17th U.S.-Japan-New Zealand Workshop on the Improvement of Structural Engineering and Resilience

LEGAL RUMBLINGS IN CALIFORNIA HIGH-RISES: EMERGING LIABILITY PATTERNS WHEN FIELD PERFORMANCE FALLS SHORT OF DESIGN PREDICTIONS

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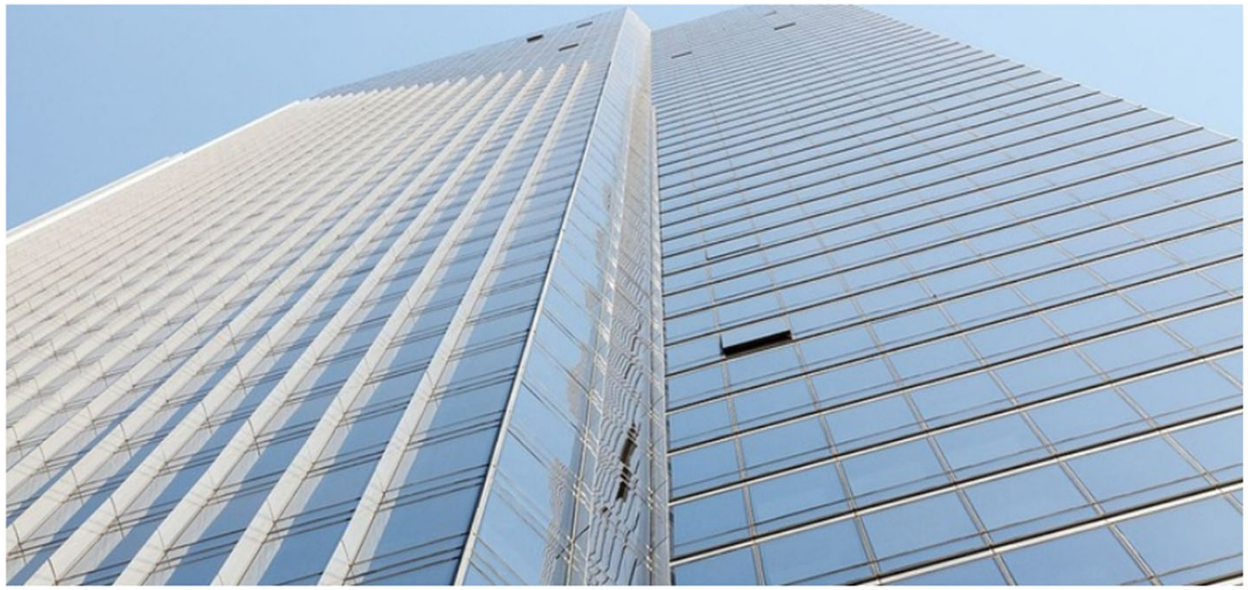
大鯨後光生酔
はらだち上戸
鹿島太神宮

Professor Gregory James Smits, Penn State University (interview on November 1, 2018); http://pinktentacle.com/2011/04/namazu-e-earthquake-catfish-prints/

How can structural consultants develop incentives for developers/owners to reduce their legal exposure during High-Rise design development?

One step:
Reveal your testimony before construction, particularly your predictions of field performance after commencement of construction.

Lessons to be learned from two recent additions to San Francisco's urban center.



The most spine-tingling structural scares since last Halloween

AUTHOR

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Large-scale construction projects are almost always tricky, but when the possibility of a structural flaw or defect enters the picture, contractors can face a downright scary situation.

These projects have presented owners and contractors with some particularly spine-tingling predicaments.

The Millennium Tower, San Francisco

The Millennium Tower luxury residential high-rise opened in 2009 but has been sinking steadily, up to as much as 18 inches according to recent estimates, and has been leaning ever so slightly since. It took a citizen complaint call to launch an investigation into the building's structural integrity, and, so far, the results have been a mixed bag for the skyscraper that had not been anchored into bedrock during initial groundwork.

High-Rise Liability Patterns:

The Field Performance Gap Problem

The Field Performance Gap Problem:

First, before construction, a structural consultant predicts how the completed structure will perform in the field.

Second, during or after construction, in the field, the structure falls short of predicted performance.

After the Performance Gap is discovered, what Legal Patterns emerge?

The Field Performance Gap at the Millennium Tower:

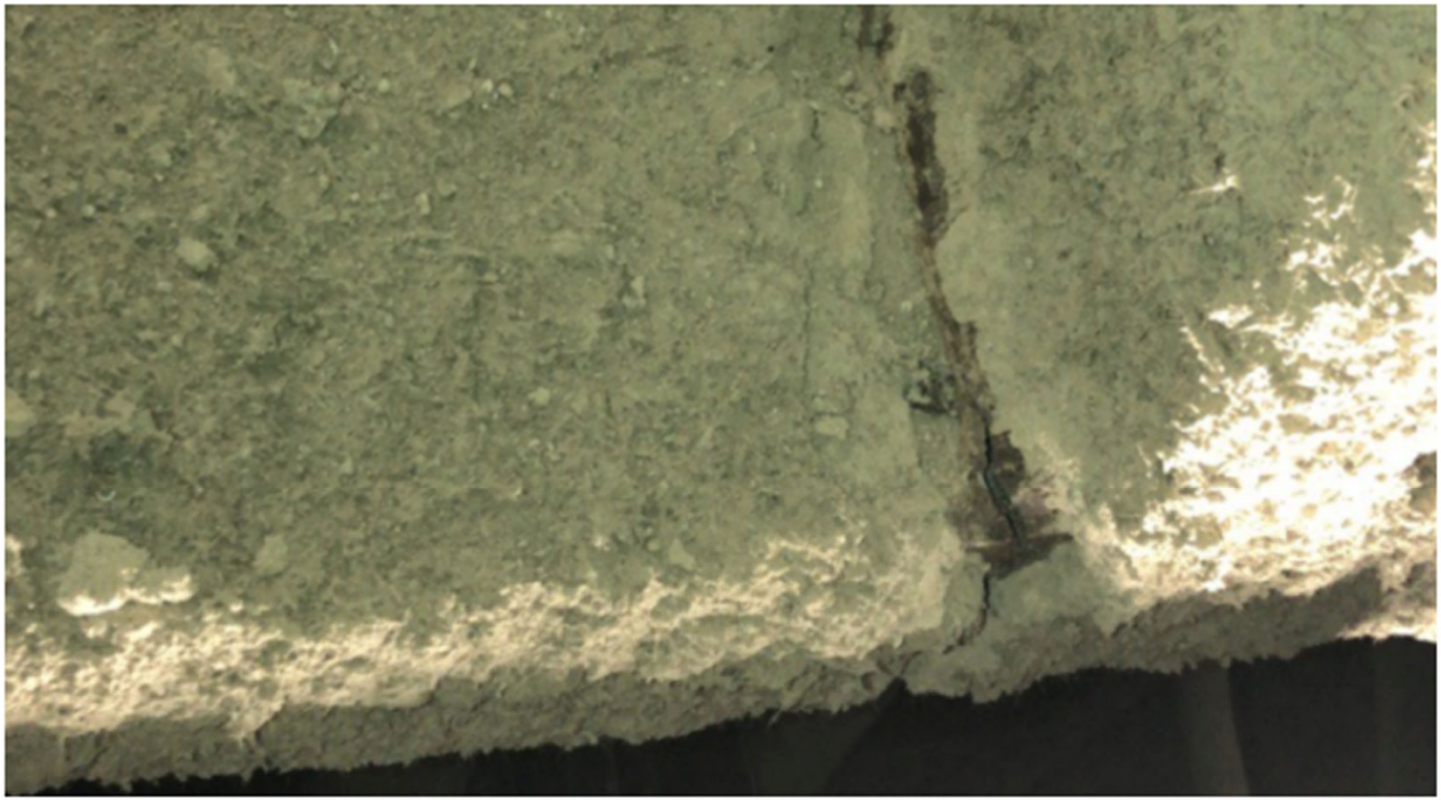
The amount of settlement sustained by the Millennium Tower far exceeds that predicted by members of the project design team.

What are the legal ramifications?

Salesforce Transit Center, San Francisco

Next door to the Millennium Tower is another troubled project, the $2.2 billion Salesforce Transit Center, also known as the Transbay Transit Center, which opened in August. The new transportation hub currently serves only buses, but the plan is to bring rail service there as well, including a stop for the California bullet train.

But in late September, transit center workers discovered a fissure in one of the structure's steel beams. The center and its public rooftop park were temporarily shut down for further inspections, and one more cracked beam was found in the same area as the first.



