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# **Functional Recovery Performance Targets Workshop Report**

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## **Abstract**

Held in October 2024, the *Workshop on Functional Recovery Performance Targets* was hosted by the National Institute of Standards and Technology (NIST) and managed by the Applied Technology Council (ATC-169). The workshop convened 48 interdisciplinary experts to provide input on the Functional Recovery Goal Matrix (FRGM), a proposed framework to guide building design provisions that support timely post-earthquake functional recovery. Developed by the Functional Recovery Task Committee under the National Earthquake Hazards Reduction Program (NEHRP) Provisions Update Committee, the FRGM links community services and functions to specific target recovery times, with the goal of minimizing disruption and accelerating recovery.

Prompted by a 2018 Congressional mandate and building on prior work by NIST and the Federal Emergency Management Agency (FEMA), the workshop expanded stakeholder engagement beyond structural engineers to include experts in emergency management, housing, economics, urban planning, and lifeline infrastructure. The goal was to enhance incorporation of broader social and economic perspectives critical to real-world recovery outcomes.

Structured around five breakout sessions, participants examined criteria for prioritization, evaluated existing recovery categories and target recovery times, reassigned functions and services to revised categories, assessed the FRGM's generalizability across community types, and identified future research needs. Key prioritization criteria included ensuring access to housing, healthcare, and lifeline services; reducing population displacement; and serving the entire community, including at-risk populations.

A key outcome of the workshop was the development of a matrix with revised recommendations—the FRGM-W—which expands recovery categories from five to seven and refined target recovery times to include more granular timeframes (e.g., 0 hours, 24 hours, 72 hours, 1 month, 3 months). Participants reached broad agreement on prioritizing housing, healthcare, emergency services, and lifeline infrastructure for the earlier recovery timeframes.

The workshop underscored challenges in applying target recovery times to specific services due to interdependencies, implementation constraints, and limited data. Nonetheless, participants emphasized that incorporating functional recovery into design standards is essential to reducing downtime, supporting vulnerable populations, and accelerating community recovery.

The findings from this workshop will inform ongoing efforts by NIST, FEMA, and the broader NEHRP community to embed functional recovery objectives into building codes and standards, enhancing earthquake resilience and recovery nationwide.

## **Keywords**

Functional Recovery, Functional Recovery Goal Matrix, Functional Recovery Target Recovery Times, Earthquake Hazard Mitigation, Post-Earthquake Reoccupancy, Housing, Lifeline Infrastructure, Community Resilience, NEHRP Provisions, Built Environment, Structural Engineering, Public Policy & Urban Planning

## Executive Summary

Held in October 2024, the *Workshop on Functional Recovery Performance Targets* was hosted by the National Institute of Standards and Technology (NIST) and managed by the Applied Technology Council (ATC-169). The workshop convened a multidisciplinary team of 48 academics and practitioners with a shared interest in community recovery and resilience and decades of experience. Participants included leaders in housing, economics, emergency management, infrastructure systems, insurance, urban planning, public policy, and social science—each contributing perspectives essential to understanding how communities withstand and recover from major disruptions.

The workshop extends the work of the National Institute of Standards and Technology (NIST) and the Federal Emergency Management Agency (FEMA) to develop performance goals for post-earthquake reoccupancy and recovery of services and functions, called “functional recovery,” in response to the 2018 Congressional Mandate reauthorizing the National Earthquake Hazards Reduction Program (NEHRP). It was organized to consider and suggest improvements to the Functional Recovery Goal Matrix (FRGM) developed by the NEHRP Building Seismic Safety Council’s (BSSC) Provisions Update Committee (PUC) Functional Recovery Task Committee (FRTC). The FRGM identifies recovery categories, target recovery times (TRTs), and the functions and services associated with each recovery category and target recovery time. Its purpose is to point decision makers to the design standards needed to achieve functional recovery in a particular TRT (e.g., 72 hours).

Recognizing that functional recovery is as much a social and economic challenge as it is a technical one, workshop organizers deliberately expanded beyond engineering-focused discussions. Their purpose was to build on the foundation laid by the PUC FRTC while ensuring that recovery objectives are grounded in the lived realities of entire communities—not just physical structures.

Structured around five breakout sessions, the workshop focused on:

1. Establishing criteria for prioritizing recovery of functions and services.
2. Revising target recovery time categories.
3. Assigning functions and services to recovery categories and TRTs.
4. Evaluating the FRGM applicability across different community contexts.
5. Identifying data gaps and future research priorities.

A key outcome was the development of suggested recommendations for the matrix—FRGM-W (“W” for workshop) (see Table 10-2)—that expanded the number of recovery categories to seven from five and introduced more nuanced recovery timeframes, including 0 hours, 24 hours, 72 hours, 1 month, 3 months, 6 months, and Not Designed for Functional Recovery. These changes reflect the range of functions and services needed for an effective society and acknowledge the critical importance of restoring certain functions and services quickly to support a community’s broader recovery.

**Housing** emerged as the most discussed function throughout the workshop. Participants emphasized that prompt recovery of housing—especially forms such as multi-unit housing, congregate settings, and workforce housing—is essential to community stability. Without accessible housing, other recovery efforts stall: businesses cannot reopen, schools cannot resume, and health systems remain strained. Participants called for recovery performance objectives that enable residents to remain in their communities, maintain livelihoods, and resume daily life with as little disruption as possible. Discussions also revealed broad agreement on prioritizing life-safety services, healthcare, and education.

At the same time, assigning precise recovery timelines to housing and other community functions proved difficult. Uncertainty about **design constraints, costs and benefits**, availability of materials and labor, and regulatory processes complicates the development of realistic, achievable TRTs for functions and services. Participants highlighted the importance of considering how various lifeline systems—such as water, electricity, and transportation—are interconnected and must be restored concurrently to support a community’s essential functions and services.

While challenges remain, several themes emerged with broad agreement from participants:

- Recovery frameworks should promote stability, reduce population displacement, and support the well-being of all population groups. **Housing is the key** to this.
- Recovery strategies must reflect the interconnected needs of the whole community.
- Lifeline systems and health care are foundational to recovery and must be prioritized accordingly.
- Functional recovery efforts must be informed by credible **data**, grounded in lived experience, and applicable across geographic and demographic contexts.

The workshop underscored the need to build recovery standards not only on engineering models but also on social, economic, and governance considerations. Participants repeatedly emphasized that achieving community resilience requires a shift in focus for building codes—from life safety to enabling people to swiftly resume their daily lives.

It is hoped that findings from this workshop will inform future input to the NEHRP seismic provisions and potentially influence updates to national and international building codes (such as ASCE/SEI 7 and the IBC). Continuing to refine the FRGM-W with data on costs and design constraints will offer a more realistic and inclusive framework for defining recovery goals and measuring progress. By aligning building design and policy with the everyday needs of communities, this work aims to accelerate recovery after earthquakes and enhance long-term resilience nationwide.

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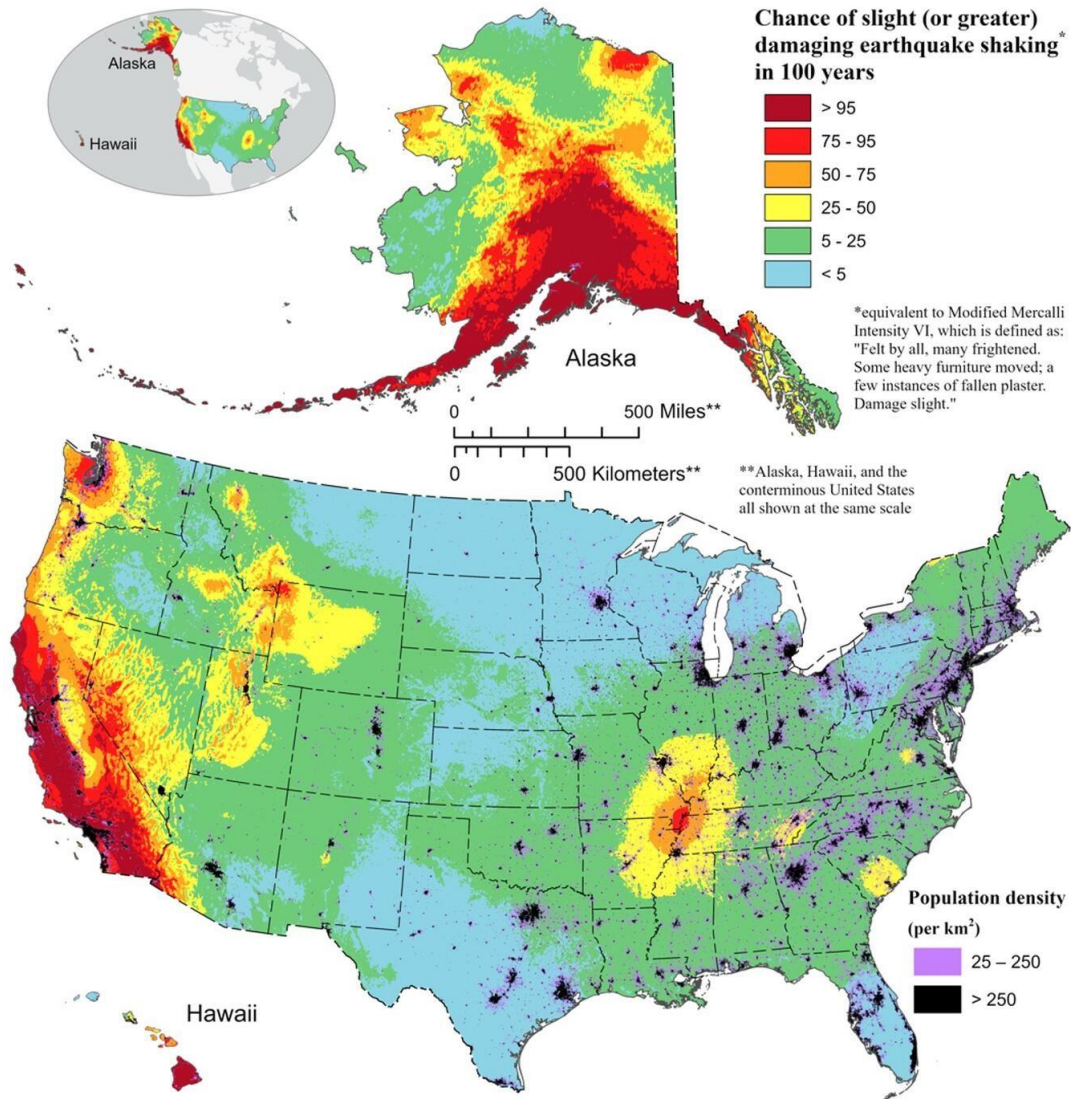
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## 1. Introduction

Earthquakes are among the most formidable natural hazards, capable of causing extensive structural damage, significant loss of life and injury, and long-term socioeconomic disruption. In 2015, the United States Geological Survey (USGS) estimated that nearly half of all Americans were exposed to potentially damaging earthquakes [1]. However, the scope of risk is even more widespread than commonly understood (Fig. 1-1).



**Fig. 1-1. National Seismic Hazard Model (2023).** Map displays the likelihood of damaging earthquake shaking in the United States over the next 100 years. (image from <https://www.usgs.gov/news/national-news-release/new-usgs-map-shows-where-damaging-earthquakes-are-most-likely-occur-us>)

According to the USGS description of the latest (2023) National Seismic Hazard Model [2],

- *Risk to People:* Approximately 75 % of U.S. land is susceptible to damaging earthquakes and intense ground shaking, placing hundreds of millions of residents at risk.
- *Widespread Hazard:* Historical data indicate that 37 U.S. states have experienced earthquakes of magnitude 5 or greater over the past two centuries, highlighting the extensive earthquake activity nationwide.

Historically, building codes have served as the primary mechanism for state and local governments to mitigate earthquake risks. These codes predominantly aim to protect human life and reduce injuries rather than ensure the continued functionality of buildings and infrastructure post-event [3]. Economic ramifications extend beyond immediate structural repair costs. They include disruptions to essential services (shelter, water, sanitation, and food supply), job and business losses, involuntary population displacement, and depletion of critical community assets, which impose substantial economic burdens. Besides the direct costs of repair, costs associated with physical and mental health, as well as downtime, can prove catastrophic to individuals and the communities in which they live.

A 2024 *NIST Research Brief* (RB 4r1) [6] depicts the “improved recovery trajectory between current design practice and the new functional recovery performance objective under development for buildings.” As shown in Fig. 1-2, implementing functional recovery design is expected to significantly shorten the time needed to reoccupy, repair, and resume a building’s basic functions and services (top row of buildings) as compared to current code design (bottom row of buildings). Beyond life safety, the goal of functional recovery is to shorten the length of time that people are displaced from their homes, schools, and places of employment; reduce teardowns and lengthy repair processes; and decrease the costs of short- and long-term recovery in terms of economic costs as well as physical and mental health costs. While it is impractical to eliminate all damage during major earthquake events, prioritizing post-earthquake **functional recovery** enables people to return home, go back to school, and resume jobs within a reasonable amount of time, facilitating community recovery and resilience.

### 1.1. Congressional Mandate

Congress recognized the need to extend the target of mitigation through building codes from preserving lives to also preserving the functionality of buildings and lifeline infrastructure in its December 2018 reauthorization of the Earthquake Hazards Reduction Act of 1977 (Public Law No. 115-307) [4]. The Act was amended to direct the Director of the National Institute of Standards and Technology (NIST) and the Administrator of the Federal Emergency Management Agency (FEMA) to convene a committee of experts charged with producing a report to Congress that addressed “options for improving the built environment and critical infrastructure.” Both NIST and FEMA contribute personnel and resources to the National Earthquake Hazards Reduction Program (NEHRP), which collaborates with the USGS and the National Science Foundation (NSF) to enhance earthquake resilience across the nation. The completed report, *FEMA P-2090 / NIST SP-1254: Recommended Options for Improving the Built Environment for Post-Earthquake Reoccupancy and Functional Recovery Time* [5], was submitted to Congress in 2021. Since then, functional recovery has become an emerging topic in earthquake engineering.

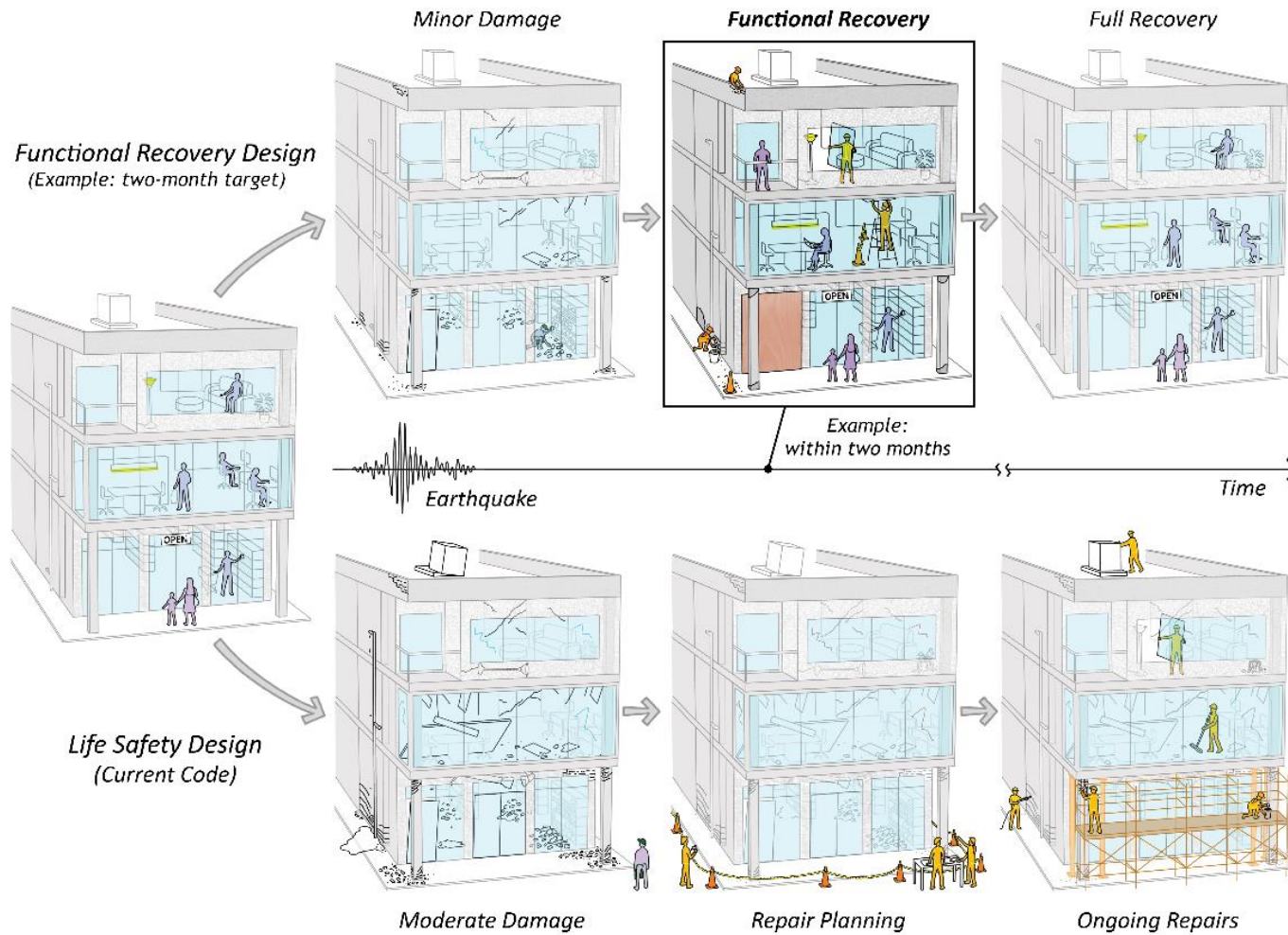


Fig. 1-2. Functional Recovery Performance Compared to Life Safety Design [6]

## 2. Catalyst for the Functional Recovery Targets Workshop

The drive to advance functional recovery principles began in parallel with the Congressional report's development and has continued since the publication of *FEMA P-2090/NIST SP-1254* in January 2021. Several initiatives have been undertaken to further functional recovery research and implementation for buildings and lifelines infrastructure. Those most related to this effort and primarily focused on building performance include:

- NIST Stakeholder Workshops (2020): Findings documented in *NIST SP-1269: NIST-FEMA Post-Earthquake Functional Recovery Workshop Report* [7].
- NIST Mini-Workshop on Recovery Categories and Target Recovery Times for Development of a Functional Recovery Framework (2022): Held at the EERI 12th National Conference on Earthquake Engineering (12NCEE) [8].
- FEMA-Sponsored Workshop on Functional Recovery (2022): Findings published in *ATC-58-7: Proceedings of FEMA-Sponsored Workshop on Functional Recovery* [9].
- FEMA-funded ATC-138 Project (2019-2023): Expansion of FEMA P-58 Methodology to incorporate functional recovery metrics into performance-based design.

As noted in the *Functional Recovery Planning Committee Report* [10], FEMA has historically supported the development of national standards and model building codes intended to reduce the impacts of future earthquakes. To this end, FEMA contracted in 2021 with the Building Seismic Safety Council of the National Institute of Building Sciences (NIBS) to develop and update the *NEHRP Recommended Seismic Provisions for New Buildings and Other Structures* [11] (Provisions). NIBS assumed sole responsibility for updating the Provisions in April 2025.

The Provisions typically serve as technical resources for updates to the ASCE/SEI 7 Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE 7). ASCE-7 is a reference standard for the International Building Code (IBC) and may be locally adopted by U.S. jurisdictions in the design and construction of most new buildings. The Provisions are developed by the Provisions Update Committee (PUC), a technical committee of earthquake experts from industry and universities who identify and apply the most advanced earthquake technology available. The PUC is supported by expert Issue Teams that address specific aspects of earthquake design methodology and construction.

In line with the Provisions Update structure, the *Functional Recovery Planning Committee Report* [10] recommended that the PUC establish a Functional Recovery Task Committee (FRTC) and any needed topic subcommittees to explore design criteria and related provisions for improving functional recovery in new building design.

The work by the FRTC has been ongoing since 2022. Two of the topic subcommittees, #2 and #3, have focused on developing and refining a **functional recovery goal matrix (FRGM)** along with commentary explaining the proposed number of categories, target recovery times (TRTs), and assignment of functions and services to each category. Fig 2-1 illustrates the general structure of the FRGM. Additional rows name the other recovery categories (e.g., B, C), TRTs, and definitions. A short list of possible examples for each recovery category serves to illuminate

which functions and services might be included in the categories. Each category (e.g., A, B, C) is associated with specific design provisions, articulated separately in the proposal submitted by the FRTC for review by the PUC. The matrix facilitates the application of TRTs that reflect function and service priorities for a community’s recovery after an earthquake.

**Summary of FRGM Content:** A goal matrix guides a project team in the design and repair of a structure providing a given function or service. The table can include recovery category labels, TRTs, category definitions, and examples of functions and services included in the category.

Functional Recovery Category	TRTs	Definitions	Examples
A	xxx hours		
B	xxx hours or days		
C	xxx days		
D	xxx months		
Not designed for FR	no target time		

**Fig. 2-1. General Structure of the FRGM.**

Initial recommendations about the contents of the FRGM were made using subject matter expert input from the workshops described in *NIST SP-1269: NIST-FEMA Post-Earthquake Functional Recovery Workshop Report (2020)* [7] as well as the professional experience of the two topic subcommittees.

The iterative process for developing and refining the proposed matrix began in 2023 and continued into 2025, beginning with discussion within the subcommittees. Their efforts were shared with the FRTC for review and comments. The topic subcommittees responded to the FRTC’s comments, making changes as needed. Once the FRTC agreed that the proposals from the topic subcommittees were ready for PUC review, the PUC reviewed and voted on the FRTC’s proposals. The topic subcommittees then acted on the PUC’s feedback to further develop the matrix. And, as the proposed FRGM continued to evolve, it became increasingly clear it would benefit from input by individuals with expertise in community recovery, emergency management, economics, and insurance. Recognizing the need for broader interdisciplinary engagement, NIST initiated the Functional Recovery Performance Targets Workshop.

### 3. Overview of the Workshop on Functional Recovery Performance Targets

The workshop was convened at NIST's National Cybersecurity Center of Excellence (NCCoE) in Rockville, Maryland, on October 8 and 9, 2024.

#### 3.1. Goal and Objectives

The goal of the effort was to bring together diverse stakeholders with interests in functional recovery concepts, largely from outside the engineering and code development world, to examine existing efforts to develop a FRGM and augment the broader collective body of knowledge developed by NIST and others advancing functional recovery concepts. The specific objectives for the workshop were to:

1. Collect research, papers, experiential data, and other **information** from participants that could be used to support categorization of functions and services in the FRGM as it currently stands or to justify changes to it.
2. Review and identify possible **changes** to the FRGM (version October 2024), using defined criteria/guiding principles (e.g., impact on population displacement). Changes may include the number of categories, timeframes, and assignment of community functions and services. Considerations should include possible differences between new and existing structures and lifeline systems.
3. Identify key **stakeholders** who should be involved in future decisions on categorization of functions and services, including those who may have additional information that could be used to further refine the FRGM.
4. Identify functional recovery **research needs** in terms of gaps in knowledge and additional information needed to further refine the FRGM.

#### 3.2. Description of Attendees

A distinguishing feature of this workshop was the broad spectrum of its 48 participants (Appendix A). The individuals who participated are a mix of academics and practitioners—emerging and established national and global leaders—whose work sits at the powerful intersection of science, policy, and practice. With deep expertise spanning housing and community recovery, social science and disaster recovery, urban and regional planning, resilience planning and public policy, business continuity and economic resilience, emergency management, and lifeline infrastructure systems, they brought to the workshop a systems-level understanding of how communities prepare for, respond to, and recover from disruption. Their work has led to national standards development and public policy, guided investments in lifeline infrastructure, strengthened local economies, and fostered recovery outcomes that have served whole communities. Drawing from decades of multi-hazard fieldwork, innovative research, and cross-sector collaboration, they are shaping the future of community resilience, turning risk into readiness, and adversity into opportunity. The experts who participated in this workshop are well-respected individuals leading change at local, national, and global scales.

### 3.3. Workshop Agenda

The workshop organizers (See Table A.1. in Appendix A) developed the workshop agenda (Appendix B). The workshop commenced with introductory remarks by Jason Averill, Deputy Director of the NIST Engineering Laboratory, who described NIST's mission and the role of the Engineering Laboratory, emphasizing the importance of functional recovery in disaster resilience research. Subsequent plenary sessions addressed functional recovery concepts; efforts to develop a FRGM; and the workshop's framework and objectives.

#### 3.3.1. Breakout Sessions and Discussions

The workshop incorporated five structured breakout sessions. All five sessions had handouts associated with them to be completed by the participants (Appendices D-H):

- Session 1. Decision Criteria for Functional Recovery Targets – Identifying key factors influencing recovery prioritization.
- Session 2. Recovery Categories and Target Timeframes – Establishing appropriate recovery timelines for different building functions and services.
- Session 3. Prioritization of Essential Community Services – Determining which services should be restored first based on societal needs.
- Session 4. Generalizability of the FRGM – Assessing the applicability of functional recovery targets across different geographic and socioeconomic contexts.
- Session 5. Identifying Research Gaps and Future Data Needs – Defining critical areas for future research and policy development.

Participants were assigned to four small groups, each with 9 to 11 members representing a mix of different areas of expertise. Breakout groups were provided with *community archetype* profiles (Appendix C), representing four different U.S. regions with varying earthquake risk, urban density, and infrastructure characteristics. These archetypes enabled participants to ground their discussions in real-world scenarios. The communities were modeled on characteristics found in the New Madrid region, the Pacific Northwest, California, and the U.S. East Coast. The rationale for assigning community archetypes was four-fold, to:

- discover commonalities relative to functional recovery times (Breakout Session 2),
- discover differences relative to the prioritization of community functions and services (Breakout Session 3),
- reduce the impact of assumptions based on individual experiences/perceptions, and
- capture national realities.

Participants were asked to vote on items during breakout sessions with the goal of understanding the general degree of agreement rather than seeking consensus through a more deliberative process.

#### **4. Breakout Session 1: Understanding the FRGM and Developing Criteria for Defining Target Recovery Times**

Ryan Kersting introduced Session 1 reiterating the purpose of the FRGM and discussing the need for identifying prioritization criteria to further develop the matrix. Several key factors with the potential to influential functional recovery prioritization were noted, including public safety, economic and social stability, infrastructure, and environment.

##### **4.1. Objective**

The objective was to discuss, develop, and prioritize the full group's top five criteria for use in later breakout sessions. Specifically, the hope was that participants' decisions would reflect and be influenced by the agreed-upon criteria rather than strictly individual perceptions as they engaged in the discussions of recovery categories and TRTs in Breakout Session 2, and assignments of functions and services to recovery categories in Breakout Session 3.

##### **4.2. Process**

Participants were given a handout describing functional recovery concepts and two session-specific handouts (Appendix D). The session began with icebreaker questions designed to elicit criteria for prioritizing and assigning functions and services to categories and times, as follows:

- If your family experienced an earthquake, which impact of many would you be most concerned about for your family from 24 hours to 6 months after the event?
- Across your neighborhood, town, or city, who do you think is likely to be most impacted, and who needs extra protection from impacts?
- If you were a city planner or mayor, what kinds of assets, either types of buildings or other infrastructure such as utilities, come to mind as needing priority for recovery?
- Some buildings or utilities have straightforward and possibly singular functions or services. For example, a bank provides access to financial resources, and the electrical grid provides power. Can you think of other examples of buildings or infrastructure that may provide multiple important functions or services or may provide both primary and secondary (or possibly indirect or hidden) functions or services?

After spending 10 minutes on icebreaker questions, the groups spent 10-15 minutes discussing factors to inform decisions on how quickly functions and services recover. Participants were encouraged to think at the community scale and individual/family scale. Finally, participants were asked to specify the criteria for prioritizing functional recovery goals for resilient communities. Each group considered which factors, attributes, or characteristics of a community should be emphasized for prioritizing functional recovery goals for the functions and services provided by buildings, utilities, and infrastructure, as well as the basic conditions considered desirable and any overarching consequences to be avoided or minimized. A facilitator led each group and recorded high-level content on an easel, while a scribe took more detailed notes to capture information related to the conversation.

### 4.3. Description of Criteria

When asked which *populations were among the most impacted*, all four groups identified several at risk populations. Three groups listed children and immigrant or language minority groups, and two groups recognized emergency responders and pets (Table 4-1). Only results with two or more groups reporting are included in the tables in this section.

**Table 4-1. Populations Most Likely to be Negatively Impacted by an Earthquake.**

Populations	# of Groups
At risk populations (e.g., elderly, disabled, medically fragile, low-income, unhoused, transportation-dependent, renters)	4
Children	3
Immigrant or language minority groups	3
Emergency responders	2
Pets	2

When asked what *type of assets to prioritize for community recovery*, all four groups listed shelter (housing and congregate shelters), lifelines (utilities like water, power, transportation, communication, data centers/hubs), and health services (hospitals, outpatient care, pharmacies, mental health, nursing homes). Three of the four groups identified education (schools, daycare) and emergency response facilities (police stations, fire stations, emergency operations centers). Two groups also prioritized food supply (grocery and food stores), financial infrastructure (banks, financial services), and government and community facilities (Table 4-2).

