

HAZUS-MH: Earthquake Event Report

Region Name: Colliston_Segment_M68

Earthquake Scenario: Colliston Segment M6.8

Print Date: December 16, 2009

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

Disclaimer:

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific 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 is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of HAZUS is to provide a methodology and software application to develop earthquake losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 10 county(ies) from the following state(s):

Utah

Note:

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

The geographical size of the region is 22,043.15 square miles and contains 335 census tracts. There are over 547 thousand households in the region and has a total population of 1,709,111 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 462 thousand buildings in the region with a total building replacement value (excluding contents) of 98,004 (millions of dollars). Approximately 96.00 % of the buildings (and 70.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 20,700 and 4,044 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

HAZUS estimates that there are 462 thousand buildings in the region which have an aggregate total replacement value of 98,004 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 40% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

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

For essential facilities, there are 32 hospitals in the region with a total bed capacity of 4,966 beds. There are 690 schools, 173 fire stations, 73 police stations and 2 emergency operation facilities. With respect to HPL facilities, there are 231 dams identified within the region. Of these, 93 of the dams are classified as 'high hazard'. The inventory also includes 545 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

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

The total value of the lifeline inventory is over 24,744.00 (millions of dollars). This inventory includes over 2,627 kilometers of highways, 1,508 bridges, 72,480 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	1,508	2,202.00
	Segments	709	16,103.10
	Tunnels	0	0.00
	Subtotal		18,305.10
Railways	Bridges	28	3.60
	Facilities	9	24.00
	Segments	876	1,507.80
	Tunnels	0	0.00
	Subtotal		1,535.40
Light Rail	Bridges	0	0.00
	Facilities	24	63.90
	Segments	24	37.20
	Tunnels	0	0.00
	Subtotal		101.10
Bus	Facilities	7	7.50
	Subtotal		7.50
Ferry	Facilities	0	0.00
	Subtotal		0.00
Port	Facilities	0	0.00
	Subtotal		0.00
Airport	Facilities	10	106.50
	Runways	17	645.40
	Subtotal		751.90
		Total	20,701.00

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	872.70
	Facilities	1	32.60
	Pipelines	0	0.00
	Subtotal		905.30
Waste Water	Distribution Lines	NA	523.60
	Facilities	29	1,892.80
	Pipelines	0	0.00
	Subtotal		2,416.40
Natural Gas	Distribution Lines	NA	349.10
	Facilities	1	1.10
	Pipelines	340	750.00
	Subtotal		1,100.10
Oil Systems	Facilities	15	1.50
	Pipelines	228	280.70
	Subtotal		282.10
Electrical Power	Facilities	10	1,078.00
	Subtotal		1,078.00
Communication	Facilities	82	8.00
	Subtotal		8.00
		Total	5,790.00

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	Colliston Segment M6.8
Type of Earthquake	User-defined
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	6.80
Depth (Km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Building Damage

Building Damage

HAZUS estimates that about 5,883 buildings will be at least moderately damaged. This is over 1.00 % of the total number of buildings in the region. There are an estimated 247 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 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	522	0.12	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	10,939	2.46	217	1.88	122	2.68	35	3.20	9	3.74
Education	526	0.12	16	0.14	11	0.25	4	0.39	1	0.58
Government	1,060	0.24	28	0.25	24	0.53	12	1.07	4	1.57
Industrial	4,153	0.93	75	0.65	52	1.15	18	1.66	5	1.86
Other Residential	50,349	11.33	1,688	14.61	859	18.87	187	17.20	73	29.41
Religion	1,870	0.42	50	0.43	37	0.82	11	1.04	3	1.13
Single Family	375,157	84.39	9,481	82.05	3,445	75.70	818	75.44	153	61.71
Total	444,577		11,555		4,551		1,085		247	

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

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	180,088	40.51	2775	24.02	138	3.04	4	0.38	0	0.16
Steel	3,109	0.70	78	0.68	80	1.77	28	2.59	10	3.90
Concrete	2,423	0.55	96	0.83	73	1.61	22	1.99	6	2.34
Precast	1,048	0.24	38	0.33	44	0.98	19	1.72	5	2.20
RM	100,083	22.51	826	7.15	282	6.20	28	2.57	5	1.85
URM	147,426	33.16	6962	60.25	3,408	74.87	841	77.52	154	62.49
MH	10,399	2.34	780	6.75	525	11.54	144	13.23	67	27.05
Total	444,577		11,555		4,551		1,085		247	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 4,966 hospital beds available for use. On the day of the earthquake, the model estimates that only 4,817 hospital beds (97.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 100.00% of the beds will be back in service. By 30 days, 100.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	32	0	0	32
Schools	690	0	0	689
EOCs	2	0	0	2
PoliceStations	73	0	0	73
FireStations	173	0	0	171

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	709	0	0	709	709
	Bridges	1,508	29	0	1,479	1,484
	Tunnels	0	0	0	0	0
Railways	Segments	876	0	0	876	876
	Bridges	28	0	0	28	28
	Tunnels	0	0	0	0	0
	Facilities	9	0	0	9	9
Light Rail	Segments	24	0	0	24	24
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	24	0	0	24	24
Bus	Facilities	7	0	0	7	7
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	10	0	0	10	10
	Runways	17	0	0	17	17

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	1	0	0	1	1
Waste Water	29	0	0	21	29
Natural Gas	1	0	0	1	1
Oil Systems	15	0	0	15	15
Electrical Power	10	0	0	10	10
Communication	82	0	0	82	82

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

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	43,634	620	155
Waste Water	26,180	490	123
Natural Gas	1,690	4	1
Oil	976	1	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	547,976	73	0	0	0	0
Electric Power		0	0	0	0	0

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 10 ignitions that will burn about 0.32 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 703 people and burn about 29 (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 0.300 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 50.00% 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 12,160,000 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

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 366 households to be displaced due to the earthquake. Of these, 291 people (out of a total population of 1,709,111) will seek temporary shelter in public shelters.

Casualties

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

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

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

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

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	1	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	1	0	0	0
	Industrial	2	0	0	0
	Other-Residential	47	7	1	1
	Single Family	202	39	5	10
	Total	252	48	6	11
2 PM	Commercial	67	15	2	4
	Commuting	0	0	0	0
	Educational	46	11	2	3
	Hotels	0	0	0	0
	Industrial	16	4	0	1
	Other-Residential	7	1	0	0
	Single Family	39	8	1	2
	Total	176	39	6	11
5 PM	Commercial	63	15	2	4
	Commuting	2	3	6	1
	Educational	5	1	0	0
	Hotels	0	0	0	0
	Industrial	10	2	0	1
	Other-Residential	18	3	0	0
	Single Family	81	16	2	4
	Total	180	40	10	10

Economic Loss

The total economic loss estimated for the earthquake is 560.66 (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 474.29 (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 44 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	1.18	14.10	1.52	5.76	22.56
	Capital-Related	0.00	0.50	10.12	0.92	1.21	12.76
	Rental	6.46	5.11	9.36	0.62	1.28	22.83
	Relocation	23.70	4.67	14.12	3.10	16.06	61.64
	Subtotal	30.16	11.46	47.71	6.16	24.31	119.80
Capital Stock Losses							
	Structural	31.37	6.61	17.30	8.37	11.93	75.58
	Non_Structural	71.91	25.58	39.55	22.02	35.23	194.28
	Content	24.60	6.70	19.65	13.94	15.58	80.47
	Inventory	0.00	0.00	0.85	3.30	0.00	4.15
	Subtotal	127.88	38.89	77.35	47.63	62.73	354.49
	Total	158.05	50.36	125.06	53.79	87.04	474.29