Credit: TRANSBAY JOINT POWERS AUTHORITY

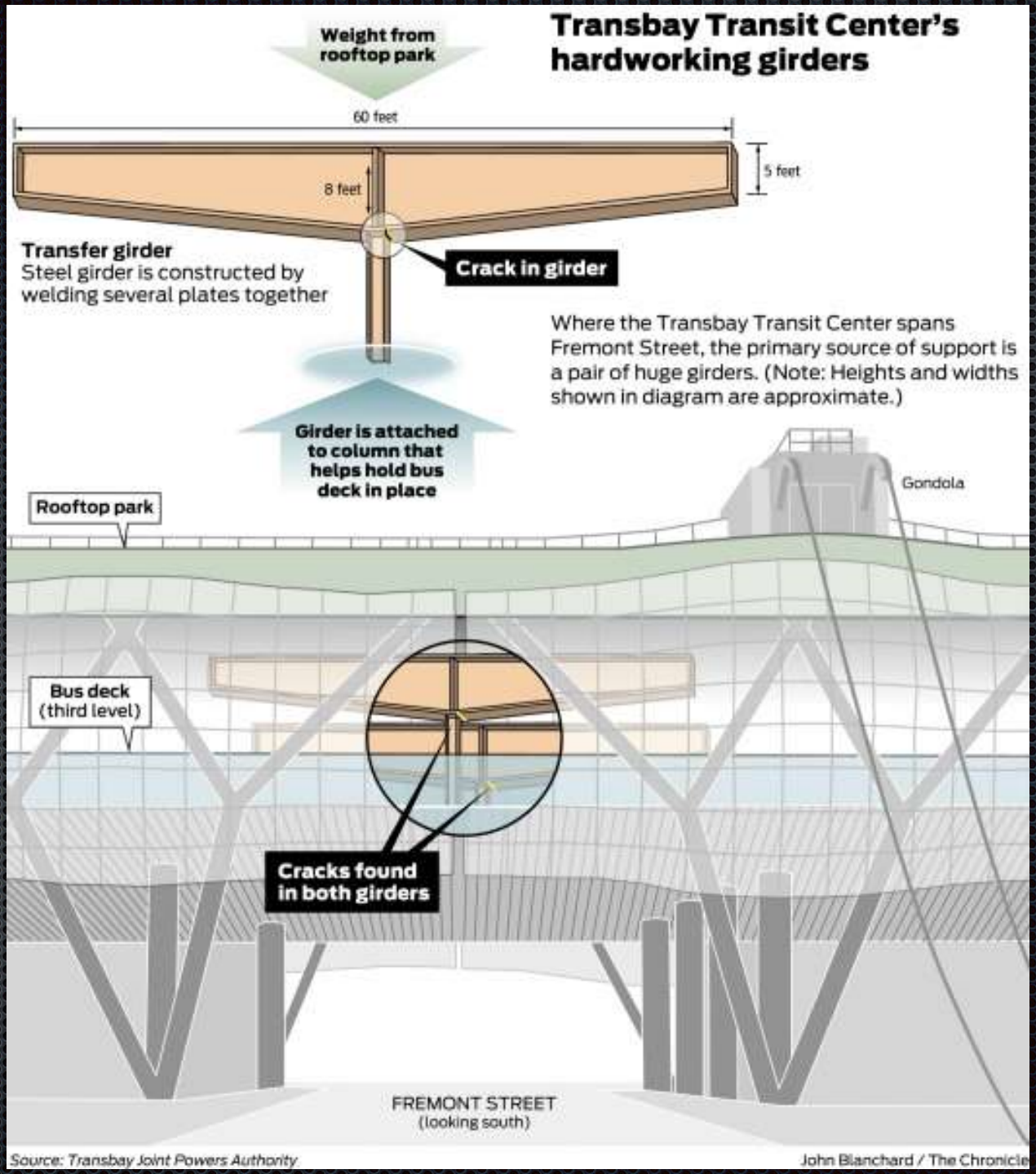
The Field Performance Gap at the Transbay Transit Center:

Cracks in two girders were discovered a few weeks after the Center opened.

As of November 12, 2018 the Center remains closed.

What are the legal ramifications?

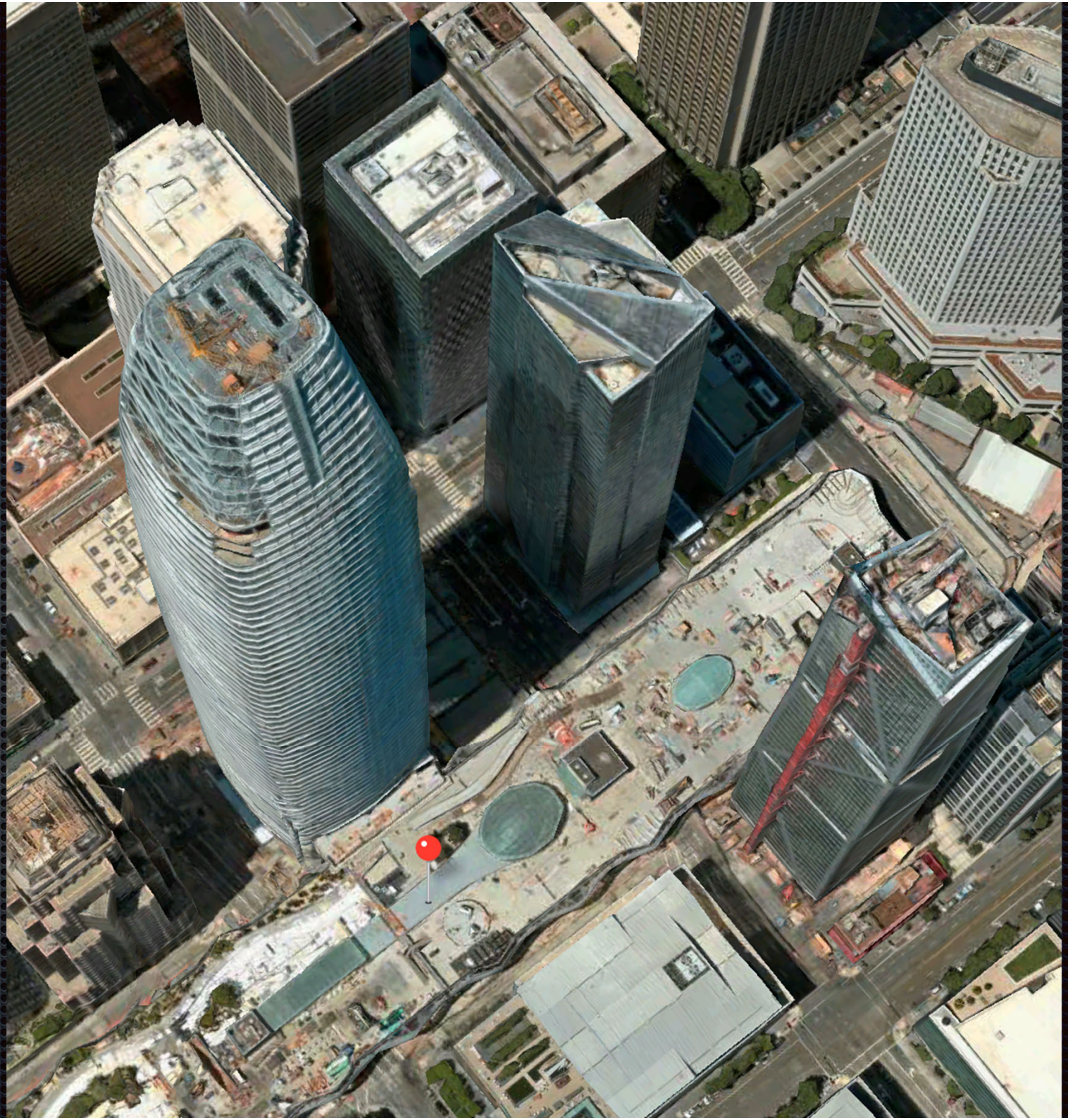
http://www.sfexaminer.com/breed-schaaf-call-regional-agency-review-investigation-cracked-beams/


Transbay Transit Center's hardworking girders
Weight from rooftop park
60 feet
8 feet
5 feet
Transfer girder
Steel girder is constructed by welding several plates together
Crack in girder
Where the Transbay Transit Center spans Fremont Street, the primary source of support is a pair of huge girders. (Note: Heights and widths shown in diagram are approximate.)
Girder is attached to column that helps hold bus deck in place
Gondola
Rooftop park
Bus deck (third level)
Cracks found in both girders
FREMONT STREET
(looking south)
Source: Transbay Joint Powers Authority
John Blanchard / The Chronicle

