



Pacific Earthquake Engineering Research Center

# Design of High Rise Buildings in the Western United States

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**SGH**

Simpson Gumpertz & Heger inc.

Consulting Engineers

Boston

Los Angeles

New York

San Francisco

Washington DC

# Fathers of the Tall Building



Andrew Carnegie



Elisha Graves Otis

# The First High Rise Building

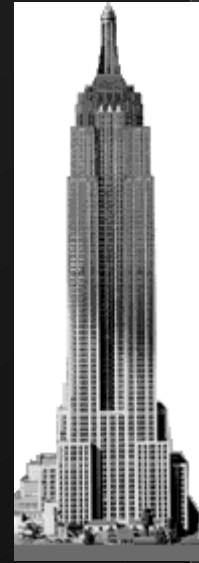
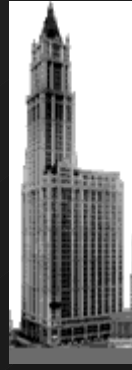


- Chicago, IL
- 1885
- 10 stories
- 138'
- First building with
  - steel frame
  - safe elevator

# Three Great Eras of Construction

- 1885-1932 - The first great boom
  - steel frame buildings
  - infill masonry walls
  - small floor plates with many light wells and set backs
- 1950-1990 - The 2nd Generation
  - welded steel frame buildings
  - glass curtain walls
  - large floor plates
- 1990- present - The 3rd Generation
  - composite concrete and steel structures
  - moderate size floor plates
  - tallest buildings not constructed in U.S.

# The First Great Boom



Park Row

1899

306 ft

Singer

1908

612 ft

Metropolitan Life

1909

700 ft

Woolworth

1913

792 ft

Manhattan Company

1930

950 ft

Chrysler

1930

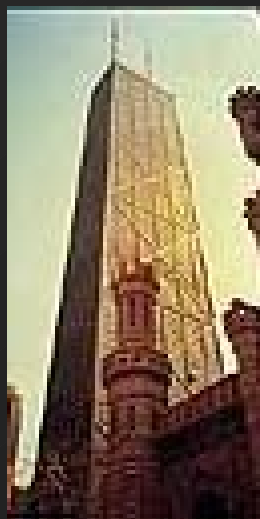
1046 ft

Empire State

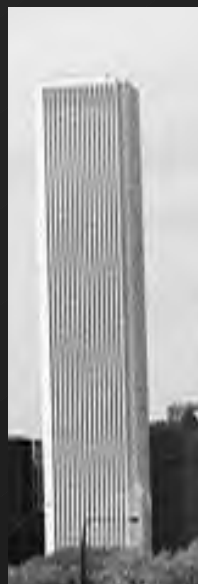
1931

1250 ft

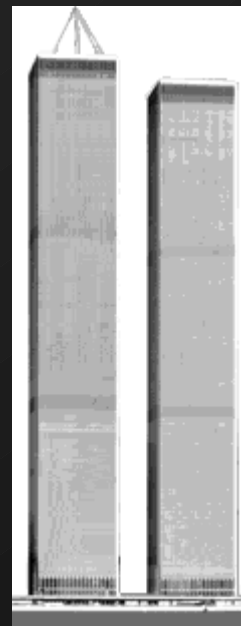
# The 2nd Generation



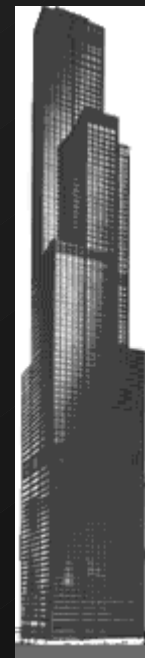
John Hancock  
1967  
1172'



Standard Oil of Indiana  
1972  
1136'



World Trade Center  
1972  
1368 ft



Sears Tower  
1974  
1454 ft

## Some facts about design of tall buildings

- Many of the tallest buildings in our cities were designed in advance of or outside of the requirements of contemporary building codes
- Assuming you believe response spectra, and near field pulses don't exceed about 4 second period, very tall buildings experience little earthquake demand
- There have been very few tall buildings that have ever experienced significant earthquake shaking