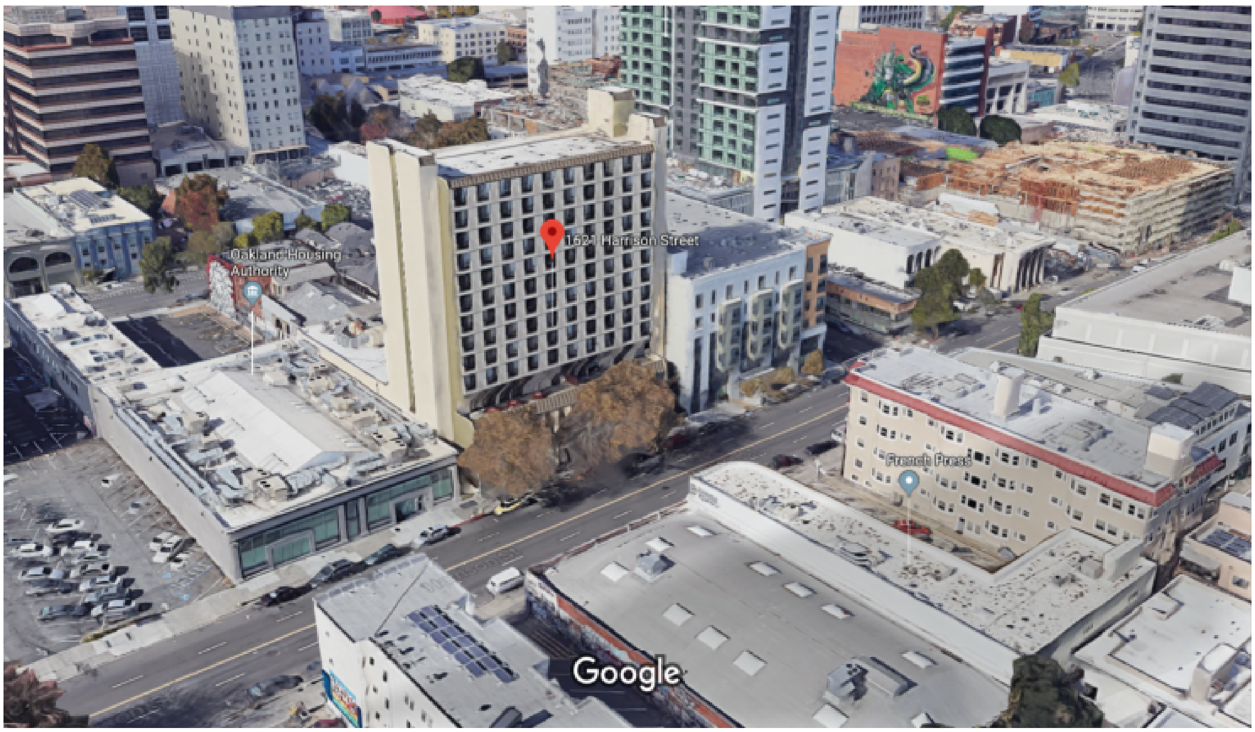
ATTACHMENT B

Seismic Risk Assessment of building at 1621 Harrison Street, Oakland, CA

PML REPORT

2019 September 30



Disclaimer

This report, and analyses, estimates and conclusions are based on scientific data, mathematical and empirical models. Due to the nature of this analysis methodology and input data, actual losses experienced during an earthquake may differ substantially from the estimates provided in this report

The professional structural engineering services summarized in this report have been performed using that degree of care and skill ordinarily exercised under similar circumstances, by reputable practicing structural engineers in this or similar localities at this time. No other warranty, express or implied, is made as to the professional content included in this report. This report has been prepared for the indicated client to be used solely for its evaluation of the above-mentioned building. The report has not been prepared for use by other parties and may not contain sufficient information for purposes of other parties or other uses.

Miyamoto International, Inc.

www.miyamotointernational.com

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1. EXECUTIVE SUMMARY

1.1 Findings

Miyamoto International has completed seismic risk assessment of the building, located at 1621 Harrison Street, Oakland, CA 94612. This assessment was performed at the request of Saida + Sullivan Design Partners.

The building under investigation consists of 13 stories and contains approximately 130,000 ft^2 of space. The lateral system consists of concrete shear walls while the gravity system is comprised of concrete columns, concrete beams and a mix of one-way and two-way slabs. The assessment was conducted utilizing methods and procedures consistent with good commercial or customary practices designed to conform to acceptable industry standards. The assessment relied on determining the Probable Maximum Loss (PML) for the building. PML is a tool used by structural engineers to calculate the anticipated 90-pecentile loss expected in the event of a design earthquake. The design earthquake has the level of shaking and intensity that is implied in the modern codes for the design of new buildings. For new buildings designed per provisions of modern seismic codes, PML value of less than 20% is expected and PML of greater than 20% is indicative of seismic deficiencies.

The seismic risk of the building is judged moderate with a PML of 30%. The higher PML for this building is not unexpected because:

- It was constructed in 1970 at a time when the knowledge of ground motion magnitude and the effects of ground motion on building/soil structures was less refined than current knowledge. Thus, it is not surprising that the design did not incorporate some of the lessons learned from earthquakes since.
- It is located in Oakland, which is a region of high seismicity with many active faults which could generate large magnitude ground accelerations.
- Deficiencies of the building are listed below:
  - Expansion joints in walls and slabs at podium levels
  - Discontinuous vertical concrete walls
  - Torsional behavior of the building
  - Minimal reinforcing confinement in gravity columns

Many buildings constructed during this time period, with these types of structural systems, in regions of high seismicity have similar or higher PML. The site visit indicated that the visual observation of lateral and gravity systems were in general conformance with available existing drawings and no significant deterioration or seismic damage was observed and that is one of the factors enhancing the performance of the building.

To reduce the PML below 20%, there are robust and cost-efficient options available that have been used to seismically retrofit similar types of buildings in the past. The goal of a successful upgrade is to mitigate the key deficiencies in an efficient manner while staying cognizant of the need to minimize retrofit costs and maintain building occupancy. We have taken the step to prepare a mathematical model to simulate the building performance based on available as-built drawings, these are steps consistent with a Tier 2 analysis. An initial step to help lower the PML would consist of a more detailed structural assessment of the existing building condition through material testing and soils investigations at the site. The outcome of this step would help identify the key deficiencies that need to be addressed, confirm our analysis assumptions, more accurately predict material strengths, and verify as-built details not presented in the as-built structural drawings. After a more detailed material testing and soil investigation, the PML could be reduced, although we don't anticipate it would lower the PML below 20%. We believe strengthening of existing columns, beams, and walls, adding shotcrete walls, and floor strengthening to eliminate expansion joints at the podium would bring the PML below 20%. Adding shotcrete walls could come in the form of replacing non-structural partitions with shotcrete walls where vertical discontinuities exist in the lateral system. In appendix A.6 of this report, conceptual details and plans are provided to help with understanding what these retrofits look like, the PML associated with these concepts are provided in appendix A.7. The conceptual details and plans provided are considered a conservative design. Progressing the conceptual design to a construction document would entail more detailed analysis and offers the possibility of a reduced number of concrete walls necessary to retrofit the building. We want to emphasize that all details are conceptual in nature, not final retrofit solutions, and any pricing generated based on these details should incorporate a sufficient amount of contingency.

1.2 Limitations

The findings are based on engineering judgment and knowledge of how similar buildings have performed in past earthquakes. The findings are general in nature and do not express or imply any warranty on the existing structure and its performance during a seismic event.

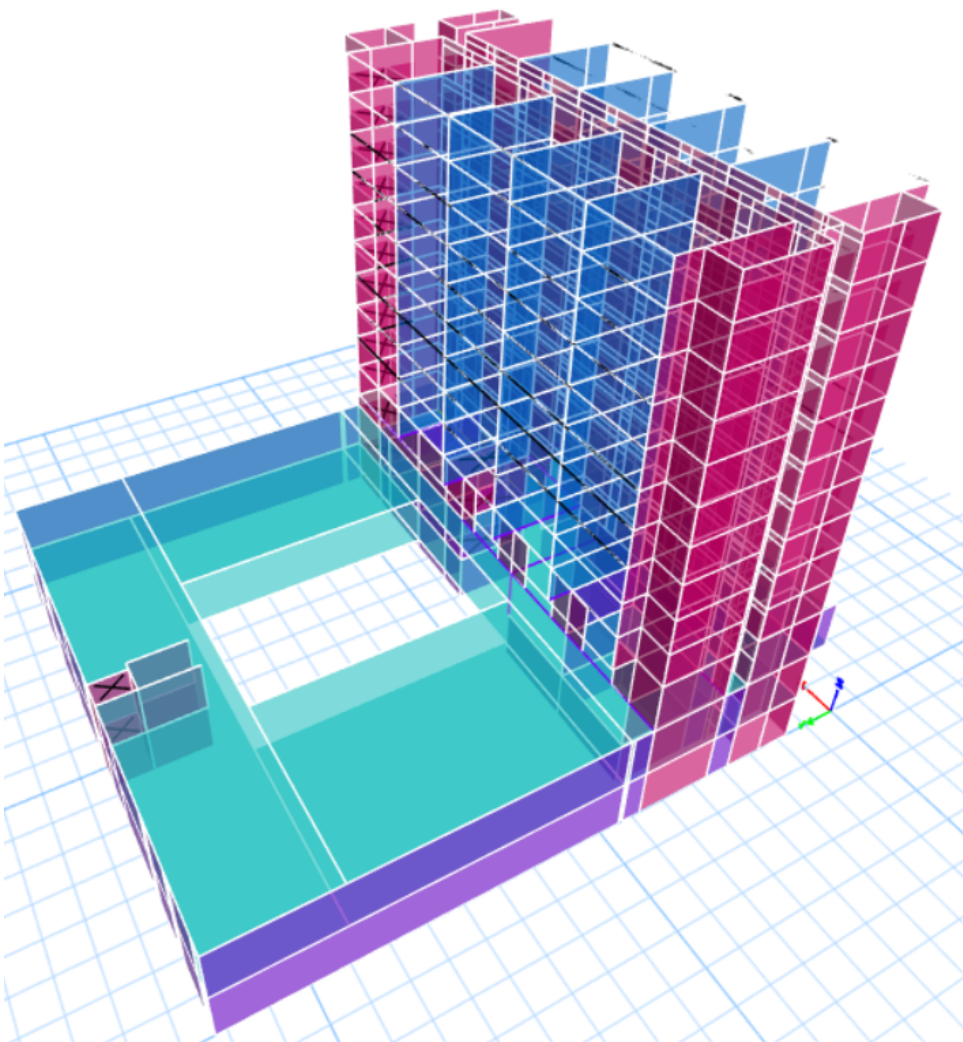


Figure 1. 1621 Harrison ETABS Analytical Model

2. Introduction

2.1 Overview

The purpose of this project is to perform a seismic risk assessment of the building located at 1621 Harrison Street, Oakland, CA, hereafter referred to as the Building, and to develop an opinion on the likely performance of the building in an earthquake. The earthquake performance of the buildings was projected based on factors such as type and quality of construction, configuration, age, condition, design code used, seismic-resisting system, structural design and details, local geology and seismicity, distance to nearby faults, site earthquake history, and performance of similar buildings in past earthquakes.

