Appendix 2

Impact of Earthquakes on the Central USA

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Mid-America Earthquake Center
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Impact of Earthquakes on the Central USA

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Disclaimer

The assessments, comments and opinions in this report are those of the authors and do not necessarily represent the opinions of the Federal Emergency Management Agency or the US Army Corps of Engineers.

Kentucky New Madrid Seismic Zone Scenario

The northeast fault segment generates substantial shaking in western Kentucky. As a result 25 counties are identified in that area and are expected to incur the majority of the damage from a NMSZ earthquake. These critical counties are highlighted in Figure 15 and are also listed below:

- Ballard
- Caldwell
- Calloway
- Carlisle
- Christian
- Crittenden
- Daviess
- Fulton
- Graves
- Hancock
- Henderson
- Hickman
- Hopkins
- Livingston
- Logan
- Lyon
- McCracken
- McLean
- Marshall
- Muhlenberg
- Ohio
- Todd
- Trigg
- Union
- Webster

The State of Kentucky experiences substantial damage to its building stock of nearly 1.5 million buildings, most of which is confined to the western half of the state. Table 37 illustrates the number of building damaged by the NMSZ event. Nearly 30,000 buildings are completely damaged and another 53,000 buildings experience moderate or severe damage. All but roughly 150 cases of complete damage occur in the critical counties and approximately 95% of all moderate and severe damage occurs in these counties. As with many other scenarios, residential structures comprise the majority of the damage. Nearly 98% of all complete damage and over 99% of all moderate and severe damage occurs to single family homes and other residential buildings. This percentage of damage is proportional to the inventory; however, roughly 98% of the building stock is residential construction. As mentioned earlier, other residential structures are most commonly multi-unit dwellings.

Table 37: NMSZ Event Building Damage by Occupancy Type for the State of Kentucky

General Occupancy Type Damage			
General Occupancy Type	**Total No. Buildings**	**Moderate to Severe Damage**	**Complete Damage**
Single Family	1,159,114	39,150	18,768
Other Residential	292,873	13,050	9,673
Commercial	16,431	306	475
Industrial	3,002	48	53
Other	1,900	34	60
Total	1,473,320	52,588	29,029

Building damage by building type is shown in Table 38. Nearly half of all complete damage occurs in wood frame structures, with mobile homes comprising 30% of complete damage and unreinforced masonry (URM) representing slightly less than 30%. Though nearly 14,000 cases of complete damage occur to wood frame structures, this only represents 1.3% of all wood frame buildings in Kentucky. The roughly 6,200 URMs and 8,800 mobile homes that are completely damaged represent a much higher portion of

their respective inventories at 3.9% of all URMs and 3.6% of all mobile homes. When comparing these percentages, it is evident that URMs are more vulnerable to damage despite having fewer actual instances of complete damage. The same type of comparison can be done for moderate and extensive damage. In this case, the 11,800 instances of moderate and severe damage to mobile homes represents 4.8% of all mobile homes in Kentucky, which is the greatest proportion of inventory damaged at this level by far. Only 3.4% of wood frame buildings and 2.7% of URMs are damaged at these severity levels.

Table 38: NMSZ Event Building Damage by Building Type for the State of Kentucky

Building Damage by Building Type					
Building Type	**None**	**Slight**	**Moderate**	**Extensive**	**Complete**
Wood	992,135	18,737	24,772	11,617	13,726
Steel	6,430	264	93	39	201
Concrete	1,782	51	22	15	58
Precast	1,907	74	42	19	69
Reinforced Masonry	1,109	20	13	10	39
Unreinforced Masonry	137,881	8352	2,434	1,720	6,161
Mobile Home	197,127	25935	7,952	3,840	8,775
Total	1,338,371	53,433	35,328	17,260	29,029

Essential facilities experience substantial damage, particularly in the westernmost counties in Kentucky. Nearly 100 schools are at least moderately damaged, with roughly 80 being completely damaged. This leaves nearly all schools in Fulton, Hickman, Carlisle, Ballard, McCracken, Graves, Calloway and Marshall Counties completely damaged and non functional for a significant period after the earthquake. Schools are often used as public shelters, though with so many damaged in western Kentucky displaced people will need to be housed elsewhere. Emergency services also suffer tremendous losses in western Kentucky. There are 77 at least moderately damaged fire stations and 23 police stations similarly damaged, as shown in Table 39. In addition, 107 fire stations and 34 police stations, all in the western Kentucky, are not operational the day after the event. With 17 hospitals in that same area not operational, all emergency response services will be impaired.

Table 39: NMSZ Event Essential Facilities Damage for the State of Kentucky[17]

Essential Facilities Damage & Functionality				
Essential Facility Type	**Total No. Facilities**	**At Least Moderate Damage (Damage >50%)**	**Complete Damage (Damage >50%)**	**Functionality >50% at Day 1**
Hospitals	135	6	4	118
Schools	1,846	98	79	1,713
EOCs	0	0	0	0
Police Stations	407	23	19	373
Fire Stations	1,066	77	61	959

[17] See footnote (3).

Transportation lifelines in the critical counties incur substantial damage and are likely to make travel within the region and access to the region from the outside difficult. There are approximately 200 damaged bridges in western Kentucky and nearly 50 of those are completely damaged, indicating they will not regain functionality for a significant period of time (see Table 40). The majority of these completely damaged bridges are in Fulton, Hickman, Carlisle, Ballard, McCracken and Graves Counties. In addition, there are 14 completely damaged port facilities, with roughly half on the Mississippi and half on the Ohio Rivers. Also, 19 airports are moderately or more severely damaged with 13 non operational immediately after the earthquake.

Table 40: NMSZ Event Highway Bridge Damage for the State of Kentucky[18]

Highway Bridge Damage Assessments				
	Total No. of Bridges	**At Least Moderate Damage (Damage >50%)**	**Complete Damage (Damage >50%)**	**Functionality >50% at Day 1**
25 Critical Counties	2,173	197	46	1,974
Remaining Counties	4,632	0	0	4,630
Total State	6,805	197	46	6,604

Table 41: NMSZ Event Waste Water Facilities Damage for the State of Kentucky[19]

Waste Water Facilities Damage Assessments				
	Total No. of Waste Water Facilities	**At Least Moderate Damage (Damage >50%)**	**Complete Damage (Damage >50%)**	**Functionality >50% at Day 1**
25 Critical Counties	1,561	523	81	764
Remaining Counties	7,530	0	0	7,530
Total State	9,081	523	81	8,294

In addition, numerous utility lifelines are damaged and not functioning in the critical counties. As shown in Table 41 more than 500 waste water facilities incur at least moderate damage and 81 of those facilities are completely damaged. In the days immediately after the earthquake, approximately 800 waste water facilities in the critical counties are not functioning, which will severely limit service to many residents in western Kentucky. Electric power facilities in the critical counties are also heavily damaged with 132 facilities incurring at least moderate damage and 232 of the 463 electric power facilities not operational immediately after the event. In addition, 850 communication facilities are out of service in the days after the earthquake.

With such extensive functional losses in the critical counties, tens of thousands of households are without crucial services. Table 42 illustrates the numbers of households without potable water and electric power in the days and weeks after the NMSZ earthquake. The day after the event, nearly 109,000 households are without water and 77,000 are without electricity. A large portion of households regain service within the

[18] See footnote (3).
[19] See footnote (3).

first week, but there are still 67,000 households without water in the most heavily damaged areas. With such extended service losses in western Kentucky, some residents whose homes are not heavily damaged may be forced to leave due to a lack of drinking water and electricity. For more information on direct damage and functional losses in the State of Kentucky, please refer to Appendix V for detailed assessment results and to Appendix VIII for damage and functionality maps.

Table 42: NMSZ Event Utility Service Interruptions for the State of Kentucky

Utility Service Interruptions Number of Households without Service						
	No. Households	Day 1	Day 3	Day 7	Day 30	Day 90
Potable Water	1,590,647	108,556	92,742	66,608	38,964	0
Electric Power		77,263	60,273	36,450	11,464	86

Mississippi New Madrid Seismic Zone Scenario

The NMSZ event on the southwest segment of the fault generates intense shaking in Mississippi's northern counties. As a result, 25 counties are identified as critical and most of the damage incurred by the State of Mississippi is expected to occur in this set of counties. These 25 critical counties are highlighted in Figure 16 and are listed below:

- Alcorn
- Benton
- Bolivar
- Calhoun
- Chickasaw
- Coahoma
- Desoto
- Grenada
- Itawamba
- Lafayette
- Lee
- Marshall
- Monroe
- Panola
- Pontotoc
- Prentiss
- Quitman
- Sunflower
- Tallahatchie
- Tate
- Tippah
- Tishomingo
- Tunica
- Union
- Yalobusha

Buildings in Mississippi are expected to incur moderate damage in the northern portion of the state, with limited cases of complete damage which are limited to the critical counties. There are 7,300 buildings that are estimated to incur complete damage, all of which are in the 25 critical counties. Approximately 35,000 of the 39,000 moderate and severe damage cases occur in the critical counties. Table 43 illustrates the distribution of building damage by occupancy type. Nearly all complete and moderate/severe damage is experienced by residential construction, leaving 45,000 of the one million residential structures in Mississippi damaged.

As with many other NMSZ states, wood frame buildings and mobile homes are the most common structural systems. What is uncommon, however, is the small percentage of building inventory belonging to URMs. In Mississippi, approximately 5% of the total building inventory is URM construction. Nearly half of all complete damage occurs in wood frame buildings even though only 25% of moderate damage is incurred by this type of construction. Approximately 60% of all moderate damage is attributed to mobile homes, as shown in Table 44. It is also relevant to note that while steel, concrete and

Kentucky – New Madrid Seismic Zone Scenario

This earthquake impact assessment includes all 120 counties in the State of Kentucky. Kentucky is approximately 40,400 square miles and is bordered by Indiana and Ohio to the north, Tennessee to the south, West Virginia and Virginia to the east and Illinois and Missouri to the west. For the purposes of this analysis, 25 critical counties have been identified in the western portion of the state where shaking is anticipated to be most intense. These 25 counties are the focus of much of the damage assessment included within this document. The critical counties are listed below:

- Ballard
- Caldwell
- Calloway
- Carlisle
- Christian
- Crittenden
- Daviess
- Fulton
- Graves
- Hancock
- Henderson
- Hickman
- Hopkins
- Livingston
- Logan
- Lyon
- McCracken
- McLean
- Marshall
- Muhlenberg
- Ohio
- Todd
- Trigg
- Union
- Webster

The NMSZ scenario for the State of Kentucky consists of a magnitude 7.7 (M_w7.7) earthquake along the northeast extension of the presumed eastern fault line in the New Madrid fault system. The ground motions used to represent this seismic event were developed by the U.S. Geological Survey (USGS) for the middle fault in the proposed New Madrid Seismic Zone (NMSZ). Each fault line is presumed to consist of three fault segments; northeastern, central, and southwestern. This scenario, the worst case event for Kentucky, employs an event in the northeast segment of the eastern fault. The location of this scenario event is illustrated in Figure 7. For more information on the ground motion used in this scenario please reference Appendix I.

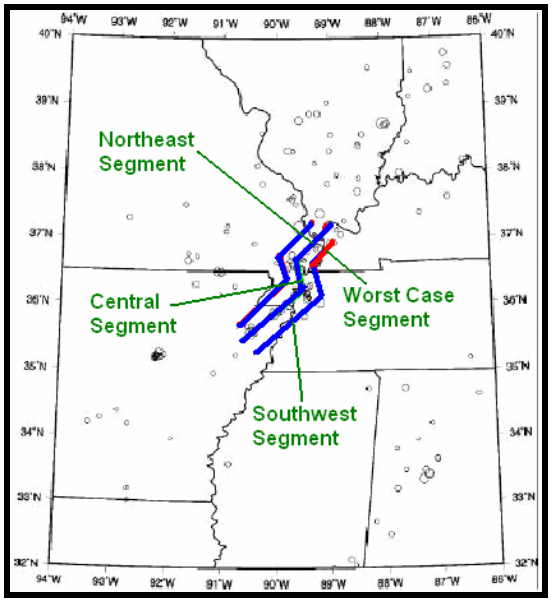


Figure 7: Scenario Fault Location for the State of Kentucky

Within the State of Kentucky, nearly 29,000 buildings experience complete damage, which are included in the nearly 53,000 at least moderately damaged buildings. While this is roughly 2% of all Kentucky buildings, many of these collapsed structures are concentrated in the western counties. As with previous state scenarios, residential buildings experience the greatest amount of damage. Nearly 98% of all building collapses occur to residential structures. In addition, about 94% of all at least moderate damage occurs in the 25 critical counties for Kentucky.

Table 180: Damage by General Occupancy Type for the State of Kentucky

General Occupancy Type Damage (State level)			
General Occupancy Type	**Total No. Buildings**	**Moderate to Severe Damage**	**Complete Damage**
Single Family	1,159,114	39,150	18,768
Other Residential	292,873	13,050	9,673
Commercial	16,431	306	475
Industrial	3,002	48	53
Other	1,900	34	60
Total	1,473,320	52,588	29,029

Table 181: Damage by General Occupancy Type for the 25 Critical Counties

General Occupancy Type Damage (25 Critical Counties)			
General Occupancy Type	**Total No. Buildings**	**Moderate to Severe Damage**	**Complete Damage**
Single Family	189,655	38,707	18,652
Other Residential	50,493	10,619	9,619
Commercial	1,682	259	475
Industrial	265	37	53
Other	242	29	60
Total	242,337	49,651	28,859

Wood frame construction is the most common type of building in the State of Kentucky and also generates the most cases of complete damage. Over 47% of all collapses, 13,700 buildings, is experienced by wood frame structures. Unreinforced masonry (URM) construction and mobile homes (MH) also show high frequencies of collapse and account for nearly all non-wood construction building collapses. This damage state is identified by significant cracking to unreinforced masonry walls as well as some connection damage to column/beam joints in unreinforced masonry building. The remaining building types show far less inventory throughout the state and thus experience a far lesser proportion of damage.

Table 182: Building Damage by Building Type for the State of Kentucky

Building Damage by Building Type					
Building Type	**None**	**Slight**	**Moderate**	**Extensive**	**Complete**
Wood	992,135	18,737	24,772	11,617	13,726
Steel	6,430	264	93	39	201
Concrete	1,782	51	22	15	58
Precast	1,907	74	42	19	69
Reinforced Masonry	1,109	20	13	10	39
Unreinforced Masonry	137,881	8352	2,434	1,720	6,161
Mobile Home	197,127	25935	7,952	3,840	8,775
Total	1,338,371	53,433	35,328	17,260	29,029

Of the 1,066 fire stations in the state, 77 (more than 7%) are estimated to experience at least moderate damage. Approximately 5-7% of most other essential facility types (schools, hospitals, and police stations) each sustain at least moderate damage. In addition, 79 of the 1,846 schools and 61 fire stations are estimated to collapse. All of these facilities are in the most western counties in Kentucky. The Kentucky inventory does not specify any locations for emergency operations centers, thus no damage can be determined for this type of essential facility.

Not only are numerous facilities damaged but many facilities located in the western portion of Kentucky are not functional in the days immediately after the earthquake. All of the non-functional facilities are located in the western portion of the state. Of Kentucky's 135 hospitals, 118 are considered functional the day after the earthquake and after one week that number increases to 129 functional facilities. Roughly 90% of all fire stations and police stations in Kentucky are estimated to remain functional the day after the earthquake, though all of these functioning facilities are located in the central and eastern portions of the state. Most of Kentucky's western counties are left without functioning facilities and will likely experience diminished services in the immediate aftermath of an earthquake.

Transportation lifelines, particularly in western Kentucky counties incur the most severe damage. Roughly 200 of the 6,800, or approximately 3% of all bridges, are estimated to incur at least moderate damage. Of the nearly 200 damaged bridges, almost 50 are expected to collapse. These collapses are shown to occur in counties along the western border of Kentucky. Highway road segments connecting these damaged bridges are expected to incur slightly less damage than the bridges themselves, even in the counties with the most severe shaking. Highway segments are most generally defined as a section of highway between two end nodes. These end nodes are frequently highway bridges. At least moderate damage to highway bridges is characterized by moderate shear (diagonal) cracking of columns, spalling of cover concrete and shear keys, abutment movement less than two-inches, extensive cracking to shear keys, bent connection bolts, and moderate settlement of the bridge approaches.

Table 183: Essential Facilities Damage & Functionality for the State of Kentucky[7]

Essential Facilities Damage & Functionality (State)				
Essential Facility Type	**Total No. Facilities**	**At Least Moderate Damage (Damage >50%)**	**Complete Damage (Damage >50%)**	**Functionality >50% at Day 1**
Hospitals	135	6	4	118
Schools	1,846	98	79	1,713
EOCs	0	0	0	0
Police Stations	407	23	19	373
Fire Stations	1,066	77	61	959

Table 184: Essential Facilities Damage & Functionality for the 25 Critical Counties

Essential Facilities Damage & Functionality (25 Critical Counties)				
Essential Facility Type	**Total No. Facilities**	**At Least Moderate Damage (Damage >50%)**	**Complete Damage (Damage >50%)**	**Functionality >50% at Day 1**
Hospitals	21	6	4	5
Schools	301	98	79	168
EOCs	0	0	0	0
Police Stations	77	23	19	44
Fire Stations	238	77	61	133

Table 185: Highway Bridge Damage Assessments

Highway Bridge Damage Assessments				
	Total No. Of Bridges	**At Least Moderate Damage (Damage >50%)**	**Complete Damage (Damage >50%)**	**Functionality >50% at Day 1**
25 Critical Counties	2,173	197	46	1,974
Remaining Counties	4,632	0	0	4,630
Total State	6,805	197	46	6604

Table 186: Airport Damage Assessments

Airport Damage Assessments				
	Total No. Of Airports	**At Least Moderate Damage (Damage >50%)**	**Complete Damage (Damage >50%)**	**Functionality >50% at Day 1**
25 Critical Counties	53	19	1	40
Remaining Counties	166	0	0	166
Total State	219	19	1	206

[7] For Tables 183-193 the following method is used to determine the number of facilities in a damage category. HAZUS-MH MR2 assigns each facility a probability of reaching a specific damage level (at least moderate, complete, etc.). In order to provide quantities of facilities at various damage levels, all those facilities that experience a damage probability of 50% or greater for a given damage level are counted as 'damaged'. Therefore, the facilities that are not 50% likely to incur damage at a specific damage level are deemed 'undamaged'.

Furthermore, 86 ports, 23 railway facilities and 19 airports reach at least moderate damage state and follow roughly the same damage distribution throughout the state as highway bridges. At least moderate damage to port facilities includes considerable ground settlement, derailment of port equipment and damage to structural members. For airports, at least moderate damage is defined in the same manner as damage to other building types discussed previously. The lack of functionality of many transportation lifelines in western Kentucky will make the movement of people and supplies difficult in the days immediately following the earthquake.

Table 187: Transportation System Damage for the State of Kentucky

Transportation System Damage					
Transportation System	**Type**	**Quantity**	**At Least Moderate Damage (Damage >50%)**	**Complete Damage (Damage >50%)**	**Functionality at Day 1 < 50%**
Highway	Segments	9,481	0	0	9,481
	Bridges	6,805	197	46	6,604
	Tunnels	4	0	0	4
Railways	Segments	2,761	0	0	2,761
	Bridges	166	3	0	163
	Tunnels	18	0	0	18
	Facilities	117	23	0	96
Bus	Facilities	26	2	0	25
Light Rail	Segments	0	0	0	0
	Bridges	0	0	0	0
	Facilities	0	0	0	0
Ferry	Facilities	16	16	16	0
Port	Facilities	301	86	14	221
Airport	Facilities	219	19	1	206
	Runways	155	0	0	155

Table 188: Damage to Potable Water Facilities

Potable Water Facilities Damage Assessments				
	Total No. of Potable Water Facilities	**At Least Moderate Damage (Damage >50%)**	**Complete Damage (Damage >50%)**	**Functionality >50% at Day 1**
25 Critical Counties	36	11	0	27
Remaining Counties	143	0	0	143
Total State	179	11	0	170

Utility lifelines' damage and functionality are similar to those found for the transportation systems. Over 500 waste water facilities are moderately or more severely damaged while 81 incur complete damage. Approximately 1,050 communication facilities incur at least moderate damage, while 133 experience complete damage. Additionally, 8% of all electric power facilities reach at least moderate damage state.

Table 189: Damage to Waste Water Facilities

Waste Water Facilities Damage Assessments				
	Total No. of Waste Water Facilities	At Least Moderate Damage (Damage >50%)	Complete Damage (Damage >50%)	Functionality >50% at Day 1
25 Critical Counties	1,561	523	81	764
Remaining Counties	7,530	0	0	7,530
Total State	9,081	523	81	8,294

Table 190: Damage to Natural Gas Facilities

Natural Gas Facilities Damage Assessments				
	Total No. of Natural Gas Facilities	At Least Moderate Damage (Damage > 50%)	Complete Damage (Damage > 50%)	Functionality >50% at Day 1
25 Critical Counties	24	6	4	0
Remaining Counties	313	0	0	313
Total State	337	6	4	313

Table 191: Damage to Oil Facilities

Oil Facilities Damage Assessments				
	Total No. of Oil Facilities	At Least Moderate Damage (Damage > 50%)	Complete Damage (Damage > 50%)	Functionality >50% at Day 1
25 Critical Counties	31	6	1	23
Remaining Counties	57	0	0	57
Total State	88	6	1	80

Table 192: Damage to Electric Power Facilities

Electric Power Facilities Damage Assessments				
	Total No. of Electric Power Facilities	At Least Moderate Damage (Damage >50%)	Complete Damage (Damage >50%)	Functionality >50% at Day 1
25 Critical Counties	463	132	40	231
Remaining Counties	1,230	0	0	1,230
Total State	1,693	132	40	1,461

Table 193: Damage to Communication Facilities

Communication Damage Assessments				
	Total No. of Communication Facilities	At Least Moderate Damage (Damage >50%)	Complete Damage (Damage >50%)	Functionality >50% at Day 1
25 Critical Counties	3,262	1,044	133	2,410
Remaining Counties	13,095	0	0	13,095
Total State	16,357	1,044	133	15,505

Pipeline damage is estimated for local potable water, waste water and natural gas systems. Major transmission pipelines for natural gas are added from HSIP 2007 data. Oil pipelines are not included in the HAZUS-MH MR2 default inventory, called local inventory in HAZUS-MH MR2, though regional oil pipelines are added to provide damage estimates for these major oil transmission lines. These oil pipelines are composed of major crude oil and refined product lines only. Regional and local natural gas networks are represented separately and damage is estimated for each. Potable water lines show the greatest amount of both breaks and leaks at roughly 7,283 and 7,804, respectively. Local natural gas lines experience the greatest leak and break rates per length of pipe, at roughly 0.16 leaks/mile (1 leak every 6.2 miles) and approximately 0.15 breaks/mile (1 break every 6.7 miles), respectively. In addition, estimates for local and regional damage to natural gas lines can be combined for a total state damage estimate of 6,702 leaks and 6,457 breaks over the combined length of 48,499 miles of natural gas pipeline.

Potable water service is cut off to nearly 109,000 residences the day after the scenario earthquake. This number is reduced to roughly 67,000 residences within a week. After three months, potable water service is restored for all residences, as shown in Table 195. These estimates are calculated employing a formula that uses the damage to the distribution system to determine the rate of repair. Additional information on this formula is available in the HAZUS-MH MR2 Technical Manual that accompanies the program. This period of time without water prevents thousands of people from remaining in their homes in the weeks and months following the earthquake. Electric power service shows similar trends, with over 77,000 residences without electric power the day after the earthquake, or nearly 5% of all State residences. Even a month after the earthquake, over 36,000 residences are still without power. All electric power lines in Kentucky are presumed to be above ground and less likely to incur damage from moderate ground shaking, unlike buried pipelines that are vulnerable to damage from liquefaction and ground deformation.

Table 194: Pipeline Damage

Pipeline Damage			
System	**Total Pipelines (mi)**	**No. Leaks**	**No. Breaks**
Potable Water - Local	102,749	7,804	7,283
Waste Water - Local	61,650	6,173	5,760
Natural Gas - Regional	7,399	104	300
Natural Gas - Local	41,100	6,598	6,157
Oil - Regional	1,165	43	116

Table 195: Utility Service Interruptions for the State of Kentucky

Utility Service Interruptions Number of Households without Service						
	No. Households	**Day 1**	**Day 3**	**Day 7**	**Day 30**	**Day 90**
Potable Water	1,590,647	108,556	92,742	66,608	38,694	0
Electric Power		77,263	60,273	36,450	11,464	86

The infrastructure damage in HAZUS-MH MR2 is evaluated based on a percentage of reaching a specified damage level. There are various methods available to quantify damage based on the likelihoods of reaching the four damage levels available in HAZUS-MH MR2. Two different methods are employed in this report and are discussed herein.

Some of the following damage tables depict damage at the county level for essential, transportation and utility facilities. This is the format employed to generate the HAZUS-MH MR2 summary reports for various types of infrastructure and networks. The damage state likelihoods (shown as percentages) represent the **average** damage state likelihoods for all facilities of a given type in a specific county. The damage estimates shown previously for corresponding infrastructure types are based on a different set of criteria as discussed in footnote (7) and employed in the preceding damage tables for this scenario. Both methods are employed in HAZUS-MH MR2 and are valid estimation methodologies, though they generate different estimations of county damage for a specific facility type. Consider the following comparison:

- Lyon County, Kentucky – 33 waste water facilities
  - Estimation procedure according to footnote 7:
    - Summation of individual facilities after that facility is deemed 'damaged' or 'undamaged' based on 50% or greater damage likelihood requirement estimates **24 at least moderately damaged waste water facilities**
  - Estimation procedure according to topic damage tables in this appendix:
    - To determine the percentage of waste water facilities in the at least moderate damage category add the percentages for moderate, extensive and complete damage county then multiply by the number of facilities in that county
    - Using these damage state probabilities averaged over all the facilities in the county provides an estimate of **18 at least moderately damages waste water facilities**

In the case of Lyon County, Kentucky, the topic damage tables in this appendix provide a lower estimate of damage as oppose to the facility-by-facility damage summation detailed in footnote (7). Though not illustrated here, other counties in Kentucky are estimated to incur greater damage when this averaging estimation procedure is used. Comparing the total number of at least moderately damaged waste water facilities for the 25 critical counties in Kentucky shows the following:

- Total number of at least moderately damaged waste water facilities according to the HAZUS-MH MR2 procedure for averaging damage at the county level
  - **663 at least moderately damaged waste water facilities**
- Total number of at least moderately damaged waste water facilities according to the other HAZUS-MH MR2 method of assessing facility-by-facility damage
  - **523 at least moderately damaged waste water facilities**

Comparing damage estimates for these two methods clearly shows that the averaging procedure produces greater damage. This trend holds true for other infrastructure types including highway bridges.

The following tables provide damage and functionality estimates for the NMSZ scenario critical counties in Kentucky. There tables employ the HAZUS-MH MR2 damage methodology of averaging each of four damage levels for a county.

