Hazus: Earthquake Global Risk Report

Region Name: AntelopeValley

Earthquake Scenario: antelopevalley2011el_m7p03_se

Print Date: April 25, 2024

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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General Description of the Region

Hazus-MH is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 21 county(ies) from the following state(s):

California

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 47,272.06 square miles and contains 1,258 census tracts. There are over 1,860 thousand households in the region which has a total population of 5,490,338 peopleF. The distribution of population by Total Region and County is provided in Appendix B.

There are an estimated 1,831 thousand buildings in the region with a total building replacement value (excluding contents) of 999,602 (millions of dollars). Approximately 91.00 % of the buildings (and 65.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 97,530 and 105,161 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 1,831 thousand buildings in the region which have an aggregate total replacement value of 999,602 (millions of dollars) . Appendix B provides a general distribution of the building value by Total Region and County.

In terms of building construction types found in the region, wood frame construction makes up 87% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 96 hospitals in the region with a total bed capacity of 12,531 beds. There are 2,178 schools, 714 fire stations, 193 police stations and 37 emergency operation facilities. With respect to high potential loss facilities (HPL), there are no dams identified within the inventory. The inventory also includes no hazardous material sites, no military installations and no nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 202,691.00 (millions of dollars). This inventory includes over 6,368.43 miles of highways, 5,207 bridges, 139,653.75 miles of pipes.

Table 1: Transportation System Lifeline Inventory

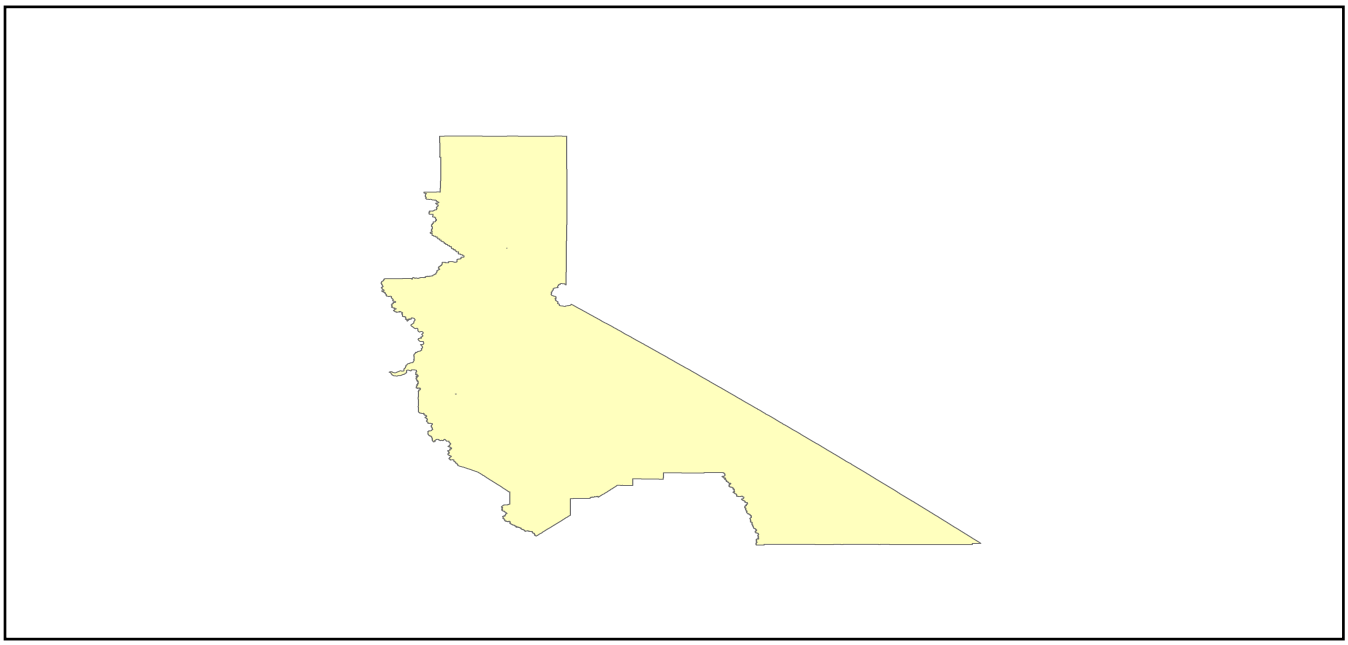
System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	5,207	16978.4967
	Segments	2,798	48890.2929
	Tunnels	11	141.5031
		Subtotal	**66010.2927**
Railways	Bridges	845	4808.0500
	Facilities	40	106.5200
	Segments	2,095	22909.1762
	Tunnels	0	0.0000
		Subtotal	**27823.7462**
Light Rail	Bridges	0	0.0000
	Facilities	55	314.0500
	Segments	3	1508.4477
	Tunnels	0	0.0000
		Subtotal	**1822.4977**
Bus	Facilities	19	41.8687
		Subtotal	**41.8687**
Ferry	Facilities	5	6.6550
		Subtotal	**6.6550**
Port	Facilities	60	228.7106
		Subtotal	**228.7106**
Airport	Facilities	75	945.3153
	Runways	90	651.1925
		Subtotal	**1596.5078**
		Total	**97,530.30**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	2786.5333
	Facilities	8	314.3520
	Pipelines	0	0.0000
		Subtotal	**3100.8853**
Waste Water	Distribution Lines	NA	1671.9200
	Facilities	73	12552.4814
	Pipelines	0	0.0000
		Subtotal	**14224.4014**
Natural Gas	Distribution Lines	NA	1114.6133
	Facilities	1	18.2016
	Pipelines	479	6440.6675
		Subtotal	**7573.4824**
Oil Systems	Facilities	2	0.2360
	Pipelines	0	0.0000
		Subtotal	**0.2360**
Electrical Power	Facilities	248	80240.4826
		Subtotal	**80240.4826**
Communication	Facilities	190	22.4200
		Subtotal	**22.4200**
		Total	**105,161.90**