Transportation and Utility Lifeline Losses

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

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

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

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	16,103.14	\$0.00	0.00
	Bridges	2,201.97	\$15.46	0.70
	Tunnels	0.00	\$0.00	0.00
	Subtotal	18305.10	15.50	
Railways	Segments	1,507.82	\$0.00	0.00
	Bridges	3.63	\$0.00	0.09
	Tunnels	0.00	\$0.00	0.00
	Facilities	23.97	\$0.48	2.02
	Subtotal	1535.40	0.50	
Light Rail	Segments	37.15	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	63.91	\$0.39	0.61
	Subtotal	101.10	0.40	
Bus	Facilities	7.48	\$0.40	5.40
	Subtotal	7.50	0.40	
Ferry	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Port	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Airport	Facilities	106.51	\$4.31	4.05
	Runways	645.39	\$0.00	0.00
	Subtotal	751.90	4.30	
	Total	20701.00	21.00	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	\$0.00	0.00
	Facilities	32.60	\$0.29	0.89
	Distribution Lines	872.70	\$2.79	0.32
	Subtotal	905.32	\$3.08	
Waste Water	Pipelines	0.00	\$0.00	0.00
	Facilities	1,892.80	\$56.19	2.97
	Distribution Lines	523.60	\$2.21	0.42
	Subtotal	2,416.38	\$58.39	
Natural Gas	Pipelines	750.00	\$0.01	0.00
	Facilities	1.10	\$0.00	0.07
	Distribution Lines	349.10	\$2.36	0.68
	Subtotal	1,100.12	\$2.37	
Oil Systems	Pipelines	280.70	\$0.00	0.00
	Facilities	1.50	\$0.01	0.48
	Subtotal	282.13	\$0.01	
Electrical Power	Facilities	1,078.00	\$1.36	0.13
	Subtotal	1,078.00	\$1.36	
Communication	Facilities	8.00	\$0.12	1.43
	Subtotal	8.04	\$0.12	
	Total	5,789.97	\$65.32	

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

	LOSS	Total	%
First Year			
	Employment Impact	4,930	0.83
	Income Impact	9	0.04
Second Year			
	Employment Impact	1,939	0.33
	Income Impact	(3)	-0.01
Third Year			
	Employment Impact	39	0.01
	Income Impact	(11)	-0.05
Fourth Year			
	Employment Impact	0	0.00
	Income Impact	(13)	-0.05
Fifth Year			
	Employment Impact	0	0.00
	Income Impact	(13)	-0.05
Years 6 to 15			
	Employment Impact	0	0.00
	Income Impact	(13)	-0.05

Appendix A: County Listing for the Region

Box Elder,UT

Cache,UT

Davis,UT

Morgan,UT

Rich,UT

Salt Lake,UT

Summit,UT

Tooele,UT

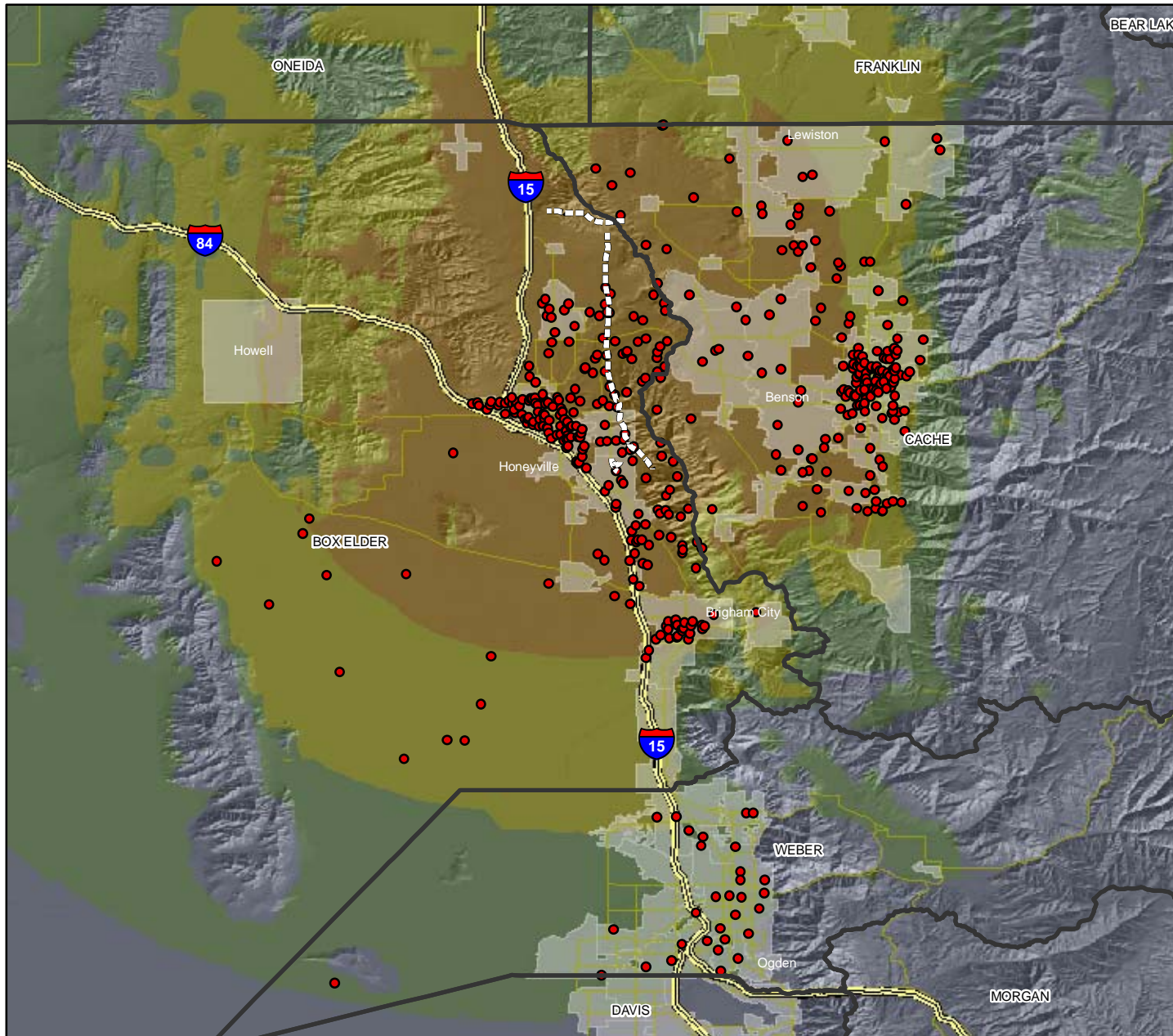
Wasatch,UT

Weber,UT

Appendix B: Regional Population and Building Value Data

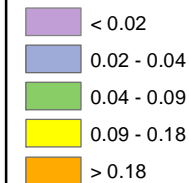
State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Utah	Box Elder	45,659	1,658	687	2,346
	Cache	100,585	3,382	1,703	5,085
	Davis	270,344	10,230	3,870	14,101
	Morgan	7,910	305	139	444
	Rich	2,327	249	38	288
	Salt Lake	962,837	39,526	18,636	58,162
	Summit	35,804	2,598	708	3,307
	Tooele	50,184	1,782	564	2,347
	Wasatch	18,879	0	89	89
	Weber	214,582	8,462	3,369	11,831
Total State		1,709,111	68,192	29,803	98,000
Total Region		1,709,111	68,192	29,803	98,000

