Figure 3-192 presents historical earthquake epicenters spatially across the Northeast, illustrating and indicating, through areas of historical earthquake groupings, a generally higher incidence and magnitude of earthquakes. Historical earthquake occurrence as presented on **Figure 3-192** also supports previous discussion which identified the areas of the state: northeast, southeast, and far western sections as having a higher seismic risk according to the % PGA and SA maps. **Figure 3-192** was prepared by the GIS section of NY SEMO using NYS Geological Survey; National Institute of Building Sciences data.

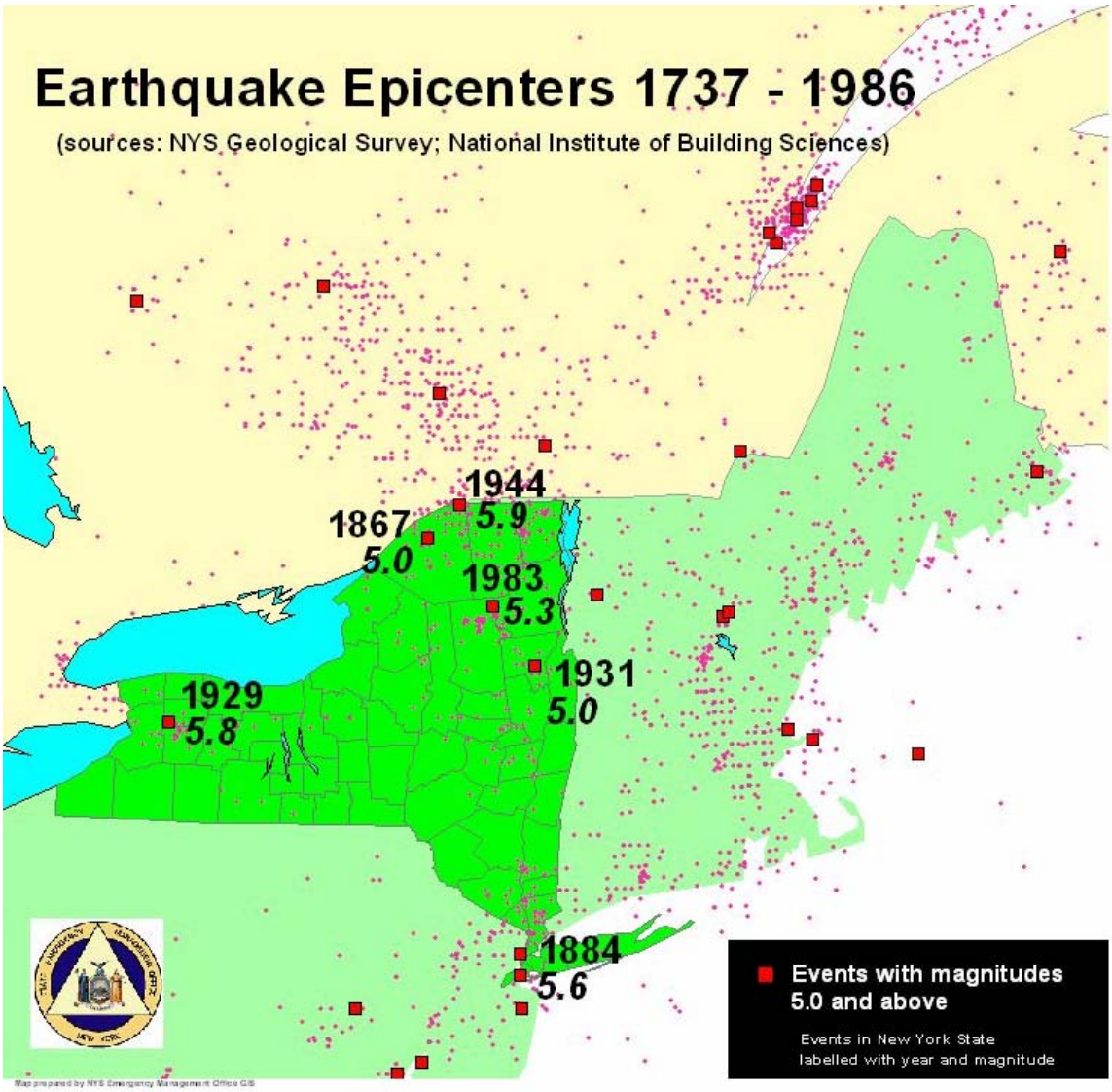
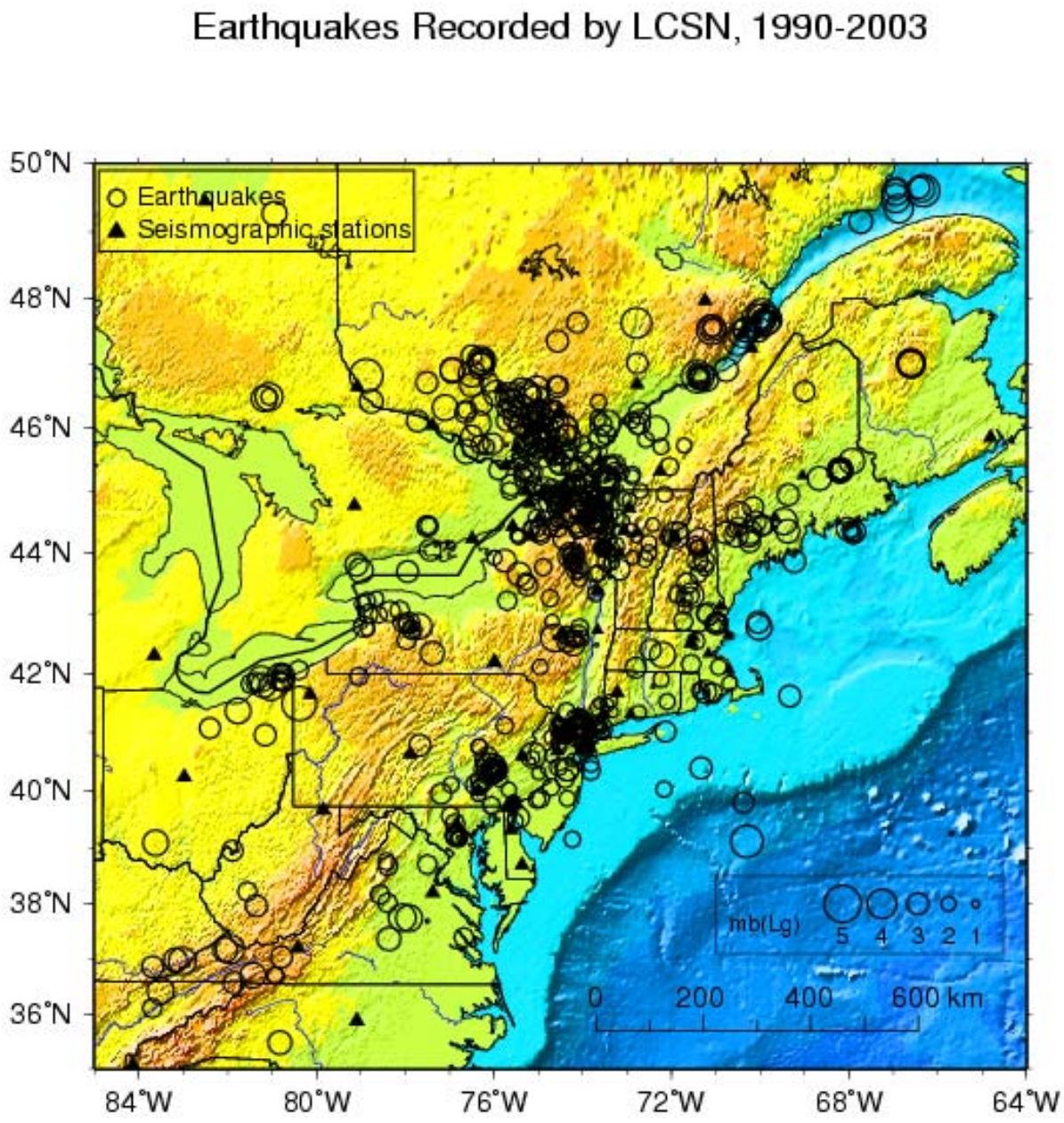


Figure 3-192 an Excerpt figure from the NYCEM 2nd Year Technical Report 1999-2000, Figure 1.2—Earthquakes of New England and Adjacent Regions (1638-1995)11, 11 Seismic Event Serve at Massachusetts Institute of Technology Earth Resources Laboratory(SEASAME), Cambridge, MA, 1999., demonstrates the historical existence of the earthquake hazard in eastern NY.

Figure 3-193 was obtained from the Lamont-Doherty Cooperative Seismographic Network, and portrays earthquake events that have occurred between 1990 and 2003.

Figure 3-193 Earthquake Events from 1990-2003



In addition, there have been multiple earthquakes originating outside New York's borders that have been felt within the State. These quakes have come from Quebec, Canada and Massachusetts. Such events are considered significant for hazard mitigation planning because they could produce damage within the State in certain situations. **Figure 3-194** presents historical earthquake epicenters spatially across the Northeast. The map was prepared by the GIS section of NY SEMO using NYS Geological Survey; National Institute of Building Sciences data.

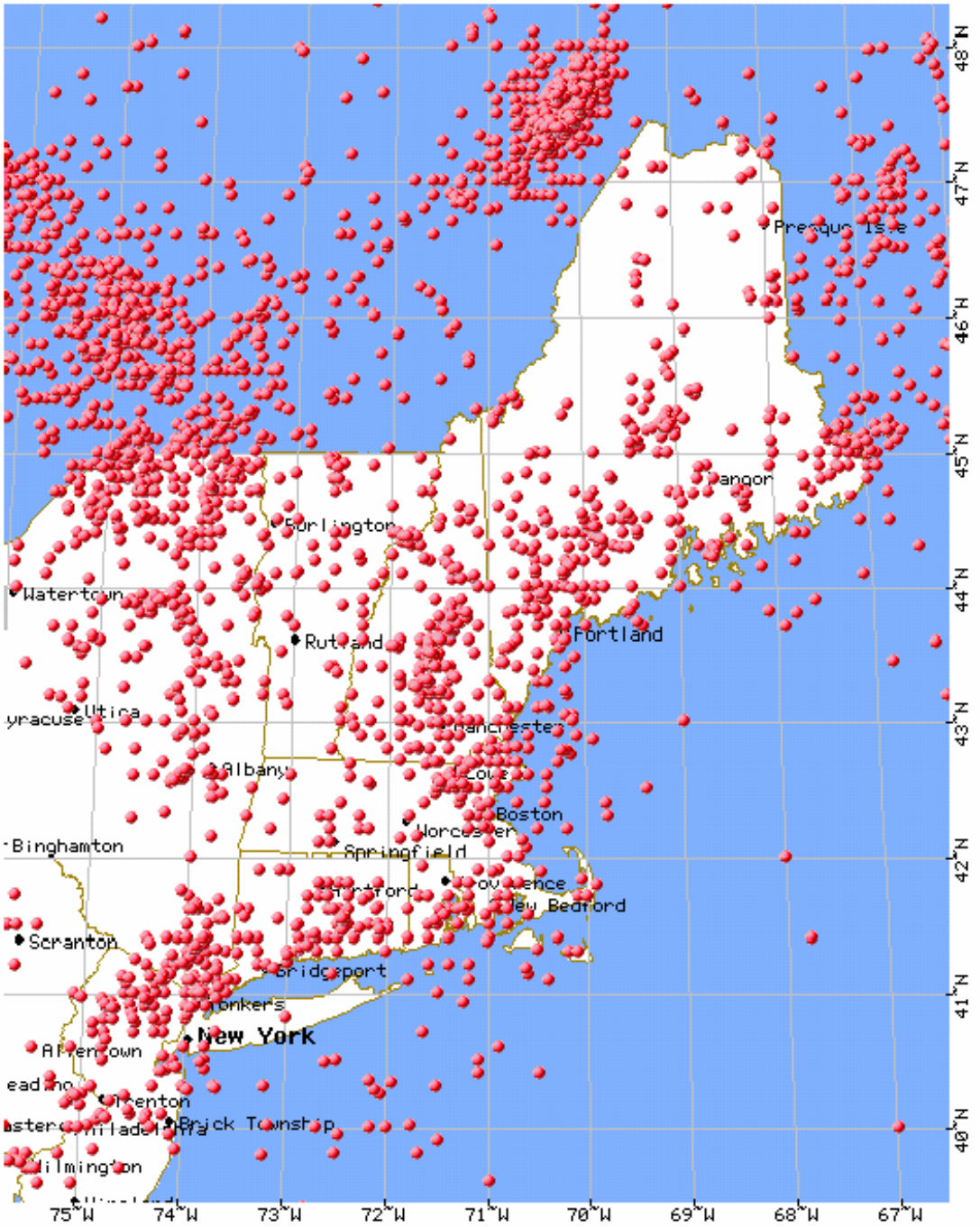


Figure 3-194 Excerpt figure from the NYCEM 2nd Year Technical Report 1999-2000, Figure 1.2—Earthquakes of New England and Adjacent Regions (1638-1995)11, 11 Seismic Event Serve at Massachusetts Institute of Technology Earth Resources Laboratory (SEASAME), Cambridge, MA, 1999.

