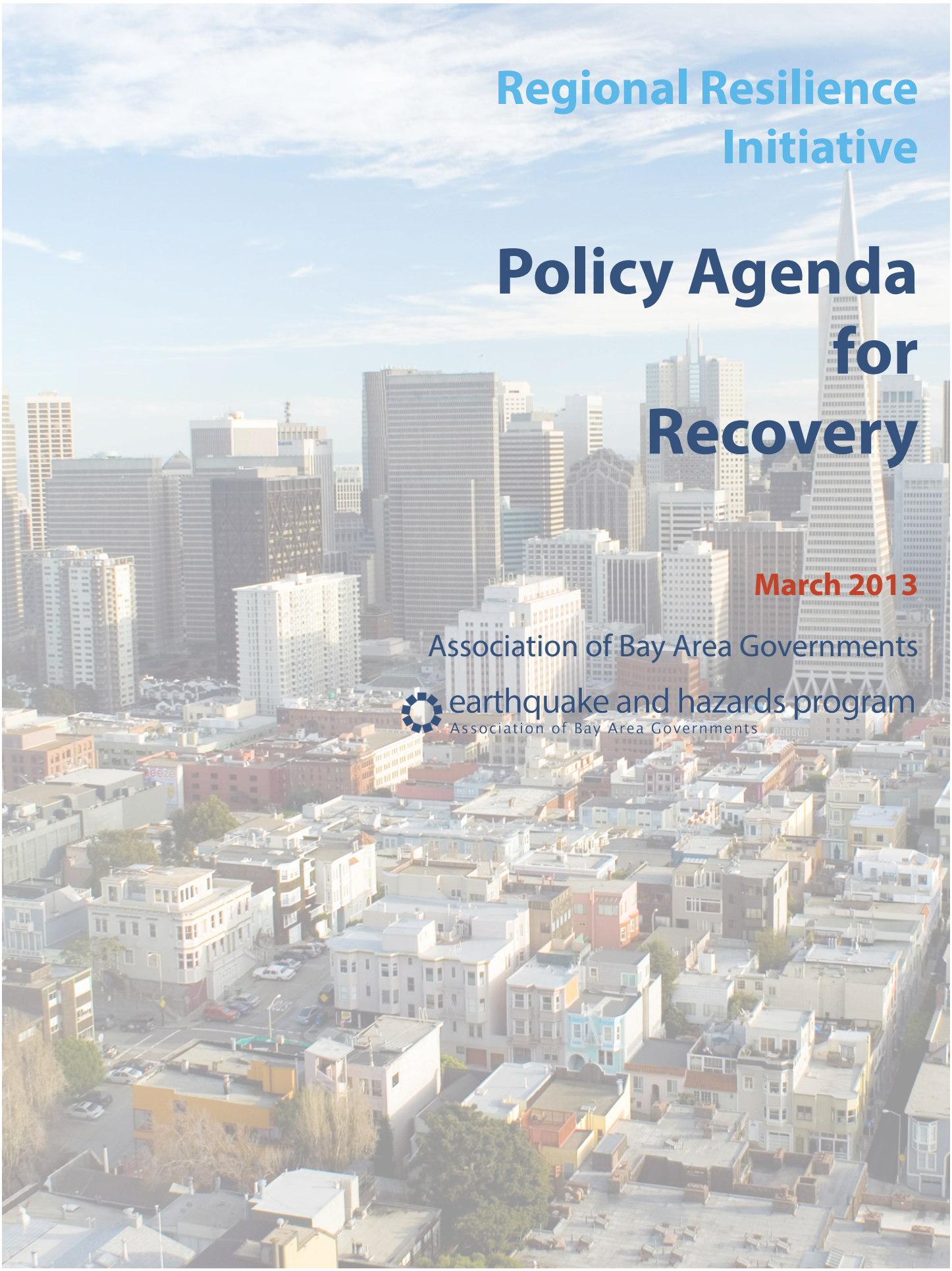

Regional Resilience Initiative

Policy Agenda for Recovery

March 2013

Association of Bay Area Governments

earthquake and hazards program
Association of Bay Area Governments

Regional Resilience Initiative

Policy Agenda for Recovery

March 2013

Paper 1: Executive Summary and Methodology

Paper 2: Background and Context

Paper 3: Governance Policy Paper

Paper 4: Housing Policy Paper

Paper 5: Infrastructure Policy Paper

Paper 6: Economy and Business Policy Paper

Paper 7: Action Plan

earthquake and hazards program
Association of Bay Area Governments

Credits

Principal Authors

Danielle Hutchings Mieler
Earthquake and Hazards Program Coordinator
Dana Brechwald
Earthquake and Hazards Specialist

ABAG Executive Staff

Ezra Rapport
Executive Director
Patricia M. Jones
Assistant Executive Director
Kenneth Moy
Legal Council
Miriam Chion
Planning and Research Director

ABAG Executive Board Leadership

Mark Luce
President
Supervisor, City of Napa
Julie Pierce
Vice President
Mayor, City of Clayton
Mark Green
Immediate Past President
Mayor, City of Union City

ABAG Regional Planning Council

Erin Hannigan
Supervisor, County of Solano
John Holtzclaw
Sierra Club
Tim Sbranti
Mayor, City of Dublin
Jeremy Masden
Executive Director, Greenbelt Alliance
Allen Fernandez Smith
Executive Director, Urban Habitat
Nate Miley
Supervisor, County of Alameda
Desley Brooks
Councilmember, City of Oakland
Julie Pierce
Mayor, City of Clayton
Harry Price
Mayor, City of Fairfield
Mark Ross
Vice Mayor, City of Martinez
Kristina Lawson
Councilmember, City of Walnut Creek
Pixie Hayward Schickele
California Teachers Association
Carol Severin
East Bay Regional Parks District Board of Directors
James P. Spering
Supervisor, County of Solano
Egon Terplan
Planning Director, SPUR
Karen Mitchoff
Supervisor, Contra Costa County

ABAG Publication Staff

Kathleen Cha
Senior Communications Officer, Editorial Assistance
Leah Zippert
Communications Officer, Editorial Assistance
Halimah Anderson
Communications Officer, Editorial Assistance
Victoria Rutherford
Communications Assistant

Project Consultants

Arrietta Chakos
Urban Resilience Strategies
Paula Schulz
Natural Hazards Mitigation

A special thanks to all participants in our workshop series, who provided the basis for our Policy Papers.

Thanks also to our interviewees, who provided detailed input essential to the development of these papers:

Doug Ahlers
Adjunct Lecturer in Public Policy, Harvard Kennedy School
Renee Domingo
Director of Emergency Services and Homeland Security, City of Oakland
Rich Eisner
Regional Administrator, Director of Earthquake and Tsunami Programs, Governor's Office of Emergency Service (retired)
Peter Ohtaki
Executive Director, California Resiliency Alliance
Julie Pierce
Mayor, City of Clayton
Sue Piper
Communications Director, City of Oakland (retired)
Chris Poland
Chairman and Senior Principal, Degenkolb Engineers
Laurel Prevetti,
Assistant Planning Director, City of San Jose
Bruce Riordan
Staff Consultant, Joint Policy Committee
Julie Sinai
Director, Local Government and Community Relations, University of California, Berkeley
Tom Tobin
President, Earthquake Engineering Research Institute
Will Travis
Staff Consultant, Joint Policy Committee (retired)

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ASSOCIATION OF BAY AREA GOVERNMENTS
Mailing Address: P.O. Box 2050, Oakland CA 94604-2050
Location: Joseph P. Bort MetroCenter, 101 8th Street, Oakland CA
(P) (510) 464-7900 (F) (510) 464-7979

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Regional Resilience Initiative

Introduction and Executive Summary

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earthquake and hazards program
Association of Bay Area Governments

Resilience Initiative Overview

This document and the six papers that follow represent the culmination of the analysis phase of the Regional Resilience Initiative undertaken by the Association of Bay Area Governments (ABAG). The goal of ABAG's Regional Resilience Initiative is to develop a sustainable process through which stakeholders in the Bay Area can progressively build resilience through collaborative planning for long-term disaster recovery. Through the Initiative, we have identified sector-specific recovery issues that may require jurisdictional coordination and collaboration. We have sought to understand the current capacity of the region to implement a coordinated recovery around these issues, and identified recommended actions needed to improve this capacity. Our focus has largely been on planning for long-term recovery.

Disaster recovery, as in past disasters, can span decades. Anticipating post-disaster issues and acting now to support post-disaster recovery is essential. Communities can work in concert with mitigation and disaster response initiatives to create a more sustainable and resilient region—one that has the ability to prepare and plan for adverse events, absorb and recover from their impacts and successfully adapt in the face of change. [1]

Building disaster resilience is an on-going, dynamic process where we seek to continually improve our capacity to respond to and recover from natural disasters. We also recognize that disaster resilient regions must be socially, economically, and environmentally resilient and that resilient regions are composed of resilient individuals, organizations, and communities.

To facilitate an effective and coordinated regional recovery from disasters, local governments, special districts, and regional, state and the federal government must come together in collaboration with key actors, such as businesses, nonprofit institutions, community leaders, and infrastructure agencies to determine responsibilities and decision-making structures.

1 Adapted from Disaster Resilience: A National Imperative. National Academies of Engineering, 2012.

While regional governance structures for coordination are well-established for disaster response, developing regional governance for long-term recovery is needed for large-scale disasters because:

How will Bay Area leaders work together to plan for and address the impacts of a major Bay Area Earthquake?

- A common vision for regional recovery will instill investment confidence in residents, businesses and the larger global community that the Bay Area will recover;
- Damage to regional infrastructure systems will require coordinated and prioritized decision-making about restoration and reconstruction;
- Many cities will simultaneously face similar decisions about rebuilding housing, restoring business and financing restoration. Crafting consistent and effective practices and leveraging mutual resources can facilitate a more uniform recovery across the region;
- A coordinated regional recovery will further existing goals for a more sustainable, equitable and prosperous region.

A major Bay Area earthquake will leave lasting impacts on our region, altering our built environment, economy, and many other characteristics that make the Bay Area unique. How will Bay Area leaders work together to plan for and address the impacts? Who are the major players in this work? How will cities and counties come together with business, nonprofit, and community partners to rebuild our region and restore our economy? What is the message and image we will send to the outside world after an earthquake? Will it be one of competition for limited resources or will we work together in the interest of the entire region and collectively advocate for our common needs? How will priorities be set?

Stakeholders indicate that a financing strategy to address rebuilding of the Bay Area's economy, infrastructure and housing is a regional necessity. In addition, advocacy for state and federal funding, along with needed legislative and

regulatory authority could be successfully crafted through an inclusive process. How we come together as a region to grapple with these questions and build regional resilience is the focus of these papers.

The papers are organized around the four Policy topics that emerged from our process: Governance, Housing, Infrastructure, and Economy and Business.

Governance

Recommendations from ABAG's Regional Resilience Initiative interview process confirm both the research and workshop findings that regional coordination and decision-making can speed disaster recovery and improve resilience if accomplished prior to the event. There is region-wide agreement that crises are the worst time to come together to craft public policy. Though many small and large cities make up the region, we are one economy, with shared physical and social systems. Environmental issues and regulations cut across jurisdictions and require coordination among levels of government and agencies well before these systems are disrupted. More than half of the Bay Area residents cross county lines to commute to work, making housing workers a regional concern.[2] Many assets are regional, including our transportation, power, sewer, water and communications systems.

The overarching goal of the Governance paper is to develop forums for **regional communication and collaboration**. Our recommendation is to accomplish this through three goals – **create a regional resilience policy forum, develop regional resilience leaders,** and **use information and data analytics for disaster resilience**.

No regional coordinating body or disaster recovery framework is currently in operation to facilitate sharing and decision-making in the aftermath of a major disaster, although Federal Emergency Management Agency (FEMA)'s National *Disaster Recovery Framework* and California Emergency Management Agency (CalEMA)'s *Regional Emergency Coordination Plans* may provide guidance on such a framework. Jurisdictions independently work their way through the FEMA regulatory system and make recovery decisions on their own, based on their current situation. The urgency for quick action and competing demands for time may inhibit decision-makers' awareness of and access to information about other actions occurring around the Bay Area, and knowledge about where building decisions fit within regional context. This can lead to fragmented recovery efforts and competition for federal funds. This is particularly an issue with the restoration and recovery of regional assets, such as infrastructure systems. A forum to help coordinate and guide jurisdictions within the region could not only speed restoration of regional services but expedite jurisdictional recovery as well, and ensure that the recovery process fits with larger regional goals for residents and businesses.

Governance Goals

- *Regional communication and collaboration*
- *Create a regional resilience policy forum*
- *Develop regional resilience leaders*
- *Use information and data analytics for disaster resilience*

Helping staff and officials understand what may be asked of them before the disaster hits can help ensure that those involved have adequate powers and tools and are prepared for what they may be expected to contribute in the post-disaster recovery phase. Identifying champions or new types of professionals who deeply understand recovery needs and have the ability to move between departments and influence officials can also greatly assist recovery if they are given appropriate roles and forums to use their skills.

In addition, jurisdictions need many different types of information after a disaster. For example, local officials must have essential damage assessment information for utilities, government, and private sector organizations to assist with decisions about outages, damaged infrastruc-

2 *The Bay Area Regional Economic Assessment. A Bay Area Council Economic Institute Report, October 2012.*

ture, transportation disruptions, red-tagged buildings, and related debris and transportation issues. The same damage impact information can support decisions about long-term sheltering, temporary housing, and expedited disaster assistance. Information needs may range from information on individual buildings to a general picture of damage in other parts of the region.

Housing

One of the most seismically active regions in the country, California has developed strong building codes that will largely prevent loss of life in a major earthquake. These codes were developed over many decades and have been continually improved as earthquakes have demonstrated the need for new techniques and stricter codes. Still, these codes cannot guarantee that even a new building will be habitable or restorable after earthquakes, and many older buildings built before modern codes have not been upgraded and may need to be demolished due to extreme earthquake damage. The challenge for policy makers during the recovery framework is to maintain affordable housing while also improving the seismic resilience of existing housing so that quality affordable housing can survive an earthquake or other disaster.

The first goal of the Housing paper is to **facilitate rapid housing recovery that fulfills regional goals of enhanced quality of life**. Some disaster projections forecast the loss of more than 150,000 housing units across the region. One possibility is to focus replacement housing construction within Priority Development Areas (PDAs), locally-nominated and regionally-supported infill development opportunity areas within existing communities.[3] PDAs are generally areas where there is local commitment to develop more housing along with amenities and services to meet the day-to-day needs of residents in a pedestrian-friendly environment served by transit. These qualities that make neighborhoods an enjoyable place to live also promote more resilient communities and supporting these services after an earthquake will be key to ensuring that residents can remain in their homes.

Housing Goals

- *Facilitate rapid housing recovery that fulfills regional goals of enhanced quality of life*
- *Promote housing mitigation to reduce housing loss and expedite recovery*

The second goal is to **promote housing mitigation to reduce housing loss and expedite recovery**. Seismically vulnerable multi-family buildings pose particular challenges for local governments and are expected to account for two-thirds of housing losses.[4] These buildings are not easy to identify and retrofits can be expensive, but the benefits of retrofitting are significant. Rebuilding multi-family housing post-earthquake is generally very slow, taking several years longer than for single-family homes and affordable units are often rebuilt above market rate, resulting in loss of affordable housing options. In some cities soft-story buildings are clustered together, creating potential for widespread loss of housing in concentrated areas.

Older single-family homes will likely account for nine percent of overall housing losses after each major earthquake.[5] Single-family homes are generally relatively easy and affordable to retrofit. However, owners who embark on retrofit projects often quickly become perplexed by the lack of retrofit standards for some types of homes and the inconsistent array of retrofitting techniques proposed by contractors. Owners are further discouraged by the lack of incentive programs enjoyed by residents for energy retrofits. An estimated two-thirds of single-family retrofits are done improperly,[6] a waste of homeowners' money that provides inadequate seismic benefits and

3 Association of Bay Area Governments, FOCUS Program http://www.bayareavision.org/initiatives/prioritydevelopmentareas.html

4 Preventing the Nightmare (update), Association of Bay Area Governments, 2003.

5 ibid

6 Preventing the Nightmare: Technical Appendix B, Association of Bay Area Governments, 1999 and False Sense of Security, Contra Costa Times, 2006.

Infrastructure Goals

- *Increase technical understanding of region-wide system vulnerabilities*
- *Increase ways to share risk information to collectively increase regional system resilience*

creates a false sense of security. Quality retrofits benefit not only homeowners and their families, but entire communities when they can get back on their feet faster after earthquakes.

Infrastructure

In the wake of a major disaster, the recovery of our major infrastructure systems will play a large role in our ability to recover quickly and effectively. Many recovery activities are highly dependent upon these systems. For example, the movement of goods - including supplies for rebuilding and daily goods and food for resuming daily lives - depends on a workable transportation system. People will not be able to stay in their homes if water and wastewater services are not available, and businesses will not be able to reopen. Repairing failed infrastructure systems and restoring their services are vital to the recovery of the Bay Area after a disaster, and failure to do so quickly and efficiently will result in widespread and long ranging, potentially devastating impacts.

The first goal of the infrastructure paper is to **increase technical understanding of region-wide system vulnerabilities**. Currently, few individuals understand how systems are interdependent. The knowledge that is available is largely based on speculation, not on rigorous analysis. The region needs peer-reviewed technical studies to better understand system vulnerabilities and what consequences may result from cascading failures.

The second goal is to **increase ways to share risk information to collectively increase regional system resilience**. To better understand interdependencies,

Economy and Business Goals

- *Retain big business*
- *Keep small and neighborhood serving businesses open*
- *Minimize supply chain disruption and keep goods moving*

we must improve sharing of risk information among service providers and regional stakeholders before a disaster occurs. We also have to participate in collaborative planning and accelerate mitigation. This sharing and collaboration is vital to an effective recovery. Communication and information sharing also allows for informed prioritization of infrastructure recovery. Understanding upstream and downstream interdependencies for repairs, as well as which systems key community resources rely upon, can be used to develop an appropriate timeline for streamlined recovery. Understanding priorities and system interdependencies allows providers to identify primary repairs to minimize interdependency and restore certain portions of systems quickly.

Economy and Business

The impact of an earthquake on the economy has one of the farthest-ranging implications for disaster recovery in the Bay Area. Without a swift and strong economic recovery, the Bay Area will suffer from a protracted recovery with slow repopulation in heavily damaged areas, slow rebuilding of homes and businesses, loss of revenue from business, tourism, and taxes, and the potential relocation of major industries. Estimates are that a repeat of the 1906 earthquake would cause $120 billion in direct economic

building related losses. [7] We have seen repeatedly in disasters that areas with the fastest economic recovery are those which already have strong economies and cultivate conditions to help businesses thrive before a disaster.

The Economy and Business paper identifies three post-disaster goals: **retain big business, keep small and neighborhood serving businesses open**, and **minimize supply chain disruption and keep goods moving**. The Bay Area regulatory environment, including zoning, permitting and environmental regulations may also inhibit businesses after a disaster, making it too difficult to stay or re-open. Businesses have identified a lack of consistency between regulatory agencies' policies at the local, regional and state level and commented that this situation limited their ability to expand within the region under normal business conditions.[8] The challenges of post-disaster recovery will elicit calls for regulatory relief. With large volumes of rebuilding happening simultaneously, the capacity of regulatory agencies could potentially slow down the process.

Small and locally serving businesses remain an important component of a strong region and are especially vulnerable to closure after a disaster. An estimated twenty-five percent of small businesses do not re-open following severe disruptions from a major disaster.[9] One reason why small businesses are so likely to fail is that they tend to operate with small profit margins and limited reserve funds, which means that even a short period without cash flow may have a significant impact on business. Small businesses also may not be eligible for SBA loans, which require businesses to demonstrate that loans can be repaid—a challenge when disasters disrupt business operations.

7 Kircher, Charles, et al, 2006. When the Big One Strikes Again—Estimated Losses due to a Repeat of the 1906 San Francisco Earthquake. Earthquake Spectra, Volume 22, No. S2, pages S297–S339. Note: similar losses are expected for a Hayward fault scenario earthquake.

8 The Bay Area Regional Economic Assessment. A Bay Area Council Economic Institute Report, October 2012.

9 California Seismic Safety Commission, March 2012. Post-Disaster Rapid Economic Recovery Plan Project – Leading Practices and Potential Steps for a Rapid Post-Disaster Economic Recovery," Report by Deloitte Consulting.

Other potential barriers to economic recovery include the disruption of vendors and supply chains to and from the region and the repercussions for national and international markets. Business disruption has upstream and downstream impacts on supply chains that can exacerbate impacts on the economy. For example, disruption of a manufacturing business may limit global supply of a particular product, disrupting the economy far beyond the impacted area. While the Bay Area's share of the manufacturing industry is not particularly concentrated, what is manufactured here is highly specialized and focused on sophisticated equipment design and development. Disruption of this specialized manufacturing could have global economic impacts.

Papers Structure and Format

This suite of papers seeks to provide a high-level analysis of the major goals for increasing resilience through a regional forum along with recommended actions for reaching these goals. The papers are structured into three general categories:

Theory—*Resilience Background and Context*

This paper provides the overall background and theory behind planning for resilience. It places disaster resilience planning in context with other types of resilience and sustainability efforts, particularly ongoing climate change planning and national resilience efforts. This paper also touches upon current state of disaster planning in the Bay Area and identifies major hazards of concern for the Bay Area.

Assessment—*Regional Governance, Infrastructure, Housing, and Economy and Business Policy Papers*

This suite of four papers examines the major issues of governance, infrastructure, housing, and economy and business. The four papers follow a similar format presenting significant goals for regional disaster recovery planning, and identifies regional actions that can be taken to address these issues. The regional decision-making paper serves as the foundation for the three other topic papers, as the goals and actions outlined there set the context for more easily

implementing sector-specific recommended actions.

Action—*Action Plan*

The action plan summarizes and prioritizes the actions identified in each of the four issue papers. The actions are analyzed for feasibility and include discussion of how to implement our recommended regional policy platform.

