNECT

DYSTOPIA OF ABANDONMENT

THE SEAM WHERE FUTURES SPLIT

GROWTH IS PHASED, NOT DICTATED.

UTOPIA HERE IS NOT PERFECT—IT IS PARTICIPATORY

CNC-CUT, HUMAN-SCALED, REVERSIBLE ASSEMBLY

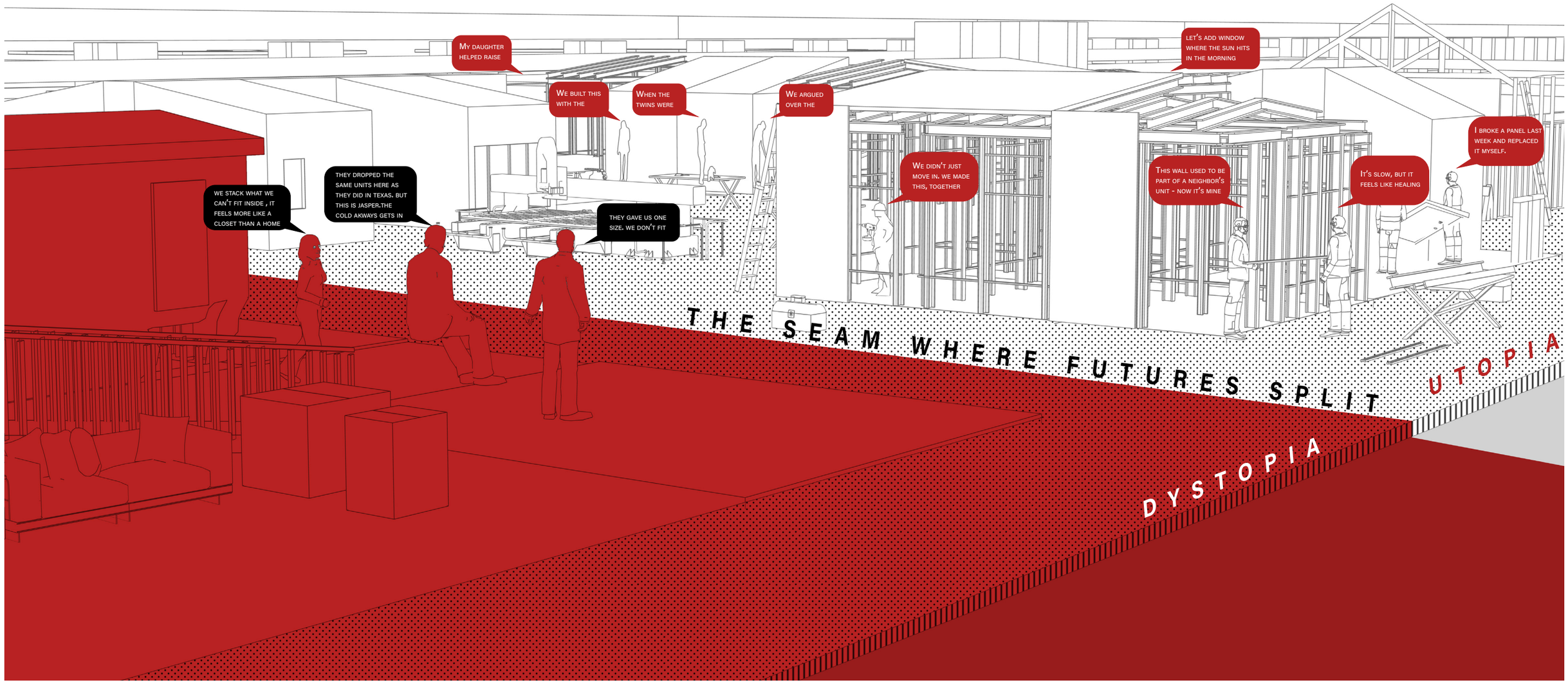
REBUILDING AS COLLECTIVE LABOR

OCCUPANCY AND EXPANSION ARE CONTINUOUS

ASSEMBLY DEFINES AUTHORSHIP

THE FUTURE IS NOT IMPOSED, BUT ASSEMBLED

UTOPIA OF PARTICIPATION


My daughter helped raise
We built this with the
When the twins were
We argued over the
let's add window where the sun hits in the morning
We didn't just move in. we made this, together
This wall used to be part of a neighbor's unit - now it's mine
It's slow, but it feels like healing
I broke a panel last week and replaced it myself.
we stack what we can't fit inside , it feels more like a closet than a home
they dropped the same units here as they did in Texas. but this is Jasper.the cold akways gets in
they gave us one size. we don't fit
THE SEAM WHERE FUTURES SPLIT
DYSTOPIA
UTOPIA

GLOSSARY

Accessory Dwelling Unit (ADU) – A secondary residential unit on the same lot as a primary home, often used for family members, rental income, or post-disaster resettlement.

Biopolitics – A concept by Michel Foucault describing how governments regulate populations through control of life processes, often relevant in disaster housing governance.

Circular Construction – Building approach that prioritizes reuse, recycling, and design for disassembly to extend material lifecycles.

Core-and-Expand – A housing strategy where an initial core unit is provided, allowing residents to incrementally add spaces over time based on needs and resources.

Design for Disassembly (DfD) – Design methodology where buildings are constructed with reversible connections, allowing components to be removed, reused, or relocated with minimal waste.

Disaster Continuum – The sequential phases of response after a disaster: emergency shelter, temporary housing, and permanent reconstruction.

Emergency Shelter – Immediate, short-term accommodation provided to displaced persons in the days or weeks following a disaster.

Flat-Pack Construction – Prefabricated components manufactured for compact shipping and quick assembly on site, often using CNC fabrication.

Governance Charter – A locally adapted set of protocols guiding decision-making, labour coordination, and conflict resolution in recovery sites.

Incremental Housing – Housing that is designed to be expanded or modified over time as resources and needs change.

Kit-of-Parts – A modular building system composed of standardized, interchangeable components designed for flexibility, adaptability, and ease of assembly/disassembly.

Life Cycle Assessment (LCA) – A method for assessing environmental impacts associated with all stages of a product's life from material extraction to disposal.

Mega-Shelter – Large-scale emergency shelters such as stadiums or convention centres used to house thousands of displaced people simultaneously.

Modular Housing – Housing built from prefabricated sections or modules that are transported and assembled on site.

Not In My Backyard (NIMBY) – Public opposition to the siting of housing or infrastructure in one's own community, often influencing disaster recovery housing placement.

Participatory Architecture – Design processes in which future residents or community members actively contribute to decision-making, design, and construction.

Precovery – The act of planning and preparing for post-disaster recovery before a disaster occurs, including social, cultural, and infrastructural readiness.

Recreational Vehicle (RV) – A motorized or towable vehicle equipped with living space, sometimes used as temporary housing after disasters.

Support/Infill Architecture (SAR) – A theory by John Habraken separating the permanent structure (support) from adaptable interior elements (infill) to allow user-driven change.

Sweat Equity – The contribution of labour by future residents to the construction of their homes, building ownership and agency in the process.

Typological Flexibility – The capacity of a housing system to support multiple spatial arrangements and adapt to changing family structures, cultural norms, and site conditions.

Vernacular Architecture – Building traditions using locally available materials and techniques adapted to local climates, cultures, and needs.