2.2 Scope

The scope of work for this project consisted of the following tasks:

- Cursory review general geologic information, fault maps, and the earthquake history for the area to determine the seismic hazard.
- Briefly review available drawings to understand the primary lateral-load-carrying systems, and their strengths and weaknesses.
- Conduct walkthrough surveys of the Building to assess the general condition of the structure and general conformance of visible as-built structure to available existing structural drawings.
- Estimate a Probable Maximum Loss (PML) percentage for the Building based on the preliminary findings. The PML estimate is appropriate for a major earthquake affecting the region.
- Prepare a report summarizing our findings.

2.3 Procedure

A Level 2 Probable Maximum Loss (PML) study was conducted for the Property. A Level 2 PML study (ASTM 2016a and ASTM 2016b and ATC 2002) is a slightly more detailed level of analysis compared to a Level 1 study and still provides a low level of confidence. A level 2 study requires existing construction documents, identification of specific structural deficiencies, and site-specific geotechnical information to determine the economic loss associated with various levels of ground shaking. A 3D analytical model of the building, created in ETABS, was used to evaluate specific structural behaviors such as soft stories, weak stories, and torsional behavior of the building. With a more accurate prediction of building behavior, we used the probabilistic seismic hazard analysis software ST-RISK (2019) to formulate the PML and possible remedies to the lower the PML. Probabilistic seismic hazard analysis is the process of determining the probability of ground shaking intensity for a given site. Four important contributors to this analysis are: the proximity of the site to earthquake faults, the size of the earthquakes that can be generated by these nearby faults, the resulting ground motion at the site, and the effects of local site conditions.

The hazard analysis only reflects the likelihood and intensity of ground shaking. To obtain risk measurements, the effects of the ground movement on the building must also be considered. A PML study is based on scientific data, mathematical and empirical models, past performance of similar buildings, the encoded experience of engineers, geologists and geotechnical specialists, professional opinions and user specified input information, using state-of-the art probabilistic seismic hazard analysis software.

3. SEISMICITY OF THE BUILDING

3.1 Overview

The Building is located in downtown Oakland, California, as shown in Figure 2. The building coordinates are: latitude of 37.804998 and longitude of -122.266761.

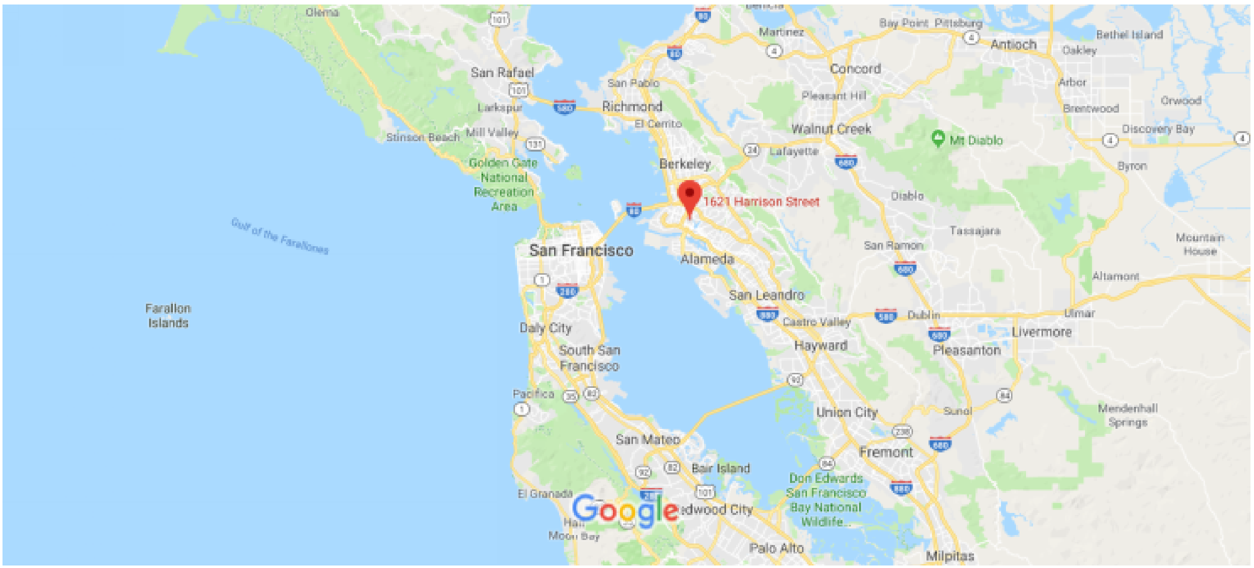


Figure 2. Location of the Building

3.2 Active faults

As shown in Figure 2, the Building is located in close proximity to a number of known faults including San Andreas (North Coast), San Andres (Peninsula) and Hayward (North). These faults can generate large earthquakes as has been witnessed in the previous Bay Area earthquakes.

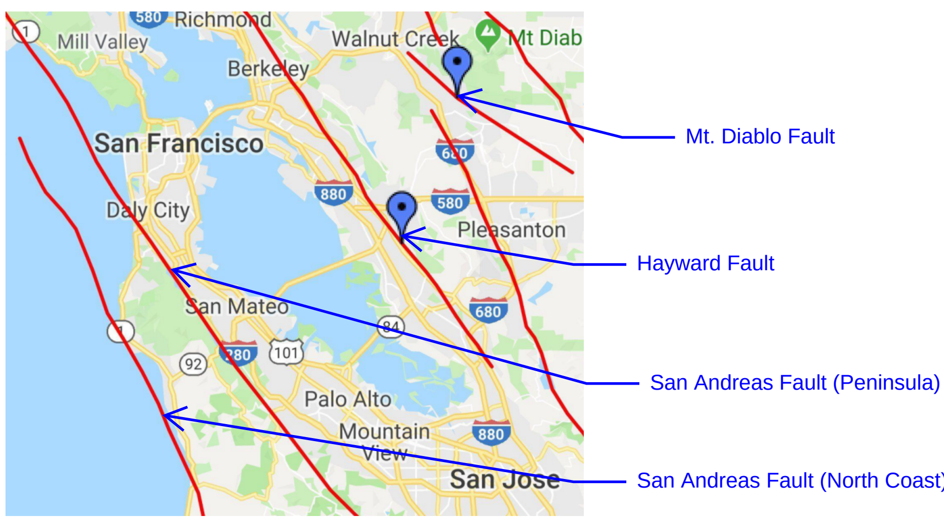


Figure 3. Known faults near the Building

3.3 Site class

In addition to the ground shaking, the underlying soil has significant effect on the intensity of shaking experienced by structures. Based on available USGS soil type maps and information from a previous soils report entitled *Geotechnical Investigation 1633 Harrison Street* prepared by Treadwell & Rollo dated 29, August 2008, including an addendum dated 15, June 2009 the soil profile was assumed to have a site classification of D.

3.4 Earthquake intensity

The PML values are usually expressed using the Modified Mercalli Intensity (MMI) scale, which is a commonly used measure of earthquake intensity. A description of the MMI scale is shown in. Section A.1.

3.5 Seismic hazard

The seismic hazard for the site was calculated from the platform developed by SEAOC & OSHPD (2019) based on the location and underlying soil. The seismic hazard is shown in Figure 4. The 2016 California building code, has assigned the subject site to Seismic Design Category D, which implies the area considered to be of high seismic risk.

OSHPD

1621 Harrison St, Oakland, CA 94612, USA

Latitude, Longitude: 37.805008, -122.26677000000001

Date	6/26/2019, 11:15:35 AM
Design Code Reference Document	ASCE41-17
Custom Probability	
Site Class	D - Stiff Soil

Type	Description	Value
Hazard Level		BSE-2E
S_S	spectral response (0.2 s)	1.716
S_1	spectral response (1.0 s)	0.639
S_{XS}	site-modified spectral response (0.2 s)	1.716
S_{X1}	site-modified spectral response (1.0 s)	1.086
f_a	site amplification factor (0.2 s)	1
f_v	site amplification factor (1.0 s)	1.7

Figure 4. Design earthquake seismic hazard

3.6 Site vulnerability potential

In addition to shaking damage, buildings and contents can be damaged from seismically induced soil failure, such as fault rupture, land sliding, liquefaction, and soil compaction. The potential susceptibility of the site to experience these failures has been estimated for the 475-year seismic hazard, as presented in Table 1.

- There are no known faults at the Building site and thus, fault rupture is not of a concern.
- The Building is located in downtown Oakland; which has not experienced landslides in past earthquakes.
- The Building has a basement and.as such; the risk from earthquake induced soil compaction is low.
- The Building has site class D or stiffer and was not constructed on fill near the bay and thus the potential for liquefaction is low.