Methodology

The Regional Resilience Initiative was convened over an 18-month period. Stakeholder workshops were held throughout the process to solicit input on the major topic areas of housing, economy and business, including goods and services, and infrastructure. A final policy forum was held in October 2012 in conjunction with ABAG's Fall General Assembly, which focused on coordinated regional governance for long-term recovery and identified ways to increase shared understanding, opportunities for coordination, and tools for communication that will lead to regional strategies before an event that may improve the post-disaster recovery process.

In addition, the team conducted interviews in the summer of 2012 with key resilience stakeholders, thought leaders, and elected officials closely involved with exploring new public approaches on resilience. A complete list of our interviewees can be found on the credits page in the beginning of the suite of papers.

The work was also periodically reviewed by ABAG's Regional Planning Committee and will be formally adopted by ABAG's Executive Board in 2013. •

Regional Resilience Initiative

Background and Context

Photo source: www.fema.gov

earthquake and hazards program
Association of Bay Area Governments

Introduction

The research conducted through the Regional Resilience Initiative at ABAG may offer larger lessons for other communities facing similar regional resilience issues, but is grounded in the unique context of the Bay Area and the factors that characterize our region and vulnerabilities. The research perspective is also based in the Earthquake and Hazards Program's grounding in resilience and recovery theories, definitions, and tools, which gives these papers their unique voice. This paper provides the background ideas for the rest of the work, as well as paints our regional context's picture. Each of the subsequent papers comes from the point of view expressed in this paper.

The definitions and theory presented here may also help the region establish a baseline understanding of what resilience means, hopefully engaging a wider variety of stakeholders. While it is not necessary to be fully engaged with all the concepts laid out here to implement actions towards increased resiliency, this paper may provide the narrative that some need to further explore the topic of disaster resilience.

The first part of this paper defines of "resilience" and relates it to sustainability and disasters. With many definitions of resilience in use, we felt it was useful to define within this paper what constitutes resilience and a resilient region. The paper then describes the importance of planning to recover, as well as some of the tools that can be leveraged to address recovery and resilience. We then address where recovery fits within the context of the umbrella of resilience, which also includes mitigation and response.

The second part of the paper describes the Bay Area's unique conditions, including our assets and vulnerabilities. Understanding general trends and characteristics of the Bay Area, as well as a sense of the potential threats, allows stakeholders to better predict the types of issues we will face after a major disaster. The Bay Area enjoys a high quality of life with many natural and man-made resources and assets. By understanding what makes our region unique, we can plan to preserve and enhance our quality of life, despite major disruptions.

The following papers in this suite, with their high-level goals and specific recommended actions, all emerged from the foundation herein, which guided our process and set the context for the Resilience Initiative work.

Defining Disaster Resilience

Resilience itself is not a new concept. Cities and counties have been and are currently pursuing various strategies to become more resilient, but may use a wide range of language to define, understand and communicate what they are doing.

Resilience may combine aspects of environmental sustainability, economic strength, risk management, emergency preparedness, and strong social communities; however a major aspect of defining resilience as a region is coming to a common understanding about what a desired resilient state looks like. It is ultimately not important that every county, jurisdiction, and special district in the Bay Area use the same definition of resilience, but it is helpful to have an overarching common concept to use to begin to create a usable and common language within the region.

Below are some widely accepted definitions of many of the elements we feel contribute to resilience to help create a platform for regional understanding.

Sustainability

Sustainability and resilience are tightly integrated concepts – a sustainable region is inherently more resilient, and a resilient region is inherently more sustainable. Sustainability is commonly defined as "meeting the needs of the present without compromising the ability of future generations to meet their own needs." [1] California's *State Hazard Mitigation Plan* further defines sustainability using a vision by the National Commission on the Environment, which states that sustainability is "a strategy for improving the quality of life while preserving the environmental

1 *Our Common Future, Bruntland Commission (1987)*

Resilience and sustainability have a symbiotic relationship. Increasing the sustainability of a community can increase resilience to disasters.

potential of the future," of "living off interest rather than consuming natural capital."[2] Sustainability largely refers to the way that a society uses resources and the implications of those actions on various systems, scales, and timeframes.

The term sustainability is often used to speak about environmental issues, but can be expanded to also include social and economic sustainability. This basic pyramid of environmental, social, and economic sustainability is often referred to as the "triple bottom line." Expanding on this thought can include any valuable resource that a community relies upon for its quality of life, including physical, historical, and cultural resources. This multiple-resource approach to sustainability is particularly beneficial to use in the context of resilience, as resilience addresses not just protecting the built environment or physical world but maintaining and enhancing economies, social systems, and any number of other resources as well.

Resilience and sustainability have a symbiotic relationship. Increasing the sustainability of a community can increase resilience to disasters. For example, resilience to disasters cannot be maximized if environmental sustainability is not valued – in many instances, the degradation of the environment in fact can contribute to disaster vulnerability, such as the loss of wetlands increasing vulnerability to hurricanes or sea level rise. In addition, disasters that destroy or dramatically alter resources render communities unsustainable, since they impact the long-term ability of the community to access and use resources. Increasing resilience to disasters thus inherently increases the sustainability of a community, as it helps maintain access to resources, now and in the future.

Resilience

There are many specific definitions of resilience in academic literature, but we have found that all definitions share common characteristics. The National Academies Committee on Increasing National Resilience to Hazards and Disasters defines resilience as "the ability to prepare and plan for, absorb, and recover from or more successfully adapt to actual or potential adverse events."[3] California's *State Hulti-Hazard Mitigation Plan* similarly defines resilience as "the ability of a system to absorb shock and maintain its structure and functions with a minimum loss… (and) resume pre-event functionality in a relatively short time."[4] From these definitions, we can gather that the inherent attributes of resilience are that it is a function, not an end state (it is an ability); it helps to minimize negative impacts of large events; and it facilitates the quick resumption of an operable state to a system, which may be similar to the previous state or superior to the previous state.

The San Francisco Planning and Urban Research Association's (SPUR) *Resilient City* initiative defines "seismic resilience" specifically around the concept of resilience to a major earthquake. The organization's definition is the "ability of a city to remain safe and usable after a major earthquake. A resilient city is able to contain the effects of earthquakes when they occur, carry out recovery activities in ways that minimize social disruption, and rebuild following earthquakes in ways that mitigate the effects of future earthquakes." [5]

While the exact definition of resilience may vary in its specifics in terms of describing its focus and scope, the Community and Regional Resilience Institute (CARRI) gives us a language of five core concepts to anchor every definition:

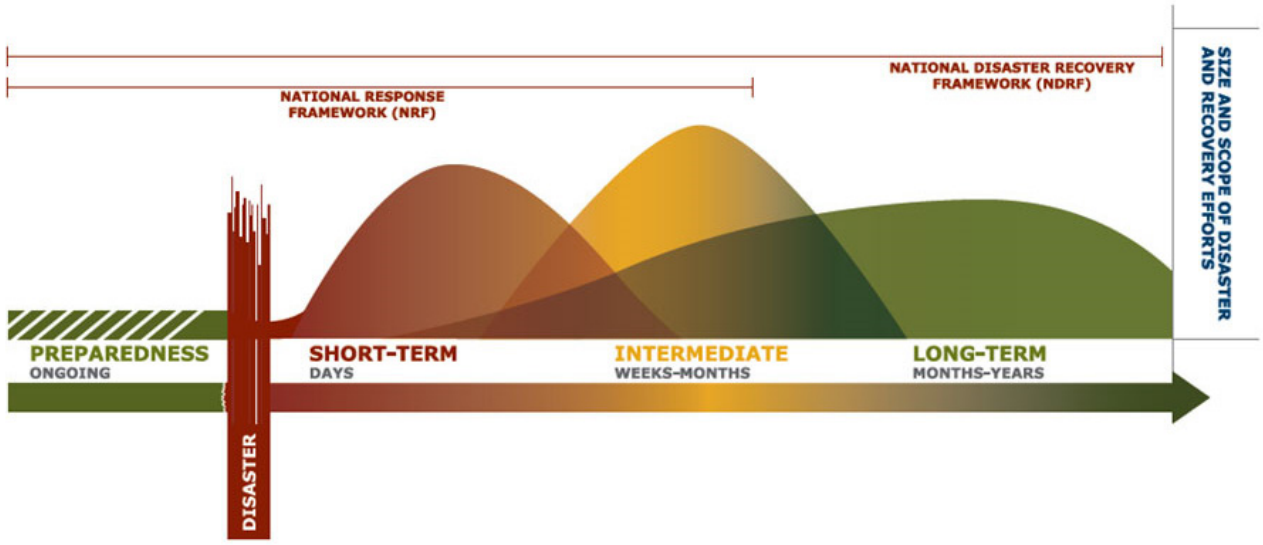
- Resilience is an **attribute** of the community, system, region, etc
- Resilience is **continuing**, an inherent and dynamic aspect of the system

2 *State Hazard Mitigation Plan, p. 102 (2010)*

3 *Disaster Resilience: A National Imperative (2012). The National Academies Committee on Increasing National Resilience to Hazards and Disasters and Committee on Science, Engineering, and Public Policy*

4 *California State Hazard Mitigation Plan (p. 102) http://hazardmitigation.calema.ca.gov/docs/2010_SHMP_Final.pdf*

5 *Defining what San Francisco needs from its seismic mitigation policies, (2009). SPUR.*



Disaster Recovery Continuum, Federal Emergency Management Agency's National Disaster Recovery Framework, p. 8

- Resilience involves elements of **adaptation** and can easily adapt to new variables
- Resilience puts systems on a positive **trajectory** relative to its pre-disaster state
- Resilience is **comparable** and **relative** – it is possible to compare systems' ability to be resilient. [6]

It is helpful to examine a few other factors that contribute to a state of resilience or that help to explain how resilience is defined. First is the concept of scale – the state of being resilient is greatly enhanced when it exists at multiple scales, ranging from the individual, neighborhood, community, city, county, and region to the state and federal levels. Second, for our purposes we also wish to emphasize adaptability and the ability to recognize opportunities for growth and improvement as a key element of resilience – the ability to see a disruption as a chance for transformation – to "build back better."[7] Lastly, as discussed above, it is important to see resilience and sustainability as highly interconnected.

Resilience can also be viewed through the complete life cycle of a disaster: beginning with mitigating a system to be able to withstand or adapt during a disaster, continuing with response immediately after a disaster. An effective and resilient response effort understands how actions undertaken during the response phase have implications for the long-term health and recovery of the system. Resilience continues throughout short-term and long-term recovery, and effectively shortens the period of time between the disaster and full recovery. Lastly, in a resilient society, the long-term recovery phase includes the integration of mitigation measures in rebuilding practices, effectively beginning the life cycle again.

Similar to the term "sustainability," the term "resilience" applies more to a "philosophical perspective than a scientific concept."[8] An understanding of the many definitions and attributes of resilience helps to form the baseline concept of regional resilience, despite variations that neighborhoods, communities, cities, counties, infrastructure providers, and businesses may define in terms of system boundaries and scale within their own definition of resilience.

Defining a Disaster

It is also helpful to understand what we mean by the term "disaster." In general, the types of disasters considered are those that are due to natural hazards, have disruptive

6 Definitions of Resilience: An Analysis. (2009). Plodinec, M.J. Community and Regional Resilience Institute (CARRI)

7 State of California Multi-Hazard Mitigation Plan, California Emergency Management Agency (2010). http://hazardmitigation.calema.ca.gov/docs/2010_SHMP_Final.pdf

8 Disasters by Design: A Reassessment of Natural Hazards in the United States (1999). Joseph Henry Press.

consequences on one or more built environment, social, or economic system (man-made system), and are large enough to cross jurisdictional boundaries or overwhelm the capacity of a single jurisdiction or entity to overcome, making them regional in nature.

Disasters and their consequences can take on many forms and characteristics. Disasters can be "fast," such as a sudden earthquake or tornado; "slow," such as long-term degradation due to sea level rise or changes in weather patterns; or "hybrid," when fast and slow disasters occur simultaneously and a sudden event is exacerbated or compounded by existing slow disasters.[9] The impact of the disaster can be low or high, and can range in geographic scale. [10] Impacts can also vary based on pre-existing conditions – if a community has a strong economy and is on a general upward trajectory in terms of quality of life and well-being, an impact may be much less devastating than in a community dealing with disinvestment and lowering of quality of life.

It should be noted that natural hazards are not in themselves disasters. In *Disasters by Design*, a natural hazard – an extreme, low-probability phenomena – has the potential to cause a disaster when it strikes a human collective, but is not in and of itself a disaster. The disaster emerges at the point of intersection between the hazard and man-made systems, and only if the hazard causes negative impacts on the systems. This interrelationship is a complex one with many variables – for example, man-made systems often create a negative feedback system that increases the frequency or strength of a natural hazard, such as when paving over wetlands reduces its ability to attenuate hurricanes and major storms; additionally the consequences of a natural hazard become more severe as man-made systems become more complex. The trauma and consequences of a disaster are inherently defined, reshaped, and redirected by human actions and perception. [11]

It is also worth examining the difference between a disaster and a catastrophe. Webster's dictionary defines a catastrophe as a disastrous event that results in a final end or conclusion. This definition implies a disaster that is insurmountable and where recovery to a pre-disaster or equivalent state is not feasible. According to thinking by San Francisco author Rebecca Solnit, in her book *A Paradise Built in Hell: The Extraordinary Communities That Arise in Disaster*, communities can overcome disasters, but by definition they cannot overcome catastrophes. The defining element that differentiates a disaster from a catastrophe is resilience. The elements that allow a community or system to adapt and overcome a disaster prevent any one event from becoming catastrophic and insurmountable.[12]

Objectives of Planning for Recovery

Why plan to recover?

After a disaster, many people in positions of authority face immense pressure to quickly make decisions and ensure that recovery action is taking place. The public expects quick restoration of the life they had previously known, and this pressure can often lead to decisions that are uncoordinated, not fully considered, stopgap in nature, or do not align with a community's agreed-upon long-term goals. Communication among various levels of authority and different systems may be lacking. Outside interests or financial constraints may place additional pressure on decision-makers. Decisions may be made without public input or public consideration. Outdated rules and regulations may present unforeseen problems, with no public policy tools available for change. Many ad-hoc groups may arise and make decisions of their own without awareness of or regard for other groups. Outside experts with little or no knowledge of local issues may come in to contribute their opinion, without sufficient knowledge of the local social context and with little regard to follow-through and consequences.

9 Envirenew Resilience Part 1 Report: Creating Resilient Communities (2012) http://quake.abag.ca.gov/wp-content/documents/resilience/toolkit/Envirenew%20Resilience%20Part%201%20Report_Creating%20Resilient%20Communities.pdf

10 Ken Topping (2012)

11 Disasters by Design: A Reassessment of Natural Hazards in the United States (1999). Joseph Henry Press.

12 A Paradise Built in Hell: The Extraordinary Communities That Arise in Disaster (2009), Penguin Books.

Many issues may arise in the recovery phase that can have repercussions in the community for decades.

Planners can play a large role in how quicly and effectively rebuilding happens and what the vision is for the process and outcome of rebuilding.

While specific recovery actions cannot be known or implemented until after a disaster, when the full consequences are assessed and the immediate needs of the community are met, there are many actions that can be taken before a disaster that assist and expedite recovery, such as adopting a Long Term Recovery Plan, creating a Recovery Task Force, and adopting a Recovery and Reconstruction Ordinance.

It is possible, however, to begin to understand, anticipate, and put planning tools in place before a disaster to minimize or eliminate many of these issues and conflicts. The region, as well as individual jurisdictions, has many tools at its disposal to "plan for recovery." Planning for recovery can result in an expedited recovery, due to coordinated communication, pre-approved recovery plans, and established planning systems and frameworks. Resilience and recovery planning in advance of a disaster may also result in a recovery phase that requires far less repair or restoration investment, because interjurisdictional efforts are not duplicated, money is spent in a coordinated manner, and pre-disaster mitigation has lessened damage. Anticipating where people will live and creating a post-disaster housing plan means fewer displaced residents, which can contribute to a more stable economy post-disaster. Planning with businesses on how to retain their services after a disaster can also stabilize the local economy, and minimize disruption to people's everyday lives.

Planning for recovery can also identify and prioritize actions for vulnerable populations and anticipate their unique needs. Lastly, the process of planning for disaster recovery before a disaster happens can result in a shared vision for the future, as stakeholders and residents begin to understand how they want their region to grow and what it could look like if a disaster expedites change and renewal. This can also result in a more empowered and informed public.

What planning/policy/legislative tools are available to support disaster recovery planning?

There are many tools currently in use today that can be used by stakeholders to plan for recovery. In considering these tools, we must keep in mind that the post-disaster decision-making landscape will likely be significantly different than the current landscape and so the way these tools are used may change. In examining existing tools it is also useful to consider which tools are not helpful or useful or may hinder recovery, and to begin to identify new tools that may be needed for long-term disaster recovery.

Planners largely have tools for managing land use, housing distribution, and the urban character in the recovery phase. Planners can play a large role in how quickly and effectively rebuilding happens, and what the vision is for the process and outcome of rebuilding. Some planning tools are below.

- General plans and specific plans: These will guide the vision of the city with or without a disaster, but must make it clear that in the event of a disaster, the vision will still be followed.
- Zoning tools such as overlay districts, nonconforming use regulations, special use permits, etc: Review existing zoning through the lens of recovery and rebuilding to identify potential conflicts or issues.
- Zoning for temporary housing and temporary commercial spaces: Temporary zoning has major implications for reconstruction and land use decisions. Understanding how this will work before a disaster will greatly aid recovery.
- Buyouts and financial incentives for where to build/not build, easements, etc.: Have a plan for where a buyout program might be a possibility and where funding might come from.

- Other tools: Historic preservation/historic district ordinances, historic landmark designations, and associated state and federal tax credits.

Who conducts this work?

Traditionally, work around disasters has been largely conducted by emergency managers. Yet as the practice of recovery planning evolves, the work involves new and different stakeholders throughout the recovery process. In addition to emergency managers, elected officials, city managers, county administrators, city/county attorneys, planners, community development staff, economic development staff, finance staff, and many other players in day-to-day government operations will likely play a large role in the recovery process. Additionally, a new type of professional is emerging that engages in recovery planning as a large percentage or all of their job. These professionals are largely still defining their role and developing support for their positions. The *National Disaster Recovery Framework* from FEMA identifies the role of a Recovery Manager and Recovery Coordinator at the local, state, and tribal levels along with a Federal Disaster Recovery Coordinator position within FEMA. These FEMA-designated roles can help inform what recovery professionals may look like.

As recovery planning evolves, these new professionals, as well as existing staff who will perform beyond their daily duties after a disaster, will need outlets for sharing information, learning new skills and knowledge, and making connections with other recovery professionals. The region needs a forum to gather these professionals including hosting lectures, learning events, and networking events, publishing newsletters, conducting research, setting standards for newly-defined tasks and job roles, and helping to match professionals to jobs and needy cities to professionals.

Schools may also begin to develop curriculum and new degrees, similar to the newly developed Graduate Programs in Sustainable Management at the Presidio Graduate School of Management.

A new type of professional is emerging that engages in recovery planning as their job. These professionals are largely still defining their role and developing support for their positions.

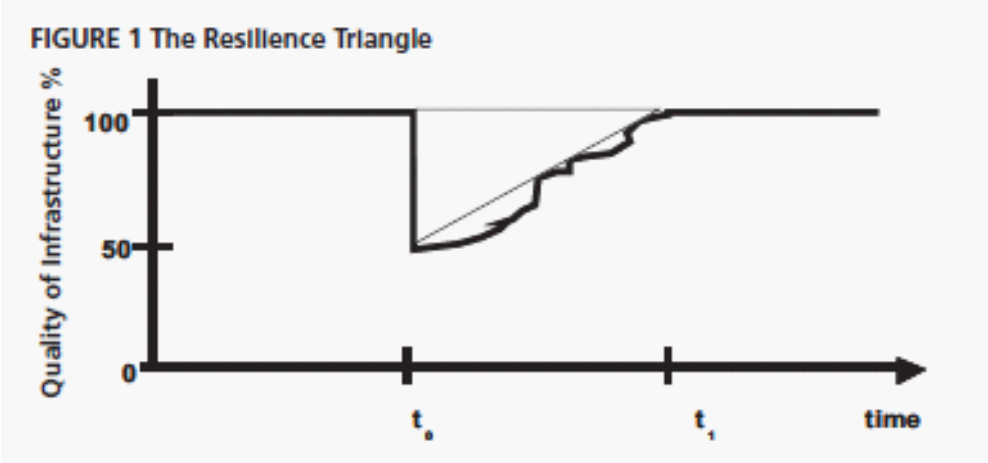
Mitigation and response planning to facilitate recovery

Appropriate and robust pre-disaster mitigation can mean the difference between a speedy, stabilized recovery process and a city or area that does not ever fully recover. Most disasters will cause the greatest amount of damage, by far, to the built environment. Damage to the built environment can cause injuries and deaths, displace residents from their homes and employees and employers from places of business, and disrupt the provision of basic services. Damages to infrastructure can impede the flow of people and goods and have spillover effects on multiple sectors. While not all damages can be anticipated and mitigated against, structurally mitigating homes and other buildings to withstand ground shaking can significantly lessen overall damage to the built environment, and mitigation to infrastructure can reduce loss of service.

Mitigating damages means a more intact built environment after a disaster, greater stability for residents and businesses, and far less money required for physical repairs. If people are able to stay in their homes because of minimal damage, they are less likely to leave the area and also do not require temporary housing. Minimizing physical damage to businesses allows them to begin functioning again more quickly and keeps the economy more stabilized.

While mitigation to buildings now may require an upfront investment, the money spent pre-disaster will likely prevent a much larger outlay of money that would be required post-disaster to make repairs or rebuild in a tightened and competitive construction market. One federally-sponsored study on multi-hazard mitigation efforts states that for every dollar invested in pre-event risk reduction, four

The Resilience Triangle illustrates the typical disaster cycle of sudden loss and recovery, with the triangle representing economic loss. Mitigating before a disaster reduces the size of the triangle, minimizing economic loss. Source: Conceptualizing and Measuring Resilience (Tierney and Bruneau, 2007)



dollars in response and recovery funds are saved.[13] Keeping the built environment more intact through mitigation also preserves the character of the urban area, maintains existing affordable housing, and minimizes the likelihood of a significant change in demographics after a disaster.