Table 196: Building Damage by General Occupancy

Counties	Green (None)	Green (Slight)	Green (Moderate)	Yellow (Extensive)	Red (Complete)	Total
Ballard						
Single Family	5	172	1,038	722	749	2,686
Other Residential	0	1	40	158	562	761
Commercial	0	0	0	2	13	15
Industrial	0	0	0	0	6	6
Other	0	0	0	0	4	4
Caldwell						
Single Family	3,696	495	61	4	6	4,262
Other Residential	440	327	180	5	2	954
Commercial	22	9	4	0	0	35
Industrial	3	2	1	0	0	6
Other	2	0	0	0	0	2
Calloway						
Single Family	2,030	4,143	2,463	368	615	9,619
Other Residential	412	748	1,192	910	381	3,643
Commercial	3	16	47	35	17	118
Industrial	0	0	2	2	1	5
Other	0	32	5	54	2	93
Carlisle						
Single Family	1	45	455	633	607	1,741
Other Residential	0	0	1	23	471	495
Commercial	0	0	0	0	12	12
Industrial	0	0	0	0	2	2
Other	0	0	0	0	5	5
Christian						
Single Family	14,778	1,980	242	11	0	17,011
Other Residential	2,235	1,265	654	17	0	4,171
Commercial	99	42	17	1	0	159
Industrial	17	8	5	0	0	30
Other	15	5	2	0	0	22
Crittenden						
Single Family	2,321	311	38	2	0	2,672
Other Residential	486	399	224	5	0	1,114
Commercial	7	3	1	0	0	11
Industrial	2	1	1	0	0	4
Other	2	0	0	0	0	2
Daviess						
Single Family	24,709	545	59	3	2,850	28,166
Other Residential	3,095	364	123	2	335	3,919
Commercial	256	8	1	0	39	304
Industrial	21	1	0	0	3	25
Other	23	0	0	0	3	26

Counties	Green (None)	Green (Slight)	Green (Moderate)	Yellow (Extensive)	Red (Complete)	Total
Fulton						
Single Family	24	364	819	509	681	2,397
Other Residential	2	22	50	47	227	348
Commercial	0	0	0	1	15	16
Industrial	0	0	0	0	3	3
Other	0	0	0	0	4	4
Graves						
Single Family	76	1,499	5,201	2,202	2,326	11,304
Other Residential	1	37	308	688	1,741	2,775
Commercial	0	0	8	21	49	78
Industrial	0	0	1	3	19	23
Other	0	0	1	2	10	13
Hancock						
Single Family	2,314	14	1	0	0	2,329
Other Residential	844	85	10	0	0	939
Commercial	8	0	0	0	0	8
Industrial	10	0	0	0	0	10
Other	1	0	0	0	0	1
Henderson						
Single Family	9,907	1,452	176	9	1,294	12,838
Other Residential	1,473	892	469	12	272	3,118
Commercial	74	31	13	1	22	141
Industrial	23	11	6	1	3	44
Other	10	3	1	0	4	18
Hickman						
Single Family	2	118	862	414	307	1,703
Other Residential	0	0	4	33	424	461
Commercial	0	0	0	0	5	5
Industrial	0	0	0	0	1	1
Other	0	0	0	0	4	4
Hopkins						
Single Family	11,326	1,518	186	11	818	13,859
Other Residential	1,647	1,219	670	17	190	3,743
Commercial	81	34	14	1	5	135
Industrial	14	7	4	0	0	25
Other	16	6	2	0	1	25
Livingston						
Single Family	1,078	1,067	583	85	109	2,922
Other Residential	206	255	453	368	106	1,388
Commercial	3	5	10	7	3	28
Industrial	1	0	1	1	0	3
Other	2	1	2	1	0	6

Counties	Green (None)	Green (Slight)	Green (Moderate)	Yellow (Extensive)	Red (Complete)	Total
Logan						
Single Family	8,039	50	3	0	0	8,092
Other Residential	1,987	187	23	0	0	2,197
Commercial	63	2	0	0	0	65
Industrial	18	1	0	0	0	19
Other	11	0	0	0	0	11
Lyon						
Single Family	2,175	386	46	2	59	2,668
Other Residential	492	394	219	5	34	1,144
Commercial	14	6	2	0	1	23
Industrial	0	0	0	0	0	0
Other	4	2	0	0	0	6
Marshall						
Single Family	164	2,569	5,461	1,244	1,115	10,553
Other Residential	2	42	495	1,072	1,350	2,961
Commercial	0	1	8	20	39	68
Industrial	0	0	1	2	5	8
Other	0	0	1	2	5	8
McCracken						
Single Family	11	705	7,951	6,619	5,431	20,717
Other Residential	0	26	371	873	3,032	4,302
Commercial	0	0	5	32	241	278
Industrial	0	0	0	1	8	9
Other	0	0	2	3	16	21
McLean						
Single Family	2,351	130	15	1	113	2,610
Other Residential	868	225	96	2	53	1,244
Commercial	11	2	1	0	1	15
Industrial	0	0	0	0	0	0
Other	3	0	0	0	0	3
Muhlenberg						
Single Family	8,250	52	3	0	256	8,561
Other Residential	2,791	272	34	0	78	3,175
Commercial	47	1	0	0	4	52
Industrial	4	0	0	0	1	5
Other	18	0	0	0	2	20
Ohio						
Single Family	6,020	38	3	0	0	6,061
Other Residential	2,357	230	28	0	0	2,615
Commercial	33	1	0	0	0	34
Industrial	6	0	0	0	0	6
Other	6	0	0	0	0	6

Counties	Green (None)	Green (Slight)	Green (Moderate)	Yellow (Extensive)	Red (Complete)	Total
Todd						
Single Family	3,359	21	1	0	0	3,381
Other Residential	986	99	12	0	0	1,097
Commercial	9	0	0	0	0	9
Industrial	5	0	0	0	0	5
Other	11	0	0	0	0	11
Trigg						
Single Family	4,171	559	68	3	0	4,801
Other Residential	637	514	287	7	0	1,445
Commercial	14	6	2	0	0	22
Industrial	9	4	3	0	0	16
Other	3	1	0	0	0	4
Union						
Single Family	2,664	547	64	4	1,092	4,371
Other Residential	414	334	186	5	313	1,252
Commercial	16	7	3	0	8	34
Industrial	3	1	1	0	1	6
Other	0	0	0	0	0	0
Webster						
Single Family	3,567	478	59	3	224	4,331
Other Residential	494	417	235	6	80	1,232
Commercial	10	4	2	0	1	17
Industrial	2	1	1	0	0	4
Other	4	1	0	0	0	5

Table 197: Hospital Functionality

Counties	Total # of Beds	Day 1		Day 3		Day 7		Day 30		Day 90	
		# of Beds	%	# of Beds	%	# of Beds	%	# of Beds	%	# of Beds	%
Ballard	0	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
Caldwell	15	7	46.67	7	46.67	11	73.33	15	100.00	15	100.00
Calloway	378	2	0.53	2	0.53	10	2.65	110	29.10	212	56.08
Carlisle	0	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
Christian	592	282	47.64	286	48.31	436	73.65	578	97.64	585	98.82
Crittenden	48	23	47.92	23	47.92	35	72.92	47	97.92	47	97.92
Daviess	469	422	89.98	423	90.19	435	92.75	438	93.39	438	93.39
Fulton	70	0	0.00	0	0.00	2	2.86	28	40.00	45	64.29
Graves	106	0	0.00	0	0.00	0	0.00	0	0.00	2	1.89
Hancock	0	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
Henderson	205	73	35.61	74	36.10	113	55.12	150	73.17	152	74.15
Hickman	0	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
Hopkins	401	191	47.63	194	48.38	295	73.57	391	97.51	396	98.75
Livingston	26	12	46.15	12	46.15	19	73.08	25	96.15	26	100.00
Logan	92	89	96.74	89	96.74	91	98.91	92	100.00	92	100.00
Lyon	0	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
Marshall	563	0	0.00	0	0.00	0	0.00	0	0.00	1	0.18
McCracken	0	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
McLean	84	0	0.00	0	0.00	0	0.00	0	0.00	1	1.19
Muhlenberg	135	130	96.30	130	96.30	134	99.26	135	100.00	135	100.00
Ohio	49	47	95.92	47	95.92	49	100.00	49	100.00	49	100.00
Todd	0	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
Trigg	25	12	48.00	12	48.00	18	72.00	24	96.00	25	100.00
Union	54	24	44.44	24	44.44	37	68.52	49	90.74	50	92.59
Webster	0	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A

Table 198: Police Station Functionality

Counties	Count	Functionality At Day 1 (%)
Ballard	2	0.00
Caldwell	2	51.90
Calloway	3	0.73
Carlisle	2	0.00
Christian	6	51.90
Crittenden	2	51.90
Daviess	2	81.60
Fulton	3	0.00
Graves	3	0.00
Hancock	3	94.10
Henderson	3	45.30
Hickman	2	0.00
Hopkins	7	51.90
Livingston	1	0.80
Logan	5	94.10
Lyon	2	47.00
Marshall	3	0.00
McCracken	4	0.00
McLean	2	51.90
Muhlenberg	3	94.10
Ohio	3	89.93
Todd	4	94.10
Trigg	2	51.90
Union	4	39.65
Webster	4	49.38

Table 199: School Functionality

Counties	Count	Functionality at Day 1 (%)
Ballard	7	0.00
Caldwell	6	51.90
Calloway	13	0.80
Carlisle	4	0.00
Christian	27	51.90
Crittenden	3	51.90
Daviess	45	80.67
Fulton	9	0.00
Graves	18	0.00
Hancock	4	94.10
Henderson	16	44.00
Hickman	3	0.00
Hopkins	23	51.59
Livingston	5	14.60
Logan	15	94.10
Lyon	5	47.00
Marshall	13	0.00
McCracken	28	0.00
McLean	6	64.83
Muhlenberg	12	94.10
Ohio	12	89.93
Todd	7	94.10
Trigg	5	51.90
Union	7	42.76
Webster	8	51.08

Table 200: Fire Station Functionality

Counties	Count	Functionality at Day 1 (%)
Ballard	10	0.00
Caldwell	3	51.90
Calloway	11	12.91
Carlisle	6	0.00
Christian	23	51.90
Crittenden	7	51.90
Daviess	17	78.29
Fulton	3	0.00
Graves	18	0.00
Hancock	4	94.10
Henderson	14	46.19
Hickman	5	0.00
Hopkins	18	51.52
Livingston	8	12.30
Logan	6	94.10
Lyon	4	47.00
Marshall	12	0.00
McCracken	9	0.00
McLean	8	76.71
Muhlenberg	8	92.54
Ohio	9	91.32
Todd	7	94.10
Trigg	11	51.90
Union	8	40.40
Webster	9	51.17

Table 201: Communication Functionality

Counties	# of Facilities	At day 1 (%)	At day 3 (%)	At day 7 (%)	At day 30 (%)	At day 90 (%)
Ballard	92	22.21	31.44	41.11	69.63	94.55
Caldwell	70	78.28	93.85	95.95	99.38	99.88
Calloway	111	54.85	76.56	82.38	94.77	99.03
Carlisle	42	25.33	37.56	47.96	76.44	95.79
Christian	265	89.51	97.68	98.58	99.80	99.90
Crittenden	61	77.69	93.40	95.58	99.20	99.84
Daviess	338	92.83	98.53	99.03	99.59	99.84
Fulton	63	31.29	47.21	56.97	82.15	96.82
Graves	158	33.29	50.54	60.26	84.62	97.23
Hancock	85	99.70	99.90	99.90	99.90	99.90
Henderson	320	86.22	95.32	96.42	98.40	99.63
Hickman	43	28.77	43.93	54.51	81.69	96.68
Hopkins	255	89.92	97.75	98.59	99.74	99.88
Livingston	82	43.75	64.76	72.93	91.61	98.45
Logan	125	93.20	98.90	99.40	99.90	99.90
Lyon	62	66.78	87.10	91.10	98.48	99.68
Marshall	146	38.80	57.97	66.24	86.48	97.54
McCracken	251	24.67	36.00	45.71	73.31	95.23
McLean	53	93.00	98.70	99.20	99.73	99.87
Muhlenberg	177	93.16	98.86	99.36	99.87	99.89
Ohio	127	93.10	98.80	99.30	99.81	99.88
Todd	63	93.20	98.90	99.40	99.90	99.90
Trigg	71	78.40	94.00	96.10	99.50	99.90
Union	113	77.54	92.90	95.00	98.67	99.69
Webster	89	85.36	96.00	97.30	99.37	99.82

Table 202: Households without Potable Water Service

Counties	# of Households	At day 1 (%)	At day 3 (%)	At day 7 (%)	At day 30 (%)	At day 90 (%)
Ballard	3,395	99.41	99.26	98.76	0.00	0.00
Caldwell	5,431	0.00	0.00	0.00	0.00	0.00
Calloway	13,862	55.34	42.19	7.59	0.00	0.00
Carlisle	2,208	98.19	97.24	92.71	0.00	0.00
Christian	24,857	0.00	0.00	0.00	0.00	0.00
Crittenden	3,829	0.00	0.00	0.00	0.00	0.00
Daviess	36,033	34.44	20.03	0.02	0.00	0.00
Fulton	3,237	98.33	97.62	94.84	0.00	0.00
Graves	14,841	99.34	99.28	99.12	96.83	0.00
Hancock	3,215	0.00	0.00	0.00	0.00	0.00
Henderson	18,095	38.88	22.65	0.00	0.00	0.00
Hickman	2,188	97.71	96.66	92.37	0.00	0.00
Hopkins	18,820	61.06	51.14	23.07	0.00	0.00
Livingston	3,996	22.15	0.00	0.00	0.00	0.00
Logan	10,506	0.00	0.00	0.00	0.00	0.00
Lyon	2,898	0.10	0.00	0.00	0.00	0.00
Madison	27,152	0.00	0.00	0.00	0.00	0.00
Marshall	12,412	69.05	58.86	25.88	0.00	0.00
Mason	6,847	0.00	0.00	0.00	0.00	0.00
Muhlenberg	12,357	0.30	0.00	0.00	0.00	0.00
Ohio	8,899	0.00	0.00	0.00	0.00	0.00
Todd	4,569	0.00	0.00	0.00	0.00	0.00
Trigg	5,215	0.00	0.00	0.00	0.00	0.00
Union	5,710	97.93	97.48	96.09	0.00	0.00
Webster	5,560	27.09	2.55	0.00	0.00	0.00

Table 203: Potable Water Facility Damage

Counties	# of Facilities	None (%)	Slight (%)	Moderate (%)	Extensive (%)	Complete (%)
Ballard	N/A	N/A	N/A	N/A	N/A	N/A
Caldwell	N/A	N/A	N/A	N/A	N/A	N/A
Calloway	N/A	N/A	N/A	N/A	N/A	N/A
Carlisle	N/A	N/A	N/A	N/A	N/A	N/A
Christian	2	0.50	0.38	0.11	0.01	0.00
Crittenden	1	0.20	0.42	0.31	0.07	0.01
Daviess	2	0.50	0.37	0.11	0.01	0.01
Fulton	N/A	N/A	N/A	N/A	N/A	N/A
Graves	N/A	N/A	N/A	N/A	N/A	N/A
Hancock	2	0.94	0.06	0.00	0.00	0.00
Henderson	1	0.50	0.37	0.11	0.01	0.01
Hickman	N/A	N/A	N/A	N/A	N/A	N/A
Hopkins	2	0.35	0.40	0.21	0.04	0.00
Livingston	3	0.02	0.13	0.36	0.32	0.18
Logan	2	0.50	0.38	0.11	0.01	0.00
Lyon	3	0.12	0.35	0.37	0.12	0.04
Marshall	3	0.02	0.13	0.35	0.32	0.18
McCracken	3	0.00	0.03	0.20	0.38	0.38
McLean	2	0.50	0.37	0.11	0.01	0.00
Muhlenberg	2	0.50	0.38	0.11	0.01	0.00
Ohio	3	0.50	0.37	0.11	0.01	0.00
Todd	1	0.50	0.38	0.11	0.01	0.00
Trigg	1	0.20	0.42	0.31	0.07	0.01
Union	N/A	N/A	N/A	N/A	N/A	N/A
Webster	3	0.29	0.40	0.24	0.05	0.03

Table 204: Potable Water Pipeline Damage

Counties	Length (miles)	Total Number of Leaks	Total Number of Breaks
Ballard	500	675	718
Caldwell	708	4	3
Calloway	1,129	143	229
Carlisle	376	968	384
Christian	1,615	9	2
Crittenden	694	4	1
Daviess	1,399	53	185
Fulton	442	941	459
Graves	1,318	1,200	1,780
Hancock	474	3	1
Henderson	1,203	50	177
Hickman	446	996	417
Hopkins	1,267	78	284
Livingston	571	65	73
Logan	1,271	7	2
Lyon	597	26	32
Madison	981	418	266
Marshall	997	1,447	1,180
Mason	519	14	45
Muhlenberg	1,193	17	43
Ohio	1,289	7	2
Todd	712	4	1
Trigg	1,044	6	1
Union	773	187	732
Webster	767	29	99

Table 205: Households without Electric Power Service

Counties	# of Households	At day 1 (%)	At day 3 (%)	At day 7 (%)	At day 30 (%)	At day 90 (%)
Ballard	3,395	95.58	87.22	67.01	26.10	0.09
Caldwell	5,431	0.00	0.00	0.00	0.00	0.00
Calloway	13,862	79.17	48.43	18.66	3.64	0.10
Carlisle	2,208	94.47	82.47	57.38	19.43	0.09
Christian	24,857	0.00	0.00	0.00	0.00	0.00
Crittenden	3,829	13.76	7.00	1.91	0.24	0.03
Daviess	36,033	0.00	0.00	0.00	0.00	0.00
Fulton	3,237	91.75	74.51	46.18	14.15	0.09
Graves	14,841	90.93	72.19	43.30	13.11	0.10
Hancock	3,215	0.00	0.00	0.00	0.00	0.00
Henderson	18,095	0.00	0.00	0.00	0.00	0.00
Hickman	2,188	93.19	78.02	49.82	15.08	0.09
Hopkins	18,820	0.00	0.00	0.00	0.00	0.00
Livingston	3,996	86.26	61.11	29.40	6.58	0.10
Logan	10,506	0.00	0.00	0.00	0.00	0.00
Lyon	2,898	56.04	28.54	7.94	1.04	0.07
Madison	27,152	0.00	0.00	0.00	0.00	0.00
Marshall	12,412	85.98	60.13	28.16	6.10	0.10
Mason	6,847	0.00	0.00	0.00	0.00	0.00
Muhlenberg	12,357	0.00	0.00	0.00	0.00	0.00
Ohio	8,899	0.00	0.00	0.00	0.00	0.00
Todd	4,569	0.00	0.00	0.00	0.00	0.00
Trigg	5,215	0.00	0.00	0.00	0.00	0.00
Union	5,710	0.00	0.00	0.00	0.00	0.00
Webster	5,560	0.00	0.00	0.00	0.00	0.00

Table 206: Waste Water Facility Damage

Counties	# of Facilities	None (%)	Slight (%)	Moderate (%)	Extensive (%)	Complete (%)
Ballard	22	0.00	0.01	0.11	0.37	0.51
Caldwell	16	0.20	0.42	0.31	0.07	0.01
Calloway	40	0.03	0.19	0.38	0.23	0.16
Carlisle	16	0.00	0.02	0.18	0.41	0.39
Christian	83	0.43	0.39	0.16	0.02	0.00
Crittenden	11	0.18	0.41	0.33	0.08	0.01
Daviess	162	0.50	0.37	0.11	0.01	0.01
Fulton	15	0.00	0.06	0.25	0.39	0.29
Graves	57	0.01	0.06	0.28	0.39	0.27
Hancock	82	0.94	0.06	0.00	0.00	0.00
Henderson	165	0.36	0.38	0.19	0.03	0.03
Hickman	24	0.00	0.04	0.22	0.41	0.33
Hopkins	99	0.40	0.39	0.18	0.03	0.00
Livingston	51	0.02	0.13	0.36	0.32	0.17
Logan	45	0.50	0.38	0.11	0.01	0.00
Lyon	33	0.11	0.35	0.37	0.12	0.04
Marshall	125	0.01	0.10	0.32	0.31	0.26
McCracken	147	0.00	0.02	0.15	0.37	0.45
McLean	19	0.50	0.37	0.11	0.01	0.01
Muhlenberg	89	0.50	0.38	0.11	0.01	0.00
Ohio	102	0.50	0.37	0.11	0.01	0.00
Todd	20	0.50	0.38	0.11	0.01	0.00
Trigg	28	0.20	0.42	0.31	0.07	0.01
Union	51	0.19	0.41	0.30	0.06	0.03
Webster	59	0.36	0.39	0.20	0.03	0.02

Table 207: Waste Water Pipeline Damage

Counties	Length (miles)	Total Number of Leaks	Total Number of Breaks
Ballard	300	534	568
Caldwell	425	4	3
Calloway	678	113	181
Carlisle	225	765	303
Christian	969	7	2
Crittenden	417	3	1
Daviess	840	42	147
Fulton	265	744	363
Graves	791	949	1,408
Hancock	284	2	1
Henderson	722	40	140
Hickman	268	788	330
Hopkins	760	61	225
Livingston	343	52	58
Logan	763	5	1
Lyon	358	20	25
Madison	589	330	211
Marshall	598	1,145	934
Mason	311	11	36
Muhlenberg	716	13	34
Ohio	773	6	1
Todd	427	3	1
Trigg	627	5	1
Union	464	148	579
Webster	460	23	78

Table 208: Highway Bridge Damage

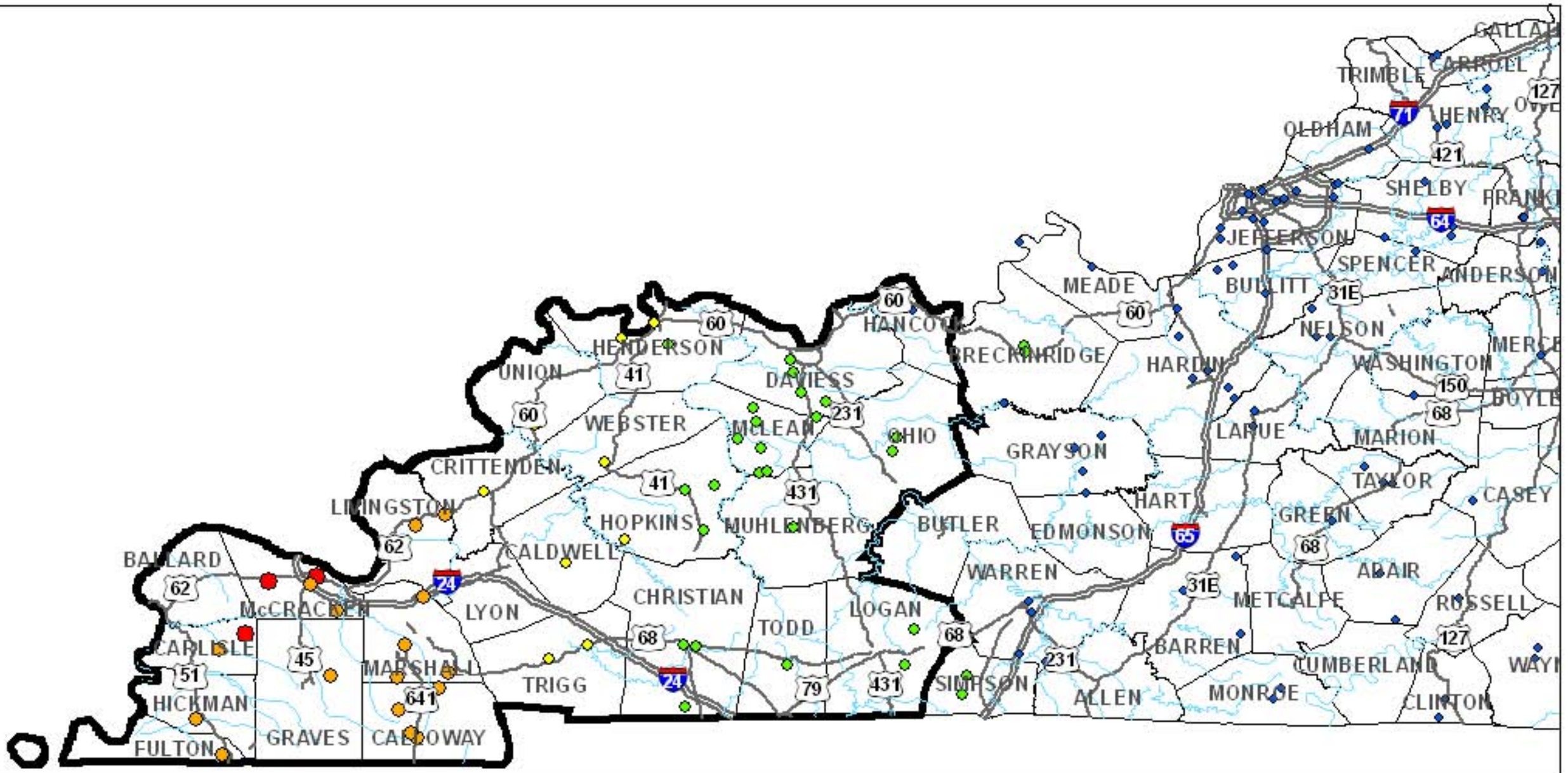
Counties	# of Bridges	None (%)	Slight (%)	Moderate (%)	Extensive (%)	Complete (%)
Ballard	25	0.33	0.10	0.07	0.12	0.38
Caldwell	84	0.93	0.02	0.01	0.00	0.04
Calloway	36	0.75	0.06	0.02	0.03	0.14
Carlisle	15	0.16	0.09	0.09	0.17	0.49
Christian	202	0.97	0.02	0.01	0.00	0.00
Crittenden	19	0.98	0.01	0.00	0.00	0.01
Daviess	233	0.86	0.02	0.01	0.10	0.01
Fulton	18	0.17	0.11	0.09	0.18	0.45
Graves	122	0.40	0.11	0.08	0.12	0.29
Hancock	64	0.98	0.01	0.00	0.00	0.00
Henderson	171	0.82	0.02	0.00	0.06	0.10
Hickman	22	0.23	0.11	0.12	0.19	0.36
Hopkins	207	0.89	0.03	0.01	0.03	0.04
Livingston	30	0.84	0.04	0.01	0.03	0.08
Logan	33	0.97	0.02	0.01	0.00	0.00
Lyon	49	0.94	0.05	0.00	0.01	0.00
Marshall	90	0.46	0.09	0.07	0.11	0.27
McCracken	80	0.32	0.08	0.07	0.17	0.37
McLean	64	0.85	0.02	0.01	0.11	0.01
Muhlenberg	127	0.91	0.02	0.01	0.06	0.00
Ohio	190	0.92	0.01	0.00	0.06	0.01
Todd	22	0.98	0.01	0.00	0.00	0.00
Trigg	38	0.97	0.01	0.00	0.00	0.01
Union	114	0.71	0.06	0.00	0.00	0.22
Webster	118	0.81	0.02	0.00	0.05	0.12

Table 209: Highway Bridge Functionality

Counties	# of Bridges	At day 1 (%)	At day 3 (%)	At day 7 (%)	At day 30 (%)	At day 90 (%)
Ballard	25	43.66	48.30	51.16	53.08	61.64
Caldwell	84	94.87	95.56	95.75	95.87	96.34
Calloway	36	80.56	82.69	83.59	84.11	86.38
Carlisle	15	27.03	31.97	35.49	38.07	49.69
Christian	202	98.60	99.32	99.53	99.58	99.75
Crittenden	19	98.09	98.33	98.43	98.47	98.67
Daviess	233	87.79	88.35	88.68	89.62	94.92
Fulton	18	29.21	34.68	38.51	41.17	53.23
Graves	122	51.79	56.95	60.06	61.86	69.57
Hancock	64	99.11	99.51	99.67	99.70	99.81
Henderson	171	83.86	84.50	84.75	85.37	88.80
Hickman	22	35.71	41.92	46.60	49.32	61.11
Hopkins	207	92.05	93.13	93.49	93.84	95.61
Livingston	30	87.43	88.78	89.31	89.72	91.57
Logan	33	98.76	99.38	99.60	99.64	99.77
Lyon	49	97.83	99.09	99.24	99.32	99.66
Madison	90	55.47	59.77	62.42	64.12	71.63
Marshall	80	41.12	45.08	47.83	50.12	60.88
Mason	64	86.98	87.66	88.03	89.04	94.75
Muhlenberg	127	92.91	93.79	94.19	94.72	97.58
Ohio	190	92.99	93.50	93.75	94.28	97.17
Todd	22	99.00	99.44	99.63	99.66	99.79
Trigg	38	98.06	98.34	98.42	98.46	98.63
Union	114	76.04	77.63	77.82	78.15	79.80
Webster	118	83.04	83.59	83.83	84.39	87.47

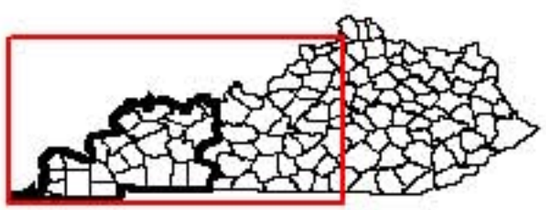
Airport Damage - New Madrid Seismic Zone: M7.7 Event

March 2008



State of Kentucky - Critical Counties (25)

County	Total No. of Facilities	At Least Moderate Damage	Complete Damage	County	Total No. of Facilities	At Least Moderate Damage	Complete Damage
Ballard	0	0	0	Livingston	2	2	0
Caldwell	1	0	0	Logan	2	0	0
Calloway	4	4	0	Lyon	0	0	0
Carlisle	2	2	0	Marshall	4	4	0
Christian	3	0	0	McCracken	4	4	1
Crittenden	1	0	0	McLean	7	0	0
Daviess	4	0	0	Muhlenberg	1	0	0
Fulton	1	1	0	Ohio	2	0	0
Graves	1	1	0	Todd	1	0	0
Hancock	1	0	0	Trigg	2	0	0
Henderson	3	0	0	Union	1	0	0
Hickman	1	1	0	Webster	1	0	0
Hopkins	4	0	0				



Critical counties are those that experience the greatest probability of reaching the specified damage state. For definitions of 'Complete' and 'At Least Moderate' damage states please consult the attached document,"GUIDE FOR IMPACT ASSESSMENT TERMINOLOGY."

