Hazus: Flood Global Risk Report

Region Name: Chester

Flood Scenario: ChesterAll

Print Date: Monday, January 6, 2020

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
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.

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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 (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):

- Connecticut

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

The geographical size of the region is approximately 17 square miles and contains 174 census blocks. The region contains over 2 thousand households and has a total population of 3,994 people (2010 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 1,833 buildings in the region with a total building replacement value (excluding contents) of 831 million dollars. Approximately 89.31% of the buildings (and 78.16% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 1,833 buildings in the region which have an aggregate total replacement value of 831 million 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	649,896	78.2%
Commercial	110,478	13.3%
Industrial	55,516	6.7%
Agricultural	3,118	0.4%
Religion	6,871	0.8%
Government	460	0.1%
Education	5,151	0.6%
Total	**831,490**	**100%**

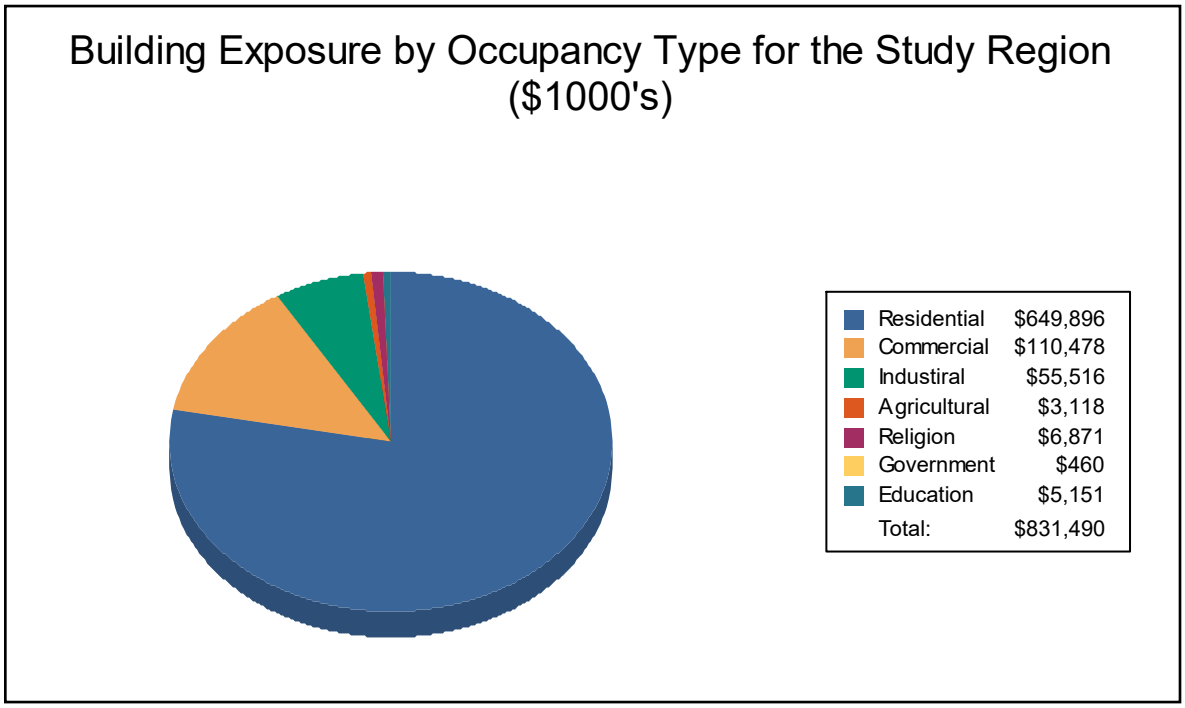
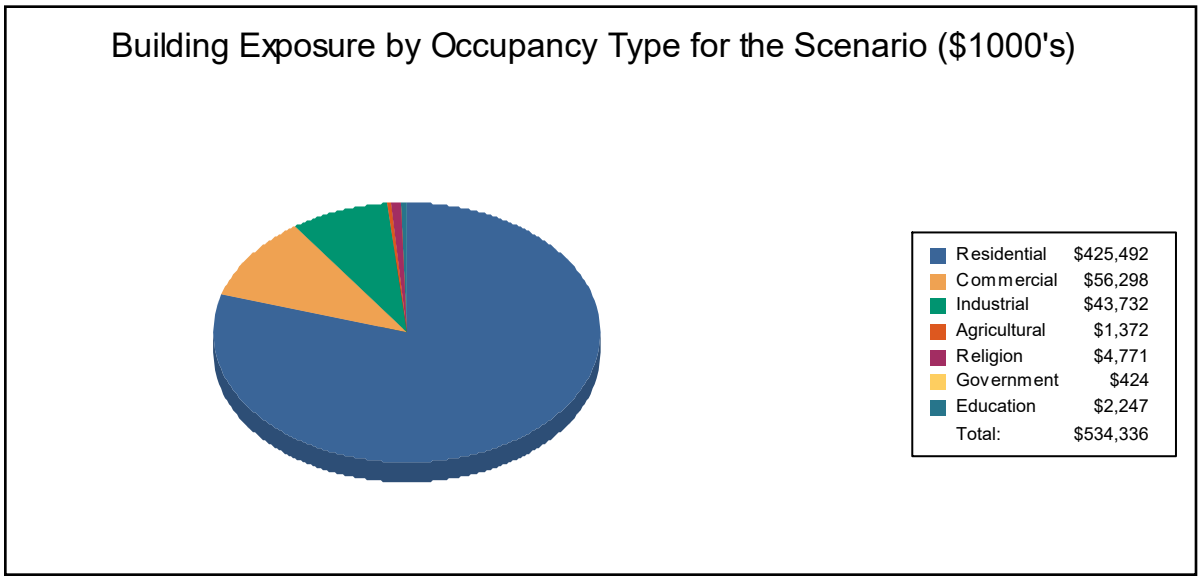


Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	425,492	79.6%
Commercial	56,298	10.5%
Industrial	43,732	8.2%
Agricultural	1,372	0.3%
Religion	4,771	0.9%
Government	424	0.1%
Education	2,247	0.4%
Total	**534,336**	**100%**



Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds.
There are 2 schools, 1 fire station, 1 police station and 1 emergency operation center.

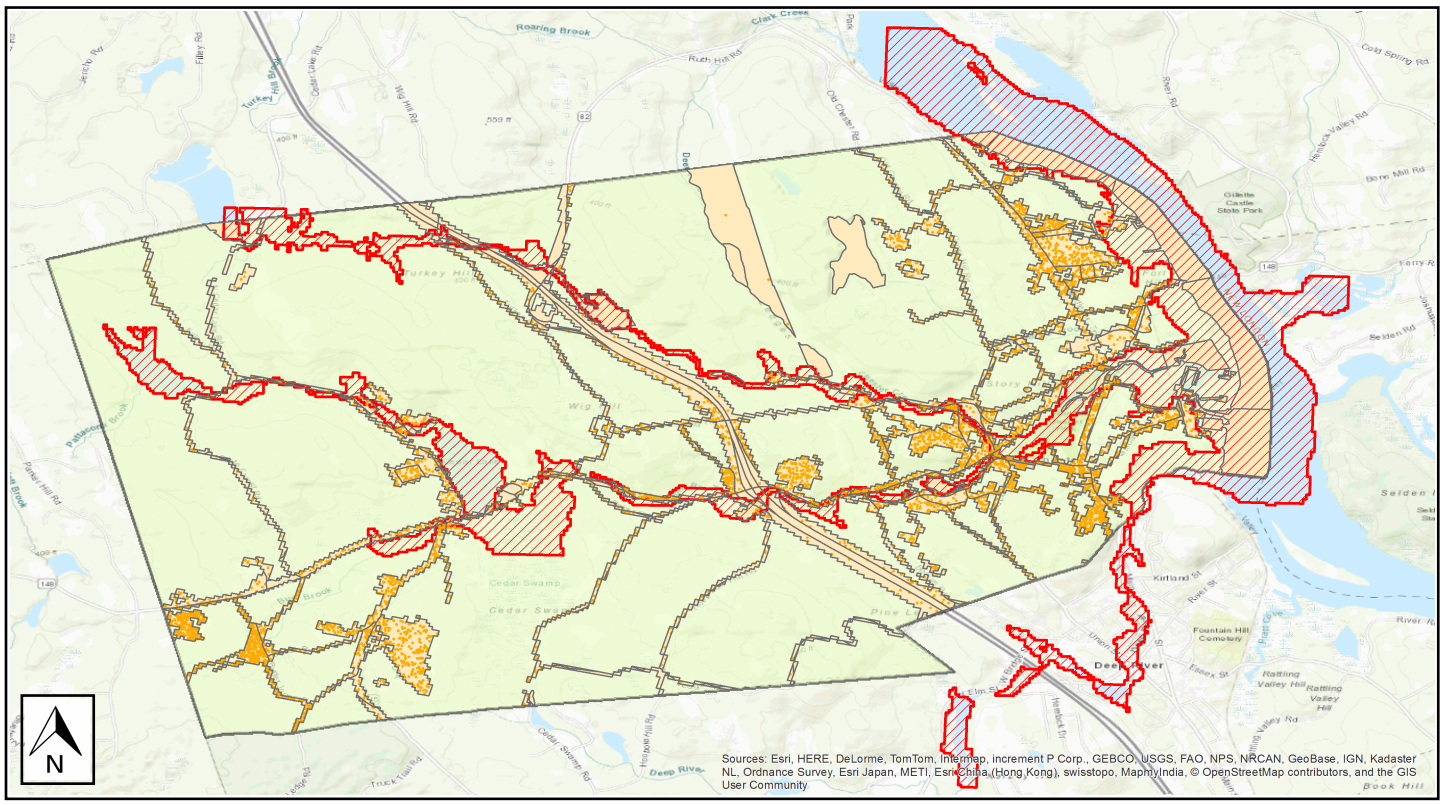
Flood Scenario Parameters

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

Study Region Name:	Chester
Scenario Name:	ChesterAll
Return Period Analyzed:	10
Analysis Options Analyzed:	No What-Ifs

Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure



Building Damage

General Building Stock Damage

Hazus estimates that about 9 buildings will be at least moderately damaged. This is over 93% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in 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.

Total Economic Loss (1 dot = $300K) Overview Map

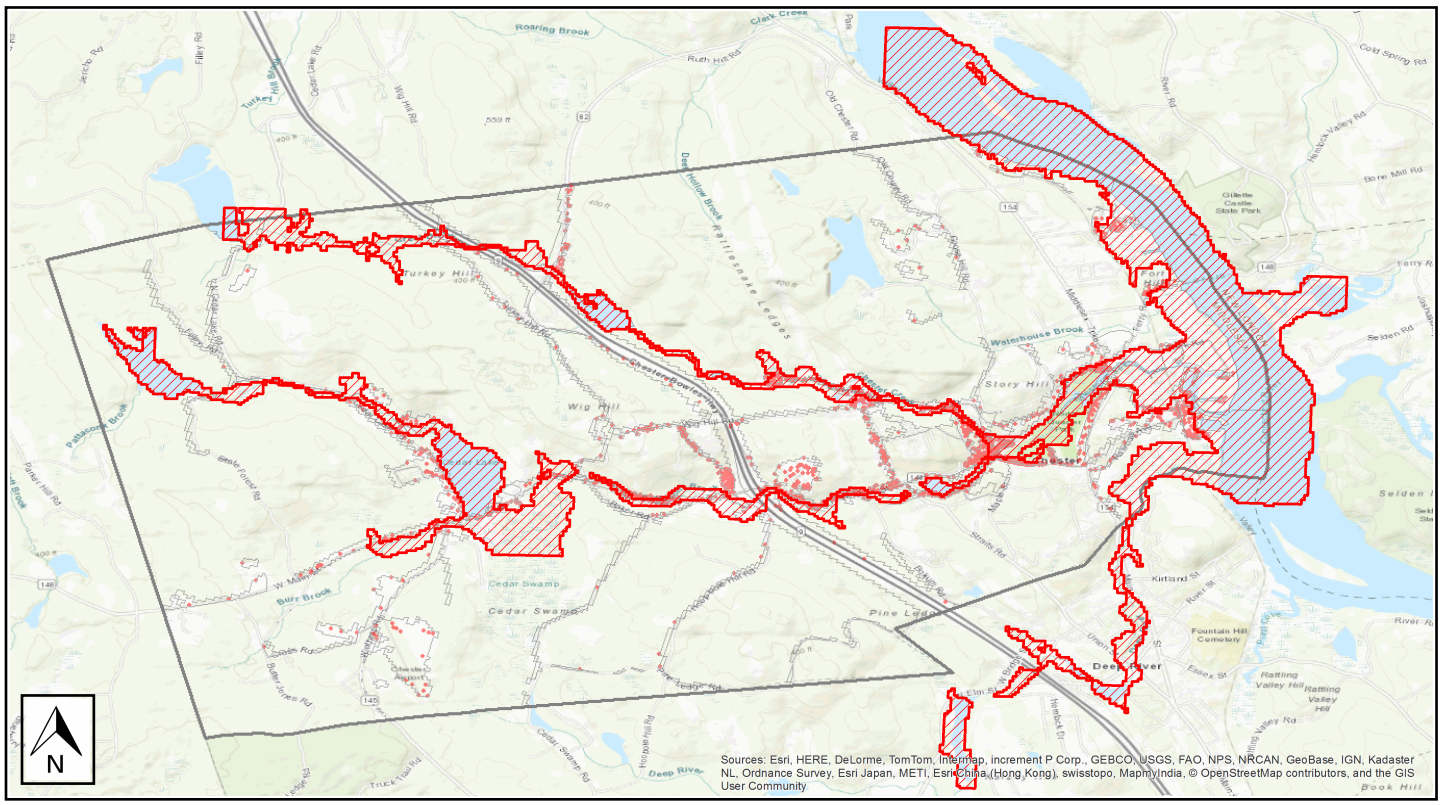


Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		>50	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Commercial	2	100	0	0	0	0	0	0	0	0	0	0
Education	0	0	0	0	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0	0	0	0	0
Residential	39	81	9	19	0	0	0	0	0	0	0	0
Total	**41**		**9**		**0**		**0**		**0**		**0**	

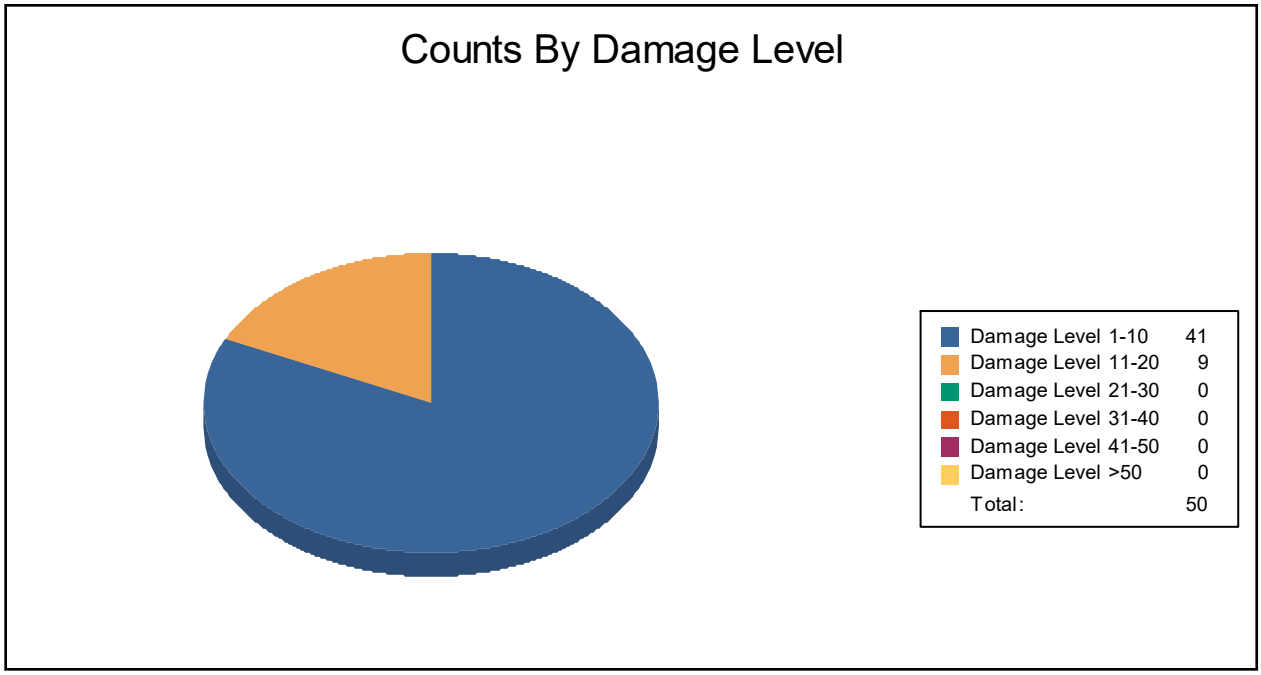


Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		>50	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0	0	0	0	0
Masonry	0	0	0	0	0	0	0	0	0	0	0	0
Steel	0	0	0	0	0	0	0	0	0	0	0	0
Wood	39	81	9	19	0	0	0	0	0	0	0	0

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 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
Emergency Operation Centers	1	0	0	0
Fire Stations	1	0	0	0
Hospitals	0	0	0	0
Police Stations	1	0	0	0
Schools	2	0	0	0

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

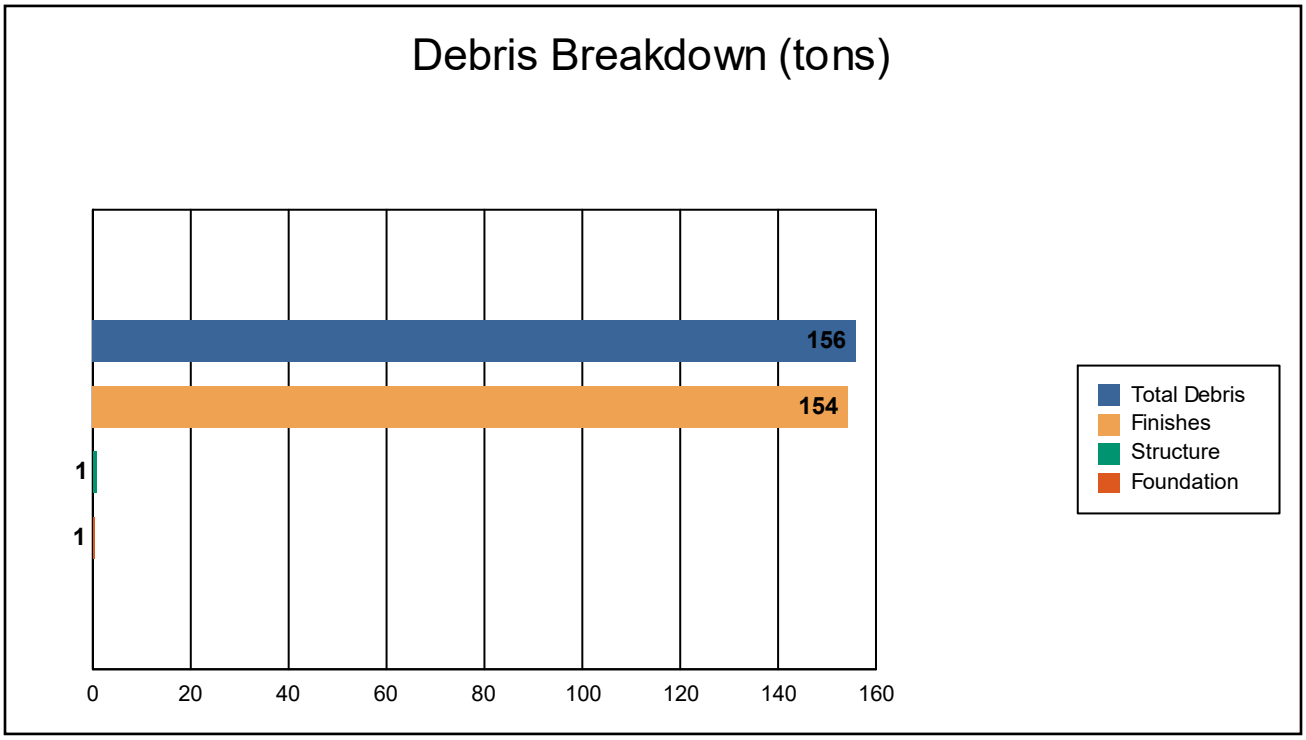
(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(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.

Induced Flood Damage

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.

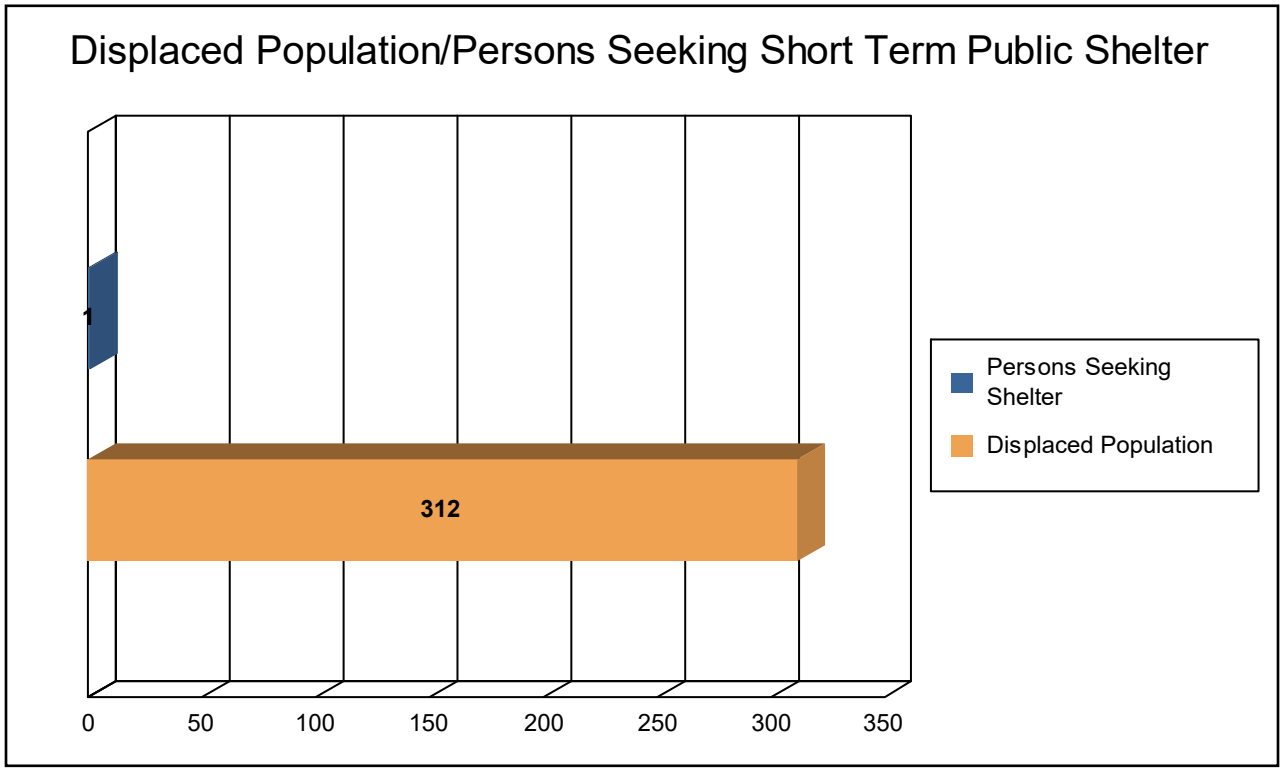


The model estimates that a total of 156 tons of debris will be generated. Of the total amount, Finishes comprises 99% of the total, Structure comprises 1% of the total, and Foundation comprises 0%. If the debris tonnage is converted into an estimated number of truckloads, it will require 7 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

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 104 households (or 312 of people) will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 1 people (out of a total population of 3,994) will seek temporary shelter in public shelters.



Economic Loss

The total economic loss estimated for the flood is 21.25 million dollars, which represents 3.98 % of the total replacement value of the scenario buildings.

Building-Related Losses

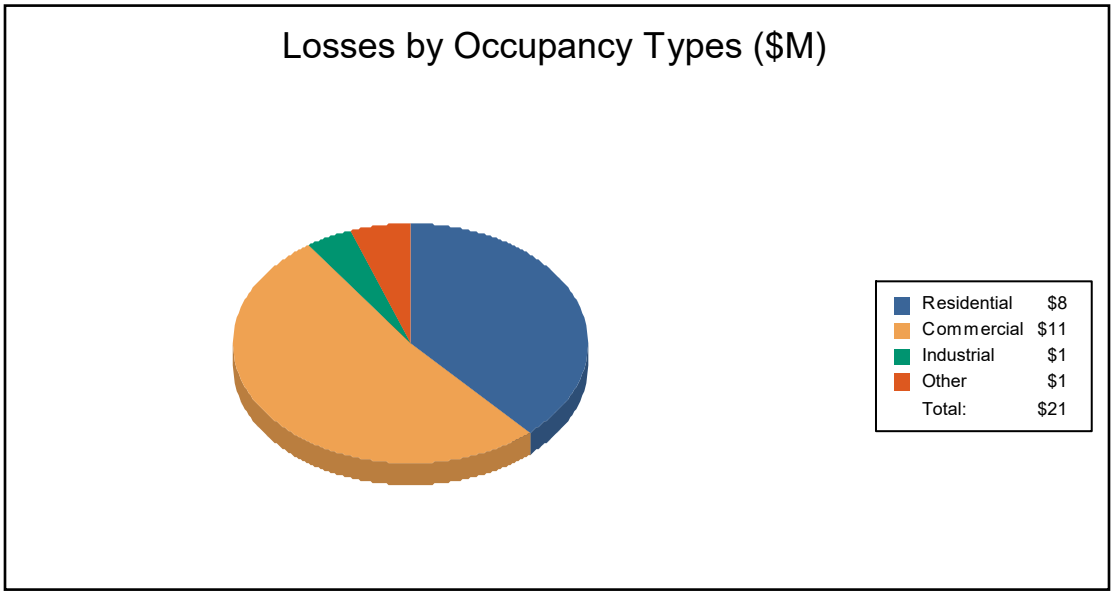
The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability 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 7.84 million dollars. 63% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 38.25% 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	2.82	0.54	0.23	0.05	3.64
	Content	1.56	1.68	0.47	0.41	4.12
	Inventory	0.00	0.01	0.07	0.00	0.08
	Subtotal	**4.38**	**2.23**	**0.77**	**0.46**	**7.84**
Business Interruption						
	Income	0.38	4.11	0.02	0.19	4.69
	Relocation	1.73	0.89	0.04	0.09	2.74
	Rental Income	0.75	0.67	0.01	0.01	1.43
	Wage	0.90	3.16	0.04	0.45	4.54
	Subtotal	**3.74**	**8.83**	**0.10**	**0.74**	**13.41**
ALL	**Total**	**8.13**	**11.06**	**0.87**	**1.19**	**21.25**



Appendix A: County Listing for the Region

Connecticut

- Middlesex

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
Middlesex	3,994	649,896	181,594	831,490
Total	**3,994**	**649,896**	**181,594**	**831,490**
Total Study Region	**3,994**	**649,896**	**181,594**	**831,490**

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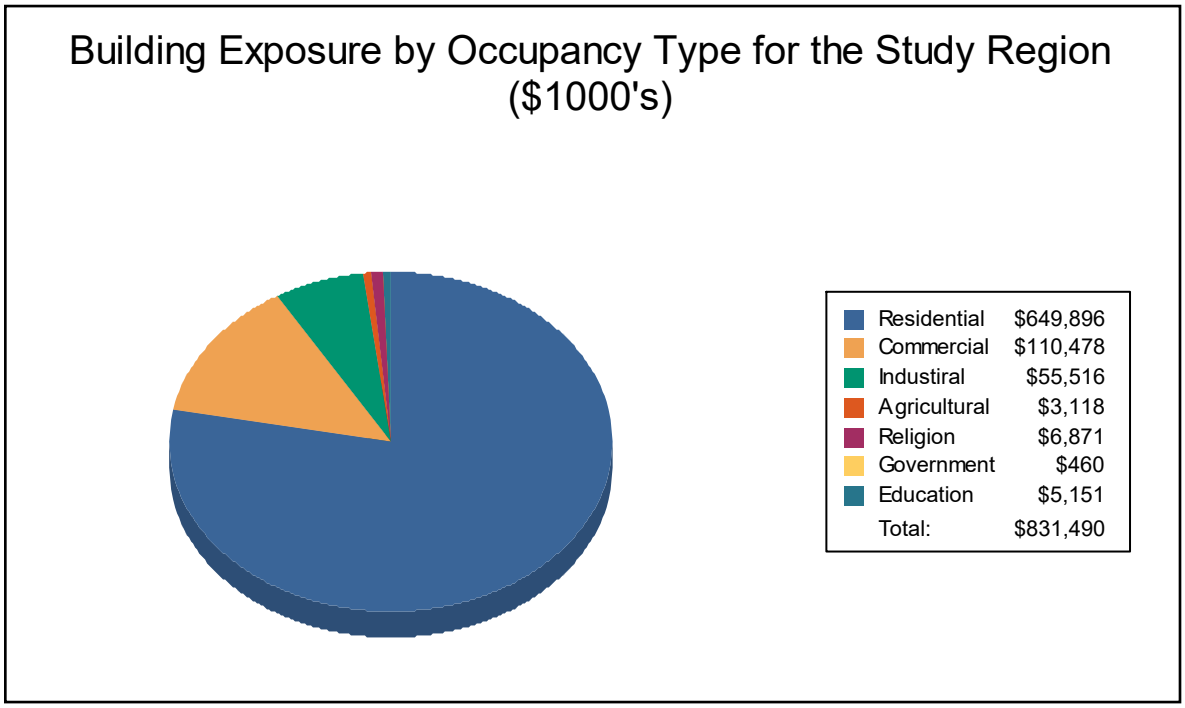

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
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Commercial	56,298	10.5%
Industrial	43,732	8.2%
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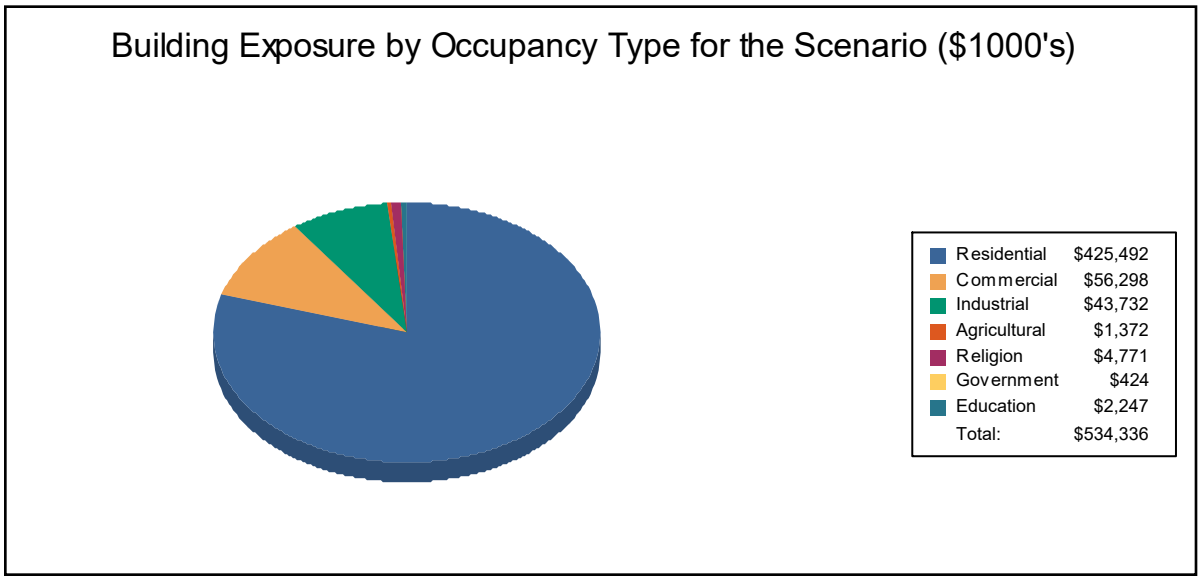


Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds.
There are 2 schools, 1 fire station, 1 police station and 1 emergency operation center.

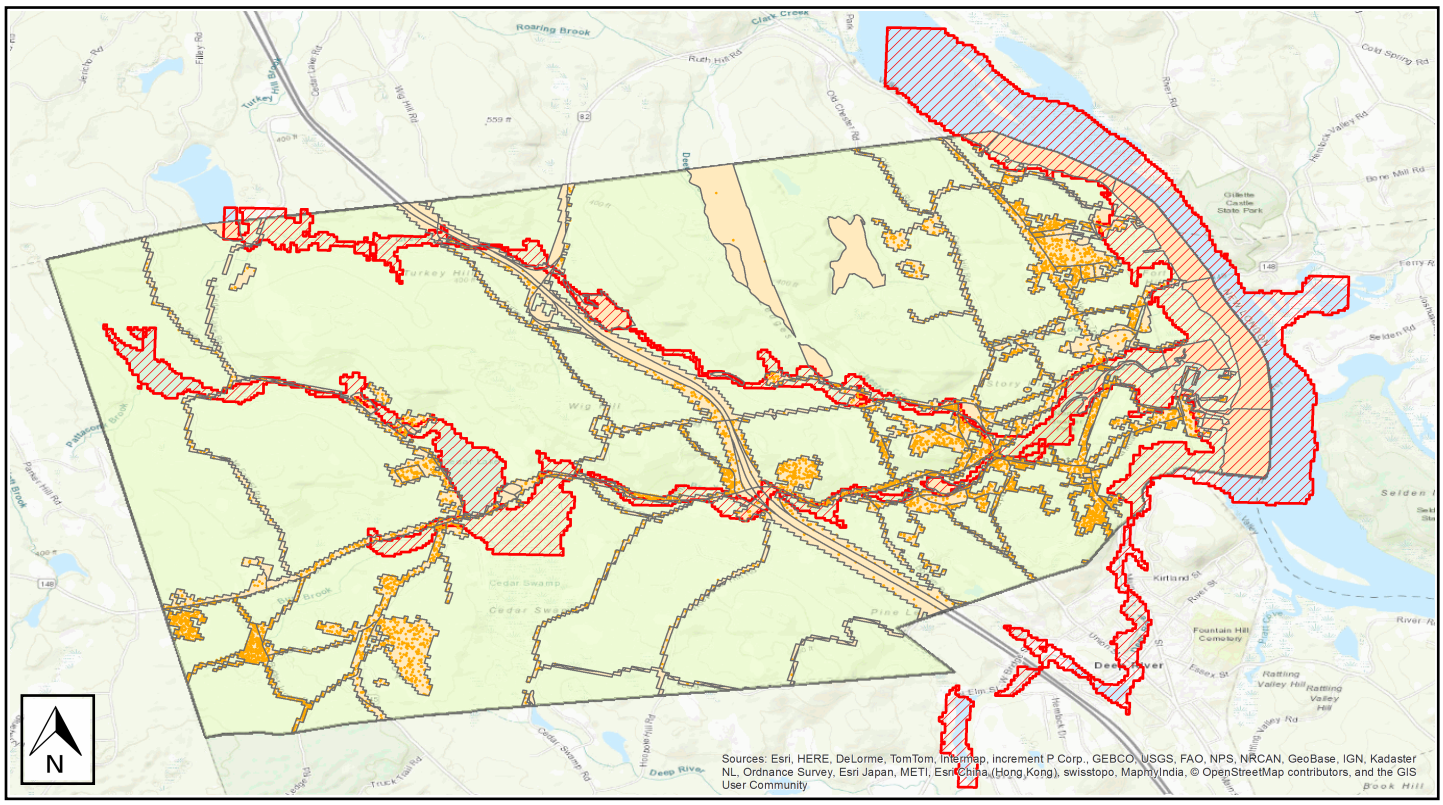
Flood Scenario Parameters

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

Study Region Name:	Chester
Scenario Name:	ChesterAll
Return Period Analyzed:	25
Analysis Options Analyzed:	No What-Ifs

Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure



Building Damage

General Building Stock Damage

Hazus estimates that about 9 buildings will be at least moderately damaged. This is over 95% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in 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.

Total Economic Loss (1 dot = $300K) Overview Map

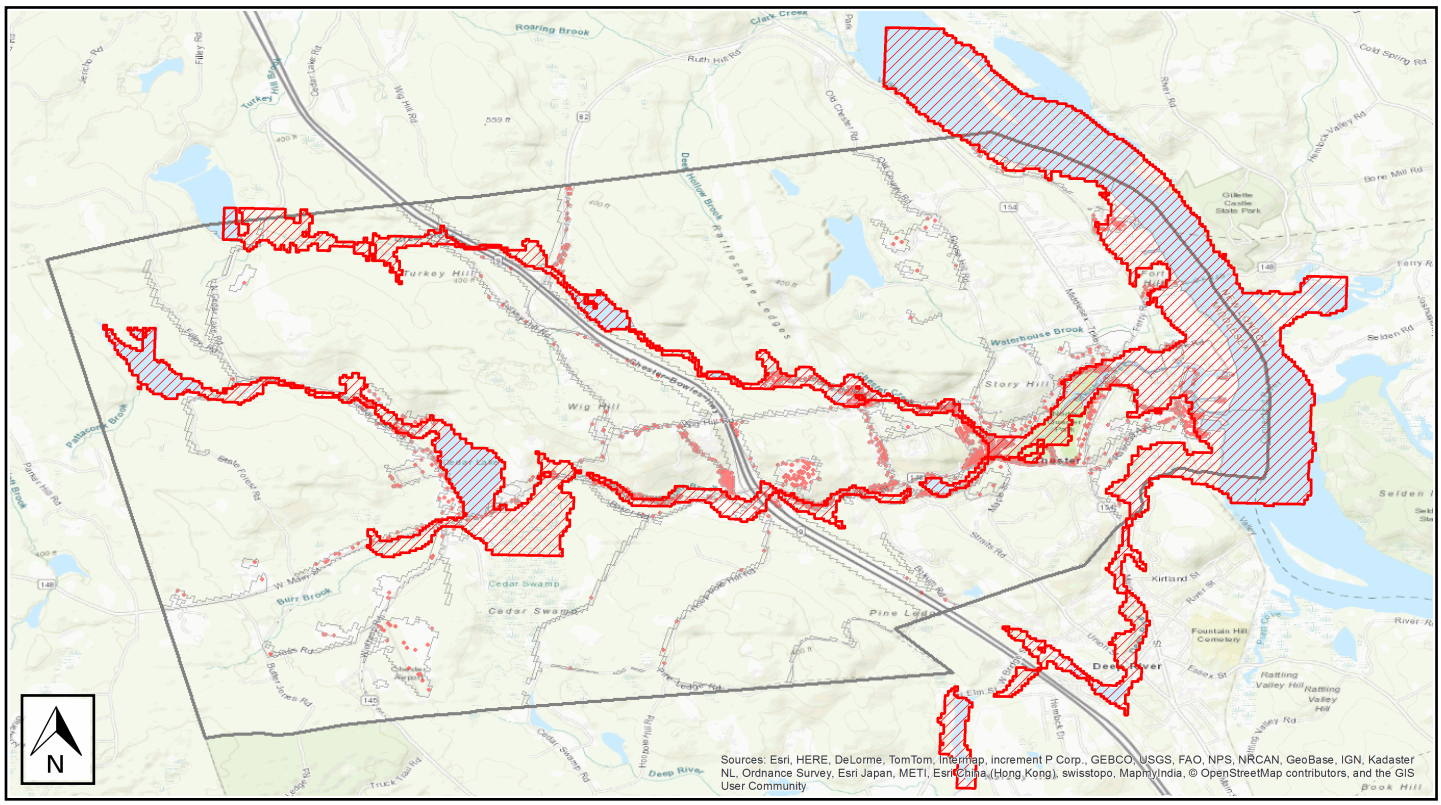


Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		>50	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Commercial	4	100	0	0	0	0	0	0	0	0	0	0
Education	0	0	0	0	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0	0	0	0	0
Residential	43	83	9	17	0	0	0	0	0	0	0	0
Total	**47**		**9**		**0**		**0**		**0**		**0**	

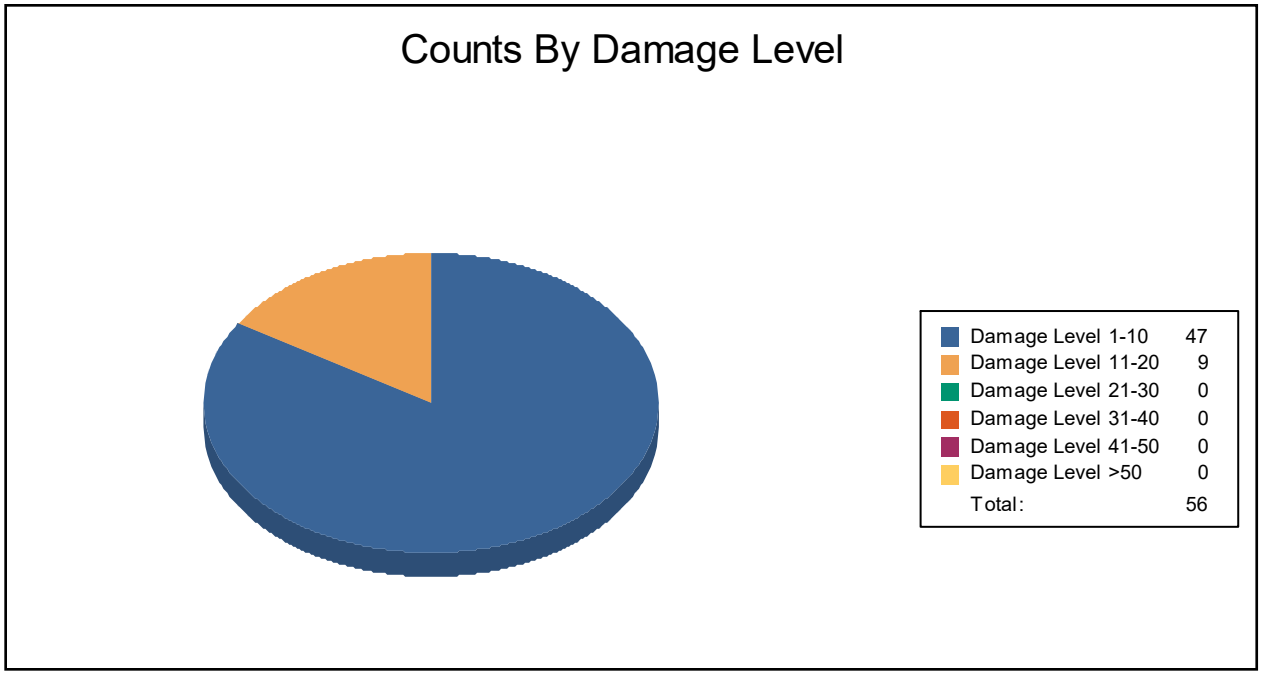


Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		>50	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0	0	0	0	0
Masonry	1	100	0	0	0	0	0	0	0	0	0	0
Steel	1	100	0	0	0	0	0	0	0	0	0	0
Wood	43	83	9	17	0	0	0	0	0	0	0	0

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 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
Emergency Operation Centers	1	0	0	0
Fire Stations	1	0	0	0
Hospitals	0	0	0	0
Police Stations	1	0	0	0
Schools	2	0	0	0

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

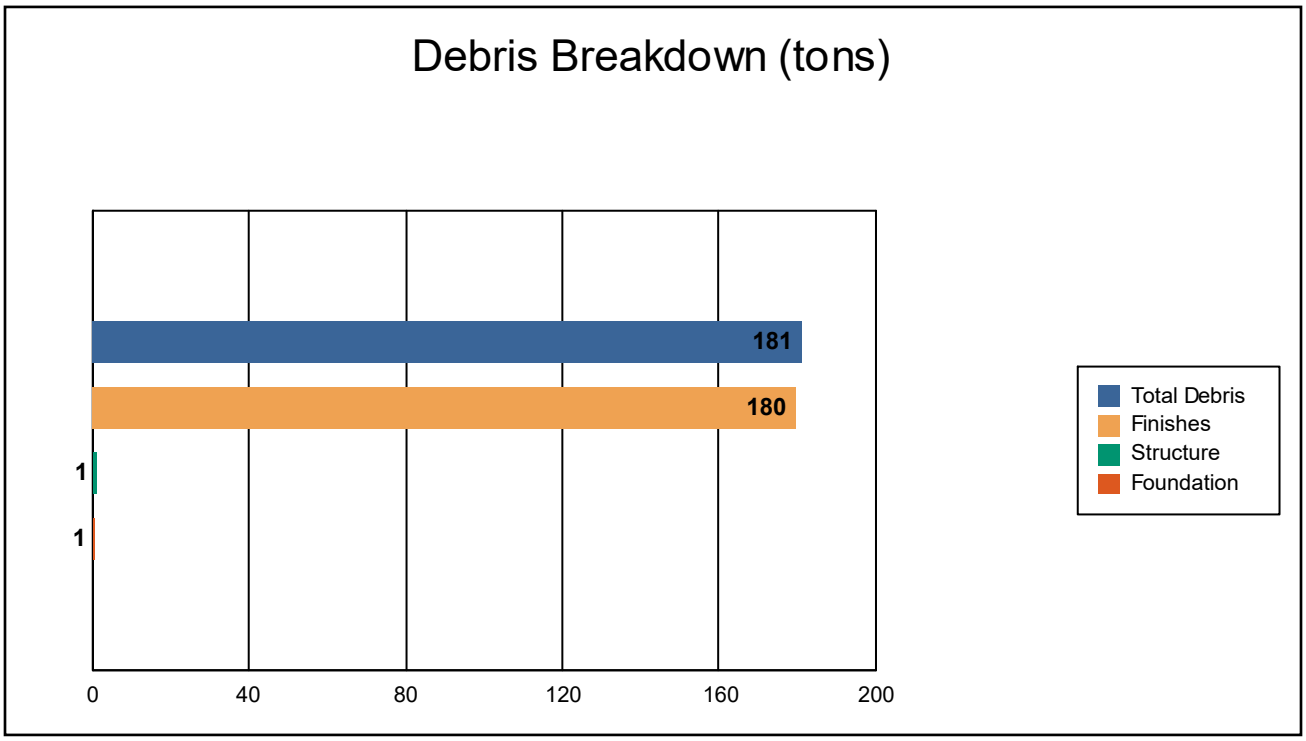
(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(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.