Hazard	Fault rupture	Land sliding	Soil compaction	Liquefaction
Probability	Low	Low	Low	Low

Table 1. Site vulnerability potential

4. Description of the Building

The Building; see Figure 5, was constructed in 1970. It has a group housing (R2) occupancy. The building footprint measures 127 x 150 ft, and comprises ten (10) stories on top of a 3 story podium, and one below-grade basement. The ground has a flat slope and the first level corresponds to the ground level. The building footprint steps back at the third level.

Figure 5. Photograph of the building

4.1 Building framing

The available structural plans; see Figure 6 show a system of reinforced concrete walls on the interior and perimeter. This framing was confirmed during the site visit (see Figure A.1). As such, using the FEMA 310 (1998) description, the building was classified as Type C2: Concrete Shear Walls with Stiff Diaphragms.

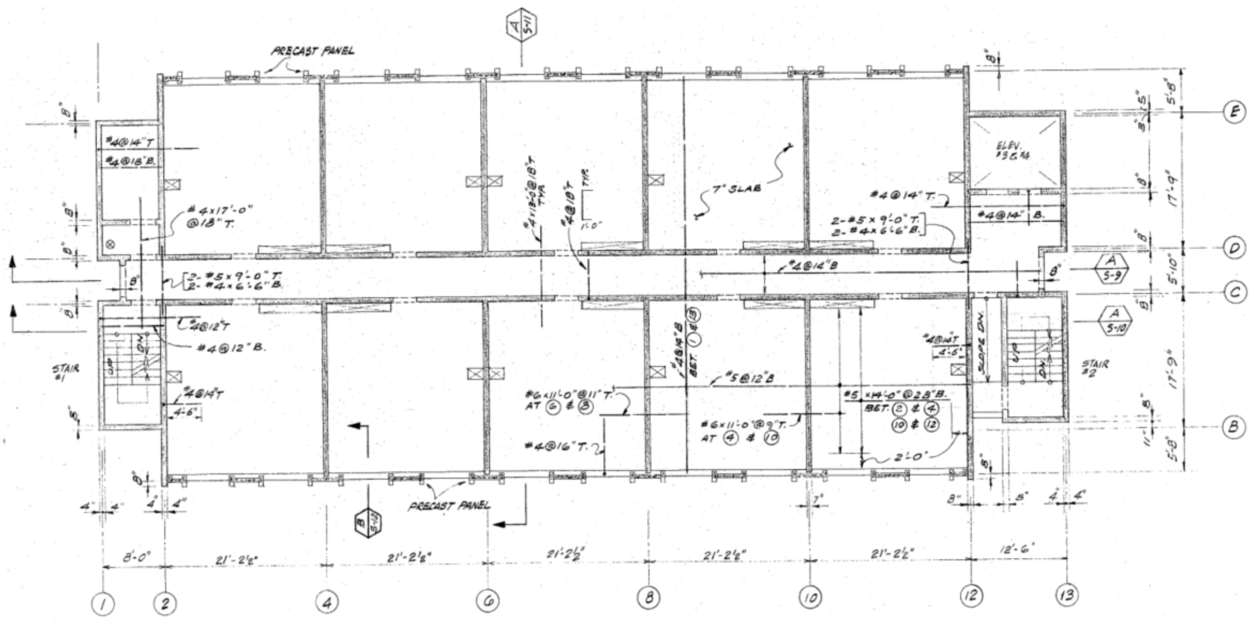


Figure 6. Typical floor layout

4.2 Site visit

A site visit of the building was conducted to assess its existing condition, verify the main building framing, and note any significant anomalies. Data from this visit is presented in Section A.2.

5. Findings

5.1 Overview

The seismic risk evaluation for the Building is presented as Probable Maximum Loss (PML). PML is a percentage of total building replacement value and does not take into consideration values of equipment or monetary loss from personal property. Section A.4 presents description on the anticipated level of damage associated with given PML percentages

The PML does take into account the intensity of shaking, soil conditions, and structural features. The PML is based on an event with a 475-year return period—commonly referred to as the design earthquake because it is the earthquake intensity implied in the building codes and which has a 10% probability of exceedance in 50 years—and is associated with a 90 percent confidence level on the structural response of the building. For this study, the PML is based on the review criteria discussed in Section 2.2 and Section 2.3

Given the building construction year of 1970, it was constructed based on the archaic building codes developed prior to the implementation of earthquake resistant design in the past thirty years. Accordingly, non-ductile concrete details and lateral system layout were assumed in the assessment.

5.2 Development of the checklist

As part of the assessment a checklist was developed to identify the key characteristics of the Building. This checklist (FEMA 1998) was initially developed during the site visit and further refined at the office (ASCE 2017) is replicated in Section A.3.

The key factors enhancing the seismic performance of the Building are its complete load path, consistent mass distribution, and redundant concrete wall layout. The main contributing factor to the Building's seismic vulnerability is the vertical irregularity in concrete walls, the expansions joints at the podium floors, poorly confined concrete columns, and the torsional behavior at the podium floors.

5.3 Results

The seismic risk to the Building is summarized in Table 2. See Section A.4 for a correlation of this level of seismic risk to loss and damage.

Earthquake return period, year	MMI	Loss %*		
		PL	SUL	SEL
43	VI-VII	5	11	7
285	VIII	17	28	18
475	VIII	20	PML=30	20
2475	IX	31	38	25

Table 2. Seismic risk to the Building

5.4 PML

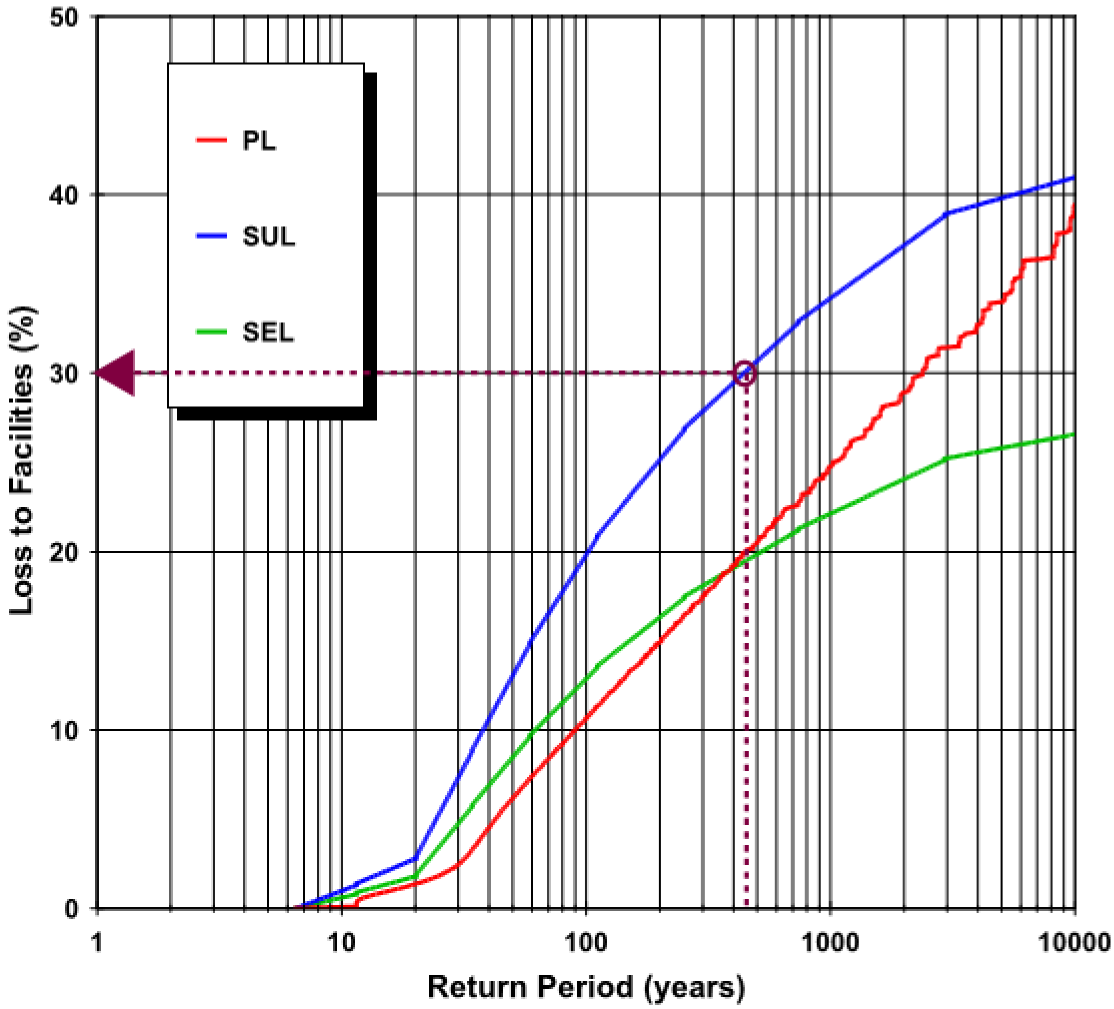
The PML (90% percentile for 475 year earthquake) for the Building was determined to be 30%; see Figure 7.

* PL=probable loss; SEL=scenario expected loss (50 percentile); SUL=scenario upper loss (90 percentile); PML=probable maximum loss (SUL for 475-year earthquake)

1621 HARRISO PML EVALUATION (TIER 1)

Company Name:	Miyamoto International	**Date:**	June 23, 2019
Building Name:	1621 Harrison	**Job Number:**	MI1917008.00
Street Address:	1621 Harrison St	**Engineer:**	Jacob Gruber
	Oakland, CA, United States 94612	**PE Number/State:**	85179, CA

Distribution of Risk at Your Site



RISK ENGINEERING, INC. Report generated by ST-RISK Version 4.51 Page 1 of 1

Figure 7. Determination of PML for the Building

6. References

American Society of Testing and Material (ASTM) International (2016a), *ASTM E2026, Standard Guide for Seismic Risk Assessment of Buildings*, West Conshohocken, PA

American Society of Testing and Material (ASTM) International (2016b*), ASTME 2557, Standard Practice for Probable Maximum Loss (PML) Evaluations for Earthquake Due-Diligence Assessments1,2,* West Conshohocken, PA

American Society of Civil Engineers (ASCE) (2017) , *ASCE 41-17, Seismic Evaluation and Retrofit of Existing Buildings,* Reston, Virginia

Applied Technology Council (ATC) (2002) *ATC 13-1, Commentary on the Use of ATC-13 Earthquake Damage Evaluation Data for Probable Maximum Loss Studies of California Buildings*, Redwood City, CA.

