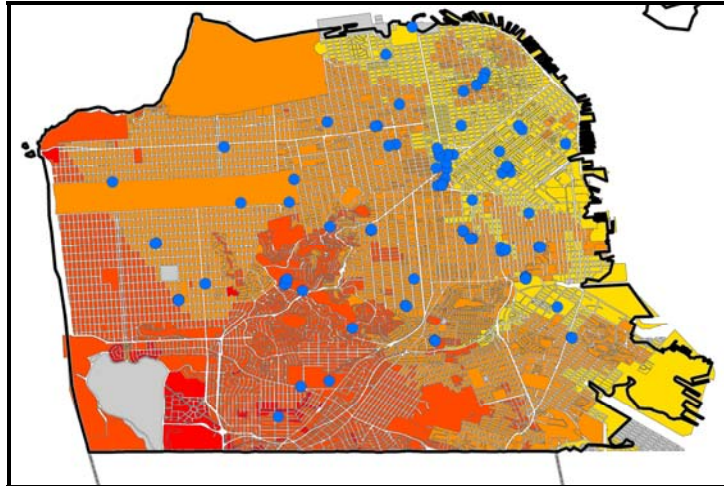


Hazus (HAZards United States) Analysis for the City and County of San Francisco's High Priority City-Owned Buildings

Prepared for the City and County of San Francisco's Capital Planning Program



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EXECUTIVE SUMMARY

The City of San Francisco directs considerable attention to reducing their seismic risks. Since the 1989 Loma Prieta earthquake, the City has completed more than 190 seismic retrofit projects (including City Hall, the Main Library, the Ferry Building, library and park facilities, various critical facilities, such as police and fire stations, and infrastructure systems including critical pump stations and transmission pipelines), with 34 additional projects currently underway. In addition, the City has a number of active earthquake planning programs and activities, including the Building Occupancy Resumption Program (BORP), the Community Action Plan for Seismic Safety (CAPSS) Project, the Infrastructure Branch Working Group, and the Lifelines Council. The City and County of San Francisco's Capital Planning Program (CPP) is currently leading an interdepartmental effort to strengthen the City's mitigation, emergency response and recovery efforts by developing estimates of physical damage and economic loss to City-owned facilities as a result of a severe earthquake. Damage and loss estimates of interest include building damage, operational losses resulting from damage, potential injuries and deaths, and predicted occupancy tagging. These types of pre-disaster loss estimates are critical for hazard mitigation planning, submitting financial assistance requests to the federal government, and prioritizing capital improvements of critical facilities.

This report summarizes the results of a risk assessment for 82 high-priority city-owned buildings conducted by MMI Engineering (MMI) using the Federal Emergency Management Agency's (FEMA's) Hazus (HAZards U.S.) natural hazard loss estimation methodology and software. In designing the study, it was anticipated that the results would be used for a relative risk review, to help identify those buildings expected to perform "better" or "worse" than average, and further prioritize these buildings for mitigation action.

For the City of San Francisco, the implementation of the current HAZUS risk assessment provides significant benefits. The current study provides comprehensive, quantitative risk estimates to support on-going seismic mitigation prioritization efforts. HAZUS allows determination of both structural and non-structural damage, as well as damage to building contents. In addition, operational losses have been included in the current assessment. HAZUS provides a consistent risk assessment platform to determine the City's various risks; HAZUS was previously used to estimate earthquake impacts to privately-owned buildings in the CAPSS Project. HAZUS provides a cost-effective solution for determining relative earthquake risk within the City's portfolio, to prioritize buildings for more detailed engineering evaluations. The database constructed for the current assessment can easily be augmented and modified to reflect changes in the City's portfolio over time.

The high-priority buildings, listed in Table E-1, were selected by the Capital Planning Committee based on an internal prioritization scheme developed to identify buildings for potential inclusion in the City's Building Occupancy Resumption Program (BORP). Four earthquake scenarios previously studied by the City's CAPSS Project have been analyzed; M7.9, M7.2 and M6.5 earthquakes on the San Andreas Fault, and a M6.9 event on the Hayward Fault.

To facilitate analysis of the city-owned buildings within Hazus, various data for each building were required, including location, structural system, seismic design level or code basis, building usage, building and content replacement value, and peak occupancy. These data were determined by a collaborative team, including CPP personnel, structural engineers from the DPW Infrastructure Division, and the MMI Project Team, through review of available building studies and/or drawings, supplemented by discussions with City engineers, architects and others familiar with the facilities. In addition to physical building data, some economic data were also required, including costs for relocation and rental of alternate space, and potential income generated by a small number of the studied facilities.

Hazus, originally developed for FEMA by the National Institute of Building Sciences (NIBS), is geographic information system (GIS) based, standardized, nationally applicable multi-hazard loss estimation methodology and software. Local, state and federal government officials use Hazus for preparedness, emergency response, and mitigation planning. Initially released in 1997 as an earthquake loss estimation tool, Hazus also includes flood and hurricane wind modeling capabilities. Hazus' main analysis modules allow for regional or community-wide loss assessment using default building inventory databases provided with the software, or with user-generated custom inventory databases, as was done for the City's CAPSS Project. This study makes use of the Hazus Advanced

Engineering Building Module (AEBM), which allows users with site-specific data to take advantage of the Hazus loss and damage methodologies at a building-specific level.

City-owned buildings have been categorized according to Hazus' standard "Model Building types" and "Design Levels". Structures have been assumed to be similar to typical buildings, whose performance is adequately represented with Hazus' standard building models. Detailed modeling of specific building vulnerabilities and customization of the Hazus vulnerability functions (e.g., adjusting Hazus' model parameters to reflect a building with a soft first story) would require an engineering evaluation of each building and is beyond the scope of the current study. **Accordingly, it is recommended that the reader focus on the order of magnitude of the projected losses and the relative risk relationships, rather than the specific loss values.**

**Table E-1: 82 Buildings Included in the Hazus Scenario Analyses
(in CPC-Identified Priority Order, from Top Left to Bottom Right)**

1 South Van Ness	Hamilton Rec Center (Pool Building)
County Fair Building	Animal Care and Control Facility
1650 Mission	30 Van Ness
Hall of Justice	Laguna Honda Main Hospital (A and B Wings)
DPH Central Office (101 Grove)	Laguna Honda Main Hospital (H Wing)
Pump Station #1 (SFFD HQ)	SFGH - Building 80
DPW Yard - Building A	SFGH - Building 5 (Main Hospital)
DPW Yard - Building B	Ashbury Street Tank & Tank House
DPW Yard - Building C	Fire Station #31
McLaren Lodge Annex	Fire Station #40
YGC Admin & Courts Building	Ingleside Police Station
1660 Mission	Laguna Honda Main Hospital (C Wing)
Bill Graham Civic Auditorium	Taraval Police Station - Original Wing
South of Market/Gene Friend Rec Center	Taraval Police Station - Addition #1
Minnie & Lovie Ward Rec Center	Taraval Police Station - Addition #2
Moscone Center (South)	Tom Waddell Clinic
1680 Mission	Eureka Valley Rec Center (Gym)
Glen Park Rec Center	Eureka Valley Rec Center (Auditorium & Locker Room)
Jackson Playground and Clubhouse	Fire Station #11
Kezar Pavilion	Fire Station #15
Moscone Rec Center	Fire Station #36
Moscone North	Fire Station #38
Park Senior Center	Fire Station #7
Potrero Hill Rec Center (Gym)	Hall of Justice Gas Station
Potrero Hill Rec Center (Field House)	SFGH - Building 2 (Service Building)
170 Otis	Sheriffs Facility (Admin Building)
Chinese Rec Center (New)	Sheriffs Facility (Inmate Housing)
Joseph Lee Rec Center (Gym)	YGC Service Building (Building #2)
Joseph Lee Rec Center (Field House)	Public Defender's Office
Central Shops	Northern Police Station
St. Mary's Rec Center (Gym)	War Memorial Opera House
St. Mary's Rec Center (Field House)	Fire Station #2
Sunset Rec Center (Gym)	SFGH - Mental Health Building
Sunset Rec Center (Field House)	SFGH - Mental Health Support Building
Upper Noe Rec Center (Auditorium & Lobby)	War Memorial Veterans Building
Upper Noe Rec Center (Gym)	Jones St Tank & Tank House
Mission Rec Center (Main)	Pump Station #2 (Fort Mason)
Mission Rec Center (Clubhouse)	Fire Division of Training
Tenderloin Rec Center	Fire Station #10
Woh Hei Yuen Rec Center	Fire Station #5
Hamilton Rec Center (Gym)	Davies Symphony Hall

Results

An overview of economic losses incurred by the 82 buildings in the four CAPSS earthquake scenarios is provided in Table E-2. For each event, the table reports the total expected structural and non-structural damage, which together represent total building damage. Also tabulated are expected content damage and operational losses, which include lost revenue, costs to relocate operations, and costs for rental of alternate facilities. As shown, the M7.9 San Andreas event could produce economic losses close to \$1.3 billion for these 82 buildings alone. This number would increase if the entire City portfolio of 500 to 600 properties were included. Smaller events may still cause appreciable damage; the M6.9 Hayward event, which causes lower ground motions within San Francisco due to the greater distance from the earthquake fault rupture, still generates losses exceeding \$0.3 billion.

Table E-2: Summary of Estimated Economic Impact for 82 High-Priority City-Owned Buildings in the Four CAPSS Scenario Earthquakes

	San Andreas M7.9	San Andreas M7.2	San Andreas M6.5	Hayward M6.9
Structural Damage (\$M)	190.3	108.6	66.1	55.2
Non-Structural Damage (\$M)	791.2	429.7	256.8	209.8
<i>Total Building Damage (\$M)</i>	<i>981.5</i>	<i>538.3</i>	<i>322.9</i>	<i>264.9</i>
Content Damage (\$M)	146.2	74.8	41.1	32.7
Operational Losses; Rent, Relocation & Lost Income (\$M)	151.1	92.6	71.0	63.4
Total Economic Impact (\$M)	1,278.9	705.8	435.0	361.1

Note: 30-Year earthquake probabilities¹ are available for three of the CAPSS scenario events, as follows:

- M7.9 San Andreas – 3.8% probability of occurrence in the next 30 years
- M7.2 San Andreas – 0.6% probability of occurrence in the next 30 years
- M6.9 Hayward – 9.9% probability of occurrence in the next 30 years

While these specific event probabilities may appear small, it should be noted that there is a 63% probability of an earthquake of M6.7 or larger striking the Bay Area in the next 30 years.

Building damage impacts are summarized in Table E-3. For each scenario, total building damage (the sum of structural and non-structural damage for all buildings) is expressed as a percent of total building value². The M7.9 CAPSS San Andreas event causes damage equivalent to 31% of total building value for the 82 studied buildings.

For this study, occupancy tagging has been derived from expected building damage; damage of 50% or more is assumed to result in “red-tagging”, with the facility generally expected to be non-repairable. Damage between 25 and 50% is assumed to be “yellow-tagged”; the facility is assumed to be repairable, but not available for immediate occupancy. Finally, damage less than 25% is assumed to result in a “green-tag”, with the facility considered usable following the earthquake, and while any necessary repairs are being made. In the M7.9 San Andreas scenario, as many as 20 buildings are expected to be red-tagged, with an additional 34 yellow-tagged. These numbers decrease significantly in the smaller earthquake scenarios, with just one or two red-tagged and eight to 26 yellow-tagged in the remaining CAPSS scenario events.

¹ 30 year earthquake probabilities from: 2007 Working Group on California Earthquake Probabilities, 2008.

² current replacement value (CRV) as tabulated by the City

Table E-3 also provides the distribution of buildings within three categories of collapse potential, defined by ranges of collapse probability (0 – 5%, 5 – 10% and 10 – 15%). Very few buildings – just three – have collapse probabilities exceeding 10% in the M7.9 San Andreas scenario, and none of the buildings are expected to reach this threshold in the smaller events.

Table E-3: Summary of Building Damage Impacts for 82 High-Priority City-Owned Buildings in the Four CAPSS Scenario Earthquakes

	San Andreas M7.9	San Andreas M7.2	San Andreas M6.5	Hayward M6.9
Total building damage (% of building value)	31%	17%	10%	8%
<i>Occupancy Tagging (Number of Buildings in Each Category):</i>				
# Green Tagged (Usable, Light or Moderate Damage)	28	54	69	73
# Yellow Tagged (Repairable, Cannot be Occupied)	34	26	12	8
# Red Tagged (Not Repairable)	20	2	1	1
Total # Buildings	82	82	82	82
<i>Collapse Probabilities (Number of Buildings in Each Category):</i>				
<5%	68	81	81	81
5 – 10%	11	1	1	1
10 – 15%	3	0	0	0
Total # Buildings	82	82	82	82

The total number of expected casualties in each event (including both non-fatal and fatal injuries), as well as overall casualty rates, are summarized in Table E-4. Casualties have been estimated assuming peak facility occupancy; occupants include City employees, visitors, and members of the public, depending on facility usage. Total casualties occurring in the 82 buildings at peak building occupancy range from 310 to 1,700 for the four CAPSS scenarios.

High occupancy facilities, even when moderately damaged, may generate more casualties than buildings with lower occupancy levels. To better understand the range of vulnerability to casualties, buildings have been categorized by both the number of expected casualties, and by their expected casualty rates. As shown in the table, nine buildings each result in more than 50 casualties in the M7.9 CAPSS San Andreas scenario. All of these facilities have large peak occupancies, ranging from 1,600 to as many as 13,000 people. In addition, six buildings have casualty rates greater than 10% in the same event.

There are various factors behind whether a particular building suffers significant impacts, as represented by the categories of damage appearing in the previous tables. Table E-5 summarizes the more significant driving factors contributing to each category of loss in the current study.

Table E-4: Summary of Estimated Casualties in 82 High-Priority City-Owned Buildings in the Four CAPSS Scenario Earthquakes

	San Andreas M7.9	San Andreas M7.2	San Andreas M6.5	Hayward M6.9
<i>Total Casualties at Peak Occupancy (Fatal and Non-Fatal Injuries):</i>				
Total # Casualties	1,700	900	470	310
<i>Total Casualties at Peak Occupancy (Number of Buildings in Each Category):</i>				
None Expected	5	25	33	49
10 or Less	56	43	40	25
11 to 25	8	5	6	6
26 to 50	4	4	1	1
51 to 100	4	3	0	0
101 or More	5	2	2	1
<i>Total # Buildings</i>	<i>82</i>	<i>82</i>	<i>82</i>	<i>82</i>
<i>Total Casualty Rates at Peak Occupancy (Number of Buildings in Each Category):</i>				
None Expected	5	25	33	49
< 5%	50	51	48	32
5 to 10%	21	6	1	1
>10%	6	0	0	0
<i>Total # Buildings</i>	<i>82</i>	<i>82</i>	<i>82</i>	<i>82</i>

Table E-5: Driving Factors Behind Various Impact Categories

Impact Category	Potential Loss Drivers
High Mean Damage Estimates (%)/ High Relative Probability of Collapse/ High Casualty Rates	<ul style="list-style-type: none"> • Pre-Code or Low-Code building design levels • Significant liquefaction susceptibility (e.g., the Animal Care and Control Facility is located in an area of Very High liquefaction susceptibility)
Large Magnitude Total Economic Impact (\$)	<ul style="list-style-type: none"> • Very large building exposure values (e.g., SFGH – Building 5/Main Hospital is valued at more than \$600 million) • Pre-Code or Low-Code building design levels • Significant Liquefaction Susceptibility • Large Operational Losses (e.g., the Hall of Justice is estimate to incur more than \$69 million in operational losses in the M7.9 San Andreas scenario)
High Casualty Estimates	<ul style="list-style-type: none"> • Large peak building occupancies (e.g., peak occupancy of Moscone Center South has been estimated to be 13,000 people) • Significant Liquefaction Susceptibility

For the purposes of this study, a variety of “High-Impact” criteria have been established, including:

- Total economic impact exceeding \$50M
- Operational losses exceeding \$5M
- Red-Tagged, with mean damage exceeding 70% (Note that red-tagged buildings have been defined as those with mean damage exceeding 50%; this is a subset of the more heavily damaged red-tagged buildings)
- Probability of collapse greater than 10%
- More than 50 non-fatal injuries, and/or more than 10 fatalities
- Injury rates exceeding 10% and/or fatality rates exceeding 1%.

Table E-6 provides a list of specific buildings which meet these “High-Impact” criteria for the CAPSS San Andreas M7.9 scenario event, while Table E-7 provides a similar table for the M6.9 Hayward scenario. Within these tables, buildings appearing in multiple categories have been highlighted in color; buildings with no shading appear in just one category. Each column is presented in descending value order; buildings at the top of the list incur larger impacts than those at the bottom. Similar tables have been developed for the other scenario earthquakes, and are presented in Tables 4-11 and 4-12 of this report. Additional detail on the performance of each of the 82 high-priority buildings in each scenario event is provided in **Appendix C**. While the number of buildings meeting the various “High-Impact” criteria decreases in the smaller events, just one building - the Hall of Justice - meets the economic loss and high casualty criteria in all events modeled.

Table E-6: Buildings Meeting Selected “High Impact” Criteria in the CAPSS San Andreas M7.9 Scenario Earthquake

	Buildings with total economic impact > \$50M	Buildings with operational losses >\$5M	Red-Tagged Buildings w/ >70% Mean Building Damage	Buildings with Probability of Collapse >10%	Buildings with more than 50 Non-Fatal Injuries (& More Than 10 Fatalities, in italics)	Buildings with Injury Rates >10% and/or Fatality Rates >1%
 	Hall of Justice	Hall of Justice	Kezar Pavilion	Animal Care and Control Facility	<i>Kezar Pavilion</i>	Ingleside Police Station
	SFGH – Building 5 (Main Hospital)	SFGH – Building 5 (Main Hospital)	Animal Care and Control Facility	Tom Waddell Clinic	<i>Hall of Justice</i>	Tom Waddell Clinic
	1 South Van Ness	1 South Van Ness	Tom Waddell Clinic	Ingleside Police Station	<i>Moscone Center (South)</i>	Animal Care & Control Facility
	War Memorial Veterans Building	170 Otis	Ingleside Police Station		Bill Graham Civic Auditorium	
	War Memorial Opera House		War Memorial Veterans Building		War Memorial Veterans Building	
	SFGH – Building 80		Pump Station #2 (Fort Mason)		Moscone North	
			DPH Central Office (101 Grove)		War Memorial Opera House	
			Park Senior Center		Davies Symphony Hall	
				1 South Van Ness		

Table E-7: Buildings Meeting Selected “High Impact” Criteria in the CAPSS Hayward M6.9 Scenario Earthquake

Buildings with total economic impact > \$50M	Buildings with operational losses >\$5M	Red-Tagged Buildings w/ >70% Mean Building Damage	Buildings with Probability of Collapse >10%	Buildings with 51 or more Non-Fatal Injuries (& 11 or More Fatalities, in italics)	Buildings with Injury Rates >10% and/or Fatality Rates >1%
Hall of Justice	Hall of Justice			Hall of Justice	
	SFGH – Building 5 (Main Hospital)				

Recommendations

The results of the current study may be used to further prioritize mitigation activities, including recommending the “High-Impact” buildings as candidates for detailed engineering evaluations (if such studies do not exist or are out of date), design of building strengthening or retrofit recommendations, as necessary, and implementation of such retrofit activities. While the buildings identified in Table E-6 and E-7 are valid candidates for further review and evaluation, the CPP may want to set alternate selection criteria, based on the results of the current risk assessment combined with other internal priority schemes. With just under \$1.3 billion in losses possible in a M7.9 San Andreas earthquake for just 82 of the City’s more than 500 buildings, serious consideration should be given to addressing these risks, starting with further detailed engineering reviews.

A large number of loss estimates have been produced in the current study; detailed building level results are provided in **Appendix C**. Every effort has been made to accurately classify each building’s structural system and design level. For buildings where the current categorization differs from user expectations, sensitivity studies or “what-if” analyses could be conducted to shed further light on the potential variations in performance resulting from a range of building categorizations, or a more detailed engineering review could be implemented to fine-tune the categorization. Further, a similar analytical approach can be used to assess the potential improvement in performance associated with various conceptual mitigation strategies, including those related to liquefaction.

A number of high-priority buildings were omitted from the current analysis because the standard Hazus models are not designed for direct application to base-isolated buildings (i.e., Main Library, City Hall, and the City’s Emergency Operations Center). While these buildings are expected to perform well under earthquake loading, if the quantification of potential impacts to these buildings is considered essential, an engineering evaluation to assess how best to modify the Hazus vulnerability models to reflect base-isolation could be conducted, allowing these facilities to be analyzed within Hazus. This may be of lower priority, however, than the activities mentioned above.

The data developed in this study should be incorporated into the City’s future prioritization activities. It may also be used as input to Benefit-Cost Analyses. In particular, the characterization of the buildings “as-is” may be input into FEMA’s Benefit Cost Analysis (BCA) Software, whose implementation is required as part of FEMA’s mitigation grant application process.

Finally, to provide the City with a more comprehensive view of their earthquake risk, it is recommended that the remainder of the City-owned buildings be similarly analyzed using Hazus. Further, to better reflect the full range of potential seismic hazards threatening the City, implementation of Hazus’ Average Annualized Loss (AAL) methodology is also recommended³. Use of the AAL would provide several benefits; the City would have access to a single comprehensive risk estimate for each building, developed using the United States Geological Survey’s current state-of-the-art probabilistic ground motion data.

³ It should be noted that the AAL methodology is automated within Hazus only for the regional building inventory. However, the AAL methodology can be implemented for an AEBM analysis by executing a series of “return period” runs, and combining these results outside of Hazus (e.g., in a spreadsheet).

1.0 INTRODUCTION

1.1 Project Scope & Objectives

The City and County of San Francisco's Capital Planning Program (CPP) is leading an interdepartmental effort to strengthen the City's mitigation, emergency response and recovery efforts by developing estimates of physical damage and economic loss to City-owned facilities as a result of a severe earthquake. Damage and loss estimates of interest include building damage, operational losses resulting from damage, potential injuries and deaths, and predicted safety tagging. These types of pre-disaster loss estimates are critical for hazard mitigation planning, submitting financial assistance requests to the federal government, and prioritizing capital improvements of critical facilities.

To accomplish this task, the CPP contracted with MMI Engineering to implement the Federal Emergency Management Agency's (FEMA's) Hazus (HAZards U.S.) natural hazard loss estimation tool to study approximately 75 high-priority, city-owned buildings; the final number of buildings analyzed reached 82. Potential building performance has been assessed for four earthquake scenarios previously modeled by the City's Community Action Plan for Seismic Safety (CAPSS) project.

1.2 Hazus Background

Hazus, originally developed for FEMA by the National Institute of Building Sciences (NIBS), is geographic information system (GIS) based, standardized, nationally applicable multi-hazard loss estimation methodology and software (<http://www.fema.gov/plan/prevent/hazus/>). Hazus operates as an extension of ESRI's ArcGIS software (www.esri.com). Local, state and federal government officials use Hazus for preparedness, emergency response, and mitigation planning. Initially released in 1997 as an earthquake loss estimation tool, Hazus now also includes flood and hurricane wind modeling capabilities. The version of Hazus used in this study is Hazus-MH MR-4. It is anticipated that any follow-on work will be conducted Hazus 2.1, expected to be released in February or March, 2012.

Hazus' standard configuration allows for "out-of-the-box" regional or community-wide earthquake loss assessment using default building inventory databases aggregated to the census tract level. The Advanced Engineering Building Module (AEBM) allows users with site-specific data to take advantage of Hazus' loss and damage methodologies at a more detailed, building-specific level. For this study, the AEBM has been used to assess damage and loss to the selected buildings.

Within Hazus, buildings are classified both by their use or Occupancy (Table 1-1), and by their structure or Model Building Type (Table 1-2). In the Hazus earthquake module, Model Building Types are further categorized by their "Design Level", reflecting both the expected hazard level (High, Moderate and Low) and performance level (Superior, Code or Ordinary, and Pre-Code or Inferior), to which the building was designed, as summarized in Table 1-3. In California, structures are generally assumed to be Hazus "Design Level" High-Code if constructed after 1975, Moderate-Code if constructed between 1941 and 1975, and Pre-Code if constructed before 1941, although application of these general rules is superseded by specific design characteristics and code changes for individual construction types. For example, to reflect the lessons learned regarding steel moment frame (S1) construction as a result of the 1994 Northridge earthquake, the High-Code threshold for S1 construction is, in some applications, adjusted to 1995 or later.

Notable applications of the Hazus AEBM include the effort by the California Office of Statewide Health Planning & Development (OSHPD) to evaluate hospital seismic risk for buildings classified under Senate Bill 1953 as Structural Performance Category (SPC-1)⁴. SPC-1 buildings are those that "pose a significant risk of collapse and a danger to the public after a strong earthquake". OSHPD has used the Hazus AEBM to determine whether the participating SPC-1 buildings could be reclassified into a lower risk category, thereby allowing the hospital owners additional time to comply with seismic safety standards.

