

Unreinforced Masonry

History

Long Beach Earthquake

- Took place in 1933
- 120 lives were lost
- The Coroner's Jury in Long Beach concluded, "Masonry buildings were the principal suffers and their failure occasioned the principal loss of life."
- Despite this known fact it still took the city almost forty years to adopt an ordinance requiring seismic upgrades

Sylmar Earthquake

- Took place in 1971
- 65 lives were lost
- Two hospitals were severely damaged

State Response

- Fields Act of 1933
 - o Required schools to be inspected during construction
- Riley Act of 1935
 - o Required buildings to resist lateral loads
- Hospital Act 1973
 - o Required new and old hospitals to be reinforced

Long Beach Requirements

- Long Beach earthquake caused Long Beach to adopt the strictest requirements in the nation
- First adopted in 1970s
- URM buildings were inspected and divided into 3 categories
 - o Most dangerous – repair immediately or tear down
 - o More dangerous – given until 1985 to be brought to code
 - o Least dangerous – given until 1991 to comply
- Retrofitting is the sole responsibility of the owner and must be completed within two years of starting the project.
- The city would finance building owners

2003 URM Survey

- 936 URM buildings exist in Long Beach
- 90% are commercial
- 10% are residential
- 370 buildings had been demolished at this time

Components of URM

Footing made of concrete, masonry or rock

- Contains very little cement
- Moisture has deteriorated it over time

Load bearing exterior walls less than 6 stories

Wood floor and roof systems

- Conventional or heavy timber
- Arched roofs are common

Sand lime mortar

No rebar

Exterior walls about 13 inches thick that taper vertically

Parapet walls

Floor and roof joists that rest in a cavity

Fire cut floor and roof joists

Government anchor used to anchor fire cut rafter into cavity, usually spaced every 8-10 rafters

Common Seismic Upgrades

Roof/floor to wall ties

- Rafter tie plates
- Tie rods and turn buckles
- Must be torqued to UBC standard

Bond Beams

Concrete Caps

- On parapets over walkways and exits

Parapet Bracing

Tuck Pointing

- Mortar must resist 30psi or greater

Metal strapping across roof (Drag Strap)

Indications of Pre 33 construction

Rafter tie plates

- Squares, stars, diamonds, straight bars or s-shaped rods.
- Give you a good idea of roof and floor lines
- Un-evenly spaced may indicate parapet supports
- May represent location of tie rod turnbuckle between floors

Deeply recessed windows

Concrete bond beams

- On the tops of exterior walls or between floors, over windows and doors, corners of building

King Rows

- Done every four to seven rows of bricks.
- You will see the ends of bricks

Windows will have lintels

- May be arched or straight
 - o Arched window uses the brick as the lintel
 - o Square window uses angle iron as lintel
 - o Both are used as a horizontal beam to support and distribute load

Mortar

- May be crumbling away
- Can be uneven or sloppy

Stucco Buildings

- Lintels and recessed window will help you identify
- Usually only the front is stucco

Hazards

Wall collapse

- 90 degree, pancake, inward outward, curtain
- Tie plates make fire cuts ineffective and can cause total wall collapse
- The hip sections of arched roofs will push out the exterior walls if the roof collapses
- Roofs carry a severe dead load because of the multiple layers of comp

Retrofits

- Made of unprotected steel and can fail under fire conditions

Mortar

- Hose lines can deteriorate sand lime mortar
- Mortar chemically changes at 600 degrees and loses all structural integrity

Masonry

- Spalling can remove or weaken masonry units

Operational Considerations

Collapse

- Zones may be greater than the wall height
 - o Corners are safe zones
 - o Resources should be located away from the structures
- Fire exposure can cause parapet bracing to fail

Ventilation

- Metal strapping can interfere with your cuts

Steel lintels

Watch Outs

Sagging floors

Spongy floors or roofs

Bulging or leaning walls

Abnormally tight doors or windows

Flame impingement on steel lintels

Smoke showing through walls

Cracking groaning or creaking

Rafter tie plates and bars protruding from walls

Rafter tie plates and bars pulled back into walls

Cracks running full wall height

Numerous individual bricks breaking or fragmenting in a localized area

Separation of plaster overcoat

Large portion of building is involved