City and County of San Francisco

Office of the Controller – Office of Economic Analysis

Hazus: A Tool for Modeling Damages and Economic Losses from Natural Disasters

Office of Economic Analysis
Controller's Office
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What is Hazus?

- Hazus is a geographic information system (GIS) based hazard modelling platform that can estimate potential damages and losses to life and property from natural disasters such as earthquakes, floods and hurricanes.
- The model was developed by the Federal Emergency Management Agency and the National Institute of Building Science to have a consistent and standardized tool across all jurisdictions for damage and loss estimation purposes.
- Hazus is a planning and impact assessment tool, not an engineering tool, even though model results are based on detailed engineering level data and assumptions.

When is Hazus Used?

- Pre-disaster planning (Preparedness)
  - The model can be used to simulate the effect of different types of hazards on a locality.
  - The estimates such as damage to buildings and infrastructure can be used for risk assessment purposes and can help inform and design better mitigation strategies.

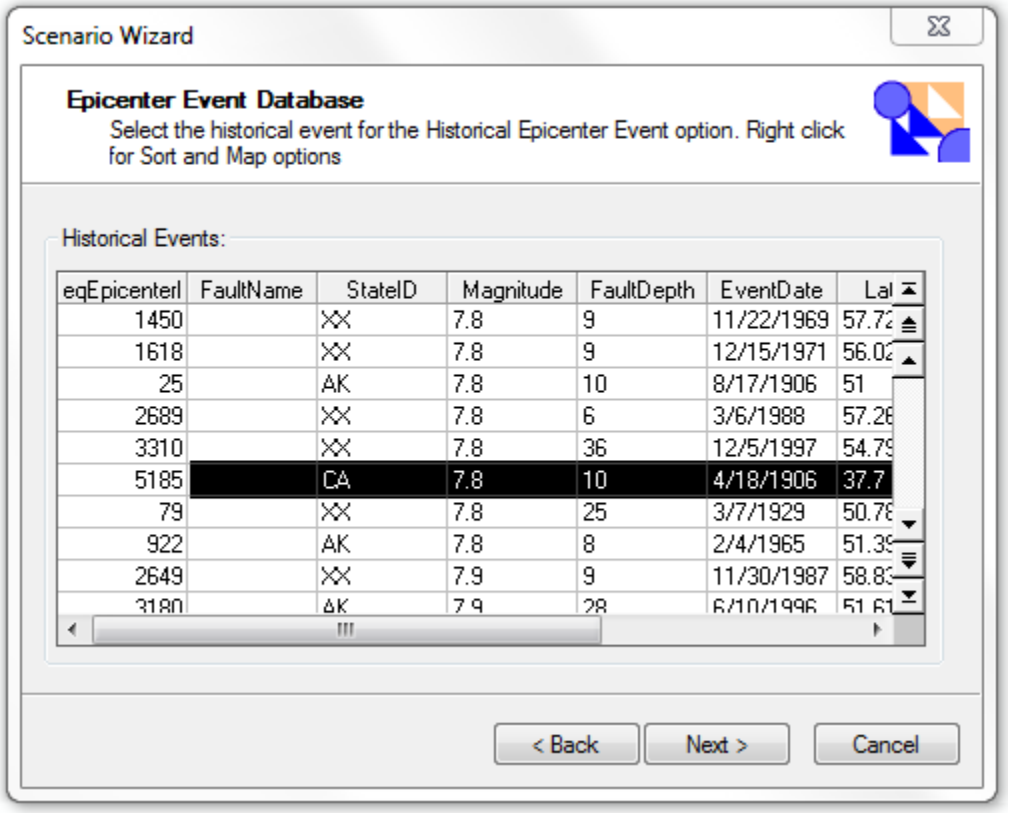
- Post-disaster planning (Response & Recovery)
  - Each county's office of emergency services is required to submit initial damage estimates to the California Governor's Office of Emergency Services for all local governments within the county boundary.
  - In an event of actual disaster Hazus can be an invaluable tool to calculate initial damage estimates in the first 72 hours when the dollar value of potential damage is largely unknown.