⁴ http://www.oshpd.ca.gov/FDD/Regulations/Triennial_Code_Adoption_Cycle/Hazus.html

Table 1-1: Hazus Occupancy Classes

Occupancy Class Label	Occupancy Class	Example Descriptions
RES1	Single Family Dwelling	House
RES2	Mobile Home	Mobile Home
RES3	Multi Family Dwelling RES3A (Duplex) RES3B (3-4 Units) RES3C (5-9 Units) RES3D (10-19 Units) RES3E (20-49 Units) RES3F (50+ Units)	Apartment/Condominium
RES4	Temporary Lodging	Hotel/Motel
RES5	Institutional Dormitory	Group Housing (military, college), Jails
RES6	Nursing Home	
COM1	Retail Trade	Store
COM2	Wholesale Trade	Warehouse
COM3	Personal and Repair Services	Service Station/Shop
COM4	Professional/Technical Services	Offices
COM5	Banks	
COM6	Hospital	
COM7	Medical Office/Clinic	
COM8	Entertainment & Recreation	Restaurants/Bars
COM9	Theaters	Theaters
COM10	Parking	Garages
IND1	Heavy	Factory
IND2	Light	Factory
IND3	Food/Drugs/Chemicals	Factory
IND4	Metals/Minerals Processing	Factory
IND5	High Technology	Factory
IND6	Construction	Office
AGR1	Agriculture	
REL1	Church/Non-Profit	
GOV1	General Services	Office
GOV2	Emergency Response	Police/Fire Station/EOC
EDU1	Grade Schools	
EDU2	Colleges/Universities	Does not include group housing

Table 1-2: Hazus Model Building Types

Model Building Type Label	Description	Height (Number of Stories)
W1	Wood, Light Frame (\leq 5,000 sq. ft.)	(1 – 2 Stories)
W2	Wood, Commercial and Industrial ($>$ 5,000 sq. ft.)	All
S1L	Steel Moment Frame	Low-Rise (1 – 3 Stories)
S1M		Mid-Rise (4 – 7 stories)
S1H		High-Rise (8+ Stories)
S2L	Steel Braced Frame	Low-Rise (1 – 3 Stories)
S2M		Mid-Rise (4 – 7 stories)
S2H		High-Rise (8+ Stories)
S3	Steel Light Frame	All
S4L	Steel Frame with Cast-in-Place Concrete Shear Walls	Low-Rise (1 – 3 Stories)
S4M		Mid-Rise (4 – 7 stories)
S4H		High-Rise (8+ Stories)
S5L	Steel Frame with Unreinforced Masonry Infill Walls	Low-Rise (1 – 3 Stories)
S5M		Mid-Rise (4 – 7 stories)
S5H		High-Rise (8+ Stories)
C1L	Concrete Moment Frame	Low-Rise (1 – 3 Stories)
C1M		Mid-Rise (4 – 7 stories)
C1H		High-Rise (8+ Stories)
C2L	Concrete Shear Walls	Low-Rise (1 – 3 Stories)
C2M		Mid-Rise (4 – 7 stories)
C2H		High-Rise (8+ Stories)
C3L	Concrete Frame with Unreinforced Masonry Infill Walls	Low-Rise (1 – 3 Stories)
C3M		Mid-Rise (4 – 7 stories)
C3H		High-Rise (8+ Stories)
PC1	Precast Concrete Tilt-Up Walls	All
PC2L	Precast Concrete Frames with Concrete Shear Walls	Low-Rise (1 – 3 Stories)
PC2M		Mid-Rise (4 – 7 stories)
PC2H		High-Rise (8+ Stories)
RM1L	Reinforced Masonry Bearing Walls with Wood or Metal Deck Diaphragms	Low-Rise (1 – 3 Stories)
RM1M		Mid-Rise (4 – 7 stories)
RM2L	Reinforced Masonry Bearing Walls with Precast Concrete Diaphragms	Low-Rise (1 – 3 Stories)
RM2M		Mid-Rise (4 – 7 stories)
RM2H		High-Rise (8+ Stories)
URML	Unreinforced Masonry Bearing Walls	Low-Rise (1 – 3 Stories)
URMM		Mid-Rise (4 – 7 stories)
MH	Mobile Homes	All

Table 1-3: Hazus Seismic Design and Performance Levels

Seismic Design Level	Seismic Performance Level		
	Superior	Ordinary	Inferior
High (UBC Zone 4)	Special High-Code	High-Code	
Moderate (UBC Zone 2B)	Special Moderate-Code	Moderate-Code	
Low (UBC Zone 1)	Special Low-Code	Low-Code	Pre-Code

Results produced by the Hazus AEBM include damage, loss, and casualties:

- Damage state probabilities (i.e., the probability that a building will be in each of the Hazus damage states; None, Slight, Moderate, Extensive and Complete) for both structural and non-structural damage.
- Building-related direct economic losses; structural damage, non-structural damage, and contents losses, as well as operational losses, such as the cost to relocate operations, rent alternate facilities, and revenue losses associated with a subset of the City's facilities.
- Casualties, classified in terms of Hazus injury severity (see Table 1-4), ranging from injuries requiring basic first aid (Severity 1) to fatal injuries (Severity 4).

Additional results have been derived from the information produced by Hazus. Potential building occupancy tagging (i.e., "Red", "Yellow" and "Green" tags) has been predicted. For this study, occupancy tagging has been derived from expected (mean) building damage; damage of 50% or more is assumed to result in "red-tagging", with the facility generally expected to be non-repairable. Damage between 25 and 50% is assumed to be "yellow-tagged"; the facility is assumed to be repairable, but not available for immediate occupancy. Finally, damage less than 25% is assumed to result in a "green-tag", with the facility considered usable following the earthquake, and while any necessary repairs are being made. Similar information has been generated by FEMA as part of various regional Hazus analyses using an Urban Search and Rescue (USAR) Resource Assessment Spreadsheet that estimates USAR team requirements, as well as the associated building safety-tag distribution (D. Bausch, personal communication).

Table 1-4: Hazus Injury Severity Categories

Injury Severity Level	Injury Description
Severity 1	Injuries requiring basic medical aid that could be administered by paraprofessionals. These types of injuries would require bandages or observation. Some examples are: a sprain, a severe cut requiring stitches, a minor burn (first degree or second degree on a small part of the body), or a bump on the head without loss of consciousness. Injuries of lesser severity that could be self-treated are not estimated by Hazus.
Severity 2	Injuries requiring a greater degree of medical care and use of medical technology such as x-rays or surgery, but not expected to progress to a life threatening status. Some examples are third degree burns or second degree burns over large parts of the body, a bump on the head that causes loss of consciousness, fractured bone, dehydration or exposure.
Severity 3	Injuries that pose an immediate life threatening condition if not treated adequately and expeditiously. Some examples are: uncontrolled bleeding, punctured organ, other internal injuries, spinal column injuries, or crush syndrome.
Severity 4	Instantaneously killed or mortally injured

Hazus’ Deterministic and Probabilistic Analysis Capabilities

For earthquake risk assessment, Hazus provides the capability to estimate both deterministic (scenario) losses and probabilistic losses. Earthquake scenarios may be defined within Hazus by identifying the fault rupture location (e.g., by entering an epicenter location or choosing a historic epicenter) and allowing Hazus to estimate ground motions from built-in attenuation relationships. Alternatively, the user may import “User-Defined” maps of ground motion developed outside of Hazus (e.g., United States Geological Survey (USGS) ShakeMaps, or the Community Action Plan for Seismic Safety (CAPSS) Project ground motion data). The current study utilizes the “User-Defined” ground motion import capabilities.

In addition to deterministic losses, Hazus may be used to estimate probabilistic losses (by return period) and annualized losses. To facilitate the probabilistic analysis, Hazus is delivered with default probabilistic seismic hazard data; the current default data are derived from the USGS 2008 National Seismic Hazard Maps (Petersen et al., 2008). Hazus stores the probabilistic seismic hazard data as a set of eight return period ground motions (100, 250, 500, 750, 1000, 1500, 2000 and 2500 year return periods), allowing for the computation of approximate annualized loss for community-wide building inventories (Hazus’ “General Building Stock”), as well as losses at individual return periods.

It should be noted that the Hazus framework allows for the direct computation of annualized loss for the aggregated building inventory, but the same functionality does not exist for the site specific inventories, such as those used in the AEBM or for other facility types (e.g., essential facilities, utilities and transportation). Nevertheless, annualized losses may be estimated for these other inventory databases by first estimating individual return period losses, and combining these outside of Hazus to determine the resulting annualized loss. While the current scope of work is focused on estimating deterministic losses, it may also be of value for the CPP to consider including annualized loss estimates in future studies.

2.0 DATA COLLECTION & REVIEW

2.1 Earthquake Scenarios & Hazard Data

2.1.1 The CAPSS Project's Earthquake Scenarios

San Francisco's Community Action Plan for Seismic Safety (CAPSS) Project was conducted by the Applied Technology Council (ATC) and its subcontractors in two phases; Phase 1 was executed in 2002 – 2003, while Phase 2 was performed in 2008 – 2010.

The earthquake scenario data developed for the CAPSS Project is in the form of GIS data stored at the City Block level. These data, generated by Treadwell & Rollo for the CAPSS Phase 1 effort, include ground motions for the four earthquake scenarios identified in Table 2-1, computed as the average of three attenuation relationships that were considered to be "state-of-the-art" at that time (Abrahamson and Silva, 1997; Campbell, 1997; and Sadigh et al., 1997). For each event, Treadwell & Rollo provided city block level estimates of Peak Ground Acceleration (PGA), and Spectral Accelerations (Sa) at 0.2 and 1.0 seconds; these data were used to derive additional parameters required for analysis in Hazus (Spectral Acceleration at 0.3 seconds and Peak Ground Velocity (PGV), etc.) as described in the CAPSS Project Reports ATC-52-1 and ATC-52-1A ("Potential Earthquake Impacts", and "Potential Earthquake Impacts: Technical Documentation"), both available from the ATC CAPSS Project website at: <http://www.sfcapss.org/news.html>.

Table 2-1: Earthquake Scenarios

Event	Fault/Segment	Moment Magnitude	Range of Peak Ground Acceleration	Range of 0.3 Second Spectral Acceleration	Range of 1.0 Second Spectral Acceleration
SA79	San Andreas/Multi-Segment	7.9	0.36 - 0.67g	0.75 - 1.37g	0.40 - 1.0g
SA72	San Andreas/Peninsula Segment	7.2	0.29 - 0.61g	0.60 - 1.24g	0.28 - 0.93g
SA65	San Andreas/Peninsula Segment	6.5	0.22 - 0.55g	0.45 - 1.11g	0.17 - 0.72g
H69	Hayward/ North & South Segments	6.9	0.15 - 0.36g	0.30 - 0.81g	0.14 - 0.68g

30-Year earthquake probabilities are available for three of the CAPSS events (2007 WGCEP, 2008), as follows:

- M7.9 San Andreas – 3.8% probability of occurrence in the next 30 years
- M7.2 San Andreas – 0.6% probability of occurrence in the next 30 years
- M6.9 Hayward – 9.9% probability of occurrence in the next 30 years

While these specific event probabilities may appear small, it should be noted that there is a 63% probability of an earthquake of M6.7 or larger striking the Bay Area in the next 30 years. In addition, because of the San Andreas' historic rupture patterns, the multi-segment rupture on the San Andreas (e.g., the M7.9 repeat of the 1906 earthquake) has been determined to be more likely than the smaller single segment rupture.

For the current study, CAPSS ground motion data were converted to a format compatible with the current version of Hazus for re-use. Re-use of the CAPSS scenario data was done with the permission of the CAPSS Earthquake Safety Implementation Program Manager (Laurence Kornfield, personal communication, 11/10/2011). Maps depicting the distribution of peak ground acceleration across the City for the four CAPSS scenarios are provided in Figures 2-1 through 2-4.

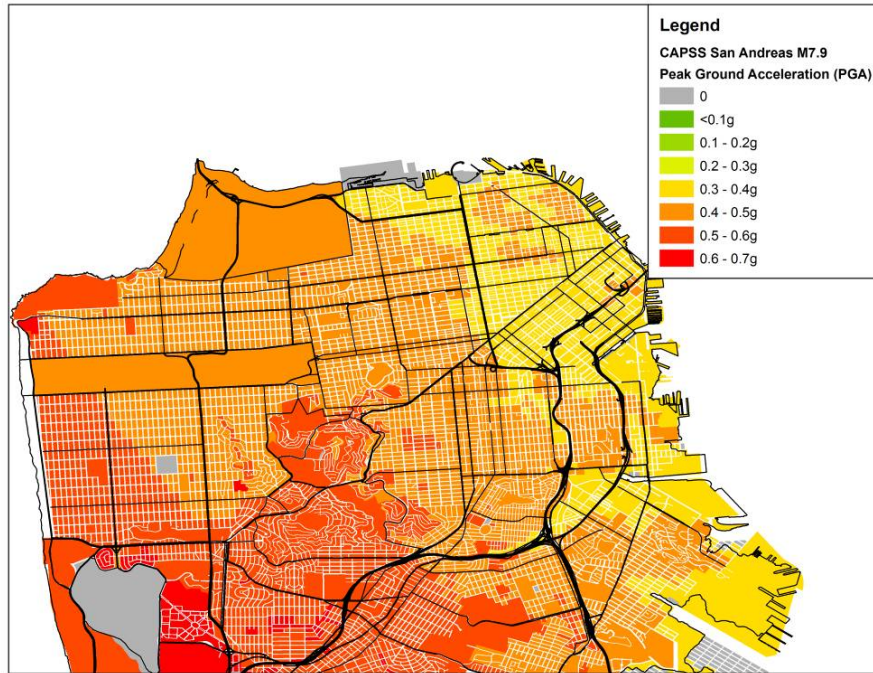


Figure 2-1: Peak Ground Acceleration for the CAPSS San Andreas M7.9 Scenario Earthquake

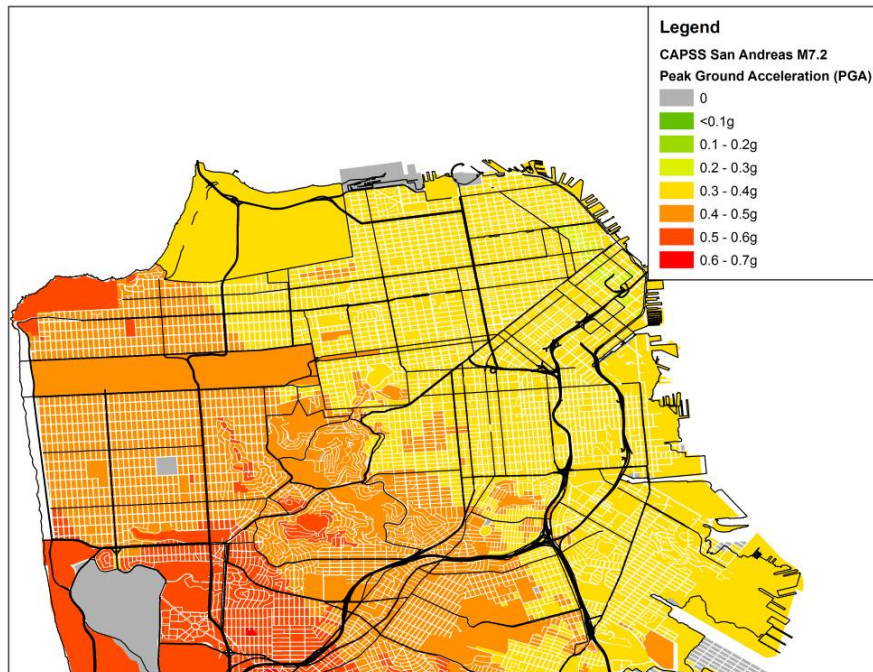


Figure 2-2: Peak Ground Acceleration for the CAPSS San Andreas M7.2 Scenario Earthquake

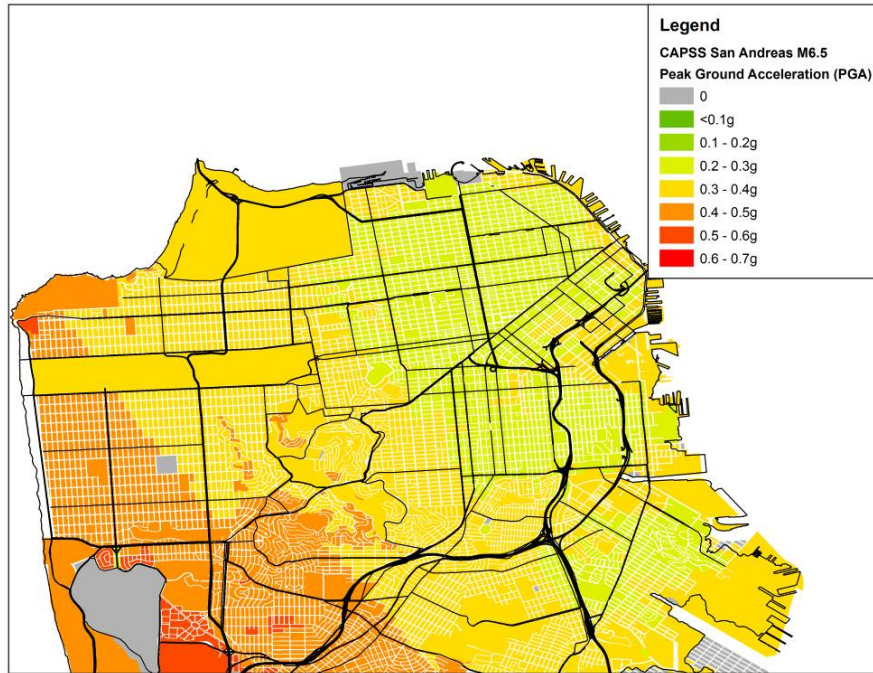


Figure 2-3: Peak Ground Acceleration for the CAPSS San Andreas M6.5 Scenario Earthquake

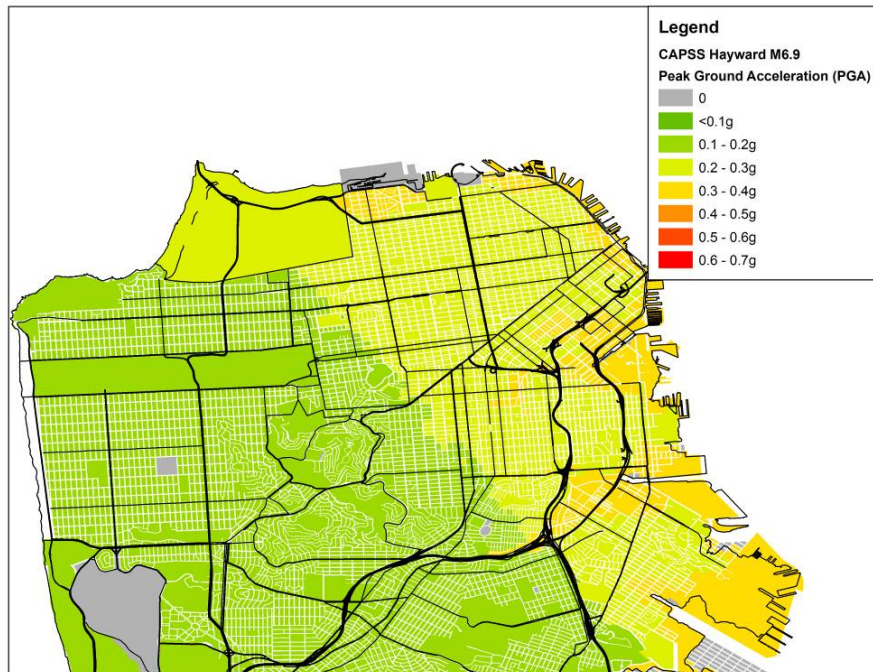


Figure 2-4: Peak Ground Acceleration for the CAPSS Hayward M6.9 Scenario Earthquake

2.1.2 Liquefaction Susceptibility Data

Regional liquefaction susceptibility data mapped by the USGS (Knudsen et al., 2000) were utilized in the CAPSS Project. For that study, data sampled at the city block were provided by Treadwell & Rollo. The USGS liquefaction susceptibility data still represents the best available digital database of regional liquefaction data for the Bay Area. GIS data made available by the USGS (see: <http://pubs.usgs.gov/of/2000/of00-444/>) were incorporated into Hazus for the current analysis, as shown in Figure 2-5, with the location of the high-priority buildings superimposed.

Assigned liquefaction susceptibility for each of the 82 high-priority buildings is given in Table 2-2. It should be noted that a few of the high-priority buildings are built on caissons (Taraval Police Station), deep driven piles (Sheriff's Facility), or have jet-grouted foundations (Sunset Recreation Center), such that liquefaction damage is not expected. Accordingly, these facilities have had their liquefaction susceptibility set to "None", as seen in Table 2-2. Review of geotechnical reports and other available information was also used to adjust the susceptibility category for several other buildings, including Moscone North and South, Bill Graham Civic Auditorium, War Memorial Opera House, 30 Van Ness and 1 South Van Ness.

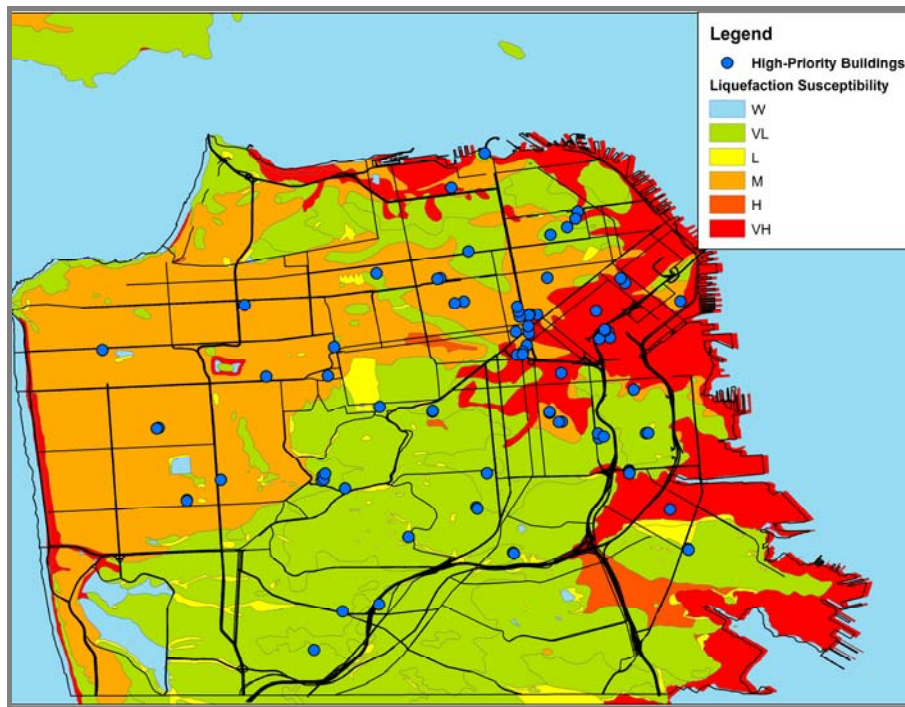


Figure 2-5: USGS Liquefaction Susceptibility Data for San Francisco (after Knudsen et. al, 2000)

**Table 2-2: Assigned Liquefaction Susceptibility
(in CPC-Identified Priority Order)**

Building	Liquefaction Susceptibility Category
1 South Van Ness	Medium
County Fair Building	Medium
1650 Mission	Medium
Hall of Justice	Very High
DPH Central Office (101 Grove)	Medium
Pump Station #1 (SFFD HQ)	Medium
DPW Yard - Building A	Very Low
DPW Yard - Building B	Very Low
DPW Yard - Building C	Very Low
McLaren Lodge Annex	Medium
YGC Admin & Courts Building	Very Low
1660 Mission	Medium
Bill Graham Civic Auditorium	None
South of Market/Gene Friend Rec Center	Very High
Minnie & Lovie Ward Rec Center	Very Low
Moscone Center (South)	Low
1680 Mission	Medium
Glen Park Rec Center	Very Low
Jackson Playground and Clubhouse	Medium
Kezar Pavilion	Medium
Moscone Rec Center	Very High
Moscone North	Low
Park Senior Center	Medium
Potrero Hill Rec Center (Gym)	Very Low
Potrero Hill Rec Center (Field House)	Very Low
170 Otis	Very High
Chinese Rec Center (New)	Very Low
Joseph Lee Rec Center (Gym)	Low
Joseph Lee Rec Center (Field House)	Very Low
Central Shops	Very High
St. Mary's Rec Center (Gym)	Very Low
St. Mary's Rec Center (Field House)	Very Low
Sunset Rec Center (Gym)	None
Sunset Rec Center (Field House)	None
Upper Noe Rec Center (Gym)	Very Low
Upper Noe Rec Center (Auditorium & Lobby)	Very Low
Mission Rec Center (Main)	Medium
Mission Rec Center (Clubhouse)	Medium
Tenderloin Rec Center	Medium
Woh Hei Yuen Rec Center	Very High
Hamilton Rec Center (Gym)	Medium
Hamilton Rec Center (Pool Building)	Medium
Animal Care and Control Facility	Very High
30 Van Ness	None
Laguna Honda Main Hospital (A and B Wings)	Very Low
Laguna Honda Main Hospital (H Wing)	Very Low
SFGH - Building 80	Very Low
SFGH - Building 5 (Main Hospital)	Very Low

**Table 2-2: Assigned Liquefaction Susceptibility
(in CPC-Identified Priority Order)**

Building	Liquefaction Susceptibility Category
Ashbury Street Tank & Tank House	Very Low
Fire Station #31	Medium
Fire Station #40	Medium
Ingleside Police Station	Very Low
Laguna Honda Main Hospital (C Wing)	Very Low
Taraval Police Station - Original Wing	None
Taraval Police Station - Addition #1	None
Taraval Police Station - Addition #2	None
Tom Waddell Clinic	Medium
Eureka Valley Rec Center (Auditorium & Locker Room)	Very Low
Eureka Valley Rec Center (Gym)	Very Low
Fire Station #11	Very Low
Fire Station #15	Very Low
Fire Station #36	Medium
Fire Station #38	Very Low
Fire Station #7	Medium
Hall of Justice Gas Station	Very High
SFGH - Building 2 (Service Building)	Very Low
Sheriffs Facility (Inmate Housing)	None
Sheriffs Facility (Admin Building)	None
YGC Service Building (Building #2)	Very Low
Public Defender's Office	Very High
Northern Police Station	Medium
War Memorial Opera House	Low
Fire Station #2	Very Low
SFGH - Mental Health Building	Very Low
SFGH - Mental Health Support Building	Very Low
War Memorial Veterans Building	Medium
Jones St Tank & Tank House	Very Low
Pump Station #2 (Fort Mason)	Very Low
Fire Division of Training	Medium
Fire Station #10	Medium
Fire Station #5	Medium
Davies Symphony Hall	Medium

2.2 Building Inventory Data

A variety of building attributes are required for analysis in the Hazus AEBM, including:

- Building location, e.g., address, city block/lot location, or geocoded building location in terms of latitude and longitude
- Building occupancy type or usage (e.g., office, warehouse, fire station, etc.)
- Building square footage
- Building replacement value (\$)
- Content value (\$)
- Number of stories
- Year built (including applicable building code information)
- Structural system of original building design
- Structural system information for any significant renovations/additions or seismic upgrades
- Peak Occupancy (number of people)

Basic building data, such as building occupancy type, number of stories, square footage, and replacement value, were assembled by CPP from existing internal sources. Building location was taken from GIS data available from the San Francisco GIS Data Catalog, posted on-line at: <http://gispub02.sfgov.org/website/sfshare/index2.asp>.

Occupancy Class Assignments

Care was taken in assigning appropriate Hazus occupancy classes, as this choice can impact determination of secondary economic losses. For example, within Hazus, damaged government office buildings (Hazus occupancy GOV1) are assumed to have more rapid recovery times than regular offices (Hazus occupancy COM4). For the Hazus damage states of Slight, Moderate, Extensive and Complete Damage, the “down time” for government offices is just one, two, 10 and 14 days, respectively, vs. two, nine, 72 and 144 days for other office buildings. For the current study, office buildings (or buildings that include space dedicated to office use) that house operations that are expected to be back up and running quickly in alternate facilities, if necessary (i.e., have an expectation of rapid restoration of operations), have been categorized as GOV1 rather than as COM4.

