SEISMIC RISK REDUCTION THROUGH BUILDING CODE ENFORCEMENT

SEAOSC
Earthquake Loss Reduction Summit

Presented by:

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City of Los Angeles
Department of Building and Safety (LADBS)

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Overview

- What Does LADBS Do?
- Seismic Risk Reduction through Building Code Adoptions, Implementations, and Enforcement
- Seismic Retrofit Programs in Los Angeles
What Does LADBS DO?

MISSION

- To protect the lives and safety of the residents and visitors of the City
- To enhance the quality of life, housing, and economic prosperity
- These are accomplished by:
  - Advising, guiding and assisting customers to achieve compliance with the City Codes, City Regulations, and State Laws
  - Providing a timely process to facilitate construction and maintenance of commercial, industrial, and residential buildings
What Does LADBS DO?

SCOPE OF RESPONSIBILITIES

- Approval of Construction Projects
  - All New Buildings, Additions & Alterations Require Plan Review, Permit and Inspection
    - Residential Projects
      - Single Family Dwellings
      - Multi-Family Dwellings (Apartments & Condominiums)
    - Commercial Buildings
      - New Buildings
      - Tenant Improvements
    - Private Schools
      - Public Schools are handled by a State Agency
Seismic Risk Reduction Through Building Code Enforcement

- The following adoptions, implementations and enforcements are essential contributors in the Department’s proactive role in resolving building safety issues and mitigating earthquake hazards in buildings:
  - LA City Codes for Design and Construction
  - Approval Process for Construction
  - Lessons from Past Earthquakes

- Seismic Retrofit Programs in Los Angeles
LA City Codes for Design and Construction
Seismic Risk Reduction

LA CITY CODES:

- LA Building Code was established in 1889
- LA Seismic code was initiated as a result of a 6.25 magnitude earthquake in 1933 (Long Beach)
- LA codes have been amended and revised regularly, mostly every three years, to keep pace with the:
  - Ever-changing technology of the construction industry
  - New proven concepts of structural design
Seismic Risk Reduction

LA CITY CODES (cont.):

- Model Building Code
  - Every three years, the International Building Code (IBC) is published by the International Code Council (ICC)

- State of California adopts the California Building Code (CBC) after making necessary amendments to the IBC

- State mandates all local jurisdictions to adopt the CBC after six months from its publication with any necessary local amendments
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LA CITY CODES (cont.):

- Local amendments made to the CBC can only be:
  - Due to geologic, topographic or climatic findings
  - More restrictive

- LA City adopts *Los Angeles Building Code (LABC)* after making necessary amendments to the CBC
  - Requires Public Hearing Process and Approval by:
    - Board of Building & Safety Commissioners
    - Planning and Land Use Management Committee
    - LA City Council
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LA CITY CODES (cont.):

- Current 2011 LABC is based on the 2010 CBC with the LA amendments
  - Seismic Design requirements are based on ASCE7-05 published by the American Society of Civil Engineers
Approval Process for Construction
Seismic Risk Reduction

APPROVAL PROCESS:

- Plan Check & Permit Issuance by LADBS

  - Types of Permits
    - Building
    - Grading
    - Plumbing
    - Mechanical
    - Electrical
    - Elevator, etc.
Seismic Risk Reduction

APPROVAL PROCESS (cont.):

- Construction Inspection by LADBS Inspectors
  - Ensures compliance with the approved plans
  - Provides quality control and quality assurance for the approved construction
  - Holds the contractor accountable to correct all construction deficiencies
  - Requires approval by LADBS inspectors before proceeding to each new construction phase
  - Issuance of Final Certificate of Occupancy by LADBS
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APPROVAL PROCESS (cont.):

- Alternate Materials/Products Approval by LADBS Research/Testing Laboratories
  - LADBS reviews and approves technical reports of alternate materials/products that are at least equivalent to the code prescribed quality, strength, effectiveness, durability and safety.
Lessons From Past Earthquakes
Lessons Learned

Long Beach Earthquake, 5:55 P.M., March 10, 1933 (6.25 Magnitude)

- Reported Problems:
  - Unreinforced masonry bearing wall buildings, including over 100 school buildings failed catastrophically
  - If the earthquake had struck when school was in session, the loss of lives would have been horrifying
Lessons Learned

Northridge Earthquake, 4:30 A.M. January 17, 1994 (6.7 Magnitude)

❖ Reported Problems:

➢ Masonry and tilt-up concrete wall buildings with wood flexible roof diaphragms needed to be better connected to hold the buildings together