The Process of Running Hazus

1. Define a scenario. Potential scenarios include:
   - Modeling an actual historical earthquake.
   - Modeling a user-defined scenario by clicking the epicenter on a map
   - Modeling a user-defined scenario by entering the lat-long of an epicenter and magnitude.
   - Modeling the average annualized loss given the region's earthquake risk.
2. Run a scenario
3. Map and report results

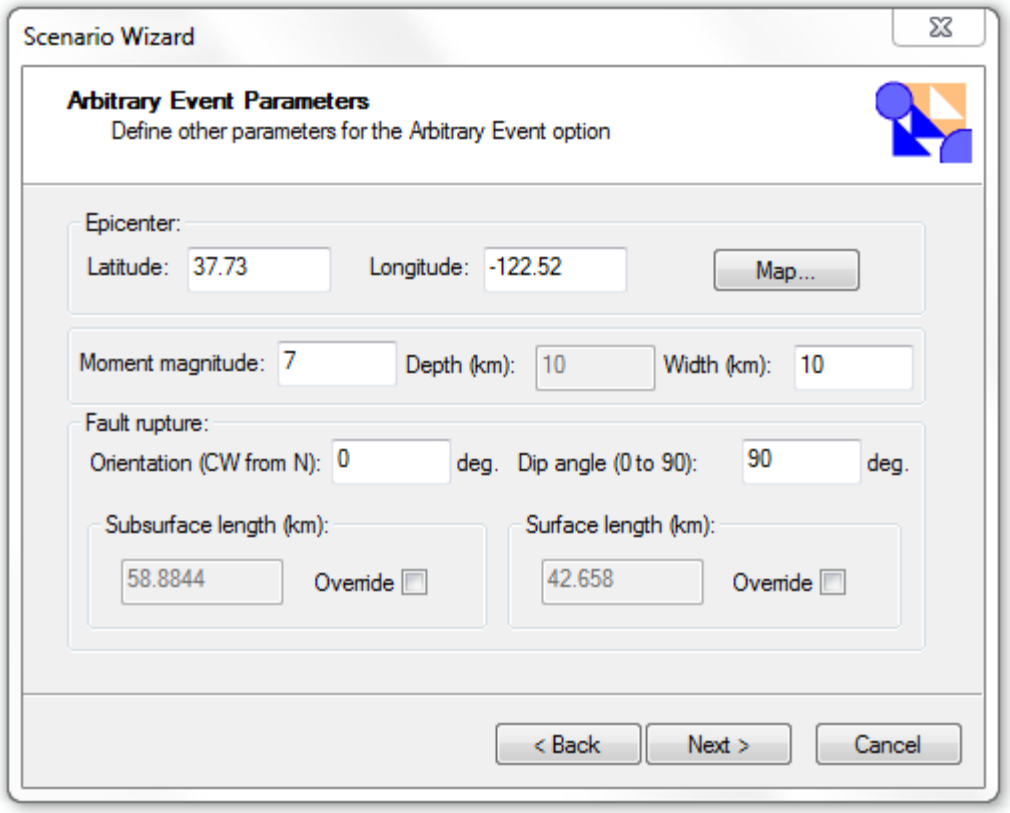
We'll show the definition of a historical event, and a user-defined scenario using information we're likely to have quickly after an earthquake.

Historical Event Scenario



Hazus contains a database of historical earthquakes that can be selected, to illustrate what a similar earthquake might do today.

User-Defined Scenario



This scenario is based on the location of the epicenter, and the magnitude of the earthquake.

This information would be available shortly after an event, allowing loss estimation before reports from the field come in.

