

# **Community Planning for Resilience SPUR**

*Standards for Disaster Resilience for Buildings and  
Physical Infrastructure Systems*

*November 10, 2011*

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SAN FRANCISCO  
PLANNING + URBAN RESEARCH  
ASSOCIATION



## The Resilient City:

*Defining what San Francisco needs from its  
seismic mitigation policies for three phases*

**Before the Disaster, Response, Recovery**

[www.spur.org](http://www.spur.org)

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# Seismic Mitigation Task Force

Urban Planners:	Laurie Johnson, George Williams
City Officials:	Laurence Kornfield, Hanson Tom, Debra Walker
Public Policy Makers:	Sarah Karlinsky, Laura Dwelley-Samant, Tom Tobin
Engineers:	Chris Barkley, David Bonowitz, Joe Maffei, Jack Moehle, Robert Pekelnicky, Chris Poland
Labor:	Michael Theriault
Developers:	John Paxton, Ross Asselstine
Economist:	Jessica Zenk
Contractor:	Jes Penderson
PG&E:	Kent Ferre

***A unique gathering of Earthquake professionals and Stakeholders***

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# Healthy Cities



Require jobs, heritage, urban planning, progressive governance, sustainability and disaster resilience

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# Earthquake Resilient Communities

## Requires a Holistic Approach

- **Physical Resilience** is the foundation
- Environmental sustainability is a parallel goal
  - eliminate the deconstruct/reconstruct cycle.
- Integrated with urban design
- Supportive of Social issues
- Conscience of Institutional and governance constraints
- Supported by new financial mechanism and incentives

# Earthquake Resilient Communities

## Physical Resilience

- A place, ability and procedures to govern
- Building and lifeline design standards that support continuity and recovery
- Repair standards for reconstruction

# How Much Damage Can a City Endure?



**Haiti - 2010**



**Katrina - 2005**



**Chile - 2010**



**L'Aquila - 2009**

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# Approach:

- Define concept of ***resilience*** in the context of disaster planning and recovery, not a measure of the status
- Establish ***performance goals*** for the physical infrastructure for the “**expected**” earthquake that supports the definition of resilience
- Define transparent ***performance measures*** that help reach the performance goals



# Performance Goals for the “Expected” Earthquake

Phase	Time Frame	Condition of the built environment
I	1 to 7 days	Initial response and staging for reconstruction
II	7 to 60 days	Workforce housing restored – ongoing social needs met
III	2 to 36 months	Long term reconstruction

# Transparent Hazard Definitions

<b>Category</b>	<b>Hazard Level</b>
Routine	Likely to occur routinely
Expected	Reasonably expected to occur once during the useful life of a structure or system
Extreme	Reasonably be expected to occur on a nearby fault

# Transparent Performance Measures for Buildings

Category	Performance Standard
Category A	<b>Safe and operational:</b> Essential facilities such as hospitals and emergency operations centers
Category B	<b>Safe and usable during repair:</b> “shelter-in-place” residential buildings and buildings needed for emergency operations
Category C	<b>Safe and usable after repair:</b> current minimum design standard for new, non-essential buildings
Category D	<b>Safe but not repairable:</b> below current standards for new buildings, often used for voluntary retrofit
Category E	<b>Unsafe – partial or complete collapse:</b> damage that will lead to casualties in the event of the “expected” earthquake - the killer buildings

# What is Safe?

# What is Useable?



Observed Damage  
L'Aquila, Italy  
May 2009

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# ATC 20 Tagging

**Green tag** – May be used for continuous occupancy

**Yellow tag** – Safe enough to remove contents and do repair work

**Red tag** – Unsafe for entry during aftershock sequence

# Transparent Performance Measures for Lifelines

<b>Category</b>	<b>Performance Standard</b>
Category I	Resume 100% service within 4 hours
Category II	Resume 90% service within 72 hours 95% within 30 days 100% within 4 months
Category III	Resume 90% service within 72 hours 95% within 30 days 100% within 3 years

