The Legal Cloud Looming Over San Francisco High-Rises: Legal Developments Since Loma Prieta

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What practical steps can design professionals personally take to reduce seismic risk in the legal arena?
Evolving Best Practices When Advising Commercial Owners

1. Make your predictions of structural performance more explicit.

2. Spell out what your sworn testimony would be on seminal issues.
High-Rise Liability Patterns:
The Field Performance Gap Problem
Managing The Field
Performance Gap Problem
Three Legalistic Questions Related To Best Practices:

1. How can Owner’s consultants induce Owner to spend the money necessary to attain satisfactory seismic performance instead of minimizing expenditures?
Three Legalistic Questions Related To Best Practices:

2. Can Owner or its consultants zero out risk of legal liability during the lifespan of a structure in urban California?
Three Legalistic Questions Related To Best Practices:

3. Can third parties pursue claims against design professionals even when no contractual relationship exists among them?

(Hint: Beacon case)
Bonus Legalistic (Leading) Questions:

4. Does liability increase for Owner when it becomes aware of a seismic vulnerability in its structure?
Bonus Legalistic (Leading) Questions:

5. Should vacating the premises be considered during the “interim use period”? 

The Millennium Tower Litigation
Millennium Tower Characteristics (Probable Expert Testimony)

- 58 stories
- 605 feet tall tower over one-story basement
- Located at 301 Mission Street
- Cast in place construction, using post-tensioned slabs above ground level
- Seismic force-resisting system ("dual") is a 36-inch thick special reinforced concrete shear wall core with outriggers and concrete special moment-resisting frames
What Members of the Design Team Predicted (Probable Expert Testimony)

- One inch of settlement by completion of construction.
- Five inches of settlement (due to compression of clay layers) over the long-term.
- Uniform settlement over the foundation area.
Field Settlement is Much Worse than that Predicted by Members of Design Team (Probable Expert Testimony)

- Settlement in the field by completion of construction was actually six inches instead of one.
- Settlement in the field as of July 2017 was actually on the order of 17 inches instead of five over the long-term.
- As of July 2017, settlement has not been uniform over the foundation area (e.g., Tower out of plumb to west by 14 inches and to the north by six inches).
- In the short-term, additional settlement on the order of one inch per year is likely.
Gist of Claims by Homeowners Association and Unit Owners:

- Since construction started, settlement of the Tower in the field far exceeds the predictions of members of the design team.
- That disparity was wrongfully concealed from claimants before unit sales took place.
Examples of High-Rise Performance Predictions Which May Be Missed In Foreseeable San Francisco Earthquakes
AB-083 Requirements for “Service-Level Evaluation” (Elasticity)

- Design team must demonstrate “acceptable seismic performance for moderate earthquakes.”
- “Primary Structural System” must demonstrate “essentially elastic seismic performance” during a “service-level” earthquake (50% probability of exceedance in 30 years)
AB-083 Requirements for “Service-Level Evaluation” (Minor Damage)

- Design team must demonstrate no worse than “minor yielding of ductile elements of the primary structural system,” but not “permanent deformation in the elements, strength degradation, or significant damage to the elements requiring more than minor repair.”
- “It is expected that the building cladding will remain undamaged and that egress from the building will not be impeded when the building is subjected to the service-level ground motion.”
Conclusion:

Evolving Best Practices When Advising Commercial Owners

1. Make your predictions of structural performance more explicit.

2. Spell out what your sworn testimony would be on seminal issues.
A structure (such as a missile command center) belongs in DOD Risk Category V when it has certain "national security" characteristics.

Because a Risk Category V structure must remain virtually elastic during an MCE earthquake, the "Maximum Probability" that a Risk Category V structure will

- sustain total or partial structural collapse is less than one percent; and

- endanger individual lives is minimal.
A structure belongs in Risk Category IV if

- its failure during an earthquake has the potential to pose a substantial hazard to the community; or
- it is an "essential facility."
During an MCE earthquake, the "Maximum Probability" that a Risk Category IV structure will

- sustain total or partial structural collapse is 3 percent; and

- endanger individual lives is 10 percent.
A structure belongs in Risk Category III if its failure during an earthquake has the potential

- to pose a substantial risk to human life; or
- to cause a "substantial economic impact"; or
- to cause "mass disruption of day-to-day civilian life."
During an MCE earthquake, the "Maximum Probability" that a Risk Category III structure will

- sustain total or partial structural collapse is 6 percent; and

- endanger individual lives is 15 percent.
During an MCE earthquake, the "Maximum Probability" that a Risk Category II structure will

- sustain total or partial structural collapse is 10 percent; and
- endanger individual lives is 25 percent.
WHAT POLICIES SHOULD BE CONSIDERED?

- Improve ability of community to recover from earthquakes by tailoring seismic protection requirements to importance of high-rise (ASCE 7-10).

- Facilitate community resilience (SF GP).

- Apply highest applicable Risk Category to high rise (ASCE 7-10).

- Minimize property damage arising from future earthquakes (ASCE 7-10 and SFGP).

- Reduce future loss of life, injuries, property loss, environmental damage, and social and economic disruption from earthquakes (SFGP).

- Assure that residents will “be able to stay in their own homes” following earthquakes (SFGP).
Sources:

High rise elevations courtesy of MKA.

DOD UFC section 3-310-04.

ASCE 7-10 section 1.5 and Tables 1.5-1 and 1.5-2. See also Commentary section C1.51 ("The lives at risk from a structural failure include persons who may be outside the structure in question who are nonetheless put at serious risk by the failure of the structure") and Table C.1.3.1b.