Legend

Airport Damage

At Least Moderate

- Highly Unlikely
- Unlikely
- Moderate Likelihood
- Highly Likely
- Certain

- Critical Counties
- Interstates
- US Routes
- Rivers

0 10 20 40 60

Miles

Mid-America Earthquake Center

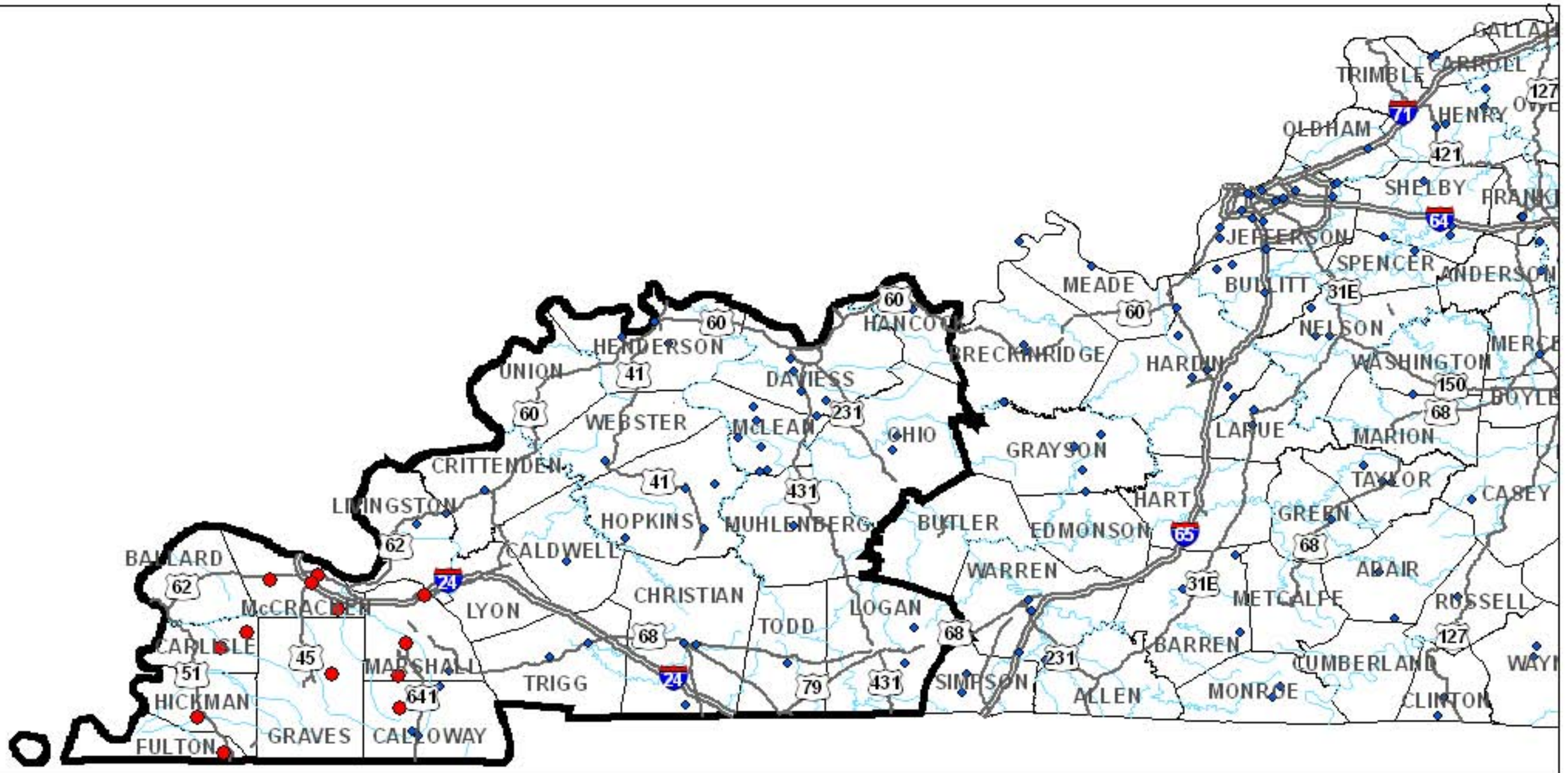
University of Illinois at Urbana-Champaign, Illinois, USA

Amr S. Elnashai, Project Principal Investigator

Reid Goetchius, Principal Investigator

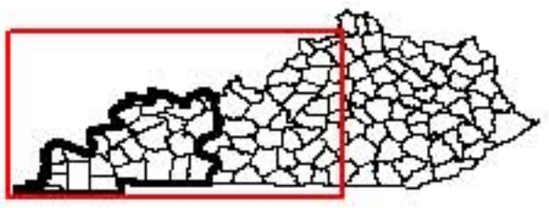
Airport Functionality at Day 1 - New Madrid Seismic Zone: M7.7 Event

March 2008



State of Kentucky - Critical Counties (25)

County	No. of Functional Facilities	Total No. of Facilities	County	No. of Functional Facilities	Total No. of Facilities
Ballard	0	0	Livingston	2	2
Caldwell	1	1	Logan	2	2
Calloway	3	4	Lyon	0	0
Carlisle	0	2	Marshall	1	4
Christian	3	3	McCracken	0	4
Crittenden	1	1	McLean	7	7
Daviess	4	4	Muhlenberg	1	1
Fulton	0	1	Ohio	2	2
Graves	0	1	Todd	1	1
Hancock	1	1	Trigg	2	2
Henderson	3	3	Union	1	1
Hickman	0	1	Webster	1	1
Hopkins	4	4			



Critical counties are those that experience the greatest probability of reaching the specified damage state. For definitions of 'Complete' and 'At Least Moderate' damage states please consult the attached document,"GUIDE FOR IMPACT ASSESSMENT TERMINOLOGY."

Legend

Airport Functionality

Day 1

- Not Functional
- Functional

US Routes

Interstates

Critical Counties

Rivers

0 10 20 40 60

Miles

Mid-America Earthquake Center

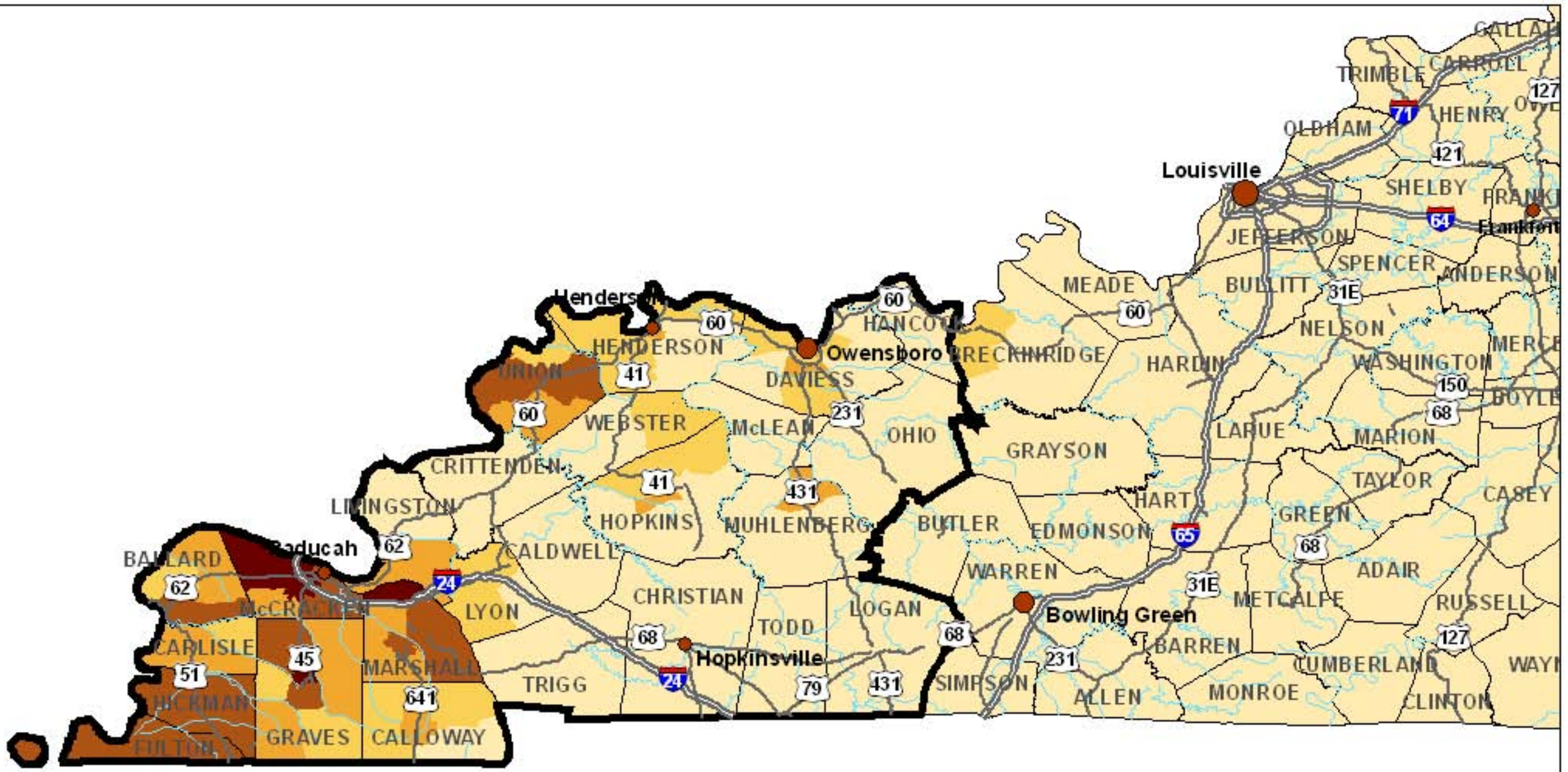
University of Illinois at Urbana-Champaign, Illinois, USA

Amr S. Elnashai, Project Principal Investigator

Reid Goettsch, Principal Investigator

Worst Case Casualties (2PM) - New Madrid Seismic Zone: M7.7 Event

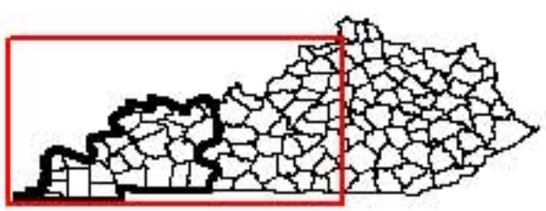
March 2008



State of Kentucky - Critical Counties (25)

County	No. of Injuries (Minor & Severe)	No. of Fatalities	No. of Casualties
Ballard	302	20	322
Caldwell	4	0	4
Calloway	346	19	365
Carlisle	190	12	202
Christian	14	0	14
Crittenden	2	0	2
Daviess	687	43	730
Fulton	409	28	437
Graves	1,053	67	1,120
Hancock	0	0	0
Henderson	329	19	348
Hickman	165	11	176
Hopkins	124	6	130

County	No. of Injuries (Minor & Severe)	No. of Fatalities	No. of Casualties
Livingston	68	3	71
Logan	0	0	0
Lyon	18	1	19
McCracken	4,116	283	4,399
McLean	16	1	17
Marshall	895	59	954
Muhlenberg	76	4	80
Ohio	0	0	0
Todd	0	0	0
Trigg	2	0	2
Union	240	15	255
Webster	33	2	35



Critical counties are those that experience the greatest probability of reaching the specified damage state. For definitions of 'Complete' and 'At Least Moderate' damage states please consult the attached document,"GUIDE FOR IMPACT ASSESSMENT TERMINOLOGY."

Legend

Worst Case Casualties (2PM)

- 0 - 25
- 26 - 100
- 101 - 250
- 251 - 500
- 501 - 1,725

Major Cities

- 25,000 - 40,000
- 40,001 - 60,000
- 60,001 - 271,000

- US Routes
- Interstates
- Rivers
- Critical Counties

0 10 20 40 60

Miles

Mid-America Earthquake Center

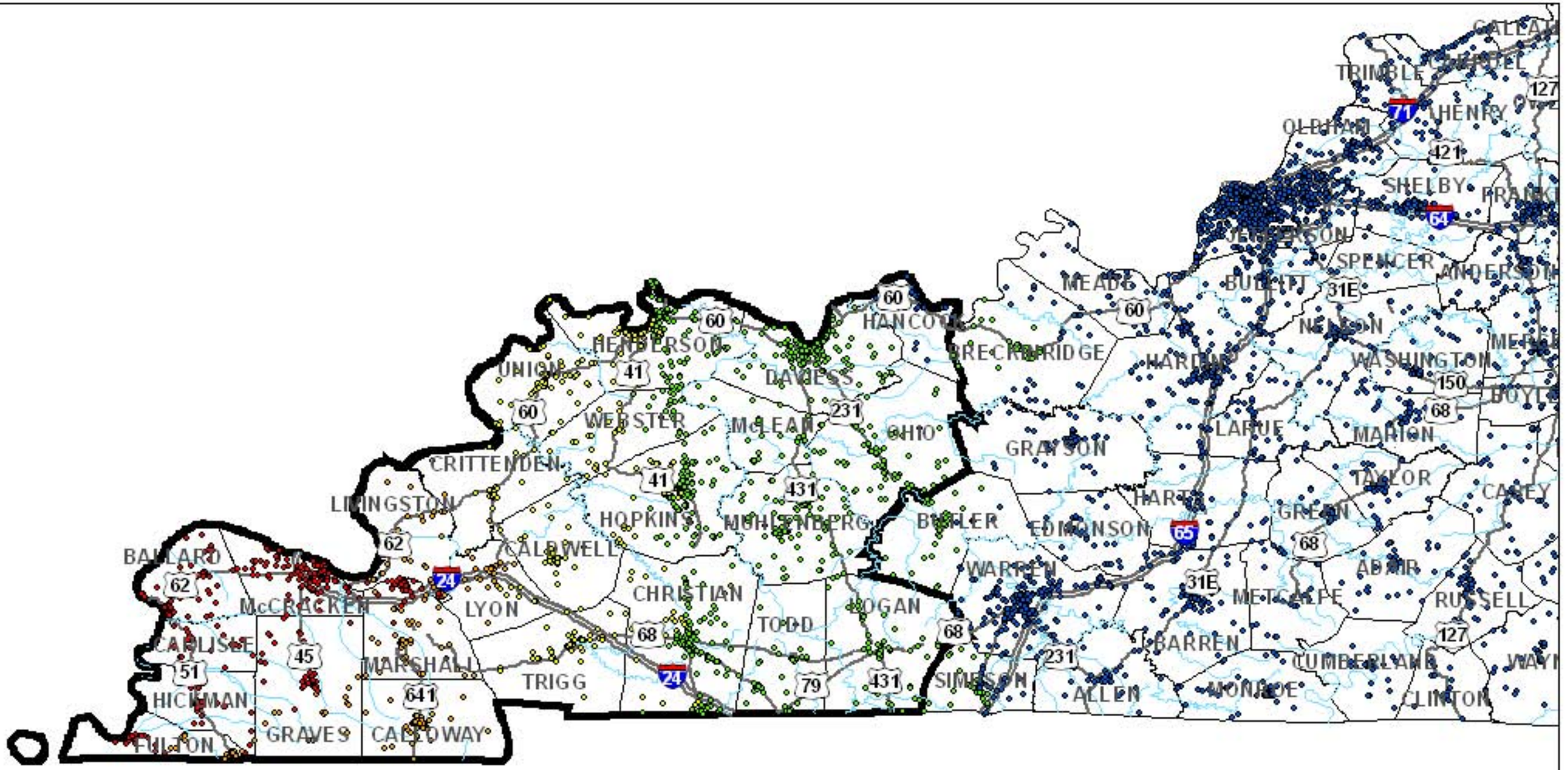
University of Illinois at Urbana-Champaign, Illinois, USA

Applied Technology Council Project Principal Investigator

Theresa Jefferson, Principal Investigator

Communication Facility Damage - New Madrid Seismic Zone: M7.7 Event

March 2008



State of Kentucky - Critical Counties (25)

County	Total No. of Facilities	At Least Moderate Damage	Complete Damage	County	Total No. of Facilities	At Least Moderate Damage	Complete Damage
Ballard	92	92	53	Livingston	82	82	0
Caldwell	70	0	0	Logan	125	0	0
Calloway	111	111	0	Lyon	62	54	0
Carlisle	42	42	1	Marshall	146	146	0
Christian	265	0	0	McCracken	251	251	79
Crittenden	61	2	0	McLean	53	0	0
Daviess	338	0	0	Muhlenberg	177	0	0
Fulton	63	63	0	Ohio	127	0	0
Graves	158	158	0	Todd	63	0	0
Hancock	85	0	0	Trigg	71	0	0
Henderson	320	0	0	Union	113	0	0
Hickman	43	43	0	Webster	89	0	0
Hopkins	255	0	0				

Critical counties are those that experience the greatest probability of reaching the specified damage state. For definitions of 'Complete' and 'At Least Moderate' damage states please consult the attached document,"GUIDE FOR IMPACT ASSESSMENT TERMINOLOGY."

Legend

Communication Damage

At Least Moderate

- Highly Unlikely
- Unlikely
- Moderate Likelihood
- Highly Likely
- Certain

- Critical Counties
- Interstates
- US Routes
- Rivers

0 10 20 40 60

Miles

Mid-America Earthquake Center

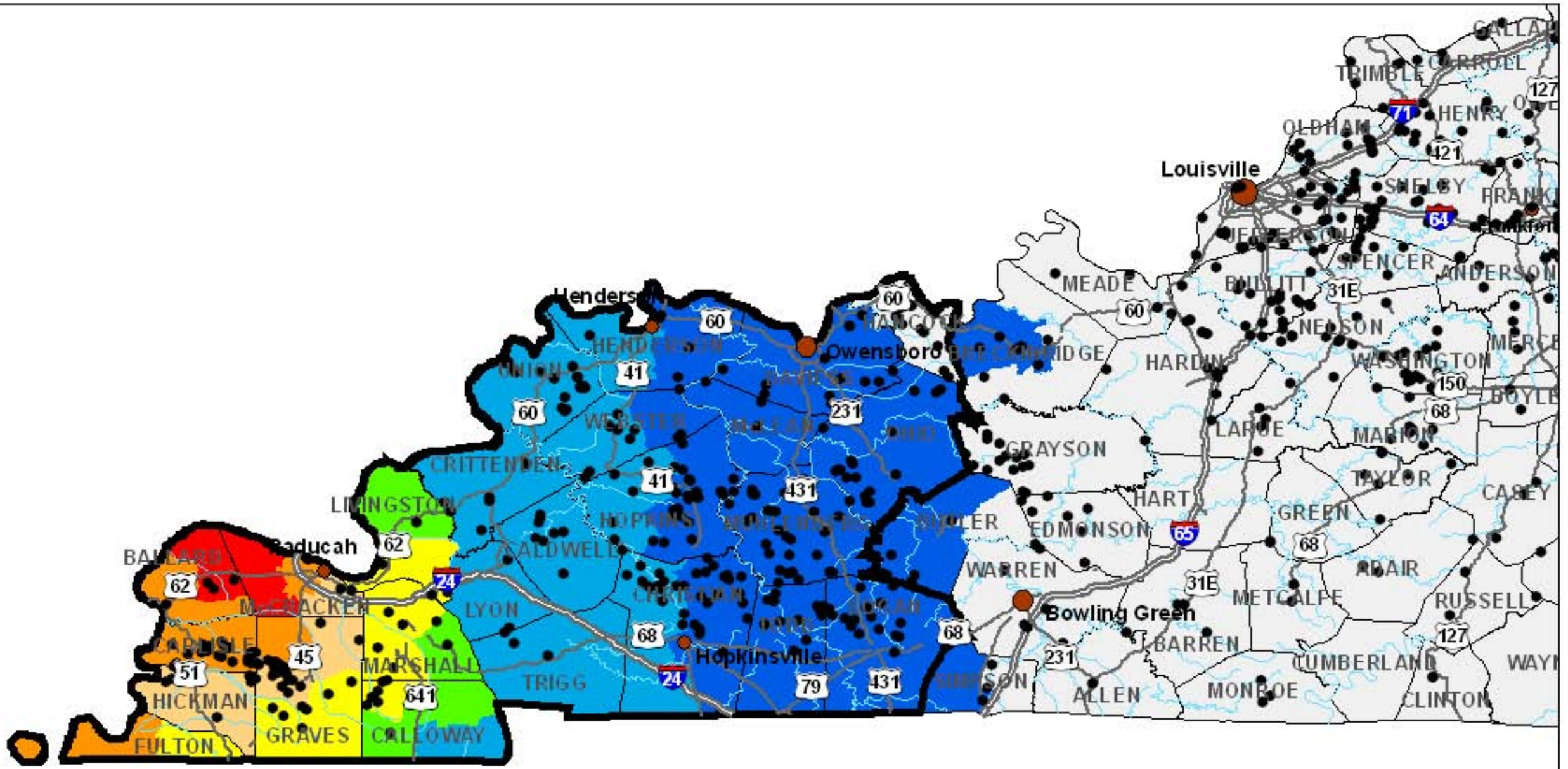
University of Illinois at Urbana-Champaign, Illinois, USA

Amr S. Elnashai, Project Principal Investigator

Therese Jefferson, Principal Investigator

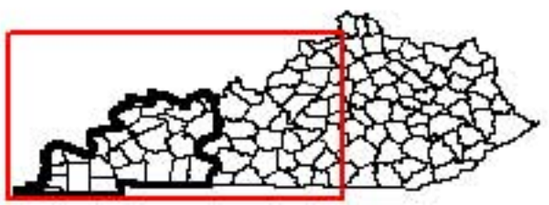
Dams - New Madrid Seismic Zone: M7.7 Event

March 2008



State of Kentucky - Critical Counties (25)

County	No. of Facilities	County	No. of Facilities	County	No. of Facilities
Ballard	5	Hancock	14	McLean	3
Caldwell	9	Henderson	10	Muhlenberg	31
Calloway	8	Hickman	5	Ohio	22
Carlisle	23	Hopkins	33	Todd	12
Christian	32	Livingston	4	Trigg	3
Crittenden	6	Logan	16	Union	34
Daviess	13	Lyon	3	Webster	10
Fulton	0	Marshall	6		
Graves	28	McCracken	3		



Critical counties are those that experience the greatest probability of reaching the specified damage state. For definitions of 'Complete' and 'At Least Moderate' damage states please consult the attached document,"GUIDE FOR IMPACT ASSESSMENT TERMINOLOGY."

Legend

Modified Mercalli Intensity (MMI)

- < VI
- VI
- VII
- VIII
- IX
- X
- XI
- XII

- US Routes
- Rivers
- Interstates
- Critical Counties
- Dams

Major Cities

- 25,000 - 40,000
- 40,001 - 60,000
- 60,001 - 271,000

0 10 20 40 60

Miles

Mid-America Earthquake Center

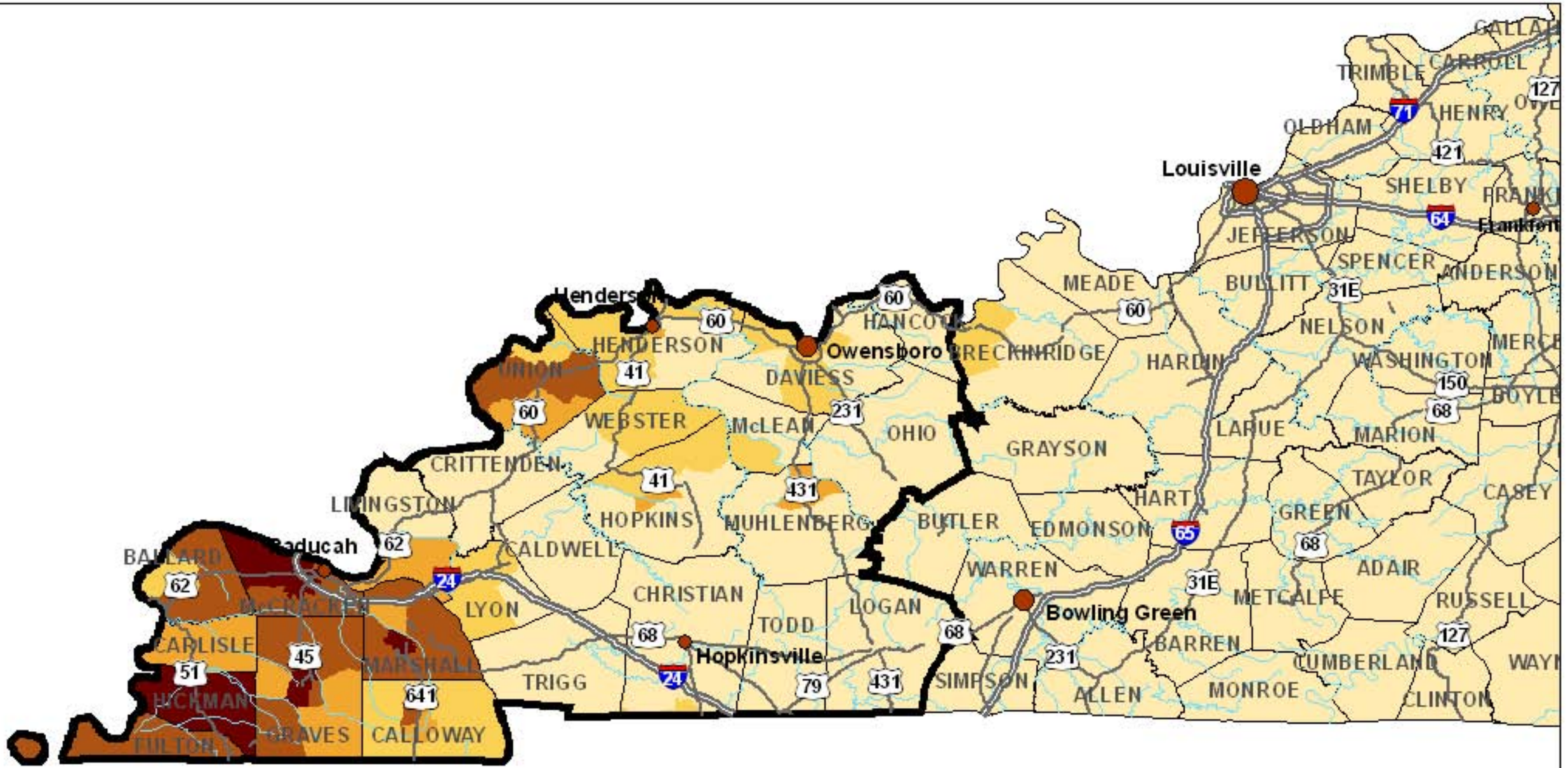
University of Illinois at Urbana-Champaign, Illinois, USA

Amit S. Elnashai, Project Principal Investigator

Therese Jefferson, Principal Investigator

Total Debris - New Madrid Seismic Zone: M7.7 Event

March 2008



State of Kentucky - Critical Counties (25)

County	Brick/Wood (Thousands of Tons)	Concrete/Steel (Thousands of Tons)	Total Debris (Thousands of Tons)
Ballard	87	96	183
Caldwell	3	5	8
Calloway	122	129	251
Carlisle	68	69	136
Christian	16	8	24
Crittenden	2	1	3
Daviess	158	175	333
Fulton	78	91	169
Graves	307	340	647
Hancock	0	0	0
Henderson	87	93	180
Hickman	51	51	102
Hopkins	49	49	98

County	Brick/Wood (Thousands of Tons)	Concrete/Steel (Thousands of Tons)	Total Debris (Thousands of Tons)
Livingston	24	21	44
Logan	0	0	0
Lyon	6	5	11
McCracken	756	879	1,635
McLean	7	6	13
Marshall	215	227	442
Muhlenberg	16	19	35
Ohio	0	0	0
Todd	0	0	0
Trigg	3	1	5
Union	66	72	137
Webster	14	13	27

Critical counties are those that experience the greatest probability of reaching the specified damage state. For definitions of 'Complete' and 'At Least Moderate' damage states please consult the attached document,"GUIDE FOR IMPACT ASSESSMENT TERMINOLOGY."

