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# SAMPLE SEISMIC RISK ASSESSMENT

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## EXECUTIVE SUMMARY REPORT



162 Folsom Street  
San Francisco, CA

Prepared for: Hunter Real Estate  
Prepared by: FB&C Engineers Consulting Group

June 22, 2015

Report Generated by the:



## I. PROJECT OVERVIEW

### A. OVERVIEW

Project Name: 8-Story Reinforced Concrete Special Moment Frame – Example for Sample Report

Client Name: Hunter Real Estate

Project Engineer: Curt Haselton

### B. SITE INFORMATION

Address: 162 Folsom Street, San Francisco, CA 94105

Latitude: 37.7898

Longitude: -122.3918

Site Class: C

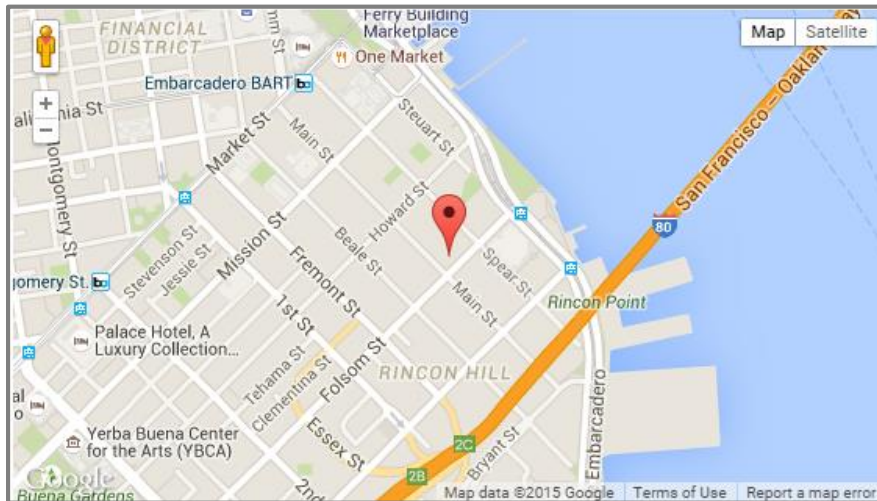


Figure 1. Site Location

### C. BUILDING INFORMATION

Material Type: Reinforced Concrete, Building Type: Moment Frame Perimeter

Design Year: 2015

Number of Stories: 8

Occupancy Type: Commercial Office

Total Building Square Footage: 172,800 sq. ft.

Total Building Value: \$34,560,000

### D. SUMMARY OF ANALYSIS COMPLETED

FEMA P-58 Analyses: Intensity-based analysis: Yes; Time-based analysis: Yes

U.S. Resiliency Council Building Rating: FEMA P-58 rating: Yes; ASCE 31/41 rating: No

REDi Recovery Times: Repair times: Yes; Recovery times with impeding factors: Yes

## II. U.S. RESILIENCY COUNCIL SEISMIC RATING

The following is a summary of the building seismic rating based on the FEMA P-58 rating approach developed by the U.S. Resiliency Council (USRC) ([www.usrc.org](http://www.usrc.org)). Note that this is not an official USRC rating unless submitted to the USRC for review and archival.

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### Safety: 4 Stars



Expected performance results in conditions that are unlikely to cause serious injuries.

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### Damage: 3 Stars



The repair cost in a 475-year earthquake is less than 20% of building value  
(13.4% for analysis of this building).

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### Recovery: 3 Stars



The REDi Functional Recovery Time in a 475-year earthquake is less than 6 months  
(5.6 months for analysis of this building).

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### III. DAMAGE AND REPAIR COSTS