➢ Steel moment frame welded joints were found to have fractures through the welds and beam-column panel zones

➢ Numerous fires were caused by broken gas pipes due to building shifting off foundation or unsecured water heaters falling

➢ Narrow wood shear panel, stucco and drywall construction did not perform as expected
Lessons Learned

Northridge Earthquake, 4:30 A.M., January 17, 1994 (6.7 Magnitude)

- Reported Problems (cont.):
  - Multi-story wood frame buildings with tuck-under parking performed poorly and collapsed
  - Numerous houses on steep slopes had severe damage, with some collapsing which caused a few deaths

- Resulted in the development and implementation of emergency code changes, retrofit standards and code amendments
Lessons Learned

- Building Code Amendments

  - LADBS was proactive in proposing code amendments for new construction and mandatory and voluntary retrofit ordinances for existing buildings.
  - The Northridge Earthquake pointed out the importance of proper detailing and assurance that the load path be maintained.
  - This led to requiring periodic observations of the engineer or architect of record to assure that major structural elements and connections were properly installed.
  - Also, resulted in requirements for new hillside buildings to be horizontally anchored to their foundations.
Seismic Retrofit Programs in Los Angeles
# Mandatory Seismic Retrofit Programs

<table>
<thead>
<tr>
<th>Type of Building / Program</th>
<th>Starting Date</th>
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</thead>
<tbody>
<tr>
<td>Earthquake Hazard Reduction in Existing Unreinforced Masonry Buildings</td>
<td>1981</td>
</tr>
<tr>
<td><em>(designed Prior to October 1933)</em></td>
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<tr>
<td>(LABC Chapter 88)</td>
<td></td>
</tr>
<tr>
<td>8,080 Buildings Affected</td>
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<tr>
<td>8,079 Buildings Complied</td>
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<tr>
<td>Earthquake Hazard Reduction in Existing Tilt-Up Concrete Wall Buildings</td>
<td>1994</td>
</tr>
<tr>
<td><em>(designed Prior to January 1976)</em></td>
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</tr>
<tr>
<td>(LABC Chapter 91)</td>
<td></td>
</tr>
<tr>
<td>2,638 Buildings Affected</td>
<td></td>
</tr>
<tr>
<td>2,638 Buildings Complied</td>
<td></td>
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<tr>
<td>Damaged Areas</td>
<td></td>
</tr>
<tr>
<td>(Ordinance No. 170406, effective 3/7/95)</td>
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</tr>
<tr>
<td>520 Buildings Affected</td>
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<tr>
<td>519 Buildings Complied</td>
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<tr>
<td>Seismic Gas Shutoff Valves</td>
<td>1995</td>
</tr>
<tr>
<td>(Ordinance No. 170406, effective 3/7/95)</td>
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<tr>
<td>30,000 Complied per year</td>
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## Voluntary Seismic Retrofit Programs

<table>
<thead>
<tr>
<th>Type of Building / Program</th>
<th>Starting Date</th>
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</thead>
<tbody>
<tr>
<td>Earthquake Hazard Reduction in Existing Wood Frame Residential Buildings with Weak Cripple Walls and Unbolted Sill Plates - Anchor LA Program. Los Angeles City’s developed standards, which are being used outside of the City by other agencies (LABC Chapter 92)</td>
<td>1996</td>
</tr>
<tr>
<td>Earthquake Hazard Reduction in Existing Wood Frame Residential Buildings with Soft, Weak or Open Front Walls (LABC Chapter 93)</td>
<td>1998</td>
</tr>
<tr>
<td>Earthquake Hazard Reduction in Existing Hillside Buildings (LABC Chapter 94)</td>
<td>1996</td>
</tr>
<tr>
<td>Earthquake Hazard Reduction in Existing Reinforced Concrete Buildings and Concrete Frame Buildings with Masonry Infills - designed Prior to January 1976 (LABC Chapter 95)</td>
<td>1996</td>
</tr>
<tr>
<td>Earthquake Hazard Reduction in Existing Reinforced Concrete and Reinforced Masonry Wall Buildings with Flexible Diaphragms - designed prior to January 1995 (LABC Chapter 96)</td>
<td>1996</td>
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Seismic Risk Reduction

All these core functions, along with the LADBS’ constant efforts to improve quality control and quality assurance in building construction, collectively, are integral parts of building a safer Los Angeles.
Los Angeles Department of Building and Safety
For more information, visit our website
www.ladbs.org
Thank You