Appendix K

HAZUS Loss Estimates (Flooding and Earthquake)

HAZUS-MH: Earthquake Event Report

Region Name City of Merced_2

Earthquake Scenario: Merced County Ortigalita Fault Zone

Print Date: May 12, 2011

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

General Description of the Region

HAZUS is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of HAZUS is to provide a methodology and software application to develop earthquake 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 earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 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 1,970.53 square miles and contains 47 census tracts. There are over 63 thousand households in the region and has a total population of 210,554 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 69 thousand buildings in the region with a total building replacement value (excluding contents) of 12,947 (millions of dollars). Approximately 93.00 % of the buildings (and 78.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 3,078 and 445 (millions of dollars), respectively.

Building and Lifeline Inventory

Building Inventory

HAZUS estimates that there are 69 thousand buildings in the region which have an aggregate total replacement value of 12,947 (millions of dollars). Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 84% 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 (HPL) facilities. 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 4 hospitals in the region with a total bed capacity of 288 beds. There are 122 schools, 10 fire stations, 23 police stations and 0 emergency operation facilities. With respect to HPL facilities, there are 13 dams identified within the region. Of these, 8 of the dams are classified as 'high hazard'. The inventory also includes 23 hazardous material sites, 0 military installations and 0 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 3,523.00 (millions of dollars). This inventory includes over 441 kilometers of highways, 471 bridges, 14,182 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	471	379.10
	Segments	124	2,365.70
	Tunnels	0	0.00
	Subtotal		2,744.80
Railways	Bridges	2	0.70
	Facilities	2	5.30
	Segments	117	179.00
	Tunnels	0	0.00
	Subtotal		185.00
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
	Subtotal		0.00
Bus	Facilities	2	2.60
	Subtotal		2.60
Ferry	Facilities	0	0.00
	Subtotal		0.00
Port	Facilities	0	0.00
	Subtotal		0.00
Airport	Facilities	3	32.00
	Runways	3	113.90
	Subtotal		145.80
	Total		3,078.20

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	141.80
	Facilities	46	0.00
	Pipelines	0	0.00
	Subtotal		141.80
Waste Water	Distribution Lines	NA	85.10
	Facilities	4	314.40
	Pipelines	0	0.00
	Subtotal		399.40
Natural Gas	Distribution Lines	NA	56.70
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		56.70
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		0.00
Electrical Power	Facilities	1	129.80
	Subtotal		129.80
Communication	Facilities	14	1.70
	Subtotal		1.70
	Total		729.40

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	Merced County Ortigalita Fault Zone
Type of Earthquake	Source
Fault Name	Ortigalita
Historical Epicenter ID #	170
Probabilistic Return Period	NA
Longitude of Epicenter	-121.14
Latitude of Epicenter	37.10
Earthquake Magnitude	7.10
Depth (Km)	0.00
Rupture Length (Km)	50.58
Rupture Orientation (degrees)	0.00
Attenuation Function	WUS Shallow Crustal Event - Extensional

Building Damage

Building Damage

HAZUS estimates that about 2,436 buildings will be at least moderately damaged. This is over 3.00 % of the total number of buildings in the region. There are an estimated 209 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 summaries the expected damage by general occupancy for the buildings in the region. Table 4 summaries the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	600	0.98	73	1.19	38	2.13	11	2.36	4	2.04
Commercial	2,382	3.90	240	3.94	142	8.05	40	8.60	12	5.61
Education	121	0.20	10	0.16	4	0.23	1	0.19	0	0.10
Government	87	0.14	7	0.12	4	0.23	1	0.30	1	0.26
Industrial	553	0.91	59	0.96	36	2.03	10	2.16	3	1.40
Other Residential	11,430	18.72	1,392	22.83	800	45.52	368	78.62	181	86.22
Religion	235	0.38	20	0.33	10	0.55	2	0.53	1	0.31
Single Family	45,663	74.77	4,297	70.47	725	41.25	34	7.23	9	4.07
Total	61,072		6,098		1,758		469		210	