The way disaster response is conducted also has lasting impacts on long-term recovery. Traditionally, these two phases have been seen as separate. However, the connection between response and recovery should be made explicit, since they so heavily influence one another. Disaster response procedures set up structures, timelines, and precedents that can carry long into recovery.

Where emergency housing is located impacts where rebuilding and new development goes. Structures for decision-making may be set up hastily and place important decisions in uninformed hands or leave out important stakeholders. Short-sighted and compartmentalized decisions made to expedite rebuilding may not be coordinated regionally or fit in with long-term goals. Hours-long delays in decision-making during the response phase can translate into months-long delays during the recovery process. Actions during response can easily set a community on a difficult or unintended recovery path unless there is clear-sighted, long-term thinking taking place during response and communicated widely and effectively.

Quick, confident, and coordinated actions that foresee the long-term future, however, can be very powerful in instilling confidence and faith in residents and business leaders. If the community trusts that recovery will be effective and beneficial, people will be more likely to stay in the region. Transmitting this message quickly is highly important – if people perceive incompetence, lack of coordination, delay, or contentiousness in decision-makers, they will quickly lose confidence in the recovery of their community and are far more likely to leave. The same is true for businesses – small and large alike.

Quick, confident, and coordinated actions that foresee the long-term future can be very powerful in instilling confidence and faith in residents and business leaders.

Context

While the concepts of resilience and recovery planning may be largely universal and relatable to many different locations and conditions, the unique characteristics of the Bay Area allow us to tailor our understanding to the specific needs and vulnerabilities we face. The following briefly describes many of the major components of the Bay Area's assets and vulnerabilities – what we want to protect and preserve, what we can leverage for a successful recovery, and what types of threats we can anticipate that will disrupt our quality of life.

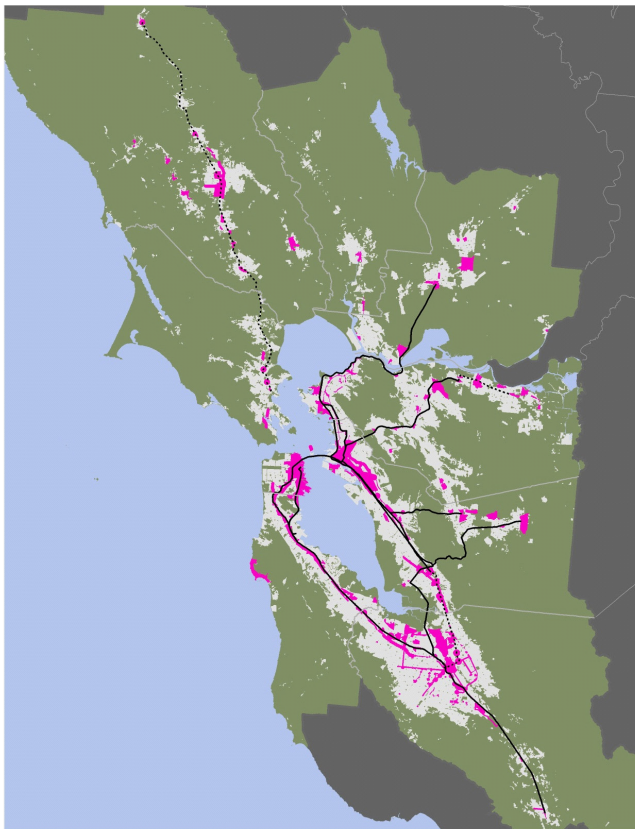
13 *Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities. Multihazard Mitigation Council/National Institute of Building Sciences, (2005)*

Bay Area Overview[14]

The focus of this study is the greater 12-county Bay Area, which combines the 9-county San Francisco Bay Area, consisting of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma Counties, plus the counties of Santa Cruz, Monterey, and San Benito around Monterey Bay. The greater Bay Area is extremely diverse in every sense of the word - it is culturally rich, with a large diversity of ethnic groups; it is geographically diverse, with the bay, salt marshes, estuaries, wetlands, and hills and valleys, all shaped by major and minor faults; and its urban character ranges from downtown San Francisco with its high-density, highly urban form to the preserved farmland and rural areas to the North and South including the area around Monterey Bay. This diversity is what makes our region a unique, beautiful, and desirable place to live, but this is also what creates many unique challenges to building regional resilience.

Population

In 2010, the greater 12-county Bay Area had a population of 7.88 million people, with 7.15 million people located in the San Francisco Bay Area and 732,000 people in the Monterey Bay Area. The three most populous cities in the San Francisco Bay Area are San Jose (Population: 946,000), San Francisco (Population: 805,000) and Oakland (Population: 391,000). The three biggest cities in the Monterey Bay Area are Salinas (Population: 150,000) Santa Cruz City (Population: 60,000) and Watsonville (Population: 51,000). While the core area around the San Francisco Bay is densely populated and has a highly urbanized character especially in the big three cities (San Jose, San Francisco and Oakland), the area north of the San Francisco Bay and around Monterey Bay have a lower population density and a more rural character, dominated by open space and agricultural land. The greater 12-county Bay Area population is expected to grow by 1.98 million people or 25% in the next 25 years taking the overall population to 9.86 million by 2035. The majority of this growth will be focused in the core urban areas around the San Francisco Bay within the urban growth boundaries to protect open space and agricultural land.

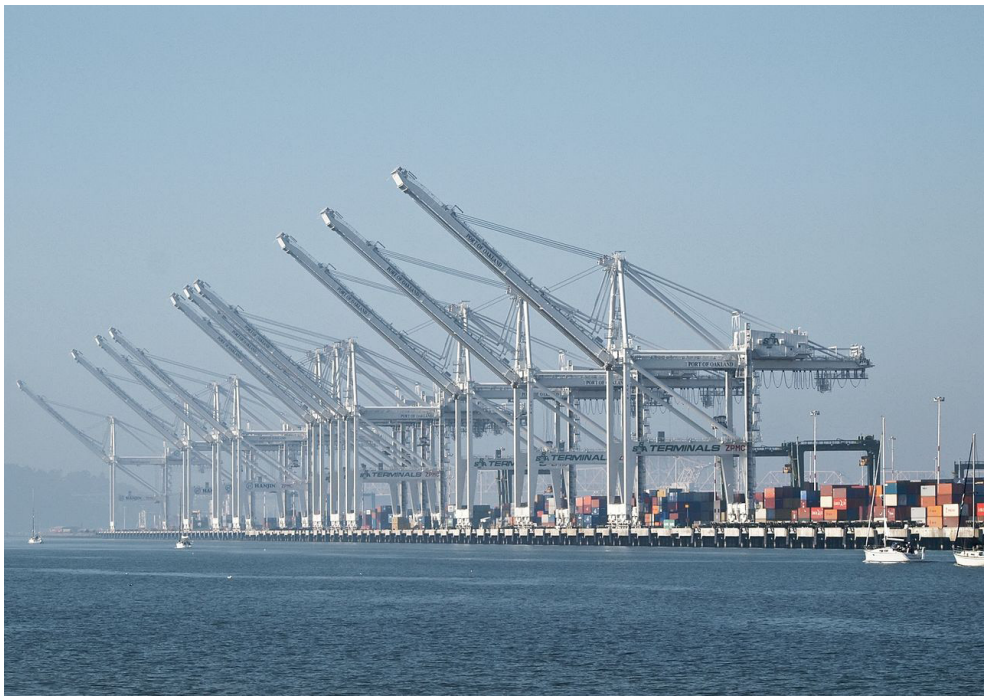


Bay Area map, illustrating areas of urbanized land (grey), non-urbanized land (green), and Priority Development Areas for future growth (pink).

Jobs and Economy

The greater 12-county Bay Area was home to around 3.71 million jobs in 2010. A large majority of jobs (3.39 million) are located in the San Francisco Bay Area with the biggest employment centers in San Francisco (569,000 jobs), San Jose (375,000 jobs) and Oakland (190,000 jobs). The Monterey Bay Area had a total of 329,000 jobs. San Francisco has the highest proportion of jobs to population, making it an employment hub for the region. The biggest employment sectors in the San Francisco Bay Area in 2010 were Professional Services, Government, Leisure and

14 Source for the following numbers are: ABAG (2012): Plan Bay Area, Jobs-Housing Connection Scenario (Draft) and AMBAG (2011): Envisioning the Monterey Bay Area, A Blueprint for Sustainable Growth and Smart Infrastructure, unless marked differently.



The Port of Oakland is the fourth busiest container port in the U.S., handling over 2 million freight tons annually. Photo source: Flickr user ingridtaylar

Hospitality and Manufacturing and Wholesale. The biggest employment sectors for the Monterey Bay Area were Educational Services and Health Care and Social Assistance, Retail Trade, Agriculture and Fishing and Professional Services.[15]

With the economy expected to grow in the next decades, employment for the 12-county Bay Area is expected to increase by 22% to 4.72 million jobs in 2035. A large proportion of those new jobs will be concentrated in the employment centers of San Jose, San Francisco and Oakland or in the development corridors that stretch along both sides of the San Francisco Bay.

The employment growth will be driven by the Knowledge-Based sector, which includes professional services, Information and Finance, the Health and Education sectors and the Leisure and Hospitality sectors. Many major corporations are headquartered throughout the region. Silicon Valley and the broader South Bay is home to many leading IT and high-tech companies making it a world-class business location. There are four national laboratories, over 30 public and nearly 50 private colleges and universities, and over a dozen seminaries. Students, faculty, visiting lecturers, and researchers come to the Bay Area from around the world to take advantage of the rich resources these facilities provide, and they also contribute greatly to our economy by being major regional employers.

15 US Census (2010)

Regional Infrastructure

The regional transportation system in the greater Bay Area is divided between the San Francisco and Monterey areas with some linkages between. The highly urbanized core area around the San Francisco Bay is serviced by multiple transit options, such as Bay Area Rapid Transit (BART), Amtrak, or the regional rail system operated by Caltrain as well as inter-county light rail and ferries. The areas outside the core area such as the North Bay, West Peninsula or the areas south of San Jose, are more dependent on bus services or the personal use of the automobile and the network of highways.

Much of this transportation system has been retrofitted over the 20 plus years since the 1989 Loma Prieta earthquake. Weaknesses, however, still exist and according to a recent study by the San Francisco Planning and Urban Research Association (SPUR), the failure or significant damage to any of these regional transportation systems could temporarily paralyze San Francisco or a wider regional area.[16] In addition to maintaining the currently existing infrastructure and its public transit network, expansion compatible with future population growth of the greater

16 *Lifelines: Upgrading Infrastructure to Enhance San Francisco's Earthquake Resilience. SPUR (2009)*

The Oakland Hills Firestorm in 1991 killed 25 residents and destoryed almost 4,000 homes. The economic loss has been estimated at over $1.5 billion. Source: www.sfgate.com

Bay Area is crucial. Developments in this direction are already being made with the planned expansion of BART to San Jose.

In general, there is a regional priority to increase non-auto modes of transportation, including walking, biking, and public transportation. Besides various transit improvements the region has seen developments to improve 'bikeability' with the San Francisco Bay Trail, which covers almost the entire shoreline of the San Francisco Bay. This improvement not only meets regional goals of sustainable development, but also provides alternate transit routes post-disaster.

The region has three major airports – San Francisco, San Jose and Oakland International, as well as Monterey Regional and Sonoma County Airports. San Francisco and Oakland International are directly connected to BART, while San Jose International is also well connected to other public transport.

The Bay Area has three ports located in Oakland, Richmond, and San Francisco. The Port of Oakland is the fourth busiest container port in the U.S., handling over 2 million freight units annually, and is served by the Burlington Northern Santa Fe and Union Pacific Railroads. Oakland loads and unloads over 99% of the containerized goods that move throughout Northern California. The Port of Richmond handles oil tankers and associated shipping, as well as automobiles and other dry and liquid bulk goods, and is the leading port in the San Francisco Bay Area in tonnage of automobiles and bulk liquids. The port has five city-owned and ten private terminals and is served by the Burlington Northern Santa Fe and Union Pacific Railroads.

The Port of San Francisco handles mainly cruise ships, passenger ferries, and commercial and sport fishing activities on the northern waterfront. Fisherman's Wharf is the center of Northern California's commercial and sport fishing fleets, and is a key tourist destination. Pier 45 houses the West Coast's largest concentration of commercial fish processors and distributors. All three ports play a major part in the regional economy, not only as hubs of trade, but also as employment centers.

The region has five major oil refineries in Benicia (Valero), Martinez (Shell and Tesoro), Richmond (Chevron), and Rodeo (ConocoPhillips), and depends on multiple power plants, wastewater treatment plants, waste management locations, and an extensive telecommunications system located throughout the Bay Area. The majority of the Bay Area depends on Pacific Gas and Electric (PG&E) for power (some jurisdictions, including Palo Alto, Marin, and Alameda, generate their own), while multiple entities provide water, wastewater, and waste services, which vary widely in size and scope. Both the San Francisco Bay and Monterey Bay Areas are serviced by a dense network of PG&E gas transmission pipelines.

Natural and Manmade Hazards Affecting the Bay Area

While the focus of this Initiative was on the effects of earthquakes on the region, other natural and manmade hazards can have regional consequences requiring a recovery effort similar to that for an earthquake. These threats include tsunamis, firestorms and windstorms, prolonged rain events with widespread flooding and landslides, droughts, pandemics, terrorist attacks, catastrophic events caused by aging infrastructures and systems failures and technological disasters.

There is a need for additional assessment capabilities and studies of impacts particularly to infrastructure from earthquakes and other major disasters, including vulnerability of the Bay Area water supplies to Delta levees and flooding from a super storm, to better determine restoration requirements, timelines, and costs in advance of an event. There is also a need to identify vulnerable neighborhoods that might be most heavily impacted by various earthquake events in the Bay Area. Focusing on areas that may suffer significant structural damage, housing and business loss could stimulate pre disaster recovery planning and discover organizational, programmatic, financial, and legislative gaps.

Earthquakes

The region is particularly vulnerable to large earthquakes. There are numerous major active faults in the region with a combined thirty year probability of a major earthquake in excess of sixty percent. Two fault systems pose significant risk in the Bay Area. The Hayward Fault runs about 74 miles long mainly along the western base of the hills on the east side of San Francisco Bay through densely-populated Richmond, El Cerrito, Berkeley, Oakland, San Leandro, Hayward, Fremont, and San Jose.

The San Andreas Fault, which cuts through Tomales Bay in Marin, runs offshore as it passes San Francisco and returns to shore as it passes through the San Francisco Peninsula,

Crews work to stabilize a hillside after heavy rains caused a landslide in densely popualted North Beach, San Francisco, forcing evacuations.
Photo source: www.sfgate.com

is the other significant regional threat. A large magnitude earthquake on either the Hayward or San Andreas Faults would cause significant damage to the region.

Soil liquefaction is a significant problem throughout much of Bay Area. Large areas around the Bay have been filled and now support residential and commercial buildings and infrastructure assets. Often the soils compaction at these sites is not sufficient to prevent liquefaction. Underground infrastructure assets—water and sewer pipes, natural gas and liquid fuel pipelines, power distribution lines, and communications cables and equipment are particularly vulnerable to liquefaction, as well as above ground structures. Deep soil basins, such as in Silicon Valley, can amplify ground shaking. Bridges, tunnels, and roadways will be impacted by disaster damage and debris. Large proportions of older buildings are not retrofitted for earthquakes and will be at risk, and others will be subject to land and mudslides. Along the coastal areas, there is the threat of tsunamis. For detailed information on earthquake and tsunami threats and impacts, see the ABAG website at http://quake.abag.ca.gov/.

Catastrophic Rain Events and Major Floods

So-called "pineapple express" storms which start off the ocean near Hawaii can cause a "super storm" that can result in a rapid "mega flood" which, in turn, could trigger a

catastrophic failure of many of the old and degraded levees in the 1100-mile area in the Sacramento-San Joaquin Delta, originally built to control floodwaters and increase farmland. Such a flood would submerge hundreds of square miles, impacting and washing away communities and some of the region's (and the nation's) most productive farmland.

Fire and Windstorms

Between late November and early March strong Pacific storms can bring both substantial rainfall (saturating and weakening soil) and strong wind gusts that can cause trees to fall on power lines, sometimes affecting hundreds of miles of coast and interrupting essential services for up to several days in some more remote localities. In the spring and fall, strong offshore winds often develop. These winds are an especially dangerous fire hazard in the fall when vegetation is at its driest. Examples of firestorms are the 1923 Berkeley Fire and the 1991 Oakland-Berkeley Hills Fire (Tunnel Fire). In the last 120 years, there have been over 100 significant urban/wildland interface fires in the East Bay hills alone.

Mudslides and Landslides

Some geologically unstable areas have been extensively urbanized, and can become mobile due to changes in drainage patterns and grading created for development. These are usually confined to small areas, but there have been larger problems in the Santa Cruz Mountains.

Climate Change

In coming years, the Bay Area will be subject to increasing effects of climate change. The extensive coastline and bay shoreline will be subject to rising sea level, leading to more frequent and more severe temporary flooding as well as eventual permanent inundation. The Bay Area will also experience more frequent and more severe storms and storm surges, increased risk for wildfires, and increased temperatures, heat waves, and air pollution. Increased snowmelt earlier in the season could flood the delta, and beaches will experience increased erosion and sand loss.

Sea level rise will put many regional assets at risk, including transportation, water, and power infrastructure, and will impact shoreline ecosystems and recreational space. Existing flood control measures will soon become inadequate, bearing greater loads and experiencing overtopping.

Disaster recovery is not separate from many of the tasks that cities pursue today – it is the process of city-building and economic development, amplified and intensified.

Multiple Hazards

Some locations in the Bay Area are located in areas that have conditions that make them susceptible to multiple hazards. In the case of earthquakes, many areas will experience not just ground shaking, but liquefaction, landsliding, surface fault ruptures, or tsunamis. Many of the same areas that will experience sea level rise are also areas that are highly vulnerable to liquefaction, and so will need to consider multiple hazards in the future. Fire ignitions after an earthquake due to damaged natural gas valves may cause significant damage in areas particularly susceptible to firestorms. In planning for recovery and resilience, hazards must be considered together, as planning efforts may be wasted if all hazards are not considered.

Conclusion

We have placed the work of the Regional Resilience Initiative and the papers that have resulted from this initiative in context and embedded in theory helps to validate our work. This standard definition and theory of resilience within the region provides a platform for all additional work initiated by this project and helps create a baseline standard for discussing the idea of resilience. We can expand the conversation around resilience beyond the well-known realms of mitigation and response also encourages new professionals to join in the conversation, which helps ensure a more complete recovery process. Disaster recovery is not separate from many of the tasks that cities pursue today – it is the process of city-building and economic development, amplified and intensified. Resilience is largely

about maintaining and improving the Bay Area's quality of life, despite natural events that may have the potential to disrupt our most significant systems. Presenting this more holistic vision allows resilience-building actions to become more integrated into all aspects of developing and planning for our region. •

Regional Resilience Initiative

Governance Policy Paper

Photo source: http://www.freeimageslive.co.uk

earthquake and hazards program
Association of Bay Area Governments

Introduction

A major Bay Area earthquake will have lasting impacts on our region, altering our built environment, economy, and many other characteristics that contribute to the Bay Area's high quality of life. How will Bay Area leaders work together to plan for and address the impacts? Who are the major players in this work? How will cities and counties come together with business, nonprofit and community partners to rebuild our region and restore our economy? What is the message and image we will send to the outside world after an earthquake? Will it be one of competition for limited resources or will we work together in the interest of the entire region and collectively advocate for our common needs? How will priorities be set?

Stakeholders who participated in ABAG's Regional Resilience Initiative process indicate that a financing strategy to address rebuilding of the Bay Area's economy, infrastructure and housing is a regional necessity. In addition, advocacy for state and federal funding, along with needed legislative and regulatory changes could be successfully crafted through a consensus process. ABAG's role has been to examine how we come together as a region to grapple with these questions and build regional resilience.

Governance in the context of this paper refers to the broad spectrum of regional actors, stakeholders, and institutions that will be involved in regional recovery from an earthquake. This paper addresses the major issues uncovered during the Regional Resilience Initiative about setting priorities, making decisions, and implementing policy. Our key recommendation is to facilitate a regional resilience policy forum to enhance resilience. The desired end product is a region that makes coordinated decisions and works for common resilience goals, at both the jurisdictional and the regional levels.

The San Francisco Bay Area governance structure is complex, with: 101 cities, nine counties, and hundreds of special districts with overlapping jurisdictional boundaries. Four regional agencies are responsible, respectively, for land use (Association of Bay Area Governments), transportation (Metropolitan Transportation Commission), air quality (Bay Area Air Quality Management District), and shoreline development planning, programming, and regulation (Bay Conservation and Development Commission). The agencies connect through the Joint Policy Committee (JPC). As well, many other organizations and agencies have a stake in our region's recovery, including state and federal agencies, businesses, nonprofits, and faith-based and community organizations. Their interests should be folded into local and regional discussions and planning efforts.

The Bay Area has already developed a nationally recognized structure for emergency response to disasters. The planning that supports this response includes diverse stakeholders. [1] The long-term recovery process, however, is more complex and less defined. Few jurisdictions have developed recovery plans and even fewer plans or studies have been performed to develop a regional recovery process. The time period for recovery can last decades, and all levels of government and the private sector have roles to play. The recently released *National Disaster Recovery Framework* from Federal Emergency Management Agency (FEMA) provides some guidance for recovery roles and responsibilities, but maintains the emergency response in the city-county-state-federal structure. As a region with an interconnected economy, the Bay Area has a long history of effective planning across counties. How should we organize to continue this tradition to build a more resilient region and plan our recovery from earthquakes and other regional scale disasters?