Induced Flood Damage

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.

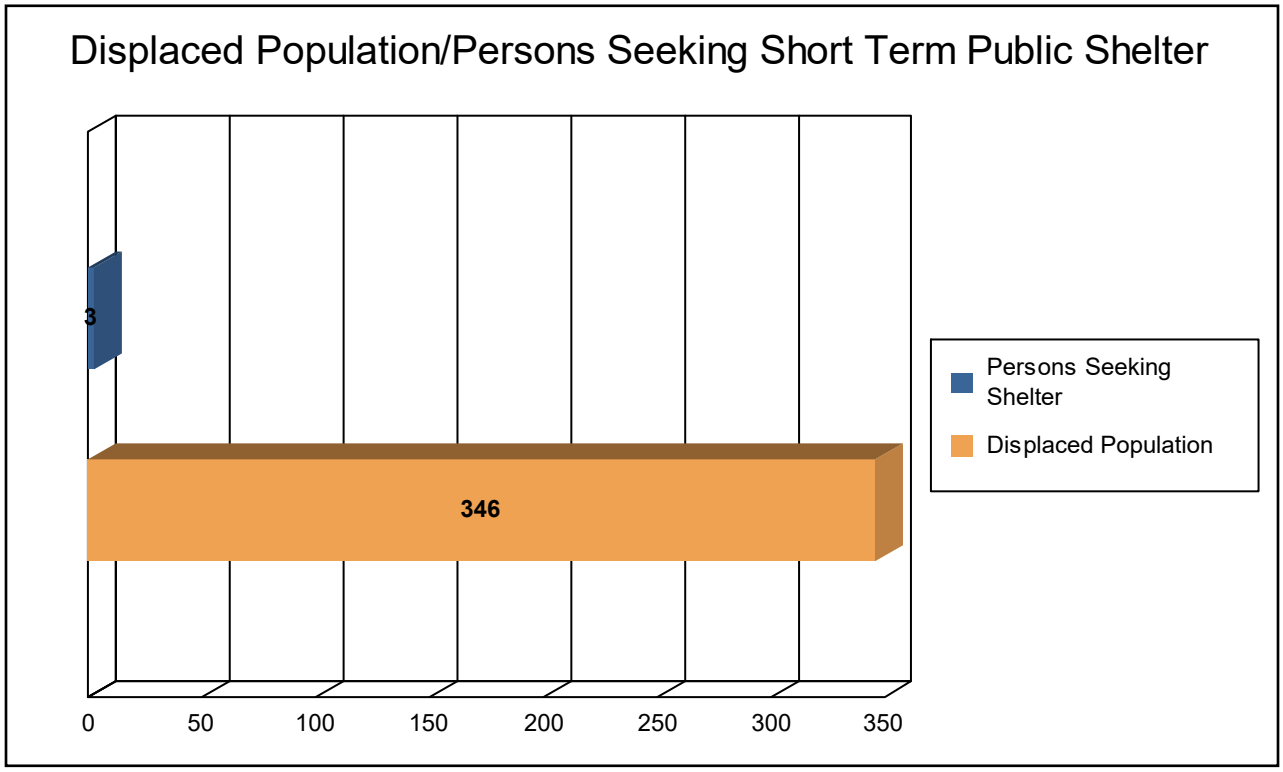


The model estimates that a total of 181 tons of debris will be generated. Of the total amount, Finishes comprises 99% of the total, Structure comprises 1% of the total, and Foundation comprises 0%. If the debris tonnage is converted into an estimated number of truckloads, it will require 8 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

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 115 households (or 346 of people) will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 3 people (out of a total population of 3,994) will seek temporary shelter in public shelters.



Economic Loss

The total economic loss estimated for the flood is 25.14 million dollars, which represents 4.71 % of the total replacement value of the scenario buildings.

Building-Related Losses

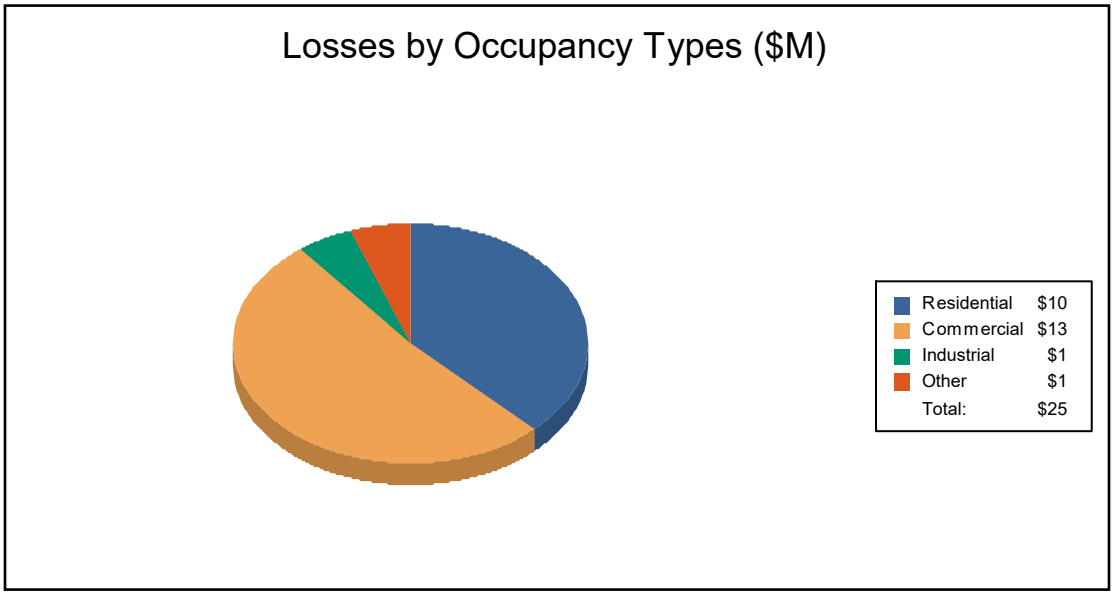
The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability 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 10.32 million dollars. 59% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 37.79% 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	3.51	0.77	0.33	0.06	4.67
	Content	1.95	2.41	0.69	0.49	5.54
	Inventory	0.00	0.02	0.09	0.00	0.11
	Subtotal	**5.46**	**3.19**	**1.11**	**0.55**	**10.32**
Business Interruption						
	Income	0.38	4.55	0.03	0.21	5.17
	Relocation	1.92	0.97	0.06	0.10	3.05
	Rental Income	0.84	0.74	0.01	0.01	1.59
	Wage	0.90	3.56	0.06	0.50	5.02
	Subtotal	**4.04**	**9.82**	**0.16**	**0.81**	**14.83**
ALL	**Total**	**9.50**	**13.01**	**1.27**	**1.36**	**25.14**



Appendix A: County Listing for the Region

Connecticut

- Middlesex

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
Middlesex	3,994	649,896	181,594	831,490
Total	**3,994**	**649,896**	**181,594**	**831,490**
Total Study Region	**3,994**	**649,896**	**181,594**	**831,490**

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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 (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):

- Connecticut

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

The geographical size of the region is approximately 17 square miles and contains 174 census blocks. The region contains over 2 thousand households and has a total population of 3,994 people (2010 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 1,833 buildings in the region with a total building replacement value (excluding contents) of 831 million dollars. Approximately 89.31% of the buildings (and 78.16% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 1,833 buildings in the region which have an aggregate total replacement value of 831 million 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	649,896	78.2%
Commercial	110,478	13.3%
Industrial	55,516	6.7%
Agricultural	3,118	0.4%
Religion	6,871	0.8%
Government	460	0.1%
Education	5,151	0.6%
Total	**831,490**	**100%**

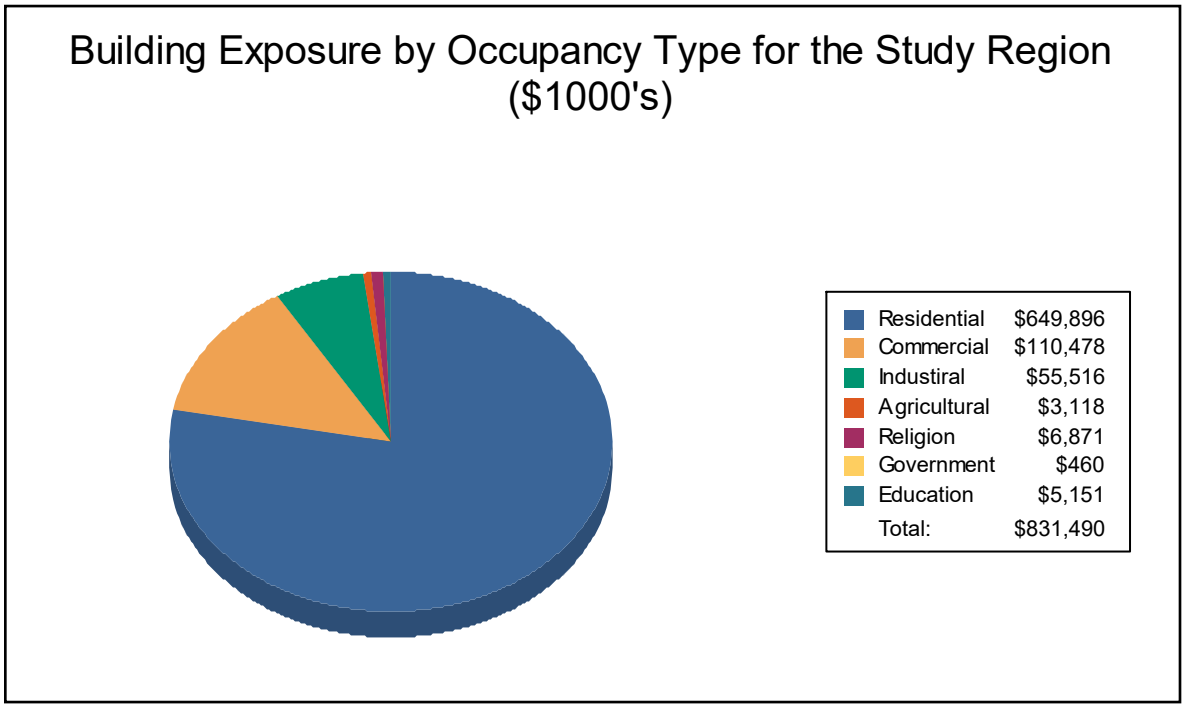
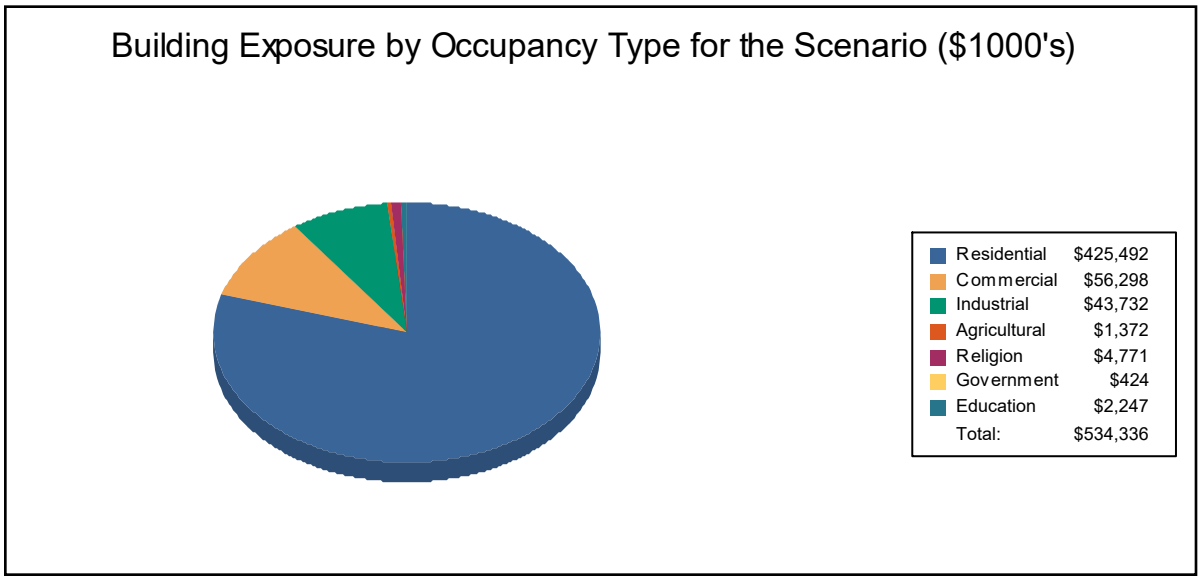


Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	425,492	79.6%
Commercial	56,298	10.5%
Industrial	43,732	8.2%
Agricultural	1,372	0.3%
Religion	4,771	0.9%
Government	424	0.1%
Education	2,247	0.4%
Total	**534,336**	**100%**



Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds.
There are 2 schools, 1 fire station, 1 police station and 1 emergency operation center.

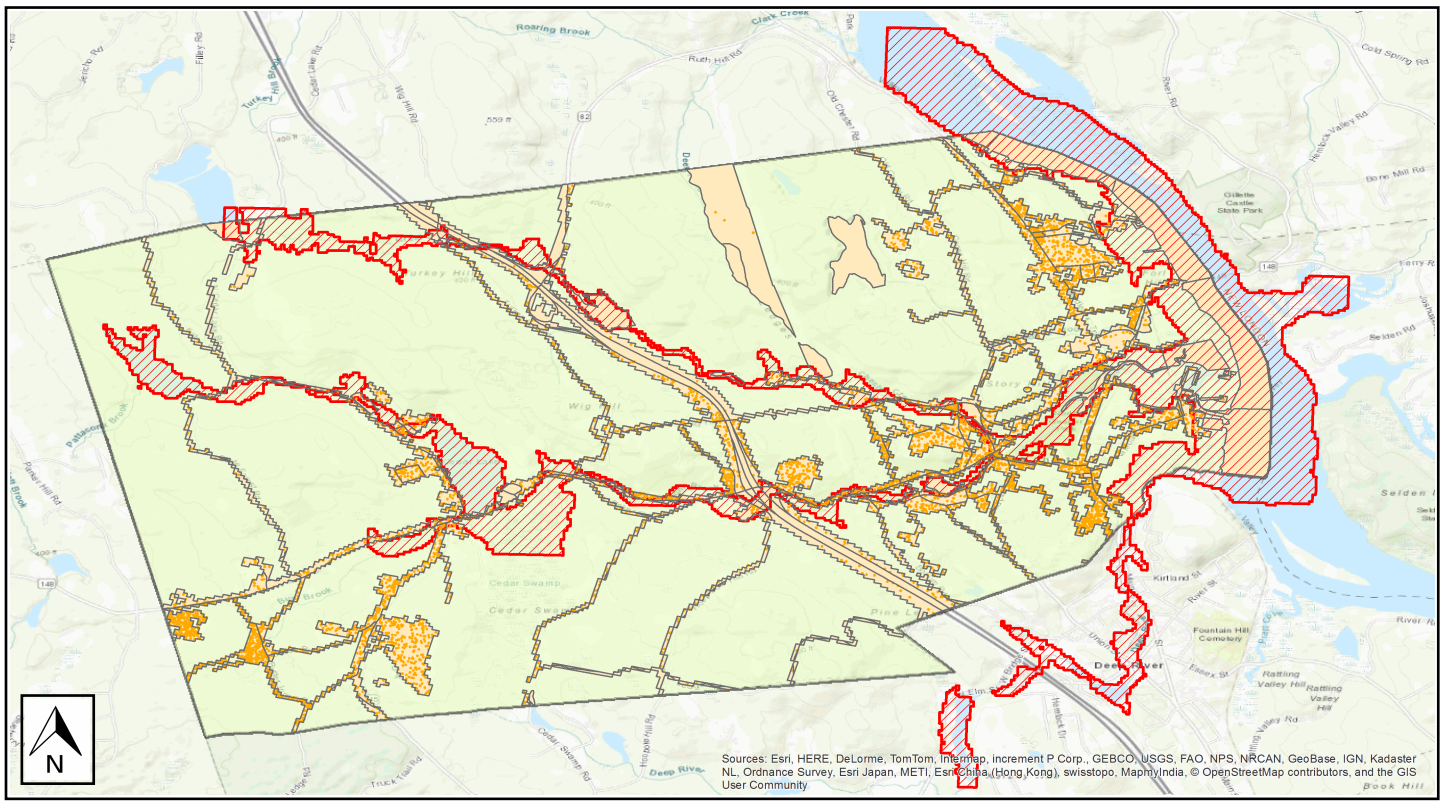
Flood Scenario Parameters

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

Study Region Name:	Chester
Scenario Name:	ChesterAll
Return Period Analyzed:	50
Analysis Options Analyzed:	No What-Ifs

Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure



Building Damage

General Building Stock Damage

Hazus estimates that about 15 buildings will be at least moderately damaged. This is over 94% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in 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.

Total Economic Loss (1 dot = $300K) Overview Map

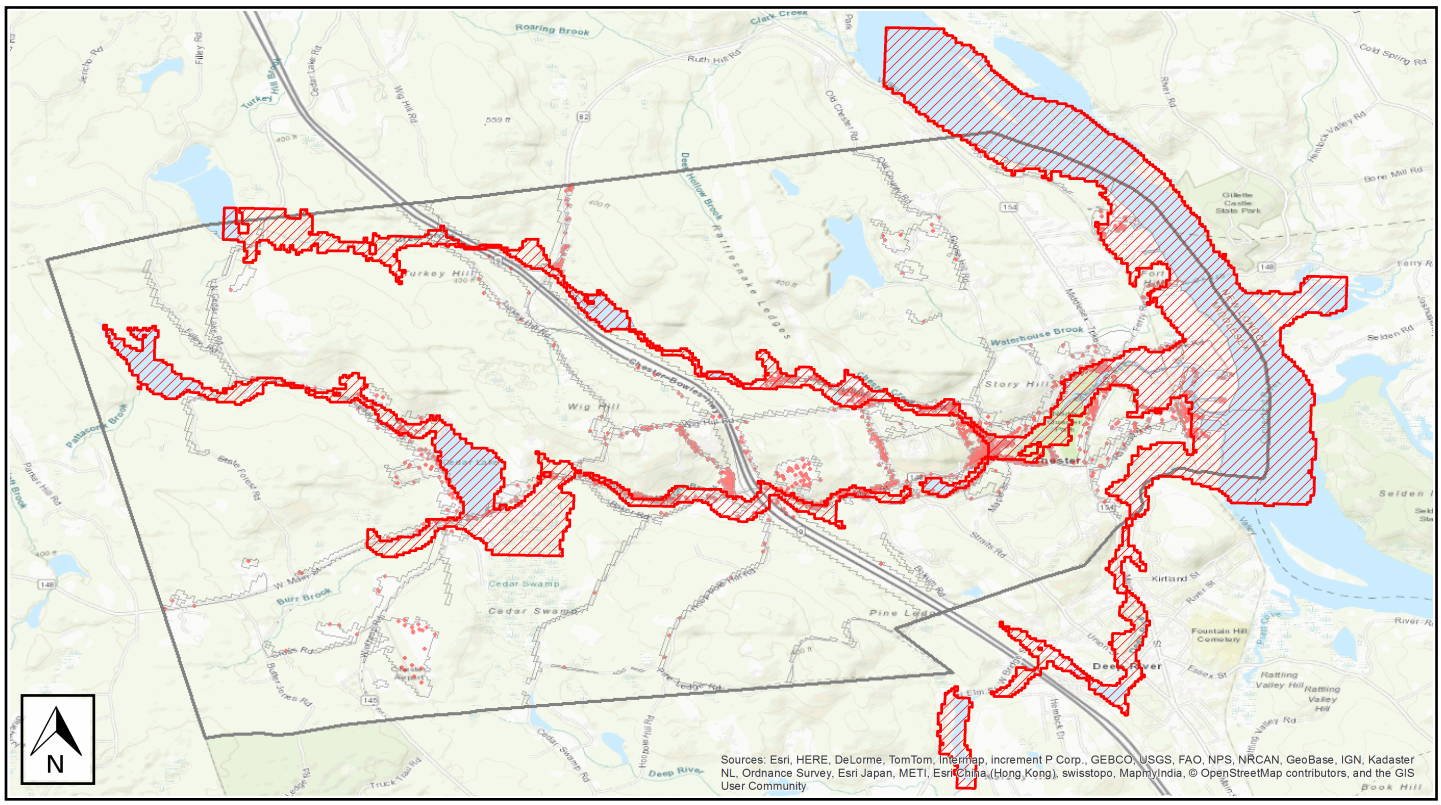


Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		>50	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Commercial	3	75	1	25	0	0	0	0	0	0	0	0
Education	0	0	0	0	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0	0	0	0	0
Residential	43	75	14	25	0	0	0	0	0	0	0	0
Total	**46**		**15**		**0**		**0**		**0**		**0**	

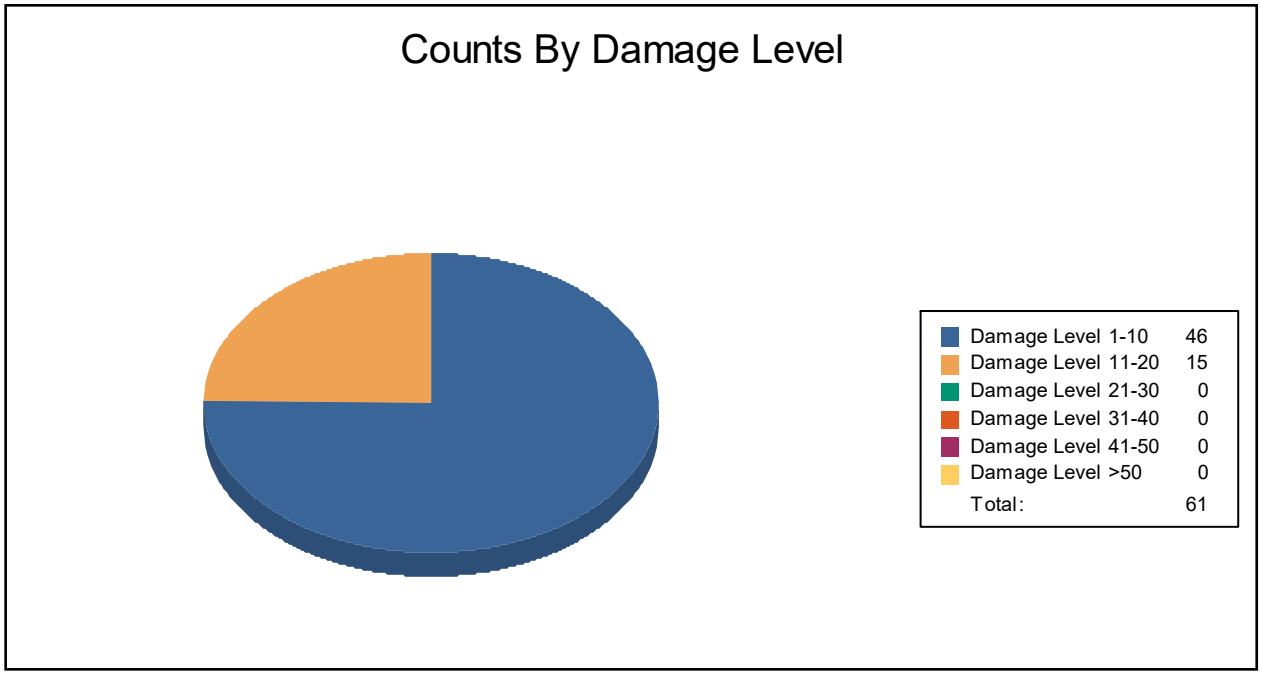


Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		>50	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0	0	0	0	0
Masonry	0	0	0	0	0	0	0	0	0	0	0	0
Steel	1	50	1	50	0	0	0	0	0	0	0	0
Wood	43	75	14	25	0	0	0	0	0	0	0	0

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 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
Emergency Operation Centers	1	0	0	0
Fire Stations	1	0	0	0
Hospitals	0	0	0	0
Police Stations	1	0	0	0
Schools	2	0	0	0

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

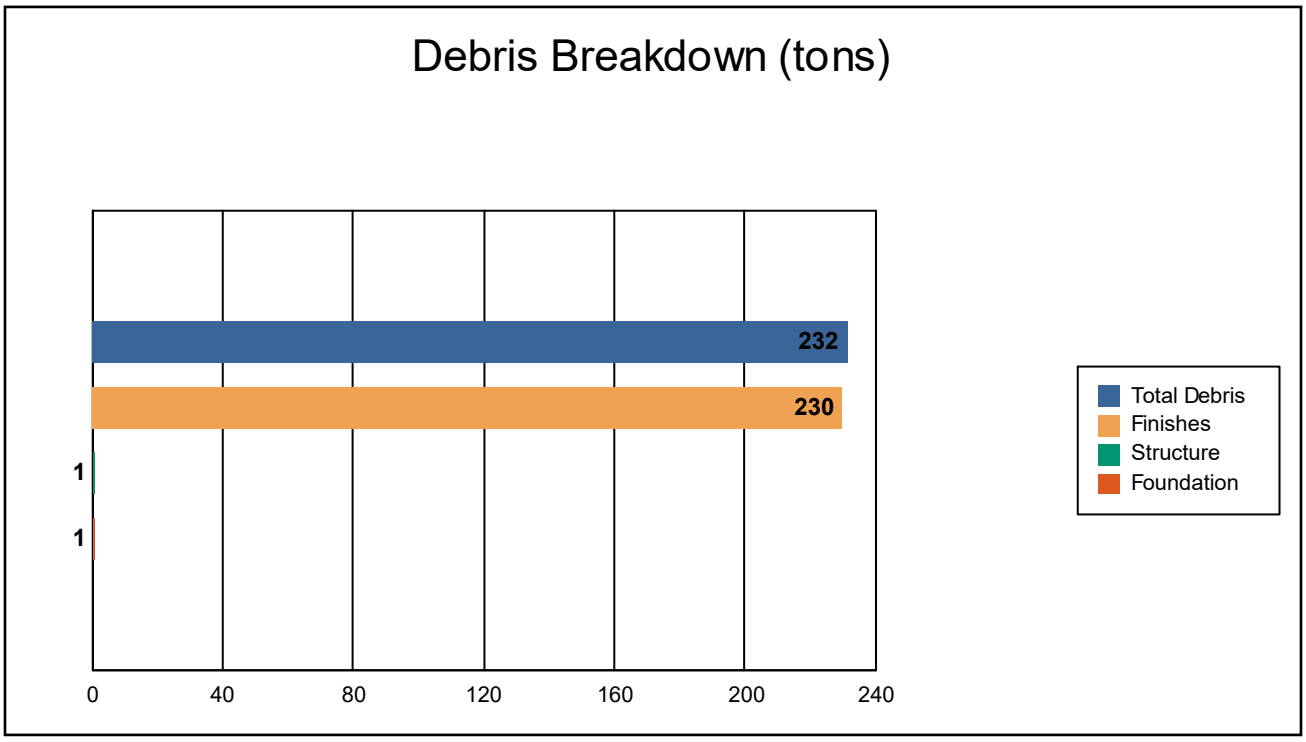
(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(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.

Induced Flood Damage

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.

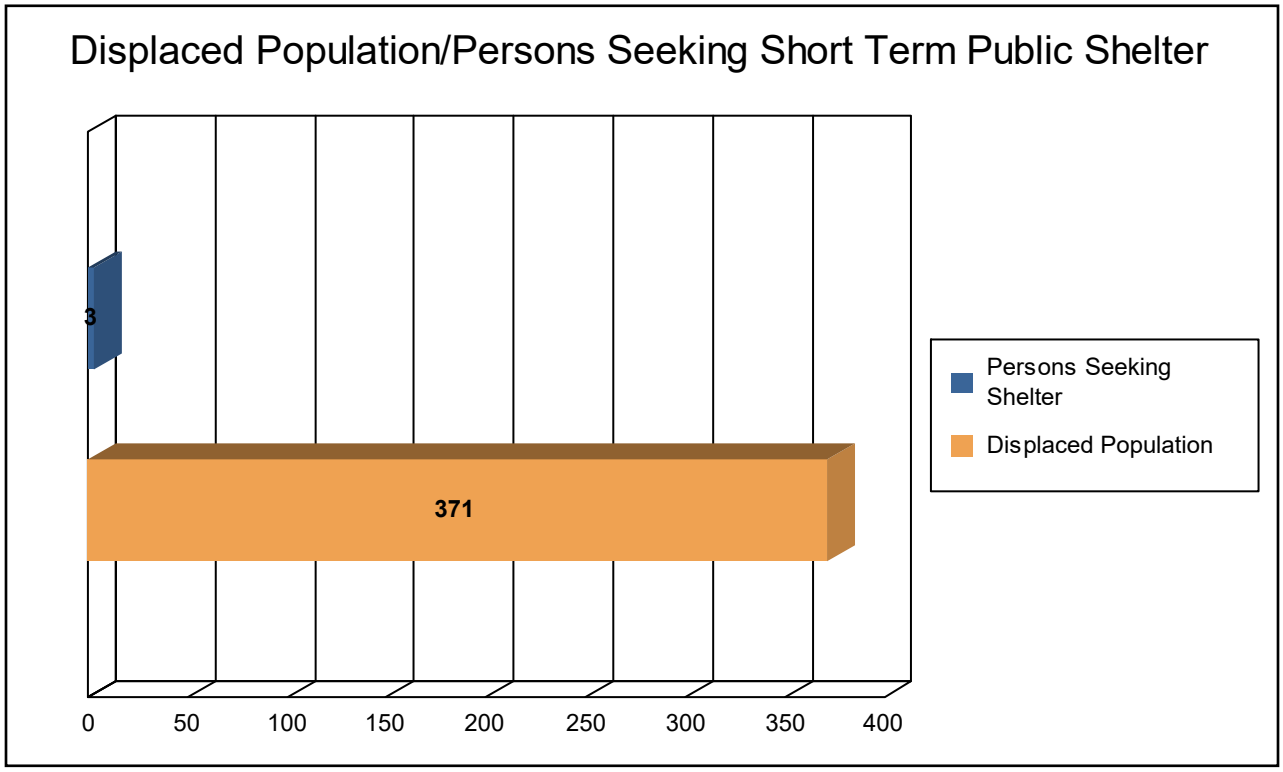


The model estimates that a total of 232 tons of debris will be generated. Of the total amount, Finishes comprises 99% of the total, Structure comprises 0% of the total, and Foundation comprises 0%. If the debris tonnage is converted into an estimated number of truckloads, it will require 10 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

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 124 households (or 371 of people) will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 3 people (out of a total population of 3,994) will seek temporary shelter in public shelters.



Economic Loss

The total economic loss estimated for the flood is 28.94 million dollars, which represents 5.42 % of the total replacement value of the scenario buildings.

Building-Related Losses

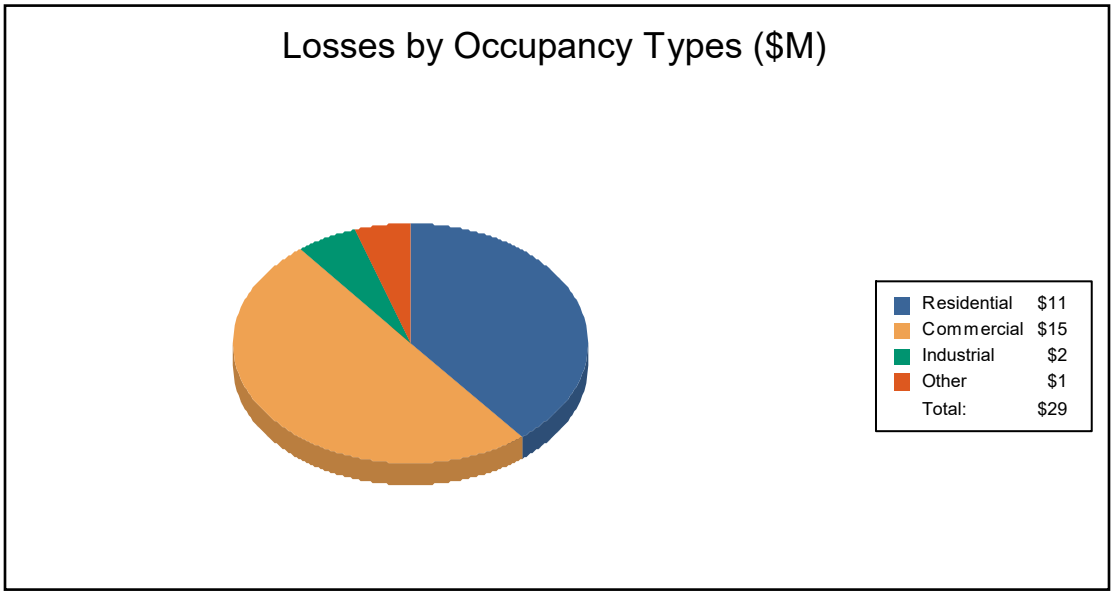
The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability 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 13.17 million dollars. 54% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 39.05% 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	4.47	1.00	0.41	0.07	5.96
	Content	2.51	3.10	0.91	0.55	7.06
	Inventory	0.00	0.03	0.12	0.00	0.15
	Subtotal	**6.98**	**4.13**	**1.44**	**0.62**	**13.17**
Business Interruption						
	Income	0.40	4.84	0.04	0.21	5.49
	Relocation	2.08	1.03	0.07	0.10	3.29
	Rental Income	0.89	0.78	0.01	0.01	1.69
	Wage	0.95	3.78	0.06	0.51	5.30
	Subtotal	**4.32**	**10.44**	**0.18**	**0.84**	**15.77**
ALL	**Total**	**11.30**	**14.56**	**1.62**	**1.46**	**28.94**



Appendix A: County Listing for the Region

Connecticut

- Middlesex

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
Middlesex	3,994	649,896	181,594	831,490
Total	**3,994**	**649,896**	**181,594**	**831,490**
Total Study Region	**3,994**	**649,896**	**181,594**	**831,490**

Hazus: Flood Global Risk Report

Region Name: Chester

Flood Scenario: ChesterAll

Print Date: Tuesday, January 7, 2020

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
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.

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The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Connecticut

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

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There are an estimated 1,833 buildings in the region with a total building replacement value (excluding contents) of 831 million dollars. Approximately 89.31% of the buildings (and 78.16% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 1,833 buildings in the region which have an aggregate total replacement value of 831 million 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.

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Religion	6,871	0.8%
Government	460	0.1%
Education	5,151	0.6%
Total	**831,490**	**100%**

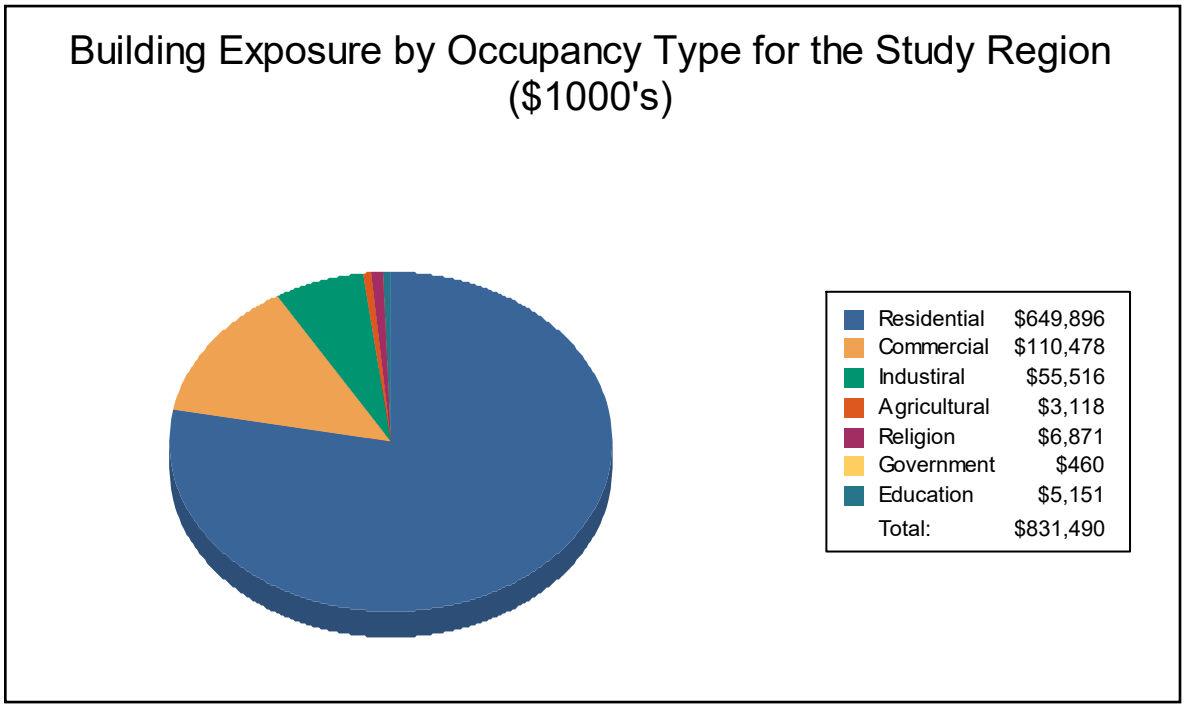
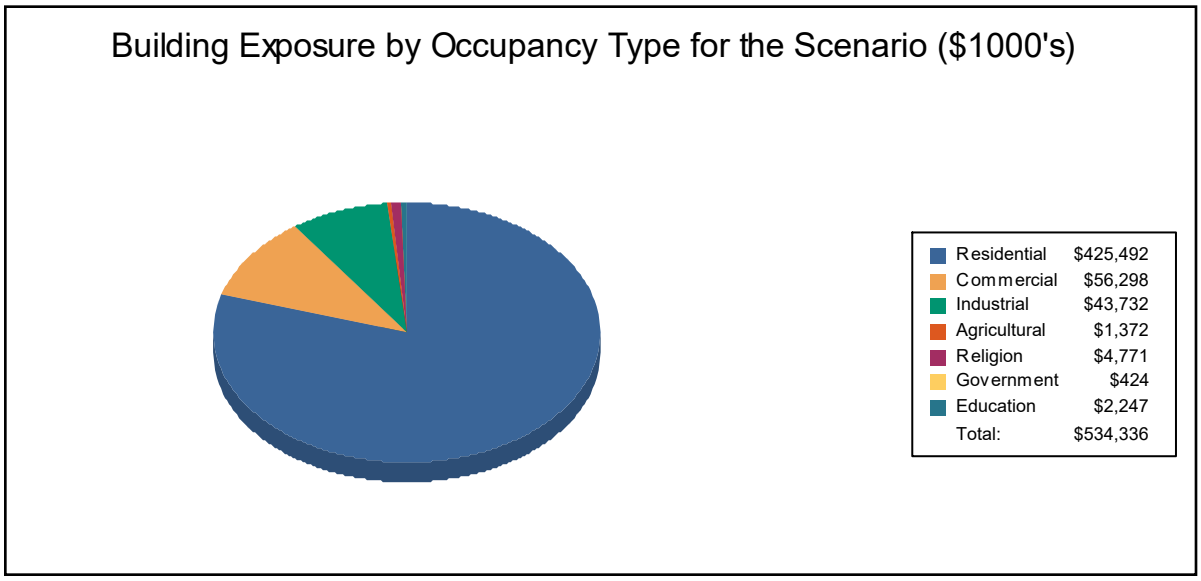


Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	425,492	79.6%
Commercial	56,298	10.5%
Industrial	43,732	8.2%
Agricultural	1,372	0.3%
Religion	4,771	0.9%
Government	424	0.1%
Education	2,247	0.4%
Total	**534,336**	**100%**



Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds.
There are 2 schools, 1 fire station, 1 police station and 1 emergency operation center.

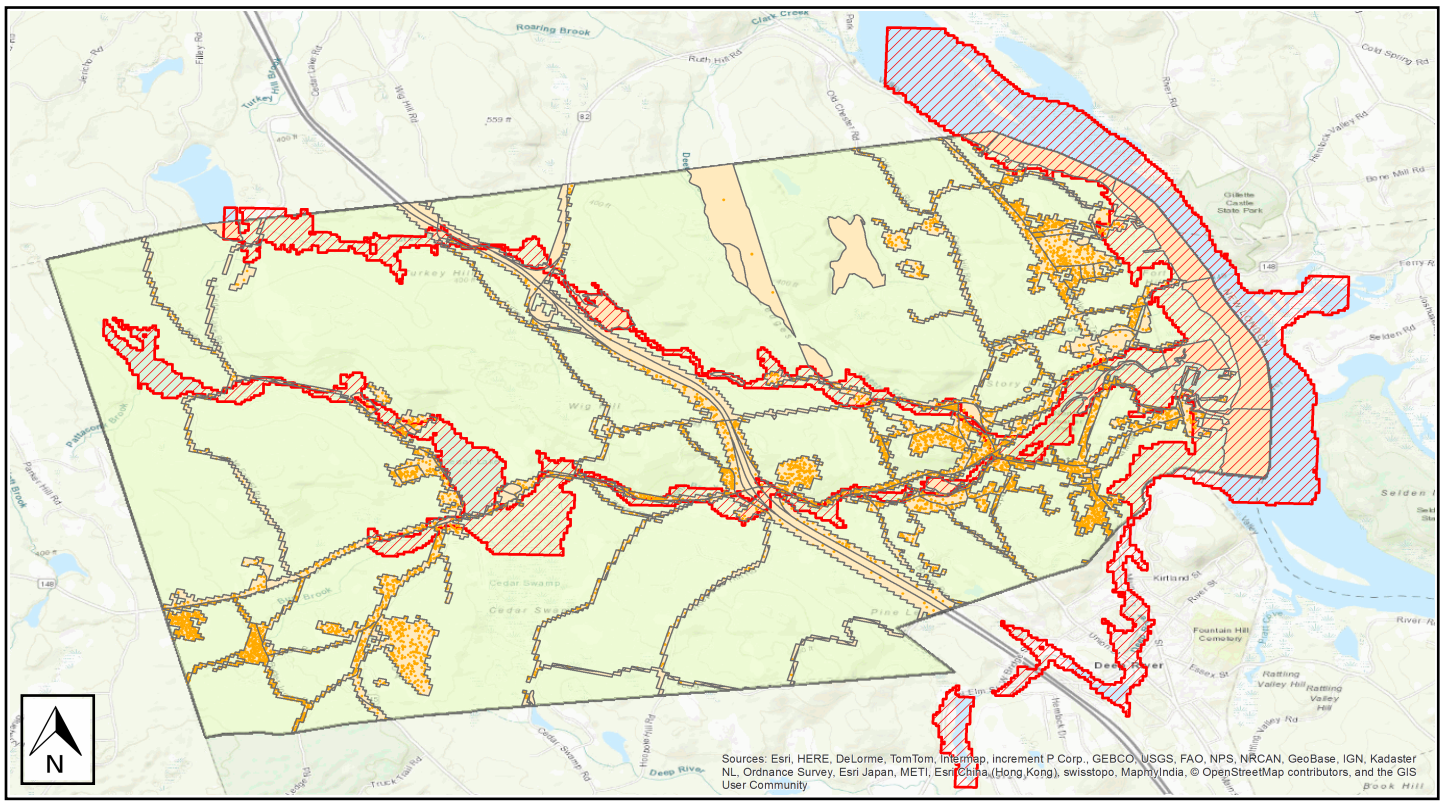
Flood Scenario Parameters

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

Study Region Name:	Chester
Scenario Name:	ChesterAll
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure



Building Damage

General Building Stock Damage

Hazus estimates that about 25 buildings will be at least moderately damaged. This is over 96% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in 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.

