

# Northridge Earthquake Failure

Total collapse



# Cosmetic damage



# Soft-story collapse



# Soft-story collapse



# Soft-story collapse



# Soft-story collapse



# Soft-story collapse



# Soft-story collapse



# Almost soft-story collapse



# Hazard configurations: wings split at intersections



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U



# Flawed construction quality



## Slender shear wall failure



## Brick veneer failure (avoid brick veneer on tall wood walls)





## Prefab parking garage

- Collapse



- CMU wall failure

Prefab parking garage  
parapet failure



wall failure



wall cracks





## Parking garage

- Wall pulled over by concrete slabs



- Exit stair collapse

## Parking garage

- Prefab tree elements split at intersections



Medical center

Second story collapse



Medical center

Second story collapse



# Medical center second story collapse

Column punctures  
concrete slab



Exploded column



Collapsed side wall



# Un-reinforced masonry failure



# Un-reinforced masonry failure



# Un-reinforced masonry

## Corner failure



## Parapet failure

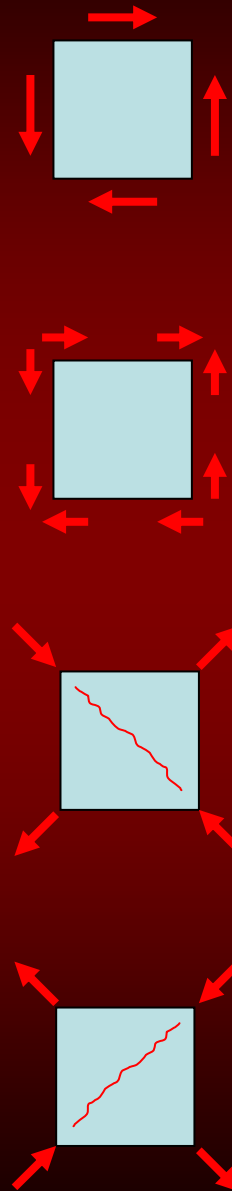


# Brick veneer failure



# Diagonal cracks

Narrow shear wall  
reduced by opening ☹️



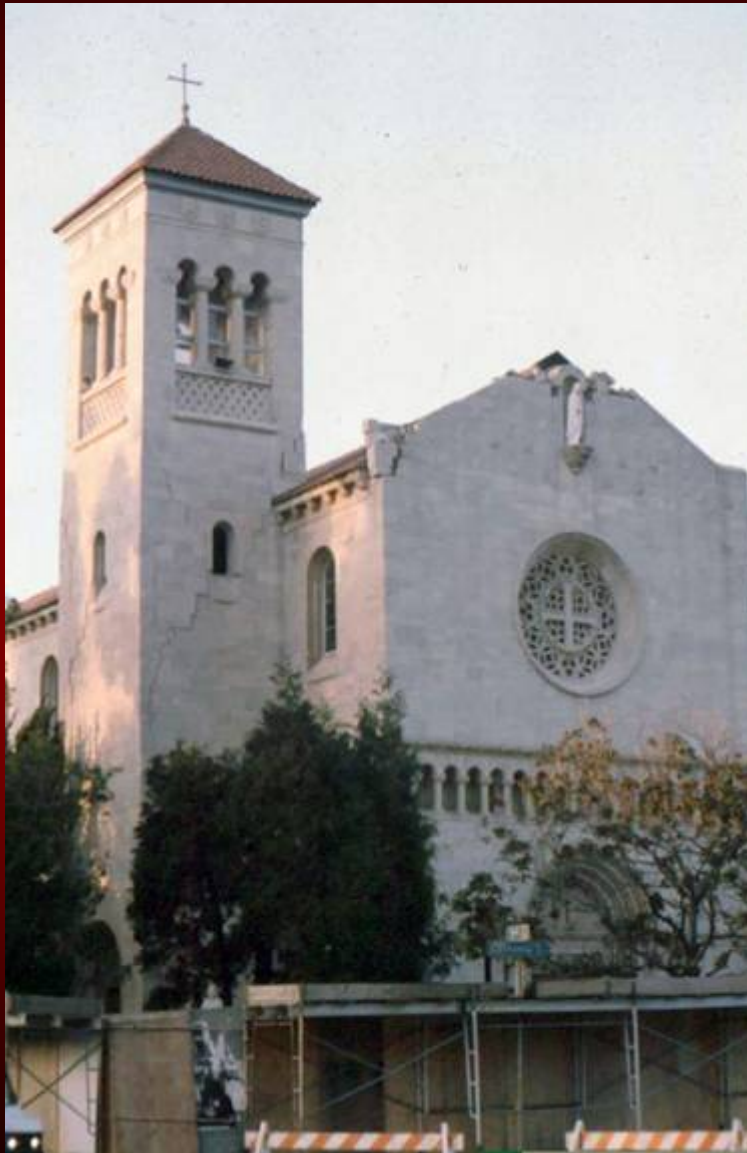
Corner failure



# Un-reinforced masonry cracks



# Un-reinforced masonry cracks



# Veneer peeled off steel frame (stiff veneer / flexible steel frame are incompatible)



Column shear cracks  
required demolition



# Concrete wall with diagonal shear cracks



# Prefab concrete panels

(cosmetic damage appearance required major repair)



# Partial wall collapse



# Roof parapet debris on ground



# Suspended ceiling failure



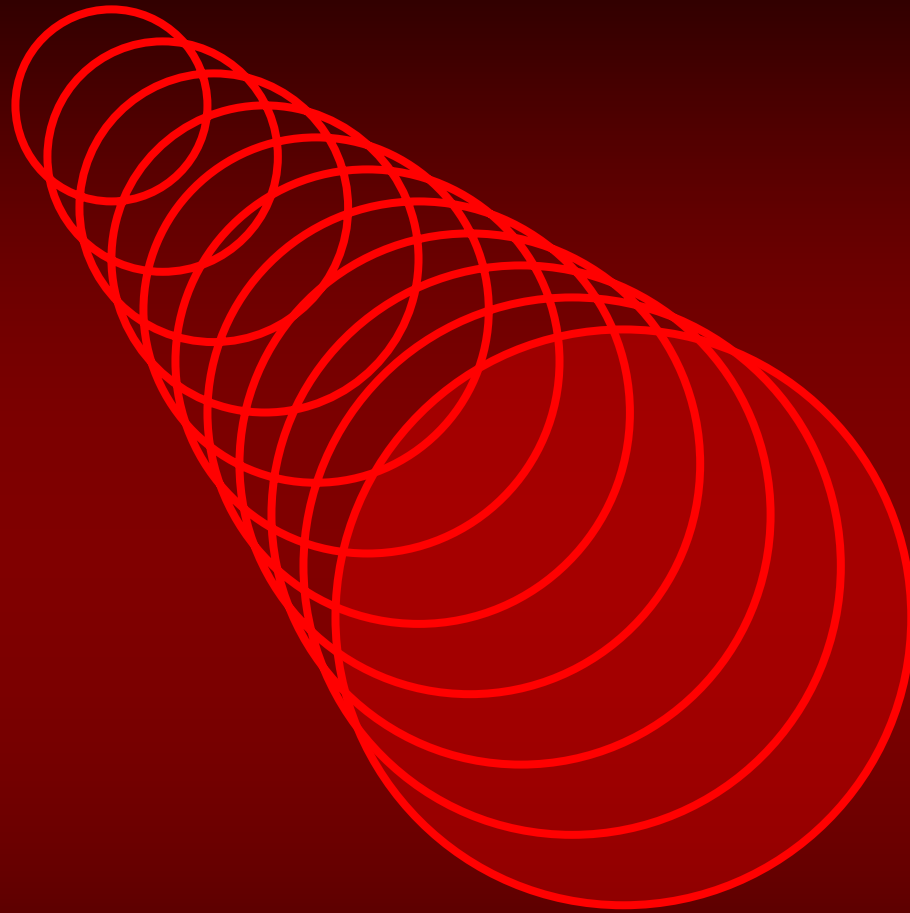
# Garden wall (effect of shaking direction)

East-west no damage



North-south collapsed





# **Seismic design prevents failure**