Previous Earthquake Hazard Occurrences:

Table 3-55 below lists significant earthquakes in New York State according to the NYS Geological Survey data. (Note: this table does not cover every event from 1737-2005, only those mentioned in the 2006 NYS Statistical Yearbook)

Table 3-55

Earthquake History Throughout New York State 1737-2005			
Date	**Location**	**Size**	**Damage Estimates**
December 18, 1737	New York City	5.2	Bells rang, several chimneys fell

January 16, 1840	Herkimer	3.7	No reference and/or No damage reported
September 2, 1847	Offshore NYC	3.5	No reference and/or No damage reported
September 9, 1848	Rockland Lake	V	Felt by many
March 12, 1853	Lowville	VI	Machinery knocked over
February 7, 1855	Saugerties[1]	VI	Cryoseism[2,3]
October 23, 1857	Buffalo (Lockport[1])	4.0	Bells rang, crocks fell from shelves
December 18, 1867	Canton	4.7	Sleepers awakened
December 11, 1874	Tarrytown	3.4	No reference and/or No damage reported
November 4, 1877	Lyon Mountain[1]	VII	Chimneys down, walls cracked, window damaged, crocks overturned
August 10, 1884	New York Bight (NYC)	5.2	Chimneys and bricks fell, walls cracked
May 28, 1897	Dannemora	4.5	No reference and/or No damage reported
February 3, 1916	Schenectady	3.8	Broke windows, people thrown out of bed
March 18, 1928	Saranac Lake	4.0	No reference and/or No damage reported
August 12, 1929	Attica	5.2	250 chimneys fell, brick buildings damaged, Attica prison walls, wells went dry
April 20, 1931	Warrensburg	4.8	Chimneys fell, church spire twisted
April 15, 1934	Dannemora	3.9	House shifted
July 9, 1937	Brooklyn[1]	3.5	No reference and/or No damage reported
September 5, 1944	Corwall, Ontario/Massena, NY	5.8	Nearly all chimneys fell, buildings damaged, $2 million damage
September 5, 1944	Corwall, Ontario/Massena, NY	4.5	Chimneys destroyed, houses damaged
September 3, 1951	Rockland County	3.6	No reference and/or No damage reported
January 1, 1966	Attica	4.7	Chimneys and walls damaged
June 13, 1967	Attica	3.9	Chimneys and walls damaged
May 23, 1971	Blue Mountain Lake	4.1	No reference and/or No damage reported
May 23, 1971	Blue Mountain Lake	3.5	No reference and/or No damage reported
June 7, 1974	Wappingers Falls	3.0	Windows broken
June 9, 1975	Plattsburgh (Altona)	3.5	Chimneys and fireplaces cracked
November 3, 1975	Raquette Lake	4.0	No reference and/or No damage reported
February 2, 1983	Scarsdale-Lagrangeville	3.0	Chimneys cracked

October 7, 1983	Goodnow, Adirondack Mountains	5.1	Tombstones rotated, some cracked chimneys, windows broken, walls damaged
October 19, 1985	Ardsley	4.0	Windows broken, walls damaged
June 17, 1991	Richmondville	4.0	No reference and/or No damage reported
March 10, 1992	East Hampton, Suffolk County	4.1	No reference and/or No damage reported[2]
April 20, 2000	Newcomb	3.8	Aftershock of the 1983 event. No damage reported
April 20, 2002	Au Sable Forks	5.1	Cracked walls, chimneys fell, road collapsed, power outages
May 24, 2002	Au Sable Forks	3.1	Aftershock of the April 20, 2002 event, no damage reported

Source: NYS Statistical Yearbook 2006, 1=Location Unknown, 2=Damage Uncertain, 3=Frostquake

Records indicate during the period 1534-1975, 70 damaging earthquakes (intensity 6 or greater on the Modified Mercalli Intensity Scale) have occurred in the northeastern United States and Canada. According to a study at Massachusetts Institute of Technology Earth Research Laboratory, as referenced in the NYCEM study, *"….more than 400 earthquakes with magnitude greater than 2.0 have occurred in New York State between 1730 and 1986."* The following study also supports the existence of seismic hazard in NYS. *Isachson, Y.W., E. Landing, J. M. Lauber, et el., "Do Earthquakes Occur in New York State?", Geology of New York: A simplified Account, Albany: New York State Museum/Geological Survey, 1991, pp. 231-238,* as referenced by the NYCEM study states, "*This (data) ranks New York as having the third highest earthquake activity level east of the Mississippi during this period; only South Carolina and Tennessee were more seismically active"*.

According to a U.S. Department of Commerce Study, "Earthquake History of the United States" by Coffman, J.L. and Hake, C.A., the record of seismic activity in New York State dates back to 1737 when on December 18th in the New York City area an earthquake occurred with Modified Mercalli Intensity VII (Modified Mercalli Intensity is the local effect or damage caused by an earthquake, MMI VII represent very strong shaking and moderate damage potential and is equivalent to a PGA of 10-34% of gravity). This New York City earthquake which reportedly caused chimneys to fall is estimated to have had a 4.5 Richter magnitude, and is one of two (2) major earthquakes on record.
The most recent damaging earthquake occurred in the Northeast portion of the state on April 20, 2002. Dubbed the North Country or Ausable Forks Earthquake, this earthquake was recorded as an epicenter magnitude 5.1 on the Richter scale causing widespread light to moderate damage.

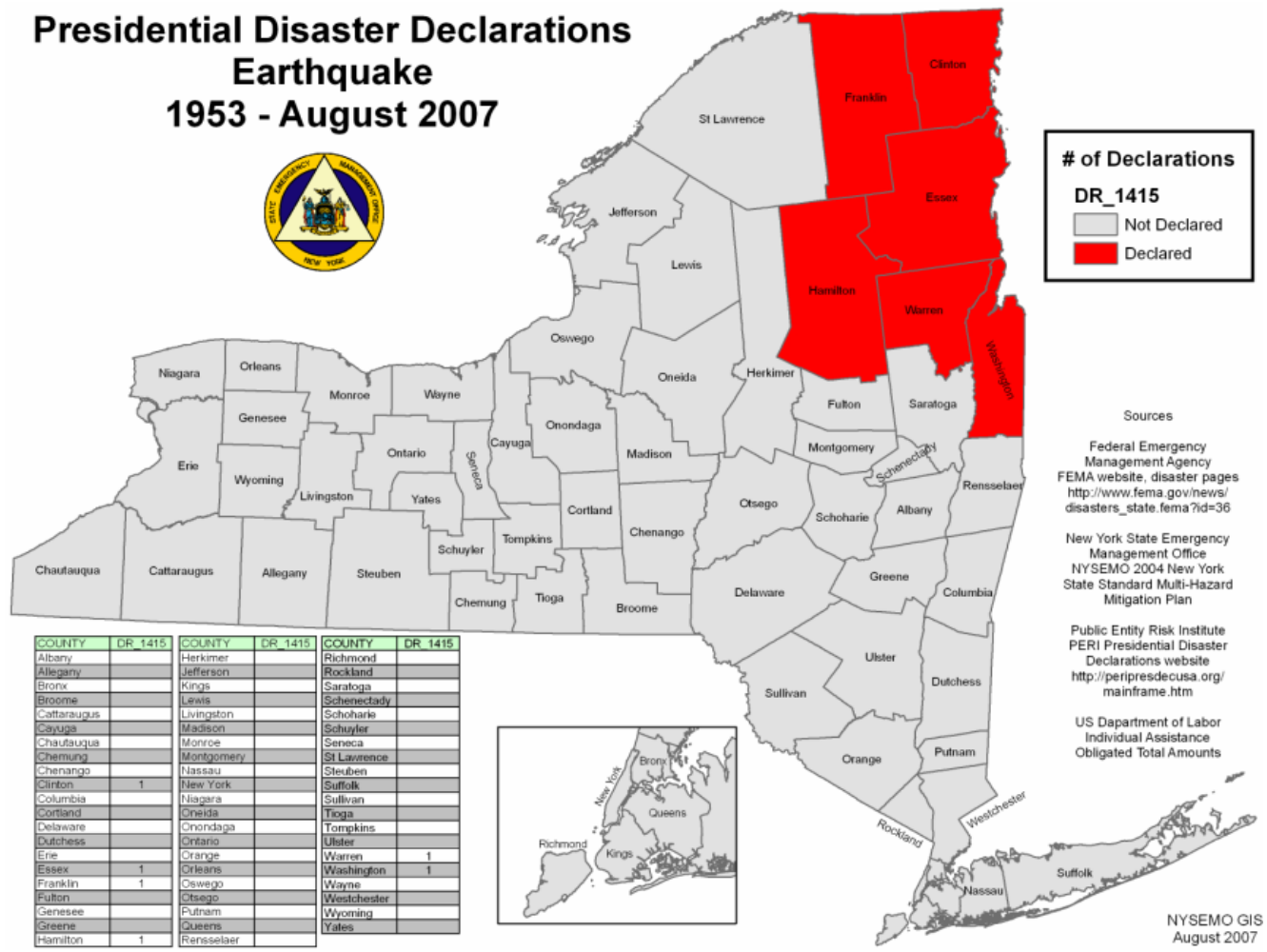
This earthquake resulted in a Presidential disaster declaration (DR–1415) and roughly $3 million dollars in eligible damage.

Table 3-56

New York State Declared Earthquake Disasters from 1950-2007	
Disaster # and Date	**Counties Affected**
FEMA: DR: 1415, 5/16/2002	Washington, Warren, Hamilton, Franklin, Essex, and Clinton

Source: FEMA

Figure 3-195



COUNTY	DR_1415
Albany	
Allegany	
Bronx	
Broome	
Cattaraugus	
Cayuga	
Chautauqua	
Chemung	
Chenango	
Clinton	1
Columbia	
Cortland	
Delaware	
Dutchess	
Erie	
Essex	1
Franklin	1
Fulton	
Genesee	
Greene	
Hamilton	1

COUNTY	DR_1415
Herkimer	
Jefferson	
Kings	
Lewis	
Livingston	
Madison	
Monroe	
Montgomery	
Nassau	
New York	
Niagara	
Oneida	
Onondaga	
Ontario	
Orange	
Orleans	
Oswego	
Putnam	
Queens	
Rensselaer	

COUNTY	DR_1415
Richmond	
Rockland	
Saratoga	
Schenectady	
Schoharie	
Schuyler	
Seneca	
St Lawrence	
Steuben	
Suffolk	
Sullivan	
Tioga	
Tompkins	
Ulster	
Warren	1
Washington	1
Wayne	
Westchester	
Wyoming	
Yates	

Following the April 20th, 2002 event there were recordings of four aftershocks that hit the region, these were recorded as follows:

- **M 4.0** at 7:04 a.m., April 20
- **M 1.7** at 7:08 a.m., April 20
- **M 2.9** at 7:45 a.m., April 20
- **M 2.2** at 7:47 a.m., April 21
- **M 2.3** at 7:49 a.m., April 21

Probability of Future Earthquake Events:

The following excerpt is from the USGS website.

There's a 100 percent chance of an earthquake today. Though millions of persons may never experience an earthquake, they are very common occurrences on this planet. So today -- somewhere -- an earthquake will occur.

It may be so light that only sensitive instruments will perceive its motion; it may shake houses, rattle windows, and displace small objects; or it may be sufficiently strong to cause property damage, death, and injury.

It is estimated that about 700 shocks each year have this capability when centered in a populated area. But fortunately, most of these potentially destructive earthquakes center in unpopulated areas far from civilization.

Since a major portion of the world's earthquakes each year center around the rim of the Pacific Ocean (Ring of Fire), referred to by seismologists as the circum-Pacific belt, this is the most probable location for today's earthquake. But it could hit any location, because no region is entirely free of earthquakes.

Stating that an earthquake is going to occur today is not really "predicting earthquakes". To date, they cannot be predicted. But anyone, on any day, could make this statement and it would be true. This is because several million earthquakes occur annually; thereby, thousands occur each day, although most are too small to be located. The problem, however, is in pinpointing the area where a strong shock will center and when it will occur.