**Table 4-2. Assets to Prioritize for Community Recovery.**

Assets to Prioritize	# of Groups
Shelter (housing and congregate shelters)	4
Lifelines (utilities like water, power, transportation, communication, data centers/hubs)	4
Health services (hospitals, outpatient care, pharmacies, mental health, nursing homes)	4
Education (schools, daycare)	3
Emergency response facilities (police, fire, emergency operations centers)	3
Food supply (grocery and food stores)	2
Financial infrastructure (banks, financial services)	2
Government and community facilities	2

With respect to *factors driving prioritization in recovery*, all four groups recorded access to shelter and housing, access to lifelines, access to physical and mental health services, and focus on the whole community. Three groups agreed on economic livelihoods and wellbeing, avoiding significant population displacement, and sustaining life safety. Two groups listed hazard

mitigation for secondary disasters, considering the scale of the event’s impact, and taking note of pre-existing condition (e.g., awareness of hazards, state of infrastructure) (Table 4-3).

**Table 4-3. Factors Driving Prioritization in Recovery.**

Factors Driving Prioritization in Recovery	# of Groups
Access to shelter and housing	4
Access to lifelines	4
Access to physical and mental health services	4
Focus on the whole community	4
Economic livelihoods and wellbeing	3
Avoiding significant population displacement	3
Sustaining life safety	3
Hazard mitigation	2
Scale of the event’s impact	2
Pre-existing conditions	2

When selecting their top five *criteria for recovery*, all four groups listed access to shelter and housing, access to lifelines (e.g., utilities, food, telecommunication, transportation), and access to physical and mental health services. Three groups chose economic livelihood and wellbeing, along with a focus on the whole community. Two groups listed avoiding significant population displacement and access to education. Table 4-4 shows the “top-5” criteria across groups.

**Table 4-4. Top Criteria for Recovery.**

Criteria for Recovery	# of Groups
Access to shelter and housing	4
Access to lifelines	4
Access to physical and mental health services	4
Economic livelihood and wellbeing	3
Focus on the whole population	2
Avoiding significant population displacement	2
Access to education	2

#### 4.4. Discussion

Drawing on the groups’ discussions, the report authors note three broad themes.

**Focusing on the Whole Community:** All groups emphasized the importance of recognizing and addressing the needs of the whole community, including populations susceptible to compounding negative effects, such as the elderly, people with disabilities, low-income

groups, and those dependent on transportation. Groups 2 and 4 also included pets, undocumented populations, language minorities, and renters, highlighting the variability and potentially unique nature of what might be considered issues within specific communities. Similarly, Group 3 talked about economically disadvantaged populations, unhoused people, the elderly, and children.

**Prioritizing for Effective Recovery:** All four groups emphasized that recovery priorities should consider characteristics of individual communities that may want to shift the prioritization of some functions and services to a faster recovery category. Groups 1 and 4 stressed prioritizing recovery efforts to avoid exacerbating preexisting problems. Groups 1 and 3 focused heavily on lifeline infrastructure and education, while Groups 2 and 4 considered broader socio-economic and governance aspects. Group 1 mentioned hospitals, utilities, transportation systems, schools, and shelters. Group 3 focused on schools, daycares, hospitals, and financial services like ATMs. Group 2 included health centers, schools, utilities, faith institutions, and emergency facilities. To this, Group 4 added financial institutions, food stores, and community and government buildings alongside utilities.

**Long-Term Vision:** All groups acknowledged the need for strategies that restore pre-disaster conditions but also adapt to long-term challenges and evolving community needs. Group 1 stressed saving lives, mental health, consistent recovery times for all community members, and leadership. Group 2 highlighted social vulnerability, community-scale considerations, and a need for updated building inventories. Group 3 focused on cultural variety, social cohesion, and multi-stakeholder management. Group 4 also emphasized social cohesion, wellbeing across the community, adaptability, and governance capacity.

#### 4.5. Selection of Criteria for Use in Breakout Sessions 2 and 3

After Session 1 concluded and the criteria were compiled, workshop participants completed an online poll in which they selected their individual top five criteria from a potential 12 options. Participants assigned five points to their top criterion, four points to their next criterion, three to the next, two to the next, and one to the last of five. Workshop organizers used the poll results to identify the criteria intended for use in later sessions, with their overall rank and number of points accumulated from voting appearing in the brackets.

- Maximize availability of housing [1, 113]
- Maximize access to healthcare, both physical and mental [2, 100]
- Maximize access to utilities, including lifelines [3, 91]
- Serve the whole community's basic needs [4, 81]
- Reduce population displacement [5, 49]

Participants were informed about the top 5 criteria and asked to keep these topics in mind as they worked in small groups for Breakout Sessions 2 and 3. However, they were presented in alphabetical order and without ranking or point values to avoid over-biasing subsequent discussions.

## **5. Breakout Session 2: Defining Categories for Recovery and Target Times for the Resumption of Key Services and Functions**

Siamak Sattar introduced Breakout Session 2, in which participants were asked to define recovery categories and establish TRTs to inform functional recovery design provisions. The TRTs indicate the maximum allowable time for recovery of various community functions and services to meet user and community needs and minimize negative consequences. The times should include time to complete repair work, but exclude external factors (e.g., utility failures, delays due to regulation or funding). Sattar observed that not all functions and services are needed immediately after an earthquake and that recovery timeframes should reflect the role of each service in community recovery. Participants were asked to consider realistic vs. idealistic recovery goals, without focusing on cost and implementation constraints.

### **5.1. Objective**

The goal of this second breakout session was to discuss and gather feedback on specific TRTs and the recovery categories needed to support functional recovery performance. Specific categories are essential for applying performance targets through code and standard procedures.

### **5.2. Process**

Prior to completing the session's exercises, participants were reminded via the background on Handout 2.0 (Appendix E.1) that "not all functions and services are needed right after an earthquake, and that the acceptable target recovery time of various services depends on the role of each community service within the community. Some services are required immediately after the event, some within a short timeframe, and others might be required in an intermediate- or long-term time period after the event. Some services may not play a significant role in the community's recovery and may not need to be designed for FR."

*Exercise 1.* This 10-minute exercise began with participants completing Handout 2.1 in which they were asked to assign the maximum acceptable time (i.e., ten timeslots, ranging from 0 to 24 hours and greater than 18 months) for each of five qualitative recovery phases (i.e., from immediate to long-term) (Appendix E.2). While participants were asked to "vote" on these items, the intent was not to establish or seek consensus among participants. Rather, the intent was to prompt participants to begin thinking about how they might interpret the recovery phases, unrelated to the FRGM.

*Exercise 2.* Next, groups discussed the October 2024 version of the functional goal recovery matrix (FGRM), with target times and community functions supported by structures. The summary matrix shared with the group provided descriptions for each of the categories and target times. It is shown below in Table 5-1 and in Breakout Session 2 materials discussed in Appendix E. For example, Category A, with a target time of 0 hours, was described as, "Community functions that support essential and immediate safety and survival needs." The

groups reviewed each of the five categories (A, B, C, D, Not Designed for FR) in turn, responding to question prompts such as,

- “Is within 2 months an appropriate target recovery time for those types of services? Why or why not?” and
- “Other than services that would go in the “immediate” and “72 hours” bins, do you think there are services that need to be recovered in less than two months—say closer to one month—to avoid severe social or economic impacts?”

The questions used to guide the discussion are included in Appendix E.3. This discussion of the TRTs and categories lasted approximately 40 minutes, with groups providing their rationale for their agreement and/or disagreement with the target times and categories in the FGRM (Appendix E.3 and Appendix E.4). As part of this breakout session, facilitators were asked to summarize their group’s suggested recommendations for the FGRM with respect to the number of recovery categories and TRTs in Document 2.4 (Appendix E.5). Each group was also asked to indicate the degree of its agreement with the final goal matrix it had produced.

The group’s work was led by a facilitator and written on easel sheets as well as transcribed by a scribe. Participants were asked to give their completed Handout 2.1 and Handout 2.3 to their facilitators (results are discussed in Section 5.3). Notably, while the groups were encouraged to use the top five criteria from Breakout Session 1 (housing, healthcare (physical and mental), access to lifelines, serve the whole community’s basic needs, and reduce population displacement), it was not apparent in any of the groups that this was done systematically for this breakout session.

**Table 5-1. Summary Functional Recovery Goal Matrix (FRGM) Provided to Workshop Participants.<sup>a</sup>**

Functional Recovery Categories	Target Recovery Time	Community Functions Supported by Structures
A	[0 hours]	<p>Community functions that support <u>essential and immediate safety and survival</u> needs. Functions in this category include but are not limited to:</p> <ul style="list-style-type: none"> <li>- Emergency response and communication</li> <li>- Emergency and acute healthcare</li> <li>- Housing of non-ambulatory populations and people incapable of self-preservation (e.g., nursing homes, assisted living), and people in custodial care (e.g., correctional facilities)</li> </ul>
B	[72 hours]	<p>Community functions that support <u>urgent and basic human survival needs</u> and that prevent the escalation of adverse disaster consequences. Functions in this category include but are not limited to:</p> <ul style="list-style-type: none"> <li>- Emergency services not included in Functional Recovery Category A</li> <li>- Food and potable water services, both wholesale and retail</li> <li>- Healthcare providing urgent, non-emergency life sustaining treatments</li> <li>- Residential or non-transient housing</li> <li>- Transient housing (lodging)</li> <li>- Urgent veterinary services</li> <li>- Vital utility services</li> <li>- Services and employing organizations critical to national economic stability</li> </ul>
C	[2 months]	<p>Community functions that support <u>routine self- and group-preservation</u>, and that <u>sustain short- and long-term economic, educational, and governance activities and services</u>. Functions in this category include but are not limited to:</p> <ul style="list-style-type: none"> <li>- Recovery-focused local government services</li> <li>- Child and adult daycare</li> <li>- Healthcare providing routine or elective treatments</li> <li>- Education (PK-12)</li> <li>- Services and employing organizations critical to regional economic stability</li> <li>- Non-urgent veterinary services</li> </ul>
D	[6 months]	<p>Community functions that <u>enhance a community's general well-being and expedite the return to normalcy</u>. Functions in this category include but are not limited to:</p> <ul style="list-style-type: none"> <li>- Post-secondary</li> <li>- Routine local government services</li> <li>- Services and employing organizations critical to local economic stability</li> </ul>
Not Designed for FR	[no target]	<p>All other community functions not addressed in Categories A through D. These include functions expected to support people's quality of life that are not essential to the community's recovery.</p>
<p><sup>a</sup> This table summarizes, but does not directly reproduce, the FRGM draft being discussed by the PUC as of October 2024.</p>		

### 5.3. Recovery Times

#### Exercise 1

Data from this exercise was provided by each group and then collated by the authors. As shown in Table 5-2, moderate to high agreement was registered both within and across the groups when individuals were asked to complete the table of recovery phase targets (in hours, days, weeks, and months) vs. five qualitative descriptors (immediate, near-term, short-term, etc.). Of 39 responses, 31 (79 %) equated *immediate* with 0 to 24 hours, with all but one of the remaining respondents choosing 2 days to 3 days for immediate. More variability in voting was registered for the *near-term* qualifier, with 23 (59 %) selecting 4 days to 7 days, eight (21 %) choosing 2 days to 3 days, seven (18 %) marking 2 to 4 weeks, and one person picking 3 days to 6 months. Together, 31 (79 %) chose within 4 days to 7 days.

**Why These Timeframe Selections?**

Participants identified four key factors for assigning phases to specific time periods:

- Critical services (e.g., hospitals) need either continuous function or rapid recovery.
- Economic stability – small businesses and economic hubs require shorter recovery windows to sustain operations.
- Public perceptions and psychological thresholds around recovery times influence their ability to adapt.
- Lifelines (e.g., power, water) are critical to key functions such as healthcare and communications.

**Table 5-2. Recovery Phase Targets (number, percent).**

*These results are based on the compiled responses across individuals to Exercise 1 in Breakout Session 2.*

	Immediate	Near-term	Short-term	Intermediate	Long-term
<b>0 to 24 hours</b>	<b>31 (79 %)</b>				
<b>2 to 3 days</b>	7 (18 %)	8 (20 %)			
<b>4 to 7 days</b>	1 (3 %)	<b>23 (59 %)</b>	3 (7 %)		
<b>2 to 4 weeks</b>		7 (18 %)	12 (31 %)		
<b>5 to 8 weeks</b>			<b>16 (41 %)</b>	4 (10 %)	
<b>3 to 6 months</b>		1 (3 %)	7 (18 %)	<b>15 (38 %)</b>	3 (7 %)
<b>7 to 9 months</b>			1 (3 %)	5 (13 %)	1 (3 %)
<b>10 to 12 months</b>				6 (16 %)	5 (13 %)
<b>13 to 18 months</b>				7 (18 %)	7 (18 %)
<b>&gt;18 months</b>				2 (5 %)	<b>23 (59 %)</b>

Even more variability characterized the remaining three phases, suggesting less agreement around the meaning of these qualifiers in the community recovery context. While the highest number of votes (16, 41 %) in the *short-term* category was registered for 5 weeks to 8 weeks, another 15 (3+12, 41 %) were assigned to shorter periods (3: 4 days to 7 days, 12: 2 weeks to 4 weeks). Thus, the majority of respondents indicated that short-term was no more than 5 to 8 weeks. The largest number of votes (15, 38 %) were cast for 3 to 6 months for the *intermediate* category, with another four (10 %) cast for 5 weeks to 8 weeks. Remaining votes were registered for 7 to 9 months (5, 13 %), 10 months to 12 months (6, 15 %), 13 months to 18 months (7, 18 %), and greater than 18 months (2, 5 %). This distribution suggests less agreement around what constitutes *intermediate*. For the last category, *long-term*, selections ranged from 3 months to 6 months (3, 8 %) to greater than 18 months (23, 59 %), with the majority greater than one year (30, 77 %). The box below describes some reasons captured by workshop organizers for the assignment of specific times to each phase.

## Exercise 2

Data for this exercise was created by each group and then collated by the authors. Table 5-3 summarizes both agreement with and proposed changes to the October 2024 FRGM. Descriptions of this agreement and proposed changes are provided here under the category headings used in the FRGM.

*Category A (0 hours)*—All four groups generally agreed with this time category, emphasizing the immediate need for some but not all life-safety services, including hospitals, fire stations, and correctional facilities. Groups 1, 2, and 4 suggested both a 0-hour category as well as a separate 24-hour category, recognizing that “zero recovery time” might be unrealistic for some services. Group 2 emphasized that a 0 to 24 category must be narrowly constrained in terms of functions and services to be meaningful. Group 3 also supported the 0-hour category, stressing its importance for continuous-function facilities like hospitals. They did not discuss a 24-hour category. Group 4 suggested adding hazardous materials facilities to the 0-hour category. In Table 5-3, a category for 24 hours is added.

*Category B (72 hours)*—While Groups 1 and 3 agreed on 72 hours, Group 2 proposed reducing it to 48 hours for critical functions like dialysis centers and other medical facilities that serve people with important medical needs. Groups discussed challenges in restoring lifelines (power, water) necessary for achieving this target. It was observed that the 72-hour target could work well with sufficient lead time and adequate preparedness (e.g., food on hand, generators, and water storage on site). Group 4 found 72 hours “appropriate but too long” in the case of some functions, emphasizing the need for adaptations and partial functionality. In Table 5-3, a 48 hour category is added.

*Category C (2 months)*—Groups 2, 3, and 4 suggested adding a 1-month category to bridge the gap between 72 hours and 2 months, citing economic and social impacts as well as needing government services, housing, and childcare earlier than 2 months. While Group 2 also suggested adding a 2-week category if the 2-month deadline was to be retained, the 1-month category was the most popular choice overall. In addition, three of four groups suggested

adding a 3-month category. In adding this recovery time category, Group 3 noted that 3 months (one quarter of the year) aligns with decision-making milestones for governance and reconstruction. Group 2 also emphasized the importance of recovering small businesses, ports, and government services within this timeframe. In Table 5-3, the 2-month category has been changed to two categories, one for 1 month and one for 3 months.

*Category D (6 months)*—While six months was generally supported as a milestone by all four groups, one group shared that the three-month timeline was sufficient for longer-term recovery, given the characteristics of its assigned community, which was judged to be generally prepared for an earthquake and therefore not in need of a longer timeframe. It was noted that small businesses need a faster recovery time, given their poor outcomes with prolonged business closures (as cash flow becomes a problem and customers identify substitutes with continued closures). In addition to the six-month milestone, Group 1 added 18 months as a long-term target, citing federal funding timelines, while Group 2 proposed 12 months for community functions that are not essential to initial recovery (e.g., recreational and cultural facilities). Some suggested adding a 12 to 18 month, or 18-month category to the existing functional recovery matrix to align with federal funding cycles and longer-term recovery needs. Finally, Group 3 highlighted that beyond six months, rebuilding efforts should focus on improvements rather than recovery and restoration. Therefore, in Table 5-3, the 6-month category was retained, and a 12 to 18 month category was added.

Participants highlighted the same four factors as they mentioned after Exercise 1 when asked to explain these timeframe selections: critical services, economic stability, public perceptions, and lifelines. The participants' feedback highlights the need for TRTs that balance urgency, feasibility, and community needs. They suggested that adding intermediate categories (e.g., 1 and 3 months) might address gaps in current recovery frameworks, while additional long-term categories (e.g., 12 to 18 months) might more realistically reflect the recovery trajectories for different community functions.

**Table 5-3. Summary of Target Recovery Times Suggestions for FRGM-W Development.**

*These results are based on the compiled responses across groups to Exercise 2 in Breakout Session 2.*

<b>FRGM Category/ TRT</b>	<b>Workshop TRTs</b>	<b>Proposed By</b>	<b>Summary of Rationale for Maintaining or Changing TRTs</b>
<i>A/ 0 hours</i>	0 hours	Groups 1-4	<ul style="list-style-type: none"> <li>• General agreement; push to separate 0 and 24 hours (see next row)</li> <li>• Added hazardous materials, clarified expectations for lifeline dependencies</li> <li>• Focus: Essential safety and survival needs</li> </ul>
	24 hours	Groups 1, 2, 4	<ul style="list-style-type: none"> <li>• Added to provide flexibility to “immediate” recovery with 0 hours (continuous service) <u>and</u> recovery within 24 hours</li> </ul>
<i>B/ 72 hours</i>	48 hours	Group 2	<ul style="list-style-type: none"> <li>• Added to accommodate faster recovery needs for critical medical services</li> <li>• Focus: Urgent survival needs and mitigation of escalating consequences</li> </ul>
	72 hours	Groups 1, 3, 4	<ul style="list-style-type: none"> <li>• Maintained 72 hours category</li> </ul>
<i>C/ 2 months</i>	1 month <sup>a</sup>	Groups 2, 3, 4	<ul style="list-style-type: none"> <li>• Added to bridged gap between 72 hours and 2 months for schools, housing, and businesses</li> <li>• Focus: Housing, education, and business continuity</li> </ul>
	3 months	Groups 2, 3, 4	<ul style="list-style-type: none"> <li>• Added to reflect governance milestones and quarter-based timelines</li> <li>• Focus: Broader community governance and infrastructure</li> </ul>
<i>D/ 6 months</i>	6 months	All but Group 2, which stated that 3 months should be the max	<ul style="list-style-type: none"> <li>• Maintained: Good timing for local government determining spending priorities, debris management, student retention in schools</li> <li>• Focus: Return to normalcy, enhanced resilience</li> </ul>
<i>NA</i>	12 to 18 months	Groups 1, 2	<ul style="list-style-type: none"> <li>• Added to accommodate recovery for recreational and cultural facilities</li> <li>• Focus: Remaining community functions and recreational facilities</li> </ul>
<i>E/ not defined</i>	no target	All Groups	<ul style="list-style-type: none"> <li>• Maintained: Category for “not designed to a FR standard”</li> </ul>

<sup>a</sup> Group 1 also proposed a 2-week category

## 5.4. Discussion

Drawing on the groups’ discussions, the report authors note three broad themes.

### Dividing and Extending the FRGM Target Recovery Times

Three of four groups agreed that the 0-hours TRT should be split into two: 0 and 24 hours, and the 2-month TRT should be split into two: 1 month and 3 months. In general, the groups wanted more TRTs earlier in the overall timeline to accommodate more granular needs for functional recovery. Two groups recommended that the timeline be extended to 12 months to 18 months. Therefore, workshop group discussions resulted in a recommendation for nine total categories with eight TRTs (versus the five categories with four TRTs in the FRGM). This points to more granular needs for recovery achievements than what was included in the FRGM.

### Importance of Critical Lifelines and Preparedness

Two groups emphasized the interdependencies among infrastructure systems (e.g., power, water) and the need for simultaneous recovery across functions to achieve realistic recovery timeframes. All groups noted that adequate preparedness including customized recovery plans (e.g., to include pre-positioned resources) could help achieve ambitious TRTs like 72 hours or less for critical services.

### Social and Economic Considerations

Three groups prioritized faster recovery in housing and childcare facilities to prevent displacement and mitigate economic stress. Two groups noted the risks to small businesses when exposed to extended downtime, suggesting a need for faster TRTs for these activities.

## 5.5. Selection of Target Recovery Times for Use in Breakout Session 3

Based on the group discussions in Session 2, the workshop leaders decided on seven categories and TRTs for use in activities in Breakout Session 3. These are presented in Table 5-4, as compared to the October 2024 FRGM and organized to correspond to the same or similar TRTs.

**Table 5-4. FRGM vs. Workshop Categories & Target Recovery Times.**

FRGM Category	FRGM TRT	Workshop Category	Workshop TRT
A	0 hours	A	0 hours
		B	24 hours
B	72 hours	C	72 hours
C	2 months	D	1 month
		E	3 months
D	6 months	F	6 months
E/ NDFR	no target	NDFR	no target

This version has two key differences from the information presented in Table 5-3. First, workshop leaders decided not to include the 12 months to 18 months category since only two groups had voted for this. And second, to collapse the 48-hour category into the 72-hour category since achieving TRTs for 24 hours, 48 hours, and 72 hours may be impractical for the design of building and lifeline infrastructure assets at this time.

The workshop categories and TRTs utilized for Breakout Session 3 vary from the five categories proposed in the FRGM (Table 5-4) by (a) adding a 24-hour category, and (b) by splitting the 2-month category into 1-month and 3-month categories.

## 6. Breakout Session 3: Prioritization of Functions and Services for Functional Recovery

Lucy Arendt introduced Breakout Session 3, noting that its goal was to prioritize functions and services based on their role in community recovery after an earthquake. She reminded participants that functional recovery applies at the building level because building codes cover individual structures. The importance of specific assets depends on the role they serve in providing functions and services within a community. While some functions (e.g., emergency response, utilities, healthcare) may be needed immediately after an event, the delivery of other services could be delayed to the short-term, medium-term, or long-term recovery phases. Arendt pointed out that the criteria for prioritization, as discussed in Breakout Session 1, should be transparent, driven by societal needs, and based on evidence.

### 6.1. Objective

The objective of this third breakout session was to discuss and assign community functions and services to the seven categories and TRTs resulting from Breakout Session 2 (summarized in Table 5-4), using the top five criteria from Breakout Session 1 (housing, healthcare (physical and mental), access to lifelines, serve the whole community's basic needs, and reduce population displacement). See Section 4.5 for more information on the criteria.

### 6.2. Process

*Part 1:* Participants were first asked to spend a few minutes working individually to assign 62 specific functions and services listed in Handouts 3.1 and 3.3 (Appendix F.2, Appendix F.4) to the workshop-defined target recovery categories (A-F, and Not Designed for Functional Recovery). The intent for this activity was to prompt participants to begin considering priorities for group assignments for the group discussion on target recovery times that comprised the main activity of Breakout 3. Results of individual "voting" related to general categories functions/services are presented in Section 6.3.1. The analysis of group voting across recovery categories is presented in Section 6.3.3. The compiled results from individual voting are provided in Appendix I.

**Note on the Functions/ Services Utilized in Workshop Activities:** The functions and services utilized for the workshop were drawn from the October 2024 FRGM and Sattar et al. (2022). The additions from Sattar et al. (2022) were informed by the development of NIST SP 1269 and were included to give workshop participants the opportunity to consider a wider range of functions and services than those included in the FRGM. As of the timing of the workshop, the FRTC had neither considered nor prioritized all of the functions and services discussed in the workshop.

*Part 2:* The session then moved to a 15-minute group discussion of three icebreaker questions (Appendix F.1) designed to encourage participants to think about prioritization of functions and services according to the seven categories and TRTs identified in Breakout Session 2.

*Part 3:* Then, for the main work of the breakout session, participants had an hour in their groups to discuss and assign prioritization of functions and services into the seven recovery

categories. This activity included the specific functions/services based on Handout 3.1 (Appendix F.2), two additions across all groups,<sup>1</sup> and a few functions/services brought up only in individual groups. The initial discussion excluded housing, which was covered later in the Session.

- 1) First, participants were asked to determine whether they agreed with the functions and services listed in the “Immediate” and “Not Designed for Functional Recovery” categories, which were unchanged from the FRGM (see Handout 3.2, Appendix F.3) and were expected to have the highest levels of agreement.
- 2) Second, the groups continued to discuss and assign functions and services based on Handout 3.1 to the B-F workshop categories (presented in Table 5-4). Not all of the functions and services from Handout 3.1 were assigned due to some groups running out of discussion time.
- 3) Next, participants discussed the assignment of different types of housing to the seven categories and TRTs using Handout 3.3 (Appendix F.4) and Handout 3.4 (Appendix F.5). Again, time constraints meant that not all of the groups were able to fully complete prioritization for all items.
- 4) Participants were also given the opportunity to bring up other functions or services that should be considered for functional recovery performance. Examples of items mentioned are: facilities handling or managing hazardous materials, critical research facilities, post-disaster related retail (i.e., home improvement stores), and mobile/recreational/vacation homes.

Results of group voting related to general categories functions/services are presented in Section 6.3.2., the analysis of group voting across recovery categories is shown in Section 6.3.3., and the data from group assignments is included in Appendix I.

A facilitator led the group’s work, which was written on easel sheets and transcribed by a scribe. Notably, while the groups were encouraged to use the top five criteria from Breakout Session 1 (housing, healthcare (physical and mental), access to lifelines, serve the whole community’s basic needs, and reduce population displacement), it was not apparent that the groups used the criteria (summarized in Table 4-4) systematically for either Breakouts 2 or 3.

### **6.3. Assignment of Community Functions and Services to Recovery Categories**

Data from the workshop are described in three sections below. First, 6.3.1 describes the individual-level data provided via handouts completed by participants and collected at the workshop on tallies related to general function/service categories. Next, Section 6.3.2. presents tallies of group agreement related to the general function/service categories. And finally, in Section 6.3.3., more in-depth analysis is provided comparing individual and group tallies with the FRGM across each workshop-derived functional recovery category and target recovery time as identified in Table 5-4.

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<sup>1</sup> For Part 3 of Breakout Session 3, “electronic news media facilities” and “phone, cellular facilities” were added, and “energy, power generation & distribution” replaced “facilities for natural gas pumping, production and customer distribution” for consideration by all groups.

### 6.3.1. Individual-level Analysis of Vote Tallies by General Function/ Service

Participants were asked to assign individual workshop target recovery categories (A-F, and Not Designed for Functional Recovery) to the functions and services listed in Handouts 3.1 and 3.3 (Appendix F.2, Appendix F.4). Handout 3.1 included 52 individual functions and services, ranging from (1) banking and finance to (52) transportation services.

Handout 3.3 included 10 additional individual housing options, as follows:

- Community treatment and recovery facilities, group homes, boarding houses (e.g., unhoused populations, furlough)
- Custodial care (e.g., jails/prisons)
- Foster care housing
- Hotels (e.g., transient, residential)
- Low-income housing
- Multi-family housing (2-5 units)
- Multi-family housing (5+ units)
- Residential care facilities for the elderly, assisted living facilities, adult care facilities
- Multi-unit housing with shared common spaces (e.g., convents, monasteries, dormitories)
- Single-family housing

Of the 48 workshop attendees, 36 submitted one or both Handouts 3.1 (functions and services excluding housing) and 3.3 (on housing). The remaining attendees did not participate or were workshop organizers and were not included in this voting. Of the 36, 13 did not submit their individual responses (Handout 3.1.), so the individual-level analyses are based on just 23 submissions. The average number of functions and services assigned to functional recovery categories by the 36 respondents to the Handouts was about 43 out of a possible 62 functions and service categories (52 non-housing, 10 housing). Of the 23 participant submissions, only eight completed all 62 functions and services included in Handouts 3.1 and 3.3.

Table 6-1 shows the 1162 individual “votes” cast across the 62 functions and services (including housing) and aggregated into 16 general functional categories for a better understanding of the prioritization of items across topics/ sectors. Specific functions and services were each affiliated with General categories, following the model set forth in NIST SP 1269. The varied number of specific functions/services (ranging from 1 to 10) included in each general category makes the comparison between the general categories, in terms of the number of votes in each category, unhelpful. Instead, these votes reflect the degree of agreement in the assignment of individual items to the general functional category. Bold table entries (which include the number of votes and the percentage of votes within a general functional category) indicate the recovery category receiving the largest percentage of votes. These “winning” votes for recovery category **A**, for **Not Designed for Function Recovery**, and for housing (recovery category **C**) reflect a majority or strong plurality in terms of the relative prioritization of that general function/service for functional recovery.