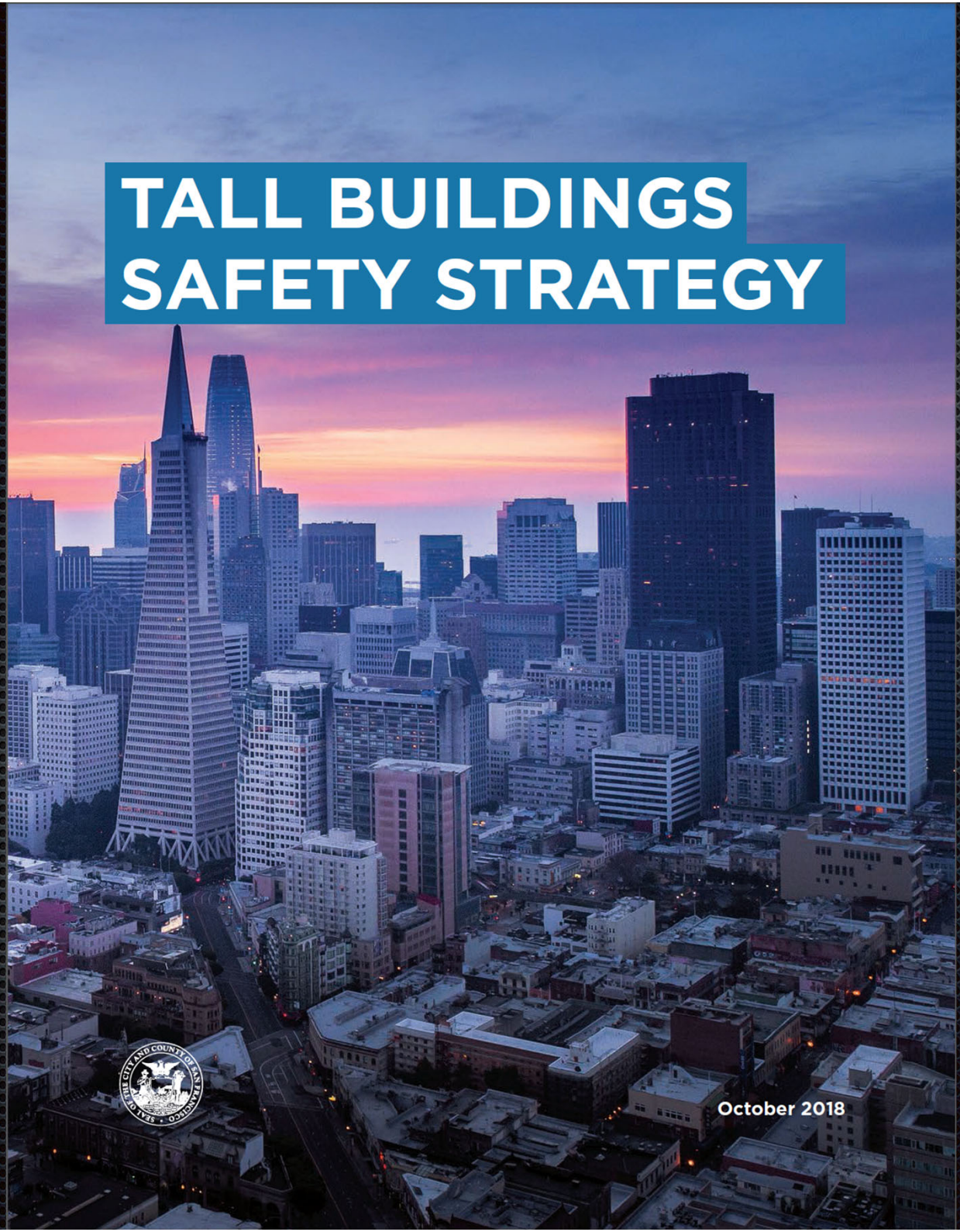

FREMONT ST
ROAD
CLOSED
DETOUR
CMC
CMC

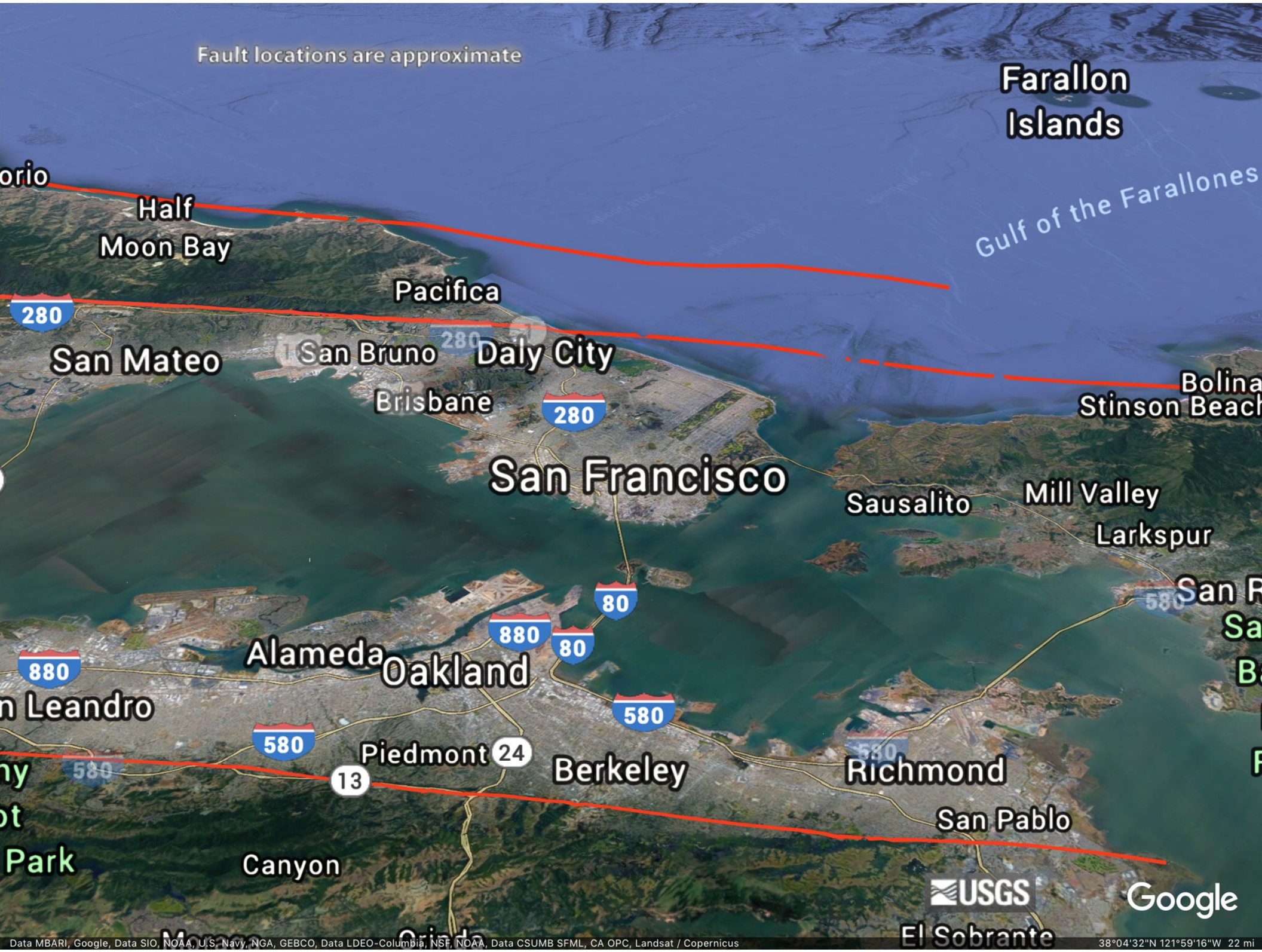
woman crosses at Fremont and Howard streets where the road is closed around the shuttered Salesforce Transit Center after the discovery of a second cracked steel beam on Wednesday, Sept. 26, 2018. (Kevin N. Hume/S.F. Examiner)

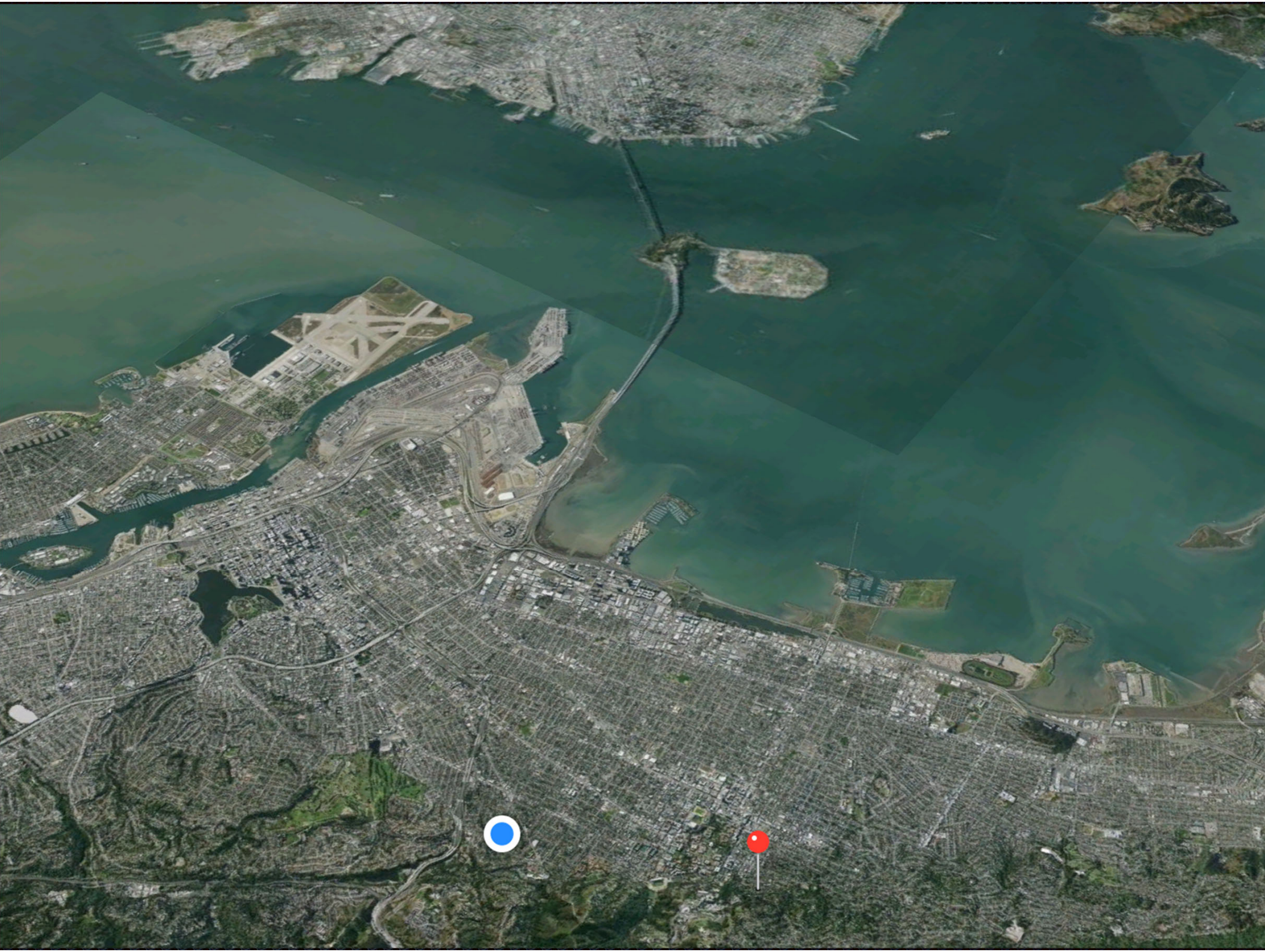
http://www.sfexaminer.com/will-pay-salesforce-transit-center-cracked-beams-testing-may-tell/