Earthquake prediction is a future possibility, though. Just as the Weather Bureau now predicts hurricanes, tornadoes, and other severe storms, the NEIC may one day issue forecasts on earthquakes. Earthquake research was stepped up after the Alaska shock in 1964. Today, research is being conducted by the USGS and other federal and state agencies, as well as universities and private institutions. Earthquake prediction may some day become a reality, but only after much more is learned about the earthquake mechanism. **(Source: USGS)**

This depiction is very general but as it states, with the advances in technology and earthquake study the possibility of prediction and probability studies have and will advance dramatically. This plan expresses the probability of future earthquakes using recognized scientific methods as well as, simple historic frequency to show future potential. The earthquake PGA values in **Figure 3-128** represent given intensities with a 10% chance of being exceeded over 50 years. Using historical information to predict future occurrences, it was determined that NYS can expect damaging earthquake events on average only once every 22 years. Furthermore, they are more likely to occur within one of the three (3) regional areas identified previously. The NYS GS study by W. Mitronovas, “Earthquake Hazard in New York State” describes the probability of in the following terms,

"…at present an earthquake of magnitude 3.5 to 4 occurs, on the average every 3 years somewhere in the State. Such earthquakes do not cause any appreciable damage (except for cracks in plaster, perhaps) but are large enough to be felt strongly by many people near the epicenter." Additionally, according to an article in the *CompuServe New York Magazine Online Cover* titled "New York Earthquake: The Quake Next Time-Waiting for the Big One" by Graver, Fred, Charlie Rubin, as referred to in the NYCEM year 2 study, *"Geologists predict that an earthquake of magnitude 5.0* (some sources describe 5.0 as moderately destructive) *or above on the Richter scale has a 2% probability of occurring in the New York area within the next 50 years."*

In summary, the frequency of damaging earthquakes within and adjacent to New York State has been relatively low. However, the fact that large, damaging earthquakes have occurred here in the past, combined with the State's high population density and number of old, deteriorating buildings suggests that many people are at risk from damaging earthquakes in New York State.

State Facilities – Assessing Vulnerability and Estimating Loss for Earthquake Hazard

Table 3-57 presents the result of the earthquake hazard vulnerability assessment and loss analysis for state facilities. The results present a gross estimate of potential earthquake losses to those identified vulnerable State facilities in terms of dollar value of exposed property. In this plan, earthquake hazard vulnerability analysis and loss estimation methodology was supported by GIS technology and involved collaboration with key state agencies. Collaboration resulted in the identification of 2 state databases that provided key facility information. The NYS Offices of General Services (OGS) fixed asset data base and Cyber Security Critical Infrastructure Coordination (CSCIC) database included fields that provide facility location data and replacement value in dollars. The analysis involved creation of a GIS layer for state facilities using the coordinate information and an overlay onto an earthquake hazard layer developed using USGS Percent Peak Ground Acceleration (%PGA) value data. The table shows the outcome of the overlay in terms of the number, dollar replacement value, and percent of state facilities, by agency, within each classification of seismic potential. The seismic potential classes begin at 4% PGA which represents a lower threat of seismic activity increasing to 10% PGA indicating the highest seismic threat in NYS. We acknowledge the limitations of this analysis to provide site specific accuracy and that its applicability may not be appropriate beyond a general indication. Instead, the analysis results may be best used as a guide to help target facilities that might benefit from further analysis. We have established activities in our mitigation strategy that will advance the accuracy of the state facilities risk assessment through further analysis. Future analysis will include use of NEHRP soil classification data **Figure 3-127**, and the gathering of data to include site specific and building specific attribute information such as construction type, i.e. wood, masonry, reinforced concrete, steel, etc. and continued application of GIS technology. Site specific analysis will allow targeting of the most vulnerable facilities.

Table 3-57
Earthquake Hazard Exposure (by PGA value)
New York State Agency Facilities

NY State Agency	Total Facilities	4 % PGA Total number #, percent %, and $ replacement value	4 % PGA Critical facilities total #, %, and and $ replacement value	5 % PGA Total number #, percent % and $ replacement value	5 % PGA Critical facilities total #, % and $ replacement value	6 % PGA Total number #, percent % and $ replacement value	6 % PGA Critical facilities total #, % and $ replacement value
Department of Environmental Conservation	1880	203 (10.8%)	0	283 (15.1 %)	0	295 (15,7%)	0
	$104,611,361	$19,802,755 (18.9%)	0	$11,051,514 (10.6%)	0	$8,149,121 (7.8%)	0
Department of Transportation	908	298 (32.8%)	0*	74 (8.1%)	0*	39 (4.3%)	0*
	$232514852	$110,753,093 (47.6%)	0*	$16,310,579 (7.0%)	0*	$6,889,651 (3.0%)	0*
Office of General Services	130	102 (78.5 %)	102 (78.5 %)	0	0	4 (3.1%)	4 (3.1%)
	$2,133,659,048	$1,989,172,043 (93.2 %)	$1,989,172,043 (93.2 %)	0	0	$59,820,214 (2.8%)	$59,820,214 (2.8%)
State Emergency Management Office	4	2 (50 %)	2 (50 %)	1 (25 %)	1 (25 %)	0	0
	$3,365,434	$1,422,523 (42.3%)	$1,422,523 (42.3%)	$1,002,095 (30%)	$1,002,095 (30%)	0	0
Number of facilities Total	**2922**	**605 (20.7%)**	**104**	**358 (12.3%)**	**1**	**338 (11.6%)**	**4**
~ Replacement Value of total Structures ($)	**$2,472,819,244**	**$2,121,150,414 (85.8%)**	**$1,990,594,566 (80.5%)**	**$28,364,188 (1.1%)**	**$1,002,095**	**$74,858,986 (3.0%)**	**$59,820,214 (2.4%)**

Source: NYS Fixed Asset information -Offices of General Services and Cyber Security Critical Infrastructure Coordination data bases, USGS % Peak ground Acceleration Seismic Hazard Map. Analysis supported by GIS technology. * DOT facility determined critical is included in the OGS listing

Table 3-57
Earthquake Hazard Exposure (by PGA value)
New York State Agency Facilities

NY State Agency	Total Facilities	7 % PGA Total number # and percent %	7 % PGA Critical facilities total # and %	8 % PGA Total number # and percent %	8 % PGA Critical facilities total # and %	9%PGA Total number # and percent %	9%PGA Critical facilities total # and %
Department of Environmental Conservation	1880	110 (5.9 %)	0	46 (2.4%)	0	279 (14.8%)	0
	$104611361	$2,261,761 (2.2%)	0	$1,378,449 1.3%	0	$16,931,009 (16.2%)	0
Department of Transportation	908	5 (0.5%)	0*	6 (0.6%)	0*	13 (1.3%)	0*
	$232514852	$992,784 (0.4%)	0*	$2,534,910 (1.1%)	0*	$ 2,372,784 (1.0%)	0*

Table 3-57
Earthquake Hazard Exposure (by PGA value)
New York State Agency Facilities

NY State Agency	Total Facilities	7 % PGA Total number # and percent %	7 % PGA Critical facilities total # and %	8 % PGA Total number # and percent %	8 % PGA Critical facilities total # and %	9%PGA Total number # and percent %	9%PGA Critical facilities total # and %
Office of General Services	130	0	0	0	0	0	0
	$2,133,659,048	0	0	0	0	0	0
State Emergency Management Office	4	0	0	0	0	0	0
	$2,033,983	0	0	0	0	0	0
Number of facilities Total	**2922**	**115 (3.9%)**	**0**	**52 (1.8%)**	**0**	**292 (10.0%)**	**0**
~ Replacement Value of Structure ($)	**$2,472,819,244**	**$3,254,545 (0.1%)**	**0**	**$3,913,359 (0.2%)**	**0**	**$4,634,545 (0.2%)**	**0**

Source: NYS Fixed Asset information -Offices of General Services and Cyber Security Critical Infrastructure Coordination data bases, USGS % Peak ground Acceleration Seismic Hazard Map. Analysis supported by GIS technology. * DOT facility determined critical is included in the OGS listing

Table 3-57

Earthquake Hazard Exposure (by PGA value)

New York State Agency Facilities

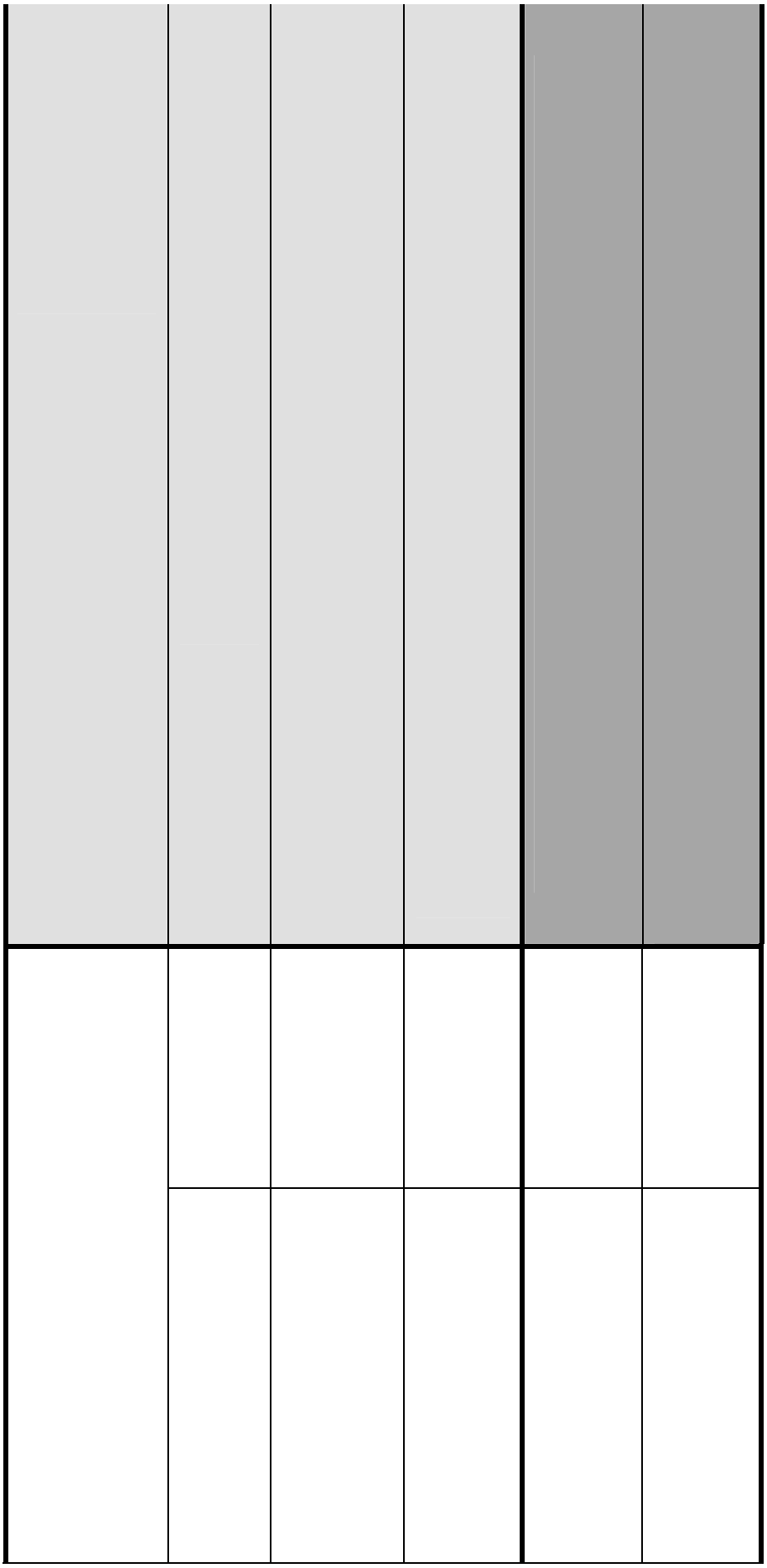


Table 3-57

Earthquake Hazard Exposure (by PGA value)

New York State Agency Facilities

Table 3-57

Earthquake Hazard Exposure (by PGA value)

New York State Agency Facilities

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Earthquake Hazard Exposure (by PGA value)