Legend

Total Debris (Thousands of Tons)
- 0 - 5
- 5 - 25
- 25 - 50
- 50 - 100
- 100 - 235

Major Cities
- 25,000 - 40,000
- 40,001 - 60,000
- 60,001 - 271,000

- US Routes
- Interstates
- Rivers
- Critical Counties

0 10 20 40 60
Miles

Mid-America Earthquake Center

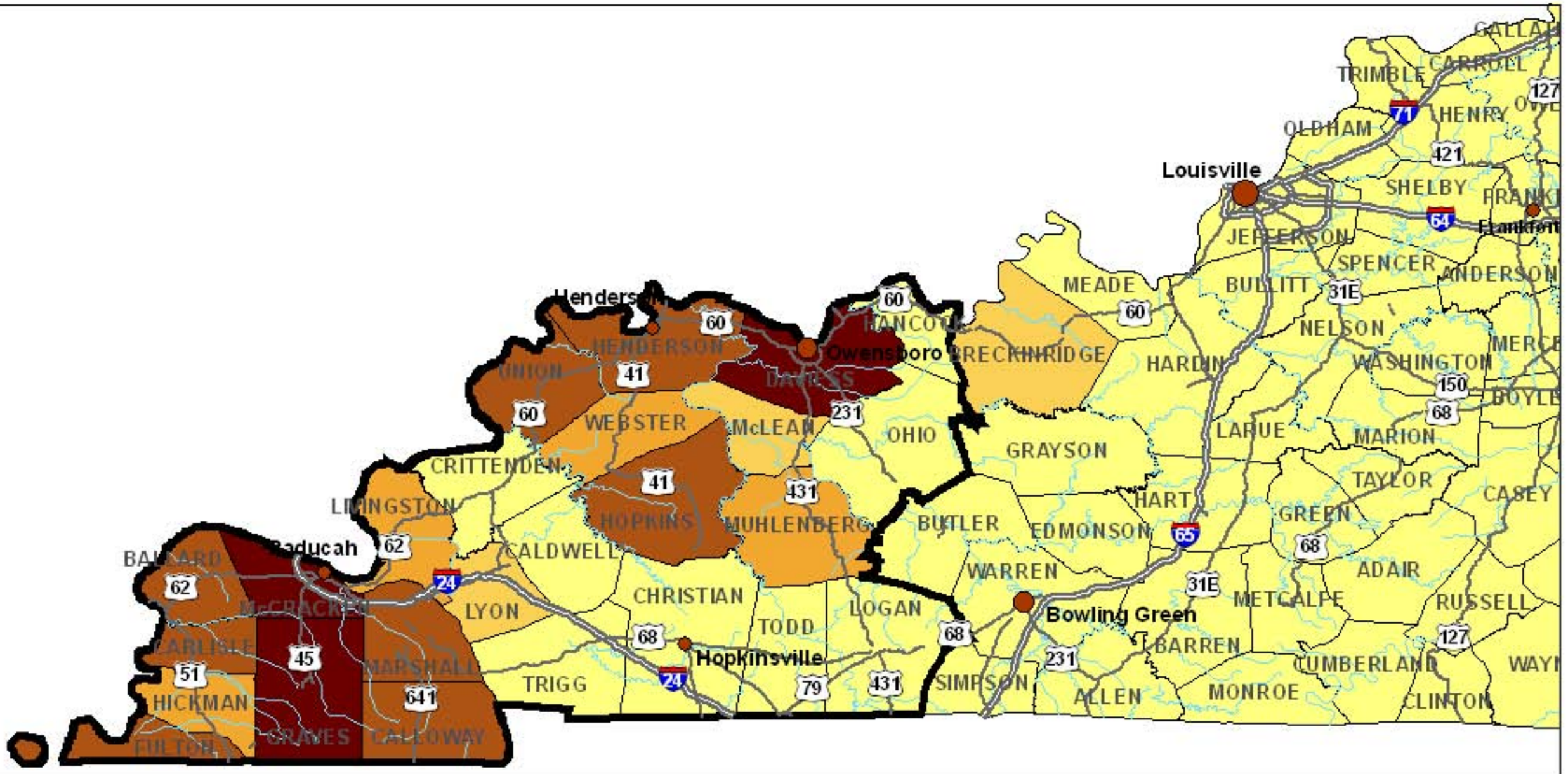
University of Illinois at Urbana-Champaign, Illinois, USA

Amr S. Elnashai, Project Principal Investigator

Therese Jefferson, Principal Investigator

Displaced Population - New Madrid Seismic Zone: M7.7 Event

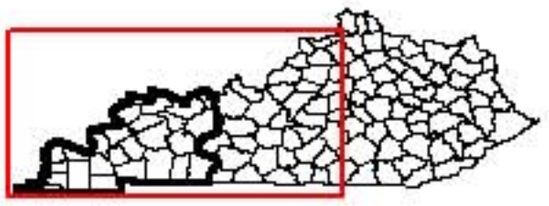
March 2008



State of Kentucky - Critical Counties (25)

County	Displaced Residences	Estimate of Displaced Population
Ballard	1,275	3,113
Caldwell	8	20
Calloway	1,243	3,064
Carlisle	1,051	2,548
Christian	5	15
Crittenden	0	0
Daviess	3,817	9,697
Fulton	1,156	2,769
Graves	4,307	10,745
Hancock	0	0
Henderson	1,963	4,864
Hickman	740	1,779
Hopkins	993	2,453

County	Displaced Residences	Estimate of Displaced Population
Livingston	205	504
Logan	0	0
Lyon	76	212
McCracken	10,321	24,379
McLean	172	428
Marshall	2288	5553
Muhlenberg	379	975
Ohio	0	0
Todd	0	0
Trigg	0	1
Union	1,427	3,907
Webster	293	745



Critical counties are those that experience the greatest probability of reaching the specified damage state. For definitions of 'Complete' and 'At Least Moderate' damage states please consult the attached document,"GUIDE FOR IMPACT ASSESSMENT TERMINOLOGY."

Legend

Displaced Population

- 0 - 50
- 51 - 500
- 501 - 2,000
- 2,001 - 6,000
- 6,001 - 24,400

Major Cities

- 25,000 - 40,000
- 40,001 - 60,000
- 60,001 - 271,000

- US Routes
- Interstates
- Rivers
- Critical Counties

0 10 20 40 60

Miles

Mid-America Earthquake Center

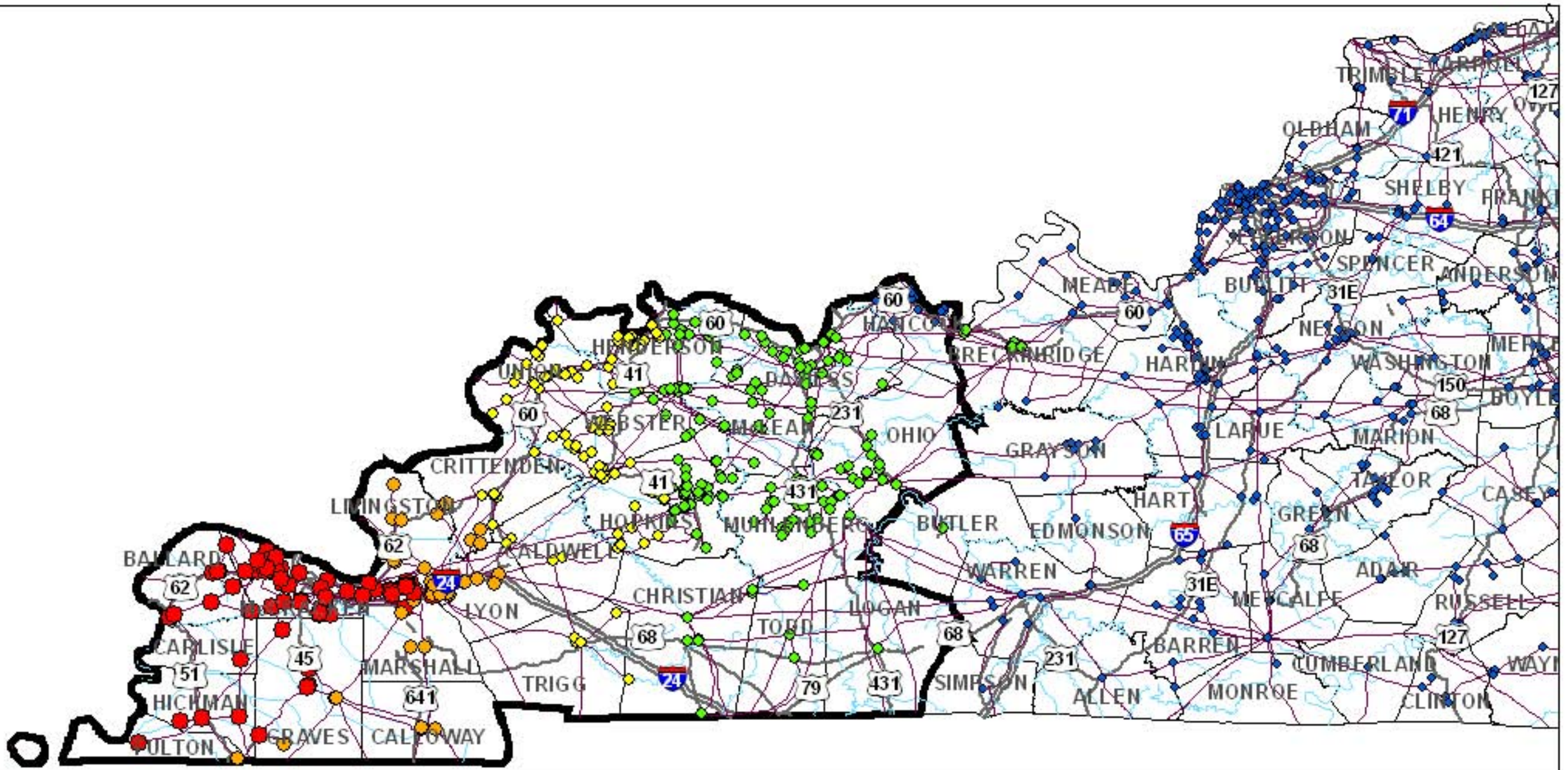
University of Illinois at Urbana-Champaign, Illinois, USA

Amr S. Elnashai, Project Principal Investigator

Neil Hyatt, Principal Investigator

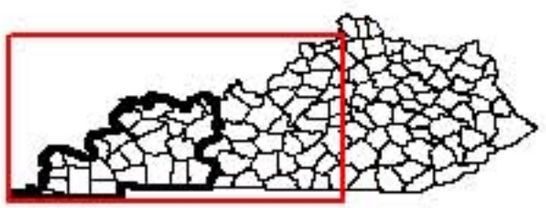
Electric Power Facility Damage - New Madrid Seismic Zone: M7.7 Event

March 2008



State of Kentucky - Critical Counties (25)

County	Total No. of Facilities	At Least Moderate Damage	Complete Damage	County	Total No. of Facilities	At Least Moderate Damage	Complete Damage
Ballard	9	9	6	Livingston	21	21	0
Caldwell	+	0	0	Logan	2	0	0
Calloway	+	+	0	Lyon	14	14	0
Carlisle	1	1	0	Marshall	17	17	0
Christian	8	0	0	McCracken	47	47	34
Crittenden	11	5	0	McLean	9	0	0
Daviess	40	0	0	Muhlenberg	46	0	0
Fulton	2	2	0	Ohio	22	0	0
Graves	9	9	0	Todd	+	0	0
Hancock	25	0	0	Trigg	+	0	0
Henderson	51	0	0	Union	18	0	0
Hickman	3	3	0	Webster	35	0	0
Hopkins	57	0	0				



Critical counties are those that experience the greatest probability of reaching the specified damage state. For definitions of 'Complete' and 'At Least Moderate' damage states please consult the attached document "GUIDE FOR IMPACT ASSESSMENT TERMINOLOGY."

Legend

Electric Facility Damage

At Least Moderate

- Highly Unlikely
- Unlikely
- Moderate Likelihood
- Highly Likely
- Certain

- Critical Counties
- Interstates
- US Routes
- Rivers
- Major Electric Lines

0 10 20 40 60

Miles

Mid-America Earthquake Center

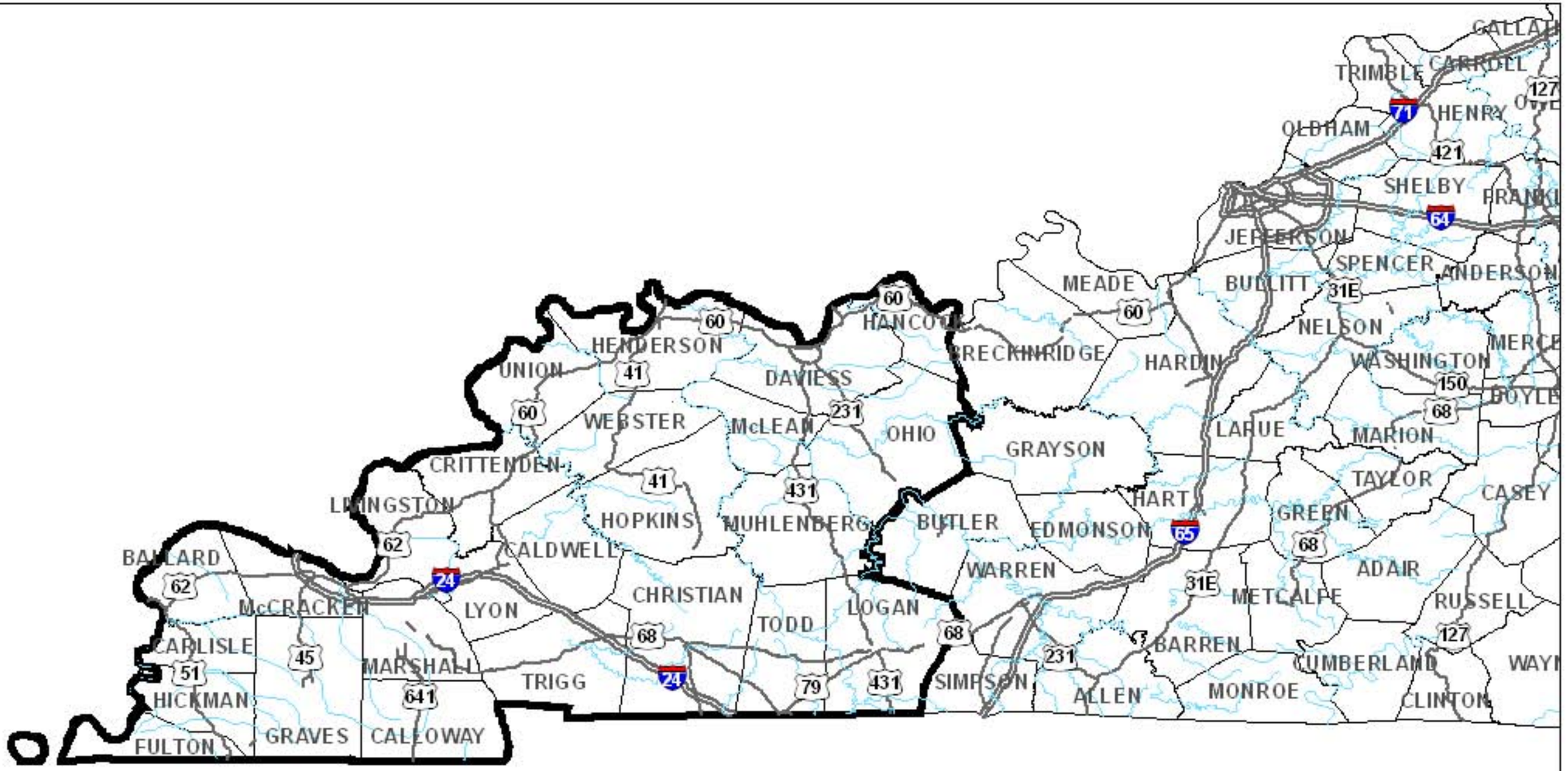
University of Illinois at Urbana-Champaign, Illinois, USA

Amr S. Elnashai, Project Principal Investigator

Neil Hyatt, Principal Investigator

Emergency Operation Center Damage - New Madrid Seismic Zone: M7.7 Event

March 2008



State of Kentucky - Critical Counties (25)

County	Total No. of Facilities	At Least Moderate Damage	Complete Damage	County	Total No. of Facilities	At Least Moderate Damage	Complete Damage
Ballard	0	0	0	Livingston	0	0	0
Caldwell	0	0	0	Logan	0	0	0
Calloway	0	0	0	Lyon	0	0	0
Carlisle	0	0	0	McCracken	0	0	0
Christian	0	0	0	McLean	0	0	0
Crittenden	0	0	0	Marshall	0	0	0
Daviess	0	0	0	Muhlenberg	0	0	0
Fulton	0	0	0	Ohio	0	0	0
Graves	0	0	0	Todd	0	0	0
Hancock	0	0	0	Trigg	0	0	0
Henderson	0	0	0	Union	0	0	0
Hickman	0	0	0	Webster	0	0	0
Hopkins	0	0	0				

Critical counties are those that experience the greatest probability of reaching the specified damage state. For definitions of 'Complete' and 'At Least Moderate' damage states please consult the attached document,"GUIDE FOR IMPACT ASSESSMENT TERMINOLOGY."

Legend

Emergency Operation Centers

At Least Moderate

- Highly Unlikely
- Unlikely
- Moderate Likelihood
- Highly Likely
- Certain

- Critical Counties
- Interstates
- US Routes
- Rivers

0 10 20 40 60

Miles

Mid-America Earthquake Center

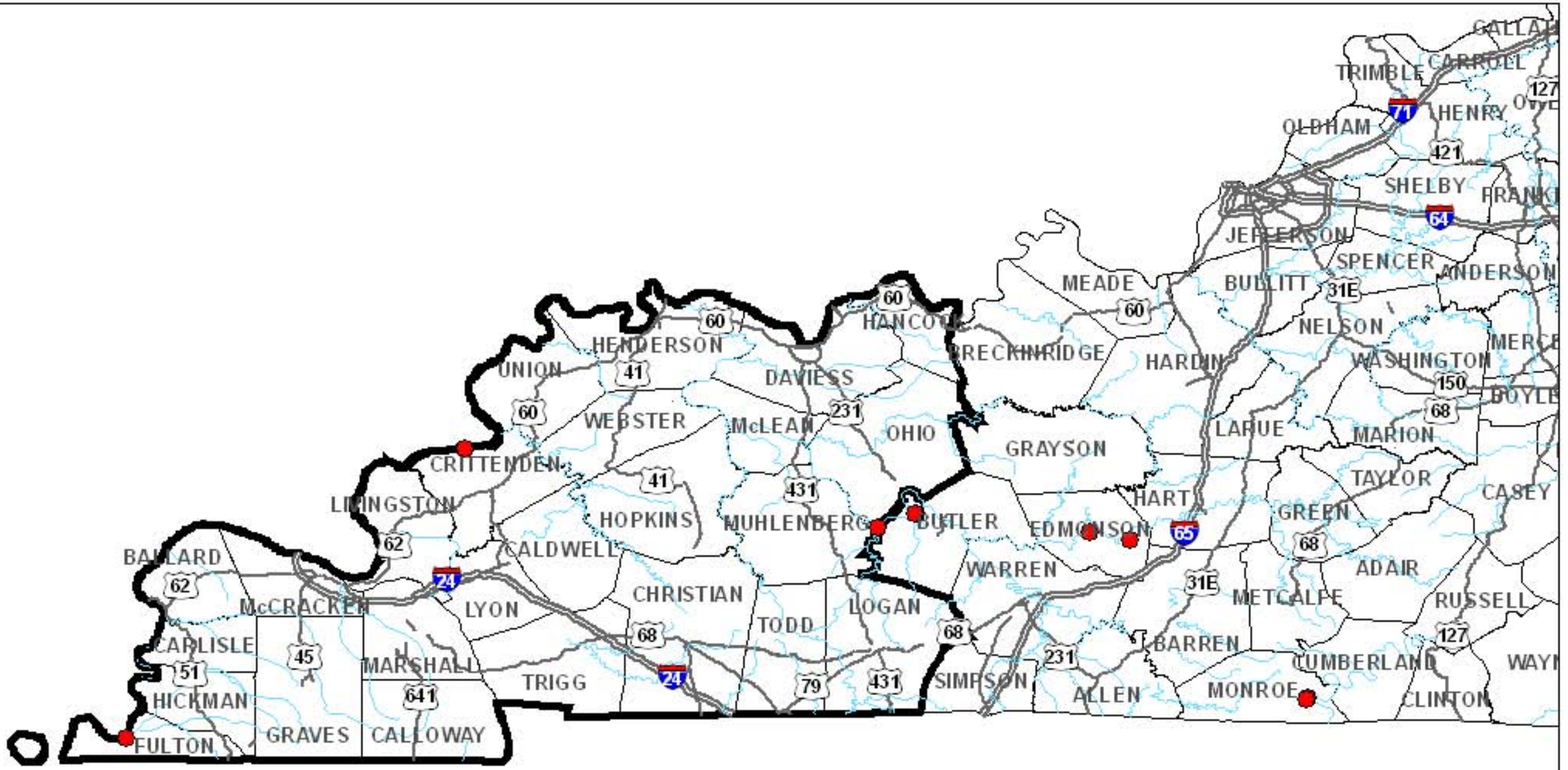
University of Illinois at Urbana-Champaign, Illinois, USA

Amr S. Elnashai, Project Principal Investigator

Therese Jefferson, Principal Investigator

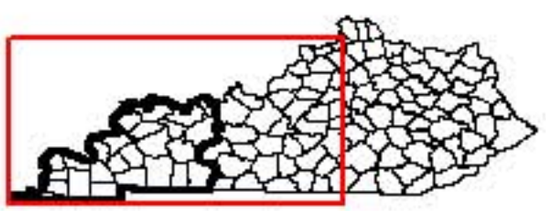
Ferry Facility Damage - New Madrid Seismic Zone: M7.7 Event

March 2008



State of Kentucky - Critical Counties (25)

County	Total No. of Facilities	At Least Moderate Damage	Complete Damage	County	Total No. of Facilities	At Least Moderate Damage	Complete Damage
Crittenden	1	1	1	Hopkins	0	0	0
Fulton	1	1	1	Livingston	0	0	0
Ohio	1	1	1	Logan	0	0	0
Ballard	0	0	0	Lyon	0	0	0
Caldwell	0	0	0	McCracken	0	0	0
Calloway	0	0	0	McLean	0	0	0
Carlisle	0	0	0	Marshall	0	0	0
Christian	0	0	0	Muhlenberg	0	0	0
Daviess	0	0	0	Todd	0	0	0
Graves	0	0	0	Trigg	0	0	0
Hancock	0	0	0	Union	0	0	0
Henderson	0	0	0	Webster	0	0	0
Hickman	0	0	0				



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Legend

Ferry Facility Damage

At Least Moderate

- Highly Unlikely
- Unlikely
- Moderate Likelihood
- Highly Likely
- Certain

- Critical Counties
- Interstates
- US Routes
- Rivers

0 10 20 40 60

Miles

Mid-America Earthquake Center

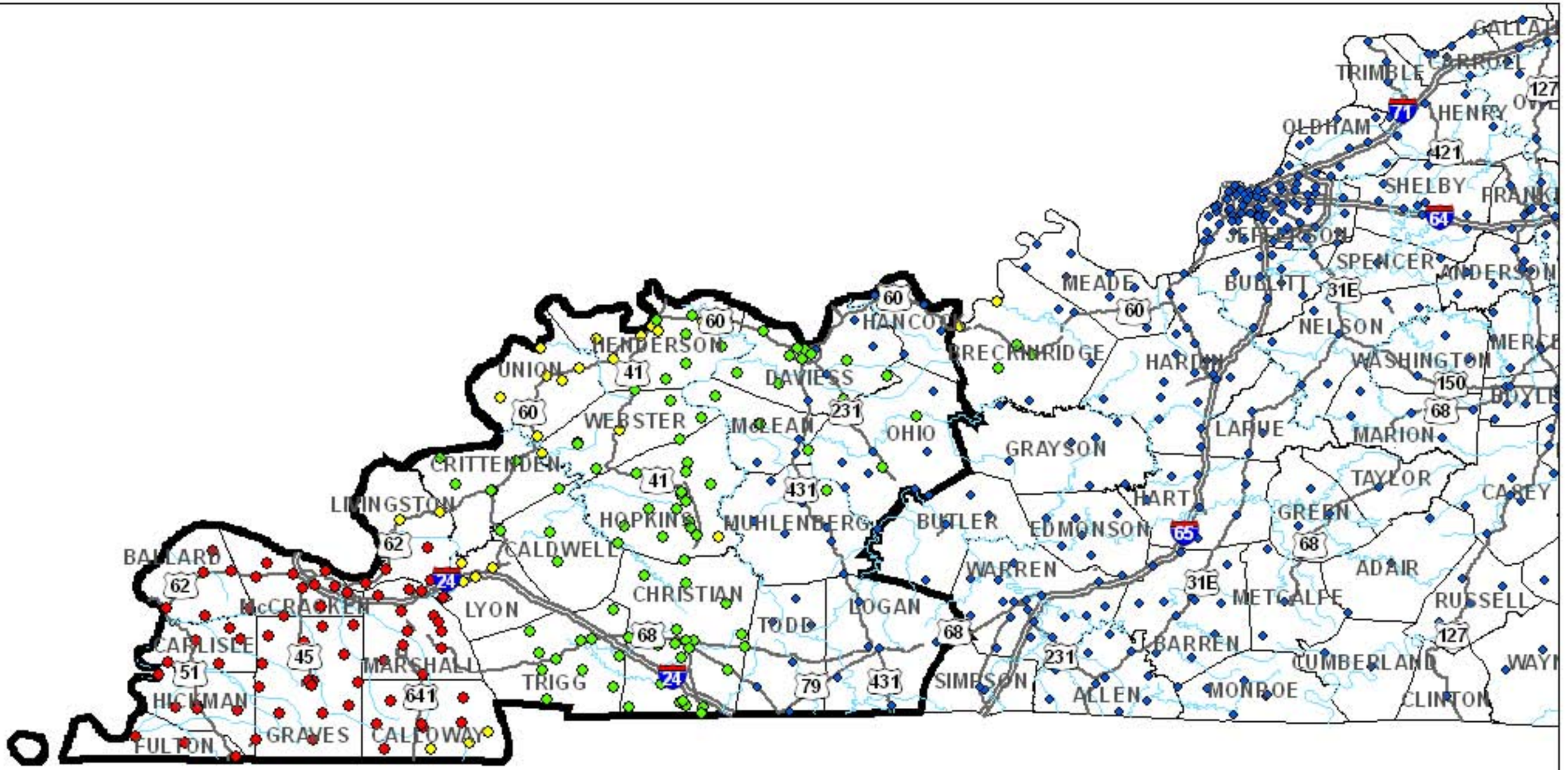
University of Illinois at Urbana-Champaign, Illinois, USA

Amr S. Elnashai, Project Principal Investigator

Therese Jefferson, Principal Investigator

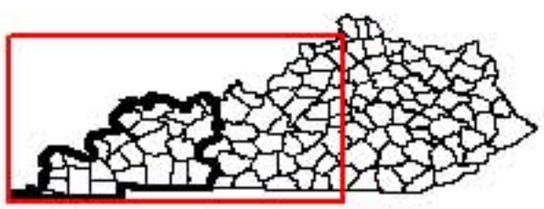
Fire Station Damage - New Madrid Seismic Zone: M7.7 Event

March 2008



State of Kentucky - Critical Counties (25)

County	Total No. of Facilities	At Least Moderate Damage	Complete Damage	County	Total No. of Facilities	At Least Moderate Damage	Complete Damage
Ballard	10	10	8	Livingston	8	6	0
Caldwell	3	0	0	Logan	6	0	0
Calloway	11	8	0	Lyon	4	0	0
Carlisle	6	6	6	McCracken	9	9	9
Christian	23	0	0	McLean	8	0	0
Crittenden	7	0	0	Marshall	12	12	12
Daviess	17	0	0	Muhlenberg	8	0	0
Fulton	3	3	3	Ohio	9	0	0
Graves	18	18	18	Todd	7	0	0
Hancock	4	0	0	Trigg	11	0	0
Henderson	14	0	0	Union	8	0	0
Hickman	5	5	5	Webster	9	0	0
Hopkins	18	0	0				



Critical counties are those that experience the greatest probability of reaching the specified damage state. For definitions of 'Complete' and 'At Least Moderate' damage states please consult the attached document,"GUIDE FOR IMPACT ASSESSMENT TERMINOLOGY."