Earthquake Scenario

Hazus uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.



Scenario Name	antelopevalley2011el_m7p03_se
Type of Earthquake	User-defined
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	7.03
Depth (km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Direct Earthquake Damage

Building Damage

Hazus estimates that about 28 buildings will be at least moderately damaged. This is over 0.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Damage Categories by General Occupancy Type

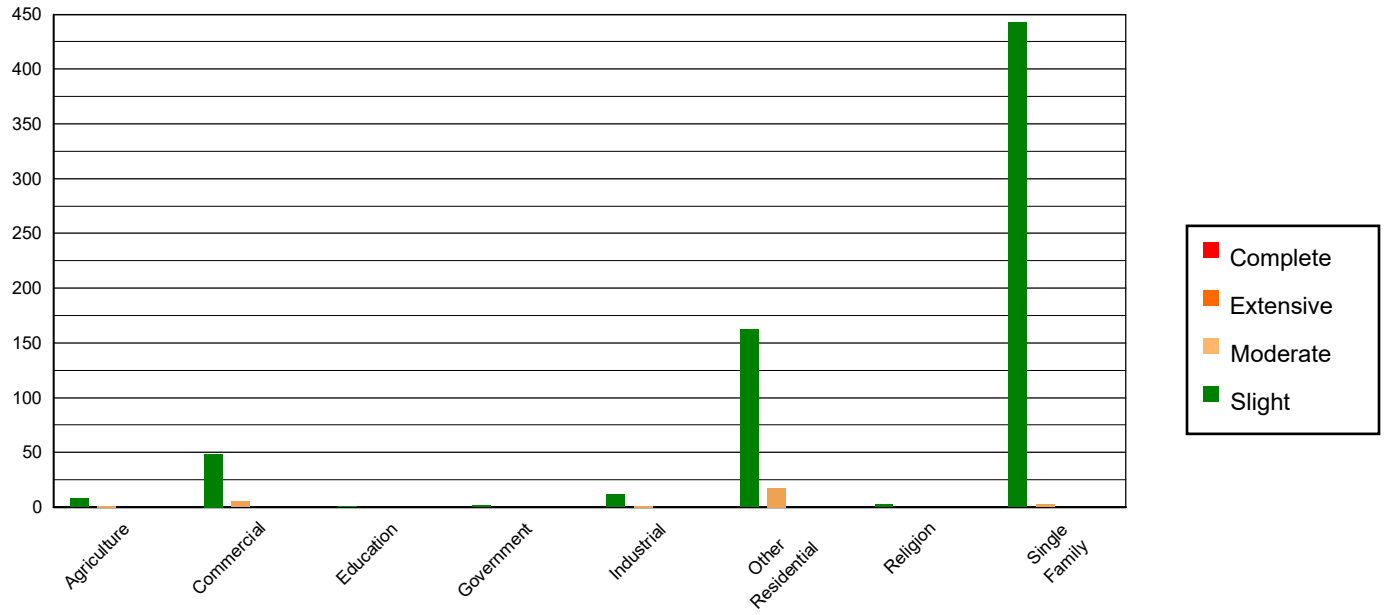


Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	18746.56	1.02	8.11	1.20	1.29	4.47	0.04	24.49	0.00	0.00
Commercial	106317.01	5.81	48.54	7.16	5.40	18.76	0.05	25.69	0.00	0.00
Education	3282.48	0.18	0.49	0.07	0.04	0.13	0.00	0.00	0.00	0.00
Government	3876.68	0.21	2.09	0.31	0.24	0.82	0.00	0.62	0.00	0.00
Industrial	30468.93	1.66	11.61	1.71	1.46	5.06	0.01	4.75	0.00	0.00
Other Residential	220365.86	12.04	162.49	23.96	17.57	61.02	0.08	43.52	0.00	0.00
Religion	6541.48	0.36	2.25	0.33	0.26	0.91	0.00	0.94	0.00	0.00
Single Family	1440905.86	78.72	442.60	65.26	2.54	8.83	0.00	0.00	0.00	0.00
Total	**1,830,505**		**678**		**29**		**0**		**0**	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	1591534.03	86.95	503.21	74.20	2.98	10.33	0.00	0.00	0.00	0.00
Steel	35805.00	1.96	26.33	3.88	4.78	16.59	0.06	34.07	0.00	0.00
Concrete	36419.67	1.99	19.43	2.86	1.86	6.47	0.02	13.35	0.00	0.00
Precast	24664.06	1.35	15.44	2.28	2.15	7.47	0.01	3.29	0.00	0.00
RM	74021.07	4.04	12.01	1.77	1.22	4.24	0.00	0.00	0.00	0.00
URM	18934.95	1.03	6.13	0.90	1.21	4.20	0.05	25.27	0.00	0.00
MH	49126.07	2.68	95.63	14.10	14.60	50.70	0.04	24.03	0.00	0.00
Total	**1,830,505**		**678**		**29**		**0**		**0**	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 12,531 hospital beds available for use. On the day of the earthquake, the model estimates that only 12,492 hospital beds (100.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 100.00% of the beds will be back in service. By 30 days, 100.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	96	0	0	96
Schools	2,178	0	0	2,175
EOCs	37	0	0	37
PoliceStations	193	0	0	193
FireStations	714	0	0	713

