HAZUS-MH: Hurricane Event Report

Region Name: Westbrook Hurricane

Hurricane Scenario: UN-NAMED-1938-4

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Disclaimer:
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 Hurricane. These results can be improved by using enhanced inventory data.

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General Description of the Region

HAZUS is a regional multi-hazard 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 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 hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

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

The geographical size of the region is 16.16 square miles and contains 1 census tracts. There are over 2 thousand households in the region and has a total population of 6,292 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 2 thousand buildings in the region with a total building replacement value (excluding contents) of 531 million dollars (2002 dollars). Approximately 99% of the buildings (and 77% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

HAZUS estimates that there are 2,907 buildings in the region which have an aggregate total replacement value of 531 million (2002 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Total
Residential	411,127	77.5%
Commercial	84,128	15.8%
Industrial	28,512	5.4%
Agricultural	1,086	0.2%
Religious	2,899	0.5%
Government	0	0.0%
Education	3,025	0.6%
Total	530,777	100.0%

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 3 schools, 2 fire stations, 2 police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	UN-NAMED-1938-4
Type:	Historic
Max Peak Gust in Study Region:	143 mph

Building Damage

General Building Stock Damage

HAZUS estimates that about 2,472 buildings will be at least moderately damaged. This is over 85% of the total number of buildings in the region. There are an estimated 1,149 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the HAZUS Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	1	4.64	1	6.67	4	18.82	13	64.17	1	5.71
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	1	5.15	1	5.10	2	15.35	9	67.59	1	6.82
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	88	3.07	343	11.93	608	21.15	688	23.92	1,147	39.92
Total	**90**		**345**		**614**		**709**		**1,149**	

Table 3: Expected Building Damage by Building Type

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	4.86	0	4.39	1	15.04	5	75.57	0	0.13
Masonry	5	3.98	9	6.34	24	18.10	77	56.80	20	14.79
MH	25	9.48	18	7.13	52	20.06	27	10.54	137	52.79
Steel	1	5.55	1	4.27	2	13.12	13	73.96	1	3.10
Wood	65	2.63	317	12.72	550	22.11	583	23.42	973	39.11

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

	# Facilities			
Classification	Total	Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	2	2	0	0
Police Stations	2	2	0	0
Schools	3	3	0	0

Induced Hurricane Damage

Debris Generation

HAZUS estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into three general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, and c) Trees. 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 -50,525 ons of debris will be generated. Of the total amount, Brick/Wood comprises 0% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 2464 truckloads (@25 tons/truck) to remove the debris generated by the hurricane.

Social Impact

Shelter Requirement

HAZUS estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 1,755 households to be displaced due to the hurricane. Of these, 381 people (out of a total population of 6,292) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 505.5 million dollars, which represents 95.23 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage 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 hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 505 million dollars. 1% 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 77% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	237,701.78	34,543.98	12,903.33	2,723.66	287,872.75
	Content	111,831.84	28,106.10	15,561.24	2,158.17	157,657.35
	Inventory	0.00	566.22	997.40	34.70	1,598.32
	Subtotal	**349,533.63**	**63,216.29**	**29,461.97**	**4,916.53**	**447,128.42**
Business Interruption Loss						
	Income	162.25	3,105.05	149.77	44.85	3,461.92
	Relocation	29,693.64	5,119.11	1,201.55	566.05	36,580.35
	Rental	10,627.22	3,624.30	309.27	37.57	14,598.36
	Wage	383.10	2,995.02	248.04	74.88	3,701.03
	Subtotal	**40,866.20**	**14,843.48**	**1,908.63**	**723.35**	**58,341.66**
Total	**Total**	**390,399.83**	**78,059.77**	**31,370.61**	**5,639.88**	**505,470.08**

Appendix A: County Listing for the Region

Connecticut
- Middlesex

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Connecticut				
Middlesex	6,292	411,127	119,650	530,777
Total State	**6,292**	**411,127**	**119,650**	**530,777**
Total Study Region	**6,292**	**411,127**	**119,650**	**530,777**