

MIT Center for Transportation & Logistics | Roundtable Report

Scaling Post-Disaster Housing Capacity

Moderated by

Jarrold Goentzel PhD

Director, MIT Humanitarian Supply Chain Lab

Principal Research Scientist, MIT Center for Transportation & Logistics

Lauren Finegan PE

Research Associate, MIT Humanitarian Supply Chain Lab

January 29–30, 2024

Washington, D.C.



**MIT Humanitarian
Supply Chain Lab**

humanitarian.mit.edu



ACKNOWLEDGEMENTS

Thank you to the industry, government, and nonprofit participants who shared their time and expertise with us during this roundtable event. We appreciated your candor and enthusiasm on the topic of disaster housing.

Thank you to the National Institute of Building Sciences for providing meeting space to host this event.

This work was supported in part by the MIT Policy Lab (policylab.mit.edu).

Suggested citation:

Finegan, Goentzel, Reissman, Russell, Story (2024). *Scaling Post-Disaster Housing Capacity*: Roundtable Report, MIT Center for Transportation & Logistics. Available at: <https://dspace.mit.edu/handle/1721.1/155788>.

Table of Contents

Executive Summary	4
Background	5
Disaster Housing Context	6
Federal Disaster Housing Programs	6
State Government and Nonprofit Organization Disaster Housing	7
Meeting Survivor Demand with Disaster Housing Programs	7
Considerations and Challenges in Scaling Capacity	9
Survivor Needs	9
Community and Land Use	9
Scale of Demand	10
Construction Capacity Limitations	10
Key Themes and Ideas for Scaling Capacity	12
Funding	12
Codes and Standards	13
Labor	14
Industrialized Housing	15
Planning and Community Engagement	15
Conclusion	17
Appendix: Summary of Ideas and Stakeholders	20

Executive Summary

IN JANUARY 2024, THE HUMANITARIAN SUPPLY CHAIN Lab at the Massachusetts Institute of Technology held a roundtable on the theme of scaling construction capacity after disasters, convening individuals from academia, nonprofit, and public and private sector organizations. Participants brought varied perspectives, including considerations of supply chains, government policies, building codes, and private sector construction operations. To ensure candor, the event was held under Chatham House Rule. The roundtable used recent natural disasters and their housing challenges to frame discussions around two goals: (1) identify approaches to increase capacity for rapidly deployable housing solutions after disasters and (2) capture policy and operational constraints that hinder implementation of those rapidly deployable housing solutions. The event and this report seek to catalyze systemic research and provide discrete recommendations to address the challenges and opportunities to restore housing for disaster survivors.

The first half-day of the roundtable focused on understanding housing demand after disasters, including survivor needs, policies governing responses, and the geography of the impacted area. Discussions explored topics of community engagement, the limitations of existing housing solutions, and the value of local resources and expertise. Further discussions on the first day differentiated the challenges of repairing vs. rebuilding homes after disasters. Builders and code experts provided context on the challenges the industry faces in responding to disasters, from funding lags to balancing existing customers and getting a true understanding of the demand for services, to paperwork and process hurdles. Participants also shared best practices including state bridge funding, portioning out work to maximize skilled and novice or volunteer labor, and data gathering and management to understand survivor needs.

The second half-day focused on gathering solutions to the challenges identified on day one, beginning with a discussion on ways to scale construction capacity for rebuilding homes—when repair is not feasible. This included perspectives from the modular building industry, including builders with experience in panelized and volumetric modular construction, as well as federal, state, and nonprofit experiences with rebuilding.

Participants considered the spectrum of post-disaster housing challenges to propose and discuss a range of interventions that could speed up the restoration of housing for disaster survivors. Interventions emerged around the key themes of funding, codes and standards, labor, industrialized housing, and planning and community engagement.

Roundtable participants represented stakeholder groups with differing jurisdiction, capacity, and influence over the responses that occur immediately after a disaster and for the months and years that follow. This roundtable report concludes with descriptions of actions available to these stakeholder groups and recommendations for their implementation.

Background

THE HUMANITARIAN SUPPLY CHAIN LAB (HSCL) within the Center for Transportation & Logistics (CTL) at the Massachusetts Institute of Technology (MIT) launched new research on post-disaster housing in 2017. One of the Lab's first projects was a two-year effort supporting the Federal Emergency Management Agency's (FEMA) housing mission with the objective of designing a cost-effective and survivor-centric direct housing process. One key outcome of this work was a report titled, "Disaster Housing Construction Challenges in America: Exploring the Role of Factory-Built Housing." It explored the feasibility of scaling systems-built (e.g. modular, panelized, pre-assembled) housing after disasters through analysis, interviews, and roundtable dialogue with housing manufacturers, home builders and emergency management, housing development and codes officials at various government levels. Report recommendations highlighted process improvements, decision support capabilities, direction setting and areas for future research.

The work resumed in May of 2023 when HSCL hosted a virtual roundtable on direct repair of homes after disasters, including representatives from the builder, code, state, and federal perspective. This event was prompted by the progression of federal legislation¹ that would have expanded FEMA's authority to repair damaged homes after disasters. It sought to increase understanding of the capacity and considerations for large-scale home repairs.

To identify further research needs, examine policy barriers, and explore various actions to increase post-disaster housing construction capacity, HSCL organized the Scaling Post-Disaster Construction Capacity Roundtable in January 2024 at the National Institute of Building Sciences. Participation spanned MIT researchers, industry and nonprofit professionals, and government stakeholders who represented a comprehensive array of expertise, experience, and decision-making jurisdictions. Key government perspectives were shared by federal and state representatives with specialized roles

in logistics, policy, disaster housing, infrastructure, planning, and recovery. Home manufacturers, home-builders, code experts, and industry groups contributed practical industry perspectives, while research and academic insights came from MIT's Center for Transportation and Logistics. This diverse group provided a rich blend of theoretical knowledge, practical experience, regulatory insights, and strategic management capabilities, all with a focus on enhancing post-disaster housing solutions.