Transportation Lifeline Damage

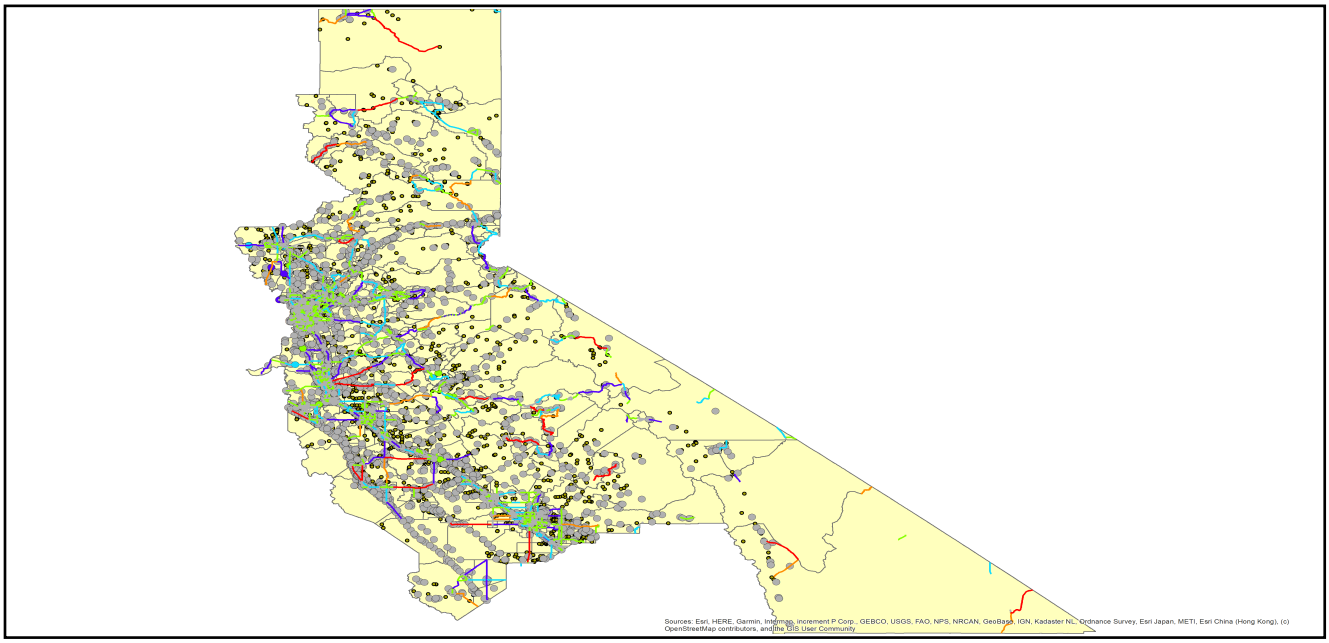


Table 6: Expected Damage to the Transportation Systems

System	Component		Number of Locations			
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	2,798	0	0	2,798	2,798
	Bridges	5,207	0	0	5,207	5,207
	Tunnels	11	0	0	11	11
Railways	Segments	2,095	0	0	2,095	2,095
	Bridges	845	0	0	845	845
	Tunnels	0	0	0	0	0
	Facilities	40	0	0	40	40
Light Rail	Segments	3	0	0	3	3
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	55	0	0	55	55
Bus	Facilities	19	0	0	19	19
Ferry	Facilities	5	0	0	5	5
Port	Facilities	60	0	0	60	60
Airport	Facilities	75	0	0	75	75
	Runways	90	0	0	90	90

Table 6 provides damage estimates for the transportation system.

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	8	0	0	8	8
Waste Water	73	0	0	73	73
Natural Gas	1	0	0	1	1
Oil Systems	2	0	0	2	2
Electrical Power	248	0	0	248	248
Communication	190	0	0	190	190

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (miles)	Number of Leaks	Number of Breaks
Potable Water	86,574	205	51
Waste Water	51,944	103	26
Natural Gas	1,136	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	1,860,063	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

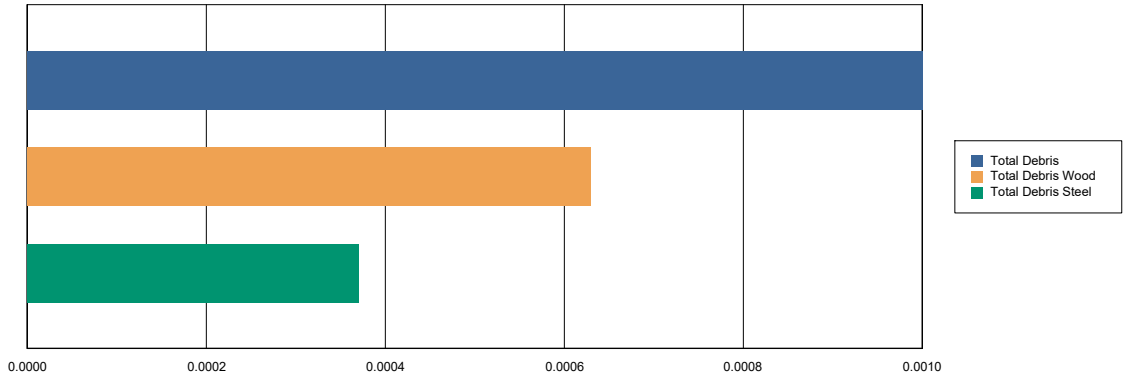
Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 1,000 tons of debris will be generated. Of the total amount, Brick/Wood comprises 63.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 40 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Earthquake Debris (millions of tons)



Brick/ Wood	Reinforced Concrete/Steel	Total Debris	Truck Load
0.00	0.00	0.00	40 (@25 tons/truck)

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 5,490,338) will seek temporary shelter in public shelters.