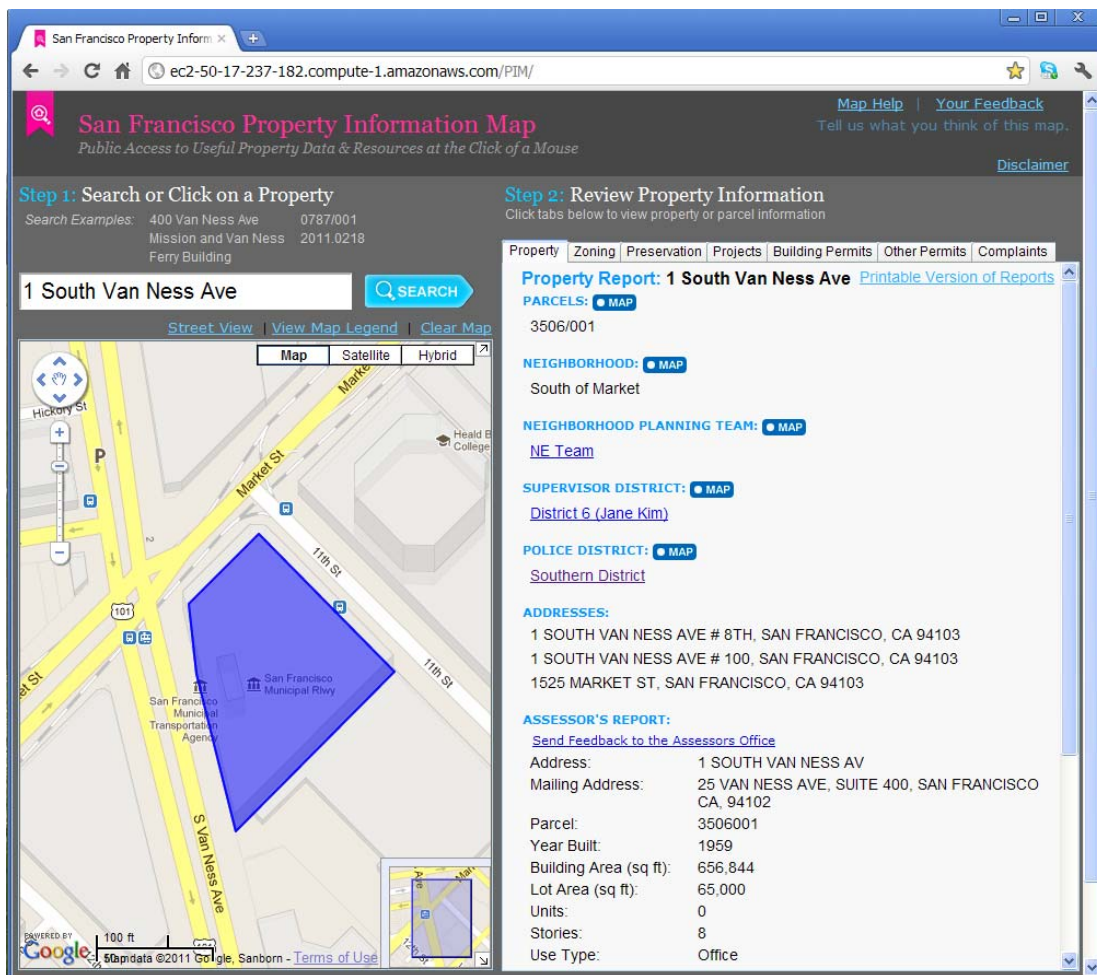
Determination of Structural System and Design Level

To collect the remaining information required to construct the Hazus AEBM databases, the MMI Project Team worked collaboratively with CPP and DPW Infrastructure Division, Structural Engineering Section personnel to review and characterize the structural system and design level of each of the high-priority City-owned buildings (listed previously in Table E-1). A variety of source material was reviewed, including:

- Seismic Assessment Reports generated as part of the Earthquake Safety Program conducted in the early 1990s.
- Other structural evaluation reports, including a series of fire station seismic evaluation studies conducted by EQE/AGS in 1989, updated by SOHA Engineers in 2009, and the structural evaluation report for Auxiliary Water Supply System (AWSS) facilities, also prepared by SOHA in 2009.
- Building Occupancy Resumption Program (BORP) Reports
- Selected architectural and structural drawings
- San Francisco Property Information data available on-line (<http://ec2-50-17-237-182.compute-1.amazonaws.com/PIM/>), see for example, Figure 2-6) including assessor’s parcel data, building permit data, and Sanborn map data.

For each building included in the analysis, the resources identified above were used to assign a Hazus Occupancy (see Table 1-1), Model Building Type (see Table 1-2) and appropriate Design Level (see Table 1-3). Final assignments are presented in Table 2-3.

It should be noted that for a small number of facilities, the structural systems were determined to be mixed. For example, the lateral force-resisting system for 1680 Mission is considered to be a concrete shear wall in one direction, with retrofitted steel braced frames in the other direction. As Hazus does not include a mechanism to model mixed systems directly, these buildings were modeled twice (i.e., duplicate inventory records were included in the AEBM database, one for each structural system), and the results were averaged to arrive at final loss estimates for the building. The eleven buildings with mixed structural systems can be identified in Table 2-3 by their dual entries for Model Building Type and Design Level.



The screenshot displays the San Francisco Property Information Map interface. The search bar contains '1 South Van Ness Ave'. The map shows a blue-shaded parcel at the intersection of South Van Ness Ave and Market St. The right-hand panel provides detailed information for this property:

- Property:** Zoning, Preservation, Projects, Building Permits, Other Permits, Complaints
- Property Report: 1 South Van Ness Ave** (Printable Version of Reports)
- PARCELS:** 3506/001
- NEIGHBORHOOD:** South of Market
- NEIGHBORHOOD PLANNING TEAM:** NE Team
- SUPERVISOR DISTRICT:** District 6 (Jane Kim)
- POLICE DISTRICT:** Southern District
- ADDRESSES:**
 - 1 SOUTH VAN NESS AVE # 8TH, SAN FRANCISCO, CA 94103
 - 1 SOUTH VAN NESS AVE # 100, SAN FRANCISCO, CA 94103
 - 1525 MARKET ST, SAN FRANCISCO, CA 94103
- ASSESSOR'S REPORT:**
 - Address: 1 SOUTH VAN NESS AV
 - Mailing Address: 25 VAN NESS AVE, SUITE 400, SAN FRANCISCO CA, 94102
 - Parcel: 3506001
 - Year Built: 1959
 - Building Area (sq ft): 656,844
 - Lot Area (sq ft): 65,000
 - Units: 0
 - Stories: 8
 - Use Type: Office

Figure 2-6: Sample Property Data Available On-line from the San Francisco Property Information Map

Table 2-3: Assigned Hazus Occupancy, Model Building Type, and Design Level for the 82 Buildings Included in the Hazus Scenario Analyses (in CPC-Identified Priority Order)

Building	Occupancy (see Table 1-1)	Model Building Type (see Table 1-2)	Design Level (see Table 1-3)
1 South Van Ness	GOV1	C1H	MC
County Fair Building	COM8	C1L	MC
1650 Mission	GOV1	C2M	MC
Hall of Justice	GOV1	C2M	MC
DPH Central Office (101 Grove)	COM4	S5M	PC
Pump Station #1 (SFFD HQ)	GOV1	C2L	MC
DPW Yard - Building A	COM4	C2L	MC
DPW Yard - Building B	COM3	S1L/S2L	MC/LC
DPW Yard - Building C	COM3	S1L/S2L	MC/LC
McLaren Lodge Annex	COM4	C2L	MC
YGC Admin & Courts Building	GOV1	C2L	MC
1660 Mission	GOV1	S2M	MC
Bill Graham Civic Auditorium	COM8	S4M	MC
South of Market/Gene Friend Rec Center	COM8	S2L	HC
Minnie & Lovie Ward Rec Center	COM8	RM1	HC
Moscone Center (South)	COM8	C2L	MC
1680 Mission	COM4	S2M/C2M	MC/PC
Glen Park Rec Center	COM8	W2	MC
Jackson Playground and Clubhouse	COM8	W2	LC
Kezar Pavilion	COM8	S4L	PC
Moscone Rec Center	COM8	W2	HC
Moscone North	COM8	C2L	HC
Park Senior Center	COM8	C2L	LC
Potrero Hill Rec Center (Gym)	COM8	W2	MC
Potrero Hill Rec Center (Field House)	COM8	C2L	MC
170 Otis	COM4	C2H	LC
Chinese Rec Center (New)	COM8	S2L/C2L	HC/HC
Joseph Lee Rec Center (Gym)	COM8	W2	MC
Joseph Lee Rec Center (Field House)	COM8	C2L	MC
Central Shops	COM3	S1L	MC
St. Mary's Rec Center (Gym)	COM8	W2	MC
St. Mary's Rec Center (Field House)	COM8	C2L	MC
Sunset Rec Center (Gym)	COM8	W2	MC
Sunset Rec Center (Field House)	COM8	C2L	MC
Upper Noe Rec Center (Auditorium & Lobby)	COM8	C2L	MC
Upper Noe Rec Center (Gym)	COM8	C1L	MC
Mission Rec Center (Main)	COM8	URML	LS
Mission Rec Center (Clubhouse)	COM8	URML	LS
Tenderloin Rec Center	COM8	S1L	MC
Woh Hei Yuen Rec Center	COM8	C2L/W2	HC/HC
Hamilton Rec Center (Gym)	COM8	S1L	HC
Hamilton Rec Center (Pool Building)	COM8	C1L	HC
Animal Care and Control Facility	COM7	C2L	LC
30 Van Ness	GOV1	C2M/S2M	PC/MC
Laguna Honda Main Hospital (A and B Wings)	GOV1	C2M	PC
Laguna Honda Main Hospital (H Wing)	COM7	C2M	MC
SFGH - Building 80	COM7	S5M	PC

Table 2-3: Assigned Hazus Occupancy, Model Building Type, and Design Level for the 82 Buildings Included in the Hazus Scenario Analyses (in CPC-Identified Priority Order)

Building	Occupancy (see Table 1-1)	Model Building Type (see Table 1-2)	Design Level (see Table 1-3)
SFGH - Building 5 (Main Hospital)	COM6	S2H	MC
Ashbury Street Tank & Tank House	GOV1	C3L	PC
Fire Station #31	GOV2	W2/C2L	LC/PC
Fire Station #40	GOV2	W2/S3	MC/PC
Ingleside Police Station	GOV2	C2L	PC
Laguna Honda Main Hospital (C Wing)	GOV1	C2M	PC
Taraval Police Station - Original Wing	GOV2	S4L	MC
Taraval Police Station - Addition #1	GOV2	S1L	MC
Taraval Police Station - Addition #2	GOV2	S1L/C2L	MC/MC
Tom Waddell Clinic	COM7	C2L	PC
Eureka Valley Rec Center (Gym)	COM8	C2L	MC
Eureka Valley Rec Center (Auditorium & Locker Room)	COM8	C1L	MC
Fire Station #11	GOV2	C2L	MC
Fire Station #15	GOV2	C2L	MC
Fire Station #36	GOV2	C2L	MC
Fire Station #38	GOV2	W2	MC
Fire Station #7	GOV2	C2L	MC
Hall of Justice Gas Station	COM3	RM1L/S1L	MC/MC
SFGH - Building 2 (Service Building)	COM3	S1L	HC
Sheriffs Facility (Admin Building)	GOV1	S2M	HC
Sheriffs Facility (Inmate Housing)	GOV2	C2M	HC
YGC Service Building (Building #2)	GOV1	C2L	LC
Public Defender's Office	COM7	W2	HC
Northern Police Station	GOV2	RM1L	LC
War Memorial Opera House	COM8	S4M	MC
Fire Station #2	GOV2	S2L/S1L	HC/MC
SFGH - Mental Health Building	COM7	S1L	MC
SFGH - Mental Health Support Building	COM7	S1L	MC
War Memorial Veterans Building	COM8	S4M	PC
Jones St Tank & Tank House	GOV1	C2L	MC
Pump Station #2 (Fort Mason)	GOV1	C2L	PC
Fire Division of Training	GOV2	C2L	MC
Fire Station #10	GOV2	C2L	MC
Fire Station #5	GOV2	C2L	LC
Davies Symphony Hall	COM8	S2M	MC

Content Value Estimation

Within the Hazus methodology, building content value models are used to estimate content value as a percent of building replacement cost. For most commercial and government occupancies, the default content value ratio is 100%, except for hospitals, medical clinics and emergency response facilities, which use 150% of building value. Initial review of these default models relative to available City building data indicated that, for most City of San Francisco building occupancies, the Hazus default content value model would vastly overestimate actual content value. Accordingly, custom content value ratios based on available information were used to estimate content value in the current analysis, as follows:

- COM3, COM4, GOV1 and GOV2 facilities (except as noted below) – 20% of building value
 - Jails (or the portion of the building apportioned to jail usage) – 7% of building value
 - Pump Stations #1 and #2 – content value taken to be equal to equipment replacement costs reported in the AWSS Facility Improvements Cost Estimate (Metcalf & Eddy/AECOM, 2009), which are \$4.55 million and \$4.43 million, respectively.
- COM8 – 5% of building value

For two occupancy classes with limited City-specific information and large expected content values (COM6/Hospitals and COM7/Medical Clinics), the Hazus default content value ratio of 150% was used.

Peak Population Occupancy

Expected peak facility occupancies were estimated in a variety of ways. Several departments (Recreation & Parks, Building Inspection, Animal Care & Control, and Fire Department-Division of Training) provided occupancy estimates for their facilities. For offices (both COM4 and GOV1), the City’s space planning “rule of thumb” of “1 person per 350 square feet” was used to estimate office occupancy levels. Occupancy estimates for several buildings with complex mixed-use patterns (e.g., the Hall of Justice, Wall Memorial Veterans Building) were determined by dividing the building square footage into component uses, and estimating occupancies for each. High occupancy facility estimates were developed from information on venue seating capacity, increased by 5% to account for staff and performers. Finally, occupancy estimates for Moscone North and South were estimated based on review of available floor plans and capacities, and limited information on historic meeting attendance. The final peak occupancy estimates are shown in Figure 2-7, and are included in the inventory data presented **Appendix B**.

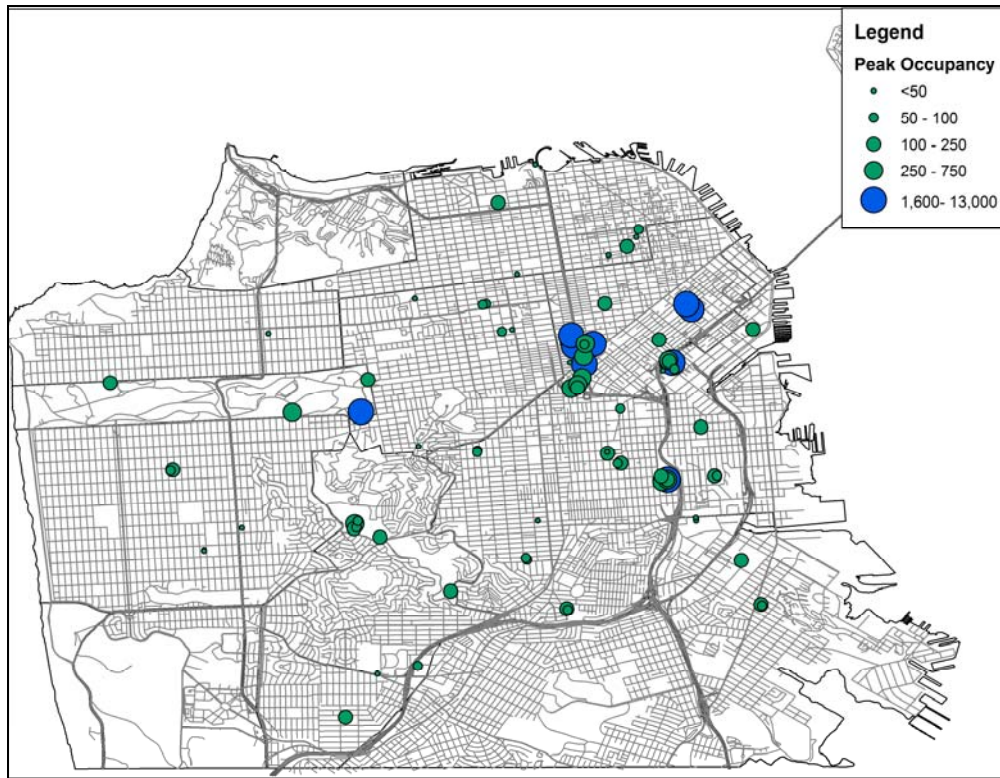


Figure 2-7: Peak Building Occupancy for the 82 High-Priority City-Owned Buildings

2.3 Economic and Other Data

To facilitate estimation of operational losses resulting from building damage, a few additional pieces of economic information were required, including:

- Wages Paid: \$/square foot/day
- Business Income Generated: \$/square foot/day
- Relocation Disruption Cost (cost to relocate operations): \$/square foot
- Rental Cost - \$/square foot/day by occupancy
- Owned vs. leased

Wage Data

Because it was reported that City workers would be paid even if they were unable to report to work as a result of building damage (i.e., no loss of wages was expected), wage data were not required.

Business Income Data

Only a handful of buildings were determined to be significant revenue generators for the City; these include facilities operated by the Recreation & Parks Department, Moscone Center (North & South), and the Department of Building Inspection's 1660 Mission. Monthly or annual revenue estimates were provided by the operating departments for use in the current analysis.

Relocation Costs

Costs for relocation of office and similar occupancies (COM3, COM4, GOV1 and GOV2) were estimated to be on the order of \$1 per square foot, based on the City's recent real estate experience. Similarly, relocation costs for hospitals and medical clinics (COM6 and COM7) were estimated as to be approximately \$2/square foot, based on recent experience at Laguna Honda. It was determined that facilities operated by Recreation & Parks would not be expected to relocate operations to alternate facilities as a result of building damage. Relocation costs for jail facilities were derived from annual costs to transport inmates to courts/hearings, on a per inmate basis.

Rental Cost

Rental Costs were taken from a Real Estate estimate of average annual rent for office space of \$30/square foot/year or \$2.50/square foot per month. This value was used as a baseline for all occupancies.

3.0 IMPLEMENTATION OF THE HAZUS AEBM

3.1 Hazus AEBM Databases

Implementation of the earthquake risk analyses required the development of Hazus AEBM-compatible databases that characterize the City-owned buildings, developed from the data described in the previous sections.

The Hazus AEBM utilizes two types of databases:

- 1) *Generalized AEBM “profiles” (these data are not tied to any specific building).* Each profile represents a typical building configuration (e.g., a high-rise steel moment frame office building, with Moderate Code design), and associated data consists of the various analysis parameters required by the Hazus AEBM. Specific data associated with each model building type and design level include capacity curve parameters (spectral accelerations and displacements at yield and ultimate capacity), response parameters (e.g., damping), fragility curve parameters for structural damage and non-structural damage related to both drift and acceleration, repair cost ratios, and loss of function parameters. The profiles developed for this study reflect the range of occupancy/structure type combinations existing in the list of high-priority City-owned Buildings. No parameter customization has been included; each building (or building variant, for the eleven building with mixed structural systems) is represented by the default parameters for the identified model building type and design level. The 53 different profiles used for this study, reflecting the mix of occupancy, structure type and design levels existing for the 82 studied buildings, are listed in Table 3-1. It should be noted that profiles used to model variants for mixed system buildings are included in this list, bringing the total number of records to 93. As shown, there is a wide range of construction types in use, of varying design vintages.
- 2) *Building specific inventory data (specific to the individual buildings).* An inventory database has been developed reflecting each of the identified high-priority building’s assigned AEBM profile, physical location, building size (square footage), peak occupancy, building replacement value, estimated content value, and revenue generated, relocation cost and rental costs (where applicable). The final inventory data are provided in **Appendix B**.

Table 3-1: AEBM Profiles

Profile Name	Number of Buildings (Including Mixed System Building Variants)
COM3_RM1L_MC	1
COM3_S1L_HC	1
COM3_S1L_MC	4
COM3_S2L_LC	2
COM4_C2H_LC	1
COM4_C2L_MC	2
COM4_C2M_PC	1
COM4_S2M_MC	1
COM4_S5M_PC	1
COM6_S2H_MC	1
COM7_C2L_LC	1
COM7_C2L_PC	1
COM7_C2M_MC	1
COM7_S1L_MC	2
COM7_S5M_PC	1
COM7_W2_HC	1
COM8_C1L_HC	1

Table 3-1: AEBM Profiles

Profile Name	Number of Buildings (Including Mixed System Building Variants)
COM8_C1L_MC	3
COM8_C2L_HC	3
COM8_C2L_LC	1
COM8_C2L_MC	7
COM8_RM1L_HC	1
COM8_S1L_HC	1
COM8_S1L_MC	1
COM8_S2L_HC	2
COM8_S2M_MC	1
COM8_S4L_PC	1
COM8_S4M_MC	2
COM8_S4M_PC	1
COM8_URML_LS	2
COM8_W2_HC	2
COM8_W2_LC	1
COM8_W2_MC	5
GOV1_C1H_MC	1
GOV1_C2L_LC	1
GOV1_C2L_MC	3
GOV1_C2L_PC	1
GOV1_C2M_MC	2
GOV1_C2M_PC	3
GOV1_C3L_PC	1
GOV1_S2M_HC	1
GOV1_S2M_MC	2
GOV2_C2L_LC	1
GOV2_C2L_MC	7
GOV2_C2L_PC	2
GOV2_C2M_HC	1
GOV2_RM1L_LC	1
GOV2_S1L_MC	3
GOV2_S2L_HC	1
GOV2_S3_PC	1
GOV2_S4L_MC	1
GOV2_W2_LC	1
GOV2_W2_MC	2
TOTAL	93

3.2 Hazus Study Regions

The Hazus framework utilizes “Study Regions”, defined geographically within GIS to include the user’s area of interest. For this study, Study Regions were defined to include the entire City and County of San Francisco. To maintain analytic results for future reference (i.e., to avoid over-writing results with each subsequent analysis), each scenario has been analyzed in its own study region. Study Regions may be exported from one computer, and then imported for re-use on another computer with the same version of Hazus installed. Archived Hazus study regions for each scenario earthquake are being provided as part of the deliverable package for this study.

Preliminary AEBM profiles were created in a Hazus initial study region, into which the initial inventory data were imported. Following review and revision to both the profiles and the inventory database, the initial study region (now containing all of the revised AEBM information) was duplicated and served as the baseline for each subsequent scenario analysis.

For each scenario identified in Table 2-1, the required hazard data (ground shaking data and liquefaction susceptibility) were imported into the individual Hazus study region as “User-Defined” ground motions, and “User-Defined” hazard maps, respectively, and the AEBM analysis module was executed.

3.3 Hazus Summary Reports

Hazus provides its users with standard “Summary Reports”, exportable in .PDF and other formats. For the AEBM, the summary reports include an “Individual Building Report” (IBR), providing results for individual buildings as modeled in the AEBM, and a “Portfolio Report”, summarizing the overall results of the entire portfolio modeled in the AEBM. A sample IBR for the Hall of Justice in the CAPSS San Andreas M7.9 scenario event is provided in Figure 3-1. The raw results that Hazus uses to generate the IBR have been extracted and further analyzed, as described in the next section of this report. While the IBRs associated with this study may be of value to the CPP, because of the dual-modeling approach taken to address mixed system buildings, any “Portfolio Report” generated directly by Hazus would not reflect the final results presented in this report. Accordingly, only the Individual Building Reports are being provided; PDFs of the IBRs for each scenario event are being provided as part of the deliverable package for this project.

HAZUS AEBM- Individual Building Report

1/13/2012

Building Information

Id Number: US000004
Building Name: HALL OF JUSTICE
Address: 824 Bryant
Latitude / Longitude: 37.77/-122.40
Building Profile: GOV1_C2M_MC

Ground Motion

SA @ 0.3 seconds (g) : 0.83
SA @ 1.0 seconds (g) : 0.98
PGA (g) : 0.38
Soil Type : Stiff Soils

Building Intersection Points

Displacement (in) : 10.50
Acceleration (g) : 0.40

Building Damage

Damage State	Damage State Probabilities (%)		
	Structural	Non-Structural Drift	Non-Structural Acceleration
None	0.0	1.0	13.0
Slight	2.0	5.0	22
Moderate	19.0	30.0	15
Extensive	33.0	17.0	9
Complete	46.0	46.0	41

Casualties

Casualty Level	Estimated Number of Occupants & Casualties		
	Description	Day Time Scenario	Night Time Scenario
Occupants	# of people in building	3,027	1,049
Level 1	Requires Medical Attention	129	45
Level 2	Requires Hospitalization	41	14
Level 3	Life Threatening Injury	7	2
Level 4	Death	14	5

Economic Loss

Loss Category	Building Exposure & Economic Loss		
	Exposure(\$)	Loss (\$)	Damage Ratio
Building-Structural		30,690	11.49
Building-Nonstructural	267,107	110,278	41.29
Contents	46,824	11,061	23.62
Business Interruption		69,046	
Total	313,931	221,075	

Study Region : San Francisco Capital Planning - CAPSS SA79
Scenario : CAPSS San Andreas M7.9

Figure 3-1 – Sample Hazus AEBM Individual Building Report – Hall of Justice Performance in the CAPSS M7.9 San Andreas Scenario Earthquake

4.0 RESULTS

4.1 Hazus AEBM Outputs

For each individual building modeled in the AEBM, Hazus produces the following results, considering the effects of both ground shaking and liquefaction:

- Damage state probability distributions (i.e., the probability that the building is in each of the five Hazus damage states; None, Slight, Moderate, Extensive and Complete) for structural damage, as well as non-structural damage for both drift-sensitive and acceleration-sensitive components.
- Casualties in each of the four Hazus casualty severity categories (see Table 1-4), ranging from injuries requiring basic first aid (Severity 1) to fatal injuries (Severity 4), for “Daytime” occupancy (taken in this study to represent Peak Occupancy) and “Nighttime” occupancy (off-peak occupancy). Severity Categories 1 through 3 have been grouped to represent “non-fatal injuries”, with Category 4 representing “fatalities”. Results have been provided in ranges; non-fatal injuries are reported as “none expected”, “10 or less”, “11 to 25”, “26 to 50”, “51 to 100” and “101 or more”, while fatalities are reported as “none expected”, “10 or less”, and “11 to 25”.
- Building-related direct economic losses:
 - structural damage
 - non-structural damage to drift-sensitive components
 - non-structural damage to acceleration-sensitive components
 - contents losses
 - operational losses, including relocation costs, rental costs, and lost revenue

In addition to the standard Hazus results, a number of derivative results were generated for this study, including:

- Expected mean building damage, determined as the total building loss (structural + non-structural) divided by building replacement value.
- Occupancy tagging, derived from expected mean building damage:
 - damage $\geq 50\%$ = red tag (generally non-repairable)
 - $25\% \leq$ damage $< 50\%$ = yellow tag (repairable, but not available for immediate occupancy)
 - damage $< 25\%$ = green tag (usable following the earthquake, and while any necessary repairs are being made)

These tagging definitions are consistent with those used in the City’s CAPSS project.

- Probability of collapse, determined according to the Hazus methodology as: the building’s probability of being in the Complete damage state, multiplied by the assumed probability of collapse given Complete damage, for the building’s particular Model Building Type. Hazus’ collapse rates for each model building type are provided in Table 4-1. Results have been presented in probability ranges: $<5\%$, 5 – 10% and 10 – 15%.
- Casualty rates have been derived by dividing each building’s non-fatal injury and fatality totals by peak occupancy estimates. Resulting casualty rates have been provided in ranges; non-fatal injury rates are reported as “none expected”, “5% or less”, “5 to 10%”, and “greater than 10%”, while fatalities rates are reported as “none expected”, “0.5% or less”, “0.6% to 1.0”, and “greater than 1%”.

Table 4-1: Hazus Collapse Rates

Model Building Type	Collapse Rate (Probability of Collapse Given a Complete Damage State)
C1H	5%
C1L	13%
C1M	10%
C2H	5%
C2L	13%
C2M	10%
C3H	10%
C3L	15%
C3M	13%
MH	3%
PC1	15%
PC2H	10%
PC2L	15%
PC2M	13%
RM1L	13%
RM1M	10%
RM2H	5%
RM2L	13%
RM2M	10%
S1H	3%
S1L	8%
S1M	5%
S2H	3%
S2L	8%
S2M	5%
S3	3%
S4H	3%
S4L	8%
S4M	5%
S5H	3%
S5L	8%
S5M	5%
URML	15%
URMM	15%
W1	3%
W2	3%

4.2 Overview of Scenario Losses

An overview of economic losses incurred by the 82 buildings in each of the CAPSS earthquake scenarios, due to both ground shaking and liquefaction is provided in Table 4-2. For each event, the table reports the total expected structural and non-structural damage, which together represent total building damage. Also tabulated are expected content damage and operational losses, which include lost revenue, costs to relocate operations, and costs for rental of alternate facilities. As shown, the CAPSS M7.9 San Andreas scenario event could produce economic losses close to \$1.3 billion for these 82 buildings alone. This number would increase if the entire City portfolio of 500 to 600 properties were included. Smaller events may still cause appreciable damage; the M6.9 Hayward event, which causes lower ground motions within San Francisco due to the greater distance from the earthquake fault rupture, still generates losses exceeding \$0.3 billion.