New York State Agency Facilities

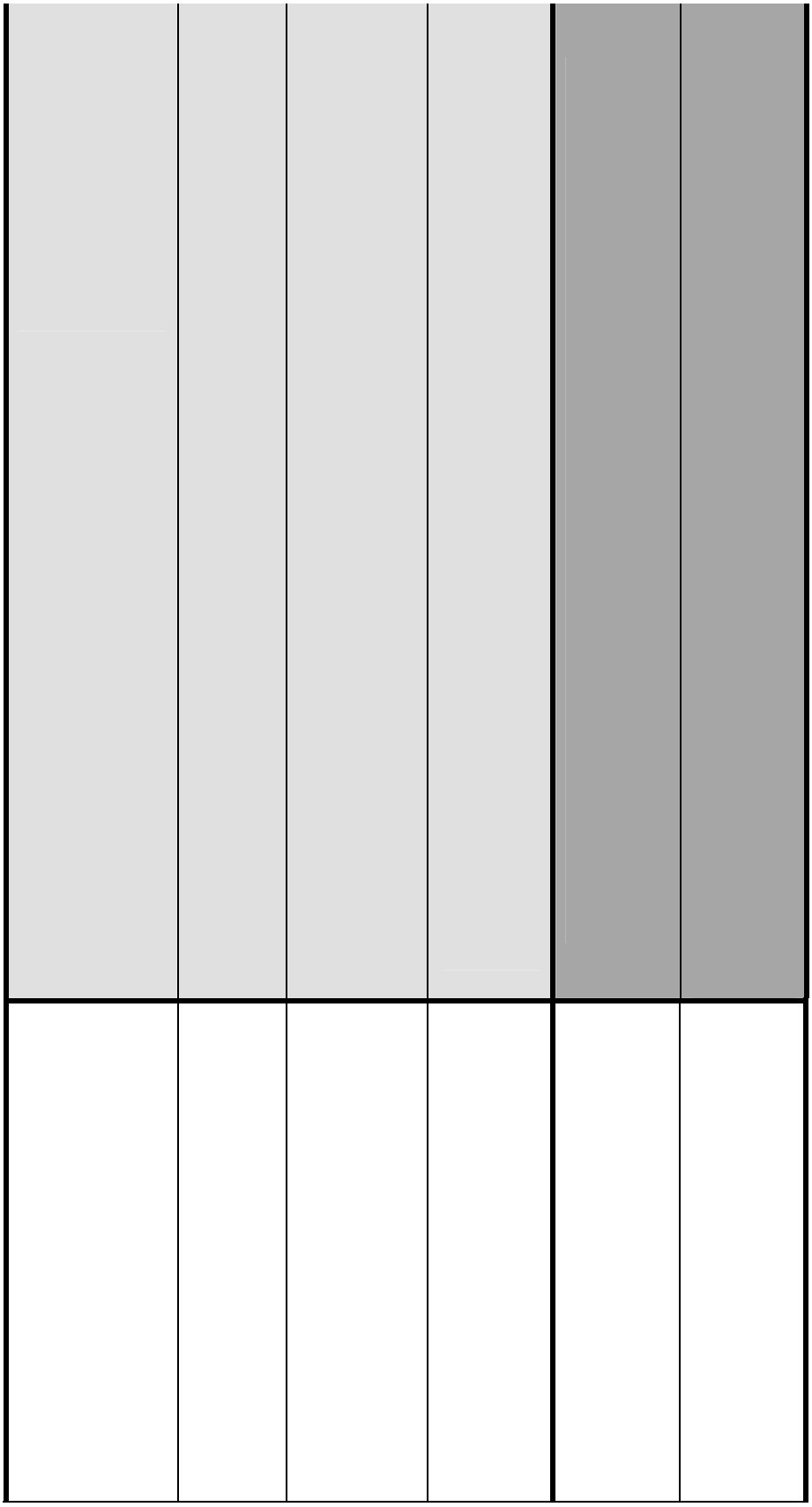


Table 3-57

Earthquake Hazard Exposure (by PGA value)

New York State Agency Facilities

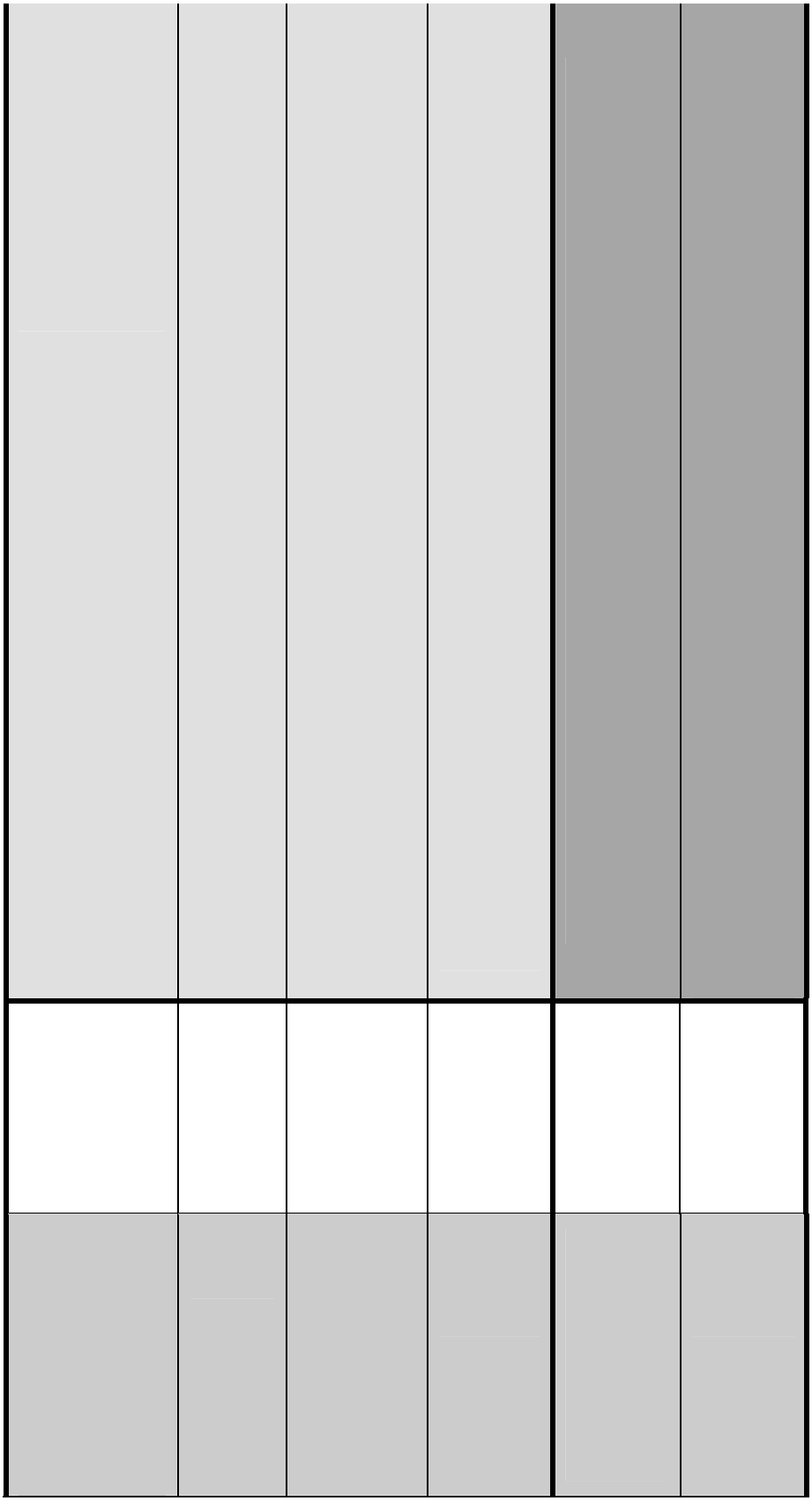


Table 3-57

Earthquake Hazard Exposure (by PGA value)

New York State Agency Facilities

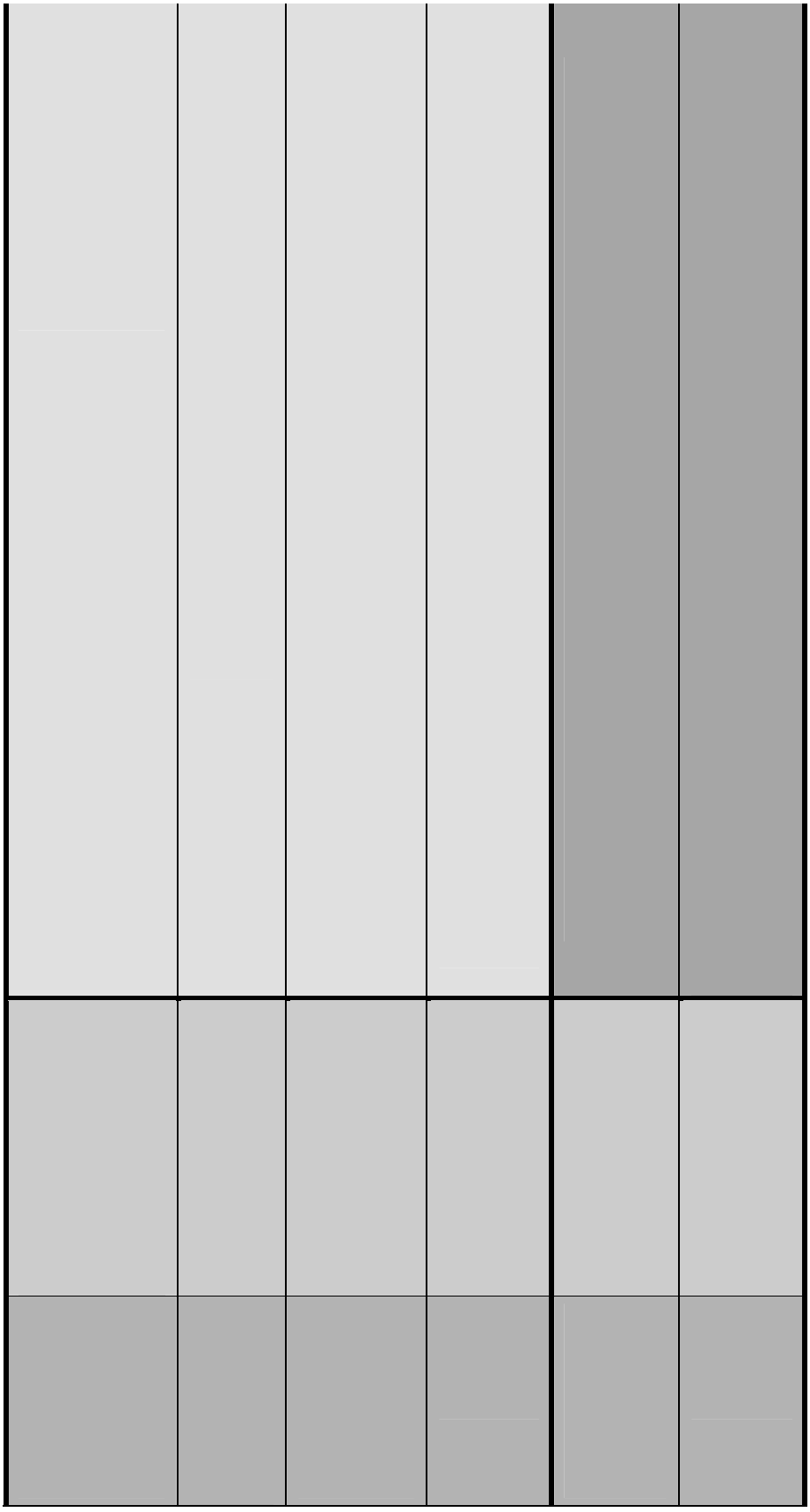


Table 3-57

Earthquake Hazard Exposure (by PGA value)