**Table 6-1. Individual Functional Recovery Category Votes by General Functional Categories.**

General Function/Service Category	A	B	C	D	E	F	NDFR
Public Health and Safety	<b>104 (74 %)</b>	9 (6 %)	22 (16 %)	4 (3 %)	2 (1 %)		
Healthcare – Inpatient	<b>74 (83 %)</b>	9 (10 %)	5 (6 %)		1 (1 %)		
Housing	34 (21 %)	16 (10 %)	<b>77 (48 %)</b>	28 (18 %)	1 (1 %)	3 (2 %)	
Shelter	<b>19 (51 %)</b>	11 (30 %)	3 (8 %)	1 (3 %)			3 (8 %)
Healthcare - Outpatient	16 (16 %)	30 (31 %)	<b>34 (35 %)</b>	10 (10 %)	5 (5 %)	2 (2 %)	
Food and Water Resources	<b>15 (38 %)</b>	12 (30 %)	10 (25 %)	3 (8 %)			
Cultural Identity	10 (16 %)	7 (11 %)	6 (10 %)	7 (11 %)	2 (3 %)	9 (15 %)	<b>20 (33 %)</b>
Telecom/Information	<b>8 (53 %)</b>	3 (20 %)	3 (20 %)	1 (7 %)			
Energy	7 (37 %)	2 (11 %)	<b>8 (42 %)</b>	2 (11 %)			
Governance	5 (9 %)	5 (9 %)	<b>20 (35 %)</b>	16 (28 %)	8 (14 %)	2 (4 %)	1 (2 %)
Social Support	4 (6 %)	10 (15 %)	11 (16 %)	<b>16 (24 %)</b>	11 (16 %)	10 (15 %)	6 (9 %)
Transportation Services	3 (6 %)	11 (22 %)	<b>19 (38 %)</b>	14 (28 %)	3 (6 %)		
Banking and Finance	1 (5 %)	3 (16 %)	<b>10 (53 %)</b>	4 (21 %)		1 (5 %)	
Education		2 (4 %)	12 (21 %)	<b>29 (52 %)</b>	9 (16 %)	4 (7 %)	
Local Economy		2 (4 %)	18 (22 %)	<b>28 (34 %)</b>	10 (12 %)	15 (18 %)	9 (11 %)
Entertainment/Recreation			4 (2 %)	9 (5 %)	15 (9 %)	55 (32 %)	<b>89 (52 %)</b>

Individual results are available and tallied for each specific functional recovery category, organized by General category, as shown in Table I-1 (Appendix I). General categories are listed the same as in Table 6-1, to simplify comparisons between the two tables. Table 6-2 uses the Public Health and Safety general category to show how the more detailed specific functional categories in Table I-1 are condensed to the general categories in Table 6-1.

**Table 6-2. Example Illustrating Aggregation of Individual Functional Recovery Category Votes by Specific Functional Categories to the General Category: Public Health and Safety.**

General	Specific	A	B	C	D	E	F	NDFR
Public Health and Safety	Emergency response/communication facilities	21						
	EMS/critical transportation services (ambulance)	21	1					
	Fire stations	22						
	Police stations	20		2				
	Sewer system facilities	6	3	7	1	1		
	Wastewater treatment infrastructure	6	3	7	1	1		
	Water infrastructure facilities	8	2	6	2			
Total		104	9	22	4	2		

### 6.3.2. Group-level Analysis of Vote Tallies by General Function/Service

During the group discussions at the workshop, each group spent approximately 60 minutes working collaboratively to assign 64 specific examples of community functions and services (including housing) to the functional recovery categories resulting from Breakout Session 2.

As was the case with the individual-level analysis, specific functions and services were each affiliated with General categories, following the model set forth in *NIST SP-1269*. The varied number of specific functions (ranging from 1 to 10) included in each general category makes comparison between the general categories, in terms of number of votes across categories, unhelpful. Instead, these votes reflect the degree of agreement in the assignment of individual functions/services to each general category (in a given row of the table). Group votes are tallied for each General category by functional recovery category, as shown in Table 6-3. General categories are listed in the same order as in Table 6-1, to simplify comparisons between the two tables. The bolded items reflect clear majorities. These include the group assignments of “public health and safety” and “healthcare – inpatient” to recovery category **A**; “housing,” “transportation services,” and “healthcare – outpatient” to recovery category **C**; “education” to recovery category **D**; and “entertainment/recreation” and “cultural identity” to **Not Designed for Functional Recovery**.

**Table 6-3. Group Functional Recovery Category Votes by General Functional Categories.**

General Function/Service Category	A	B	C	D	E	F	NDFR
Public Health and Safety	<b>16</b>	3	9				
Healthcare – Inpatient	<b>15</b>	1					
Housing	11		<b>19</b>	4			
Shelter	<b>3</b>	2					2
Healthcare - Outpatient	1	5	<b>9</b>	1	2		
Food and Water Resources	2	2	2	2			
Cultural Identity	2	1			1	1	<b>5</b>
Telecommunications/Information	1	<b>3</b>					
Energy/Electricity		2	2				
Governance		1	<b>4</b>	2	3		
Social Support			3	3	1	1	<b>5</b>
Transportation Services		1	<b>9</b>	2			
Banking and Finance		1	1			1	
Education			1	<b>9</b>	1	1	
Local Economy			3	<b>7</b>	6	1	
Entertainment/Recreation			1			1	<b>30</b>

Group voting results are available and tallied for each specific functional recovery category, organized by General category, as shown in Table I-2 (Appendix I). General categories are listed the same as in Table 6-3 to simplify comparisons between the two tables. As with Table 6-3, Table I-2 visually shows the overall trend from votes assigned to A through votes assigned to Not Designed for Functional Recovery.

### 6.3.3. Analysis of Vote Tallies Across Workshop Categories and TRTs

In Sections 6.3.3.1 through 6.3.3.7., the assignment of specific functions/services to each workshop-derived functional recovery category and associated target recovery time (TRT) are analyzed in more detail. Each category has a table which presents information related to included functions and services if they received at least one group vote. Data is provided to enable comparison across group voting and individual voting, alongside a reference to the assignment for that item according to the October 2024 FRGM. Note that functions/services can be included in more than one category discussed below.

The functions or services in Tables 6-4 through 6-9 for each target recovery category were included in the tables if they received at least one group vote.

#### 6.3.3.1. Category A (0 hours)

Raw data used for the summary provided in this section can be found in Table I-1 in Appendix I, and an overview of these findings can be found in Table 6-4.

During Breakout 3, group conversations concerning Category A began with the groups determining whether they agreed with the FRGM in including the following six specific community functions and services in Category A (Handout 3.2), instead of asking groups which functions/services to include.

- Emergency response/communication facilities
- EMS/critical transportation services (ambulance)
- Acute care hospitals and support facilities
- Emergency departments
- Emergency shelter
- Emergency supply - warehouse, storage (food, water, PPE)

The FRGM also assigned housing of non-ambulatory populations and people incapable of self-preservation (e.g., nursing homes, assisted living), and people in custodial care (e.g., jails/prisons) to Category A. There was broad agreement on including emergency and life-critical services in Category A (Table 6-4).

All four groups agreed with the first four examples on the list. Three groups supported emergency shelter, and two supported emergency supplies. The groups added several items to the FRGM list, with all four including fire stations, and three adding long-term care hospitals, psychiatric care (in-patient), and police stations.

**Table 6-4. Category A Tallies.**

Specific Function/Service Assigned to 0-hour TRT	Group Votes (X of 4)	Individual Votes (X/of votes cast)	FRTC/FRGM Proposal
1. Emergency departments	0 hours (4)	22 of 22	0 to 24 hours
2. Fire stations	0 hours (4)	22 of 22	0 to 24 hours
3. Acute care hospitals & support facilities	0 hours (4)	21 of 23	0 to 24 hours
4. Emergency response/communication facilities	0 hours (4)	21 of 21	0 to 24 hours
5. EMS/critical transportation services (ambulance)	0 hours (4)	21 of 22	0 to 24 hours
6. Police stations	0 hours (3)	20 of 22	0 to 24 hours
7. Psychiatric care (inpatient)	0 hours (3)	16 of 22	72 hours
8. Emergency shelter	0 hours (3)	15 of 19	0 to 24 hours
9. Long-term care hospitals & support facilities	0 hours (3)	15 of 22	72 hours
10. Custodial care (e.g., jails/prisons)	0 hours (4)	14 of 16	0 to 24 hours
11. Emergency supply - warehouse, storage (food, water, PPE)	0 hours (2)	13 of 20	0 to 24 hours
12. Residential care facilities for the elderly, assisted living facilities, adult care facilities	0 hours (4)	10 of 16	0 to 24 hours
13. Foster care housing	0 hours (3)	4 of 15	72 hours

All four groups also agreed with the FRGM assignment to Category A of (1) residential care facilities for the elderly, assisted living facilities, adult care facilities; and (2) custodial care (e.g., jails/prisons). Three of the groups also added foster care housing to this category.

### 6.3.3.2. Not Designed for Functional Recovery Category

Raw data used for the summary provided in this section can be found in Table I-1 in Appendix I, and an overview of findings can be found in Table 6-5.

The workshop’s participants next discussed the Not Designed for Functional Recovery (NDFR) category. Prior to the workshop, its developers decided that both Category A and this category were the most likely to be perceived similarly by the FRTC and workshop participants. Hence, this category, like Category A, was pre-populated with the functions and services in the FRGM.

As with the group discussion of Category A, group discussions for the NDFR category entailed the groups deciding whether they agreed with the FRGM’s placement of 10 specific functions and services in the NDFR Category (Handout 3.2, Appendix F.3).

- Religious centers (e.g., churches/temples/mosques, excluding schools)
- Arenas (indoor; not intended to be used for emergency shelter/service)
- Country clubs
- Libraries

- Movie and performance theaters, concert halls
- Museums
- Night clubs
- Recreation center/gymnasium (private; not to provide emergency shelter or service)
- Stadiums (outdoor)
- Community recreational facilities (e.g., gym, pool)

There was broad agreement for including all items on the FRGM list for the Not Designed for Functional Recovery Category with two exceptions: (1) religious centers (e.g., churches, temples, mosques, excluding schools), and (2) libraries (Table 6-5). Three of the groups agreed with including religious centers and two of the groups agreed with libraries. Two groups added historic buildings to the list and one group included veterinary services (outpatient). No housing options were assigned to this category.

**Table 6-5. Not Designed for Functional Recovery Tallies.**

Specific Function/Service Assigned to “No TRT”	Group Votes (X of 4)	Individual Votes (X/of votes cast)	FRTC/FRGM Proposal
1. Country clubs	ND for FR (4)	15 of 22	ND for FR
2. Night clubs	ND for FR (4)	15 of 22	ND for FR
3. Movie and performance theaters, concert halls	ND for FR (4)	14 of 22	ND for FR
4. Museums	ND for FR (4)	13 of 22	ND for FR
5. Historic buildings	ND for FR (2)	11 of 19	<b>Added for workshop</b>
6. Stadiums (outdoor)	ND for FR (4)	11 of 21	ND for FR
7. Arenas (indoor; not intended for to be used for emergency shelter/service)	ND for FR (4)	10 of 20	ND for FR
8. Recreation center/gymnasium - private; not to provide emergency shelter or service	ND for FR (4)	10 of 22	ND for FR
9. Religious centers (e.g., churches, temples, mosques, excluding schools)	ND for FR (3)	8 of 21	ND for FR
10. Community recreational facilities (e.g., gym, pool)	ND for FR (4)	4 <sup>a</sup> of 17	ND for FR
11. Libraries	ND for FR (2)	1 of 21	ND for FR
12. Veterinary clinics - outpatient	ND for FR (1)	1 of 17	2 months

<sup>a</sup> The only category with 4 individual votes listed in this table to align with the FRTC and Group Discussions.

### 6.3.3.3. Category B (24 hours)

Raw data used for the summary provided in this section can be found in Table I-1 in Appendix I, and an overview of findings can be found in Table 6-6.

While 12 different functions or services were assigned to Category B by at least one group, none were agreed to by all four groups (Table 6-6). Phone and cellular facilities were agreed to by three groups. Two groups agreed with (1) dialysis centers, (2)

emergency supply, (3) urgent care clinics, (4) energy, power generation and distribution, and (5) Internet and communication infrastructure. No other functions or services identified by individuals received more than one vote. In general, participants emphasized the need for ensuring continuity for communication, power, and critical healthcare within the first day. No housing options were assigned to this category.

**Table 6-6. Category B Tallies.**

Specific Function/Service Assigned to 24-hour TRT	Group Votes (X of 4)	Individual Votes (X/of votes cast)	FRTC/FRGM Proposal
1. Dialysis centers	24 hours (2)	10 of 20	72 hours
2. Religious facilities that seek to provide emergency shelter and services, including food	24 hours (1)	7 of 21	ND for FR
3. Temporary housing and facilities; temporary structures (e.g., tents, tent structures)	24 hours (1)	7 of 18	ND for FR
4. Pharmacies	24 hours (1)	6 of 19	72 hours
5. Airports	24 hours (1)	5 of 17	72 hours
6. Emergency supply - warehouse, storage (food, water, PPE)	24 hours (2)	5 of 20	0 to 24 hours
7. Emergency shelter	24 hours (1)	4 of 19	0 to 24 hours
8. Recovery-focused local government services (e.g., debris management)	24 hours (1)	4 of 19	2 months
9. Urgent care clinics	24 hours (2)	4 of 20	72 hours
10. Internet (server farms, facilities, data centers)	24 hours (2)	3 of 15	72 hours
11. Energy, power generation & distribution	24 hours (2)	2 of 19	72 hours
12. Phone/cellular facilities	24 hours (3)	<b>Not on Handout</b>	72 hours

#### 6.3.3.4. Category C (72 hours)

Raw data used for the summary provided in this section can be found in Table I-1 in Appendix I, and an overview of findings can be found in Table 6-7.

Of the 20 distinct non-housing examples assigned to Category C, only railroad facilities were chosen by all four groups (Table 6-7). Three groups also selected (1) airports, (2) pharmacies, (3) veterinary care (urgent), (4) wastewater treatment infrastructure, and (5) sewer system facilities. Overall, there was general agreement on the importance of utilities/lifeline infrastructure and transportation systems being functionally recovered within three days. The remaining functions and services each received votes by either one or two groups, suggesting limited agreement. All four groups agreed that multi-family housing (2-5 units, >5 units) should be assigned to Category C. Three of the groups placed both (1) multi-unit housing with shared common spaces and (2) low-income housing in this category. In making these assignments, the groups observed that **housing** was critical to everything else in terms of key community functions (e.g.,

hospitals, education, employment) and community recovery and that its recovery should be prioritized.

**Table 6-7. Category C Tallies.**

Specific Function/Service Assigned to 72-hour TRT	Group Votes (X of 4)	Individual Votes (X/of votes cast)	FRTC/FRGM Proposal
1. Low-income housing ( <i>housing</i> )	72 hours (3)	12 of 16	72 hours <sup>a</sup>
2. Multi-family housing (2-5 units) ( <i>housing</i> )	72 hours (4)	11 of 16	72 hours <sup>a</sup>
3. Multi-family housing (5+ units) ( <i>housing</i> )	72 hours (4)	11 of 16	72 hours <sup>a</sup>
4. Banking and finance	72 hours (1)	10 of 19	2 months
5. Community treatment and recovery facilities, group homes, boarding houses (e.g., unhoused populations, furlough)	72 hours (1)	9 of 16	72 hours <sup>a</sup>
6. Multi-unit housing with shared common spaces (e.g., convents, monasteries, dormitories) ( <i>housing</i> )	72 hours (3)	9 of 16	72 hours <sup>a</sup>
7. Pharmacies	72 hours (3)	9 of 19	72 hours
8. Routine local government services (e.g., municipal admin/tax, elected officials offices)	72 hours (2)	9 of 19	6 months
9. ^Facilities for natural gas pumping, production, and consumer distribution, e.g., gas stations, propane stores	72 hours (2)	8 of 19	72 hours <sup>b</sup>
10. Food and potable water services, both retail (e.g., grocery stores) and wholesale	72 hours (2)	8 of 20	72 hours
11. Foster care housing ( <i>housing</i> )	72 hours (1)	8 of 15	72 hours <sup>a</sup>
12. Single-family housing ( <i>housing</i> )	72 hours (2)	8 of 16	72 hours <sup>a</sup>
13. Dialysis centers	72 hours (2)	7 of 20	72 hours
14. Hotels (e.g., transient, residential) ( <i>housing</i> )	72 hours (1)	7 of 16	72 hours
15. Psychiatric care (outpatient)	72 hours (2)	7 of 18	2 months
16. Railroad facilities - maintenance yards	72 hours (4)	7 of 16	72 hours <sup>b</sup>
17. Recovery-focused local government services (e.g., debris management)	72 hours (2)	7 of 19	2 months
18. Sewer system facilities	72 hours (3)	7 of 18	72 hours <sup>b</sup>
19. Urgent care clinics	72 hours (1)	7 of 20	72 hours
20. Wastewater treatment infrastructure	72 hours (3)	7 of 18	72 hours <sup>b</sup>
21. Airports	72 hours (3)	6 of 17	72 hours <sup>b</sup>
22. Childcare/daycare - private and religious	72 hours (1)	6 of 19	2 months
23. Public/mass transportation facilities	72 hours (2)	6 of 17	72 hours <sup>b</sup>
24. Water infrastructure facilities	72 hours (2)	6 of 18	72 hours <sup>b</sup>
25. Veterinary care- urgent	72 hours (3)	3 of 18	72 hours
26. Industrial (construction, manufacturing)	72 hours (2)	3 of 16	2 to 6 months
27. Commercial (major employer)	72 hours (1)	4 of 17	2 to 6 months

<sup>a</sup> Most housing, regardless of type, was included in the FRGM Category B (72 hours)

<sup>b</sup> Included with "vital utility services/lifeline infrastructure"

<sup>^</sup> For group voting, the broader category "energy, power generation & distribution" was used.

### 6.3.3.5. Category D (1 month)

Raw data used for the summary provided in this section can be found in Table I-1 in Appendix I, and an overview of findings can be found in Table 6-8.

While 16 specific functions or services were assigned to Category D, only PK-12 education was selected by all four groups (Table 6-8). Three groups also assigned both (1) childcare and daycare, and (2) commercial (small business, retail) to this category. The remaining functions were aligned with governance and education (e.g., courthouses, post-secondary education), business and employment (e.g., restaurants, commercial—major employer), and critical public services (e.g., food and potable water services, public/mass transportation facilities), and non-urgent healthcare (e.g., social services, medical centers, veterinary clinics (outpatient)). The housing options assigned to this category by the groups included hotels (2 groups), single-family housing (1 group), and community treatment and recovery facilities (1 group).

**Table 6-8. Category D Tallies.**

Specific Function/Service Assigned to 1-month TRT	Group Votes (X of 4)	Individual Votes (X/of votes cast)	FRTC/FRGM Proposal
1. PK-12 schools - private and religious	1 month (4)	13 of 19	2 months
2. Childcare/daycare - private and religious	1 month (3)	10 of 19	2 months
3. Commercial (major employer)	1 month (1)	8 of 17	2 to 6 months
4. Court houses	1 month (2)	8 of 19	6 months
5. Veterinary clinics - outpatient	1 month (1)	8 of 17	2 months
6. Commercial (small business, retail)	1 month (3)	7 of 17	2 to 6 months
7. Hotels (e.g., transient, residential) ( <i>housing</i> )	1 month (2)	6 of 16	72 hours
8. Medical clinics, surgical centers	1 month (1)	6 of 20	2 months
9. Post-secondary (i.e., colleges, universities)	1 month (2)	6 of 18	6 months
10. Single-family housing ( <i>housing</i> )	1 month (1)	6 of 16	72 hours
11. Public/mass transportation facilities	1 month (2)	5 of 17	72 hours
12. Office buildings	1 month (1)	4 of 15	2 to 6 months
13. Food and potable water services, both retail (e.g., grocery stores) and wholesale	1 month (2)	3 of 20	72 hours
14. Social services, community & elder centers, neighborhood support services	1 month (2)	3 of 16	2 months
15. Restaurants	1 month (2)	3 of 17	2 to 6 months
16. Community treatment & recovery facilities, group homes, boarding houses (e.g., unhoused populations, furlough) ( <i>housing</i> )	1 month (1)	<b>Not on Handout</b>	2 months

### 6.3.3.6. Category E (3 months)

Raw data used for the summary provided in this section can be found in Table I-1 in Appendix I, and an overview of findings can be found in Table 6-9.

One of the challenges of analyzing the groups' assignments to the recovery categories is that the groups began running out of time as they proceeded through the categories. Thus, while Category E had 12 specific functions and services assigned to it, there were only 14 group votes out of a possible 48 (if all four groups had assigned the functions and services to Category E) (Table 6-9). Two groups assigned (1) courthouses, and (2) restaurants to this category; the remaining 10 functions and services received one group vote each. No housing options were assigned to this category.

**Table 6-9. Category E Tallies.**

Specific Function/Service Assigned to 3-month TRT	Group Votes (X of 4)	Individual Votes (X/of votes cast)	FRTC/FRGM Proposal
1. Social services, community & elder centers, neighborhood support services	3 months (1)	6 of 16	2 months
2. Court houses	3 months (2)	5 of 19	6 months
3. Post-secondary (i.e., colleges, universities)	3 months (1)	5 of 18	6 months
4. Medical clinics, surgical centers	3 months (1)	3 of 20	2 months
5. Office buildings	3 months (1)	3 of 15	2 to 6 months
6. Restaurants	3 months (2)	3 of 17	2 to 6 months
7. Routine local government services (e.g., municipal admin/tax, elected officials' offices)	3 months (1)	3 of 19	6 months
8. Commercial (major employer)	3 months (1)	1 of 17	2 to 6 months
9. Commercial (small business, retail)	3 months (1)	1 of 17	2 to 6 months
10. Industrial (construction, manufacturing)	3 months (1)	2 of 16	2 to 6 months
11. Psychiatric care (outpatient)	3 months (1)	1 of 18	2 months
12. Religious centers (e.g., churches, temples, mosque, excluding schools)	3 months (1)	0 of 21	ND for FR

### 6.3.3.7. Category F (6 months)

Raw data used for the summary provided in this section can be found in Table I-1 in Appendix I, and an overview of findings can be found in Table 6-10.

As shown in Table 6-10, at least 4 individuals (bolded) assigned one of 13 different functions and services (including housing) to Category F, representing 78 % of the total 101 individual votes cast for this category (Table I-1, Appendix I). Only one group

assigned community functions and services to this category, as the other three groups ran out of time. Thus, no group-level tallies are provided for Category F in Table 6-10. Functions and services were included in the table if they received at least four individual votes. Three functions or services received three individual votes each: commercial (major employer), industrial (construction, manufacturing), and restaurants. Three functions or services received two individual votes each: psychiatric care (outpatient), veterinary clinics (outpatient), and office buildings. Finally, seven functions or services each received one individual vote: multi-unit housing with shared common spaces, multi-family housing (2-5 units), single-family housing, courthouses, routine local government services, social services, and finance and banking).

**Table 6-10. Category F Tallies.**

Specific Function/Service Assigned to 6-month TRT	Individual Votes (X/of votes cast)	FRTC/FRGM Proposal
1. Libraries	10 of 21	ND for FR
2. Recreation center/gymnasium (private; not to provide emergency shelter or service)	9 of 22	ND for FR
3. Community recreational facilities (e.g., gym, pool)	7 of 17	ND for FR
4. Night clubs	7 of 22	ND for FR
5. Arenas (indoor; not intended to be used for emergency shelter/service)	6 of 20	ND for FR
6. Movie and performance theaters, concert halls	6 of 22	ND for FR
7. Museums	6 of 22	ND for FR
8. Stadiums (outdoor)	6 of 21	ND for FR
9. Country clubs	5 of 22	ND for FR
10. Historic buildings	5 of 19	<b>Added for workshop</b>
11. Commercial (small businesses, retail)	4 of 17	2 to 6 months
12. Post-secondary (i.e., colleges, universities)	4 of 18	6 months
13. Religious centers (e.g., churches, temples, mosque, not schools)	4 of 21	ND for FR

## 6.4. Discussion

Authors want to emphasize three key areas of findings from the Breakout 3 workshop discussion. These include themes related to assignment of functions/services, the levels of agreement across the functional recovery categories, and also the identification of six factors influencing the prioritization of assignments across TRTs.

### 6.4.1. Themes

Three general themes appeared consistently across the groups in terms of needs for the prioritization of functional recovery target recovery times, and are summarized here as follows:

- *At Risk Populations.* Groups strongly and consistently emphasized support for the whole community, including those needing low-income housing, elder care, foster care, etc. Housing for all was highlighted as something which should be a key priority for recovery.
- *Community-Specific Needs.* Groups consistently emphasized enabling faster recovery based on local priorities, such as high-density populations, or sector requirements, such as the importance of agriculture or tourism. In other words, groups indicated that communities might want to shift some functions and services into recovery categories with shorter TRTs (e.g., from D (1 month) to C (72 hours)).
- *Balancing Economic and Social Priorities.* Deciding how to prioritize some functions, like small businesses and social services, revealed mild tensions between economic recovery and community well-being. Functions directly tied to economic recovery, such as small businesses and tourism facilities, had mixed support among the groups which may have been contingent on the perceived ability to generate short-term recovery benefits.

#### 6.4.2. Level of Agreement

Understanding the degree of agreement in how the groups assigned functions and services to the seven recovery categories (i.e., A, B, C, D, E, F, Not Designed for Functional Recovery) is important as results from this report are expected to inform future iterations of the FRGM. Greater levels of agreement indicate more evidence for a shared basis for the assignment of functions/services to a particular TRT. However, it should be noted that items without a lot of agreement may need extra consideration or research, since the basis for agreement may mean there are conflicting priorities or understanding of the function/service, rather than signaling lack of importance for a particular TRT. For this discussion, the metric used to assess relative levels of agreement across the functional recovery category was group-level voting, as follows:

- **High:** Three or more workshop groups assigned at least 75 % of the listed functions or services to the category
- **Moderate:** Two or more workshop groups assigned at least 50 % of the listed functions or services to the category
- **Low:** 1 workshop group assigned at least 50 % of the listed functions or services to the category.

##### 6.4.2.1. Agreement for Category A Functions/ Services (0 hours): HIGH

*Category A functions were noted by workshop participants as essential for life safety and immediate recovery.* These functions/services showed the highest level of agreement among the groups, with either 3 or 4 of the groups assigning all but one of the functions or services to Category A and were the functions/services consistently prioritized across all categories. Groups also observed that water, power, and communication services

tend to underpin recovery efforts, even though they did not explicitly include these services in Category A.

#### **6.4.2.2. Agreement for Category B Functions/ Services (24 hours): MODERATE**

*Category B addresses services crucial to maintaining basic human survival and preventing escalation of disaster impacts or consequences.* Less consistent agreement among the groups was observed for these functions or services. None of the functions or services received votes from all four groups. One service, phone/cellular facilities, received votes from three of the four groups. 5 remaining functions or services assigned to Category B had at least two group votes.

This lower level of agreement appears to reflect variations in perceived urgency and feasibility of achieving functional recovery in 24 hours for many of the listed functions or services. The functions and services for which there was the greatest lack of agreement—with only one group voting for them—included religious facilities providing shelter, temporary housing, pharmacies, airports, emergency shelters, and recovery-focused local government services. Participants often mentioned the potential for adaptations or substitutions when stating why these functions and services might not need to be designed to achieve functional recovery performance within 24 or even 72 hours. In addition, participants may have viewed certain functions, such as recovery-focused local government services, as more appropriate for assignment to later phases.

#### **6.4.2.3. Agreement for Category C Functions/ Services (72 hours): MODERATE**

*Category C emphasizes routine community services and structures necessary for social and economic stability.* Agreement in assignments for this category may highlight perspectives on urgency and the resources required for early recovery. The functions and services for which the greatest level of agreement existed, with 3 or 4 groups assigning listed functions or services to this category, related to housing (low-income, multi-family), lifelines (sewer, wastewater treatment, airports), and medical-adjacent (pharmacies, urgent veterinary).

As with other categories, participants noted the interdependencies between lifelines and these functions and services. Additional lifelines functions that received votes from at least two groups included facilities for natural gas pumping, food and potable water services, public/mass transportation, and water infrastructure. Expecting lifelines to be sufficiently recovered in time for more functions and services than those receiving at least two group votes may be unrealistic. Assigned community characteristics may have also affected the prioritization of the functions or services assigned to this category. For example, public transportation may have been perceived as more important for larger urban communities than for suburban or rural communities. Expected adaptations may also affect the evaluation of and subsequent prioritization of these functions.

#### **6.4.2.4. Agreement for Category D Functions/ Services (1 month): MODERATE**

*Category D targets functions and services that enhance social well-being, educational continuity, and governance.* Findings for this category may reflect diverging perspectives on the role and urgency of less immediate, critical services. Some of the functions and services for which there was only one group voting for them (total n=6) included commercial (major employer), medical clinics/ surgical centers, and office buildings. Those receiving votes from only two groups (total n=7) included courthouses, post-secondary, and social services. Only two of the listed functions or services received votes from three groups: childcare and commercial (small business, retail). PK-12 schools was the only function or service that received votes from all four groups. The factors that appear to account for the lower level of agreement among the groups include perceived urgency vs. community well-being, economic recovery vs. social stability, and community-specific needs.

#### **6.4.2.5. Agreement in Assignment of Category E Functions/ Services (3 months): LOW**

*Category E focuses on functions that enhance the general well-being of the community and contribute to long-term normalcy.* The degree of agreement in this category may reflect differing perspectives on the priority and feasibility of less critical but socially significant functions. It may also simply reflect the reality that not all of the groups were able to assign functions and services to all seven of the recovery categories, including the Not Designed for Functional Recovery category.