Table 4-2: Summary of Estimated Economic Impact for 82 High-Priority City-Owned Buildings in the Four CAPSS Scenario Earthquakes

	San Andreas M7.9	San Andreas M7.2	San Andreas M6.5	Hayward M6.9
Structural Damage (\$M)	190.3	108.6	66.1	55.2
Non-Structural Damage (\$M)	791.2	429.7	256.8	209.8
<i>Total Building Damage (\$M)</i>	<i>981.5</i>	<i>538.3</i>	<i>322.9</i>	<i>264.9</i>
Content Damage (\$M)	146.2	74.8	41.1	32.7
Operational Losses; Rent, Relocation & Lost Income (\$M)	151.1	92.6	71.0	63.4
Total Economic Impact (\$M)	1,278.9	705.8	435.0	361.1

Building damage impacts resulting from ground shaking and liquefaction are summarized in Table 4-3. For each scenario, total building damage (the sum of structural and non-structural damage for all buildings) is expressed as a percent of total building value⁵. The M7.9 CAPSS San Andreas event causes damage equivalent to 31% of total building value for the 82 studied buildings.

For this study, occupancy tagging has been derived from expected building damage as described previously. In the M7.9 San Andreas scenario, as many as 20 buildings are expected to be red-tagged, with an additional 34 yellow-tagged. These numbers decrease significantly in the smaller earthquake scenarios, with just one or two red-tagged and eight to 26 yellow-tagged in the remaining scenario events.

Table 4-3 also provides the distribution of buildings within three categories of collapse potential, defined by ranges of collapse probability (0 – 5%, 5 – 10% and 10 – 15%). Very few buildings – just three – have collapse probabilities exceeding 10% in the M7.9 San Andreas scenario, and none of the buildings are expected to reach this threshold in the smaller events.

⁵ current replacement value (CRV) as tabulated by the City

Table 4-3: Summary of Building Damage Impacts for 82 High-Priority City-Owned Buildings in the Four CAPSS Scenario Earthquakes

	San Andreas M7.9	San Andreas M7.2	San Andreas M6.5	Hayward M6.9
Total building damage (% of building value)	31%	17%	10%	8%
<i>Occupancy Tagging (Number of Buildings in Each Category):</i>				
# Green Tagged (Usable, Light or Moderate Damage)	28	54	69	73
# Yellow Tagged (Repairable, Cannot be Occupied)	34	26	12	8
# Red Tagged (Not Repairable)	20	2	1	1
Total # Buildings	82	82	82	82
<i>Collapse Probabilities (Number of Buildings in Each Category):</i>				
<5%	68	81	81	81
5 – 10%	11	1	1	1
10 – 15%	3	0	0	0
Total # Buildings	82	82	82	82

Expected casualties, in terms of the number of non-fatal injuries and fatalities in each event, as well as injury and fatality rates, are summarized in Table 4-4. Casualties have been estimated assuming peak facility occupancy; occupants include City employees, visitors, and members of the public, depending on facility usage. Estimates should be considered upper bound, since it is unlikely that all facilities will experience peak occupancy simultaneously. Non-fatal injuries occurring in the 82 studied buildings at peak building occupancy, including those requiring first aid, injuries requiring hospital outpatient treatment (e.g., “treat and release”) and those requiring hospitalization, range from 300 to 1,600 for the four CAPSS scenarios. Fatalities range from 10 in the M6.9 Hayward event to 100 in the M7.9 San Andreas event.

High occupancy facilities, even when moderately damaged, may generate more casualties than buildings with lower occupancy levels. To better understand the range of vulnerability to casualties, buildings have been categorized by both the number of expected injuries and deaths, and by their expected injury and fatality rates. As shown in the table, nine buildings each result in more than 50 injuries, and three of these buildings also produce more than 10 fatalities in the M7.9 CAPSS San Andreas scenario. Just three buildings have injury rates greater than 10% and four have fatality rates exceeding 1% in the same event.

Table 4-4: Summary of Estimated Casualties in 82 High-Priority City-Owned Buildings in the Four CAPSS Scenario Earthquakes

	San Andreas M7.9	San Andreas M7.2	San Andreas M6.5	Hayward M6.9
<i>Casualties (Fatal and Non-Fatal Injuries):</i>				
# Non-Fatal Injuries at Peak Occupancy	1,600	850	450	300
# Fatalities at Peak Occupancy	100	50	20	10
Total # Casualties	1,700	900	470	310
<i>Non-Fatal Injuries at Peak Occupancy (Number of Buildings in Each Category):</i>				
None Expected	6	25	36	51
10 or Less	57	44	37	23
11 to 25	8	4	6	6
26 to 50	2	5	1	1
51 to 100	4	2	0	0
101 or More	5	2	2	1
Total # Buildings	82	82	82	82
<i>Fatalities at Peak Occupancy (Number of Buildings in Each Category):</i>				
None Expected	57	65	74	77
10 or Less	22	16	8	5
11 to 25	3	1	0	0
Total # Buildings	82	82	82	82
<i>Non-Fatal Injury Rates at Peak Occupancy (Number of Buildings in Each Category):</i>				
None Expected	6	25	36	51
5% or less	53	52	45	30
5 to 10%	20	5	1	1
>10%	3	0	0	0
Total # Buildings	82	82	82	82
<i>Fatality Rates at Peak Occupancy (Number of Buildings in Each Category):</i>				
None Expected	58	69	75	78
0.5% or less	17	11	6	4
0.6 - 1%	3	1	0	0
>1%	4	1	1	0
Total # Buildings	82	82	82	82

4.3 Relationship to the CAPSS Study Results

The CAPSS study provided earthquake scenario risk assessments (including the effects of both ground shaking and liquefaction) focused on taxable properties; in general, data on non-taxable or government-owned properties were missing from the analyses. Accordingly, the results of the current study may be considered additive to the CAPSS results, although it should be noted that the current study addresses only a portion of the inventory of City-owned buildings. Table 4-5 allows for a review of predicted building damage in the CAPSS study relative to the current study. As shown, in the M7.9 San Andreas event, damage to the 82 City-owned buildings would add just 2% to the event's economic loss. It should be noted, however, that the expected mean damage levels for the City-owned buildings exceeds that of the general building inventory in most of the modeled events.

A similar comparison can be made for casualty estimates; the reader is cautioned, however, that the results here are driven by the large occupancy facilities included in the current study. In addition, there are also differences in the underlying population models used by the two studies. The CAPSS study utilized Hazus default occupancy models and census data to estimate exposed population at specific times of day (day time = 2 pm, night time = 2 am). The current study developed building-specific estimates of building occupancy at peak occupancy. For most government occupancies, peak occupancy occurs during the day; for many high-occupancy facilities, peak occupancy time is likely to be in the evening. Casualty estimates for the current study should be considered upper bound, since it is unlikely that all facilities will experience peak occupancy simultaneously. As shown in the tables, the number of additional casualties expected to occur in the City-owned buildings is not insignificant (11% more non-fatal and fatal injuries in the M7.9 San Andreas), mostly due to the specific inclusion of high-occupancy facilities.

Table 4-5: Review of Building Damage in the CAPSS Relative to the Current Assessment of 82 City-owned Buildings

	San Andreas M7.9	San Andreas M7.2	San Andreas M6.5	Hayward M6.9
Predicted Building Damage, \$Billion (percent of replacement value)				
Privately-owned Buildings in CAPSS Study	\$48 (25%)	\$30 (16%)	\$20 (10.5%)	\$14 (7%)
CPP Hazus Study (82 City-owned buildings)	\$0.98 (31%)	\$0.54 (17%)	\$0.32 (10%)	\$0.26 (8%)
Non-Fatal and Fatal Injuries at Peak Occupancy				
Privately-owned Buildings in CAPSS Study	14,050 880	7,050 300	4,400 120	2,870 120
CPP Hazus Study (82 City-owned buildings)	1,600 100	850 50	450 20	300 10

4.4 Individual Building Results

Detailed individual building results in each of the scenario earthquakes are provided in **Appendix C**. Table 4-6 provides building rankings in each scenario event, based on total economic impact. As shown, the Hall of Justice experiences the largest economic impact in all four CAPSS scenarios. This is due, in part, to significant operational losses (e.g., \$69 million in the M7.9 San Andreas scenario) expected for continued operation of the building's function in an alternate location(s), should the building be significantly damaged. At the other end of the spectrum, the Jones Street Tank House has the smallest economic impact in all scenario events.

Table 4-7 provides building rankings in each scenario event, based on mean percent building damage. As shown, the buildings with the highest expected percent building damage in the San Andreas events include Kezar Pavilion and the Animal Care & Control Facility (which is also highly ranked in the Hayward scenario.) Facilities expecting the least amount of damage include the new Chinese Rec Center, and the Sheriff's Facility - Inmate Housing.

Table 4-8 provides building rankings based on expected number of non-fatal injuries, for each scenario event. Kezar Pavilion and the Hall of Justice are highly ranked in all events, as are the City's high occupancy venues (Moscone Center (North and South), Bill Graham Civic Auditorium, War Memorial Opera House, and Davies Symphony Hall), all of which rank in the top 12 for all scenarios. Facilities with the least number of expected injuries include the new Chinese Rec Center, Minnie & Lovie Ward Rec Center, and the recently retrofitted SFGH Service Building (Building #2). An equivalent table for fatalities rankings is not provided, as the rankings are similar to those for non-fatal injuries.

Table 4-9 lists the building rankings for non-fatal injury rates in each scenario event. While the buildings ranked highly on this list may not produce a large number of injuries, the likelihood of a building occupant being injured in these buildings is greater. Rankings for this loss metric are less uniform than that for casualty estimates, especially for the smaller events. Highly ranked buildings in the larger San Andreas scenarios include the Animal Care & Control Facility, Ingleside Police Station, Tom Waddell Clinic, Park Senior Center, and Kezar Pavilion. It is noteworthy that Kezar Pavilion is highly ranked both in total non-fatal injuries and in non-fatal injury rates.

Table 4-6: Building Rankings – Total Economic Impact

Building	San Andreas M7.9	San Andreas M7.2	San Andreas M6.5	Hayward M6.9
Hall of Justice	1	1	1	1
SFGH - Building 5 (Main Hospital)	2	2	2	2
1 South Van Ness	3	3	3	3
War Memorial Veterans Building	4	4	5	5
War Memorial Opera House	5	6	8	11
SFGH - Building 80	6	5	7	7
Davies Symphony Hall	7	7	6	6
Laguna Honda Main Hospital (A and B Wings)	8	10	11	21
170 Otis	9	8	4	4
DPH Central Office (101 Grove)	10	9	9	9
Moscone Center (South)	11	11	15	13
30 Van Ness	12	13	18	17
Bill Graham Civic Auditorium	13	17	21	19
1650 Mission	14	12	13	15
Laguna Honda Main Hospital (H Wing)	15	16	17	23
Moscone North	16	15	19	16
Laguna Honda Main Hospital (C Wing)	17	21	24	30
Animal Care and Control Facility	18	14	10	8
Tom Waddell Clinic	19	20	23	20
Central Shops	20	18	14	12
SFGH - Mental Health Building	21	26	27	27
Sheriffs Facility (Inmate Housing)	22	19	12	10
1660 Mission	23	24	25	22
Kezar Pavilion	24	23	20	28
1680 Mission	25	27	28	26
YGC Admin & Courts Building	26	29	26	34
Public Defender's Office	27	22	16	14
Sheriffs Facility (Admin Building)	28	25	22	18
SFGH - Mental Health Support Building	29	32	33	31
YGC Service Building (Building #2)	30	30	32	39
Pump Station #1 (SFFD HQ)	31	28	30	24
Ingleside Police Station	32	31	31	40
Northern Police Station	33	33	34	33
Pump Station #2 (Fort Mason)	34	35	40	32
Fire Station #5	35	36	38	35
Fire Station #31	36	37	37	49
DPW Yard - Building B	37	46	53	42
DPW Yard - Building C	38	47	54	43
McLaren Lodge Annex	39	44	39	56
Ashbury Street Tank & Tank House	40	42	48	52
South of Market/Gene Friend Rec Center	41	34	29	25
Fire Station #7	42	41	41	37
Fire Station #40	43	38	35	45
Fire Station #10	44	45	43	41
Park Senior Center	45	40	42	65
Fire Station #36	46	43	44	36
Taraval Police Station - Original Wing	47	48	46	77
Tenderloin Rec Center	48	49	51	38
Fire Station #11	49	65	59	59
Fire Station #15	50	50	47	69
Eureka Valley Rec Center (Auditorium & Locker Room)	51	57	60	67

Table 4-6: Building Rankings – Total Economic Impact

Building	San Andreas M7.9	San Andreas M7.2	San Andreas M6.5	Hayward M6.9
Sunset Rec Center (Gym)	52	61	56	72
Moscone Rec Center	53	39	36	29
Fire Station #2	54	56	62	44
Glen Park Rec Center	55	54	52	66
DPW Yard - Building A	56	66	69	57
Upper Noe Rec Center (Gym)	57	60	64	68
Mission Rec Center (Main)	58	51	50	47
Joseph Lee Rec Center (Gym)	59	63	63	64
Eureka Valley Rec Center (Gym)	60	73	75	70
SFGH - Building 2 (Service Building)	61	59	57	48
Jackson Playground and Clubhouse	62	62	65	55
St. Mary's Rec Center (Gym)	63	58	58	63
Taraval Police Station - Addition #1	64	64	61	78
Hamilton Rec Center (Gym)	65	52	49	46
Taraval Police Station - Addition #2	66	67	68	79
Upper Noe Rec Center (Auditorium & Lobby)	67	71	72	73
Minnie & Lovie Ward Rec Center	68	53	45	71
Sunset Rec Center (Field House)	69	77	76	80
Potrero Hill Rec Center (Gym)	70	72	74	58
Hamilton Rec Center (Pool Building)	71	55	55	51
Fire Station #38	72	69	77	61
Fire Division of Training	73	70	70	62
Mission Rec Center (Clubhouse)	74	68	66	60
St. Mary's Rec Center (Field House)	75	75	78	75
Potrero Hill Rec Center (Field House)	76	81	81	74
Joseph Lee Rec Center (Field House)	77	80	80	76
Chinese Rec Center (New)	78	74	73	54
Hall of Justice Gas Station	79	76	67	50
County Fair Building	80	79	79	81
Woh Hei Yuen Rec Center	81	78	71	53
Jones St Tank & Tank House	82	82	82	82

Table 4-7: Building Rankings – Mean Building Damage

Building	San Andreas M7.9	San Andreas M7.2	San Andreas M6.5	Hayward M6.9
Kezar Pavilion	1	2	2	14
Animal Care and Control Facility	2	1	1	1
Tom Waddell Clinic	3	8	16	10
Ingleside Police Station	4	6	14	43
War Memorial Veterans Building	5	10	18	13
Pump Station #2 (Fort Mason)	6	13	29	12
DPH Central Office (101 Grove)	7	9	17	11
Park Senior Center	8	5	9	42
SFGH - Building 80	9	14	30	15
Central Shops	10	4	3	2
Fire Station #31	11	7	13	27
Ashbury Street Tank & Tank House	12	18	25	36
Laguna Honda Main Hospital (C Wing)	13	19	27	48
Laguna Honda Main Hospital (A and B Wings)	14	20	26	47
Fire Station #5	15	12	19	22
Fire Station #40	16	3	4	17
Northern Police Station	17	15	21	24
YGC Service Building (Building #2)	18	23	23	55
170 Otis	19	11	6	5
Hall of Justice	20	16	5	3
1680 Mission	21	27	28	16
County Fair Building	22	21	15	51
Taraval Police Station - Addition #1	23	28	22	70
Taraval Police Station - Original Wing	24	29	24	81
Jackson Playground and Clubhouse	25	30	33	18
Taraval Police Station - Addition #2	26	34	31	73
30 Van Ness	27	36	53	28
McLaren Lodge Annex	28	33	20	52
Hall of Justice Gas Station	29	17	8	6
1 South Van Ness	30	31	34	21
Sunset Rec Center (Field House)	31	55	47	77
DPW Yard - Building C	32	46	57	39
DPW Yard - Building B	33	45	56	40
Eureka Valley Rec Center (Auditorium & Locker Room)	34	54	51	61
Tenderloin Rec Center	35	32	41	20
Fire Station #10	36	38	32	38
SFGH - Mental Health Building	37	52	60	45
SFGH - Mental Health Support Building	38	53	61	46
South of Market/Gene Friend Rec Center	39	22	7	4
Fire Station #15	40	48	44	79
1660 Mission	41	35	39	26
Moscone Rec Center	42	24	10	8
Woh Hei Yuen Rec Center	43	25	11	7
Public Defender's Office	44	26	12	9
Upper Noe Rec Center (Gym)	45	51	54	65
Fire Station #7	46	43	37	34
Fire Division of Training	47	42	38	35
Davies Symphony Hall	48	37	45	25
Sunset Rec Center (Gym)	49	59	50	80
YGC Admin & Courts Building	50	56	49	74
Fire Station #36	51	44	42	29

Table 4-7: Building Rankings – Mean Building Damage

Building	San Andreas M7.9	San Andreas M7.2	San Andreas M6.5	Hayward M6.9
Eureka Valley Rec Center (Gym)	52	69	63	67
1650 Mission	53	39	43	30
Fire Station #11	54	70	64	69
War Memorial Opera House	55	57	69	54
Mission Rec Center (Main)	56	40	36	32
Mission Rec Center (Clubhouse)	57	41	35	31
Upper Noe Rec Center (Auditorium & Lobby)	58	62	59	71
Pump Station #1 (SFFD HQ)	59	50	52	23
DPW Yard - Building A	60	73	70	63
Bill Graham Civic Auditorium	61	66	77	53
Joseph Lee Rec Center (Field House)	62	74	71	60
Potrero Hill Rec Center (Field House)	63	75	74	59
Joseph Lee Rec Center (Gym)	64	61	65	68
Hamilton Rec Center (Gym)	65	47	40	33
Glen Park Rec Center	66	63	58	78
SFGH - Building 5 (Main Hospital)	67	64	72	49
Moscone Center (South)	68	72	78	50
St. Mary's Rec Center (Field House)	69	60	62	72
Fire Station #2	70	71	73	44
Laguna Honda Main Hospital (H Wing)	71	65	67	76
Hamilton Rec Center (Pool Building)	72	49	46	37
Sheriffs Facility (Admin Building)	73	58	48	19
Jones St Tank & Tank House	74	76	75	56
Potrero Hill Rec Center (Gym)	75	79	79	64
St. Mary's Rec Center (Gym)	76	67	68	75
Fire Station #38	77	78	80	66
Moscone North	78	77	82	57
Minnie & Lovie Ward Rec Center	79	68	55	82
SFGH - Building 2 (Service Building)	80	80	76	62
Chinese Rec Center (New)	81	82	81	58
Sheriffs Facility (Inmate Housing)	82	81	66	41

Table 4-8: Building Rankings – Non-Fatal Injuries

Building	San Andreas M7.9	San Andreas M7.2	San Andreas M6.5	Hayward M6.9
Kezar Pavilion	1	1	1	2
Hall of Justice	2	2	2	1
Moscone Center (South)	3	4	9	6
Bill Graham Civic Auditorium	4	5	5	4
War Memorial Veterans Building	5	3	3	3
Moscone North	6	7	12	10
War Memorial Opera House	7	9	10	11
Davies Symphony Hall	8	6	4	5
1 South Van Ness	9	8	6	8
County Fair Building	10	10	7	19
SFGH - Building 5 (Main Hospital)	11	11	11	9
170 Otis	12	12	8	7
30 Van Ness	13	16	21	21
SFGH - Building 80	14	14	19	17
DPH Central Office (101 Grove)	15	13	18	15
Laguna Honda Main Hospital (A and B Wings)	16	19	22	23
Park Senior Center	17	17	15	32
1650 Mission	18	15	14	16
1660 Mission	19	20	20	20
Animal Care and Control Facility	20	18	13	12
Central Shops	21	21	16	13
McLaren Lodge Annex	22	24	23	33
Tom Waddell Clinic	23	23	25	24
Laguna Honda Main Hospital (C Wing)	24	25	28	34
SFGH - Mental Health Building	25	31	32	36
Ingleside Police Station	26	26	29	35
1680 Mission	27	27	30	26
Laguna Honda Main Hospital (H Wing)	28	32	33	37
YGC Service Building (Building #2)	29	33	34	38
Tenderloin Rec Center	30	28	31	27
Jackson Playground and Clubhouse	31	34	35	28
South of Market/Gene Friend Rec Center	32	22	17	14
Mission Rec Center (Main)	33	29	26	25
Northern Police Station	34	35	36	39
SFGH - Mental Health Support Building	35	40	47	47
Eureka Valley Rec Center (Auditorium & Locker Room)	36	41	48	48
YGC Admin & Courts Building	37	42	49	49
Fire Station #5	38	43	40	42
Moscone Rec Center	39	30	24	18
Fire Division of Training	40	36	37	40
Pump Station #1 (SFFD HQ)	41	37	38	29
Ashbury Street Tank & Tank House	42	44	50	50
Fire Station #31	43	45	41	43
Pump Station #2 (Fort Mason)	44	46	51	51
Sunset Rec Center (Field House)	45	58	58	58
Sunset Rec Center (Gym)	46	59	59	59
Upper Noe Rec Center (Gym)	47	47	52	52
Upper Noe Rec Center (Auditorium & Lobby)	48	60	60	60
Eureka Valley Rec Center (Gym)	49	61	61	61

Table 4-8: Building Rankings – Non-Fatal Injuries

Building	San Andreas M7.9	San Andreas M7.2	San Andreas M6.5	Hayward M6.9
Public Defender's Office	50	38	27	22
Mission Rec Center (Clubhouse)	51	39	39	41
Fire Station #40	52	48	42	44
DPW Yard - Building B	53	62	62	62
DPW Yard - Building C	54	63	63	63
Taraval Police Station - Addition #1	55	64	64	64
Taraval Police Station - Original Wing	56	49	53	53
Taraval Police Station - Addition #2	57	65	65	65
Fire Station #15	58	66	66	66
Fire Station #10	59	50	54	54
St. Mary's Rec Center (Field House)	60	67	67	67
Fire Station #11	61	68	68	68
Glen Park Rec Center	62	69	69	69
Woh Hei Yuen Rec Center	63	51	43	30
Fire Station #36	64	52	55	55
Fire Station #7	65	53	56	56
St. Mary's Rec Center (Gym)	66	70	70	70
Fire Station #2	67	71	71	71
Joseph Lee Rec Center (Field House)	68	72	72	72
Hamilton Rec Center (Gym)	69	54	44	45
Hamilton Rec Center (Pool Building)	70	55	45	46
Joseph Lee Rec Center (Gym)	71	73	73	73
DPW Yard - Building A	72	74	74	74
Potrero Hill Rec Center (Field House)	73	75	75	75
Sheriffs Facility (Admin Building)	74	56	57	57
Potrero Hill Rec Center (Gym)	75	76	76	76
Sheriffs Facility (Inmate Housing)	76	57	46	31
Hall of Justice Gas Station	77	77	77	77
Jones St Tank & Tank House	78	78	78	78
Fire Station #38	79	79	79	79
Minnie & Lovie Ward Rec Center	80	80	80	80
SFGH - Building 2 (Service Building)	81	81	81	81
Chinese Rec Center (New)	82	82	82	82

Table 4-9: Building Rankings – Non-Fatal Injury Rates

Building	San Andreas M7.9	San Andreas M7.2	San Andreas M6.5	Hayward M6.9
Animal Care and Control Facility	1	1	1	1
Ingleside Police Station	2	3	16	37
Tom Waddell Clinic	3	4	9	10
Park Senior Center	4	5	7	34
Kezar Pavilion	5	2	3	12
Ashbury Street Tank & Tank House	6	6	47	47
Pump Station #2 (Fort Mason)	7	8	48	48
Laguna Honda Main Hospital (C Wing)	8	18	28	43
Fire Station #5	9	25	11	35
Fire Station #31	10	10	4	33
Laguna Honda Main Hospital (A and B Wings)	11	21	24	22
Northern Police Station	12	11	15	36
Taraval Police Station - Addition #1	13	58	58	58
Taraval Police Station - Addition #2	14	59	59	59
YGC Service Building (Building #2)	15	23	22	40
War Memorial Veterans Building	16	14	20	11
Central Shops	17	9	6	2
DPH Central Office (101 Grove)	18	12	23	9
SFGH - Building 80	19	20	26	14
Hall of Justice	20	15	5	3
County Fair Building	21	19	13	25
1680 Mission	22	24	31	13
170 Otis	23	17	10	5
30 Van Ness	24	34	36	24
Fire Station #40	25	7	2	32
McLaren Lodge Annex	26	38	21	39
Mission Rec Center (Main)	27	26	17	15
Eureka Valley Rec Center (Auditorium & Locker Room)	28	45	54	54
Sunset Rec Center (Field House)	29	60	60	60
Taraval Police Station - Original Wing	30	13	49	49
Mission Rec Center (Clubhouse)	31	16	19	38
1 South Van Ness	32	33	30	17
Fire Division of Training	33	32	29	44
Tenderloin Rec Center	34	35	37	18
South of Market/Gene Friend Rec Center	35	22	8	4
Jackson Playground and Clubhouse	36	43	38	19
DPW Yard - Building A	37	61	61	61
Fire Station #15	38	62	62	62
SFGH - Mental Health Building	39	50	39	45
Eureka Valley Rec Center (Gym)	40	63	63	63
1650 Mission	41	37	33	21
Upper Noe Rec Center (Auditorium & Lobby)	42	64	64	64
DPW Yard - Building B	43	65	65	65
DPW Yard - Building C	44	66	66	66
Fire Station #11	45	67	67	67
Fire Station #10	46	27	50	50
1660 Mission	47	39	32	23
Davies Symphony Hall	48	41	35	20
SFGH - Mental Health Support Building	49	52	56	56
Upper Noe Rec Center (Gym)	50	44	53	53

Table 4-9: Building Rankings – Non-Fatal Injury Rates

Building	San Andreas M7.9	San Andreas M7.2	San Andreas M6.5	Hayward M6.9
Public Defender's Office	51	28	12	6
YGC Admin & Courts Building	52	53	57	57
Pump Station #1 (SFFD HQ)	53	40	34	16
Fire Station #36	54	29	51	51
War Memorial Opera House	55	47	41	27
Fire Station #7	56	30	52	52
Woh Hei Yuen Rec Center	57	31	14	7
Fire Station #2	58	68	68	68
St. Mary's Rec Center (Field House)	59	69	69	69
Joseph Lee Rec Center (Field House)	60	70	70	70
Potrero Hill Rec Center (Field House)	61	71	71	71
Moscone Rec Center	62	36	18	8
Bill Graham Civic Auditorium	63	51	43	28
Sunset Rec Center (Gym)	64	72	72	72
Laguna Honda Main Hospital (H Wing)	65	55	42	46
Moscone Center (South)	66	54	45	30
SFGH - Building 5 (Main Hospital)	67	49	40	26
Hamilton Rec Center (Pool Building)	68	42	25	41
Hamilton Rec Center (Gym)	69	46	27	42
St. Mary's Rec Center (Gym)	70	73	73	73
Joseph Lee Rec Center (Gym)	71	74	74	74
Potrero Hill Rec Center (Gym)	72	75	75	75
Sheriffs Facility (Admin Building)	73	48	55	55
Moscone North	74	56	46	31
Glen Park Rec Center	75	76	76	76
Sheriffs Facility (Inmate Housing)	76	57	44	29
Hall of Justice Gas Station	77	77	77	77
Jones St Tank & Tank House	78	78	78	78
Fire Station #38	79	79	79	79
Minnie & Lovie Ward Rec Center	80	80	80	80
SFGH - Building 2 (Service Building)	81	81	81	81
Chinese Rec Center (New)	82	82	82	82

To provide “highlights” of the individual building results and provide a view of highly ranked buildings across the various metrics, Table 4-10 provides a list of specific buildings which meet a variety of “High-Impact” criteria for the CAPSS San Andreas M7.9 scenario event, including:

- Total economic impact exceeding \$50M
- Operational losses exceeding \$5M
- Red-Tagged, with mean damage exceeding 70% (Note that red-tagged buildings have been defined as those with mean damage exceeding 50%; this is a subset of the more heavily damaged red-tagged buildings)
- Probability of collapse greater than 10%
- More than 50 non-fatal injuries, and/or more than 10 fatalities
- Injury rates exceeding 10% and/or fatality rates exceeding 1%.