Seismic Hazard Context and the Field Performance Gap at the Millennium Tower


TALL BUILDINGS
SAFETY STRATEGY
October 2018


Fault locations are approximate
Farallon Islands
Gulf of the Farallones
Half Moon Bay
Pacifica
San Mateo
San Bruno
Daly City
Brisbane
Bolina
Stinson Beach
San Francisco
Sausalito
Mill Valley
Larkspur
Alameda
Oakland
Piedmont
Berkeley
Richmond
San Pablo
Canyon
El Sobrante
280
880
80
580
24
13
USGS
Google
Data MBARI, Google, Data SIO, NOAA, U.S. Navy, NGA, GEBCO, Data LDEO-Columbia, NSF, NOAA, Data CSUMB SFML, CA OPC, Landsat / Copernicus
38°04'32"N 121°59'16"W 22 mi




Transamerica Pyramid
FINANCIAL DISTRICT
Ferry Building Marketplace
Autodesk Gallery
Embarcadero
Spear St
Main St
Montgomery St
Millennium Tower San Francisco
Folsom St
Rincon Point
Montgomery
Palace Hotel, A Luxury Collection...
1st St
RINCON HILL
Bryant St
San Francisco Museum of Modern Art
Yerba Buena Gardens
2nd St
80
Bayside Village
Children's

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.

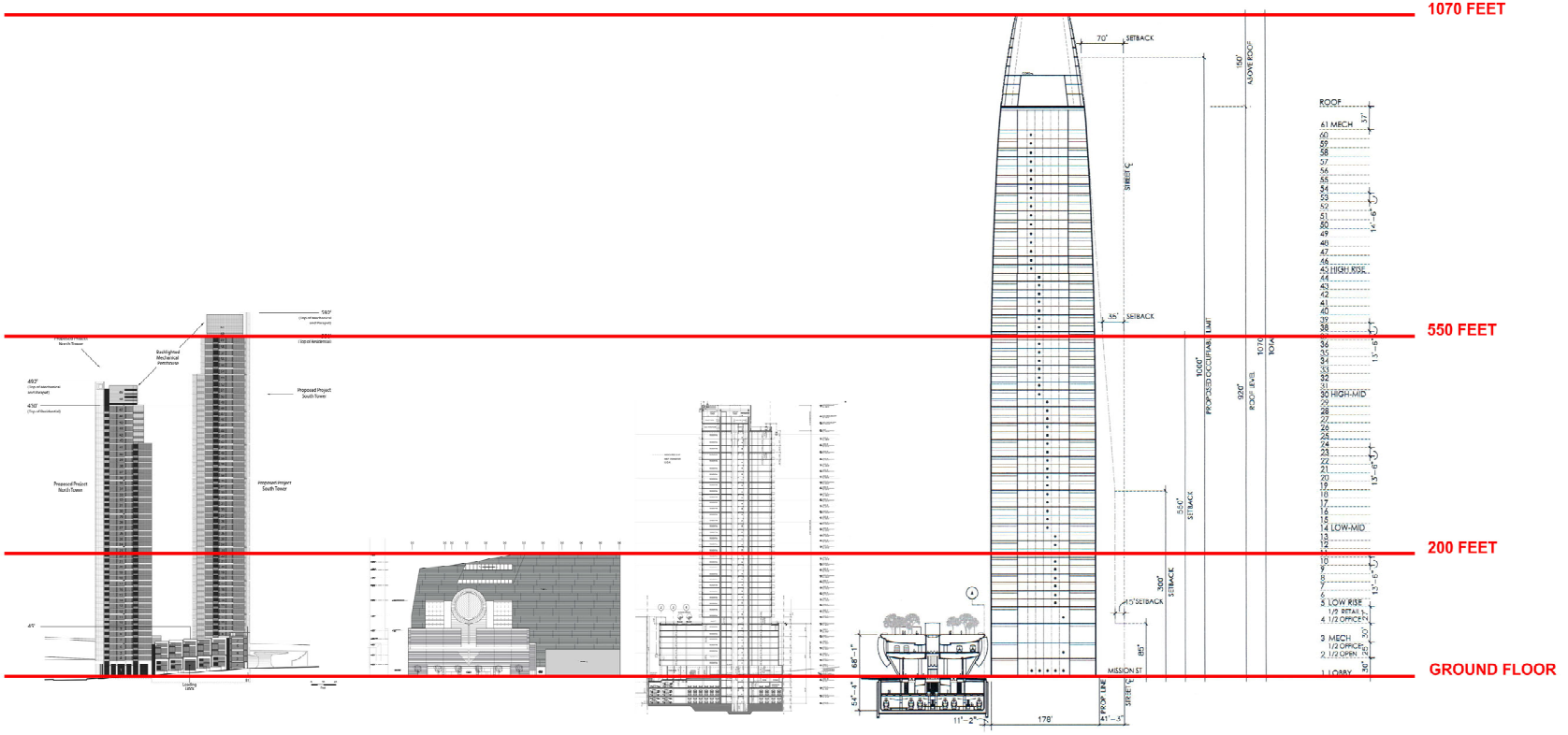
Field Settlement is Much Worse than that Predicted by Members of Design Team (Probable Expert Testimony)

- 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.

Legal Patterns that will Emerge from Field Performance of San Francisco High-Rises during Foreseeable Earthquakes


1070 FEET
550 FEET
200 FEET
GROUND FLOOR
70' SETBACK
55' SETBACK
150' ABOVE ROOF
ROOF
61 MECH
14 LOW-MID
5 LOW RISE
3 MECH
1 LOBBY
MISSION ST
STREET 'C'
PROPERTY LINE
178'
41'-5"

Examples of
High-Rise Performance Predictions
Which May Be Missed In
Foreseeable San Francisco Earthquakes

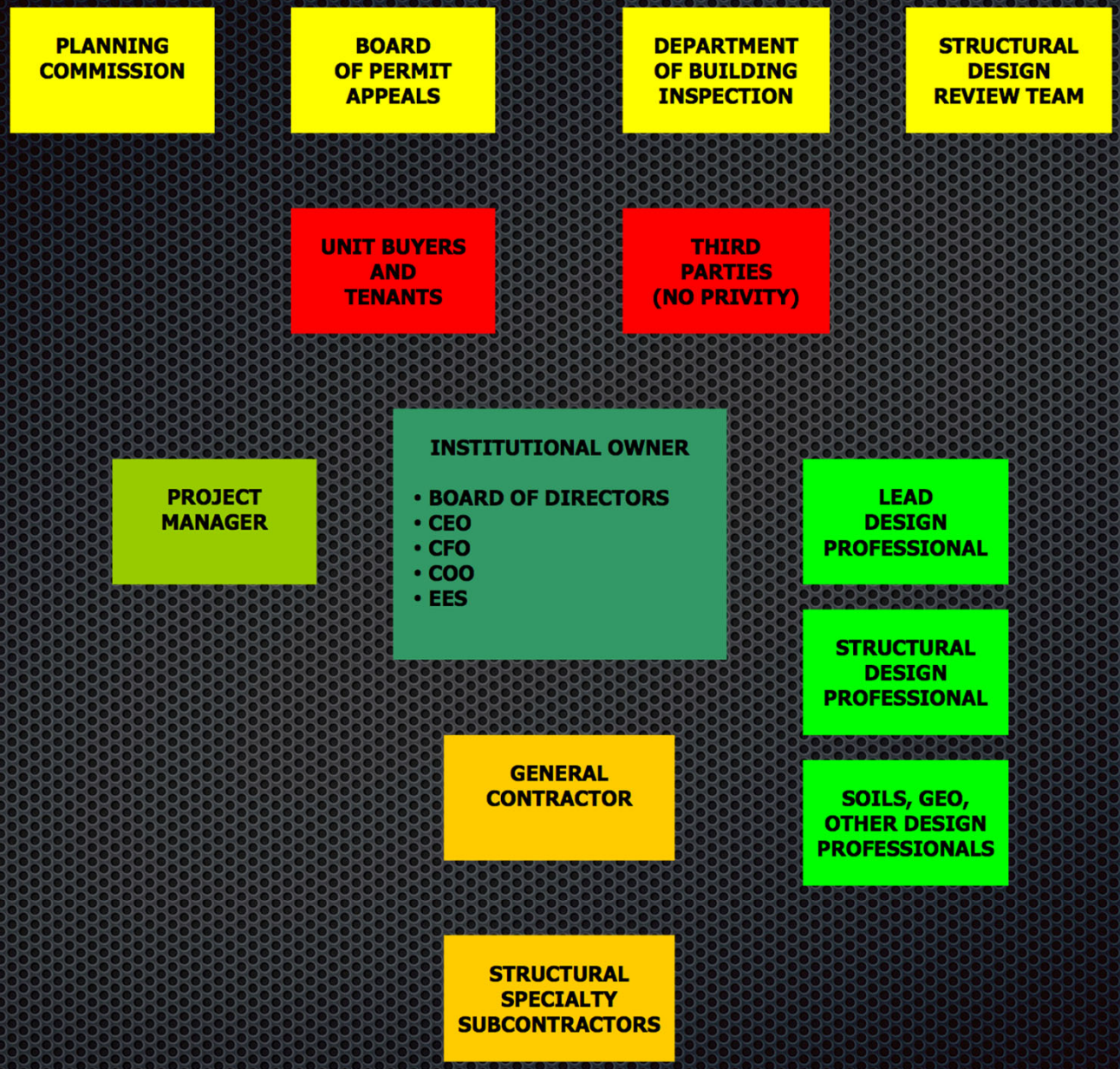
AB-083 Requirements for "Service-Level Evaluation" (Elasticity)

- 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."