Legend

Fire Station Damage

At Least Moderate

- Highly Unlikely
- Unlikely
- Moderate Likelihood
- Highly Likely
- Certain

- Critical Counties
- Interstates
- US Routes
- Rivers

0 10 20 40 60

Miles

Mid-America Earthquake Center

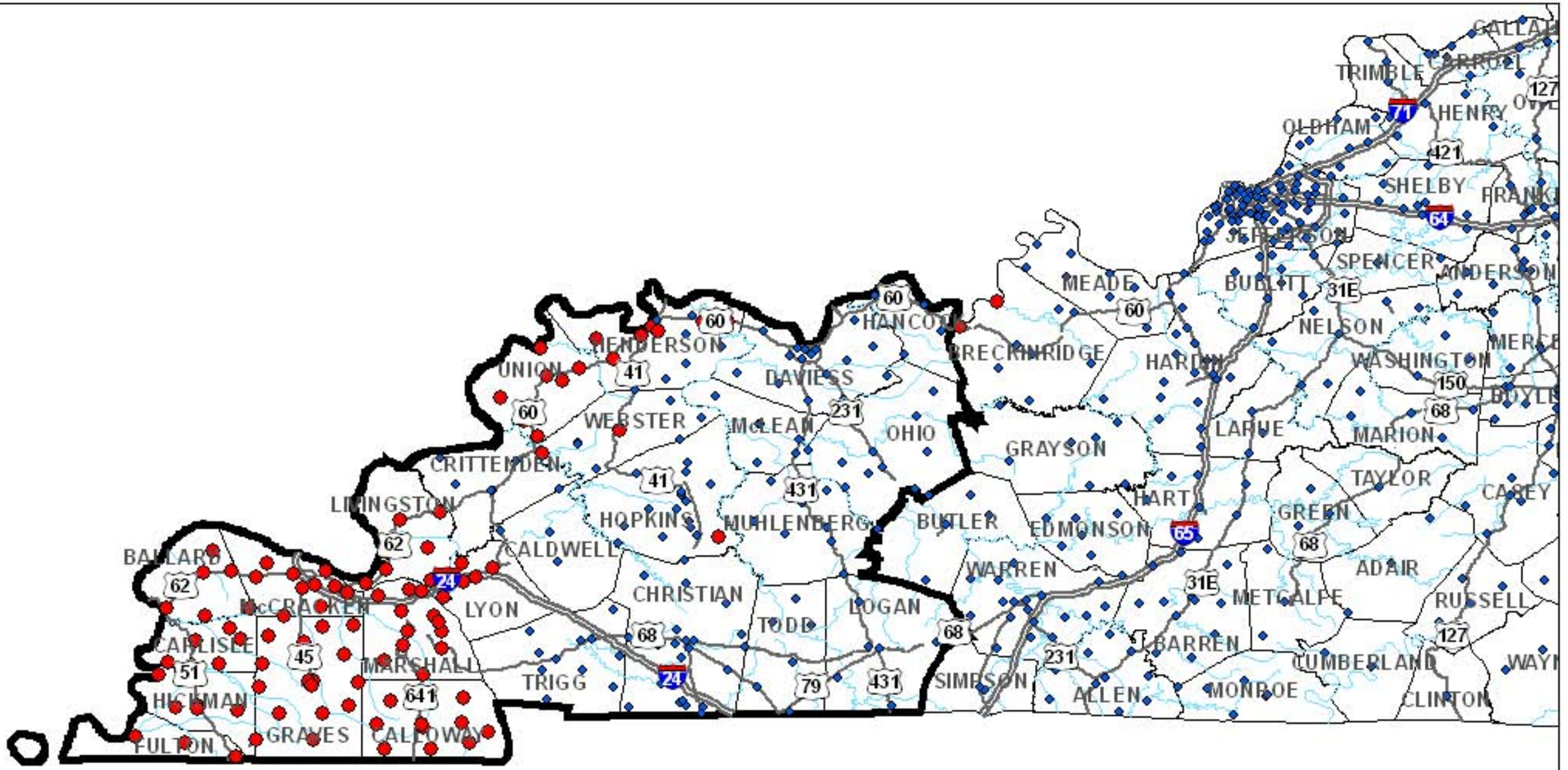
University of Illinois at Urbana-Champaign, Illinois, USA

Amr S. Elnashai, Project Principal Investigator

Therese Jefferson, Principal Investigator

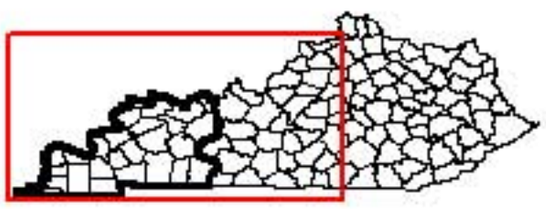
Fire Station Functionality at Day 1 - New Madrid Seismic Zone: M7.7 Event

March 2008



State of Kentucky - Critical Counties (25)

County	No. of Functional Facilities	Total No. of Facilities	County	No. of Functional Facilities	Total No. of Facilities
Ballard	0	10	Livingston	0	8
Caldwell	3	3	Logan	6	6
Calloway	0	11	Lyon	0	4
Carlisle	0	6	Marshall	0	12
Christian	23	23	McCracken	0	9
Crittenden	7	7	McLean	8	8
Daviess	17	17	Muhlenberg	8	8
Fulton	0	3	Ohio	9	9
Graves	0	18	Todd	7	7
Hancock	4	4	Trigg	11	11
Henderson	6	14	Union	0	8
Hickman	0	5	Webster	7	9
Hopkins	17	18			



Critical counties are those that experience the greatest probability of reaching the specified damage state. For definitions of 'Complete' and 'At Least Moderate' damage states please consult the attached document,"GUIDE FOR IMPACT ASSESSMENT TERMINOLOGY."

Legend

Fire Station Functionality

Day 1

- Not Functional
- Functional

- US Routes
- Interstates
- Critical Counties
- Rivers

0 10 20 40 60

Miles

Mid-America Earthquake Center

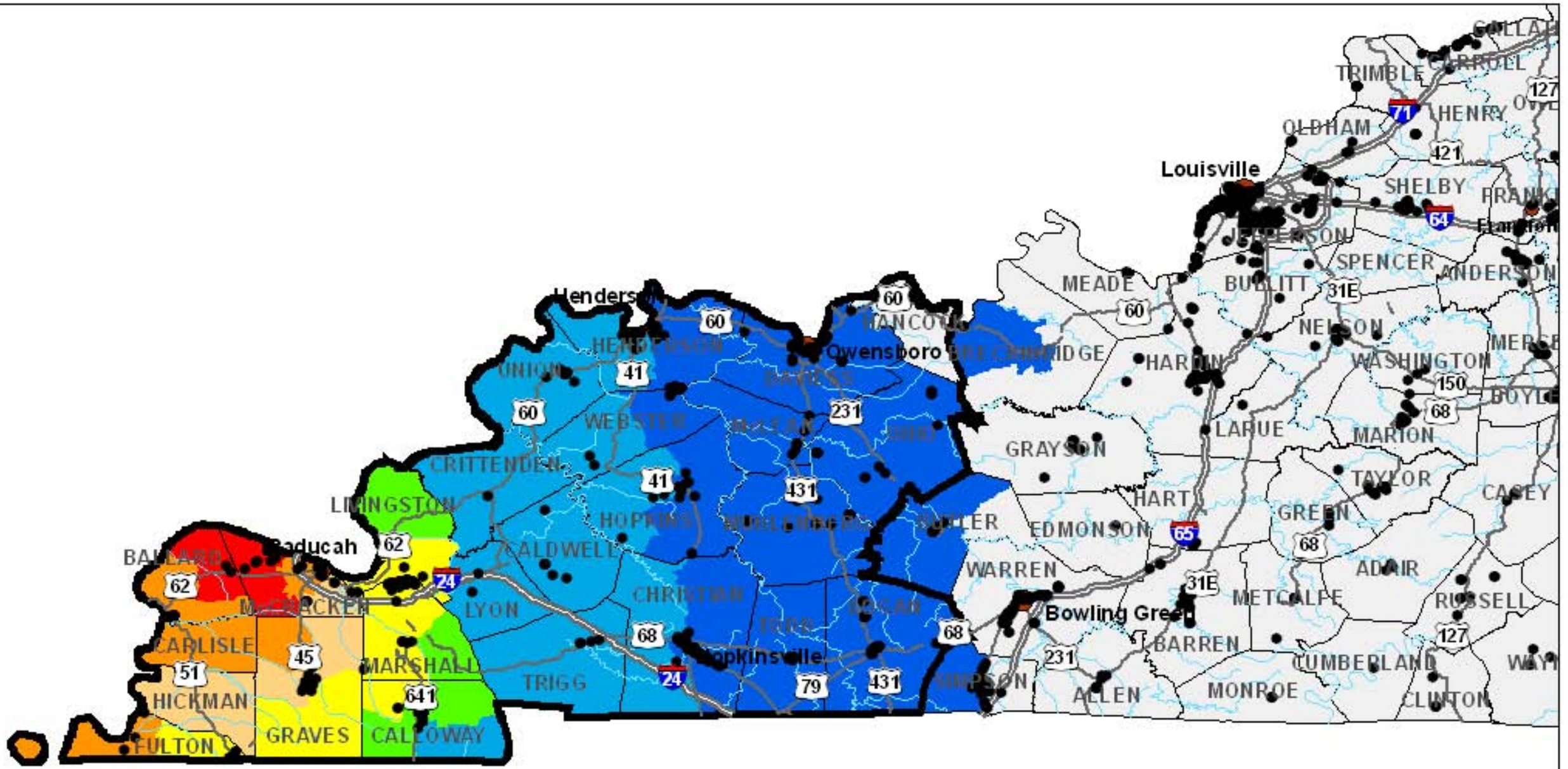
University of Illinois at Urbana-Champaign, Illinois, USA

Amr S. Elnashai, Project Principal Investigator

Therese Jefferson, Principal Investigator

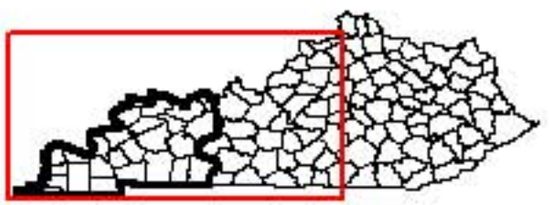
Hazardous Materials Facilities - New Madrid Seismic Zone: M7.7 Event

March 2008



State of Kentucky - Critical Counties (25)

County	No. of Facilities	County	No. of Facilities	County	No. of Facilities
Ballard	28	Hancock	74	McLean	7
Caldwell	7	Henderson	81	Muhlenberg	54
Calloway	21	Hickman	0	Ohio	20
Carlisle	0	Hopkins	21	Todd	5
Christian	53	Livingston	2	Trigg	5
Crittenden	1	Logan	34	Union	13
Daviess	69	Lyon	2	Webster	19
Fulton	9	Marshall	231		
Graves	18	McCracken	47		



Critical counties are those that experience the greatest probability of reaching the specified damage state. For definitions of 'Complete' and 'At Least Moderate' damage states please consult the attached document,"GUIDE FOR IMPACT ASSESSMENT TERMINOLOGY."

Legend

Modified Mercalli Intensity (MMI)

- < VI
- VI
- VII
- VIII
- IX
- X
- XI
- XII

Major Cities

- 25,000 - 40,000
- 40,001 - 60,000
- 60,001 - 271,000

US Routes · Hazardous Materials Facilities · Rivers

Interstates · Critical Counties

0 10 20 40 60

Miles

Mid-America Earthquake Center

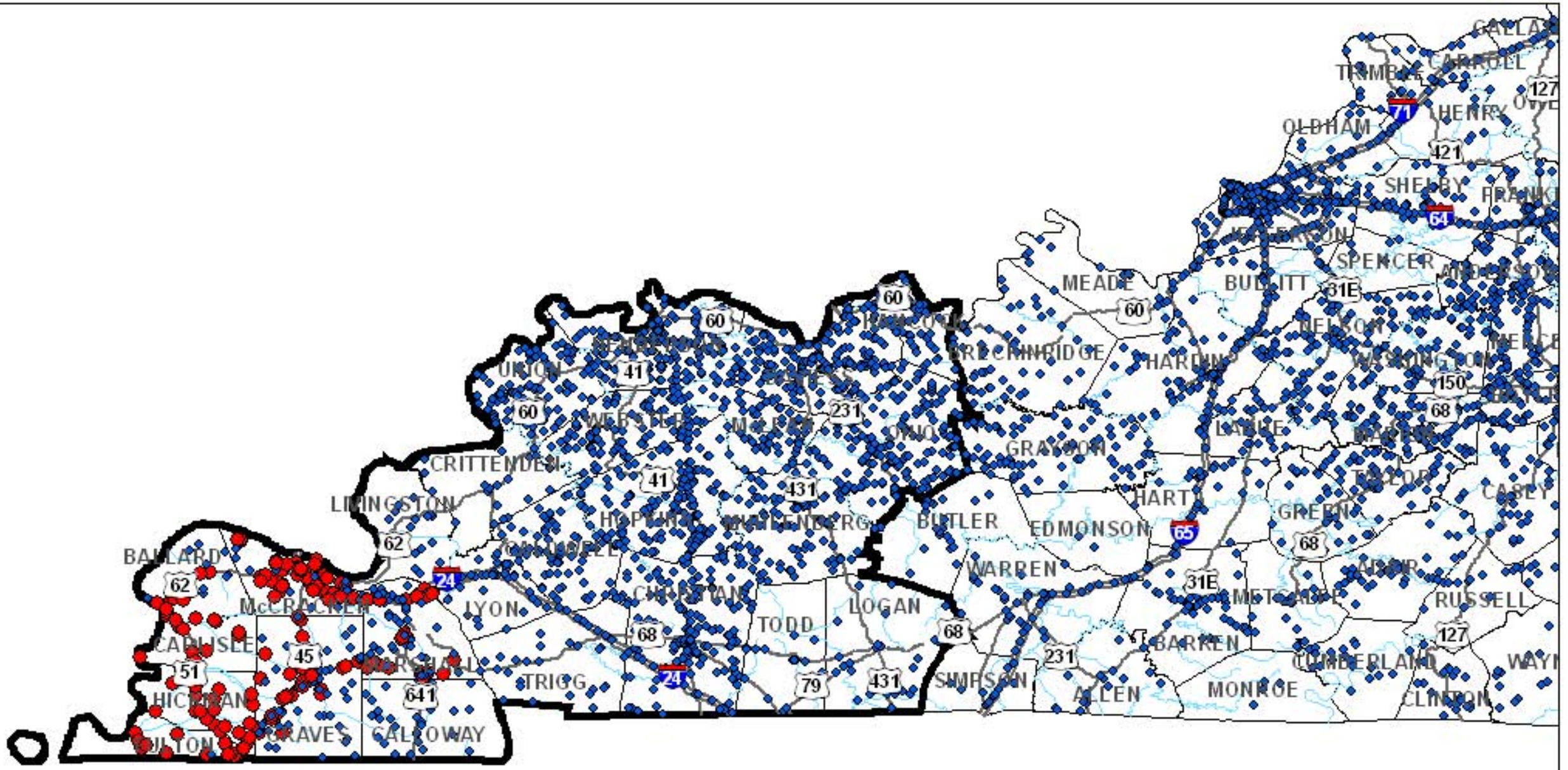
University of Illinois at Urbana-Champaign, Illinois, USA

Amr S. Elnashai, Project Principal Investigator

Therese Jefferson, Principal Investigator

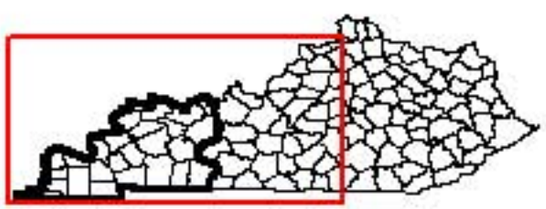
Highway Bridge Functionality at Day 1 - New Madrid Seismic Zone: M7.7 Event

March 2008



State of Kentucky - Critical Counties (25)

County	No. of Functional Facilities	Total No. of Facilities	County	No. of Functional Facilities	Total No. of Facilities
Ballard	12	25	Livingston	29	30
Caldwell	84	84	Logan	33	33
Calloway	34	36	Lyon	49	49
Carlisle	0	15	McCracken	18	80
Christian	202	202	McLean	64	64
Crittenden	19	19	Marshall	64	90
Daviess	233	233	Muhlenberg	127	127
Fulton	2	18	Ohio	190	190
Graves	80	122	Todd	22	22
Hancock	64	64	Trigg	38	38
Henderson	171	171	Union	114	114
Hickman	0	22	Webster	118	118
Hopkins	207	207			



Critical counties are those that experience the greatest probability of reaching the specified damage state. For definitions of 'Complete' and 'At Least Moderate' damage states please consult the attached document,"GUIDE FOR IMPACT ASSESSMENT TERMINOLOGY."

Legend

Highway Bridge Functionality

Day 1

- Not Functional
- Functional

US Routes

Interstates

Critical Counties

Rivers

0 10 20 40 60

Miles

Mid-America Earthquake Center

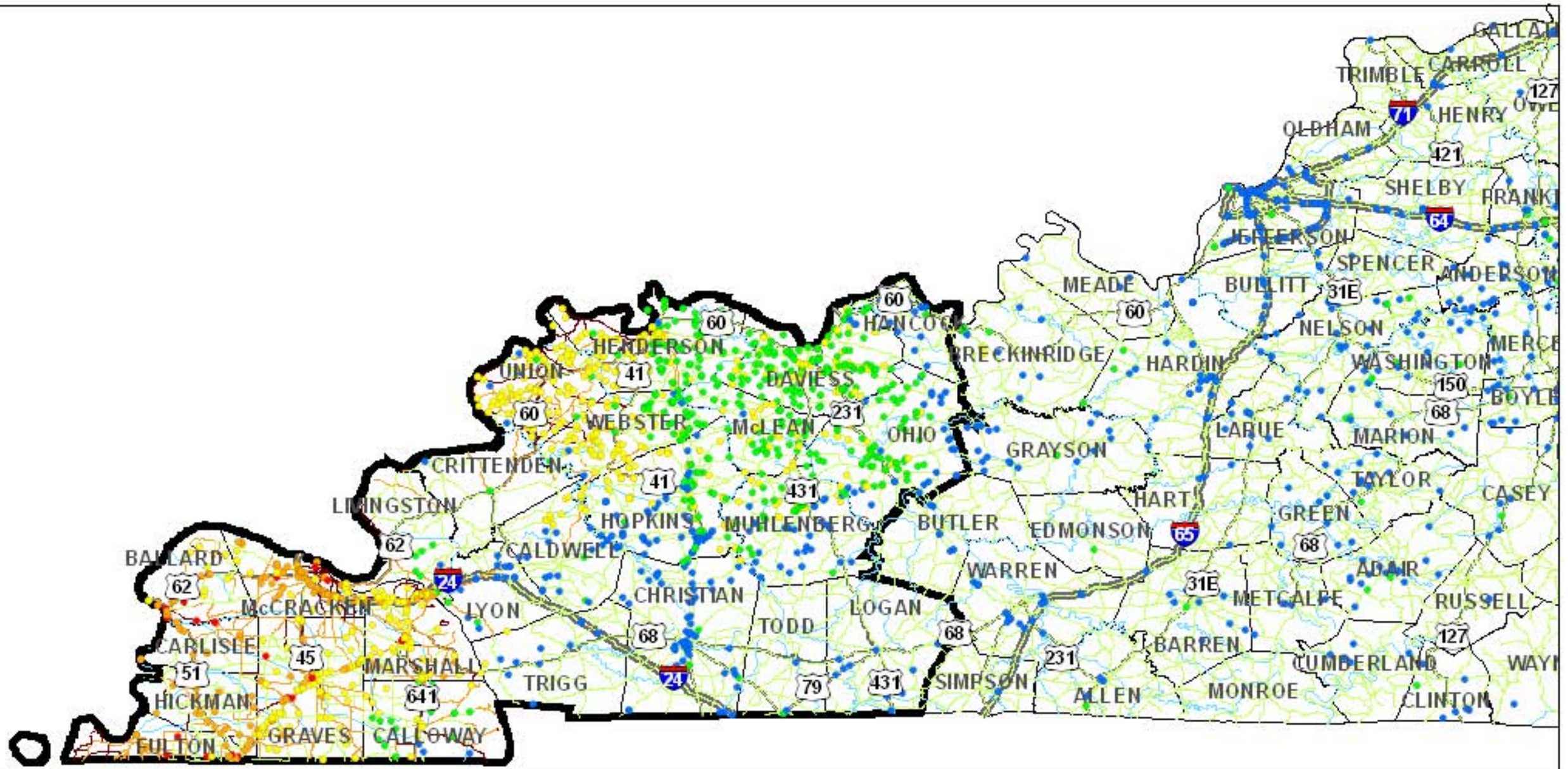
University of Illinois at Urbana-Champaign, Illinois, USA

Amr S. Elnashai, Project Principal Investigator

Therese Jefferson, Principal Investigator

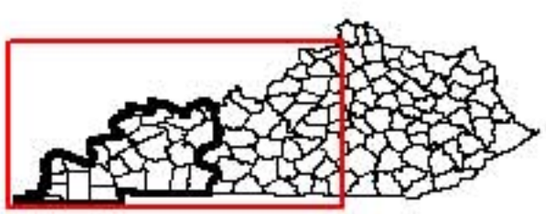
Highway Bridge & Segment Damage - New Madrid Seismic Zone: M7.7 Event

March 2008



State of Kentucky - Critical Counties (25)

County	Total No. of Facilities	At Least Moderate Damage	Complete Damage	County	Total No. of Facilities	At Least Moderate Damage	Complete Damage
Ballard	25	13	6	Livingston	30	1	0
Caldwell	84	0	0	Logan	33	0	0
Calloway	36	2	0	Lyon	49	0	0
Carlisle	15	15	3	McCracken	80	62	11
Christian	202	0	0	McLean	64	0	0
Crittenden	19	0	0	Marshall	90	25	4
Daviess	233	0	0	Muhlenberg	127	0	0
Fulton	18	16	6	Ohio	190	0	0
Graves	122	41	16	Todd	22	0	0
Hancock	64	0	0	Trigg	38	0	0
Henderson	171	0	0	Union	114	0	0
Hickman	22	22	0	Webster	118	0	0
Hopkins	207	0	0		955		



Critical counties are those that experience the greatest probability of reaching the specified damage state. For definitions of 'Complete' and 'At Least Moderate' damage states please consult the attached document "GUIDE FOR IMPACT ASSESSMENT TERMINOLOGY."