Within the table, buildings appearing in multiple categories have been highlight in color; buildings with no shading appear in just one category. Each column is presented in descending value order; buildings at the top of the list incur larger impacts than those at the bottom. Similar tables for the other scenarios are provided in Tables 4-11 (San Andreas M7.2), Table 4-12 (San Andreas M6.5), and Table 4-13 (Hayward M6.9). While the number of buildings meeting the various “High-Impact” criteria decreases in the smaller events, just one building - the Hall of Justice - meets the economic loss and high casualty criteria in all events modeled.

Table 4-10: Buildings Meeting Selected “High Impact” Criteria in the CAPSS San Andreas M7.9 Scenario Earthquake

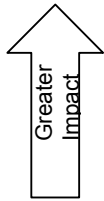
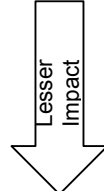
	Buildings with total economic impact > \$50M	Buildings with operational losses >\$5M	Red-Tagged Buildings w/ >70% Mean Building Damage	Buildings with Probability of Collapse >10%	Buildings with more than 50 Non-Fatal Injuries (& More Than 10 Fatalities, in italics)	Buildings with Injury Rates >10% and/or Fatality Rates >1%
 	Hall of Justice	Hall of Justice	Kezar Pavilion	Animal Care and Control Facility	<i>Kezar Pavilion</i>	Ingleside Police Station
	SFGH – Building 5 (Main Hospital)	SFGH – Building 5 (Main Hospital)	Animal Care and Control Facility	Tom Waddell Clinic	<i>Hall of Justice</i>	Tom Waddell Clinic
	1 South Van Ness	1 South Van Ness	Tom Waddell Clinic	Ingleside Police Station	<i>Moscone Center (South)</i>	Animal Care & Control Facility
	War Memorial Veterans Building	170 Otis	Ingleside Police Station		Bill Graham Civic Auditorium	
	War Memorial Opera House		War Memorial Veterans Building		War Memorial Veterans Building	
	SFGH – Building 80		Pump Station #2 (Fort Mason)		Moscone North	
			DPH Central Office (101 Grove)		War Memorial Opera House	
			Park Senior Center		Davies Symphony Hall	
					1 South Van Ness	

Table 4-11: Buildings Meeting Selected “High Impact” Criteria in the CAPSS San Andreas M7.2 Scenario Earthquake

Buildings with total economic impact > \$50M	Buildings with operational losses >\$5M	Red-Tagged Buildings w/ >70% Mean Building Damage	Buildings with Probability of Collapse >10%	Buildings with 51 or more Non-Fatal Injuries (& 11 or More Fatalities, in italics)	Buildings with Injury Rates >10% and/or Fatality Rates >1%
Hall of Justice	Hall of Justice	Animal Care and Control Facility		Kezar Pavilion	Animal Care and Control Facility
SFGH – Building 5 (Main Hospital)	SFGH – Building 5 (Main Hospital)			Hall of Justice	
1 South Van Ness	1 South Van Ness			War Memorial Veterans Building	
				Moscone Center (South)	

Table 4-12: Buildings Meeting Selected “High Impact” Criteria in the CAPSS San Andreas M6.5 Scenario Earthquake

Buildings with total economic impact > \$50M	Buildings with operational losses >\$5M	Red-Tagged Buildings w/ >70% Mean Building Damage	Buildings with Probability of Collapse >10%	Buildings with 51 or more Non-Fatal Injuries (& 11 or More Fatalities, in italics)	Buildings with Injury Rates >10% and/or Fatality Rates >1%
Hall of Justice	Hall of Justice			Kezar Pavilion	Animal Care and Control Facility
	SFGH – Building 5 (Main Hospital)			Hall of Justice	
	1 South Van Ness				

Table 4-13: Buildings Meeting Selected “High Impact” Criteria in the CAPSS Hayward M6.9 Scenario Earthquake

Buildings with total economic impact > \$50M	Buildings with operational losses >\$5M	Red-Tagged Buildings w/ >70% Mean Building Damage	Buildings with Probability of Collapse >10%	Buildings with 51 or more Non-Fatal Injuries (& 11 or More Fatalities, in italics)	Buildings with Injury Rates >10% and/or Fatality Rates >1%
Hall of Justice	Hall of Justice			Hall of Justice	
	SFGH – Building 5 (Main Hospital)				

4.5 Summary of Project Deliverables

In addition to this project report, the following materials are included in the deliverable package for this study:

- Spreadsheets of the AEBM profile information, AEBM inventory data, and detailed analysis results.
- Archived Hazus Study Regions for each scenario, containing the custom AEBM profile and inventory databases, as well as the analysis results. (It should be noted that the Hazus software (and associated ArcGIS license) will be required to make use of the study region data.)
- PDFs of the Hazus Individual Building Reports (IBRs) for each scenario event.

5.0 RECOMMENDATIONS

The results of the current study may be used to further prioritize mitigation activities, including recommending the “High-Impact” buildings as candidates for detailed engineering evaluations (if such studies do not exist or are out of date), design of building strengthening or retrofit recommendations, as necessary, and implementation of such retrofit activities. While the buildings identified in Tables 4-10 through 4-13 are valid candidates for further review and evaluation, the CPP may want to set alternate selection criteria, based on the results of the current risk assessment combined with other internal priority schemes. With more than \$1.3 billion in losses possible in a M7.9 San Andreas earthquake for just 82 of the City’s more than 500 buildings, serious consideration should be given to addressing these risks, starting with further detailed engineering reviews.

A large number of loss estimates have been produced in the current study; detailed building level results are provided in this report’s appendix (**Appendix C**). Every effort has been made to accurately classify each building’s structural system and design level. For buildings where the current categorization differs from user expectations, sensitivity studies or “what-if” analyses could be conducted to shed further light on the potential variations in performance resulting from a range of building categorizations, or a more detailed engineering review could be implemented to fine-tune the categorization. Further, a similar analytical approach can be used to assess the potential improvement in performance associated with various conceptual mitigation strategies, including those related to liquefaction.

A number of high-priority buildings were omitted from the current analysis because the standard Hazus models are not designed for direct application to base-isolated buildings (i.e., Main Library, City Hall, and the City’s Emergency Operations Center). While these buildings are expected to perform well under earthquake loading, if the quantification of potential impacts to these buildings is considered essential, an engineering evaluation to assess how best to modify the Hazus vulnerability models to reflect base-isolation could be conducted, allowing these facilities to be analyzed within Hazus. This may be of lower priority, however, than the activities mentioned above.

The data developed in this study should be incorporated into the City’s future prioritization activities. It may also be used as input to Benefit-Cost Analyses. In particular, the characterization of the buildings “as-is” may be input into FEMA’s Benefit Cost Analysis (BCA) Software, whose implementation is required as part of FEMA’s mitigation grant application process.

Finally, to provide the City with a more comprehensive view of their earthquake risk, it is recommended that the remainder of the City-owned buildings be similarly analyzed using Hazus. Further, to better reflect the full range of potential seismic hazards threatening the City, implementation of Hazus’ average annualized loss (AAL) methodology is also recommended⁶. Use of the AAL would provide several benefits; the City would have access to a single comprehensive risk estimate for each building, developed using the USGS’ current state-of-the-art probabilistic ground motion data.

⁶ It should be noted that the AAL methodology is automated within Hazus only for the regional building inventory. However, the AAL methodology can be implemented for an AEBM analysis by executing a series of “return period” runs, and combining these results outside of Hazus (e.g., in a spreadsheet).

6.0 REFERENCES

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APPENDIX A – ALTERNATE ANALYSIS FOR THE M7.9 SAN ANDREAS SCENARIO (USGS SHAKEMAP)

Alternate Analysis for the M7.9 San Andreas Earthquake Scenario Using a USGS ShakeMap

In addition to the four CAPSS earthquake scenarios, an alternate “ShakeMap” scenario for the M7.9 San Andreas event, developed by the United States Geological Survey (USGS), was also analyzed. The CAPSS scenarios were developed for the Phase 1 CAPSS Project in 2002, using best available ground motion estimation methods. These differ somewhat from the relationships used by the USGS as the ShakeMap development standard. The ShakeMap scenario was considered in addition to the CAPSS scenarios to provide insight into potential differences resulting from the different ground motion estimation techniques employed. As demonstrated in Table A-1, there are differences between the CAPSS and ShakeMap ground motions, particularly for 1.0 second spectral accelerations. It should also be noted that the CAPSS ground motions were computed at a City Block level, providing much greater refinement than the regional ShakeMap, both geographically and in terms of contour intervals.

Table A-1: Comparison of M7.9 San Andreas Earthquake Scenario Ground Motions

Scenario	Event	Fault/Segment	Moment Magnitude	Range of Peak Ground Acceleration	Range of 0.3 Second Spectral Acceleration	Range of 1.0 Second Spectral Acceleration
CAPSS	SA79	San Andreas/ Multi-Segment	7.9	0.36 - 0.67g	0.75 - 1.37g	0.40 - 1.0g
USGS	SA79_V2	San Andreas/ Multi-Segment	7.9	0.32 - 0.60g	0.60 - 1.28g	0.40 - 1.48g

USGS ShakeMap data for the M7.9 San Andreas Scenario

In addition to providing real-time earthquake hazard information, the USGS ShakeMap Program (<http://earthquake.usgs.gov/earthquakes/shakemap/>) has generated a significant number of ground motion maps for earthquake scenarios. Among the 36 ShakeMaps currently available for the Bay Area (<http://earthquake.usgs.gov/earthquakes/shakemap/list.php?x=1&n=nc&s=1>) are three events equivalent to the CAPSS M7.9 San Andreas, the M7.2 San Andreas, and the M6.9 Hayward scenarios. The current standard ShakeMap attenuation relationships (Boore et al., 1997 for PGA and Sa, and Joyner and Boore 1988 for PGV) differ from those used in the CAPSS Project.

Analysis of the USGS ShakeMap for the M7.9 San Andreas event (shown in Figure A-1) was included to assess the potential difference in loss for the high-priority city-owned buildings resulting from the variation in ground motions. The M7.9 event was selected because it creates the strongest ground motions within the City of San Francisco, and would effectively “bound” the difference in loss (i.e., smaller scenarios could be expected to show smaller differences in loss).

It should be noted that the current “state-of-the-art” in attenuation, as represented by the “Next Generation of Attenuation” (NGA) Relationships, have not yet made their way into standard practice in the development of ShakeMaps, or for use in Hazus. Nevertheless, some initial testing of NGA-based ground motions has occurred. In 2009, the California Geological Survey (CGS) implemented a statewide Hazus loss estimate study using USGS ShakeMaps and Hazus default inventory data (California Geological Survey, 2009). Included in their analysis was a comparison of Hazus results for selected scenarios using standard USGS ShakeMaps and NGA-based ShakeMaps, developed using earthquake source parameters and probability results from the 2008 “Uniform California Earthquake Rupture Forecast” Version 2 (UCERF2). For Northern California, the four scenarios analyzed show a 40 – 63% decrease in building-related economic loss estimates (see: http://www.consrv.ca.gov/cgs/rghm/loss/Pages/2009_analysis.aspx), when modeled using the UCERF2-NGA scenarios. This implies that an even larger range of losses is possible, with NGA-based ground motions likely representing a lower bound, although the actual outcome would depend on how these ground motion data finally make their way into standard Hazus applications.

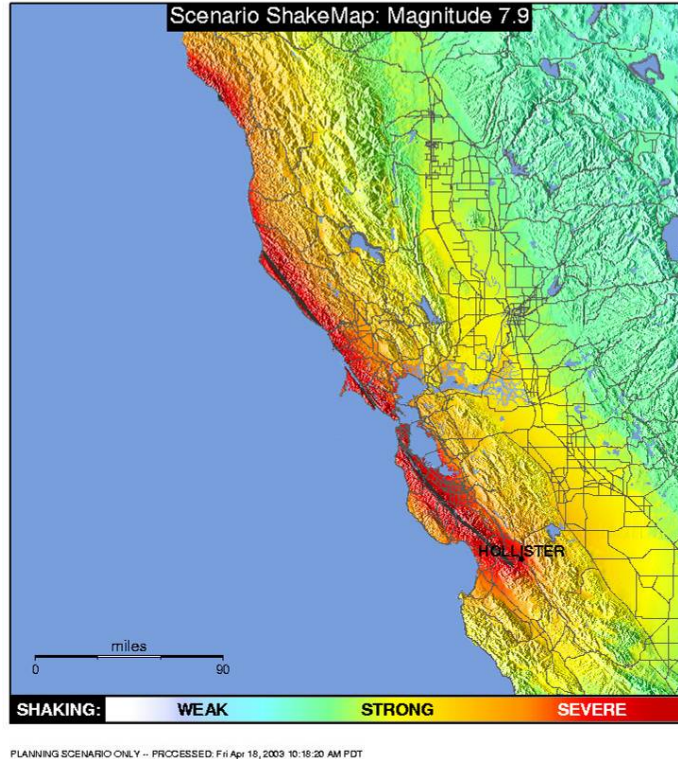


Figure A-1: USGS ShakeMap for the M7.9 San Andreas Scenario Earthquake
http://earthquake.usgs.gov/earthquakes/shakemap/nc/shake/SanAndreas_10_se/

Results

As discussed in this report, and shown in Table A-2, the M7.9 San Andreas event (as modeled for the CAPSS Project) could produce economic losses close to \$1.3 billion for the 82 high-priority buildings studied. This number would increase if the entire City portfolio of 500 to 600 properties were included. The potential uncertainty in this number is demonstrated by comparing this estimate to the losses incurred in the alternate version of the M7.9 scenario, as modeled by the USGS' ShakeMap, which is 33% larger with losses exceeding \$1.7 billion.

Table A-2: Estimated Economic Impact for 82 High-Priority City-Owned Buildings in Alternate Versions of the M7.9 San Andreas Scenario Earthquake

	San Andreas M7.9 (CAPSS)	San Andreas M7.9 (USGS ShakeMap)
Structural Damage (\$M)	190.3	239.7
Non-Structural Damage (\$M)	791.2	1,068.5
<i>Total Building Damage (\$M)</i>	<i>981.5</i>	<i>1,308.2</i>
Content Damage (\$M)	146.2	237.1
Operational Losses; Rent, Relocation & Lost Income (\$M)	151.1	162.6
Total Economic Impact (\$M)	1,278.9	1,708.0

Table A-3 provides a comparison of building damage impacts in the two versions of the M7.9 San Andreas scenario. As shown, the ShakeMap scenario causes damage equivalent to 41% of total building value for the 82 studied buildings, relative to 31% estimated in the CAPSS scenario.

In the CAPSS San Andreas M7.9 scenario, as many as 20 buildings are expected to be red-tagged, with an additional 34 yellow-tagged. In the alternate ShakeMap scenario, the distribution of red and yellow tagged buildings is reversed, with 35 red-tagged and 26 yellow-tagged buildings.

While just three buildings have collapse probabilities exceeding 10% in the M7.9 CAPSS San Andreas scenario, nine are in this category under the alternate M7.9 ShakeMap scenario.

Table A-3: Building Damage Impacts for 82 High-Priority City-Owned Buildings in Alternate Versions of the M7.9 San Andreas Scenario Earthquake

	San Andreas M7.9 (CAPSS)	San Andreas M7.9 (USGS ShakeMap)
Total building damage (% of building value)	31%	41%
<i>Occupancy Tagging (Number of Buildings in Each Category):</i>		
# Green Tagged (Usable, Light or Moderate Damage)	28	21
# Yellow Tagged (Repairable, Cannot be Occupied)	34	26
# Red Tagged (Not Repairable)	20	35
Total # Buildings	82	82
<i>Collapse Probabilities (Number of Buildings in Each Category):</i>		
<5%	68	57
5 – 10%	11	16
10 – 15%	3	9
Total # Buildings	82	82

Expected casualties, in terms of the number of non-fatal injuries and fatalities in each event, as well as injury and fatality rates, are summarized in Table A-4. As noted in the main body of this report, casualties have been estimated assuming peak facility occupancy; occupants include City employees, visitors, and members of the public, depending on facility usage.

Non-fatal injuries occurring in the 82 studied buildings at peak building occupancy, including those requiring first aid, injuries requiring hospital outpatient treatment (e.g., “treat and release”) and those requiring hospitalization, reach 1,600 in the CAPSS M7.9 San Andreas Scenario, and 2,050 in the alternate ShakeMap version of the same event. Fatalities reach 100 in the CAPSS M7.9 San Andreas event, and 130 in the ShakeMap scenario.

Table A-4: Estimated Casualties in 82 High-Priority City-Owned Buildings in Alternate Versions of the M7.9 San Andreas Scenario Earthquake

	San Andreas M7.9 (CAPSS)	San Andreas M7.9 (USGS ShakeMap)
<i>Casualties (Fatal and Non-Fatal Injuries):</i>		
# Non-Fatal Injuries at Peak Occupancy	1,600	2,050
# Fatalities at Peak Occupancy	100	130
<i>Total # Casualties</i>	<i>1,700</i>	<i>2,180</i>
<i>Non-Fatal Injuries at Peak Occupancy (Number of Buildings in Each Category):</i>		
None Expected	6	8
10 or Less	57	51
11 to 25	8	8
26 to 50	2	4
51 to 100	4	5
101 or More	5	6
<i>Total # Buildings</i>	<i>82</i>	<i>82</i>
<i>Fatalities at Peak Occupancy (Number of Buildings in Each Category):</i>		
None Expected	57	48
10 or Less	22	31
11 to 25	3	3
<i>Total # Buildings</i>	<i>82</i>	<i>82</i>
<i>Non-Fatal Injury Rates at Peak Occupancy (Number of Buildings in Each Category):</i>		
None Expected	6	8
5% or less	53	38
5 to 10%	20	24
>10%	3	12
<i>Total # Buildings</i>	<i>82</i>	<i>82</i>
<i>Fatality Rates at Peak Occupancy (Number of Buildings in Each Category):</i>		
None Expected	58	48
0.5% or less	17	18
0.6 - 1%	3	9
>1%	4	7
<i>Total # Buildings</i>	<i>82</i>	<i>82</i>

Table A-5 provides building rankings in each scenario event, based on total economic impact for the two versions of the M7.9 San Andreas scenario. As shown, there are some differences in the individual rankings, although the general performance trends are similar.

Table A-6 provides building rankings based on mean percent building damage. These rankings reflect more closely the differences in underlying ground motions, and as such, show more significant differences than the total economic impact rankings.

Table A-7 provides building rankings based on expected number of non-fatal injuries. Rankings for the two M7.9 San Andreas events are, in general, similar.

Finally, Table A-8 provides the building rankings for non-fatal injury rates. While the buildings ranked highly on this list may not produce a large number of injuries, the likelihood of a building occupant being injured in these buildings is greater. Because these rankings are closely related to building damage, which reflect the differences in underlying ground motion, the two sets of rankings show disparities similar to those for mean percent building damage.

Table A-5: Building Rankings for Alternate Versions of the M7.9 San Andreas Scenario Earthquake – Total Economic Impact

Building	San Andreas M7.9 (CAPSS)	San Andreas M7.9 (ShakeMap)
Hall of Justice	1	2
SFGH - Building 5 (Main Hospital)	2	1
1 South Van Ness	3	3
War Memorial Veterans Building	4	5
War Memorial Opera House	5	4
SFGH - Building 80	6	6
Davies Symphony Hall	7	7
Laguna Honda Main Hospital (A and B Wings)	8	9
170 Otis	9	8
DPH Central Office (101 Grove)	10	11
Moscone Center (South)	11	15
30 Van Ness	12	13
Bill Graham Civic Auditorium	13	10
1650 Mission	14	14
Laguna Honda Main Hospital (H Wing)	15	12
Moscone North	16	20
Laguna Honda Main Hospital (C Wing)	17	16
Animal Care and Control Facility	18	21
Tom Waddell Clinic	19	18
Central Shops	20	23
SFGH - Mental Health Building	21	17
Sheriffs Facility (Inmate Housing)	22	26
1660 Mission	23	19
Kezar Pavilion	24	27
1680 Mission	25	25
YGC Admin & Courts Building	26	22
Public Defender's Office	27	29
Sheriffs Facility (Admin Building)	28	31
SFGH - Mental Health Support Building	29	24
YGC Service Building (Building #2)	30	28
Pump Station #1 (SFFD HQ)	31	33
Ingleside Police Station	32	30
Northern Police Station	33	32
Pump Station #2 (Fort Mason)	34	34
Fire Station #5	35	37
Fire Station #31	36	40
DPW Yard - Building B	37	35
DPW Yard - Building C	38	36
McLaren Lodge Annex	39	38
Ashbury Street Tank & Tank House	40	39
South of Market/Gene Friend Rec Center	41	50
Fire Station #7	42	52
Fire Station #40	43	47
Fire Station #10	44	42
Park Senior Center	45	45
Fire Station #36	46	53
Taraval Police Station - Original Wing	47	44
Tenderloin Rec Center	48	51
Fire Station #11	49	49
Fire Station #15	50	41
Eureka Valley Rec Center (Auditorium & Locker Room)	51	46

Table A-5: Building Rankings for Alternate Versions of the M7.9 San Andreas Scenario Earthquake – Total Economic Impact

Building	San Andreas M7.9 (CAPSS)	San Andreas M7.9 (ShakeMap)
Sunset Rec Center (Gym)	52	43
Moscone Rec Center	53	61
Fire Station #2	54	55
Glen Park Rec Center	55	48
DPW Yard - Building A	56	68
Upper Noe Rec Center (Gym)	57	54
Mission Rec Center (Main)	58	64
Joseph Lee Rec Center (Gym)	59	65
Eureka Valley Rec Center (Gym)	60	58
SFGH - Building 2 (Service Building)	61	66
Jackson Playground and Clubhouse	62	67
St. Mary's Rec Center (Gym)	63	56
Taraval Police Station - Addition #1	64	60
Hamilton Rec Center (Gym)	65	69
Taraval Police Station - Addition #2	66	62
Upper Noe Rec Center (Auditorium & Lobby)	67	57
Minnie & Lovie Ward Rec Center	68	70
Sunset Rec Center (Field House)	69	59
Potrero Hill Rec Center (Gym)	70	73
Hamilton Rec Center (Pool Building)	71	72
Fire Station #38	72	71
Fire Division of Training	73	74
Mission Rec Center (Clubhouse)	74	75
St. Mary's Rec Center (Field House)	75	63
Potrero Hill Rec Center (Field House)	76	80
Joseph Lee Rec Center (Field House)	77	77
Chinese Rec Center (New)	78	78
Hall of Justice Gas Station	79	79
County Fair Building	80	76
Woh Hei Yuen Rec Center	81	81
Jones St Tank & Tank House	82	82

Table A-6: Building Rankings for Alternate Versions of the M7.9 San Andreas Scenario Earthquake – Mean Building Damage

Building	San Andreas M7.9 (CAPSS)	San Andreas M7.9 (ShakeMap)
Kezar Pavilion	1	1
Animal Care and Control Facility	2	11
Tom Waddell Clinic	3	5
Ingleside Police Station	4	4
War Memorial Veterans Building	5	10
Pump Station #2 (Fort Mason)	6	17
DPH Central Office (101 Grove)	7	8
Park Senior Center	8	3
SFGH - Building 80	9	9
Central Shops	10	27
Fire Station #31	11	12
Ashbury Street Tank & Tank House	12	2
Laguna Honda Main Hospital (C Wing)	13	6
Laguna Honda Main Hospital (A and B Wings)	14	7
Fire Station #5	15	15
Fire Station #40	16	18
Northern Police Station	17	16
YGC Service Building (Building #2)	18	13
170 Otis	19	14
Hall of Justice	20	42
1680 Mission	21	22
County Fair Building	22	21
Taraval Police Station - Addition #1	23	23
Taraval Police Station - Original Wing	24	24
Jackson Playground and Clubhouse	25	44
Taraval Police Station - Addition #2	26	25
30 Van Ness	27	29
McLaren Lodge Annex	28	30
Hall of Justice Gas Station	29	40
1 South Van Ness	30	28
Sunset Rec Center (Field House)	31	26
DPW Yard - Building C	32	20
DPW Yard - Building B	33	19
Eureka Valley Rec Center (Auditorium & Locker Room)	34	33
Tenderloin Rec Center	35	38
Fire Station #10	36	43
SFGH - Mental Health Building	37	32
SFGH - Mental Health Support Building	38	31
South of Market/Gene Friend Rec Center	39	55
Fire Station #15	40	34
1660 Mission	41	36
Moscone Rec Center	42	56
Woh Hei Yuen Rec Center	43	58
Public Defender's Office	44	57
Upper Noe Rec Center (Gym)	45	39
Fire Station #7	46	60
Fire Division of Training	47	61
Davies Symphony Hall	48	46
Sunset Rec Center (Gym)	49	35
YGC Admin & Courts Building	50	37

Table A-6: Building Rankings for Alternate Versions of the M7.9 San Andreas Scenario Earthquake – Mean Building Damage

Building	San Andreas M7.9 (CAPSS)	San Andreas M7.9 (ShakeMap)
Fire Station #36	51	59
Eureka Valley Rec Center (Gym)	52	52
1650 Mission	53	41
Fire Station #11	54	50
War Memorial Opera House	55	47
Mission Rec Center (Main)	56	62
Mission Rec Center (Clubhouse)	57	63
Upper Noe Rec Center (Auditorium & Lobby)	58	48
Pump Station #1 (SFFD HQ)	59	66
DPW Yard - Building A	60	71
Bill Graham Civic Auditorium	61	51
Joseph Lee Rec Center (Field House)	62	67
Potrero Hill Rec Center (Field House)	63	72
Joseph Lee Rec Center (Gym)	64	70
Hamilton Rec Center (Gym)	65	68
Glen Park Rec Center	66	54
SFGH - Building 5 (Main Hospital)	67	53
Moscone Center (South)	68	73
St. Mary's Rec Center (Field House)	69	49
Fire Station #2	70	65
Laguna Honda Main Hospital (H Wing)	71	45
Hamilton Rec Center (Pool Building)	72	69
Sheriffs Facility (Admin Building)	73	75
Jones St Tank & Tank House	74	74
Potrero Hill Rec Center (Gym)	75	77
St. Mary's Rec Center (Gym)	76	64
Fire Station #38	77	76
Moscone North	78	79
Minnie & Lovie Ward Rec Center	79	78
SFGH - Building 2 (Service Building)	80	80
Chinese Rec Center (New)	81	81
Sheriffs Facility (Inmate Housing)	82	82