Total Economic Loss (1 dot = $300K) Overview Map

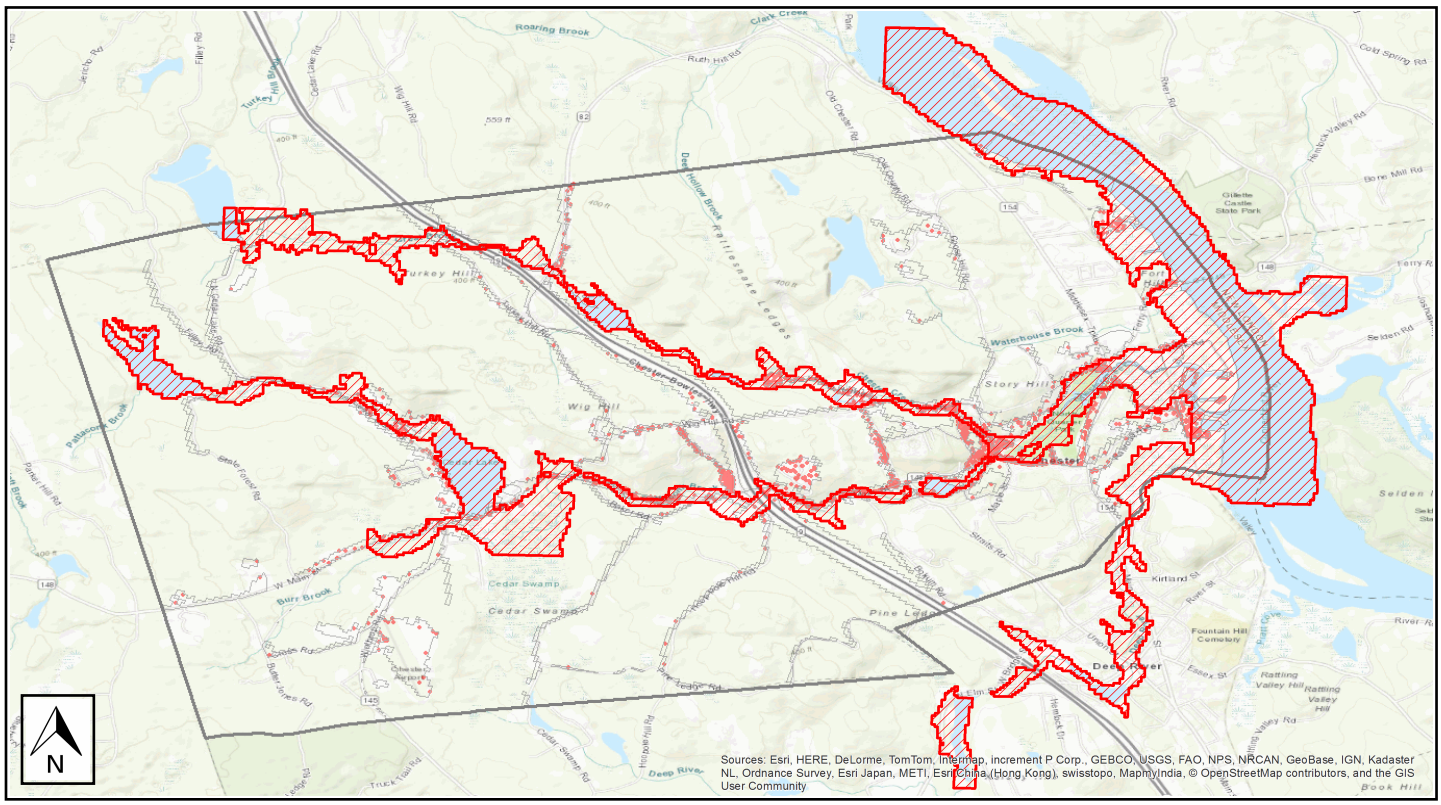


Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		>50	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Commercial	2	67	1	33	0	0	0	0	0	0	0	0
Education	0	0	0	0	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0	0	0	0	0
Religion	0	0	1	100	0	0	0	0	0	0	0	0
Residential	38	62	22	36	1	2	0	0	0	0	0	0
Total	**40**		**24**		**1**		**0**		**0**		**0**	

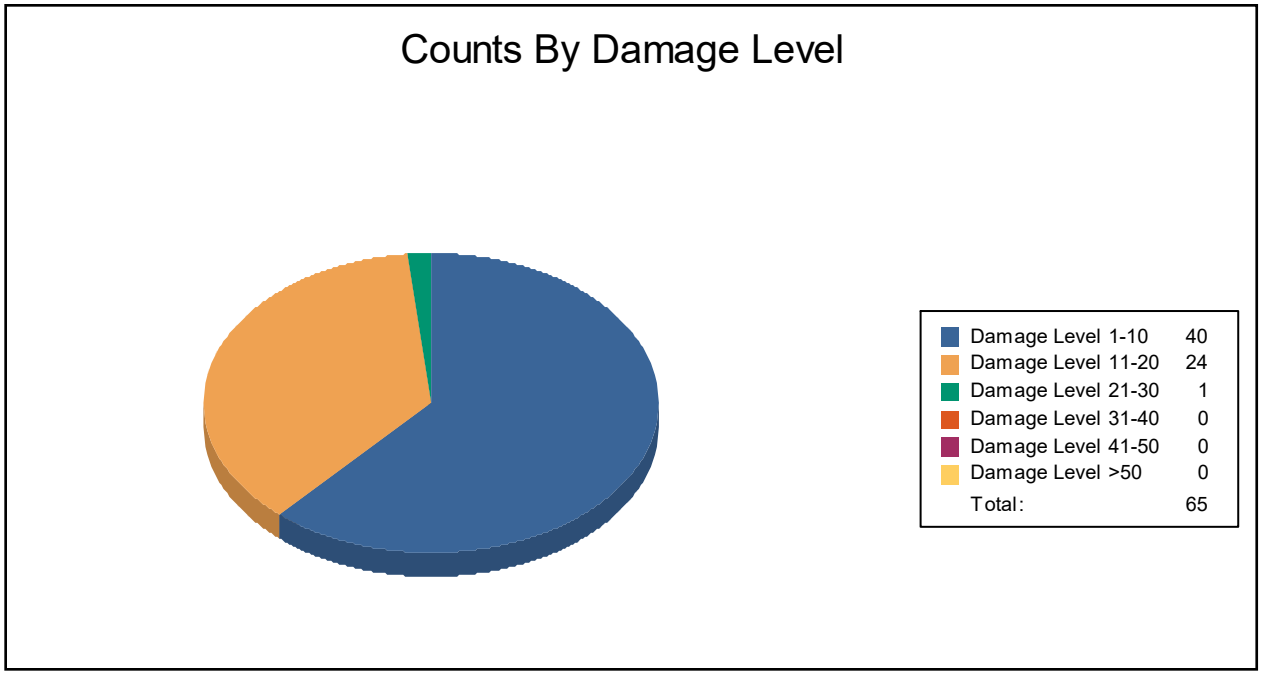


Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		>50	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0	0	0	0	0
Masonry	0	0	1	100	0	0	0	0	0	0	0	0
Steel	0	0	1	100	0	0	0	0	0	0	0	0
Wood	38	61	23	37	1	2	0	0	0	0	0	0

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 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
Emergency Operation Centers	1	0	0	0
Fire Stations	1	0	0	0
Hospitals	0	0	0	0
Police Stations	1	0	0	0
Schools	2	0	0	0

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

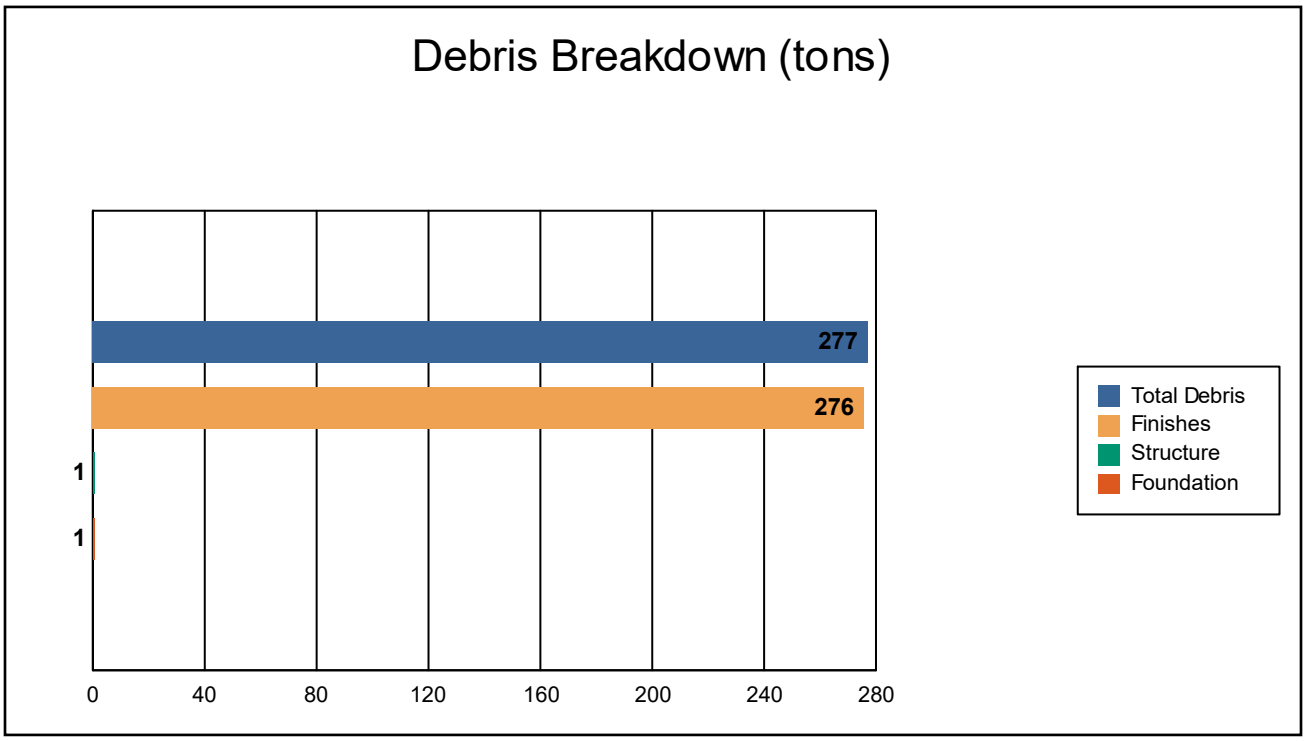
(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(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.

Induced Flood Damage

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.

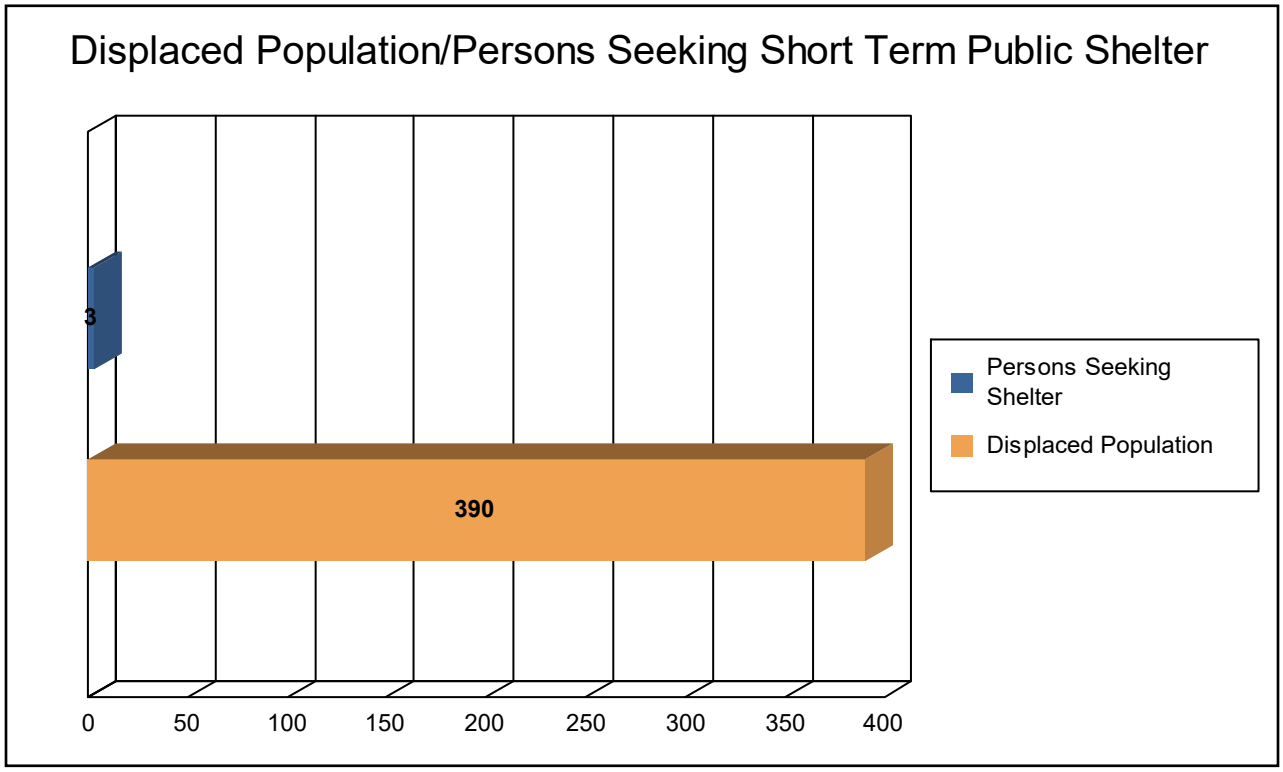


The model estimates that a total of 277 tons of debris will be generated. Of the total amount, Finishes comprises 99% of the total, Structure comprises 0% of the total, and Foundation comprises 0%. If the debris tonnage is converted into an estimated number of truckloads, it will require 12 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

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 130 households (or 390 of people) will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 3 people (out of a total population of 3,994) will seek temporary shelter in public shelters.



Economic Loss

The total economic loss estimated for the flood is 32.35 million dollars, which represents 6.05 % of the total replacement value of the scenario buildings.

Building-Related Losses

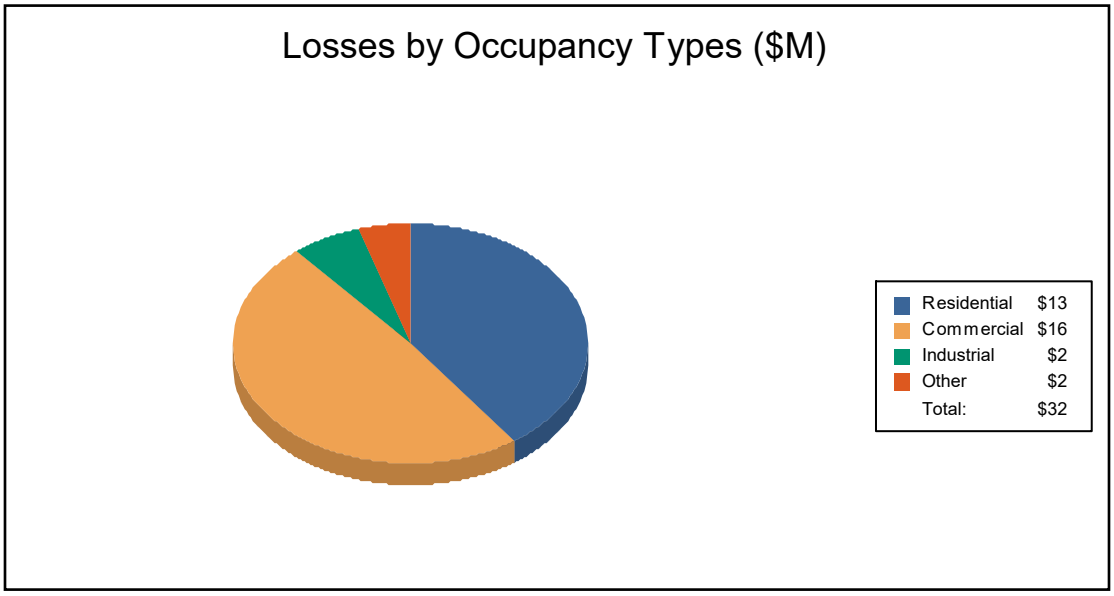
The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability 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 15.84 million dollars. 51% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 39.94% 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	5.37	1.20	0.53	0.08	7.18
	Content	2.95	3.72	1.18	0.61	8.47
	Inventory	0.00	0.03	0.16	0.00	0.19
	Subtotal	**8.33**	**4.95**	**1.87**	**0.69**	**15.84**
Business Interruption						
	Income	0.42	5.05	0.04	0.22	5.73
	Relocation	2.22	1.08	0.07	0.10	3.47
	Rental Income	0.95	0.82	0.01	0.01	1.78
	Wage	1.00	3.93	0.07	0.53	5.53
	Subtotal	**4.59**	**10.88**	**0.19**	**0.86**	**16.51**
ALL	**Total**	**12.92**	**15.83**	**2.05**	**1.55**	**32.35**



Appendix A: County Listing for the Region

Connecticut

- Middlesex

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
Middlesex	3,994	649,896	181,594	831,490
Total	**3,994**	**649,896**	**181,594**	**831,490**
Total Study Region	**3,994**	**649,896**	**181,594**	**831,490**

Hazus: Flood Global Risk Report

Region Name: Chester

Flood Scenario: ChesterAll

Print Date: Tuesday, January 7, 2020

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
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.

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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 (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):

- Connecticut

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

The geographical size of the region is approximately 17 square miles and contains 174 census blocks. The region contains over 2 thousand households and has a total population of 3,994 people (2010 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 1,833 buildings in the region with a total building replacement value (excluding contents) of 831 million dollars. Approximately 89.31% of the buildings (and 78.16% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 1,833 buildings in the region which have an aggregate total replacement value of 831 million 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	649,896	78.2%
Commercial	110,478	13.3%
Industrial	55,516	6.7%
Agricultural	3,118	0.4%
Religion	6,871	0.8%
Government	460	0.1%
Education	5,151	0.6%
Total	**831,490**	**100%**

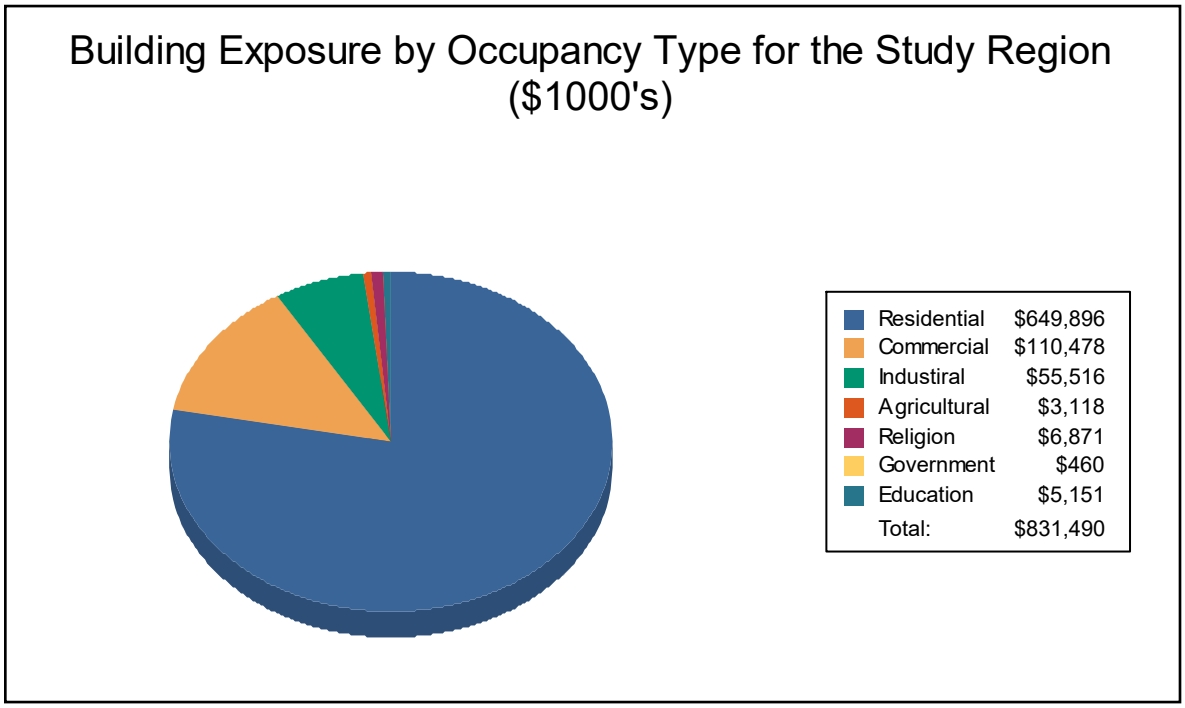
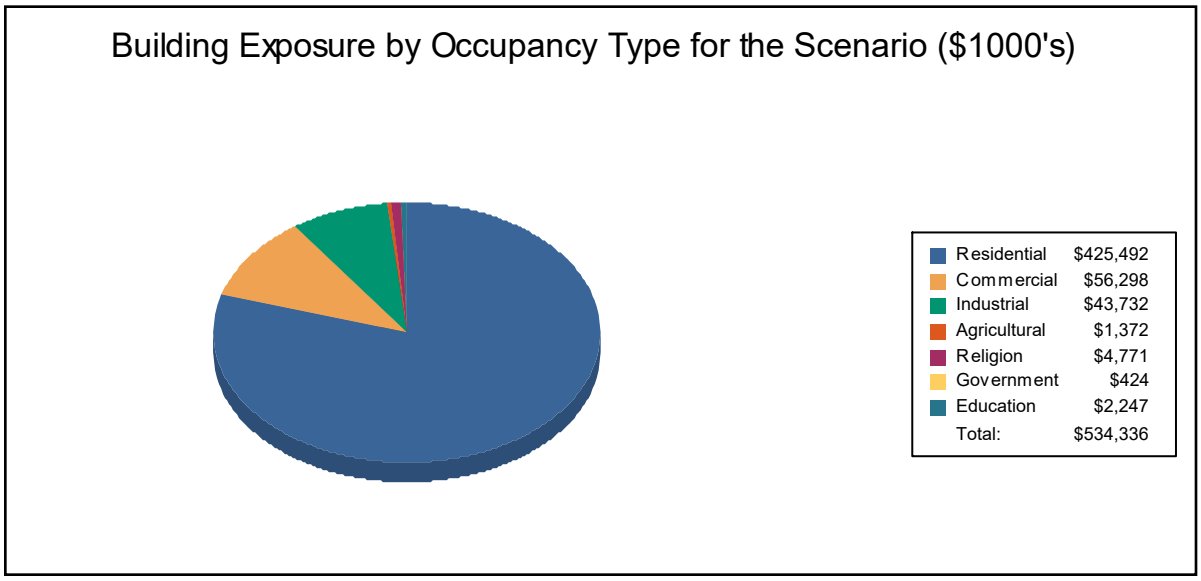


Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	425,492	79.6%
Commercial	56,298	10.5%
Industrial	43,732	8.2%
Agricultural	1,372	0.3%
Religion	4,771	0.9%
Government	424	0.1%
Education	2,247	0.4%
Total	**534,336**	**100%**



Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds.
There are 2 schools, 1 fire station, 1 police station and 1 emergency operation center.

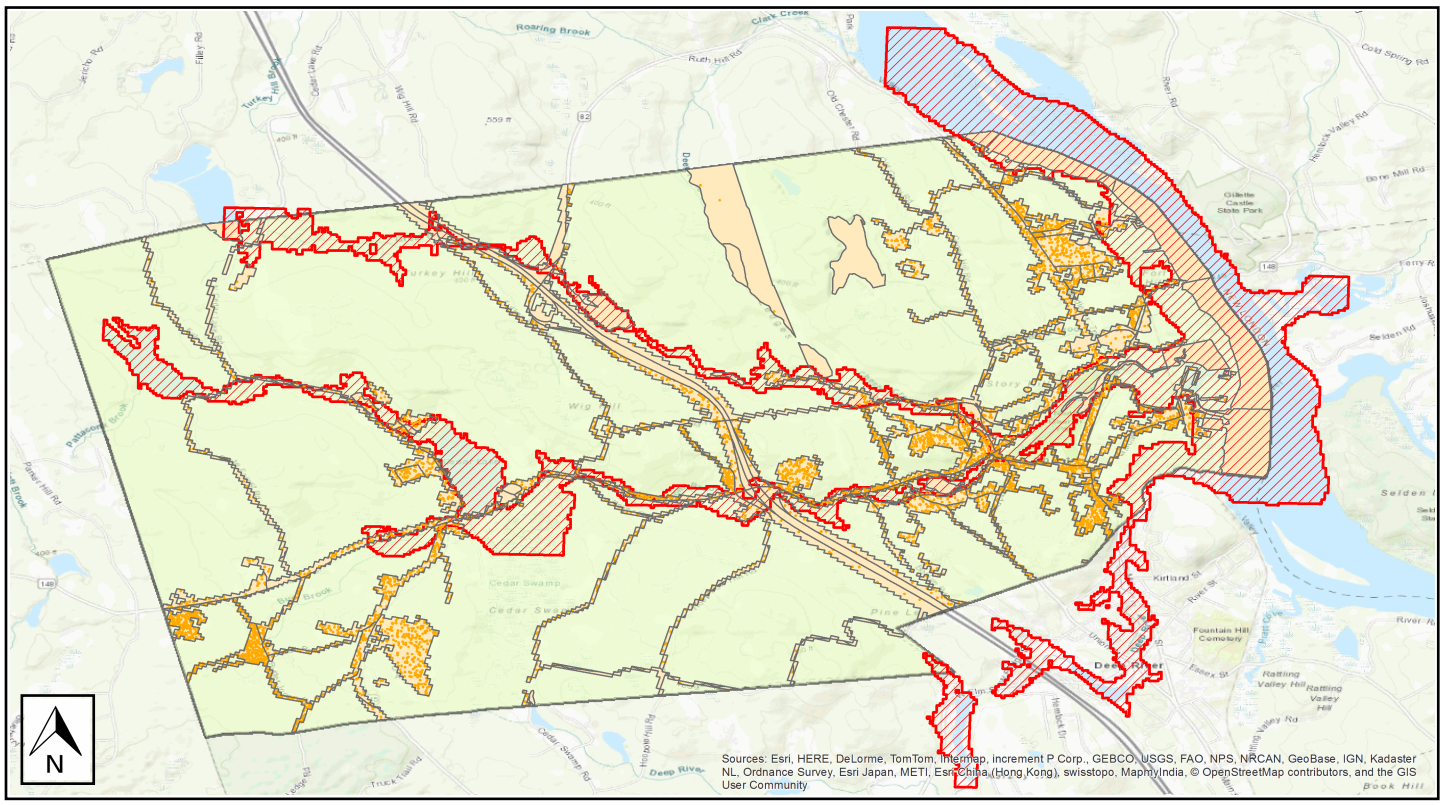
Flood Scenario Parameters

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

Study Region Name:	Chester
Scenario Name:	ChesterAll
Return Period Analyzed:	500
Analysis Options Analyzed:	No What-Ifs

Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure



Building Damage

General Building Stock Damage

Hazus estimates that about 57 buildings will be at least moderately damaged. This is over 97% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in 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.

Total Economic Loss (1 dot = $300K) Overview Map

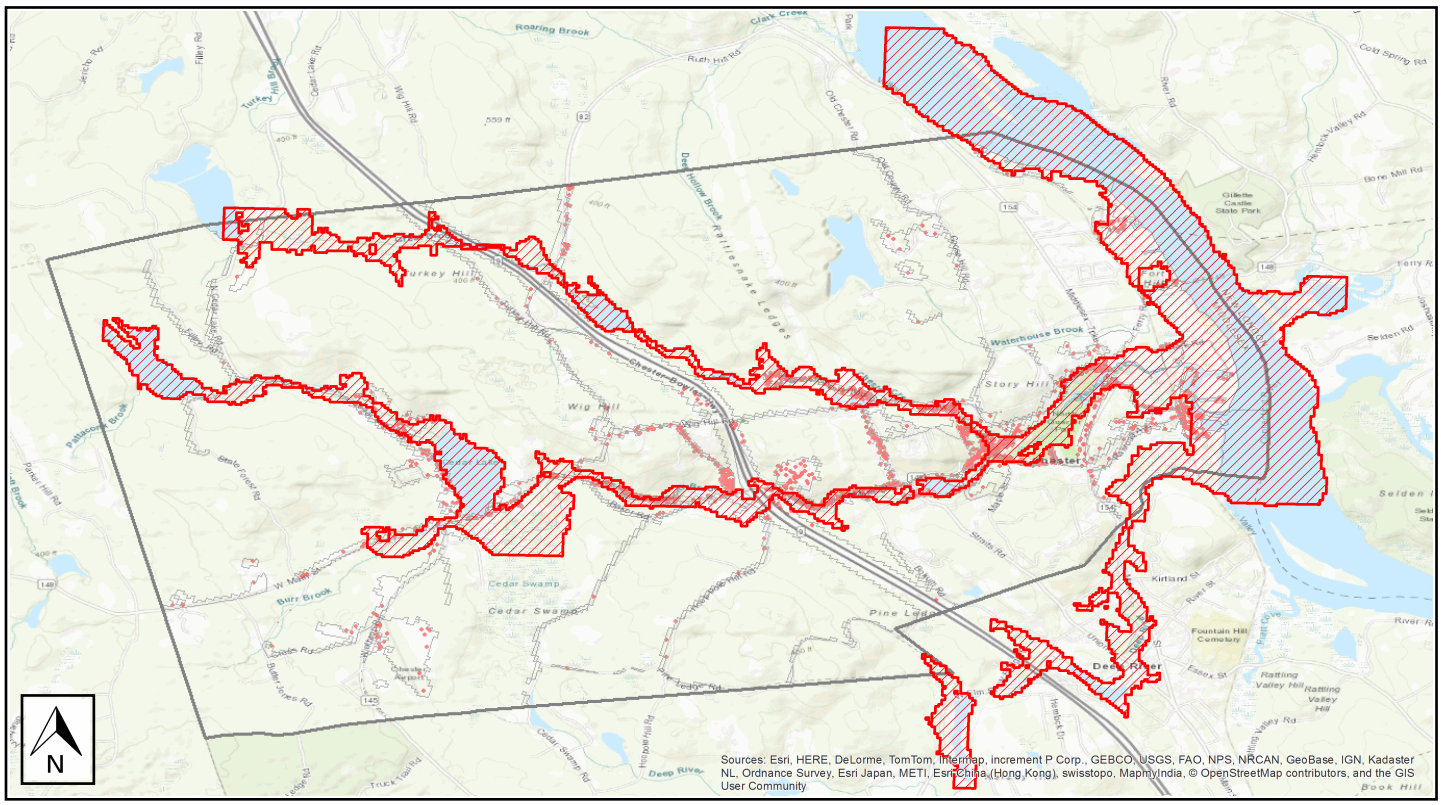


Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		>50	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Commercial	0	0	5	100	0	0	0	0	0	0	0	0
Education	0	0	0	0	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0	0	0	0	0
Religion	0	0	1	100	0	0	0	0	0	0	0	0
Residential	34	40	47	55	4	5	0	0	0	0	0	0
Total	**34**		**53**		**4**		**0**		**0**		**0**	

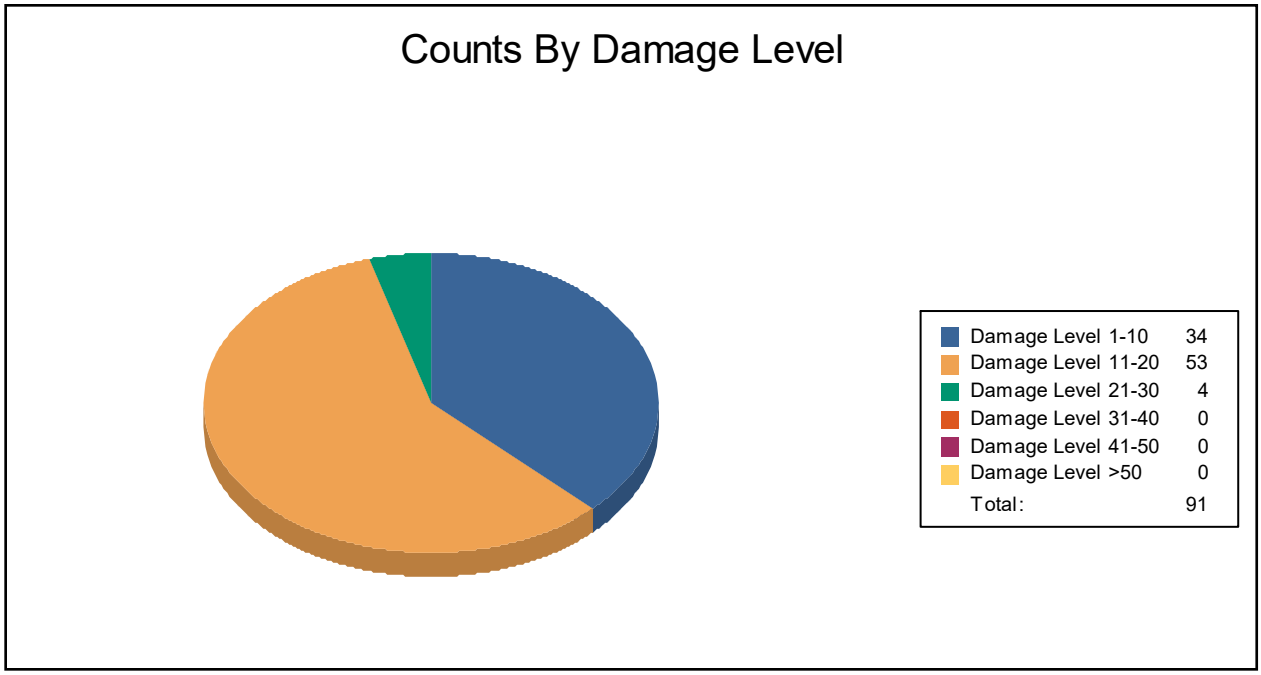


Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		>50	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0	0	0	0	0
Masonry	0	0	2	100	0	0	0	0	0	0	0	0
Steel	0	0	2	100	0	0	0	0	0	0	0	0
Wood	34	40	48	56	4	5	0	0	0	0	0	0

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 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
Emergency Operation Centers	1	0	0	0
Fire Stations	1	0	0	0
Hospitals	0	0	0	0
Police Stations	1	0	0	0
Schools	2	0	0	0

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

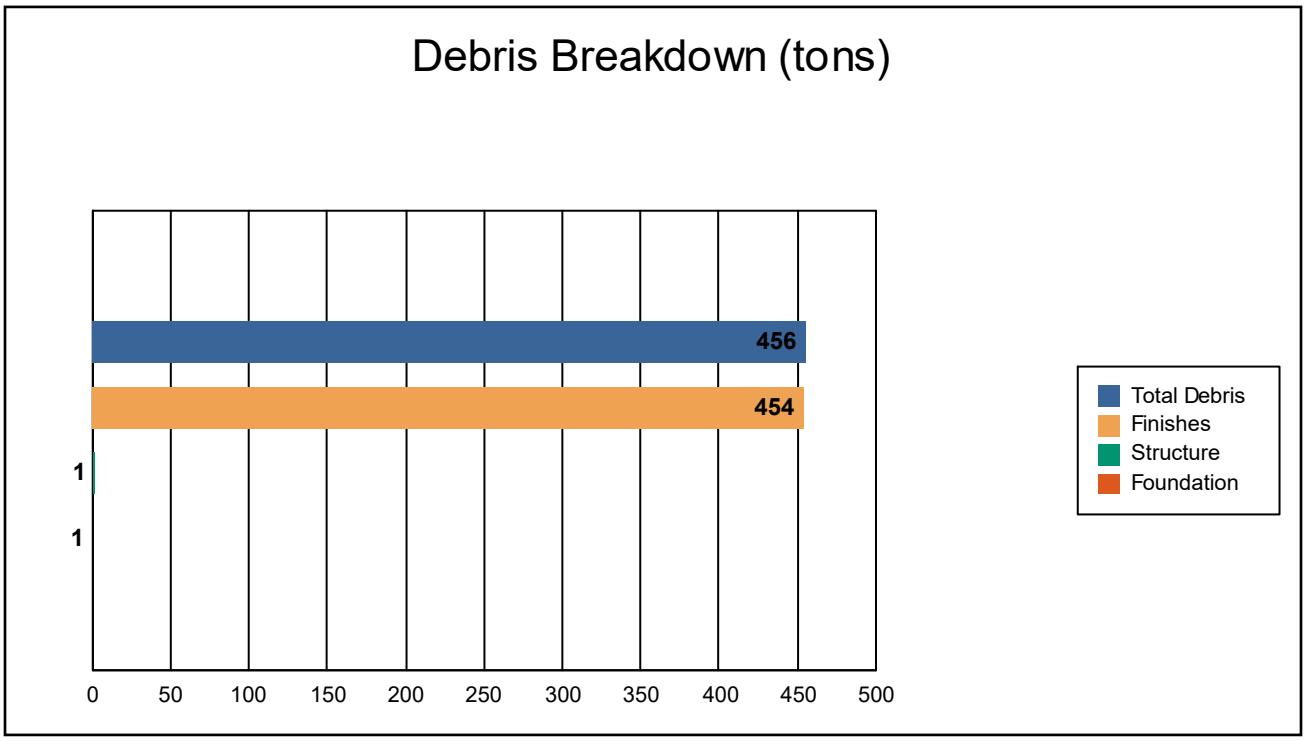
(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(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.

Induced Flood Damage

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.

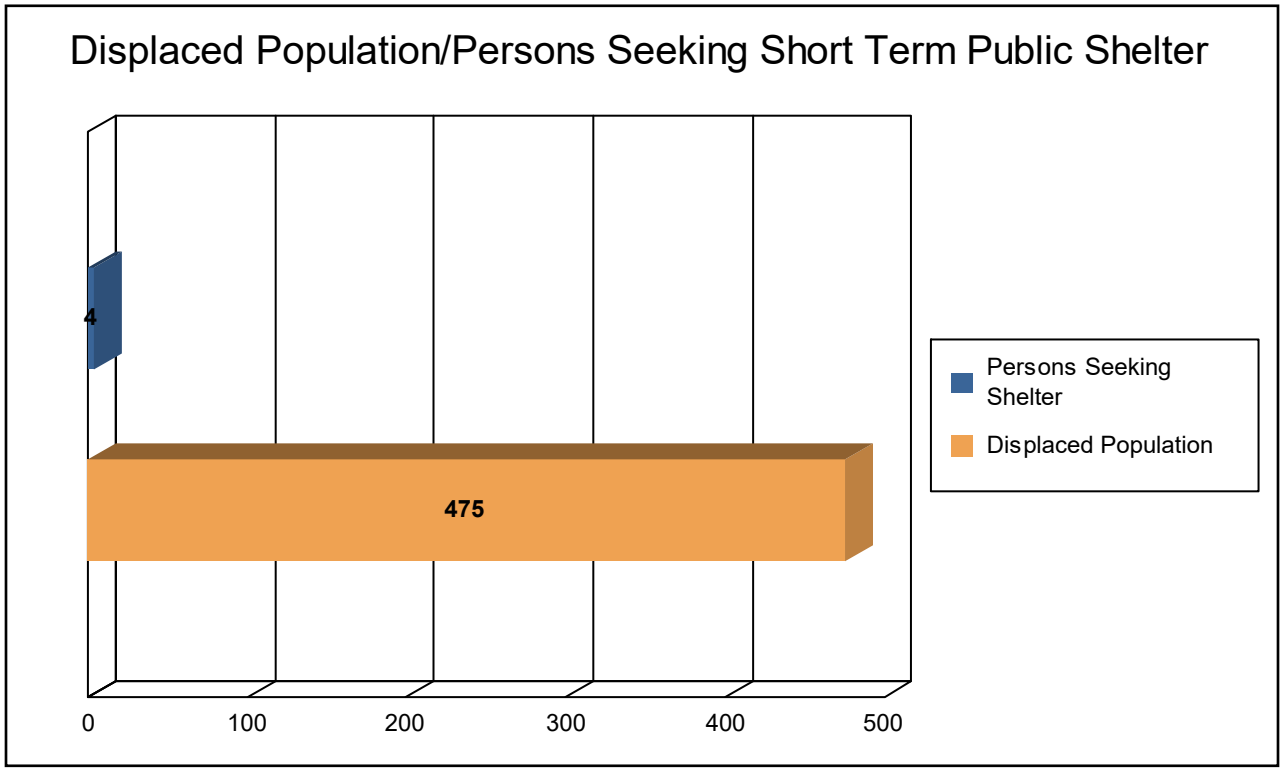


The model estimates that a total of 456 tons of debris will be generated. Of the total amount, Finishes comprises 100% of the total, Structure comprises 0% of the total, and Foundation comprises 0%. If the debris tonnage is converted into an estimated number of truckloads, it will require 19 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

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 158 households (or 475 of people) will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 4 people (out of a total population of 3,994) will seek temporary shelter in public shelters.



Economic Loss

The total economic loss estimated for the flood is 43.38 million dollars, which represents 8.12 % of the total replacement value of the scenario buildings.

Building-Related Losses

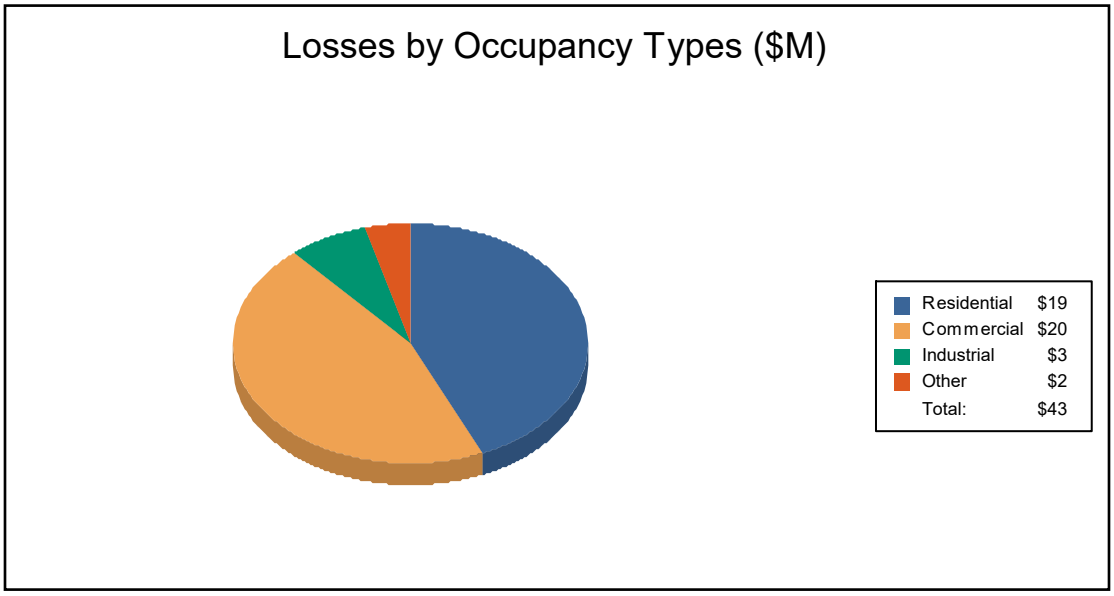
The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability 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 24.05 million dollars. 45% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 43.21% 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	8.33	1.77	0.80	0.10	11.00
	Content	4.59	5.45	1.95	0.76	12.75
	Inventory	0.00	0.05	0.25	0.00	0.30
	Subtotal	**12.92**	**7.27**	**3.00**	**0.86**	**24.05**
Business Interruption						
	Income	0.57	5.79	0.05	0.24	6.64
	Relocation	2.72	1.18	0.09	0.11	4.09
	Rental Income	1.20	0.90	0.01	0.01	2.11
	Wage	1.34	4.51	0.08	0.56	6.49
	Subtotal	**5.83**	**12.37**	**0.23**	**0.91**	**19.33**
ALL	**Total**	**18.75**	**19.64**	**3.23**	**1.77**	**43.38**



Appendix A: County Listing for the Region

Connecticut

- Middlesex

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
Middlesex	3,994	649,896	181,594	831,490
Total	**3,994**	**649,896**	**181,594**	**831,490**
Total Study Region	**3,994**	**649,896**	**181,594**	**831,490**

Hazus: Hurricane Global Risk Report

Region Name: Chester

Hurricane Scenario: Probabilistic 10-year Return Period

Print Date: Tuesday, October 1, 2019

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
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 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 16.83 square miles and contains 1 census tracts. There are over 1 thousand households in the region and a total population of 3,994 people (2010 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 1 thousand buildings in the region with a total building replacement value (excluding contents) of 831 million dollars (2014 dollars). Approximately 89% of the buildings (and 78% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 1,833 buildings in the region which have an aggregate total replacement value of 831 million (2014 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.