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

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	52,616	86.15	4975	81.58	856	48.70	41	8.74	12	5.54
Steel	1,139	1.86	117	1.92	90	5.09	33	6.96	11	5.22
Concrete	1,163	1.90	112	1.83	54	3.08	18	3.90	6	3.01
Precast	732	1.20	78	1.27	56	3.21	15	3.25	3	1.51
RM	1,804	2.95	118	1.93	78	4.41	21	4.45	4	1.85
URM	374	0.61	50	0.81	28	1.60	8	1.79	4	1.87
MH	3,244	5.31	650	10.66	596	33.91	332	70.92	170	81.01
Total	61,072		6,098		1,758		469		210	

*Note:
RM   Reinforced Masonry
URM   Unreinforced Masonry
MH   Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 288 hospital beds available for use. On the day of the earthquake, the model estimates that only 282 hospital beds (98.00%) 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	4	0	0	4
Schools	122	0	0	121
EOCs	0	0	0	0
PoliceStations	23	0	0	23
FireStations	10	0	0	10

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

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	124	0	0	124	124
	Bridges	471	12	0	454	471
	Tunnels	0	0	0	0	0
Railways	Segments	117	0	0	117	117
	Bridges	2	0	0	2	2
	Tunnels	0	0	0	0	0
	Facilities	2	0	0	2	2
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	2	0	0	2	2
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	3	0	0	3	3
	Runways	3	0	0	3	3

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	46	0	0	46	46
Waste Water	4	0	0	3	4
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	1	0	0	1	1
Communication	14	1	0	14	14

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

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	7,091	1845	461
Waste Water	4,255	1459	365
Natural Gas	2,836	1560	390
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	63,815	18,115	15,153	9,126	0	0
Electric Power		796	457	168	28	1

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 6 ignitions that will burn about 0.01 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 16 people and burn about 1 (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 0.050 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 46.00% 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 1,920 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

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 28 households to be displaced due to the earthquake. Of these, 27 people (out of a total population of 210,554) will seek temporary shelter in public shelters.

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	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	1	0	0	0
	Industrial	0	0	0	0
	Other-Residential	33	7	0	1
	Single Family	14	1	0	0
	Total	49	8	0	1
2 PM	Commercial	16	3	0	1
	Commuting	0	0	0	0
	Educational	9	2	0	1
	Hotels	0	0	0	0
	Industrial	1	0	0	0
	Other-Residential	8	2	0	0
	Single Family	3	0	0	0
	Total	37	7	1	2
5 PM	Commercial	20	5	1	1
	Commuting	5	7	12	2
	Educational	1	0	0	0
	Hotels	0	0	0	0
	Industrial	1	0	0	0
	Other-Residential	12	2	0	0
	Single Family	5	0	0	0
	Total	45	14	13	4

The total economic loss estimated for the earthquake is 214.51 (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 167.28 (millions of dollars); 16 % 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 57 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates
(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Loses							
	Wage	0.00	0.36	4.98	0.16	0.33	5.83
	Capital-Related	0.00	0.15	5.13	0.10	0.10	5.48
	Rental	1.00	1.10	2.31	0.09	0.15	4.65
	Relocation	3.48	2.94	3.19	0.52	1.14	11.27
	Subtotal	4.48	4.56	15.61	0.87	1.72	27.24
Capital Stock Loses							
	Structural	7.46	4.16	4.60	1.58	3.15	20.95
	Non_Structural	41.85	16.33	15.98	6.01	5.56	85.73
	Content	13.60	3.35	7.66	4.11	3.36	32.08
	Inventory	0.00	0.00	0.24	0.76	0.29	1.28
	Subtotal	62.91	23.84	28.47	12.45	12.36	140.04
	Total	67.39	28.40	44.08	13.32	14.09	167.28

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.

