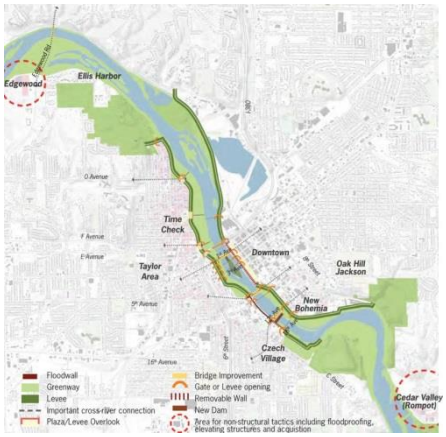
Executive Summary

Developing a Disaster Resilient Plan. In the United States, there are always a handful of individual communities working to recover from a hazard event. Whether due to severe weather, fire, floods or earthquakes, each community will eventually need to recover from a hazard event. All communities recover, but the length of recovery and the ultimate outcome depends on planning, preparedness, mitigation, response, and facilitation of the recovery. A disaster resilient community recovers quickly and to a better state than before the event occurred. An unprepared community often faces decades of recovery and may never achieve full restoration.

Envisioning a Better Outcome. Communities are overwhelmed with issues, policies, and regulations that need to be addressed. Each demands time and investment to resolve. Dealing with low probability-high consequence hazard events is often a low priority without a government mandate or recent event that focuses community interests. These stories illustrate the reality: resilience planning makes a major difference in how well community recovery is executed and illustrates why it should become part of normal planning and operations.

Cedar Rapids, Iowa. Cedar Rapids, Iowa, has multiple sources of natural hazards: floods, severe weather, tornadoes, severe windstorms, and heat waves. The city is also just downstream from a commercial nuclear power facility. The community has a well exercised evacuation plan for dealing with a nuclear disaster. Those plans played a large role during the flooding of 2008 when the river crested at well above its predicted 500-year flood event (http://www.cedar-rapids.org/city-news/flood-recovery-progress/floodrecoveryplans/Pages/FloodRecoveryTimeline.aspx). No lives were lost in that event because the evacuation plans were in place (NRC 2012). In addition, because the City Council and City Manager instituted a community engagement process to develop a shared vision and planning system months before the 2008 flood, they successfully responded to the flooding. Currently, they are rapidly implementing their Recovery and Reinvestment Plan, which is improving the community's resilience for flooding events (CARRI 2013).

Downtown Cedar Rapids, Iowa, during the 2008 Floods that Crested at 31 Feet
http://www.nydailynews.com/news/world/flooding-puts-cedar-rapids-iowa-water-article-1.292913



Cedar Rapids, Iowa Resilience Plan
http://corridorrecovery.org/rcrp/04_flood_management_map.asp)

Figure 1. Cedar Rapids, Iowa

Chile. Chile is a country that knows earthquakes well. After a massive event in 1960, the country developed and continued to update stringent building codes and emergency response procedures. In 2010, the country experienced a similar major seismic event that caused damage from Santiago in the North to Conception 500 miles to the south and generated a large tsunami. New emergency response procedures that grew out of hat experience, along with greatly improved building standards that had been in place for 50 years, resulted in much less damage, especially to high-rise residential buildings. Power restoration began to critical infrastructure within days; within a few months over 50,000 provisional homes had been constructed; and within three years infrastructure repairs were complete. Within four years, nearly all subsidized home rebuilding projects were complete. Even though this extreme event caused widespread damage to older buildings and infrastructure systems, the extent of modern construction and the response and recovery plans that were in place allowed the communities, with the assistance of the national government, to manage the event and rapidly build back in a way that is better prepared for the next seismic event (Britannica.com 2015).

Figure 2. Santiago Chile Skyline. A Resilient City in a Resilient Nation. (en.wikipedia.org)

New Orleans, Louisiana. Hurricane Katrina (2005) followed a scenario that had been frequently predicted and was the focus of multiple State and Federal response exercises. One scenario even envisioned a levee breach. However, numerous communities and industrial facilities that support national fuel supplies were severely damaged. Communities either did not understand the threat posed by storm surge or ignored the predictions and did not prepare at the local level for response and recovery (APA 2014). The lack of suitable design codes, response plans, processes to coordinate various local, state, and Federal agencies, and local leadership stalled the recovery. In New Orleans, the local government now has the New Orleans Redevelopment Authority (NORA, http://www.noraworks.org/) that supports land stewardship, commercial revitalization, and affordable housing. Organizations like Habitat for Humanity, Make-it-Right Foundation, and Rebuilding Together New Orleans (RTNO 2015, http://www.rtno.org/) have, in cooperation with local government and community leaders, made significant, though somewhat controversial, strides in aiding homeowners to return to their communities and rebuild their lives. However, the population is at approximately 75% of its pre-Katrina levels after 10 years (APA 2014) and it may be decades before New Orleans fully recovers from the event.