Direct Building Economic Loss - Earthquake Scenario: Collinston Segment, UT



M 6.8 Collinston Segment Earthquake

PGA (% g's)



1 Dot =
\$1,000,000

County	Cost Structural Damage	Cost Non-Structural Damage	Total Loss (Including Contents)
Wasatch	0	0	0
Box Elder	41,705	101,289	244,118
Tooele	0	0	0
Salt Lake	422	1,261	3,025
Weber	3,569	13,417	29,001
Summit	2	24	45
Cache	29,170	75,323	192,031
Morgan	4	15	31
Rich	8	22	44
Davis	701	2,934	5,994
Total	\$75,580	\$194,284	\$474,289

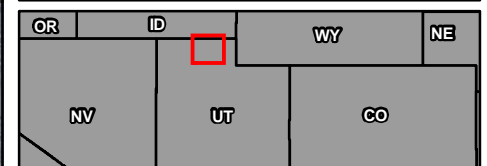
* All values are thousands of dollars

- Collinston Segment
- Counties
- Interstate
- Major Roads
- City Boundaries

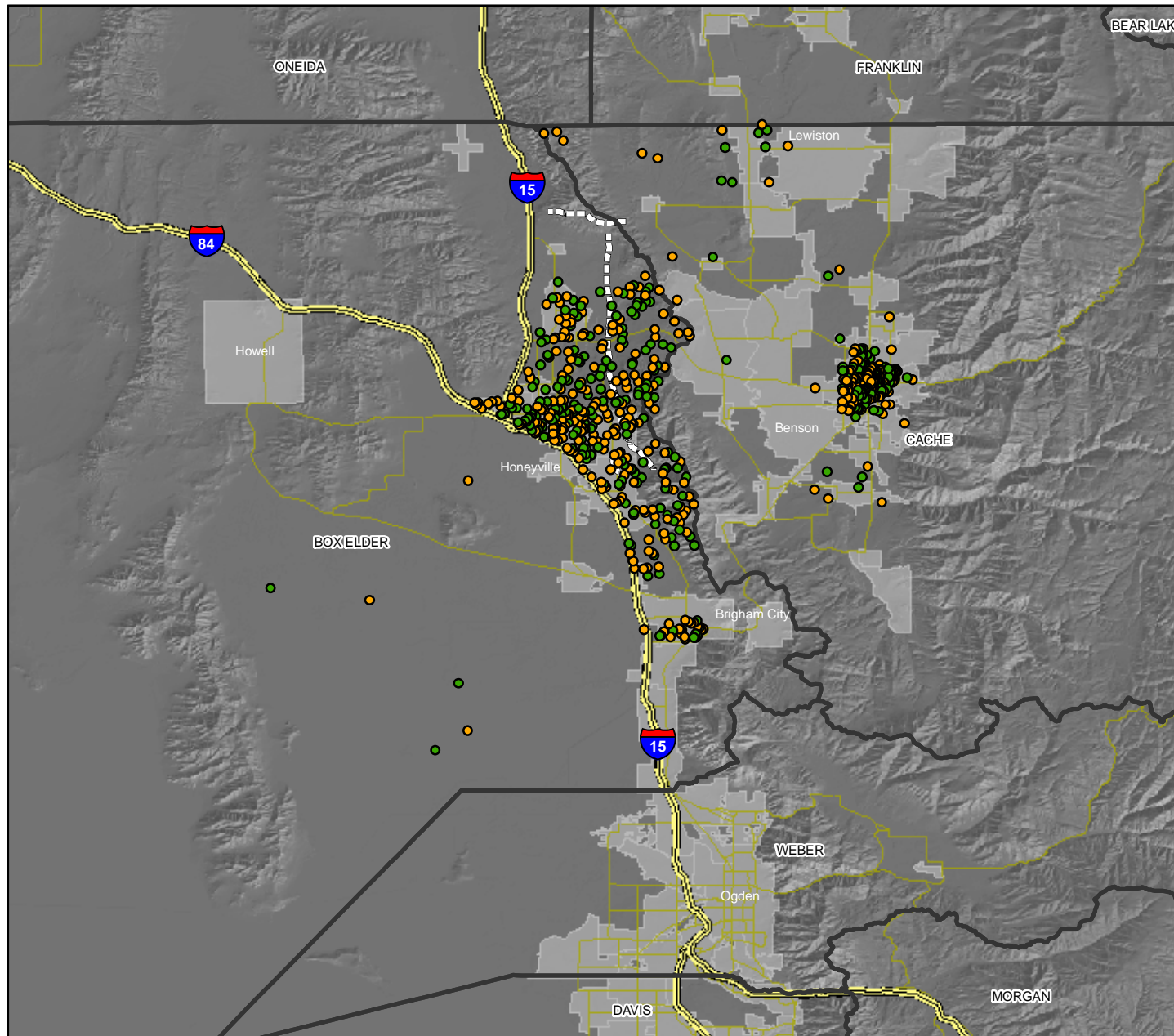
0 2.5 5 7.5 10 12.5 15
Miles



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Estimated Displaced Households & Short Term Public Shelter Needs - Earthquake Scenario: Collinston Segment, UT



M 6.8 Collinston Segment Earthquake

	Total #
Public Shelter Needs (Individuals)	291
Displaced Households	366

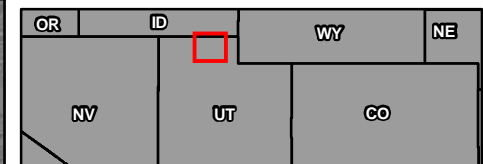
- 1 Dot = 1 Public Shelter Need (Individuals)*
 - 1 Dot = 1 Displaced Household*
- * delineated by census tract*

