



## **Resilience Case Studies & Tools**

### **City of Los Angeles Programs Supporting Resilience**

Judith Steele Stern, Ph.D., Consultant Services

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**“Sometimes it’s hard to get things  
done until people really see the  
disaster ahead.”**

***Governor Jerry Brown***

***Unveiling his proposed 2014-15 State Budget***

# TOWARD RESILIENCE IN LOS ANGELES

- **The Scale of the City**
- **1994 damage overview**
- **Resiliency**
  - **Consequences vs Causes**
  - **Creative response to surprise**
  - **Adaptability & Redundancy**
  - **Positive Outcomes**
- **What makes Hazard Mitigation Happen?**

# L.A. City Profile

*Census & City of LA*

**Size: 469 sq. miles**  
**Including 157 sq. miles of urban forest**

**Population: 3.85 mil**

**8,000+ persons per square mile**

**450,000+ businesses**

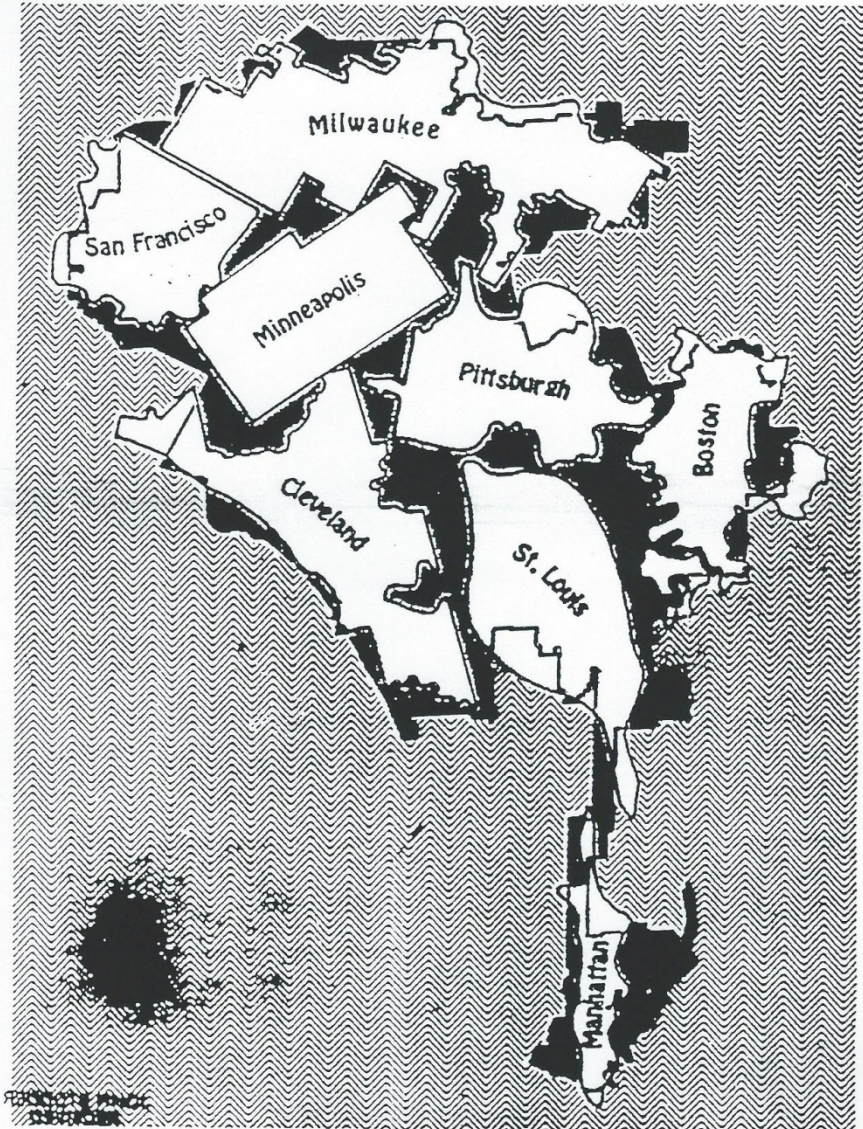
**15 Council Districts**

**20 Police Areas**

**106 Fire Stations**

**6,500 miles of centerline streets**

## How Big is Los Angeles?



PHOTOGRAPH BY  
REUTERS