New York State Agency Facilities

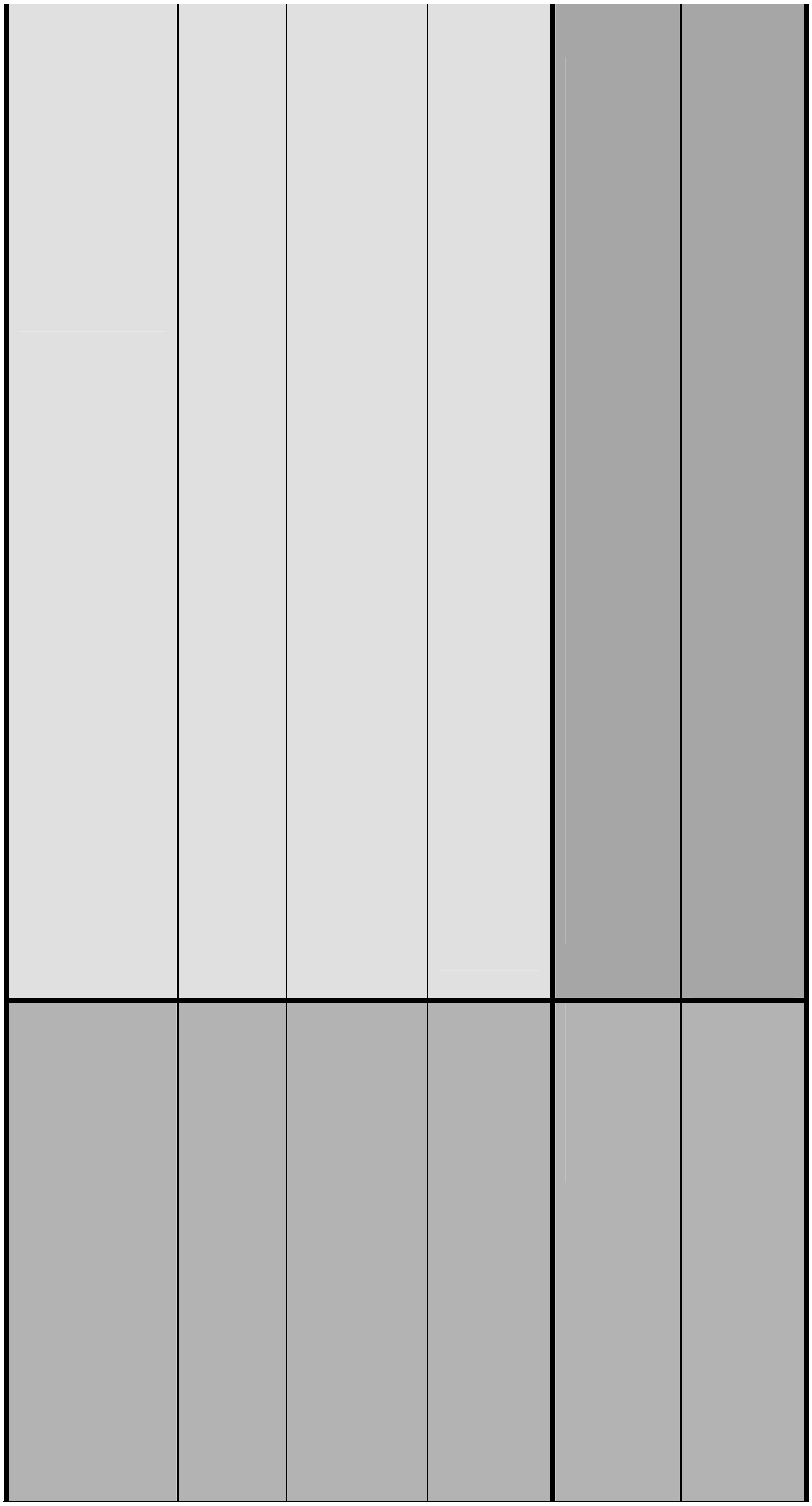
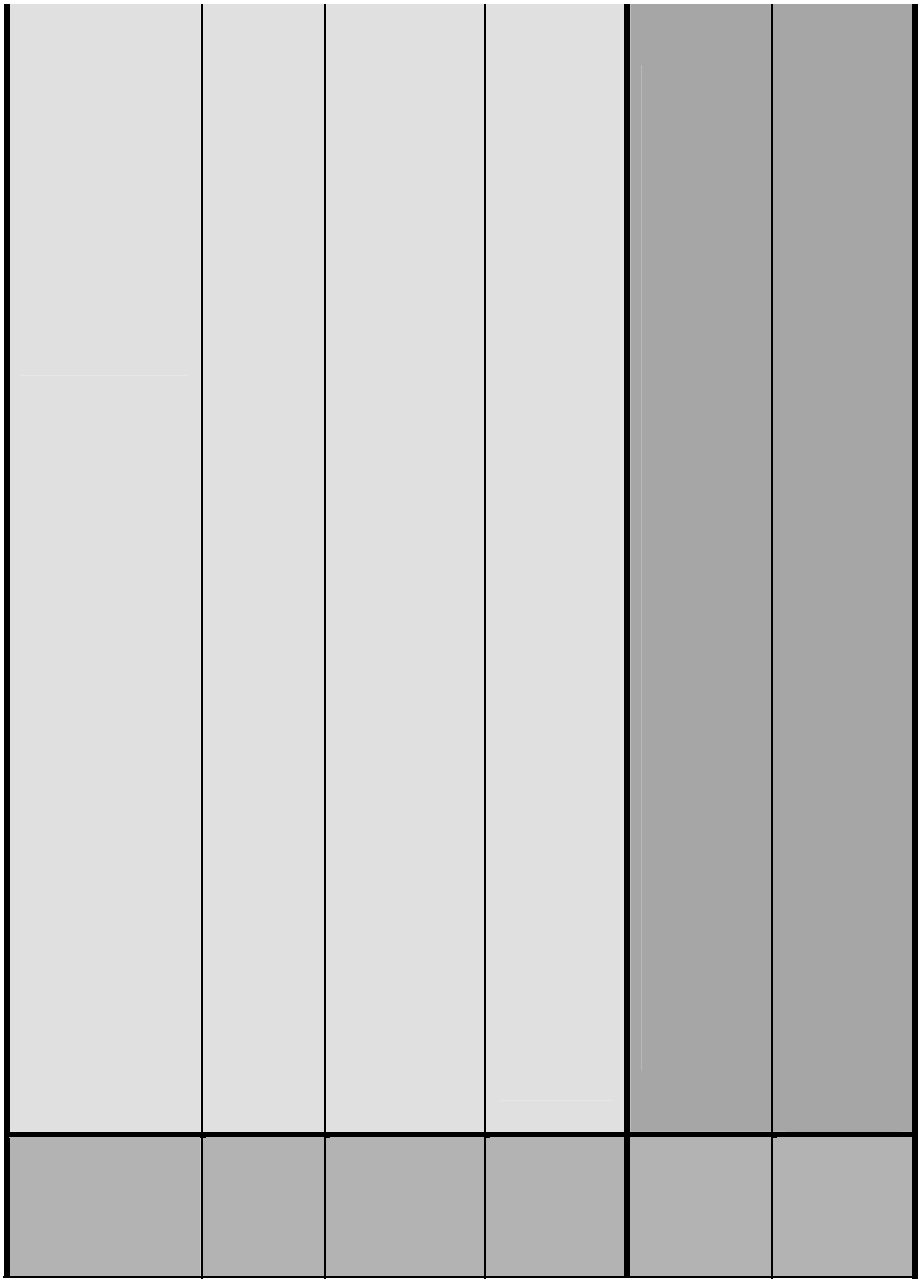


Table 3-57

Earthquake Hazard Exposure (by PGA value)

New York State Agency Facilities



Estimating Potential Losses from the Earthquake Hazard:

Loss Comparison by State

Using HAZUS earthquake loss estimation software, FEMA, in a September 2000 report entitled "*HAZUS99 Estimated Annualized Earthquake Losses for the United States*" ranked New York State fourth behind California, Washington, and Oregon in annualized earthquake loss (AEL). This report also ranked New York State twentieth in annualized earthquake loss ratio (AELR) which addresses annualized loss as a fraction of the replacement value of the building stock. (**See Table 3-58**) The HAZUS99 methodology factors both the variation in earthquake hazard with the variation and extent

in the built environment. For instance, the annualized loss enables the comparison of risk between states having areas of high potential for earthquakes but with, on average, lower population densities with states having regions of lower probability for earthquakes but with high population densities. The *annualized loss* methodology combines the estimated losses associated with ground shaking for eight return periods: 100, 250, 500, 750, 1000, 1500, 2000, 2500-year, which are based on values from the USGS seismic probabilistic curves. The aggregation of these losses and exceedance probabilities are then annualized, providing, in essence, the estimated cost of earthquakes to a state each year. An earthquake loss estimation calculation was performed for New York State using a beta version of HAZUS-MH, an updated version of HAZUS99, with a nearly identical methodology. The results of the analysis provided loss estimations by county. It should be noted that the State total annualized earthquake loss figures dropped from $83,987,000 in the FEMA HAZUS99 report to $67,680,000 using the HAZUS-MH software. Several factors contribute to the drop in estimated New York State total annualized earthquake loss between the FEMA "HAZUS99 Estimated Annualized Earthquake Loss for the United States" report figure of $83,987,000 and the August 2004 calculations using a beta version of HAZUS-MH. Firstly, the HAZUS-MH annualized loss calculation methodology has been revised in HAZUS-MH, resulting in lower and hopefully more accurate estimations. Secondly, the data inputs have been revised, including the use of the 2000 census as well as Dun & Bradstreet building data. Thirdly, there have been some slight variations in USGS ground motion parameters which have been updated since FEMA's report. Although FEMA has not completed a nationwide annualized loss estimation using HAZUS-MH to date, it is likely that these changes will result in a drop in values for most if not all states. In either case, it is unlikely that New York State will drop significantly from its current ranking fourth in highest estimated total annualized earthquake loss.

Table 3-58

HAZUS99 Estimated Annualized Earthquake Losses for the United States

Order	State	AEL (x $1,000)
1	California	3,261,751
2	Washington	227,860
3	Oregon	167,496
4	New York	83,987
5	Nevada	55,041
6	Tennessee	52,117
7	Utah	51,448
8	Alaska	42,353
9	South Carolina	41,812
10	New Jersey	38,655
11	Missouri	38,400
12	Illinois	35,585
13	Hawaii	34,935
14	Massachusetts	24,896
15	Georgia	22,908
16	Pennsylvania	21,906
17	Arizona	20,602
18	North Carolina	18,742
19	Kentucky	18,680
20	New Mexico	17,729
21	Arkansas	16,669
22	Montana	15,609
23	Connecticut	12,189
24	Indiana	11,991
25	Virginia	8,640
26	Alabama	8,422
27	Ohio	8,169
28	Idaho	7,986
29	New Hampshire	6,828
30	Colorado	5,791
31	Mississippi	5,214
32	Maine	5,122
33	Oklahoma	4,681
34	Maryland	3,952
35	Vermont	3,446
36	Wyoming	3,269
37	Rhode Island	2,449
38	West Virginia	2,411
39	Delaware	1,467
40	Florida	922
41	District of Columbia	911
42	Texas	722
43	Louisiana	622
44	Michigan	300
45	Kansas	294
46	Wisconsin	121
47	Nebraska	93
48	Iowa	27
49	South Dakota	25
50	Minnesota	< 10
51	North Dakota	<10

Order	State	AELR ($ Per Million)
1	California	2,049
2	Alaska	1,165
3	Oregon	1,063
4	Washington	878
5	Nevada	835
6	Utah	792
7	Hawaii	581
8	Montana	365
9	South Carolina	319
10	New Mexico	274
11	Tennessee	245
12	Idaho	172
13	Arkansas	171
14	Wyoming	164
15	Missouri	153
16	Arizona	121
17	Vermont	120
18	Kentucky	116
19	New Hampshire	114
20	New York	90
21	New Jersey	88
22	Georgia	86
23	Maine	80
24	North Carolina	69
25	Massachusetts	68
26	Connecticut	62
27	Illinois	58
28	Mississippi	54
29	Alabama	52
30	Indiana	44
31	Rhode Island	42
32	Delaware	40
33	Pennsylvania	35
34	Virginia	34
35	Colorado	34
36	Oklahoma	32
37	West Virginia	30
38	District of Columbia	23
39	Maryland	18
40	Ohio	15
41	Louisiana	4
42	Kansas	2
43	Florida	1
44	Nebraska	1
45	Texas	1
46	South Dakota	1
47	Michigan	1
48	Wisconsin	< 1
49	Iowa	< 1
50	Minnesota	< 1
51	North Dakota	< 1

Loss Comparison by County

This section presents the results of our vulnerability assessment indicating Counties most vulnerable to the earthquake hazard based on loss estimation calculations using HAZUS MH software. FEMA's **HAZUS®*M*** software provides a useful method to quantify and compare the relative earthquake risk of New York State counties through its annualized loss estimation methodology.

This methodology factors both the regional variation in earthquake hazard with the variation and extent in the built environment from county to county. For instance, the annualized loss enables the comparison of risk between a county having a high potential for earthquakes but with a low population density with a county having a low probability for earthquakes but with a high population density.

The annualized loss methodology combines the estimated losses associated with ground shaking for eight return periods: 100, 250, 500, 750, 1000, 1500, 2000, 2500-year, which are based on values from

the USGS seismic probabilistic curves. The aggregation of these losses and excedance probabilities are then annualized, providing, in essence, the estimated cost of earthquakes to a county each year.

Table 3-59 presents the results of the HAZUS-MH earthquake loss estimation run and includes; Total Exposure – representing dollar value of all general building stock and calculated potential total losses (Capital Stock + Income Losses) for the 4 return periods of 2500, 1000, 500, & 250-years.