HAZUS estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

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

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	2,365.68	$0.00	0.00
	Bridges	379.11	$11.29	2.98
	Tunnels	0.00	$0.00	0.00
	Subtotal	2744.80	11.30	
Railways	Segments	178.98	$0.00	0.00
	Bridges	0.71	$0.00	0.01
	Tunnels	0.00	$0.00	0.00
	Facilities	5.33	$0.17	3.19
	Subtotal	185.00	0.20	
Light Rail	Segments	0.00	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	0.00	0.00	
Bus	Facilities	2.57	$0.10	4.00
	Subtotal	2.60	0.10	
Ferry	Facilities	0.00	$0.00	0.00
	Subtotal	0.00	0.00	
Port	Facilities	0.00	$0.00	0.00
	Subtotal	0.00	0.00	
Airport	Facilities	31.95	$2.84	8.90
	Runways	113.89	$0.00	0.00
	Subtotal	145.80	2.80	
	Total	3078.20	14.40	

Table 13: Utility System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Line	141.80	$8.30	5.85
	subtotal	141.82	$8.30	
Waste Water	Pipelines	0.00	$0.00	0.00
	Facilities	314.40	$9.52	3.03
	Distribution Line	85.10	$6.57	7.72
	subtotal	399.44	$16.09	
Natural Gas	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Line	56.70	$7.02	12.37
	subtotal	56.73	$7.02	
Oil Systems	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	subtotal	0.00	$0.00	
Electrical Power	Facilities	129.80	$1.36	1.05
	subtotal	129.80	$1.36	
Communication	Facilities	1.70	$0.05	2.73
	subtotal	1.65	$0.05	
	total	729.45	$32.81	

Table 14. Indirect Economic Impact with outside aid
(Employment as # of people and Income in millions of $)

LOSS		Total	%
First Year	Employment Impact	0	0.00
	Income Impact	(1)	-0.07
Second Year	Employment Impact	0	0.00
	Income Impact	(4)	-0.20
Third Year	Employment Impact	0	0.00
	Income Impact	(5)	-0.26
Fourth Year	Employment Impact	0	0.00
	Income Impact	(5)	-0.26
Fifth Year	Employment Impact	0	0.00
	Income Impact	(5)	-0.26
Years 6 to 15	Employment Impact	0	0.00
	Income Impact	(5)	-0.26

Appendix A: County Listing for the Region

Merced,CA

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
California					
	Merced	210,554	10,116	2,830	12,947
Total State		210,554	10,116	2,830	12,947
Total Region		210,554	10,116	2,830	12,947

HAZUS-MH: Flood Event Report

Region Name: 100 Yr Flood Merced

Flood Scenario: 100 Year Flood

Print Date: Tuesday, April 26, 2011

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 Flood. These results can be improved by using enhanced inventory data and flood hazard information.

HAZUS is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). 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 flood loss estimates provided in this report were based on a region that included 1 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 1,900 square miles and contains 5,793 census blocks. The region contains over 64 thousand households and has a total population of 210,554 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 69,606 buildings in the region with a total building replacement value (excluding contents) of 12,948 million dollars (2006 dollars). Approximately 93.24% of the buildings (and 78.14% of the building value) are associated with residential housing.

General Building Stock

HAZUS estimates that there are 69,606 buildings in the region which have an aggregate total replacement value of 12,948 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	10,116,811	78.1%
Commercial	1,504,286	11.6%
Industrial	608,550	4.7%
Agricultural	283,558	2.2%
Religion	171,822	1.3%
Government	76,087	0.6%
Education	186,479	1.4%
Total	12,947,593	100.00%

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	2,366,561	76.8%
Commercial	504,151	16.4%
Industrial	89,259	2.9%
Agricultural	19,964	0.6%
Religion	41,904	1.4%
Government	30,460	1.0%
Education	31,101	1.0%
Total	3,083,400	100.00%

Essential Facility Inventory

For essential facilities, there are 3 hospitals in the region with a total bed capacity of 288 beds. There are 121 schools, 6 fire stations, 23 police stations and no emergency operation centers.