California Builing Code (CBC) (2017) *2016 California Building Code: California Code of Regulations Title 24. Part 2, Volume 2*. Sacramento, CA.

Federal Emeregency Management Agency (FEMA) (1998) *FEMA 310 Handbook for the Seismic Evaluation of Buildings, Washington DC.*

ST-RISK (2019) http://www.st-risk.com/tech.html

United States Geological Survey (USGS) (2017) https://earthquake.usgs.gov/

Appendix A Supplementary Material

Supplementary material pertinent to this report are presented in the following sections.

A.1 Modified Mercalli Intensity (MMI) Scale of 1931

The MMI scale is used to measure the intensity of an earthquake. It is based on the observed effects of earthquakes; see Table A.1.

Scale	Intensity	Description
I	Not felt	Not felt except by a very few under especially favorable circumstances.
II	Weak	Felt only by a few persons at rest, especially on upper floors of buildings Delicately suspended objects may swing.
III	Weak	Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize as an earthquake. Standing motorcars may rock slightly. Vibration is like passing of a truck. Duration estimated.
IV	Light	During the day felt indoors by many, outdoors by few. At night, some awakened. Dishes, windows, doors disturbed; wall make cracking sound. Sensation like heavy truck striking building. Standing motor cars rock noticeably.
V	Moderate	Felt by nearly everyone, many awakened. Some dishes, windows, etc. broken; a few instances of cracked plaster; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster or damaged chimneys. Damage slight.
VII	Very strong	Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; chimneys broken. Noticed by persons driving motor cars.
VIII	Severe	Damage slight in specially designed structures; considerable in ordinary substantial buildings, with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving motor cars disturbed.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from river banks and steep slopes. Shifted sand and mud. Water splashed and slopped over banks.
XI	Extreme	Few, if any, (masonry) structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.
XII	Extreme	Damage total. Practically all works of construction are damaged greatly or destroyed. Waves seen on ground surface. Lines of sight and level are distorted. Objects are thrown in the air

Table A.1. MMI scale

A.2 Site visit

A site visit of the building was undertaken on 2019 May 20 to perform preliminary assessment. Sample photographs taken during the visit are presented in Figure A.1

Building Basement & MEP Bracing

Building Basement & MEP Bracing

Third Floor Suspended Ceilings with Wire Bracing

Third Floor Suspended Ceilings

Third Floor Roof mounted equipment

Third Floor Roof mounted equipment anchorage

Building Exterior Roof MEP Equipment

Figure A.1. Photographs of the building taken during the site visit

A.3 FEMA 310/ASCE 41-13 CHECKLIST

Table 17-1. Very Low Seismicity Checklist

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
Structural Components			
C NC N/A U	LOAD PATH: The structure contains a complete, well-defined load path, including structural elements and connections, that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation.	5.4.1.1	A.2.1.1
C NC N/A U	WALL ANCHORAGE: Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.4.3.7.	5.7.1.1	A.5.1.1

Note: C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

Table 17-2. Collapse Prevention Basic Configuration Checklist

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
Low Seismicity			
Building System—General			
C NC N/A U	LOAD PATH: The structure contains a complete, well-defined load path, including structural elements and connections, that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation.	5.4.1.1	A.2.1.1
C NC N/A U	ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 0.25% of the height of the shorter building in low seismicity, 0.5% in moderate seismicity, and 1.5% in high seismicity.	5.4.1.2	A.2.1.2
C NC N/A U	MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure.	5.4.1.3	A.2.1.3
Building System—Building Configuration			
C NC N/A U	WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above.	5.4.2.1	A.2.2.2
C NC N/A U	SOFT STORY: The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above.	5.4.2.2	A.2.2.3
C NC N/A U	VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation.	5.4.2.3	A.2.2.4
C NC N/A U	GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines.	5.4.2.4	A.2.2.5
C NC N/A U	MASS: There is no change in effective mass of more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered.	5.4.2.5	A.2.2.6
C NC N/A U	TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension.	5.4.2.6	A.2.2.7

continues

Table 17-2 *(Continued)*. Collapse Prevention Basic Configuration Checklist

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
Moderate Seismicity (Complete the Following Items in Addition to the Items for Low Seismicity)			
Geologic Site Hazards			
C NC N/A U	LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance do not exist in the foundation soils at depths within 50 ft (15.2 m) under the building.	5.4.3.1	A.6.1.1
C NC N/A U	SLOPE FAILURE: The building site is located away from potential earthquake-induced slope failures or rockfalls so that it is unaffected by such failures or is capable of accommodating any predicted movements without failure.	5.4.3.1	A.6.1.2
C NC N/A U	SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated.	5.4.3.1	A.6.1.3
High Seismicity (Complete the Following Items in Addition to the Items for Moderate Seismicity)			
Foundation Configuration			
C NC N/A U	OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than $0.6S_a$.	5.4.3.3	A.6.2.1
C NC N/A U	TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C.	5.4.3.4	A.6.2.2

Note: C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

Table 17-24. Collapse Prevention Structural Checklist for Building Types C2 and C2a

Status	Evaluation Statement	Tier 2 Reference	Commentary Reference
Low and Moderate Seismicity			
Seismic-Force-Resisting System			
C NC N/A U	COMPLETE FRAMES: Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system.	5.5.2.5.1	A.3.1.6.1
C NC N/A U	REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2.	5.5.1.1	A.3.2.1.1
C NC N/A U	SHEAR STRESS CHECK: The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 4.4.3.3, is less than the greater of 100 lb/in.^{2} (0.69 MPa) or $2\sqrt{f'_c}$.	5.5.3.1.1	A.3.2.2.1
C NC N/A U	REINFORCING STEEL: The ratio of reinforcing steel area to gross concrete area is not less than 0.0012 in the vertical direction and 0.0020 in the horizontal direction.	5.5.3.1.3	A.3.2.2.2
Connections			
C NC N/A U	WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS: Exterior concrete or masonry walls that are dependent on flexible diaphragms for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have strength to resist the connection force calculated in the Quick Check procedure of Section 4.4.3.7.	5.7.1.1	A.5.1.1
C NC N/A U	TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls.	5.7.2	A.5.2.1
C NC N/A U	FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation with vertical bars equal in size and spacing to the vertical wall reinforcing directly above the foundation.	5.7.3.4	A.5.3.5
High Seismicity (Complete the Following Items in Addition to the Items for Low and Moderate Seismicity)			
Seismic-Force-Resisting System			
C NC N/A U	DEFLECTION COMPATIBILITY: Secondary components have the shear capacity to develop the flexural strength of the components.	5.5.2.5.2	A.3.1.6.2
C NC N/A U	FLAT SLABS: Flat slabs or plates not part of the seismic-force-resisting system have continuous bottom steel through the column joints.	5.5.2.5.3	A.3.1.6.3
C NC N/A U	COUPLING BEAMS: The ends of both walls to which the coupling beam is attached are supported at each end to resist vertical loads caused by overturning.	5.5.3.2.1	A.3.2.2.3
Diaphragms (Stiff or Flexible)			
C NC N/A U	DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints.	5.6.1.1	A.4.1.1
C NC N/A U	OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length.	5.6.1.3	A.4.1.4
Flexible Diaphragms			
C NC N/A U	CROSS TIES: There are continuous cross ties between diaphragm chords.	5.6.1.2	A.4.1.2
C NC N/A U	STRAIGHT SHEATHING: All straight-sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered.	5.6.2	A.4.2.1
C NC N/A U	SPANS: All wood diaphragms with spans greater than 24 ft (7.3 m) consist of wood structural panels or diagonal sheathing.	5.6.2	A.4.2.2
C NC N/A U	DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft (12.2 m) and aspect ratios less than or equal to 4-to-1.	5.6.2	A.4.2.3
C NC N/A U	OTHER DIAPHRAGMS: Diaphragms do not consist of a system other than wood, metal deck, concrete, or horizontal bracing.	5.6.5	A.4.7.1
Connections			
C NC N/A U	UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps.	5.7.3.5	A.5.3.8

Note: C = Compliant, NC = Noncompliant, N/A = Not Applicable, and U = Unknown.

Figure A.2. FEMA 310 checklist for the Building

A.4 DESCRIPTION OF EXPECTED DAMAGE FOR SEISMIC LOSSES

Table A.2 presents correlation of loss estimates, damage, and seismic risk.