Table 3-59
HAZUS-MH Earthquake Loss Estimation by County

		Total Losses [x$1,000]			
County	**Total Exposure**	**2500-year**	**1000-year**	**500-year**	**250-year**
Albany	20,119,613	881,871	263,834	89,094	27,124
Allegany	2,990,114	55,984	15,466	4,879	1,363
Bronx	57,711,578	4,573,819	1,171,119	341,111	66,758
Broome	11,382,780	230,235	71,314	22,320	7,373
Cattaraugus	5,152,572	98,905	26,320	8,164	2,221
Cayuga	4,982,291	94,791	30,861	10,865	3,445
Chautauqua	7,809,159	144,369	40,188	12,391	3,144
Chemung	5,002,377	87,828	25,498	8,669	2,606
Chenango	3,002,501	63,791	20,245	7,053	2,183
Clinton	4,056,072	554,920	190,687	75,769	24,901
Columbia	4,424,658	143,757	42,900	14,229	3,975
Cortland	2,921,586	58,669	18,676	6,553	1,951
Delaware	3,563,527	83,816	24,599	8,463	2,581
Dutchess	18,623,546	758,948	223,125	68,087	16,916
Erie	60,698,794	2,650,440	670,569	164,041	39,215
Essex	3,134,459	295,644	101,594	38,738	12,310
Franklin	3,216,633	471,742	180,652	70,501	21,592
Fulton	3,610,457	144,264	44,880	16,163	4,913
Genesee	3,644,533	156,415	39,112	10,023	2,547
Greene	3,613,986	120,929	35,584	11,757	3,346
Hamilton	963,719	59,675	19,255	6,889	2,079
Herkimer	4,024,223	152,722	47,458	16,782	5,197
Jefferson	6,154,355	303,900	100,231	36,742	12,179
Kings	133,212,617	9,390,494	2,483,422	683,594	126,878
Lewis	1,964,398	104,659	30,427	12,426	4,050
Livingston	3,639,797	105,044	24,964	7,870	2,136
Madison	4,209,514	106,417	31,149	11,170	3,460
Monroe	45,905,022	1,322,173	339,477	108,535	30,982
Montgomery	2,977,606	137,029	41,800	13,017	4,284
Nassau	109,313,341	5,723,355	1,583,463	429,131	84,883
New York	150,402,244	6,827,893	1,846,166	518,696	95,061
Niagara	13,029,741	556,006	123,989	34,016	8,005
Oneida	12,655,491	457,199	138,672	46,302	15,593
Onondaga	28,809,478	693,666	208,329	74,038	23,144
Ontario	6,575,215	134,621	38,508	12,594	3,764
Orange	22,678,519	1,097,619	317,536	93,951	21,925
Orleans	2,401,498	92,624	23,405	6,185	1,617
Oswego	6,721,236	169,866	51,029	18,816	6,067
Otsego	3,970,727	108,987	31,363	11,090	3,475
Putnam	7,650,043	371,484	104,852	29,977	6,403
Queens	104,306,383	6,998,401	1,741,715	508,677	96,493
Rensselaer	10,118,116	376,809	112,760	39,707	11,936
Richmond	24,730,061	1,217,919	319,522	87,625	16,439
Rockland	19,231,069	1,227,919	305,359	93,644	19,424
Saint Lawrence	6,603,502	809,394	294,422	113,934	36,479
Saratoga	13,032,344	547,979	174,660	59,495	17,782
Schenectady	10,330,052	455,849	136,720	46,052	14,103
Schoharie	2,130,375	70,126	20,886	7,122	2,239
Schuyler	1,104,098	15,601	4,707	1,644	498
Seneca	2,104,810	40,338	12,519	4,217	1,305
Steuben	5,960,935	105,002	30,367	9,952	2,910
Suffolk	104,092,729	3,620,032	917,576	262,522	64,312
Sullivan	6,081,204	185,457	47,027	16,024	4,757
Tioga	2,808,841	46,423	14,107	4,643	1,397
Tompkins	5,887,685	109,066	32,188	11,411	3,699

Warren	4,475,350	261,034	83,893	29,930	9,442
Washington	3,646,352	140,511	46,568	15,783	5,211
Wayne	5,547,769	113,490	33,209	11,286	3,436
Westchester	69,147,392	4,579,368	1,218,843	343,001	69,121
Wyoming	2,368,856	87,280	20,706	5,627	1,441
Yates	1,680,925	25,098	7,421	2,461	729

Types of Direct Economic Loss (Total Loss)

Direct economic losses are the cost of repair and replacement of damaged or destroyed buildings. However, building damage will result in a number that, in **HAZUS®*MH***, are defined as direct. Thus, building-related direct economic losses (which are all expressed in dollars) comprise two groups. The first group consists of losses that are directly derived from building damage, (**Capital Stock Loss)** and include;

- Cost of repair and replacement of damaged and destroyed buildings
- Costs of damage to building contents
- Losses of building inventory (contents related to business activities)

The second group consists of losses that are related to the length of time the facility is non-operational or the immediate economic consequences of damage, also termed (**Income Related Loss or Functional Loss)**:

- Relocation expenses (for businesses and institutions)
- Capital-related income losses (a measure of the loss of productivity, services or sales)
- Wage losses (consistent with income loss)
- Rental income losses (to building owners)

Expressing Potential Loss

The analysis this Plan presents expresses potential earthquake loss using 4 distinct approaches and ranks counties according to these values to illustrate those jurisdiction most threatened by and vulnerable to the earthquake hazard.

- Annualized Total Loss - Rank
- Annualized Total Loss Per Capita - Rank
- Exposure Ratio (Annualized Total Loss Ratio - in Dollars per Million in Exposure) - Rank
- Exposure - Rank

Table 3-52 presents the values for each of the methods used to express loss and provides the county ranking results.

Annualized Total Loss - Rank

In terms of **annualized total earthquake dollar loss,** *Kings County (Brooklyn)* is the most vulnerable to earthquake hazard with a potential annualized losses totaling nearly $10,093,000. Ranking Kings County highest in terms of HAZUS-MH calculated potential dollar loss is understandable. Based on HAZUS-MH general building stock data, Brooklyn is one of the most

dense built environments, one of the highest populations (over 2.4 Million), and the highest population densities (34951 Per Sq. Mi) in a relatively small area. In terms of general building stock **total dollar value exposure** Kings County Ranks 2nd only to New York (Manhattan) with a total value of $133 Billion. Furthermore, Kings County and the other 4 boroughs of New York City are in a higher hazard area with a 6 percent Peak Ground Acceleration (%PGA) value –(in %g). (see Figure XX PGA % gravity with 10% probability exceedence in 50 years Hazard Map). 6%PGA is a higher than average acceleration than throughout the rest of the state, with the exception of some of the Northern Adirondack Counties where %PGA values range up to 10 (%g), but have much lower populations, lower population density and smaller numbers of structures in it's built environment. On a per capita basis (**annualized total loss per capita)** note that Kings drops down to a rank of 13.

Annualized Total Loss per Capita - Rank

When considering **annualized total loss per capita** (normalized or divided by population), Hamilton County ranks first, even though it's exposure rank is last (62) and it's annualized loss rank is low (56). This outcome results from the fact that Hamilton County has the lowest county population (5379) and population density (3 people per square mile according to HAZUS & Census data calculations). A similar trend due to low population numbers and a low density built environment is occurring in the other top 4 of 5 highest ranking counties for annualized loss per capita (*Franklin Essex, St. Lawrence, Clinton).* These northern Adirondack counties are within the highest Earthquake hazard areas in the State (%PGA values of 7-10 %g for 10 % exceedence in 50 years). The annualized loss per capita for these 5 highest counties ($9.44 – $14.10) is greater than almost twice the dollar amount for the next highest range of annualized loss per capita, i.e. the heavily populated counties in planning area 1 an 2 where the range of annualized loss per capita Ranges from $3.66 (Orange County) to $5.38 (Westchester County).

Exposure Ratio - Rank

By examining the **exposure ratio rank**, the rank of the Annualized Loss Ratio [in dollars per $1 million of exposure] we observe a similar trend to that of *annualized total loss per capita* occurring in the Northern-most counties of the State, where 4 of the same 5 highest counties are *Franklin, Essex, St. Lawrence, Clinton*. *Hamilton* ranks a close 6th behind Bronx County. Once again, due to the density and total numbers in population, coupled with the relatively low total value of the building stock in these areas (low total exposure in these counties), the exposure rank ratio (normalized) value results in these counties ranking much higher than their ranks in terms of *total exposure* dollars (see Exposure Rank).

Exposure - Rank

Exposure Rank is a column ordered by it's Total Exposure [x$1,000]. Total Exposure is the expected repair and replacement costs directly derived from all buildings, contents, and inventory, assuming an event causes complete damage, expressed in dollars. It does not include income related loss, nor does it account for regional variability in earthquake hazard (i.e. differences across the state in %PGA, Spectral Acceleration, Liquefaction, etc.). These replacement costs supplied with **HAZUS®*M*** software/data are derived from the Means Square Foot costs of a nationally accepted reference on building construction (2002), for residential, commercial, industrial, and institutional buildings (Chapter 9 HAZUS Technical Reference Manual). The highest ranking counties are, understandably, the most densely built and populated counties including those within Planning Areas 1 and 2 (i.e. 5 boroughs of New York City, Long Island, Westchester, Rockland counties, etc.), Planning Area 5 (Monroe and Onondaga counties) and Erie County in particular from planning area 7. With a few exceptions, the exposure ranks are very similar in terms of order to annualized total loss rank.

Table 3-60

HAZUS-MH Earthquake Annualized Loss Estimation and Ranking Results

Alphabetical	Total Exposure [x $1,000]	Annualized Capital Stock Losses	Annualized Income Losses	Annualized Total Losses [x $1,000]	Annualized Loss Ratio [in Dollars per $1 Million of exposure]	Annualized Loss per Capita [in Dollars]	Exposure Rank	Exposure Ratio Rank	Annualized Loss Rank	Annualized Loss per Capita Rank
Albany	20,119,613	849	221	1,071	53	3.63	13	19	14	17
Allegany	2,990,114	57	7	64	22	1.29	51	56	58	56
Bronx	57,711,578	4,137	780	4,917	85	3.69	8	5	6	15
Broome	11,382,780	220	61	281	25	1.40	20	49	29	53
Cattaraugus	5,152,572	97	15	111	22	1.33	33	55	49	55
Cayuga	4,982,291	102	19	121	24	1.48	35	51	47	51
Chautauqua	7,809,159	139	26	164	21	1.18	23	58	38	59
Chemung	5,002,377	83	22	105	21	1.16	34	57	50	60
Chenango	3,002,501	68	12	80	27	1.56	50	47	55	48
Clinton	4,056,072	644	110	754	186	9.44	39	2	17	5
Columbia	4,424,658	149	23	172	39	2.73	37	36	35	34
Cortland	2,921,586	62	12	74	25	1.52	53	48	57	49
Delaware	3,563,527	89	13	101	28	2.11	47	46	51	41
Dutchess	18,623,546	765	115	880	47	3.14	15	26	15	23
Erie	60,698,794	2,409	386	2,795	46	2.94	7	27	8	29
Essex	3,134,459	346	50	396	126	10.18	49	4	27	3
Franklin	3,216,633	592	75	667	207	13.04	48	1	19	2
Fulton	3,610,457	155	25	181	50	3.28	46	22	33	22
Genesee	3,644,533	146	20	166	46	2.75	43	29	37	33
Greene	3,613,986	123	21	144	40	2.99	45	35	40	25
Hamilton	963,719	66	10	76	79	14.10	62	6	56	1
Herkimer	4,024,223	163	28	191	47	2.96	40	25	32	26
Jefferson	6,154,355	334	63	397	64	3.55	28	13	26	18
Kings	133,212,617	8,981	1,112	10,093	76	4.09	2	7	1	13
Lewis	1,964,398	116	16	132	67	4.92	59	12	43	8
Livingston	3,639,797	100	14	114	31	1.77	44	43	48	45
Madison	4,209,514	112	18	130	31	1.87	38	44	45	43
Monroe	45,905,022	1,228	256	1,484	32	2.02	9	41	9	42
Montgomery	2,977,606	142	24	166	56	3.34	52	15	36	20
Nassau	109,313,341	5,576	681	6,256	57	4.69	3	14	4	10
New York	150,402,244	6,274	1,141	7,415	49	4.82	1	24	3	9
Niagara	13,029,741	501	70	571	44	2.60	17	31	20	36
Oneida	12,655,491	461	102	563	44	2.39	18	30	21	37
Onondaga	28,809,478	700	156	856	30	1.87	10	45	16	44
Ontario	6,575,215	134	25	159	24	1.59	27	52	39	47
Orange	22,678,519	1,081	170	1,251	55	3.66	12	16	12	16
Orleans	2,401,498	90	10	99	41	2.25	55	33	52	38
Oswego	6,721,236	186	27	212	32	1.73	25	42	30	46
Otsego	3,970,727	113	19	132	33	2.14	41	40	44	39
Putnam	7,650,043	376	39	414	54	4.33	24	17	25	12
Queens	104,306,383	6,534	907	7,441	71	3.34	4	10	2	21
Rensselaer	10,118,116	397	64	461	46	3.02	22	28	24	24
Richmond	24,730,061	1,176	129	1,305	53	2.94	11	20	11	28
Rockland	19,231,069	1,176	146	1,322	69	4.61	14	11	10	11
Saint Lawrence	6,603,502	1,000	119	1,119	169	10.00	26	3	13	4
Saratoga	13,032,344	587	97	684	52	3.41	16	21	18	19
Schenectady	10,330,052	455	99	554	54	3.78	21	18	22	14
Schoharie	2,130,375	73	12	85	40	2.71	57	34	54	35
Schuyler	1,104,098	17	2	19	17	1.00	61	62	62	62
Seneca	2,104,810	43	7	50	24	1.49	58	53	60	50
Steuben	5,960,935	108	17	124	21	1.26	30	59	46	57
Suffolk	104,092,729	3,437	482	3,919	38	2.76	5	38	7	32
Sullivan	6,081,204	184	27	211	35	2.85	29	39	31	30
Tioga	2,808,841	50	6	56	20	1.09	54	60	59	61
Tompkins	5,887,685	112	22	134	23	1.39	31	54	42	54
Ulster	11,868,772	425	70	495	42	2.79	19	32	23	31
Warren	4,475,350	271	62	333	74	5.25	36	8	28	7
Washington	3,646,352	157	23	180	49	2.95	42	23	34	27
Wayne	5,547,769	120	16	137	25	1.46	32	50	41	52
Westchester	69,147,392	4,393	579	4,972	72	5.38	6	9	5	6
Wyoming	2,368,856	82	10	92	39	2.12	56	37	53	40
Yates	1,680,925	26	4	30	18	1.22	60	61	61	58
TOTAL		58,787	8,893	67,680						