- Collinston Segment
- Counties
- == Interstate
- Major Roads
- City Boundaries

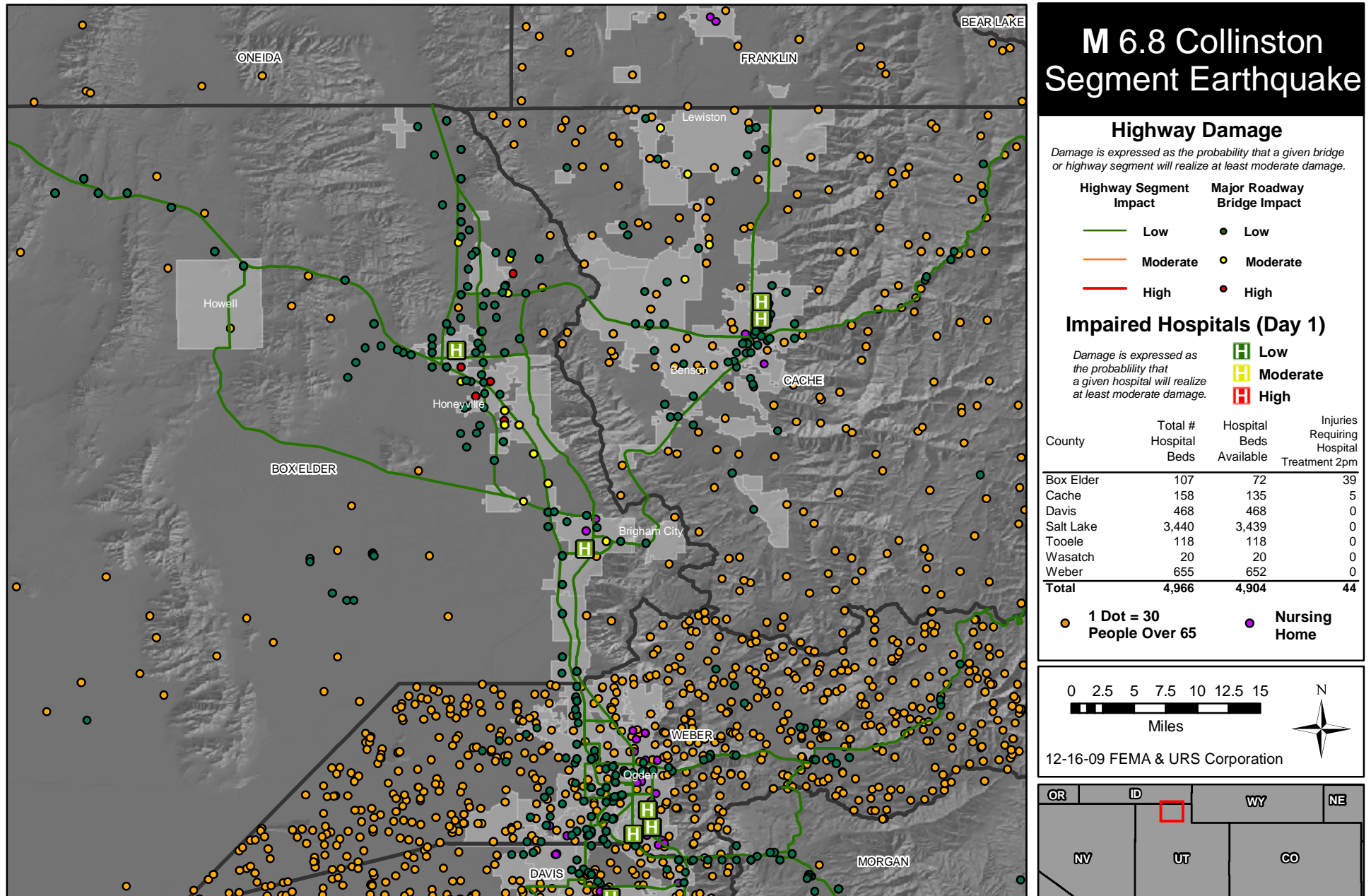
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Miles



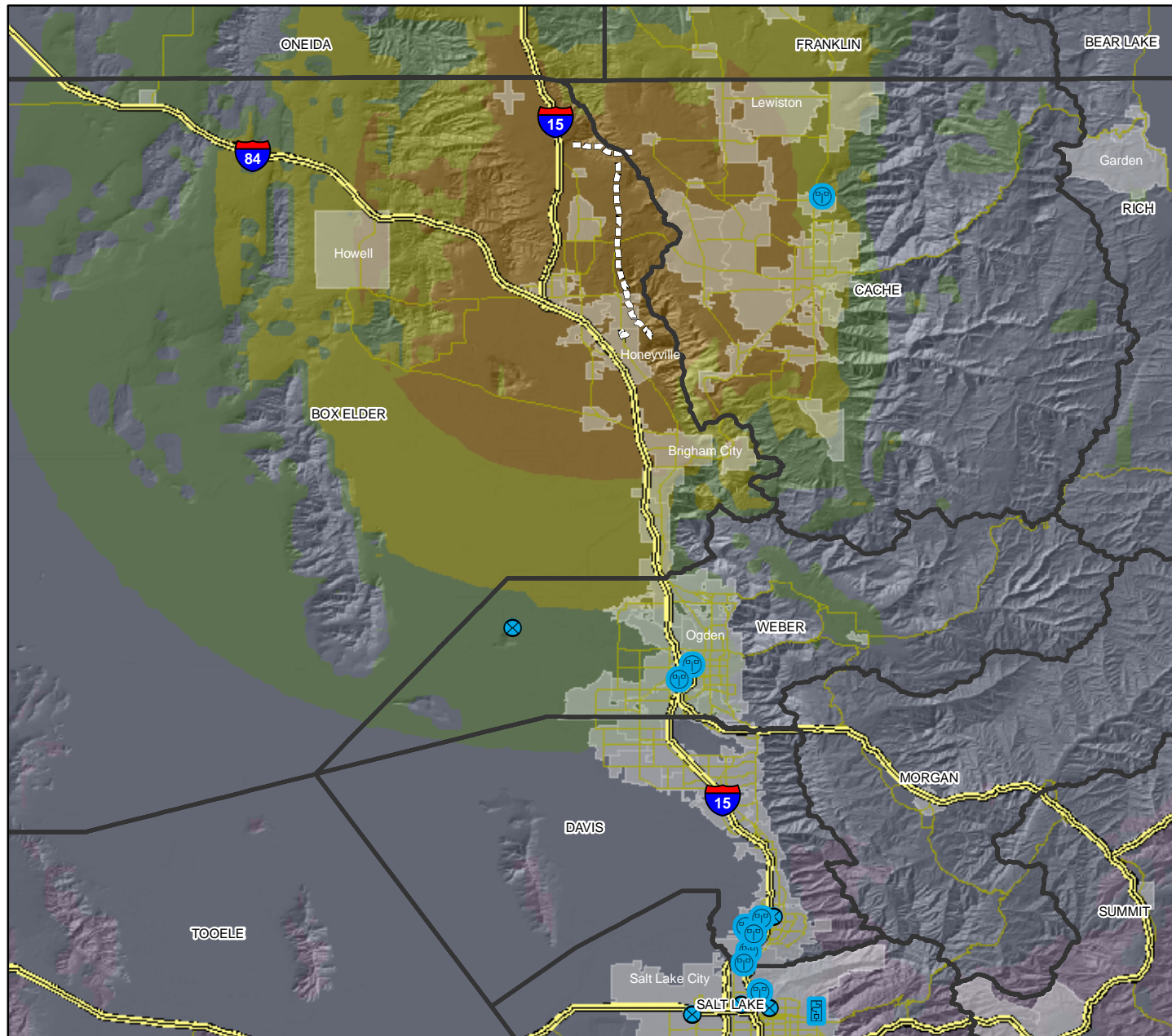
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Distribution of Elderly, Impaired Hospitals (Day 1) & Hospital Bed Availability - Earthquake Scenario: Collinston Segment, UT



Electrical, Natural Gas & Oil Facility Damage- Earthquake Scenario: Collinston Segment, UT



M 6.8 Collinston Segment Earthquake

Utility Damage (at least moderate)

Damage is expressed as the probability chance that a given utility system will realize at least moderate damage.