Table A-7: Building Rankings for Alternate Versions of the M7.9 San Andreas Scenario Earthquake – Non-Fatal Injuries

Building	San Andreas M7.9 (CAPSS)	San Andreas M7.9 (ShakeMap)
Kezar Pavilion	1	1
Hall of Justice	2	3
Moscone Center (South)	3	5
Bill Graham Civic Auditorium	4	2
War Memorial Veterans Building	5	4
Moscone North	6	11
War Memorial Opera House	7	6
Davies Symphony Hall	8	7
1 South Van Ness	9	8
County Fair Building	10	10
SFGH - Building 5 (Main Hospital)	11	9
170 Otis	12	12
30 Van Ness	13	13
SFGH - Building 80	14	15
DPH Central Office (101 Grove)	15	17
Laguna Honda Main Hospital (A and B Wings)	16	16
Park Senior Center	17	19
1650 Mission	18	14
1660 Mission	19	18
Animal Care and Control Facility	20	27
Central Shops	21	28
McLaren Lodge Annex	22	22
Tom Waddell Clinic	23	24
Laguna Honda Main Hospital (C Wing)	24	23
SFGH - Mental Health Building	25	21
Ingleside Police Station	26	32
1680 Mission	27	29
Laguna Honda Main Hospital (H Wing)	28	20
YGC Service Building (Building #2)	29	31
Tenderloin Rec Center	30	30
Jackson Playground and Clubhouse	31	37
South of Market/Gene Friend Rec Center	32	35
Mission Rec Center (Main)	33	36
Northern Police Station	34	33
SFGH - Mental Health Support Building	35	25
Eureka Valley Rec Center (Auditorium & Locker Room)	36	34
YGC Admin & Courts Building	37	26
Fire Station #5	38	39
Moscone Rec Center	39	43
Fire Division of Training	40	45
Pump Station #1 (SFFD HQ)	41	44
Ashbury Street Tank & Tank House	42	46
Fire Station #31	43	54
Pump Station #2 (Fort Mason)	44	47
Sunset Rec Center (Field House)	45	40
Sunset Rec Center (Gym)	46	41
Upper Noe Rec Center (Gym)	47	38
Upper Noe Rec Center (Auditorium & Lobby)	48	42
Eureka Valley Rec Center (Gym)	49	48

Table A-7: Building Rankings for Alternate Versions of the M7.9 San Andreas Scenario Earthquake – Non-Fatal Injuries

Building	San Andreas M7.9 (CAPSS)	San Andreas M7.9 (ShakeMap)
Public Defender's Office	50	52
Mission Rec Center (Clubhouse)	51	53
Fire Station #40	52	62
DPW Yard - Building B	53	49
DPW Yard - Building C	54	50
Taraval Police Station - Addition #1	55	68
Taraval Police Station - Original Wing	56	55
Taraval Police Station - Addition #2	57	69
Fire Station #15	58	57
Fire Station #10	59	56
St. Mary's Rec Center (Field House)	60	58
Fire Station #11	61	59
Glen Park Rec Center	62	51
Woh Hei Yuen Rec Center	63	60
Fire Station #36	64	65
Fire Station #7	65	66
St. Mary's Rec Center (Gym)	66	70
Fire Station #2	67	71
Joseph Lee Rec Center (Field House)	68	72
Hamilton Rec Center (Gym)	69	63
Hamilton Rec Center (Pool Building)	70	64
Joseph Lee Rec Center (Gym)	71	73
DPW Yard - Building A	72	75
Potrero Hill Rec Center (Field House)	73	76
Sheriffs Facility (Admin Building)	74	67
Potrero Hill Rec Center (Gym)	75	77
Sheriffs Facility (Inmate Housing)	76	61
Hall of Justice Gas Station	77	74
Jones St Tank & Tank House	78	78
Fire Station #38	79	79
Minnie & Lovie Ward Rec Center	80	80
SFGH - Building 2 (Service Building)	81	81
Chinese Rec Center (New)	82	82

Table A-8: Building Rankings for Alternate Versions of the M7.9 San Andreas Scenario Earthquake – Non-Fatal Injury Rates

Building	San Andreas M7.9 (CAPSS)	San Andreas M7.9 (ShakeMap)
Animal Care and Control Facility	1	8
Ingleside Police Station	2	5
Tom Waddell Clinic	3	2
Park Senior Center	4	4
Kezar Pavilion	5	12
Ashbury Street Tank & Tank House	6	1
Pump Station #2 (Fort Mason)	7	3
Laguna Honda Main Hospital (C Wing)	8	6
Fire Station #5	9	11
Fire Station #31	10	19
Laguna Honda Main Hospital (A and B Wings)	11	10
Northern Police Station	12	9
Taraval Police Station - Addition #1	13	23
Taraval Police Station - Addition #2	14	24
YGC Service Building (Building #2)	15	7
War Memorial Veterans Building	16	15
Central Shops	17	30
DPH Central Office (101 Grove)	18	17
SFGH - Building 80	19	16
Hall of Justice	20	38
County Fair Building	21	13
1680 Mission	22	22
170 Otis	23	21
30 Van Ness	24	28
Fire Station #40	25	43
McLaren Lodge Annex	26	27
Mission Rec Center (Main)	27	45
Eureka Valley Rec Center (Auditorium & Locker Room)	28	29
Sunset Rec Center (Field House)	29	18
Taraval Police Station - Original Wing	30	20
Mission Rec Center (Clubhouse)	31	51
1 South Van Ness	32	31
Fire Division of Training	33	54
Tenderloin Rec Center	34	42
South of Market/Gene Friend Rec Center	35	55
Jackson Playground and Clubhouse	36	56
DPW Yard - Building A	37	75
Fire Station #15	38	32
SFGH - Mental Health Building	39	35
Eureka Valley Rec Center (Gym)	40	48
1650 Mission	41	37
Upper Noe Rec Center (Auditorium & Lobby)	42	39
DPW Yard - Building B	43	25
DPW Yard - Building C	44	26
Fire Station #11	45	40
Fire Station #10	46	41
1660 Mission	47	46
Davies Symphony Hall	48	50
SFGH - Mental Health Support Building	49	34

Table A-8: Building Rankings for Alternate Versions of the M7.9 San Andreas Scenario Earthquake – Non-Fatal Injury Rates

Building	San Andreas M7.9 (CAPSS)	San Andreas M7.9 (ShakeMap)
Upper Noe Rec Center (Gym)	50	33
Public Defender's Office	51	58
YGC Admin & Courts Building	52	36
Pump Station #1 (SFFD HQ)	53	59
Fire Station #36	54	60
War Memorial Opera House	55	49
Fire Station #7	56	61
Woh Hei Yuen Rec Center	57	62
Fire Station #2	58	63
St. Mary's Rec Center (Field House)	59	47
Joseph Lee Rec Center (Field House)	60	64
Potrero Hill Rec Center (Field House)	61	76
Moscone Rec Center	62	65
Bill Graham Civic Auditorium	63	52
Sunset Rec Center (Gym)	64	53
Laguna Honda Main Hospital (H Wing)	65	44
Moscone Center (South)	66	69
SFGH - Building 5 (Main Hospital)	67	57
Hamilton Rec Center (Pool Building)	68	67
Hamilton Rec Center (Gym)	69	68
St. Mary's Rec Center (Gym)	70	70
Joseph Lee Rec Center (Gym)	71	71
Potrero Hill Rec Center (Gym)	72	77
Sheriffs Facility (Admin Building)	73	72
Moscone North	74	73
Glen Park Rec Center	75	66
Sheriffs Facility (Inmate Housing)	76	74
Hall of Justice Gas Station	77	14
Jones St Tank & Tank House	78	78
Fire Station #38	79	79
Minnie & Lovie Ward Rec Center	80	80
SFGH - Building 2 (Service Building)	81	81
Chinese Rec Center (New)	82	82

To further highlight the individual building results and provide a view of highly ranked buildings across the various metrics, Tables A-9 and A-10 provide lists of specific buildings which meet the “High-Impact” criteria for the two versions of the San Andreas M7.9 scenario event, including:

- Total economic impact exceeding \$50M
- Operational losses exceeding \$5M
- Red-Tagged, with mean damage exceeding 70% (Note that red-tagged buildings have been defined as those with mean damage exceeding 50%; this is a subset of the more heavily damaged red-tagged buildings)
- Probability of collapse greater than 10%
- More than 50 non-fatal injuries, and/or more than 10 fatalities
- Injury rates exceeding 10% and/or fatality rates exceeding 1%.

Within the tables, buildings appearing in multiple categories have been highlight in color; buildings with no shading appear in just one category. Each column is presented in descending value order; buildings at the top of the list incur larger impacts than those at the bottom. As shown, more buildings meet the various high-impact criteria in the ShakeMap M7.9 San Andreas scenario than in the CAPSS scenario.

Table A-9: Buildings Meeting Selected “High Impact” Criteria in the CAPSS San Andreas M7.9 Scenario Earthquake

	Buildings with total economic impact > \$50M	Buildings with operational losses >\$5M	Red-Tagged Buildings w/ >70% Mean Building Damage	Buildings with Probability of Collapse >10%	Buildings with more than 50 Non-Fatal Injuries (& More Than 10 Fatalities, in italics)	Buildings with Injury Rates >10% and/or Fatality Rates >1%
	Hall of Justice	Hall of Justice	Kezar Pavilion	Animal Care and Control Facility	<i>Kezar Pavilion</i>	Ingleside Police Station
	SFGH – Building 5 (Main Hospital)	SFGH – Building 5 (Main Hospital)	Animal Care and Control Facility	Tom Waddell Clinic	<i>Hall of Justice</i>	Tom Waddell Clinic
	1 South Van Ness	1 South Van Ness	Tom Waddell Clinic	Ingleside Police Station	<i>Moscone Center (South)</i>	Animal Care & Control Facility
	War Memorial Veterans Building	170 Otis	Ingleside Police Station		Bill Graham Civic Auditorium	
	War Memorial Opera House		War Memorial Veterans Building		War Memorial Veterans Building	
	SFGH – Building 80		Pump Station #2 (Fort Mason)		Moscone North	
			DPH Central Office (101 Grove)		War Memorial Opera House	
			Park Senior Center		Davies Symphony Hall	
					1 South Van Ness	

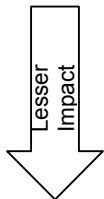
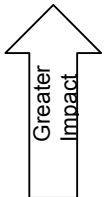


Table A-10: Buildings Meeting Selected “High Impact” Criteria in the USGS ShakeMap San Andreas M7.9 Scenario Earthquake

Buildings with total economic impact > \$50M	Buildings with operational losses >\$5M	Red-Tagged Buildings w/ >70% Mean Building Damage	Buildings with Probability of Collapse >10%	Buildings with 51 or more Non-Fatal Injuries (& 11 or More Fatalities, in italics)	Buildings with Injury Rates >10% and/or Fatality Rates >1%
SFGH – Building 5 (Main Hospital)	Hall of Justice	Kezar Pavilion	Ashbury Street Tank & Tank House	<i>Kezar Pavilion</i>	Ashbury Street Tank & Tank House
Hall of Justice	SFGH – Building 5 (Main Hospital)	Ashbury Street Tank & Tank House	Ingleside Police Station	<i>Bill Graham Civic Auditorium</i>	Tom Waddell Clinic
1 South Van Ness	1 South Van Ness	Park Senior Center	Park Senior Center	<i>Hall of Justice</i>	Pump Station #2 (Fort Mason)
War Memorial Opera House	170 Otis	Ingleside Police Station	Tom Waddell Clinic	War Memorial Veterans Building	Park Senior Center
War Memorial Veterans Building	1650 Mission	Tom Waddell Clinic	Animal Care and Control Facility	Moscone Center (South)	Ingleside Police Station
SFGH – Building 80	30 Van Ness	Laguna Honda Main Hospital (C Wing)	YGC Service Building (Building #2)	War Memorial Opera House	Laguna Honda Main Hospital (C Wing)
Davies Symphony Hall		Laguna Honda Main Hospital (A and B Wings)	Fire Station #5	Davies Symphony Hall	YGC Service Building (Building #2)
170 Otis		DPH Central Office (101 Grove)	Northern Police Station	1 South Van Ness	Animal Care and Control Facility
Laguna Honda Main Hospital (A and B Wings)		SFGH - Building 80	Pump Station #2 (Fort Mason)	SFGH – Building 5 (Main Hospital)	Northern Police Station
		War Memorial Veterans Building		County Fair Building	Laguna Honda Main Hospital (A and B Wings)
		Animal Care and Control Facility		Moscone North	Fire Station #5
		Fire Station #31			Kezar Pavilion
		YGC Service Building (Building #2)			
		170 Otis			
		Fire Station #5			
		Northern Police Station			
		Pump Station #2 (Fort Mason)			
		Fire Station #40			
		DPW Yard - Building B			
		DPW Yard - Building C			
		County Fair Building			

APPENDIX B – HAZUS AEBM INVENTORY DATA FOR 82 HIGH-PRIORITY BUILDINGS

eqAebmId	Name	ProfileName	Tract	Address	City	State	Zipcode	DayOccupants (Peak Occupancy)	NightOccupants	BldgArea (SqFt)	BldgValue (\$1,000)	ContentValue (\$1,000)	BusinessInv (\$1,000)	BusinessIncome (\$1,000/day)
US000001	1 SO. VAN NESS OFFICE BLDG	GOV1_C1H_MC	6075017700	1 South Van Ness	San Francisco	CA		1602	16	560000	213686	42737	0	0
US000002	1650 Mission	GOV1_C2M_MC	6075020100	1650 Mission	San Francisco	CA		620	6	216712	75176	15035	0	0
US000003	1660 MISSION	GOV1_S2M_MC	6075020100	1660 Mission	San Francisco	CA		480	5	72000	27474	5495	0	228
US000004	HALL OF JUSTICE	GOV1_C2M_MC	6075018000	824 Bryant	San Francisco	CA		3027	1049	700000	267107	46823.52	0	0
US000005	BILL GRAHAM CIVIC AUDITORIUM	COM8_S4M_MC	6075012400	99 Grove Street	San Francisco	CA		8925	89	302250	131060	6553	0	0
US000007	MOSCONE CENTER (South)	COM8_C2L_MC	6075017800	747 Howard St	San Francisco	CA		13000	130	650000	225480	11274	0	38.13
US000008	MOSCONE NORTH	COM8_C2L_HC	6075017602		San Francisco	CA		10400	104	520000	180384	9019	0	30.45
US000009	MAIN SHOP BLDG - CENTRAL	COM3_S1L_MC	6075060900	1758 Jerrold	San Francisco	CA		143	1	49976	17336	3467	0	0
US000010	ANIMAL CONTROL FACILITY	COM7_C2L_LC	6075017700	1200 15th Street	San Francisco	CA		80	1	30000	10407	15611	0	0
US000011	30 VAN NESS OFFICE BUILDING	GOV1_C2M_PC	6075012400	30 Van Ness	San Francisco	CA		517	5	180939	62766	12553	0	0
US000012	30 VAN NESS OFFICE BUILDING	GOV1_S2M_MC	6075012400	30 Van Ness	San Francisco	CA		517	5	180939	62766	12553	0	0
US000013	555 7th STREET OFFICE BUILDING	COM7_W2_HC	6075018000	356 7th Street	San Francisco	CA		92	1	32000	22201	4440	0	0
US000014	HALL OF JUSTICE GAS STATION	COM3_RM1L_MC	6075018000	1155 Harrison	San Francisco	CA		12	0	4360	605	121	0	0
US000015	HALL OF JUSTICE GAS STATION	COM3_S1L_MC	6075018000	1155 Harrison	San Francisco	CA		12	0	4360	605	121	0	0
US000016	DPH CENTRAL OFFICE (DOC)	COM4_S5M_PC	6075012400	101 Grove	San Francisco	CA		297	3	104000	48704	9741	0	0
US000017	LAGUNA HONDA MAIN HOSP #1 (A,B)	GOV1_C2M_PC	6075030500	375 Laguna Honda	San Francisco	CA		235	2	82033	64027	12805	0	0
US000018	LAGUNA HONDA MAIN HOSP #1 (H)	COM7_C2M_MC	6075030500	375 Laguna Honda	San Francisco	CA		431	4	86164	67252	100878	0	0
US000019	LAGUNA HONDA MAIN HOSP #1 (C)	GOV1_C2M_PC	6075030500	375 Laguna Honda	San Francisco	CA		97	1	33966	23329	4666	0	0
US000020	SFGH - Building 80	COM7_S5M_PC	6075022802	1001 Potrero	San Francisco	CA		334	3	66832	56336	84504	0	0
US000021	SFGH - MAIN HOSPITAL (BLDG 5)	COM6_S2H_MC	6075022802	1001 Potrero	San Francisco	CA		3087	1235	617400	470320	705480	0	0
US000022	TOM WADDELL CLINIC	COM7_C2L_PC	6075012400	50 Lech Walesa St.	San Francisco	CA		75	1	15000	11708	17562	0	0
US000023	SFGH - SERVICE BLDG. (Bldg #2)	COM3_S1L_HC	6075022802	1001 Potrero	San Francisco	CA		112	1	39171	7745	1549	0	0
US000024	SFGH - MENTAL HEALTH NURSING	COM7_S1L_MC	6075022802	1001 Potrero	San Francisco	CA		312	3	62490	21677	32516	0	0
US000025	SFGH - MENTAL HEALTH SPRT BLDG	COM7_S1L_MC	6075022802	1001 Potrero	San Francisco	CA		182	2	36359	12613	18920	0	0
US000026	DPW - BLDG A	COM4_C2L_MC	6075060900	Cesear Chavez & Kansas	San Francisco	CA		35	0	12101	4198	840	0	0
US000027	DPW - BLDG B	COM3_S1L_MC	6075060900	Cesear Chavez & Kansas	San Francisco	CA		42	0	14756	5119	1024	0	0
US000028	DPW - BLDG B	COM3_S2L_LC	6075060900	Cesear Chavez & Kansas	San Francisco	CA		42	0	14756	5119	1024	0	0
US000029	DPW - BLDG C	COM3_S1L_MC	6075060900	Cesear Chavez & Kansas	San Francisco	CA		42	0	14601	5065	1013	0	0
US000030	DPW - BLDG C	COM3_S2L_LC	6075060900	Cesear Chavez & Kansas	San Francisco	CA		42	0	14601	5065	1013	0	0
US000031	Pump Station #1 (SFFD HQ)	GOV1_C2L_MC	6075017901	698 2nd St	San Francisco	CA		143	1	50000	21681	4550	0	0
US000032	Ashbury Street Tank & Tank House	GOV1_C3L_PC	6075020400	1234 Clayton St.	San Francisco	CA		22	0	7800	2706	541	0	0
US000033	Fire Division of Training (TI)	GOV2_C2L_MC	6075022801	2310 Folsom St.	San Francisco	CA		103	1	5040	1748	350	0	0
US000034	Fire Station #31	GOV2_W2_LC	6075045200	441 12th Ave.	San Francisco	CA		26	20	8500	2949	590	0	0
US000035	Fire Station #31	GOV2_C2L_PC	6075045200	441 12th Ave.	San Francisco	CA		26	20	8500	2949	590	0	0
US000036	Fire Station #40	GOV2_W2_MC	6075030400	2155 18th Ave	San Francisco	CA		22	18	7350	2550	510	0	0
US000037	Fire Station #40	GOV2_S3_PC	6075030400	2155 18th Ave	San Francisco	CA		22	18	7350	2550	510	0	0
US000038	Fire Station #11	GOV2_C2L_MC	6075021400	3880 26th St.	San Francisco	CA		42	34	14000	4856	971	0	0
US000039	Fire Station #15	GOV2_C2L_MC	6075031000	1000 Ocean Ave.	San Francisco	CA		36	29	12138	4211	842	0	0
US000040	Fire Station #36	GOV2_C2L_MC	6075016800	109 Oak St.	San Francisco	CA		48	39	16100	5585	1117	0	0
US000041	Fire Station #38	GOV2_W2_MC	6075013500	2150 California	San Francisco	CA		40	32	13400	4648	930	0	0
US000042	Fire Station #7	GOV2_C2L_MC	6075022801	2310 Folsom	San Francisco	CA		49	40	16488	5720	1144	0	0
US000044	Fire Station #2	GOV2_S2L_HC	6075010700	1340 Powell St.	San Francisco	CA		51	41	16920	5869	1174	0	0
US000045	Fire Station #2	GOV2_S1L_MC	6075010700	1340 Powell St.	San Francisco	CA		51	41	16920	5869	1174	0	0
US000046	Fire Station #10	GOV2_C2L_MC	6075015400	655 Presidio Ave.	San Francisco	CA		43	34	14300	4961	992	0	0
US000047	Fire Station #5	GOV2_C2L_LC	6075016100	1301 Turk St.	San Francisco	CA		38	30	12600	4371	874	0	0
US000048	Jones St Tank & Tank House	GOV1_C2L_MC	6075011200	1239 Jones St.	San Francisco	CA		3	0	1200	520	104	0	0
US000049	Pump Station #2 (FORT MASON)	GOV1_C2L_PC	6075012600	3455 Van Ness Ave	San Francisco	CA		23	0	8000	3469	4430	0	0
US000050	170 OTIS / OFFICE BLDG	COM4_C2H_LC	6075020100	170 Otis	San Francisco	CA		490	5	171385	65397	13079	0	0

eqAebmId	Name	ProfileName	Tract	Address	City	State	Zipcode	DayOccupants (Peak Occupancy)	NightOccupants	BldgArea (SqFt)	BldgValue (\$1,000)	ContentValue (\$1,000)	BusinessInv (\$1,000)	BusinessIncome (\$1,000/day)
US000051	Ingleside Police Station	GOV2_C2L_PC	6075031100	Phelan & Judson	San Francisco	CA		56	44	18500	6418	1284	0	0
US000052	Northern Police Station	GOV2_RM1L_LC	6075016100	1125 Filmore	San Francisco	CA		54	43	18000	6244	1249	0	0
US000053	Taraval Police Station - Original Wing	GOV2_S4L_MC	6075032800	2345 24th Ave.	San Francisco	CA		27	22	9035	3134	627	0	0
US000054	Taraval Police Station - Addition #1	GOV2_S1L_MC	6075032800	2345 24th Ave.	San Francisco	CA		14	11	4518	1567	313	0	0
US000055	Taraval Police Station - Addition #2	GOV2_S1L_MC	6075032800	2345 24th Ave.	San Francisco	CA		14	11	4518	1567	313	0	0
US000056	Taraval Police Station - Addition #2	GOV2_C2L_MC	6075032800	2345 24th Ave.	San Francisco	CA		14	11	4518	1567	313	0	0
US000057	COUNTY FAIR BLDG/LIBRARY	COM8_C1L_MC	6075060300	1199 9th Ave	San Francisco	CA		750	8	2125	590	30	0	0.4385
US000058	MCLAREN LODGE-Annex (not ADMIN bldg)	COM4_C2L_MC	6075060300	501 Stanyan St.	San Francisco	CA	94117	200	2	12288	4263	853	0	0
US000059	Minnie & Lovie Ward Rec Center	COM8_RM1L_HC	6075031400	650 Capital	San Francisco	CA		175	2	19461	8271	414	0	0.2488
US000060	Gene Friend Rec Center @ SOMA	COM8_S2L_HC	6075017800	270 6th Street	San Francisco	CA		175	2	16354	6950	348	0	0.1291
US000061	CHINESE RECREATION CTR	COM8_S2L_HC	6075011200	1101 Washington St.	San Francisco	CA		175	2	15596	6628	331	0	0.0881
US000062	CHINESE RECREATION CTR	COM8_C2L_HC	6075011200	1101 Washington St.	San Francisco	CA		175	2	15596	6628	331	0	0.0881
US000063	GLEN PARK RECREATION CENTER	COM8_W2_MC	6075021700	Elk St & Chenery St.	San Francisco	CA		175	2	14819	6298	315	0	1.2971
US000064	JACKSON PLAYGROUND & CLUBHS	COM8_W2_LC	6075022701	17th & Arkansas	San Francisco	CA		175	2	4818	2048	102	0	0.1671
US000065	Kezar Pavilion	COM8_S4L_PC	6075060300		San Francisco	CA		3150	32	24254	10517	526	0	0.9425
US000066	JOSEPH LEE RECREATION CTR - Gymnasium	COM8_W2_MC	6075023101	1395 Mendell St	San Francisco	CA		123	1	12215	5191	260	0	0.1266
US000067	JOSEPH LEE RECREATION CTR - Field House	COM8_C2L_MC	6075023101	1395 Mendell St	San Francisco	CA		52	1	5235	2225	111	0	0.0543
US000068	HAMILTON PK POOL BLDG/REC CTR- Gymnasium	COM8_S1L_HC	6075015500	1900 Geary Blvd.	San Francisco	CA		93	1	9003	4502	225	0	0.1577
US000069	HAMILTON PK POOL BLDG/REC CTR- Pool Bldg	COM8_C1L_HC	6075015500	1900 Geary Blvd.	San Francisco	CA		82	1	7984	3992	200	0	0.1398
US000070	MOSCONE CLUBHS & REC CTR.	COM8_W2_HC	6075012900	1800 Chestnut St.	San Francisco	CA		175	2	9650	4101	205	0	0.6601
US000071	PARK SENIOR CENTER	COM8_C2L_LC	6075060300	6101 Fulton St.	San Francisco	CA		150	2	5940	2524	126	0	0.0069
US000072	POTRERO HILL GYM & REC CTR -Gymnasium	COM8_W2_MC	6075022703	801 Arkansas St.	San Francisco	CA		123	1	13188	5605	280	0	0.1034
US000073	POTRERO HILL GYM & REC CTR - Field House	COM8_C2L_MC	6075022703	801 Arkansas St.	San Francisco	CA		52	1	5652	2402	120	0	0.0443
US000074	MISSION RECREATION CENTER - Main Bldg	COM8_URML_LS	6075022801	2450 Harrison St.	San Francisco	CA		116	1	9873	4196	210	0	0.0776
US000075	MISSION RECREATION CENTER - Clubhouse	COM8_URML_LS	6075022801	2450 Harrison St.	San Francisco	CA		59	1	5033	2139	107	0	0.04
US000076	ST MARYS PG: CLUBHSE/REC CTR-Gymnasium	COM8_W2_MC	6075025403	Murray & Justin Dr.	San Francisco	CA		123	1	15437	6561	328	0	0.2774
US000077	ST MARYS PG: CLUBHSE/REC CTR-Field House	COM8_C2L_MC	6075025403	Murray & Justin Dr.	San Francisco	CA		52	1	6616	2812	141	0	0.1189
US000078	SUNSET REC CENTER - Gymnasium	COM8_W2_MC	6075032700	2201 Lawton St.	San Francisco	CA		124	1	11661	4956	248	0	0.1167
US000079	SUNSET REC CENTER - Field House	COM8_C2L_MC	6075032700	2201 Lawton St.	San Francisco	CA		51	1	4763	2024	101	0	0.0477
US000080	UPPER NOE REC CENTER - Auditorium/Lobby	COM8_C2L_MC	6075021500	Day & Sanchez St.	San Francisco	CA		84	1	7894	3355	168	0	0.2782
US000081	UPPER NOE REC CENTER - Basketball Court	COM8_C1L_MC	6075021500	Day & Sanchez St.	San Francisco	CA		91	1	8552	3635	182	0	0.3013
US000082	TENDERLOIN REC CTR	COM8_S1L_MC	6075012200	526 Ellis 570 Ellis	San Francisco	CA		175	2	10133	4307	215	0	0.1279
US000083	WOH HEI YUEN REC CENTER	COM8_C2L_HC	6075011300	922 Jackson	San Francisco	CA		50	1	1667	708	35	0	0.2396
US000084	WOH HEI YUEN REC CENTER	COM8_W2_HC	6075011300	922 Jackson	San Francisco	CA		50	1	1667	708	35	0	0.2396
US000085	EUREKA VALLEY PG & REC CTR-Gymnasium	COM8_C2L_MC	6075020500	100 Collingwood St.	San Francisco	CA		82	1	8404	3572	179	0	0.2444
US000086	EUREKA VALLEY PG & REC CTR-Locker/Audit.	COM8_C1L_MC	6075020500	100 Collingwood St.	San Francisco	CA		93	1	9476	4027	201	0	0.2756
US000087	Sheriff's Facility (Admin)	GOV1_S2M_HC	6075018000	425 7th Street	San Francisco	CA		130	1	45400	41210	8242	0	0
US000088	Sheriff's Facility (Inmate Housing)	GOV2_C2M_HC	6075018000	425 7th Street	San Francisco	CA		683	613	158923	146111	10227.77	0	0
US000089	Davies Symphony Hall	COM8_S2M_MC	6075016200	201 Van Ness	San Francisco	CA		2880	29	203500	171540	8577	0	0
US000090	War Memorial Opera House	COM8_S4M_MC	6075016200	301 Van Ness	San Francisco	CA		3303	33	315700	285831	14292	0	0
US000091	WAR MEMORIAL VETERANS BLDG	COM8_S4M_PC	6075016200	401 Van Ness	San Francisco	CA		1712	17	247500	115905	5795	0	0
US000092	YGC ADMIN/COURTS Bldg	GOV1_C2L_MC	6075030500		San Francisco	CA		187	2	65530	22732	4546	0	0
US000094	YGC SERVICE BUILDING; BLDG. 2	GOV1_C2L_LC	6075030500	375 Woodside	San Francisco	CA		71	1	24815	9469	1894	0	0
US000095	1680 Mission	COM4_S2M_MC	6075020100	1680 Mission	San Francisco	CA	NULL	109	1	38000	13182	2636	0	0
US000096	1680 Mission	COM4_C2M_PC	6075020100	1680 Mission	San Francisco	CA	NULL	109	1	38000	13182	2636	0	0