**The area of Los Angeles could hold the combined areas of St. Louis, Cleveland, Minneapolis, Milwaukee, Boston, Pittsburgh, Manhattan, and San Francisco.**

# 94 Northridge EQ Damage - **\$44+ billion**

- **57 PEOPLE DIED**
- **8,000 INJURED**
- **1,500 HOSPITALIZED**
- **92,000 BUILDINGS DAMAGED**
- **20,000 DWELLING UNITS VACATED**
- **100 FIRES IGNITED DUE TO RUPTURED GAS LINES & COULDN'T BE EXTINGUISHED DUE TO BROKEN WATER SUPPLY SYSTEMS**
- **SEVERAL ELEVATED FREEWAY SECTIONS BROKE & FELL CUTTING OFF MAJOR COMMUTER ROUTES**

# 1994 Structural Failures

## Moderate to Severe

*LABSD 11/30/94*

<b>WOOD-FRAME</b>	<b>DAMAGE</b>	<b>COLLAPSE</b>
<b>HOUSES</b>	<b>1,650</b>	<b>30 hillside (10 collapsed, 20 leaning)</b>
<b>APARTMENTS, HOTELS &amp; CONDOMINIUMS</b>	<b>630</b>	<b>40 partial or leaning</b>

# 1994 Structural Failures

## Moderate to Severe

*LABSD 11/30/94*

MASONRY	DAMAGE	COLLAPSE
TILT-UPS	350	200 partial roof collapse
URM RETROFITTED	213	6 partial roof collapses commercial

# 1994 Structural Failures

## Moderate to Severe

*LABSD 11/30/94*

<b>OTHER</b>	<b>DAMAGE</b>	<b>COLLAPSE</b>
<b>NON-DUCTILE CONCRETE BLDGS</b>	<b>20</b>	<b>4</b>
<b>GARAGES</b>	<b>20</b>	<b>8</b>
<b>STRUCTURAL STEEL BLDGS</b>	<b>100</b>	<b>0</b>