#### A. EXPECTED LOSSES FOR 10% IN 50 YEAR EARTHQUAKE

Mean Loss: 13.4%    Median Loss: 6.2%    90<sup>th</sup> Percentile Loss: 26%

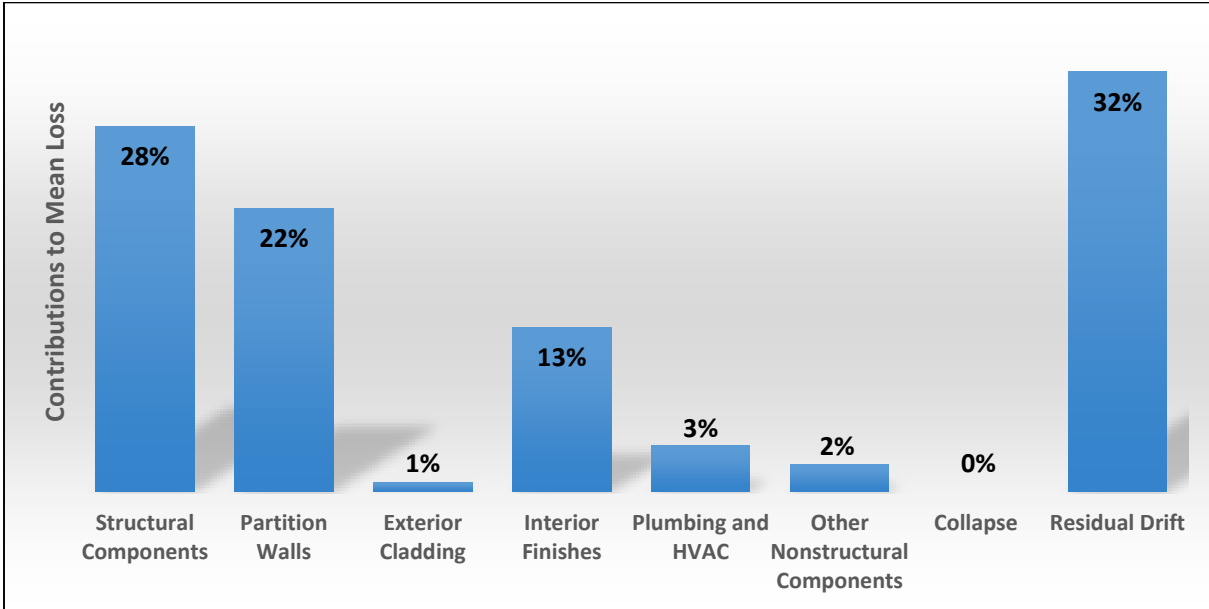


Figure 2. Contributions of Various Component Types of Mean Loss for 10% in 50 year Ground Motion

#### B. MOST DAMAGED COMPONENTS

##### **Structural Components**

Component: Post Tensioned Concrete Flat Slab Columns

Expected Damage State: Damage State 1 - Yield strain of the slab flexural reinforcement has been exceeded, spalling of concrete may or may not occur, and slab exhibits large enough crack widths to allow epoxy injection.

Average Loss from Component: \$590k

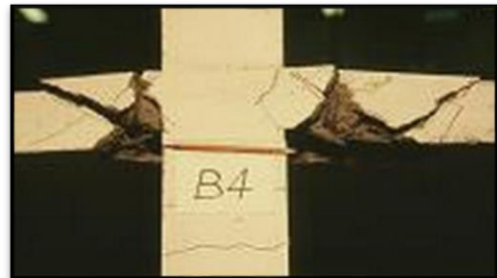


Figure 3. Yielding of slab reinforcement for a post-tensioned concrete flat slab column

##### **Non-Structural Components**

Component: Wall Partitions - Full Height with Fixed Connections

Expected Damage State: Damage State 3 - Significant Cracking and/or crushing of gypsum wallboards, buckling of studs and tearing of tracks.

Average Loss from Component: \$390k



Figure 4. Buckling of studs for a fixed connection partition wall

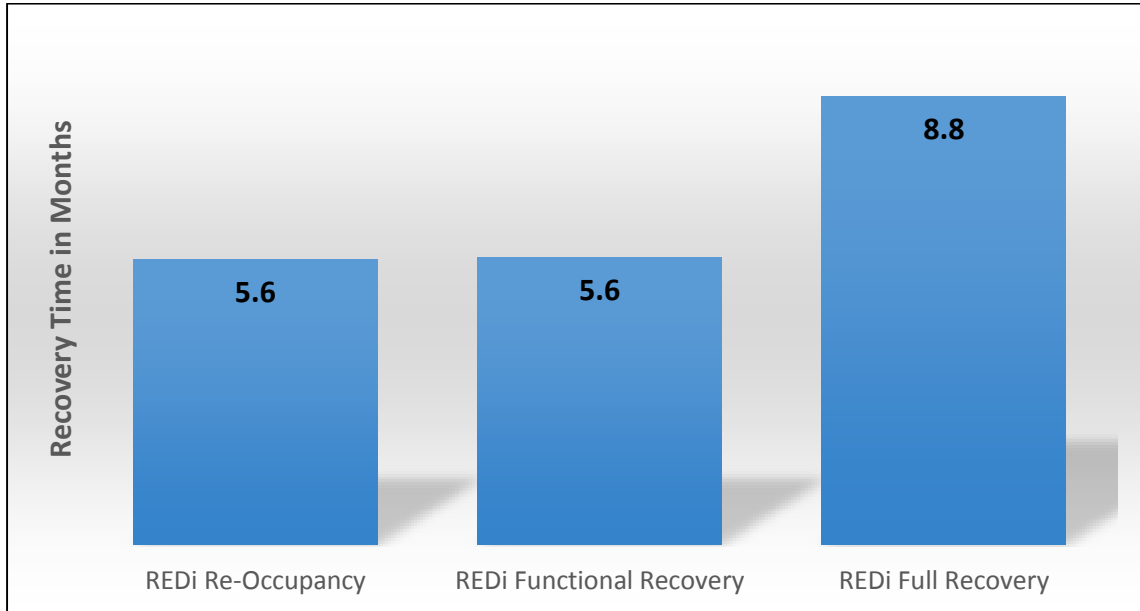
## IV. REPAIR AND RECOVERY TIME

Average REDi repair times without impeding factors:

- 5.6 months to Reoccupancy
- 5.6 months to Functional Recovery
- 8.8 months to Full Recovery

Average REDi recovery times including impeding factors:

- 12.8 months to Functional Recovery



**Figure 5.** Average repair times (in months), excluding factors that may impede the onset of repairs.

## V. SUMMARY OF THE LEVEL OF ANALYSIS COMPLETED

### A. SITE HAZARD

Site Class: User-input value

Hazard: USGS Hazard Curve

### B. STRUCTURAL ANALYSIS

Method: FEMA P-58 Simplified Method

Building Period: User-input value

Base Shear Strength: Default values used

Yield Drifts: Default values used

Mode Shape: Default values used

### C. BUILDING CAPACITY

Collapse:

- Included in the analysis
- FEMA 154 checklist method used to estimate collapse capacity

Residual Drifts:

- Included in the analysis
- Default capacities used

### D. BUILDING COMPONENTS

Non-Structural Components:

- FEMA P-58 normative quantities used - Yes
- Automated ASCE7 Chapter 13 capacity calculations used - Yes
- User modified quantity values (see next section for details) - Done for 2 components
- User added a user-defined fragility curve (see next section for details) - Done for 1 component

Structural Components:

- SP3 normative quantities used (with user-input structural layout and component types) - Yes
- No user modifications were made.

Contents:

- No contents were included in the SP3 analysis model.

## VI. SUMMARY OF USER-MODIFICATIONS TO DEFAULT VALUES

### A. SITE HAZARDS

#### **Site Class**

User Input: Site Class C

Default Value: Site Class D

**Ground Motion Hazard:** No exception was taken to defaults.

#### **User Explanation of Modified Inputs**

“Based on a site-specific geotechnical evaluation, this site has been shown to be Site Class C.”

### B. STRUCTURAL RESPONSES

#### **Building Period**

User Input: 1.6 sec. for Direction 1, 1.8 sec. for Direction 2, and hazard analysis done at 1.7 sec.

Suggested Values: HAZUS – 1.2 sec., Building – 1.2 sec., Bare Frame – 2.2 sec.

**Building Strength and Yield Drift:** No exception was taken to defaults.

**Mode Shape:** No exception was taken to defaults.

#### **User Explanation of Modified Inputs**

“To be reasonable for a 10% in 50 year ground motion level, an average building period of 1.7 seconds was used, which is the central point between a bare frame period and a HAZUS building period. Additionally, the building configuration shows that Direction 1 is slightly stiffer than Direction 2.”

### C. REDI RECOVERY TIME CALCULATION INPUTS

User Input: 60 maximum workers on site; Default Value: 46 maximum workers on site

User-Explanation of Modified Inputs: “Based on the feedback of my contractor, this site and building should be able to accommodate up to 60 workers.”

### D. BUILDING COMPONENTS

**Table 1.** Documentation of user-modified building component types and quantities.

Component Description	Location	Default Quantity	User Quantity
C3032.003d: Suspended Ceiling, SDC D,E (I <sub>p</sub> =1.0), Area (A): A > 2500, Vert & Lat support	All Floors	1.94	0
User Defined 1: Suspended Ceiling for SDC D/E Designed with Better Bracing and Double Capacity, Area (A): A > 2500	All Floors	0	1.94
C3033.002: Recessed lighting in suspended ceiling - with independent support wires	All Floors	324	30
C31011.001a: Wall Partition, Type: Gypsum with metal studs, Full Height, Fixed Below, Fixed Above	Story 1	8	6

### ***User Explanation of Modified Inputs***

“For large ceiling areas, additional ceiling bracing was provided to increase the ceiling capacity by a factor of two. This factor of two is supported by testing done by Doe et al. (2013).”

“The lighting falling hazards were causing too many injuries to achieve the 4-star safety rating. To remedy this, nearly all of the recessed lighting in the building were provided additional anchoring to prevent falling (with the anchoring scheme shown to prevent falling at very high acceleration levels by Doe et al 2011). This additional anchoring was used for all by 30 fixtures per floor, so the 30 were left in the building model. The new anchored fixtures are anticipated to be robust and were not included in the model (which may slightly under-estimate repair costs, but the results show that lighting is mostly a safety issue and not a repair cost issue).”

“The quantity of wall partitions on the first floor was reduced by 30% to account for the open floor plan in the building lobby.”