eqAebmid	Name	WagesPaid (\$1,000/day)	RelocationDisruptCost (\$1,000)	RentalCost (\$1,000/day)	RatioOwnerOccupied	Latitude	Longitude	Comment
US000001	1 SO. VAN NESS OFFICE BLDG	0	560	46.03	1	37.77469	-122.418798	1
US000002	1650 Mission	0	216.71	17.81	1	37.77247	-122.419191	2
US000003	1660 MISSION	0	72	5.92	1	37.77131	-122.419922	4
US000004	HALL OF JUSTICE	0	492.7	193.15	1	37.77499	-122.404328	6
US000005	BILL GRAHAM CIVIC AUDITORIUM	0	0	0	1	37.77808	-122.417316	7
US000007	MOSCONE CENTER (South)	0	0	0	0	37.78388	-122.401187	9
US000008	MOSCONE NORTH	0	0	0	0	37.78473	-122.402013	10
US000009	MAIN SHOP BLDG - CENTRAL	0	49.98	4.11	1	37.7422	-122.392945	11
US000010	ANIMAL CONTROL FACILITY	0	60	2.47	1	37.76736	-122.412896	12
US000011	30 VAN NESS OFFICE BUILDING	0	180.94	14.87	1	37.77595	-122.418937	13-STR1
US000012	30 VAN NESS OFFICE BUILDING	0	180.94	14.87	1	37.77595	-122.418937	13-STR2
US000013	555 7th STREET OFFICE BUILDING	0	32	2.63	1	37.7739	-122.403969	14
US000014	HALL OF JUSTICE GAS STATION	0	4.36	0.36	1	37.77367	-122.405885	15-STR1
US000015	HALL OF JUSTICE GAS STATION	0	4.36	0.36	1	37.77367	-122.405885	15-STR2
US000016	DPH CENTRAL OFFICE (DOC)	0	104	8.55	1	37.77813	-122.418653	16
US000017	LAGUNA HONDA MAIN HOSP #1 (A,B)	0	82.03	6.74	1	37.74743	-122.456762	17
US000018	LAGUNA HONDA MAIN HOSP #1 (H)	0	172.33	7.08	1	37.74826	-122.456633	18
US000019	LAGUNA HONDA MAIN HOSP #1 (C)	0	33.97	2.79	1	37.74767	-122.456354	19
US000020	SFGH - Building 80	0	133.66	5.49	1	37.75532	-122.406008	20
US000021	SFGH - MAIN HOSPITAL (BLDG 5)	0	1234.8	50.75	1	37.75564	-122.405094	21
US000022	TOM WADDELL CLINIC	0	30	1.23	1	37.77798	-122.418794	22
US000023	SFGH - SERVICE BLDG. (Bldg #2)	0	39.17	3.22	1	37.75621	-122.406146	23
US000024	SFGH - MENTAL HEALTH NURSING	0	124.98	5.14	1	37.75564	-122.405094	24
US000025	SFGH - MENTAL HEALTH SPRT BLDG	0	72.72	2.99	1	37.75564	-122.405094	25
US000026	DPW - BLDG A	0	12.1	0.99	0	37.74929	-122.400443	26
US000027	DPW - BLDG B	0	14.76	1.21	0	37.74903	-122.400388	27-STR1
US000028	DPW - BLDG B	0	14.76	1.21	0	37.74903	-122.400388	27-STR2
US000029	DPW - BLDG C	0	14.6	1.2	0	37.74876	-122.400389	28-STR1
US000030	DPW - BLDG C	0	14.6	1.2	0	37.74876	-122.400389	28-STR2
US000031	Pump Station #1 (SFFD HQ)	0	50	4.11	1	37.78055	-122.391048	31
US000032	Ashbury Street Tank & Tank House	0	7.8	0.64	1	37.76115	-122.446152	32
US000033	Fire Division of Training (TI)	0	5.04	0.41	1	37.76001	-122.415011	33
US000034	Fire Station #31	0	8.5	0.7	1	37.77984	-122.470911	34-STR1
US000035	Fire Station #31	0	8.5	0.7	1	37.77984	-122.470911	34-STR2
US000036	Fire Station #40	0	7.35	0.6	1	37.74761	-122.475269	35-STR1
US000037	Fire Station #40	0	7.35	0.6	1	37.74761	-122.475269	35-STR2
US000038	Fire Station #11	0	14	1.15	1	37.74878	-122.426486	36
US000039	Fire Station #15	0	12.14	1	1	37.72349	-122.452927	37
US000040	Fire Station #36	0	16.1	1.32	1	37.77493	-122.421211	38
US000041	Fire Station #38	0	13.4	1.1	1	37.78972	-122.42988	39
US000042	Fire Station #7	0	16.49	1.36	1	37.76026	-122.415042	40
US000044	Fire Station #2	0	16.92	1.39	1	37.79703	-122.409879	42-STR1
US000045	Fire Station #2	0	16.92	1.39	1	37.79703	-122.409879	42-STR2
US000046	Fire Station #10	0	14.3	1.18	1	37.78563	-122.446723	43
US000047	Fire Station #5	0	12.6	1.04	1	37.78046	-122.430716	44
US000048	Jones St Tank & Tank House	0	1.2	0.1	1	37.79282	-122.414856	45
US000049	Pump Station #2 (FORT MASON)	0	8	0.66	1	37.80785	-122.426917	46
US000050	170 OTIS / OFFICE BLDG	0	171.39	14.09	1	37.77073	-122.421013	48

eqAebmId	Name	WagesPaid (\$1,000/day)	RelocationDisruptCost (\$1,000)	RentalCost (\$1,000/day)	RatioOwnerOccupied	Latitude	Longitude	Comment
US000051	Ingleside Police Station	0	18.5	1.52	1	37.72477	-122.446251	59
US000052	Northern Police Station	0	18	1.48	1	37.78016	-122.43239	60
US000053	Taraval Police Station - Original Wing	0	9.04	0.74	1	37.74384	-122.481481	61
US000054	Taraval Police Station - Addition #1	0	4.52	0.37	1	37.74393	-122.481483	62
US000055	Taraval Police Station - Addition #2	0	4.52	0.37	1	37.74377	-122.481489	63-STR1
US000056	Taraval Police Station - Addition #2	0	4.52	0.37	1	37.74377	-122.481489	63-STR2
US000057	COUNTY FAIR BLDG/LIBRARY	0	0	0	1	37.76672	-122.466964	64
US000058	MCLAREN LODGE-Annex (not ADMIN bldg)	0	12.29	1.01	1	37.77218	-122.454503	65
US000059	Minnie & Lovie Ward Rec Center	0	0	0	1	37.71627	-122.458176	66
US000060	Gene Friend Rec Center @ SOMA	0	0	0	1	37.77879	-122.406523	67
US000061	CHINESE RECREATION CTR	0	0	0	1	37.79421	-122.411786	68-STR1
US000062	CHINESE RECREATION CTR	0	0	0	1	37.79421	-122.411786	68-STR2
US000063	GLEN PARK RECREATION CENTER	0	0	0	1	37.73714	-122.440846	69
US000064	JACKSON PLAYGROUND & CLUBHS	0	0	0	1	37.76432	-122.399607	70
US000065	Kezar Pavilion	0	0	0	1	37.76685	-122.455617	71
US000066	JOSEPH LEE RECREATION CTR - Gymnasium	0	0	0	1	37.73499	-122.389723	72
US000067	JOSEPH LEE RECREATION CTR - Field House	0	0	0	1	37.7348	-122.389554	73
US000068	HAMILTON PK POOL BLDG/REC CTR- Gymnasium	0	0	0	1	37.78472	-122.435032	74
US000069	HAMILTON PK POOL BLDG/REC CTR- Pool Bldg	0	0	0	1	37.78464	-122.435554	75
US000070	MOSCONE CLUBHS & REC CTR.	0	0	0	1	37.80145	-122.433046	76
US000071	PARK SENIOR CENTER	0	0	0	1	37.7716	-122.496946	77
US000072	POTRERO HILL GYM & REC CTR -Gymnasium	0	0	0	1	37.75627	-122.397343	78
US000073	POTRERO HILL GYM & REC CTR - Field House	0	0	0	1	37.75631	-122.39696	79
US000074	MISSION RECREATION CENTER - Main Bldg	0	0	0	1	37.75836	-122.412783	80
US000075	MISSION RECREATION CENTER - Clubhouse	0	0	0	1	37.75832	-122.413322	81
US000076	ST MARYS PG: CLUBHSE/REC CTR-Gymnasium	0	0	0	1	37.7343	-122.421716	82
US000077	ST MARYS PG: CLUBHSE/REC CTR-Field House	0	0	0	1	37.73408	-122.421542	83
US000078	SUNSET REC CENTER - Gymnasium	0	0	0	1	37.75723	-122.486653	84
US000079	SUNSET REC CENTER - Field House	0	0	0	1	37.75712	-122.486985	85
US000080	UPPER NOE REC CENTER - Auditorium/Lobby	0	0	0	1	37.74259	-122.428462	86
US000081	UPPER NOE REC CENTER - Basketball Court	0	0	0	1	37.74233	-122.428258	87
US000082	TENDERLOIN REC CTR	0	0	0	1	37.78481	-122.415444	88
US000083	WOH HEI YUEN REC CENTER	0	0	0	1	37.7958	-122.41027	89-STR1
US000084	WOH HEI YUEN REC CENTER	0	0	0	1	37.7958	-122.41027	89-STR2
US000085	EUREKA VALLEY PG & REC CTR-Gymnasium	0	0	0	1	37.76025	-122.436469	93
US000086	EUREKA VALLEY PG & REC CTR-Locker/Audit.	0	0	0	1	37.76046	-122.436416	94
US000087	Sheriff's Facility (Admin)	0	45.4	3.73	1	37.77516	-122.404808	101
US000088	Sheriff's Facility (Inmate Housing)	0	0	89.99	1	37.77534	-122.404939	102
US000089	Davies Symphony Hall	0	0	0	1	37.77767	-122.420477	105
US000090	War Memorial Opera House	0	0	0	1	37.77862	-122.420733	106
US000091	WAR MEMORIAL VETERANS BLDG	0	0	0	1	37.77953	-122.420981	107
US000092	YGC ADMIN/COURTS Bldg	0	65.53	5.39	1	37.74602	-122.452505	49
US000094	YGC SERVICE BUILDING; BLDG. 2	0	24.82	2.04	1	37.74876	-122.456118	57
US000095	1680 Mission	0	38	3.12	1	37.77079	-122.419937	8-STR2
US000096	1680 Mission	0	38	3.12	1	37.77079	-122.419936	8-STR1

APPENDIX C – HAZUS AEBM RESULTS FOR 82 HIGH-PRIORITY BUILDINGS

CAPSS San Andreas M7.9 (USGS 30 Year Event Probability = 3.8%)																					
Facility Name	Special Treatment	Liquefaction Susceptibility	CPP Priority	SHR	Retro-fitted?	Structural Damage (\$M)	Non-Structural Damage (\$M)	Total Building Damage (\$M)	Contents Damage (\$M)	Operational Losses; Rent, Relocation & Lost Income (\$M)	Total Economic Impact (\$M)	Mean Building Damage %	Predicted Occupancy Tag (based on damage %)	Probability of Collapse	Peak Occupancy	Expected Non-Fatal Injuries (Peak)	Expected Fatalities (Peak)	Overall Expected Casualties (Peak)	Non-Fatal Injury Rates (Peak)	Fatality Rates (Peak)	Overall Casualty Rate (Peak)
Fire Station #40	Dual System	Medium	47	3	N	\$0.3	\$1.3	\$1.6	\$0.1	\$0.2	\$1.9	63%	Red	< 5%	22	10 or Less	None Expected	10 or Less	4.5%	0.0%	4.5%
Ingleside Police Station		Very Low	48	3	N	\$0.8	\$4.0	\$4.9	\$0.5	\$0.5	\$5.8	76%	Red	10-15%	56	10 or Less	10 or Less	10 or Less	10.7%	1.8%	12.5%
Laguna Honda Main Hospital (C Wing)		Very Low	49	3	N	\$3.3	\$11.8	\$15.1	\$1.3	\$1.2	\$17.6	65%	Red	5-10%	97	10 or Less	10 or Less	10 or Less	8.2%	1.0%	8.2%
Taraval Police Station - Original Wing		None	50	3	Y	\$0.3	\$1.2	\$1.4	\$0.1	\$0.2	\$1.8	46%	Yellow	< 5%	27	10 or Less	None Expected	10 or Less	3.7%	0.0%	3.7%
Taraval Police Station - Addition #1		None	50	3	Y	\$0.1	\$0.6	\$0.7	\$0.1	\$0.1	\$0.9	47%	Yellow	< 5%	14	10 or Less	None Expected	10 or Less	7.1%	0.0%	7.1%
Taraval Police Station - Addition #2	Dual System	None	50	3	Y	\$0.1	\$0.5	\$0.7	\$0.1	\$0.1	\$0.8	43%	Yellow	< 5%	14	10 or Less	None Expected	10 or Less	7.1%	0.0%	7.1%
Tom Waddell Clinic		Medium	51	--	N	\$1.5	\$7.5	\$9.0	\$6.3	\$0.6	\$15.8	77%	Red	10-15%	75	10 or Less	10 or Less	10 or Less	10.7%	1.3%	12.0%
Eureka Valley Rec Center (Auditorium & Locker Room)		Very Low	62	3	N	\$0.2	\$1.3	\$1.5	\$0.0	\$0.0	\$1.5	36%	Yellow	< 5%	93	10 or Less	None Expected	10 or Less	4.3%	0.0%	4.3%
Eureka Valley Rec Center (Gym)		Very Low	62	3	N	\$0.1	\$0.8	\$0.9	\$0.0	\$0.0	\$1.0	26%	Yellow	< 5%	82	10 or Less	None Expected	10 or Less	2.4%	0.0%	2.4%
Fire Station #11		Very Low	63	3	N	\$0.2	\$1.0	\$1.2	\$0.1	\$0.2	\$1.5	26%	Yellow	< 5%	42	10 or Less	None Expected	10 or Less	2.4%	0.0%	2.4%
Fire Station #15		Very Low	64	3	N	\$0.2	\$1.0	\$1.2	\$0.1	\$0.2	\$1.5	29%	Yellow	< 5%	36	10 or Less	None Expected	10 or Less	2.8%	0.0%	2.8%
Fire Station #36		Medium	65	3	N	\$0.3	\$1.2	\$1.5	\$0.1	\$0.2	\$1.8	27%	Yellow	< 5%	48	10 or Less	None Expected	10 or Less	2.1%	0.0%	2.1%
Fire Station #38		Very Low	66	2	N	\$0.1	\$0.4	\$0.5	\$0.0	\$0.1	\$0.6	11%	Green	< 5%	40	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Fire Station #7		Medium	67	2	N	\$0.3	\$1.3	\$1.6	\$0.1	\$0.2	\$1.9	28%	Yellow	< 5%	49	10 or Less	None Expected	10 or Less	2.0%	0.0%	2.0%
Hall of Justice Gas Station	Dual System	Very High	69	2	N	\$0.0	\$0.2	\$0.2	\$0.0	\$0.1	\$0.3	40%	Yellow	< 5%	12	None Expected	None Expected	10 or Less	0.0%	0.0%	8.3%
SFGH - Building 2 (Service Building)		Very Low	74	3	Y	\$0.1	\$0.6	\$0.7	\$0.1	\$0.2	\$1.0	9%	Green	< 5%	112	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Sheriffs Facility (Admin Building)		None	75	--	N	\$1.7	\$4.6	\$6.3	\$0.5	\$0.7	\$7.5	15%	Green	< 5%	130	10 or Less	None Expected	10 or Less	0.8%	0.0%	0.8%
Sheriffs Facility (Inmate Housing)		None	75	--	N	\$1.2	\$6.8	\$8.0	\$0.4	\$2.9	\$11.3	6%	Green	< 5%	683	10 or Less	None Expected	10 or Less	0.1%	0.0%	0.1%
YGC Service Building (Building #2)		Very Low	77	--	N	\$1.2	\$4.3	\$5.5	\$0.5	\$0.8	\$6.7	58%	Red	5-10%	71	10 or Less	None Expected	10 or Less	7.0%	0.0%	8.5%
Public Defender's Office		Very High	78	--	N	\$0.9	\$5.5	\$6.4	\$0.7	\$0.4	\$7.5	29%	Yellow	< 5%	92	10 or Less	None Expected	10 or Less	2.2%	0.0%	2.2%
Northern Police Station		Medium	80	--	N	\$0.7	\$3.1	\$3.8	\$0.3	\$0.4	\$4.6	60%	Red	5-10%	54	10 or Less	None Expected	10 or Less	7.4%	0.0%	9.3%
War Memorial Opera House		Low	81	3	Y	\$11.1	\$58.8	\$69.9	\$1.5	\$0.0	\$71.4	24%	Green	< 5%	3,303	51 to 100	10 or Less	51 to 100	2.1%	0.1%	2.1%
Fire Station #2	Dual System	Very Low	83	3	N	\$0.2	\$0.8	\$1.0	\$0.1	\$0.2	\$1.2	17%	Green	< 5%	51	10 or Less	None Expected	10 or Less	2.0%	0.0%	2.0%
SFGH - Mental Health Building		Very Low	86	--	N	\$1.3	\$5.4	\$6.7	\$3.5	\$1.4	\$11.6	31%	Yellow	< 5%	312	10 or Less	None Expected	10 or Less	2.6%	0.0%	2.6%
SFGH - Mental Health Sprt Building		Very Low	87	--	N	\$0.7	\$3.1	\$3.9	\$2.1	\$0.8	\$6.8	31%	Yellow	< 5%	182	10 or Less	None Expected	10 or Less	2.2%	0.0%	2.7%
War Memorial Veterans Building		Medium	88	3	Y	\$10.0	\$75.0	\$85.0	\$2.0	\$0.0	\$87.0	73%	Red	< 5%	1,712	101 or More	10 or Less	101 or More	7.0%	0.4%	7.4%
Jones St Tank & Tank House		Very Low	89	1	N	\$0.0	\$0.1	\$0.1	\$0.0	\$0.0	\$0.1	14%	Green	< 5%	3	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Pump Station #2 (Fort Mason)		Very Low	90	1	N	\$0.5	\$2.0	\$2.5	\$1.5	\$0.3	\$4.3	73%	Red	5-10%	23	10 or Less	None Expected	10 or Less	8.7%	0.0%	13.0%
Fire Division of Training		Medium	91	1	N	\$0.1	\$0.4	\$0.5	\$0.0	\$0.1	\$0.6	28%	Yellow	< 5%	103	10 or Less	None Expected	10 or Less	2.9%	0.0%	2.9%
Fire Station #10		Medium	92	3	N	\$0.3	\$1.3	\$1.6	\$0.1	\$0.2	\$1.9	31%	Yellow	< 5%	43	10 or Less	None Expected	10 or Less	2.3%	0.0%	2.3%
Fire Station #5		Medium	93	3	N	\$0.5	\$2.2	\$2.7	\$0.2	\$0.3	\$3.3	63%	Red	5-10%	38	10 or Less	None Expected	10 or Less	7.9%	0.0%	7.9%
Davies Symphony Hall		Medium	95	1	N	\$6.7	\$40.5	\$47.2	\$1.0	\$0.0	\$48.2	28%	Yellow	< 5%	2,880	51 to 100	10 or Less	51 to 100	2.3%	0.1%	2.4%
						\$190.3	\$791.2	\$981.5	\$146.2	\$151.1	\$1,278.9				61,523						

CAPSS San Andreas M7.2 (USGS 30 Year Event Probability = 0.6%)																					
Facility Name	Special Treatment	Liquefaction Susceptibility	CPP Priority	SHR	Retro-fitted?	Structural Damage (\$M)	Non-Structural Damage (\$M)	Total Building Damage (\$M)	Contents Damage (\$M)	Operational Losses; Rent, Relocation & Lost Income (\$M)	Total Economic Impact (\$M)	Mean Building Damage %	Predicted Occupancy Tag (based on damage %)	Probability of Collapse	Peak Occupancy	Expected Non-Fatal Injuries (Peak Occupancy)	Expected Fatalities (Peak Occupancy)	Overall Expected Casualties (Peak Occupancy)	Non-Fatal Injury Rates (Peak Occupancy)	Fatality Rates (Peak Occupancy)	Overall Casualty Rate (Peak Occupancy)
Fire Station #40	Dual System	Medium	47	3	N	\$0.2	\$1.0	\$1.2	\$0.1	\$0.1	\$1.5	48%	Yellow	< 5%	22	10 or Less	None Expected	10 or Less	4.5%	0.0%	4.5%
Ingleside Police Station		Very Low	48	3	N	\$0.5	\$2.2	\$2.7	\$0.2	\$0.4	\$3.3	42%	Yellow	< 5%	56	10 or Less	None Expected	10 or Less	5.4%	0.0%	5.4%
Laguna Honda Main Hospital (C Wing)		Very Low	49	3	N	\$1.8	\$5.1	\$7.0	\$0.6	\$0.8	\$8.3	30%	Yellow	< 5%	97	10 or Less	None Expected	10 or Less	3.1%	0.0%	3.1%
Taraval Police Station - Original Wing		None	50	3	Y	\$0.2	\$0.6	\$0.8	\$0.1	\$0.1	\$1.0	24%	Green	< 5%	27	10 or Less	None Expected	10 or Less	3.7%	0.0%	3.7%
Taraval Police Station - Addition #1		None	50	3	Y	\$0.1	\$0.3	\$0.4	\$0.0	\$0.1	\$0.5	25%	Yellow	< 5%	14	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Taraval Police Station - Addition #2	Dual System	None	50	3	Y	\$0.1	\$0.2	\$0.3	\$0.0	\$0.0	\$0.4	19%	Green	< 5%	14	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Tom Waddell Clinic		Medium	51	--	N	\$0.9	\$4.0	\$4.9	\$3.2	\$0.4	\$8.5	42%	Yellow	< 5%	75	10 or Less	None Expected	10 or Less	5.3%	0.0%	5.3%
Eureka Valley Rec Center (Auditorium & Locker Room)		Very Low	62	3	N	\$0.1	\$0.4	\$0.5	\$0.0	\$0.0	\$0.5	13%	Green	< 5%	93	10 or Less	None Expected	10 or Less	1.1%	0.0%	1.1%
Eureka Valley Rec Center (Gym)		Very Low	62	3	N	\$0.0	\$0.2	\$0.3	\$0.0	\$0.0	\$0.3	8%	Green	< 5%	82	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Fire Station #11		Very Low	63	3	N	\$0.1	\$0.3	\$0.4	\$0.0	\$0.1	\$0.5	8%	Green	< 5%	42	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Fire Station #15		Very Low	64	3	N	\$0.1	\$0.5	\$0.6	\$0.1	\$0.1	\$0.7	14%	Green	< 5%	36	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Fire Station #36		Medium	65	3	N	\$0.1	\$0.7	\$0.9	\$0.1	\$0.1	\$1.1	16%	Green	< 5%	48	10 or Less	None Expected	10 or Less	2.1%	0.0%	2.1%
Fire Station #38		Very Low	66	2	N	\$0.0	\$0.2	\$0.3	\$0.0	\$0.0	\$0.3	6%	Green	< 5%	40	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Fire Station #7		Medium	67	2	N	\$0.1	\$0.8	\$0.9	\$0.1	\$0.1	\$1.1	16%	Green	< 5%	49	10 or Less	None Expected	10 or Less	2.0%	0.0%	2.0%
Hall of Justice Gas Station	Dual System	Very High	69	2	N	\$0.0	\$0.2	\$0.2	\$0.0	\$0.1	\$0.3	31%	Yellow	< 5%	12	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
SFGH - Building 2 (Service Building)		Very Low	74	3	Y	\$0.0	\$0.3	\$0.4	\$0.0	\$0.1	\$0.5	5%	Green	< 5%	112	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Sheriffs Facility (Admin Building)		None	75	--	N	\$1.2	\$3.2	\$4.3	\$0.3	\$0.5	\$5.1	11%	Green	< 5%	130	10 or Less	None Expected	10 or Less	0.8%	0.0%	0.8%
Sheriffs Facility (Inmate Housing)		None	75	--	N	\$1.0	\$6.0	\$7.0	\$0.4	\$2.3	\$9.6	5%	Green	< 5%	683	10 or Less	None Expected	10 or Less	0.1%	0.0%	0.1%
YGC Service Building (Building #2)		Very Low	77	--	N	\$0.7	\$2.1	\$2.7	\$0.2	\$0.5	\$3.4	29%	Yellow	< 5%	71	10 or Less	None Expected	10 or Less	2.8%	0.0%	2.8%
Public Defender's Office		Very High	78	--	N	\$0.8	\$5.3	\$6.1	\$0.6	\$0.4	\$7.2	28%	Yellow	< 5%	92	10 or Less	None Expected	10 or Less	2.2%	0.0%	2.2%
Northern Police Station		Medium	80	--	N	\$0.4	\$1.6	\$2.1	\$0.2	\$0.3	\$2.5	33%	Yellow	< 5%	54	10 or Less	None Expected	10 or Less	3.7%	0.0%	3.7%
War Memorial Opera House		Low	81	3	Y	\$5.0	\$26.0	\$31.0	\$0.7	\$0.0	\$31.7	11%	Green	< 5%	3,303	26 to 50	10 or Less	26 to 50	0.8%	0.0%	0.8%
Fire Station #2	Dual System	Very Low	83	3	N	\$0.1	\$0.4	\$0.4	\$0.0	\$0.1	\$0.5	7%	Green	< 5%	51	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
SFGH - Mental Health Building		Very Low	86	--	N	\$0.6	\$2.3	\$2.9	\$1.5	\$0.8	\$5.1	13%	Green	< 5%	312	10 or Less	None Expected	10 or Less	0.6%	0.0%	0.6%
SFGH - Mental Health Sprt Building		Very Low	87	--	N	\$0.3	\$1.4	\$1.7	\$0.9	\$0.4	\$3.0	13%	Green	< 5%	182	10 or Less	None Expected	10 or Less	0.5%	0.0%	0.5%
War Memorial Veterans Building		Medium	88	3	Y	\$6.4	\$38.9	\$45.3	\$1.0	\$0.0	\$46.3	39%	Yellow	< 5%	1,712	51 to 100	10 or Less	51 to 100	3.6%	0.2%	3.8%
Jones St Tank & Tank House		Very Low	89	1	N	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	6%	Green	< 5%	3	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Pump Station #2 (Fort Mason)		Very Low	90	1	N	\$0.3	\$0.9	\$1.2	\$0.6	\$0.2	\$2.0	34%	Yellow	< 5%	23	10 or Less	None Expected	10 or Less	4.3%	0.0%	4.3%
Fire Division of Training		Medium	91	1	N	\$0.0	\$0.2	\$0.3	\$0.0	\$0.0	\$0.3	16%	Green	< 5%	103	10 or Less	None Expected	10 or Less	1.9%	0.0%	1.9%
Fire Station #10		Medium	92	3	N	\$0.1	\$0.7	\$0.8	\$0.1	\$0.1	\$1.0	16%	Green	< 5%	43	10 or Less	None Expected	10 or Less	2.3%	0.0%	2.3%
Fire Station #5		Medium	93	3	N	\$0.3	\$1.2	\$1.5	\$0.1	\$0.2	\$1.8	34%	Yellow	< 5%	38	10 or Less	None Expected	10 or Less	2.6%	0.0%	5.3%
Davies Symphony Hall		Medium	95	1	N	\$4.0	\$26.3	\$30.2	\$0.7	\$0.0	\$30.9	18%	Green	< 5%	2,880	26 to 50	10 or Less	26 to 50	1.4%	0.1%	1.4%
						\$108.6	\$429.7	\$538.3	\$74.8	\$92.6	\$705.8				61,523						