# 1994 Non-Structural Failures

## Moderate to Severe

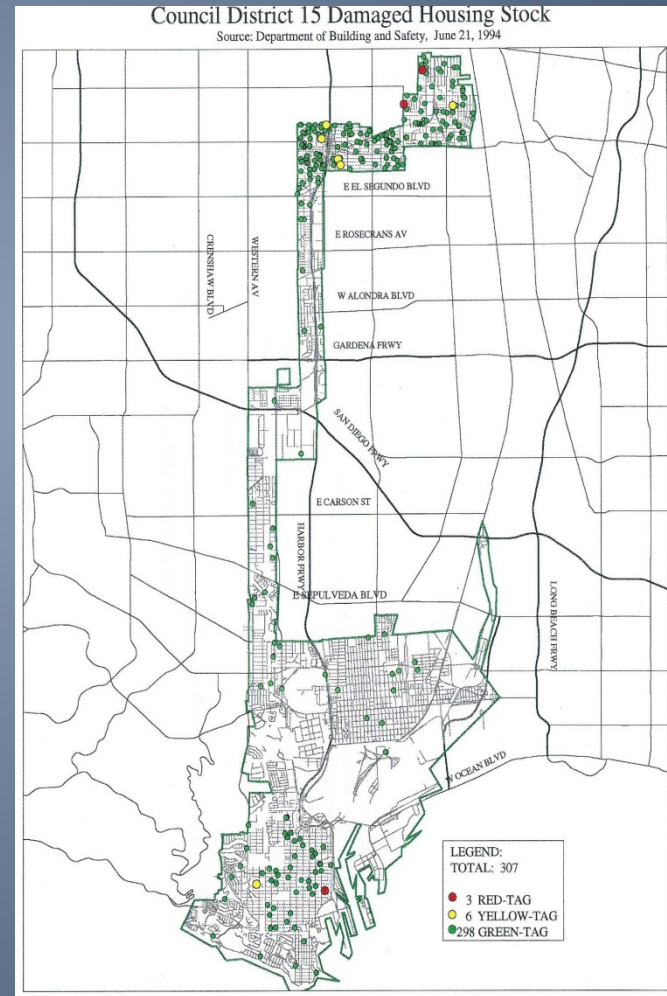
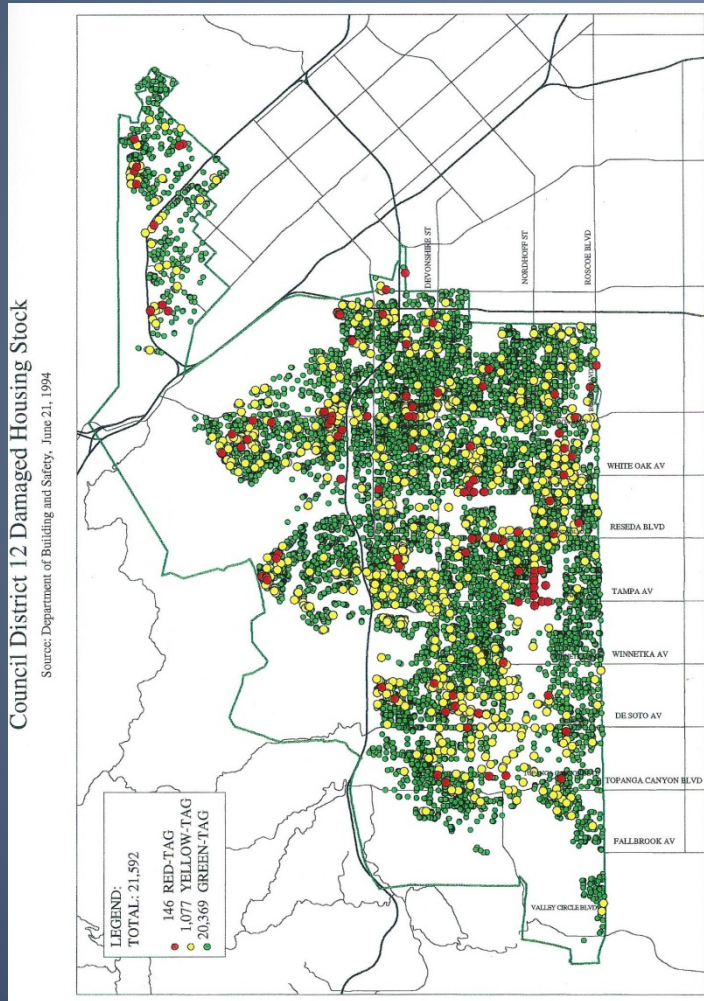
*LABSD 11/30/94*

OTHER	MODERATE TO SEVERE DAMAGE
NON-STRUCTURAL	CONSIDERABLE DAMAGE – CEILINGS, GLASS, SPRINKLER LINES, RACKS & SHELVES, MERCHANDISE FALLING, ETCS