HAZUS Factoring In NEHRP Soil Classifications

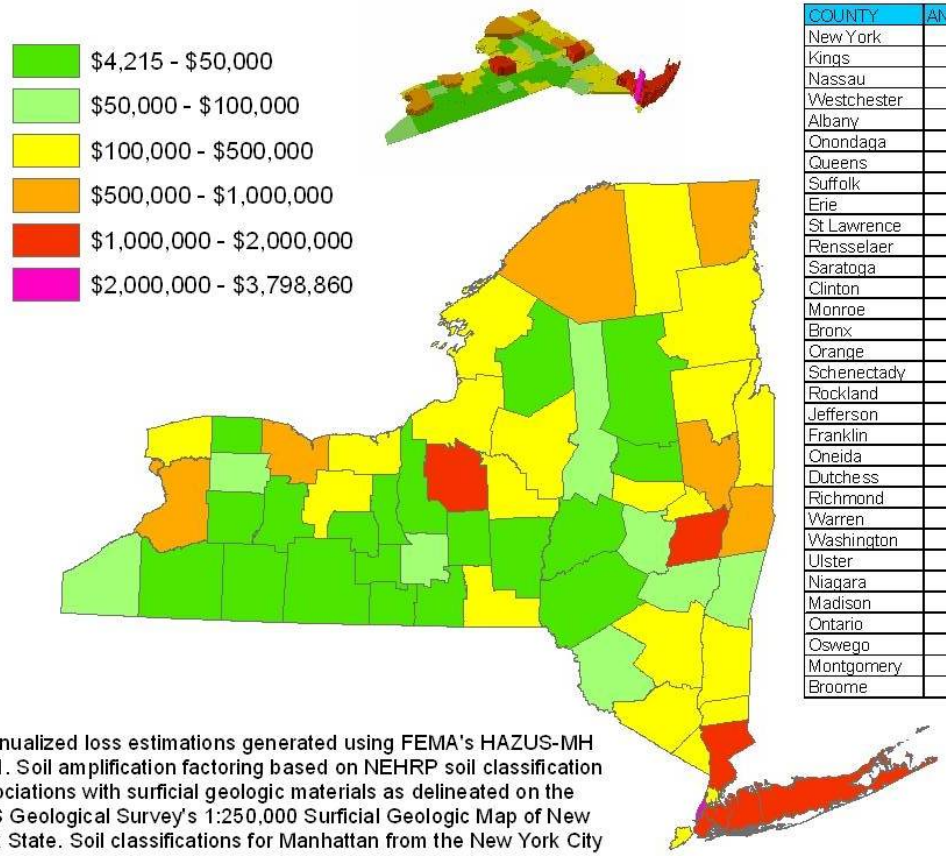
The 2004 State Mitigation Plan's annualized earthquake loss analysis was based on HAZUS model's default soil classification – the National Earthquake Hazard Reduction Program's (NEHRP) soil class "D". This was applied across the entire state. The "D" soil class is next to the worst soil class in terms of ground shaking amplification. Although there are many areas of the state that have been classified with soil class "D" and even worse class "E" in this most recent study, there was overall a better (less amplification) soil class assigned resulting in a significant loss reduction. This demonstrates the significance of soil factors in earthquake risk assessment.

This new HAZUS run factoring in soils shows the annualized earthquake loss by county. One of the key notes here is that in the drop of the States total annualized earthquake loss, in the prior NYS Plan the States total annualized loss was $67,680,000, the current data shows that the new annualized loss is that of $24,234,873. This dramatic drop is attributed to the use of NEHRP soil classifications.

The following maps indicate the Annualized Earthquake Loss factoring in the NEHRP Soil Classifications for all counties throughout New York State.

Figure 3-196

ANNUALIZED EARTHQUAKE LOSS



Annualized Loss By County

COUNTY	ANNUALIZED
New York	$3,798,860
Kings	$1,973,417
Nassau	$1,633,705
Westchester	$1,498,958
Albany	$1,375,282
Onondaga	$1,243,881
Queens	$1,078,028
Suffolk	$1,073,528
Erie	$872,128
St Lawrence	$869,129
Rensselaer	$818,101
Saratoga	$667,085
Clinton	$606,224
Monroe	$573,267
Bronx	$479,224
Orange	$427,984
Schenectady	$414,914
Rockland	$401,306
Jefferson	$382,453
Franklin	$339,417
Oneida	$327,226
Dutchess	$296,089
Richmond	$208,120
Warren	$199,447
Washington	$193,600
Ulster	$178,400
Niagara	$170,973
Madison	$159,977
Ontario	$158,019
Oswego	$134,870
Montgomery	$134,068
Broome	$130,155
Wayne	$123,061
Essex	$122,238
Putnam	$118,373
Schoharie	$80,146
Sullivan	$72,961
Herkimer	$72,720
Columbia	$62,441
Chautauqua	$59,858
Tompkins	$56,275
Greene	$53,265
Genesee	$50,763
Chemung	$48,508
Steuben	$45,836
Fulton	$40,507
Seneca	$39,566
Cattaraugus	$39,386
Livingston	$39,228
Delaware	$38,022
Chenango	$33,935
Cortland	$30,374
Orleans	$28,866
Wyoming	$26,076
Lewis	$24,863
Cayuga	$24,353
Allegany	$22,374
Tioga	$19,836
Otsego	$17,429
Hamilton	$14,315
Schuyler	$7,452
Yates	$4,215

Total State Annualized Loss: $24,234,877

* Annualized loss estimations generated using FEMA's HAZUS-MH MR1. Soil amplification factoring based on NEHRP soil classification associations with surficial geologic materials as delineated on the NYS Geological Survey's 1:250,000 Surficial Geologic Map of New York State. Soil classifications for Manhattan from the New York City Area Consortium for Earthquake Loss Mitigation (NYCEM) - Earthquake Risk and Mitigation in the New York, New Jersey and Connecticut Region, 1999 - 2003

NYSEMO
September 2007

Figure 3-197

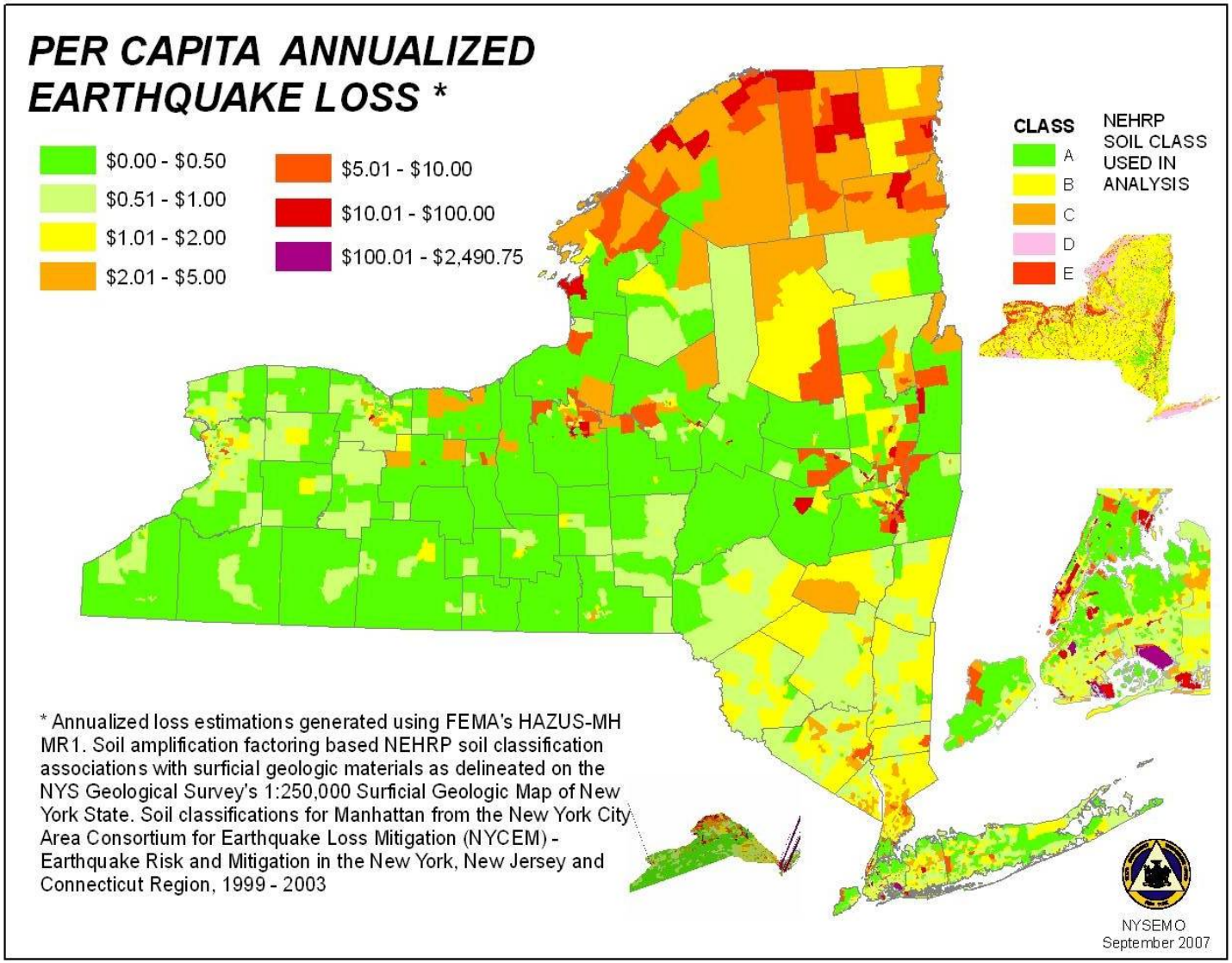
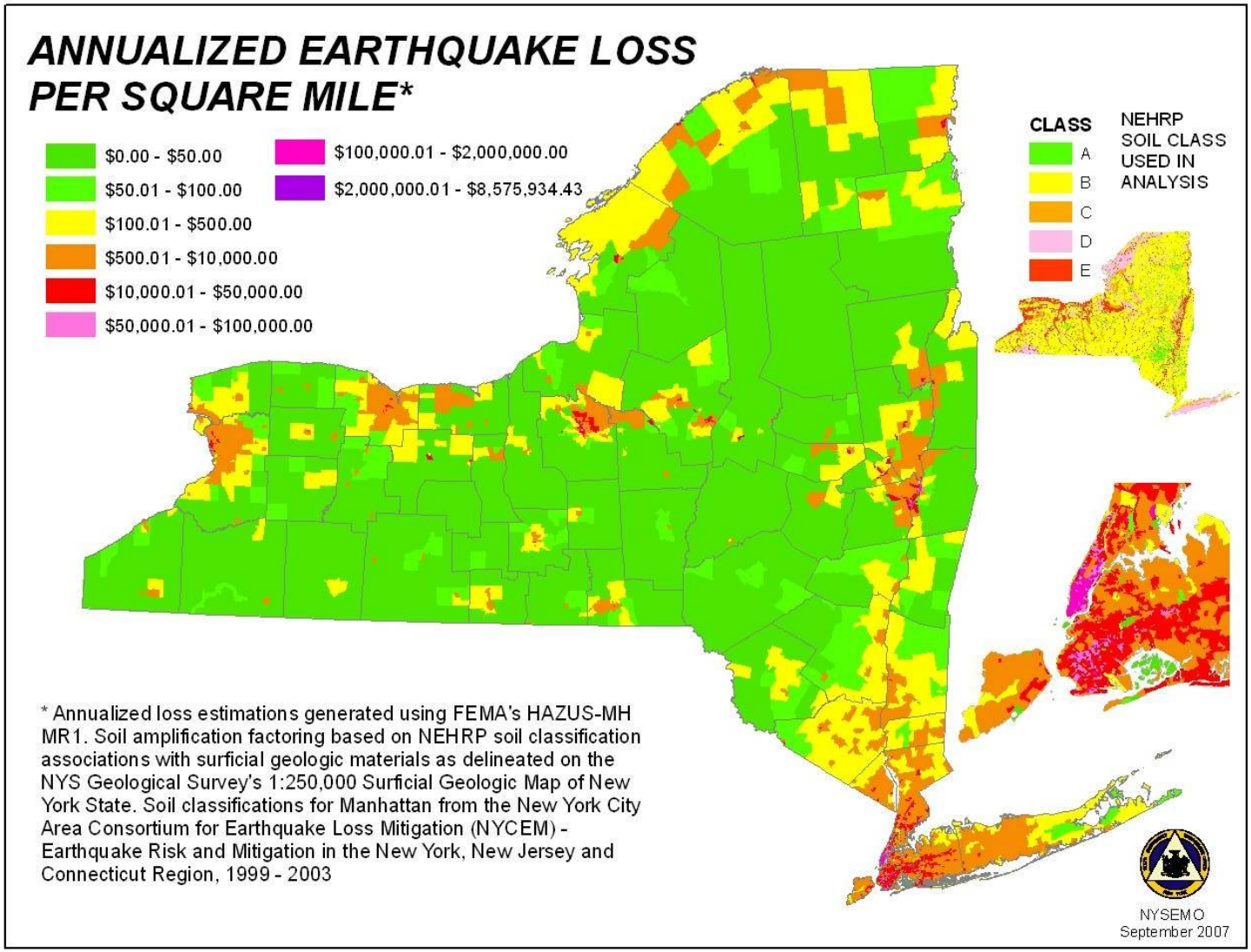