Displaced Households/ Persons Seeking Short Term Public Shelter

Displaced households as a result of the earthquake	Persons seeking temporary public shelter
0	0

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0.01	0.00	0.00	0.00
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.01	0.00	0.00	0.00
	Other-Residential	0.32	0.01	0.00	0.00
	Single Family	0.30	0.00	0.00	0.00
	Total	**1**	**0**	**0**	**0**
2 PM	Commercial	0.48	0.02	0.00	0.00
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.10	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.05	0.00	0.00	0.00
	Other-Residential	0.10	0.00	0.00	0.00
	Single Family	0.09	0.00	0.00	0.00
	Total	**1**	**0**	**0**	**0**
5 PM	Commercial	0.31	0.01	0.00	0.00
	Commuting	0.02	0.05	0.05	0.01
	Educational	0.02	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.03	0.00	0.00	0.00
	Other-Residential	0.11	0.00	0.00	0.00
	Single Family	0.11	0.00	0.00	0.00
	Total	**1**	**0**	**0**	**0**

Economic Loss

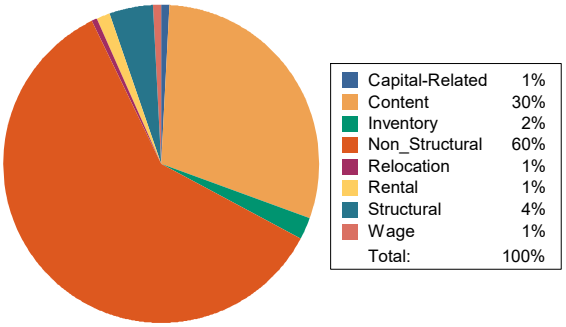
The total economic loss estimated for the earthquake is 157.06 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 35.93 (millions of dollars); 4 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 60 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type ($ millions)



Earthquake Losses by Occupancy Type ($ millions)