# 1994 Damaged Housing Stock

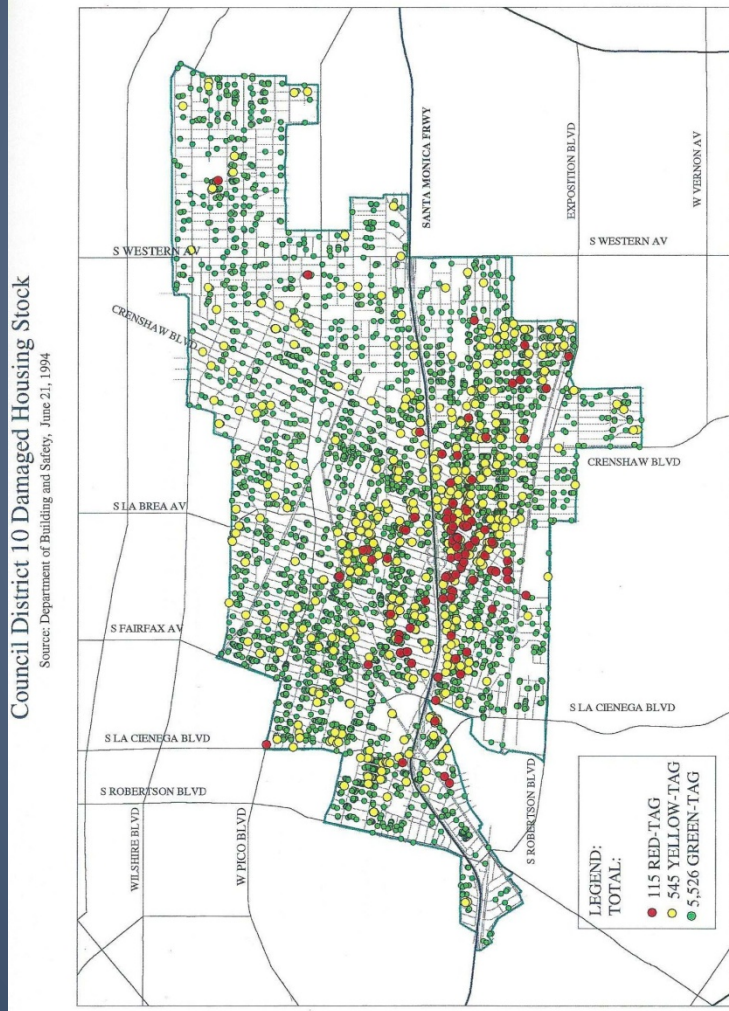
## Northridge

## San Pedro

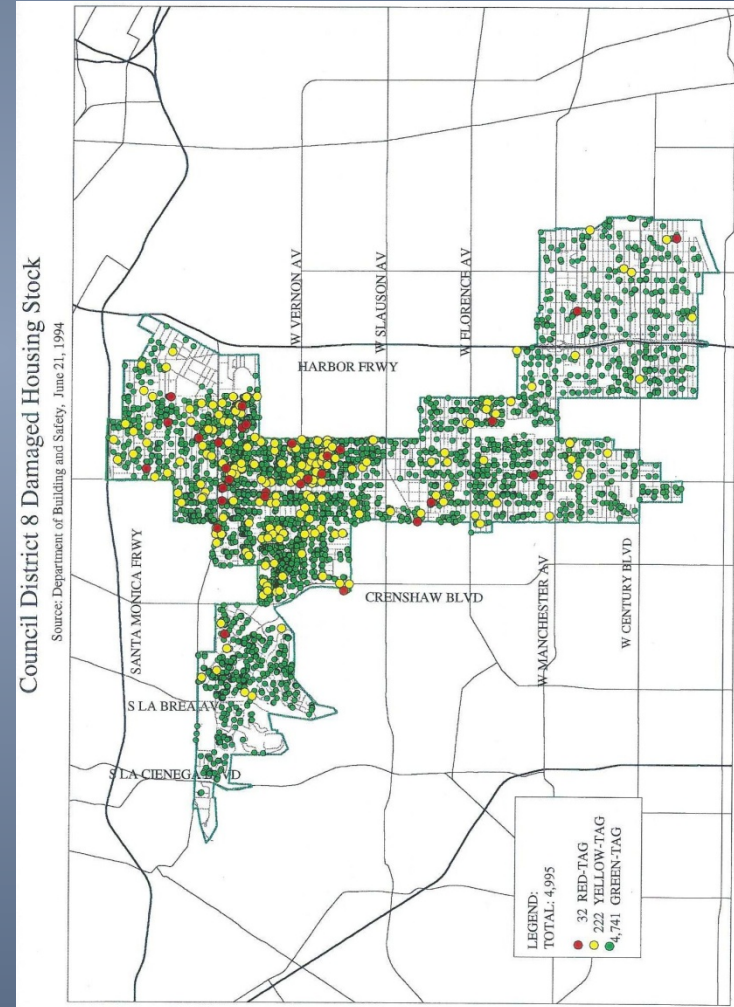


# 1994 Damaged Housing Stock