Long term disaster recovery begins immediately after a disaster. A recovery plan needs to be adopted by the region with an assertive strategy for securing supplemental

1 During the 1991 Oakland-Berkeley Hills Fire (Tunnel Fire), regional first responders could not effectively coordinate to fight the blaze. Consequently, Bay Area legislators, Tom Bates and Nicholas Petris, sponsored legislation requiring the California Office of Emergency Services (now CalEMA) to develop a Standardized Emergency Response System (SEMS)—a comprehensive system for multi-agency and multi-jurisdictional response to emergencies. This system was taken to scale and adapted nationally as the National Incident Management System (NIMS). Through SEMS aid and resources are requested by cities to the county, by counties to the state, and finally by states to the federal government. Response coordination is organized and managed effectively. In addition, the Urban Areas Security Initiative has developed five Regional Emergency Coordination Plans.

federal assistance. Given the federal deficit and increasing frequency of climate change related disasters, this assistance will be increasingly difficult to obtain in the future; consequently, the regional recovery plan will need to be comprehensive, detailed, and as accurate as possible. Community and elected leaders must recognize that few Bay Area assets, whether housing or infrastructure, are insured for earthquake damages. The region will rely upon a recovery plan that is funded from local, state, and federal sources – but also needs to provide security such that private property and business owners choose to re-invest.

Jurisdictions can and should plan for their own recovery. To adequately address regional recovery objectives, we need more than a few local plans. We need a coordinated regional effort that balances the needs and priorities of cities and counties. Only through coordination can a recovery plan be expedited that includes interjurisdictional and local priorities.

We recognize that regional agencies simultaneously grapple with similar questions about strengthening the regional economy and adapting to a rising bay. It is ABAG's intention that these efforts coalesce into a unified campaign to build resilience to all major threats. The recommendations are crafted as a regional policy agenda specific to earthquake risks, but can have a great impact if also applied to support and strengthen regional policy around all threats. Many of the recommendations are similar to those made by other policy bodies to address other regional disasters or threats.

The Overarching Goal: Regional Communication and Collaboration

Recommendations from ABAG's Regional Resilience Initiative interview process confirm both the research and workshop findings that regional coordination and decision-making can speed disaster recovery and improve resilience if accomplished before the unexpected occurs. There is region-wide agreement that crises are the worst time to come together to craft public policy. Though many small and large cities make up the region, our economy shares physical and social systems. Environmental issues and regulations cut across jurisdictions and require coordination among levels of government and agencies well before these systems are disrupted. More than half of the Bay Area residents cross county lines to commute to work, making housing workers a regional concern.[2] Many assets are regional, including our transportation, power, sewer, water, and communications systems.

Our ability to recover from a disaster as a region is uneven. The capacity to fully prepare for disruptions is a challenge for many local jurisdictions given current economic difficulties. This uneven ability can impede a consistent, region-wide recovery. Many municipalities don't have the financial resources to fund or manage disaster recovery; all would benefit from a regional approach to overcome resource disparities and support regional neighbors. Best practices and technical assistance for planning can be effectively provided at a region-wide level to coordinate regional information in support of local decisions and needs. Examining recovery at a regional level can strengthen restoration of local economies, address environmental concerns, and project confidence that encourages private sector business and financial institutions to continue to invest in the region.

The Regional Resilience Initiative's participants agreed that more region-wide coordination could support resilience-building at the local level. Bay Area leaders coming together to identify and address these issues now will reduce disaster impacts and promote an accelerated recovery that is equitable and strengthens our economy. Though commonly agreed upon issues emerged in the process and are presented below, findings from the stakeholder participation process must be further explored to plan better implementation and overcome barriers to disaster recovery. Our recommended actions begin to suggest ways in which to prioritize further research and action.

The overarching drive towards increased regional communication and collaboration, facilitated by the region while driven by jurisdictions, spurs ABAG's recommended actions in this paper, the other issue papers, and the Ac-

2 *The Bay Area Regional Economic Assessment. A Bay Area Council Economic Institute Report (October 2012)*

tion Plan. Improved regional communication will help facilitate our recommended actions, and in mutual support, each of our recommended actions work to increase regional communication. All issues and recommendations laid out aim to use a regional forum to increase collaboration to enhance jurisdictions' ability to be more resilient to disasters.

Goal #1: Create a Regional Resilience Policy Forum

No regional coordinating body or disaster recovery framework is currently in operation to facilitate sharing and decision-making in the aftermath of a major disaster, although FEMA's *National Disaster Recovery Framework* and California Emergency Management Agency (CalEMA)'s *Regional Emergency Coordination Plans* may provide guidance on such a framework. Jurisdictions independently work their way through FEMA regulatory system and make recovery decisions on their own, based on their current situation. The urgency for quick action and competing demands for time may inhibit decision-makers' awareness of and access to information about other actions occurring around the Bay Area, or where their rebuilding decisions fit within the regional agenda. This can lead to fragmented recovery efforts and competition for federal funds, particularly an issue with the restoration and recovery of regional assets, such as infrastructure systems. A forum to help coordinate and guide jurisdictions within the region could not only speed restoration of regional services but expedite jurisdictional recovery as well and ensure that the recovery process fits with larger regional goals.

G-1: Use existing intergovernmental committees to convene jurisdictions and facilitate communication around disaster recovery collaboration

The Joint Policy Committee (JPC) is tasked with overseeing and coordinating the work of the four regional agencies, including Association of Bay Area Governments (ABAG), the Bay Conservation Development Commission (BCDC), Metropolitan Transportation Agency (MTC), and the Bay Area Air Quality Management District (BAAQMD). Since recovery spans all four agencies, the JPC, as one option, is uniquely poised to facilitate a regional conversation around recovery, including local stakeholders from all four agencies.

Additionally, ABAG's Regional Planning Committee (RPC) is an existing body that convenes regularly to bring together regional stakeholders around planning issues in the Bay Area. The RPC seeks to represent the greater interests of the Bay Area and find planning solutions that consider and accommodate a wide variety of Bay Area stakeholders. Since the Committee is composed of Bay Area elected officials representing jurisdictions and special districts, with a diverse stakeholders and the nonprofit community, the perspectives and opinions uniquely represent the local perspective, yet seek regional solutions. Such an existing body, along with a staff-level task force, could serve as the structure for convening jurisdictions and facilitating recovery planning that comes up from the jurisdictions, rather than down from the region.

The role of a regional convener is to create a forum for policy discussions and information sharing, as the jurisdictions direct the content. Such a regional facilitator could involve varied stakeholders, convene in person on a regular basis, provide timely information, and facilitate projects and initiatives designated by the stakeholders. Desired outcomes would be more involved and informed stakeholders, consensus on major recovery decisions, and a coordinated regional policy platform. Providing a platform to develop disaster recovery planning could facilitate regional, state, and federal policy changes that benefit all jurisdictions.

G-2: Examine the feasibility of a regional disaster recovery framework

Case Study: Houston-Galveston Area Council

Following Hurricane Ike in 2008 the Houston-Galveston Area Council of Governments (HGAC), a 13-county region with more than 5.7 million people, helped rebuild its region. The COG's robust databases on infrastructure and household information provided decision makers with damage estimates for the whole region within days. The COG acted as an impartial mediator as funding and programmatic decisions were made, and facilitated regional discussions about economic development and needed structural protections such as seawalls.

We had people and staff who were not heavily impacted by the storm, while a lot of our communities were literally digging out—trying to clear roads and get sewage plants back online—we were able to focus on some of those high-level needs we knew would be important as people moved at the federal and state levels to allocate disaster funds.

– Chuck Wemple, HGAC's economic development program director

Within a broader forum, a regional disaster recovery framework could allow jurisdictions to develop procedures for making decisions about operations or processes as well as financial management issues that cross jurisdictional boundaries or are too cumbersome for one jurisdiction to manage alone. Jurisdictions will make many decisions independently based on their unique needs, and will largely run their recovery process within their own boundaries. Agreeing upon larger regional goals can help the Bay Area present a coordinated coalition to better attract and utilize resources and assistance.

A decision-making structure or framework could also speed the transition between disaster response, which has an existing regional system, and disaster recovery, where a system needs to be developed. Facilitating a transition ensures that communication and coordination take place and that decisions made during disaster response are considered in recovery, and allows recovery stakeholders to communicate their goals and priorities during the response phase. Often, decisions made during response have long-term repercussions on recovery, such as when rebuilding is allowed to take place in highly vulnerable areas, driven by the desire to return to "normal" as fast as possible. Having a structure in place for communication and decision-making that has consensus-driven goals during the response phase can help avoid mistakes in recovery. Certainly, rebuilding in recovery must take into account future hazard mitigation, as well as long term community sustainability.

A regional recovery framework must incorporate input from a wide variety of stakeholders. The roles of local, state, and federal agencies and regional organizations in recovery vary and overlap; cities and local jurisdictions must integrate the practical application of resources from the public and private sectors and institutions that are partnering in the recovery collaboration. Outreach to local community political leaders is also needed in recovery planning, along with boosted public outreach and education campaigns for community resilience, with defined recovery guidance measures and standards.

This framework may take the form of a written recovery plan, outlining procedures, roles, and tasks for all stakeholders involved, similar to FEMA's recently released *National Disaster Recovery Framework*. It should align with and incorporate other established recovery structures and concepts, such as the National Academy of Science's *Disaster Resilience: A National Imperative*. Model post-disaster recovery plans, such as those released by the American Planning Association, San Francisco's *Resilient City Initiative*, and Florida's *Post-Disaster Redevelopment Planning: A Guide for Florida Communities* could also serve as templates for a regional plan.

This framework should also be flexible enough to consider other long-term growth issues, such as economic chal-

lenges, environmental sustainability, sea level rise, and other threats to the Bay Area's long-term quality of life. However, the final product should be guided by stakeholders' needs. The framework can provide information to help local jurisdictions identify staff and leadership roles as a part of local recovery plans, with guidance on how to fulfill those roles. If operational authority at both the regional and local levels is identified before a disaster, responsibility and accountability are defined, ensuring that the recovery process succeeds.

G-3: Integrate resilience policy into existing current plans and practices

Many elements that support resilience and recovery can be integrated into existing regional and local work. The region should seek ways to integrate resilience work with existing projects to facilitate increased resilience without significant additional resources. Regionally, disaster resilience policy should be incorporated into ABAG's Sustainable Communities Strategy (SCS), the Joint Policy Committee's work on climate change, and other regional initiatives towards sustainability, economy, land use planning, and quality of life. These efforts create a regional vision with the potential to effectively guide disaster recovery.

For example, through Plan Bay Area[3] the Bay Area has already begun developing a vision for its future which will be carried out over the coming decades to create a more sustainable, equitable, prosperous place to live. The plan is a blueprint for sustainable future growth; this vision could be incorporated as we rebuild damaged neighborhoods and cities. The Bay Area has a rich history of visioning and implementing plans. We decided to reroute the Cypress freeway to better connect the Port of Oakland and enhance the West Oakland neighborhood; the Embarcadero and Central freeways in San Francisco were torn down to better connect the city with the waterfront and revive nearby neighborhoods. We know that such decisions can take years to reach and are hotly contested. However, having a common vision and guiding principles before a disaster can help guide and hasten our decision making process after the disaster.

Local leaders already grapple with difficult issues in their daily work, including finding affordable housing solutions, attracting good jobs and businesses, competing with other jurisdictions for tax dollars, providing services for residents, and reducing greenhouse gas emissions. Language and policy on recovery can be integrated into existing city-level documents to formalize policy and procedures rather than requiring new initiatives.

Discussion of recovery can be integrated into the General Plan's Community Safety Element during a routine General Plan update, and Climate Adaptation Plans can be updated to acknowledge liquefaction as a threat that is often concurrent with areas vulnerable to sea level rise. Such efforts provide a solid basis for policy and action for disaster recovery. Robust, well-developed plans for the future adopted now can serve as blueprints for the future, whether or not a disaster hits. If a disaster does hit, the plans serve as a framework already in place for a recovery plan and reduce the need for a lengthy planning process after a disaster, which delays recovery.

Goal #2: Develop Regional Resilience Leaders

Initiative stakeholders felt that disaster recovery was well handled by emergency managers. However, long-term recovery can extend years or even decades after response ends and requires many specific capabilities and expertise in addition to those required of an emergency manager. Disaster recovery actively requires input from the whole community and requires coordination among a wide range of departments over a very long period of time. It also re-

3 Plan Bay Area is an integrated regional land use and transportation plan that combines the Sustainable Communities Strategy (SCS), Regional Transportation Plan (RTP), and Regional Housing Needs Allocation (RHNA) into a single vision for the Bay Area. This plan identifies anticipated growth and where it should be focused in coordination with jobs and transportation. Jurisdictions participate by nominating Priority Development Areas (PDAs) to focus future growth. ABAG and MTC presented multiple growth scenarios and solicited feedback from ABAG Executive board as well as the general public to arrive at the preferred growth plan, the Jobs-Housing Connection Strategy.

quires knowledge, understanding of and coordination with state and federal agency policies, programs and both public and private funding sources.

In the recovery phase, many local government staff and officials will find themselves conducting similar tasks and fulfilling similar roles as they do today – only with the added pressure of how to permit quickly the rebuilding of housing, businesses, their own buildings, their economy, and major infrastructure systems. Everyday tasks will become elevated with higher stakes, more and impassioned input, and extreme pressure on quick implementation. The fiscal base of many cities will be severely damaged, necessitating the layoff of staff. They may also find that they are asked to perform tasks well beyond the original scope of their jobs. Helping staff and officials understand their post-disaster responsibilities before disaster hits can help ensure that adequate authorities and tools and are prepared for what may be needed in the recovery phase. Identifying champions and professionals with expertise in recovery policy and are adept in working with senior officials can assist recovery in strategic roles that leverage their skills.

G-4: Lead reconnaissance missions for local leaders, staff, and community stakeholders to areas undergoing disaster recovery

Many of our local leaders who have led their jurisdictions to greater resilience began to do so after they experienced firsthand the disaster recovery process, such as visiting New Orleans after Hurricane Katrina. Many of our region's earthquake planning champions were staff and elected officials during the Loma Prieta earthquake and the Oakland-Berkeley Hills Fire (Tunnel Fire); they vividly remember the challenges they faced in responding to and recovering from those disasters with little training or planning. For those who haven't experienced them firsthand and without recent local disasters in recent collective memory, disaster recovery tends to be abstract. It becomes easy to ignore risks and focus on short-term, urgent issues. However, seeing, speaking to, and relating to official counterparts in disaster-stricken cities can make tangible the reality of the recovery process and spur action at home. Experiencing the aftermath of a disaster can be a strong motivator for elected and community leaders to assume new responsibilities and guide action in their jurisdictions.

Professional groups already conduct such reconnaissance trips. The Earthquake Engineering Research Institute's (EERI) *Learning from Earthquakes* Program sends out reconnaissance teams into the field after major disasters to assess damage, document initial observations, and assess the need for follow-up research. The region could consider working with EERI to expand reconnaissance teams to include local and community leaders and appropriate staff. SPUR also leads annual learning trips for members, which could be geared towards disaster recovery as suitable.

Goal #3: Use Information and Data Analytics for Disaster Resilience

Jurisdictions need many different types of information after a disaster. Local officials must have essential damage impact information for utilities, government, and private sector organizations to assist with decisions about outages, damaged infrastructure, transportation disruptions, and related debris and transportation hazards issues. The same damage impact information can support decisions about long-term sheltering, temporary housing, and expedited disaster assistance. Information needs may range from information on individual buildings to a general picture of damage in other parts of the region.

Activities underway in the Bay Area support this information sharing, and existing technologies can be leveraged for this purpose to expand current efforts. More focused development of and integration with existing capabilities are called for to advance a system that communicates a common operating picture and supports regional situational awareness.

G-4: Establish and maintain a recovery clearinghouse to house resources for pre-disaster recovery planning and post-disaster recovery guidance

Currently, there is no central repository for information on long-term recovery, so knowledge distribution throughout the region is uneven and lacking. Many stakeholders simply don't have sufficient information to plan for recovery and don't know where to find the information. The region could benefit from an informational clearinghouse to house and share case studies, best practices, model ordinances, checklists, recovery plans, financing strategies, and other forms of guidance to help stakeholders better understand the recovery process and to have easily accessible tools to enact relevant policy, before and after a disaster. A sample of such information was shared at ABAG's 2012 Fall General Assembly for all participants and regional members.

The clearinghouse should not just collect information, but direct stakeholders to the information they need most at the times they need it most –for example, just-in-time checklists, ordinances, and other information readily accessible to them immediately after a disaster strikes. The clearinghouse should allow for contributions and updated content from the users within the region as it is developed, which can be vetted and organized by clearinghouse managers. Staff can also provide technical assistance so users can understand what kind of resources and information is available to them at critical points in their recovery process. For example, distributing FEMA reimbursement checklists before money is spent to ensure that jurisdictions comply with reimbursement requirements.

In addition to collecting information and tools, the clearinghouse should manage regional hazards data and data on the recovery process. Data by itself, such as building damage data, does little for stakeholders who need to make decisions quickly and under immense pressure in the post-disaster period. The data needs to be analyzed to tell its story and find its role in the larger disaster and recovery narrative. Specialized analysis can detect trends and patterns of land and building damage, population movement, and recovery trends; such analysis can inform policy decisions and plans and incite action. For example, mapping analysis can indicate to jurisdictions areas of concentrated damage, where significant demolition and rebuilding will need to occur, and where services for residents will need to be concentrated. At a regional scale, identifying jurisdictions with disproportionately severe damage can help inform where funding for rebuilding may go. Elected officials and the media can use maps, charts, or tables, or even narratives and statistics to convey understandable damage and recovery data. Analyzing data and crafting useful messages for varied stakeholders requires technical skills as well as understanding of who needs what information, at what time, and how to convey it effectively.

ABAG's Planning Group currently manages and analyzes land use, planning, and population data for the region and uses this data to work with local jurisdictions to meet long-term regional goals. Expanding the type of data sets it manages and analysis it performs to include disaster data, such as HAZUS™ results or vulnerability analysis before a disaster, and damage data after a disaster, would enable local jurisdictions to more fully understand disaster planning implications without major significant resources. •

Regional Resilience Initiative

Housing Policy Paper

Photo source: www.nbcnews.com

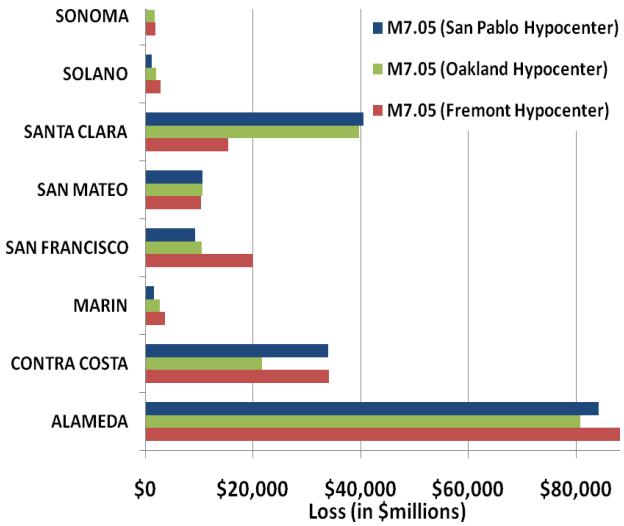
earthquake and hazards program
Association of Bay Area Governments

Background

As one of the most seismically active regions in the country, California has developed strong building codes that will largely prevent loss of life in a major earthquake. These codes were developed over many decades and have been continually improved as earthquakes have demonstrated the need for new techniques and stricter codes. However, these codes do not guarantee that even a new building will be inhabitable after earthquakes and many older buildings built before modern codes have not been upgraded.

In a major earthquake on the Hayward or San Andreas faults, it is estimated that five percent of the Bay Area's housing stock—approximately 150,000 units—will be immediately and permanently damaged.[1] Nearly two-thirds of these losses will be in multi-family apartment buildings. Approximately $85-90 billion in direct residential building-related economic losses are expected in this scenario.[2] Compounding the problem, fires that occur after an earthquake can consume many more units, especially if fire suppression systems are not upgraded to survive an earthquake.

Rebuilding and repairing damaged housing after an earthquake in the Bay Area will be particularly challenging since only six to seven percent of the loss from ground shaking will be covered by residential earthquake insurance.[3] This is in contrast to disasters in other areas where a greater proportion of losses would be covered by insurance. For example, if the same earthquake were to occur in the Midwest, 60-80 percent of losses would be covered by insurance because earthquake coverage is part of a standard insurance policy.[4] In Hurricane Katrina, 50 percent of losses were covered due to the availability of and requirements for flood insurance under the National Flood Insurance Program.



The Bay Area is dramatically underinsured for future earthquakes. Source: 1868 Hayward Earthquake: 140-Year Retrospective, RMS (November 2010)

While the greatest loss of housing in the Bay Area will occur primarily along either the Hayward or San Andreas fault, the impact will be felt region-wide. Following the earthquake, many uninhabitable units may be demolished quickly or abandoned. To accommodate displaced persons, temporary housing in offsite locations may need to be constructed. Displaced residents will seek alternate housing options across the region, impacting commute patterns and housing prices, and small business recovery. Housing is the key to a strong region and will impact the recovery of businesses and the strength of our regional economy.

It is particularly important to consider the needs of low-income residents, who have fewer resources to handle the challenges of a major earthquake. Low-income residents who live in flatland neighborhoods in cities such as Richmond, Oakland, San Leandro, and Hayward and parts of San Francisco will be particularly impacted due to liquefaction, proximity to the fault, and the preponderance of vulnerable housing types in these neighborhoods. Some low-income residents may be permanently displaced out-

1 Shaken Awake! Estimates of Uninhabitable Dwelling Units and Peak Shelter Populations in Future Earthquake Affecting the San Francisco Bay Area, ABAG, (2003); and ABAG Housing Data,(2009)

2 1868 Hayward Earthquake: 140-Year Retrospective, RMS (November 2010). Modeled loss estimates consider post-event loss amplification. All loss estimates are for property insurance coverage only. All losses above include shake and fire following earthquake. Note: This estimate includes losses for Alameda, Contra Costa, Marin, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma counties only. Similar losses are expected for a San Andreas fault scenario earthquake.

3 Ibid.

4 Ibid.

side of the region due to loss of affordable housing options and temporary loss of jobs. In some of these areas, it will be difficult to rebuild housing in-kind and future climate change effects like sea level rise, storm surges, increased flooding, and liquefaction may make the decision to rebuild in certain areas unattractive.