Figure 3. NGO Make-it-right reconstruction plans for New Orleans 9th Ward (www.makeitright.org)

The Resilient Community. The concept of setting recovery goals for community resilience is easy to understand but requires detailed development and involvement by all stakeholders. Community resilience addresses the complex interactions of people, the services they need, and the local economy that sustains life and drives growth. Community resilience requires a governance structure that sets direction and provides services, and a built environment that supports the community's social institutions. The built

environment is the foundation of recovery; governance sets the direction; financing governs the pace; and the community provides the support and will to make improvements.

Disaster resilience planning must eventually include in depth understanding of a community's interwoven social, political, and economic systems; how they are supported by the built environment; a clear understanding of their vulnerability and damage for expected hazard events; and how any damage will impact community recovery. The most useful plans are developed by a broad cross section of planners and stakeholders and include a sufficient level of detail that informs specific short and long term actions aimed at improving resilience over time.

This Disaster Resilience Framework provides a methodology and supporting detail to help communities understand and characterize their social community and built environment, and how to link the community's social institutions with the built environment. With that understanding, the resilience plan can identify the buildings and infrastructure systems and the levels of functionality needed during and after a hazard event, including recovery plans to restore community functionality. The gaps between desired and anticipated performance of the physical infrastructure are prioritized, and strategies are developed to implement the resilience plan. The framework provides guidance on developing a community-level resilience plan, with specific guidance for identifying the social aspects of resilience, their dependence on buildings and infrastructure systems, and is compatible with FEMA Mitigation plans.

Striving for community disaster resilience need not be expensive, but the process is unique for each community and will take time both to implement and to accrue benefits. The process to achieve disaster resilience requires concentration; persistence; a willingness to understand the present effectiveness of the social institutions, governance, economics, the buildings, and infrastructure systems; and the consequences for the community that an actual hazard event will trigger. The intersection of a community's daily needs and the anticipated damage from hazard events forms the basis for resilience planning.

Short term plans can be developed for emergency and interim solutions that can be implemented if the event occurs tomorrow. Long term plans provide the roadmap for eventually achieving disaster resilience. It begins by envisioning a better outcome, understanding your community, developing a resilience plan, and initiating implementation.

Many communities have Mitigation Plans, which are required by FEMA since the passage of the Disaster Mitigation Act in 2000 (DMA 2000). These plans are complementary to Community Resilience Planning outlined in the framework. A combination of FEMA-directed mitigation planning and the resilience planning described in this framework provides a first step toward becoming a disaster resilient community.

Understanding Your Community and its Built Environment. Communities are gatherings of people who need places to live, work, find security, and a sense of belonging so they can grow and achieve. All communities have a common set of social institutions in place to meet the needs of individuals and households. While common in description, they are organized and delivered uniquely in each community.

Individual needs and social institutions are described in Chapter 2 and include Family and Kinship, Economic, Government, Health Care, Education, Community service organizations, Religious Organizations and others that support belief systems, and the media. When considering a community's social institutions and their dependence on the built environment, it is important to recognize and address social vulnerability and inequity since all people do not have equal access to the social institutions nor do they have the same needs. This becomes especially critical after a hazard event occurs.

Linking a community's social institutions to the built-environment is illustrated in Chapter 2. People need housing, kids need schools, neighborhoods need retail districts, businesses need suitable facilities and

everyone needs healthcare, a transportation network, electricity, fuel, water, sewer systems and communication tools. Any disruption in availability of these services needs immediate attention, even without a hazard event.