## Wilshire/Fairfax



## South Central



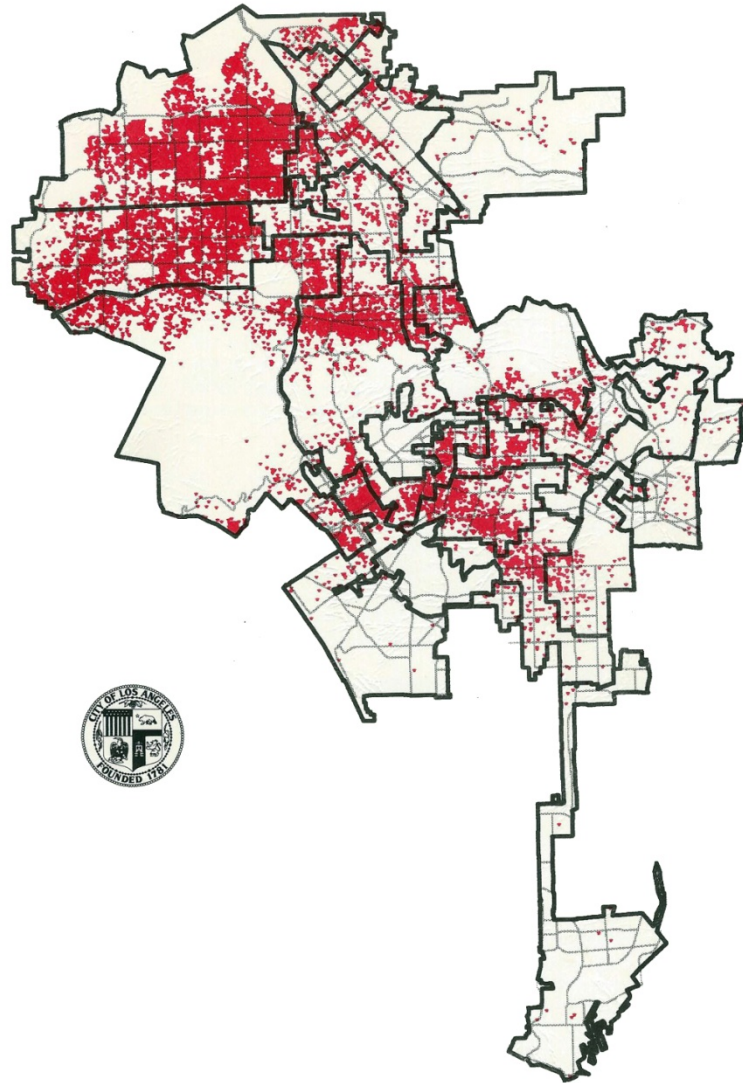
**L.A. City  
Northridge EQ  
Recovery Permits  
Issued by  
June 22, 1994  
(6 months)**