The challenge for policy makers is to address the present need to create and maintain affordable housing while also improving the seismic resilience of existing housing so that quality affordable housing can be maintained for the long-term. Looking to the region's Priority Development Areas (PDAs) as defined in Plan Bay Area (see sidebar), is a good place to start for reconstruction. Before the earthquake these neighborhoods of regional significance can be strengthened and made more resilient to provide quality housing options and preserve regional investments for many years to come. After the earthquake, these neighborhoods can provide a blueprint for planning and reconstruction for the region. Some of the recommendations in this paper are verytechnical and specific, reflecting the advanced state of knowledge in the region on housing mitigation and recovery needs. A major barrier to implementation of many of these needs is adequate financing and public will.

Priority Development Areas

ABAG and MTC have developed, with other regional agencies, local governments, and other stakeholders, *Plan Bay Area*, the region's first Sustainable Communities Strategy (SCS), an integrated long-range transportation and land-use plan for the San Francisco Bay Area. A cornerstone of the SCS are Priority Development Areas (PDAs): locally-nominated and regionally-supported infill development opportunity areas within existing communities.[1] They are generally areas where there is local commitment to develop more housing along with amenities and services to meet the day-to-day needs of residents in a pedestrian-friendly environment served by transit. Over the next 30 years, the 169 PDAs in 72 jurisdictions across the region are expected to accommodate 80percent of new housing and 66 percent of new jobs on little more than four percent of the region's land.[2]

1 San Francisco Bay Area FOCUS Program. http://www.bayareavision.org/initiatives/prioritydevelopmentareas.html

2 Jobs-Housing Connection Strategy. http://scs.abag.ca.gov/pdf/JHCS/May_2012_Jobs_Housing_Connection_Strategy_Main_Report.pdf

Goal #1: Facilitate a rapid housing recovery that fulfills regional goals of enhanced quality of life

PDA's provide a good framework for aligning investments to improve the region's disaster resiliency with regional goals for future increased housing and transportation choices, economic prosperity, and environmental enhancement. The qualities that make PDAs and neighborhoods enjoyable places to live can also promote more resilient communities. Using the PDA framework after an earthquake to guide the rebuilding process will help us achieve regional goals and can expedite rebuilding.

Policy makers have already begun to invest in PDAs by improving transit and infrastructure and encouraging policies to promote compact, complete communities. Further investment to retrofit existing housing and require stronger building standards for new construction will improve the seismic resilience of these neighborhoods and will ensure that good affordable housing options are maintained even after major earthquakes.

When the earthquake strikes, homeowners with adequate insurance coverage and access to capital will be able to quickly rebuild their homes. Regional leaders can help ensure that earthquake insurance is a sensible investment for every homeowner. Homeowners who lack insurance coverage will struggle to repair and rebuild their homes and may abandon their equity rather than paying their mortgage, delaying recovery of the region.

While permanent housing is being built, temporary housing will be necessary. Policy makers must develop solutions for temporary and interim housing that maintain community synergy and encourage residents to invest in the Bay Area, and that are coordinated with plans for the region's long-term housing recovery.

H-1: Identify areas where mitigation and recovery resources are particularly important

Some areas will rebuild much faster than others and likely require fewer resources to do so due to prevailing market strength and current levels of investment (e.g. San Francisco). Areas with lower household incomes, lower savings rates, and limited access to financing will face longer housing reconstruction times than other areas. It is estimated that a disproportionate number of vulnerable populations live in earthquake vulnerable neighborhoods across the region, particularly in cities along the Hayward fault. Multi-family housing in particular tends to take longer to rebuild and is often not rebuilt as affordable housing.

Incorporating future land use planning and development feasibility into disaster planning can result in more mitigation and recovery resources devoted to places that especially need them. By overlaying information on hazard zones with vulnerable housing type, vulnerable populations, locations of subsidized housing units, and PDAs, policy makers can direct policies and allocate resources to the places that need it most; strengthening housing, reducing individual losses, shortening housing reconstruction timelines, minimizing economic disruption and promoting long-term regional growth and economic goals.

H-2: Explore interim housing solutions that encourage residents to invest in the Bay Area's recovery

If possible, while homes are being repaired, residents should be enabled to remain in their home or neighborhood through shelter-in-place policies.[5] When residents remain, local businesses are more likely to stay in business, and families are more likely to quickly return to the routine of school and work. Regional plans to provide neighborhood support centers can enable families to remain in place by providing centralized food and water distribution, access to generators and medicine, and other needed services and supplies. Neighborhood support centers facilitate maintenance of existing neighborhood support networks.

Many residents in uninhabitable buildings will seek temporary emergency shelter and then rental or temporary housing until their homes are rebuilt or they find alternate permanent housing. When temporary housing solutions are needed, counties should strive to accommodate displaced residents within their own counties to help maintain access to jobs and schools while preserving community fabric. In addition, the siting of temporary housing should be carefully considered as it has important impacts on the locations and timing of permanent housing solutions and the long-term recovery of neighborhoods.

H-3: Use *Plan Bay Area* as a framework to directing resources for permanent replacement of housing

When housing needs to be reconstructed on a large scale, regional leaders can use *Plan Bay Area* and the SCS framework and the identified areas for growth (PDAs) to guide post-earthquake planning and development. PDAs have plans for building that in some cases are ready to be executed and an earthquake can be an opportunity to implement these plans. This will have the dual benefit of stimulating recovery while achieving our regional vision.

5 *Safe Enough to Stay, SPUR (2012)*

A soft-story residential building is one that has large openings on the first floor, typically for parking or commercial space, with residential units on the upper floors. In some cases, the first floor may also contain residential units. Most were built prior to 1990. Photo source: www.chandler-properties.com

Regional leaders should also work with other disaster prone areas to reform the Stafford Act to allow Federal Emergency Management Agency (FEMA) to help pay for permanent replacement housing, not just interim housing. Certainly, the region will be looking to state and federal housing finance assistance to construct new replacement units.

H-4: Address the problem of underinsured homes with more realistic hazard insurance availability

To reduce the need for government assistance and stimulate rebuilding, policymakers can ensure that damaged homes are repaired and rebuilt more quickly by ensuring that more homeowners are covered by adequate hazard insurance. Policymakers should work with the California Earthquake Authority (CEA) to reduce both its annual premium and deductibles. The CEA has made some changes to make its porducts more affordable and is undertaking a research program that may allow for additional significant premium reductions for homes that have been seismically strengthened, providing both incentive for retrofit and benefit to homeowners. Earthquake insurance policies for renters, however, are a good value and their use should be more widely encouraged.

Goal #2: Promote housing mitigation to reduce housing loss and expedite recovery

Multi-family buildings

Seismically vulnerable multi-family buildings, such as soft-story buildings, pose particular challenges for local governments. These buildings are not easy to identify and retrofits are expensive, but the benefits of retrofitting are significant. Rebuilding multi-family housing post-earthquake is generally very slow, taking several years longer than for single-family homes, and affordable units are often rebuilt as market rate units, resulting in the loss of affordable housing options. In some cities, soft-story buildings are clustered together, leading to the potential for widespread loss of housing in concentrated areas. Because of the large number of residents living in multi-family soft-story buildings across the region (an estimated 100,000 dwelling units), regional solutions may be beneficial. Further work is needed region-wide to accurately identify soft-story buildings and make the cost of retrofitting more affordable.[6]

6 Development of Simplified Guidance for Seismic Rehabilitation of Soft-Story Wood-Frame Buildings (ATC 71-1). This soon-to-be-released document will provide guidance for addressing seismic retrofit requirements for soft-story wood-frame buildings in seismically active regions. The project will also develop practical

Policy makers in cities with particularly large numbers of soft-story buildings such as Oakland, Berkeley and San Francisco have made progress in identifying potentially vulnerable buildings, but have had limited success to date in encouraging owners to retrofit these buildings. This is in part because the size and complexity of the retrofit may trigger requirements for additional upgrades to meet building codes, which can increase the total cost of the project and may exceed the value of the property.

Better awareness of seismic issues by tenants and prospective buyers may help create market-driven incentives for owners to retrofit. Financial assistance programs can make retrofitting more feasible while providing a vehicle for education about seismically vulnerable buildings.

A revolving loan program through a voluntary assessment district, similar to those being developed for solar installations under the PACE program,[7] has potential to provide financing to as many owners as possible. These loans are paid back in first position on property tax bills. The loan payments stay with each building and not with their originating owners, so when the buildings change hands, loans can be transferred to new owners and spread out over 30-year loan periods. The seismic improvements enhance the value of the building and help secure the existing mortgages. No sources of capital, however, have been identified to initiate such a program.

H-5: Encourage accurate identification of soft-story buildings

Owner notification and evaluation programs such as those taking place in Berkeley, Oakland, San Francisco, and Alameda are part of a broader societal trend recognizing the seismic vulnerabilities of soft-story buildings and placing liability on building owners. This exposure is something that owners will have to take into account when deciding how they will operate their buildings.[8] Future phases of such programs may include mandatory retrofit requirements. While politically difficult, these programs will likely serve the cities', the building owners', and the residents' best interests in the long run.

While each of these cities has begun the process of identifying soft-story buildings in their city, better tools are needed to refine these assessments, and other cities with significant numbers of soft-story buildings need to begin this process to identify buildings in their cities. ABAG can assist by sharing best practices and lessons learned from other cities already embarking on this process.

H-6: Establish affordable financing mechanisms to facilitate seismic mitigation of multi-family residential properties vulnerable to damage in earthquakes

We recommend that policymakers work together to find creative financing mechanisms to facilitate retrofit of residential properties. One possible avenue to explore is working through ABAG's Finance Authority to utilize the PACE program for seismic retrofits and to lobby the federal government to provide the initiating capital.[9] In addition to PACE, a suite of policies and incentives can be adopted by cities wishing to encourage seismic retrofit.[10] Other

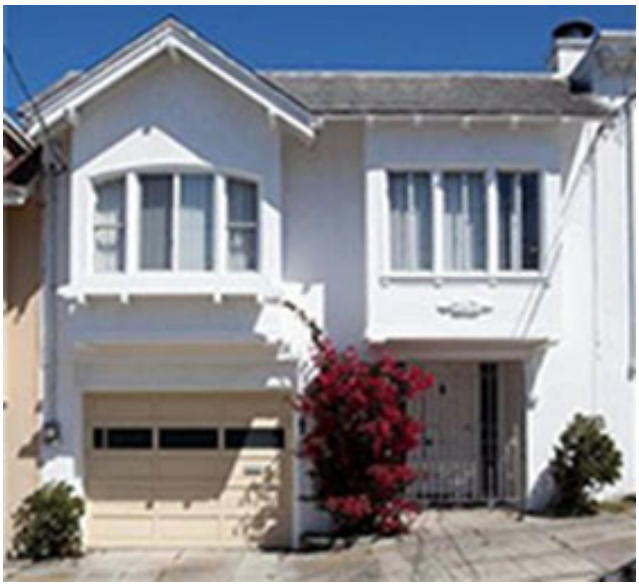
model code provisions for seismic retrofit of soft-story wood-frame buildings that can be adopted by cities.

7 Property Assessed Clean Energy (PACE) is a means of financing rooftop solar panel installation and other energy improvements through issuance of bonds to investors and then making loans to consumers which are repaid via an annual assessment on their property tax bill over the assigned term (typically 15 or 20 years). One of the most notable characteristics of PACE programs is that the loan is attached to the property rather than an individual. Recent legislation (AB 184, Swanson) has broadened the use of PACE to seismic retrofits. The residential PACE program is currently on hold nationwide pending a ruling by the Federal Housing Finance Agency that PACE assessments pose unusual and difficult financial risk for lenders, servicers, and mortgage securities investors without community benefits (PACEnow.org).

8 Personal communication, Ken Moy, ABAG legal counsel

9 AB184 (Swanson) allows PACE to be used for seismic retrofits, but it is not currently being implemented. Cities wishing to implement these programs must also come up with the initial funds to be distributed as loans.

10 Samant, Laura and Tom Tobin. Memo to the Advisory Committee, Community Action Plan for Seismic Safety, "Incentives to Encourage Seismic Retrofits: Options for San Francisco". San Francisco, CA. 5 Sept. 2008. http://www.sfcapss.org/PDFs/Incentives_to_Encourage_Seismic_Retrofits.pdf



Single family homes with living space over garages may exhibit soft-story conditions, where the garage lacks the interior walls of the living space above it and may be unable to support the living space above it during an earthquake.
Photo source: quake.abag.ca.gov

existing programs that can be tapped for seismic retrofits include the California Earthquake Authority (CEA), local Community Development Block Grants (CDBG), transfer tax rebates (see case study on page 8), and the Strong Motion Instrumentation Program fee (SMIP) fund, an assessment on building permits, a portion of which can be retained by each jurisdiction for appropriate earthquake programs.[11] In addition, local governments working together with lending institutions, insurance companies, and other government agencies before future earthquakes could design new coordinated lending processes.

Single Family Homes

Older (typically pre-World War II) single-family homes will likely account for nine percent of overall housing losses after each major earthquake.[12] Single-family homes are generally relatively easy and affordable to retrofit. However, owners who embark on retrofit projects often quickly become perplexed by the lack of retrofit standards for some types of homes and the inconsistent array of retrofitting techniques proposed by contractors. An estimated two-thirds of single-family retrofits are done improperly,[13] a waste of homeowners' money that provides inadequate seismic benefits and creates a false sense of security. Owners are further discouraged by the lack of incentive programs enjoyed by residents for energy retrofits.

Quality retrofits benefit not only homeowners and their families, but entire communities when they can get back on their feet faster after earthquakes. Local policymakers can work with state and national policymakers to implement the following policies that would encourage more and higher quality home retrofits.

H-7: Reduce personal and community losses by increasing resilient building and retrofit practices

While the California Building Code has adopted, by reference, a standard for retrofit of single-family homes for the retrofitting of homes not requiring an engineer,[14] it only applies to very specific housing types that have crawl spaces with walls less than four feet in height. Adoption of this standard was an important step for residential seismic risk reduction, but there remain broad categories of single-family dwellings that are not covered by a retrofit building code. Clear and comprehensive guidelines for the retrofit of all remaining single-family dwellings are needed. This lack of a standard means that permits will be issued for voluntary seismic retrofits that may not be adequate. Local policy makers should encourage efforts by CEA and FEMA to develop recommendations for future evaluation and retrofit codes and standards.

11 Public Resources Code Section 2700-2709.1

12 Preventing the Nightmare (update), Association of Bay Area Governments. (2003)

13 Preventing the Nightmare: Technical Appendix B, Association of Bay Area Governments (1999), and (2006) False Sense of Security, Contra Costa Times (2006).

14 Chapter A3 of the International Existing Building Code.

Older (usually pre-WWII) houses are often not bolted to their foundations and lack bracing on the wood framed exterior walls enclosing the crawl space (cripple wall). Damage can include the home sliding off its foundation or the collapse of the cripple walls. Photo source: Danielle Hutchings Mieler

H-8: Improve the quality of non-engineered retrofits by developing a statewide retrofitting license for contractors, or providing contractor training

Similar to a plumbing or electrical license or the Home Improvement Certification category (which was allowed to sunset on January 1, 2004) a retrofitting license or certification would help ensure that contractors performing seismic retrofits are properly trained and licensed. Implementation would require action by the California State License Board to develop new regulations. A new class of license, or a certification within the existing license, would provide a new skilled class of contractors who could advertise their services and who would be better trained. This would greatly benefit owners by increasing the likelihood that work is performed properly and by allowing owners recourse for work not performed properly.

A first step in implementation is to organize best management practices in a structural design bulletin to help inform the industry of the complexity of this type of work and add credibility to the need for a specialty license.

Bay Area local governments may not be able to wait for state action to implement this policy. An interim step might be to establish a regional certification program for pre-disaster retrofit and post-disaster repair that would address the most vulnerable Bay Area building types. This certification should build on previous ABAG efforts to train contractors on proper retrofitting techniques for a small class of single-family home. Bay Area cities and ABAG should develop improved retrofit training for single-family homes and encourage homeowners to hire contractors that have been properly and adequately trained.

Future training should:

- Include testing to ensure comprehension;

Case Study: Berkeley Transfer Tax Rebate

Berkeley has a model incentive program that could be emulated by other local governments. Berkeley raised the transfer tax from one to 1.5 percent and then offered to refund new homebuyers the 0.5 percent difference if it was used to seismically strengthen their home. Since its implementation, 600-800 homeowners have taken advantage of the program. Costs to the City are very low since the owners themselves are effectively paying for their retrofits through tax refunds.

The City of Oakland successfully implemented a similar program from 2008-2010 during which 360 retrofit permits were issued, compared to only six prior to the program. These programs demonstrate the effectiveness of incentives, that they do not have to cover the full cost, and time of sale is a very effective way to reach homeowners when it is easy to add the cost of the retrofit to the mortgage or alternatively lower asking prices.

- Require refresher courses every three years coincident with building code updates to disseminate new knowledge and information, and;
- Provide certification of completion to the retrofit installer who took the training, rather than a company to ensure that the individual on site during construction has actually been trained.

H-9: Increase the number of retrofitted homes by providing financial incentives for homeowners to retrofit

Financial incentives not only make retrofitting more affordable, they can also improve the quality of retrofits by setting a minimum standard that retrofits must achieve in order to receive assistance, and create opportunities to educate communities about the prudence of seismic retrofitting.

Regional agencies could consider including seismic improvements in any funding made available to support implementation of the Sustainable Communities Strategy. Funding seismic upgrades of existing buildings would help ensure the long-term sustainability of PDAs.

We recommend that policy makers also endorse the involvement of the insurance industry in developing owner incentives for retrofitting structures. As required by state law,[15] the California Earthquake Authority (CEA) has set aside approximately $20 million from annual investment income for residential mitigation efforts. The CEA is developing a statewide mitigation program that may provide financial incentives to consumers that retrofit their houses and provide training to retrofit contractors. ABAG could use the results of Recommended Action H-1 (**Identify areas where mitigation and recovery resources are particularly important**) to identify the most vulnerable residential structures and provide a list of target neighborhoods to CEA for funding consideration. •

15 *California Insurance Code section 10089.37*

Regional Resilience Initiative

Infrastructure Policy Paper

Photo source: www.earthquake.usgs.gov

earthquake and hazards program
Association of Bay Area Governments

Background

In the wake of a major disaster, the recovery of major infrastructure systems will play a large role in our ability to recover quickly and effectively. Many recovery activities are highly dependent upon these systems. For example, goods movement - including supplies for rebuilding and daily goods and food for resuming daily lives - depends on a workable transportation system. People will not be able to stay in their homes if water and wastewater services are not available, and businesses will not be able to reopen. Repairing failed infrastructure systems and restoring their services are vital to the recovery of the Bay Area after a disaster, and failure to do so quickly and efficiently will result in widespread and long ranging, potentially devastating impacts.

Many of our significant infrastructure systems are vulnerable to damage in earthquakes.[1] The majority of the Bay Area population resides along two transportation corridors along major fault lines. Highway 101, connecting the South Bay to the Peninsula and the North Bay, parallels the San Andreas Fault and Highways 580 and 880, linking the South Bay to the East Bay and Solano County, are situated on and adjacent to the Hayward fault.

Nearly every major east-west connection that the Bay Area depends on upon for water, power, gas and transportation crosses several major faults. Hundreds of streets underlain with transmission lines also cross faults. In an earthquake, these major lifelines transmission systems will be damaged by significant lateral movement caused by crossing fault lines. East Bay Municipal Utility District (EBMUD) estimates that 40 percent of its customers will be without water, and that it could take as many as 50 days to restore full service.[2] Similarly San Francisco Public Utilities Commission estimates that until its Hetch-Hetchy pipeline retrofit is complete in 2014, a major earthquake could cause catastrophic failure of the pipeline, which could take as long as 60 days for full repair.[3] The liquefaction prone margins of the Bay will cause additional infrastructure damage, particularly for sewer treatment plants, the Port of Oakland and the San Francisco and Oakland airports.

Many issues will impact our ability to quickly repair damaged infrastructure. These warrant further understanding and study now, before a disaster, so stakeholders are better prepared to face the complex task of restoring infrastructure systems when disaster hits.

The major infrastructure systems included in the recommendations set forth in this paper are:

- Power systems
  - Electricity generation and transmission
  - Oil and natural gas pipelines
- Water and wastewater
  - Treatment
  - Transmission systems
- Transportation systems
  - Local roads
  - Highways
  - Public transportation systems – buses, rail and ferries;
- Telecommunications systems
  - Phone and data lines

Other significant infrastructure systems in the Bay Area not included in this initial study include gas refineries, airports and ports. Each system depends on physically or virtually linked elements to stay operational. These elements range from the people who operate and control the systems; mechanical and electrical equipment; transmission lines; buildings that house operations and equipment; and information systems that process large amounts of data. In a disaster, all these elements are vulnerable to damage from ground shaking, liquefaction, landslides, fire, or flooding, and damage to just one portion of the system may cause complete failure in all or part of the system, cutting off services to customers. Cascading systems' failure is a norm in metropolitan disruptive events due to tightly coupled infrastructure mechanics.

1 This section is largely adapted from 1868 Hayward Earthquake: 140-Year Retrospective, RMS November 2010. Modeled loss estimates consider post-event loss amplification.

2 "EBMUD: A Decade of Seismic Mitigation Progress – More Work to Do." Presented at ABAG's Regional Planning Committee, December 3 2008 by Bill Cain.

3 City and County of San Francisco Emergency Response Plan, Earthquake Annex. (April 2008).

Infrastructure systems are interdependent and will not be able to be fully restored without the repair of corresponding, upstream structures. For example, treating wastewater is dependent upon power systems to operate pumps and other equipment. Because of such dependencies and links, it can be very difficult to make assumptions about how disasters will impact a particular system or how recovery will take place if the impacts to lateral or upstream system are unknown. Interdependencies also create new or exacerbate existing failures over time if not promptly resolved. The implications of delayed recovery due to interdependencies are largely unknown. Salient lessons in social restoration and recovery can be found from recent regional disasters such as the 2011 Tohoku earthquake and 2012 Superstorm Sandy and can be applied in other disaster-prone regions.