Legend

Highway Bridge Damage
At Least Moderate
- Highly Unlikely
- Unlikely
- Moderate Likelihood
- Highly Likely
- Certain

Highway Segment Damage
At Least Moderate
- Highly Unlikely
- Unlikely
- Moderate Likelihood

- Rivers
- US Routes
- Critical Counties
- Interstates

0 10 20 40 60
Miles

Mid-America Earthquake Center

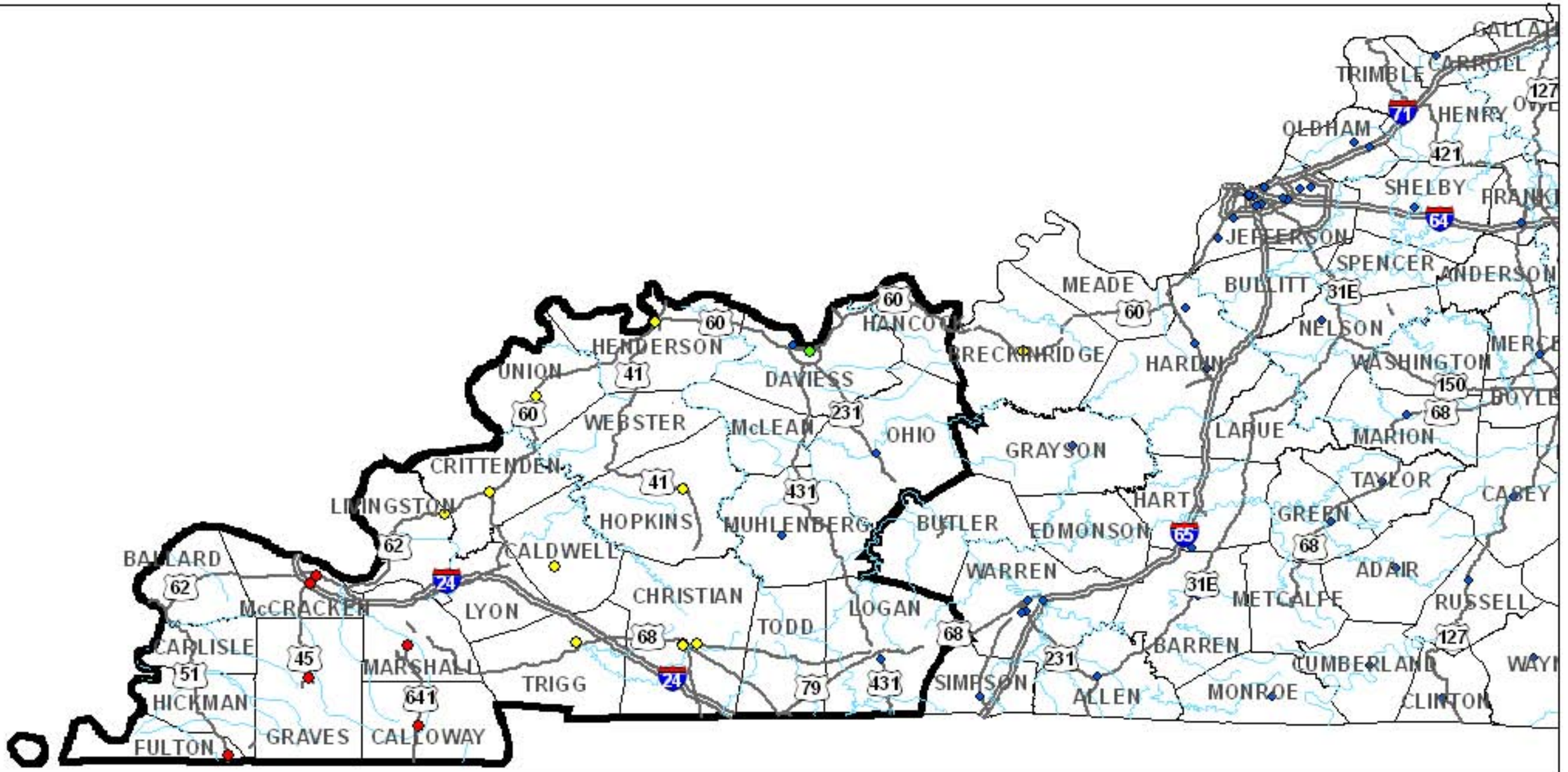
University of Illinois at Urbana-Champaign, Illinois, USA

Amr S. Elnashai, Project Principal Investigator

Neil Hyatt, Principal Investigator

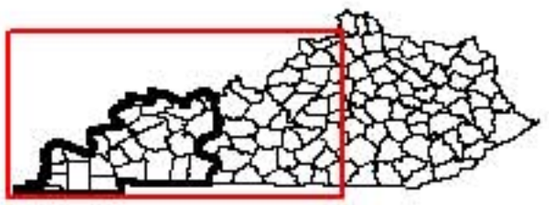
Hospital Damage - New Madrid Seismic Zone: M7.7 Event

March 2008



State of Kentucky - Critical Counties (25)

County	Total No. of Facilities	At Least Moderate Damage	Complete Damage	County	Total No. of Facilities	At Least Moderate Damage	Complete Damage
Caldwell	1	0	0	Muhlenberg	1	0	0
Calloway	1	1	0	Ohio	1	0	0
Christian	3	0	0	Trigg	1	0	0
Crittenden	1	0	0	Union	1	0	0
Daviess	2	0	0	Ballard	0	0	0
Fulton	1	1	0	Carlisle	0	0	0
Graves	1	1	1	Hancock	0	0	0
Henderson	1	0	0	Hickman	0	0	0
Hopkins	1	0	0	Lyon	0	0	0
Livingston	1	0	0	McLean	0	0	0
Logan	1	0	0	Todd	0	0	0
McCracken	2	2	2	Webster	0	0	0
Marshall	1	1	1				



Critical counties are those that experience the greatest probability of reaching the specified damage state. For definitions of 'Complete' and 'At Least Moderate' damage states please consult the attached document,"GUIDE FOR IMPACT ASSESSMENT TERMINOLOGY."

Legend

Hospital Damage

At Least Moderate

- Highly Unlikely
- Unlikely
- Moderate Likelihood
- Highly Likely
- Certain

- Critical Counties
- Interstates
- US Routes
- Rivers

0 10 20 40 60

Miles

Mid-America Earthquake Center

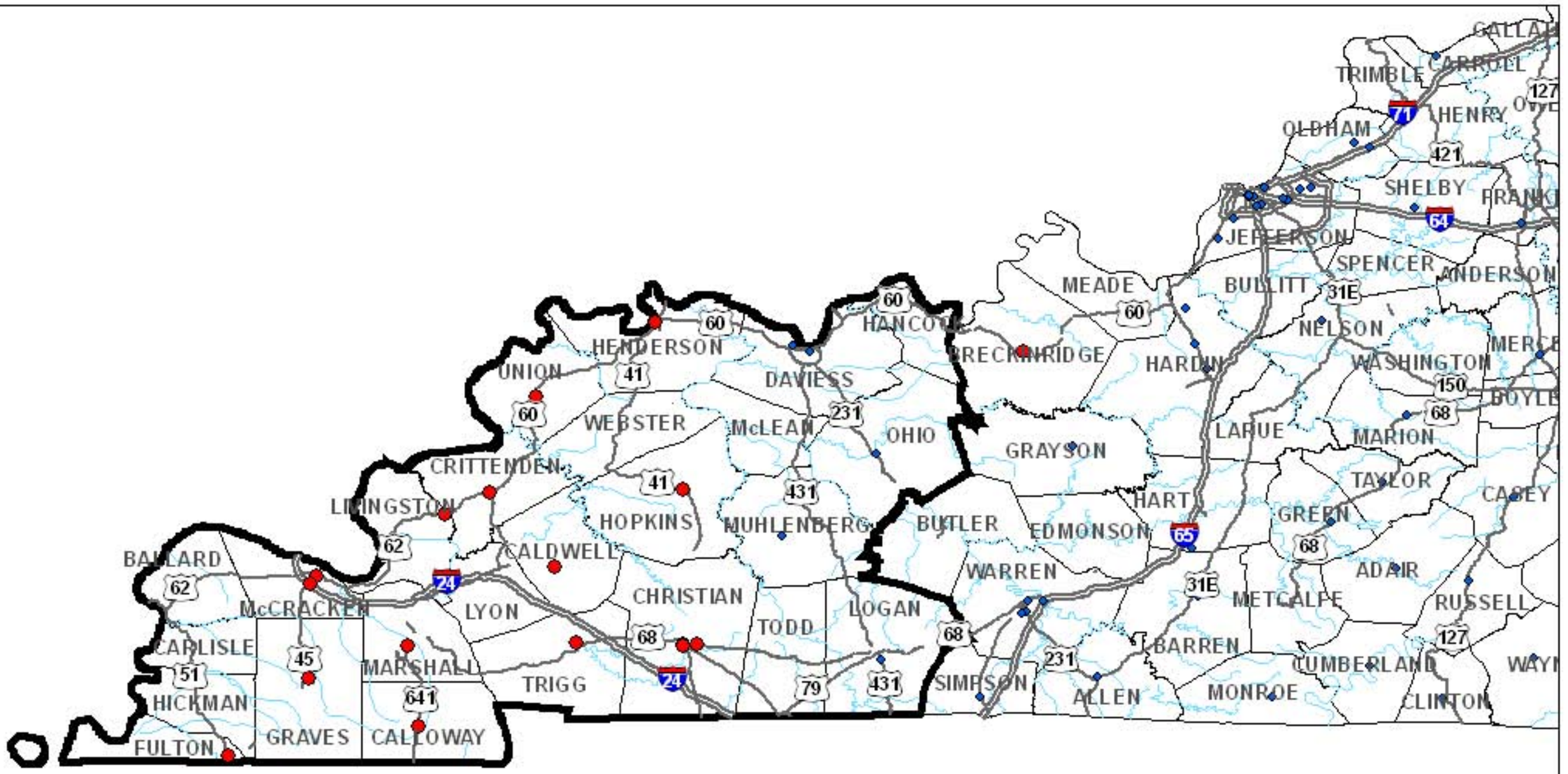
University of Illinois at Urbana-Champaign, Illinois, USA

Amr S. Elnashai, Project Principal Investigator

Ahsan Kareem, Principal Investigator

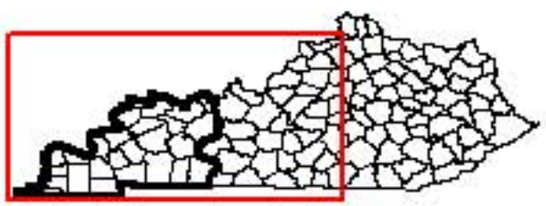
Hospital Functionality at Day 1 - New Madrid Seismic Zone: M7.7 Event

March 2008



State of Kentucky - Critical Counties (25)

County	No. of Functional Facilities	Total No. of Facilities	County	No. of Functional Facilities	Total No. of Facilities
Ballard	0	0	Livingston	0	1
Caldwell	0	1	Logan	1	1
Calloway	0	1	Lyon	0	0
Carlisle	0	0	Marshall	0	1
Christian	0	3	McCracken	0	2
Crittenden	0	1	McLean	0	0
Daviess	2	2	Muhlenberg	1	1
Fulton	0	1	Ohio	1	1
Graves	0	1	Todd	0	0
Hancock	0	0	Trigg	0	1
Henderson	0	1	Union	0	1
Hickman	0	0	Webster	0	0
Hopkins	0	1			



Critical counties are those that experience the greatest probability of reaching the specified damage state. For definitions of 'Complete' and 'At Least Moderate' damage states please consult the attached document,"GUIDE FOR IMPACT ASSESSMENT TERMINOLOGY."

Legend

Hospital Functionality
Day 1
- Not Functional
- Functional

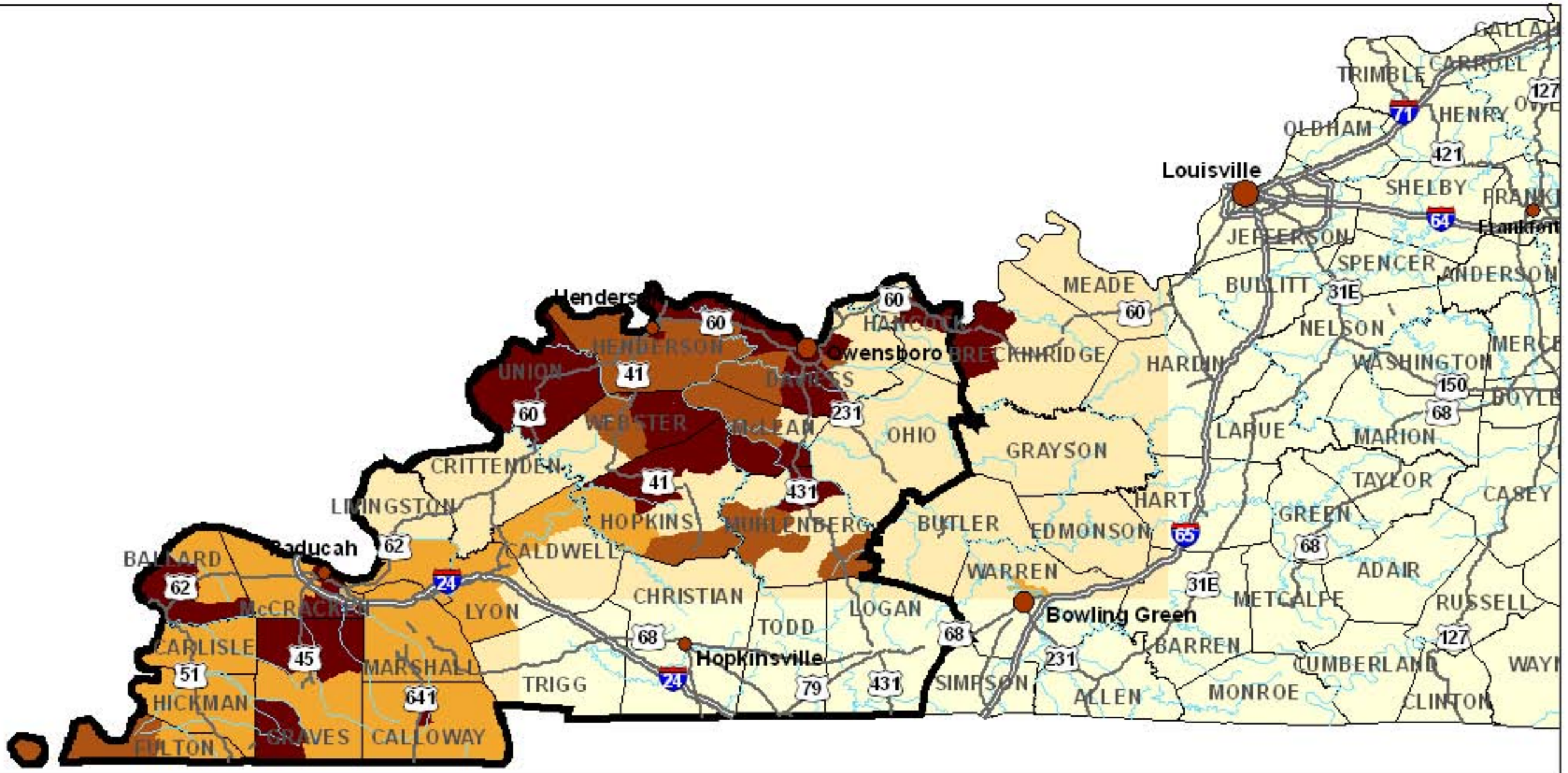
US Routes
Interstates
Critical Counties
Rivers

0 10 20 40 60
Miles

Mid-America Earthquake Center
University of Illinois at Urbana-Champaign, Illinois, USA
Amr S. Elnashai, Project Principal Investigator
Therese Jefferson, Principal Investigator

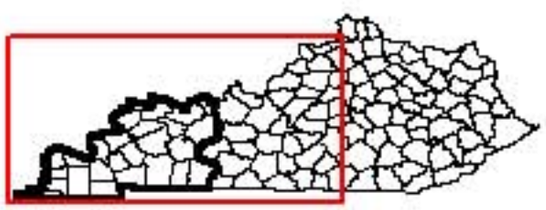
Liquefaction Susceptibility - New Madrid Seismic Zone: M7.7 Event

March 2008



State of Kentucky - Critical Counties (25)

County	Minimum Susceptibility	Maximum Susceptibility	County	Minimum Susceptibility	Maximum Susceptibility
Ballard	Low	Very High	Livingston	None	Low
Caldwell	Unknown	Low	Logan	Unknown	None
Calloway	Low	Very High	Lyon	Unknown	Low
Carlisle	Low	Very High	McCracken	Low	Very High
Christian	Unknown	None	McLean	None	Very High
Crittenden	None	None	Marshall	Low	Low
Daviess	None	Very High	Muhlenberg	None	Very High
Fulton	Low	Moderate	Ohio	None	None
Graves	Low	Very High	Todd	Unknown	None
Hancock	None	Very High	Trigg	Unknown	None
Henderson	Moderate	Very High	Union	Very High	Very High
Hickman	Low	Low	Webster	None	Very High
Hopkins	None	Very High			



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Legend

Liquefaction Susceptibility

- Unknown
- None
- Low
- Moderate
- Very High

Major Cities

- 25,000 - 40,000
- 40,001 - 60,000
- 60,001 - 271,000

- US Routes
- Interstates
- Rivers
- Critical Counties

0 10 20 40 60

Miles

Mid-America Earthquake Center

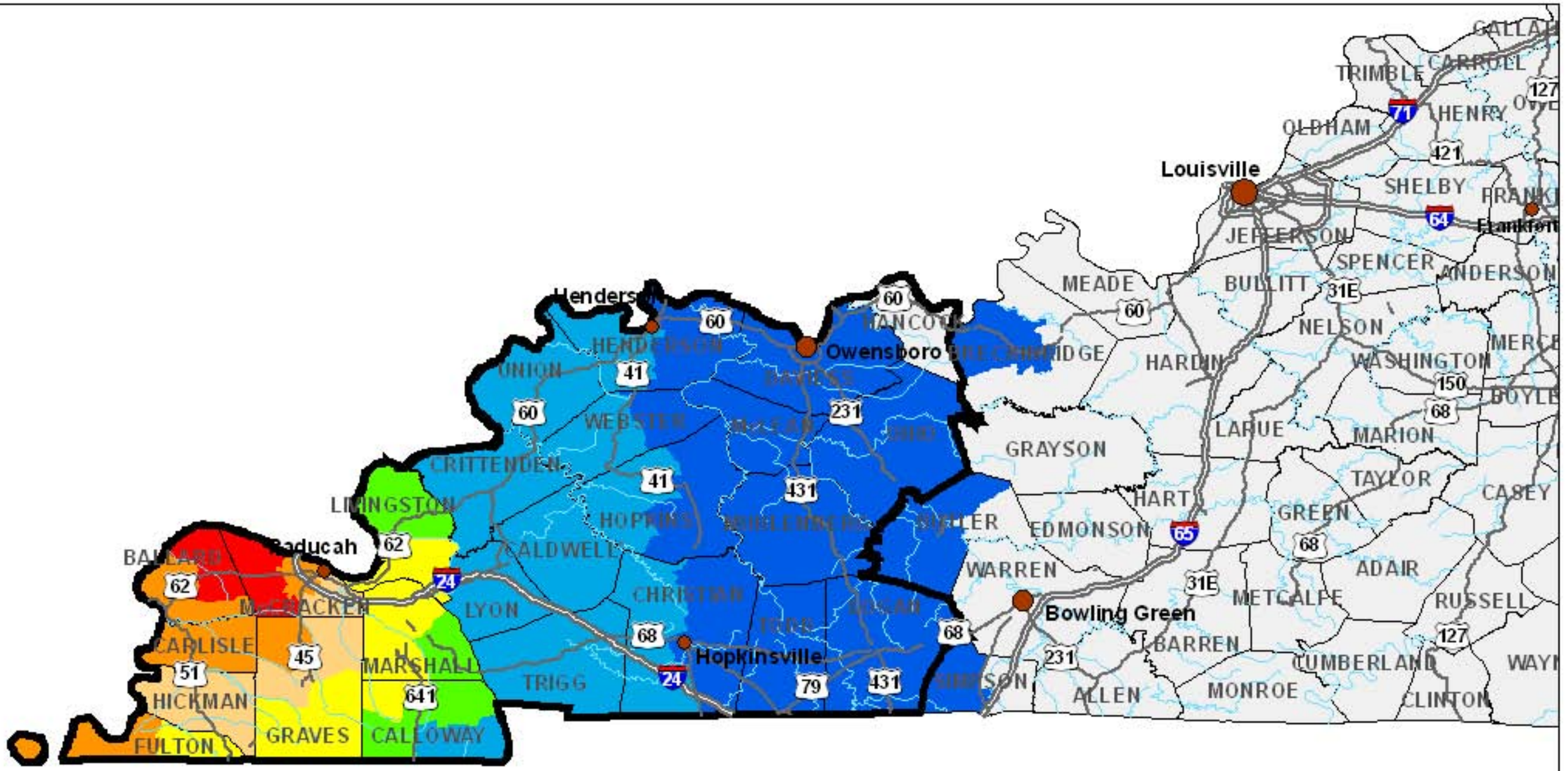
University of Illinois at Urbana-Champaign, Illinois, USA

Amr S. Elnashai, Project Principal Investigator

Neil Hyatt, Principal Investigator

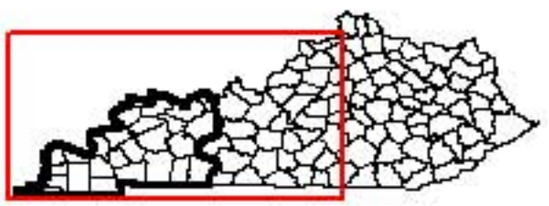
Modified Mercalli Intensity - New Madrid Seismic Zone: M7.7 Event

March 2008



State of Kentucky - Critical Counties (25)

County	Max. MM	County	Max. MM	County	Max. MM
Ballard	XII	Hancock	< VI	Marshall	IX
Caldwell	VII	Henderson	VII	Muhlenberg	VI
Calloway	IX	Hickman	X	Ohio	VI
Carlisle	XI	Hopkins	VII	Todd	VI
Christian	VII	Livingston	IX	Trigg	VII
Crittenden	VII	Logan	VI	Union	VII
Daviess	VI	Lyon	VII	Webster	VII
Fulton	XI	McCracken	XII		
Graves	XI	McLean	VI		



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Legend

Modified Mercalli Intensity (MMI)

- < VI
- VI
- VII
- VIII
- IX
- X
- XI
- XII

Major Cities

- 25,000 - 40,000
- 40,001 - 60,000
- 60,001 - 271,000

US Routes — Rivers

Interstates — Critical Counties

0 10 20 40 60

Miles

Mid-America Earthquake Center

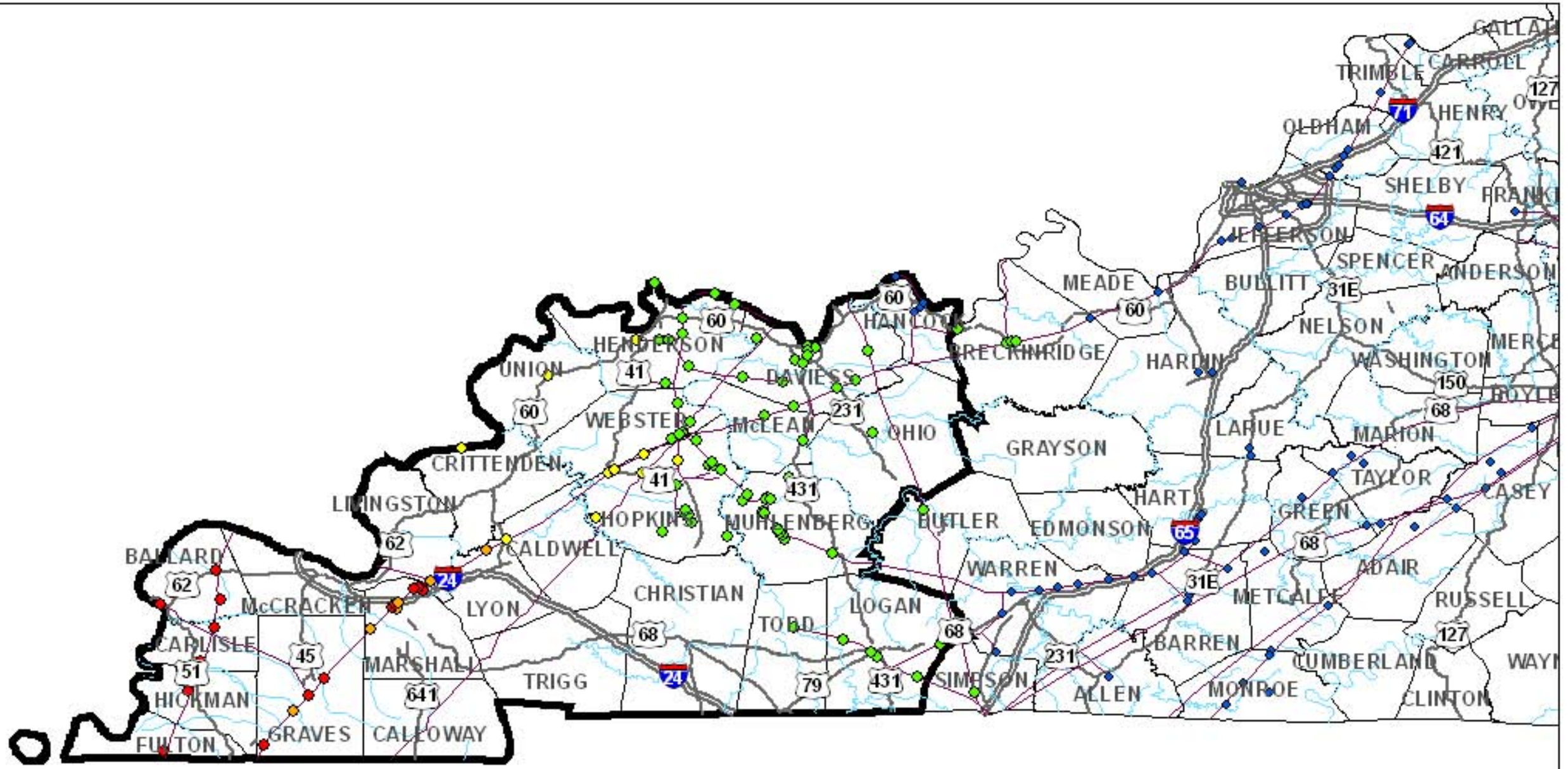
University of Illinois at Urbana-Champaign, Illinois, USA

Amr S. Elnashai, Project Principal Investigator

Therese Jefferson, Principal Investigator

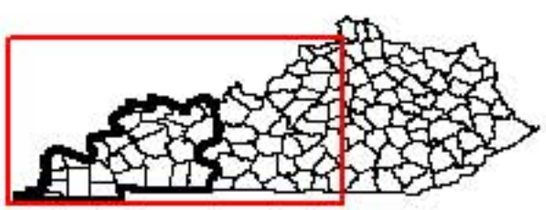
Natural Gas Facility Damage - New Madrid Seismic Zone: M7.7 Event

March 2008



State of Kentucky - Critical Counties (25)

County	Total No. of Facilities	At Least Moderate Damage	Complete Damage	County	Total No. of Facilities	At Least Moderate Damage	Complete Damage
Ballard	0	0	0	Livingston	1	0	0
Caldwell	1	0	0	Logan	1	0	0
Calloway	1	1	0	Lyon	0	0	0
Carlisle	0	0	0	Marshall	1	1	1
Christian	3	0	0	McCracken	2	2	2
Crittenden	1	0	0	McLean	0	0	0
Daviess	2	0	0	Muhlenberg	1	0	0
Fulton	1	1	0	Ohio	1	0	0
Graves	1	1	1	Todd	0	0	0
Hancock	0	0	0	Trigg	1	0	0
Henderson	1	0	0	Union	1	0	0
Hickman	0	0	0	Webster	0	0	0
Hopkins	1	0	0				



Critical counties are those that experience the greatest probability of reaching the specified damage state. For definitions of 'Complete' and 'At Least Moderate' damage states please consult the attached document,"GUIDE FOR IMPACT ASSESSMENT TERMINOLOGY."