Electric Power Facility

-  Low
-  Moderate
-  High






Oil Facility

-  Low
-  Moderate
-  High

Natural Gas Facility

-  Low
-  Moderate
-  High

PGA (% g's)

-  < 0.02
-  0.02 - 0.04
-  0.04 - 0.09
-  0.09 - 0.18
-  > 0.18

Collinston Segment

Counties

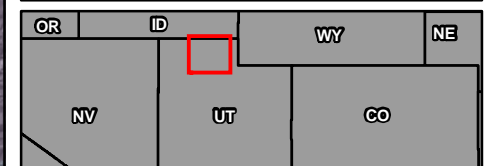
Interstate

Major Roads

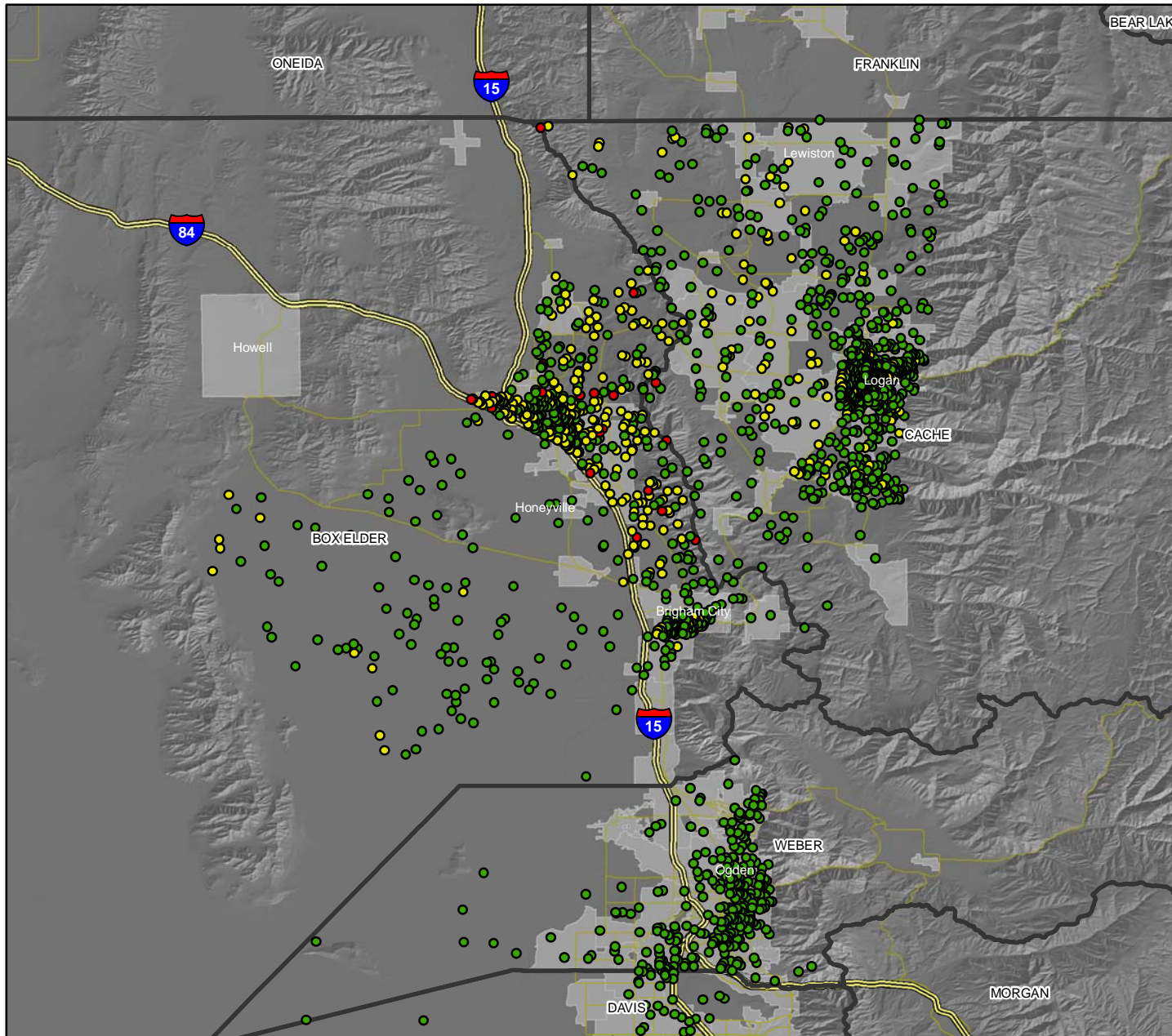
City Boundaries



12-16-09 FEMA & URS Corporation



Estimated Building Inspection Needs - Earthquake Scenario: Collinston Segment, UT



M 6.8 Collinston Segment Earthquake

	Estimated # of Structures	Estimated # of Inspectors Needed
Red (Complete)	247	2
Yellow (Extensive)	3,395	46
Light Green (Slight/ Moderate)	16,106	108
Total	19,748	156

*Estimated number of inspectors needed
to complete inspections in 30 days.

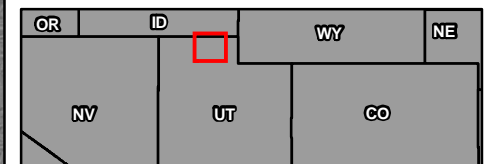
- Red Tag
(Complete Damage)
- Yellow Tag
(Extensive Damage)
- Green Tag
(Slight/Moderate Damage)

*1 Dot = 10 (by census tract)

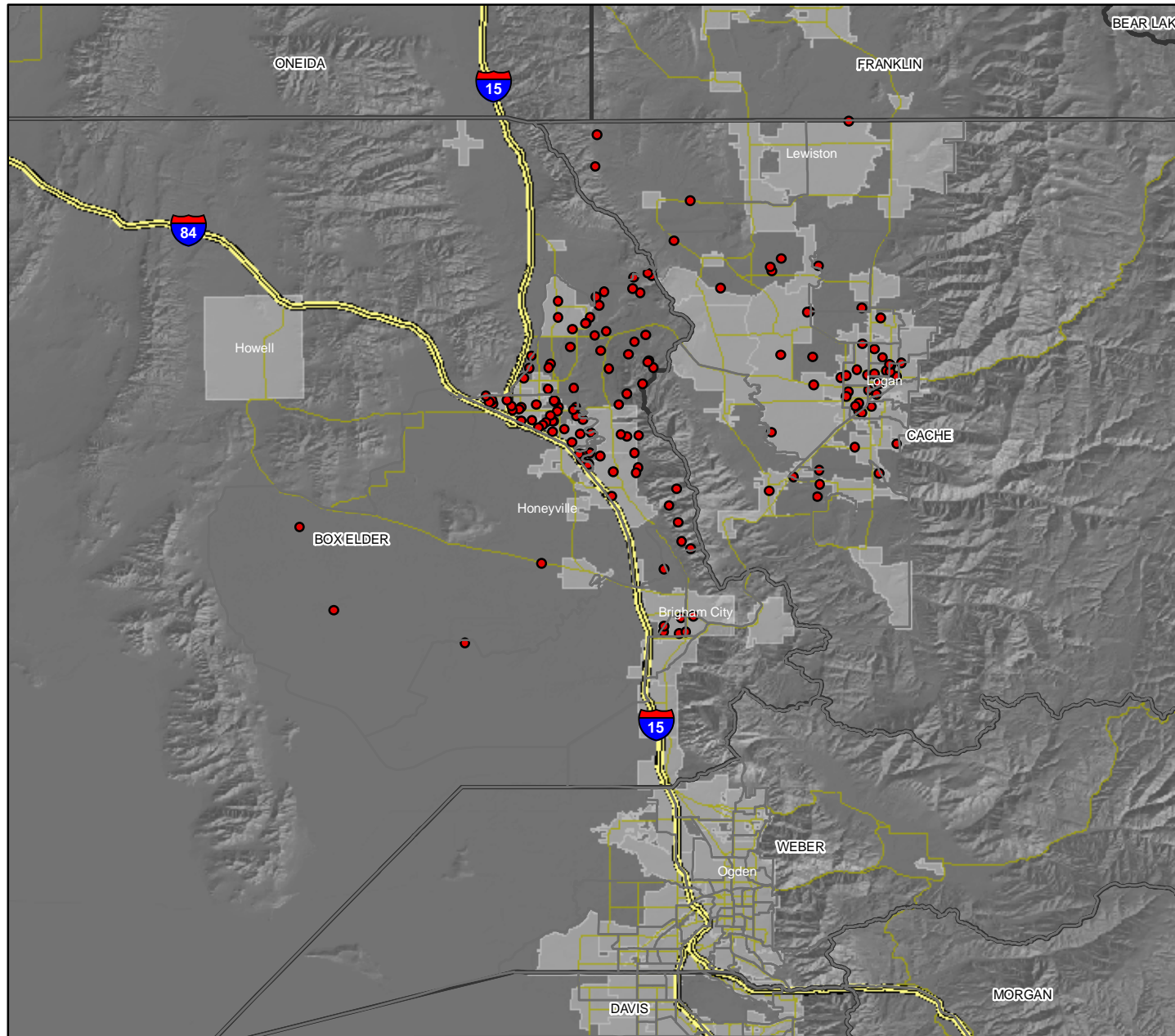
0 2.5 5 7.5 10 12.5 15
Miles



12-16-09 FEMA & URS Corporation



Estimated Concrete, Steel Debris & Highway Damage - Earthquake Scenario: Collinston Segment, UT