# Target States of Recovery for San Francisco's Building & Infrastructure

Phase	Time Frame	Focus of Attention
I	1 to 7 days reconstruction	Initial response and staging for

*EOC's,  
City Buildings,  
Hospitals,  
Police and Fire Stations,  
Shelters*



VIEW FROM POTRERO AVENUE  
SAN FRANCISCO GENERAL HOSPITAL AND TRAUMA CENTER  
CITY AND COUNTY OF SAN FRANCISCO

FONG & COON ARCHITECTS  
MARCH 24, 2009

San Francisco General Hospital

*Building Category A: "Safe and Operational"*

*Life Line Category I: "Resume essential service in 4 hours"*

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# Target States of Recovery for San Francisco's Building & Infrastructure

Phase	Time Frame	Focus of Attention
II	7 to 30 days	Workforce housing restored – ongoing social needs met

*Residential structures,  
Schools,  
Community retail centers,  
Doctors offices*



*Building Category B: "Safe and usable while being repaired"*

*Life Line Category II: "Resume 100% workforce service within 4 months"*



# Target States of Recovery for San Francisco's Building & Infrastructure

Phase	Time Frame	Focus of Attention
III	2to 36 months	Long term reconstruction

*Industrial Buildings*

*Commercial buildings*

*Historic buildings*



*Building Category C: "Safe and usable after repair"*

*Life Line Category III: "Resume 100% commercial service within 36 months"*






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# Target States of Recovery for San Francisco's Building & Infrastructure

TARGET STATES OF RECOVERY FOR SAN FRANCISCO'S BUILDINGS AND INFRASTRUCTURE									
INFRASTRUCTURE CLUSTER FACILITIES	Event occurs	Phase 1 Hours			Phase 2 Days		Phase 3 Months		
		4	24	72	30	60	4	36	36+
<b>CRITICAL RESPONSE FACILITIES AND SUPPORT SYSTEMS</b>									
Hospitals								X	
Police and fire stations			X						
Emergency Operations Center	X								
Related utilities						X			
Roads and ports for emergency				X					
CalTrain for emergency traffic				X	X				
Airport for emergency traffic				X					
<b>EMERGENCY HOUSING AND SUPPORT SYSTEMS</b>									
95% residence shelter-in-place								X	
Emergency responder housing				X					
Public shelters							X		
90% related utilities								X	
90% roads, port facilities and public transit							X		
90% Muni and BART capacity						X			

## Phase I

### TARGET STATES OF RECOVERY

Performance measure	Description of usability after expected event
	<b>BUILDINGS</b> <b>LIFELINES</b>
	<b>Category A:</b> Safe and operational
	<b>Category B:</b> 100% restored in 4 hours during repairs
	<b>Category C:</b> 100% restored in 4 months after moderate repairs
	<b>Category D:</b> 100% restored in 3 years after major repairs
	Expected current status






Note: Categories A–D are defined on page 10.

# Target States of Recovery for San Francisco's Building & Infrastructure

## Phase II

TARGET STATES OF RECOVERY FOR SAN FRANCISCO'S BUILDINGS AND INFRASTRUCTURE										
INFRASTRUCTURE CLUSTER FACILITIES	Event occurs	Phase 1 Hours			Phase 2 Days		Phase 3 Months			
		4	24	72	30	60	4	36	36+	
<b>HOUSING AND NEIGHBORHOOD INFRASTRUCTURE</b>										
Essential city service facilities								X		
Schools								X		
Medical provider offices									X	
90% neighborhood retail services										X
95% of all utilities									X	
90% roads and highways							X			
90% transit							X			
90% railroads								X		
Airport for commercial traffic					X					
95% transit								X		

### TARGET STATES OF RECOVERY

Performance measure	Description of usability after expected event
	<b>Category A:</b> Safe and operational
	<b>Category B:</b> 100% restored Safe and usable in 4 hours during repairs
	<b>Category C:</b> 100% restored Safe and usable in 4 months after moderate repairs
	<b>Category D:</b> 100% restored Safe and usable in 3 years after major repairs
	Expected current status

Note: Categories A–D are defined on page 10.