All but two of the functions or services assigned to Category E received only one group vote. The other two functions or services received only two group votes. Five of the 12 functions or services assigned by these groups related to business or employment of some kind: office buildings, restaurants, commercial (major employer), commercial (small business, retail), and industrial (construction, manufacturing). Four were medical-adjacent: social services, medical clinics/ surgical centers, psychiatric care (outpatient), and religious centers. Two dealt with governance: courthouses and routine local government services. The last one was post-secondary education.

Participants may have considered whether all business facilities are essential to a community's economy within 3 to 6 months or if only those tied to local economies should be prioritized. It was noted that large-scale industrial recovery may require considerable time and resources, pushing recovery beyond six months. In all cases, restoring the structures housing these functions and services may depend on resolving broader infrastructure and lifeline challenges.

#### **6.4.2.6. Agreement in Assignment of Category F Functions/ Services (6 months): N/A**

**Since only one group assigned functions to Category F, there was no agreement among the groups to analyze.** In addition, there is notable overlap with the items

included in the Category F list based on the voting of just one group, and the functions/services included in the NDFR table (6-5) which have high levels of agreement.

#### 6.4.2.7. Agreement for Not Designed for Functional Recovery: HIGH

The **NDFR** category includes functions that are not deemed critical for recovery and that do not require functional recovery standards. Agreement among the groups for this category may reflect shared perspectives on the importance of these functions in supporting community well-being and resilience. The functions and services for which all four groups voted were (n=8 of 12): country clubs, night clubs, movie and performance theaters, museums, stadiums, arenas, private recreation centers, and community recreational facilities. Religious centers received votes from three of the four groups. Historical buildings and libraries earned votes from two of the groups. Outpatient veterinary services garnered one group vote.

Many of these functions or services may have been viewed by participants as nonessential for recovery and more of a recreational luxury. With respect to libraries, some participants noted that libraries often serve as essential hubs for information, education, and community engagement. Others may perceive that online resources reduce the urgency of restoring physical library facilities. Finally, while religious centers often play significant roles in disaster response and recovery for their members by providing emotional and logistical support, their recovery may be understood to be redundant with other community services.

#### 6.4.2.8. Summary of Agreement

Table 6-11 summarizes the degree of agreement within each recovery category. Overall, these findings point to higher levels of agreement on nearer-term needs for functional recovery, whereas those items slated for recovery beyond 3 months have greater variability in terms of group trends in assignment of target recovery timeframes.

**Table 6-11. Summary of Level of Agreement for Workshop Recovery Categories.**

Category	Agreement Level
Category A	High
Category B	Moderate
Category C	Moderate
Category D	Moderate
Category E	Low
Category F	NA
NDFR	High

Items with high agreement indicate shared views on the importance of these assets' basic intended functions. This data can serve as strong evidence for assigning that function or service

to a specific TRT and for developing definitions and categorizations for that category, enabling the assignment of similar functions or services in the future. Examples of high agreement include emergency response/ communication services and multifamily and low-income housing. Items with low agreement highlight the need for future research to better understand differences in opinion about their importance, order for recovery, or perceived feasibility of design for these assets to meet recovery goals. Some examples of items with low levels of agreement (assigned to three or more categories by four workshop groups) include: banking and finance, commercial employers, medical clinics, and veterinary clinics.

### 6.4.3. Factors Influencing Prioritization of Functions and Services

Based on the analyses conducted, there appear to be at least six factors that may influence the prioritization of functions/services. Each is summarized in Table 6-12 and briefly discussed.

**Table 6-12. Summary of Factors Influencing Prioritization of Functions or Services.**

Factor	Examples	Impact on Prioritization of Functions or Services
a. Urgency of Recovery	Emergency services vs. historical buildings	Immediate needs see higher prioritization; functions or services less essential to community recovery face lower prioritization
b. Resource Allocation	Housing vs. industrial facilities	Limited resources force trade-offs
c. Lifeline Dependencies	Public transport, energy facilities	Recovery feasibility depends on other systems, creating contention due to limited resources
d. Balancing Concerns	Recreational facilities vs. PK-12 education	Perceived special purpose vs. whole community benefit
e. Feasibility of Recovery	Industrial facilities, multi-family housing	Complex restoration requirements create feasibility concerns
f. Economic Impact	Small businesses vs. libraries	Economic recovery functions compete with social stability priorities

#### a. Urgency of Recovery

The immediacy with which a function or service must be functionally recovered often determines its prioritization. Emergency medical facilities, fire departments, and law enforcement are indispensable during the initial response phase and are also foundational to restoring the sense of safety and order needed to initiate community recovery. By contrast, cultural or less essential functions (e.g., museums or historic landmarks) may be postponed because they are not seen as essential to immediate survival or the early stages of community stabilization. However, this can lead to tensions when long-term community identity or cohesion is also a concern.

#### b. Resource Allocation

In post-disaster contexts, scarce resources must be directed where they yield the greatest overall benefit. This creates difficult decisions, such as whether to prioritize housing (immediate shelter for displaced residents) over the rapid restart of industrial facilities (which may restore jobs). Prioritization is further complicated by the potential for temporary substitutions—e.g., using hotels as temporary housing—which can justify delaying permanent repairs. These trade-

offs often reveal deeper community values and vulnerabilities, as well as practical limits on what can be done simultaneously.

### **c. Lifeline Dependencies**

Certain facilities depend on the functionality of critical lifelines (e.g., electricity, water, transportation) to operate. Even if a facility is essential, if its supporting systems are severely compromised, its recovery may be delayed or downgraded in prioritization due to low feasibility. For instance, a hospital cannot reopen without reliable lifelines services such as potable water and reliable power, while a transit hub may require both structural repairs limited by construction timelines and restored access roads dependent upon labor and materials. These interdependencies must be mapped and coordinated, or else recovery planning becomes fragmented and inefficient.

### **d. Balancing Concerns**

Community-wide benefits are often used to justify higher prioritization. Functions serving all residents—such as schools or grocery stores—may be prioritized over recreational or specialized-use facilities like stadiums or theaters. The distinction often lies in whether a function is seen as central to basic societal functioning or as serving only discretionary needs. However, even facilities that seem less essential (e.g., places of worship or senior centers) may be deeply valued by specific subgroups, essential to psychosocial recovery, or access points to resources and support—adding complexity to the balancing process.

### **e. Feasibility of Recovery**

Some functions may remain low on the prioritization scale due to the sheer complexity, time, and cost required for restoration. Facilities with significant structural damage, complex utility needs, or regulatory requirements (e.g., industrial plants, airports, or multi-family housing) may be deferred—not because they lack value, but because they require long-term solutions. Planners may choose to focus first on lower-effort, high-impact projects that restore basic functionality across a broader swath of the population.

### **f. Economic Impact**

Prioritizing recovery functions with economic significance can be contentious, as communities must weigh immediate livelihood restoration against longer-term social stability. For example, small businesses are often central to local economies, employment, and tax revenue, making them strong candidates for early recovery prioritization. However, essential social infrastructure—like public libraries or community centers—may be undervalued despite their critical roles in education, communication access, and emotional recovery. Prioritization decisions may vary based on local context: in a tourism-dependent town, restaurants and hotels may shift to higher categories (e.g., from D to B) because they are essential for economic rebound. Thus, the perceived and actual contributions of different functions to local economic vitality can elevate (or lower) their recovery priority, often revealing tensions between commercial interests and community well-being. Additionally, sectors with strong economic advocacy may gain influence in prioritization debates, especially where limited resources and urgent fiscal recovery are dominant concerns.

## **7. Breakout Session 4: Assessing Factors Necessary to Promote Generalizability of Functional Recovery Target Times**

Laurie Johnson introduced Breakout Session 4, the objective of which was to evaluate the applicability and scalability of the FRGM as discussed and revised on Day 1 of the workshop (FRGM-W) across different community profiles and hazard levels. Discussions were expected to address both impeding and external factors, while also exploring how to extend functional recovery concepts to existing buildings, infrastructure, and different community needs. Johnson shared lessons from past disasters, such as post-Northridge “Ghost Towns” in Los Angeles (i.e., apartments abandoned due to financial barriers) and the problem of long-term safety cordons impacting rebuilding efforts in Christchurch, New Zealand. Groups were asked to consider how hazard levels, secondary hazards, and earthquake clusters might affect the FRGM-W. Johnson observed that the matrix must be flexible, scalable, adaptable, and community driven and that the session’s findings would help to guide future policy, funding strategies, and code development for seismic resilience.

### **7.1. Objective**

The objective of this fourth breakout session was to discuss and address the generalizability of the FRGM-W as revised from the FRGM during the Day 1 breakout sessions.

### **7.2. Process**

The hourlong session began with discussion of three questions (Appendix G), each designed to “ground truth” the FRGM-W. Each question was expected to prompt approximately 15 minutes of discussion. A final “wrap up” question pulled the discussion together.

The first question asked participants to consider how to ensure that the FRGM-W meets the necessary conditions for all communities, beginning with a discussion of any differences in the matrix for the community prototypes used in the workshop. Participants were asked specifically to consider rural vs. large metropolitan communities, suburban vs. urbanized areas, areas with aging vs. younger and diverse populations, areas of predominantly owner-occupied vs. renter-occupied housing, areas of socio-economically vulnerable or highly mobile populations, and communities lacking financial resources to conduct repairs (i.e., loans/grants, personal wealth) after an earthquake. These results are discussed in Section 7.3.1.

The second question asked participants to consider the appropriate target risk for new buildings constructed according to the FRGM-W, noting that the current building code has a target risk for collapse of 1 % in 50 years. The prompts used to aid this discussion were:

- In the next 50 years, there should be no more than an <X %> chance that a building designed to an FR code has an unacceptably long downtime (i.e., greater than the design target recovery time in its design lifetime (assumed to be 50 years)).
- No more than <X %> of all buildings designed to FR should exceed their design target recovery time in the next 50 years.

Participants were asked to identify additional factors that should be considered in establishing an appropriate target risk for functional recovery, such as earthquake clusters or catastrophic level earthquakes with secondary hazards, such as tsunamis, fires, and ground failure. These results are discussed in Section 7.3.2.

The third question asked whether the concept of functional recovery should be extended to existing structures and lifelines, noting that the focus on new structures would lead to incremental improvements in community resilience given the mix of existing (more) to new (fewer) structures. Participants discussed how the functional recovery concept might “scale up” from the individual building scale to the community scale, what else could be done to “inject” more resilience into a community or to shorten the resilience timeline, and whether the resilience gap can and should be addressed with voluntary and/or mandatory building retrofits. They also discussed whether lifeline infrastructure system upgrades can and should be encouraged or required. Finally, they were asked to consider what levels of public and private collaboration and coordination are needed and feasible. Results are discussed in Section 7.3.3.

The final 15 minutes were spent discussing whether there were potential weaknesses in the groups’ logic, including unquestioned assumptions and biases (e.g., confirmation bias). Participants were asked to consider whether there were any potential negative, unintended consequences associated with the recommendations from Day 1 and the FRGM-W, and how those might be mitigated. Finally, participants addressed key obstacles to implementation and how those might be addressed. These results are discussed in Sections 7.3.4. and 7.4. A facilitator led the group’s work, which was written on easel sheets and transcribed by a scribe.

### **7.3. Findings Related to the Generalizability of the Target Recovery Times**

Three key areas of findings are important for the generalizability of the target recovery times, including meeting community needs, considering the risk target for new buildings, and making sure that functional recovery can be extended in the future to existing structures and lifelines.

#### **7.3.1. Ensuring Targets Meet Community Conditions**

Four themes dominated the groups’ discussions of the first set of questions. The first theme addressed the customizability of the FRGM-W, with three of the four groups suggesting that the functions and services assigned to the recovery categories should be at least somewhat *customizable* for communities with across-the-board standards as minimums. Finding the right balance between standardization and customization may well affect communities’ willingness to adopt functional recovery. Two of the groups likewise suggested that customizability should reflect the alignment of functional recovery goals with community resilience goals. It was emphasized in the discussions that while communities might choose to elevate the prioritization of a function or service (e.g., from recovery category D to B), it would be more problematic from a building code perspective for them to lower the prioritization of a function or service (e.g., from recovery category B to D).

The next theme addressed *resource allocation*, with three groups noting the importance of external support from outside the community and targeted interventions for under-resourced

communities, and two highlighting the need for developing multi-purpose assets in low-resourced areas. Group 2 proposed a Community Rating System (CRS)-style incentive program to help low-resource communities meet functional recovery standards. Additionally, it was noted that communities need to deal with existing as well as new buildings to address the potential for disproportionate effects on the populations who often occupy older dwellings. Also raised was the potential for interaction issues between new and existing buildings. How might the physical mix of new structures built to functional recovery standards and existing structures built to previous codes impact overall community resilience?

The third theme emphasized the *criticality of community-specific needs*, such as socioeconomic and geographic variability (e.g., urban vs. rural) (4 groups), aging populations and service continuity (2 groups), and the value of addressing cultural norms and isolation preferences (1 group). Participants noted that the socio-economic profile of communities might have an impact on the thresholds at which people decide to stay or leave their community post-disaster (leading potentially to longer-term displacement) and therefore might impact TRTs. They also stated that the characteristics of geographically isolated places (e.g., mountainous areas in the Rockies) might influence the reality of recovery (e.g., impeding factors, external factors). Similarly, people in these communities might also prefer living independently and not being co-located with others.

Lastly, three of the four groups emphasized the need for *education* on recovery standards, engineering needs, and costs as well as community involvement in recovery planning (2 groups). Participants observed that when talking about functional recovery, advocates should be thinking not only about the role of the building code, but also other factors such as policy, insurance, and emergency planning. The groups also suggested that the TRTs might be daunting in their rapidity to the point of non-adoption as people question the feasibility of achieving swift TRTs. Even getting the provisions into the International Building Code may be challenging. For example, some may advocate against functional recovery performance because of worries about increased costs or requirements; these issues require further research and consideration.

### **7.3.2. Appropriate Target Risk for New Buildings**

This was a challenging discussion for the groups to have, with many participants unaccustomed to consideration of target risk levels as described in the workshop. As a result, although the exercise sought quantitative feedback, most participants' recommendations were qualitative. Groups 1, 2, and 3 debated various confidence levels (e.g., 1 % in 100 years, 10 % in 50 years), reflecting uncertainty over realistic targets. It was shared that it made the most sense to leave the focus on 50 years, as buildings are often designed with a 50-year lifespan in mind. Group 2 proposed variable risk levels based on the building category (e.g., 0 % for Category A & B, 1 % for others). Yet another suggestion was the use of conditional probabilities (e.g., 10 % collapse given this or that maximum event). It was noted that hazard curves are different in different geographic areas, and that reliability is connected to the uncertainty of the hazard.

Group 4 suggested that it might be more realistic to establish thresholds that relate functions to event severity. For example, target reliability levels could be discretized into three tiers: (1) for a more frequent and less damaging earthquake: everything is ready to go right away; (2) for a

moderate earthquake: just X/Y/Z operate; and (3) for an extreme earthquake: focus only on survivability and critical safety needs.

With respect to deciding on a risk target, two of the groups observed that adoption challenges for functional recovery might be tied to cost, public perception, and historical precedent, and the interplay between policy and engineering feasibility. Groups 1 and 3 also emphasized designing for multiple hazards, such as earthquakes, wind, and floods. Group 4 advocated for targeting high-impact assets, such as multi-family housing.

Additional factors provided by the groups to consider in setting target risk numbers include:

- The need to set backup targets for multi-purpose buildings: 2 groups
- The use of sliding-scale risk based on building use: 2 groups
- Consideration of cascading hazards: 1 group
- The value of avoiding (or minimizing) post-event teardowns: 1 group

### **7.3.3. Extending Functional Recovery to Existing Structures and Lifelines**

Several key observations were shared throughout the groups' discussions of this topic, including the reality that while the current focus is on new buildings, it is hoped that existing buildings and lifelines will also be part of the functional recovery conversation in the future. It was noted that if the overarching goal is to improve community resilience, then communities will need to address existing buildings and lifelines as they represent the vast majority of structures in most communities at any given point in time. With a focus on new structures only, communities will be addressing a small percentage of the problem over the next 100 years.

Another observation was to question assumptions about building life expectancy in communities due to differing geography, weather, reliance on materials, mix of building functions and construction types, and other factors. Buildings may have longer or shorter lives than projected, thereby influencing how people think about the return on investment of existing codes vs. moving to functional recovery. Data is needed on differing average ages and average lifetime lengths across different types of communities. A third observation was that functional recovery for existing structures might involve implementing better nonstructural design focused on the components and systems within a building that are not part of its primary load-bearing structure, but that are essential for its functionality and safety. This includes elements like HVAC systems, electrical wiring, plumbing, and interior finishes. Construction or renovation triggered upgrades, as with ADA requirements, may also be implemented to enable functional recovery of existing buildings.

Groups 1, 3, and 4 supported incremental retrofitting of existing structures and lifelines to achieve functional recovery standards. Three of the groups shared their perception that lifelines may provide the best return on investment for retrofits, and that people more easily understand the benefits of addressing functional recovery for lifelines. Two groups argued for the alignment of lifeline recovery plans with building requirements to better achieve community resilience.

Group 2 called for financial incentives, including retrofitting subsidies and insurance-based programs, to facilitate extending functional recovery to existing structures and lifelines. Incentive-based retrofits for existing structures and lifelines were noted as especially important to bridge the gap in resource-constrained areas. Group 3 suggested prioritizing lifeline retrofits due to their perceived higher benefit-cost ratio compared to buildings as lifelines typically serve many buildings and therefore functions and services. Three of the four groups called for feasibility and cost analyses for retrofits.

Finally, participants called for community and policy integration, with clear timelines for recovery established and communicated to aid residents with planning needed adaptations given planned-for event scenarios.

#### **7.3.4. Wrap-Up: Common Themes**

In their concluding discussions, groups covered three themes in common:

*Barriers to Adoption-* Participants in three groups highlighted the potential cost implications of functional recovery for low-income and affordable housing. Two groups also noted the potential roadblocks by special interest groups who are incentivized against functional recovery performance, and challenges with garnering public support for what may be perceived as a complex engineering problem. All groups stressed the need for community involvement in defining functional recovery priorities and balancing costs against benefits. Education, effective stakeholder communication, and integration with resilience goals were noted as vital to successful implementation of functional recovery. Group 3 explored emerging technologies and the role of communication to promote functional recovery adoption.

*Knowledge and Access to Resources-* Groups 2 and 4 emphasized the potential *economic challenges* of implementing functional recovery, particularly given disparities in resources, and advocated for cost analyses and availability of financial resources in cases where building owner/operators or users may not have extra capital for recovery goals. Participants argued a need to identify and confront underlying *assumptions* about capacity and resource availability within communities. Basically, not all communities and not everyone within those communities have knowledge about or access to the resources that can enable functional recovery and community resilience. Help from others who do have the requisite knowledge as well as resources will be needed to achieve the desired ends.

*Complexity and Unintended Consequences-* Proponents of functional recovery performance also need to recognize the potential for unintended consequences. Tied to this were comments about sustaining housing at the community level and needing low-cost solutions for housing, so that functional recovery is a benefit for the whole community. Groups 1, 3, and 4 noted that functional recovery introduces *complexities* beyond what was required for life safety design, such as operational interdependencies and recovery timelines. Potential solutions included taking multi-hazard approaches to functional recovery in order to increase the benefit-cost ratio of functional recovery. Participants encouraged taking incremental steps toward functional recovery goals, with a **focus on lifelines and housing** as critical starting points (3 groups). It was argued that low-cost solutions will be needed for broad application.

## **7.4. Discussion of Challenges Raised to Generalizability for Implementation**

Several major challenges to implementing functional recovery emerged from discussions across Breakout Session 4.

### **7.4.1. Economic and Financial Barriers**

- **Cost of Implementation:** The most consistently noted challenge among participants is the potential for increased costs with functional recovery implementation, particularly to existing buildings, which may require innovative funding mechanisms. Groups 1, 2, and 4 highlighted the potentially significant costs of implementing functional recovery standards, especially for low resource communities. Group 3 emphasized the difficulty of articulating financial benefits to justify the additional costs to stakeholders. The report authors note that developing functional recovery guidelines that are efficient requires careful analysis considering both costs and benefits.
- **Need for Incentives:** Cost analyses, financial incentives, and return on investment were seen as pivotal to functional recovery implementation. Groups 2 and 3 called for financial mechanisms such as retrofitting subsidies, insurance incentives, and other programs to offset costs for communities and property owners. Group 4 noted that without relatively low-cost solutions, policy adoption might be infeasible. It was acknowledged that costs remain an unknown at the present time, so this concern was precautionary rather than reactionary.

### **7.4.2. Adapting to Local Contexts and Resource Disparities**

- **Customizability:** All groups acknowledged the need for functional recovery standards to adapt to local contexts and resource availability. Groups 1 and 2 emphasized that communities may want to tailor the FRGM-W to community-specific needs to ensure effective implementation—such as elevating the priority of a function or service (e.g., from recovery category D to B)—while also maintaining a high degree of consistency across communities.

### **7.4.3. Technical and Logistical Complexity**

- **Interdependencies:** Groups 3 and 4 highlighted challenges in addressing interdependencies between buildings and lifelines, particularly when retrofitting existing infrastructure. Group 1 noted that geographic and cultural factors add complexity to recovery goals, particularly in rural or isolated areas.
- **Uncertainty and Lack of Data:** Groups proposed varying risk levels, reflecting differing perceptions of feasibility and priorities. Groups 1 and 3 emphasized that uncertainty in hazard levels and recovery timelines complicates the establishment of realistic functional recovery targets. Group 2 noted a lack of quantifiable data to make evidence-based decisions about functional recovery implementation.

#### **7.4.4. Policy and Regulatory Hurdles**

- **Adoption Challenges:** Overcoming stakeholder resistance and regulatory inertia will be critical for the successful adoption of functional recovery performance standards by local jurisdictions. Groups 3 and 4 discussed potential resistance from stakeholders, such as developers, affordable housing advocates, and policymakers, due to perceived increased costs.
- **Balancing Standards and Flexibility:** Groups 1 and 2 pointed out the tension between codifying uniform standards and allowing flexibility for community-specific needs.

#### **7.4.5. Community Awareness and Engagement**

- **Perception of Risk:** A lack of awareness about likely post-earthquake outcomes and comprehensibility of technical information about earthquake hazards, engineering design, and infrastructure interdependencies by the public complicates stakeholder buy-in and thus decision-making. Groups 1 and 3 observed that many communities and stakeholders may lack a clear understanding of the differences between functional recovery and life safety, making it harder to communicate the need for functional recovery standards. Similarly, many in the public may assume that the current building code is already designed to produce functional recovery performance, rather than the current goal of life safety (except in specific cases, such as Risk Category IV buildings).
- **Stakeholder Buy-In:** Groups 3 and 4 noted that effective functional recovery implementation requires educating stakeholders about its benefits and the importance of the ability to resume key societal functions and services.

#### **7.4.6. Lifelines and Existing Structures**

- **Retrofit Challenges:** Addressing the interdependencies between lifelines and buildings is essential but logistically challenging. All groups agreed that retrofitting existing structures and lifelines poses significant logistical and financial challenges. Group 3 noted that lifelines require complex coordination in part due to ownership structures.
- **System-Wide Impact:** Retrofits and lifeline enhancements were consistently identified as essential for existing structures. Group 4 emphasized the need to align both lifelines and building recovery timelines for coherent community-level resilience.

## **8. Breakout Session 5: Collecting Additional Information on Research, Data, and People to Inform Future Development of the FRGM**

Divya Chandrasekhar provided a brief overview of what workshop participants were to do in this last session, which was to identify gaps in existing vs. needed research, available vs. needed data, and key stakeholders and partnerships needed to advance the FRGM-W. The objective was to outline future directions and determine who should be involved in ongoing discussions to improve the FRGM-W. Chandrasekhar noted that the future of functional recovery depends on continued research, data collection, and interdisciplinary collaboration, and that this session was created to help establish a roadmap for improving the FRGM-W, keeping in mind the context of functional recovery and the opportunity that this performance goal gives to enhancing overall resilience for communities.

### **8.1. Objective**

The focus of this final breakout session was to identify existing and new *research* and *data* needed to further develop the FRGM-W. Participants were also asked to identify people and partners who should be involved in ongoing conversations around functional recovery, people and partners who can help close knowledge gaps, or who have data to consider in further developing the FRGM-W.

### **8.2. Process**

The original intent was to generate discussion around these questions (Appendix H) in participants' assigned breakout groups. Instead, participants worked individually to add the requested information to either Handout 5 or an online form. Participants had been encouraged to add their thoughts to the handout and/or online form from the beginning of the workshop, as ideas came to them. The handout was completed during the breakout session time and turned in by 35 participants; nine offered ideas via the online form. Participants did not necessarily provide information for all six categories addressed in the session (i.e., existing/new research, existing/new data, people/partners to be involved, and people/partners to close knowledge gaps). While some participants may have preferred to work in their breakout groups, most appeared content to work individually.

### **8.3. Research, Data, and People**

#### **8.3.1. Existing Research**

Participants shared a variety of research topics, notes, and references related to disaster risk reduction, functional recovery, community resilience, and infrastructure performance. They are summarized in no particular order.

- Resilient Building and Functional Recovery. Research from the [Resilient Buildings Project](#) stages emphasizing tolerance to downtime, categorizing building uses, and linking

community-level impacts to building performance. Also, functional recovery times for lifeline sectors and interdependencies, as seen in the [San Francisco Lifelines Restoration Performance Project](#).

- Community Resilience and Engagement. Definitions of community resilience, including measurement techniques and robust retrofitting programs for older structures. Listening to community-specific hazards, vulnerabilities, and opportunities as a foundation for recovery discussions. Significant work is occurring at local, regional, and federal levels to produce knowledge and tools (such as the [NIST Community Resilience Program](#)).
- Infrastructure Systems and Lifelines. Studies on the role of lifelines in recovery, addressing dependencies on utility services and functional cost analyses. Gaps in research, such as [FEMA P-58](#) studies for nonbuilding structures and transmission systems like roads, water, and electric lines.
- Disaster Financing and Workforce Factors. Research on the exploration of disaster financing timeframes, extending beyond insurance models. Research on workforce challenges and their impact on recovery schedules.
- Household Adaptations to Disruptions. Household adaptations to service interruptions (electric, water, and telecom systems), particularly during significant events like the 2021 Texas winter storm.
- Economic and Structural Considerations. Research balancing financial and structural implementations for disaster mitigation (e.g., seawall solutions in New York Bay). Studies tying functional costs to building designs and implications for recovery.
- Risk Tolerance and Target Recovery Times. Investigations into appropriate risk levels and target recovery durations for critical infrastructure and buildings. Threshold analysis for services such as wastewater and small business survival during disruptions.
- Consistency and Policy Implications. Focus on consistency in resilience planning, advocating for robust retrofitting and improved utility systems across all communities. Policy implications derived from models like [IN-CORE](#) and [Lumberton Field Study](#) data.
- Global Insights and Probabilistic Models. International frameworks, such as the [European Macro Seismic Scale \(EMS-98\)](#), offering probabilistic definitions of functional recovery states. Cross-disciplinary learnings from non-seismic events to inform future earthquake preparations.
- Key Publications and Contributors. Citations of influential research and publications (NIST, NIST-funded, and academic) for guiding functional recovery and mitigation efforts. Systematic literature reviews on disaster preparedness and the role of community engagement in hazard mitigation.

### 8.3.2. New Research Needed

These responses span several topics related to disaster resilience, recovery processes, and consistency in implementing functional recovery standards. What follows is a summary of the key research themes and questions that were volunteered by participants and summarized by the report's authors, in no particular order.

- **Cost Implications and Financial Analysis.** Understanding incremental costs for different functional recovery timelines (e.g., 0 hours vs. 72 hours) and their relation to affordability. Identifying available funding mechanisms, including incentives, subsidies, and financing strategies. Ensuring retrofits and functional recovery adoption don't lead to gentrification or disproportionately affect low-income communities. Quantifying the community-wide financial and societal benefits of functional recovery adoption.
- **Consistency and Community Considerations.** Developing approaches that ensure affordability and availability for everyone in a community. Addressing thresholds for population displacement, recovery timelines for vital services, and consistency in code adoption by communities. Studying how local governance and participation influence functional recovery standards and recovery efforts.
- **Technical and Structural Design.** Incorporating hazards like earthquakes, floods, and blasts (bombings) into functional recovery design. Coupling functional recovery codes with improvements in utility and transportation systems to ensure broader community resilience. Establishing measurable performance targets for structural and non-structural elements. Setting recovery goals first and designing buildings backward to meet those standards.
- **Risk Communication and Adoption.** Communicating the value and benefits of risk reduction and functional recovery adoption to individuals and communities. Exploring certification, financial incentives, and insurance mechanisms to encourage functional recovery adoption. Determining acceptable recovery timelines and failure risks, particularly in different community contexts.
- **Research Methodologies and Gaps.** Developing systems to collect and calibrate functional recovery performance data from real events. Analyzing existing building code adoption and gaps at local, state, and national levels. Investigating the interplay between functional recovery, future hazards, and long-term community recovery.
- **Impeding Factors and Recovery Challenges.** Understanding governance, workforce, and financial challenges that slow recovery processes. Addressing workplace disruptions caused by post-recovery repair activities. Recovery interdependencies: Studying how recovery in one sector (e.g., housing) affects others (e.g., transportation).
- **Multi-Hazard Approaches.** Extending functional recovery frameworks to address hazards beyond earthquakes, such as floods and wildfires. Accounting for variability in hazard levels and recovery expectations across geographic regions.