M 6.8 Collinston Segment Earthquake

1 Dot = 1 thousand tons of
Concrete and Steel Debris
(by census tract)

County	Brick and Wood (tons)	Concrete and Steel (tons)	*Estimated Truck Loads
Box Elder	72,000	99,000	6,880
Cache	62,000	49,000	4,440
Davis	2,000	0	80
Morgan	0	0	0
Rich	0	0	0
Salt Lake	3,000	0	120
Summit	0	0	0
Tooele	0	0	0
Wasatch	0	0	0
Weber	14,000	2,000	640
Total	154,000	151,000	12,080

* Truck loads estimated at 25 tons per truck

Collinston Segment

Counties

Interstate

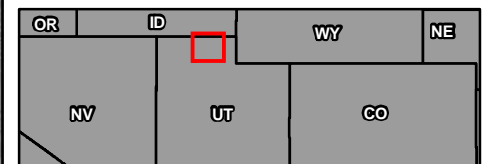
Major Roads

City Boundaries

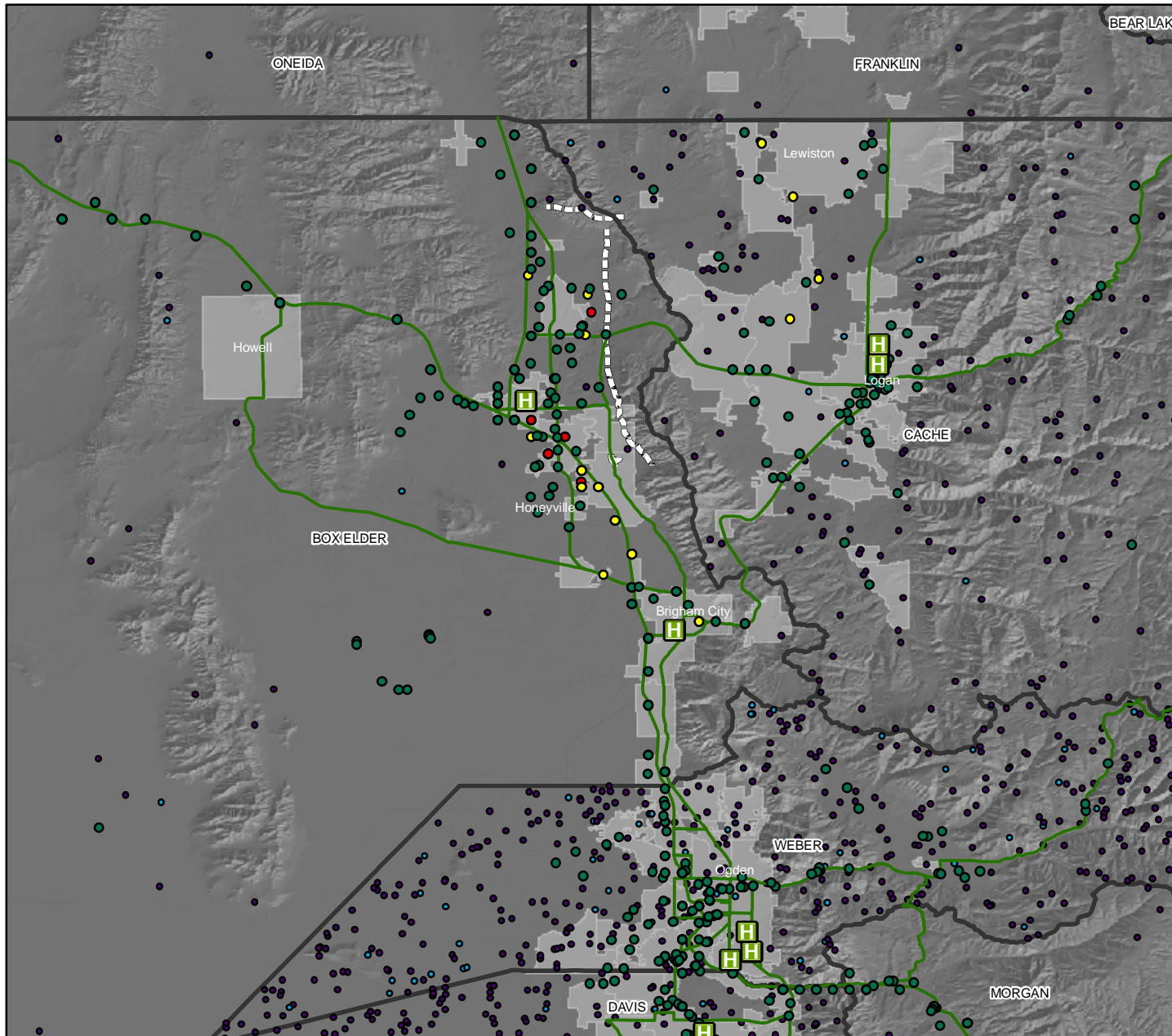
0 2.5 5 7.5 10 12.5 15
Miles



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Demographic Distribution & Highway Damage - Earthquake Scenario: Collinston Segment, UT



M 6.8 Collinston Segment Earthquake

Highway Damage

Damage is expressed as the probability that a given bridge or highway segment will realize at least moderate damage.

Highway Segment Impact

- Low
- Moderate
- High

Major Roadway Bridge Impact

- Low
- Moderate
- High

Impaired Hospitals (Day 1)

Damage is expressed as the probability that a given hospital will realize at least moderate damage.

- Low
- Moderate
- High

Demographics

- English Speaking
- Potentially Non-English Speaking

*1 Dot = 500 People (by census tract)