The roundtable took place over two half-day sessions. Each session began with a series of introductory remarks by an attendee who could set the stage for fruitful discussion. Topics included the characteristics and current state of housing demand, the needs of survivors after a disaster, policy barriers, and potential solutions. The roundtable was designed with ample time for in-depth discussions, several breaks to facilitate networking and increase candor, and operated under Chatham House Rule. The roundtable concluded with a collective debrief to synthesize the discussions into concrete steps forward.

This report is a summary of the deliberations and outcomes of the roundtable. It includes context for post-disaster housing and its challenges, followed by brief summaries of the roundtable discussions and key themes that emerged. The report concludes with actionable recommendations for those groups integral to expanding capacity for housing disaster survivors.

¹ H.R. 8416 Disaster Survivor Fairness Act of 2022 passed the House of Representatives in November 2022 in the 117th Congress. The bill has since been reintroduced as H.R. 1796—Disaster Survivor Fairness Act of 2023 in the 118th Congress.

Disaster Housing Context

As disasters have become more frequent and more costly,² impacts on individuals and their homes have also intensified. Much of the burden to address the increased needs of disaster survivors falls to government agencies like FEMA, the US Department of Housing and Urban Development (HUD) and state and local emergency management and housing agencies. Nonprofit organizations often supplement the assistance provided by governments. Contextual examination of the existing post-disaster housing programs and their delivery is necessary to inform and guide any recommendations for improvements.

Federal Disaster Housing Programs

Between FEMA, HUD, and the Small Business Administration (SBA), there are several federal government-funded post-disaster housing options to support disaster survivors, though each has limitations.

FEMA's housing programs are of three general types: **sheltering, temporary housing, and permanent housing**. These designations are based on the authorities given to the agency by the US Congress. **Sheltering** programs aim to provide physical shelter for survivors, which can include anything from a school gymnasium to hotels and can include funding for emergency repairs to a survivor's home. **Temporary housing** programs are meant to provide housing for up to 18 months, but these programs are often extended if survivors are unable to find more permanent housing. FEMA's congressional authorities limit the provision of **permanent housing** to cases where other options are not feasible.

Historically, programmatic decisions aimed at providing more stable or improved housing for survivors but blurring the lines between these buckets of housing have caused challenges. For example, survivors living in temporary housing units far longer than their originally intended use following Hurricanes Katrina and Rita

² NOAA National Centers for Environmental Information (NCEI) US Billion-Dollar Weather and Climate Disasters (2023). <https://www.ncei.noaa.gov/access/billions/>, DOI: [10.25921/stkw-7w73](https://doi.org/10.25921/stkw-7w73).

experienced formaldehyde exposure.³ More recently, after the 2017 hurricane season, FEMA faced challenges implementing its Sheltering and Temporary Essential Power (STEP) program, designed to enable survivors to remain in their damaged homes while limited, temporary repairs are being completed to make the home safe, clean, and habitable. Repairs took longer and were costlier than anticipated.⁴

In January 2024, FEMA published rulemaking to update its Individual Assistance program, including several changes relevant to housing.⁵ These changes include helping underinsured survivors by providing funding up to a certain amount (the maximum authorized by Congress to cover repairs, \$42,500 in 2024) to cover expenses not covered by insurance, expanding habitability criteria to allow for repairs of a home that may have sustained damage prior to the declared disaster, expanding the hazard mitigation measures that may be taken to prevent future damage to a home, and in general simplifying the process for applying for assistance.

In addition to FEMA assistance, homeowners, renters, and personal property owners in a declared disaster area are eligible to apply for an SBA home disaster loan. These loans are either (a) personal property loans, which provide a creditworthy homeowner or renter in a disaster area with up to \$40,000 to repair or replace personal property owned by the disaster survivor, or (b) real property loans, which provide creditworthy homeowners with uninsured or underinsured loss in a declared disaster area with up to \$200,000 to repair or replace the homeowner's primary residence to its pre-disaster condition. SBA places certain restrictions on the use of the funding.

³ Formaldehyde levels in FEMA-Supplied Trailers: Summary of a CDC Study in the Gulf Coast Region, flyer (2008). https://www.fema.gov/pdf/media/2008/formaldehyde_resident_flyer_english.pdf.

⁴ DHS Office of the Inspector General. OIG-22-25: FEMA Should Apply Lessons Learned from the STEP Pilot Program Implementation in Puerto Rico to Future Programs (Feb. 4, 2022).

⁵ Individual Assistance Program Equity, 89 Fed. Reg. 3990 (Jan. 22, 2024) (Amending 44 C.F.R. § 206).

HUD's assistance after disasters that directly supports individual home repair and reconstruction includes two Federal Housing Assistance (FHA) loan insurance and finance programs that can help survivors rebuild or buy another home. HUD's Community Development Block Grant Disaster Recovery (CDBG-DR) funds provide extra funds to help with long-term recovery. However, CDBG-DR funds, if made available by Congress following a Presidentially declared disaster, often are not available for months to years after a disaster.

State Government and Nonprofit Organization Disaster Housing

In addition to federal government support, disaster survivors may access housing resources through state and nonprofit sources. Non-profits in the housing space may have dedicated programs for disaster housing, providing assistance with building the structure, the building contents, case work to manage the interactions between multiple programs, or other means of support. States vary in their housing programs. Most have limited options for disasters that do not exceed the threshold for federal assistance (FEMA's Individual Assistance program), directing survivors to voluntary organizations and other limited sources of assistance. Some states have the capacity to manage a federally funded housing program, and most rely on a close partnership with FEMA to carry out a housing mission.