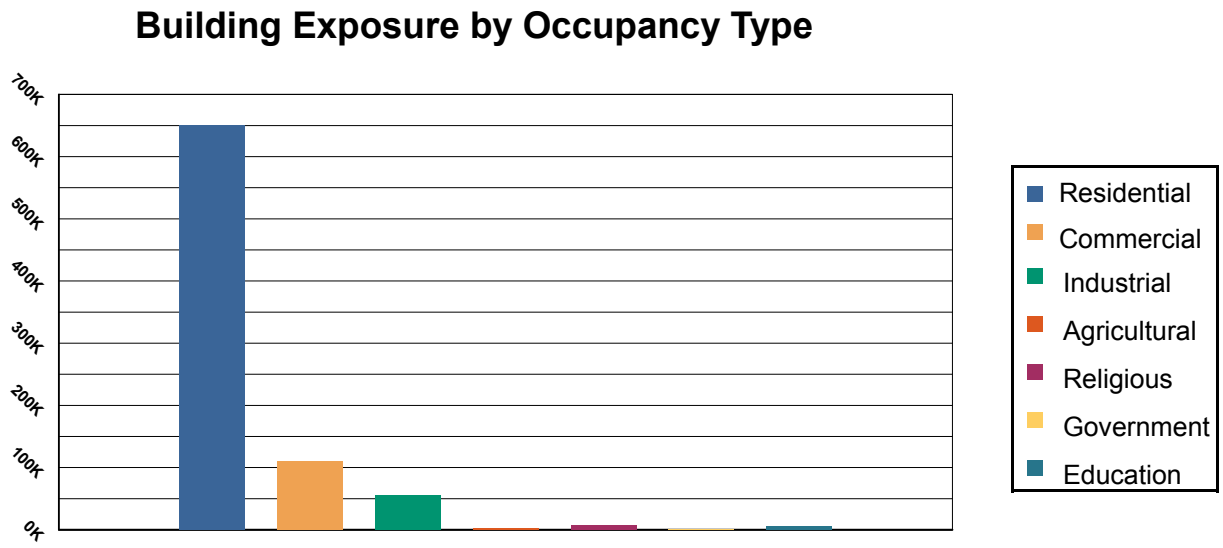


Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Tot
Residential	649,896	78.16 %
Commercial	110,478	13.29%
Industrial	55,516	6.68%
Agricultural	3,118	0.37%
Religious	6,871	0.83%
Government	460	0.06%
Education	5,151	0.62%
Total	**831,490**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 2 schools, 1 fire stations, 1 police stations and 1 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:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in 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.

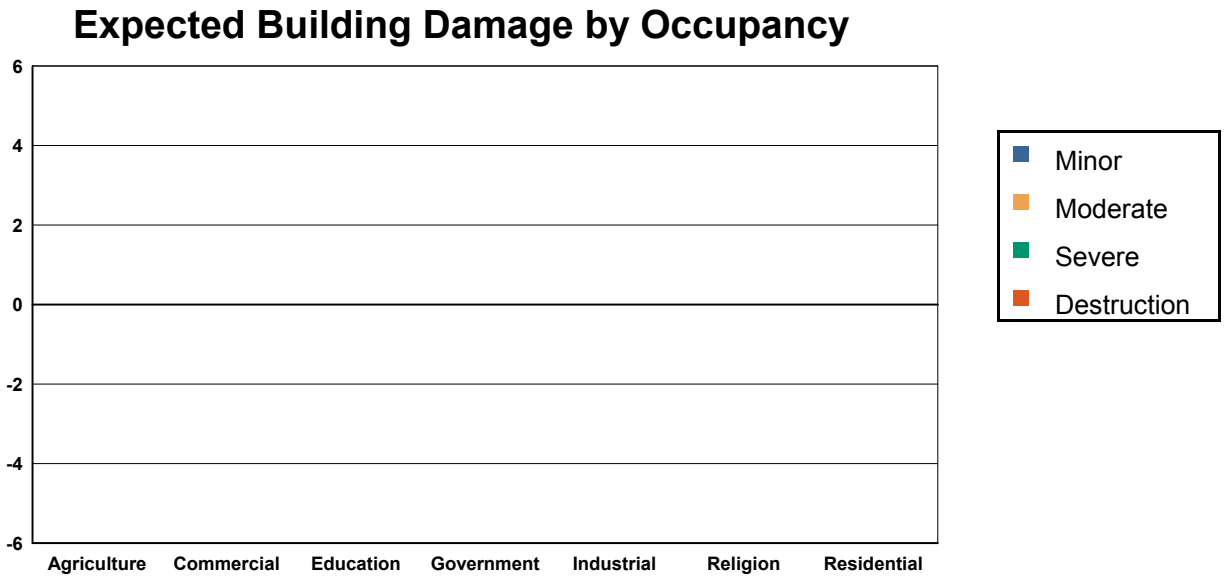


Table 2: Expected Building Damage by Occupancy : 10 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	9.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Commercial	124.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Education	5.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Government	1.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Industrial	49.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Religion	8.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residential	1,637.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**1,833.00**		**0.00**		**0.00**		**0.00**		**0.00**	

Table 3: Expected Building Damage by Building Type : 10 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	9	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	103	100.00	0	0.00	0	0.00	0	0.00	0	0.00
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	83	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	1,547	100.00	0	0.00	0	0.00	0	0.00	0	0.00

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 by patients already in the hospital and those injured by the hurricane. After one week, none of the beds will be in service. By 30 days, none will be operational.

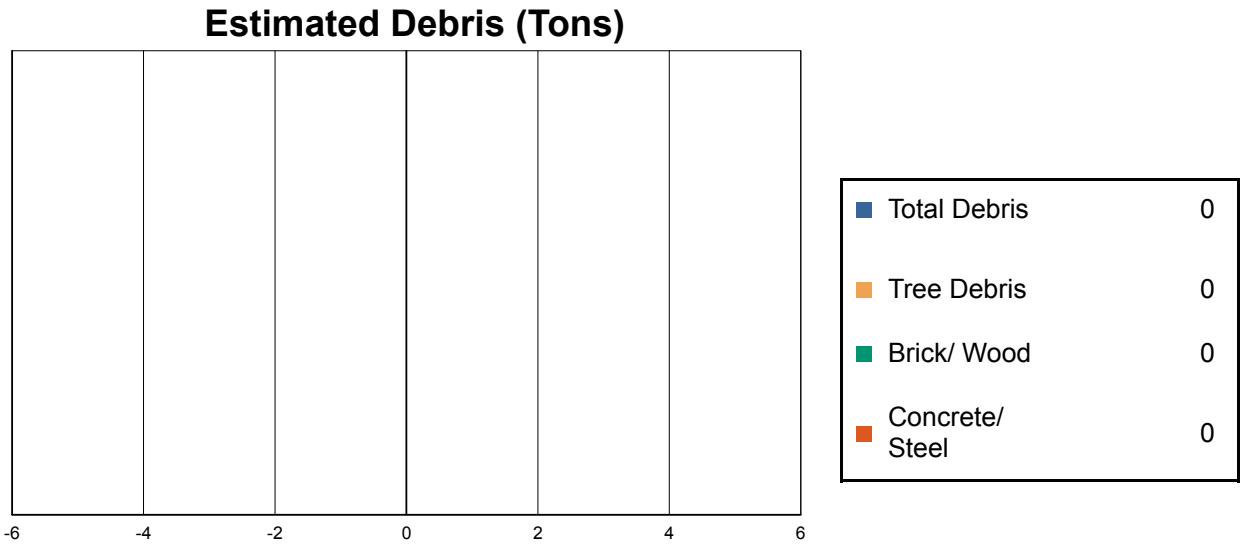
Thematic Map of Essential Facilities with greater than 50% moderate

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**
EOCs	1	0	0	1
Fire Stations	1	0	0	1
Police Stations	1	0	0	1
Schools	2	0	0	2

Induced Hurricane Damage

Debris Generation

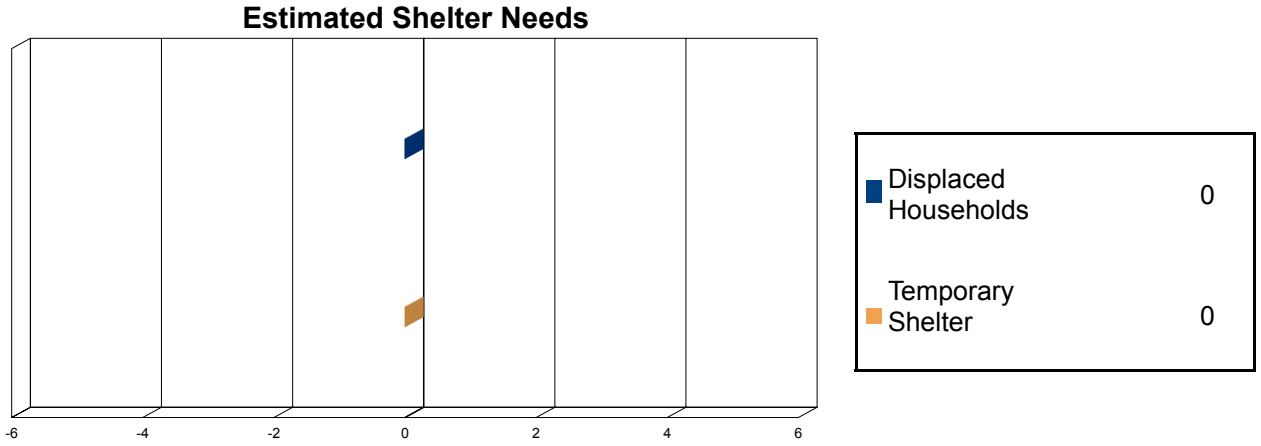


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0 tons of debris will be generated. Of the total amount, 0 tons (0%) is Other Tree Debris. Of the remaining 0 tons, Brick/Wood comprises 0% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 0 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

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 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 3,994) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 0.0 million dollars, which represents 0.00 % 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 0 million dollars. 0% 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 0% of the total loss. Table 5 below provides a summary of the losses associated with the building damage.

Loss by Business Interruption Type (left) and Building Damage Type (right)

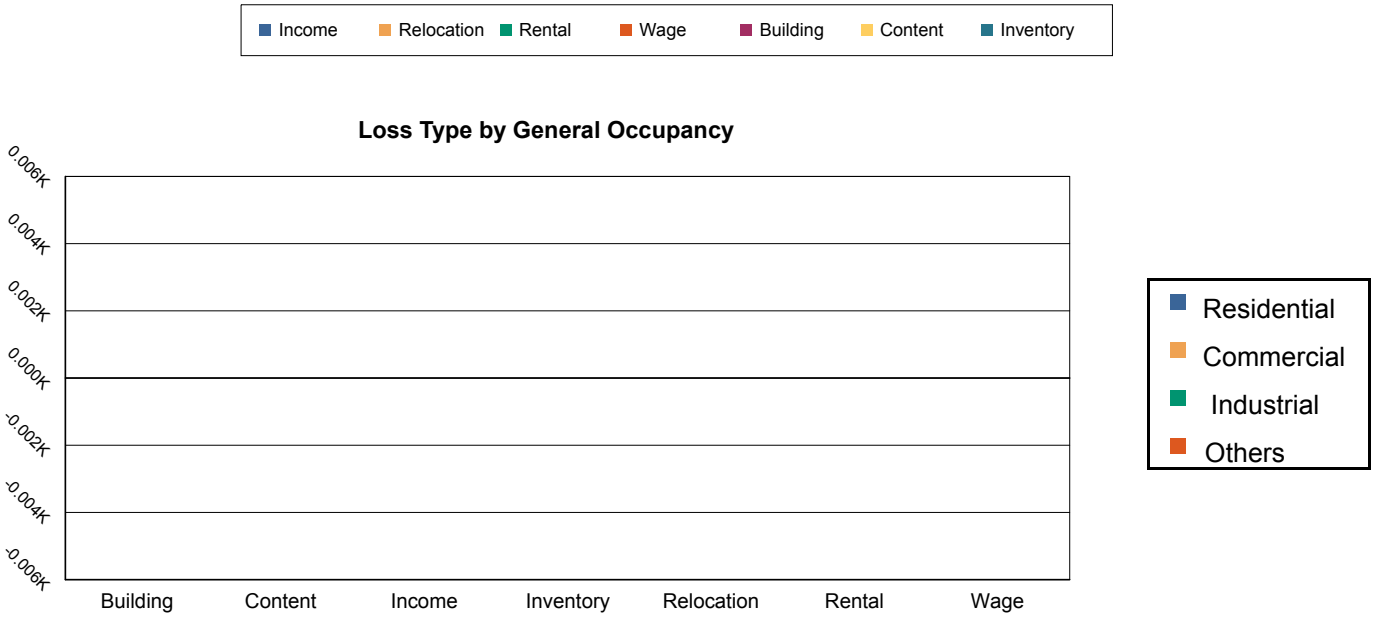


Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Business Interruption Loss						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Total

Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

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	3,994	649,896	181,594	831,490
Total	**3,994**	**649,896**	**181,594**	**831,490**
Study Region Total	**3,994**	**649,896**	**181,594**	**831,490**

Hazus: Hurricane Global Risk Report

Region Name: Chester

Hurricane Scenario: Probabilistic 20-year Return Period

Print Date: Tuesday, October 1, 2019

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

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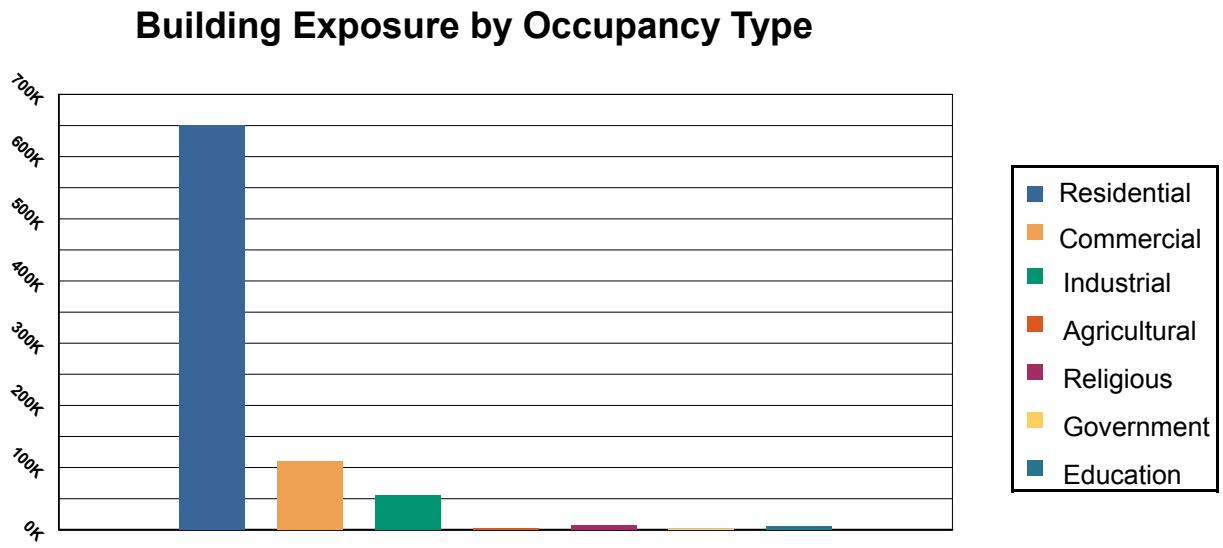

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Religious	6,871	0.83%
Government	460	0.06%
Education	5,151	0.62%
Total	**831,490**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 2 schools, 1 fire stations, 1 police stations and 1 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:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in 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.

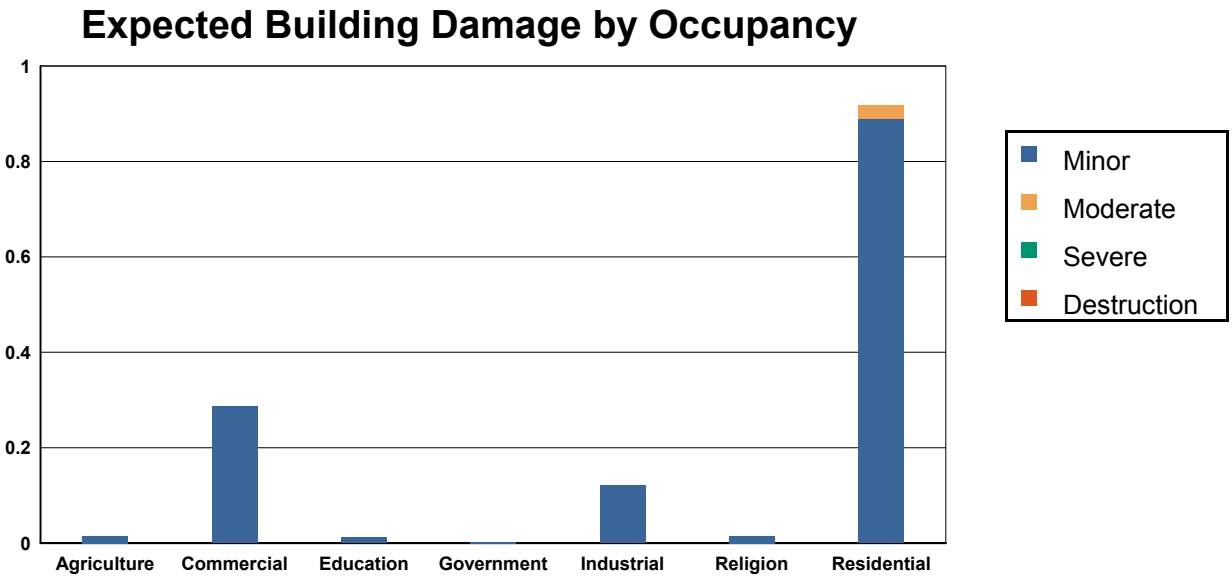


Table 2: Expected Building Damage by Occupancy : 20 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	8.98	99.83	0.02	0.17	0.00	0.00	0.00	0.00	0.00	0.00
Commercial	123.71	99.77	0.29	0.23	0.00	0.00	0.00	0.00	0.00	0.00
Education	4.99	99.77	0.01	0.23	0.00	0.00	0.00	0.00	0.00	0.00
Government	1.00	99.76	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.00
Industrial	48.88	99.75	0.12	0.25	0.00	0.00	0.00	0.00	0.00	0.00
Religion	7.99	99.81	0.02	0.19	0.00	0.00	0.00	0.00	0.00	0.00
Residential	1,636.08	99.94	0.89	0.05	0.03	0.00	0.00	0.00	0.00	0.00
Total	**1,831.63**		**1.34**		**0.03**		**0.00**		**0.00**	

Table 3: Expected Building Damage by Building Type : 20 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	9	99.68	0	0.32	0	0.00	0	0.00	0	0.00
Masonry	103	99.66	0	0.34	0	0.00	0	0.00	0	0.00
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	83	99.74	0	0.26	0	0.00	0	0.00	0	0.00
Wood	1,547	99.99	0	0.01	0	0.00	0	0.00	0	0.00

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 by patients already in the hospital and those injured by the hurricane. After one week, none of the beds will be in service. By 30 days, none will be operational.

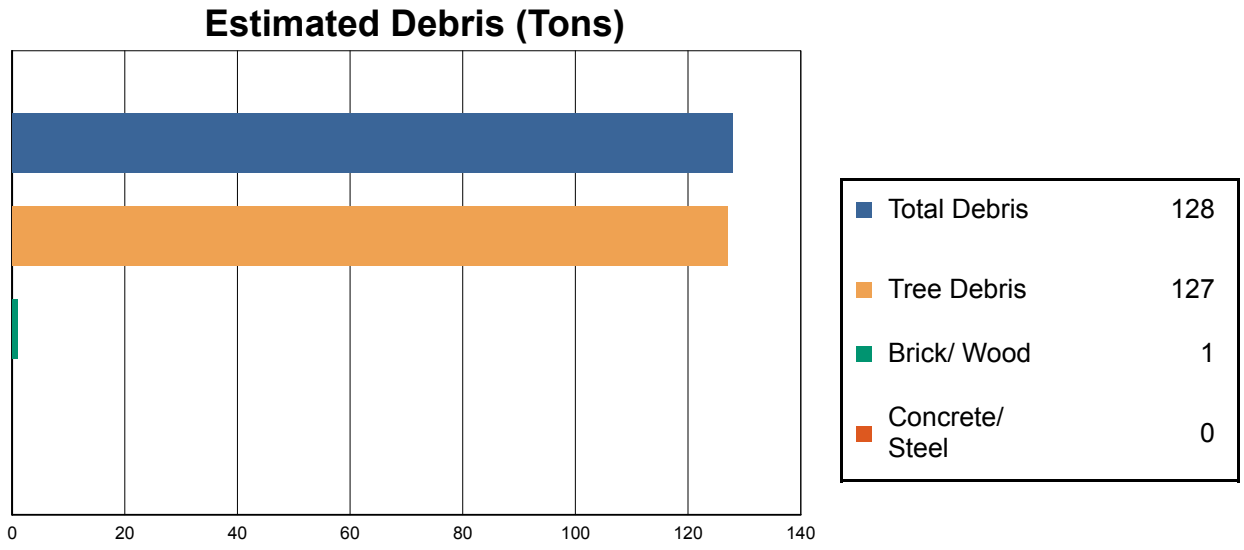
Thematic Map of Essential Facilities with greater than 50% moderate

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**
EOCs	1	0	0	1
Fire Stations	1	0	0	1
Police Stations	1	0	0	1
Schools	2	0	0	2

Induced Hurricane Damage

Debris Generation

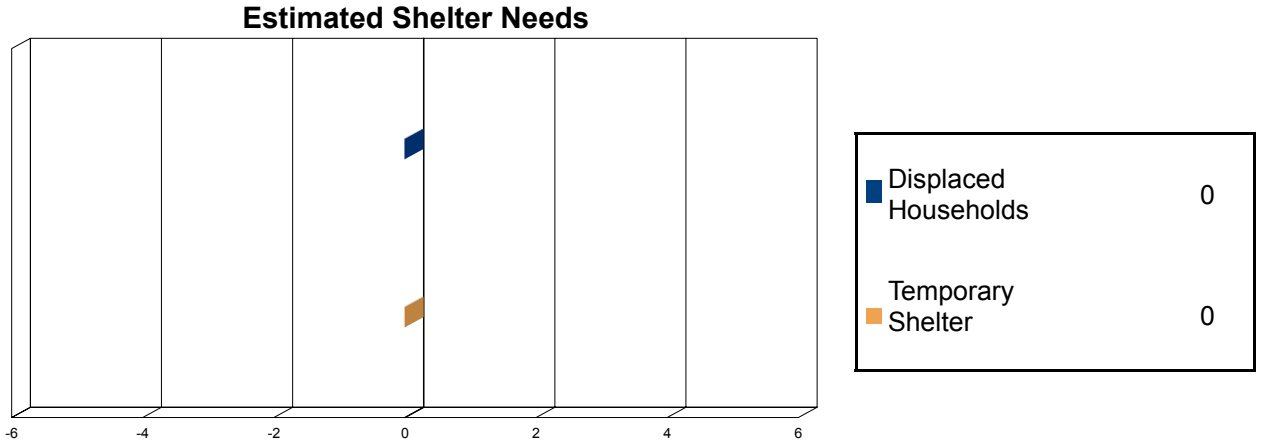


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 128 tons of debris will be generated. Of the total amount, 106 tons (83%) is Other Tree Debris. Of the remaining 22 tons, Brick/Wood comprises 4% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 21 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

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 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 3,994) will seek temporary shelter in public shelters.

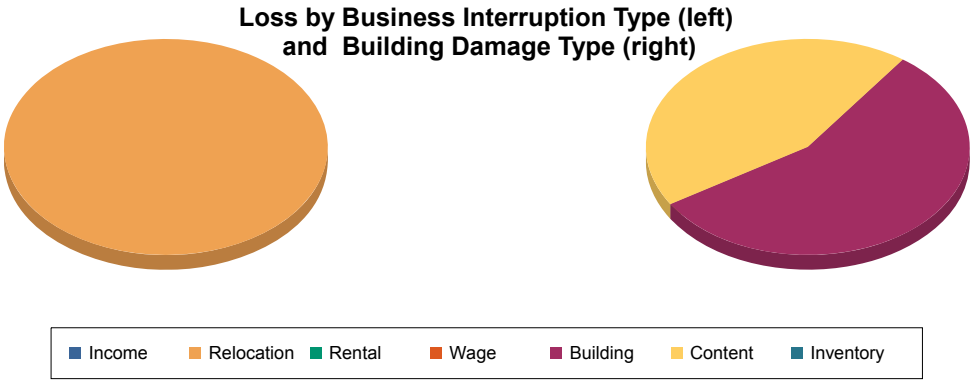
Economic Loss

The total economic loss estimated for the hurricane is 0.1 million dollars, which represents 0.01 % 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 0 million dollars. 0% 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 100% of the total loss. Table 5 below provides a summary of the losses associated with the building damage.



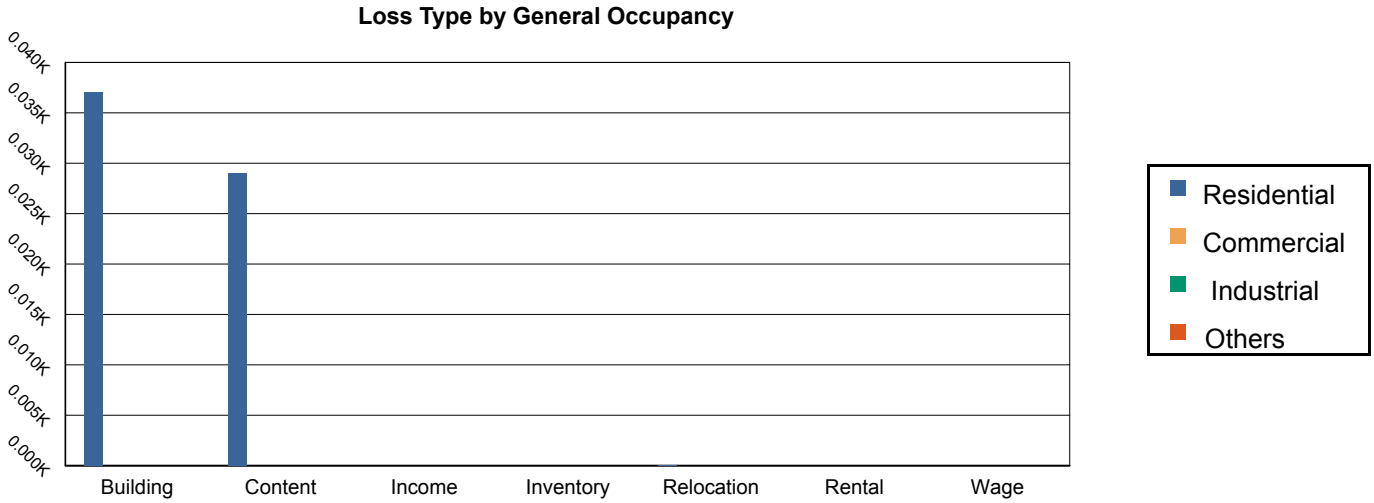


Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	37.01	0.00	0.00	0.00	37.01
	Content	28.99	0.00	0.00	0.00	28.99
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	**66.00**	**0.00**	**0.00**	**0.00**	**66.00**
Business Interruption Loss						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.05	0.00	0.00	0.00	0.05
	Rental	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.05**	**0.00**	**0.00**	**0.00**	**0.05**

Total

Total	**66.05**	**0.00**	**0.00**	**0.00**	**66.05**

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	3,994	649,896	181,594	831,490
Total	**3,994**	**649,896**	**181,594**	**831,490**
Study Region Total	**3,994**	**649,896**	**181,594**	**831,490**

Hazus: Hurricane Global Risk Report

Region Name: Chester

Hurricane Scenario: Probabilistic 50-year Return Period

Print Date: Tuesday, October 1, 2019

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
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 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 16.83 square miles and contains 1 census tracts. There are over 1 thousand households in the region and a total population of 3,994 people (2010 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 1 thousand buildings in the region with a total building replacement value (excluding contents) of 831 million dollars (2014 dollars). Approximately 89% of the buildings (and 78% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 1,833 buildings in the region which have an aggregate total replacement value of 831 million (2014 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.

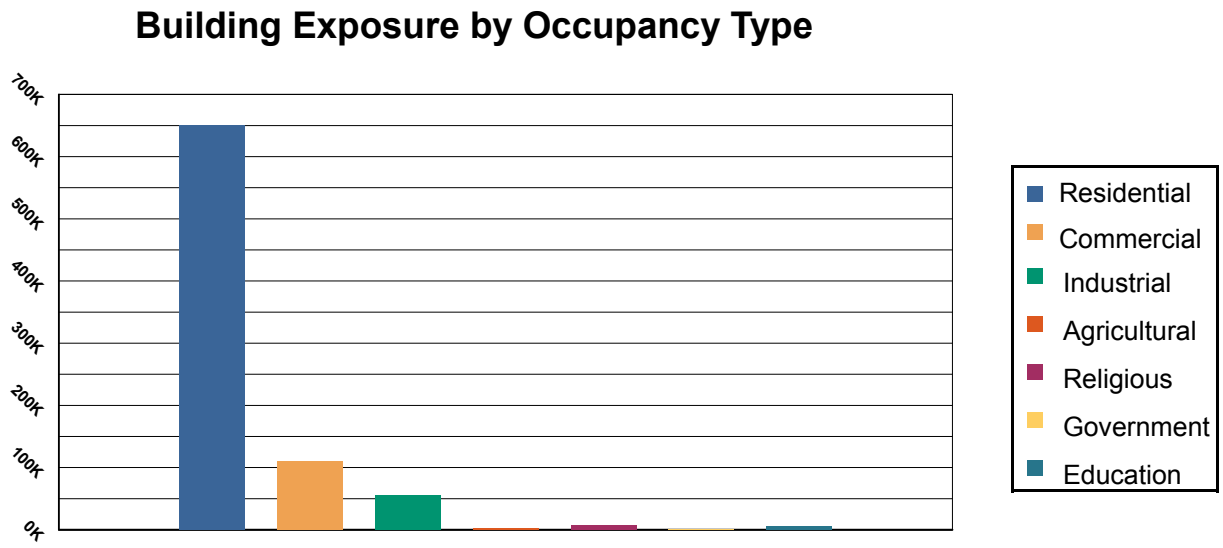


Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Tot
Residential	649,896	78.16 %
Commercial	110,478	13.29%
Industrial	55,516	6.68%
Agricultural	3,118	0.37%
Religious	6,871	0.83%
Government	460	0.06%
Education	5,151	0.62%
Total	**831,490**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 2 schools, 1 fire stations, 1 police stations and 1 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:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 1 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in 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.

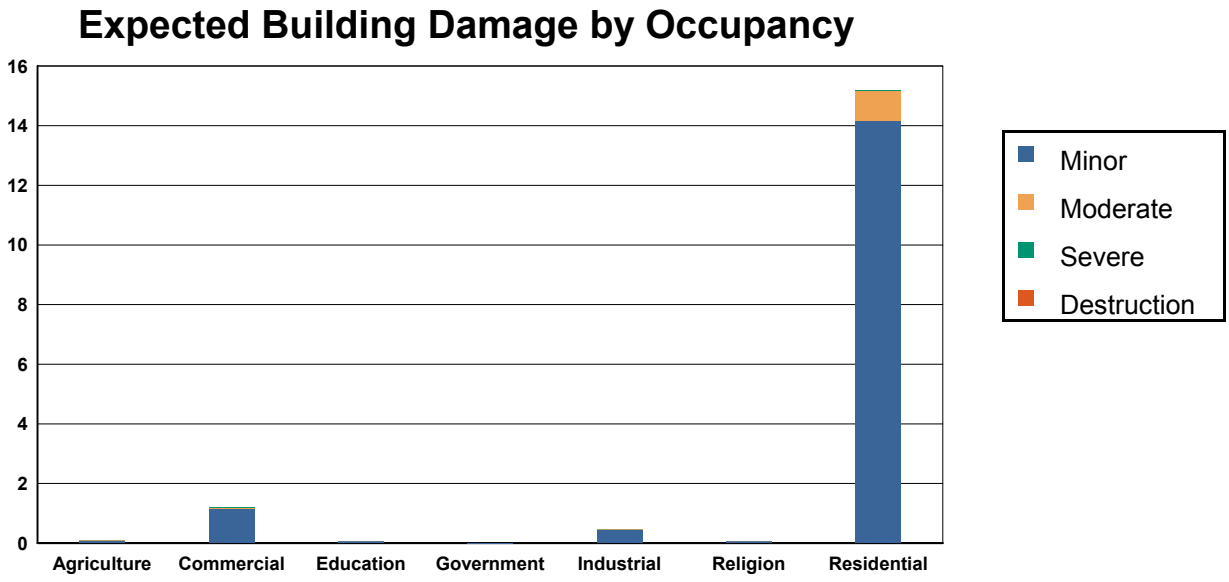


Table 2: Expected Building Damage by Occupancy : 50 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	8.92	99.07	0.08	0.86	0.01	0.06	0.00	0.01	0.00	0.00
Commercial	122.79	99.02	1.15	0.93	0.06	0.05	0.00	0.00	0.00	0.00
Education	4.96	99.13	0.04	0.86	0.00	0.01	0.00	0.00	0.00	0.00
Government	0.99	99.14	0.01	0.85	0.00	0.01	0.00	0.00	0.00	0.00
Industrial	48.53	99.04	0.46	0.93	0.01	0.02	0.00	0.00	0.00	0.00
Religion	7.94	99.24	0.06	0.74	0.00	0.02	0.00	0.00	0.00	0.00
Residential	1,621.81	99.07	14.16	0.87	1.01	0.06	0.02	0.00	0.00	0.00
Total	**1,815.93**		**15.96**		**1.08**		**0.03**		**0.00**	

Table 3: Expected Building Damage by Building Type : 50 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	9	98.75	0	1.24	0	0.01	0	0.00	0	0.00
Masonry	101	97.96	2	1.77	0	0.27	0	0.01	0	0.00
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	82	99.01	1	0.97	0	0.02	0	0.00	0	0.00
Wood	1,537	99.33	10	0.65	0	0.02	0	0.00	0	0.00

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 by patients already in the hospital and those injured by the hurricane. After one week, none of the beds will be in service. By 30 days, none will be operational.

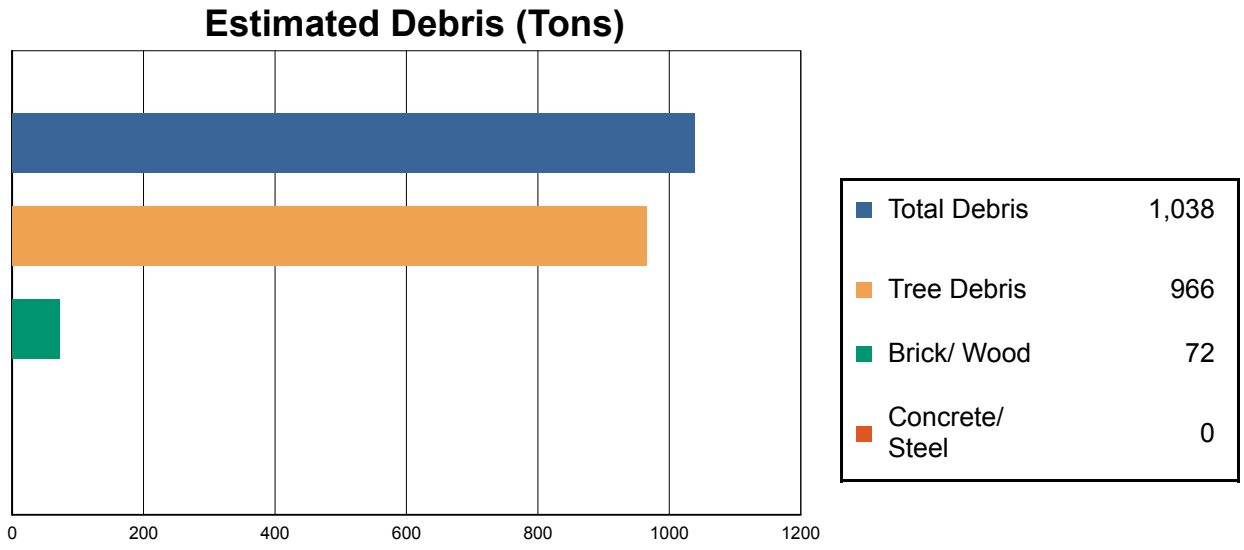
Thematic Map of Essential Facilities with greater than 50% moderate

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**
EOCs	1	0	0	1
Fire Stations	1	0	0	1
Police Stations	1	0	0	1
Schools	2	0	0	2

Induced Hurricane Damage

Debris Generation

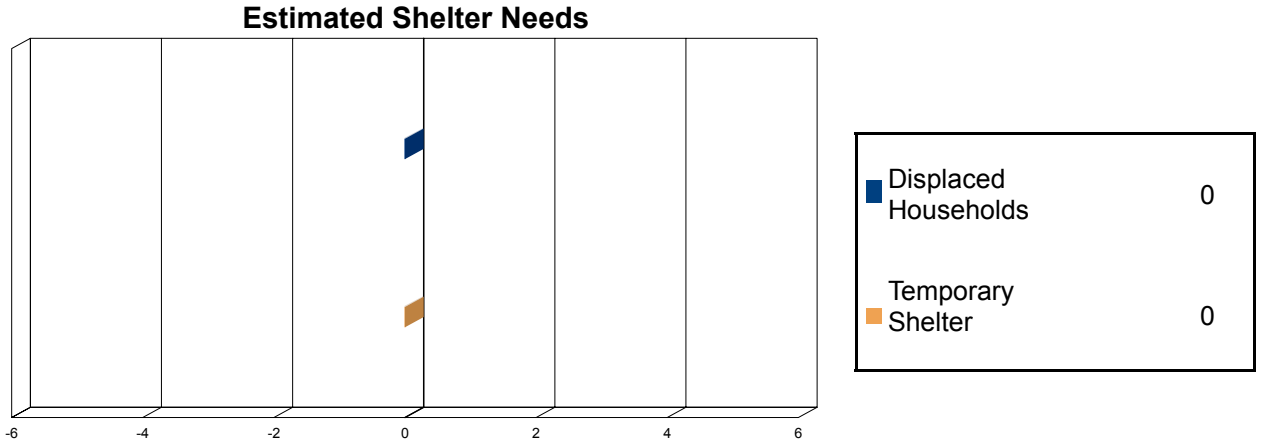


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 1,038 tons of debris will be generated. Of the total amount, 803 tons (77%) is Other Tree Debris. Of the remaining 235 tons, Brick/Wood comprises 31% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 3 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 163 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

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 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 3,994) will seek temporary shelter in public shelters.

Economic Loss

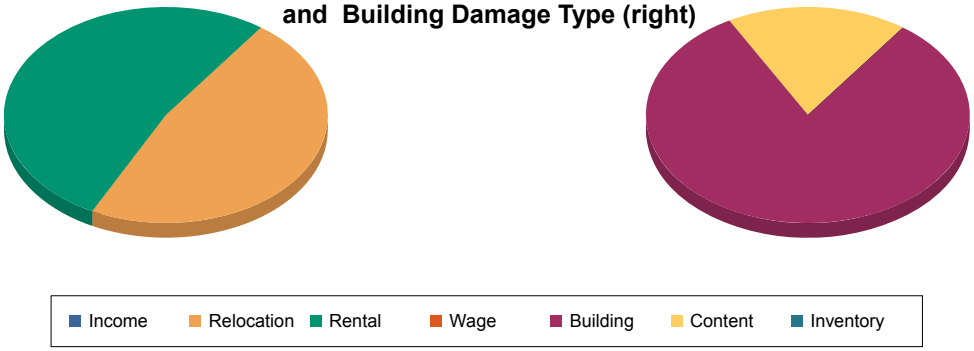
The total economic loss estimated for the hurricane is 1.6 million dollars, which represents 0.19 % of the total replacement value of the region's buildings.

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 2 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 96% of the total loss. Table 5 below provides a summary of the losses associated with the building damage.

Loss by Business Interruption Type (left) and Building Damage Type (right)



Loss Type by General Occupancy

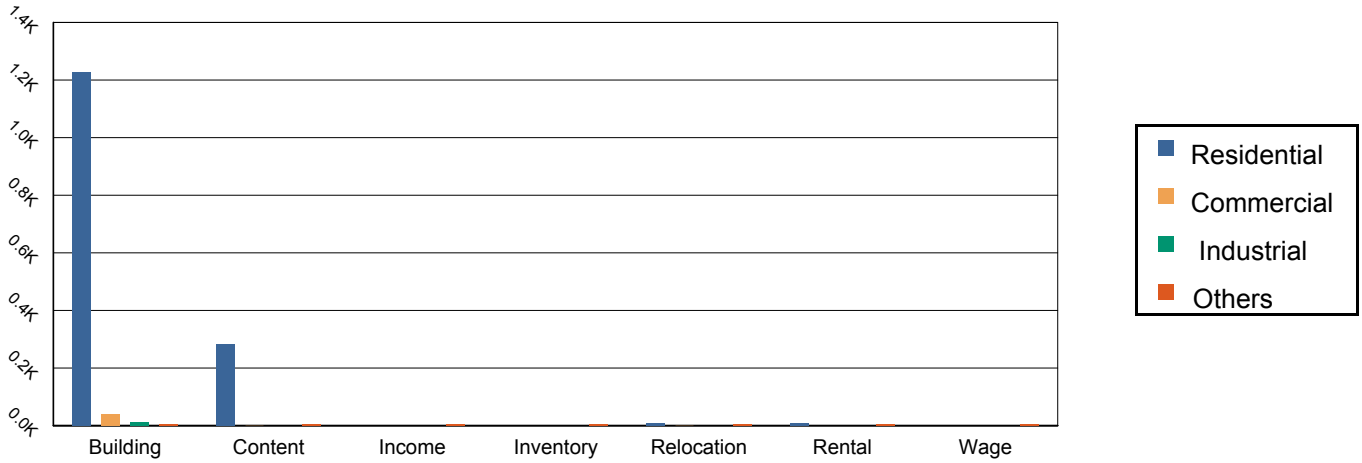


Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	1,228.57	39.25	14.10	4.35	1,286.26
	Content	282.59	0.41	0.00	0.00	283.00
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	**1,511.16**	**39.66**	**14.10**	**4.35**	**1,569.27**
Business Interruption Loss						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	7.63	0.36	0.04	0.02	8.06
	Rental	8.94	0.00	0.00	0.00	8.94
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**16.57**	**0.36**	**0.04**	**0.02**	**17.00**

Total

Total	**1,527.73**	**40.02**	**14.14**	**4.37**	**1,586.27**

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	3,994	649,896	181,594	831,490
Total	**3,994**	**649,896**	**181,594**	**831,490**
Study Region Total	**3,994**	**649,896**	**181,594**	**831,490**

Hazus: Hurricane Global Risk Report

Region Name: Chester

Hurricane Scenario: Probabilistic 100-year Return Period

Print Date: Tuesday, October 1, 2019

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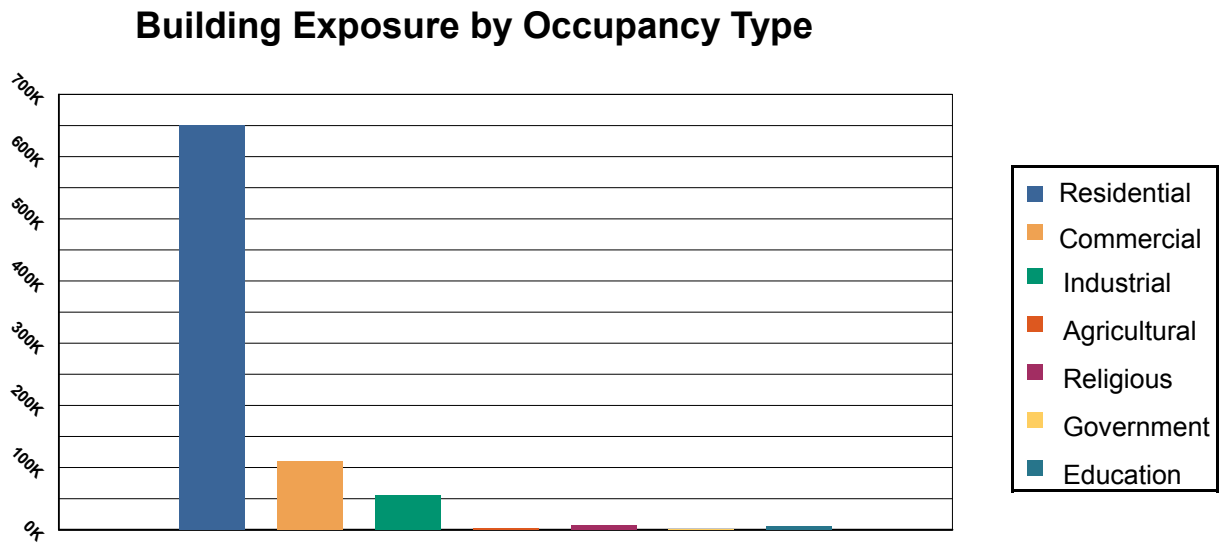

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Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 2 schools, 1 fire stations, 1 police stations and 1 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:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 7 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in 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.