CAPSS San Andreas M6.5 (USGS 30 Year Event Probability Not Available)																						
Facility Name	Special Treatment	Liquefaction Susceptibility	CPP Priority	SHR	Retro-fitted?	Structural Damage (\$M)	Non-Structural Damage (\$M)	Total Building Damage (\$M)	Contents Damage (\$M)	Operational Losses; Rent, Relocation & Lost Income (\$M)	Total Economic Impact (\$M)	Mean Building Damage (%)	Predicted Occupancy Tag (based on damage %)	Probability of Collapse	Peak Occupancy	Expected Non-Fatal Injuries		Expected Fatalities (Peak Occupancy)	Overall Expected Casualties (Peak Occupancy)	Non-Fatal Injury Rates (Peak Occupancy)	Fatality Rates (Peak Occupancy)	Overall Casualty Rate (Peak Occupancy)
																(Peak Occupancy)	(Peak Occupancy)					
Fire Station #40	Dual System	Medium	47	3	N	\$0.2	\$0.8	\$1.0	\$0.1	\$0.1	\$1.2	38%	Yellow	< 5%	22	10 or Less	None Expected	10 or Less	4.5%	0.0%	4.5%	
Ingleside Police Station		Very Low	48	3	N	\$0.3	\$1.1	\$1.4	\$0.1	\$0.2	\$1.8	22%	Green	< 5%	56	10 or Less	None Expected	10 or Less	1.8%	0.0%	1.8%	
Laguna Honda Main Hospital (C Wing)		Very Low	49	3	N	\$0.9	\$2.2	\$3.1	\$0.3	\$0.4	\$3.7	13%	Green	< 5%	97	10 or Less	None Expected	10 or Less	1.0%	0.0%	1.0%	
Taraval Police Station - Original Wing		None	50	3	Y	\$0.1	\$0.3	\$0.4	\$0.0	\$0.1	\$0.5	14%	Green	< 5%	27	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%	
Taraval Police Station - Addition #1		None	50	3	Y	\$0.0	\$0.2	\$0.2	\$0.0	\$0.0	\$0.3	14%	Green	< 5%	14	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%	
Taraval Police Station - Addition #2	Dual System	None	50	3	Y	\$0.0	\$0.1	\$0.2	\$0.0	\$0.0	\$0.2	12%	Green	< 5%	14	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%	
Tom Waddell Clinic		Medium	51	--	N	\$0.5	\$1.7	\$2.2	\$1.4	\$0.2	\$3.8	19%	Green	< 5%	75	10 or Less	None Expected	10 or Less	2.7%	0.0%	2.7%	
Eureka Valley Rec Center (Auditorium & Locker Room)		Very Low	62	3	N	\$0.0	\$0.2	\$0.3	\$0.0	\$0.0	\$0.3	7%	Green	< 5%	93	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%	
Eureka Valley Rec Center (Gym)		Very Low	62	3	N	\$0.0	\$0.2	\$0.2	\$0.0	\$0.0	\$0.2	5%	Green	< 5%	82	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%	
Fire Station #11		Very Low	63	3	N	\$0.0	\$0.2	\$0.2	\$0.0	\$0.0	\$0.3	5%	Green	< 5%	42	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%	
Fire Station #15		Very Low	64	3	N	\$0.1	\$0.3	\$0.4	\$0.0	\$0.1	\$0.5	10%	Green	< 5%	36	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%	
Fire Station #36		Medium	65	3	N	\$0.1	\$0.5	\$0.5	\$0.1	\$0.1	\$0.7	10%	Green	< 5%	48	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%	
Fire Station #38		Very Low	66	2	N	\$0.0	\$0.1	\$0.1	\$0.0	\$0.0	\$0.2	3%	Green	< 5%	40	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%	
Fire Station #7		Medium	67	2	N	\$0.1	\$0.5	\$0.6	\$0.1	\$0.1	\$0.7	10%	Green	< 5%	49	None Expected	None Expected	10 or Less	0.0%	0.0%	2.0%	
Hall of Justice Gas Station	Dual System	Very High	69	2	N	\$0.0	\$0.1	\$0.2	\$0.0	\$0.0	\$0.2	28%	Yellow	< 5%	12	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%	
SFGH - Building 2 (Service Building)		Very Low	74	3	Y	\$0.0	\$0.2	\$0.3	\$0.0	\$0.1	\$0.3	3%	Green	< 5%	112	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%	
Sheriffs Facility (Admin Building)		None	75	--	N	\$0.9	\$2.5	\$3.4	\$0.3	\$0.4	\$4.0	8%	Green	< 5%	130	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%	
Sheriffs Facility (Inmate Housing)		None	75	--	N	\$1.0	\$5.9	\$6.8	\$0.3	\$2.3	\$9.5	5%	Green	< 5%	683	10 or Less	None Expected	10 or Less	0.1%	0.0%	0.1%	
YGC Service Building (Building #2)		Very Low	77	--	N	\$0.3	\$1.0	\$1.3	\$0.1	\$0.3	\$1.7	14%	Green	< 5%	71	10 or Less	None Expected	10 or Less	1.4%	0.0%	1.4%	
Public Defender's Office		Very High	78	--	N	\$0.8	\$5.1	\$5.9	\$0.6	\$0.4	\$6.9	27%	Yellow	< 5%	92	10 or Less	None Expected	10 or Less	2.2%	0.0%	2.2%	
Northern Police Station		Medium	80	--	N	\$0.2	\$0.8	\$1.0	\$0.1	\$0.2	\$1.2	16%	Green	< 5%	54	10 or Less	None Expected	10 or Less	1.9%	0.0%	1.9%	
War Memorial Opera House		Low	81	3	Y	\$1.9	\$9.9	\$11.8	\$0.3	\$0.0	\$12.1	4%	Green	< 5%	3,303	10 or Less	None Expected	10 or Less	0.3%	0.0%	0.3%	
Fire Station #2	Dual System	Very Low	83	3	N	\$0.0	\$0.2	\$0.2	\$0.0	\$0.0	\$0.3	4%	Green	< 5%	51	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%	
SFGH - Mental Health Building		Very Low	86	--	N	\$0.2	\$1.0	\$1.2	\$0.7	\$0.4	\$2.3	6%	Green	< 5%	312	10 or Less	None Expected	10 or Less	0.3%	0.0%	0.3%	
SFGH - Mental Health Sprt Building		Very Low	87	--	N	\$0.1	\$0.6	\$0.7	\$0.4	\$0.2	\$1.3	6%	Green	< 5%	182	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%	
War Memorial Veterans Building		Medium	88	3	Y	\$3.4	\$16.4	\$19.7	\$0.4	\$0.0	\$20.2	17%	Green	< 5%	1,712	26 to 50	10 or Less	26 to 50	1.5%	0.1%	1.6%	
Jones St Tank & Tank House		Very Low	89	1	N	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	3%	Green	< 5%	3	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%	
Pump Station #2 (Fort Mason)		Very Low	90	1	N	\$0.1	\$0.3	\$0.4	\$0.2	\$0.1	\$0.7	13%	Green	< 5%	23	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%	
Fire Division of Training		Medium	91	1	N	\$0.0	\$0.2	\$0.2	\$0.0	\$0.0	\$0.2	10%	Green	< 5%	103	10 or Less	None Expected	10 or Less	1.0%	0.0%	1.0%	
Fire Station #10		Medium	92	3	N	\$0.1	\$0.5	\$0.6	\$0.1	\$0.1	\$0.7	12%	Green	< 5%	43	None Expected	None Expected	10 or Less	0.0%	0.0%	2.3%	
Fire Station #5		Medium	93	3	N	\$0.1	\$0.6	\$0.7	\$0.1	\$0.1	\$0.9	17%	Green	< 5%	38	10 or Less	None Expected	10 or Less	2.6%	0.0%	2.6%	
Davies Symphony Hall		Medium	95	1	N	\$2.0	\$14.3	\$16.3	\$0.4	\$0.0	\$16.7	10%	Green	< 5%	2,880	11 to 25	10 or Less	11 to 25	0.7%	0.0%	0.7%	
						\$66.1	\$256.8	\$322.9	\$41.1	\$71.0	\$435.0				61,523							

		CAPSS Hayward M6.9 (USGS 30 Year Event Probability = 9.9%)																			
Facility Name	Special Treatment	Liquefaction Susceptibility	CPP Priority	SHR	Retro-fitted?	Structural Damage (\$M)	Non-Structural Damage (\$M)	Total Building Damage (\$M)	Contents Damage (\$M)	Operational Losses; Rent, Relocation & Lost Income (\$M)	Total Economic Impact (\$M)	Mean Building Damage (%)	Predicted Occupancy Tag (based on damage %)	Probability of Collapse	Peak Occupancy	Expected Non-Fatal Injuries (Peak Occupancy)	Expected Fatalities (Peak Occupancy)	Overall Expected Casualties (Peak Occupancy)	Non-Fatal Injury Rates (Peak Occupancy)	Fatality Rates (Peak Occupancy)	Overall Casualty Rate (Peak Occupancy)
Fire Station #40	Dual System	Medium	47	3	N	\$0.1	\$0.2	\$0.2	\$0.0	\$0.0	\$0.3	9%	Green	< 5%	22	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Ingleside Police Station		Very Low	48	3	N	\$0.1	\$0.2	\$0.3	\$0.0	\$0.1	\$0.4	4%	Green	< 5%	56	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Laguna Honda Main Hospital (C Wing)		Very Low	49	3	N	\$0.3	\$0.6	\$0.8	\$0.1	\$0.1	\$1.1	4%	Green	< 5%	97	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Taraval Police Station - Original Wing		None	50	3	Y	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.1	1%	Green	< 5%	27	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Taraval Police Station - Addition #1		None	50	3	Y	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	2%	Green	< 5%	14	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Taraval Police Station - Addition #2	Dual System	None	50	3	Y	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	2%	Green	< 5%	14	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Tom Waddell Clinic		Medium	51	--	N	\$0.4	\$1.5	\$1.9	\$1.1	\$0.2	\$3.2	16%	Green	< 5%	75	10 or Less	None Expected	10 or Less	1.3%	0.0%	1.3%
Eureka Valley Rec Center (Auditorium & Locker Room)		Very Low	62	3	N	\$0.0	\$0.1	\$0.1	\$0.0	\$0.0	\$0.1	2%	Green	< 5%	93	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Eureka Valley Rec Center (Gym)		Very Low	62	3	N	\$0.0	\$0.1	\$0.1	\$0.0	\$0.0	\$0.1	2%	Green	< 5%	82	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Fire Station #11		Very Low	63	3	N	\$0.0	\$0.1	\$0.1	\$0.0	\$0.0	\$0.1	2%	Green	< 5%	42	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Fire Station #15		Very Low	64	3	N	\$0.0	\$0.1	\$0.1	\$0.0	\$0.0	\$0.1	2%	Green	< 5%	36	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Fire Station #36		Medium	65	3	N	\$0.0	\$0.3	\$0.3	\$0.0	\$0.0	\$0.4	6%	Green	< 5%	48	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Fire Station #38		Very Low	66	2	N	\$0.0	\$0.1	\$0.1	\$0.0	\$0.0	\$0.1	2%	Green	< 5%	40	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Fire Station #7		Medium	67	2	N	\$0.0	\$0.3	\$0.3	\$0.0	\$0.0	\$0.4	6%	Green	< 5%	49	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Hall of Justice Gas Station	Dual System	Very High	69	2	N	\$0.0	\$0.1	\$0.2	\$0.0	\$0.0	\$0.2	28%	Yellow	< 5%	12	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
SFGH - Building 2 (Service Building)		Very Low	74	3	Y	\$0.0	\$0.2	\$0.2	\$0.0	\$0.0	\$0.2	2%	Green	< 5%	112	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Sheriffs Facility (Admin Building)		None	75	--	N	\$0.9	\$2.6	\$3.5	\$0.3	\$0.4	\$4.2	9%	Green	< 5%	130	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Sheriffs Facility (Inmate Housing)		None	75	--	N	\$0.9	\$5.6	\$6.5	\$0.3	\$2.1	\$8.9	4%	Green	< 5%	683	10 or Less	None Expected	10 or Less	0.1%	0.0%	0.1%
YGC Service Building (Building #2)		Very Low	77	--	N	\$0.1	\$0.2	\$0.3	\$0.0	\$0.1	\$0.4	3%	Green	< 5%	71	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Public Defender's Office		Very High	78	--	N	\$0.8	\$5.1	\$5.9	\$0.6	\$0.4	\$6.9	26%	Yellow	< 5%	92	10 or Less	None Expected	10 or Less	2.2%	0.0%	2.2%
Northern Police Station		Medium	80	--	N	\$0.1	\$0.4	\$0.4	\$0.0	\$0.1	\$0.6	7%	Green	< 5%	54	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
War Memorial Opera House		Low	81	3	Y	\$1.5	\$6.9	\$8.4	\$0.2	\$0.0	\$8.6	3%	Green	< 5%	3,303	10 or Less	None Expected	10 or Less	0.2%	0.0%	0.2%
Fire Station #2	Dual System	Very Low	83	3	N	\$0.0	\$0.2	\$0.2	\$0.0	\$0.0	\$0.3	4%	Green	< 5%	51	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
SFGH - Mental Health Building		Very Low	86	--	N	\$0.1	\$0.7	\$0.8	\$0.5	\$0.2	\$1.5	4%	Green	< 5%	312	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
SFGH - Mental Health Sprt Building		Very Low	87	--	N	\$0.1	\$0.4	\$0.5	\$0.3	\$0.1	\$0.9	4%	Green	< 5%	182	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
War Memorial Veterans Building		Medium	88	3	Y	\$3.0	\$13.2	\$16.2	\$0.3	\$0.0	\$16.5	14%	Green	< 5%	1,712	11 to 25	10 or Less	11 to 25	1.3%	0.1%	1.3%
Jones St Tank & Tank House		Very Low	89	1	N	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	3%	Green	< 5%	3	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Pump Station #2 (Fort Mason)		Very Low	90	1	N	\$0.2	\$0.4	\$0.5	\$0.2	\$0.1	\$0.9	15%	Green	< 5%	23	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Fire Division of Training		Medium	91	1	N	\$0.0	\$0.1	\$0.1	\$0.0	\$0.0	\$0.1	6%	Green	< 5%	103	None Expected	None Expected	10 or Less	0.0%	0.0%	1.0%
Fire Station #10		Medium	92	3	N	\$0.0	\$0.2	\$0.3	\$0.0	\$0.0	\$0.3	5%	Green	< 5%	43	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Fire Station #5		Medium	93	3	N	\$0.1	\$0.3	\$0.4	\$0.0	\$0.1	\$0.5	8%	Green	< 5%	38	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Davies Symphony Hall		Medium	95	1	N	\$1.6	\$10.3	\$11.9	\$0.3	\$0.0	\$12.2	7%	Green	< 5%	2,880	11 to 25	10 or Less	11 to 25	0.5%	0.0%	0.5%
						\$55.2	\$209.8	\$264.9	\$32.7	\$63.4	\$361.1				61,523						

		ShakeMap San Andreas M7.9 (USGS 30 Year Event Probability = 3.8%)																			
		Liquefaction Susceptibility	CPP Priority	Retro-fitted?	Structural Damage (\$M)	Non-Structural Damage (\$M)	Total Building Damage (\$M)	Contents Damage (\$M)	Operational Losses; Rent, Relocation & Lost Income (\$M)	Total Economic Impact (\$M)	Mean Building Damage (%)	Predicted Occupancy Tag (based on damage Probability of Collapse)	Peak Occupancy	Expected Non-Fatal Injuries (Peak Occupancy)	Expected Fatalities (Peak Occupancy)	Overall Expected Casualties (Peak Occupancy)	Non-Fatal Injury Rates (Peak Occupancy)	Fatality Rates (Peak Occupancy)	Overall Casualty Rate (Peak Occupancy)		
Fire Station #40	Dual System	Medium	47	3	N	\$0.3	\$1.6	\$1.9	\$0.2	\$0.2	\$2.2	73%	Red	< 5%	22	10 or Less	None Expected	10 or Less	4.5%	0.0%	4.5%
Ingleside Police Station		Very Low	48	3	N	\$1.0	\$4.7	\$5.6	\$0.5	\$0.6	\$6.7	88%	Red	10-15%	56	10 or Less	10 or Less	10 or Less	12.5%	1.8%	14.3%
Laguna Honda Main Hospital (C Wing)		Very Low	49	3	N	\$4.0	\$15.8	\$19.8	\$1.9	\$1.3	\$23.0	85%	Red	5-10%	97	11 to 25	10 or Less	11 to 25	11.3%	1.0%	11.3%
Taraval Police Station - Original Wing		None	50	3	Y	\$0.4	\$1.7	\$2.1	\$0.2	\$0.2	\$2.5	67%	Red	5-10%	27	10 or Less	None Expected	10 or Less	7.4%	0.0%	7.4%
Taraval Police Station - Addition #1		None	50	3	Y	\$0.2	\$0.9	\$1.1	\$0.1	\$0.1	\$1.3	68%	Red	5-10%	14	10 or Less	None Expected	10 or Less	7.1%	0.0%	7.1%
Taraval Police Station - Addition #2	Dual System	None	50	3	Y	\$0.2	\$0.8	\$1.0	\$0.1	\$0.1	\$1.2	64%	Red	5-10%	14	10 or Less	None Expected	10 or Less	7.1%	0.0%	7.1%
Tom Waddell Clinic		Medium	51	--	N	\$1.6	\$8.5	\$10.1	\$7.3	\$0.7	\$18.1	87%	Red	10-15%	75	10 or Less	10 or Less	10 or Less	13.3%	1.3%	13.3%
Eureka Valley Rec Center (Auditorium & Locker Room)		Very Low	62	3	N	\$0.3	\$1.9	\$2.2	\$0.0	\$0.0	\$2.2	54%	Red	5-10%	93	10 or Less	10 or Less	10 or Less	6.5%	1.1%	7.5%
Eureka Valley Rec Center (Gym)		Very Low	62	3	N	\$0.2	\$1.1	\$1.3	\$0.0	\$0.0	\$1.3	36%	Yellow	< 5%	82	10 or Less	None Expected	10 or Less	3.7%	0.0%	3.7%
Fire Station #11		Very Low	63	3	N	\$0.3	\$1.4	\$1.8	\$0.1	\$0.3	\$2.2	37%	Yellow	< 5%	42	10 or Less	None Expected	10 or Less	4.8%	0.0%	4.8%
Fire Station #15		Very Low	64	3	N	\$0.4	\$1.8	\$2.3	\$0.2	\$0.3	\$2.7	54%	Red	5-10%	36	10 or Less	None Expected	10 or Less	5.6%	0.0%	8.3%
Fire Station #36		Medium	65	3	N	\$0.3	\$1.2	\$1.5	\$0.1	\$0.2	\$1.8	27%	Yellow	< 5%	48	10 or Less	None Expected	10 or Less	2.1%	0.0%	2.1%
Fire Station #38		Very Low	66	2	N	\$0.1	\$0.5	\$0.6	\$0.0	\$0.1	\$0.7	13%	Green	< 5%	40	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Fire Station #7		Medium	67	2	N	\$0.3	\$1.3	\$1.5	\$0.1	\$0.2	\$1.9	27%	Yellow	< 5%	49	10 or Less	None Expected	10 or Less	2.0%	0.0%	2.0%
Hall of Justice Gas Station	Dual System	Very High	69	2	N	\$0.1	\$0.2	\$0.3	\$0.0	\$0.1	\$0.4	45%	Yellow	< 5%	12	10 or Less	None Expected	10 or Less	8.3%	0.0%	8.3%
SFGH - Building 2 (Service Building)		Very Low	74	3	Y	\$0.1	\$0.6	\$0.6	\$0.1	\$0.2	\$0.9	8%	Green	< 5%	112	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Sheriffs Facility (Admin Building)		None	75	--	N	\$1.4	\$3.8	\$5.2	\$0.4	\$0.6	\$6.2	13%	Green	< 5%	130	10 or Less	None Expected	10 or Less	0.8%	0.0%	0.8%
Sheriffs Facility (Inmate Housing)		None	75	--	N	\$1.0	\$6.3	\$7.4	\$0.4	\$2.4	\$10.2	5%	Green	< 5%	683	10 or Less	None Expected	10 or Less	0.1%	0.0%	0.1%
YGC Service Building (Building #2)		Very Low	77	--	N	\$1.6	\$6.2	\$7.7	\$0.7	\$1.0	\$9.4	82%	Red	10-15%	71	10 or Less	10 or Less	10 or Less	11.3%	1.4%	12.7%
Public Defender's Office		Very High	78	--	N	\$0.9	\$5.5	\$6.4	\$0.7	\$0.4	\$7.5	29%	Yellow	< 5%	92	10 or Less	None Expected	10 or Less	2.2%	0.0%	2.2%
Northern Police Station		Medium	80	--	N	\$0.8	\$4.0	\$4.8	\$0.5	\$0.5	\$5.8	77%	Red	10-15%	54	10 or Less	10 or Less	10 or Less	11.1%	1.9%	13.0%
War Memorial Opera House		Low	81	3	Y	\$16.6	\$97.3	\$114.0	\$2.4	\$0.0	\$116.4	40%	Yellow	< 5%	3,303	101 or More	10 or Less	101 or More	3.6%	0.2%	3.8%
Fire Station #2	Dual System	Very Low	83	3	N	\$0.2	\$1.0	\$1.3	\$0.1	\$0.2	\$1.5	21%	Green	< 5%	51	10 or Less	None Expected	10 or Less	2.0%	0.0%	2.0%
SFGH - Mental Health Building		Very Low	86	--	N	\$2.1	\$9.9	\$12.0	\$7.2	\$2.1	\$21.2	55%	Red	< 5%	312	11 to 25	10 or Less	11 to 25	5.4%	0.3%	5.8%
SFGH - Mental Health Sprt Building		Very Low	87	--	N	\$1.2	\$5.7	\$7.0	\$4.2	\$1.2	\$12.4	55%	Red	< 5%	182	10 or Less	10 or Less	11 to 25	5.5%	0.5%	6.0%
War Memorial Veterans Building		Medium	88	3	Y	\$11.0	\$86.6	\$97.6	\$2.3	\$0.0	\$99.9	84%	Red	< 5%	1,712	101 or More	10 or Less	101 or More	8.2%	0.5%	8.6%
Jones St Tank & Tank House		Very Low	89	1	N	\$0.0	\$0.1	\$0.1	\$0.0	\$0.0	\$0.1	13%	Green	< 5%	3	None Expected	None Expected	None Expected	0.0%	0.0%	0.0%
Pump Station #2 (Fort Mason)		Very Low	90	1	N	\$0.5	\$2.1	\$2.7	\$1.6	\$0.3	\$4.5	77%	Red	10-15%	23	10 or Less	None Expected	10 or Less	13.0%	0.0%	13.0%
Fire Division of Training		Medium	91	1	N	\$0.1	\$0.4	\$0.5	\$0.0	\$0.1	\$0.6	27%	Yellow	< 5%	103	10 or Less	None Expected	10 or Less	2.9%	0.0%	2.9%
Fire Station #10		Medium	92	3	N	\$0.4	\$1.7	\$2.1	\$0.2	\$0.3	\$2.6	43%	Yellow	< 5%	43	10 or Less	None Expected	10 or Less	4.7%	0.0%	4.7%
Fire Station #5		Medium	93	3	N	\$0.6	\$2.9	\$3.4	\$0.3	\$0.4	\$4.1	79%	Red	10-15%	38	10 or Less	None Expected	10 or Less	10.5%	0.0%	13.2%
Davies Symphony Hall		Medium	95	1	N	\$9.6	\$59.4	\$69.0	\$1.5	\$0.0	\$70.4	40%	Yellow	< 5%	2,880	51 to 100	10 or Less	101 or More	3.5%	0.2%	3.6%
						\$239.7	\$1,068.5	\$1,308.2	\$237.1	\$162.6	\$1,708.0				61,523						