PER CAPITA ANNUALIZED EARTHQUAKE LOSS *
$0.00 - $0.50
$0.51 - $1.00
$1.01 - $2.00
$2.01 - $5.00
$5.01 - $10.00
$10.01 - $100.00
$100.01 - $2,490.75
CLASS
NEHRP SOIL CLASS USED IN ANALYSIS
A
B
C
D
E
* Annualized loss estimations generated using FEMA's HAZUS-MH MR1. Soil amplification factoring based NEHRP soil classification associations with surficial geologic materials as delineated on the NYS Geological Survey's 1:250,000 Surficial Geologic Map of New York State. Soil classifications for Manhattan from the New York City Area Consortium for Earthquake Loss Mitigation (NYCEM) - Earthquake Risk and Mitigation in the New York, New Jersey and Connecticut Region, 1999 - 2003
NYSEMO
September 2007

Figure 3-198


ANNUALIZED EARTHQUAKE LOSS PER SQUARE MILE*
$0.00 - $50.00
$50.01 - $100.00
$100.01 - $500.00
$500.01 - $10,000.00
$10,000.01 - $50,000.00
$50,000.01 - $100,000.00
$100,000.01 - $2,000,000.00
$2,000,000.01 - $8,575,934.43
CLASS
NEHRP SOIL CLASS USED IN ANALYSIS
A
B
C
D
E
* Annualized loss estimations generated using FEMA's HAZUS-MH MR1. Soil amplification factoring based on NEHRP soil classification associations with surficial geologic materials as delineated on the NYS Geological Survey's 1:250,000 Surficial Geologic Map of New York State. Soil classifications for Manhattan from the New York City Area Consortium for Earthquake Loss Mitigation (NYCEM) - Earthquake Risk and Mitigation in the New York, New Jersey and Connecticut Region, 1999 - 2003
NYSEMO
September 2007

Local Jurisdictions and HAZUS

When preparing a local hazard mitigation plan regarding your jurisdictions vulnerability, FEMAs HAZUS system is a highly recommended tool to be used for determining risk, loss, and exposure.

(NYCEM) Report: New York City Area Consortium for Earthquake Loss Mitigation

In 2005 the New York City Area Consortium for Earthquake Loss Mitigation (NYCEM) published a report known as the NYCEM report. This study began in 1999 and was concluded in 2003. The report combines the New York, New Jersey, and Connecticut metro region. This group was created in 1998 with the intent to create public awareness of seismic risk. The group consists of interested organizations and major public and private stakeholders from Federal and State emergency management, public service, engineering, architecture, financial and insurances companies, and academia.

The following excerpt is from the NYCEM report on why they did this study.

> **Why This Study?**
>
> Our specific objectives for this study were to:
> - Develop and implement a risk and loss estimation for the metropolitan NY-NJ-CT region using *HAZUS*, which is FEMA's methodology for performing loss estimations
> - Assemble soil information for the entire Tri-State region to quantify details of the seismic hazard
> - Compile a complete building inventory for Manhattan to estimate local impact, and a less detailed building inventory for the surrounding metropolitan areas to realistically quantify regional risk
> - Identify and model a variety of earthquake scenarios and their probable consequences
> - Assess the performance of individual, essential facilities relative to the probable demands placed on them
> - Present results and recommendations for developing and implementing cost-effective risk management plans to reduce potential damage and losses.

Table 3-61
A Summary of the Findings of the NYCEM Report

Study Results for the Tri-State Region for different Scenarios									
Scenario	Building Damage	Income Losses	Total	Hospital-ization	Deaths	Shelter Needs	Fires	Buildings Complete Damage	Debris
M5	$4.4 b	$0.4 b	$4.8 b	24	13	2,800	500	45	1.6 m tons
M6	$28.5 b	$10.8 b	$39.3 b	2,296	1,170	197,705	900	2,600	31.9m tons
M7	$139.8b	$57.1b	$196.8b	13,171	6,705	766,746	1,200	12,800	132.1m tons
100-yr	$0.1 b	$0.1 b	$0.2 b	0	0	0	0	0	0.2 m tons
500-yr	$6.1 b	$2.0 b	$8.1 b	28	14	575	50	100	3.1 m tons
2500-yr	$64.3 b	$20.4b	$84.8 b	1,430	727	84,626	900	2,200	34.0 m tons
9/11/01	$13.0 b	$52-64b	$98.0 b	6,000		300	10	20	1.6 m tons

Source: NYCEM Report

NOTE: For this report the events of September 11th 2001 are used as a real life benchmark to be able to make a comparison for the listed earthquake scenarios.

One of the key findings to take from **Table 3-61** is that in the case of an M6 Earthquake which is considered a moderate event. The total devastation for the area is quite high, in all a total economic loss of almost $40 billion (**does not include critical infrastructure**) with an estimated loss of life at 1,170. The loss of life is almost on par with that of Hurricane Katrina. Another key issue to point out is that Earthquakes are not seasonal they can happen at any time of the year. For example imagine the varying differences in need and response if an M6 Earthquake were to occur in July compared to January. A winter scenario could dramatically alter the needs of affected people and response to the event.

This following excerpt from the NYCEM report summarizes critical data regarding Population, Buildings and Real estate, and Infrastructure and Essential Facilities.

Population

In the event of a damaging earthquake in the NY-NJ-CT region, about 18.5 million people in 7 million households would be at risk. The number of human fatalities is the ultimate measure of severity in any disaster.

Buildings and Real Estate

The large population lives and works in about 3.5 million buildings with a combined 13 billion square feet and a total replacement value of $1 trillion, excluding contents. About 95% of the buildings are residential. The region occupies nearly 12,000 square miles, has 28 counties, and contains about 5,000 census tracts.

Infrastructure and Essential Facilities

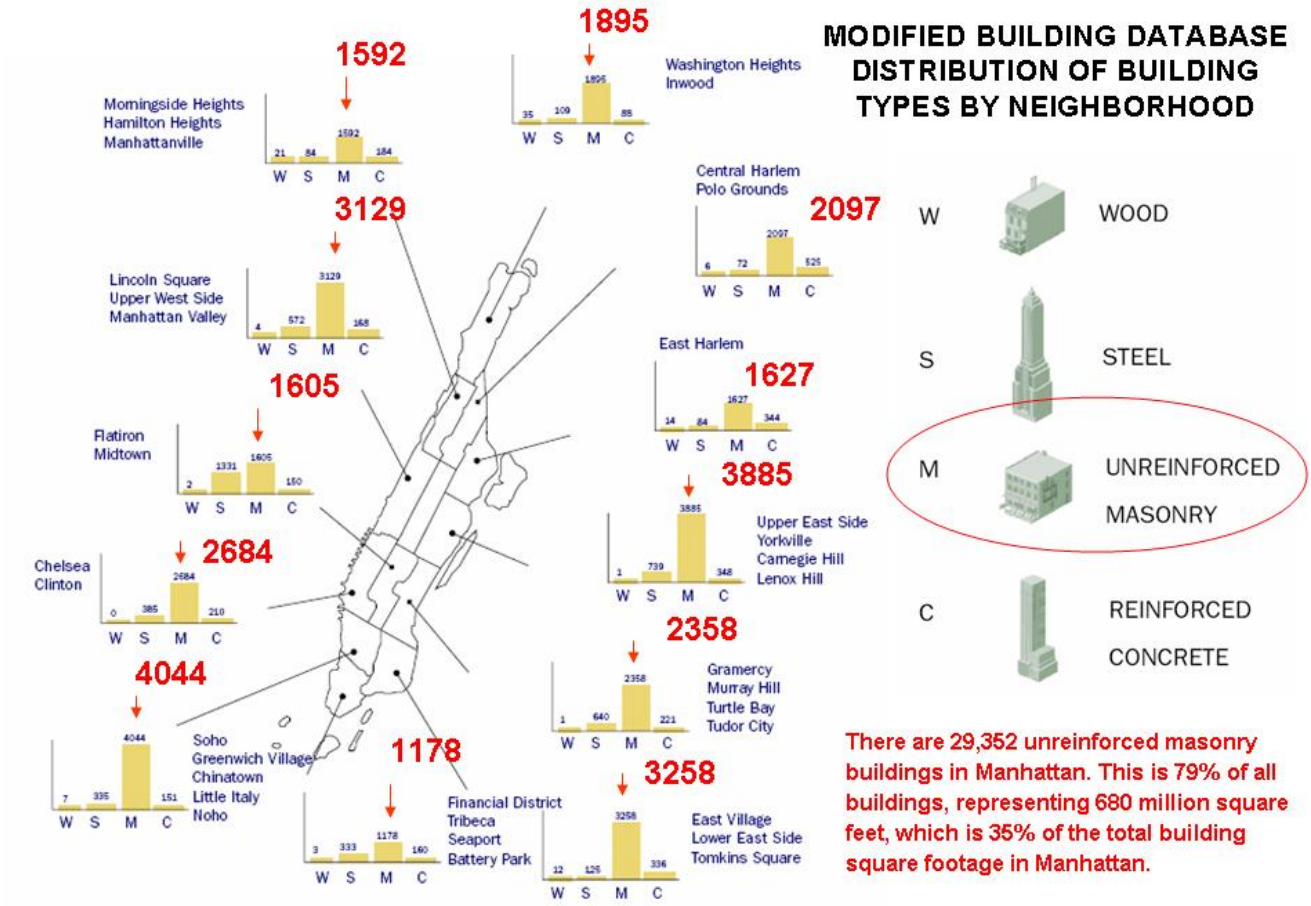
The region has a very valuable infrastructure that would be severely at risk in the event of a damaging earthquake. Replacing transportation and utility systems alone is estimated to cost $200 billion. Add to this the damage to essential facilities, and the value at risk increases significantly:

- 246 hospitals
- 123 emergency operation facilities
- 878 fire stations
- 1,348 dams (402 considered “high hazard”)
- 744 police stations
- 53,095 hazardous material sites
- 2 nuclear power plants

(Excerpt from the NYCEM Report)

An extremely alarming and valuable conclusion of this report is that, the greatest damage and concentration of affected population would be in and around the New York City Metro Area.

Figure 3-199
Building Types in Manhattan Neighborhoods



“Determining what level of damage buildings experience is the essential component and heart of the loss estimation process.” (NYCEM Report)

The alarming situation with Unreinforced Masonry is that buildings made of this material are highly susceptible to damage in an Earthquake event and they constitute 79% of all

buildings in Manhattan. They are the most vulnerable to damage out of any building type evaluated. The reason is that they are brittle and do not absorb the motion, as well, as the other structure types do (Wood, Steel, and Reinforced Concrete). For more information regarding the NYCEM report please visit their website at www.nycem.org.

Mitigation Actions

One of the crucial factors in prevention and mitigation requires that jurisdictions adhere to the building codes that NYS has adopted. New York State follows the International Building and Residential Codes and each jurisdiction within NYS is required to meet these standards. Local jurisdictions can have there own codes and variances as well, but the International Building and Residential Codes must be met. These codes have specific requirements for construction (typically new construction) that take into account wind load and seismic activity. For further information regarding New York State's building codes please visit the Department of States website at http://www.dos.state.ny.us/, as well please reference any local codes or variances that may apply to your specific area.

The following chart lists and describes Hazard Mitigation Projects that have been applied for and approved by FEMA from. This chart is not intended to represent all projects that may have been completed or approved that have a seismic or earthquake related mitigation benefit. This chart includes only those projects that were specifically a Seismic Retrofit.

Table 3-62
Mitigation Actions

HMGP APPL	APPLICANT	PROJECT TYPE	FEMA APPROVAL DATE	DR #	STATUS	COUNTY
0012	Port Authority	Bus Terminal Seismic Retrofit	3/19/2003	1391	Open	New York
0009	Port Authority	George Washington Bridge Seismic Retrofit	3/19/2003	1391	Closed	New York

Source: SEMO Mitigation Database