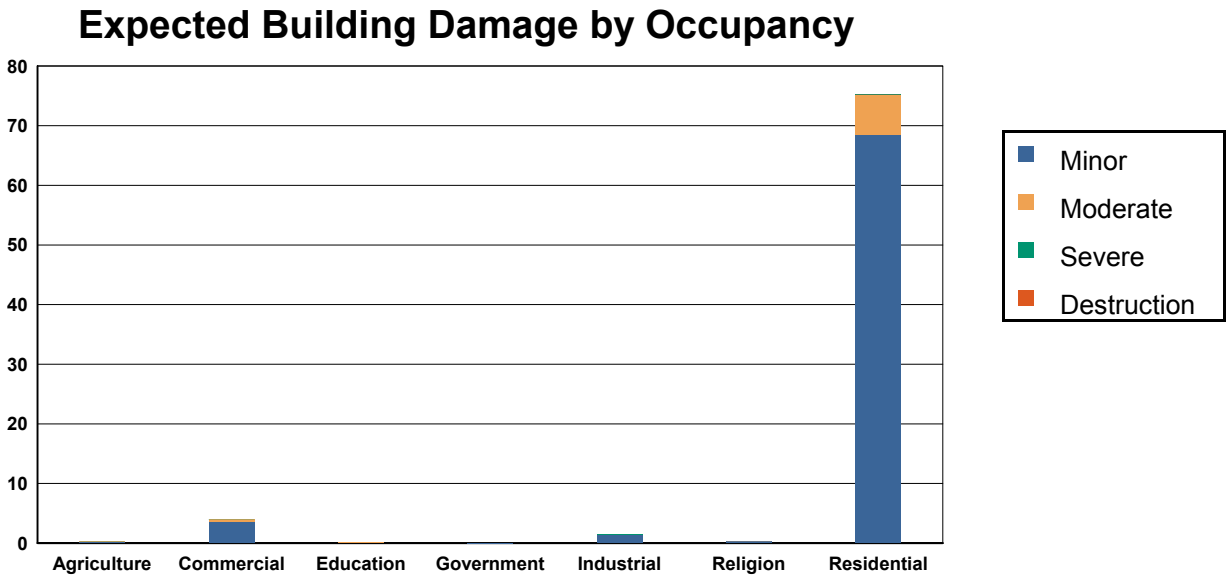


Table 2: Expected Building Damage by Occupancy : 100 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	8.64	95.97	0.30	3.36	0.04	0.48	0.02	0.19	0.00	0.00
Commercial	120.02	96.79	3.61	2.91	0.36	0.29	0.02	0.02	0.00	0.00
Education	4.87	97.42	0.13	2.51	0.00	0.07	0.00	0.00	0.00	0.00
Government	0.98	97.63	0.02	2.32	0.00	0.05	0.00	0.00	0.00	0.00
Industrial	47.54	97.03	1.32	2.70	0.10	0.21	0.03	0.06	0.00	0.00
Religion	7.78	97.27	0.21	2.64	0.01	0.09	0.00	0.01	0.00	0.00
Residential	1,561.72	95.40	68.48	4.18	6.72	0.41	0.08	0.00	0.00	0.00
Total	**1,751.55**		**74.07**		**7.24**		**0.15**		**0.00**	

Table 3: Expected Building Damage by Building Type : 100 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	9	96.47	0	3.38	0	0.15	0	0.00	0	0.00
Masonry	96	93.66	5	4.78	2	1.50	0	0.06	0	0.00
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	81	97.15	2	2.67	0	0.17	0	0.01	0	0.00
Wood	1,485	95.98	60	3.86	2	0.16	0	0.00	0	0.00

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 by patients already in the hospital and those injured by the hurricane. After one week, none of the beds will be in service. By 30 days, none will be operational.

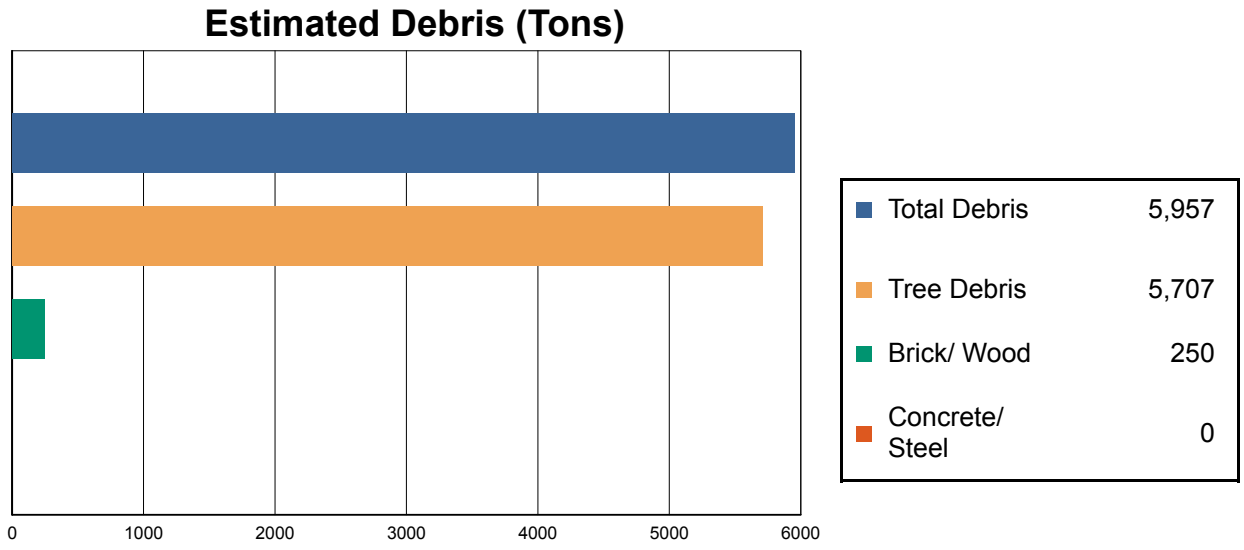
Thematic Map of Essential Facilities with greater than 50% moderate

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**
EOCs	1	0	0	1
Fire Stations	1	0	0	1
Police Stations	1	0	0	1
Schools	2	0	0	2

Induced Hurricane Damage

Debris Generation

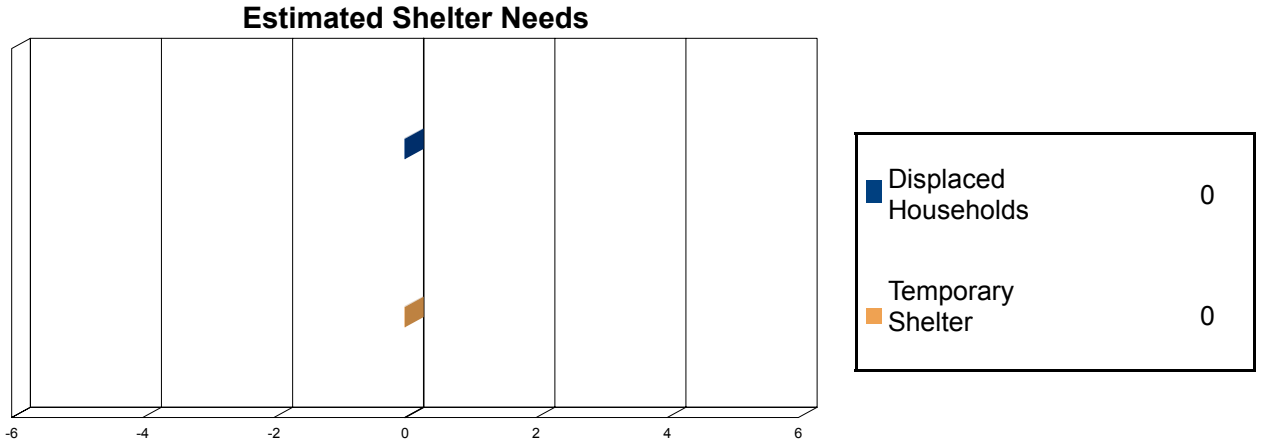


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 5,957 tons of debris will be generated. Of the total amount, 4,746 tons (80%) is Other Tree Debris. Of the remaining 1,211 tons, Brick/Wood comprises 21% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 10 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 961 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

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 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 3,994) will seek temporary shelter in public shelters.

Economic Loss

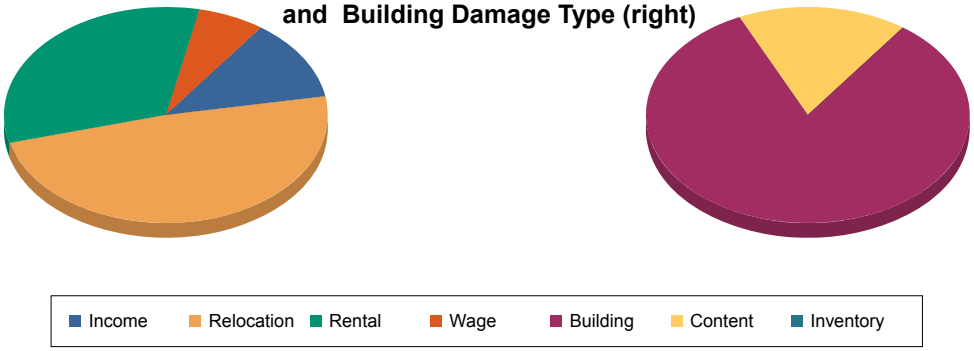
The total economic loss estimated for the hurricane is 4.5 million dollars, which represents 0.54 % of the total replacement value of the region's buildings.

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 4 million dollars. 5% 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 93% of the total loss. Table 5 below provides a summary of the losses associated with the building damage.

Loss by Business Interruption Type (left) and Building Damage Type (right)



Loss Type by General Occupancy

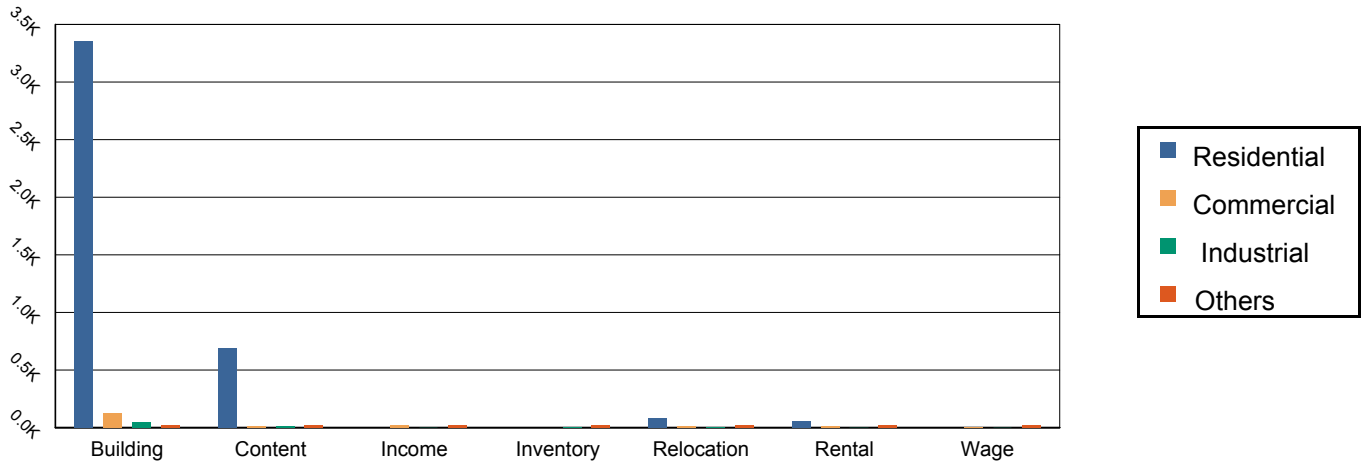


Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	3,356.97	129.20	50.59	15.04	3,551.80
	Content	688.89	17.48	14.02	1.69	722.07
	Inventory	0.00	0.09	2.16	0.10	2.35
	Subtotal	**4,045.86**	**146.77**	**66.76**	**16.83**	**4,276.22**
Business Interruption Loss						
	Income	0.00	22.88	0.51	2.03	25.43
	Relocation	84.55	14.92	1.58	1.39	102.43
	Rental	57.25	10.48	0.42	0.13	68.29
	Wage	0.00	8.39	0.85	4.76	14.00
	Subtotal	**141.80**	**56.67**	**3.37**	**8.31**	**210.15**

Total

Total	**4,187.66**	**203.45**	**70.13**	**25.14**	**4,486.37**

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	3,994	649,896	181,594	831,490
Total	**3,994**	**649,896**	**181,594**	**831,490**
Study Region Total	**3,994**	**649,896**	**181,594**	**831,490**

Hazus: Hurricane Global Risk Report

Region Name: Chester

Hurricane Scenario: Probabilistic 200-year Return Period

Print Date: Tuesday, October 1, 2019

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
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 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 16.83 square miles and contains 1 census tracts. There are over 1 thousand households in the region and a total population of 3,994 people (2010 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 1 thousand buildings in the region with a total building replacement value (excluding contents) of 831 million dollars (2014 dollars). Approximately 89% of the buildings (and 78% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 1,833 buildings in the region which have an aggregate total replacement value of 831 million (2014 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.

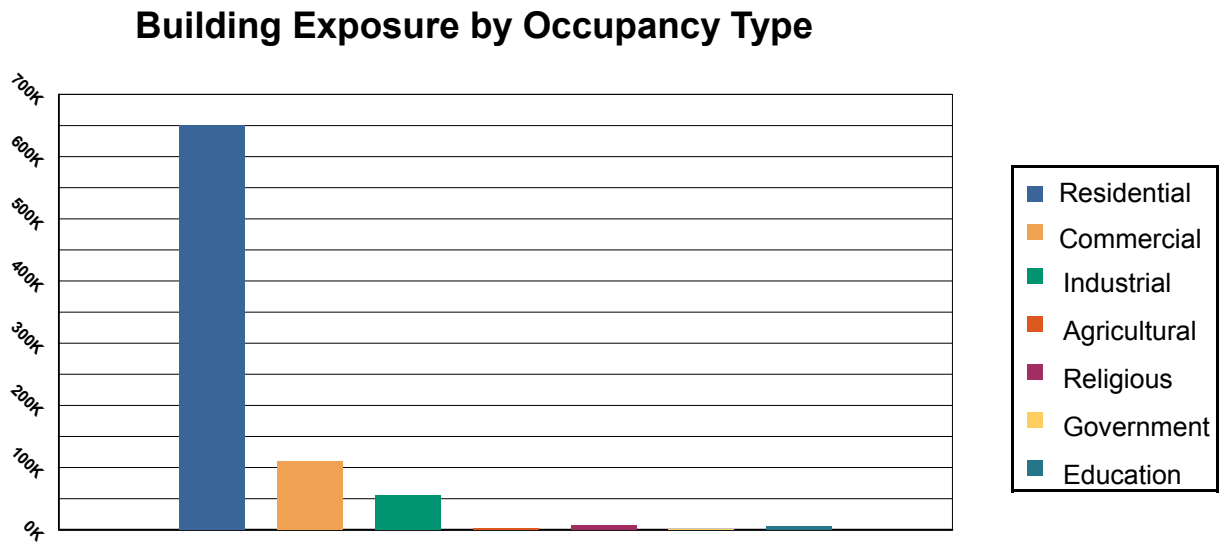


Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Tot
Residential	649,896	78.16 %
Commercial	110,478	13.29%
Industrial	55,516	6.68%
Agricultural	3,118	0.37%
Religious	6,871	0.83%
Government	460	0.06%
Education	5,151	0.62%
Total	**831,490**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 2 schools, 1 fire stations, 1 police stations and 1 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:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 28 buildings will be at least moderately damaged. This is over 2% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in 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.

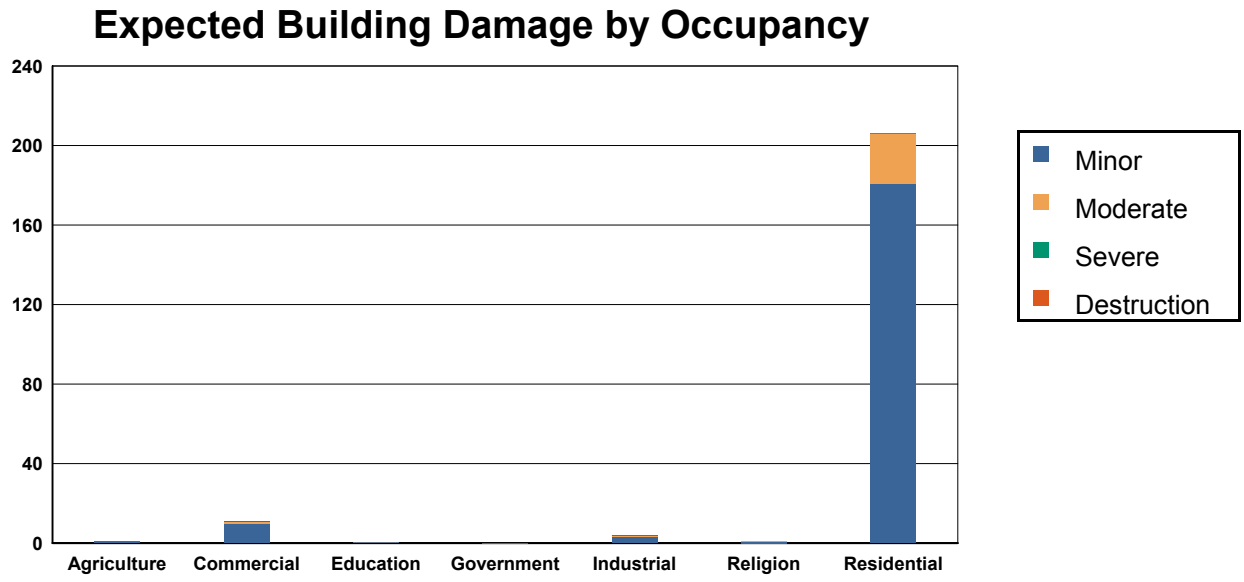


Table 2: Expected Building Damage by Occupancy : 200 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	7.95	88.30	0.80	8.91	0.17	1.86	0.08	0.86	0.01	0.07
Commercial	112.98	91.12	9.43	7.60	1.47	1.18	0.12	0.10	0.00	0.00
Education	4.64	92.84	0.33	6.64	0.03	0.50	0.00	0.02	0.00	0.00
Government	0.94	93.68	0.06	5.90	0.00	0.41	0.00	0.01	0.00	0.00
Industrial	45.03	91.90	3.29	6.72	0.52	1.06	0.15	0.30	0.01	0.02
Religion	7.34	91.80	0.61	7.61	0.04	0.56	0.00	0.03	0.00	0.00
Residential	1,430.79	87.40	180.78	11.04	24.81	1.52	0.44	0.03	0.17	0.01
Total	**1,609.67**		**195.30**		**27.04**		**0.80**		**0.19**	

Table 3: Expected Building Damage by Building Type : 200 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	8	90.82	1	8.11	0	1.07	0	0.01	0	0.00
Masonry	88	85.57	10	9.88	4	4.26	0	0.28	0	0.02
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	77	92.31	6	6.64	1	0.94	0	0.11	0	0.00
Wood	1,366	88.27	167	10.81	14	0.89	0	0.03	0	0.01

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 by patients already in the hospital and those injured by the hurricane. After one week, none of the beds will be in service. By 30 days, none will be operational.

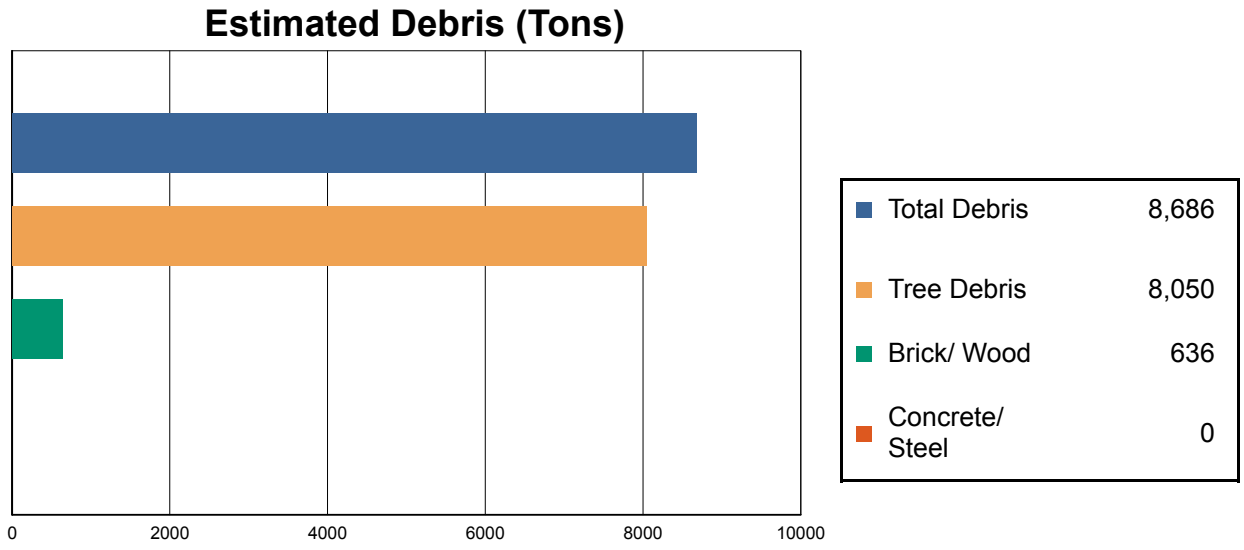
Thematic Map of Essential Facilities with greater than 50% moderate

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**
EOCs	1	0	0	1
Fire Stations	1	0	0	1
Police Stations	1	0	0	1
Schools	2	0	0	2

Induced Hurricane Damage

Debris Generation

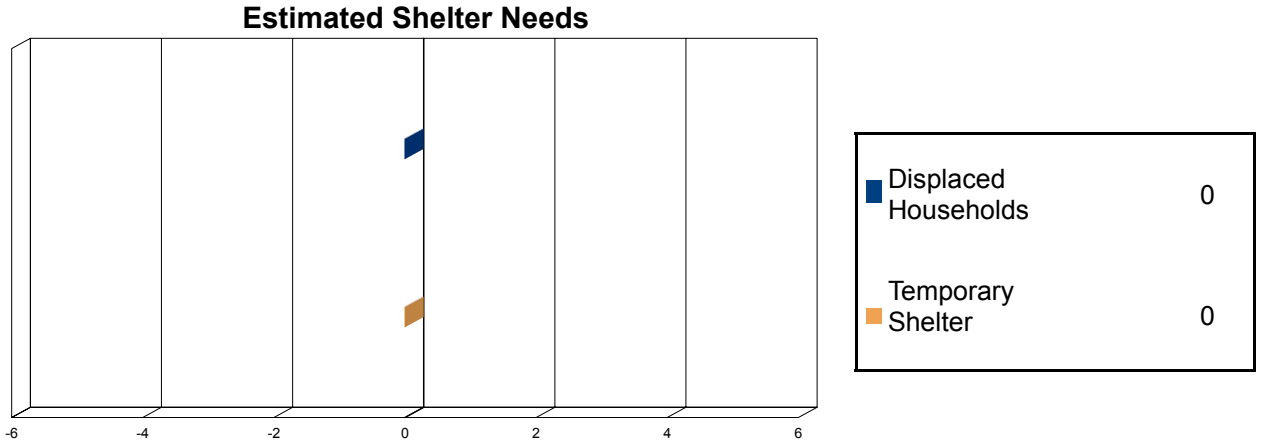


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 8,686 tons of debris will be generated. Of the total amount, 6,694 tons (77%) is Other Tree Debris. Of the remaining 1,992 tons, Brick/Wood comprises 32% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 25 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 1,356 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

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 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 3,994) will seek temporary shelter in public shelters.

Economic Loss

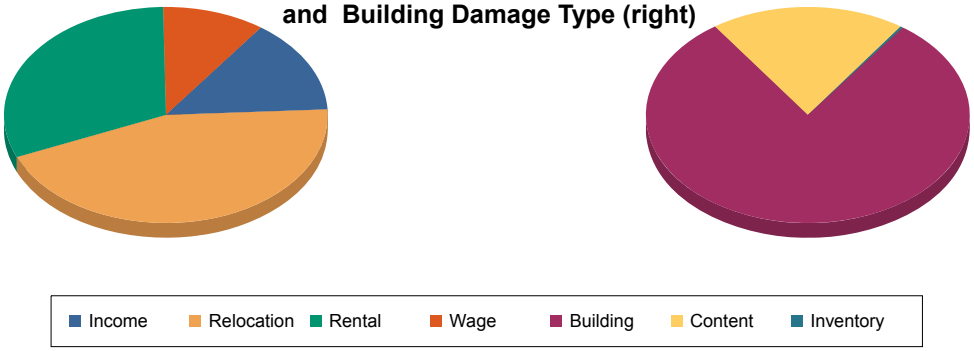
The total economic loss estimated for the hurricane is 9.7 million dollars, which represents 1.16 % of the total replacement value of the region's buildings.

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 10 million dollars. 6% 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 90% of the total loss. Table 5 below provides a summary of the losses associated with the building damage.

Loss by Business Interruption Type (left) and Building Damage Type (right)



Loss Type by General Occupancy

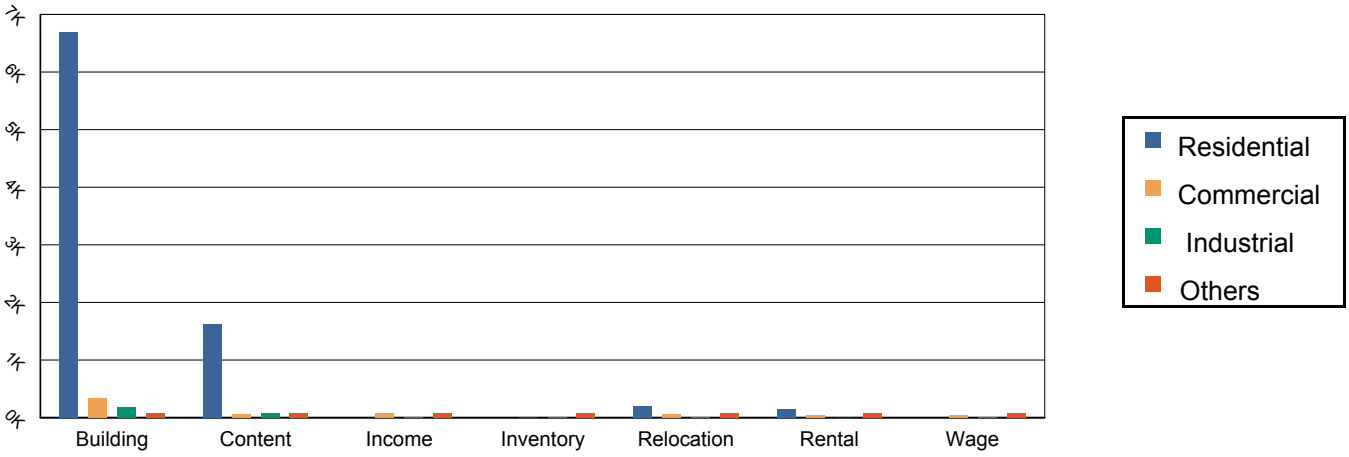


Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	6,698.50	338.42	176.80	45.80	7,259.52
	Content	1,621.45	54.65	84.94	9.57	1,770.61
	Inventory	0.00	0.38	13.17	0.54	14.09
	Subtotal	**8,319.95**	**393.45**	**274.90**	**55.92**	**9,044.22**
Business Interruption Loss						
	Income	0.00	78.22	2.59	4.74	85.55
	Relocation	196.24	58.67	8.72	6.51	270.14
	Rental	144.50	40.92	2.12	0.48	188.02
	Wage	0.00	45.84	4.32	12.04	62.20
	Subtotal	**340.75**	**223.64**	**17.75**	**23.77**	**605.91**

Total

Total	**8,660.70**	**617.09**	**292.65**	**79.69**	**9,650.13**

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	3,994	649,896	181,594	831,490
Total	**3,994**	**649,896**	**181,594**	**831,490**
Study Region Total	**3,994**	**649,896**	**181,594**	**831,490**

Hazus: Hurricane Global Risk Report

Region Name: Chester

Hurricane Scenario: Probabilistic 500-year Return Period

Print Date: Tuesday, October 1, 2019

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

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Building Inventory

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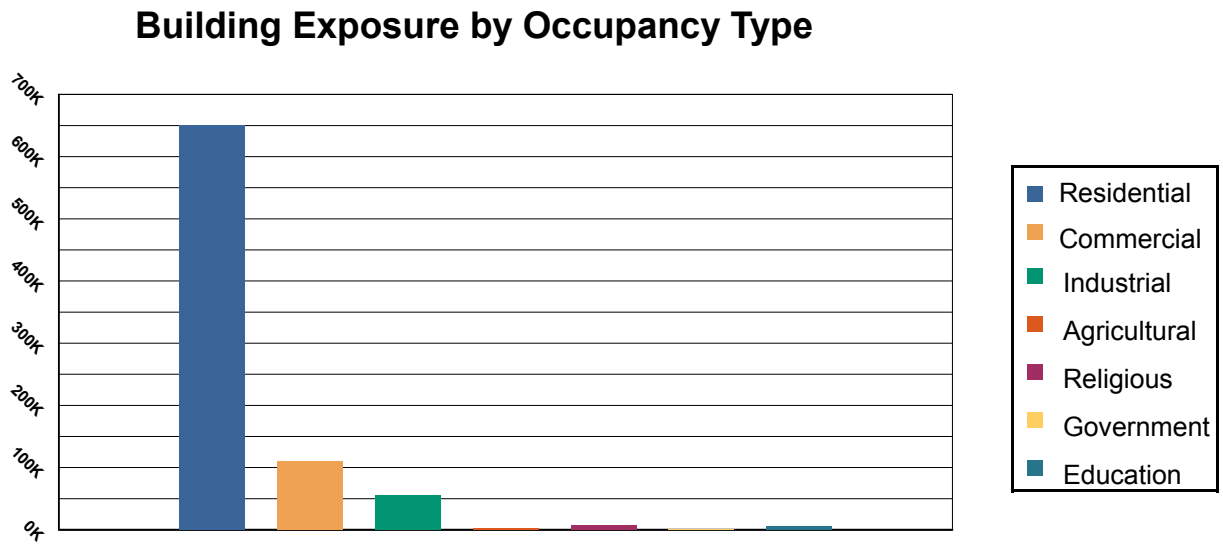

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Tot
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Industrial	55,516	6.68%
Agricultural	3,118	0.37%
Religious	6,871	0.83%
Government	460	0.06%
Education	5,151	0.62%
Total	**831,490**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 2 schools, 1 fire stations, 1 police stations and 1 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:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 90 buildings will be at least moderately damaged. This is over 5% of the total number of buildings in the region. There are an estimated 2 buildings that will be completely destroyed. The definition of the 'damage states' is provided in 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.

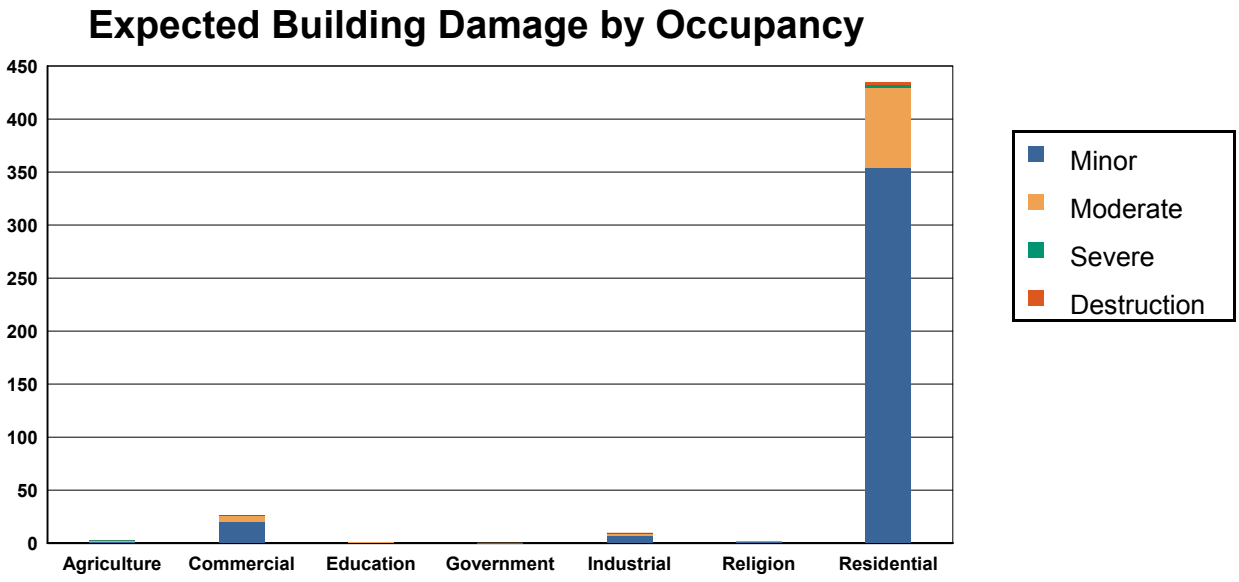


Table 2: Expected Building Damage by Occupancy : 500 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	6.64	73.82	1.63	18.06	0.47	5.25	0.23	2.54	0.03	0.33
Commercial	97.57	78.68	20.11	16.22	5.73	4.62	0.59	0.48	0.00	0.00
Education	4.08	81.59	0.75	15.05	0.16	3.22	0.01	0.14	0.00	0.00
Government	0.84	83.61	0.14	13.54	0.03	2.74	0.00	0.11	0.00	0.00
Industrial	39.30	80.20	7.03	14.35	2.10	4.28	0.53	1.07	0.05	0.10
Religion	6.35	79.44	1.37	17.10	0.26	3.28	0.02	0.19	0.00	0.00
Residential	1,202.52	73.46	354.38	21.65	74.59	4.56	3.64	0.22	1.87	0.11
Total	**1,357.30**		**385.40**		**83.34**		**5.01**		**1.95**	

Table 3: Expected Building Damage by Building Type : 500 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	7	78.08	1	16.54	0	5.28	0	0.11	0	0.00
Masonry	74	71.56	18	17.49	10	9.92	1	0.91	0	0.12
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	67	80.70	12	14.30	4	4.43	0	0.56	0	0.01
Wood	1,153	74.52	338	21.83	51	3.32	4	0.23	2	0.11

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 by patients already in the hospital and those injured by the hurricane. After one week, none of the beds will be in service. By 30 days, none will be operational.

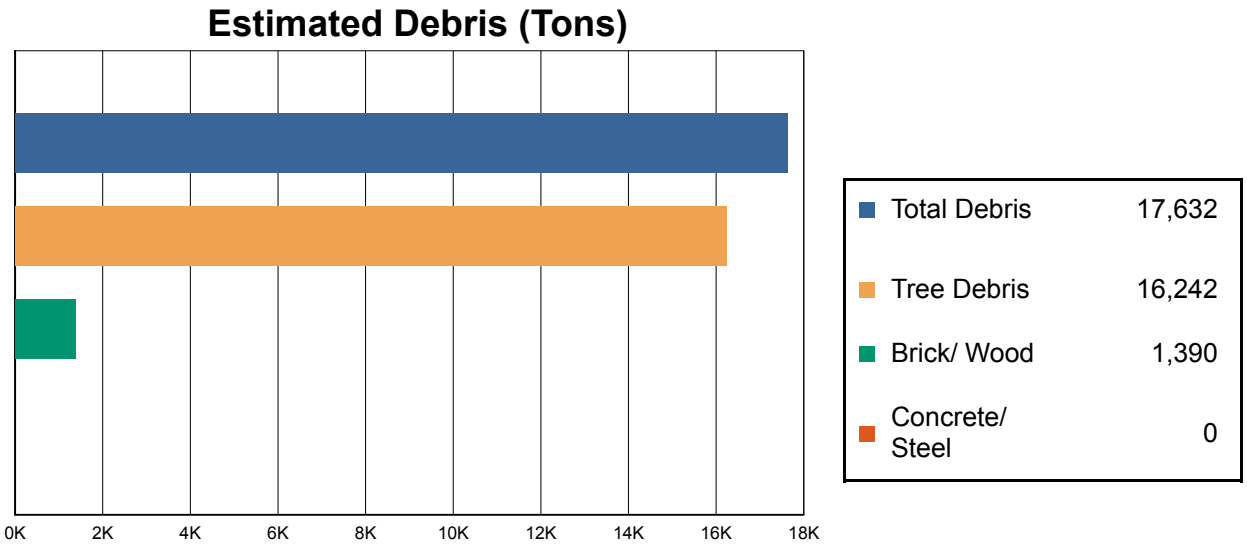
Thematic Map of Essential Facilities with greater than 50% moderate

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**
EOCs	1	0	0	1
Fire Stations	1	0	0	1
Police Stations	1	0	0	1
Schools	2	0	0	2

Induced Hurricane Damage

Debris Generation

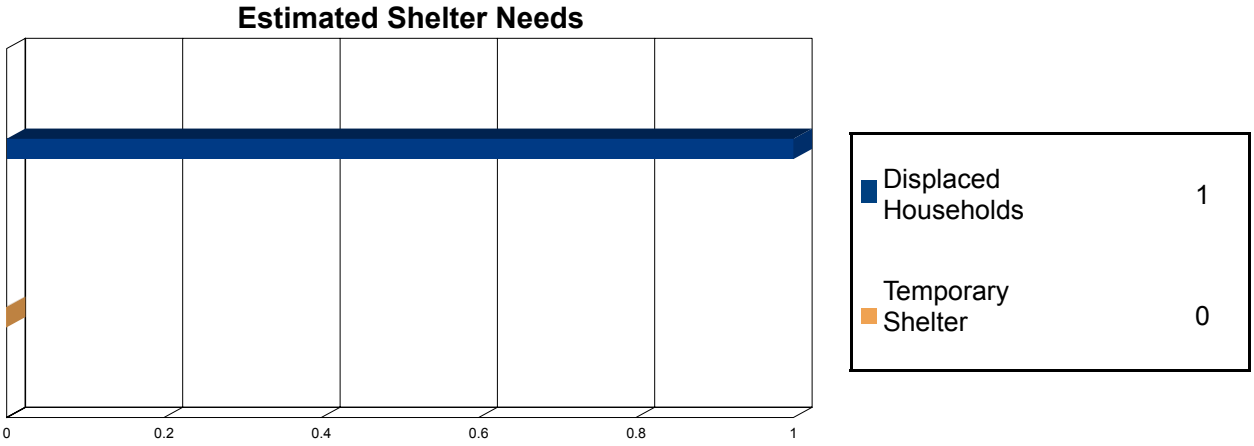


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 17,632 tons of debris will be generated. Of the total amount, 13,507 tons (77%) is Other Tree Debris. Of the remaining 4,125 tons, Brick/Wood comprises 34% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 56 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 2,735 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

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 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 3,994) will seek temporary shelter in public shelters.

Economic Loss

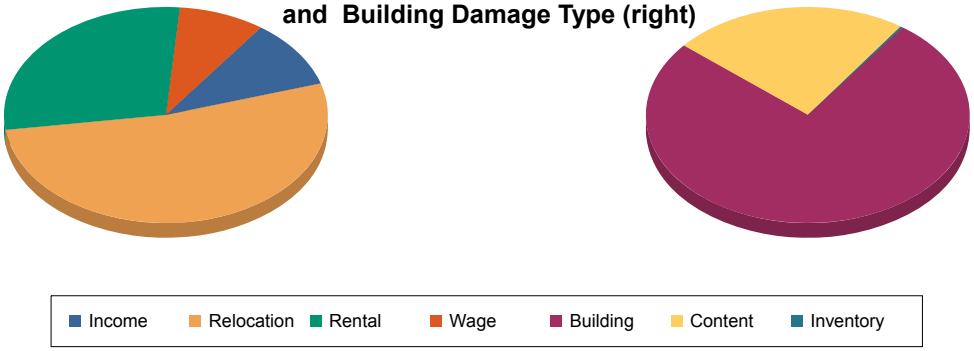
The total economic loss estimated for the hurricane is 22.2 million dollars, which represents 2.66 % of the total replacement value of the region's buildings.

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 22 million dollars. 7% 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 87% of the total loss. Table 5 below provides a summary of the losses associated with the building damage.

Loss by Business Interruption Type (left) and Building Damage Type (right)



Loss Type by General Occupancy

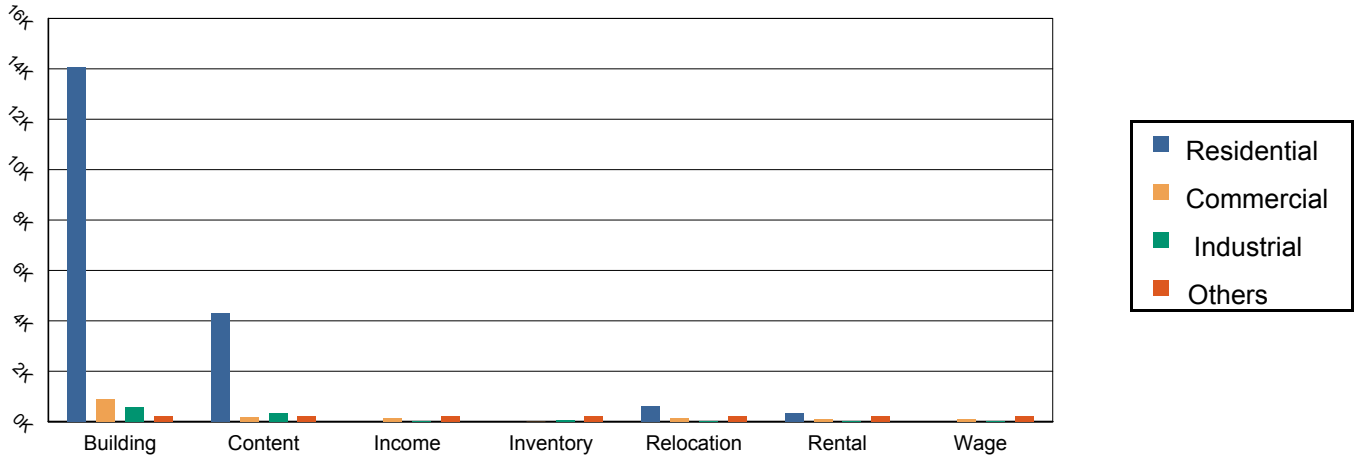


Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	14,059.83	884.69	564.98	133.46	15,642.96
	Content	4,297.64	190.78	344.74	35.25	4,868.41
	Inventory	0.00	1.68	51.61	1.96	55.24
	Subtotal	**18,357.47**	**1,077.16**	**961.32**	**170.66**	**20,566.61**
Business Interruption Loss						
	Income	0.00	144.32	6.82	12.05	163.19
	Relocation	631.74	148.14	29.49	21.92	831.30
	Rental	351.17	94.53	5.96	1.49	453.16
	Wage	0.00	94.91	11.38	30.74	137.03
	Subtotal	**982.92**	**481.90**	**53.64**	**66.21**	**1,584.67**

Total

Total	**19,340.39**	**1,559.06**	**1,014.96**	**236.87**	**22,151.29**

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	3,994	649,896	181,594	831,490
Total	**3,994**	**649,896**	**181,594**	**831,490**
Study Region Total	**3,994**	**649,896**	**181,594**	**831,490**

Hazus: Hurricane Global Risk Report

Region Name: Chester

Hurricane Scenario: Probabilistic 1000-year Return Period

Print Date: Tuesday, October 1, 2019

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
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 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 16.83 square miles and contains 1 census tracts. There are over 1 thousand households in the region and a total population of 3,994 people (2010 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 1 thousand buildings in the region with a total building replacement value (excluding contents) of 831 million dollars (2014 dollars). Approximately 89% of the buildings (and 78% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 1,833 buildings in the region which have an aggregate total replacement value of 831 million (2014 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.

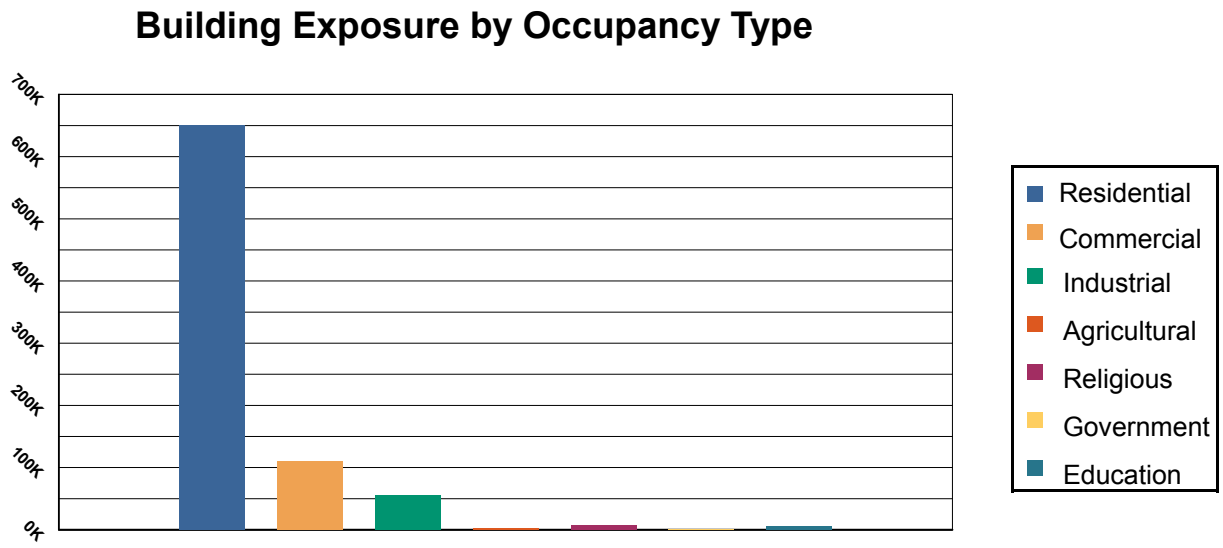


Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Tot
Residential	649,896	78.16 %
Commercial	110,478	13.29%
Industrial	55,516	6.68%
Agricultural	3,118	0.37%
Religious	6,871	0.83%
Government	460	0.06%
Education	5,151	0.62%
Total	**831,490**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 2 schools, 1 fire stations, 1 police stations and 1 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:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 176 buildings will be at least moderately damaged. This is over 10% of the total number of buildings in the region. There are an estimated 7 buildings that will be completely destroyed. The definition of the 'damage states' is provided in 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.