In a perfect world, hazard events would not cause serious disruptions or damage to the built environment or its support of individuals and social institutions. Unfortunately, that is not the case. Most of the built environment in the nation does not have the ability to remain in service after significant hazard events occur, even though most people are not prepared to be on their own after disruptive events. This reality is demonstrated every time a significant hazard event occurs. Most communities try to rebuild as quickly as possible to restore damaged buildings and infrastructure, sometimes waiving code enforcement, with no time to develop improved reconstruction plans. The significant amount of funding available for rebuilding becomes a lost opportunity without a plan to improve community resilience.

In reality, only a fraction of the built environment is essential in the first few days after a significant hazard event, primarily to support emergency response. More of the built environment needs to be functional in the subsequent weeks and months of recovery. The key question is, "When do the buildings and infrastructure systems that support each social institution needs to be fully restored to service?" The desired time for recovery of community functions is the performance goal. The difference between the current anticipated performance and the desired performance is the key question to be answered during resilience planning.

Developing a Community Resilience Plan. The NIST framework provides a methodology for developing a Community Resilience Plan that accounts for social aspects of resilience when setting performance goals and recovery plans for the built environment. For example, the buildings and infrastructure systems that support emergency response typically include hospitals, police and fire stations, and emergency response centers. Housing and neighborhoods need to be restored within weeks with special attention to vulnerable populations. Once people are safe, recovery attention turns to restoring government, business, industry, education, general healthcare, and other services. Desired performance goals in terms of recovery times for community functions are set, informed by social issues. The current anticipated performance of the existing infrastructure may indicate longer recovery times than identified in the plan and that cause significant impediments to community recovery.

Understanding the gaps between desired and actual performance are determined for specific clusters of buildings and infrastructure systems and can then inform short and long terms solutions. In the short term, these gaps can be addressed with interim plans for emergency response and temporary actions. In the long term, new construction can be designed to the designated performance goals and the existing infrastructure can be retrofit as appropriate. Recognizing the balance between pre-event and post-event actions and resource allocation is a key outcome of the process. Not all buildings and systems need to be mitigated or retrofit to current standards to achieve resilience.

Figure 4 shows a flow chart of the Community Resilience Planning process. First steps include establishing the core resilience planning team, determining social assets and identifying key social needs for community recovery, and determining physical infrastructure assets and natural resources that support the key social needs. With this community

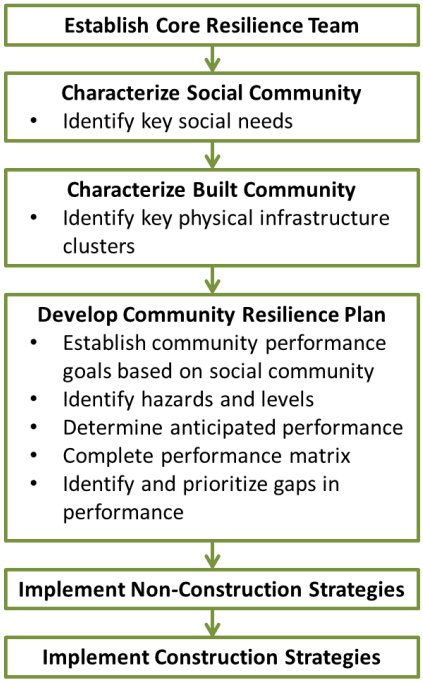


Figure 4: Flow Chart for Developing Resilience Plan

information, the community resilience plan is developed with the following steps: 1) establish community-level performance goals, 2) determine anticipated performance of infrastructure clusters; 3) complete the performance matrix, and 4) identify and prioritize gaps between the desired and anticipated performance for the clusters and each hazard. Once the gaps are prioritized, the community can develop strategies to mitigate damage and improve recovery of functions across the community.

The built environment is a complex and highly interdependent system of systems. Buildings generally house the functions that support the social institutions. Their functionality after a hazard event not only depends on the condition of the building but also on the infrastructure systems that service it. Roads are needed to access the building, and electricity, water, sewer systems, and communication networks are needed to let it operate and function as intended.

Infrastructure systems are also highly interdependent with each other. For example, the electrical power system needs roads for their crews to access damaged areas and restore power, water for cooling, and communication networks for repair coordination, etc. The framework presents considerations and examples of interdependencies that may need to be addressed when setting performance goals for recovery of community functions. Substantial background information is also provided about buildings and infrastructure systems, as well as guidance for setting performance goals, and strategies for improvement of infrastructure systems for new and existing construction.