Collinston Segment

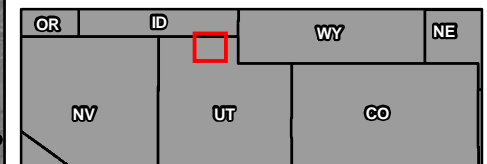
Counties

City Boundaries

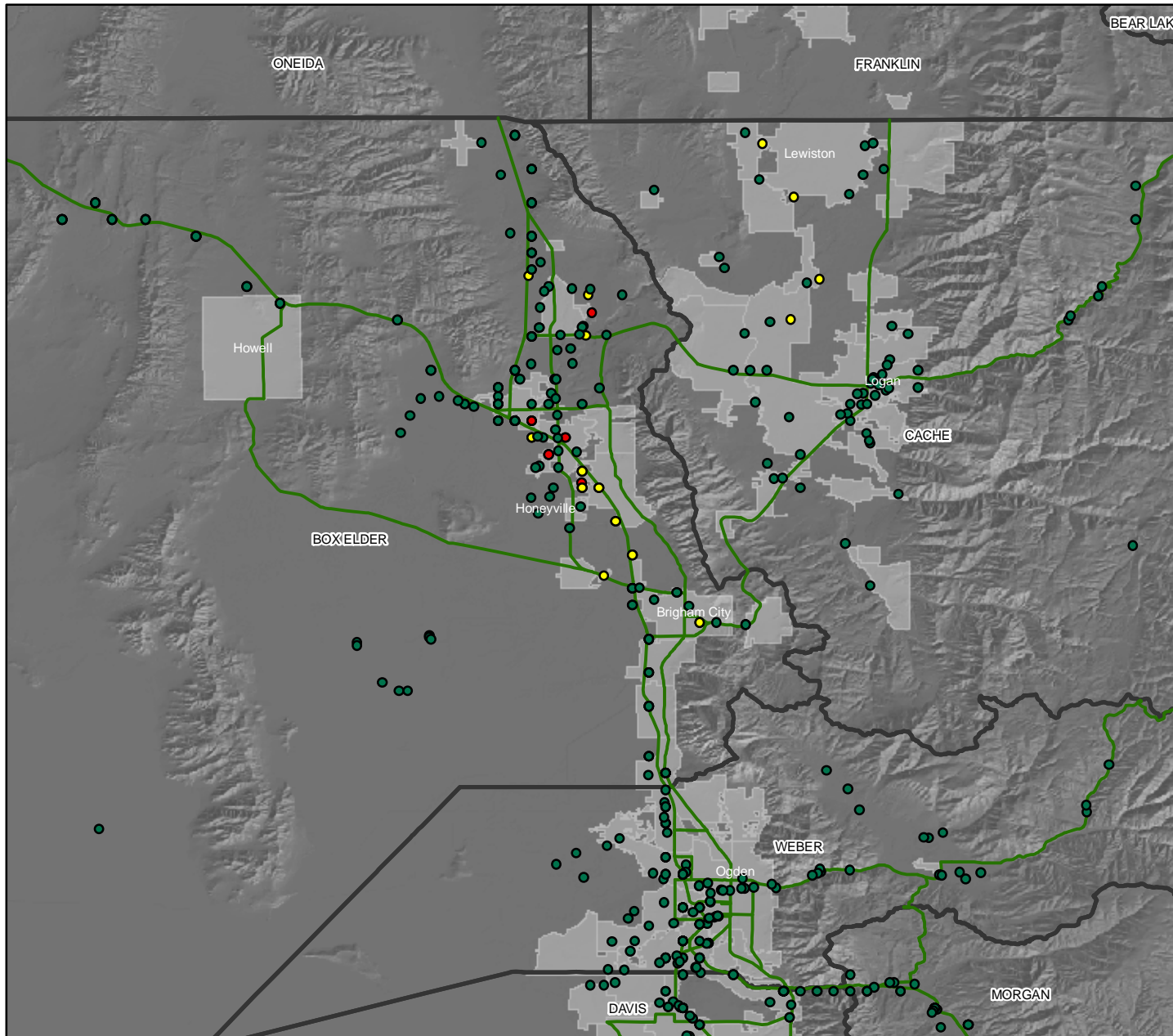
0 2.5 5 7.5 10 12.5 15
Miles



12-17-09 FEMA & URS Corporation



Estimated Highway Infrastructure Damage - Earthquake Scenario: Collinston Segment, UT



M 6.8 Collinston Segment Earthquake

Highway Damage

Damage is expressed as the probability that a given bridge or highway segment will realize at least moderate damage.

Highway Segment Impact

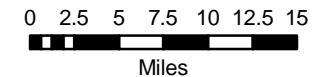
- Low
- Moderate
- High

Major Roadway Bridge Impact

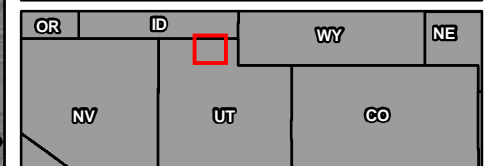
- Low
- Moderate
- High

County	Total # of Bridges	# Bridges Needing Priority Inspection	*# of Bridge Engineers Needed
Box Elder	230	41	5
Cache	62	1	1
Davis	130	0	0
Duchesne	80	0	0
Morgan	80	0	0
Rich	23	0	0
Salt Lake	608	0	0
Summit	156	0	0
Tooele	54	0	0
Utah	314	0	0
Wasatch	24	0	0
Weber	141	0	0
Total	1,902	42	0

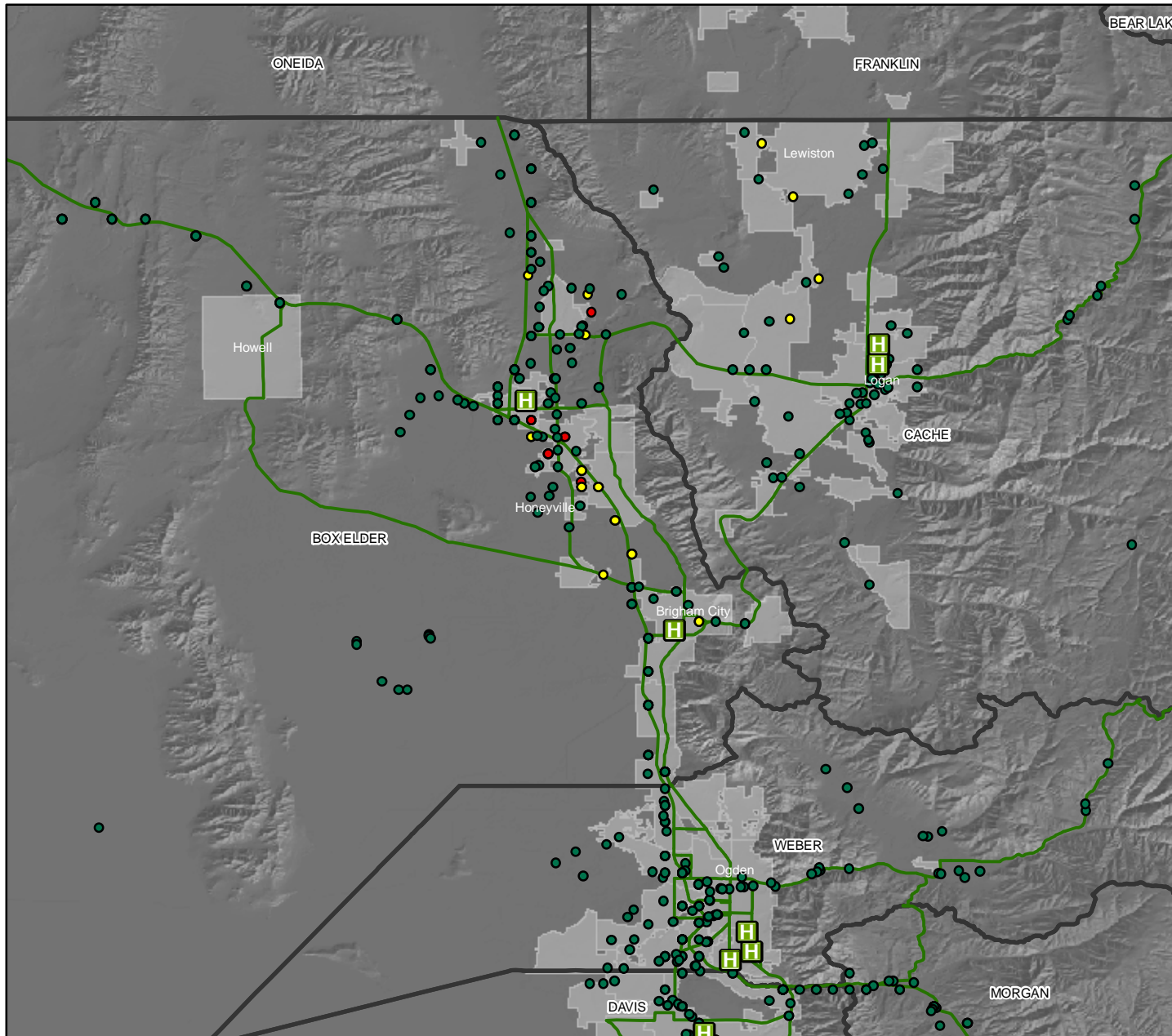
*Based on assuming that 2 engineers can inspect 5 bridges a day for 3 days.