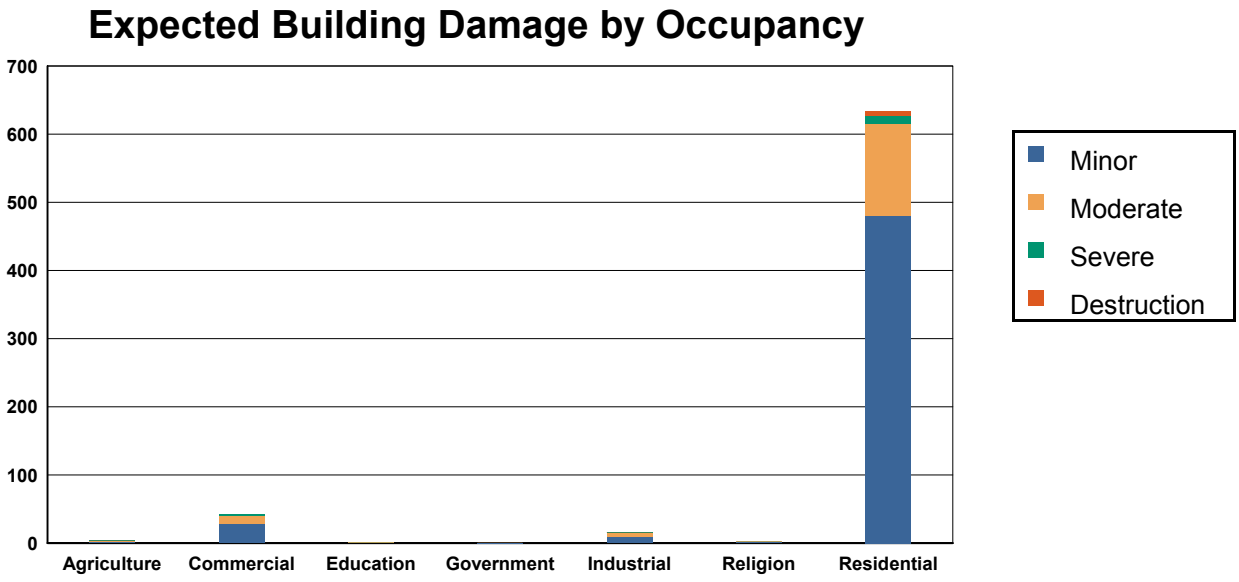


Table 2: Expected Building Damage by Occupancy : 1000 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	5.45	60.53	2.25	25.01	0.84	9.28	0.40	4.49	0.06	0.70
Commercial	81.59	65.80	28.38	22.89	12.26	9.88	1.76	1.42	0.01	0.01
Education	3.45	68.91	1.10	21.98	0.42	8.33	0.04	0.77	0.00	0.00
Government	0.72	71.80	0.20	20.19	0.07	7.39	0.01	0.62	0.00	0.00
Industrial	33.13	67.60	10.00	20.40	4.60	9.39	1.17	2.38	0.11	0.22
Religion	5.32	66.53	1.98	24.72	0.64	7.96	0.06	0.78	0.00	0.00
Residential	1,002.78	61.26	480.22	29.34	135.43	8.27	12.05	0.74	6.53	0.40
Total	**1,132.43**		**524.12**		**154.24**		**15.49**		**6.72**	

Table 3: Expected Building Damage by Building Type : 1000 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	6	64.61	2	22.53	1	12.25	0	0.61	0	0.00
Masonry	61	58.87	23	22.62	17	16.28	2	1.95	0	0.29
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	56	67.90	17	20.24	8	10.17	1	1.67	0	0.02
Wood	965	62.38	464	30.02	100	6.48	11	0.72	6	0.41

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 by patients already in the hospital and those injured by the hurricane. After one week, none of the beds will be in service. By 30 days, none will be operational.

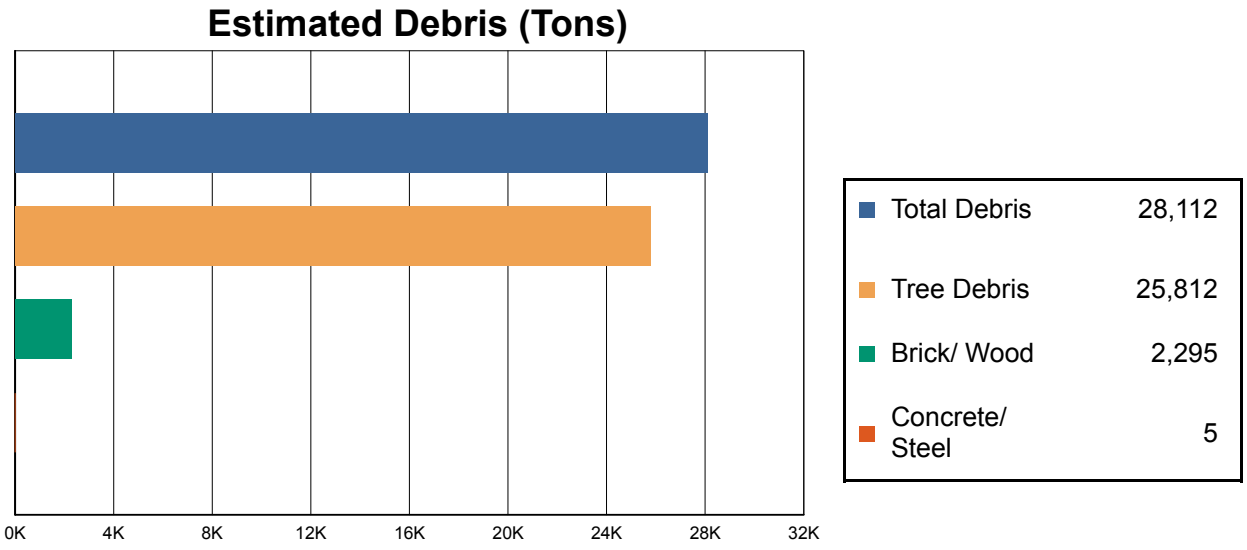
Thematic Map of Essential Facilities with greater than 50% moderate

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**
EOCs	1	0	0	1
Fire Stations	1	0	0	1
Police Stations	1	0	0	1
Schools	2	0	0	0

Induced Hurricane Damage

Debris Generation

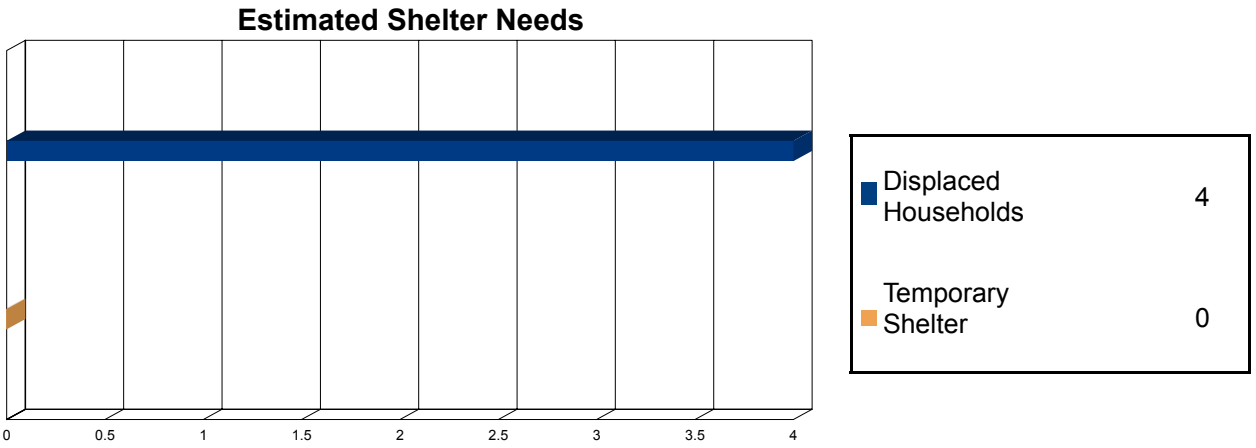


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 28,112 tons of debris will be generated. Of the total amount, 21,466 tons (76%) is Other Tree Debris. Of the remaining 6,646 tons, Brick/Wood comprises 35% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 92 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 4,346 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

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 4 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 3,994) will seek temporary shelter in public shelters.

Economic Loss

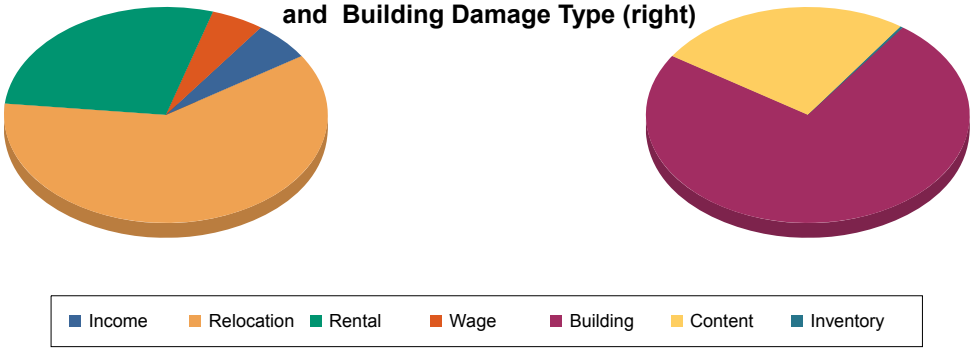
The total economic loss estimated for the hurricane is 39.0 million dollars, which represents 4.69 % of the total replacement value of the region's buildings.

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 39 million dollars. 8% 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 86% of the total loss. Table 5 below provides a summary of the losses associated with the building damage.

Loss by Business Interruption Type (left) and Building Damage Type (right)



Loss Type by General Occupancy

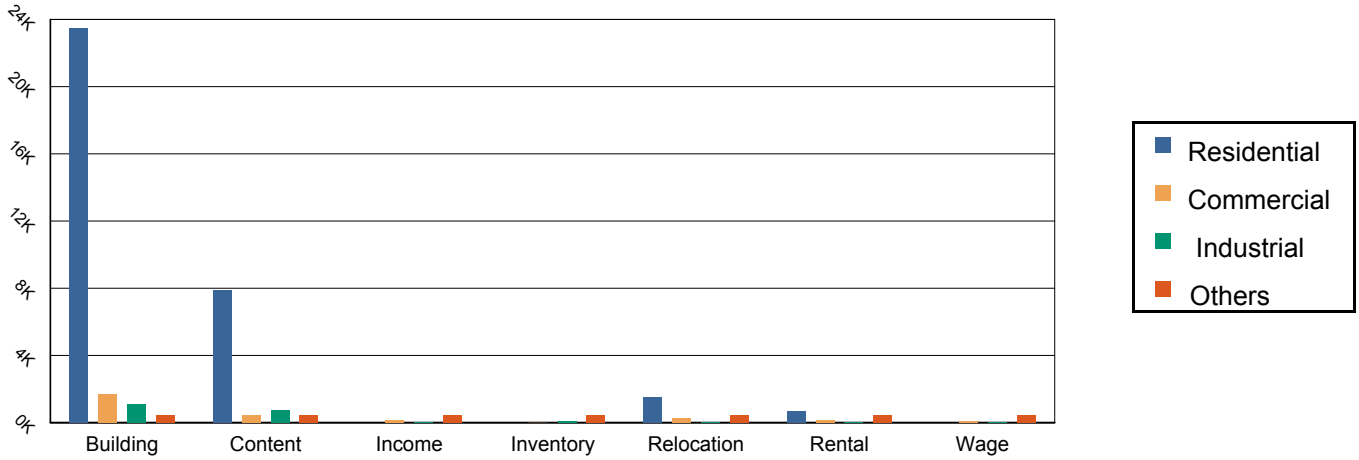


Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	23,457.75	1,681.93	1,111.57	253.88	26,505.13
	Content	7,868.25	479.52	750.82	81.81	9,180.40
	Inventory	0.00	4.20	109.10	3.88	117.19
	Subtotal	**31,326.00**	**2,165.65**	**1,971.50**	**339.57**	**35,802.71**
Business Interruption Loss						
	Income	0.27	158.02	12.27	13.79	184.35
	Relocation	1,549.82	283.11	61.95	41.77	1,936.65
	Rental	714.95	172.73	11.29	2.79	901.76
	Wage	0.64	108.38	20.43	35.75	165.20
	Subtotal	**2,265.68**	**722.24**	**105.94**	**94.10**	**3,187.95**

Total

Total	**33,591.68**	**2,887.89**	**2,077.43**	**433.67**	**38,990.67**

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	3,994	649,896	181,594	831,490
Total	**3,994**	**649,896**	**181,594**	**831,490**
Study Region Total	**3,994**	**649,896**	**181,594**	**831,490**

Hazus: Hurricane Global Risk Report

Region Name: Chester

Hurricane Scenario: UN-NAMED-1938-4

Print Date: Tuesday, October 15, 2019

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
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 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 16.83 square miles and contains 1 census tracts. There are over 1 thousand households in the region and a total population of 3,994 people (2010 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 1 thousand buildings in the region with a total building replacement value (excluding contents) of 831 million dollars (2014 dollars). Approximately 89% of the buildings (and 78% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 1,833 buildings in the region which have an aggregate total replacement value of 831 million (2014 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.

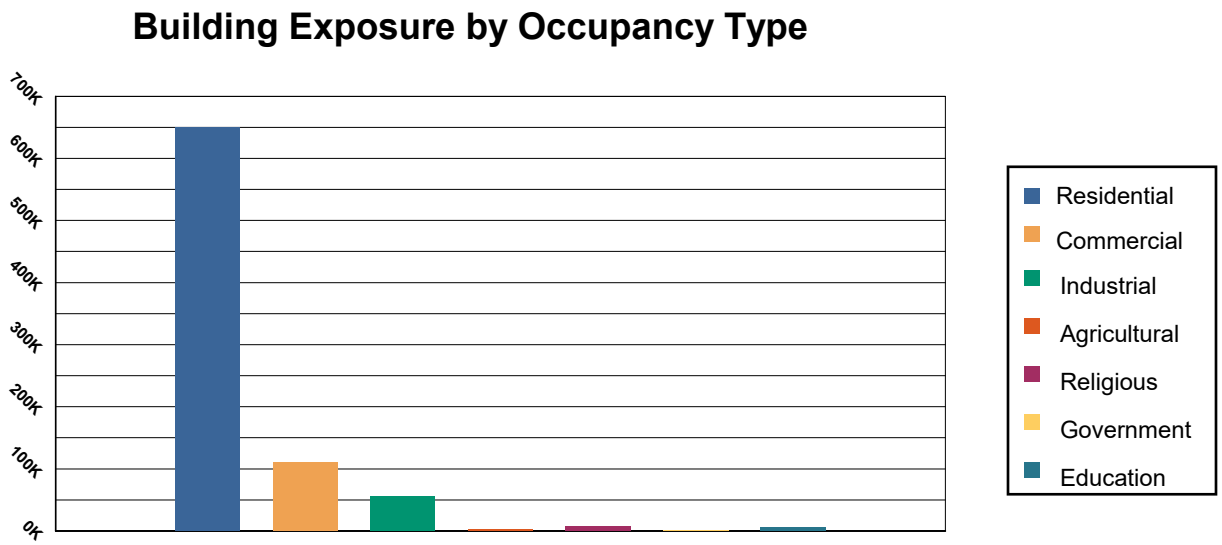


Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Tot
Residential	649,896	78.16%
Commercial	110,478	13.29%
Industrial	55,516	6.68%
Agricultural	3,118	0.37%
Religious	6,871	0.83%
Government	460	0.06%
Education	5,151	0.62%
Total	**831,490**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 2 schools, 1 fire stations, 1 police stations and 1 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:	112 mph

Building Damage

General Building Stock Damage

Hazus estimates that about 129 buildings will be at least moderately damaged. This is over 7% of the total number of buildings in the region. There are an estimated 4 buildings that will be completely destroyed. The definition of the 'damage states' is provided in 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.

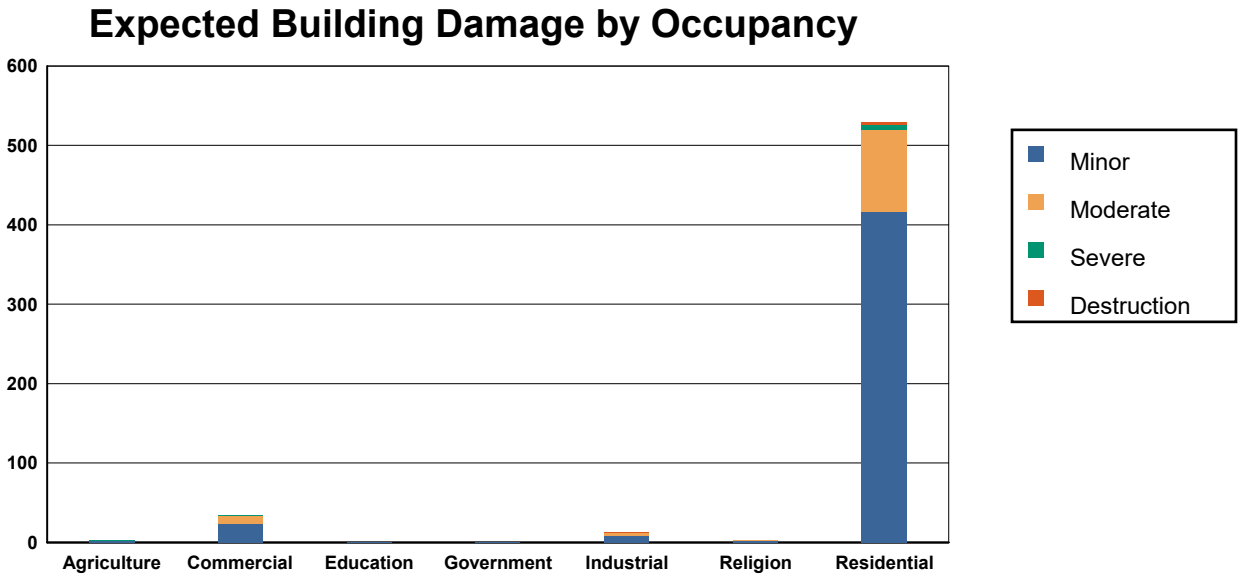


Table 2: Expected Building Damage by Occupancy

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	6.08	67.51	1.93	21.46	0.64	7.10	0.31	3.42	0.04	0.50
Commercial	90.09	72.65	24.18	19.50	8.64	6.97	1.08	0.87	0.01	0.00
Education	3.79	75.70	0.92	18.45	0.27	5.46	0.02	0.39	0.00	0.00
Government	0.78	78.17	0.17	16.76	0.05	4.76	0.00	0.31	0.00	0.00
Industrial	36.42	74.33	8.49	17.32	3.21	6.55	0.80	1.64	0.08	0.16
Religion	5.87	73.40	1.67	20.83	0.43	5.33	0.03	0.43	0.00	0.00
Residential	1,107.08	67.63	416.52	25.44	102.38	6.25	7.24	0.44	3.78	0.23
Total	**1,250.11**		**453.89**		**115.61**		**9.49**		**3.91**	

Table 3: Expected Building Damage by Building Type

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	6	71.79	2	19.54	1	8.37	0	0.29	0	0.00
Masonry	67	65.53	21	20.07	13	12.85	1	1.36	0	0.19
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	62	74.75	14	17.24	6	6.98	1	1.02	0	0.01
Wood	1,063	68.72	400	25.85	74	4.76	7	0.43	4	0.23

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 by patients already in the hospital and those injured by the hurricane. After one week, none of the beds will be in service. By 30 days, none will be operational.

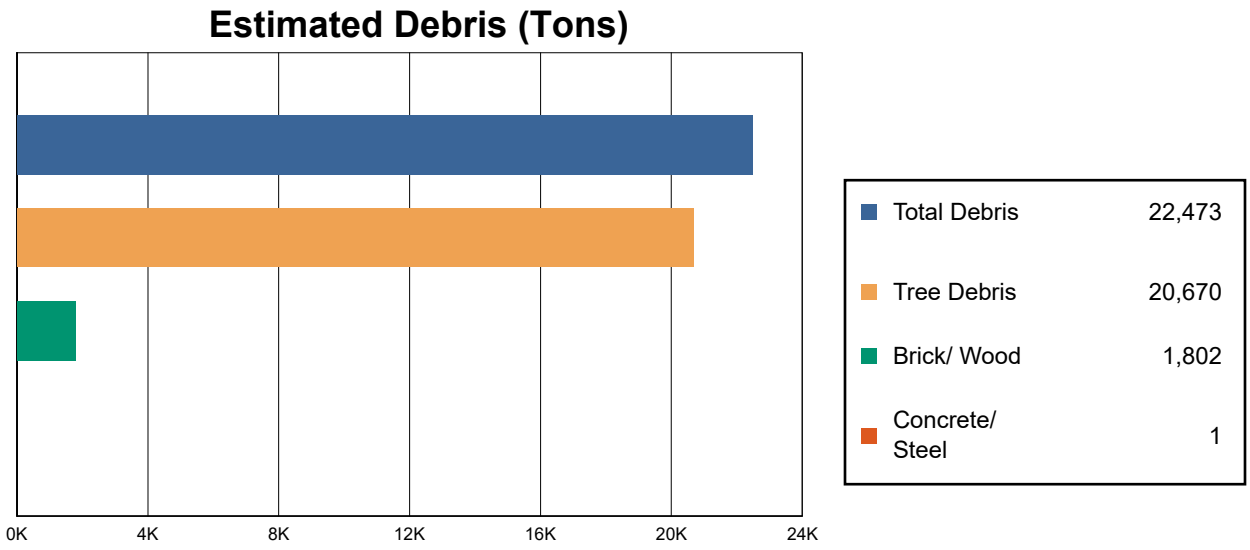
Thematic Map of Essential Facilities with greater than 50% moderate

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
EOCs	1	0	0	1
Fire Stations	1	0	0	1
Police Stations	1	0	0	1
Schools	2	0	0	0

Induced Hurricane Damage

Debris Generation

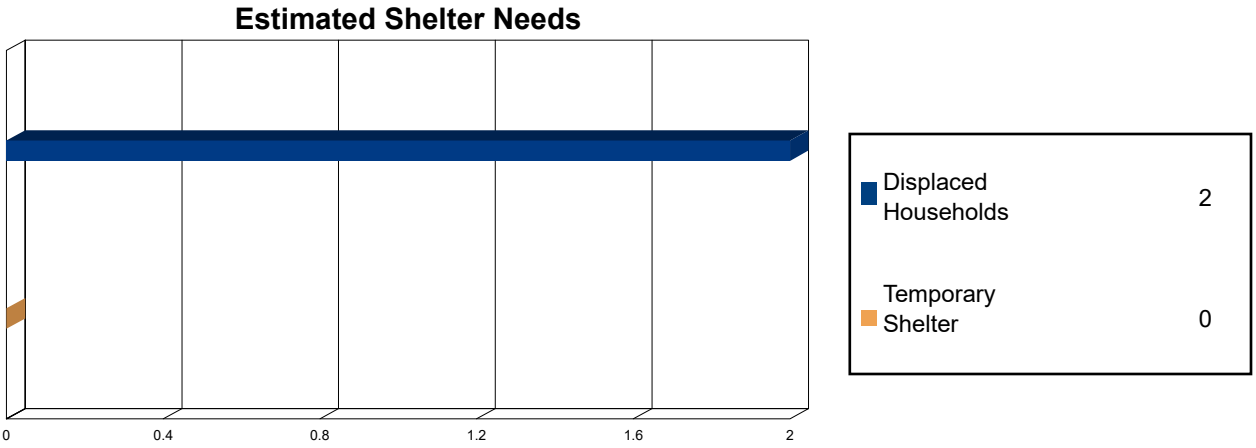


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 22,473 tons of debris will be generated. Of the total amount, 17,189 tons (76%) is Other Tree Debris. Of the remaining 5,284 tons, Brick/Wood comprises 34% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 72 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 3,481 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

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 2 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 3,994) will seek temporary shelter in public shelters.

Economic Loss

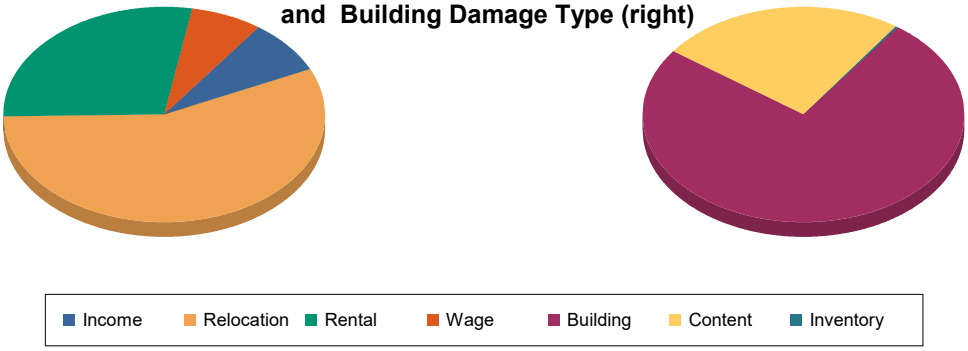
The total economic loss estimated for the hurricane is 29.7 million dollars, which represents 3.57 % of the total replacement value of the region's buildings.

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 30 million dollars. 8% 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 87% of the total loss. Table 5 below provides a summary of the losses associated with the building damage.

Loss by Business Interruption Type (left) and Building Damage Type (right)



Loss Type by General Occupancy

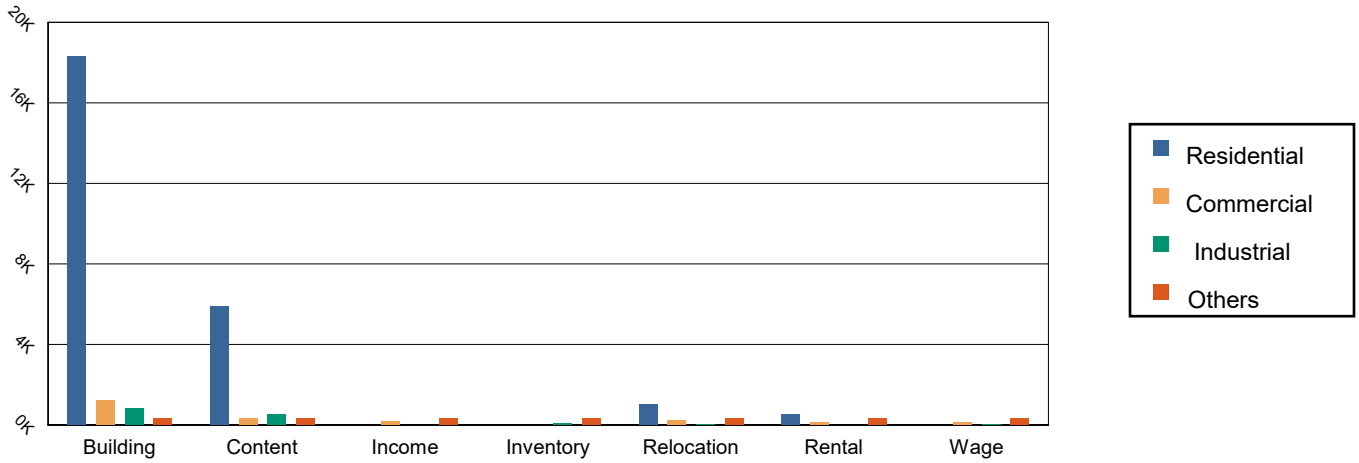


Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	18,285.14	1,242.11	808.72	187.32	20,523.29
	Content	5,904.63	316.73	523.26	55.57	6,800.18
	Inventory	0.00	2.79	77.15	2.84	82.77
	Subtotal	**24,189.76**	**1,561.63**	**1,409.12**	**245.72**	**27,406.24**
Business Interruption Loss						
	Income	0.00	164.23	9.56	15.16	188.95
	Relocation	1,016.01	213.03	44.90	32.22	1,306.16
	Rental	505.40	133.32	8.68	2.24	649.64
	Wage	0.00	111.20	15.95	39.15	166.30
	Subtotal	**1,521.41**	**621.77**	**79.09**	**88.76**	**2,311.04**

Total

Total	**25,711.17**	**2,183.40**	**1,488.22**	**334.49**	**29,717.28**

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	3,994	649,896	181,594	831,490
Total	**3,994**	**649,896**	**181,594**	**831,490**
Study Region Total	**3,994**	**649,896**	**181,594**	**831,490**

Hazus: Earthquake Global Risk Report

Region Name: Chester

Earthquake Scenario: Chester-EastHaddam

Print Date: October 15, 2019

Disclaimer:

This version of Hazus utilizes 2010 Census Data.

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

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

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General Description of the Region

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

The earthquake loss estimates provided in this report was based on a region that includes 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 16.82 square miles and contains 1 census tracts. There are over 1 thousand households in the region which has a total population of 3,994 people (2010 Census Bureau data). The distribution of population by Total Region and County is provided in Appendix B.

There are an estimated 1 thousand buildings in the region with a total building replacement value (excluding contents) of 831 (millions of dollars). Approximately 89.00 % 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 582 and 9 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

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

In terms of building construction types found in the region, wood frame construction makes up 85% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

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

For essential facilities, there are 0 hospitals in the region with a total bed capacity of beds. There are 2 schools, 1 fire stations, 1 police stations and 1 emergency operation facilities. With respect to high potential loss facilities (HPL), there are no dams identified within the inventory. The inventory also includes 2 hazardous material sites, no military installations and no nuclear power plants.

Transportation and Utility Lifeline Inventory

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

The total value of the lifeline inventory is over 591.00 (millions of dollars). This inventory includes over 47.22 miles of highways, 15 bridges, 303.23 miles of pipes.

Table 1: Transportation System Lifeline Inventory

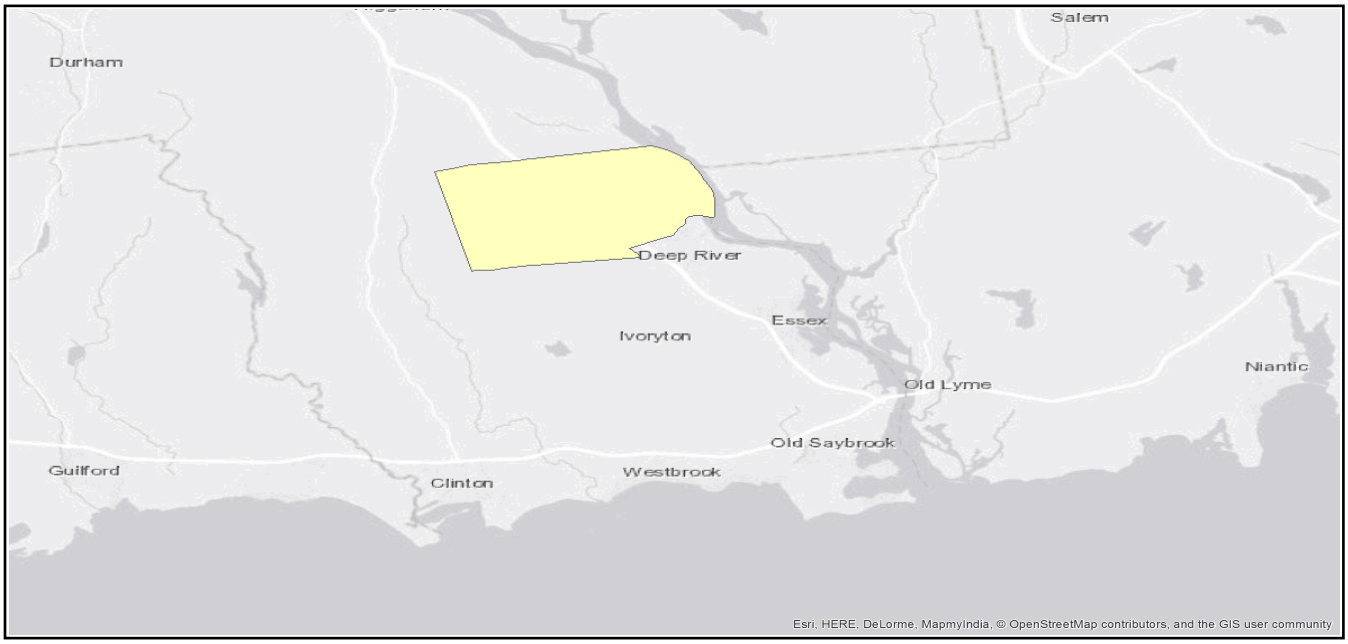
System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	15	104.8172
	Segments	14	420.1513
	Tunnels	0	0.0000
		Subtotal	**524.9685**
Railways	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	1	5.9474
	Tunnels	0	0.0000
		Subtotal	**5.9474**
Light Rail	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	0	0.0000
	Tunnels	0	0.0000
		Subtotal	**0.0000**
Bus	Facilities	0	0.0000
		Subtotal	**0.0000**
Ferry	Facilities	1	1.3310
		Subtotal	**1.3310**
Port	Facilities	1	1.9970
		Subtotal	**1.9970**
Airport	Facilities	1	10.6510
	Runways	1	37.9640
		Subtotal	**48.6150**
		Total	**582.90**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	4.8820
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**4.8820**
Waste Water	Distribution Lines	NA	2.9292
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**2.9292**
Natural Gas	Distribution Lines	NA	1.9528
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**1.9528**
Oil Systems	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**0.0000**
Electrical Power	Facilities	0	0.0000
		Subtotal	**0.0000**
Communication	Facilities	0	0.0000
		Subtotal	**0.0000**
		Total	**9.80**

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	Chester-EastHaddam
Type of Earthquake	Arbitrary
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	-72.40
Latitude of Epicenter	41.50
Earthquake Magnitude	6.40
Depth (km)	10.00
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	Central & East US (CEUS 2008)

Direct Earthquake Damage

Building Damage

Hazus estimates that about 1,032 buildings will be at least moderately damaged. This is over 56.00 % of the buildings in the region. There are an estimated 241 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Damage Categories by General Occupancy Type

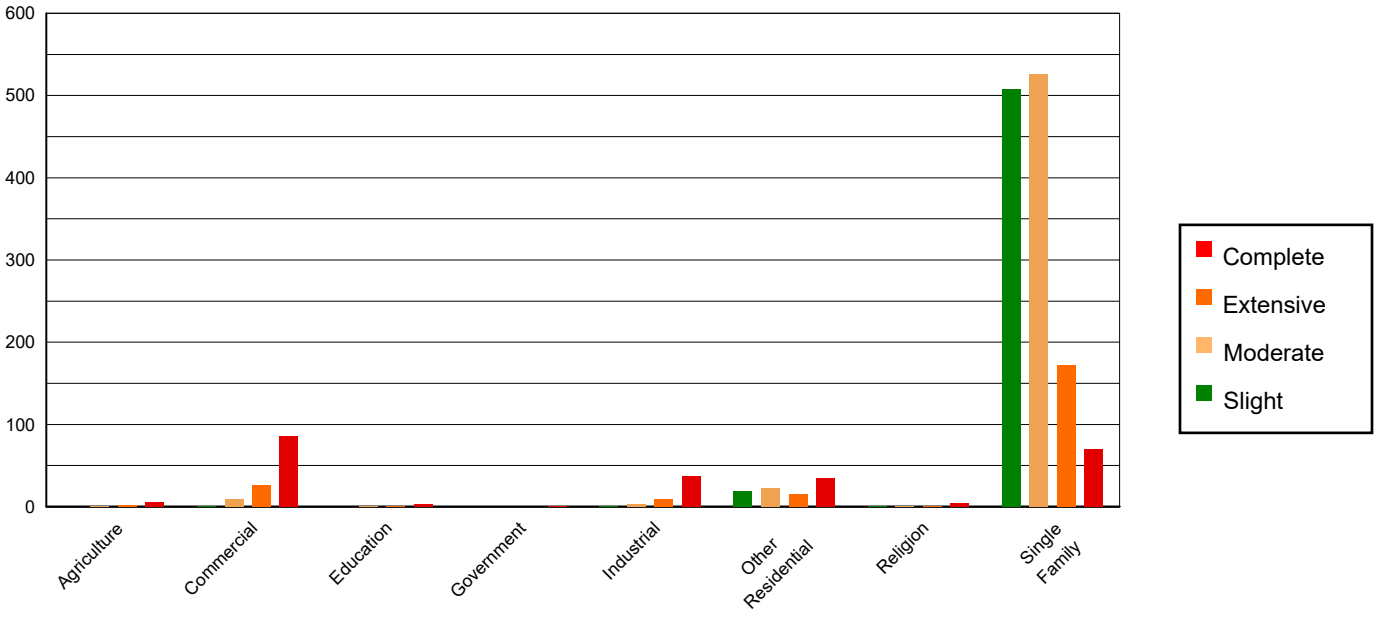


Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	0.02	0.01	0.12	0.02	0.98	0.17	2.26	0.99	5.61	2.32
Commercial	0.32	0.12	1.30	0.24	9.72	1.72	26.32	11.58	86.34	35.75
Education	0.01	0.00	0.05	0.01	0.35	0.06	1.05	0.46	3.54	1.46
Government	0.00	0.00	0.01	0.00	0.05	0.01	0.19	0.08	0.75	0.31
Industrial	0.10	0.04	0.35	0.07	2.74	0.49	9.23	4.06	36.58	15.15
Other Residential	9.86	3.66	19.62	3.69	22.81	4.04	14.76	6.50	34.96	14.48
Religion	0.52	0.19	1.05	0.20	1.38	0.24	1.26	0.55	3.79	1.57
Single Family	258.20	95.97	508.53	95.76	526.17	93.26	172.16	75.77	69.94	28.96
Total	**269**		**531**		**564**		**227**		**242**	

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

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	268.37	99.75	528.38	99.50	547.79	97.09	179.01	78.78	43.57	18.04
Steel	0.14	0.05	0.30	0.06	2.94	0.52	16.11	7.09	73.98	30.63
Concrete	0.03	0.01	0.07	0.01	0.66	0.12	3.09	1.36	14.66	6.07
Precast	0.02	0.01	0.03	0.01	0.32	0.06	0.98	0.43	6.30	2.61
RM	0.14	0.05	0.23	0.04	1.80	0.32	4.60	2.02	17.34	7.18
URM	0.35	0.13	2.02	0.38	10.68	1.89	23.44	10.32	85.65	35.47
MH	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**269**		**531**		**564**		**227**		**242**	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had hospital beds available for use. On the day of the earthquake, the model estimates that only hospital beds (%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, % of the beds will be back in service. By 30 days, % 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	0	0	0	0
Schools	2	2	2	0
EOCs	1	1	1	0
PoliceStations	1	1	1	0
FireStations	1	1	1	0

Transportation Lifeline Damage

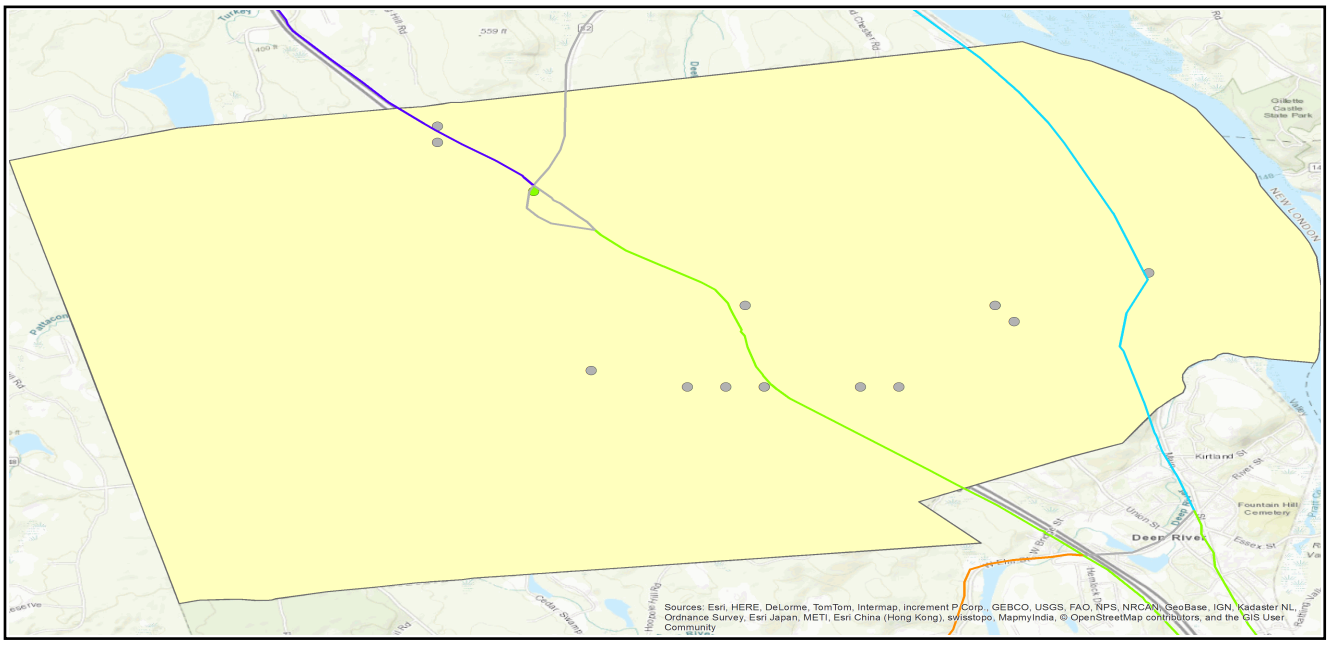


Table 6: Expected Damage to the Transportation Systems

System	Component		Number of Locations			
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 % After Day 1	With Functionality > 50 % After Day 7
Highway	Segments	14	0	0	10	10
	Bridges	15	9	4	7	8
	Tunnels	0	0	0	0	0
Railways	Segments	1	0	0	1	1
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
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	0	0	0	0	0
Ferry	Facilities	1	1	0	0	0
Port	Facilities	1	1	0	0	0
Airport	Facilities	1	1	0	1	1
	Runways	1	0	0	1	1

Table 6 provides damage estimates for the transportation system.

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

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

Table 7 : Expected Utility System Facility Damage

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

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

System	Total Pipelines Length (miles)	Number of Leaks	Number of Breaks
Potable Water	152	0	0
Waste Water	91	0	0
Natural Gas	61	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

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

Induced Earthquake Damage

Fire Following Earthquake

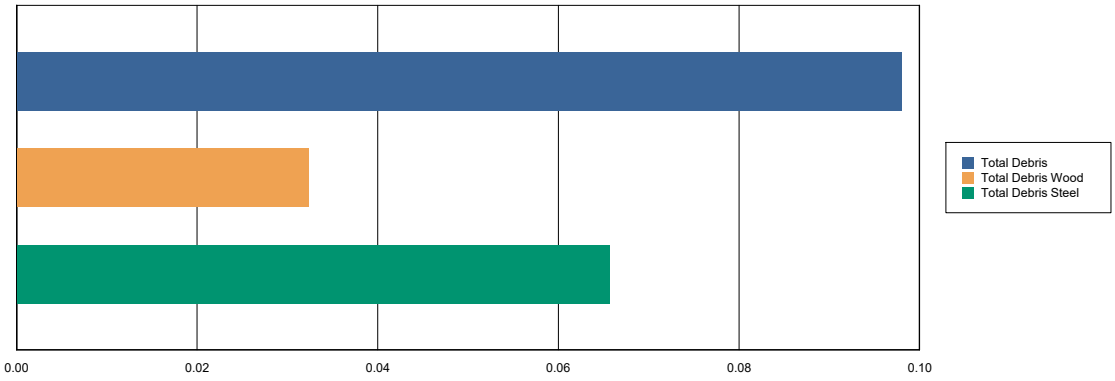
Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there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

Debris Generation

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

The model estimates that a total of 98,000 tons of debris will be generated. Of the total amount, Brick/Wood comprises 33.00% 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 3,920 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Earthquake Debris (millions of tons)



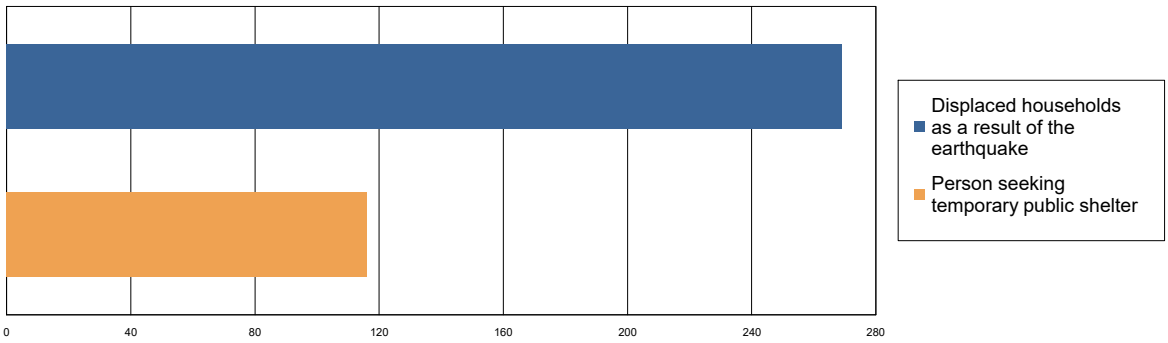
Brick/ Wood	Reinforced Concrete/Steel	Total Debris	Truck Load
0.03	0.07	0.10	3,920 (@25 tons/truck)

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 269 households to be displaced due to the earthquake. Of these, 116 people (out of a total population of 3,994) will seek temporary shelter in public shelters.