Estimated Loss (% of Replacement Cost)[†]	**Expected Damage**	**Risk (Applicable to PML Only)**
0 - 10	Architectural damage, light and easily repairable; minimal disruption of use	Low
10 - 20	Limited damage, with some localized structural damage potentially leading to short-term business interruption	Moderately Low
20 - 30	Substantial structural damage, with potential for localized collapse; structure likely to be closed for inspection and until critical repairs are completed	Moderate
30 - 50	Severe structural damage, possibly including partial collapse and critical economic loss; structure likely to be closed for an extended period; repair may not be economically attractive	High
> 50	Severe structural damage leading to partial or total structural collapse and possibly complete economic loss	Very High

Table A.2. Description of damage associated with losses

[†] 20% or above could be potential life safety hazard

A.5 ST-RISK Results and Glossary

1621 HARRISO PML EVALUATION (TIER 1) - Seismic Risk Analysis

Company Name:	Miyamoto International	**Date:**	June 23, 2019
Building Name:	1621 Harrison	**Job Number:**	MI1917008.00
Street Address:	1621 Harrison St Oakland, CA, United States 94612	**Engineer:**	Jacob Gruber
		PE Number/State:	85179, CA

INFORMATION SOURCES

SiteVisit: Sean Fraser
Date: May 20, 2019
Interviewed:
Docs Reviewed: ASCE 41 checklist and documents reviewed by JG

BUILDING DESCRIPTION

Building Classification: C2(4B) - Concrete Shear Walls w/ Stiff Diaphragms
Occupancy: Habitational
Latitude/Longitude: 37.8050 -122.2670
Region: USA: California
Region Version: 3.10
Evaluation Lifetime (yrs): 30
Uniform Building Code Design Edition: ? (pre-1973)
Year Constructed: 1970
Year Retrofitted:
Building Height (stories): 13
Fundamental Period (s): 0.786000
Area (sf): 130,000
Replacement Cost ($):
Plan Dimensions: 134ft X 127ft
Exterior North-South Walls:
Exterior East-West Walls:
Roof Deck/Framing: Concrete flat slab
Intermediate Floors/Framing: Concrete flat slabs ,beams
Ground Floors:
Columns: Concrete Columns
Foundation: Shallow spread foundations
Basement Levels: Slab on grade on shallow foundations
Parking Structure:

LATERAL FORCE RESISTING SYSTEM

Floors/Roof: Typical floors are constructed of Flat slabs. At the podium level, the slab is supported by concrete beams. There is also PT slab at levels 1, 2, and 33.
Walls/Braces: The lateral system consists of concrete shearwalls.

BUSINESS INTERRUPTION

Max. Loss With No BI:
Min. Loss At Abandonment:
BI Months At Abandonment:
BI Revenue Loss Rate($/Month):

1621 HARRISO PML EVALUATION (TIER 1) - Seismic Risk Analysis

Company Name:	Miyamoto International	**Date:**	June 23, 2019
Building Name:	1621 Harrison	**Job Number:**	MI1917008.00
Street Address:	1621 Harrison St Oakland, CA, United States 94612	**Engineer:**	Jacob Gruber
		PE Number/State:	85179, CA

GEOTECHNICAL DESCRIPTION

Provider:
Date:
UBC Soil Class: D
Liquefaction Resilience: High
Liquefaction Susceptibility: Low
Depth to Water Table (ft): 28
Landslide Susceptibility: Very Low

Topography:
Soil Conditions:

COMMENTS

Comments:

Company Name:	Miyamoto International	**Date:**	June 23, 2019
Building Name:	1621 Harrison	**Job Number:**	MI1917008.00
Street Address:	1621 Harrison St Oakland, CA, United States 94612	**Engineer:**	Jacob Gruber
		PE Number/State:	85179, CA

MODIFIED FEMA-310 WORKSHEET

C2(4B)Concrete Shear Walls w/ Stiff Diaphragms

Category	Range	Typical	Modifier
GENERAL BUILDING FEATURES			
Complete load path	T, F	T	T
No strength irregularity	T, F	F	F
No soft story	T, F	T	F
No geometrical irregularities	T, F	T	F
No mass irregularity	T, F	T	T
No vertical discontinuities	T, F	F	F
Only minor torsion	T, F	T	F
No captive columns	T, F	T	T
Deflection compatibility	T, F	F	F
Interior mezzanines adequately braced	N/A, T, F	T	N/A
LATERAL FORCE RESISTING SYSTEM			
Redundancy	T, F, 0-10	5	T
Shear stress check of shear walls	T, F, 0-25	13	F
Complete frames	T, F, 0-5	2	T
Adequate wall thickness	T, F, 0-5	2	T
No flat slabs	T, F, 0-10	5	T
Reinforcing steel	T, F, 0-5	2	T
Adequate overturning strength	T, F, 0-10	5	2
Adequate confinement reinforcing	T, F, 0-5	5	F
Adequate reinforcing at openings	N/A, T, F, 0-5	2	F
Coupling beams properly reinforced	N/A, T, F, 0-5	5	N/A
CONNECTIONS			
Wall reinforcement doweled into footing	T, F, 0-5	0	T
Lateral load path at pile caps	N/A, T, F, 0-10	0	N/A
FLOOR DIAPHRAGMS			
Reinforcing at re-entrant corner	N/A, T, F, 0-10	0	F
Diaphragm continuity	T, F, 0-10	5	F
Adequate reinforcing at openings	N/A, T, F, 0-5	0	T
Collectors	T, F, 0-5	2	T
Limited diaphragm openings at shear walls	T, F, 0-5	2	T
Adequate diaphragm transfer to shear walls	T, F, 0-10	5	T

Company Name:	Miyamoto International	**Date:**	June 23, 2019
Building Name:	1621 Harrison	**Job Number:**	MI1917008.00
Street Address:	1621 Harrison St Oakland, CA, United States 94612	**Engineer:**	Jacob Gruber
		PE Number/State:	85179, CA

MODIFIED FEMA-310 WORKSHEET

Category	Range	Typical	Modifier
ROOF DIAPHRAGM (ONLY IF 5 STORIES OR LESS)			
Reinforcing at re-entrant corner	N/A, T, F, 0-10	0	N/A
Diaphragm continuity	T, F, 0-10	5	T
Adequate reinforcing at openings	N/A, T, F, 0-5	0	N/A
Collectors	T, F, 0-5	2	T
Limited diaphragm openings at shear walls	T, F, 0-5	2	T
Adequate diaphragm transfer to shear walls	T, F, 0-10	5	T
UNUSUAL CONDITIONS			
Insignificant concrete wall cracks	T, F, 0-5	2	T
Little deterioration of concrete	T, F, 0-5	2	T
Little post-tensioning anchor deterioration	N/A, T, F, 0-5	2	T
Little foundation damage	T, F, 0-5	2	T
Little foundation deterioration	T, F, 0-5	2	T
Adequate overturning resistance	T, F, 0-5	2	T
Ties between foundation elements	N/A, T, F, 0-5	2	T
Lateral force on deep foundations	N/A, T, F, 0-5	2	N/A
Pole buildings	N/A, T, F, 0-5	0	N/A
Insignificant sloping at site	N/A, T, F, 0-5	0	T
SITE DEPENDENT HAZARDS - ACTIVE FAULTS			
Surface fault rupture	N/A, 0-50	0	0
NONSTRUCTURAL EXTERIOR 'WALLS'			
Cladding, glazing, veneer	N/A, T, F, 0-10	5	5
Chimneys	N/A, T, F, 0-5	5	N/A
NONSTRUCTURAL INTERIOR 'WALLS'			
Partitions (HC tile)	N/A, T, F, 0-10	0	N/A
Partitions (pre-cast panels..)	N/A, T, F, 0-10	5	5
EXTERIOR ORNAMENTATION			
Parapets, cornices, and appendages	N/A, T, F, 0-10	0	T
INTERIOR ORNAMENTATION			
Building contents and furnishings	T, F, 0-10	5	T
Ceiling systems	T, F, 0-5	5	T
Light fixtures	T, F, 0-5	5	T

1621 HARRISO PML EVALUATION (TIER 1)

Company Name:	Miyamoto International	**Date:**	June 23, 2019
Building Name:	1621 Harrison	**Job Number:**	MI1917008.00
Street Address:	1621 Harrison St Oakland, CA, United States 94612	**Engineer:**	Jacob Gruber
		PE Number/State:	85179, CA

MODIFIED FEMA-310 WORKSHEET

Category	Range	Typical	Modifier
MECHANICAL AND ELECTRICAL SYSTEMS			
Mechanical and electrical equipment	T, F, 0-10	5	T
Piping and sprinklers	T, F, 0-5	2	T
Ducts	T, F, 0-5	2	T
Elevators	N/A, T, F, 0-5	2	F
HAZARDOUS EXPOSURES - POUNDING			
No adjacent buildings	N/A, T, F, 0-5	0	F
HAZARDOUS EXPOSURES - MATERIALS			
No hazardous materials	N/A, T, F, 0-10	0	T
OCCUPANCY (TYPE: HABITATIONAL)			
Interior Construction	-5-5	0	?
SITE DEPENDENT CHARACTERISTICS			
UBC Soil Class	A - E	D	D
Liquefaction Resilience	Low - High	Low	High
Liquefaction Susceptibility	V. Low-V. High	Moderate	Low
Depth to Water Table (ft)	0-1000+	30	28
Landslide Susceptibility	V. Low-V. High	Very Low	Very Low

1621 HARRISO PML EVALUATION (TIER 1)

Company Name:	Miyamoto International	**Date:**	June 23, 2019
Building Name:	1621 Harrison	**Job Number:**	MI1917008.00
Street Address:	1621 Harrison St Oakland, CA, United States 94612	**Engineer:**	Jacob Gruber
		PE Number/State:	85179, CA

VULNERABILITY SUMMARY

Component Modifier Summary

Base Class 90% Fractile Loss at MMI=IX (% of Value): **47**

Modifiers to Base Class Loss

Item	Group Modifier (% of Loss)	Sigma (% of Loss)
1. Occupancy type:	0	1.7
2. Connections:	0	0.6
3. Walls:		
A. Exterior	0	3.4
B. Interior	0	2.6
4. Diaphragms:		
A. Floor(s)	2	2.5
B. Roof	-5	0.9
5. Ornamentation:		
A. Exterior	0	1.7
B. Interior	-5	1.0
6. Mechanical/electrical systems:	-5	2.6
7. Unusual conditions:	-9	1.6
8. Hazardous exposures:		
A. Tank and overhanging walls	0	1.7
B. Pounding and adjacent buildings	5	1.3
9. Site dependent hazards:		
A. Proximity of active fault	0	12.8
Total	-17	14.5

Modified Base Class 90% Fractile Loss at MMI=IX (% of Value): **39**

Loss vs MMI

MMI	Loss to Facilities (% of Value) 90% Frac. Loss	Mean
V	0	0
VI	3	2
VII	15	10
VIII	27	18
IX	39	25
X	45	29
XI	51	33
XII	57	37

1621 HARRISO PML EVALUATION (TIER 1)

Company Name: Miyamoto International
Building Name: 1621 Harrison
Street Address: 1621 Harrison St
Oakland, CA, United States 94612