The fragmented nature of infrastructure system ownership and regulations exacerbate barriers to recovery planning and impact the ability to address the vulnerability of the interdependency of physical systems. Many utility systems are privately or jointly owned and vary widely in size, control, access to resources, accountability, age, seismic standards, guidelines, and code requirements. In total, there are over 500 special districts with overlapping jurisdictions that provide services within the Bay Area. The California Utilities Emergency Association represents California utilities on emergency related issues, but currently there is no forum for utility leaders to coordinate with other owners within the Bay Area and plan for recovery and restoration, so providers may not have a comprehensive understanding of how their systems fit in with other systems. Multiple owners or service providers can lead to a wide variety of practices, technologies, and mitigation standards within any given sector. This diversity creates problems with understanding, anticipating, and coordinating disaster recovery activities.

Goal #1: Increase technical understanding of region-wide infrastructure system vulnerabilities

Currently, few understand the ways in which systems are interdependent. The information that is available is largely based on speculation, not rigorous analysis. The region needs peer-reviewed technical studies to better understand system vulnerabilities and what consequences may result from cascading failures. Some of this information is considered confidential for security reasons; however, information should be shared at levels of detail sufficient to understand how to resolve issues post-earthquake.

New technologies can assist with gathering technical data for analysis, but may increase vulnerability as operators of interdependent infrastructure systems become more reliant on virtual systems to monitor and control infrastructure. While technology has the potential to provide greater and more sophisticated information on system performance, it also introduces new interdependencies on power and IT systems because of reliance on computer servers. For example, Pacific Gas and Electric (PG&E)'s Smart Grid system provides better, more accurate information about the power system if it is operational. But reliance on specialized technology can make systems more difficult to restore and requires improved human expertise and intervention in crises, which can impede restoration and recovery.

We need a detailed understanding of how interdependencies interact and what impacts might occur in disruptions due to disasters. The following actions suggest how this might be done.

I-1: Establish regional baseline assessment and system performance standards to identify vulnerabilities and define interdependencies

Current methods for evaluating system performance in a disaster typically involve the use of an earthquake scenario to anticipate ground shaking and what damage and loss may occur. This loss estimate is then reviewed together with interviews of staff with technical expertise in different system components and operations. Performance findings for multiple system components and their links then

need to be aggregated to comprehensively understand the workings of the complete system. This approach leads to a qualitative and holistic understanding of vulnerabilities, but is limited by incomplete human understanding and interpretation. [4]

Other analytic tools include computer modeling of systems using software programs that generate disaster loss estimates based on specific disaster scenarios, including HAZUS or systems' visualization applications developed for the defense industry. These methods provide a vulnerability snapshot of systems and system components. Elements of these assessments include information on component fragility, system fragility, and critical data on functionality, repair time, and repair cost.

It is crucial to note that smaller service providers may lack resources to use existing tools effectively, or may not have accurate results due to lack of technical expertise in failure studies. Both qualitative and quantitative analyses offer data on typical systems' failures operators may encounter in disasters, which can support improved crisis response and provide powerful motivation to implement pre-disaster recovery planning.

The region needs to establish common tools for evaluation and assessment, and build consensus around the type of analysis and how to present findings. One way to begin this is to establish common earthquake scenarios for evaluating systems so consequences can be compared and interdependencies are defined across the region. San Francisco's Lifelines Council utilizes a repeat of the 1906 earthquake as its assessment scenario; this 7.9 San Andreas Fault earthquake falls within San Francisco Planning and Urban Research (SPUR)'s definition of an "Extreme" earthquake scenario.

SPUR's *Resilient City* reports typically base recommendations on an "Expected" earthquake, defined as a 7.2 San Andreas quake, the same used for San Francisco's Community Action Plan for Seismic Safety program. Both of these scenarios are appropriate for San Francisco, but other scenarios such as a Hayward Fault event, may be more useful for planning in other Bay Area locations. Therefore, utilizing multiple planning scenarios may be productive for regional planning purposes. The common earthquake scenarios should be severe enough and present a wide enough scope of damage to be realistic and useful, but should not be so extreme that mitigation strategies would be seen as too costly.

We need to, as a region, assess the existing state of infrastructure systems, much of which is aging, deteriorating, and functioning at capacities beyond their original design, which all increase vulnerability. ABAG has helped lead local efforts to assess infrastructure in Priority Development Areas (PDAs), but this effort should be expanded and considered through the lens of seismic vulnerability. Considering that much of our infrastructure is buried or difficult to acquire data on, new methods should be identified and shared for quantifying in-situ conditions. Such assessment techniques include remote sensing technologies, sensors, use of cameras and video cameras, and component testing. Existing assessments done by utilities should also be collected and made publicly available.

Regional infrastructure stakeholders could conduct and share research on evaluations, best practices, and recommendations for effective and uniform analysis of vulnerabilities. This might include common assumptions about what magnitude of earthquake to use as the basis for analysis and mitigation, and improve regional understanding about possible disaster losses.

I-2: Conduct a regional assessment of system interdependencies and the consequences of cascading failures

Similar to San Francisco Lifelines Council's current lifeline qualitative review, the region should conduct a high-level assessment of Bay Area infrastructure systems to identify and assess critical interdependencies. The study could be based on a standardized earthquake scenario or scenarios and identify and assess lifeline systems by performance

4 This approach is similar to the one taken by the San Francisco Lifelines Council for their Lifelines Interdependency Study. For more information on this approach, see http://sfgsa.org/index.aspx?page=4964

Transmission lines carrying power and phone services to the city of San Francisco. Sutro tower is perhaps the city's most well-known antenna tower in the city, transmitting television signals to residents since 1973. Photo source: Window Snyder, www.dec.net

(similar to SPUR's performance categories) along with peer-reviewed approaches. Then communities can prioritize system improvements based on defined performance targets that suggest key mitigation actions.

Understanding vulnerabilities is a first step that must be followed by defining disaster consequences. Infrastructure failures have direct and indirect economic, environmental, and societal consequences, ranging from lost revenue to a store without power to public health issues due to lack of wastewater treatment.

We need better tools to understand the short and long-term consequences to the regional economy from infrastructure failures, including how time and geographical scales impact economic consequences. Attempting to understand the number of people who will be directly affected and the severity of the consequences can also be a significant motivator for developing a better recovery plan.

I-3: Evaluate the usefulness of creating performance targets to establish region-wide performance goals for all infrastructure systems

In addition to better understanding vulnerabilities and risks, providers need to have a more accurate understanding of feasible timelines for recovering their systems, interdependent systems, and the consequences of these timelines. Many providers' anticipated recovery timelines make assumptions about the performance of interdependent systems, and may not be accurate or feasible. Providers need a better understanding of how factors outside of their control may impact their ability to quickly restore service. Providers also need to better understand potential trigger points and cascading effects of delays in recovery. Is there a point when a delay triggers a much larger consequence, either within their system or in an interdependent system?

Interdependencies may also change as time passes. For example, a system that has generator capacity for three days is not dependent upon power for this time, but once the generator fuel runs out, they become dependent on the power grid or short-term fuel supply if power is not yet restored. This type of delayed interdependency or failure is not well understood.

SPUR has created categories of expected performance for lifelines within San Francisco, as well as goals and targets for recovery of infrastructure systems within four hours, three days, 30 days, and four months and beyond after a disaster. ABAG suggests considering developing similar performance categories at a regional level using peer-reviewed evaluation methodology to provide clear expectations and goals for all utility providers, as well as provide a useful tool for evaluating the current state of systems and com-

Collapse of the upper deck of the reinforced-concrete Cypress Street Viaduct in Oakland following the 1989 Loma Prieta Earthquake. The collapse resulted in 42 fatalities. Photo source: www.nasa.gov

municating this information with other providers. SPUR also provides a table for identifying target states of recovery as compared to expected current status, and a similar table using regional performance goals could be widely utilized by regional infrastructure providers.

I-4: *Identify strategies to reduce interdependencies and develop plans to assist with implementation*

Concurrent with examining vulnerabilities and impacts, research could be conducted to identify cost-effective, feasible strategies to mitigate interdependencies, including system redundancy or backup, "islanding" vulnerable systems to limit their impacts, or creating smaller, self-contained "districts" of systems rather than one large, vulnerable system. This study should include identifying existing policies and regulations that impede or assist recovery as well as identifying what policies and regulations are need to propel infrastructure recovery.

Critical to reducing interdependencies is breaking down barriers of confidentiality. Currently, many providers have begun their own internal analysis of their systems to understand their own vulnerabilities. While being mindful of security, proprietary and liability issues, summary results of these analyses should be shared with other providers to develop a common operating picture. This can help providers understand how other sectors and providers' assumptions and timelines will impact their own restoration efforts.

Providers and regional coordinating bodies (such as that suggested below in Recommended Action I-5) could also benefit from understanding if their risk and vulnerability assessment tools are powerful and technically accurate enough to gain an adequate understanding of likely consequences from a disaster and be able to plan appropriate mitigation actions.

Goal #2: Increase ways to share risk information to collectively improve regional infrastructure system resilience

As previously identified, to better understand interdependencies the industry must improve risk information sharing among service providers and regional stakeholders before a disaster occurs. We also have to participate in collaborative planning and accelerate mitigation. This sharing and collaboration is vital to an effective recovery.

By understanding interdependent failures that occur and identifying cross-system "hot spots," communities,

facilitated by regional coordinating bodies, can best and most quickly repair all services, not just individual systems. Strategic repairs on a region-wide basis will enhance and expedite Bay Area recovery.

One way to begin to understand this is to seek lessons from past disasters on the process of infrastructure system recoveries and what providers learned after the fact. These lessons may come from Bay Area providers who recall the recovery process after Loma Prieta in 1989, or they may come from the 20 east coast states hit by Sandy. Examining the recovery process in past disasters inevitably reveals interdependencies and impacts and can also uncover missed opportunities for efficiency to implement now before a future disaster.

Communication and information sharing also allows for informed prioritization of infrastructure recovery, allowing key nodes such as hospitals, support centers, emergency housing, and government buildings to recover first. Understanding upstream and downstream interdependencies for repairs as well as which systems key community resources rely upon can to develop an appropriate timeline for streamlined recovery. Understanding priorities and system interdependencies allows providers to identify primary repairs to minimize interdependency and restore certain portions of systems quickly. Regional performance categories, as discussed above, can be utilized as a tool to make prioritizations based on the performance category.

I-5: Establish a senior leadership forum on infrastructure resilience issues to convene providers and stakeholders

Infrastructure providers and the region's jurisdictions need a forum in which to share and gain situational awareness, spark mitigation programs and create new or utilize existing decision-making and prioritization tools. Currently, there are many sources of information available to infrastructure decision-makers - ranging from Caltrans, other providers, news reports, and crews working on the ground. Organized assistance can also help to identify cross-sectoral specific data needs and ways to circulate risk studies among providers. Tapping a third-party, neutral convener can offer impartial perspectives in prioritizing policy and strategic actions as well as providing a central information hub. A committee team can engage other stakeholders for decision-making and program prioritization, including the broader community.

There are already other mechanisms in place that serve this type of function, including the Bay Area Emergency and Security Information Collaborative (BAESIC), California Water Agency Response Network (CalWARN), and the Bay Area Water Multi-Agency Coordination Group, but these are sector-specific. Bringing existing groups together and developing a larger forum based on these smaller existing models can leverage current actions. The committee team could also consider using the California Earthquake Clearinghouse, an existing body that compiles damage information after a disaster for use by government agencies, non-profit organizations, and academia, as a conduit to collect and distribute infrastructure damage information after a disaster. •

Regional Resilience Initiative

Economy and Business Policy Paper

Photo source: quake.abag.ca.gov

earthquake and hazards program
Association of Bay Area Governments

Background

The impact of an earthquake on the economy has one of the farthest-ranging implications for disaster recovery in the Bay Area. Without a swift and strong economic recovery, the Bay Area will suffer from a protracted recovery with slow repopulation in heavily damaged areas, slow rebuilding of homes and businesses, and loss of revenue from business, tourism, and taxes. Estimates are that a magnitude 7.0 earthquake on the Hayward fault would generate $90-96 billion in direct commercial building related economic losses across eight of the Bay Area counties.[1] We have seen repeatedly in disasters that areas with the fastest economic recovery are those which already have strong economies and cultivate conditions to help businesses thrive before a disaster. Just as individuals who maintain a healthy lifestyle recover more quickly from illness, a strong economy has the potential to rebound quickly from an earthquake or natural disaster.

The major keys to economic recovery after a disaster are keeping residents employed, creating an environment that motivates big businesses to stay in the region, and keeping small businesses open. Keeping residents in the Bay Area and in their homes and able to meet their daily needs is also a high priority so employers have a work force available to maintain business momentum.

Currently and historically, the Bay Area region enjoys a strong local economy that is one of the most prosperous in the country and is continuing to improve despite a slow national economy. Of the major metropolitan areas within California, the Bay Area has the highest real GDP per capita, outpacing San Diego, Los Angeles, and the United States as a whole.[2] As a recognized center of innovation and one of the largest concentrations of people and wealth in the United States, the Bay Area economy is critical not only to the entire region, but to the state and federal governments as well, providing tax revenue and cutting edge innovation technology for all sectors of the U.S. economy, including defense.

University of California, Berkeley and other major reserach institutions contribute to the knowledge-based regional economy. Photo source: oep.berkeley.edu

The Bay Area functions as a single economic unit, meaning that among the counties in the region there is a high degree of interconnectedness between where people work and live. Jobs as well as housing are distributed widely throughout region, and only 53 percent of residents work in the county in which they live. All of the counties and sub-regions are highly dependent on one another for their economic functioning and on the region's transportation network. San Francisco, as the major jobs center, has the largest net inflow of workers, while more suburban Contra Costa County has the largest net outflow.

1 1868 Hayward Earthquake: 140-Year Retrospective, RMS November 2010. Modeled loss estimates consider post-event loss amplification. All loss estimates are for property insurance coverage only. All losses above include shake and fire following earthquake. Note: This estimate includes losses for Alameda, Contra Costa, Marin, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma counties only. Similar losses are expected for a San Andreas fault scenario earthquake.

2 The following section is largely adapted from The Bay Area Council Economic Institute Report The Bay Area: A Regional Economic Assessment (October 2012)

The Bay Area economy supports innovative, highly productive technology companies, which in turn support many other job industries. The region has significantly higher levels of concentration than the nation and the state in several key sectors: computer systems design and equipment, semiconductors and other electronic equipment, magnetic and optical media, software, space research and technology, communications equipment, industrial machinery, scientific research, pharmaceuticals and medicine, information services, and beverages. Competitiveness in these areas supports jobs throughout the region and at all levels of the economy. The region is also characterized by a highly productive tourism sector, with higher than national average concentrations of accommodation and food services and the arts, entertainment, and recreation industries.

These industries benefit from a highly skilled and educated labor force, which is present in large numbers in the Bay Area. This concentration of skilled workers in turn attracts more skilled workers and businesses to employ them. The region also benefits from many research universities, private and federal laboratories, investment capital, and a business environment that encourages innovation and entrepreneurship. The local economy also benefits from the high quality of life in the Bay Area—the top reason new companies tend to locate here is because the founders live here or want to live here, suggesting that many business owners have strong ties to the region. However, the success of the region has also created drawbacks, such as high housing costs and long commutes to jobs.

Overcoming Barriers to Economic Recovery

Despite the strong regional economy, there will still be many issues impacting economic recovery after a disaster. For example, the economy will not just need to maintain its current strength, but will need to be even more profitable after an earthquake than before. After the 1989 Loma Prieta earthquake severely damaged Santa Cruz's downtown area, an economist determined that businesses in the Pacific Garden Mall needed to do 35 percent more post-disaster business to afford to move back into replacement buildings because of the increased costs of new construction. This is a single example of what will need to be overcome to create a good business environment.

The Bay Area functions as a single economic unit - among the counties in the region there is a high degree of interconnectedness between where people work and live.

Goal #1: Retain Big Businesses

The Bay Area Council's (BAC) Regional Economic Assessment, largely focused on the biggest economic players in the region, has identified impediments to regional economic growth and prosperity. These impediments will likely be exacerbated in a disaster. For example, housing costs are already very high, stemming from lack of supply. This supply will decrease when a major earthquake damages a large portion of the existing housing supply, and the cost of new construction will likely increase costs for replacement housing. If housing costs go up so that workers can no longer afford to live in the Bay Area, businesses will lose their labor force.

The Bay Area regulatory environment, including zoning, permitting and environmental regulations may also inhibit businesses after a disaster, making it too difficult to stay or rebuild. In the Bay Area Council's report, businesses identified a lack of consistency between regulatory agencies' policies at the local, regional and state level and commented that this situation limited their ability to expand within the region. These challenges will likely be highlighted after an earthquake when large amounts of rebuilding happens simultaneously, potentially overwhelming the capacity of regulatory agencies and slowing the process. The California Seismic Safety Commission has identified potential obstacles, regulations, and other impediments that can be resolved to help business quickly return to normal operations

following a catastrophic event in California such as a major earthquake.[3] Many commercial buildings may be damaged beyond repair. Services will be needed to facilitate business relocation to available space throughout the region. Policy makers can make use of recommendations from this study to improve business and economic recovery.

Other factors likely to impact economic recovery include the dependency of businesses on our regional infrastructure systems—water, sewer, power, and access to broadband and communication—which are key to business operation and continuity. Ongoing infrastructure disruptions or unreliability will challenge businesses. Public transit, roads and highways are essential for the workforce to travel to work, particularly when more than half of Bay Area residents reside in a different county than where they work.[4] The recovery of the education sector is also key—K-12 schools not only provide education to children, but provide the daycare that allows parents to return to work. Long schools closures due to structural damage or prolonged shelter use will delay return of employees to work.

Goal #2: Keep Small and Neighborhood Serving Businesses Open

The BAC study focused on the leading industries and business in the Bay Area, but small and locally serving businesses remain an important component of a strong region and are especially vulnerable to closure after a disaster. An estimated 25 percent of small businesses do not re-open following severe disruptions from a major disaster.[5] Many of these businesses provide the day-to-day necessities for residents such as groceries, shopping, doctors' offices, pharmacies, and restaurants. Essential services are mandatory for getting residents to remain or return. Until essential goods and services are available, people will stay away.

One reason why small businesses are so likely to fail is that they tend to operate with small profit margins and limited reserve funds, which means that even a short period without cash flow may have a significant impact on business. Small businesses also may not be eligible for Small Business Administration (SBA) loans, which require businesses to demonstrate that loans can be repaid. This is difficult to do with small profit margins, and particularly when your building, supplies and materials (means of production) have been damaged or destroyed. Businesses need to secure funding right away in order to plan to rebuild, but with the lack of availability of SBA loans and the fact that many small businesses cannot take on more debt, many businesses will fail if they can't secure funding. In addition, it is estimated that only about 15 percent and 20 percent of the commercial losses of a major Hayward Fault earthquake will be reimbursed by insurance.[6]

As part of the recovery process from Hurricane Sandy, New York City is offering bridge loans of up to $25,000 for small business owners needing quick capital to avoid small business closures and help businesses get back on their feet.[7] The Louisiana Bridge Loan Program after Katrina was a similar program to provide "gap funding" to businesses waiting on other types of funding. Over $55 million has been loaned to date.[8] Loans of this type can be facilitated at the regional level in the aftermath of a major disaster.

Other factors that decrease the odds of a small business staying open after a disaster include being a younger or less established business, being in a highly competitive or low-growth industry, having only one location, and leasing

3 March, 2012 California Seismic Safety Commission "Post-Disaster Rapid Economic Recovery Plan Project – Leading Practices and Potential Steps for a Rapid Post-Disaster Economic Recovery," Report by Deloitte Consulting LLP

4 Bay Area Council Economic Institute Report The Bay Area: A Regional Economic Assessment (October 2012)

5 March, 2012 California Seismic Safety Commission "Post-Disaster Rapid Economic Recovery Plan Project – Leading Practices and Potential Steps for a Rapid Post-Disaster Economic Recovery," Report by Deloitte Consulting LLP

6 RMS, 2008. 1868 Hayward Earthquake: 140 Year Retrospective

7 http://www.nyc.gov/html/sbs/nycbiz/downloads/pdf/home/Emergency_Loan_FAQ.pdf

8 The Council of State Governments 2007 Innovations Awards Program http://ssl.csg.org/innovations/2007/2007applications/Southapplications2007/07S48LADISASTERRESPONSE.pdf

Case Study: Santa Cruz Pacific Garden Mall

Local governments can look to Vision Santa Cruz as a successful model that supported local downtown businesses, provided temporary storefronts and rebuilt the downtown in a new way that strengthened local business for the future. After the Loma Prieta earthquake in October 1989, the city, together with downtown businesses, scrambled to set up tents and other temporary structures to enable local businesses to reopen in time for the holiday shopping season. The temporary downtown opened the day after Thanksgiving, just over a month after the earthquake. Holiday events and a farmers' market kept the downtown active as a destination for residents.

Photo source: Charles Eadie

as opposed to owing the business.[9] Many of these factors often apply to locally-owned, small businesses.

The federal Economic Development Agency (EDA) has various tools available to support local and regional Economic Development Districts (EDDs) in post-disaster long-term economic recovery, such as: support to develop long-term recovery strategies and integrate recovery planning into local Comprehensive Economic Development Strategies (CEDS); resources to hire a regional disaster response coordinator as a full-time EDD staff member; funds to establish revolving loan funds (RLFs); assistance for public infrastructure improvements; and technical assistance.[10]

In California, small businesses make up 99.2 percent of the state's employers and 82 percent of private sector jobs. [11] Projecting similar numbers on the Bay Area, the impact of small business loss has the potential for more widespread impacts in job losses, lost tax revenue for local governments and loss of revenue for vendors.

While there is clearly a need to identify and pursue innovative solutions to business disruption following a disaster, there is perhaps a greater need to find practical solutions to limit impacts on small businesses through economically feasible pre-disaster preparedness and mitigation initiatives. Small businesses may recognize they are located in vulnerable buildings, but often do not have the resources to undertake costly retrofits and have difficulty securing financing to do so. Some may opt to purchase insurance to provide coverage for limited damage or business disruption rather than invest in structural mitigation projects. The development of new strategies for integrating hazard mitigation and risk reduction actions into long-term economic development is crucial to maintaining small business in the post-disaster environment.