- Stakeholder and Developer Engagement. Developing tools to educate stakeholders about the costs, benefits, and processes of functional recovery. Tailoring functional recovery standards to align with developer incentives while promoting resilience.
- Specific Community and Asset Needs. Investigating recovery processes specific to multifamily units and addressing challenges in different community types. Balancing the recovery priorities of private and public structures for greater community benefits. Shared-use infrastructure: Supporting community resilience through facilities designed for long-term recovery and accommodating future hazards and stressors.
- Global Comparisons and Best Practices. Learning from building codes and recovery strategies in other countries, such as Japan. Scaling functional recovery targets: Developing adaptable functional recovery standards that suit various building types, hazards, and communities.

### 8.3.3. Existing Data

Participants mentioned various data sources, including disaster case studies, recovery metrics, and organizational frameworks. What follows is a summary of key themes and notable data sets provided by workshop participants, organized in no particular order.

- Disaster Recovery and Case Studies. *Longitudinal Recovery Studies*: Lumberton longitudinal study ([NIST SP 1230-5](#)): Examines recovery timelines for home and business sectors. *Christchurch and Tohoku Earthquake Data*: Insights into post-earthquake recovery processes. *Hurricane-focused studies* (e.g., Andrew, Katrina, Ike): Address population displacement and sheltering timelines. *Empirical Restoration Curves*: Utility restoration data post-2010 Chile and 2011 Tōhoku earthquakes.
- Functional Recovery and Building Performance. *Baseline Performance*: Data on the current functional recovery performance of building stock (limited availability but crucial for future planning). *Building Code Compliance*: Data on compliance with federal, state, and local building codes across rural, urban, and suburban communities. Information on building age and code adherence in cities and counties. *Recovery Time Metrics*: FHWA and DOT data on lifeline recovery times. *International standards* (e.g., Tokyo, Christchurch) that integrate recovery into codes.
- Cost Data and Economic Implications. *Cost-Benefit Analysis*: FEMA's studies on mitigation and resilience return on investment. Cost differentials for achieving higher functional recovery targets (e.g., Japan, New Zealand). *Insurance Impacts*: Savings for ratepayers due to functional recovery investments. Potential roles of insurance markets in incentivizing recovery-focused design. *Permitting and Process Timing*: Data on permitting timelines and retrofitting processes for building code compliance.
- Community-Level Data. *Sheltering and Displacement*: FEMA's Disaster Case Management program and related studies on recovery assistance needs. Data linking sheltering to specific functional recovery efforts. *Community Vulnerability*: Atlas of building code adoption across the U.S., identifying vulnerabilities by building age and

compliance. *Redundancies in Response Systems*: Data on community redundancies in mitigation and disaster response efforts.

- Cross-Sector and Lifeline Data. *Utility Performance*: Lifeline recovery times for bridges, water facilities, and other critical infrastructure. *Case studies* linking extreme weather and earthquake impacts (e.g., Türkiye 2023, Japan 2024). *Non-Building Structures*: Seismic performance reports for nonbuilding structures (e.g., California, Chile, Japan).
- Behavioral Insights and Human Factors. *Occupant Behavior*: Studies on actions taken by building occupants post-earthquake (e.g., reluctance to trust green tags). *Mental Health Data*: Christchurch health and development study linking earthquakes to mental health recovery.
- Relevant Tools and Frameworks. *AECOM AI Tools*: Scanning and digitizing FEMA records to analyze disaster recovery data. *Resilient Buildings Project*: Categorizing functional recovery times and linking them to community impacts. *NIST Publications*: Key resources for recovery planning, including empirical restoration and resilience planning data.

This varied collection of data sources highlights critical areas for advancing the development of functional recovery metrics, which can be tracked over time, including aspects such as baseline performance, cost implications, compliance trends, and the contribution of functional recovery design to the achievement of community resilience goals.

#### **8.3.4. New Data Needed**

Participants' insights collectively aim to improve the development of the FRGM, focusing on resilience, consistent outcomes, and practical implementation strategies. Key ideas are summarized here without any specific order.

- Time Frames and Repair: Realistic repair time targets (e.g., 24 hours vs. 72 hours). Challenges in defining functional recovery with clear end-user expectations.
- Cost Considerations and Other Barriers: Cost premiums for resilience design and quick wins for improving functionality. Economic impact of recovery timelines on housing, communities, and lifelines. Technological, political, and procedural obstacles to achieving functional recovery targets.
- Vulnerability Assessments: Nationwide evaluation of structural and social vulnerabilities. Cross-sections of vulnerable populations by structure type.
- Engineering Capacity: Availability and geographic distribution of earthquake engineering professionals. Potential investments needed to meet industry demands.
- Data Collection and Metrics: Data on downtime by sector and archetypes of structures. Metrics for lifeline system performance and retrofit costs. Post-disaster recovery data and systematic collection methods.

- **Regional Concerns and Social Inconsistencies:** Addressing biases in seismicity research towards Western U.S. Challenges in adopting stringent building codes that may disproportionately impact communities with fewer resources.
- **Design Considerations:** Benefits of enhanced design and its cost implications. Separate approaches for high-rise cities and major metropolitan areas.

### **8.3.5. People/Partners with Whom to Collaborate**

Participants identified important individuals, organizations, and sectors for discussions on functional recovery. The main suggestions are summarized here, in no specific order.

- **Government Agencies:** HUD (Housing and Urban Development). Federal, state, and local entities involved in mitigation and recovery funding.
- **Industry and Professional Organizations:** National Association of Home Builders (NAHB). American Society of Civil Engineers (ASCE). Lifeline operators and non-building professional organizations (e.g., AWWA, NIBS).
- **Finance and Insurance Sector:** Insurance companies and risk financing experts. Institutions like the World Bank's disaster risk finance program.
- **Developers and Builders:** Building developers, contractors, and investors to address practical and financial considerations.
- **Research and Academia:** Structural engineers specializing in resilience and retrofitting. Academic experts in public finance, risk, and disaster resilience.
- **Community and Advocacy Groups:** Groups that monitor the needs of under-resourced populations and understand effective mechanisms to ensure that new performance standards do not become a burden (e.g., national-level housing advocacy organization).
- **Global and Cross-Disciplinary Perspectives:** Lessons from disaster recovery can be harnessed from other contexts or countries through international organizations like the World Bank, UNDRR, and other global resilience initiatives.
- **Utilities and Lifelines:** Utility production and distribution stakeholders. Workshops focused on integrating lifeline functionality into functional recovery.
- **Local and Grassroots Engagement:** Pilot community exercises to ground discussions in affected areas. Perspectives from small businesses, rural and urban communities, and local building officials.
- **Cross-Sector Collaborations:** Involvement of professionals in disaster response and recovery planning. Coordination between sectors like healthcare, retail, and housing.

### 8.3.6. People/Partners with Knowledge to Close Gaps

Participants proposed strengthening a diverse network focused on developing a comprehensive, multi-faceted, and data-driven approach to planning for functional recovery. The options are summarized without any specific order.

- Government and Public Agencies: FEMA disaster response, recovery, and preparedness components. HUD: Perspectives on housing recovery and financing. NIST: Expertise in structural and resilience codes. USGS and hazard scientists: Earthquake science.
- Industry Stakeholders: Utility providers with proprietary data and operational perspectives. Insurance industry for risk evaluation and cost analysis. Local building departments for enforcement and feedback on codes.
- International and NGO Collaboration: United Way: Global disaster recovery expertise. Alchemy Park: Recovery-focused consultancy. NREL: Renewable energy system resilience. IDIEM: Diversity and inclusion in emergency management.
- Developer and Builder Community: Engaging developers to align functional recovery goals with practical realities. Exploring incentives for adopting higher building code standards.
- Community Representation: Advocates for varied populations to ensure selection of effective recovery strategies. Community engagement with disaster survivors for practical insights.
- Communication and Policy Advocacy: Developing strategies to communicate the importance and benefits of shorter functional recovery timelines and improved codes.
- Cross-Disciplinary Connections: Collaboration between sectors such as housing, utilities, finance, and disaster management to align data and goals.

### 8.4. Discussion

Existing research on community recovery has examined various aspects of disaster resilience, infrastructure dependencies, and financial and policy considerations. Studies have explored how resilient building designs affect downtime tolerance, categorized building uses, and linked building performance to community-wide recovery. Research on lifelines and infrastructure systems has emphasized the role of interdependencies, particularly in critical services such as utilities, water, and transportation. Additionally, economic and workforce research has highlighted challenges in disaster financing, recovery workforce availability, and cost-benefit analyses of mitigation strategies. Key global insights, such as probabilistic models and case studies from past disasters, provide valuable cross-disciplinary perspectives to refine functional recovery planning. A growing area of focus deals with resilience strategies that address the whole community, improve access to retrofitting programs, and minimize displacement risks.

Despite significant progress, there remain major gaps in research that must be addressed to develop more effective and robust functional recovery frameworks. Understanding the **cost implications** of different recovery timelines, especially in relation to affordability and

incentives, is critical. Further studies are needed on technical and structural functional recovery design, particularly for multi-hazard scenarios beyond earthquakes, such as floods and wildfires. **Risk communication** is another priority, as improving public understanding of functional recovery benefits and incentivizing adoption through policy, insurance mechanisms, and certification programs can enhance widespread implementation. Research must also examine the interdependencies of recovery across sectors, such as how housing recovery influences transportation and economic activity. Developing comprehensive methodologies for real-world data collection and aligning functional recovery with efforts to address future weather and hazards conditions are essential next steps.

To support these research priorities, robust **data collection and analysis** are needed. Existing datasets, including longitudinal studies on disaster recovery, lifeline restoration curves, and international building performance metrics, provide a strong foundation. However, data on baseline functional recovery performance, financial impacts of mitigation efforts, and compliance with existing codes are lacking. A deeper understanding of community vulnerabilities, important to earthquake hazards impacts, sheltering trends, and post-disaster behavioral responses, can inform more effective recovery strategies. Additionally, engineering capacity assessments will help evaluate the availability of skilled professionals needed to meet growing functional recovery demands. Expanding regional and social analyses can ensure that functional recovery policies achieve resilience goals while meeting the needs of each individual community.

**Collaboration** among government agencies, industry stakeholders, researchers, and community-focused organizations will be essential for bridging these knowledge gaps. Partnerships with developers, insurers, and financial institutions can help align functional recovery standards, including the FRGM-W, with practical economic incentives. International collaboration, drawing from best practices in Japan, New Zealand, and Europe, can inform scalable functional recovery strategies. Additionally, grassroots engagement with disaster-affected communities can provide real-world insights into recovery needs and priorities, further enhancing the FRGM-W. Cross-sector cooperation between utilities, transportation planners, emergency responders, and policymakers is crucial to integrating functional recovery into broader urban resilience frameworks. By leveraging an assorted network of expertise and addressing the needs of people with varied vulnerabilities, functional recovery efforts can enhance disaster resilience and support responsible community rebuilding.

## 9. Workshop Format and Scoping Limitations

The generalizability of this workshop's outcomes is necessarily limited or constrained by the participant characteristics, the workshop's timing and structure, the information available to participants, and the restrictions imposed by existing functional recovery efforts. The report's authors suggest the following limitations:

- Time for cross-disciplinary/sector knowledge building: Participants may not have had enough time to internalize introductory information, particularly for those new to functional recovery, as it is discussed by earthquake engineers. That said, the wealth of interdisciplinary expertise possessed by the participants—in community recovery, community resilience, insurance, the social sciences, public policy, urban planning, etc.—added richness and depth to the discussion.
- Creating a shared basis for decision-making: Despite the plan that the criteria identified in Breakout Session 1 should be used to guide prioritization and decision-making in Breakout Sessions 2 and 3, it was not apparent to what extent it did. Certainly, the focus on housing (criterion 1) was retained throughout, but reliance on the criteria was not formally assessed. However, the conversation around establishing criteria likely helped workshop participants become more familiar with a host of complex issues and topics relevant to functional recovery outside of their own areas of expertise.
- More discussion time: The breakout sessions needed to be longer, especially Breakout Session 3. Having enough time to allow for both individual consideration and small group discussion for Breakout Session 5 would have been valuable. The agenda was overly ambitious for the 1½-day schedule.
- Aspirational vs. resource-based thinking: Without information on costs or design constraints, and because participants were encouraged to set aside these uncertainties for decision-making at the workshop, participants may have been more likely to favor earlier TRTs for a larger number of functions and services than they might have done if additional cost or design information were available. However, the benefit is that the TRT targets for functions and services were likely more directly driven by needs of users.
- Tying community outcomes to individual assets: Thinking in terms of individual assets (e.g., hospital) rather than the community at large, proved challenging for the workshop's participants. Given their subject matter expertise, many are accustomed to thinking at the community scale, and additional consideration should be given to how best to foster conversations at both scales and on the interactions between the asset and community scales. Functional recovery design is intended to be applied at the building or infrastructure system scale, to produce outcomes that benefit users of the assets, and which compound at the community scale to improve overall recovery.

Despite these considerations, the workshop yielded new insights into the existing functional recovery work thanks to participants' backgrounds in social science, public policy, urban planning, insurance, economics, and more. The workshop also laid the foundation for future work on functional recovery, incorporating a variety of disciplines and sectors.

## 10. Summary of Workshop Findings

The workshop produced several important contributions towards the development of functional recovery performance goals. These are summarized in two sections below: participant takeaways and suggested recommendations for updating the functional recovery goal matrix (FRGM), including the final FRGM-W product.

### 10.1. Participant Takeaways

The following summarizes important takeaways from the workshop’s conversations that the report’s authors understand as needs for functional recovery performance and ongoing development of functional recovery performance objectives. This includes:

- Priorities for recovery
- Missing information
- Call for engagement

#### 10.1.1 Priorities for recovery

Two key recovery goals emphasized by workshop participants include the earlier prioritization of critical functions in recovery timelines and wanting to help people stay in their homes and communities.

##### **Earlier Recovery Prioritization for Critical Functions**

Workshop participants were most likely to attach higher priorities (earlier TRTs) to functions and services related to public health and safety, healthcare, housing, education, and employment, the majority of which appeared most often in Categories A-D, i.e., from 0 hours to one month. Participants’ suggestions for adding two more functional recovery categories and TRTs in the 0 hours to 6-month window reflected their professional assessment that “sooner rather than later” would better enable short-term and long-term community recovery, given factors identified in Breakout Session 1 (e.g., housing, healthcare). In Breakout Sessions 1 and 3, participants were vocal and clear that facilitating people’s early returns to their *homes* was critical for their mental health as well as the community’s social, educational, and economic recovery. Participants’ interest in assigning more functions and services to earlier categories may also reflect a desire to minimize teardowns and major repairs that are costly, take extensive amounts of time, and sometimes lead to longer-term displacement and negatively impact community resilience. The lowest priorities to functions and services related to cultural identity and recreation/entertainment, most of which appeared in the Not Designed for Functional Recovery category.

##### **Helping People Stay in Their Homes and Their Communities**

The results of Breakout Session 1—with “**maximize availability of housing**” being the most supported criterion—made clear the participants’ interest in helping people stay in their homes and their communities, in part to reduce both short- and long-term

population displacement. As noted previously, all groups discussed the criticality of *housing* and access to *healthcare* (both physical and mental), as well as access to *lifelines services*. Group discussions centered on the importance of *servicing basic needs across whole communities*, with considerable time addressing the interdependencies among the topics identified in the first breakout session.

Workshop organizers intentionally kept the discussion of the 10 housing options and their assignment to recovery categories in Breakout Session 3 separate from the discussion and assignment of the remaining 52 functions and services. This intentional separation stemmed from lack of agreement in the engineering community as to the appropriate timeframe in which to prioritize housing. While many members of topic subcommittees 2 and 3 agreed that housing recovery should be assigned to 72-hour (or sooner) TRT(s), others in earlier efforts did not agree with this early prioritization. This workshop presented an opportunity to gather subject matter expert (SME) guidance on the assignment of housing, something not done in prior workshops. As shown in Table 10-1, the SMEs attending this workshop generally agreed with the 72-hour TRT (or earlier) prioritization for most of the housing options.

**Table 10-1. FRGM-W: Recommendations for Categories and TRTs for Housing Options.**

Functional Recovery Categories	TRTs	Community Functions Supported by Structures
A	[0 hours]	<ol style="list-style-type: none"> <li>1. Custodial care (e.g., jails/prisons)</li> <li>2. Foster care housing</li> <li>3. Residential care facilities for the elderly, assisted living facilities, adult care facilities</li> </ol>
B	[24 hours]	NA
C	[72 hours]	<ol style="list-style-type: none"> <li>4. Low-income housing (housing)</li> <li>5. Multi-family housing (2-5 units)</li> <li>6. Multi-family housing (5+ units)</li> <li>7. Multi-unit housing with shared common spaces (e.g., convents, monasteries, dormitories)</li> <li>8. Single-family housing</li> <li>9. Community treatment and recovery facilities, group homes, boarding houses (e.g., unhoused populations, furlough) (C, D: 1 vote each)</li> </ol>
D	[1 month]	<ol style="list-style-type: none"> <li>10. Hotels (e.g., transient, residential)</li> </ol>

### 10.1.2. Missing Information

Throughout the workshop, it was clear that participants generally struggled to reconcile various priorities when assigning functions, services, or assets to the TRTs. These challenges can be grouped into three main categories: procedures for defining and categorizing buildings and systems, interdependencies that may cause obstacles (both known and unknown), and the need for better cost and design information to assess feasibility.

### **Defining and Categorizing Recovery Functions/ Services**

A key component of functional recovery is clearly defining essential services and distinguishing between critical and supplementary functions. For example, precise definitions of “basic human survival needs” prevent inconsistencies that better ensure communities’ resources are directed effectively. Continuing to refine the terminology used should enable better delineation and assignment of priorities, as well as more consistent communication among stakeholder groups, and perhaps most importantly, enable the inclusion of individuals who may have limited or no understanding of building codes and designing for functional recovery.

### **Clarifying Critical Interdependencies for Functional Recovery Performance**

Implementing functional recovery may require understanding how lifeline interdependencies affect immediate restoration efforts. Critical systems like energy, water, and transportation are intricately linked, and disruptions can cascade across systems, delaying recovery. By identifying and addressing these interdependencies early, stakeholders can refine prioritization efforts, reduce disagreements, and ensure seamless restoration of essential services. Pre-disaster investments in planning, maintenance, and upgrades to achieve system resilience may be critical to these efforts. Participants frequently mentioned that lifeline infrastructure systems recovery should probably be prioritized along with their associated functions and services, as the functional recovery of a given structure might not be possible otherwise.

### **More Inputs to Assess Feasibility are Needed**

It was evident throughout the workshop’s discussions that participants wanted and needed information on the **costs** associated with functional recovery. Attempting to make decisions about prioritization of functions and services without this information is challenging at best. In addition, more information on **design parameters** or limitations was needed. As is the case with cost data, without a sense of design realities, one is compelled to make decisions in a vacuum that may prove more aspirational than feasible. Collecting and making quantitative data available will facilitate more robust decision-making, and in particular, will enable the use of modeling tools.<sup>2</sup>

## **10.1.3. Call for Engagement**

### **Engaging Communities for Targeted Recovery Solutions**

Community engagement should be a cornerstone for developing functional recovery goals, and integrating community-level input can increase the likelihood that functional recovery solutions are both practical and effective. And the public will likely need messaging and communications to help them understand the goals of functional

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<sup>2</sup> For example, [Multi Attribute Utility Theory](#) (MAUT) helps users make complex decisions by providing a framework for systematically evaluating options based on multiple, potentially conflicting, objectives (such as minimizing cost and maximizing housing access), and incorporating the decision-maker's preferences.

recovery and how it might reduce casualties, decrease downtime, save dollars, and expedite community recovery after a disaster. In addition, communities can implement functional recovery performance goals alongside community resilience planning processes so that communities may ensure that priorities appropriately align with local conditions such as vulnerabilities, capacity, and culture. Including a variety of stakeholders in planning fosters trust and ensures recovery strategies are tailored to specific needs. For example, phased approaches to lifeline restoration, such as partial power restoration with adaptations within 72 hours for locally important network areas, followed later by complete recovery, may help address additional immediate recovery needs. Participants' high degree of interest in this topic reflects both their subject matter expertise and the criticality of creating a FRGM that can be standardized and applied across the country without customizations that might reduce the efficacy of functional recovery efforts.

### **Tapping Into Existing Research, Data, and People with Knowledge**

While current functional recovery efforts are focused on seismic risks and developing performance goals that can enable functional recovery in post-earthquake scenarios, there is much to be learned outside structural engineering and from knowledge of other hazards/impacts. Reaching out to professionals in other fields (e.g., social scientists, insurance providers, low-income housing advocates) may enhance the robustness of the FRGM/FRGM-W and other functional recovery recommendations, even if code and standards professionals are not yet ready to advance a multi-hazard functional recovery framework.

## **10.2. Recommendations for Revising the Functional Recovery Goal Matrix**

This section provides suggestions and insights to update a functional recovery goal matrix resulting from the *Workshop on Functional Recovery Performance*.

### **10.2.1. Refining Future Performance Targets: the FRGM-W**

One key workshop output is the development of suggestions to inform future development of the Functional Recovery Goal Matrix (**FRGM**, summary in Table 5-1). The current FRGM was under consideration for inclusion in the *NEHRP Recommended Seismic Provisions for New Buildings and Other Structures* at the time of the October 2024 workshop. NIST was interested in convening additional subject matter experts to confirm or advance extensive previous efforts to assess appropriate goals for the functional recovery of community functions. This includes a series of workshops (detailed in NIST SP 1269) held to produce the NIST-FEMA report to Congress on functional recovery [5] and undertaken by topic subcommittees of the Provisions Update Committee. To assist with the committee's further development of the matrix, a workshop matrix, the FRGM-W (functional recovery goal matrix-workshop), is presented in Table 10-2 and provides content that can help to improve the appropriate assignment of functions and services.

### 10.2.1.1. Description of the FRGM-W

Table 10-2 summarizes the results of group-level conversations on priorities for recovery time for community functions. These results are expected to inform the development of subsequent code, standard, and guidelines for functional recovery performance, as well as key topics in research and practice that will enable functional recovery performance and successful implementation of targeted improvements for community functions in post-earthquake conditions. The FRGM-W is organized to clearly show confidence in the placement of functions/services based on levels of agreement across the workshop groups.

Workshop sessions were designed so that participants would have the opportunity to directly review the **FRGM's** key components and make their own suggestions for recovery categories, target recovery times (TRTs), and assignment of functions and services to the recovery categories. The table's contents were derived from the agreed-upon recovery categories and target recovery times (TRTs) from Breakout Session 2 (seven categories: A, B, C, D, E, F, Not Designed for FR), coupled with the assignments of functions and services agreed to by at least two of four groups during Breakout Session 3.

In Table 10-2, functions and services are listed in terms of the level of agreement across groups for affiliation with the recovery category. If 3 or 4 groups voted for the item in that category, the item is included in the "high agreement" column. All functions/services in the "moderate/low agreement" column received two votes. These are identified by the number of groups in favor, either 2/3, 2/4, or 2/4 with a 50 % split between two categories (in which case they are repeated in both categories in the table). The FRGM-W may be compared to Table 5-1 (FRGM), but the FRGM did not include a full list of functions and services, so the FRGM-W enables consideration of a fuller set of important functions and services for society. Items that differ significantly from placement in the earlier FRGM are marked.

**Table 10-2. Recommendations for Consideration: Functional Recovery Goal Matrix- Workshop (FRGM-W).**

Category/ Time	Recommend for Inclusion: High Agreement Function/ Service	Additional Determination Needed: Moderate-Low Agreement Function/ Service
A [0 hours]	<p><u>4/4 groups:</u></p> <ul style="list-style-type: none"> <li>• Acute care hospitals &amp; support facilities</li> <li>• Custodial care (e.g., jails/prisons)</li> <li>• Emergency departments</li> <li>• Emergency response/communication facilities</li> <li>• EMS/critical transportation services (ambulance)</li> <li>• Fire stations</li> <li>• Psychiatric care (inpatient)</li> </ul> <p><u>3/ [3-4] groups:</u></p> <ul style="list-style-type: none"> <li>• Emergency shelter</li> <li>• ^Foster care housing</li> <li>• Long-term care hospitals &amp; support facilities</li> <li>• Police stations</li> <li>• Residential care facilities for the elderly, assisted living facilities, adult care facilities</li> </ul>	<p><u>2/3 groups:</u></p> <ul style="list-style-type: none"> <li>• Religious facilities (used for emergency shelter)</li> </ul> <p><u>2/4 groups (50/50 split) {repeated in table}:</u></p> <ul style="list-style-type: none"> <li>• Emergency supply - warehouse, storage (food, water, PPE) (A/B)</li> </ul>
B [24 hours]	<p><u>3/ [3-4] groups:</u></p> <ul style="list-style-type: none"> <li>• ^Phone/Cellular facilities</li> </ul>	<p><u>2/3 groups:</u></p> <ul style="list-style-type: none"> <li>• Urgent care clinics</li> <li>• ^Internet (server farms, facilities, data centers)</li> </ul> <p><u>2/4 groups (50/50 split) {repeated in table}:</u></p> <ul style="list-style-type: none"> <li>• Emergency supply - warehouse, storage (food, water, PPE) (A/B)</li> <li>• Dialysis centers (B/C)</li> <li>• Energy, power generation &amp; distribution (B/C)</li> </ul>
C [72 hours]	<p><u>4/4 groups:</u></p> <ul style="list-style-type: none"> <li>• Multi-family housing (2-5 units) (housing)</li> <li>• Multi-family housing (5+ units) (housing)</li> <li>• Railroad facilities – maintenance yards</li> </ul> <p><u>3/ [3-4] groups:</u></p> <ul style="list-style-type: none"> <li>• Airports</li> <li>• Low-income housing</li> <li>• Multi-unit housing with shared common spaces (e.g., convents, monasteries, dormitories)</li> <li>• Pharmacies</li> <li>• Sewer system facilities</li> <li>• Veterinary care- urgent</li> <li>• Wastewater treatment infrastructure</li> </ul>	<p><u>2/3 groups:</u></p> <ul style="list-style-type: none"> <li>• Industrial (construction, manufacturing)</li> <li>• Psychiatric care (outpatient)</li> <li>• ^Recovery-focused local government services (e.g., debris management)</li> <li>• ^Routine local government services (e.g., municipal admin/tax, elected officials’ offices)</li> <li>• Single-family housing</li> </ul> <p><u>2/4 group votes (majority):</u></p> <ul style="list-style-type: none"> <li>• Water infrastructure facilities (other votes: A/B)</li> </ul> <p><u>2/4 groups (50/50 split) {repeated in table}:</u></p> <ul style="list-style-type: none"> <li>• Dialysis centers (B/C)</li> <li>• Energy, power generation &amp; distribution (B/C)</li> </ul>

Category/ Time	Recommend for Inclusion: High Agreement Function/ Service	Additional Determination Needed: Moderate-Low Agreement Function/ Service
		<ul style="list-style-type: none"> <li>• Food and potable water services, both retail (e.g., grocery stores) and wholesale (C/D)</li> <li>• Public/mass transportation facilities (C/D)</li> </ul>
D [1 month]	<p><u>4/4 groups:</u></p> <ul style="list-style-type: none"> <li>• PK-12 schools – private and religious</li> </ul> <p><u>3/ [3-4] groups:</u></p> <ul style="list-style-type: none"> <li>• Child and adult daycare</li> <li>• ^Commercial (small business, retail)</li> </ul>	<p><u>2/3 groups:</u></p> <ul style="list-style-type: none"> <li>• ^Hotels (e.g., transient, residential)</li> <li>• Social services, community &amp; elder centers, neighborhood support services</li> </ul> <p><u>2/4 groups:</u></p> <ul style="list-style-type: none"> <li>• ^Post-secondary (i.e., colleges, universities) (other votes: E/F)</li> </ul> <p><u>2/4 groups (50/50 split) {repeated in table}:</u></p> <ul style="list-style-type: none"> <li>• ^Food and potable water services, both retail (e.g., grocery stores) and wholesale (C/D)</li> <li>• Public/mass transportation facilities (C/D)</li> <li>• Court houses (D/E)</li> <li>• Restaurants (D/E)</li> </ul>
E [3 months]		<p><u>2/4 groups (50/50 split) {repeated in table}:</u></p> <ul style="list-style-type: none"> <li>• Court houses (D/E)</li> <li>• Restaurants (D/E)</li> </ul>
F [6 months]	NA: Only one group assigned functions or services to this category.	
Not Designed for FR (NDFR) no target]	<p><u>4/4 groups:</u></p> <ul style="list-style-type: none"> <li>• Arenas (indoor; not intended to be used for emergency shelter/services)</li> <li>• Community recreational facilities (e.g., gym, pool)</li> <li>• Country clubs</li> <li>• Movie and performance theaters, concert halls</li> <li>• Museums</li> <li>• Night clubs</li> <li>• Recreation center/ gymnasium (private; not to provide emergency shelter or service)</li> <li>• Stadiums (outdoor)</li> </ul> <p><u>3/ [3-4] groups:</u></p> <ul style="list-style-type: none"> <li>• Religious centers (e.g., churches, temples, mosque, excluding schools)</li> </ul>	<p><u>2/3 groups:</u></p> <ul style="list-style-type: none"> <li>• Historic buildings</li> <li>• Temporary housing and facilities; temporary structures (e.g., tents, tent structures)</li> </ul> <p><u>2/4 group votes:</u></p> <ul style="list-style-type: none"> <li>• Libraries</li> </ul>
^ Items that were placed in categories that differ from the placement or intent of functions/services as represented in the FRGM (Table 5-1).		