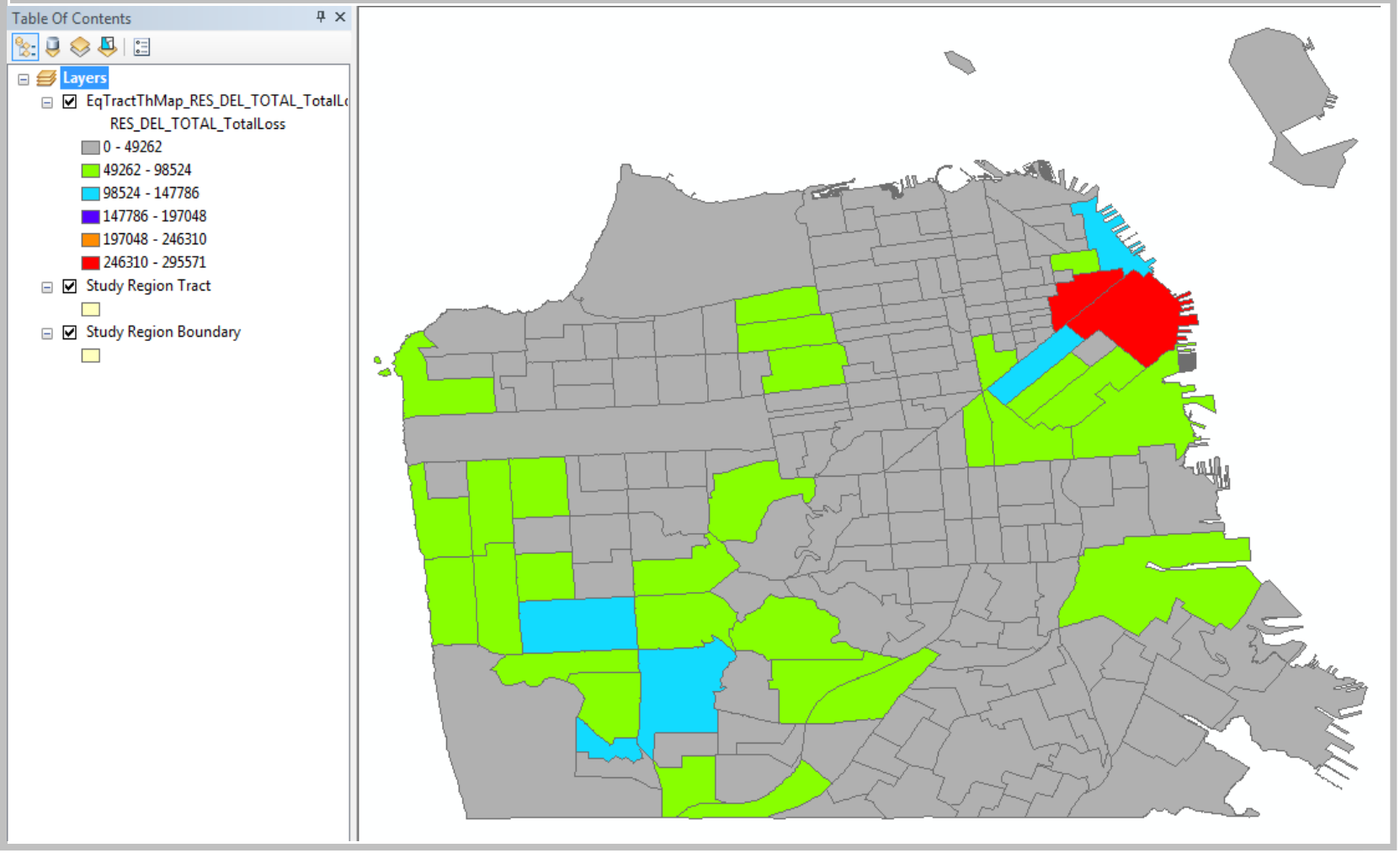
Hazus Generates a Detailed Damage Report for the Scenario

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	81.27	888.77	11.86	33.82	1,015.71
	Capital-Related	0.00	34.69	910.49	6.93	8.63	960.75
	Rental	83.37	388.67	417.22	4.90	20.84	915.00
	Relocation	299.40	232.59	632.66	27.23	150.04	1,341.92
	Subtotal	**382.77**	**737.22**	**2,849.14**	**50.92**	**213.33**	**4,233.38**
Capital Stock Losses							
	Structural	479.82	756.48	1,444.40	120.68	192.57	2,993.95
	Non_Structural	2,356.41	4,685.04	5,007.87	443.87	680.68	13,173.87
	Content	737.12	1,111.51	2,197.65	276.14	304.51	4,626.93
	Inventory	0.00	0.00	26.12	31.06	1.01	58.19
	Subtotal	**3,573.36**	**6,553.03**	**8,676.03**	**871.75**	**1,178.77**	**20,852.94**
	Total	**3,956.12**	**7,290.25**	**11,525.17**	**922.67**	**1,392.10**	**25,086.31**

Hazus Also Maps of Where Damage Would Occur, Given the Event Parameters of the Earthquake



Below are Estimated Impacts on San Francisco of Events of Different Magnitudes on Three Bay Area Faults

Fault Event	Property Damage ($ Million)	Income Losses ($ Million)	Total Building-Related Economic Losses ($ Million)	Displaced Households as a Result of the Earthquake	Persons Seeking Temporary Public Shelter	Injured or Killed (2:00 PM)
San Andreas						
5.0 Mag	1,221	112	1,333	419	219	131
6.0 Mag	4,778	742	5,521	3,973	2,079	1,036
7.0 Mag	10,631	2,042	12,673	13,021	6,664	3,644
8.0 Mag	20,853	4,233	25,086	29,562	15,136	10,436
Hayward						
5.0 Mag	51	7	58	8	4	4
6.0 Mag	977	140	1,117	328	164	94
7.0 Mag	3,476	647	4,123	2,153	1082	473
8.0 Mag	9,147	2,069	11,216	9,969	5,027	2,666
Calaveras						
5.0 Mag	2	0	2	0	0	0
6.0 Mag	116	18	134	28	14	14
7.0 Mag	822	124	946	276	141	94
8.0 Mag	2,871	623	3,494	1,814	930	566

Staff Contacts

Asim Khan, Ph.D., Principal Economist (415) 554-6369 asim.khan@sfgov.org
Ted Egan, Ph.D., Chief Economist (415) 554-5268 ted.egan@sfgov.org