MANAGING OWNER'S SEISMIC RISK IN THE LEGAL ARENA
SNAPSHOT OF RISK RELATIONSHIPS PRIOR TO ISSUANCE OF NOTICE TO PROCEED



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.

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).

Recommendations for regulatory institutions:

- **Risk Category III or IV (ASCE 7-10 & 16) should control the design for new high-rises in urban centers.**
- **All electronic and other materials exchanged with or prepared by peer reviewers should be preserved permanently as public records.**
- **Before high-rise superstructure construction commences, the peer reviewers and design team should execute a single written certification that the fully developed design incorporates mandatory performance predictions.**

Recommended testimony topics for individual structural consultants before construction:

- **Known seismic vulnerabilities of the lateral system.**
- **Seismic performance targets recommended to and/or adopted by developer/owner.**
- **Level of damage predicted in Service Level and MCE earthquake scenarios.**
- **Potential harm to occupants and third parties caused by unique seismic vulnerabilities.**
- **Steps taken to manage risk of harm to occupants and third parties in foreseeable earthquakes.**

What practical steps can design professionals personally take to reduce seismic risk in the legal arena?

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.

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?

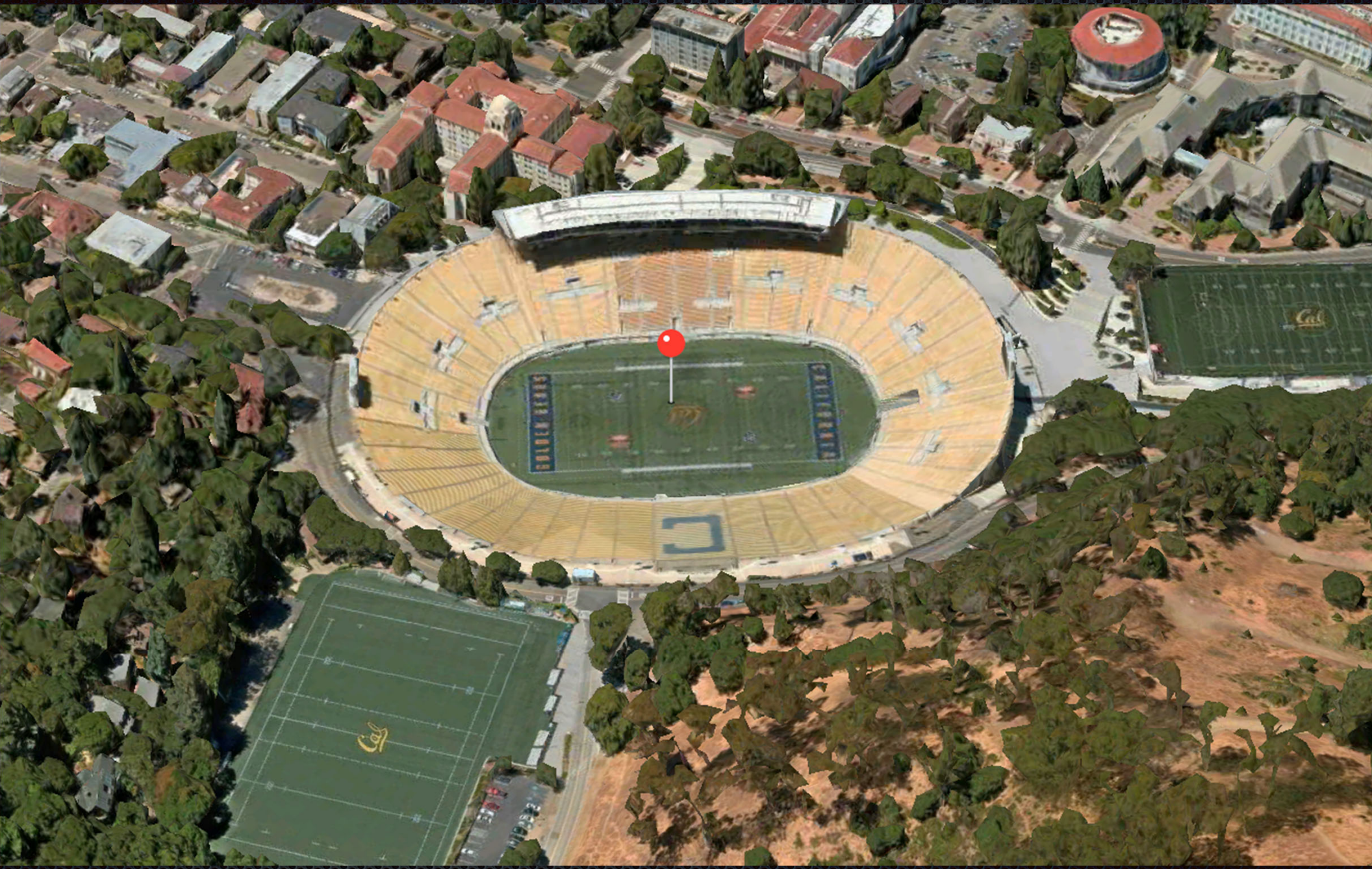
(Hint: Beacon case)

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"?

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https://www.dailynews.com/2016/02/08/sylmar-san-fernando-earthquake-45-years-ago-tuesday-64-killed/