### 10.2.2. Limitations of the FRGM-W

The FRGM-W summarizes data collected from groups of participants working in cooperation with one another to assign functions/services during Breakout 3 group conversations. The emphasis on the group perspectives for the TRT of function/services was important to help evaluate needs for recovery across society rather than simply reflecting on individuals' unique perspectives. There are several ways in which the contribution of the FRGM-W can be understood to be limited.

First, it should be noted that all functions and services listed in Handouts 3.1 and 3.3 are not assigned to a recovery category in the **FRGM-W** (Table 10-2). This is for several reasons, including:

- **Groups ran short on time:** Only some groups finished the work of assigning every function or service to a recovery category. Report authors would have preferred to use a minimum of three votes out of four for the placement of all functions/ services to ensure high levels of confidence for agreement in the item's placement. But that was not possible in cases where only one or two groups may have even considered the placement of that item. For example, even though housing was identified as critical for the workshop's participants in Breakout Session 1, this topic was not finished by all groups in Breakout Session 3, so this item may have received fewer votes simply because it was not assigned, rather than because participants felt it wasn't worth assigning to a particular category.
- **Inclusion required a minimum of 2 votes:** Items appearing in the recommended FRGM-W must have received at least 2 votes across the 4 groups. For example, functions and services that did not meet the minimum 2 vote requirement include:
  - Banking and finance (B/C/F: 1 vote each)
  - Community treatment and recovery facilities (C/D: 1 vote each)
  - Commercial (major employer) (C/D/E: 1 vote each)
  - Electronic news media facilities (B/C/D: 1 vote each)
  - Medical clinics, surgical centers (A/C/D/E: 1 vote each)
  - Office buildings (D/E: 1 vote each)
  - Veterinary clinics (outpatient) (D/F/NDFR: 1 vote each)

Clearly, many of these items are important for the return of basic services and functions that enable resumption of post-disaster activities. The diversity in voting related to these functions/ services likely has more to do with differences in opinion regarding the need for, sequencing, or perhaps the perceived feasibility of designing recovery for assets providing those services/functions. So, additional consideration should be given to how to assign these items, rather than declining to assign them.

### 10.2.3. Comparison of FRGM with FRGM-W

**Commonalities:** Careful review of the FRGM-W indicates that it holds much in common with the FRGM, as follows:

1. While the FRGM-W was developed to include seven recovery categories based on the preferences of workshop participants distilled through activities and discussions from Breakout Session 3, it actually uses only five categories: A, B, C, D, and NDFR—the same number as the FRGM. E and F had no significant assignment of functions or services despite workshop participant’s desire for those TRTs to be included.
2. There was a high degree of agreement among the groups regarding what should appear in Categories A and NDFR, both of which had been pre-populated from the FRGM’s Categories A and NDFR and were discussed more in terms of agreement/disagreement, rather than novel assignment. It was apparent, though, that there are high levels of confidence in the assignment of functions/services to these categories.
3. The 72 hours TRT—known as Category B in the FRGM and Category C in the FRGM-W— included the greatest number of functions and services, including five housing options.

**Differences:** There are also differences between the FRGM-W and the FRGM, as follows:

1. Excluding the NDFR category, the remaining four recovery categories in the FRGM-W that were populated by functions and services (A, B, C, D) have a shorter overall timeline than the four recovery categories in the FRGM. Participants discussed the need to create more TRTs within the 6-month recovery window. They parsed the 0 to 24-hour category to distinguish 0 (immediate) from 24 hours (one day). They retained the 72-hour or 3-day category. In place of the 2-month category, they asked for a 1-month category as well as a 3-month category. In addition to agreeing with the existing 6-month category, there was some group discussion about the potential value of having longer TRTs, though none were added for discussion in Breakout Session 3. The proposed changes to the FRGM TRTs from four categories in 6 months to six categories in six months in the FRGM-W reflected participants’ statements that the additional TRTs better aligned with expediting community recovery.
2. Therefore, the FRGM-W timeline provided by the workshop participants ranges from 0 hours to 3 months. This is shorter than the FRGM timeline of 0 hours to 6 months. Essentially, the FRGM-W timeline is compressed by several months, with more functions and services expected to be recovered within a shorter period.
3. Finally, the workshop findings help us better understand where there might be differences between the functional recovery provisions language currently drafted (the FRGM) and the assignments provided by subject matter experts adjacent to the engineering community (FRGM-W). These differences are marked with a ^ in Table 10-2. Functions or services with differing assignments (mostly to an earlier TRT) include:
  - Housing: foster care housing (72 hours changed to 0 hours), hotels (1 month changed to 72 hours)
  - Utilities Infrastructure: phone/cellular facilities (72 hours changed to 24 hours), internet infrastructure (72 hours changed to 24 hours)
  - Government: recovery-focused local government (2 months changed to 72 hours), routine local government services (6 months changed to 72 hours)

- Education: post-secondary (i.e., college, university) (6 months changed to 1 month)
- Other: commercial (small business, retail) (72 hours/ 2 months /6 months changed to 1 month), food and potable water services, both retail and wholesale (72 hours changed to 72 hours / 1 month split)
- Future code/standards committees tasked with TRT assignment will want to evaluate reasons for discrepancies and consider how to enable TRT categories to best support societal recovery requirements.

These differences may be connected to the complex roles that these functions/services serve in society. For example, whether a small corner store selling groceries is open on any given day might seem trivial on a normal day, but if it is the only source of nutritious food for an urban neighborhood after a disaster, its role in recovery could become much more significant in the post-event context.

Overall, while the FRGM-W aligned well with the FRGM, more research is needed to clarify the differences between TRTs and to develop definitions and frameworks that help assign specific functions and services. Although insights from the workshop's participants, who represent more of the social sciences than the FRTC, complement those of the FRTC, there are critical differences in the proposed timeline and other aspects that should be considered going forward. Identifying the source(s) of the different perceptions about the TRTs will be key to further improving the FRGM/FRGM-W.

## 11. Next Steps for Goal Matrix Development

This overview integrates workshop lessons and potential next steps for developing functional recovery performance objectives. These activities are critically linked to the options defined in FEMA P-2090/ NIST SP-1254, the 2021 Congressional report on recommendations for functional recovery. The inset provides a reminder of these options.

### 11.1. Continue Developing the FRGM

Advancing the FRGM-W (Table 10-2) and integrating it into the broader FRGM will support a standardized approach for classifying structures based on their functional recovery needs. In the absence of a robust framework—such as the one being developed by the FRTC and PUC for the NEHRP Provisions—recovery timelines and expectations can vary significantly across structures and communities, creating inefficiencies in prioritization. A structured matrix aligned with national risk assessment frameworks will promote consistency in functional recovery design. By defining tiered categories and assigning TRTs based on each function’s contribution to community recovery and resilience, the refined FRGM will offer clear guidance for policymakers, engineers, and developers in meeting performance standards for functional recovery.

#### 2021 Recommendations for Functional Recovery Implementation

1. Develop a framework for post-earthquake recovery objectives
2. Design new buildings for functional recovery
3. Retrofit existing buildings for functional recovery
4. Improve lifeline infrastructure resilience
5. Implement pre-disaster recovery planning
6. Increase public awareness and education
7. Secure financial resources for functional recovery initiatives

Based on this workshop’s findings, several next steps are recommended to continue developing the FRGM:

- 1) **Communicate** the draft FRGM-W to the FRTC and PUC. Highlight differences and similarities between the FRGM-W and the FRGM. Solicit feedback on the FRGM-W and suggest changes that reflect the most conclusive workshop findings (e.g., the criticality of housing).
- 2) Collect more **field data** on actual structures post-earthquakes, both those that are damaged and those that are undamaged. The field data should take into account the variables most likely to have affected the degree and type of damage, as well as non-damage. This type of reconnaissance represents a shift away from the more traditional approach, which entails a primary focus on damaged structures. While certainly valuable, this type of research tells us what goes wrong and not what goes right. Both types of data are needed to reach valid and reliable conclusions about structural design and the likely timeframe in which different structures (and the functions and services they support) may be functionally recoverable.
- 3) Conduct additional research to establish clear, consistent, and widely accepted **terminology** related to the FRGM and functional recovery more broadly. Without

shared definitions, the risk of miscommunication, misalignment, and inaction across stakeholders increases significantly.

- 4) Collect more empirical data on people’s prioritizations of different community functions and services. To do this well, the subjects of this research will need **cost data** as well as data on how various functions and services contribute to healthy and resilient communities. Without this data, it is challenging for people to conduct effective cost-benefit analyses and make informed choices between functions and services. Additional data on people’s prioritizations—informed by cost-benefit analyses—could be collected in workshops similar to this one.
- 5) While the prioritization of functions and services for Category A and the Not Defined for Functional Recovery was generally agreed upon by the workshop’s participants, this was not the case with Categories B, C, D, E, and F. This was partially attributable to the design of Breakout Session 3, where participants were given pre-populated matrices for Category A and Not Defined for Functional Recovery, and left to assign more than 30 additional functions and services to Categories B, C, D, E, and F. Some of the groups ran out of time, leaving the results for Category E and F inconclusive. Another workshop might **pre-populate** Categories B, C, D, E, and F as well. Doing so would yield more time for in-depth discussion of why different functions and services were assigned to different categories. It would also yield more time for robust full group discussion of these categories, beyond smaller group discussions.
- 6) One of the discussions throughout the workshop was whether the FRGM-W/FRGM should be **customizable** by individual communities. To the extent that a community might choose to elevate the prioritization of a given function or service, there is no particular issue. Outside of that, there would be, as the overarching goal is to create a national standard that applies across communities. Collecting additional data from subjects such as those who participated in this workshop on how to manage this tension would be worthwhile, particularly as uptake of a functional recovery standard will depend in part on community’s acceptance of the functional recovery standard, including the FRGM. One way to frame the conversation might be to identify some limited set of functions and services for which the prioritizations are generally clear (e.g., acute care hospitals, recreational facilities), place those in a draft FRGM, discuss whether these prioritizations should be *standard* across communities, and then decide whether other functions and services should or should not be included in the FRGM.
- 7) In addition to cost data, collect more data about what would need to be true with respect to **design practices** to achieve TRTs of 0 hours, 24 hours, 72 hours, 1 month, 3 months, and 6 months. Are all these TRTs achievable? While discussions related to drafting the FRGM were initially expected to take place without consideration of costs or design constraints, the “end-product” needs to take both into account. This data will be needed for new and existing structures, as well as lifelines.

### **11.2. Strengthen Data Collection and Analysis**

Although briefly acknowledged in relation to costs and design constraints, the critical need for more comprehensive and robust data collection and analysis deserves stronger emphasis. Enhanced data capabilities are essential for informed decision-making and for accurately tracking functional recovery outcomes. At present, data on recovery performance, economic impacts, and compliance trends is often fragmented or incomplete, limiting the ability to evaluate the effectiveness of recovery strategies. Expanding the use of real-time sensor-based monitoring, post-disaster surveys, and longitudinal studies can yield valuable insights into the performance of different recovery approaches. Moreover, making disaster recovery data publicly accessible will promote greater transparency, accountability, and shared learning across sectors and stakeholders.

### **11.3. Work to Develop a FRGM for Existing Structures**

While workshop discussions were focused on the design of new buildings, participants pointed out that existing buildings comprise a substantial portion of the built environment in most communities and are vulnerable to significant damage and extended downtime since they were not designed for functional recovery performance. This may necessitate a version of the FRGM tailored specifically for the needs of existing buildings, which may differ from the target time goals proposed for new construction. Research should investigate characteristics that influence how and to what extent the FRGM for existing buildings may differ from that for new buildings. In particular, attention should be given to the costs and effectiveness of retrofitting for functional recovery, and consideration of when retrofitting for life safety versus functional recovery may be more appropriate or desirable.

### **11.4. Clarify Lifeline Interdependencies**

Clarifying lifeline interdependencies is essential to reducing the risk of cascading failures in critical systems such as power, water, transportation, and telecommunications. Because these systems are highly interconnected, a disruption in one can rapidly propagate across others, hindering recovery efforts community wide. Comprehensive interdependency mapping can help planners and emergency managers identify systemic vulnerabilities and prioritize infrastructure restoration in a sequence that maximizes recovery efficiency. Unpacking both the direct and indirect interdependencies affecting structures will also inform the development of the FRGM—shaping the number of categories, assigning appropriate TRTs, and refining function and service classifications. Proactively addressing these interconnections will strengthen the FRGM’s practical application and significantly improve a community’s capacity to recover swiftly and effectively.

### **11.5. Incorporate Regional Needs into the FRGM**

Enhancing the FRGM to reflect regional needs can help ensure that functional recovery efforts are both practical and effective. Although the use of community archetypes in the workshop

did not highlight as many differences as anticipated, participants consistently emphasized that communities differ significantly in their needs, expectations, and operating conditions. Urban, suburban, and rural areas each face distinct recovery challenges—urban regions may prioritize public transit and high-density housing, while rural communities may focus on restoring utility services and agricultural infrastructure. Embedding the capacity for additional region-specific considerations into FR TRTs—while preserving the ability to provide nationally applicable functional recovery design—will enhance both its flexibility and relevance. This may involve local jurisdictions elevating the priority of certain functions or services based on factors such as population density, stressors or risks, economic dependencies, and infrastructure characteristics. Ultimately, regional adaptation built upon a unified framework will improve recovery outcomes in communities across the nation.

### **11.6. Engage More Stakeholders in the Continuing Development of the FRGM**

Broad-based stakeholder engagement would be an ideal contribution to the refinement and successful implementation of functional recovery target recovery times. Involving a diverse array of participants—including community members, emergency managers, engineers, architects, building owners, public health officials, educators, utilities, transportation authorities, social service providers, business leaders, insurers, and community-based and nonprofit organizations—will ensure that the FRGM reflects the complex realities of recovery across sectors and populations, and to help articulate how functional recovery performance can be effectively utilized alongside emergency management and resilience planning actions.

Additional partnerships and activities convened by research engineers, building professionals, and social scientists to reach out to these other audiences would be beneficial. Examples include:

- inclusive workshops to gather insights that can tailor functional recovery performance to more tailored needs or functional recovery priorities of particular communities,
- case study scenarios or testbeds where functional recovery performance can be evaluated for assumptions, barriers, and sequencing of recovery,
- interviews and focus groups with authorities having jurisdiction to identify gaps, roadblocks to implementation and/or enforcement, and resource constraints.

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## Appendix A. Workshop Participants

### A.1. Workshop Organizers

Name	Affiliation
Lucy A. Arendt	St. Norbert College
Divya Chandrasekhar	University of Utah
Jon Heintz*	Applied Technology Council
Katherine J. Johnson	National Institute of Standards and Technology
Laurie Johnson	Laurie Johnson Consulting
Ryan Kersting	Buehler Engineering
Siamak Sattar*	National Institute of Standards and Technology
Michael Valley*	Applied Technology Council
<b>Count = 9</b> <i>* Not included in total 48 count</i>	

### A.2. Workshop Attendees

Name	Affiliation
Shannon Abeling	Holmes US
Jason Averill	National Institute of Standards and Technology
Nicole Boothman-Shepard	Boothman Global, PBC
Sydney Brown	AECOM
Louise Comfort	University of Pittsburgh
Santina Contreras	University of Southern California
Dustin Cook	National Institute of Standards and Technology
Rodrigo Costa	University of Waterloo
Rachel Davidson	University of Delaware
Craig Davis	C A Davis Engineering
Maximilian Dixon	Washington Emergency Management
Leonardo Duenas-Osorio	Rice University
Ron Eguchi	ImageCat, Inc.
Ann-Margaret Esnard	Georgia State University
Guillermo Franco	Guy Carpenter
Juan Fung	National Institute of Standards and Technology
Alex Greer	University at Albany
Jay Harris	National Institute of Standards and Technology
Jennifer Helgeson	National Institute of Standards and Technology
Andrew Herseth	Federal Emergency Management Agency
Jamie Kruse	Colorado State University
Rebecca Laberenne	Independent Consultant
Yolanda Lin	University of New Mexico
Therese McAllister	National Institute of Standards and Technology
Katie Miller	San Francisco Public Utilities Commission
Peter Morris	AECOM

Name	Affiliation
Anuradha Mukherji	East Carolina University
Ali Nejat	Texas Tech University
Aron Newman	National Institute of Standards and Technology
Sissy Nikolaou	National Institute of Standards and Technology
Rob Olshansky	University of Illinois Urbana-Champaign
Walter Gillis Peacock	Texas A&M University
Tara Powell	University of Illinois Urbana-Champaign
Jonathan Siu	Washington Association of Building Officials
Jeff Soulages	Intel (retired)
Greg Soules	CB&I Storage Tank Solutions LLC
Elaina Sutley	University of Kansas
Mai Tong	Federal Emergency Management Agency
Shannon Van Zandt	Texas A&M University
Anne Wein	United States Geological Survey
Adam Zsarnoczay	Stanford University
<b>Count = 42</b>	

## Appendix B. Workshop Agenda

### Day 1: October 8, 2024

Start	End		
9:00 a	9:10 a	Welcome/agenda review/introductory remarks	Michael Valley
		<i>Introductory presentations</i>	
9:10 a	9:20 a	Importance of this Workshop to NIST	Jason Averill
9:20 a	9:40 a	Functional Recovery Concepts, Motivation, and Engineering Activities	Ryan Kersting
9:40 a	10:00 a	NIST Efforts to Develop a Functional Recovery Goal Matrix	Siamak Sattar
10:00 a	10:15 a	What this Workshop Will Add to the Discussion	Lucy Arendt
10:30 a	10:45 a	Plenary 1: The FR Goal Matrix: Criteria and Guiding Principles	Ryan Kersting
10:45 a	11:45 a	Breakout 1	
11:45 a	12:00 p	Introduce Communities for Breakouts 2 and 3	Lucy Arendt
12:00 p	12:15 p	Report out 1	
1:00 p	1:15 p	Plenary 2: The FR Goal Matrix: Categories and Times	Siamak Sattar
1:15 p	2:05 p	Breakout 2, Report Out (15 minutes)	
2:40 p	2:55 p	Plenary 3: The FR Goal Matrix: Assigning Functions and Services	Lucy Arendt
2:55 p	5:05 p	Breakout 3, Report Out (25 minutes)	
5:05 p	5:15 p	Wrap up & adjourn	Lucy Arendt

### Day 2: October 9, 2024

Start	End		
8:00 a	8:40 a	Debrief from Day 1	Lucy Arendt
8:40 a	8:55 a	Plenary 4: Generalizability of the FR Goal Matrix	Laurie Johnson
8:55 a	11:05 a	Breakout 4, Report Out 4 (25 minutes)	
11:05 a	11:15 a	Plenary 5: The Future of the FR Goal Matrix and FR	Divya Chandrasekhar
11:15 a	12:00 p	Breakout 5, Report Out 5 (15 minutes)	
12:00 p	12:15 p	Wrap up, last thoughts, and adjourn	Lucy Arendt

## Appendix C. Community Archetypes

### C.1. Community 1 Overview

#### Discover Community 1: A Hidden Gem on the Mississippi

Nestled along the banks of the mighty Mississippi River, Community 1 offers a captivating blend of history, culture, and natural beauty. Known for its charming downtown, vibrant arts scene, and friendly community, this city is an ideal destination for both visitors and new residents alike. Annual events bring the community together in celebration of creativity and camaraderie. Community 1 serves as a regional hub for education and healthcare, with a university playing a key role in the local economy. The area benefits from a diverse economic base, contributing to steady growth and development.

#### ***Commitment to Safety and Resilience***

While Community 1 is a beautiful place to live and visit, it is also aware of its vulnerability to natural hazards, particularly earthquakes due to its location near the New Madrid Seismic Zone.

#### Earthquake Preparedness

##### *Earthquake Hazard*

- Seismic Risk: Moderate, located near the seismic zone in the Central U.S.
- Earthquake Insurance Uptake: Generally high (nearing 50 %) since the additional coverage is offered by most property insurers and it is generally affordable. But overall, risk awareness in the populace is limited.
- Largest Known Earthquake: Magnitude 7.7.
- Magnitude Range of Earthquakes: Typically, from 3.0 to 5.0, with larger quakes possible.

##### *Building Codes*

- Adoption of the International Building Code (IBC): Community 1 uses the IBC, which includes provisions for seismic design. The IBC outlines standards for construction practices that enhance the structural integrity of buildings in seismic zones, helping them to better withstand potential earthquakes. Although it has adopted the IBC overall, the degree to which it enforces the seismic design requirements can vary.
- Local Amendments: The city has the option to implement local amendments to the IBC that address specific seismic considerations relevant to the region, ensuring that local conditions are taken into account during the design and construction phases.

##### *New Buildings*

- Seismic Design Requirements: For new construction, developers and architects are expected to incorporate the seismic design principles outlined in the IBC, they may not always choose to do so. This includes using appropriate materials, structural reinforcement techniques, and design features that enhance stability during earthquakes.
- Geotechnical Assessments: The city encourages conducting geotechnical assessments during the planning stages to evaluate soil conditions and potential earthquake impacts. This information is critical for designing foundations that can resist seismic forces.

### *Existing Buildings*

- **Retrofit Incentives:** Community 1 has a limited number of programs aimed at encouraging the retrofitting of older structures. Guidance is available to property owners on how to enhance their buildings' resilience to earthquakes, such as reinforcing walls and foundations.
- **Public Education and Outreach:** The city actively engages in community education efforts regarding earthquake preparedness. Workshops and informational sessions help residents and business owners understand the importance of retrofitting and maintaining seismic safety measures.
- **Emergency Preparedness Plans:** Community 1 includes earthquake preparedness in its broader emergency management strategies. This includes training for first responders and community drills that educate residents on safety protocols during an earthquake.

**Flood Mitigation** In addition to earthquake preparedness, the city has taken significant steps to manage flood risks associated with its riverfront location. Enhanced drainage systems and floodplain management plans have been established to minimize the impact of heavy rainfall and flooding events.

### ***Descriptive Statistics***

#### **Population**

- **Total Population:** Approximately 39,000
- **Population Density:** About 1,400 people per square mile
- **Surrounding Area (Metropolitan Area):** Approximately 78,000

#### **Demographics**

- **Age Distribution:**
  - Median Age: ≈33 years
  - Under 18: ≈22 %
  - 18-34: ≈25 %
  - 35-54: ≈24 %
  - 55+: ≈29 %
- **Sex:**
  - Female: ≈51 %
  - Male: ≈49 %
- **Race/Ethnicity:**
  - White: ≈84 %
  - Black or African American: ≈10 %
  - Hispanic or Latino: ≈4 %
  - Asian: ≈2 %
- **Income:**
  - Median Household Income: ≈\$45,000
  - Families below the poverty line: ≈15 %
- **Education:**
  - High School Graduate or Higher: ≈88 %
  - Bachelor's Degree or Higher: ≈24 %

- Marital Status:
  - Married: ≈48 %
  - Never Married: ≈35 %
  - Divorced: ≈10 %
- Employment:
  - Unemployment Rate: ≈4.0 %
  - Major Industries: Education, Healthcare, Retail, and Manufacturing
- Family Structure:
  - Average Household Size: 2.4
  - Families with children under 18: ≈25 %

#### Industry Types and Distribution

- Major Industries:
  - Education: 20 %
  - Healthcare: 18 %
  - Retail Trade: 14 %
  - Manufacturing: 12 %
  - Other Services: 10 %
- Overall Distribution:
  - Service Sector: ≈70 %
  - Goods Producing: ≈30 %

#### Building Density

- Total Buildings: Approximately 15,000
- Buildings per Square Mile: ≈500
- Building Construction Types:
  - ISO 1 (Frame): ≈35 %
  - ISO 2 (Joisted Masonry): ≈30 %
  - ISO 3 (Non-Combustible): ≈15 %
  - ISO 4 (Masonry Non-Combustible): ≈10 %
  - ISO 5 (Modified or Semi Fire Resistive): ≈5 %
  - ISO 6 (Fire Resistive): ≈5 %

#### Age Distribution of Building Stock

- Buildings Built Before 1960: ≈45 %
- 1960-1990: ≈35 %
- Post-1990: ≈20 %

#### Housing Costs

- Median Housing Cost: ≈\$175,000
- Single-Family Residence Average Cost: ≈\$200,000
- Multi-Family Residence Average Cost: ≈\$120,000
- Housing Cost Per Capita: ≈\$65,000

## **C.2. Community 2 Overview**

### **Discover Community 2: The City Awaits**

Welcome to Community 2 — a dynamic hub of innovation, creativity, and outdoor adventure. Community 2 is renowned for its thriving arts scene, with world-class museums, theaters, and music venues. For nature enthusiasts, Community 2 offers an unparalleled playground. Hike through lush forests, kayak in serene waters, or ski at nearby resorts. As a major economic hub for technology and innovation, Community 2 is home to industry giants and also has a vibrant startup culture. The city also benefits from a strong maritime industry and is a gateway for trade with Asia, contributing significantly to the regional economy. This economic dynamism fosters creativity and entrepreneurship, attracting talent from around the world.

### ***Commitment to Safety and Resilience***

While Community 2 is a beautiful city, it's also aware of its exposure to natural hazards, particularly earthquakes and landslides due to its location along a West Coast Subduction Zone.

#### Earthquake Preparedness

##### *Earthquake Hazard*

- Seismic Risk: Moderate to high, located near a West Coast Subduction Zone.
- Earthquake Insurance Uptake: Relatively high awareness; only about 15 % -20 % of homeowners carry earthquake insurance due to high costs and lack of availability.
- Largest Known Earthquake: Magnitude 7.1.
- Magnitude Range of Earthquakes: Typically, 3.0 to 7.0+, with larger quakes possible.

##### *Building Codes*

- Community 2 Building Code: The city adheres to the State Building Code, which incorporates the International Building Code (IBC) with specific amendments tailored to address seismic risks. This code includes provisions for seismic design that are among the most stringent in the country.
- Seismic Design Criteria: The city's building code mandates that new structures be designed according to specific seismic risk categories based on their location, use, and occupancy. This helps buildings withstand the forces generated by earthquakes.

##### *New Buildings*

- Enhanced Structural Standards: For new construction, Community 2 requires enhanced seismic design standards. This includes the use of reinforced concrete, steel bracing, and other technologies that improve a building's ability to absorb and dissipate seismic energy.
- Geotechnical Analysis: Developers are often required to conduct geotechnical studies that assess soil conditions and other site-specific factors. This information is critical for designing foundations that are suitable for seismic stability.
- Continuous Monitoring and Updates: The city regularly reviews and updates its building codes to incorporate the latest research and best practices in earthquake engineering. This ensures that new buildings are equipped with the most effective design strategies.

### *Existing Buildings*

- **Retrofit Programs:** Community 2 has several initiatives aimed at encouraging the retrofitting of older buildings, especially unreinforced masonry structures and soft-story buildings. The city offers resources and guidelines for property owners looking to enhance their buildings' seismic resilience.
- **Seismic Safety Assessment Program:** Community 2 provides tools for building owners to assess the seismic risk of their existing structures. This program encourages owners to understand their buildings' vulnerabilities and take appropriate mitigation measures.
- **Public Outreach and Education:** The city engages in community education campaigns that inform residents and business owners about earthquake preparedness and the importance of retrofitting.
- **Emergency Preparedness:** Community 2's Office of Emergency Management includes earthquake preparedness in its planning efforts. The city conducts drills and training for first responders and provides resources for residents to create emergency plans/kits.

Landslide Mitigation Community 2 relies on land-use planning and slope stabilization projects to reduce landslide risks; it monitors vulnerable areas and uses engineering solutions to protect property and lives.

### ***Descriptive Statistics***

#### Population

- **Total Population:** Approximately 770,000
- **Population Density:** About 8,500 people per square mile
- **Surrounding Area (Metropolitan Area):** Approximately 4 million

#### Demographics

- **Age Distribution:**
  - Median Age: ≈36 years
  - Under 18: ≈17 %
  - 18-34: ≈25 %
  - 35-54: ≈26 %
  - 55+: ≈32 %
- **Sex:**
  - Female: ≈51 %
  - Male: ≈49 %
- **Race/Ethnicity:**
  - White: ≈65 %
  - Asian: ≈15 %
  - Black or African American: ≈7 %
  - Hispanic or Latino: ≈10 %
  - Other: ≈3 %
- **Income:**
  - Median Household Income: ≈\$100,000
  - Families below the poverty line: ≈12 %

- Education:
  - High School Graduate or Higher: ≈90 %
  - Bachelor's Degree or Higher: ≈50 %
- Marital Status:
  - Married: ≈45 %
  - Never Married: ≈40 %
  - Divorced: ≈10 %
- Employment:
  - Unemployment Rate: ≈3.5 %
  - Major Industries: Technology, Aerospace, Healthcare, Education, and Trade
- Family Structure:
  - Average Household Size: ≈2.2
  - Families with children under 18: ≈30 %

#### Industry Types and Distribution

- Major Industries:
  - Technology: ≈25 %
  - Aerospace: ≈15 %
  - Healthcare: ≈12 %
  - Retail: ≈10 %
  - Education: ≈10 %
- Overall Distribution:
  - Service Sector: ≈80 %
  - Goods Producing: ≈20 %

#### Building Density

- Total Buildings: Approximately 200,000
- Buildings per Square Mile: ≈2,300
- Building Construction Types:
  - ISO 1 (Frame): ≈40 %
  - ISO 2 (Joisted Masonry): ≈25 %
  - ISO 3 (Non-Combustible): ≈20 %
  - ISO 4 (Masonry Non-Combustible): ≈10 %
  - ISO 5 (Modified or Semi Fire Resistive): ≈3 %
  - ISO 6 (Fire Resistive): ≈2 %

#### Age Distribution of Building Stock

- Buildings Built Before 1960: ≈30 %
- 1960-1990: ≈40 %
- Post-1990: ≈30 %

#### Housing Costs

- Median Housing Cost: ≈\$850,000
- Single-Family Residence Average Cost: ≈\$1.1 million
- Multi-Family Residence Average Cost: ≈\$600,000
- Housing Cost Per Capita: ≈\$150,00

### **C.3. Community 3 Overview**

#### **Discover Community 3: The City of Dreams**

Welcome to Community 3—an iconic metropolis that offers an unparalleled blend of stunning landscapes, diverse cultures, and endless opportunities for adventure and inspiration. It is a melting pot of cultures, evident in its vibrant neighborhoods, world-class museums, artsy streets, trendy boutiques, and culinary scene. Hike the community’s scenic trails, surf the waves, or relax in one of its sprawling parks. Community 3 is an economic powerhouse known for its entertainment industry, technology sector, and significant cultural diversity. The economy benefits from tourism, international trade, and a strong service sector.