Meeting Survivor Demand with Disaster Housing Programs

The roundtable opening session grounded exploration of the programs described above in the survivor demand (needs) perspective. Participants from nonprofit, state, and federal organizations reflected on experiences serving survivors via program implementation. Discussion of practical constraints and considerations in meeting needs provided foundational material for later sessions on expanding housing capacity after disasters.

As part of the discussion, a series of impactful stories were shared by state and local governments and a local chapter of a nonprofit housing organization. The speakers shared recent experiences responding to disaster housing demands with strategic collaboration, state leadership on bridge funding, and community-centered planning in disaster recovery housing efforts.

Nonprofit Housing Organization

A nonprofit housing organization discussed a collaborative effort with FEMA after Hurricane Ian. The partnership leveraged the nonprofit's land holdings to serve survivors with housing near their pre-disaster residences, with the US Army Corps of Engineers playing a pivotal role in ensuring that the land improvements supported long-term affordable housing development at the site. This project's success was further amplified through alignment in communications strategy that saw FEMA assisting the nonprofit in community engagement through town halls, facilitating a transition from community hesitation to acceptance and participation.

State and Local Governments

State and local governments shared three experiences:

The first painted a vivid picture of a region steeped in community and a resilient spirit yet plagued by poverty and recurring natural disasters. The narrative highlighted **the visionary leadership of local government**, which, in collaboration with various stakeholders, initiated a project to rebuild communities permanently on donated land. This rebuilding happened despite significant challenges like limited usable land and the need for substantial infrastructure development.

The second focused on **leveraging local construction capacity**, recognizing the inherent knowledge within communities to identify reputable builders and the need to align demand with available resources. This approach has facilitated the rapid mobilization of state funds and the engagement of non-governmental organizations, although it was noted that local capacity alone could not cover the demand.

The third focused on **recurring disasters and the challenges in providing equitable housing solutions**. This narrative underscored the complexities of federal funding allocation policies, specifically in the HUD-CDBG-DR program, and their unintended consequences on community wealth. An example of this is when a home provided after a disaster is "downgraded" from the pre-disaster home—e.g., from three bedrooms to two, thus impacting survivors' home value and generational wealth.

These narratives collectively highlighted the multifaceted approach needed to address housing shortages after disasters, emphasizing the survivors' value and the

importance of robust, inclusive planning that accommodates both immediate and long-term needs.

Federal Government

Following the experiences shared by nonprofits and state and local government, the participants discussed federal housing programs available to support disaster survivors. This section provides additional background on federal disaster housing programs.

FEMA's provision of temporary housing (one of the three "buckets" of housing assistance available) is the most frequently used direct means of assistance to survivors—direct in this case meaning that the government provides a physical home instead of financial assistance. As mentioned above, FEMA's authorities limit the provision of permanent housing to places where other options are not feasible. The roundtable discussion involved some of the practical considerations that influence FEMA's provision of temporary housing.

Participants discussed FEMA's current options for temporary housing, which include travel trailers, RVs, or manufactured homes built to the Manufactured Home Construction and Safety Standards (also referred to as the HUD code). The specifications of the units used by FEMA are influenced by considerations for standard of living, length of stay, safety, and speed to deploy. In addition to building its manufactured homes to the HUD code, the Agency also includes accessibility and above-code requirements for fire safety. As a result, these units have longer lead times and cannot be purchased "off-the-lot" in the quantities that FEMA requires. The long lead times contribute to the Agency's need to retain a stockpile of several thousand housing units to meet annual demand from disasters. In addition, FEMA can and does purchase travel trailers, designed for shorter stays, off the lot.

The other factor influencing the specifications of the housing units that FEMA uses is speed and suitability to deploy in a variety of locations. Both manufactured houses and travel trailers are regulated by national standards (e.g., the HUD code), meaning that FEMA's delivery of these units is not subject to local building code requirements. Units are placed either on a private site with utilities (e.g., at the site of a survivor's damaged home), or on a group site. Group sites involve obtaining and developing land to support a manufactured home, adding time and costs to housing missions. Estimates

cited in a DHS Office of the Inspector General (OIG) report in 2013 referenced a per-unit cost for installing units on a group site anywhere from \$69,000 to \$220,000.⁶ These numbers were based on disasters in 2005-2007; costs today are almost certainly higher when considering the cost to build up infrastructure on a group site where none previously existed.

The roundtable began with this stage-setting context on disaster housing as it is currently done and some of the on-the-ground experiences of state and local organizations currently engaged in providing housing to disaster survivors. The following section is a summary of the key considerations that emerged from this context as participants discussed and related the context to their own experience.

⁶ DHS Office of the Inspector General. OIG-13-102: Unless Modified, FEMA's Temporary Housing Plans Will Increase by an Estimated \$76 Million Annually.

Considerations and Challenges in Scaling Capacity

Discussion during early roundtable sessions exposed several considerations and challenges that we face as a country in scaling post-disaster housing capacity. This section highlights and expands on these aspects that are important in the delivery of housing after disasters in any context.

Survivor Needs

Standard of living: Discussion of survivor demand (needs) raised the issue of standard of living for post-disaster housing. Example topics included unit-level or communal spaces for bathroom/kitchen and internet access. Roundtable participants shared that the inclusion of bathrooms and kitchens were essential, in their experience, in temporary housing solutions. There are national standards for the condition of HUD housing (24 C.F.R. §5.703), and FEMA's programmatic guidance references the need for housing to be safe, sanitary, and functional.⁷

Form and function of a home: Several participants discussed the importance of working with survivors to understand their needs for the home's form and features in addition to the considerations for accessibility and life safety. This is especially critical when a permanent home is completed or permanent repairs are made. Examples of this include whether a home will be used as a multi-family or generational dwelling (e.g., to support aging family members), the number of children in a family, and the size of the home pre-disaster. Participants shared that that the size of a pre-disaster home should have not always been preserved, e.g. post-disaster housing with fewer bedrooms.