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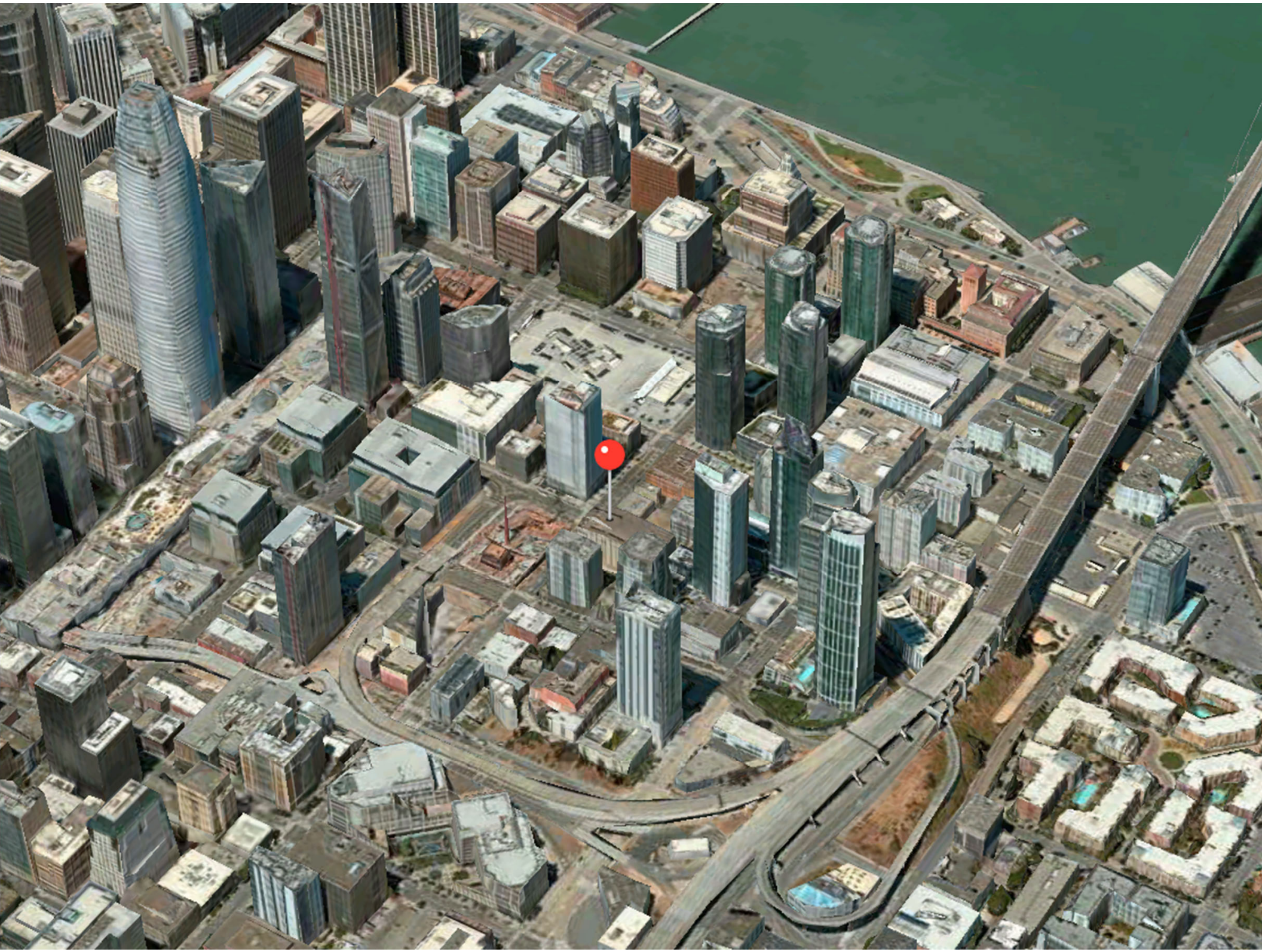
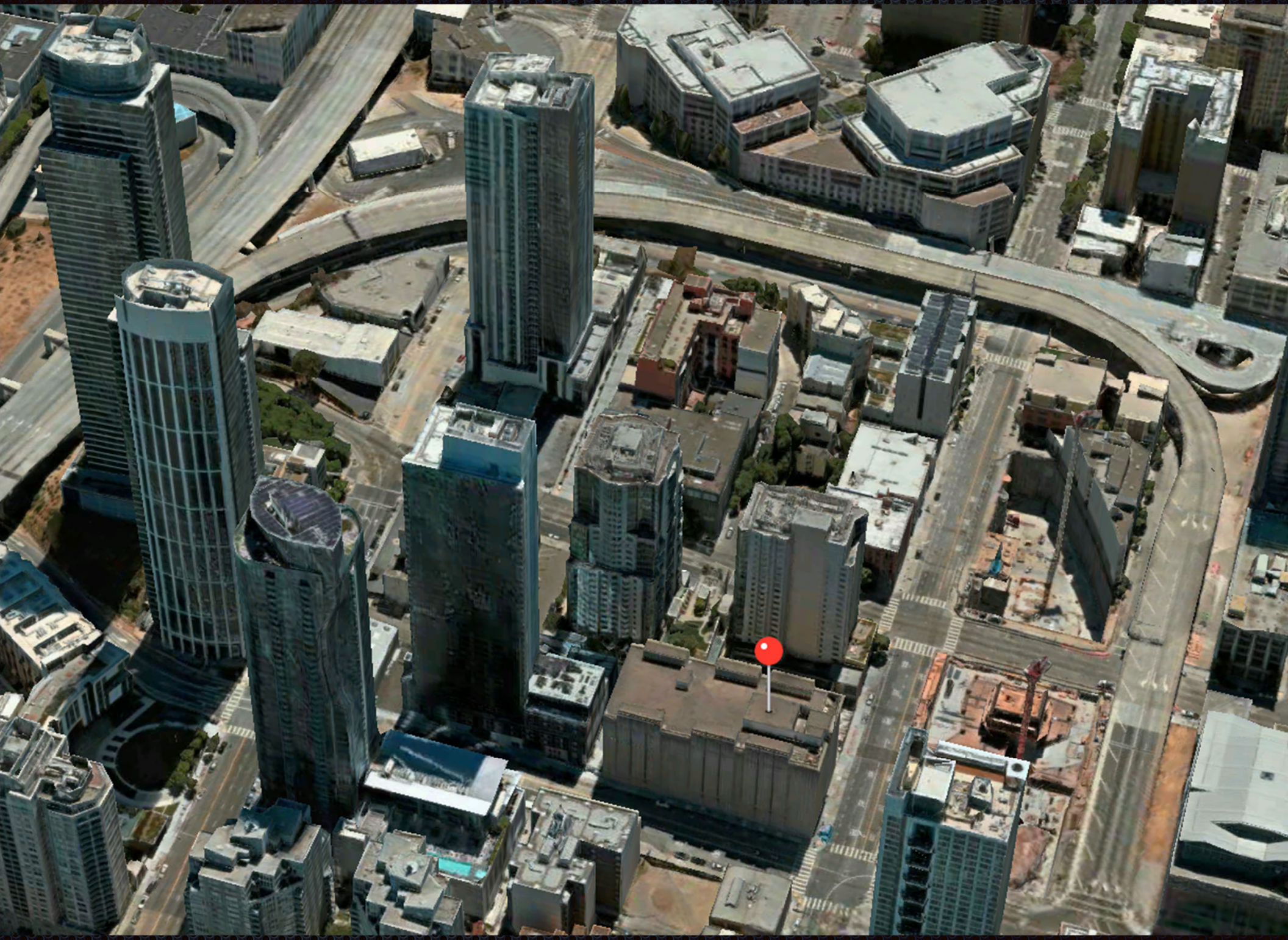
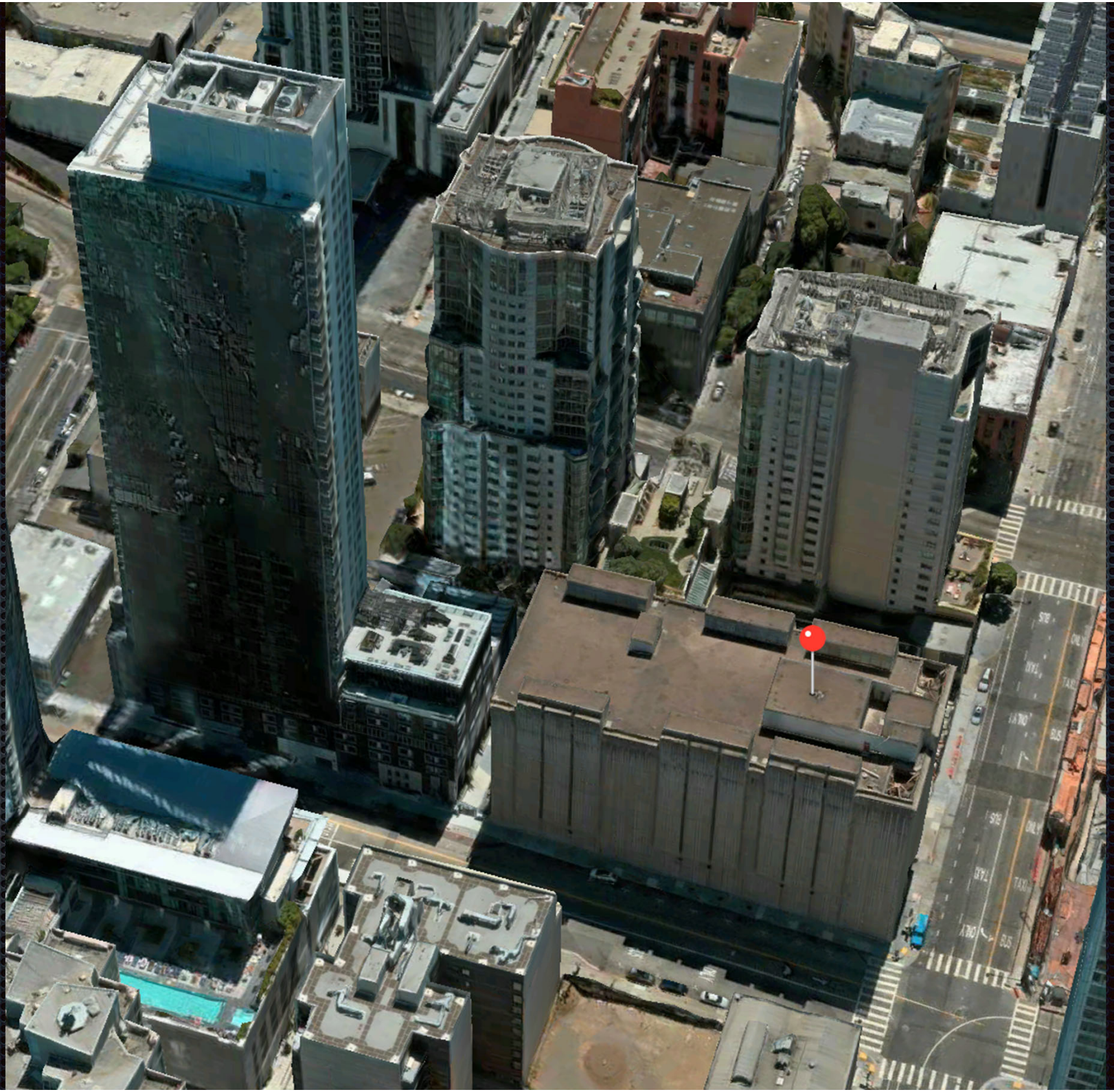
LLOYD CLUFF/GETTY IMAGES

Source= Flickr photo [http://www.flickr.com/photos/sanbeiji/220647995/ Crushed]