Displaced Households/ Persons Seeking Short Term Public Shelter



Displaced households as a result of the earthquake	Persons seeking temporary public shelter
269	116

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	1.90	0.59	0.09	0.19
	Commuting	0.01	0.01	0.02	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	4.12	1.32	0.21	0.42
	Other-Residential	37.25	12.13	2.07	4.10
	Single Family	21.62	5.34	0.69	1.34
	Total	**65**	**19**	**3**	**6**
2 PM	Commercial	109.12	34.16	5.43	10.63
	Commuting	0.10	0.13	0.22	0.04
	Educational	38.96	12.54	2.10	4.09
	Hotels	0.00	0.00	0.00	0.00
	Industrial	30.53	9.75	1.59	3.10
	Other-Residential	7.79	2.55	0.44	0.84
	Single Family	4.56	1.16	0.16	0.29
	Total	**191**	**60**	**10**	**19**
5 PM	Commercial	77.22	24.20	3.88	7.48
	Commuting	1.75	2.28	3.91	0.75
	Educational	4.04	1.30	0.22	0.42
	Hotels	0.00	0.00	0.00	0.00
	Industrial	19.08	6.10	0.99	1.94
	Other-Residential	14.80	4.84	0.84	1.60
	Single Family	8.67	2.20	0.30	0.55
	Total	**126**	**41**	**10**	**13**

Economic Loss

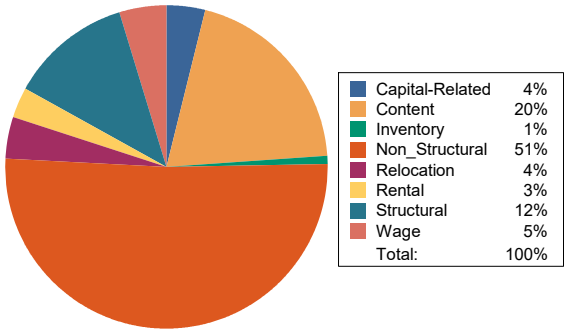
The total economic loss estimated for the earthquake is 506.04 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

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 451.50 (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 50 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type ($ millions)



Earthquake Losses by Occupancy Type ($ millions)

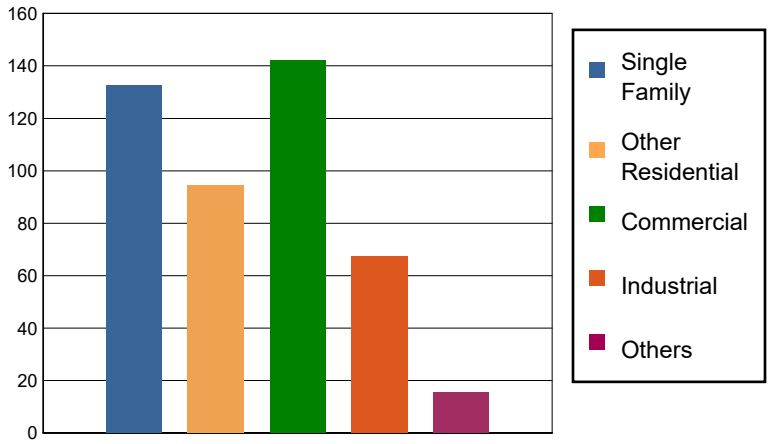


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.0000	11.5683	8.9205	0.9501	0.2201	21.6590
	Capital-Related	0.0000	4.9044	12.0300	0.5633	0.1067	17.6044
	Rental	2.0801	5.6464	6.0535	0.2969	0.1213	14.1982
	Relocation	7.3361	1.5206	8.1215	1.2233	1.2609	19.4624
	Subtotal	**9.4162**	**23.6397**	**35.1255**	**3.0336**	**1.7090**	**72.9240**
Capital Stock Losses							
	Structural	17.6432	9.9412	16.5667	7.3922	2.7420	54.2853
	Non_Structural	79.2150	49.3579	62.2984	32.3255	7.2823	230.4791
	Content	26.3122	11.2840	27.7840	21.0529	3.5411	89.9742
	Inventory	0.0000	0.0000	0.2374	3.5094	0.0944	3.8412
	Subtotal	**123.1704**	**70.5831**	**106.8865**	**64.2800**	**13.6598**	**378.5798**
	Total	**132.59**	**94.22**	**142.01**	**67.31**	**15.37**	**451.50**

Transportation and Utility Lifeline Losses

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

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

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	420.1513	0.0000	0.00
	Bridges	104.8172	47.3409	45.17
	Tunnels	0.0000	0.0000	0.00
	Subtotal	**524.9685**	**47.3409**	
Railways	Segments	5.9474	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**5.9474**	**0.0000**	
Light Rail	Segments	0.0000	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Bus	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Ferry	Facilities	1.3310	0.9609	72.19
	Subtotal	**1.3310**	**0.9609**	
Port	Facilities	1.9970	1.4435	72.28
	Subtotal	**1.9970**	**1.4435**	
Airport	Facilities	10.6510	4.7868	44.94
	Runways	37.9640	0.0000	0.00
	Subtotal	**48.6150**	**4.7868**	
	Total	**582.86**	**54.53**	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	4.8820	0.0000	0.00
	Subtotal	**4.8820**	**0.0000**	
Waste Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	2.9292	0.0000	0.00
	Subtotal	**2.9292**	**0.0000**	
Natural Gas	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	1.9528	0.0000	0.00
	Subtotal	**1.9528**	**0.0000**	
Oil Systems	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Electrical Power	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Communication	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
	Total	**9.76**	**0.00**	

Appendix A: County Listing for the Region

Middlesex,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut					
	Middlesex	3,994	649	181	831
Total Region		**3,994**	**649**	**181**	**831**

Hazus: Earthquake Global Risk Report

Region Name: Chester

Earthquake Scenario: Haddam

Print Date: October 15, 2019

Disclaimer:

This version of Hazus utilizes 2010 Census Data.

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

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

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General Description of the Region

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

The earthquake loss estimates provided in this report was based on a region that includes 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 16.82 square miles and contains 1 census tracts. There are over 1 thousand households in the region which has a total population of 3,994 people (2010 Census Bureau data). The distribution of population by Total Region and County is provided in Appendix B.

There are an estimated 1 thousand buildings in the region with a total building replacement value (excluding contents) of 831 (millions of dollars). Approximately 89.00 % 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 582 and 9 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

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

In terms of building construction types found in the region, wood frame construction makes up 85% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

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

For essential facilities, there are 0 hospitals in the region with a total bed capacity of beds. There are 2 schools, 1 fire stations, 1 police stations and 1 emergency operation facilities. With respect to high potential loss facilities (HPL), there are no dams identified within the inventory. The inventory also includes 2 hazardous material sites, no military installations and no nuclear power plants.

Transportation and Utility Lifeline Inventory

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

The total value of the lifeline inventory is over 591.00 (millions of dollars). This inventory includes over 47.22 miles of highways, 15 bridges, 303.23 miles of pipes.

Table 1: Transportation System Lifeline Inventory

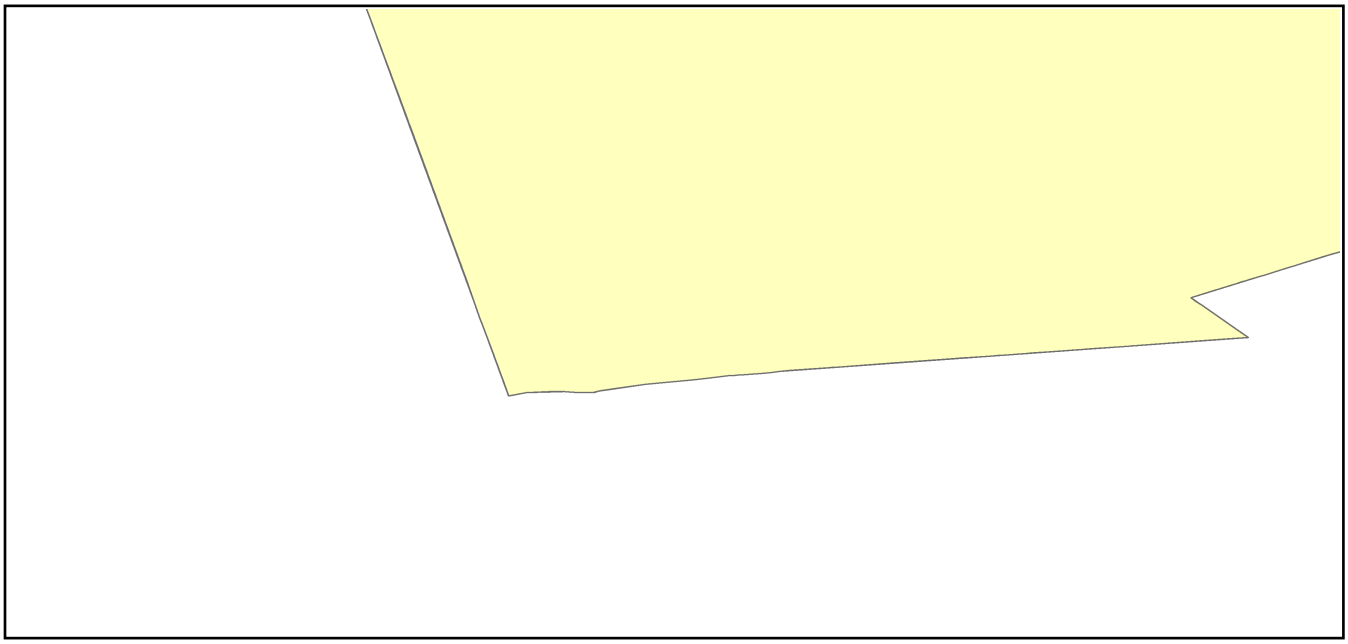
System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	15	104.8172
	Segments	14	420.1513
	Tunnels	0	0.0000
		Subtotal	**524.9685**
Railways	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	1	5.9474
	Tunnels	0	0.0000
		Subtotal	**5.9474**
Light Rail	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	0	0.0000
	Tunnels	0	0.0000
		Subtotal	**0.0000**
Bus	Facilities	0	0.0000
		Subtotal	**0.0000**
Ferry	Facilities	1	1.3310
		Subtotal	**1.3310**
Port	Facilities	1	1.9970
		Subtotal	**1.9970**
Airport	Facilities	1	10.6510
	Runways	1	37.9640
		Subtotal	**48.6150**
		Total	**582.90**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	4.8820
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**4.8820**
Waste Water	Distribution Lines	NA	2.9292
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**2.9292**
Natural Gas	Distribution Lines	NA	1.9528
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**1.9528**
Oil Systems	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**0.0000**
Electrical Power	Facilities	0	0.0000
		Subtotal	**0.0000**
Communication	Facilities	0	0.0000
		Subtotal	**0.0000**
		Total	**9.80**

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	Haddam
Type of Earthquake	Arbitrary
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	-72.50
Latitude of Epicenter	41.50
Earthquake Magnitude	5.70
Depth (km)	10.00
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	Central & East US (CEUS 2008)

Direct Earthquake Damage

Building Damage

Hazus estimates that about 791 buildings will be at least moderately damaged. This is over 43.00 % of the buildings in the region. There are an estimated 151 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Damage Categories by General Occupancy Type

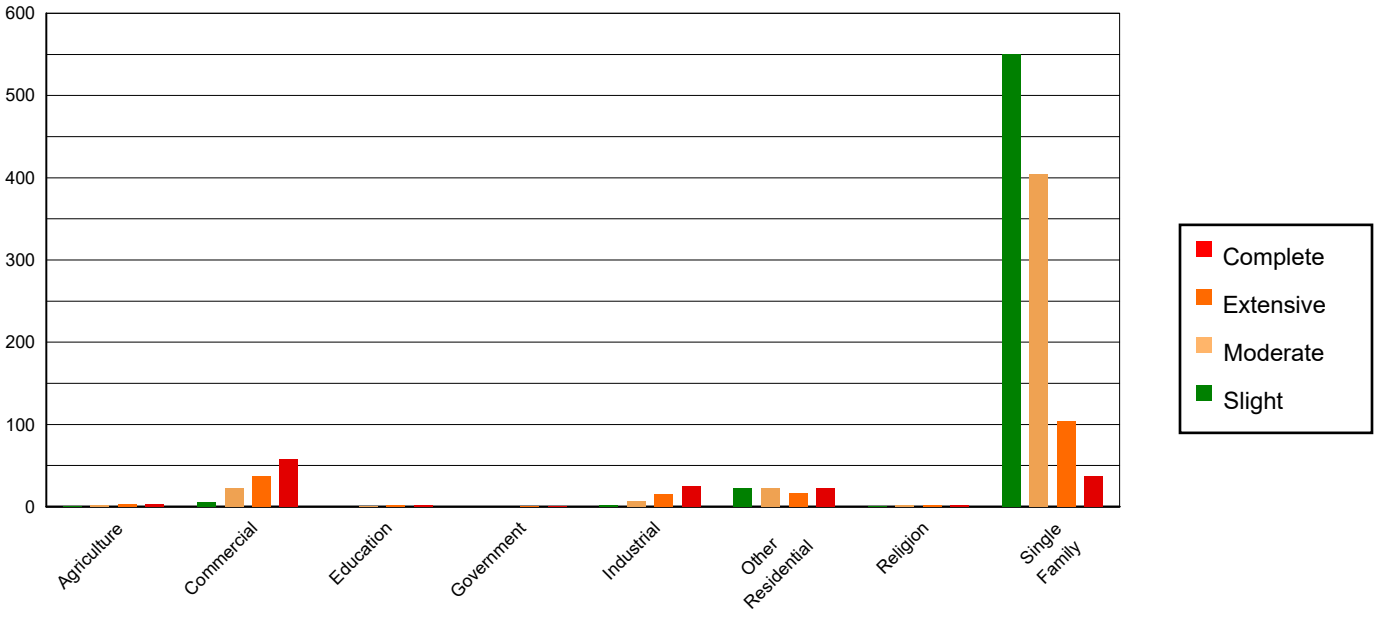


Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	0.13	0.03	0.46	0.08	2.08	0.45	2.72	1.52	3.60	2.37
Commercial	1.80	0.39	5.15	0.89	22.44	4.87	37.19	20.79	57.41	37.84
Education	0.08	0.02	0.20	0.03	0.85	0.18	1.54	0.86	2.34	1.54
Government	0.01	0.00	0.03	0.01	0.14	0.03	0.30	0.17	0.51	0.34
Industrial	0.60	0.13	1.50	0.26	7.12	1.54	14.67	8.20	25.11	16.55
Other Residential	17.35	3.78	22.67	3.90	22.41	4.86	16.80	9.39	22.76	15.00
Religion	0.95	0.21	1.30	0.22	1.61	0.35	1.63	0.91	2.51	1.65
Single Family	438.69	95.45	550.46	94.62	404.38	87.71	103.98	58.14	37.49	24.71
Total	**460**		**582**		**461**		**179**		**152**	

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

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	455.17	99.03	570.53	98.07	420.00	91.10	103.03	57.61	18.40	12.13
Steel	0.78	0.17	1.58	0.27	10.12	2.20	28.68	16.03	52.31	34.48
Concrete	0.15	0.03	0.31	0.05	2.09	0.45	5.68	3.17	10.29	6.78
Precast	0.07	0.02	0.12	0.02	0.82	0.18	1.95	1.09	4.68	3.09
RM	0.57	0.12	0.72	0.12	3.86	0.84	7.72	4.32	11.23	7.40
URM	2.87	0.62	8.52	1.46	24.14	5.24	31.79	17.78	54.82	36.13
MH	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**460**		**582**		**461**		**179**		**152**	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had hospital beds available for use. On the day of the earthquake, the model estimates that only hospital beds (%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, % of the beds will be back in service. By 30 days, % 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	0	0	0	0
Schools	2	2	0	0
EOCs	1	1	1	0
PoliceStations	1	1	1	0
FireStations	1	1	0	0

Transportation Lifeline Damage

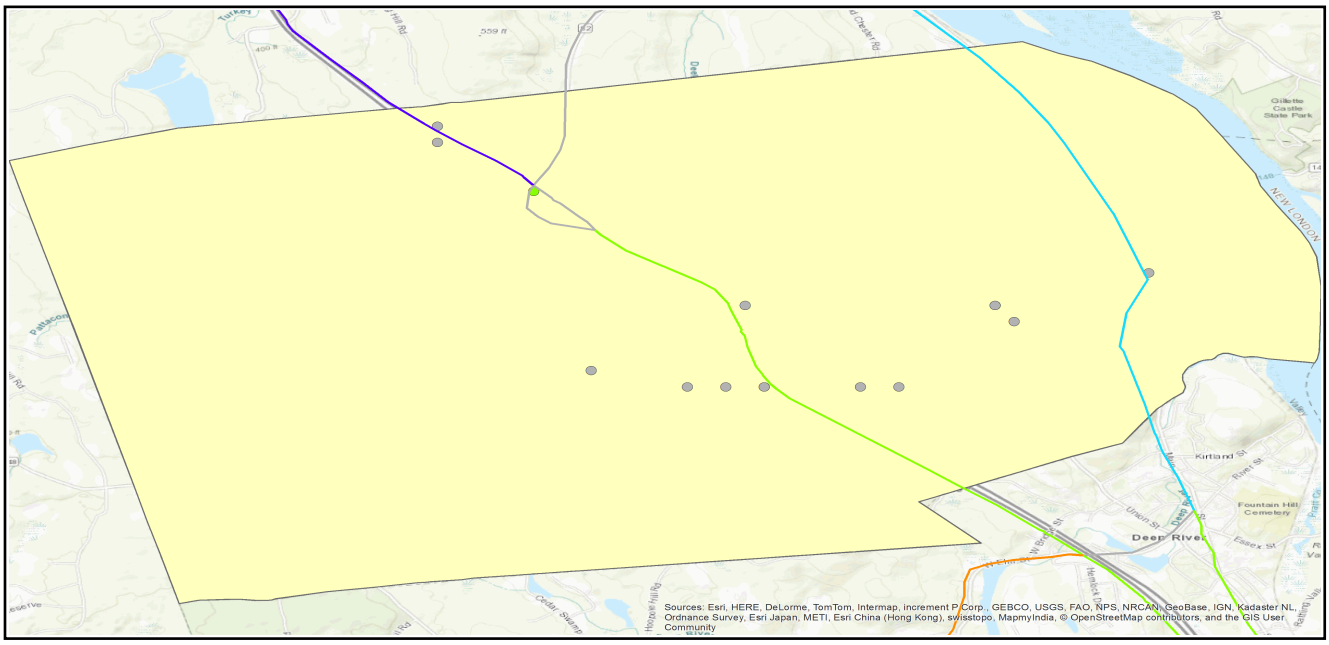


Table 6: Expected Damage to the Transportation Systems

System	Component		Number of Locations			
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 % After Day 1	With Functionality > 50 % After Day 7
Highway	Segments	14	0	0	10	10
	Bridges	15	4	2	11	11
	Tunnels	0	0	0	0	0
Railways	Segments	1	0	0	1	1
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
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	0	0	0	0	0
Ferry	Facilities	1	1	0	0	1
Port	Facilities	1	1	0	0	1
Airport	Facilities	1	1	0	1	1
	Runways	1	0	0	1	1

Table 6 provides damage estimates for the transportation system.

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

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

Table 7 : Expected Utility System Facility Damage

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

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

System	Total Pipelines Length (miles)	Number of Leaks	Number of Breaks
Potable Water	152	0	0
Waste Water	91	0	0
Natural Gas	61	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

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

Induced Earthquake Damage

Fire Following Earthquake

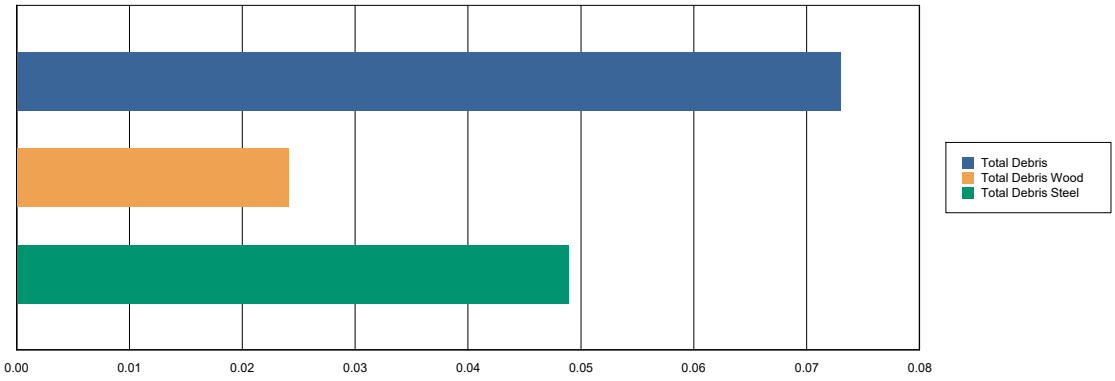
Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there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

Debris Generation

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

The model estimates that a total of 73,000 tons of debris will be generated. Of the total amount, Brick/Wood comprises 33.00% 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 2,920 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Earthquake Debris (millions of tons)



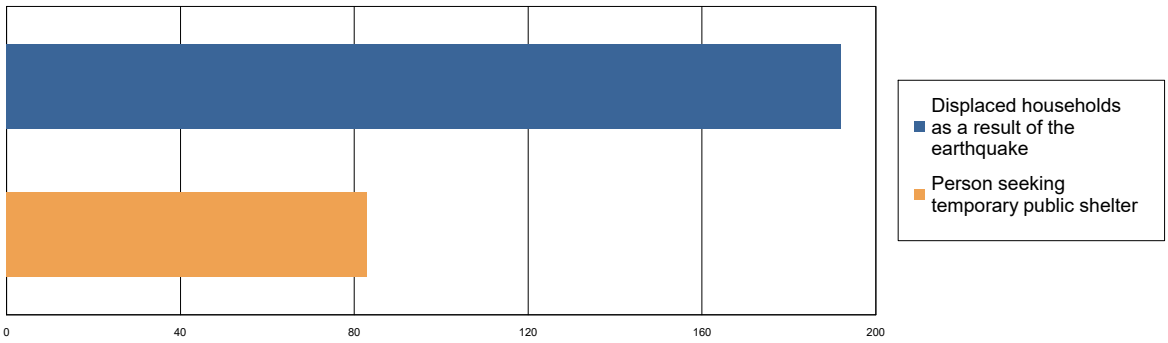
Brick/ Wood	Reinforced Concrete/Steel	Total Debris	Truck Load
0.02	0.05	0.07	2,920 (@25 tons/truck)

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 192 households to be displaced due to the earthquake. Of these, 83 people (out of a total population of 3,994) will seek temporary shelter in public shelters.

Displaced Households/ Persons Seeking Short Term Public Shelter



Displaced households as a result of the earthquake	Persons seeking temporary public shelter
192	83

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	1.31	0.40	0.06	0.12
	Commuting	0.01	0.01	0.01	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	2.94	0.91	0.15	0.29
	Other-Residential	25.75	8.16	1.38	2.74
	Single Family	13.66	3.27	0.43	0.84
	Total	**44**	**13**	**2**	**4**
2 PM	Commercial	75.37	22.90	3.60	7.04
	Commuting	0.05	0.06	0.11	0.02
	Educational	27.10	8.47	1.40	2.74
	Hotels	0.00	0.00	0.00	0.00
	Industrial	21.77	6.75	1.08	2.11
	Other-Residential	5.38	1.71	0.29	0.56
	Single Family	2.88	0.71	0.10	0.18
	Total	**133**	**41**	**7**	**13**
5 PM	Commercial	53.29	16.22	2.57	4.95
	Commuting	0.92	1.14	2.03	0.39
	Educational	2.81	0.88	0.15	0.28
	Hotels	0.00	0.00	0.00	0.00
	Industrial	13.61	4.22	0.68	1.32
	Other-Residential	10.21	3.25	0.56	1.07
	Single Family	5.46	1.35	0.19	0.35
	Total	**86**	**27**	**6**	**8**

Economic Loss

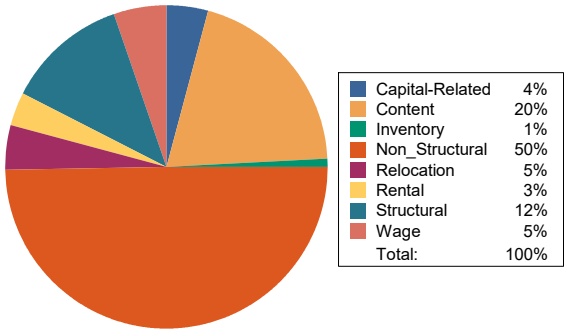
The total economic loss estimated for the earthquake is 363.96 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

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 328.13 (millions of dollars); 17 % 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 49 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type ($ millions)



Earthquake Losses by Occupancy Type ($ millions)

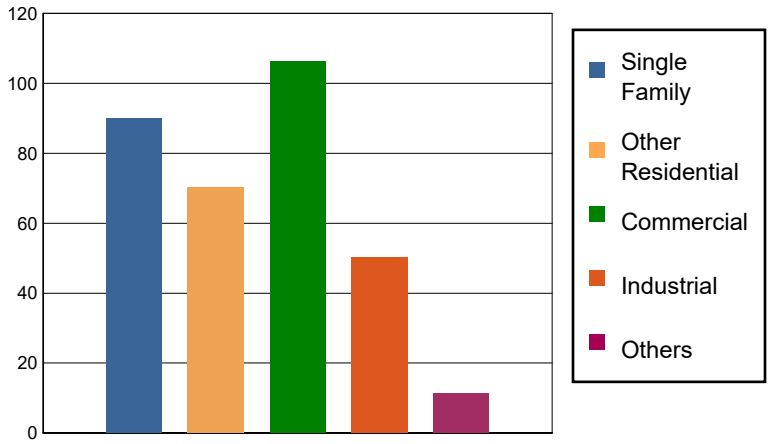


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.0000	9.1206	7.0790	0.7822	0.1763	17.1581
	Capital-Related	0.0000	3.8668	9.4550	0.4643	0.0826	13.8687
	Rental	1.3519	4.4399	4.9846	0.2504	0.0964	11.1232
	Relocation	4.8013	1.1824	6.7583	1.0609	1.0104	14.8133
	Subtotal	**6.1532**	**18.6097**	**28.2769**	**2.5578**	**1.3657**	**56.9633**
Capital Stock Losses							
	Structural	11.3790	7.6646	12.8405	5.9209	2.1045	39.9095
	Non_Structural	53.1787	35.8569	45.2877	23.6578	5.2934	163.2745
	Content	19.2195	8.1799	19.8276	15.4150	2.5331	65.1751
	Inventory	0.0000	0.0000	0.1716	2.5662	0.0661	2.8039
	Subtotal	**83.7772**	**51.7014**	**78.1274**	**47.5599**	**9.9971**	**271.1630**
	Total	**89.93**	**70.31**	**106.40**	**50.12**	**11.36**	**328.13**

Transportation and Utility Lifeline Losses

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

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

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	420.1513	0.0000	0.00
	Bridges	104.8172	29.7264	28.36
	Tunnels	0.0000	0.0000	0.00
	Subtotal	**524.9685**	**29.7264**	
Railways	Segments	5.9474	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**5.9474**	**0.0000**	
Light Rail	Segments	0.0000	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Bus	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Ferry	Facilities	1.3310	0.6578	49.42
	Subtotal	**1.3310**	**0.6578**	
Port	Facilities	1.9970	0.9869	49.42
	Subtotal	**1.9970**	**0.9869**	
Airport	Facilities	10.6510	4.4598	41.87
	Runways	37.9640	0.0000	0.00
	Subtotal	**48.6150**	**4.4598**	
	Total	**582.86**	**35.83**	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	4.8820	0.0000	0.00
	Subtotal	**4.8820**	**0.0000**	
Waste Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	2.9292	0.0000	0.00
	Subtotal	**2.9292**	**0.0000**	
Natural Gas	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	1.9528	0.0000	0.00
	Subtotal	**1.9528**	**0.0000**	
Oil Systems	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Electrical Power	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Communication	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
	Total	**9.76**	**0.00**	

Appendix A: County Listing for the Region

Middlesex,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut					
	Middlesex	3,994	649	181	831
Total Region		**3,994**	**649**	**181**	**831**

Hazus: Earthquake Global Risk Report

Region Name: Chester

Earthquake Scenario: Portland

Print Date: October 15, 2019

Disclaimer:

This version of Hazus utilizes 2010 Census Data.

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

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

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General Description of the Region

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

The earthquake loss estimates provided in this report was based on a region that includes 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 16.82 square miles and contains 1 census tracts. There are over 1 thousand households in the region which has a total population of 3,994 people (2010 Census Bureau data). The distribution of population by Total Region and County is provided in Appendix B.

There are an estimated 1 thousand buildings in the region with a total building replacement value (excluding contents) of 831 (millions of dollars). Approximately 89.00 % 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 582 and 9 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

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

In terms of building construction types found in the region, wood frame construction makes up 85% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

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

For essential facilities, there are 0 hospitals in the region with a total bed capacity of beds. There are 2 schools, 1 fire stations, 1 police stations and 1 emergency operation facilities. With respect to high potential loss facilities (HPL), there are no dams identified within the inventory. The inventory also includes 2 hazardous material sites, no military installations and no nuclear power plants.

Transportation and Utility Lifeline Inventory

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

The total value of the lifeline inventory is over 591.00 (millions of dollars). This inventory includes over 47.22 miles of highways, 15 bridges, 303.23 miles of pipes.

Table 1: Transportation System Lifeline Inventory

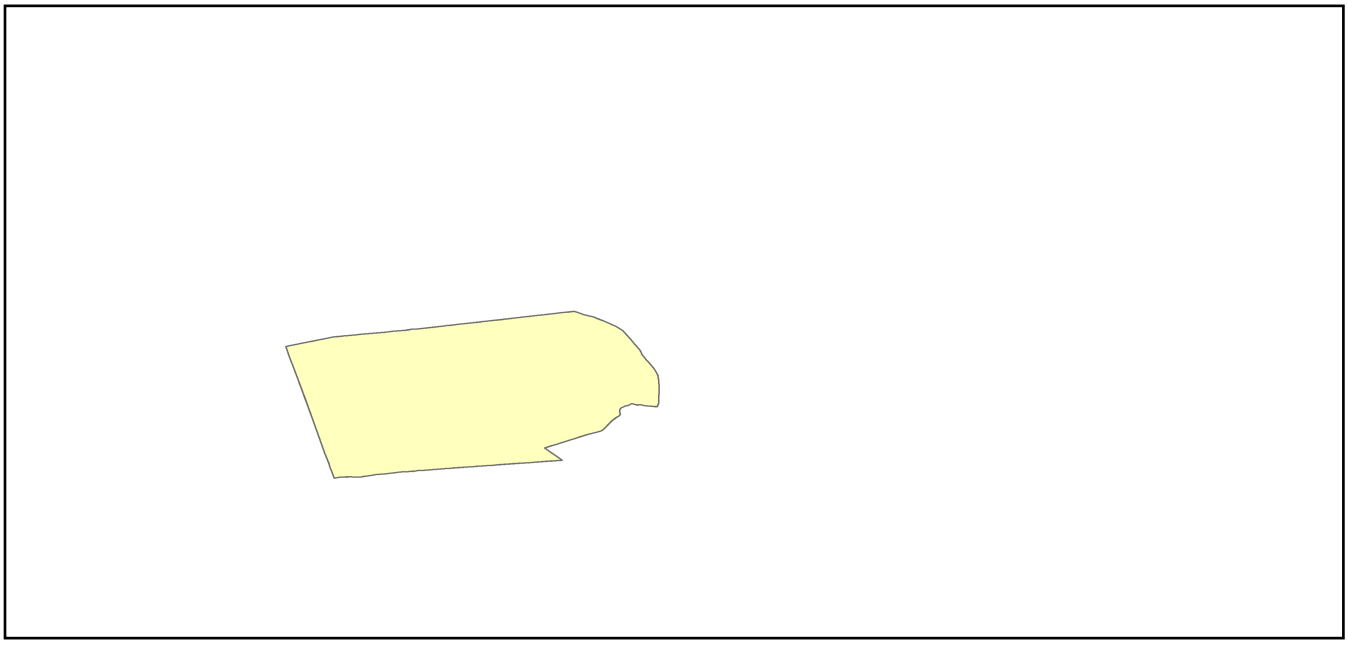
System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	15	104.8172
	Segments	14	420.1513
	Tunnels	0	0.0000
		Subtotal	**524.9685**
Railways	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	1	5.9474
	Tunnels	0	0.0000
		Subtotal	**5.9474**
Light Rail	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	0	0.0000
	Tunnels	0	0.0000
		Subtotal	**0.0000**
Bus	Facilities	0	0.0000
		Subtotal	**0.0000**
Ferry	Facilities	1	1.3310
		Subtotal	**1.3310**
Port	Facilities	1	1.9970
		Subtotal	**1.9970**
Airport	Facilities	1	10.6510
	Runways	1	37.9640
		Subtotal	**48.6150**
		Total	**582.90**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	4.8820
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**4.8820**
Waste Water	Distribution Lines	NA	2.9292
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**2.9292**
Natural Gas	Distribution Lines	NA	1.9528
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**1.9528**
Oil Systems	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**0.0000**
Electrical Power	Facilities	0	0.0000
		Subtotal	**0.0000**
Communication	Facilities	0	0.0000
		Subtotal	**0.0000**
		Total	**9.80**

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	Portland
Type of Earthquake	Arbitrary
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	-72.60
Latitude of Epicenter	41.60
Earthquake Magnitude	5.70
Depth (km)	10.00
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	Central & East US (CEUS 2008)

Direct Earthquake Damage

Building Damage

Hazus estimates that about 222 buildings will be at least moderately damaged. This is over 12.00 % of the buildings in the region. There are an estimated 10 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Damage Categories by General Occupancy Type

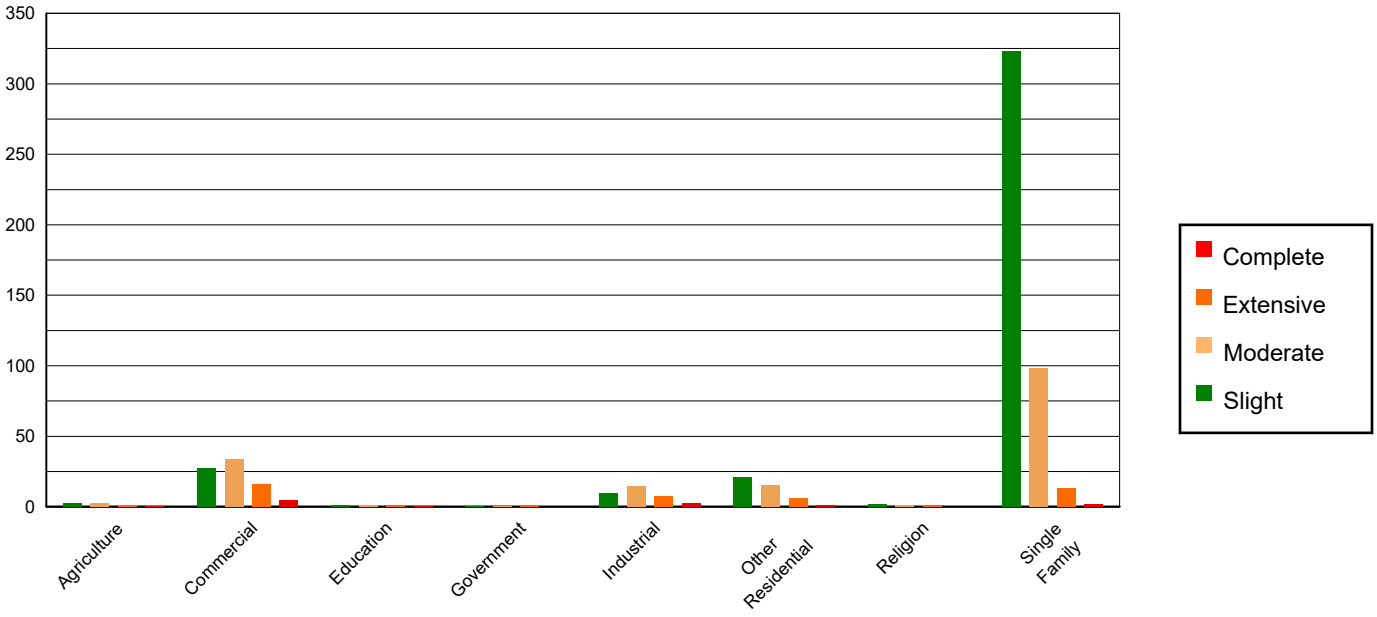


Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	3.05	0.25	2.32	0.60	2.38	1.42	0.98	2.18	0.28	2.70
Commercial	42.06	3.44	27.56	7.14	34.14	20.39	15.87	35.36	4.37	42.17
Education	1.73	0.14	1.07	0.28	1.40	0.84	0.63	1.40	0.17	1.64
Government	0.30	0.02	0.20	0.05	0.30	0.18	0.16	0.35	0.04	0.43
Industrial	14.60	1.19	9.67	2.50	14.66	8.76	7.83	17.45	2.23	21.54
Other Residential	59.01	4.82	20.83	5.39	14.95	8.93	5.88	13.09	1.33	12.88
Religion	4.19	0.34	1.64	0.43	1.42	0.85	0.61	1.35	0.14	1.34
Single Family	1099.18	89.79	322.91	83.61	98.18	58.64	12.93	28.81	1.79	17.31
Total	**1,224**		**386**		**167**		**45**		**10**	

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

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	1127.22	92.08	332.89	86.20	97.15	58.02	9.23	20.57	0.62	5.97
Steel	21.89	1.79	16.63	4.31	31.28	18.68	18.05	40.21	5.63	54.33
Concrete	4.47	0.36	3.25	0.84	6.43	3.84	3.43	7.64	0.93	8.99
Precast	2.37	0.19	1.15	0.30	2.21	1.32	1.63	3.62	0.29	2.79
RM	11.72	0.96	3.75	0.97	5.58	3.33	2.88	6.41	0.18	1.71
URM	56.45	4.61	28.53	7.39	24.78	14.80	9.67	21.54	2.72	26.21
MH	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**1,224**		**386**		**167**		**45**		**10**	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had hospital beds available for use. On the day of the earthquake, the model estimates that only hospital beds (%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, % of the beds will be back in service. By 30 days, % 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	0	0	0	0
Schools	2	0	0	0
EOCs	1	0	0	0
PoliceStations	1	0	0	0
FireStations	1	0	0	0

Transportation Lifeline Damage

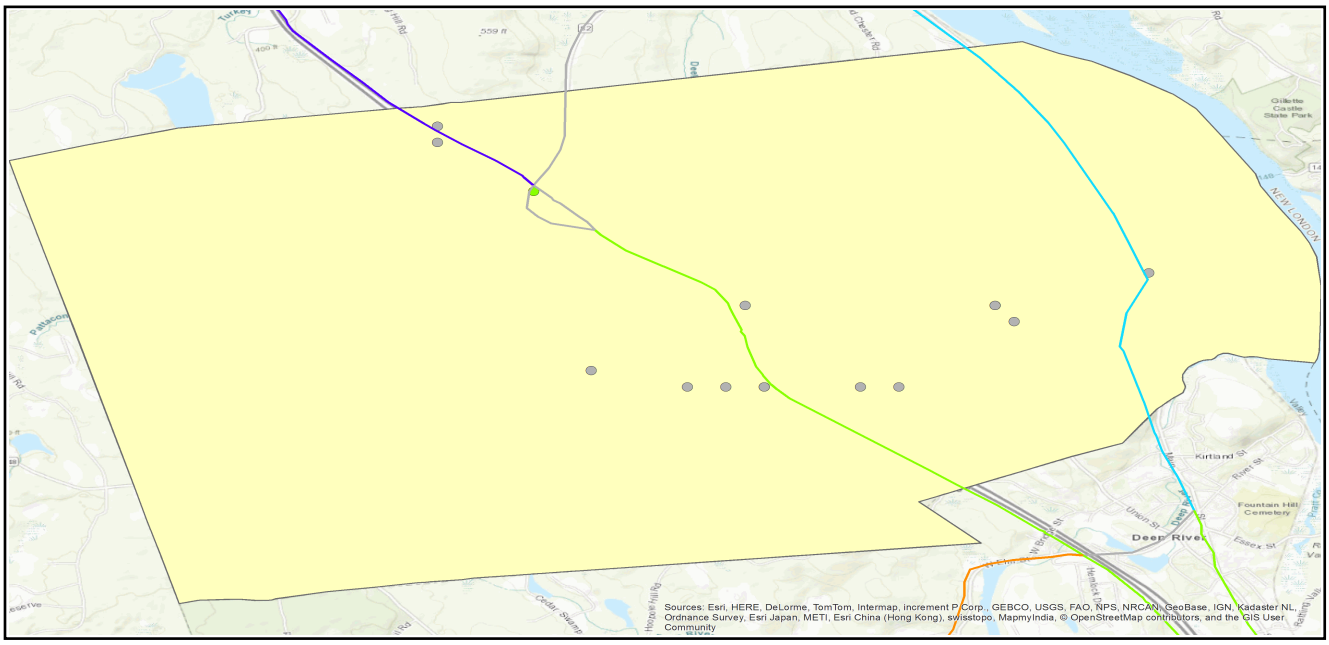


Table 6: Expected Damage to the Transportation Systems

System	Component		Number of Locations			
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 % After Day 1	With Functionality > 50 % After Day 7
Highway	Segments	14	0	0	10	10
	Bridges	15	0	0	15	15
	Tunnels	0	0	0	0	0
Railways	Segments	1	0	0	1	1
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
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	0	0	0	0	0
Ferry	Facilities	1	0	0	1	1
Port	Facilities	1	0	0	1	1
Airport	Facilities	1	0	0	1	1
	Runways	1	0	0	1	1

Table 6 provides damage estimates for the transportation system.

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

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

Table 7 : Expected Utility System Facility Damage

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

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

System	Total Pipelines Length (miles)	Number of Leaks	Number of Breaks
Potable Water	152	0	0
Waste Water	91	0	0
Natural Gas	61	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

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

Induced Earthquake Damage

Fire Following Earthquake

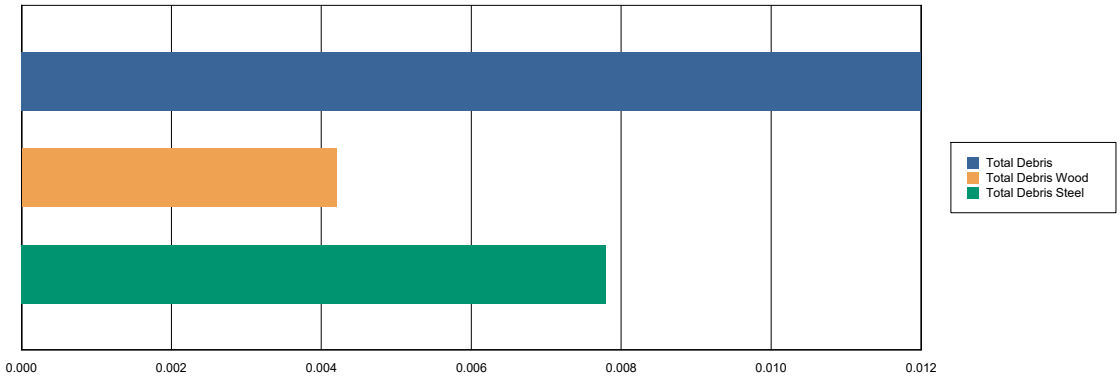
Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there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

Debris Generation

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

The model estimates that a total of 12,000 tons of debris will be generated. Of the total amount, Brick/Wood comprises 35.00% 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 480 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Earthquake Debris (millions of tons)



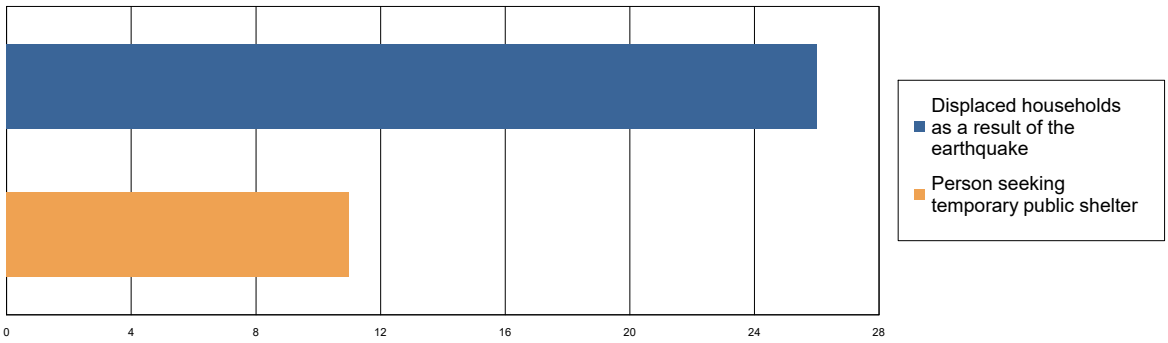
Brick/ Wood	Reinforced Concrete/Steel	Total Debris	Truck Load
0.00	0.01	0.01	480 (@25 tons/truck)

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 26 households to be displaced due to the earthquake. Of these, 11 people (out of a total population of 3,994) will seek temporary shelter in public shelters.