Survivor displacement: Several participants brought up the challenge of keeping communities together and keeping survivors as close to their pre-disaster homes as possible, if that was what the survivor wanted. State participants shared examples of communities that had been kept together through careful planning and partnership across federal, state and local organizations.

Delivery timeline: Timeliness is a key metric and discussions explored definition of a reasonable timeline and exploration of factors that influence this timeline. Specific issues such as site prep were highlighted.

Renter challenges: Participants highlighted a lack of options for individuals who rented their homes pre-disaster. It is important to consider longer-term solutions for renters after disasters, instead of relying solely on temporary options. Few federal disaster housing programs are catered specifically to renters; most are aimed at homeowners. State and local participants highlighted the growing number of renters in need of assistance after disasters.

Transition between housing options: Participants discussed the importance of minimizing the number of times a survivor must move from one place to another. There was dialogue on developing a seamless transition pipeline from temporary housing to affordable, permanent housing solutions. This pipeline would serve as a crucial framework for not merely providing immediate relief but also ensuring a sustainable housing strategy. One frequently discussed aspect of this discussion is the limitation in FEMA's authorities preventing the Agency from providing permanent housing in most cases. This forces survivors who take advantage of FEMA's temporary housing programs to move once the 18-month period for which these programs are authorized expires. Relatedly, participants discussed the importance of pre-disaster planning for a survivor's transition from temporary to permanent housing.

Community and Land Use

Building codes: Several participants brought up the challenge that the patchwork of building code requirements in the US presents to scaling disaster housing. Each state, and in some states each local jurisdiction, decides which building codes to adopt and enforce. This challenge is particularly relevant to off-site construction methods, where consistent codes would allow off-site builders to simplify the set of products they produce since standard units could be used in many geographic areas. This simplified set of products would increase production capacity and speed in off-site construction.

⁷ FEMA. Individual Assistance Program and Policy Guide (IAPPG), Version 1.1. May 2021.

Builders also highlighted the challenges when building codes do not incorporate the latest hazard-resistant provisions, making homes more vulnerable to damage in the first place.

Zoning and community acceptance: Several participants discussed the challenges with locating temporary housing. Some discussed zoning challenges preventing affordable housing in certain areas or restricting the types and sizes of homes allowed in an area (e.g. not allowing homes below a certain square footage). Others discussed challenges with community acceptance such as “not in my back yard” opposition to temporary or permanent housing developments. Participants expressed that the term “industrialized” may have a poor reputation where historical association with mobile homes is extended to approaches such as modular and other forms of offsite construction. As a result, definitions established by covenants, conditions & restrictions (CCRs) may unnecessarily or unintentionally restrict innovative construction approaches in certain communities.

Scale of Demand

Scale: Nationally, housing needs on any given disaster could range from 20–500 to 50,000+ in the case of a widespread catastrophic event. Participants shared that scale can dramatically shape solution options. Solutions that might work for a small disaster may fail or be infeasible on a catastrophic scale. Conversely, solutions that may be necessary or acceptable on a catastrophic scale may not be accepted on a smaller scale.

Surge in construction demand and permitting: Research from Hurricane Harvey was presented during the roundtable, showing a surge of residential construction dollars flowing into the area being 11 times the pre-disaster rate.⁸ Similarly, a significant spike in permit applications immediately following the disaster.⁹ This increased activity, being managed with pre-disaster permit processing staffing levels and capacity (maybe somewhat increased post-disaster) slows contractors as

⁸ The referenced 11x figure includes private insurance and several Federal assistance programs and is from analysis by MIT in 2019. Data from FEMA (as of Dec. 7, 2018), NFIP (residential buildings only, as of Dec. 26, 2018) and US Census Bureau.

⁹ Data on permits were analyzed from the city of Bellaire, Texas, population 17,000, adjacent to the city of Houston, by MIT in 2019.

they wait for projects to be permitted and lengthens the timelines for a survivor to return home.

Data: Government and nonprofit participants raised challenges with data collection and use for housing analysis. This included use both in preparing for disasters and in response to disasters. They reported the importance of building a common understanding of demand or housing related needs after a disaster to effectively coordinate resources across government and nonprofit partners, and the challenge when organizations do not have an accurate picture of the needs.

Disconnect between emergency response and long-term recovery: State and builder participants also shared the challenges in some places where the emergency management organization is not well integrated with the entity or entities in charge of long-term recovery. The two may or may not be in the same organization. As a result, decisions made in the initial response phase do not align with what might be best for longer-term recovery. Coordination with contractors, building departments and others integral in rebuilding is fragmented.

Construction Capacity Limitations

Local capacity: Builders, state and local governments, and federal participants emphasized the importance of local capacity to support the construction and repair of homes after disasters. This included modular builders referencing the need for local, on-site logistics to prepare a site for modules or panels constructed off-site. Government officials and nonprofit participants underscored the importance of site prep for the installation of any modular home solution.

Builder access to capital: Builders highlighted that limited working capital and the time consuming back-and-forth process with insurers to agree on a settlement makes it very difficult for them to move quickly and add work to their portfolio. Some builders did report the ability to be paid more quickly by insurance for “emergency services”—minimal repairs to keep a home dry while the homeowner waited for insurance to pay out.

Willingness to travel: Builders are limited in the distance they are willing to travel to complete work on a project, especially when the impacted area has limited capacity to house and support temporary workers and when it involves crossing state lines. Builders reported

traveling into an impacted area with their own personal supplies, fuel, and water, so as not to draw from the limited resources in the disaster area. Challenges accessing these resources contributes to the limited distance a builder may be willing to travel. Prior research presented during the roundtable showed, based on a survey of homebuilders, that two hours (one-way) was the extent most would be willing to drive. In addition to distance and resources, builders also consider state-specific requirements for insurance, warranty, and liability. Participants expressed that any of these hurdles could deter contractors from working out of state.