**Red dots = 25,252 permits**

**Repair of damaged  
structures**

**By December 21, 1994  
more than 56,000 permits  
had been issued  
(11 months)**

**LADBS One-Stop Rebuild  
Center**



# L.A. City's Disaster Experience

- **20 years of aggressive EQ preparedness & response planning beginning with the 1971 Sylmar (San Fernando Valley) Quake**
- **6 President Disaster Declarations between 1991-1994**
  - **Wild fires in Wildland Urban Interface**
  - **Floods**
  - **Civil Unrest 1992**

# Approach to Emergency Response

- **Emergency Operations Ordinance (EEO)**
- **Emergency Operations Board (EOB)**
  - established after the 1971 Sylmar Quake
  - Representatives of all Departments, with coordinated evolving emergency ops plans
- **Annual Disaster Response Retreat**
- **Periodic disaster response exercises**
- **Emergency Operations Communications (EOC)**
- **Emergency Management Department established in 2000**
- **Participation in inter-jurisdictional exercises**
- **Observation teams sent to other disaster events**

# Approach to Resiliency

## *Consequences over Causes more productive for planning*

DISASTER TYPE	EXAMPLE
HOUSING & SHELTER	Northridge <b>EQ</b> 1994 Hurricane Andrew 1992
FINANCIAL (CREDIT, INSURANCE, REINSURANCE)	Northridge <b>EQ</b> 1994 Oakland-East Bay Hills <b>Wildfire</b> 1991 Los Angeles <b>Civil Unrest</b> 1992
DESIGN, ENGINEERING, CONSTRUCTION	Oakland-East Bay Hills <b>Wildfire</b> 1991 Northridge <b>EQ</b> 1994

# Approach to Resiliency

## *Surprises require Creativity*

NORTHRIDGE 1994 SURPRISE	CREATIVE SOLUTION
<p><b>17 GHOST TOWNS</b></p> <p><b>Deteriorating luxury Multi Family Housing</b></p> <ul style="list-style-type: none"><li>•Continuing damage revelation</li><li>•Slow group decision making</li><li>•Multiple insurers &amp; uncoordinated response</li><li>•Lack of flexible financial tools</li><li>•Departure of insurance industry from housing market in California</li><li>•ID's by FEMA as “not EQ related”</li></ul>	<p>City Housing Department took lead</p> <ul style="list-style-type: none"><li>•<b>Identified &amp; mapped sites</b> through LADBS surveys, police reports &amp; Council Office referrals</li><li>•<b>Convinced FEMA to change view &amp; fund</b> security patrols, boarding up of structures, cleaning sites, fencing vacant property, removing spoilage and pumping out stagnate water</li><li>•<b>Aggressively pursued owners</b> to apply for the City's emergency loans &amp; rebuild ASAP</li></ul>



# Approach to Resiliency

## *Surprises require Creativity*

<b>NORTHRIDGE 1994 SURPRISE</b>	<b>CREATIVE SOLUTION</b>
<b>BROKEN GAS LINES &amp; WATER GRID</b> •Impeded fire fighting response – no water = no fire fighting	Fire pumpers hooked up to water grid to connect the breaks
<b>STEEL FRAME MOMENT CONNECTION FAILURE</b>	300 buildings were required to test a portion of connections inspected by structural engineer; 90 days to submit repair plan where necessary
<b>SEWER DAMAGE</b>	Small video cameras on sleds dropped into sewer lines & controlled from surface to assess damage by TV

# Approach to Resiliency

## *Surprises require Creativity*

NORTHRIDGE 1994 SURPRISE	CREATIVE SOLUTION
<b>FEMA REIMBURSEMENTS</b> for costs incurred for activating the California Urban Search & Rescue Task Forces	<b>Expanded US&amp;R capability</b> instead of reimbursing General Fund <ul style="list-style-type: none"><li>•new heavy rescue equipment packages</li><li>•Increased # of US&amp;R equipment sites throughout City</li></ul>
<b>PEOPLE REFUSED TO RE-ENTER HOMES</b>	<b>Created reassurance teams</b> <ul style="list-style-type: none"><li>•Info for victims</li><li>•Services for people waiting in parks &amp; other temporary shelters</li></ul>