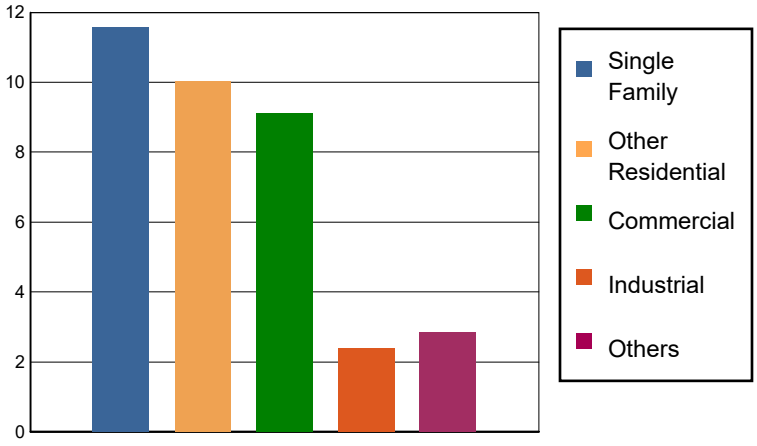


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.0000	0.0529	0.2353	0.0051	0.0329	0.3262
	Capital-Related	0.0000	0.0224	0.2705	0.0030	0.0049	0.3008
	Rental	0.0313	0.2529	0.1632	0.0046	0.0106	0.4626
	Relocation	0.0156	0.0650	0.1082	0.0193	0.0377	0.2458
	Subtotal	**0.0469**	**0.3932**	**0.7772**	**0.0320**	**0.0861**	**1.3354**
Capital Stock Losses							
	Structural	0.6888	0.3348	0.3101	0.0779	0.1571	1.5687
	Non_Structural	7.4422	6.9127	4.5379	1.2698	1.3734	21.5360
	Content	3.3987	2.3772	3.0440	0.8789	0.9993	10.6981
	Inventory	0.0000	0.0000	0.4271	0.1294	0.2319	0.7884
	Subtotal	**11.5297**	**9.6247**	**8.3191**	**2.3560**	**2.7617**	**34.5912**
	Total	**11.58**	**10.02**	**9.10**	**2.39**	**2.85**	**35.93**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	48890.2929	0.0000	0.00
	Bridges	16978.4967	0.3320	0.00
	Tunnels	141.5031	0.0000	0.00
	Subtotal	**66010.2927**	**0.3320**	
Railways	Segments	22909.1762	0.0000	0.00
	Bridges	4808.0500	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	106.5200	0.1083	0.10
	Subtotal	**27823.7462**	**0.1083**	
Light Rail	Segments	1508.4477	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	314.0500	0.3116	0.10
	Subtotal	**1822.4977**	**0.3116**	
Bus	Facilities	41.8687	0.4930	1.18
	Subtotal	**41.8687**	**0.4930**	
Ferry	Facilities	6.6550	0.0000	0.00
	Subtotal	**6.6550**	**0.0000**	
Port	Facilities	228.7106	0.0979	0.04
	Subtotal	**228.7106**	**0.0979**	
Airport	Facilities	945.3153	3.5243	0.37
	Runways	651.1925	0.0000	0.00
	Subtotal	**1596.5078**	**3.5243**	
	Total	**97,530.28**	**4.87**	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.0000	0.0000	0.00
	Facilities	314.3520	0.0322	0.01
	Distribution Lines	2786.5333	0.9240	0.03
	Subtotal	**3100.8853**	**0.9562**	