Date: June 23, 2019
Job Number: MI1917008.00
Engineer: Jacob Gruber
PE Number/State: 85179, CA

RISK SUMMARY

Expected Loss Table

Probability of Exceedence	MMI	Loss to Facilities (% of Value)			BI (months)
		PL	SUL	SEL	
50.0% in 30 years 43 year return period	VI-VII	5	11	7	N/A
10.0% in 30 years 285 year return period	VIII	17	28	18	N/A
2.0% in 30 years 1485 year return period	IX	27	36	23	N/A
10.0% in 50 years 475 year return period	VIII-IX	20	PML 30	20	N/A
2.0% in 50 years 2475 year return period	IX	31	38	25	N/A

Event and Fault Table

Close and Significant Seismic Sources	Maximum Magnitude	Closest Distance (km)	Max. MMI	Max. SUL *	Max. SEL *	Maximum Business Interuption (months)	Percent Contribution **
California Gridded***	7.0	5.0	VIII-IX	32	21	N/A	3
Hayward-Rodgers Creek;RC+HN	7.2	5.4	VIII	28	18	N/A	5
Hayward-Rodgers Creek	7.3	5.5	VIII	29	19	N/A	8
Hayward-Rodgers Creek;RC+HN+HS	7.3	5.5	VIII	29	19	N/A	4
Hayward-Rodgers Creek;HN	6.6	5.9	VII-VIII	24	15	N/A	16
Hayward-Rodgers Creek;HN+HS	7.0	5.9	VIII	27	17	N/A	20
Hayward-Rodgers Creek;HS	6.8	5.9	VIII	25	16	N/A	21
Extensional Gridded	7.0	13.4	VII-VIII	18	12	N/A	<1
Calaveras;CN	6.9	22.7	VII	13	8	N/A	<1
Calaveras;CN+CC	7.0	22.8	VII	14	9	N/A	<1
Calaveras;CN+CC+CS	7.0	22.8	VII	14	9	N/A	<1
Calaveras	7.0	22.8	VII	14	9	N/A	<1
Mount Diablo Thrust	6.7	23.0	VII	14	9	N/A	<1
N. San Andreas;SAO+SAN+SAP+SAS	8.1	23.7	VII-VIII	23	15	N/A	7
N. San Andreas	8.0	23.7	VII-VIII	23	15	N/A	2
N. San Andreas;SAP+SAS	7.5	23.7	VII-VIII	18	12	N/A	3

* Losses to individual events are from shaking only.
** Percent contributions are for the probabilistic 475 year return period risk.
*** Event causing highest loss (from shaking only)

Average Annual Loss (% of Repl. Cost): 0.367786
Return Period of Major Liquefaction/Landslide: N/A

Business Interruption Average Annual Loss ($): 0

Company Name:	Miyamoto International	**Date:**	June 23, 2019
Building Name:	1621 Harrison	**Job Number:**	MI1917008.00
Street Address:	1621 Harrison St Oakland, CA, United States 94612	**Engineer:**	Jacob Gruber
		PE Number/State:	85179, CA

DISCLAIMERS and OTHER INFORMATION

RESULTS DISCLAIMER

This report, and the analyses, estimates and conclusions are based on scientific data, mathematical and empirical models, and experience of engineers, geologist and geotechnical specialist, using the input specified by the software licensee. Actual losses experienced during any earthquake may differ substantially from these estimates. Neither Risk Engineering, Inc., Degenkolb Engineers, nor any third party supplier of information to this software can be held liable for any inaccuracies in the results obtained by ST-RISK.

SPRINKLER DAMAGE

Substantial building facilities loss has occurred in recent large earthquakes due to fire sprinkler damage. The figures presented herein may not adequately account for these potential losses. If the modifier for sprinklers in the Mechanical and Electrical Systems section of the Modified FEMA-310 Worksheet was 3 or higher, or '?', a more detailed evaluation of potential sprinkler damage should be made and additional loss anticipated.

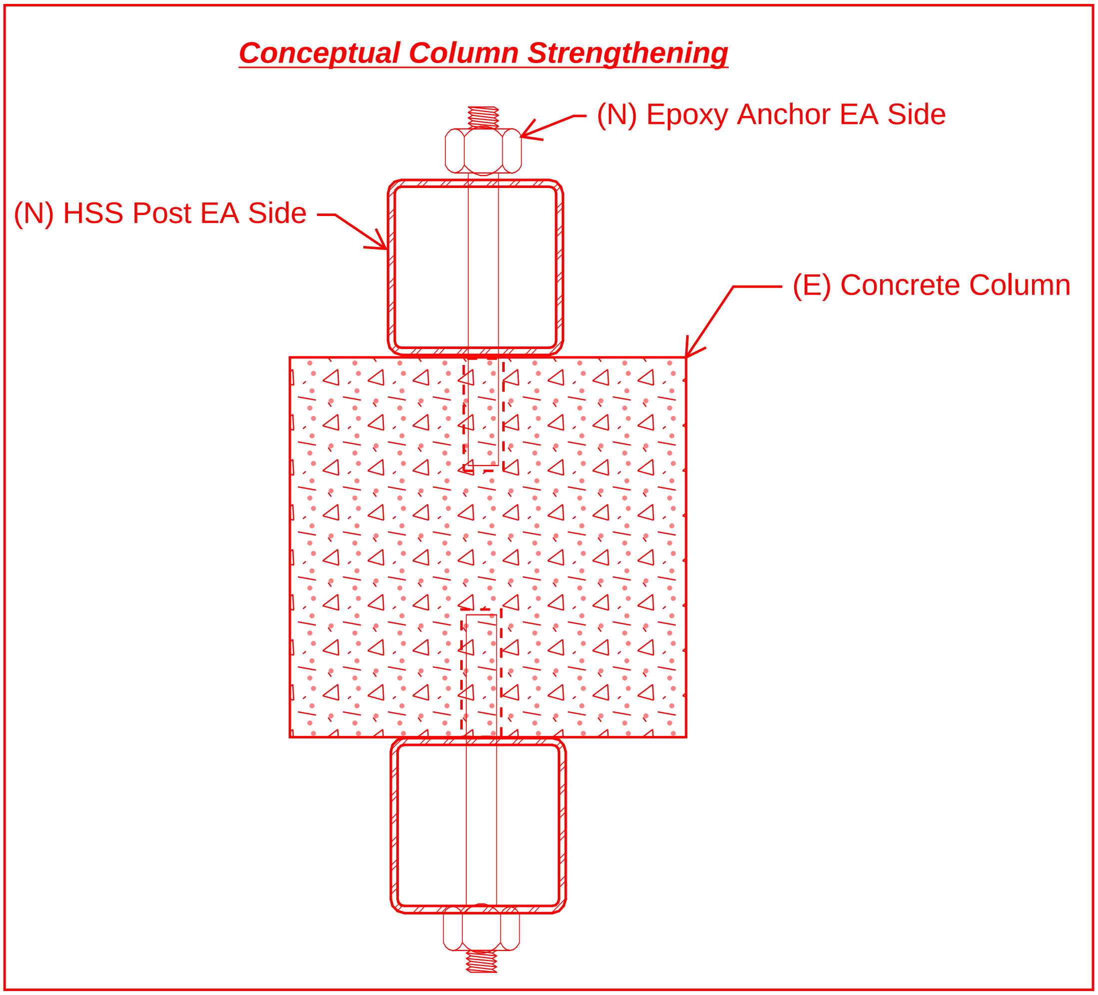
THIRD PARTY DATA

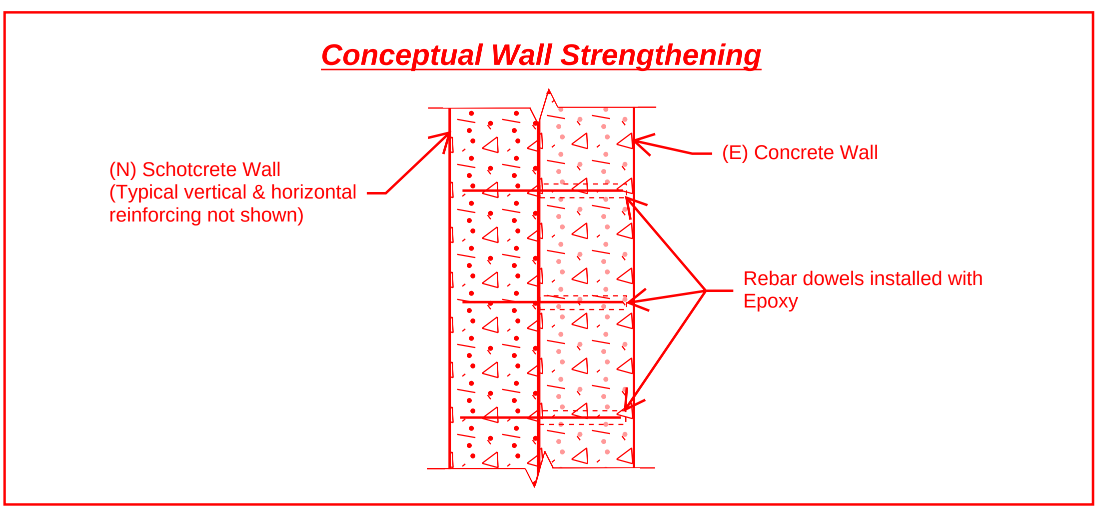
Much of the data in this report is derived from data provided by the California Geological Survey (CGS), the US Geological Survey (USGS), the Geological Survey of Canada (GSC), as well as other parties. Most of the original data received was modified to make compatible with ST-RISK. None of these parties can be held liable for any inaccuracies inherent in the data or inherent in the modifications.