Access to skilled labor: Related to a builder's willingness to travel is the availability of skilled labor in the impacted area. If a builder's subcontractors (e.g., electrical) are not able to travel, the builder must rely on local skilled labor. However, local skilled labor is in high demand after disasters.

Role of insurance: Builders highlighted the important role of the insurance industry in determining disaster survivors' timelines and options for rebuilding. Some builders can triage and perform minor repairs to their customers' homes before insurance settlements come through, while some do not have the working capital to do so. Arriving at and agreeing on an estimate for home repair or reconstruction can be a lengthy and costly process for builders. In addition, builders discussed the challenge of underinsured homeowners and situations where insurance does not cover the cost to bring a home to current code. In either case, the survivor is left without a home. Government officials raised concerns with building on an existing foundation, which is an issue that spans insurance, builder capacity and feasibility. Building on an existing foundation can create concerns with a builders' ability or comfort with issuing a warranty for the work.

Together, the roundtable participants highlighted the landscape of constraints and challenges facing an effort to consider how the US could scale up housing construction capacity after a disaster. Participants expressed a common goal: to address supply-side constraints by improving codes, collaboration, and legislative action to provide resilient housing solutions post-disaster. This discussion set the stage for exploring new, big ideas in subsequent sessions.

Key Themes and Ideas for Scaling Capacity

During the second half of the roundtable, participants thought creatively about scaling construction capacity after disasters for two goals: repairing homes and replacing/rebuilding homes. Below, we describe the discussion around each of the emergent themes. Throughout this section, we have also included several specific policy recommendations that emerged from the roundtable discussion. The Appendix includes a summary table of all ideas.

Funding

Funding and programmatic limitations tied to funding sources were a persistent topic of conversation throughout the roundtable. State and local governments and builders highlighted the delays in making repairs or rebuilding homes caused by a lag in funding, while federal participants offered context on the limitations and requirements placed on funding by existing authorities. Suggestions to address these challenges included broad legislative changes to the ways FEMA can deliver housing missions (see policy recommendation) as well as ways to expedite available programs, with many participants agreeing that state and local governments have the ability to move much faster than the federal government when it comes to starting the process of recovery and rebuilding. A state government equipped with a fund to bridge the gap between a disaster and when federal funding flows in can make headway in paying contractors to repair homes from the start. States, if using their own funds, are not bound to the FEMA

requirements to provide a temporary shelter instead of a permanent home. Participants shared examples of programs where a state had been able to offer disaster survivors a permanent home through state-raised funding. Historically, there have been attempts to have a federally funded housing recovery that is managed by a state, with limited federal involvement.

No.	Description	Who?
1	Quick access to financing (e.g., bridge funding, block grants)	SLTT governments Insurance companies Federal government
2	Collaborative models to leverage funding across sources (e.g., those providing temporary and permanent housing, nonprofit funding)	Federal government SLTT governments Non-profits
3	Cash fund for state and local flexibility in delivering assistance	SLTT governments
4	Streamline cost estimating and available funding for direct repairs, especially for repairs made to achieve code or floodplain management ordinance compliance	Insurance companies Federal government SLTT governments
5	Enabling states to utilize federal funding for community-fit programs	Federal government

Policy Recommendation 1

Congress should expand FEMA's disaster housing authority to allow funds to be used for the construction or siting of **permanent housing and subsequent transfer of ownership** (via sale or transfer) to a state or local housing authority, homeowner, or nonprofit entity for long term ownership.

Codes and Standards

The roundtable discussion on codes and standards had three themes. First, a general sentiment that building codes are important, especially when it comes to reducing future losses (e.g., the Fortified program).¹⁰ Second, code-requirements specific to the off-site construction industry including the importance of states looking at how they handle inspecting buildings constructed off-site and the overall challenge of scaling off-site construction given code differences across states. Eleven states do not yet have a modular/industrial building program. Participants expressed the need for state and local code-making bodies to adopt consistent standards for off-site construction (e.g., ICC/MBI 1200 and 1205), allowing builders to more easily construct off-site for multiple states. Third, roundtable participants highlighted delays caused by permit review and certificate of occupancy timelines. They suggested several ideas for increasing the speed and capacity of permit reviewers, including centralized or virtual review processes and artificial intelligence (AI) assisted review. The group also discussed the potential for waivers and assurances as a condition of government-funded housing assistance (e.g., for license reciprocity, certain insurance regulations, and permitting). This might also include something to address the variances in insurance, warranty, and liability that can deter contractors from working across state lines.

Policy Recommendation 2

State and local code-making bodies should adopt ICC/MBI 1200 and 1205 Standards for Off-Site Construction, and/or the federal government should adopt these standards as a condition of Federal disaster housing funding for off-site built homes (similar to how the HUD Code is used for manufactured homes today).

¹⁰ The Fortified program is an above-code way to re-build, re-roof or retrofit a home to protect against severe weather. <https://fortifiedhome.org/about>.

No.	Description	Who?
6	Codes and standards consistency across state and local jurisdictions (especially neighboring states)	SLTT governments Code bodies
7	Wider adoption of off-site construction standards by state and local jurisdictions (e.g., ICC/MBI 1200 Standard for Off-Site Construction: Planning, Design, Fabrication & Assembly & ICC/MBI 1205 Standard for Off-Site Construction: Inspection and Regulatory Compliance)	SLTT governments Federal government (disaster-specific standard)
8	Identify options to streamline permit reviews and building inspections (e.g., centralized review, virtual review, AI-assisted review)	SLTT governments
9	Waivers and assurances as a condition of disaster housing assistance (e.g., license reciprocity assurance, insurance regulations, permitting)	Federal government State government
10	Ensure that any housing actions (e.g., code, permit related) consider the extended demand timeline for construction after initial impact (years)	Federal government SLTT governments Code bodies

Labor

Participants in the roundtable identified the importance of effectively utilizing both construction/trade skilled and volunteer or novice labor in scaling construction capacity after disasters. Specifically, participants shared examples of how they divide projects into tasks that can be completed by those skilled in the construction trades and volunteer or novice construction labor, and how builders design crews to include skilled and junior staff, with junior staff learning via on-the-job training. Modular and off-site builders discussed the importance of training not only construction labor but also training code and permitting officials on the industry and how off-site buildings are constructed. Because a home built off-site arrives with walls and sometimes the entire structure complete, it is difficult to then inspect those building elements that are behind the walls (e.g., plumbing).