Displaced Households/ Persons Seeking Short Term Public Shelter



Displaced households as a result of the earthquake	Persons seeking temporary public shelter
26	11

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	0.14	0.03	0.00	0.01
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.37	0.09	0.01	0.02
	Other-Residential	2.49	0.58	0.08	0.16
	Single Family	1.58	0.23	0.02	0.04
	Total	**5**	**1**	**0**	**0**
2 PM	Commercial	8.08	1.83	0.23	0.45
	Commuting	0.01	0.01	0.01	0.00
	Educational	2.94	0.70	0.10	0.19
	Hotels	0.00	0.00	0.00	0.00
	Industrial	2.75	0.65	0.09	0.17
	Other-Residential	0.51	0.12	0.02	0.03
	Single Family	0.32	0.05	0.00	0.01
	Total	**15**	**3**	**0**	**1**
5 PM	Commercial	5.68	1.29	0.17	0.32
	Commuting	0.12	0.14	0.26	0.05
	Educational	0.31	0.07	0.01	0.02
	Hotels	0.00	0.00	0.00	0.00
	Industrial	1.72	0.40	0.05	0.10
	Other-Residential	0.98	0.23	0.03	0.06
	Single Family	0.61	0.09	0.01	0.02
	Total	**9**	**2**	**1**	**1**

Economic Loss

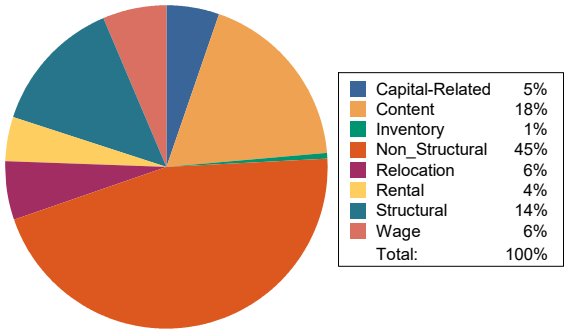
The total economic loss estimated for the earthquake is 66.26 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

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 58.19 (millions of dollars); 22 % 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 50 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type ($ millions)



Earthquake Losses by Occupancy Type ($ millions)

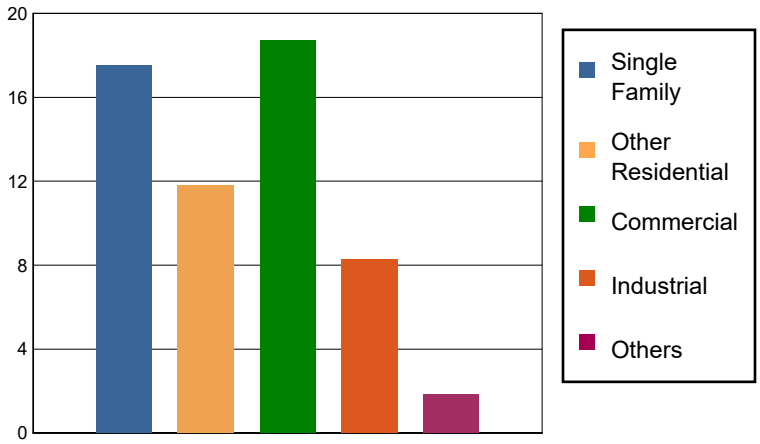


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.0000	1.7900	1.6899	0.2157	0.0393	3.7349
	Capital-Related	0.0000	0.7590	2.1262	0.1286	0.0166	3.0304
	Rental	0.2260	0.9779	1.2864	0.0769	0.0207	2.5879
	Relocation	0.7956	0.2878	1.7862	0.3734	0.2271	3.4701
	Subtotal	**1.0216**	**3.8147**	**6.8887**	**0.7946**	**0.3037**	**12.8233**
Capital Stock Losses							
	Structural	2.0024	1.5030	2.5733	1.4041	0.4106	7.8934
	Non_Structural	10.4057	5.2755	6.4948	3.4972	0.7536	26.4268
	Content	4.1021	1.2289	2.7272	2.2284	0.3545	10.6411
	Inventory	0.0000	0.0000	0.0243	0.3700	0.0096	0.4039
	Subtotal	**16.5102**	**8.0074**	**11.8196**	**7.4997**	**1.5283**	**45.3652**
	Total	**17.53**	**11.82**	**18.71**	**8.29**	**1.83**	**58.19**

Transportation and Utility Lifeline Losses

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

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

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	420.1513	0.0000	0.00
	Bridges	104.8172	5.8924	5.62
	Tunnels	0.0000	0.0000	0.00
	Subtotal	**524.9685**	**5.8924**	
Railways	Segments	5.9474	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**5.9474**	**0.0000**	
Light Rail	Segments	0.0000	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Bus	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Ferry	Facilities	1.3310	0.2162	16.24
	Subtotal	**1.3310**	**0.2162**	
Port	Facilities	1.9970	0.3244	16.24
	Subtotal	**1.9970**	**0.3244**	
Airport	Facilities	10.6510	1.6387	15.39
	Runways	37.9640	0.0000	0.00
	Subtotal	**48.6150**	**1.6387**	
	Total	**582.86**	**8.07**	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	4.8820	0.0000	0.00
	Subtotal	**4.8820**	**0.0000**	
Waste Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	2.9292	0.0000	0.00
	Subtotal	**2.9292**	**0.0000**	
Natural Gas	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	1.9528	0.0000	0.00
	Subtotal	**1.9528**	**0.0000**	
Oil Systems	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Electrical Power	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Communication	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
	Total	**9.76**	**0.00**	

Appendix A: County Listing for the Region

Middlesex,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut					
	Middlesex	3,994	649	181	831
Total Region		**3,994**	**649**	**181**	**831**

Hazus: Earthquake Global Risk Report

Region Name: Chester

Earthquake Scenario: Stamford

Print Date: October 15, 2019

Disclaimer:

This version of Hazus utilizes 2010 Census Data.

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

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

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General Description of the Region

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

The earthquake loss estimates provided in this report was based on a region that includes 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 16.82 square miles and contains 1 census tracts. There are over 1 thousand households in the region which has a total population of 3,994 people (2010 Census Bureau data). The distribution of population by Total Region and County is provided in Appendix B.

There are an estimated 1 thousand buildings in the region with a total building replacement value (excluding contents) of 831 (millions of dollars). Approximately 89.00 % 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 582 and 9 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

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

In terms of building construction types found in the region, wood frame construction makes up 85% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

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

For essential facilities, there are 0 hospitals in the region with a total bed capacity of beds. There are 2 schools, 1 fire stations, 1 police stations and 1 emergency operation facilities. With respect to high potential loss facilities (HPL), there are no dams identified within the inventory. The inventory also includes 2 hazardous material sites, no military installations and no nuclear power plants.

Transportation and Utility Lifeline Inventory

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

The total value of the lifeline inventory is over 591.00 (millions of dollars). This inventory includes over 47.22 miles of highways, 15 bridges, 303.23 miles of pipes.

Table 1: Transportation System Lifeline Inventory

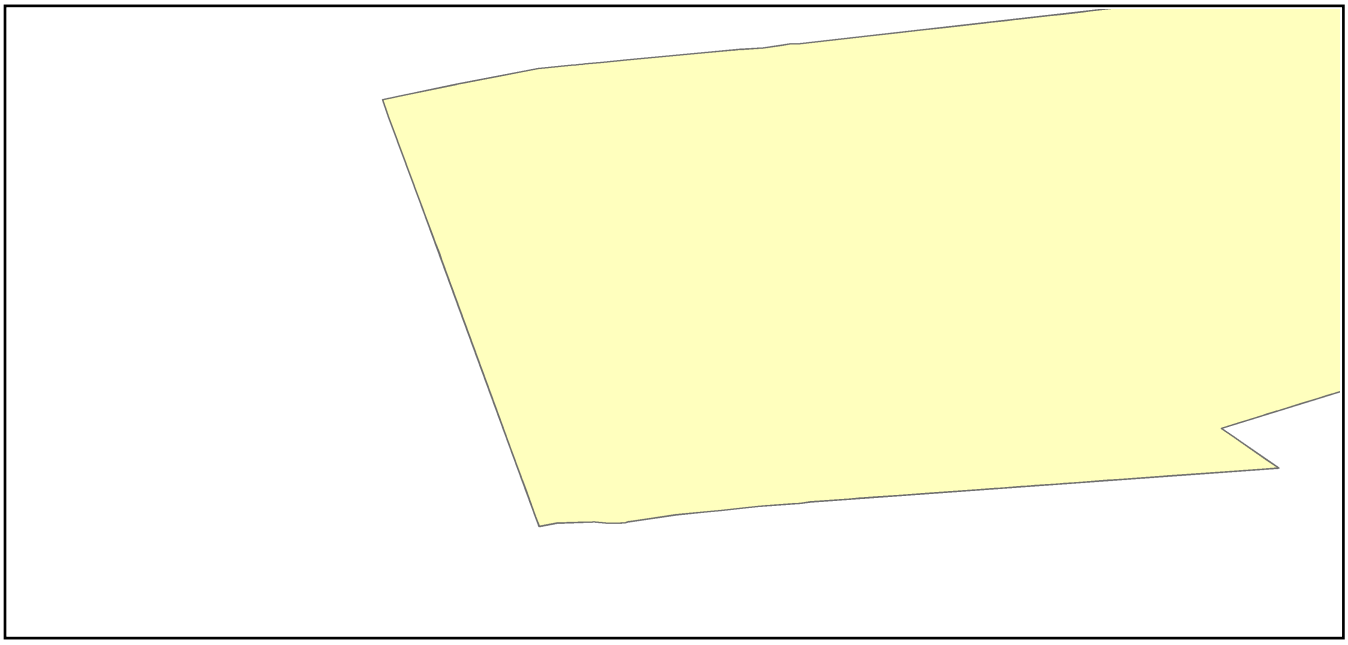
System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	15	104.8172
	Segments	14	420.1513
	Tunnels	0	0.0000
		Subtotal	**524.9685**
Railways	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	1	5.9474
	Tunnels	0	0.0000
		Subtotal	**5.9474**
Light Rail	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	0	0.0000
	Tunnels	0	0.0000
		Subtotal	**0.0000**
Bus	Facilities	0	0.0000
		Subtotal	**0.0000**
Ferry	Facilities	1	1.3310
		Subtotal	**1.3310**
Port	Facilities	1	1.9970
		Subtotal	**1.9970**
Airport	Facilities	1	10.6510
	Runways	1	37.9640
		Subtotal	**48.6150**
		Total	**582.90**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	4.8820
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**4.8820**
Waste Water	Distribution Lines	NA	2.9292
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**2.9292**
Natural Gas	Distribution Lines	NA	1.9528
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**1.9528**
Oil Systems	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**0.0000**
Electrical Power	Facilities	0	0.0000
		Subtotal	**0.0000**
Communication	Facilities	0	0.0000
		Subtotal	**0.0000**
		Total	**9.80**

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	Stamford
Type of Earthquake	Arbitrary
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	-73.56
Latitude of Epicenter	41.11
Earthquake Magnitude	5.70
Depth (km)	10.00
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	Central & East US (CEUS 2008)

Direct Earthquake Damage

Building Damage

Hazus estimates that about 8 buildings will be at least moderately damaged. This is over 0.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Damage Categories by General Occupancy Type

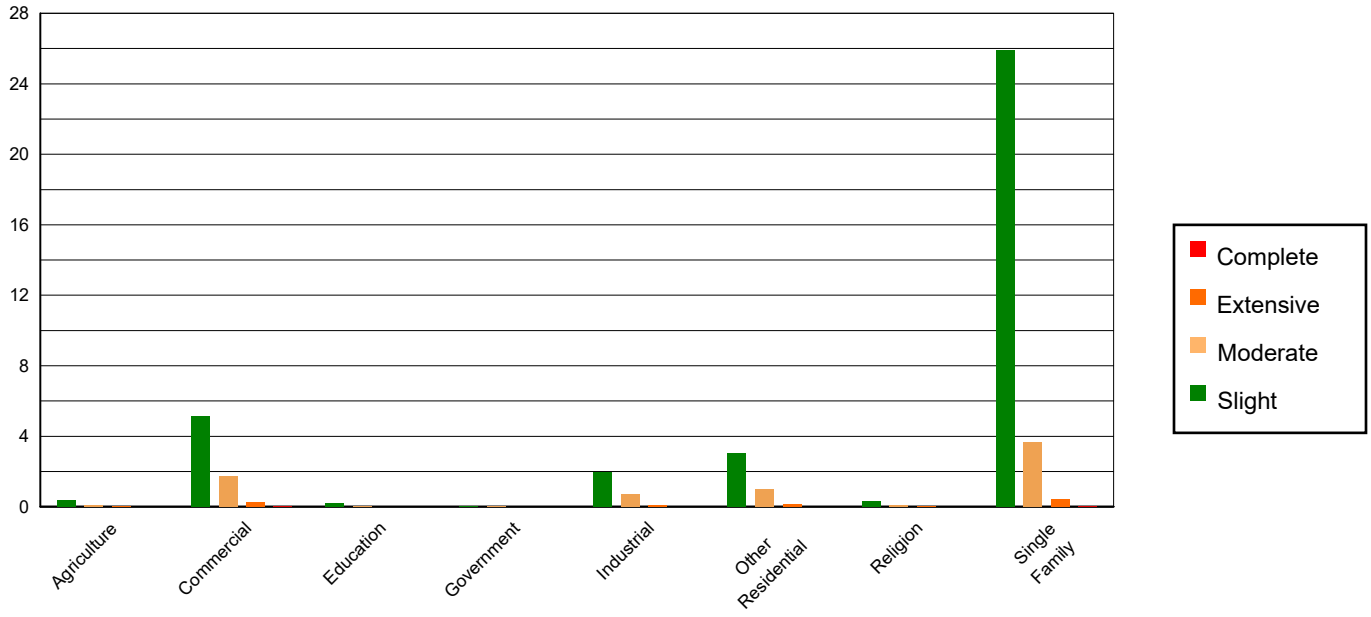


Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	8.53	0.48	0.36	0.97	0.10	1.39	0.01	1.45	0.00	0.98
Commercial	116.84	6.54	5.15	13.95	1.77	23.89	0.23	25.07	0.02	24.02
Education	4.73	0.26	0.19	0.52	0.06	0.88	0.01	0.86	0.00	0.99
Government	0.95	0.05	0.04	0.10	0.01	0.17	0.00	0.15	0.00	0.13
Industrial	46.29	2.59	1.94	5.25	0.69	9.27	0.08	8.99	0.00	7.03
Other Residential	97.82	5.47	3.04	8.25	0.99	13.40	0.14	14.89	0.01	17.10
Religion	7.56	0.42	0.31	0.83	0.12	1.56	0.02	1.85	0.00	2.27
Single Family	1504.99	84.19	25.89	70.13	3.66	49.43	0.43	46.75	0.03	47.48
Total	**1,788**		**37**		**7**		**1**		**0**	

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

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	1541.19	86.21	23.73	64.28	2.05	27.73	0.15	16.58	0.00	0.00
Steel	88.98	4.98	3.31	8.98	1.08	14.57	0.10	10.73	0.00	3.39
Concrete	17.71	0.99	0.61	1.66	0.18	2.44	0.01	0.91	0.00	0.00
Precast	7.03	0.39	0.36	0.97	0.22	3.04	0.04	4.34	0.00	0.80
RM	22.96	1.28	0.72	1.96	0.37	4.96	0.05	5.45	0.00	0.00
URM	109.83	6.14	8.18	22.16	3.49	47.25	0.57	61.99	0.06	95.81
MH	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**1,788**		**37**		**7**		**1**		**0**	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had hospital beds available for use. On the day of the earthquake, the model estimates that only hospital beds (%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, % of the beds will be back in service. By 30 days, % 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	0	0	0	0
Schools	2	0	0	2
EOCs	1	0	0	1
PoliceStations	1	0	0	1
FireStations	1	0	0	1

Transportation Lifeline Damage

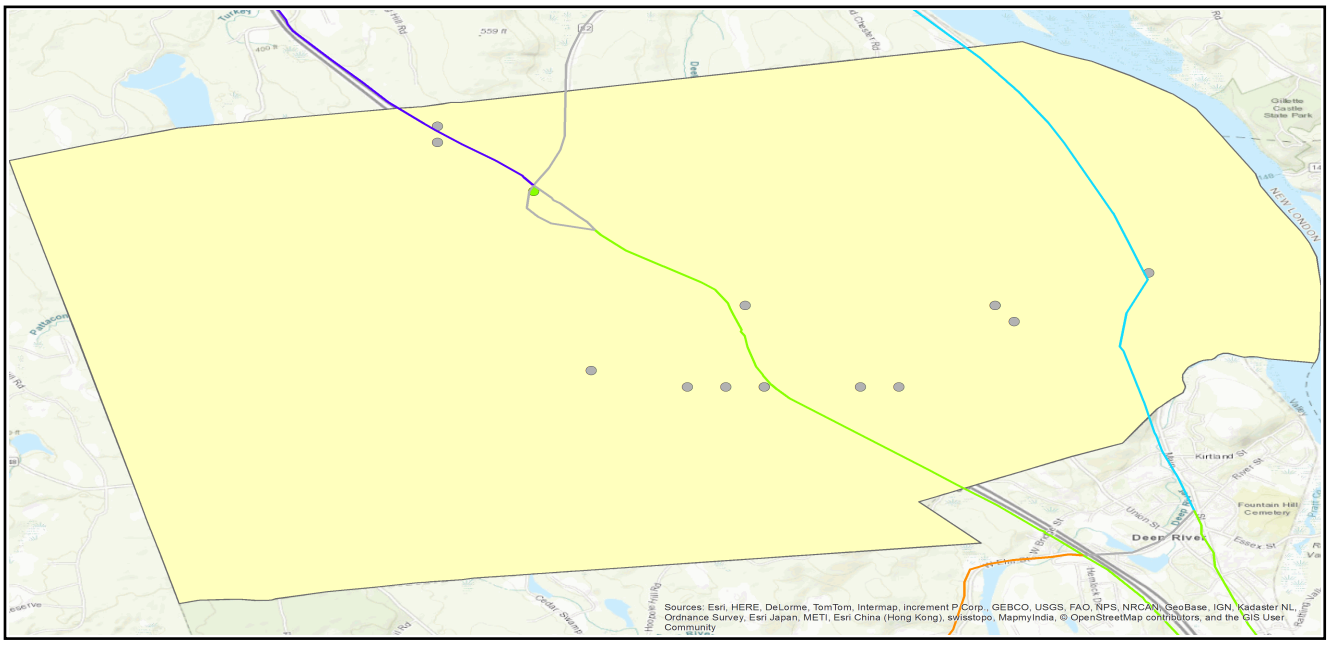


Table 6: Expected Damage to the Transportation Systems

System	Component		Number of Locations			
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 % After Day 1	With Functionality > 50 % After Day 7
Highway	Segments	14	0	0	10	10
	Bridges	15	0	0	15	15
	Tunnels	0	0	0	0	0
Railways	Segments	1	0	0	1	1
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
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	0	0	0	0	0
Ferry	Facilities	1	0	0	1	1
Port	Facilities	1	0	0	1	1
Airport	Facilities	1	0	0	1	1
	Runways	1	0	0	1	1

Table 6 provides damage estimates for the transportation system.

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

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

Table 7 : Expected Utility System Facility Damage

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

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

System	Total Pipelines Length (miles)	Number of Leaks	Number of Breaks
Potable Water	152	0	0
Waste Water	91	0	0
Natural Gas	61	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

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

Induced Earthquake Damage

Fire Following Earthquake

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

Debris Generation

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

The model estimates that a total of 0 tons of debris will be generated. Of the total amount, Brick/Wood comprises 70.00% 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 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Earthquake Debris (millions of tons)

Brick/ Wood	Reinforced Concrete/Steel	Total Debris	Truck Load
0.00	0.00	0.00	0 (@25 tons/truck)

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 3,994) will seek temporary shelter in public shelters.

Displaced Households/ Persons Seeking Short Term Public Shelter

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

Casualties

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

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

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

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

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0.00	0.00	0.00	0.00
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.01	0.00	0.00	0.00
	Other-Residential	0.07	0.01	0.00	0.00
	Single Family	0.07	0.01	0.00	0.00
	Total	**0**	**0**	**0**	**0**
2 PM	Commercial	0.18	0.02	0.00	0.00
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.06	0.01	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.04	0.00	0.00	0.00
	Other-Residential	0.02	0.00	0.00	0.00
	Single Family	0.01	0.00	0.00	0.00
	Total	**0**	**0**	**0**	**0**
5 PM	Commercial	0.12	0.02	0.00	0.00
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.01	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.03	0.00	0.00	0.00
	Other-Residential	0.03	0.00	0.00	0.00
	Single Family	0.03	0.00	0.00	0.00
	Total	**0**	**0**	**0**	**0**

Economic Loss

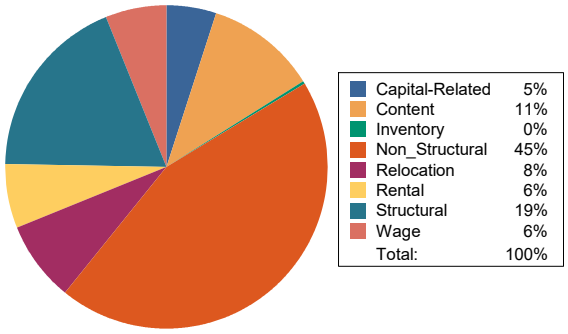
The total economic loss estimated for the earthquake is 1.55 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

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 1.34 (millions of dollars); 25 % 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.

Earthquake Losses by Loss Type ($ millions)



Earthquake Losses by Occupancy Type ($ millions)

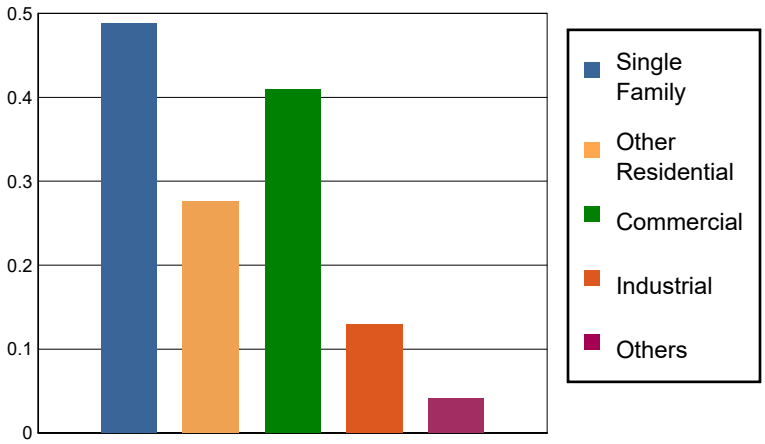


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.0000	0.0326	0.0424	0.0043	0.0014	0.0807
	Capital-Related	0.0000	0.0138	0.0515	0.0026	0.0005	0.0684
	Rental	0.0087	0.0311	0.0431	0.0019	0.0006	0.0854
	Relocation	0.0279	0.0127	0.0495	0.0097	0.0070	0.1068
	Subtotal	**0.0366**	**0.0902**	**0.1865**	**0.0185**	**0.0095**	**0.3413**
Capital Stock Losses							
	Structural	0.0936	0.0498	0.0685	0.0296	0.0114	0.2529
	Non_Structural	0.3017	0.1176	0.1160	0.0485	0.0149	0.5987
	Content	0.0564	0.0179	0.0386	0.0285	0.0051	0.1465
	Inventory	0.0000	0.0000	0.0003	0.0047	0.0001	0.0051
	Subtotal	**0.4517**	**0.1853**	**0.2234**	**0.1113**	**0.0315**	**1.0032**
	Total	**0.49**	**0.28**	**0.41**	**0.13**	**0.04**	**1.34**

Transportation and Utility Lifeline Losses

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

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

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	420.1513	0.0000	0.00
	Bridges	104.8172	0.0580	0.06
	Tunnels	0.0000	0.0000	0.00
	Subtotal	**524.9685**	**0.0580**	
Railways	Segments	5.9474	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**5.9474**	**0.0000**	
Light Rail	Segments	0.0000	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Bus	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Ferry	Facilities	1.3310	0.0123	0.92
	Subtotal	**1.3310**	**0.0123**	
Port	Facilities	1.9970	0.0184	0.92
	Subtotal	**1.9970**	**0.0184**	
Airport	Facilities	10.6510	0.1103	1.04
	Runways	37.9640	0.0000	0.00
	Subtotal	**48.6150**	**0.1103**	
	Total	**582.86**	**0.20**	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	4.8820	0.0000	0.00
	Subtotal	**4.8820**	**0.0000**	
Waste Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	2.9292	0.0000	0.00
	Subtotal	**2.9292**	**0.0000**	
Natural Gas	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	1.9528	0.0000	0.00
	Subtotal	**1.9528**	**0.0000**	
Oil Systems	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Electrical Power	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Communication	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
	Total	**9.76**	**0.00**	

Appendix A: County Listing for the Region

Middlesex,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut					
	Middlesex	3,994	649	181	831
Total Region		**3,994**	**649**	**181**	**831**

Hazus: Earthquake Global Risk Report

Region Name: Chester

Earthquake Scenario: Annualized

Print Date: October 16, 2019

Disclaimer:

This version of Hazus utilizes 2010 Census Data.

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

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

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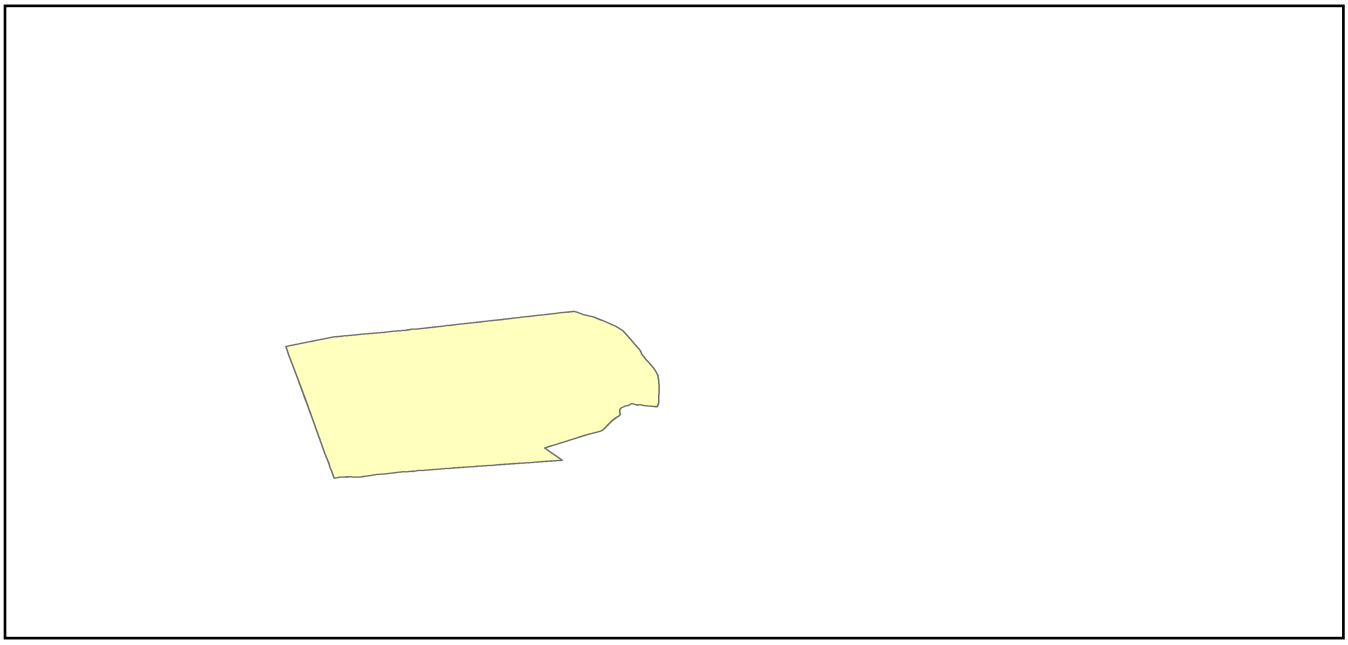
System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	15	104.8172
	Segments	14	420.1513
	Tunnels	0	0.0000
		Subtotal	**524.9685**
Railways	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	1	5.9474
	Tunnels	0	0.0000
		Subtotal	**5.9474**
Light Rail	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	0	0.0000
	Tunnels	0	0.0000
		Subtotal	**0.0000**
Bus	Facilities	0	0.0000
		Subtotal	**0.0000**
Ferry	Facilities	1	1.3310
		Subtotal	**1.3310**
Port	Facilities	1	1.9970
		Subtotal	**1.9970**
Airport	Facilities	1	10.6510
	Runways	1	37.9640
		Subtotal	**48.6150**
		Total	**582.90**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	4.8820
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**4.8820**
Waste Water	Distribution Lines	NA	2.9292
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**2.9292**
Natural Gas	Distribution Lines	NA	1.9528
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**1.9528**
Oil Systems	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**0.0000**
Electrical Power	Facilities	0	0.0000
		Subtotal	**0.0000**
Communication	Facilities	0	0.0000
		Subtotal	**0.0000**
		Total	**9.80**

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	Annualized
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	Annualized
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	NA
Depth (km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Direct Earthquake Damage

Building Damage

Hazus estimates that about 119 buildings will be at least moderately damaged. This is over 6.00 % of the buildings in the region. There are an estimated 1 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Damage Categories by General Occupancy Type

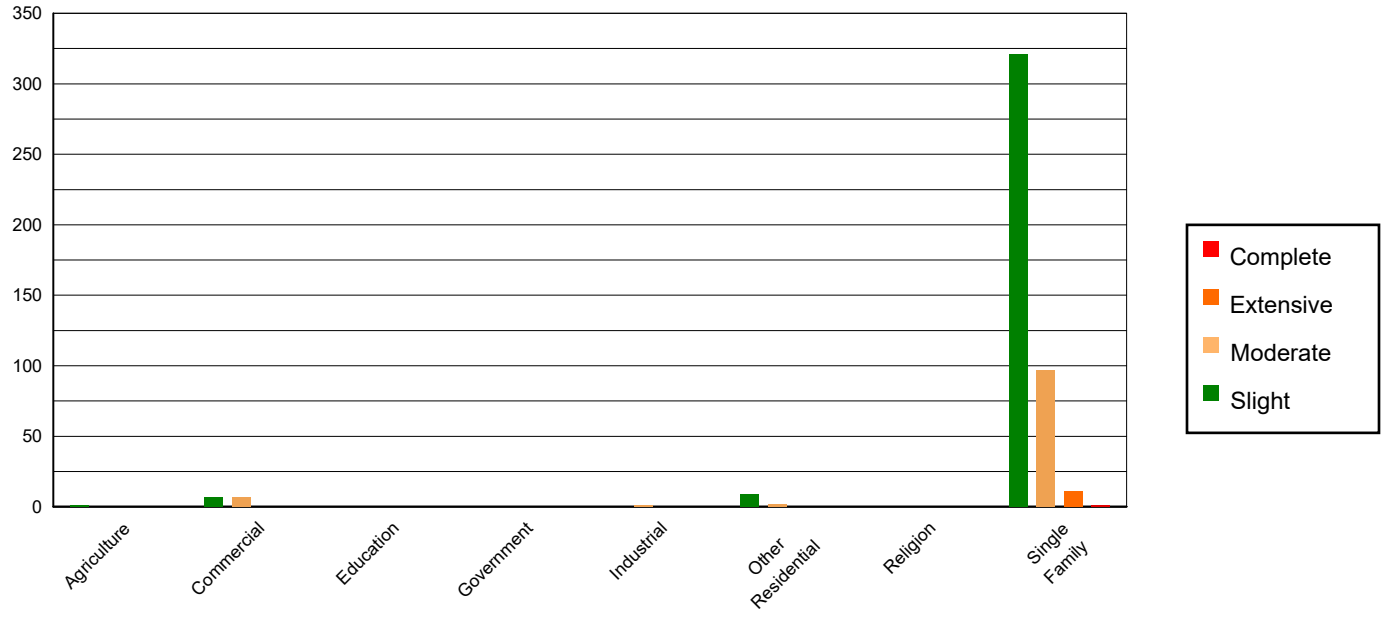


Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	1.00	0.09	1.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00
Commercial	11.00	0.95	7.00	2.07	7.00	6.54	0.00	0.00	0.00	0.00
Education	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Government	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Industrial	1.00	0.09	0.00	0.00	1.00	0.93	0.00	0.00	0.00	0.00
Other Residential	40.00	3.47	9.00	2.66	2.00	1.87	0.00	0.00	0.00	0.00
Religion	2.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Single Family	1098.00	95.23	321.00	94.97	97.00	90.65	11.00	100.00	1.00	100.00
Total	**1,153**		**338**		**107**		**11**		**1**	

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

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	1114.00	96.62	322.00	95.27	88.00	82.24	8.00	72.73	0.00	0.00
Steel	0.00	0.00	0.00	0.00	5.00	4.67	0.00	0.00	0.00	0.00
Concrete	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Precast	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
URM	39.00	3.38	16.00	4.73	14.00	13.08	3.00	27.27	1.00	100.00
MH	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**1,153**		**338**		**107**		**11**		**1**	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had hospital beds available for use. On the day of the earthquake, the model estimates that only hospital beds (%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, % of the beds will be back in service. By 30 days, % 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	0	0	0	0
Schools	2	0	0	0
EOCs	1	0	0	0
PoliceStations	1	0	0	0
FireStations	1	0	0	0

Transportation Lifeline Damage

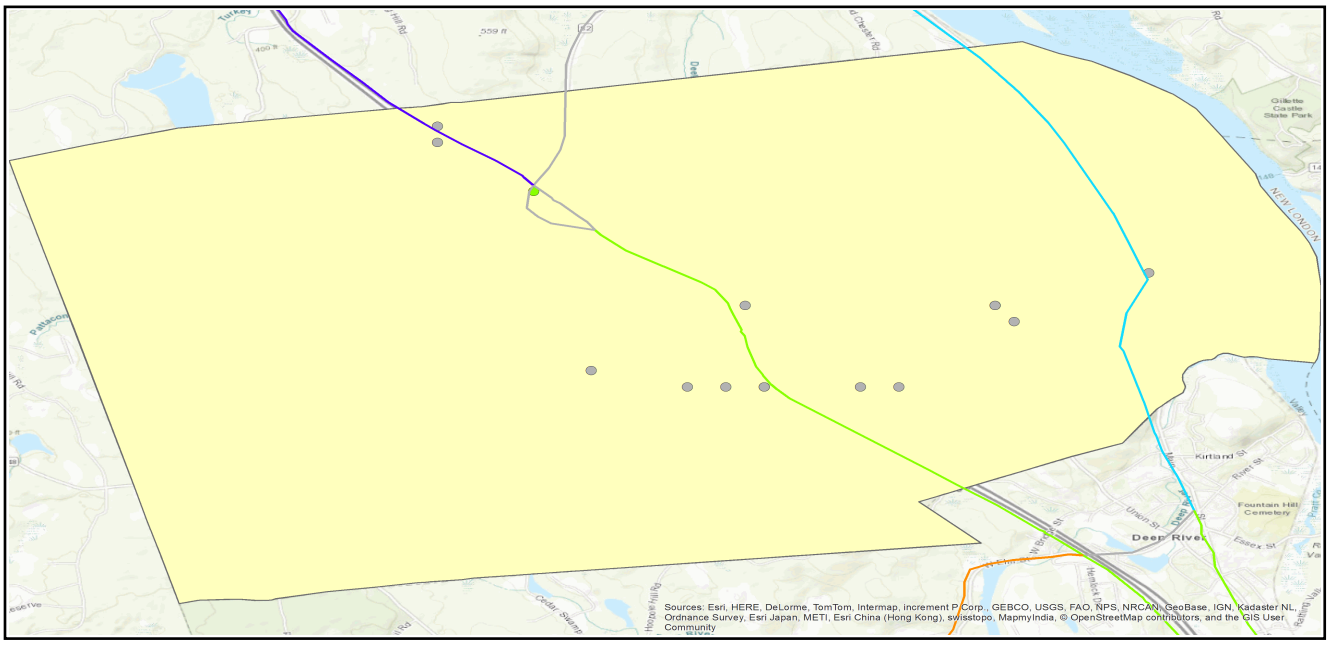


Table 6: Expected Damage to the Transportation Systems

System	Component		Number of Locations			
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 % After Day 1	With Functionality > 50 % After Day 7
Highway	Segments	14	0	0	10	10
	Bridges	15	0	0	15	15
	Tunnels	0	0	0	0	0
Railways	Segments	1	0	0	1	1
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
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	0	0	0	0	0
Ferry	Facilities	1	0	0	1	1
Port	Facilities	1	0	0	1	1
Airport	Facilities	1	0	0	1	1
	Runways	1	0	0	1	1

Table 6 provides damage estimates for the transportation system.

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

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

Table 7 : Expected Utility System Facility Damage

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

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

System	Total Pipelines Length (miles)	Number of Leaks	Number of Breaks
Potable Water	152	0	0
Waste Water	91	0	0
Natural Gas	61	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

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

Induced Earthquake Damage

Fire Following Earthquake

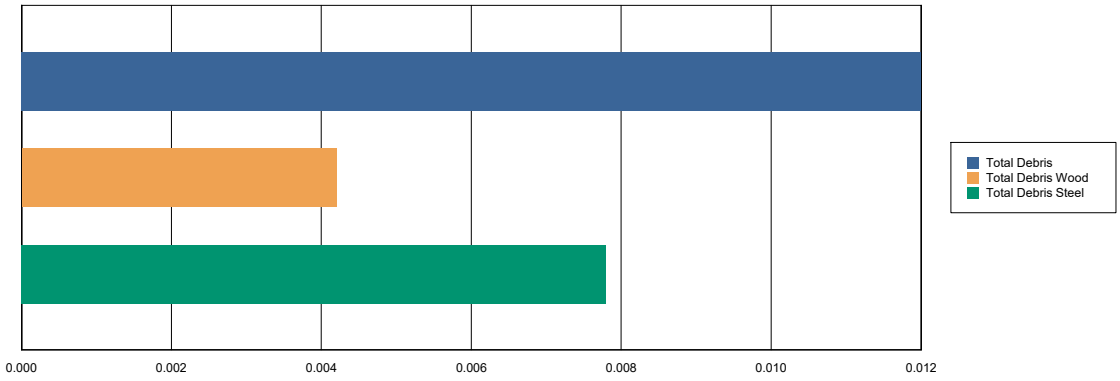
Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there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

Debris Generation

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

The model estimates that a total of 12,000 tons of debris will be generated. Of the total amount, Brick/Wood comprises 35.00% 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 480 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Earthquake Debris (millions of tons)



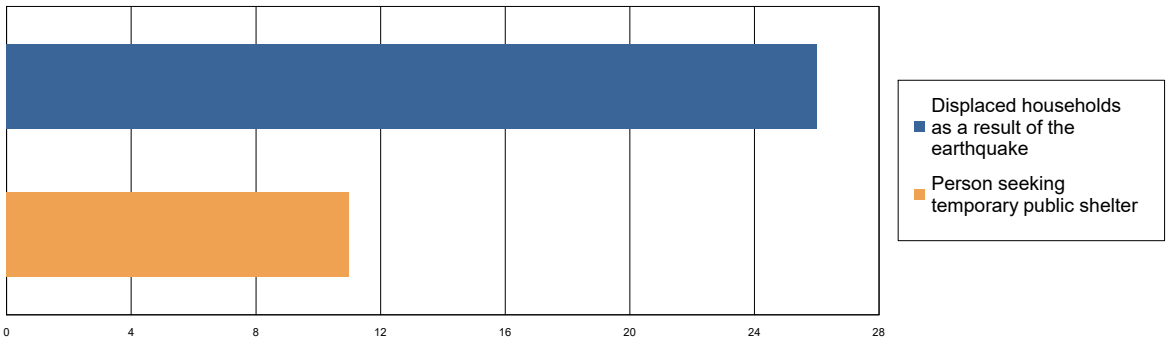
Brick/ Wood	Reinforced Concrete/Steel	Total Debris	Truck Load
0.00	0.01	0.01	480 (@25 tons/truck)

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 26 households to be displaced due to the earthquake. Of these, 11 people (out of a total population of 3,994) will seek temporary shelter in public shelters.

Displaced Households/ Persons Seeking Short Term Public Shelter



Displaced households as a result of the earthquake	Persons seeking temporary public shelter
26	11

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	0.00	0.00	0.00	0.00
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.00	0.00	0.00	0.00
	Other-Residential	0.00	0.00	0.00	0.00
	Single Family	0.00	0.00	0.00	0.00
	Total	**0**	**0**	**0**	**0**
2 PM	Commercial	0.00	0.00	0.00	0.00
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.00	0.00	0.00	0.00
	Other-Residential	0.00	0.00	0.00	0.00
	Single Family	0.00	0.00	0.00	0.00
	Total	**0**	**0**	**0**	**0**
5 PM	Commercial	0.00	0.00	0.00	0.00
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.00	0.00	0.00	0.00
	Industrial	0.00	0.00	0.00	0.00
	Other-Residential	0.00	0.00	0.00	0.00
	Single Family	0.00	0.00	0.00	0.00
	Total	**0**	**0**	**0**	**0**

Economic Loss

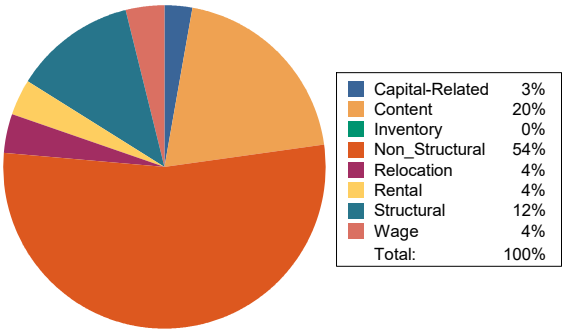
The total economic loss estimated for the earthquake is 8.08 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

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 0.01 (millions of dollars); 14 % 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 61 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type ($ millions)



Earthquake Losses by Occupancy Type ($ millions)

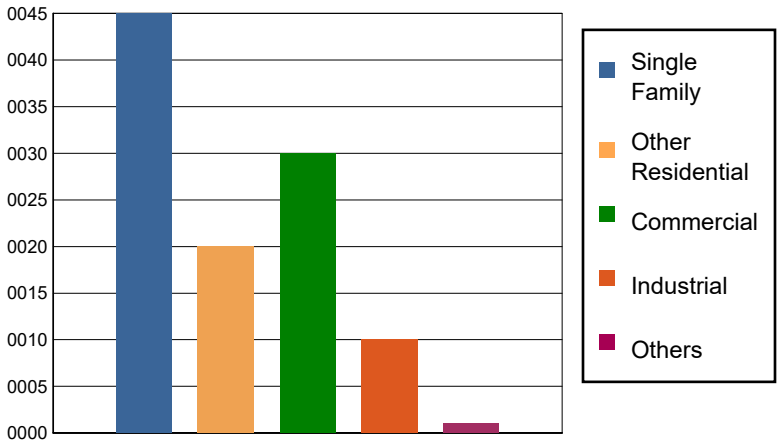


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.0000	0.0002	0.0002	0.0000	0.0000	0.0004
	Capital-Related	0.0000	0.0000	0.0003	0.0000	0.0000	0.0003
	Rental	0.0000	0.0002	0.0002	0.0000	0.0000	0.0004
	Relocation	0.0001	0.0000	0.0003	0.0000	0.0000	0.0004
	Subtotal	**0.0001**	**0.0004**	**0.0010**	**0.0000**	**0.0000**	**0.0015**
Capital Stock Losses							
	Structural	0.0005	0.0003	0.0004	0.0001	0.0000	0.0013
	Non_Structural	0.0029	0.0011	0.0011	0.0005	0.0001	0.0057
	Content	0.0010	0.0002	0.0005	0.0004	0.0000	0.0021
	Inventory	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Subtotal	**0.0044**	**0.0016**	**0.0020**	**0.0010**	**0.0001**	**0.0091**
	Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**

Transportation and Utility Lifeline Losses

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

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

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	420.1513	0.0000	0.00
	Bridges	104.8172	5.8924	5.62
	Tunnels	0.0000	0.0000	0.00
	Subtotal	**524.9685**	**5.8924**	
Railways	Segments	5.9474	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**5.9474**	**0.0000**	
Light Rail	Segments	0.0000	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Bus	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Ferry	Facilities	1.3310	0.2162	16.24
	Subtotal	**1.3310**	**0.2162**	
Port	Facilities	1.9970	0.3244	16.24
	Subtotal	**1.9970**	**0.3244**	
Airport	Facilities	10.6510	1.6387	15.39
	Runways	37.9640	0.0000	0.00
	Subtotal	**48.6150**	**1.6387**	
	Total	**582.86**	**8.07**	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	4.8820	0.0000	0.00
	Subtotal	**4.8820**	**0.0000**	
Waste Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	2.9292	0.0000	0.00
	Subtotal	**2.9292**	**0.0000**	
Natural Gas	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	1.9528	0.0000	0.00
	Subtotal	**1.9528**	**0.0000**	
Oil Systems	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Electrical Power	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Communication	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
	Total	**9.76**	**0.00**	

Appendix A: County Listing for the Region

Middlesex,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut					
	Middlesex	3,994	649	181	831
Total Region		**3,994**	**649**	**181**	**831**