Goal #3: Minimize Supply Chain Disruption and Keep Goods Moving

Other potential barriers to economic recovery include the disruption of vendors and supply chains to and from the region and the repercussions for national and international markets. Business disruption has upstream and downstream impacts on supply chains that can exacerbate impacts on the economy. For example, disruption of a manufacturing business may limit global supply of a par-

9 Dahlhamer, J., and Tierney, K. (1996). Winners and Losers: Predicting Business Disaster Recovery Outcomes Following the Northridge Earthquake. University of Delaware Disaster Research Center.

10 July 2011, NADO Research Foundation, "Resilient Regions – Integrating Economic Development Strategies, Sustainability Principles and Hazard Mitigation Planning"

11 California Seismic Safety Commission, March 2012. Post-Disaster Rapid Economic Recovery Plan Project – Leading Practices and Potential Steps for a Rapid Post-Disaster Economic Recovery," Report by Deloitte Consulting

Shipping containers moving goods to and from the Port of Oakland, a major component of goods movement for the region. The Port of Oakland is the second-largest port in the State of California. Photo source: Monaca Noble, Smithsonian Environmental Research Center

ticular product, impacting the economy far beyond the original area. While the Bay Area's share of the manufacturing industry is not particularly concentrated, what is manufactured here is highly specialized and focused on sophisticated equipment design and development.[12] Disruption of this specialized design and manufacturing could have global economic impacts or affect long-term growth in the region.

The consequences of impacts to specialized manufacturing can be seen in Japan after the 2011 Tohoku earthquake and tsunami. The shutdown of specialized parts manufacturing plants in Japan led to assembly plant shutdowns in US. Because of their specialized nature, the lack of even small parts can shutter an entire plant if there is no alternative. Often, highly specific parts can't be made just anywhere – Japan in this case had specialized producers with patented production processes. While others could learn to produce a similar product, quality is an issue and certifying quality from another producer can take up to a year. The lack of production of automobiles in the US due to the loss of parts from Japan led to a constrained auto supply worldwide, impacting global prices. This event raised awareness of the economic challenges of recovery beyond the immediate concerns for protecting human life and property but to protecting economic interest, as it continues to impact domestic and multi-national business operations.

The 2011 Tohoku earthquake has had long-term economic consequences such as loss of market share, higher unemployment, and loss of businesses entirely.[13]

On the other side of the supply chain, inability to get goods into the damaged area can cause a shortage of goods for daily needs as well as materials and labor for rebuilding. Many businesses today operate with a "just-in-time" model for goods deliveries, stocking only enough to last until the next delivery. The transportation and shipping industries are key in a "just-in-time" era – businesses need fast availability of goods in constrained environments. After a disaster, small or no stockpiles coupled with an inability to deliver new goods can have major implications on response and recovery. For example, many hospitals store limited quantities of medical supplies and rely on frequent regular deliveries of supplies.

Many may also have no requirement for suppliers to develop continuity of operations plans to enable supplies to be delivered after a major disaster, when they are needed most. Similar issues arise around groceries and food supplies - most grocery stores have limited stockroom supply and will quickly run out of food after a disaster if new deliveries cannot be made. Even banks and financial insti-

12 March, 2012 California Seismic Safety Commission "Post-Disaster Rapid Economic Recovery Plan Project – Leading Practices and Potential Steps for a Rapid Post-Disaster Economic Recovery," Report by Deloitte Consulting LLP

13 (March 30, 2011) Japan earthquake impact hits U.S. auto plants. CNN Money. http://money.cnn.com/2011/03/28/autos/japan_earthquake_autos_outlook/index.htm

tutions often have very little cash supply on hand and may not have enough cash to cover their immediate expenses, much less be able to distribute cash to residents. This may become a serious issue if lack of power or broadband makes cash the only viable currency for purchasing goods. It is unknown how these types of shortages may impact the price of goods, but history shows that a constrained market raises prices for everyday goods.

The construction industry will also likely feel a shortage as building supplies such as wood, steel, cement, and aggregate become more difficult to import at the same time as demand increases due to extensive rebuilding and repair. The shortage of construction materials and skilled labor could increase the cost of rebuilding over pre-disaster prices and render insurance payouts insufficient.

Recommended Actions

The field of economic recovery from disasters is largely unexplored and unknown. As more frequent and larger disasters put more strain on local, regional, national, and worldwide economies, more detailed research and actions will likely emerge. At this stage, our recommendations are largely policy-level and rely on the basic assumption that a strong pre-disaster regional economy will help the economy recover quickly and come back stronger after a disaster. Some additional disaster-specific actions have been identified to support this process.

EB-1: Encourage the development of best practices that support business continuity and facilitate restoration of regional economies

Concrete knowledge on economic recovery is limited, particularly within the context of the Bay Area. We recommend partnering with research bodies such as the Bay Area Council (BAC), the California Seismic Safety Commission (CSSC) and research institutions such as UC Berkeley and Stanford to continue to conduct Bay Area-specific research and studies on specific actions that local governments or regional groups can take to expedite economic recovery. We recommend implementing findings from the CSSC and conducting a more thorough survey on existing best practices, both specific to the Bay Area and from other disasters within the US. Best practices already identified by CSSC and others include:

- Provide expedited permits and create a system for requesting additional temporary skilled staff through mutual aid agreements with other government agencies to ensure fast processing of permits to help businesses rebuild quickly and minimize costly downtime
- Identify temporary space for retail and commercial businesses to quickly relocate temporarily, helping to minimize disruption and downtime.
- Provide bridge financing to assist small businesses
- Create a "toolkit" for distribution, and include a) employee preparedness at home, b) continuity plan template, c) disaster recovery plan template, d) roadmap of what to do based on each part of the disaster cycle, e) "Everything a Business Needs to Know about Government Programs and Planning Before, During, and After an Emergency" pamphlet and guidebook.

We recommend research focused around our first two issues in particular - getting large businesses to stay in the region and keeping small businesses open.

EB-2: Support pre-disaster economic development through existing regional best practices

Several regionally-focused groups have conducted extensive research on how to best maintain and grow the Bay Area's economy. ABAG has conducted extensive economic research through its Plan Bay Area, Jobs-Housing Connection Strategy, and is currently developing a Regional Prosperity Plan. ABAG is also developing a Regional Policy Background Paper on Economic Development which will include recommended actions for continued economic growth.

The Bay Area Council's Economic Assessment report outlines actions designed to strengthen today's economy, and a strong and nimble economy today will provide a basis for a strong regional economic recovery after an earthquake. We recommend that the region implement the BAC's six recommended areas for attention to ensure that the Bay Area's economy is strong before a disaster. In particular, the BAC's first recommended strategy of identifying a public-private focal point for regional economic strategy could be a strong tool in recovering the Bay Area economy and ensuring that decisions of elected officials benefit businesses and residents alike. Harmonizing regulations across the region has been identified as a potential stumbling block and can also foster a more even economic recovery, ensuring that businesses have the flexibility to recover in a uniform business climate.[14]

The research and recommended strategies around economic growth should also be considered through the lens of preparing for disaster recovery. Further study could be utilized to identify and prioritize existing strategies that strengthen the economy in areas that may be particularly susceptible to disruption from a major disaster. These strategies should also help drive recovery plans to ensure that economic recovery aligns with the region's larger economic goals.

EB-3: Implement the recommendations of the Resilience Initiative's Decision-Making, Housing, and Infrastructure Policy Papers

Many of the key factors in economic recovery are closely linked to the issues laid out in the Initiative's issue papers on housing, infrastructure and regional decision-making. Strengthening these areas will bolster our overall economy and ability to recover quickly. These recommended actions also support issues identified in BAC report as necessary for a strong regional economy.

14 California Seismic Safety Commission, March 2012. Post-Disaster Rapid Economic Recovery Plan Project – Leading Practices and Potential Steps for a Rapid Post-Disaster Economic Recovery," Report by Deloitte Consulting

We recommend a particular focus on strengthening housing for recovery, as our housing stock is such an important resource for the strength of the economy, and is both largely uninsured and highly vulnerable to damage. Protecting our housing stock allows residents and workers to stay in the region and maintains housing affordability.

Expedited repair of infrastructure systems also allows businesses to reopen sooner, since they cannot operate without basic services and employees cannot reach their places of work without a working transportation system. In addition key transportation corridors could be identified and made accessible to goods movement companies to improve supply chain continuity.

Implementing recommended actions about regional decision-making will help build political consensus on recovery priorities across the region, contributing to the sense that jurisdictions are working together for the common good of the region. This will instill confidence in businesses to continue to invest in the Bay Area, and instill confidence in residents that they will continue to have jobs and a high-quality place to live. Positive messaging about the pace of recovery will also be needed to bolster business confidence.

EB-4: Explore innovative financial incentives to support disaster resilience initiatives for small business

Pre-disaster funding directed toward hazard mitigation for small business is currently limited to conventional lending practices which generally are either not available or not cost-effective for small business owners. Additionally, earthquake or business interruption insurance can be prohibitively expensive for small businesses operating with a small profit margin. There is a need to engage Chambers of Commerce, Economic Development Departments, lending institutions, the insurance industry and federal agencies, such as the Economic Development Administration, and the Historic Trust

Main Street Program, in a discussion of potential strategies to support pre-disaster hazard mitigation incentives for small businesses. At the local level, Business Improvement Districts, revolving loan programs, or pooled financing should be explored. •

Regional Resilience Initiative

Action Plan

Photo source: www.baybridgeinfo.org

earthquake and hazards program
Association of Bay Area Governments

Introduction

This paper consolidates the recommended actions identified through ABAG's Regional Resilience Initiative process and explored in detail in our Regional Decision-Making, Housing, Infrastructure, and Business and Economy Policy Papers into one Action Plan. Organized by those four topic areas, this paper categorizes actions, sets priorities and identifies initial implementation tasks.

In general, actions associated with the Decision-Making Policy Paper serve as a platform to support and facilitate topic-specific actions. We recommend regional policy makers begin implementing many of the decision-making recommendations in the near-term, while simultaneously pursuing easily achievable strategies from the other categories. Many of the more complex recommendations will require coordinated regional policy before being enacted. Implementing the decision-making recommended actions will help with more even implementation across the region, increasing resilience as a whole.

Implementation Level

In this paper, each action has been identified by the level at which it can be initiated and implemented – regional, local, or both. Many actions will need to be developed and initiated through a regional effort, led by a regional body such as ABAG, MTC, or the JPC. For certain actions, this regional work will then spur community-specific actions at the local level with policy, assistance, or information-sharing. The focus of this work is on regional-level initiatives, therefore very few actions are recommended for local initiation prior to regional resolution. Planning and technical guidance for those local actions will be available from the region.

Action Categories

Recommended actions are also categorized by type based on thematic similarity. The categories of actions are as follows:

Facilitation: These types of actions create forums and frameworks to facilitate action, but do not necessarily generate a concrete resilience action. They depend upon enabling participants to discover, communicate, and collaborate to implement concrete actions. These actions also help to build relationships, which is crucial to building resilience.

Education/Information: Education and Information actions actively seek to gather and communicate new information to assist stakeholders and encourage voluntary actions to plan for recovery or to increase resilience.

Evaluation: In many cases we may not have a clear picture on what the status or effectiveness of existing programs, policies, or resources. Evaluation tasks help to better understand our current level of resilience and set a baseline against which to track future work.

Policy Development: This category seeks to develop policy which supports resiliency capacity building and that can be adopted at the regional level or serve as a model for adoption at the local level. The goal is to provide tools that can be easily utilized by jurisdictions as well as establish consistent baseline policy for the entire Bay Area.

Further Study/Research: Many of the recommended actions require additional understanding or technical research on best practices or development of tools before specific actions should be implemented. Actions in this category warrant additional resources for study.

Program and Operation: These actions require a program with stakeholder support, resources, public involvement, and a defined outcome. Many of these types of actions will require local-level programs, with the region providing assistance and coordination.

Timeframe

Each recommended action is assigned a general timeframe for implementation. The reasoning behind the timeframes is below:

Short-Term: These are items that can be easily accomplished in the near-term with few additional resources or research. Many of these actions require organizational changes or slightly changed or expanded scopes of work rather than entirely new scopes of work. These changes could be completed within 1-5 years.

Medium-Term: Actions in this category require a bit more effort to implement. They may require some level of resources, additional research, or depend on another task or action to be accomplished before they are feasible. They may require setting up a new program or operation, or staff to plan for implementation. These actions could be completed within 5-10 years.

Long-Term: This category encompasses the most complex actions which may require substantial resources, research, or preparatory work. They may require broad coordination or change of political will that may take years to accomplish. These actions may be subdivided into phases to make them more achievable. Actions in this category may take up to 20 years to complete.

How to Use This Document

Each action is summarized in a quick overview table, enabling the reader to easily see the timeframe, categories, and level of implementation. This is followed by a text summary of the meaning of the action and initial implementation tasks. This document also contains two larger tables – a summary table at the beginning of the document showing all of the recommended actions at-a-glance (see below) and an initial implementation timeline following. This "timeline" helps to organize the actions to prepare for the development of a detailed implementation plan.

Recommended Actions Summary

Recommended Action	Level of Implementation	Short-term	Medium-term	Long-term
Decision-Making				
G-1: Use existing intergovernmental committees to convene jurisdictions and facilitate communication around disaster recovery collaboration	Regional	√		
G-2: Examine the feasibility of a regional disaster recovery framework	Regional		√	
G-3: Integrate resilience policy into current plans and practices	Regional, local			√
G-4: Lead reconnaissance missions for local leaders, staff, and community leaders to areas undergoing disaster recovery	Regional, local	√		
G-5: Establish and maintain a recovery clearinghouse to house resources for pre-disaster recovery planning and post-disaster recovery guidance	Regional, local	√		
Housing				
H-1: Identify areas where mitigation and recovery resources are particularly important	Regional, local	√		
H-2: Explore interim housing solutions that encourage residents to invest in the Bay Area's recovery	Regional, local			√
H-3: Use Plan Bay Area as a framework to directing resources for permanent replacement of housing	Regional, local			√
H-4: Address the problem of underinsured homes with more realistic hazard insurance availability	Regional, local		√	
H-5: Encourage accurate identification of soft-story buildings	Regional, local	√		
H-6: Establish affordable financing mechanisms to facilitate seismic mitigation of multi-family residential properties vulnerable to damage in earthquakes	Regional, local		√	
H-7: Reduce personal and community losses by increasing resilient building and retrofit practices	Local	√		

Recommended Action	Level of Implementation	Short-term	Medium-term	Long-term
Housing				
H-8: Improve the quality of non-engineered retrofits by developing a statewide retrofitting license for contractors, or providing contractor training	Regional		√	
H-9: Increase the number of retrofitted homes by providing financial incentives for homeowners to retrofit	Regional, local		√	
Infrastructure				
I-1: Establish regional baseline assessment and system performance standards to identify vulnerabilities and define interdependencies	Regional		√	
I-2: Conduct a regional assessment of system interdependencies and the consequences of cascading failures	Regional	√		
I-3: Evaluate the usefulness of creating performance targets to establish region-wide performance goals for all infrastructure systems	Regional			√
I-4: Identify strategies to reduce interdependencies and develop plans to assist with implementation	Regional			√
I-5: Establish a senior leadership forum on infrastructure resilience issues to convene providers and stakeholders	Regional	√		
Economy and Business				
EB-1: Encourage best practices that support business continuity and facilitate restoration of regional economies	Regional		√	
EB-2: Support pre-disaster economic development through existing regional best practices	Regional, local	√	√	√
EB-3: Implement the recommendations of the Resilience Initiative's Decision-Making, Housing, and Infrastructure Policy Papers	Regional, local	√	√	√
EB-4: Explore innovative financial incentives to support disaster resilience initiatives for small business	Regional, local		√	

Initial Implementation Guide

Recommended Action	Initial Implementation Tasks
Short-Term (Completed in 1-5 years)	
G-1: Use existing intergovernmental committees to convene jurisdictions and facilitate communication around disaster recovery collaboration	• Convene the Joint Policy Committee (JPC) and/or Regional Planning Committee (RPC) to discuss potential formation of disaster recovery forum • Identify potential roles and organizing structure for forum • Identify goals and objectives for forum • Recruit "champion" within RPC or JPC to help gather stakeholders • Coordinate with other similar initiatives, such as the Joint Policy Committee's Climate Action and Energy Resilience Project
G-4: Lead reconnaissance missions for local leaders, staff, and community stakeholders to areas undergoing disaster recovery	• Identify potential funding sources • Identify leaders to attend, such as ABAG's RPC members or other groups • Establish a MOU with the Earthquake Engineering Research Institute (EERI) to expand their program to include local stakeholders
G-5: Establish and maintain a recovery clearinghouse to house resources for pre-disaster recovery planning and post-disaster recovery guidance	• Identify a staff lead, with funding, to begin research and resource collection • Examine platforms for sharing, including websites, Base Camp, and file-sharing systems
H-1: Identify areas where mitigation and recovery resources are particularly important	• Gather vulnerable population data to input into GIS • Secure funding for ABAG staff time
H-5: Encourage accurate identification of soft-story buildings	• Share regional best practices and lessons learned • Begin drafting policy language based on existing ordinances that is easily adoptable by jurisdictions
H-7: Reduce personal and community losses by increasing resilient building and retrofit practices	• Establish a technical team to research and develop standard guidelines for single-family retrofits • Engage with the California Earthquake Authority and FEMA to coordinate efforts
I-2: Conduct a regional assessment of system interdependencies and the consequences of cascading failures	• Utilize ABAG's existing Lifelines Committee to oversee a system assessment • Research best practices for interdependencies assessments • Partner with San Francisco Lifelines Council to avoid duplicating efforts • Develop scenario and work plan
I-5: Establish a senior leadership forum on infrastructure resilience issues to convene providers and stakeholders	• Identify existing groups that may be able to expand to take on this responsibility • Establish goals and objectives for forum
EB-2: Support pre-disaster economic development through existing regional best practices	• Identify topics for further research • Identify appropriate research teams or partnerships with research institutions to establish programs of study
EB-3: Implement the recommendations of the Resilience Initiative's Decision-Making, Housing, and Infrastructure Policy Papers	• Identify short-term tasks in previous recommendations that most effectively support the regional economy and begin implementation
EB-4: Explore innovative financial incentives to support disaster resilience initiatives for small business	• Identify private sector partners to begin conversations about incentives • Explore best practices and case studies around financing incentives

Recommended Action	Initial Implementation Tasks
Medium-Term (Completed in 5-10 years)	
G-2: Examine the feasibility of a regional disaster recovery framework	• Look at existing recovery plans and frameworks to establish best practices and ensure integration • Work with regional recovery forum to establish a working group tasked with development of a recovery framework • Establish stakeholder input process to solicit feedback from local jurisdictions
H-4: Address the problem of underinsured homes with more realistic hazard insurance availability	• Establish contact with the California Earthquake Authority and engage in discussions
H-6: Establish affordable financing mechanisms to facilitate seismic mitigation of multi-family residential properties vulnerable to damage in earthquakes	• Engage lobbyists and prepare a policy platform around PACE funds and upholding AB184 • Identify best practices and sources of funding for seismic retrofit funding • Explore innovative public/private partnerships for funding sources
H-8: Improve the quality of non-engineered retrofits by developing a statewide retrofitting license for contractors, or providing contractor training	• Organize best management practices to inform state licensing • Establish a regional certification program for pre-disaster retrofit and post-disaster repair, building on ABAG's previous efforts
H-9: Increase the number of retrofitted homes by providing financial incentives for homeowners to retrofit	• Work with One Bay Area Grant managers to establish language for seismic improvements in grant qualifications • Partner with the California Earthquake Authority to utilize their mitigation funding effectively • Implement Recommended Action H-1 to identify high priority areas for mitigation funding
I-1: Establish regional baseline assessment and system performance standards to identify vulnerabilities and define interdependencies	• Research best practices for assessing infrastructure vulnerabilities and baseline conditions • Establish a working group to identify standard earthquake scenarios and educate infrastructure providers on how to use the scenarios for assessment purposes • Provide a platform for providers to share their own research and best practices
EB-1: Encourage best practices that support business continuity and facilitate restoration of regional economies	• Identify topics for further research • Identify appropriate research teams or partnerships with research institutions to establish programs of study

Recommended Action	Initial Implementation Tasks
Long-Term (Completed in 10-20 years)	
G-3: Integrate resilience policy into existing current plans and practices	• Incorporate resilience discussions into the second iteration of the SCS • Identify best practices for jurisdictions and develop a guide to assist in implementation
H-2: Explore interim housing solutions that encourage residents to invest in the Bay Area's recovery	• Identify best practices shelter-in-place policies and the development of neighborhood support centers • Develop pre-disaster temporary sheltering plans and policies
H-3: Use Plan Bay Area as a framework to directing resources for permanent replacement of housing	• Consider the feasibility of adopting the SCS as the regional housing recovery plan
I-3: Evaluate the usefulness of creating performance targets to establish region-wide performance goals for all infrastructure systems	• Develop a technical team to examine SPUR and other existing performance categories for feasibility • Conduct necessary research on the Bay Area's infrastructure systems to develop categories tailored to our specific Bay Area needs
I-4: Identify strategies to reduce interdependencies and develop plans to assist with implementation	• Develop a technical research team composed of engineers and other mitigation experts • Research existing policy and develop recommendations based on technical research

Governance

G-1: Use existing intergovernmental committees to convene jurisdictions and facilitate communication around disaster recovery collaboration

Recommended Action	Level of Implementation	Short-Term	Medium-Term	Long-Term
G-1: Use existing intergovernmental committees to convene jurisdictions and facilitate communication around disaster recovery collaboration	Regional	√		

Action Category					
Facilitation	*Education/ Information*	*Evaluation*	**Policy Development**	*Further Study/ Research*	*Program and Operation*

Utilizing an existing body such as the Joint Policy Committee (JPC) or Association of Bay Area Government (ABAG)'s Regional Planning Committee (RPC), create a regional forum for conversation and sharing, letting jurisdictions drive the content. The desired outcome would be more involved and informed stakeholders, consensus around major recovery decisions, and a coordinated regional policy platform.