Several participants also discussed ideas for increasing the overall labor pool. Some discussed ideas for surging labor to support disaster recovery. Participants with building code backgrounds proposed support teams with code expertise that could be deployed to support an affected jurisdiction. Builders discussed the idea of “national catastrophe teams” who could be deployed to provide skilled labor or training in construction and related trades. Others suggested targeted apprenticeship programs to increase the overall construction labor pool, especially as the construction workforce is aging.

In addition to methods for utilizing, training, and incentivizing skilled labor to support housing recovery, builders highlighted the importance of supporting these workers with their own basic needs. This might include dedicated temporary lodging for construction or infrastructure workers, assistance identifying areas where builders could travel in with their own RV and hook up to power or water (if available), secure equipment storage, and other needs.

Policy Recommendation 3

State skilled labor licensing boards should **expand license reciprocity agreements** for construction labor, at least during disaster response.

No.	Description	Who?
11	Better utilization of overall worker pool (identify roles, workforce development for volunteer or novice workers)	Builders Non-profits
12	Better utilization of skilled labor (vetted lists, license reciprocity)	SLTT governments Federal governments
13	Surging expertise to support local jurisdictions (inspectors, code officials, training, “national catastrophe teams”)	SLTT governments Code bodies
14	Coordinated support for construction labor to reduce barriers to entry (e.g., increased veteran pathways and trade school programs)	Federal government SLTT governments Non-profits

Industrialized Housing

The topic of industrialized housing (housing built at a location other than the permanent site), also referred to as off-site construction, was introduced during the roundtable as one of the potential solutions for rapidly scaling housing after disasters. Participants discussed the fact that there remain knowledge gaps surrounding this method for constructing homes and its ability to scale quickly, and the sector will need to overcome this if industrialized housing is to be a part of future disaster responses. Relatedly, participants highlighted the importance of acquiring building materials to support any construction operation after a disaster and the potential supply chain challenges associated with surging materials to an affected area. Participants shared experiences with centralized distribution of construction materials to many sites as a way to streamline reconstruction activities.

Policy Recommendation 4

Research funding agencies should support studies on industrialized housing supply chains.

No.	Description	Who?
15	Analyze workflow for industrialized housing to prioritize bottlenecks	Academia Builders
16	Identify and quantify post-disaster housing material supply chain challenges and solutions (e.g., centralized material distribution)	Academia Builders
17	Study the feasibility of rapidly deployed industrialized solutions that can be reconfigured to permanent homes	Academia Builders

Planning and Community Engagement

Throughout the roundtable, participants highlighted actions that could be classified as planning or community engagement. Many of these actions would be best if taken prior to a disaster happening in a community, but some are also important during disaster response and recovery. Discussion included the importance of disaster housing planning that aligns with future affordable housing development—understanding the priorities of local and state affordable housing agencies and programs and using that understanding to inform disaster response and recovery plans. This could include the purchasing or identification of land in order to designate locations that could be used for temporary or permanent housing after disasters. An example of this was shared during the roundtable, with a federal agency partnering with a nonprofit who had already acquired land in the affected area with the intent of building affordable housing. The federal agency was able to use the land for a temporary housing site, and later will turn over the improved site to the nonprofit. States could similarly purchase land for this purpose.

Participants highlighted the value of partnerships that are made before disasters, across voluntary agencies, builders, state and local governments, and the federal government, and the private sector (e.g. insurance companies). One state representative further described the value of partnerships to facilitate data collection. This participant described how each actor, whether federal, nonprofit, state, local or other had a piece of the data to describe housing demand. Having a clear picture of the needs of survivors by sharing these data could help prioritize actions. Participants further talked about the importance of engaging survivors directly, beyond data sharing, to understand their needs and preferences. One state participant shared the importance of considering the needs of a growing population of renters in their state. A landlord may or may not be able to make permanent repairs to a rental unit, leaving this group of survivors with limited options after temporary sheltering is exhausted. Another participant highlighted that sometimes in the name of efficiency and speed, homes are constructed to minimum design requirements, resulting in homes that feel temporary even if they are intended to be permanent. In the words of one participant “you need to get people into a home that

Policy Recommendation 5

Local and state authorities with responsibilities ranging from disaster response through long term housing recovery should **coordinate planning and objectives before a disaster occurs.**

feels long-term” and that taking away what feels special to someone in a home “just means that that will be a temporary home for them.”

In addition, participants brought up important considerations for a post-disaster housing environment that should be considered in the planning process, including the long tail of demand for builders. While the immediate aftermath may see a significant spike in demand, the work can take months to years to complete. Participants also highlighted the importance of considering overall community recovery in addition to housing, including how the local economy had recovered and whether there were services to support communities such as schools and hospitals. State and builder participants also shared the challenges in some places where the emergency management organization is only set up to handle immediate response and is not well integrated with those entities in charge of long-term housing recovery, which might include the state housing authority or similar organization. As a result, decisions made in the initial response phase do not align with what might be best for longer-term recovery.