GLOSSARY

MMI	Modified Mercalli Intensity - A measure of ground motion intensity based on human perception of motion and observed structural damage.
PML	Probable Maximum Loss - The percentage monetary loss (damage/replacement cost x 100) that has a 10 percent chance of being exceeded for a 475-year ground motion.
PL	Probable Loss - For a given time interval, or return period, this is the amount of loss that a property is expected to meet or exceed on an average basis. This combines the probability distribution of hazard with the full damage distribution, representing the best overall assessment of risk.
SUL	Scenario Upper Loss - The percentage monetary loss (damage/replacement cost x 100) that has a 10 percent chance of being exceeded given any defined ground shaking intensity. Equal to PML for 475-year ground shaking.
SEL	Scenario Expected Loss - The expected, or mean, percentage monetary loss (damage/replacement cost x 100) that is predicted given any defined ground shaking intensity.
Mean Loss	The expected, or average, percentage monetary loss (damage/replacement cost x 100) that is predicted for a given ground shaking level.
Sigma	The range of building assessment variation covered by one standard deviation. This represents the uncertainty of characterizing the building properly. This does not include uncertainty in the expected ground motion intensities nor range of expected damage. It is implied that the distribution of uncertainty is truncated at 100% and 0% of building value.
BI	Business Interruption / Loss-of-Use - The number of months that the facility is out of operation.
Base Class Loss	The percentage monetary loss for 90% fractile (damage/replacement cost x 100) assigned to a building class that accounts for type of construction and important construction deficiencies.
Modified Base Class Loss	The percentage monetary loss for 90% fractile assigned to a building class that accounts for the Base Class Loss and location and minor construction deficiencies.
Probability of Exceedence	The probability that the ground shaking level or damage level will be exceeded.
Event Causing Highest Loss	The highest level of intensity due only to shaking that is experienced when considering all earthquakes given a median predicted shaking level.
Maximum Considered Earthquake (MCE)	Loss associated with a 2% in 50 year probability of exceedence.
Uniform Building Code (UBC)	Loss associated with a 10% in 50 year probability of exceedence as defined by new building design provisions found in the Uniform Building Code.
% Contribribution	Percent contribution of fault or fault segment to the 475-year return period risk.

A.6 Conceptual Retrofit Plan & Details






Note: Concept is subject to change upon completion of materials testing and coordination with other disciplines. This is not intended to be used for pricing
Concrete wall strengthening
Column strengthening from 3rd floor down to foundation, typ
Additional floor strengthening/reinforcing at levels 2 & 3 to eliminate floor expansion joint
(N) Concrete walls continuous up to the 4th floor and down to foundation
(N) Concrete walls continuous up to the 3rd floor
Line style indicates locations of beam strengthening at the 4th floor. Beam strengthening is intended to reinforce beams which support discontinuous vertical walls
NOTE: FOR POST-TENSIONED BEAM ELEV. SEE SHT. S-18
7" SLAB LT. WT. CONC.
TEMP. REINF. #4@14" TYP.
LEE STUART DARROW AIA
JIM H. ISHIMARU
ARCHITECTS AND PLANNERS
3798 GRAND AVENUE
OAKLAND, CALIF. 94610 PHONE 444-4008
T. Y. LIN, KULKA, YANG & ASSOCIATE
STRUCTURAL ENGINEERING
15 VANDEWATER STREET SAN FRANCISCO, CALIFORNIA
2ND. FLOOR PLAN
SCALE: 1/8" = 1'-0"
DEVELOPER
KORB DEVELOPMENT CO. INCORPORATED
80 GRAND AVENUE SUITE 400
OAKLAND, CALIF. 94612 PHONE (415) 465-5282
ADMINISTRATION BUILDING AND 101 UNITS (ELDERLY)
HOUSING AUTHORITY OF THE CITY OF OAKLAND
1621 HARRISON STREET
OAKLAND, CALIFORNIA
5-4-70
S4

A.7 ST-RISK RESULTS BASED ON CONCEPTUAL RETROFIT

1621 HARRISO PML EVALUATION (TIER 2) - Seismic Risk Analysis

Company Name:	Miyamoto International	**Date:**	September 23, 2019
Building Name:	1621 Harrison	**Job Number:**	MI1917008.00
Street Address:	1621 Harrison St Oakland, CA, United States 94612	**Engineer:**	Jacob Gruber
		PE Number/State:	85179, CA

INFORMATION SOURCES

SiteVisit: Sean Fraser
Interviewed:

Date: May 20, 2019
Docs Reviewed: ASCE 41 checklist and documents reviewed by JG

BUILDING DESCRIPTION

Building Classification: C2(4B) - Concrete Shear Walls w/ Stiff Diaphragms
Occupancy: Habitational
Latitude/Longitude: 37.8050 -122.2670
Region: USA: California
Region Version: 3.10
Evaluation Lifetime (yrs): 30
Uniform Building Code Design Edition: ? (pre-1973)
Year Constructed: 1970
Year Retrofitted:
Building Height (stories): 13
Fundamental Period (s): 0.786000
Area (sf): 130,000
Replacement Cost ($):
Plan Dimensions: 134ft X 127ft
Exterior North-South Walls:
Exterior East-West Walls:
Roof Deck/Framing: Concrete flat slab
Intermediate Floors/Framing: Concrete flat slabs _beams
Ground Floors:
Columns: Concrete Columns
Foundation: Shallow spread foundations
Basement Levels: Slab on grade on shallow foundations
Parking Structure:

LATERAL FORCE RESISTING SYSTEM

Floors/Roof: Typical floors are constructed of Flat slabs. At the podium level, the slab is supported by concrete beams. There is also PT slab at levels 1, 2, and 33.
Walls/Braces: The lateral system consists of concrete shearwalls.

BUSINESS INTERRUPTION

Max. Loss With No BI:
Min. Loss At Abandonment:
BI Months At Abandonment:
BI Revenue Loss Rate($/Month):

Company Name:	Miyamoto International	**Date:**	September 23, 2019
Building Name:	1621 Harrison	**Job Number:**	MI1917008.00
Street Address:	1621 Harrison St Oakland, CA, United States 94612	**Engineer:**	Jacob Gruber
		PE Number/State:	85179, CA

GEOTECHNICAL DESCRIPTION

Provider:
Date:
UBC Soil Class: D
Liquefaction Resilience: High
Liquefaction Susceptibility: Low
Depth to Water Table (ft): 28
Landslide Susceptibility: Very Low

Topography:
Soil Conditions:

COMMENTS

Comments:

Company Name:	Miyamoto International	**Date:**	September 23, 2019
Building Name:	1621 Harrison	**Job Number:**	MI1917008.00
Street Address:	1621 Harrison St Oakland, CA, United States 94612	**Engineer:**	Jacob Gruber
		PE Number/State:	85179, CA

MODIFIED FEMA-310 WORKSHEET

C2(4B)Concrete Shear Walls w/ Stiff Diaphragms

Category	Range	Typical	Modifier
GENERAL BUILDING FEATURES			
Complete load path	T, F	T	T
No strength irregularity	T, F	F	T
No soft story	T, F	T	T
No geometrical irregularities	T, F	T	F
No mass irregularity	T, F	T	T
No vertical discontinuities	T, F	F	T
Only minor torsion	T, F	T	T
No captive columns	T, F	T	T
Deflection compatibility	T, F	F	T
Interior mezzanines adequately braced	N/A, T, F	T	N/A
LATERAL FORCE RESISTING SYSTEM			
Redundancy	T, F, 0-10	5	T
Shear stress check of shear walls	T, F, 0-25	13	T
Complete frames	T, F, 0-5	2	T
Adequate wall thickness	T, F, 0-5	2	T
No flat slabs	T, F, 0-10	5	T
Reinforcing steel	T, F, 0-5	2	T
Adequate overturning strength	T, F, 0-10	5	2
Adequate confinement reinforcing	T, F, 0-5	5	F
Adequate reinforcing at openings	N/A, T, F, 0-5	2	F
Coupling beams properly reinforced	N/A, T, F, 0-5	5	N/A
CONNECTIONS			
Wall reinforcement doweled into footing	T, F, 0-5	0	T
Lateral load path at pile caps	N/A, T, F, 0-10	0	N/A
FLOOR DIAPHRAGMS			
Reinforcing at re-entrant corner	N/A, T, F, 0-10	0	F
Diaphragm continuity	T, F, 0-10	5	F
Adequate reinforcing at openings	N/A, T, F, 0-5	0	T
Collectors	T, F, 0-5	2	T
Limited diaphragm openings at shear walls	T, F, 0-5	2	T
Adequate diaphragm transfer to shear walls	T, F, 0-10	5	T

Critical items to address in retrofit

Company Name:	Miyamoto International	**Date:**	September 23, 2019
Building Name:	1621 Harrison	**Job Number:**	MI1917008.00
Street Address:	1621 Harrison St Oakland, CA, United States 94612	**Engineer:**	Jacob Gruber
		PE Number/State:	85179, CA

MODIFIED FEMA-310 WORKSHEET

Category	Range	Typical	Modifier
ROOF DIAPHRAGM (ONLY IF 5 STORIES OR LESS)			
Reinforcing at re-entrant corner	N/A, T, F, 0-10	0	N/A
Diaphragm continuity	T, F, 0-10	5	T
Adequate reinforcing at openings	N/A, T, F, 0-5	0	N/A
Collectors	T, F, 0-5	2	T
Limited diaphragm openings at shear walls	T, F, 0-5	2	T
Adequate diaphragm transfer to shear walls	T, F, 0-10	5	T
UNUSUAL CONDITIONS			
Insignificant concrete wall cracks	T, F, 0-5	2	T
Little deterioration of concrete	T, F, 0-5	2	T
Little post-tensioning anchor deterioration	N/A, T, F, 0-5	2	T
Little foundation damage	T, F, 0-5	2	T
Little foundation deterioration	T, F, 0-5	2	T
Adequate overturning resistance	T, F, 0-5	2	T
Ties between foundation elements	N/A, T, F, 0-5	2	T
Lateral force on deep foundations	N/A, T, F, 0-5	2	N/A
Pole buildings	N/A, T, F, 0-5	0	N/A
Insignificant sloping at site	N/A, T, F, 0-5	0	T
SITE DEPENDENT HAZARDS - ACTIVE FAULTS			
Surface fault rupture	N/A, 0-50	0	0
NONSTRUCTURAL EXTERIOR 'WALLS'			
Cladding, glazing, veneer	N/A, T, F, 0-10	5	5
Chimneys	N/A, T, F, 0-5	5	N/A
NONSTRUCTURAL INTERIOR 'WALLS'			
Partitions (HC tile)	N/A, T, F, 0-10	0	N/A
Partitions (pre-cast panels..)	N/A, T, F, 0-10	5	5
EXTERIOR ORNAMENTATION			
Parapets, cornices, and appendages	N/A, T, F, 0-10	0	T
INTERIOR ORNAMENTATION			
Building contents and furnishings	T, F, 0-10	5	T
Ceiling systems	T, F, 0-5	5	T
Light fixtures	T, F, 0-5	5	T