Legend

Natural Gas Facility Damage

At Least Moderate

- Highly Unlikely
- Unlikely
- Moderate Likelihood
- Highly Likely
- Certain

- Critical Counties
- Interstates
- US Routes
- Rivers
- Natural Gas Lines

0 10 20 40 60

Miles

Mid-America Earthquake Center

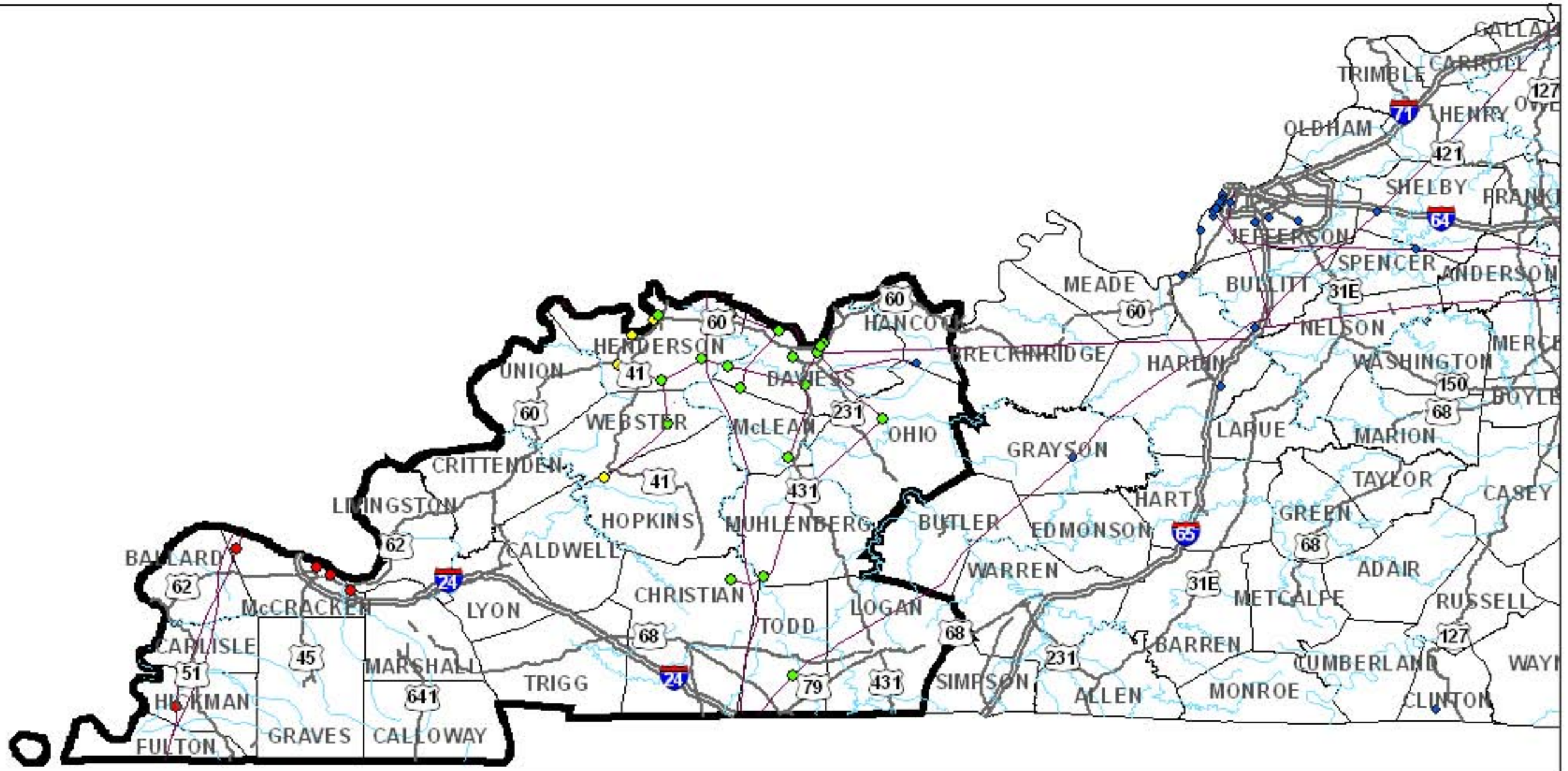
University of Illinois at Urbana-Champaign, Illinois, USA

Amr S. Elnashai, Project Principal Investigator

Therese Jefferson, Principal Investigator

Oil Facility Damage - New Madrid Seismic Zone: M7.7 Event

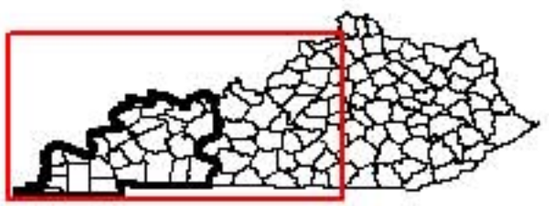
March 2008



State of Kentucky - Critical Counties (25)

County	Total No. of Facilities	At Least Moderate Damage	Complete Damage
Ballard	0	0	0
Caldwell	0	0	0
Calloway	0	0	0
Carlisle	0	0	0
Christian	1	0	0
Crittenden	0	0	0
Daviess	9	0	0
Fulton	0	0	0
Graves	0	0	0
Hancock	1	0	0
Henderson	7	0	0
Hickman	1	1	0
Hopkins	1	0	0

County	Total No. of Facilities	At Least Moderate Damage	Complete Damage
Livingston	0	0	0
Logan	0	0	0
Lyon	0	0	0
Marshall	0	0	0
McCracken	5	5	1
McLean	1	0	0
Muhlenberg	2	0	0
Ohio	1	0	0
Todd	1	0	0
Trigg	0	0	0
Union	0	0	0
Webster	1	0	0



Critical counties are those that experience the greatest probability of reaching the specified damage state. For definitions of 'Complete' and 'At Least Moderate' damage states please consult the attached document,"GUIDE FOR IMPACT ASSESSMENT TERMINOLOGY."

Legend

Oil Facility Damage

At Least Moderate

- Highly Unlikely
- Unlikely
- Moderate Likelihood
- Highly Likely
- Certain

- Critical Counties
- Interstates
- US Routes
- Rivers
- Major Oil Lines

0 10 20 40 60

Miles

Mid-America Earthquake Center

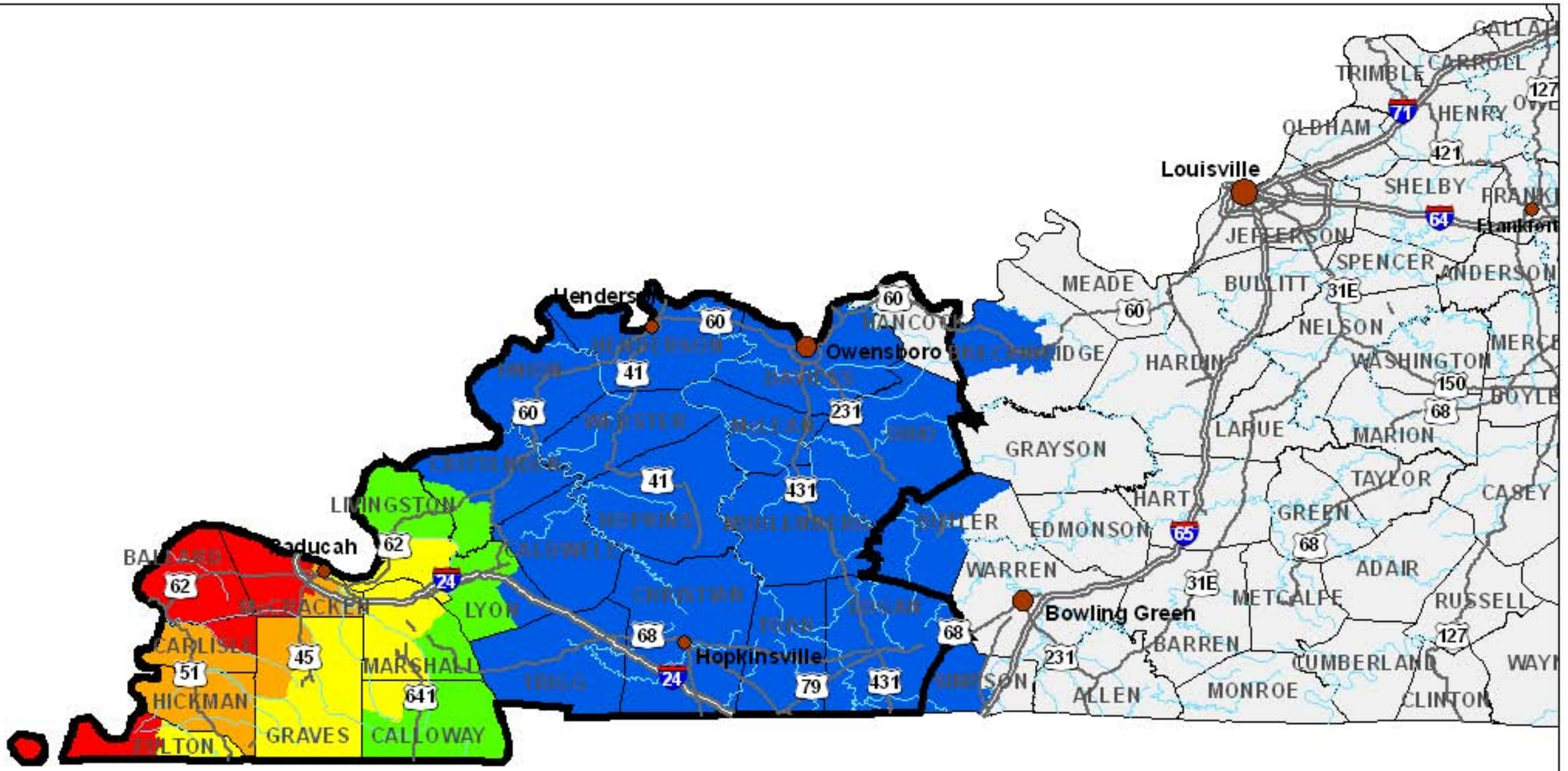
University of Illinois at Urbana-Champaign, Illinois, USA

Amr S. Elnashai, Project Principal Investigator

Neil Hyatt, Principal Investigator

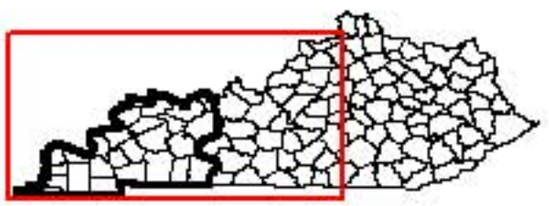
Peak Ground Acceleration - New Madrid Seismic Zone: M7.7 Event

March 2008



State of Kentucky - Critical Counties (25)

County	Min. PGA	Max. PGA	County	Min. PGA	Max. PGA	County	Min. PGA	Max. PGA
Ballard	1.04	1.25	Hancock	0.06	0.06	McLean	0.15	0.15
Caldwell	0.25	0.25	Henderson	0.15	0.25	Marshall	0.44	0.64
Calloway	0.34	0.55	Hickman	0.85	0.85	Muhlenberg	0.15	0.15
Carlisle	0.94	1.14	Hopkins	0.15	0.25	Ohio	0.15	0.15
Christian	0.15	0.25	Livingston	0.44	0.64	Todd	0.15	0.15
Crittenden	0.25	0.34	Logan	0.15	0.15	Trigg	0.25	0.25
Daviess	0.15	0.15	Lyon	0.25	0.34	Union	0.25	0.25
Fulton	0.64	1.04	McCracken	0.75	1.25	Webster	0.15	0.25
Graves	0.55	0.94						



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Legend

Peak Ground Acceleration (g)

- 0.05 - 0.1
- 0.1 - 0.25
- 0.25 - 0.5
- 0.5 - 0.75
- 0.75 - 1.0
- 1.0 - 1.25

Major Cities

- 25,000 - 40,000
- 40,001 - 60,000
- 60,001 - 271,000

- US Routes
- Interstates
- Rivers
- Critical Counties

0 10 20 40 60

Miles

Mid-America Earthquake Center

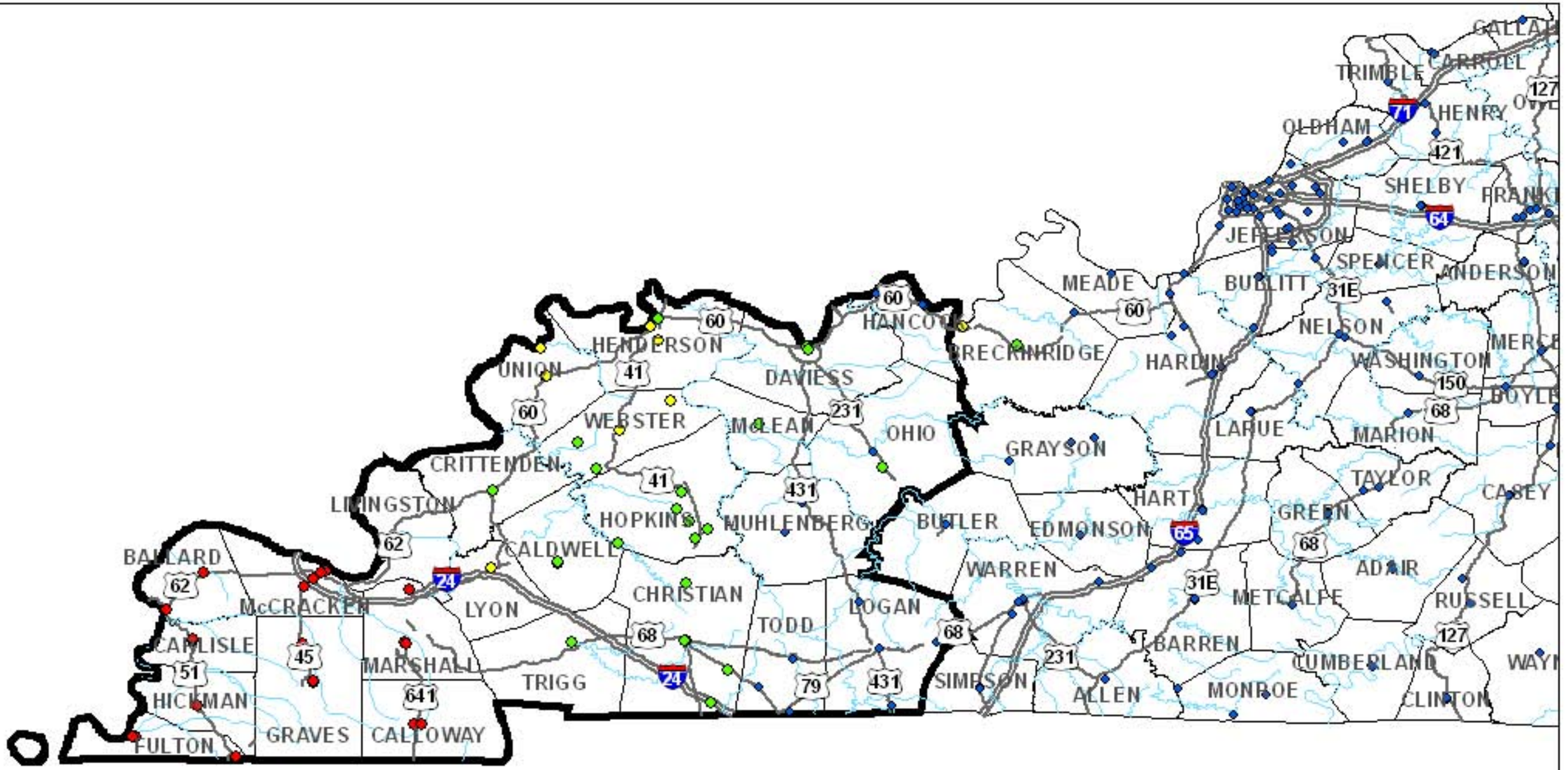
University of Illinois at Urbana-Champaign, Illinois, USA

Amr S. Elnashai, Project Principal Investigator

Therese Jefferson, Principal Investigator

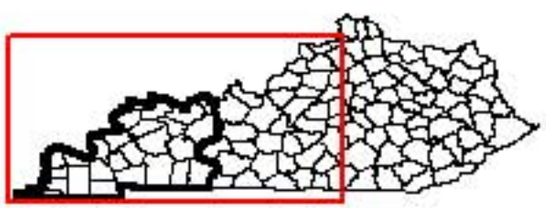
Police Station Damage - New Madrid Seismic Zone: M7.7 Event

March 2008



State of Kentucky - Critical Counties (25)

County	Total No. of Facilities	At Least Moderate Damage	Complete Damage	County	Total No. of Facilities	At Least Moderate Damage	Complete Damage
Ballard	2	2	2	Livingston	1	1	0
Caldwell	2	0	0	Logan	5	0	0
Calloway	3	3	0	Lyon	2	0	0
Carlisle	2	2	2	McCracken	4	4	4
Christian	6	0	0	McLean	2	0	0
Crittenden	2	0	0	Marshall	3	3	3
Daviess	2	0	0	Muhlenberg	3	0	0
Fulton	3	3	3	Ohio	3	0	0
Graves	3	3	3	Todd	4	0	0
Hancock	3	0	0	Trigg	2	0	0
Henderson	3	0	0	Union	4	0	0
Hickman	2	2	2	Webster	4	0	0
Hopkins	7	0	0				



Critical counties are those that experience the greatest probability of reaching the specified damage state. For definitions of 'Complete' and 'At Least Moderate' damage states please consult the attached document,"GUIDE FOR IMPACT ASSESSMENT TERMINOLOGY."

Legend

Police Station Damage

At Least Moderate

- Highly Unlikely
- Unlikely
- Moderate Likelihood
- Highly Likely
- Certain

- Critical Counties
- Interstates
- US Routes
- Rivers

0 10 20 40 60

Miles

Mid-America Earthquake Center

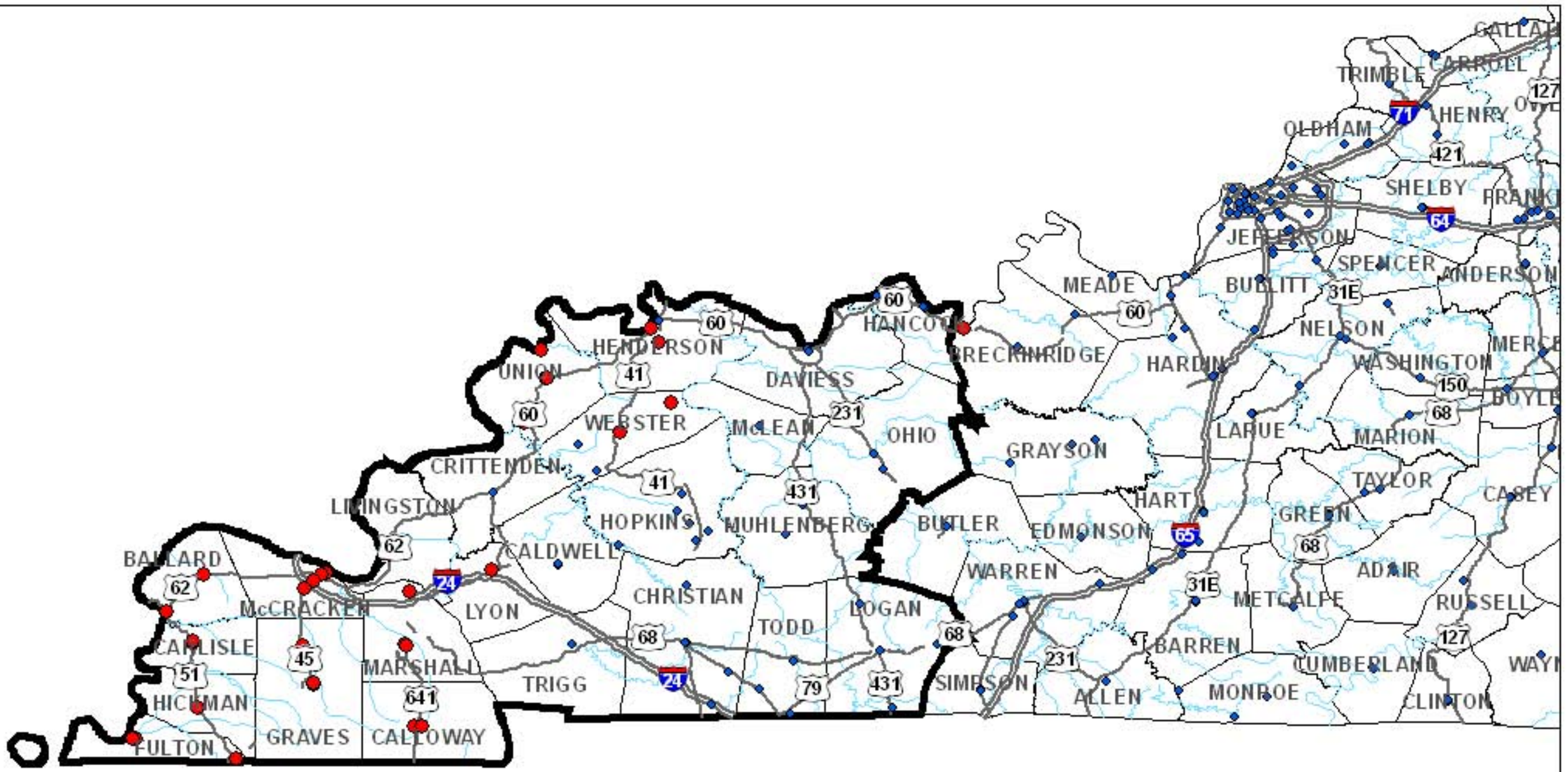
University of Illinois at Urbana-Champaign, Illinois, USA

Amr S. Elnashai, Project Principal Investigator

Therese Jefferson, Principal Investigator

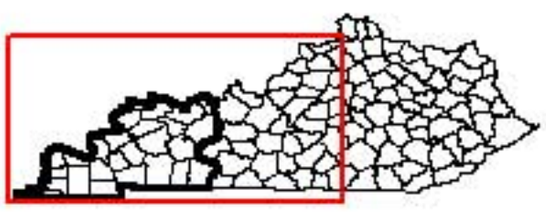
Police Station Functionality at Day 1 - New Madrid Seismic Zone: M7.7 Event

March 2008



State of Kentucky - Critical Counties (25)

County	No. of Functional Facilities	Total No. of Facilities	County	No. of Functional Facilities	Total No. of Facilities
Ballard	0	2	Livingston	0	1
Caldwell	2	2	Logan	5	5
Calloway	0	3	Lyon	0	2
Carlisle	0	2	McCracken	0	4
Christian	6	6	McLean	2	2
Crittenden	2	2	Marshall	0	3
Daviess	2	2	Muhlenberg	3	3
Fulton	0	3	Ohio	3	3
Graves	0	3	Todd	4	4
Hancock	3	3	Trigg	2	2
Henderson	1	3	Union	0	4
Hickman	0	2	Webster	2	4
Hopkins	7	7			



Critical counties are those that experience the greatest probability of reaching the specified damage state. For definitions of 'Complete' and 'At Least Moderate' damage states please consult the attached document,"GUIDE FOR IMPACT ASSESSMENT TERMINOLOGY."

Legend

Police Station Functionality

Day 1

- Not Functional
- Functional

US Routes

Interstates

Critical Counties

Rivers

0 10 20 40 60

Miles

Mid-America Earthquake Center

University of Illinois at Urbana-Champaign, Illinois, USA

Amr S. Elnashai, Project Principal Investigator

Therese Jefferson, Principal Investigator

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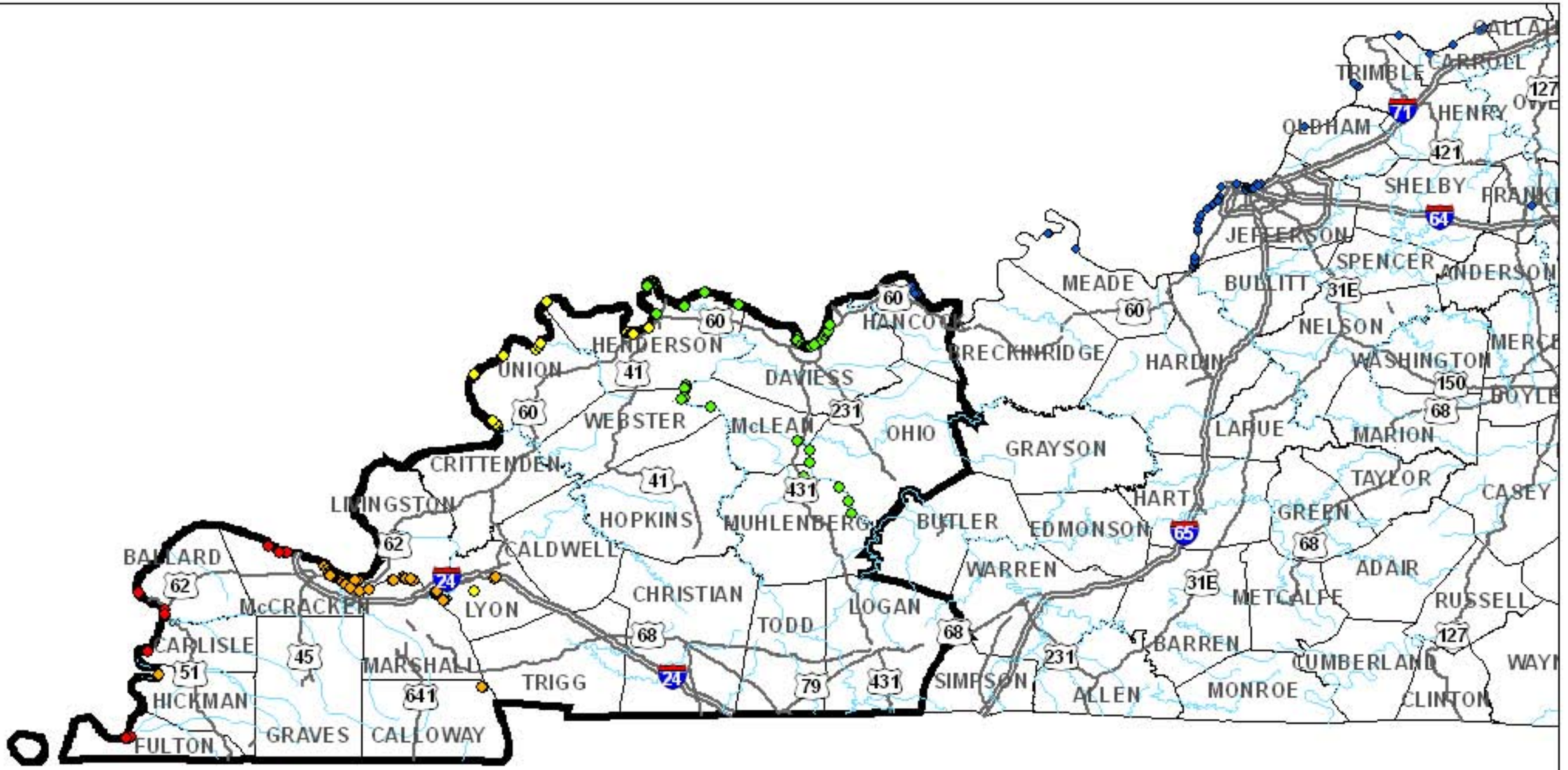
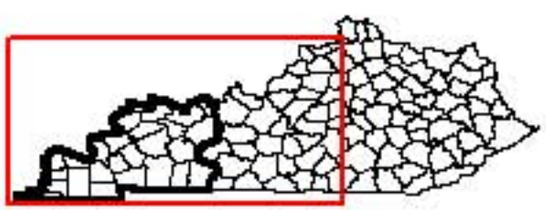
Port Facility Damage - New Madrid Seismic Zone: M7.7 Event

March 2008



State of Kentucky - Critical Counties (25)

County	Total No. of Facilities	At Least Moderate Damage	Complete Damage	County	Total No. of Facilities	At Least Moderate Damage	Complete Damage
Ballard	3	3	2	Livingston	12	12	0
Caldwell	0	0	0	Logan	0	0	0
Calloway	2	2	0	Lyon	4	3	0
Carlisle	2	2	0	Marshall	13	13	0
Christian	0	0	0	McCracken	41	41	4
Crittenden	0	0	0	McLean	5	0	0
Daviess	25	0	0	Muhlenberg	4	0	0
Fulton	8	8	8	Ohio	4	0	0
Graves	0	0	0	Todd	0	0	0
Hancock	4	0	0	Trigg	0	0	0
Henderson	25	0	0	Union	8	0	0
Hickman	2	2	0	Webster	2	0	0
Hopkins	0	0	0				



Critical counties are those that experience the greatest probability of reaching the specified damage state. For definitions of 'Complete' and 'At Least Moderate' damage states please consult the attached document,"GUIDE FOR IMPACT ASSESSMENT TERMINOLOGY."