# Approach to Resiliency

## *Adaptability & Redundancy*

ADAPTABLE ASSET	VALUE
<b>CITY PARK RECREATIONAL FACILITIES</b> <ul style="list-style-type: none"><li>•Kitchens for senior congregate meals</li><li>•After school activity areas</li></ul>	<b>Sheltering &amp; feeding sites</b> for homeless disaster victims
<b>HOUSING &amp; RENT STABILIZATION</b>	<b>Identify available housing</b> for those losing homes
<b>LEGISLATIVE PROGRAM &amp; STAFF WITH HIGH LEVEL PRESENCE IN SACRAMENTO &amp; WASHINGTON DC</b>	<b>Lobby</b> <ul style="list-style-type: none"><li>•Convey urgency</li><li>•Push for increased supplemental appropriations for financial aid</li><li>•Streamline processes</li></ul>

# 1933 Long Beach EQ – 6.25 Magnitude 5:55 pm

## The Field, Garrison & Green Acts



**1971 San Fernando EQ – 6.6 Magnitude 6:01 am**  
**Alquist –Priolo EQ Fault Zoning Act**



# 1989 Loma Prieta EQ– 6.9 Magnitude 5:04 pm

## Seismic Hazards Mapping Act



# 1994 Northridge EQ – 6.7 Magnitude 4:30 am

## More Mandatory Codes Adopted & the CEA created



**1987 Whittier Narrows EQ – 5.9 Magnitude 7:42 am**  
**LA City's Retrofitted URMs perform well**  
**unlike that below**





# City of Los Angeles

## **Mandatory Seismic Retrofit Program**

*LADBS 2011*

### **Existing URMs designed prior to 1933**

- 8,079 of 8,080 buildings complied

### **Existing Tilt-up Concrete Wall buildings designed prior to January 1976**

- All 2,638 buildings complied

### **Repair of Steel Moment Frame buildings**

- 519 of 520 complied

### **Seismic Gas Shut-off Valves**

- 30,000 complied per year; on-going

City of Los Angeles  
**Voluntary Seismic Retrofit Program**  
*LADBS 2011*

**Anchor LA Program - 1996**

- Reduce weak cripple walls & unbolted sill plates in wood-frame houses (LABC Chapter 92)

**Soft story, weak & open front walls - 1998**

- In existing wood-frame houses (LABC Chapter 93)

**Hillside buildings - 1996**

- (LABC Chapter 94)

City of Los Angeles  
**Voluntary Seismic Retrofit Program**  
*LADBS 2011*

**Masonry Infills - 1996**

- Reinforced Concrete & Concrete Frame buildings designed prior to January 1976 (LABC Chapter 95)

**Flexible Diaphragms- 1996**

- Reinforced Concrete & reinforced masonry buildings designed prior to January 1995 (LABC Chapter 96)

# TELL THE STORY

- **TO EVERY ONE YOU KNOW – WITH EXCITEMENT & PASSION & LOTS OF PICTURES**
- **IDENTIFY & SUPPORT & PROMOTE CHAMPIONS & LEADERS IN YOUR ORGANIZATIONS & COMMUNITIES**
- **CONTINUALLY IMPROVE ON YOUR SCIENCE & ART & BE READY FOR THE NEXT OPPORTUNITY TO PRESENT IT TO DECISION MAKERS**
- **DEMYSTIFY RETROFITTING & RESILIENCE**
  - **DEVELOP EDUCATIONAL TOOLS FOR**
    - **ELECTED OFFICIALS & OTHER POLICY MAKERS**
    - **COMMUNITIES & ORGANIZATIONS**
    - **CONSIDER DEVELOPING A RETROFIT TRAINING PROGRAM FOR CITIZENS BASED ON THE C.E.R.T. MODEL & ADVERTISE IT TO C.E.R.T. GRADUATES**