Initial Implementation Tasks:

- Convene the Joint Policy Committee (JPC) and/or Regional Planning Committee (RPC) to discuss potential formation of disaster recovery forum
- Identify potential roles and organizing structure for forum
- Identify goals and objectives for forum
- Recruit "champion" within RPC or JPC to help gather stakeholders
- Coordinate with other similar initiatives, such as the JPC Climate Action and Energy Resilience Project

G-2: Examine the feasibility of a regional disaster recovery framework

Recommended Action	Level of Implementation	Short-Term	Medium-Term	Long-Term
G-2: Examine the feasibility of a regional disaster recovery framework	Regional		√	

Action Category					
Facilitation	*Education/ Information*	*Evaluation*	**Policy Development**	**Further Study/ Research**	**Program and Operation**

Within a regional forum, a regional disaster recovery framework could allow jurisdictions to develop procedures for making decisions surrounding operations or processes as well as financial management issues that cross jurisdictional boundaries or are too cumbersome for one jurisdiction to manage alone. This framework may take the form of a writ-

ten recovery plan, outlining procedures, roles, and tasks for all stakeholders involved, similar to FEMA's recently released National Disaster Recovery Framework.

Initial Implementation Tasks:

- Look at existing recovery plans and frameworks to establish best practices and ensure integration
- Work with regional recovery forum to establish a working group tasked with development of a recovery framework
- Establish stakeholder input process to solicit feedback from local jurisdictions

G-3: Integrate resilience policy into existing current plans and practices

Recommended Action	Level of Implementation	Short-Term	Medium-Term	Long-Term
G-3: Integrate resilience policy into existing current plans and practices	Regional, local			√

Action Category					
Facilitation	**Education/ Information**	*Evaluation*	**Policy Development**	*Further Study/ Research*	*Program and Operation*

Many elements that support resilience and recovery can be integrated into existing work, at the regional level and within jurisdictions. At a regional level, disaster resilience policy should be incorporated into ABAG's Sustainable Communities Strategy (SCS), the Joint Policy Committee (JPC)'s work on Climate Change, and other regional initiatives towards sustainability, economy, land use planning, and quality of life. Language and policy on recovery also can be integrated into existing county and city-level documents including General Plans and Emergency Operations Plans to formalize policy and procedures rather than requiring new initiatives.

Initial Implementation Tasks:

- Incorporate resilience discussions into the second iteration of the SCS
- Identify best practices for jurisdictions and develop a guide to assist in implementation

G-4: Lead reconnaissance missions for local leaders, staff, and community stakeholders to areas undergoing disaster recovery

Recommended Action	Level of Implementation	Short-Term	Medium-Term	Long-Term
G-4: Lead reconnaissance missions for local leaders, staff, and community stakeholders to areas undergoing disaster recovery	Regional, local	√		

Action Category					
Facilitation	**Education/ Information**	**Evaluation**	*Policy Development*	*Further Study/ Research*	**Program and Operation**

Experiencing the aftermath of a disaster can be a strong motivator for elected officials and other leaders to assume new responsibilities and guide action in their jurisdictions, as well as learn new tools and skills for their own recovery process. The region could consider working with EERI to expand its reconnaissance teams to include local and community leaders and appropriate staff.

Initial Implementation Tasks:

- Identify potential funding sources
- Identify leaders to attend, such as ABAG's RPC members or other groups
- Establish a MOU with EERI to expand their program to include local stakeholders

G-5: Establish and maintain a recovery clearinghouse to house resources for pre-disaster recovery planning and post-disaster recovery guidance

Recommended Action	Level of Implementation	Short-Term	Medium-Term	Long-Term
G-5: Establish and maintain a recovery clearinghouse function to house resources for pre-disaster recovery planning and post-disaster recovery guidance	Regional, local	√		

Action Category					
Facilitation	**Education/ Information**	*Evaluation*	*Policy Development*	*Further Study/ Research*	**Program and Operation**

The region needs an informational clearinghouse to house and share case studies, best practices, model ordinances, checklists, and other forms of guidance to help stakeholders better understand the recovery process and to have easily accessible tools to enact relevant policy, before and after a disaster. Another role for the clearinghouse could be compiling an inventory of existing and newly created recovery-related Bay Area plans and assessing pre-and post-event mitigation and recovery investments to help leverage community improvements as well as managing regional hazards data and data tracking recovery after the disaster does occur.

Initial Implementation Tasks:

- Identify a staff lead, with funding, to begin research, resource and hazards data collection
- Develop an initial ordinance package to assist local governments with recovery policies
- Examine platforms for sharing, including websites, Base Camp, and file-sharing systems

Housing

H-1: Identify areas where mitigation and recovery resources are particularly important

Recommended Action	Level of Implementation	Short-Term	Medium-Term	Long-Term
H-1: Identify areas where mitigation and recovery resources are particularly important	Regional, local	√		

Action Category					
Facilitation	**Education/ Information**	*Evaluation*	*Policy Development*	**Further Study/ Research**	**Program and Operation**

By overlaying information on vulnerable housing type and vulnerable populations with hazard and Priority Development Areas policy makers can direct policies and allocate resources to strengthen housing, reduce individual losses, shorten housing reconstruction timelines, minimize economic disruption and promote long-term regional growth and economic goals.

Initial Implementation Tasks:

- Gather vulnerable population data to input into GIS
- Secure funding for ABAG staff time

H-2: Explore interim housing solutions that encourage residents to invest in the Bay Area's recovery

Recommended Action	Level of Implementation	Short-Term	Medium-Term	Long-Term
H-2: Explore interim housing solutions that encourage residents to invest in the Bay Area's recovery	Regional, local			√

Action Category					
Facilitation	**Education/ Information**	*Evaluation*	**Policy Development**	*Further Study/ Research*	**Program and Operation**

If possible, while homes are being repaired, residents should be enabled to remain in their home or neighborhood through shelter-in-place policies. When residents remain, local businesses are more likely to stay in business, and families are more likely to quickly return to the routine of school and work. Regional plans to provide neighborhood support centers can enable families to remain in place by providing centralized food and water distribution, access to generators and medicine, and other needed services and supplies. Neighborhood support centers facilitate maintenance of existing neighborhood support networks.

Initial Implementation Tasks:

- Identify best practices shelter-in-place policies and the development of neighborhood support centers
- Develop pre-disaster temporary sheltering plans and policies

H-3: Use *Plan Bay Area* as a framework to directing resources for permanent replacement of housing

Recommended Action	Level of Implementation	Short-Term	Medium-Term	Long-Term
H-3: Use Plan Bay Area as a framework to directing resources for permanent replacement of housing	Regional, local			√

Action Category					
Facilitation	**Education/ Information**	*Evaluation*	**Policy Development**	*Further Study/ Research*	**Program and Operation**

When housing needs to be reconstructed on a large scale, regional leaders can use *Plan Bay Area* and the SCS framework and the identified areas for growth (PDAs) to guide post-earthquake planning and development. PDAs have plans for building that in some cases are ready to be executed and an earthquake can be an opportunity to implement these plans. This will have the dual benefit of stimulating recovery while achieving our regional vision.

Initial Implementation Tasks:

- Examine the feasibility of adopting the SCS as the regional housing recovery plan

H-4: Address the problem of underinsured homeowners with more realistic hazard insurance availability

Recommended Action	Level of Implementation	Short-Term	Medium-Term	Long-Term
H-4: Address the problem of underinsured homeowners with more realistic hazard insurance availability.	Regional, local		√	

Action Category					
Facilitation	**Education/ Information**	*Evaluation*	**Policy Development**	*Further Study/ Research*	**Program and Operation**

Policymakers can ensure that damaged homes are repaired and rebuilt more quickly by ensuring that more homeowners are covered by adequate hazard insurance coverage. Policymakers should work with the California Earthquake Authority to reduce both its annual premium and deductibles. Earthquake insurance policies for renters, however, are a good deal and their use should be more widely encouraged.

Initial Implementation Tasks:

- Establish contact with the California Earthquake Authority (CEA) and engage in discussions

H-5: Encourage accurate identification of soft-story buildings

Recommended Action	Level of Implementation	Short-Term	Medium-Term	Long-Term
H-5: Encourage accurate identification of soft-story buildings	Regional, local	√		

Action Category					
Facilitation	**Education/ Information**	**Evaluation**	**Policy Development**	*Further Study/ Research*	**Program and Operation**

Owner notification programs such as those taking place in Berkeley, Oakland, and Alameda are part of a broader societal trend recognizing the seismic vulnerabilities of soft-story buildings and placing liability on building owners. This exposure is something that owners will have to take into account when deciding how they will operate their buildings.[1] San Francisco, in 2012, embarked upon a ten-year mandatory evaluation and retrofit program for soft-story multi-family buildings.[2] While politically difficult, this mandatory program will likely serve the City's, the building owner's, and the residents' best interests in the long run.

Initial Implementation Tasks:

- Share regional best practices and lessons learned
- Begin drafting policy language based on existing ordinances that is easily adoptable by jurisdictions

H-6: Establish affordable financing mechanisms to facilitate seismic mitigation of multi-family residential properties vulnerable to damage in earthquakes

Recommended Action	Level of Implementation	Short-Term	Medium-Term	Long-Term
H-6: Establish affordable financing mechanisms to facilitate seismic mitigation of multi-family residential properties vulnerable to damage in earthquakes	Regional, local		√	

Action Category					
Facilitation	**Education/ Information**	*Evaluation*	**Policy Development**	*Further Study/ Research*	**Program and Operation**

1 Personal communication, Ken Moy, ABAG legal counsel

2 Applies to three or more story, 5 or more unit soft-story wood frame residential buildings, phased in four categories based on geological hazard and use.

We recommend that policymakers work together to find ways to utilize the PACE program for seismic retrofits and to lobby the federal government to provide the initial pot of money. In addition to PACE, a suite of policies and incentives can be adopted by cities wishing to encourage seismic retrofit. In addition, local governments working together with lending institutions, insurance companies, and other government agencies before future earthquakes could design new coordinated lending processes.

Initial Implementation Tasks:

- Engage lobbyists and prepare a policy platform around PACE funds and upholding AB184
- Identify best practices and sources of funding for seismic retrofit funding
- Explore innovative public/private partnerships for funding sources

H-7: Reduce personal and community losses by increasing resilient building and retrofit practices

Recommended Action	Level of Implementation	Short-Term	Medium-Term	Long-Term
H-7: Reduce personal and community losses by increasing resilient building and retrofit practices	Local	√		

Action Category					
Facilitation	**Education/ Information**	*Evaluation*	**Policy Development**	*Further Study/ Research*	**Program and Operation**

Clear and comprehensive guidelines for the retrofit of all remaining single-family dwellings are needed. This lack of standard means that permits will be issued for voluntary seismic retrofits that may not be adequate. The California Earthquake Authority and FEMA are working to develop recommendations for future evaluation and retrofit codes and standards and local policy makers should encourage their effort.

Initial Implementation Tasks:

- Establish a technical team to research and develop standard guidelines for single-family retrofits
- Engage with the California Earthquake Authority and FEMA to coordinate efforts

H-8: Improve the quality of non-engineered retrofits by developing a statewide retrofitting license for contractors, or providing contractor training

Recommended Action	Level of Implementation	Short-Term	Medium-Term	Long-Term
H-8: Improve the quality of non-engineered retrofits by developing a statewide retrofitting license for contractors, or providing contractor training	Regional		√	

Action Category					
Facilitation	*Education/ Information*	*Evaluation*	*Policy Development*	*Further Study/ Research*	**Program and Operation**

Similar to a plumbing or electrical license or the Home Improvement Certification category, a retrofitting license or certification would help ensure that contractors performing seismic retrofits are properly trained. Implementation would require action the by the California State License Board to develop some new regulations. Bay Area local governments may not be able to wait for state action to implement this policy. An interim step might be to establish a regional certification program for pre-disaster retrofit and post-disaster repair that would address the most vulnerable Bay Area building types.

Initial Implementation Tasks:

- Organize best management practices to inform state licensing
- Establish a regional certification program for pre-disaster retrofit and post-disaster repair, building on ABAG's previous efforts

H-9: Increase the number of retrofitted homes by providing financial incentives for homeowners to retrofit

Recommended Action	Level of Implementation	Short-Term	Medium-Term	Long-Term
H-9: Increase the number of retrofitted homes by providing financial incentives for homeowners to retrofit	Regional, local		√	

Action Category					
Facilitation	**Education/ Information**	*Evaluation*	*Policy Development*	*Further Study/ Research*	**Program and Operation**

Financial incentives not only make retrofitting more affordable, they can also improve the quality of retrofits by setting a minimum standard that retrofits must achieve in order to receive assistance, and create opportunities to educate communities about the prudence of seismic retrofitting. Regional agencies could consider including seismic improvements to the One Bay Area Grant Program which provides funding to support implementation of the Sustainable Communities Strategy (SCS). We recommend that policy makers also endorse the involvement of insurance industry in developing owner incentives for retrofitting structures.

Initial Implementation Tasks:

- Work with One Bay Area Grant managers to establish language for seismic improvements in grant qualifications
- Partner with the California Earthquake Authority to utilize their mitigation funding effectively
- Implement Recommended Action H-1 to identify high priority areas for mitigation funding

Infrastructure

I-1: Establish regional baseline assessment and system performance standards to identify vulnerabilities and define interdependencies

Recommended Action	Level of Implementation	Short-Term	Medium-Term	Long-Term
I-1: Establish regional baseline assessment and system performance standards to identify vulnerabilities and define interdependencies	Regional		√	

Action Category					
Facilitation	*Education/ Information*	**Evaluation**	*Policy Development*	**Further Study/ Research**	*Program and Operation*

The region needs to establish common tools for evaluation and assessment, and build consensus around the type of analysis and how to present findings. One way to begin this is to establish common earthquake scenarios for evaluating systems so consequences can be compared and interdependencies are defined across the region. We need to, as a region, assess the existing state of infrastructure systems, much of which is aging, deteriorating, and functioning at capacities beyond their original design, which all increase vulnerability. Regional infrastructure stakeholders could conduct and share research on evaluations, best practices, and recommendations for effective and uniform analysis of vulnerabilities.

Initial Implementation Tasks:

- Research best practices for assessing infrastructure vulnerabilities and baseline conditions
- Establish a working group to identify standard earthquake scenarios and educate infrastructure providers on how to use the scenarios for assessment purposes
- Provide a platform for providers to share their own research and best practices

I-2: Conduct a regional assessment of system interdependencies and the consequences of cascading failures

Recommended Action	Level of Implementation	Short-Term	Medium-Term	Long-Term
I-2: Conduct a regional assessment of system interdependencies and the consequences of cascading failures	Regional	√		

Action Category					
Facilitation	*Education/ Information*	**Evaluation**	*Policy Development*	**Further Study/ Research**	*Program and Operation*

Similar to San Francisco Lifelines Council's current lifeline qualitative review, the region should conduct a high-level assessment of Bay Area infrastructure systems to identify and assess critical interdependencies. The study could be based

on a standardized earthquake scenario or scenarios (see above) and identify and assess lifeline systems by performance (similar to SPUR's performance categories) along with peer-reviewed approaches. Then communities can prioritize system improvements based on defined performance targets that suggest key mitigation actions.

Initial Implementation Tasks:

- Utilize ABAG's existing Lifelines Committee to oversee a system assessment
- Research best practices for interdependencies assessments
- Partner with San Francisco Lifelines Council to avoid duplicating efforts
- Develop scenario and work plan

I-3: Evaluate the usefulness of creating performance targets to establish region-wide performance goals for all infrastructure systems

Recommended Action	Level of Implementation	Short-Term	Medium-Term	Long-Term
I-3: Evaluate the usefulness of creating performance targets to establish region-wide performance goals for all infrastructure systems	Regional			√

Action Category					
Facilitation	*Education/ Information*	**Evaluation**	**Policy Development**	**Further Study/ Research**	*Program and Operation*

San Francisco Planning and Urban Research (SPUR) has created categories of expected performance for lifelines within San Francisco, as well as goals and targets for recovery of infrastructure systems within four hours, three days, 30 days, and four months and beyond after a disaster. We could consider developing similar performance categories at a regional level using peer-reviewed evaluation methodology to provide clear expectations and goals for all utility providers, as well as provide a useful tool for evaluating the current state of systems and communicating this information with other providers.

Initial Implementation Tasks:

- Develop a technical team to examine SPUR and other existing performance categories for feasibility
- Conduct necessary research on the Bay Area's infrastructure systems to develop categories tailored to our specific Bay Area needs

I-4: Identify strategies to reduce interdependencies and develop plans to assist with implementation

Recommended Action	Level of Implementation	Short-Term	Medium-Term	Long-Term
I-4: Identify strategies to reduce interdependencies and develop plans to assist with implementation	Regional			√

Action Category					
Facilitation	**Education/ Information**	*Evaluation*	**Policy Development**	**Further Study/ Research**	*Program and Operation*

Concurrent with examining vulnerabilities and impacts, research could be conducted to identify cost-effective, feasible strategies to mitigate interdependencies, including system redundancy or backup, "islanding" vulnerable systems to limit their impacts and impacts to them, or creating smaller, self-contained "districts" of systems rather than one large, vulnerable system. This study should include identifying existing policies and regulations that impede or assist recovery as well as identifying what policies and regulations are need to propel infrastructure recovery.

Initial Implementation Tasks:

- Develop a technical research team composed of engineers and other mitigation experts
- Research existing policy and develop recommendations based on technical research

I-5: Establish a senior leadership forum on infrastructure resilience issues to convene providers and stakeholders

Recommended Action	Level of Implementation	Short-Term	Medium-Term	Long-Term
I-5: Establish a senior leadership forum on infrastructure resilience issues to convene providers and stakeholders	Regional	√		

Action Category					
Facilitation	**Education/ Information**	*Evaluation*	*Policy Development*	*Further Study/ Research*	*Program and Operation*

Infrastructure providers and regional communities need a forum in which to share and gain situational awareness, spark mitigation programs and create new or utilize existing decision-making and prioritization tools. Tapping a third-party, neutral convener can offer impartial perspectives in prioritizing policy and strategic actions as well as providing a central information hub. A committee team can engage other stakeholders for decision-making and program prioritization, including the broader community.

Initial Implementation Tasks:

- Identify existing groups that may be able to expand to take on this responsibility
- Establish goals and objectives for forum

Economy and Business

EB-1: Encourage best practices that support business continuity and facilitate restoration of regional economies

Recommended Action	Level of Implementation	Short-Term	Medium-Term	Long-Term
EB-1: Encourage best practices that support business continuity and facilitate restoration of regional economies	Regional		√	

Action Category					
Facilitation	*Education/ Information*	*Evaluation*	*Policy Development*	**Further Study/ Research**	*Program and Operation*

Concrete knowledge on economic recovery is limited, particularly within the context of the Bay Area. We recommend partnering with research bodies such as the Bay Area Council (BAC), the California Seismic Safety Commission (CSSC) and research institutions such as UC Berkeley and Stanford to continue to conduct Bay Area-specific research and studies on specific actions that local governments or regional groups can take to expedite economic recovery. We recommend implementing findings from the CSSC and conducting a more thorough survey on existing best practices, both specific to the Bay Area and from other disasters within the US. We recommend research focused around our first two issues in particular - getting large businesses to stay in the region and keeping small businesses open.

Initial Implementation Tasks:

- Identify topics for further research
- Identify appropriate research teams or partnerships with research institutions to establish programs of study

EB-2: Support pre-disaster economic development through existing regional best practices

Recommended Action	Level of Implementation	Short-Term	Medium-Term	Long-Term
EB-2: Support pre-disaster economic development through existing regional best practices	Regional, local	√		

Action Category					
Facilitation	**Education/ Information**	*Evaluation*	**Policy Development**	**Further Study/ Research**	*Program and Operation*

Several regionally-focused groups have conducted extensive research on how to best maintain and grow the Bay Area's economy. ABAG has conducted extensive economic research through its Plan Bay Area, Jobs-Housing Connection Strategy, and is currently developing a Regional Prosperity Plan. ABAG is also developing a Regional Policy Background Paper

on Economic Development which will include recommended actions for continued economic growth. The Bay Area Council (BAC)'s Economic Assessment report also outlines actions designed to strengthen today's economy, and a strong and nimble economy today will provide a basis for a strong regional economic recovery after an earthquake.

Initial Implementation Tasks:

- Prepare an implementation plan for current best practice recommendations, identifying appropriate stakeholders, fora, and funding sources for implementation projects

EB-3: Implement the recommendations of the Resilience Initiative's Decision-Making, Housing, and Infrastructure Policy Papers

Recommended Action	Level of Implementation	Short-Term	Medium-Term	Long-Term
EB-3: Implement the recommendations of the Resilience Initiative's Housing, Infrastructure and Regional Decision-Making Issue Papers	Regional, local	√		

Action Category					
Facilitation	**Education/ Information**	**Evaluation**	**Policy Development**	**Further Study/ Research**	**Program and Operation**

Many of the key factors in economic recovery are closely linked to the issues laid out in the Initiative's issue papers on housing, infrastructure and regional decision-making. Strengthening these areas will bolster our overall economy and ability to recover quickly. These recommended actions also support issues identified in BAC report as necessary for a strong regional economy.

Initial Implementation Tasks:

- Identify short-term tasks in previous recommendations that most effectively support the regional economy and begin implementation

EB-4: Explore innovative financial incentives to support disaster resilience initiatives for small business

Recommended Action	Level of Implementation	Short-Term	Medium-Term	Long-Term
EB-4: Explore innovative financial incentives to support disaster resilience initiatives for small business	Regional, local		√	

Action Category					
Facilitation	**Education/ Information**	*Evaluation*	**Policy Development**	**Further Study/ Research**	*Program and Operation*

Pre-disaster funding directed toward hazard mitigation for small business is currently limited to conventional lending practices which generally are either not available or not cost-effective for small business owners. Additionally, earthquake or business interruption insurance can be prohibitively expensive for small businesses operating with a small profit margin. There is a need to engage Chambers of Commerce, Economic Development Departments, lending institutions, the insurance industry and federal agencies, such as the Economic Development Administration, and the Historic Trust Main Street Program, in a discussion of potential strategies to support pre-disaster hazard mitigation incentives for small businesses. At the local level, Business Improvement Districts, revolving loan programs, or pool financing should be explored.

Initial Implementation Tasks:

- Identify private sector partners to begin conversations about incentives
- Explore best practices and case studies around financing incentives