CHAMBER OF COMMERCE
MAIN STREET
CAT
CHEVROLET








E. M. O'DONNELL
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http://www.sosbrutalism.org/cms/16358767

http://www.hagenstier.com/


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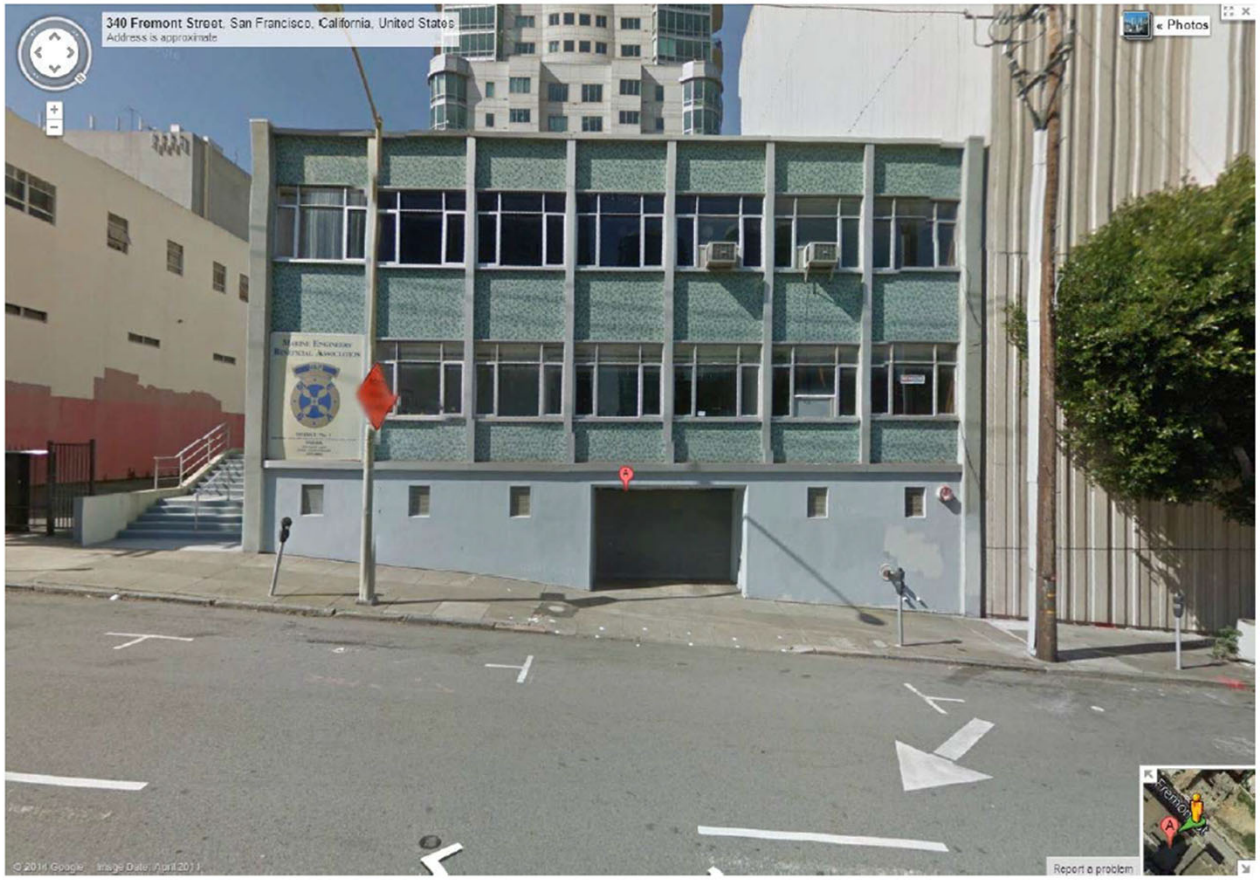

Figure 1: 340 Fremont Street, Front Elevation.

Image Copyright 2014, Google. Image Date April 2011. Access Date February 28, 2014.