No.	Description	Who?
18	Align disaster housing planning with affordable housing	Federal government SLTT governments Community
19	Purchase or identify land for potential temporary or permanent housing ahead of disasters (e.g. designate locations ahead of time with jurisdictions)	SLTT governments Non-profits

20	Incorporate mitigation into long-term planning (e.g., structural upgrades to improve hazard resistance, protection or relocation of vulnerable properties)	SLTT governments
21	Identify opportunities to leverage existing resilience funding for housing planning and enabling activities pre-disaster (e.g., FEMA mitigation funding)	Federal government SLTT governments
22	Pre-disaster partnership creation (e.g., nonprofit-public, private-sector—across local builder associations)	All
23	Collect and share data for needs, resources, and financing	Federal government SLTT government Non-profits Private sector (insurance)
24	Engaging survivors and communities to understand their needs and preferences (including considering growing population of renters for different solutions, overall community recovery)	Federal government SLTT governments Non-profits
25	Connect state and local emergency management organizations with organizations leading long term recovery	SLTT governments

Conclusion

THIS ONE-DAY EVENT DID NOT IDENTIFY A “SILVER bullet” for the issues that face survivors and the individuals and organizations who help them return home. Rather, the diverse group of roundtable participants resonated with the importance of maintaining and expanding the toolbox of approaches to address varying scenarios of housing damage and survivor needs. The key themes and ideas above, distilled from group discussion, represent an extensive set of opportunities for consideration in a toolbox. The Appendix matches these opportunities with the stakeholder groups who are well positioned to act on them. Though not exhaustive, this list provides a foundation to shape research and action agendas going forward. We conclude by proposing an initial research agenda to develop new tools and characterize an initial action agenda for the stakeholder groups best positioned to use tools in shaping policy and implementing initiatives.

The **research agenda** is a synthesis of roundtable ideas that is meant to be updated and enhanced going forward. Research is organized into five areas, or toolboxes, with near term opportunities to support policy recommendations highlighted.

- 1. Mobilize fast and flexible capital.** Roundtable participants continually emphasize the role of working capital in surging capacity to meet repair and reconstruction needs. Near-term research should target evidence that supports Congress to act on Policy Recommendation 1 in expanding FEMA’s authority to use federal funds for permanent repairs and construction. However, federal funding is only one avenue and discussions highlighted various state, local, nonprofit, and pooled capital initiatives for disaster housing. Case study research could characterize how creative capital approaches have bridged the time gap between disaster impacts and federal funding flows and how they have adapted funding requirements to better meet survivor needs. Cross case analysis could inform general success metrics, identify key factors, and explore specific research themes, such as the ability to address contractors’ chronic working capital constraints in mobilizing capacity. It is important to note that insurance was not a focal topic in this roundtable and further discussion is needed to engage appropriate stakeholders on issues that arose during this roundtable, such as how insurance conditions affect contractors’ decisions to engage in disaster recovery.
- 2. Re-engineer industrialized housing products and processes.** The roundtable affirmed strong interest in the ability to rapidly deploy industrialized housing capacity with temporary solutions that could transition into permanent homes. Near-term research should develop evidence that enables state and local code-making bodies to act on Policy Recommendation 2 in adopting ICC/MBI 1200 and 1205 Standards for Off-Site Construction. Case study research to further explore pilots and early adoption experiences, especially if combined with future roundtable discussions of cross-case analysis, should be tailored to support policymaker actions. In alignment with Policy Recommendation 4, research funding across agencies and disciplines should seek to characterize and to reengineer industrialized housing supply chains for both disaster and affordable housing solutions. Tangible outcomes of this broader research agenda should aim to frame and fill the toolbox for co-design of product and process in delivering solutions that are acceptable to survivor communities. Architectural design of temporary housing that can become acceptable permanent homes, with the option of future additions, should concurrently consider implications on capacity, cost, and time across the supply chain. Operational design research should develop tools to assess and design construction processes across the supply chain: cost and lead time analysis to acquire housing materials, produce components, and ship them to disaster-affected regions; capacity analysis to dynamically allocate resources across the integrated process of off-site production and on-site assembly.
- 3. Increase labor capacity.** Roundtable discussions revealed notable gaps in knowledge about the ability to surge labor for various roles required for post-disaster housing, ranging from jurisdiction support for permitting and inspection to skilled and novice or volunteer labor across trades to support construction operations. Near-term research should target evidence that supports state skilled labor

licensing boards to act on Policy Recommendation 3 in expanding license reciprocity agreements for construction labor and developing lists of vetted professionals. A broader research agenda should strive to create various avenues to expand labor pools: apprenticeship programs to increase the overall labor pool, reducing barriers to entry (e.g., clear pathways for groups like veterans, support access to trade school programs), developing engagement mechanisms for volunteer or novice labor, redesigning projects into tasks that effectively leverage the available mix of skill levels, and supporting all workers to meet their basic needs while working in a recovery area (e.g. dedicated temporary lodging or RV sites, secure equipment storage).

4. **Coordinate planning for communities.** Roundtable discussions continually highlighted the importance of pre-disaster relationship building and coordinated planning to realize synergies across disaster response, housing recovery, and affordable housing initiatives, as articulated in Policy Recommendation 5. Research can support such efforts with evidence to catalyze early action, tools to ease planning efforts, and frameworks to support coordination across authorities and stakeholders. Research can also support relationship development by helping to develop shared intuition among diverse stakeholders and creating space for creative planning, such as support for landowners, developers, builders and community leaders to design novel business models for disaster and affordable housing. Finally, active research with community-based organizations can ensure that the voices of future survivors are continually incorporated in pre-disaster planning.
5. **Expand the discussion and agenda.** Innovation efforts should make provision for new voices and emergent ideas, continually convening stakeholders to refresh the research and action agendas. Three promising areas identified during this roundtable include engagement with the growing population of renters, integration of the insurance industry, and exploration of emerging technology such as artificial intelligence. The research agenda should also continually collect, document, and synthesize emerging research results across interdisciplinary and interagency boundaries.