# Target States of Recovery for San Francisco's Building & Infrastructure

## Phase III

TARGET STATES OF RECOVERY FOR SAN FRANCISCO'S BUILDINGS AND INFRASTRUCTURE										
INFRASTRUCTURE CLUSTER FACILITIES	Event occurs	Phase 1 Hours			Phase 2 Days		Phase 3 Months			
		4	24	72	30	60	4	36	36+	
<b>COMMUNITY RECOVERY</b>										
All residences repaired, replaced or relocated										X
95% neighborhood retail businesses open									X	
50% offices and workplaces open										X
Non-emergency city service facilities									X	
All businesses open										X
100% utilities										X
100% roads and highways										X
100% travel										X

Source: SPUR analysis

**TARGET STATES OF RECOVERY**

**Performance measure**      **Description of usability after expected event**

**BUILDINGS**      **LIFELINES**

 **Category A:** Safe and operational

 **Category B:** 100% restored Safe and usable in 4 hours during repairs

 **Category C:** 100% restored Safe and usable in 4 months after moderate repairs

 **Category D:** 100% restored Safe and usable in 3 years after major repairs

 Expected current status

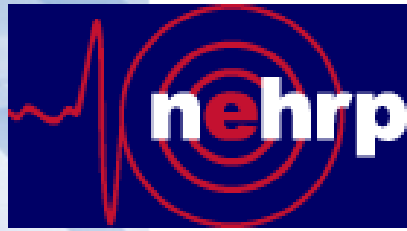
Note: Categories A–D are defined on page 10.



# Need New Design Codes and Standards

## Requires a Transparent Approach

- Next generation hazard definitions
  - Expected earthquake for building resilience
  - Extreme earthquake for lifelines and building safety
- New Vocabulary to describe damage in terms of response and recovery
  - Describe in terms of safety and usability
  - Required for Buildings and lifelines
- Performance Objectives to support resilience
  - Add an intermediate “shelter-in-place” goal
  - Add lifeline system restoration goals

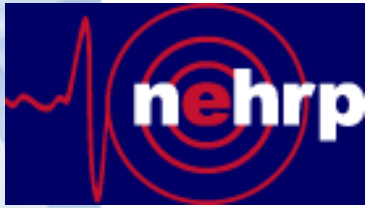


# National Earthquake Hazards Reduction Program

## Vision :

***A nation that is earthquake-resilient in public safety, economic strength, and national security***

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# National Earthquake Hazards Reduction Program

## Advisory Committee on Earthquake Hazards Reduction

Walter Arabasz

Jon Bray

Jim Harris

Mike Lindell

Chris Poland (Chair)

Anne vonWeller

Brent Woodworth

Jim Beavers

Richard Eisner

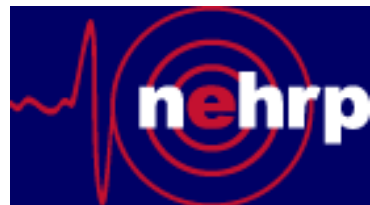
John Hooper

Tom O'Rourke

Susan Tubbesing

Yumei Wang

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# Achieving National Disaster Resilience

Unified support is required from all levels of government

- Federal Government
  - Set performance standards for all construction
  - Insist that states adopt and enforce the codes
  - Provide financial incentives to stimulate mitigation
  - Support research that leads to cost effective mitigation, response, and recovery



# Achieving National Disaster Resilience

Unified support is required from all levels of government

- State and local governments
  - Identify and mitigate regional lifeline system vulnerabilities
- Local Governments
  - Adopt and enforce appropriate Building codes
  - Current Expand preparedness planning
  - Develop mandatory mitigation programs



# Building Standards for Earthquake Resilient Communities

Unified support is required from all Earthquake Professionals

- Design Professionals need to join the conversation about achieving resiliency
- Transparent design codes based on standards for new and existing buildings and all lifeline systems need to be developed
- Research needs an expanded focus