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Impaired Hospitals (Day 1), Hospital Availability & Highway Functionality - Earthquake Scenario: Collinston Segment, UT



M 6.8 Collinston Segment Earthquake

Highway Damage

Damage is expressed as the probability that a given bridge or highway segment will realize at least moderate damage.

Highway Segment Impact

- Low
- Moderate
- High

Major Roadway Bridge Impact

- Low
- Moderate
- High

Impaired Hospitals (Day 1)

Damage is expressed as the probability that a given hospital will realize at least moderate damage.

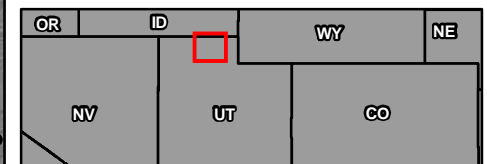
- Low
- Moderate
- High

County	Total # Hospital Beds	Hospital Beds Available	Injuries Requiring Hospital Treatment 2pm
Box Elder	107	72	39
Cache	158	135	5
Davis	468	468	0
Salt Lake	3,440	3,439	0
Tooele	118	118	0
Wasatch	20	20	0
Weber	655	652	0
Total	4,966	4,904	44

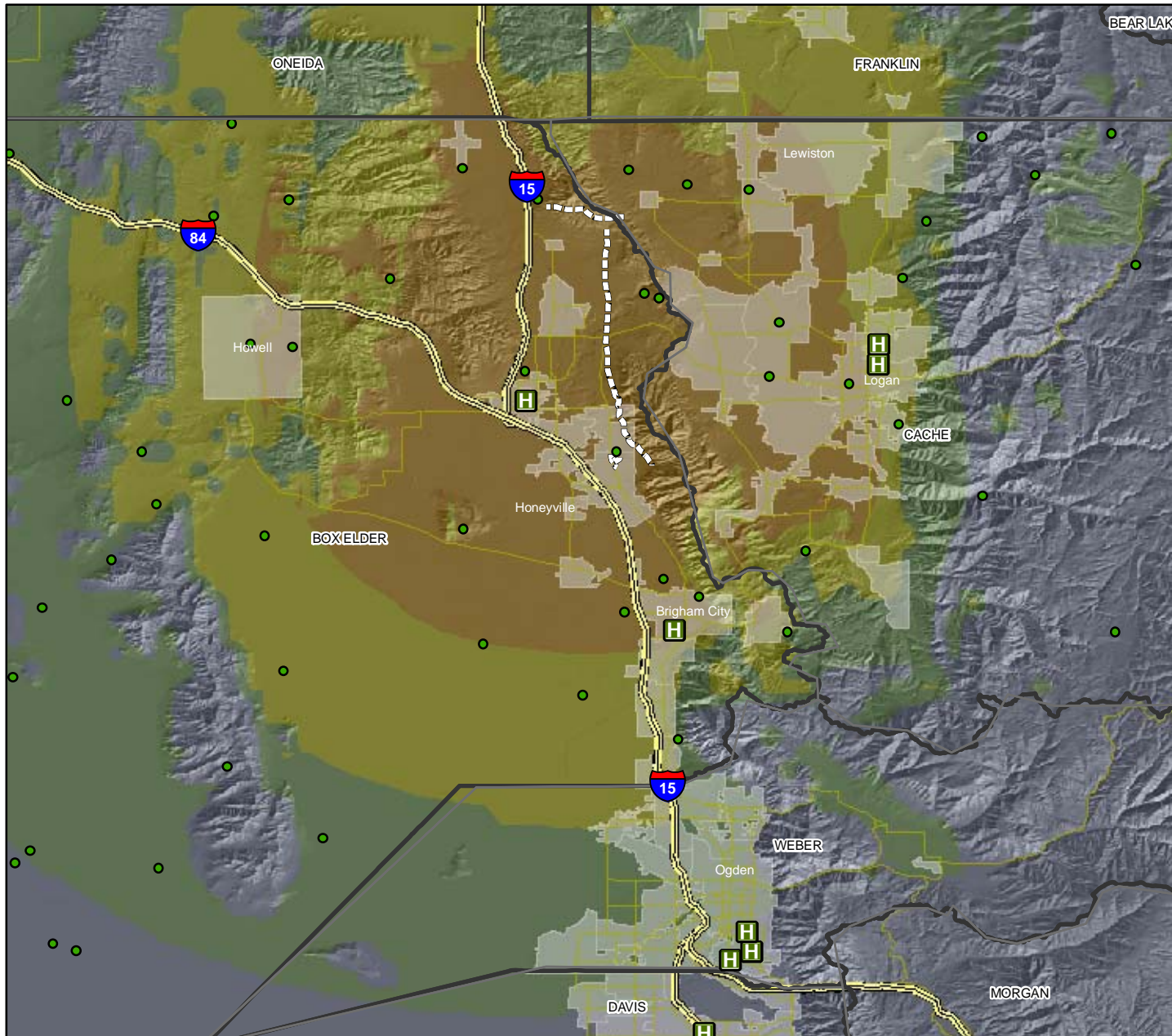
0 2.5 5 7.5 10 12.5 15
Miles



12-17-09 FEMA & URS Corporation



Potential Search & Rescue Needs - Earthquake Scenario: Collinston Segment, UT



M 6.8 Collinston Segment Earthquake

Impaired Hospitals (Day 1)

Damage is expressed as the probability that a given hospital will realize at least moderate damage.

H Low
H Moderate
H High

PGA (% g's)

< 0.02
0.02 - 0.04
0.04 - 0.09
0.09 - 0.18
> 0.18

1 Dot = 1 Life
Threatening Injury (Severity Level 3)
*Severity Level 3 is defined as injuries that require hospitalization and can become life threatening if not promptly treated.

Collinston Segment

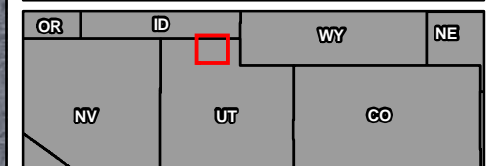
Structure Type	Red (Complete)	Collapse Rates for Complete Damage	Total Collapse
Wood	0	3%	0
Steel	10	6%	1
Concrete	6	10%	1
Precast	5	13%	1
Reinforced Masonry	5	10%	1
Unreinforced Masonry	154	15%	23
Manufactured Housing	67	3%	2
Total	247		27

Requiring Hospital Treatment	Immediate Life Threatening Injuries
149	22

0 2.5 5 7.5 10 12.5 15
Miles



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Correctional and Daycare Facilities, Impaired Hospitals (Day 1) and Highway Functionality - Earthquake Scenario: Collinston Segment, UT