Figure 4 is further developed through a description of core activities for developing a community resilience plan in Table 1. The social dimensions of the community are reviewed to identify important functions for the community, and when they need to be available during or after a hazard event. This includes considerations for the needs of individuals and social, government, business, industry, and financial institutions. Buildings and infrastructure systems that support the identified social functions are grouped, or clustered, as a subsystem. Additionally, anticipated hazards and the effects of changing conditions are identified. The desired and expected performance (i.e., recovery of function) of the clustered subsystems after a hazard event is evaluated. Significant gaps between these two performance levels are prioritized for strategies for improvement. Last, strategies are developed to address prioritized needs in the built environment.

Table 1. Core Activities for Community Resilience

Characterize Community's Social Dimensions	• Identify and assess actual and desired functions of social institutions, including business, industry, and financial systems, based on individual/social needs met by these institutions and social vulnerabilities. • Identify key stakeholders and representatives for decision making.
Characterize Community's Built Environment and Hazards	• Identify and assess building and infrastructure systems, including condition, location, and vulnerabilities, and the ways in which the built environment support social functions. • Identify hazard types and range of levels or intensities and changing conditions that the community anticipates. • Identify key stakeholders and representatives for decision making.
Develop Plan for Community Resilience	• Establish desired performance goals for the built environment during and after a hazard event that meet needed social functions after a hazard event with input from all key stakeholders • Identify and prioritize gaps in the desired performance of the built environment that need to be addressed to improve community resilience
Implement Strategies for Existing Built Environment	• Identify methods that may include mitigation, retrofit, or relocation options • Prioritize strategies based on gaps in the desired performance goals
Implement Strategies for New Built Environment	• Adopt provisions to improve the integrated performance of the built environment, such as land use, zoning, codes and standards, and local ordinances for buildings and infrastructure systems

This process is conducted at the community level for each hazard, with supporting detailed plans for buildings and infrastructure systems. Each hazard is evaluated at three hazard levels to help comunities understand performance across a reasonable range of expected hazard levels or intensities. For instance, a hazard event is likely to occur near the design level as well as below and above the design level over a 50 to 100 year period. Communities need to understand how their social systems and built environment will perform and recover over the range of hazard levels. A detailed overview of buildings and infrastructure systems is provided that addresses system performance for hazard events, how performance may affect community resilience, a review of primary codes, standards, and regulations, and possible strategies for setting performance goals and determining prioritization of resilience efforts. There is also a summary of available guidance, metrics, and tools for assessing community resilience.

Community Resilience and Mitigation Planning. Nearly 24,000 communities, representing 80% of the people in the United States, have developed mitigation plans in accordance with Federal Emergency Management Agency (FEMA) guidance. As mitigation is a component of resilience, these communities are taking substantive steps toward planning for resilience. A planning process that includes a detailed consideration of the built environment as outlined in the Disaster Resilience Framework and incorporates ongoing mitigation planning provides a comprehensive understanding of community resilience.

With the existing community mitigation planning structures, expanding the scope to resilience is the next logical step. Those already involved in mitigation activities have similar types of roles and responsibilities needed for resilience. The mitigation planning process emphasizes public participation in vetting mitigation strategies with targets, actions and priorities. Community resilience plans can be built around existing mitigation plans using the framework techniques related to the built environment.

Chapter 2 of the framework provides a methodology for understanding communities and their needs from the built environment. Chapter 3 describes a process for doing a risk assessment of the built environment which then informs both short and long term implementation planning. In FEMA's Local Mitigation Planning Handbook, the Hazard Mitigation Plan has 9 Tasks, from defining the planning area and team through Creating a Safe and Resilient Community, that are compatible with the resilience activities described in the framework.

Additionally, FEMA was tasked through Presidential Policy Directive 8 (PPD-8) on National Preparedness to produce a series of frameworks to address the spectrum of prevention, protection, mitigation, response, and recovery. Each Mission Area has a framework document associated with it that describes the roles and responsibilities of the whole community. The NIST Disaster Resilience Framework complements the PPD-8 framework documents by providing a methodology and specific guidance for developing a prioritization plan, at the local level, for recovering the function of buildings and infrastructure following a disruptive event to meet the societal goals of the community. The Disaster Resilience Framework allows a community to consider the interdependencies among buildings, infrastructure and the social and economic systems present in the community and consider the downstream cascading effects that can occur due to disruptions in these systems.