Waste Water	Pipelines	0.0000	0.0000	0.00
	Facilities	12552.4814	3.1235	0.02
	Distribution Lines	1671.9200	0.4642	0.03
	Subtotal	**14224.4014**	**3.5877**	
Natural Gas	Pipelines	6440.6675	0.0000	0.00
	Facilities	18.2016	0.0000	0.00
	Distribution Lines	1114.6133	0.1590	0.01
	Subtotal	**7573.4824**	**0.1590**	
Oil Systems	Pipelines	0.0000	0.0000	0.00
	Facilities	0.2360	0.0000	0.00
	Subtotal	**0.2360**	**0.0000**	
Electrical Power	Facilities	80240.4826	111.5476	0.14
	Subtotal	**80240.4826**	**111.5476**	
Communication	Facilities	22.4200	0.0170	0.08
	Subtotal	**22.4200**	**0.0170**	
	Total	**105,161.91**	**116.27**	

Appendix A: County Listing for the Region

Alpine,CA

Amador,CA

Calaveras,CA

El Dorado,CA

Fresno,CA

Inyo,CA

Lassen,CA

Madera,CA

Mariposa,CA

Merced,CA

Mono,CA

Nevada,CA

Placer,CA

Plumas,CA

Sacramento,CA

San Joaquin,CA

Sierra,CA

Stanislaus,CA

Sutter,CA

Tuolumne,CA

Yuba,CA

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
California					
	Alpine	1,204	721	139	861
	Amador	40,474	5,608	2,517	8,125
	Calaveras	45,292	8,305	4,893	13,199
	El Dorado	191,185	34,907	9,704	44,611
	Fresno	1,008,654	98,532	61,772	160,304
	Inyo	19,016	2,951	1,970	4,921
	Lassen	32,730	4,033	2,008	6,042
	Madera	156,255	18,025	9,641	27,667
	Mariposa	17,131	3,299	1,141	4,441
	Merced	281,202	25,194	26,098	51,292
	Mono	13,195	3,293	1,083	4,377
	Nevada	102,241	17,908	6,108	24,016
	Placer	404,739	69,985	24,193	94,179
	Plumas	19,790	6,128	2,276	8,405
	Sacramento	1,585,055	179,811	83,911	263,723
	San Joaquin	779,233	82,706	56,882	139,589
	Sierra	3,236	596	419	1,015
	Stanislaus	552,878	62,937	37,511	100,449
	Sutter	99,633	10,618	6,448	17,066
	Tuolumne	55,620	8,964	3,507	12,471
	Yuba	81,575	8,161	4,677	12,839
Total Region		**5,490,338**	**652,682**	**346,898**	**999,592**