Flood Scenario Parameters

HAZUS used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	100 Yr Flood Merced
Scenario Name:	100 Year Flood
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

HAZUS estimates that about 4,084 buildings will be at least moderately damaged. This is over 52% of the total number of buildings in the scenario. There are an estimated 131 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the HAZUS Flood technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

Occupancy	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	0	0.00	2	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	7	9.59	62	84.93	4	5.48	0	0.00	0	0.00	0	0.00
Education	1	00.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	13	92.86	1	7.14	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	9	75.00	0	0.00	3	25.00	0	0.00	0	0.00
Religion	0	0.00	2	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	1,196	29.89	2,402	60.03	238	5.95	34	0.85	131	3.27
Total	**21**		**1,272**		**2,406**		**241**		**34**		**131**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	7	25.93	19	70.37	1	3.70	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	131	100.00
Masonry	5	21.74	12	52.17	6	26.09	0	0.00	0	0.00	0	0.00
Steel	4	26.67	11	73.33	0	0.00	0	0.00	0	0.00	0	0.00
Wood	1	0.03	1,205	31.19	2,386	61.77	237	6.14	34	0.88	0	0.00

Before the flood analyzed in this scenario, the region had hospital beds available for use. On the day of the scenario flood event, the model estimates that hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

| | | # Facilities | | |
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	6	0	0	0
Hospitals	3	0	0	0
Police Stations	23	6	0	6
Schools	121	17	0	17

If this report displays all zeros or is blank, two possibilities can explain this.

   (1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

   (2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Debris Generation

HAZUS estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). 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 37,552 tons of debris will be generated. Of the total amount, Finishes comprises 93% of the total, Structure comprises 2% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 1,502 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Shelter Requirements

HAZUS estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. HAZUS also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 11,417 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 32,516 people (out of a total population of 210,554) will seek temporary shelter in public shelters.

The total economic loss estimated for the flood is 798.62 million dollars, which represents 25.90 % of the total replacement value of the scenario buildings.

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 flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 789.03 million dollars. 1% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 55.31% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates
(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	258.43	54.12	12.68	10.34	335.57
	Content	182.16	161.97	36.15	61.73	442.00
	Inventory	0.00	4.19	6.16	1.12	11.47
	Subtotal	440.59	220.27	54.99	73.19	789.03
Business Interruption						
	Income	0.02	0.92	0.01	0.17	1.12
	Relocation	0.79	0.31	0.01	0.01	1.13
	Rental Income	0.23	0.21	0.00	0.00	0.44
	Wage	0.05	1.06	0.01	5.78	6.90
	Subtotal	1.10	2.50	0.03	5.96	9.59
ALL	Total	441.69	222.78	55.01	79.14	798.62

Appendix A: County Listing for the Region

California
- Merced

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
California				
Merced	210,554	10,116,811	2,830,782	12,947,593
Total	210,554	10,116,811	2,830,782	12,947,593
Total Study Region	210,554	10,116,811	2,830,782	12,947,593

HAZUS-MH: Flood Event Report

Region Name: 200 Year Flood - Merced

Flood Scenario: 200 Year Flood

Print Date: Wednesday, June 01, 2011

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 Flood. These results can be improved by using enhanced inventory data and flood hazard information.

Table of Contents

General Description of the Region

HAZUS is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). 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 flood loss estimates provided in this report were based on a region that included 1 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 1,900 square miles and contains 5,793 census blocks. The region contains over 64 thousand households and has a total population of 210,554 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 69,606 buildings in the region with a total building replacement value (excluding contents) of 12,948 million dollars (2006 dollars). Approximately 93.24% of the buildings (and 78.14% of the building value) are associated with residential housing.