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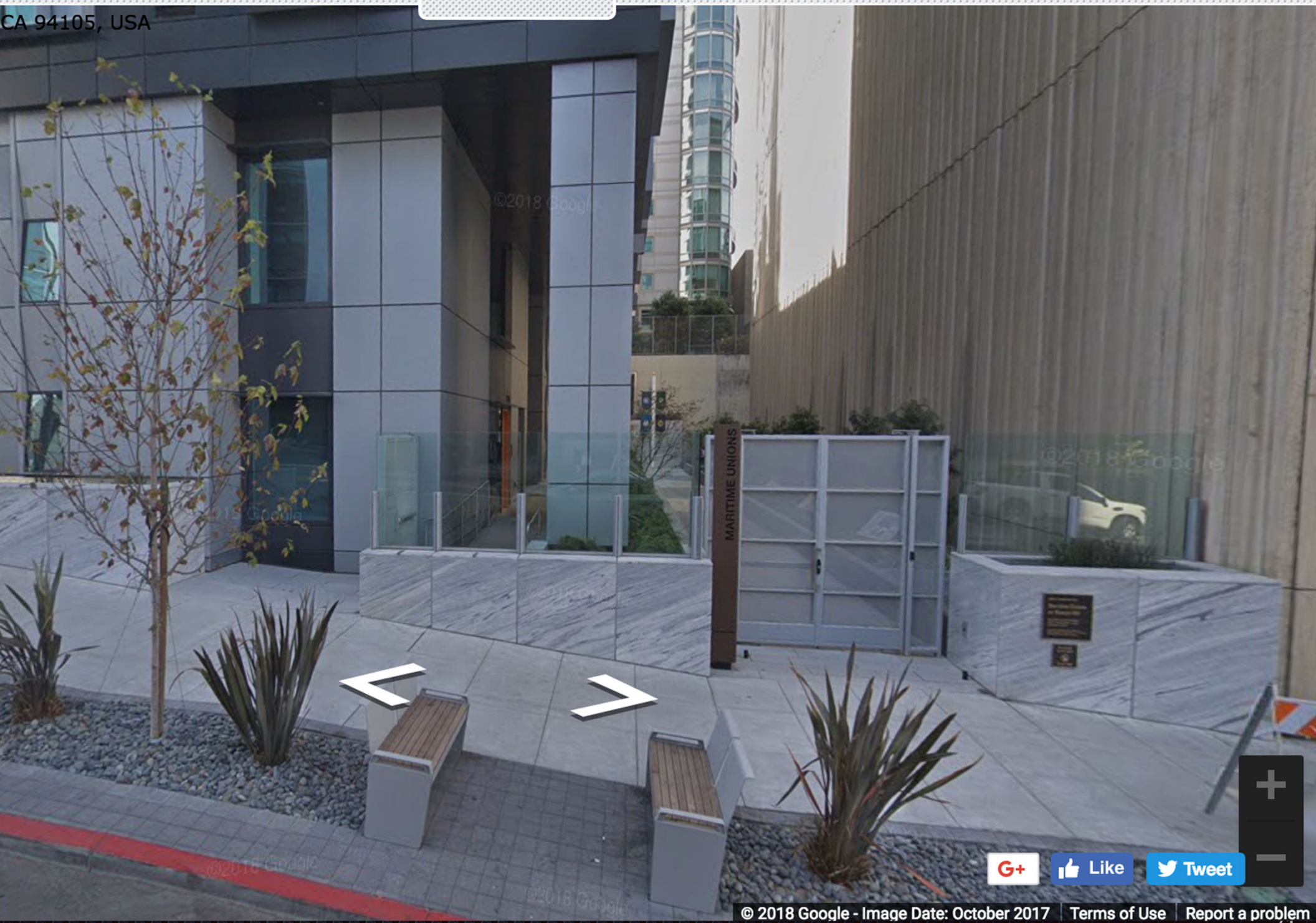
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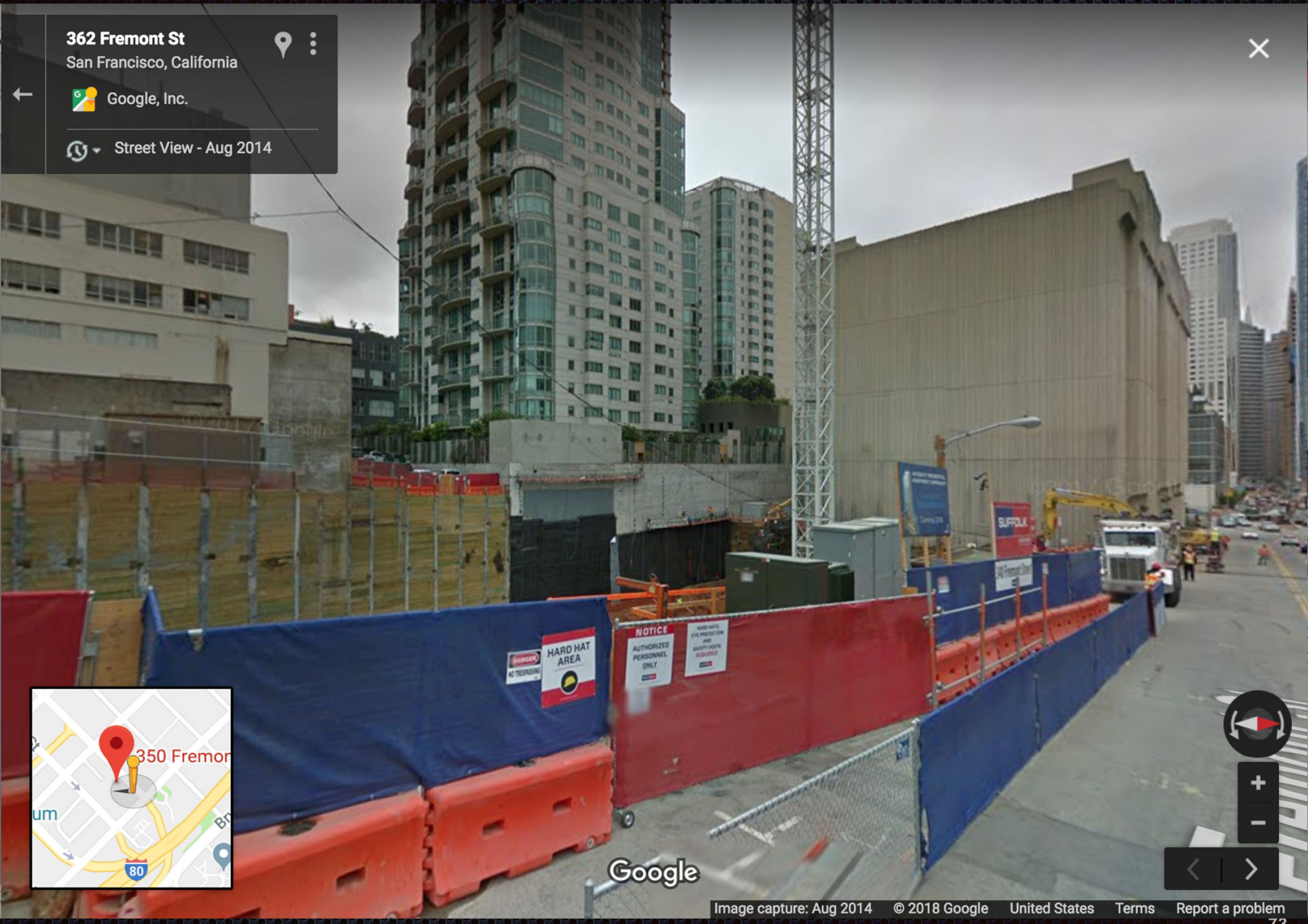
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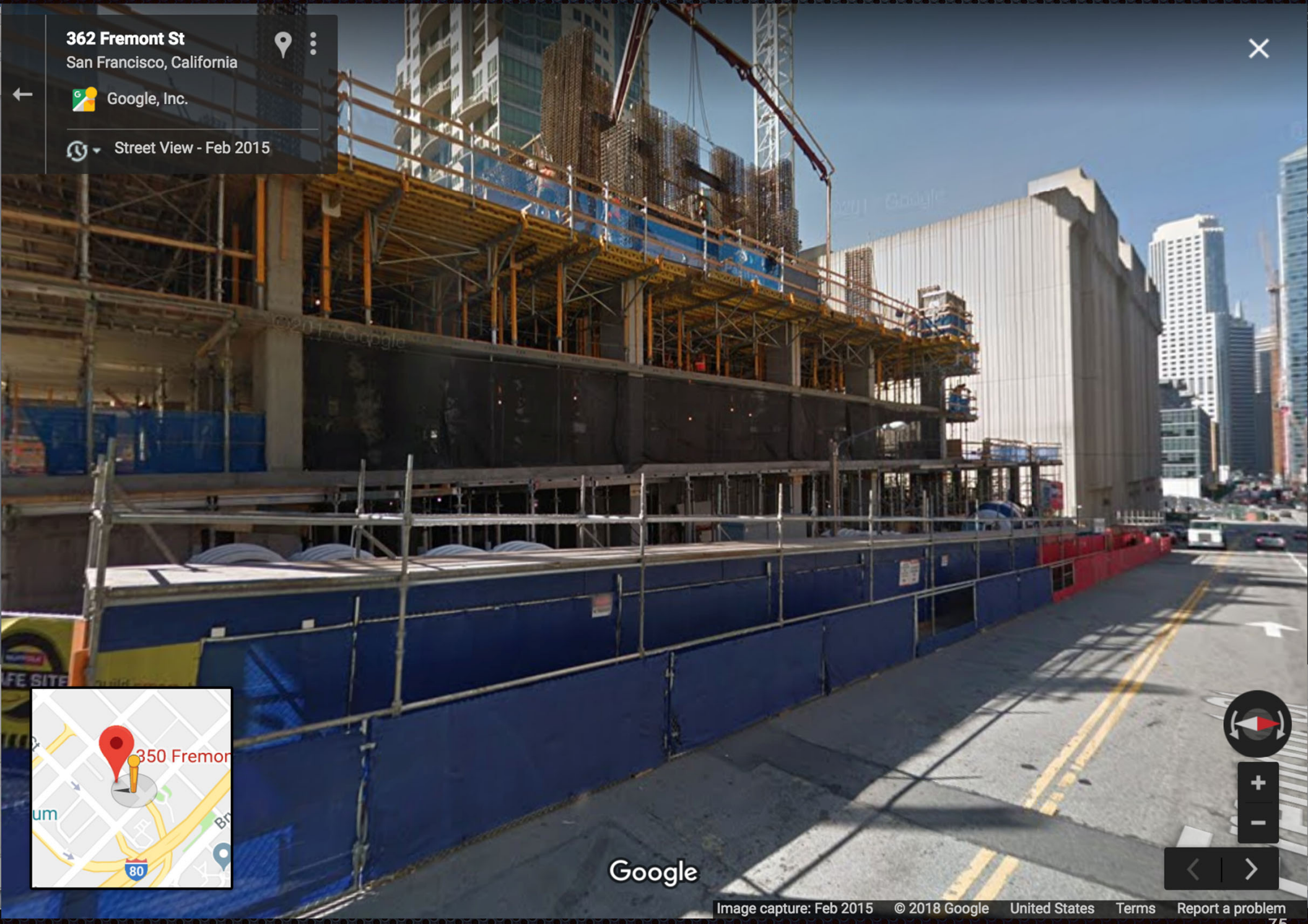
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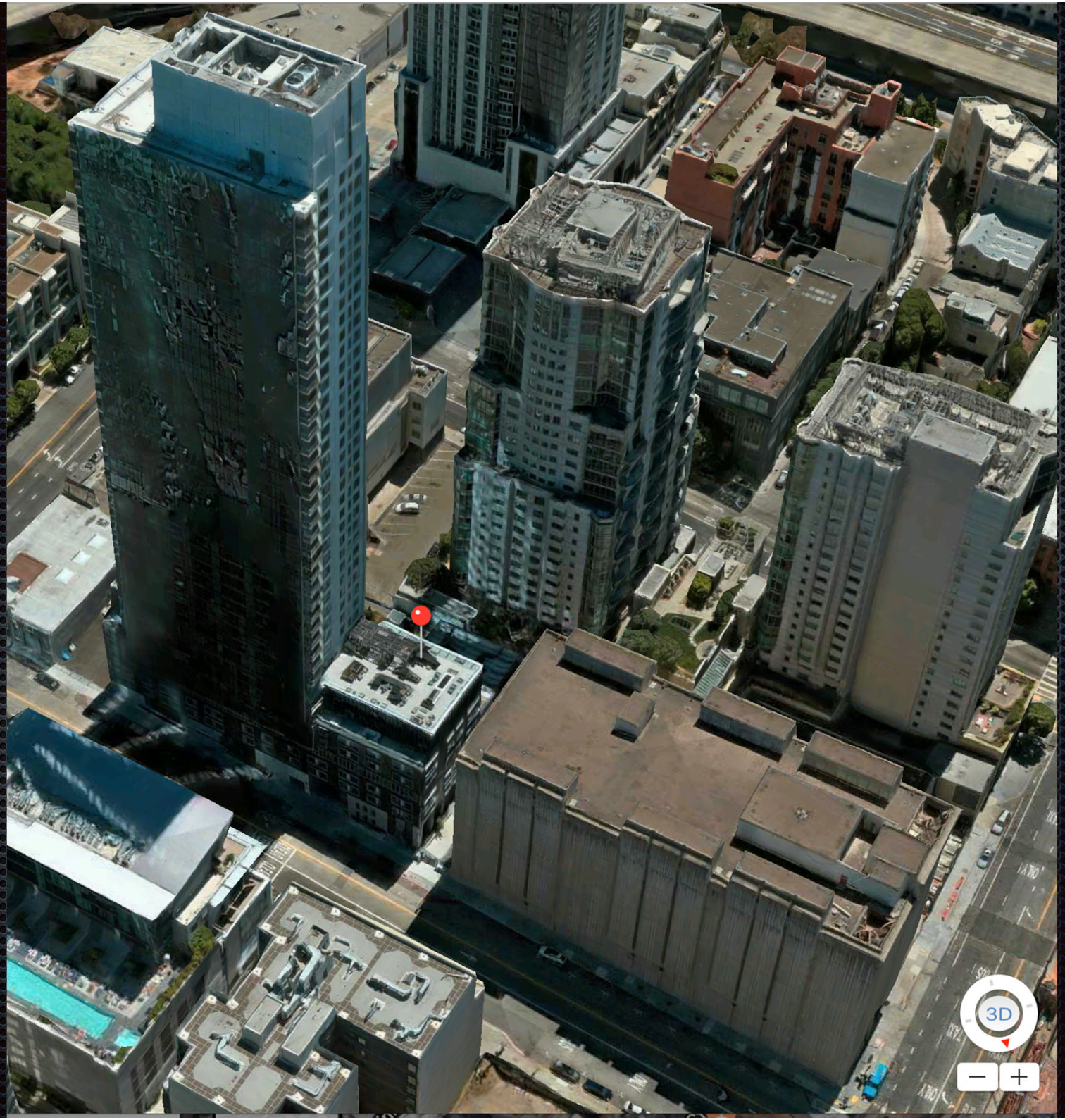
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388 Harrison St
San Francisco, California
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A structure (such as a missile command center) belongs in DOD Risk Category V when it has certain "national security" characteristics.

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.

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.

https://www.sfchronicle.com/bayarea/article/It-looks-simple-but-it-s-not-Complexity-of-13267862.php


Oct 31, 2012
Nov 4, 2012

http://www.nyccorners.com/2012/11/world-trade-center-hurricane-sandy.html

https://qz.com/21785/the-lights-at-goldman-sachs-stay-on-through-hurricane-electricity-as-the-new-symbol-of-wall-street-greed/

https://qz.com/21785/the-lights-at-goldman-sachs-stay-on-through-hurricane-electricity-as-the-new-symbol-of-wall-street-greed/

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.

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