#### ***Commitment to Safety and Resilience***

While Community 3 is a vibrant place to live and visit, it also faces natural hazards, particularly earthquakes due to its location along the Pacific Ring of Fire.

#### Earthquake Preparedness

##### *Earthquake Hazard*

- Seismic Risk: High, located near several West Coast fault lines.
- Earthquake Insurance Uptake: Generally higher than average (about 10 % statewide average for home and business owners), with many homeowners opting for additional coverage due to risk awareness.
- Largest Known Earthquake: Magnitude 7.9.
- Magnitude Range of Earthquakes: Typically, 3.0 to 8.0+, with larger quakes possible.

##### *Building Codes*

- Community 3 Building Code: The community adheres to its State Building Code, which includes stringent seismic design requirements. The community’s building code incorporates amendments that address local seismic risks, helping construction standards to reflect the unique geological conditions of the area.
- Seismic Design Criteria: The community’s building code establishes specific seismic design categories based on the building’s use, occupancy, and location. New buildings are required to meet these criteria, which include structural reinforcement and materials that enhance earthquake resistance.

##### *New Buildings*

- Enhanced Structural Standards: For new construction, Community 3 requires enhanced seismic design standards. This includes the use of reinforced concrete, steel bracing, and other technologies that improve a building’s ability to absorb and dissipate seismic energy.
- Geotechnical Studies: Developers are often required to conduct geotechnical investigations to evaluate soil conditions and potential seismic hazards. This data is critical for designing foundations that are resilient to earthquakes.
- Regular Updates to Codes: The city regularly reviews its building codes to incorporate advancements in seismic research and technology which help new buildings benefit from enhanced safety measures.

### *Existing Buildings*

- **Retrofit Programs:** Community 3 has established initiatives aimed at encouraging the retrofitting of older buildings, especially those that are unreinforced masonry or soft-story structures. Local and state governments offer resources and incentives for property owners to upgrade their buildings to meet current seismic standards.
- **Mandatory Retrofit Ordinances:** The city has implemented mandatory retrofit ordinances that require certain types of vulnerable buildings, such as those built before specific codes were enacted, to undergo seismic upgrades within a designated time frame.
- **Public Awareness Campaigns:** The community engages in outreach efforts to educate residents and business owners about earthquake preparedness and the importance of retrofitting. This includes workshops, seminars, and informational resources to promote seismic safety.
- **Emergency Preparedness Plans:** The city's emergency management department includes earthquake preparedness in its planning efforts. Regular drills, training for first responders, and community resources help residents develop emergency plans and kits.

### Wildfire and Flood Mitigation

The city has developed comprehensive fire prevention strategies, including vegetation management and community education programs. Flood control systems and stormwater management practices are also in place to minimize flood risks during heavy rains.

### ***Descriptive Statistics***

#### Population

- **Total Population:** Approximately 4 million
- **Population Density:** About 8,500 people per square mile
- **Surrounding Area (Metropolitan Area):** Approximately 13 million

#### Demographics

- **Age Distribution:**
  - Median Age: ≈35 years
  - Under 18: ≈22 %
  - 18-34: ≈24 %
  - 35-54: ≈26 %
  - 55+: ≈28 %
- **Sex:**
  - Female: ≈50.5 %
  - Male: ≈49.5 %
- **Race/Ethnicity:**
  - White: ≈28 %
  - Hispanic or Latino: ≈48 %
  - Black or African American: ≈8 %
  - Asian: ≈12 %
  - Other: ≈4 %

- Income:
  - Median Household Income: ≈\$70,000
  - Families below the poverty line: ≈18 %
- Education:
  - High School Graduate or Higher: ≈82 %
  - Bachelor's Degree or Higher: ≈30 %
- Marital Status:
  - Married: ≈48 %
  - Never Married: ≈34 %
  - Divorced: ≈10 %
- Employment:
  - Unemployment Rate: ≈5.5 %
  - Major Industries: Entertainment, Technology, Healthcare, Manufacturing, and Tourism
- Family Structure:
  - Average Household Size: ≈3.1
  - Families with children under 18: ≈30 %

#### Industry Types and Distribution

- Major Industries:
  - Entertainment: ≈20 %
  - Technology: ≈15 %
  - Healthcare: ≈13 %
  - Retail: ≈11 %
  - Tourism: ≈10 %
- Overall Distribution:
  - Service Sector: ≈85 %
  - Goods Producing: ≈15 %

#### Building Density

- Total Buildings: Approximately 300,000
- Buildings per Square Mile: ≈1,200
- Building Construction Types:
  - ISO 1 (Frame): ≈50 %
  - ISO 2 (Joisted Masonry): ≈20 %
  - ISO 3 (Non-Combustible): ≈15 %
  - ISO 4 (Masonry Non-Combustible): ≈10 %
  - ISO 5 (Modified or Semi Fire Resistive): ≈3 %
  - ISO 6 (Fire Resistive): ≈2 %

#### Age Distribution of Building Stock

- Buildings Built Before 1960: ≈35 %
- 1960-1990: ≈40 %
- Post-1990: ≈25 %

#### Housing Costs

- Median Housing Cost: ≈\$1 million

- Single-Family Residence Average Cost: ≈\$1.3 million
- Multi-Family Residence Average Cost: ≈\$750,000
- Housing Cost Per Capita: ≈\$150,000

#### **C.4. Community 4 Overview**

##### **Discover Community 4: Where History Meets Hospitality**

Welcome to Community 4—a charming city steeped in rich history, breathtaking architecture, and a vibrant culinary scene. Known for its warm Southern hospitality and picturesque landscapes, Community 4 is a treasure trove of historic sites, festivals, art galleries, theatre productions, and parks. Stroll through the cobblestone streets of the historic district, where antebellum mansions and centuries-old churches tell the story of a bygone era. Community 4 is known for its tourism, a growing tech industry, and a vibrant healthcare sector, making it a diverse economic hub.

##### ***Commitment to Safety and Resilience***

While Community 4 is a beautiful place to live and visit, it faces natural hazards, particularly hurricanes and flooding, given its coastal location.

Hurricane Preparedness Community 4 has implemented comprehensive emergency management plans that include regular community drills, evacuation routes, and public education initiatives. The city works closely with local agencies to monitor storm activity and disseminate timely information.

Flood Mitigation Community 4 has invested in infrastructure improvements, such as enhanced drainage systems, flood barrier projects, and the use of green infrastructure.

##### Earthquake Preparedness

###### *Earthquake Hazard*

- Seismic Risk: Moderate, situated near an East Coast Seismic Zone.
- Earthquake Insurance Uptake: Generally moderate (up to 40 %); many homeowners are aware of risks, but uptake of earthquake insurance varies depending upon availability and cost.
- Largest Known Earthquake: Magnitude 7.0.
- Magnitude Range of Earthquakes: Typically, from 3.0 to 6.0+, with historically larger events.

###### *Building Codes*

- State Building Code: Community 4 adheres to the State Building Code. It incorporates provisions from the International Building Code (IBC) that include seismic design requirements tailored for different regions based on seismic risk.
- Local Amendments: Community 4 has specific amendments to the state code that account for local geological conditions, ensuring that building practices reflect the city's unique seismic challenges.

### *New Buildings*

- **Seismic Design Standards:** For new construction, the State Building Code requires that buildings be designed according to seismic design categories based on their location and intended use. This includes guidelines for structural reinforcement and material specifications that enhance earthquake resilience.
- **Geotechnical Investigations:** Developers are often required to conduct geotechnical studies to assess soil conditions and seismic hazards. This information is crucial for designing appropriate foundations and structural systems to withstand seismic forces.
- **Regular Code Updates:** The city reviews and updates its building codes as needed to incorporate research and technology in earthquake engineering, helping new structures meet modern safety standards.

### *Existing Buildings*

- **Retrofit Incentives:** Property owners are encouraged to consider seismic upgrades in older buildings especially when undergoing major renovations and upgrades for hurricanes or floods. The city provides resources and guidelines to assist in identifying vulnerabilities and improving structural integrity.
- **Public Awareness and Education:** Community 4 engages in community outreach to educate residents and business owners about disaster preparedness including for earthquakes. Informational materials help raise awareness of the importance of retrofitting and maintaining seismic safety measures.
- **Historic Building Considerations:** Given the community's rich architectural heritage, the city has guidelines for retrofitting historic buildings that focus first on preserving their character while also enhancing hazard resilience, including seismic safety. This includes using compatible materials and techniques that do not compromise the historic integrity.
- **Emergency Preparedness Plans:** Community 4's emergency management plans incorporate earthquake preparedness. The city conducts drills and training for first responders, providing resources for residents to develop their own emergency plans/kits.

### ***Descriptive Statistics***

#### Population

- **Total Population:** Approximately 150,000
- **Population Density:** About 3,800 people per square mile
- **Surrounding Area (Metropolitan Area):** Approximately 800,000

#### Demographics

- **Age Distribution:**
  - Median Age: ≈37 years
  - Under 18: ≈19 %
  - 18-34: ≈25 %
  - 35-54: ≈27 %
  - 55+: ≈29 %

- Sex:
  - Female: ≈52 %
  - Male: ≈48 %
- Race/Ethnicity:
  - White: ≈68 %
  - Black or African American: ≈25 %
  - Hispanic or Latino: ≈5 %
  - Asian: ≈2 %
- Income:
  - Median Household Income: ≈\$67,000
  - Families below the poverty line: ≈12 %
- Education:
  - High School Graduate or Higher: ≈87 %
  - Bachelor's Degree or Higher: ≈36 %
- Marital Status:
  - Married: ≈45 %
  - Never Married: ≈38 %
  - Divorced: ≈10 %
- Employment:
  - Unemployment Rate: ≈4.5 %
  - Major Industries: Tourism, Healthcare, Education, and Manufacturing
- Family Structure:
  - Average Household Size: ≈2.4
  - Families with children under 18: ≈30 %

#### Industry Types and Distribution

- Major Industries:
  - Tourism: ≈25 %
  - Healthcare: ≈15 %
  - Education: ≈12 %
  - Manufacturing: ≈10 %
  - Technology and Other Services: ≈8 %
- Overall Distribution:
  - Service Sector: ≈75 %
  - Goods Producing: ≈25 %

#### Building Density

- Total Buildings: Approximately 45,000
- Buildings per Square Mile: ≈1,200
- Building Construction Types:
  - ISO 1 (Frame): ≈45 %
  - ISO 2 (Joisted Masonry): ≈25 %
  - ISO 3 (Non-Combustible): ≈15 %
  - ISO 4 (Masonry Non-Combustible): ≈10 %

- ISO 5 (Modified or Semi Fire Resistive): ≈3 %
- ISO 6 (Fire Resistive): ≈2 %

#### Age Distribution of Building Stock

- Buildings Built Before 1960: ≈40 %
- 1960-1990: ≈35 %
- Post-1990: ≈25 %

#### Housing Costs

- Median Housing Cost: ≈\$450,000
- Single-Family Residence Average Cost: ≈\$550,000
- Multi-Family Residence Average Cost: ≈\$300,000
- Housing Cost Per Capita: ≈\$75,000

## Appendix D. Breakout Session 1

### D.1. Handout—General

#### **Guiding Principles for Developing the Functional Recovery Goal Matrix:**

1. As much as we might try to minimize the negative consequences of earthquakes, it should be recognized that damage cannot be completely avoided in significant earthquake events, and some loss of function and service is likely to occur. Similarly, it is also recognized that resumption of basic intended functions does not require full repair of damage that does not impede such basic intended functions.
2. Not all functions and services are needed at the same time following an earthquake. Thus, an array of recovery categories is needed to implement priorities for time-to-recovery of functions/services.
3. Criteria should provide a basis for assigning functions/services to recovery categories.
4. Prioritization of functions/services in recovery categories can be centered around multiple considerations, including physical, environmental, social, or economic.
5. Criteria are needed that reflect goals across multiple scales, including for individual users of assets, at the asset level, and at the community level.
6. It is important to first identify the criteria, rather than immediately create specific recovery categories and time assignments, to ensure that functional recovery performance goals are motivated by meeting needs of a resilient community.

#### **Abbreviated Key Definitions:**

**Functional recovery** may be defined as: The post-earthquake recovery state in which a structure is maintained, or restored, to safely and adequately support the basic intended function associated with its pre-earthquake use or occupancy.

**Structure:** That which is built or constructed and limited to buildings and nonbuilding structures, including the structural and nonstructural systems of such structures. (Although the Functional Recovery Task Committee’s focus is on new structures only, in this workshop we will also consider existing structures and lifelines.)

**Basic Intended Function:** Basic intended function is a level of function that can be less than full pre-earthquake functionality. The subset of activities or range of activities constituting basic intended function are designated by the project team, based on the structure occupancy classification(s), and use designation(s). Structural and nonstructural systems serving the basic intended function of a structure must be designed to be functional within the target recovery time associated with the specified functional recovery category.

**System Boundary:** The concept of a system boundary allows for consideration of structures on sites with appurtenant structures, site equipment, and interconnecting mechanical, electrical, and plumbing (MEP) systems that are beyond the outside edge of the structure itself that directly serve the functions of the structure and might be included with the permit for

construction. The intent is to allow for interconnected structures and MEP systems up to the defined utility connection point to be included.

**Impeding Factor:** Impeding factors are related to the process of repairing and recovering from damage to structural and nonstructural components. Impeding factors delay or extend the time to complete repairs and, consequently, the time to restore function. Although impeding factors most commonly delay the start of repairs, they can also occur at any time during the process causing a delay in the completion of repairs.

**External Factor:** External factors are conditions outside the system boundary or outside the project team's control, which might impact functionality of the structure, but are not directly related to the response or performance of the structure itself.

**Recovery State:** Consideration of functional performance involves the identification of recovery states that define performance in terms of different levels of functionality along a theoretical recovery timeline, including reoccupancy, functional recovery, and full recovery.

- **Reoccupancy:** Reoccupancy is the post-earthquake recovery state in which a structure is maintained, or restored, to allow safe re-entry of occupants or to provide shelter or protection to contents. In the reoccupancy recovery state, a structure is expected to be free from earthquake-caused hazards that might negatively impact the general health and safety of occupants. While in this state, a structure provides limited functionality of sheltering occupants or protecting contents, but not the basic intended functions associated with functional recovery.
- **Functional Recovery:** Functional Recovery is an intermediate post-earthquake recovery state between the reoccupancy and full recovery states. Functional recovery is focused on basic intended function. Functional recovery excludes the effects of external factors because they are beyond the control of the project team. As a result, a structure that achieves a functional recovery state might not be functional because of service disruptions caused by external factors.
- **Full Recovery:** Full recovery is the post-earthquake recovery state in which all damaged components are repaired, and external factors are not limiting the structure's function. Full recovery is intended to recognize that the recovery timeline continues beyond the point at which all damage has been repaired and represents a structure that has been returned to its pre-earthquake state, with any improvements required by the Authority Having Jurisdiction (AHJ), and with all functional impacts associated with external factors eliminated.

**Recovery Time:** Recovery time is specific to the recovery state (reoccupancy time, functional recovery time, and full recovery time). Because each recovery state requires a different subset of components and systems to be functional, recovery times will be different for each state. Impeding factors are considered in the recovery times associated with all recovery states because the presence (or absence) of impeding factors depends on damage to the structure, which can be controlled through design. Whether external factors are included or excluded in recovery time is specific to the recovery state. External factors are not considered in reoccupancy and functional recovery times but are considered in full recovery times.

**Repair Time:** Repair time is specific to the recovery state (reoccupancy, functional recovery, and full recovery). Repair time is the time needed to conduct repair actions once the contractor is mobilized, and construction has commenced. Because each recovery state requires a different subset of components and systems to be functional, repair times will be different for each state. Repair time differs from recovery time because repair time excludes consideration of impeding factors, which can delay or extend the time to complete repairs and are considered part of recovery time. Repair time excludes consideration of external factors because the availability of external utilities and services are beyond control of the project team.

**Functional Recovery Category:** Structures are assigned to a functional recovery category based on their relative necessity to the recovery of community functions or services following an earthquake. Structures that support more critical functions or services are assigned to higher functional recovery categories, and those that support less critical functions or services are assigned to lower functional recovery categories.

**Recovery Objective:** A recovery objective is a description of the targeted performance state in terms of time to recovery of function in combination with a risk-based characterization of the earthquake hazard.

**Functional Recovery Earthquake (FRE<sub>R</sub>):** The Functional Recovery Earthquake (FRE<sub>R</sub>) is a risk-based characterization of the earthquake hazard used to design buildings to meet functional recovery objectives.

**Functional Recovery Goal Matrix:** The functional recovery goal matrix is part of what may be included in documents intended to influence both building codes and design practice. Practically speaking, it's intended to guide the design and repair of a structure serving a given function and/or service. The matrix may include such features as recovery category labels, times, definitions assigned to each category, and examples of functions and services for each category, along with occupancies as appropriate. Functions and services are expected to be prioritized in the matrix in line with the criteria used to assign functions and services to the various categories. While the Functional Recovery Task Committee has developed drafts of the functional recovery goal matrix, participants in this workshop will be asked to propose the prioritization criteria, recovery categories (and times), and the functions and services to be prioritized as well as their placement in the matrix.

## D.2. Breakout 1 Handout 1.0

### The Functional Recovery Goal Matrix – The Criteria

**Our Goal.** The goal of this breakout session is to discuss, develop, and prioritize criteria that will be used in later breakout sessions to decide how many categories and times to use in the matrix and to make assignments of functions and services to the categories and times.

Please see Handout 1.0 (this handout) for relevant reference material that summarizes concepts that were just presented as the introduction to this breakout session.

Please see Handout 1.1 (attached) for a list of the questions we intend to address.

### Reference Material

Guiding Principles for Developing the Functional Recovery Goal Matrix [identical to General Handout]:

- As much as we might try to minimize the negative consequences of earthquakes, it should be recognized that damage cannot be completely avoided in significant earthquake events, and some loss of function and service is likely to occur. Similarly, it is also recognized that resumption of basic intended functions does not require full repair of damage that does not impede such basic intended functions.
- Not all functions and services are needed at the same time following an earthquake. Thus, an array of recovery categories is needed to implement priorities for time-to-recovery of functions/services.
- Criteria should provide a basis for assigning functions/services to recovery categories.
- Prioritization of functions/services in recovery categories can be centered around multiple considerations, including physical, environmental, social, or economic.
- Criteria are needed that reflect goals across multiple scales, including for individual users of assets, at the asset level, and at the community level.
- It is important to first identify the criteria, rather than immediately create specific recovery categories and time assignments, to ensure that functional recovery performance goals are motivated by meeting needs of a resilient community.

Definition or context of “criteria” for purposes of this breakout session:

- For the purposes of this breakout, “criteria” refers to generalized concepts, factors, parameters, or other considerations (rather than specific metrics or statistics) that are characteristic of a resilient community in a state of post-earthquake recovery
- We are seeking criteria that describe what basic conditions are desirable and what overarching consequences are trying to be avoided or minimized, particularly those that have a time component or step-function threshold after which a result may not be proportionate or reversible (one example: permanent population displacement)
- Some criteria may be interdependent or otherwise interrelated
- Some criteria may contain different time considerations or thresholds for subcategories within the same criteria
- Some criteria may have differing perspectives: individual, organization, or community

Possible examples of criteria:

Examples of overarching considerations/motivations of the Functional Recovery Task Committee:

- Improve access to updated (post-pandemic) definition of “essential services” (not just emergency response facilities)
- Avoid significant population displacement
- Reduce total cost of ownership (including repairs, downtime, and emergency response), on varying scales: individual, organization, community

List of “factors that may influence prioritizing functions and services” from Pre-Read / Read-Ahead document:

- Avoid/limit injuries & deaths
- Avoid trauma that leads to deterioration of physical & mental health
- Avoid escalating consequences (foreclosures, learning declines, long-term population displacement)
- Consider needs of vulnerable, minoritized, and incarcerated populations
- Minimize business interruption
- Minimize environmental impacts (pollution/waste) due to debris removal, repairs, & demolition
- Minimize repair costs
- Minimize supply chain disruption
- Minimize impacts on social cohesion

Other examples (some may be too broad):

- Avoid interruption of basic life-critical services (shelter, food, water, sanitation, emergency/urgent healthcare, public safety/emergency response)
- Minimize interruption of important (but less life-critical?) physical and/or social services or assets (energy, water, transportation & communication infrastructure, routine preventative or elective healthcare, education & daycare, banking & finance, government services, businesses, construction & manufacturing, religious/cultural, recreation & entertainment)
- Minimize loss of jobs and/or businesses
- Avoid/minimize population displacement / relocation of residents (whether voluntary or forced; is this only focused on long-term/permanent?)
- Reduce damage, reduce the cost of / need for repairs, reduce the cost of downtime, hasten reoccupancy
- Simply: Prioritize recovery to provide the right functions / services at the right time

Examples of what would not be considered “criteria” but may be good ideas for later breakouts or research:

- K-12 schools open and provide “basic” education services within X days (enough for teachers and students, but maybe not full services?)

- Maintain an unemployment rate less than X % (or return to an unemployment rate of less than Y % within a certain time)

#### How will the criteria be used:

Eventually, these criteria will be used to help us answer questions like:

- How many different target recovery time categories should there be and why?
  - How many thresholds/step-functions with escalating or cascading consequences?
- How soon do we think K-12 schools need to be re-opened and why?
  - How does the recovery of schools satisfy/support the criteria we have established?
- Do all residential buildings get assigned to the same category or not, and why? Or would multi-family housing possibly be assigned to a different category from single-family? Does affordable housing get treated differently than market-rate housing?
  - How does the recovery of residential spaces satisfy/support the criteria we have established?
  - Are there differences within the residential category that warrant separate consideration?

### **D.3. Breakout 1 Handout 1.1**

#### **The Functional Recovery Goal Matrix – The Criteria**

##### **Introduction**

Some amount of time will likely be required for buildings and other infrastructure to reach functional recovery performance state (able to support “basic intended functions”) after a significant earthquake. Therefore, the concept of functional recovery performance considers two important points: that target functional recovery times may vary depending on when the function or service is needed to support community recovery, and that functional recovery (recovery of basic intended functions) does not require full repair and thus recovery of full functions or services will almost always occur later than functional recovery. By supporting the basic needs of communities across the full spectrum of recovery time after an earthquake (or other natural disaster), functional recovery performance goals address an important gap in our current toolkit for safety-based design and performance of buildings and other infrastructure.

To help determine why and how certain functions or services should be prioritized for functional recovery performance, let’s try to develop criteria that can be used to help prioritize by discussing several questions intended to explore characteristics of a resilient community.

##### **Section 1 – “Icebreakers” (10 minutes)**

1. If your family experienced an earthquake, which impact of many would you be most concerned about for your family from 24 hours to 6 months after the event? We’ll write down 6-10 responses from across the group, just to get us thinking.

2. Across your neighborhood, town, or city, who do you think is likely to be most impacted, and who needs extra protection from impacts? We'll write down 3-4 types of groups for each category.
3. If you were a city planner or mayor, what kinds of assets, either types of buildings or other infrastructure such as utilities, come to mind as needing priority for recovery? We'll write down 3-6 items here.
4. Some buildings or utilities have straightforward and possibly singular functions or services. For example, a bank provides access to financial resources, and the electrical grid provides power. Can you think of other examples of buildings or infrastructure that may provide multiple important functions or services or may provide both primary and secondary (or possibly indirect or hidden) functions or services? For example, consider whether a school or a water system provides a straightforward or singular function or service or whether it provides multiple functions or services. We'll write down 2-5 items.

## **Section 2 – “Factors” (10 minutes)**

Many people have proposed ideas about how to prioritize recovery. Emergency managers have a set of priorities for community-level emergency response; business continuity plans, or other disaster response plans help to set forth post-event objectives at an organizational or individual level. Each perspective considers their own goals for avoiding further hardship – whether from injuries or mental trauma, damage, downtime, economic losses, and business interruption, etc. It is difficult to imagine that we could develop a list of criteria that could account for all of the varied needs of a community. However, to enable advancements in engineering design that can aid our recovery, we must help engineers prioritize the recovery of buildings and infrastructure that can best serve society's needs after an earthquake. These decisions cannot be effectively made on a case-by-case basis, so building codes and standards help to establish common principles for prioritization.

5. Thinking about how our group has answered the previous questions, what are some common factors that could be identified as driving priorities for these responses?
  - Two factors that come to mind on the community scale are the size of the affected population and vulnerable populations needing extra protection. Do you agree with this? What are some others that we can think of at the community scale? Again, these may be similar to answers provided during the icebreaker questions, but let's synthesize those a little further.

We'll write down 4-7 responses from across the group

6. Of course, we also want to protect individuals. For example, after Hurricane Maria we learned that interruption to utilities and medical care likely led to excess mortality beyond the immediate storm impacts. This leads to the suggestion that buildings providing routine medical services and pharmacies might need improved priority for recovery as they are not protected by enhanced design requirements for emergency medical care (such as hospitals).

- On the individual or family scale, what are some factors that should inform decisions about how quickly functions and services are recovered? Again, these may be similar to answers provided during the icebreaker questions, but let's synthesize those a little further.

We'll write down 4-7 responses from across the group

**Section 3 – “Establishing Criteria” (30 minutes)**

7. Based on our conversations during this breakout session, if you had to describe the group's top 5 criteria for the recovery of a resilient community to inform prioritizing functional recovery goals, what would they be? Essentially, what factors, attributes, or characteristics should be emphasized when considering priorities for functional recovery goals for various functions and services provided by buildings, utilities, or other infrastructure? Stated another way, what basic conditions are desirable and what overarching consequences are trying to be avoided or minimized?
  - Think independently for a moment and write your answers below. You have 3 minutes.
8. Now, please find a neighbor or two and discuss and agree upon 5 criteria you think our breakout group should emphasize. You have 5 minutes.
9. Returning to our breakout group, let's list, compare, and consolidate answers from the rest of our group. We have 7 minutes. (Compile list on easels) Did we miss anything?
10. Finally, let's identify and rank the top 5 criteria from our list. We have 15 minutes to discuss and vote.