Company Name:	Miyamoto International	**Date:**	September 23, 2019
Building Name:	1621 Harrison	**Job Number:**	MI1917008.00
Street Address:	1621 Harrison St Oakland, CA, United States 94612	**Engineer:**	Jacob Gruber
		PE Number/State:	85179, CA

MODIFIED FEMA-310 WORKSHEET

Category	Range	Typical	Modifier
MECHANICAL AND ELECTRICAL SYSTEMS			
Mechanical and electrical equipment	T, F, 0-10	5	T
Piping and sprinklers	T, F, 0-5	2	T
Ducts	T, F, 0-5	2	T
Elevators	N/A, T, F, 0-5	2	F
HAZARDOUS EXPOSURES - POUNDING			
No adjacent buildings	N/A, T, F, 0-5	0	F
HAZARDOUS EXPOSURES - MATERIALS			
No hazardous materials	N/A, T, F, 0-10	0	T
OCCUPANCY (TYPE: HABITATIONAL)			
Interior Construction	-5-5	0	?
SITE DEPENDENT CHARACTERISTICS			
UBC Soil Class	A - E	D	D
Liquefaction Resilience	Low - High	Low	High
Liquefaction Susceptibility	V. Low-V. High	Moderate	Low
Depth to Water Table (ft)	0-1000+	30	28
Landslide Susceptibility	V. Low-V. High	Very Low	Very Low

Company Name:	Miyamoto International	**Date:**	September 23, 2019
Building Name:	1621 Harrison	**Job Number:**	MI1917008.00
Street Address:	1621 Harrison St Oakland, CA, United States 94612	**Engineer:**	Jacob Gruber
		PE Number/State:	85179, CA

VULNERABILITY SUMMARY

Component Modifier Summary

Base Class 90% Fractile Loss at MMI=IX (% of Value): **26**

Modifiers to Base Class Loss

Item	Group Modifier (% of Loss)	Sigma (% of Loss)
1. Occupancy type:	0	1.7
2. Connections:	0	0.6
3. Walls:		
A. Exterior	0	3.4
B. Interior	0	2.6
4. Diaphragms:		
A. Floor(s)	2	2.5
B. Roof	-5	0.9
5. Ornamentation:		
A. Exterior	0	1.7
B. Interior	-5	1.0
6. Mechanical/electrical systems:	-5	2.6
7. Unusual conditions:	-9	1.6
8. Hazardous exposures:		
A. Tank and overhanging walls	0	1.7
B. Pounding and adjacent buildings	5	1.3
9. Site dependent hazards:		
A. Proximity of active fault	0	12.8
Total	-17	14.5

Modified Base Class 90% Fractile Loss at MMI=IX (% of Value): **22**

Loss vs MMI

MMI	Loss to Facilities (% of Value) 90% Frac. Loss	Mean
V	0	0
VI	3	2
VII	9	6
VIII	16	10
IX	22	14
X	25	16
XI	28	18
XII	32	20

1621 HARRISO PML EVALUATION (TIER 2)

Company Name: Miyamoto International
Building Name: 1621 Harrison
Street Address: 1621 Harrison St
Oakland, CA, United States 94612

Date: September 23, 2019
Job Number: MI1917008.00
Engineer: Jacob Gruber
PE Number/State: 85179, CA

RISK SUMMARY

Expected Loss Table

Probability of Exceedence	MMI	Loss to Facilities (% of Value)			BI (months)
		PL	SUL	SEL	
50.0% in 30 years 43 year return period	VI-VII	4	7	5	N/A
10.0% in 30 years 285 year return period	VIII	10	16	10	N/A
2.0% in 30 years 1485 year return period	IX	16	20	13	N/A
10.0% in 50 years 475 year return period	VIII-IX	12	PML 17	11	N/A
2.0% in 50 years 2475 year return period	IX	17	21	14	N/A

PML with critical items addressed

Event and Fault Table

Close and Significant Seismic Sources	Maximum Magnitude	Closest Distance (km)	Max. MMI	Max. SUL *	Max. SEL *	Maximum Business Interuption (months)	Percent Contribution **
California Gridded***	7.0	5.0	VIII-IX	18	12	N/A	3
Hayward-Rodgers Creek;RC+HN	7.2	5.4	VIII	16	11	N/A	5
Hayward-Rodgers Creek	7.3	5.5	VIII	17	11	N/A	8
Hayward-Rodgers Creek;RC+HN+HS	7.3	5.5	VIII	17	11	N/A	4
Hayward-Rodgers Creek;HN	6.6	5.9	VII-VIII	14	9	N/A	16
Hayward-Rodgers Creek;HN+HS	7.0	5.9	VIII	15	10	N/A	20
Hayward-Rodgers Creek;HS	6.8	5.9	VIII	15	9	N/A	21
Extensional Gridded	7.0	13.4	VII-VIII	11	7	N/A	<1
Calaveras;CN	6.9	22.7	VII	8	5	N/A	<1
Calaveras;CN+CC	7.0	22.8	VII	9	6	N/A	<1
Calaveras;CN+CC+CS	7.0	22.8	VII	9	6	N/A	<1
Calaveras	7.0	22.8	VII	9	6	N/A	<1
Mount Diablo Thrust	6.7	23.0	VII	9	6	N/A	<1
N. San Andreas;SAO+SAN+SAP+SAS	8.1	23.7	VII-VIII	14	9	N/A	7
N. San Andreas	8.0	23.7	VII-VIII	13	9	N/A	2
N. San Andreas;SAP+SAS	7.5	23.7	VII-VIII	11	7	N/A	3

* Losses to individual events are from shaking only.
** Percent contributions are for the probabilistic 475 year return period risk.
*** Event causing highest loss (from shaking only)

Average Annual Loss (% of Repl. Cost): 0.256421
Business Interruption Average Annual Loss ($): 0
Return Period of Major Liquefaction/Landslide: N/A

DISCLAIMERS and OTHER INFORMATION

RESULTS DISCLAIMER
This report, and the analyses, estimates and conclusions are based on scientific data, mathematical and empirical models, and experience of engineers, geologist and geotechnical specialist, using the input specified by the software licensee. Actual losses experienced during any earthquake may differ substantially from these estimates. Neither Risk Engineering, Inc., Degenkolb Engineers, nor any third party supplier of information to this software can be held liable for any inaccuracies in the results obtained by ST-RISK.

SPRINKLER DAMAGE
Substantial building facilities loss has occurred in recent large earthquakes due to fire sprinkler damage. The figures presented herein may not adequately account for these potential losses. If the modifier for sprinklers in the Mechanical and Electrical Systems section of the Modified FEMA-310 Worksheet was 3 or higher, or '?', a more detailed evaluation of potential sprinkler damage should be made and additional loss anticipated.

THIRD PARTY DATA
Much of the data in this report is derived from data provided by the California Geological Survey (CGS), the US Geological Survey (USGS), the Geological Survey of Canada (GSC), as well as other parties. Most of the original data received was modified to make compatible with ST-RISK. None of these parties can be held liable for any inaccuracies inherent in the data or inherent in the modifications.

GLOSSARY

MMI	Modified Mercalli Intensity - A measure of ground motion intensity based on human perception of motion and observed structural damage.
PML	Probable Maximum Loss - The percentage monetary loss (damage/replacement cost x 100) that has a 10 percent chance of being exceeded for a 475-year ground motion.
PL	Probable Loss - For a given time interval, or return period, this is the amount of loss that a property is expected to meet or exceed on an average basis. This combines the probability distribution of hazard with the full damage distribution, representing the best overall assessment of risk.
SUL	Scenario Upper Loss - The percentage monetary loss (damage/replacement cost x 100) that has a 10 percent chance of being exceeded given any defined ground shaking intensity. Equal to PML for 475-year ground shaking.
SEL	Scenario Expected Loss - The expected, or mean, percentage monetary loss (damage/replacement cost x 100) that is predicted given any defined ground shaking intensity.
Mean Loss	The expected, or average, percentage monetary loss (damage/replacement cost x 100) that is predicted for a given ground shaking level.
Sigma	The range of building assessment variation covered by one standard deviation. This represents the uncertainty of characterizing the building properly. This does not include uncertainty in the expected ground motion intensities nor range of expected damage. It is implied that the distribution of uncertainty is truncated at 100% and 0% of building value.
BI	Business Interruption / Loss-of-Use - The number of months that the facility is out of operation.
Base Class Loss	The percentage monetary loss for 90% fractile (damage/replacement cost x 100) assigned to a building class that accounts for type of construction and important construction deficiencies.
Modified Base Class Loss	The percentage monetary loss for 90% fractile assigned to a building class that accounts for the Base Class Loss and location and minor construction deficiencies.
Probability of Exceedence	The probability that the ground shaking level or damage level will be exceeded.
Event Causing Highest Loss	The highest level of intensity due only to shaking that is experienced when considering all earthquakes given a median predicted shaking level.
Maximum Considered Earthquake (MCE)	Loss associated with a 2% in 50 year probability of exceedence.
Uniform Building Code (UBC)	Loss associated with a 10% in 50 year probability of exceedence as defined by new building design provisions found in the Uniform Building Code.
% Contribribution	Percent contribution of fault or fault segment to the 475-year return period risk.