The roundtable event closed with a conversation that literally went around the table. Referencing an initial list

of ideas captured over the past 24 hours, each participant each identified one or more next steps to continue the work. Excitement built as individuals' comments and identification of next steps built on each other such that cohesion around collective action emerged. We offer a brief description by stakeholder group of how this conversation energized their efforts toward the **action agenda** outlined in the Appendix.

- **Homebuilders:** participants were eager to start solving problems within their communities and their professional associations. Several planned to contact state officials supporting off-site construction standards and to meet with nonprofits and officials in their community about disaster recovery plans. National association staff planned to support local association initiatives and explore the potential for a new national committee to focus on these issues.
- **Nonprofit and community-based organizations:** participants welcomed opportunity to follow up with state officials to better understand recovery plans and explore creative approaches such as those shared at the roundtable. In return they wanted to share survivor experiences and community approaches. The participants energy and creative input during roundtable discussions emphasized the importance of enabling their participation in similar events going forward.
- **State and local government:** participants reciprocated the interest from nonprofit and community organizations, already planning specific discussions as they understand how such partnerships can scale efforts in areas such as land acquisition. Insights and evidence shared by other jurisdictions were referenced in planning actions to reconvene, advance or adapt initiatives. States experimenting with creative approaches were encouraged by this roundtable to continue innovating.
- **Federal government:** participants valued the open and honest engagement with various stakeholders to advance current policy efforts, open the aperture in planning approaches. Ongoing intra-agency and interagency are advancing innovation in post-disaster housing, but additional authorities granted by Congress are necessary for achieving more efficient disaster recovery. Specific legislative recommendations are included in the Key Themes and Ideas for Scaling Capacity section.

- **Academia:** participants were encouraged by the active representation across stakeholder groups and open discussion of ideas to shape a research agenda. They hope to convene future events to expand discussions and update agendas.

This roundtable spanning public, private, and nonprofit sectors demonstrated the breadth of interest in scaling capacity for post-disaster housing. Each participant contributed to multiple discussion sessions and described specific actions to pursue. Side conversations during breaks become more animated over the 24-hour period as relationships were established or enhanced. The event closed with a clear sense of collective purpose in moving forward and an enthusiasm to reconnect as research and actions advance.

Appendix: Summary of Ideas and Stakeholders

No.	Description	Builders	Cmnty.	SLTT Gov't	Fed. Gov't	Academia	Nonprofits	Insurance	Code bodies
Funding									
1	Quick access to financing (e.g., bridge or gap funding for contractors, block grants)			✓	✓			✓	
2	Collaborative models to leverage funding across sources (e.g., those providing temporary and permanent housing, nonprofit funding)			✓	✓		✓		
3	Cash fund for state and local flexibility in delivering assistance			✓					
4	Streamline cost estimating and available funding for direct repairs, especially for repairs made to achieve code or floodplain management ordinance compliance			✓	✓			✓	
5	Enabling states to utilize federal funding for community-fit programs				✓				
Codes & Standards									
6	Codes and standards consistency across state and local jurisdictions (especially neighboring states)			✓	✓				✓
7	Wider adoption of off-site construction standards by state and local jurisdictions (e.g., ICC/MBI 1200 Standard for Off-Site Construction: Planning, Design, Fabrication & Assembly & ICC/MBI 1205 Standard for Off-Site Construction: Inspection and Regulatory Compliance; potential disaster specific standard)			✓	✓				
8	Identify options to streamline permit reviews and building inspections (e.g., centralized review, virtual review, AI-assisted review)			✓					
9	Waivers and assurances as a condition of disaster housing assistance (e.g., license reciprocity, insurance regulations, permitting)			✓	✓				
10	Ensure that any housing actions (e.g., code, permit related) consider the extended demand timeline for construction after initial impact (years)			✓	✓				
Labor									
11	Better utilization of overall worker pool (identify roles, workforce development for volunteer or novice workers)	✓					✓		

No.	Description	Builders	Cmnty.	SLTT Gov't	Fed. Gov't	Academia	Nonprofits	Insurance	Code bodies
12	Better utilization of skilled labor (vetted lists, license reciprocity)			✓	✓				
13	Surging expertise to support local jurisdictions (inspectors, code officials, training)			✓					✓
14	Coordinated support for construction labor to reduce barriers to entry (e.g., increased veteran pathways and trade school programs)			✓	✓		✓		
Industrialized Housing									
15	Analyze workflow for industrialized housing to prioritize bottlenecks	✓				✓			
16	Identify and quantify post-disaster housing material supply chain challenges	✓				✓			
17	Study the feasibility of rapidly deployed industrialized solutions that can be reconfigured to permanent homes	✓				✓			
Planning & Community Engagement									
18	Align disaster housing planning with affordable housing		✓	✓	✓				
19	Purchase or identify land for potential temporary or permanent housing ahead of disasters (e.g. designate locations ahead of time with jurisdictions)			✓			✓		
20	Incorporate mitigation into long-term planning (e.g., structural upgrades to improve hazard resistance, protection or relocation of vulnerable properties)			✓					
21	Identify opportunities to leverage existing resilience funding for housing planning pre-disaster			✓	✓				
22	Pre-disaster partnership creation (e.g., nonprofit-public, private-sector—across local builder associations)	✓	✓	✓	✓	✓	✓	✓	✓
23	Collect and share data for needs, resources, and financing			✓	✓		✓	✓	
24	Engaging survivors and communities to understand their needs and preferences (including considering growing population of renters for different solutions, overall community recovery)			✓	✓		✓		
25	Connect state and local emergency management organizations with organizations leading long term recovery			✓					

Report prepared by:

Lauren Finegan, Jarrod Goentzel, Erin Reissman, Tim Russell, and Drew Story

MIT Humanitarian Supply Chain Lab

1 Amherst Street

Cambridge, MA 02142

humanitarian.mit.edu

Copyright 2024 © MIT Center for Transportation & Logistics. All rights reserved.