WORKSHEET: My top 5 criteria (mark the ones from your list that you and your neighbor(s) agree on and then add the remaining criteria from others from your neighbors here to yield your combined top 5):

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

## Appendix E. Breakout Session 2

### E.1. Breakout 2 Handout 2.0

#### The Functional Recovery Goal Matrix – Categories and Times

##### Breakout 2 Background

1. There is a general agreement that not all functions and services are needed right after an earthquake. The acceptable target recovery time of various services depends on the role of each community service within the community. Some services are required immediately after the event, some within a short timeframe, and others might be required in an intermediate- or long-term time period after the event. Some services may not play an important role in the community's recovery and may not need to be designed for FR.
2. In this breakout session, we need to identify a set of discrete target times and categories. In the session after (Breakout #3), we will discuss the content of categories with regard to “community functions supported by structures”—so we will not discuss these specifics here. While it may be difficult not to get into specifics, it is important that we consider these topics from a high level with an emphasis on creating a structure that is useful across multiple types of assets.
3. To facilitate the discussion, we will use a combination of open-ended questions, and questions regarding current drafts of FR recovery times that are currently being utilized by the group developing current seismic provisions (*you will be provided with a handout as an example later in this session*).
4. Time period targets for discussion:
  - a. Immediate
  - b. Near-term
  - c. Short-term
  - d. Intermediate
  - e. Long-term

### E.2. Breakout 2 Handout 2.1

#### Recovery Phase Targets

*Thinking about your assigned community, please shade in the box containing the **maximum acceptable time** for each row. Please remember to add your name to the top of this worksheet.*

*For example, if you feel that ‘long-term’ means less than a year and a half, you will shade box under the column ‘13 to 18 months’.*

	0 to 24 hours	2 to 3 days	4-7 days	2 to 4 weeks	5 to 8 weeks	3-6 months	7 to 9 months	10 to 12 months	13 to 18 months	>18 months
Immediate										
Near-term										
Short-term										
Intermediate										
Long-term										

*Please turn in Handout 2.1 to your moderator at the end of the breakout (and take a picture if you'd like a record of your responses).*

### E.3. Breakout 2 Handout 2.2 and questions used to guide discussion

**Table 1: Recommendations for Functional Recovery Times and Categories Currently Under Consideration<sup>a</sup>**

Functional Recovery Categories	Target Recovery Time	Community Functions Supported by Structures
A	[0 hours]	Community functions that support <u>essential and immediate safety and survival</u> needs. Functions in this category include but are not limited to: <ul style="list-style-type: none"> <li>- Emergency response and communication</li> <li>- Emergency and acute healthcare</li> <li>- Housing of non-ambulatory populations and people incapable of self-preservation (e.g., nursing homes, assisted living), and people in custodial care (e.g., correctional facilities)</li> </ul>
B	[72 hours]	Community functions that support <u>urgent and basic human survival needs</u> and that prevent the escalation of adverse disaster consequences. Functions in this category include but are not limited to: <ul style="list-style-type: none"> <li>- Emergency services not included in Functional Recovery Category A</li> <li>- Food and potable water services, both wholesale and retail</li> <li>- Healthcare providing urgent, non-emergency life sustaining treatments</li> <li>- Residential or non-transient housing</li> <li>- Transient housing (lodging)</li> <li>- Urgent veterinary services</li> <li>- Vital utility services</li> <li>- Services and employing organizations critical to national economic stability</li> </ul>
C	[2 months]	Community functions that support <u>routine self- and group-preservation</u> , and that <u>sustain short- and long-term economic, educational, and governance activities and services</u> . Functions in this category include but are not limited to: <ul style="list-style-type: none"> <li>- Recovery-focused local government services</li> <li>- Child and adult daycare</li> </ul>

Functional Recovery Categories	Target Recovery Time	Community Functions Supported by Structures
		<ul style="list-style-type: none"> <li>- Healthcare providing routine or elective treatments</li> <li>- Education (PK-12)</li> <li>- Services and employing organizations critical to regional economic stability</li> <li>- Non-urgent veterinary services</li> </ul>
D	[6 months]	<p>Community functions that <u>enhance a community’s general well-being and expedite the return to normalcy</u>. Functions in this category include but are not limited to:</p> <ul style="list-style-type: none"> <li>- Post-secondary education</li> <li>- Routine local government services</li> <li>- Services and employing organizations critical to local economic stability</li> </ul>
Not Designed for FR	[no target]	<p>All other community functions not addressed in Categories A through D. These include functions expected to support people’s quality of life that are not essential to the community’s recovery.</p>
<p><sup>a</sup> This table summarizes, but does not directly reproduce, the FRGM draft being discussed by the PUC as of October 2024.</p>		

The Moderators used the following questions to guide discussion of Handout 2.2.

Regarding Category A (immediate, 0 hours), for some services, like hospitals, which are essential for the immediate safety and survival of people in the community:

- Are there any problems or concerns that you have with this categorization?

Regarding Category B (72 hours), for services that support urgent and basic human survival needs and should be recovered quickly after the event but not necessarily immediately:

- Is within 72 hours an appropriate target recovery time for those types of services? Why or why not?
- What reason or rationale supports, or does not support, a cutoff of 72 hours?

Regarding Category C (2 months), for services that sustain short- and long-term economic and educational activities and services that users need, but can tolerate a lack of access for the short term without having severe negative consequences:

- Is within 2 months an appropriate target recovery time for those types of services? Why or why not?
- Other than services that would go in the “immediate” and “72 hours” bins, do you think there are services that need to be recovered in less than two months—say closer to one month—to avoid severe social or economic impacts?

Regarding Category D, for services that enhance a community’s general well-being and expedite the return to normalcy:

- Is within 6 months an appropriate target recovery time for those types of services (i.e., services that are not within the previous categories but still important to the recovery of the community)? Why or why not?

- Other than services that would go in the “immediate” “72 hours” and “2 months” bins, do you think there are services that need to be recovered in less than six months to avoid severe social or economic impacts?

Regarding the Not Designed for FR Category, which would apply to services that may not play an important role in the community's recovery and could still be designed according to the current code:

- Do you agree with this reasoning?

Regarding specific longer recovery times:

- Do you think that an additional target time is needed after 6 months? If so, Why? What would be the characteristics of the services in that category?

#### E.4. Breakout 2 Handout 2.3

##### Feedback on Target Recovery Categories and Times

**Table C— Needed Before 2 Months** (but not 72 hours)

Item	Why	When

**Table D— Needed Before 6 Months** (but not 2 months)

Item	Why	When

*Please turn in Handout 2.3 to your moderator at the end of the breakout (and take a picture if you'd like a record of your responses).*

### E.5. Breakout 2 Document 2.4

Each moderator summarized their breakout group’s recommended changes to FR categories and target times using Document 2.4.

**Document 2.4** *[To be filled out by moderator]*

FR Category	Target Time	Community Functions Supported by Structures
A	[0 hours]	Community functions that support <u>essential and immediate safety and survival</u> needs.
B	[72 hours]	Community functions that support <u>urgent and basic human survival needs</u> and that prevent the escalation of adverse disaster consequences.
C	[2 months]	Community functions that support <u>routine self- and group-preservation</u> , and that <u>sustain short- and long-term economic, educational, and governance activities and services</u> .
D	[6 months]	Community functions that <u>enhance a community’s general well-being and expedite the return to normalcy</u> .
Not Designed for FR	[no target]	All other community functions not addressed in Categories A through D. These include functions expected to support people’s quality of life that are not essential to the community’s recovery.

## Appendix F. Breakout Session 3

### F.1. Breakout 3 Handout 3.0

#### The Functional Recovery Goal Matrix – Assigning Functions and Services

**Our Goal** (10 minutes). The goal of this breakout session is to discuss and prioritize assignments of specific community functions and services to each functional recovery category. Please see Handout 3.0 for a list of the questions we'll do our best to tackle.

#### Section 1 – Icebreaker Questions

1. Please refer to Handout 3.1, which lists possible community functions and services (excluding housing). As you think about living in your assigned community, which 3-5 of these matters most to you on a regular daily basis? Why do these matter most to you?
2. Now, imagine that your assigned community has experienced an earthquake. Thinking about your assigned community and the functions you've said matter the most on a daily basis, does the list change at all if you are thinking about what will best help the community recover? Why or why not?
3. Are there any community functions and services you consider critical to your assigned community that are not on Handout 3.1? Are there any housing groupings that are not on Handout 3.3? Try not to replicate existing functions and services.

#### Section 2 – Prioritizing Community Functions and Services

Keeping in mind the **criteria** identified in Breakout #1 and the **characteristics of your assigned community**,

4. See Handout 3.1 for a general list of community functions and services (and those added to easel sheet #4) and Handout 3.2 for the list of functions and services that the Functional Recovery Task Committee has recommended should be in Category A, **immediately available** in the aftermath of an earthquake. This means they are able to continue providing their basic intended function without any meaningful interruption. This does not mean that no repairs are needed, just that those repairs don't interfere with the structure's basic intended function. *Moderator will have placed appropriate pre-printed Post-Its on the easel sheet #2 for Category A before the participants entered the room.* Do you agree or disagree with their placement in Category A for your assigned community? Why or why not? Are there other functions and services that should be in Category A? If yes, why?
5. On Handout 3.2, you'll see the functions and services that the Functional Recovery Task Committee has recommended as falling outside the categories for functional recovery design, as these functions and services may be the **least important** to a community's recovery. Thinking about your assigned community, do you agree or disagree with their placement in the category called, "Not Designed for Functional Recovery"? Why or why not?

6. Excluding housing, which community functions and services from Handout 3.1 do you think should be designed for functional recovery for Category B? Why do you think these functions and services belong in this category?
7. Again, excluding housing, which community functions and services from Handout 3.1 do you think should be designed for functional recovery for Category C? Why do you think these functions and services belong in this category?
8. Again, excluding housing, which community functions and services from Handout 3.1 do you think should be designed for functional recovery for Category D? Why do you think these functions and services belong in this category?
9. [If needed] Again, excluding housing, which community functions and services from Handout 3.1 do you think should be designed for functional recovery for Category E? Why do you think these functions and services belong in this category?
10. Looking at each of the categories and the functions and services tentatively assigned to each category on our easel sheet #2, is there anything that stands out as needing to be prioritized differently, given the criteria identified in Breakout #1 and the characteristics of your assigned community?
11. Is there anything about our assigned community that this group definitely wants to call out for the other groups to know about?

### **Section 3 – Prioritizing Housing (15 minutes)**

Keeping in mind the **criteria** identified in Breakout #1 and the **characteristics of your assigned community**,

1. Briefly, let's imagine someone tells you that it's OK for you and other people in your assigned community to live some place other than in your usual residence for more than six months after an earthquake. How would you respond to this statement?
2. With the groupings in Handout 3.3 in mind, should the housing groups listed be assigned to the category of immediately available? Why or why not? Should any other housing groups be assigned to Category A? If yes, which ones?
3. Again, with these groupings in mind, should any of the housing groups not be designed for functional recovery, i.e., placed in the "Not Designed for Functional Recovery"? Why or why not?
4. With the remaining housing groupings in mind, which ones should be designed for functional recovery for Category B? Why do you think these functions and services belong in this category?
5. With the remaining housing groupings in mind, which ones should be designed for functional recovery for Category C? Why do you think these functions and services belong in this category?
6. [If needed] With the remaining housing groupings in mind, which ones should be designed for functional recovery for Category D? Why do you think these functions and services belong in this category?
7. [If needed] With the remaining housing groupings in mind, which ones should be designed for functional recovery for Category E? Why do you think these functions and services belong in this category?

8. Looking at what we've put together on easel sheet #3, is there anything that stands out as needing to be prioritized differently, given the criteria identified in Breakout #1 and the characteristics of our assigned community?

**PLEASE GIVE YOUR HANDOUT 3.1. AND 3.3 TO THE MODERATOR WITH YOUR NAME ON IT.**

## F.2. Breakout 3 Handout 3.1

### Community Functions and Services (Excluding Housing)

*Alphabetized by Column 1, then Column 2*

Community Functions & Services – Generalized	Community Functions & Services – Specific Examples	Preliminary Category Assignment
Banking and Finance	Banking and finance	
Cultural Identity	Historic buildings	
Cultural Identity	Religious centers (e.g., churches, temples, mosque, excluding schools)	
Cultural Identity	Religious facilities that seek to provide emergency shelter and services, including food	
Education	Childcare/daycare - private and religious	
Education	PK-12 schools - private and religious	
Education	Post-secondary (i.e., colleges, universities)	
Energy/Electricity	Facilities for natural gas pumping, production, and consumer distribution, e.g., gas stations, propane stores	
Entertainment/Recreation	Arenas (indoor; not intended to be used for emergency shelter/service)	
Entertainment/Recreation	Country clubs	
Entertainment/Recreation	Libraries	
Entertainment/Recreation	Movie and performance theaters, concert halls	
Entertainment/Recreation	Museums	
Entertainment/Recreation	Night clubs	
Entertainment/Recreation	Recreation center/gymnasium (private; not to provide emergency shelter or service)	
Entertainment/Recreation	Stadiums (outdoor)	
Food and Water Resources	Emergency supply - warehouse, storage (food, water, PPE)	
Food and Water Resources	Food and potable water services, both retail (e.g., grocery stores) and wholesale	
Governance	Court houses	
Governance	Recovery-focused local government services (e.g., debris management)	
Governance	Routine local government services (e.g., municipal admin/tax, elected officials' offices)	

Community Functions & Services – Generalized	Community Functions & Services – Specific Examples	Preliminary Category Assignment
Healthcare - Inpatient	Acute care hospitals & support facilities <sup>^</sup>	
Healthcare - Inpatient	Emergency departments	
Healthcare - Inpatient	Psychiatric care (inpatient)	
Healthcare – Inpatient	Long-term care hospitals & support facilities <sup>^</sup>	
Healthcare - Outpatient	Dialysis centers	
Healthcare - Outpatient	Medical clinics, surgical centers	
Healthcare - Outpatient	Pharmacies	
Healthcare - Outpatient	Psychiatric care (outpatient)	
Healthcare - Outpatient	Urgent care clinics	
Local Economy	Commercial (major employer)	
Local Economy	Commercial (small businesses, retail)	
Local Economy	Industrial (construction, manufacturing)	
Local Economy	Office buildings	
Local Economy	Restaurants	
Public Health and Safety	Emergency response/communication facilities	
Public Health and Safety	EMS/critical transportation services (ambulance)	
Public Health and Safety	Fire stations	
Public Health and Safety	Police stations	
Public Health and Safety	Sewer system facilities	
Public Health and Safety	Wastewater treatment infrastructure	
Public Health and Safety	Water infrastructure facilities	
Shelter	Emergency shelter	
Shelter	Temporary housing and facilities; temporary structures (e.g., tents, tent structures)	
Social Support	Community recreational facilities (e.g., gym, pool)	
Social Support	Social services, community & elder centers, neighborhood support services	
Social Support	Veterinary care - urgent	
Social Support	Veterinary clinics - outpatient	
Telecommunications/Information	Internet - server farms, facilities, data centers	
Transportation Services	Airports	
Transportation Services	Public/mass transportation facilities	
Transportation Services	Railroad facilities - maintenance yards	
<p><i>Sources:</i> Preliminary work by the Functional Recovery Task Committee; Sattar et al. (2022); NIST-FEMA Post-Earthquake Functional Recovery Workshop Report (July 2021). NIST Special Publication 1269. <a href="https://doi.org/10.6028/NIST.SP.1269">https://doi.org/10.6028/NIST.SP.1269</a></p> <p><sup>^</sup> HVAC, mechanical, gas supply</p>		

### F.3. Breakout 3 Handout 3.2

#### Functional Recovery Goal Matrix: Community Functions and Services (Excluding Housing)

Category	Target FR Times	Function or Services
<b>A</b>	<b>Immediate</b>	<ul style="list-style-type: none"> <li>• Emergency response/communication facilities</li> <li>• EMS/critical transportation services (ambulance)</li> <li>• Acute care hospitals &amp; support facilities</li> <li>• Emergency departments</li> <li>• Emergency shelter</li> <li>• Emergency supply - warehouse, storage (food, water, PPE)</li> </ul>
<b>B</b>		
<b>C</b>		
<b>D</b>		
<b>E</b> <i>if needed</i>		
	<b>Not Designed for Functional Recovery</b>	<ul style="list-style-type: none"> <li>• Religious centers (e.g., churches, temples, mosque, excluding schools)</li> <li>• Arenas (indoor; not intended for to be used for emergency shelter/service)</li> <li>• Country clubs</li> <li>• Libraries</li> <li>• Movie and performance theaters, concert halls</li> <li>• Museums</li> <li>• Night clubs</li> <li>• Recreation center/gymnasium (private; not to provide emergency shelter or service)</li> <li>• Stadiums (outdoor)</li> <li>• Community recreational facilities (e.g., gymnasium, pool)</li> </ul>

#### F.4. Breakout 3 Handout 3.3

##### Community Functions and Services: Housing

*Alphabetized by Column 2*

Community Functions & Services – Generalized	Community Functions & Services – Specific Examples	Preliminary Category Assignment
Housing	Community treatment and recovery facilities, group homes, boarding houses (e.g., unhoused populations, furlough)	
Housing	Custodial care (e.g., jails/prisons)	
Housing	Foster care housing	
Housing	Hotels (e.g., transient, residential)	
Housing	Low-income housing	
Housing	Multi-family housing (2-5 units)	
Housing	Multi-family housing (5+ units)	
Housing	Residential care facilities for the elderly, assisted living facilities, adult care facilities	
Housing	Multi-unit housing with shared common spaces (e.g., convents, monasteries, dormitories)	
Housing	Single-family housing	

#### F.5. Breakout 3 Handout 3.4

##### Functional Recovery Goal Matrix: Housing

Category	Target FR Times	Function or Services
A	Immediate	<ul style="list-style-type: none"> <li>Residential care facilities for the elderly, assisted living facilities, adult care facilities</li> <li>Custodial care (e.g., jails/prisons)</li> </ul>
B		
C		
D		
E <i>if needed</i>		
Not Designed for Functional Recovery		

## Appendix G. Breakout Session 4

### Generalizability of the Functional Recovery (FR) Matrix

#### Part 1. (45 minutes)

Please review the workshop input to this point and test the group's thinking by considering the following three questions. Also please identify research questions, data, and people we know, or we need. Use the "parking garage" and handouts for Session #5 to capture this information. Please allow 15 minutes to discuss each question.

#### 1. How do we ensure that the FR matrix meets the conditions for all communities?

- Discuss any differences in the FR matrix for the community prototypes used in the workshop.
  - Consider how the FR matrix fares in an array of community settings and provide suggestions on how these issues might be addressed. Examples:
    - Rural vs. large metropolitan communities
    - Suburban vs. urbanized areas
    - Areas with aging vs. younger, diverse populations
    - Areas of predominantly owner-occupied vs. renter-occupied housing
    - Areas of socio-economically vulnerable or highly mobile populations
    - Communities lacking the financial resources to repair (i.e., insurance, loans/grants, personal wealth)
- 
- 
- 

#### 2. What is the appropriate target risk for new buildings constructed according to the FR matrix? *The current building code has a target risk for collapse of 1 % in 50 years.*

Discuss an appropriate target risk level for Functional Recovery, considering how best to complete the following questions:

- "In the next 50 years, there should be no more than an <X %> chance that a building designed to an FR code has an unacceptably long downtime (i.e., greater than the design target recovery time in its design lifetime (assumed to be 50 years))."
- "No more than <X %> of all buildings designed to FR should exceed their design target recovery time in the next 50 years."

Are there additional factors that should be considered in establishing an appropriate target risk for FR? Hazard-related examples are:

- Buildings experiencing several earthquakes or earthquake clusters during their design lifetime (i.e., 2010-2011 Canterbury NZ earthquake sequence)
- Catastrophic level earthquakes with widespread secondary hazards, such as tsunami, fires, and ground failure

**3. Should the concept of FR be extended to existing structures and lifelines, and if so, how?**

*With the FR focus on new structures, community resilience will increase incrementally over time.*

- How might the FR concept “scale up” from the individual building scale to the community scale?
  - What else could be done to “inject” more resilience into a community or to shorten the resilience timeline?
  - Can and should the resilience gap be addressed with voluntary and mandatory building retrofits?
  - Can and should lifeline infrastructure system upgrades be encouraged or required?
  - What levels of horizontal and vertical agency (public and private) collaboration and coordination are needed and is it feasible?
- 
- 
- 

**Part 2. (15 minutes)**

Wrap up the discussion on the FR matrix and generalizability of the FR matrix. Take time to consider:

- Are there some potential weaknesses in our logic? What assumptions did we make? Are there some key biases that may have influenced our thinking? Are they appropriate? If not, how might they be mitigated?
  - Are there some potential negative, unintended consequences and how might those be mitigated?
  - What are some of the key obstacles to implementation and how might those be addressed?
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## Appendix H. Breakout Session 5

### Research, Data, and People Handouts

As topics arise during any of the sessions, use the following handouts to record information about research, data, and people that are known/available or unknown/needed in developing the FR matrix. These topics will be the focus of discussion during Session #5.

#### ***EXISTING RESEARCH that should be considered.***

<b><i>Topic</i></b>	<b><i>Notes</i></b>

#### ***NEW RESEARCH QUESTIONS that need to be addressed in developing the FR matrix.***

<b><i>Topic</i></b>	<b><i>Notes</i></b>

#### ***EXISTING DATA that should be considered in developing the FR matrix.***

<b><i>Topic</i></b>	<b><i>Notes</i></b>

#### ***NEW DATA that is needed in developing the FR matrix.***

<b><i>Topic</i></b>	<b><i>Notes</i></b>

#### ***PEOPLE/PARTNERS who should be involved in ongoing conversations around Functional Recovery.***

<b><i>Name</i></b>	<b><i>Organization / Contact Information</i></b>

#### ***PEOPLE/PARTNERS who can help close knowledge gaps or have data to consider in developing the FR matrix.***

<b><i>Name</i></b>	<b><i>Organization / Contact Information</i></b>

## Appendix I. Data Compiled from Handouts 3.1 and 3.3.

**Table I-1. Individual Functional Recovery Category Votes by Specific Functional Categories.**  
*These results are based on Breakout Session 3 of the workshop, and present data for 62 functions/services. Up to 23 responses received for non-housing items, and up to 16 responses received for housing items since data was provided by participants for every function/service.*

General	Specific Function/ Service	A	B	C	D	E	F	ND	Total
Public Health and Safety	Emergency response/communication facilities	21							21
	EMS/critical transportation services (ambulance)	21	1						22
	Fire stations	22							22
	Police stations	20		2					22
	Sewer system facilities	6	3	7	1	1			18
	Wastewater treatment infrastructure	6	3	7	1	1			18
	Water infrastructure facilities	8	2	6	2				18
Healthcare - Inpatient	Acute care hospitals & support facilities	21	1	1					23
	Emergency departments	22							22
	Psychiatric care (inpatient)	16	6						22
	Long-term care hospitals & support facilities	15	2	4		1			22
Housing	Community treatment and recovery facilities, group homes, boarding houses (e.g., unhoused populations, furlough)	5	2	9					16
	Custodial care (e.g., jails/prisons)	14	1	1					16
	Multi-unit housing with shared common spaces (e.g., convents, monasteries, dormitories)	1	1	9	4	0	1		16
	Foster care housing	4	1	8	2				15
	Hotels (e.g., transient, residential)		2	7	6	1			16
	Low-income housing		1	12	3				16
	Multi-family housing (2-5 units)		1	11	3	0	1		16
	Multi-family housing (5+ units)		1	11	4				16
	Residential care facilities for the elderly, assisted living facilities, adult care facilities	10	5	1					16
	Single-family housing		1	8	6	0	1		16
Shelter	Temporary housing and facilities; temporary structures (e.g., tents, tent structures)	4	7	3	1	0	0	3	18
	Emergency shelter	15	4						19
Healthcare – Outpatient	Dialysis centers	3	10	7					20
	Medical clinics, surgical centers	2	5	4	6	3			20
	Pharmacies	3	6	9	1				19
Healthcare – Outpatient (cont'd)	Psychiatric care (outpatient)	1	5	7	2	1	2		18
	Urgent care clinics	7	4	7	1	1			20

General	Specific Function/ Service	A	B	C	D	E	F	ND	Total
Food and Water Resources	Emergency supply – warehouse, storage (food, water, PPE)	13	5	2					20
	Food and potable water services, both retail (e.g., grocery stores) and wholesale	2	7	8	3				20
Cultural Identity	Historic buildings			1	0	2	5	11	19
	Religious centers (e.g., churches, temples, mosque, excluding schools)			2	7	0	4	8	21
	Religious facilities that seek to provide emergency shelter and services, including food	10	7	3	0	0	0	1	21
Telecommunications/ Information	Internet – server farms, facilities, data centers	8	3	3	1				15
Energy/Electricity	Facilities for natural gas pumping, production, and consumer distribution, e.g., gas stations, propane stores	7	2	8	2				19
Governance	Court houses		1	4	8	5	1		19
	Recovery-focused local government services (e.g., debris management)	5	4	7	2	0	0	1	19
	Routine local government services (e.g., municipal admin/tax, elected officials offices)			9	6	3	1		19
Social Support	Community recreational facilities (e.g., gym, pool)			1	2	3	7	4	17
	Social services, community & elder centers, neighborhood support services		3	3	3	6	1		16
	Veterinary care – urgent	4	6	3	3	1	0	1	18
	Veterinary clinics – outpatient		1	4	8	1	2	1	17
Transportation Services	Airports	1	5	6	4	1			17
	Public/mass transportation facilities	2	4	6	5				17
	Railroad facilities – maintenance yards		2	7	5	2			16
Banking and Finance	Banking and finance	1	3	10	4	0	1		19
Education	Childcare/daycare – private and religious		1	6	10	2			19
	PK-12 schools – private and religious		1	3	13	2			19
	Post-secondary (i.e., colleges, universities)			3	6	5	4		18
Local Economy	Commercial (major employer)			4	8	1	3	1	17
	Commercial (small business, retail)			4	7	1	4	1	17
	Industrial (construction, manufacturing)		2	3	6	2	3		16
	Office buildings			3	4	3	2	3	15
	Restaurants			4	3	3	3	4	17
Entertainment/ Recreation	Arenas (indoor; not intended to be used for emergency shelter/service)			1	1	2	6	10	20
	Country clubs			1	0	1	5	15	22

General	Specific Function/ Service	A	B	C	D	E	F	ND	Total
	Libraries			2	5	3	10	1	21
	Movie and performance theaters, concert halls				2	0	6	14	22
	Museums					3	6	13	22
	Night clubs						7	15	22
	Recreation center/gymnasium (private; not to provide emergency shelter or service)				1	2	9	10	22
	Stadiums (outdoor)					4	6	11	21

**Table I-2. Group Functional Recovery Category Votes by Specific Functional Categories.**  
*These results are based on Breakout Session 3 of the workshop and present data for 64\* functions/services. Up to 4 group votes received for each item, as not all groups completed voting for all functions/services.*

General	Specific Function or Service	A	B	C	D	E	F	ND	Total
Public Health and Safety	Emergency response/communication facilities	4							4
	EMS, critical transportation services	4							4
	Fire stations	4							4
	Police stations	3		1					4
	Sewer system facilities		1	3					4
	Wastewater treatment infrastructure		1	3					4
	Water infrastructure facilities	1	1	2					4
Healthcare – Inpatient	Acute care hospitals & support facilities	4							4
	Emergency departments	4							4
	Psychiatric care (inpatient)	4							4
	Long-term care hospitals & support facilities	3	1						4
Housing	Community treatment & recovery facilities, group homes, boarding houses (e.g., unhoused populations, furlough)	1		1	1				3
	Low-income housing			3					3
	Multi-family housing (2-5 units)			4					4
	Custodial care (e.g., jails, prisons)	4							4
	Foster care housing	3		1					4
	Hotels (e.g., transient, residential)			1	2				3
	Multi-family housing (5+ units)			4					4
Housing (cont'd)	Multi-unit housing with shared common spaces (e.g., convents, monasteries, dormitories)			3					3
	Residential care facilities for the elderly, assisted living facilities, adult care facilities	3							3
	Single-family housing			2	1				3

General	Specific Function or Service	A	B	C	D	E	F	ND	Total
Shelter	Emergency shelter	3	1						4
	Temporary housing and facilities; temporary structures (e.g., tents, tent structures)		1					2	3
Healthcare - Outpatient	Dialysis centers		2	2					4
	Medical clinics, surgical centers	1		1	1	1			4
	Pharmacies		1	3					4
	Psychiatric care (outpatient)			2		1			3
	Urgent care clinics		2	1					3
Food and Water Resources	Emergency supplies	2	2						4
	Food and potable water services, both retail (e.g., grocery stores) and wholesale			2	2				4
Cultural Identity	Historic buildings						1	2	3
	Religious centers (e.g., churches, temples, mosque, excluding schools)					1		3	4
	Religious facilities that seek to provide emergency shelter and services, including food	2	1						3
Telecommunications/ Information	Internet (server farms, facilities, data centers)		2		1				3
	Phone, cellular facilities	1	3						4
	Electronic news media facilities			1	1		1		3
Energy/Electricity	^Energy, power generation & distribution		2	2					4
Governance	Court houses				2	2			4
	Recovery-focused local government services (e.g., debris management)		1	2					3
	Routine local government (e.g., municipal admin/tax, elected officials offices)			2		1			3
Social Support	Community recreational facilities							4	4
	Social services, community & elder centers, neighborhood support services				2	1			3
	Veterinary clinics- outpatient				1		1	1	3
	Veterinary care - urgent			3					3
Transportation Services	Airports		1	3					4
	Public/mass transportation facilities			2	2				4
	Railroad facilities – maintenance yards			4					4
Banking and Finance	Banking & finance		1	1			1		3
Education	Childcare, daycare – private and religious			1	3				4
	PK-12 schools – private and religious				4				4
Education (cont'd)	Post-secondary (i.e., colleges, universities)				2	1	1		4
Local Economy	Commercial (major employer)			1	1	1			3

General	Specific Function or Service	A	B	C	D	E	F	ND	Total
	Commercial (small business, retail)				3	1			4
	Industrial (construction, manufacturing)			2		1			3
	Office buildings				1	1	1		3
	Restaurants				2	2			4
Entertainment/ Recreation	Arenas (indoor; not intended to be used for emergency shelter/service)							4	4
	Country clubs							4	4
	Libraries			1			1	2	4
	Movie and performance theaters, concert halls							4	4
	Museums							4	4
	Night clubs							4	4
	Recreation center/gymnasium (private; not to provide emergency shelter or service)							4	4
	Stadiums (outdoor)							4	4
<p>* Items in addition to those included in the individual response table are “phone, cellular facilities” and “electronic news media facilities.”</p> <p>^ This item replaces the narrower “facilities for natural gas pumping, production and consumer distribution” included in the individual response table.</p>									

## **Appendix J. List of Acronyms**

### **BSSC**

Building Seismic Safety Council

### **FRGM**

Functional Recovery Goal Matrix (October 2024 version drafted for review by the BSSC PUC)

### **FRGM-W**

Functional Recovery Goal Matrix – Workshop version

### **FRTC**

Functional Recovery Task Committee

### **IBC**

International Building Code

### **NEHRP**

National Earthquake Hazards Reduction Program

### **NDFR**

Not designed for functional recovery

### **NIBS**

National Institute of Building Sciences

### **PUC**

Provisions Update Committee

### **TRT**

Target recovery time