General Building Stock

HAZUS estimates that there are 69,606 buildings in the region which have an aggregate total replacement value of 12,948 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	10,116,811	78.1%
Commercial	1,504,286	11.6%
Industrial	608,550	4.7%
Agricultural	283,558	2.2%
Religion	171,822	1.3%
Government	76,087	0.6%
Education	186,479	1.4%
Total	12,947,593	100.00%

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	2,573,198	76.3%
Commercial	540,018	16.0%
Industrial	92,484	2.7%
Agricultural	55,558	1.6%
Religion	49,171	1.5%
Government	31,370	0.9%
Education	32,255	1.0%
Total	3,374,054	100.00%

Essential Facility Inventory

For essential facilities, there are 3 hospitals in the region with a total bed capacity of 288 beds. There are 121 schools, 6 fire stations, 23 police stations and no emergency operation centers.

HAZUS used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	200 Year Flood - Merced
Scenario Name:	200 Year Flood
Return Period Analyzed:	200
Analysis Options Analyzed:	No What-Ifs

General Building Stock Damage

HAZUS estimates that about 4,899 buildings will be at least moderately damaged. This is over 52% of the total number of buildings in the scenario. There are an estimated 149 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the HAZUS Flood technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

Occupancy	1-10 Count	(%)	11-20 Count	(%)	21-30 Count	(%)	31-40 Count	(%)	41-50 Count	(%)	Substantially Count	(%)
Agriculture	0	0.00	4	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	3	3.66	73	89.02	3	3.66	3	3.66	0	0.00	0	0.00
Education	1	00.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	11	84.62	2	15.38	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	8	66.67	1	8.33	3	25.00	0	0.00	0	0.00
Religion	0	0.00	6	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	892	18.60	3,244	67.64	456	9.51	55	1.15	149	3.11
Total	**15**		**985**		**3,248**		**462**		**55**		**149**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10 Count	(%)	11-20 Count	(%)	21-30 Count	(%)	31-40 Count	(%)	41-50 Count	(%)	Substantially Count	(%)
Concrete	6	18.75	22	68.75	3	9.38	1	3.13	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	148	100.00
Masonry	3	7.89	16	42.11	17	44.74	2	5.26	0	0.00	0	0.00
Steel	3	15.79	14	73.68	2	10.53	0	0.00	0	0.00	0	0.00
Wood	1	0.02	905	19.55	3,213	69.43	453	9.79	55	1.19	1	0.02

Before the flood analyzed in this scenario, the region had hospital beds available for use. On the day of the scenario flood event, the model estimates that hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	6	1	0	0
Hospitals	3	1	0	0
Police Stations	23	6	0	6
Schools	121	18	0	18

If this report displays all zeros or is blank, two possibilities can explain this.

  (1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

  (2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Debris Generation

HAZUS estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). 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 45,659 tons of debris will be generated. Of the total amount, Finishes comprises 93% of the total, Structure comprises 2% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 1,826 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Shelter Requirements

HAZUS estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. HAZUS also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 13,008 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 37,051 people (out of a total population of 210,554) will seek temporary shelter in public shelters.

The total economic loss estimated for the flood is 974.32 million dollars, which represents 28.88 % of the total replacement value of the scenario buildings.

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 flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 963.37 million dollars. 1% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 55.28% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates
(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	318.30	64.19	14.59	12.97	410.05
	Content	219.07	202.76	41.90	75.10	538.83
	Inventory	0.00	5.59	6.88	2.03	14.49
	Subtotal	537.37	272.53	63.36	90.10	963.37
Business Interruption						
	Income	0.02	1.12	0.01	0.25	1.40
	Relocation	0.92	0.39	0.01	0.01	1.33
	Rental Income	0.28	0.26	0.00	0.00	0.54
	Wage	0.06	1.31	0.01	6.32	7.69
	Subtotal	1.27	3.07	0.03	6.58	10.95
ALL	Total	538.64	275.61	63.39	96.68	974.32

Appendix A: County Listing for the Region

California
- Merced

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
California				
Merced	210,554	10,116,811	2,830,782	12,947,593
Total	210,554	10,116,811	2,830,782	12,947,593
Total Study Region	210,554	10,116,811	2,830,782	12,947,593