Legend

Port Facility Damage

At Least Moderate

- Highly Unlikely
- Unlikely
- Moderate Likelihood
- Highly Likely
- Certain

- Critical Counties
- Interstates
- US Routes
- Rivers

0 10 20 40 60

Miles

Mid-America Earthquake Center

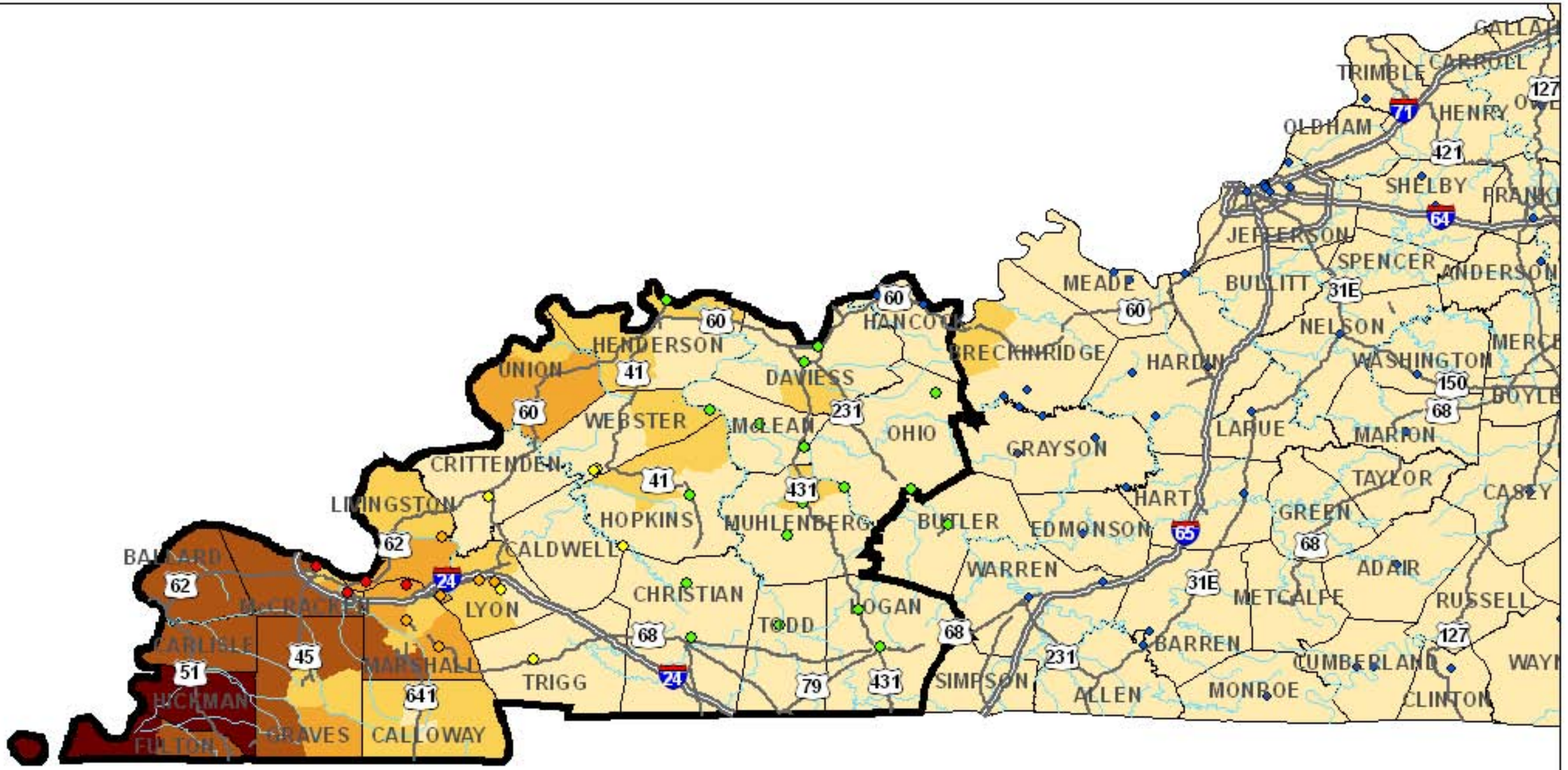
University of Illinois at Urbana-Champaign, Illinois, USA

Amr S. Elnashai, Project Principal Investigator

Therese Jefferson, Principal Investigator

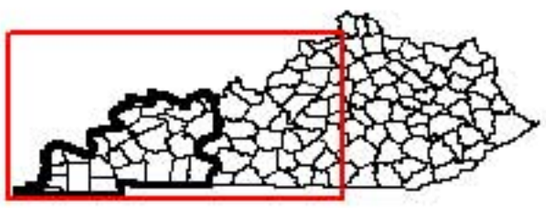
Potable Water System Damage - New Madrid Seismic Zone: M7.7 Event

March 2008



State of Kentucky - Critical Counties (25)

County	Total No. of Facilities	At Least Moderate Damage	Complete Damage	County	Total No. of Facilities	At Least Moderate Damage	Complete Damage
Ballard	0	0	0	Livingston	3	3	0
Caldwell	0	0	0	Logan	2	0	0
Calloway	0	0	0	Lyon	3	2	0
Carlisle	0	0	0	McCracken	3	3	0
Christian	2	0	0	McLean	2	0	0
Crittenden	1	0	0	Marshall	3	3	0
Daviess	2	0	0	Muhlenberg	2	0	0
Fulton	0	0	0	Ohio	3	0	0
Graves	0	0	0	Todd	1	0	0
Hancock	2	0	0	Trigg	1	0	0
Henderson	1	0	0	Union	0	0	0
Hickman	0	0	0	Webster	3	0	0
Hopkins	2	0	0				



Critical counties are those that experience the greatest probability of reaching the specified damage state. For definitions of 'Complete' and 'At Least Moderate' damage states please consult the attached document,"GUIDE FOR IMPACT ASSESSMENT TERMINOLOGY."

Legend

Potable Water Facility Damage

At Least Moderate

- Highly Unlikely
- Unlikely
- Moderate Likelihood
- Highly Likely
- Certain

Potable Water Distribution Lines

No. of Leaks

- 0 - 10
- 11 - 50
- 51 - 100
- 101 - 500
- 501 - 1,000

- US Routes
- Interstates
- Critical Counties
- Rivers

0 10 20 40 60

Miles

Mid-America Earthquake Center

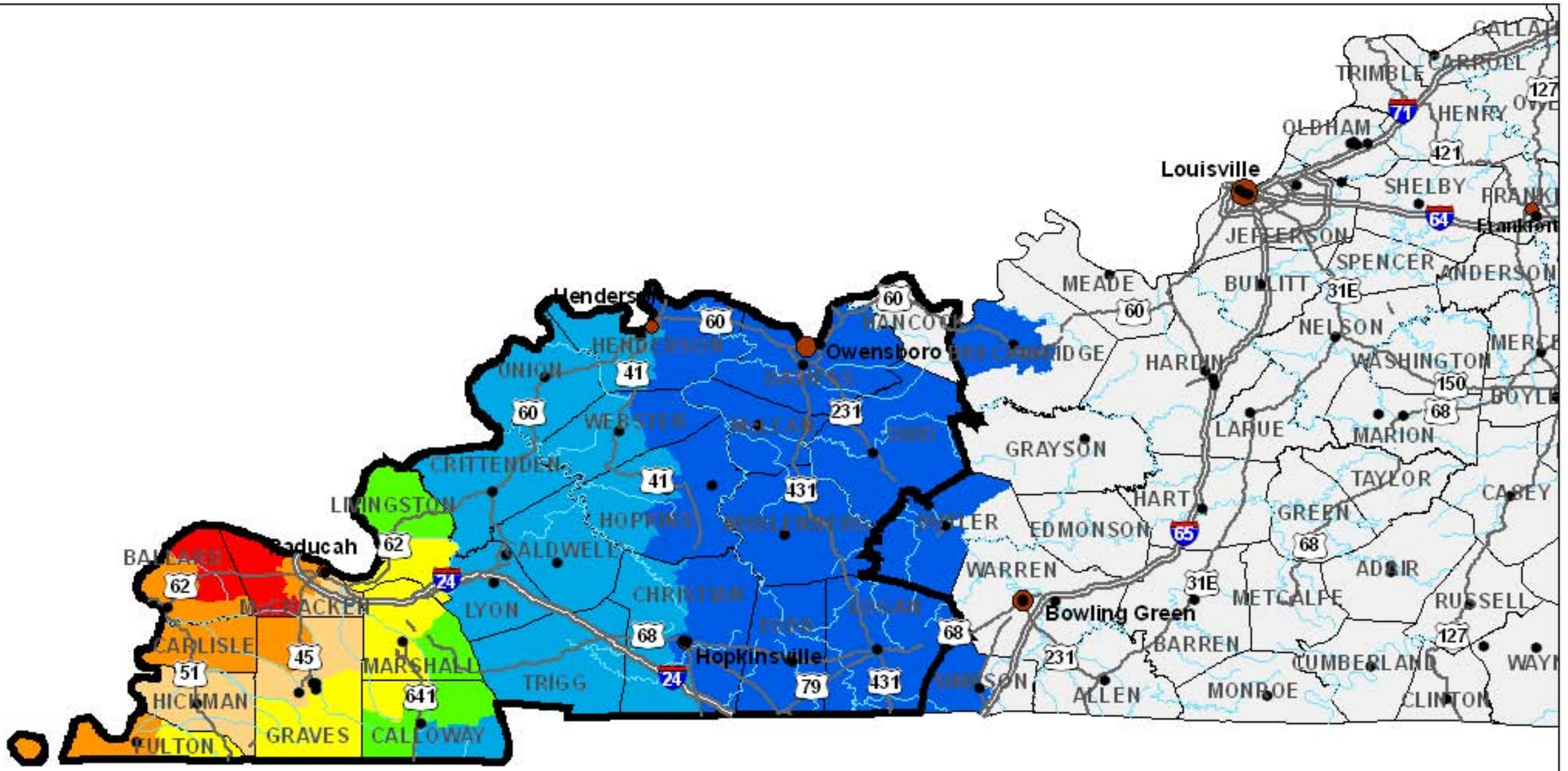
University of Illinois at Urbana-Champaign, Illinois, USA

Amr S. Elnashai, Project Principal Investigator

Therese Jefferson, Principal Investigator

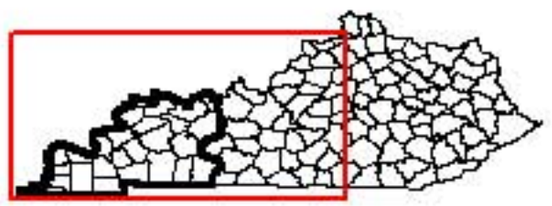
Prisons - New Madrid Seismic Zone: M7.7 Event

March 2008



State of Kentucky - Critical Counties (25)

County	No. of Facilities	County	No. of Facilities	County	No. of Facilities
Ballard	1	Hancock	0	McLean	1
Caldwell	1	Henderson	1	Muhlenberg	2
Calloway	1	Hickman	1	Ohio	1
Carlisle	0	Hopkins	2	Todd	1
Christian	2	Livingston	1	Trigg	0
Crittenden	1	Logan	1	Union	1
Daviess	2	Lyon	2	Webster	1
Fulton	1	Marshall	1		
Graves	4	McCracken	1		



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Legend

Modified Mercalli Intensity (MMI)

- < VI
- VI
- VII
- VIII
- IX
- X
- XI
- XII

- US Routes
- Interstates
- Rivers
- Critical Counties
- Prisons

Major Cities

- 25,000 - 40,000
- 40,001 - 60,000
- 60,001 - 271,000

0 10 20 40 60

Miles

Mid-America Earthquake Center

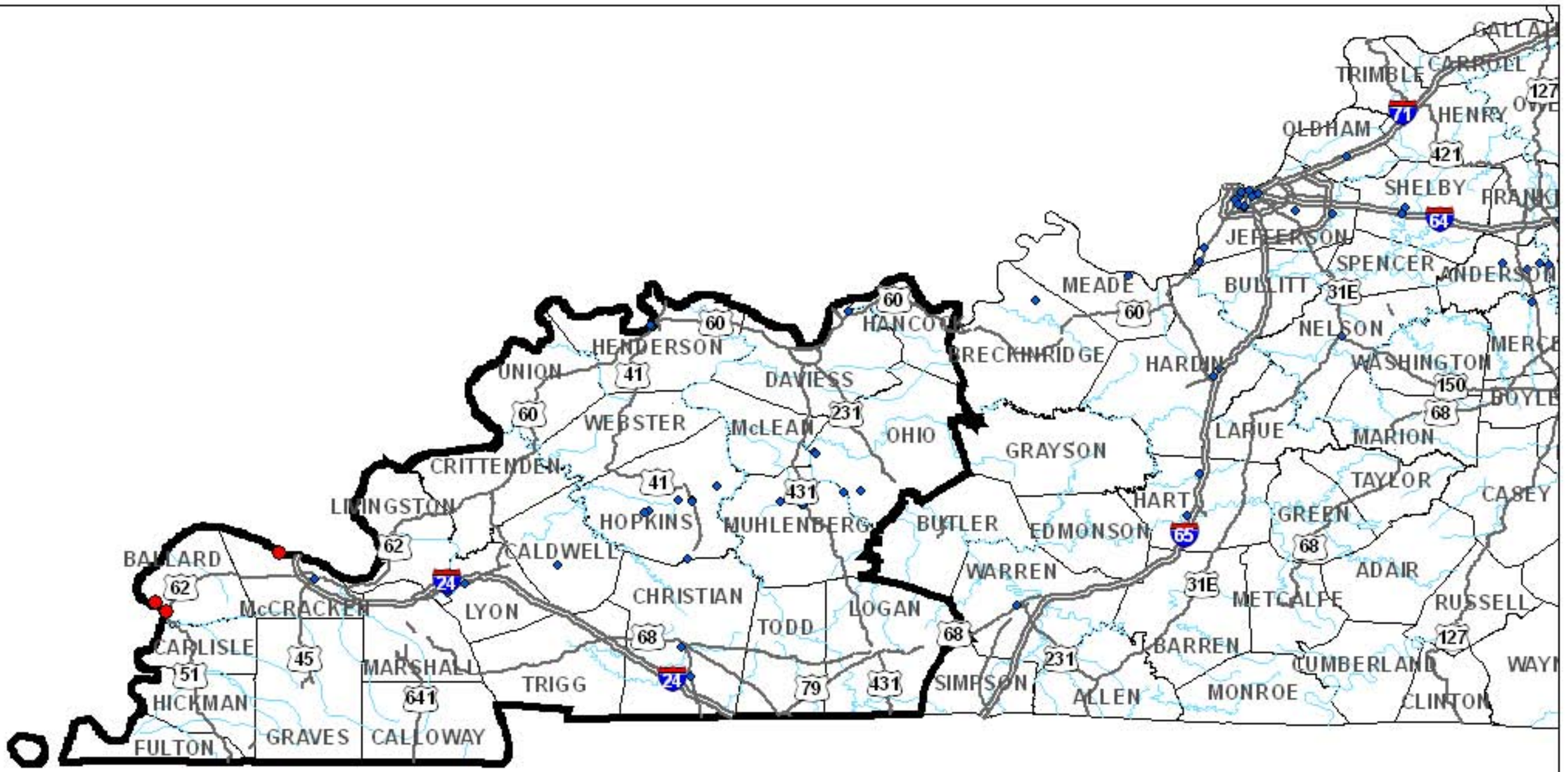
University of Illinois at Urbana-Champaign, Illinois, USA

Amr S. Elnashai, Project Principal Investigator

Therese Jefferson, Principal Investigator

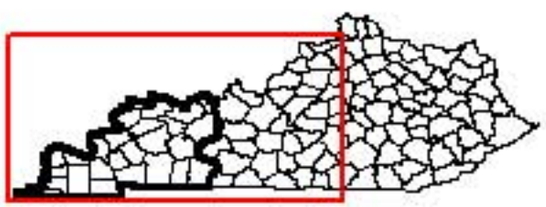
Railway Bridge Functionality at Day 1 - New Madrid Seismic Zone: M7.7 Event

March 2008



State of Kentucky - Critical Counties (25)

County	No. of Functional Facilities	Total No. of Facilities	County	No. of Functional Facilities	Total No. of Facilities
Ballard	0	2	Livingston	0	0
Caldwell	1	1	Logan	0	0
Calloway	0	0	Lyon	3	3
Carlisle	0	0	Marshall	0	0
Christian	3	3	McCracken	1	2
Crittenden	0	0	McLean	0	0
Daviess	1	1	Muhlenberg	5	5
Fulton	0	0	Ohio	3	3
Graves	0	0	Todd	0	0
Hancock	2	2	Trigg	0	0
Henderson	6	6	Union	0	0
Hickman	0	0	Webster	0	0
Hopkins	7	7			



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Legend

Railway Bridge Functionality

Day 1

- Not Functional
- Functional

US Routes

Interstates

Critical Counties

Rivers

0 10 20 40 60

Miles

Mid-America Earthquake Center

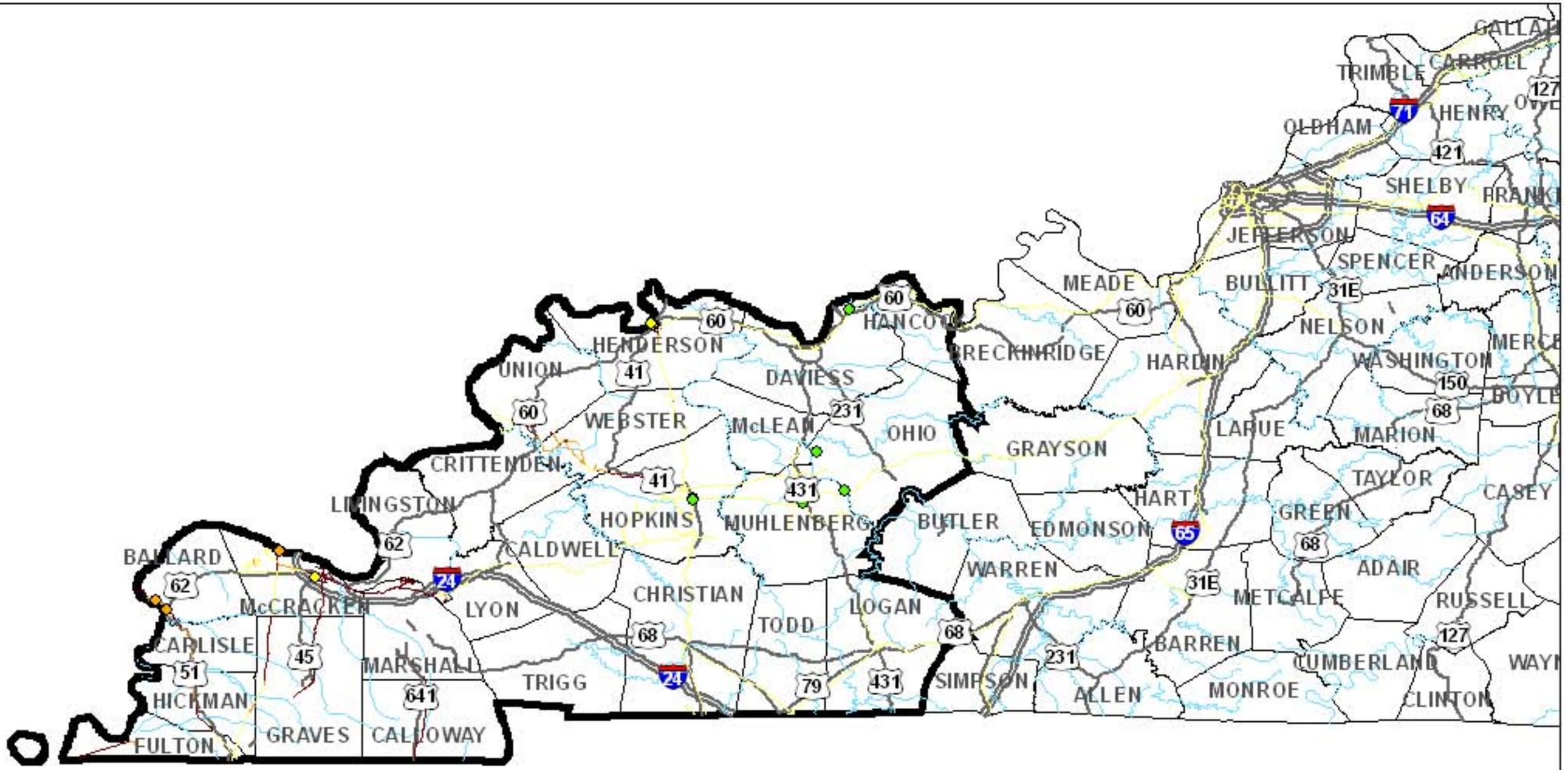
University of Illinois at Urbana-Champaign, Illinois, USA

Amr S. Elnashai, Project Principal Investigator

Therese Jefferson, Principal Investigator

Railway Bridge & Segment Damage - New Madrid Seismic Zone: M7.7 Event

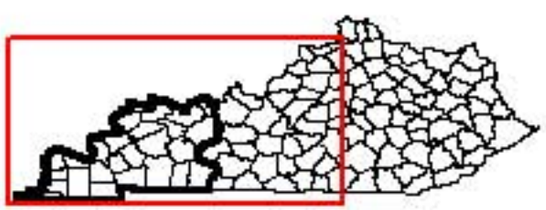
March 2008



State of Kentucky - Critical Counties (25)

County	Total No. of Facilities	At Least Moderate Damage	Complete Damage
Ballard	2	2	0
Caldwell	1	0	0
Calloway	0	0	0
Carlisle	0	0	0
Christian	3	0	0
Crittenden	0	0	0
Daviess	1	0	0
Fulton	0	0	0
Graves	0	0	0
Hancock	2	0	0
Henderson	6	0	0
Hickman	0	0	0
Hopkins	7	0	0

County	Total No. of Facilities	At Least Moderate Damage	Complete Damage
Livingston	0	0	0
Logan	0	0	0
Lyon	3	0	0
Marshall	0	0	0
McCracken	2	1	0
McLean	0	0	0
Muhlenberg	5	0	0
Ohio	3	0	0
Todd	0	0	0
Trigg	0	0	0
Union	0	0	0
Webster	0	0	0



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Legend

Railway Bridge Damage
At Least Moderate
- Highly Unlikely
- Unlikely
- Moderate Likelihood
- Highly Likely
- Certain

Railway Segment Damage
At Least Moderate
- Highly Unlikely
- Unlikely
- Moderate Likelihood

- Rivers
- US Routes
- Critical Counties
- Interstates

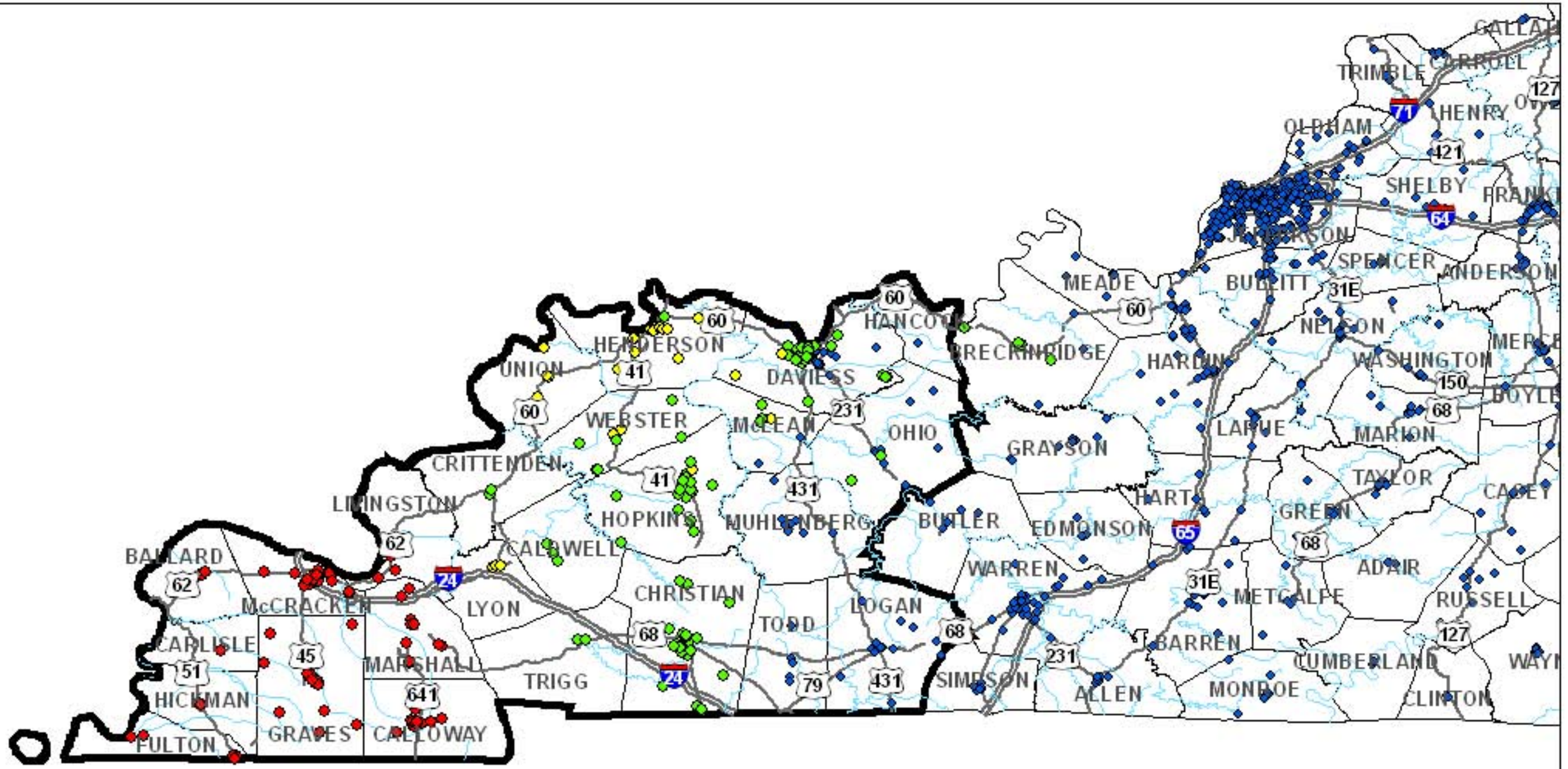
0 10 20 40 60
Miles

Mid-America Earthquake Center

University of Illinois at Urbana-Champaign, Illinois, USA
Amr S. Elnashai, Project Principal Investigator
Therese Jefferson, Principal Investigator

School Damage - New Madrid Seismic Zone: M7.7 Event

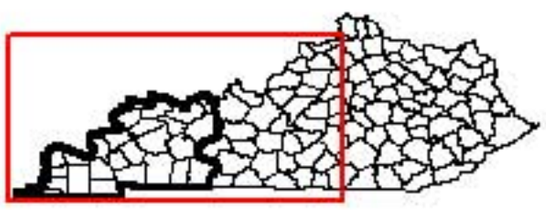
March 2008



State of Kentucky - Critical Counties (25)

County	Total No. of Facilities	At Least Moderate Damage	Complete Damage
Ballard	7	7	4
Caldwell	6	0	0
Calloway	13	13	0
Carlisle	4	4	4
Christian	27	0	0
Crittenden	3	0	0
Daviess	45	0	0
Fulton	9	9	9
Graves	18	18	18
Hancock	4	0	0
Henderson	16	0	0
Hickman	3	3	3
Hopkins	23	0	0

County	Total No. of Facilities	At Least Moderate Damage	Complete Damage
Livingston	5	3	0
Logan	15	0	0
Lyon	5	0	0
McCracken	28	28	28
McLean	6	0	0
Marshall	13	13	13
Muhlenberg	12	0	0
Ohio	12	0	0
Todd	7	0	0
Trigg	5	0	0
Union	7	0	0
Webster	8	0	0



Critical counties are those that experience the greatest probability of reaching the specified damage state. For definitions of 'Complete' and 'At Least Moderate' damage states please consult the attached document,"GUIDE FOR IMPACT ASSESSMENT TERMINOLOGY."

Legend

School Damage

At Least Moderate

- Highly Unlikely
- Unlikely
- Moderate Likelihood
- Highly Likely
- Certain

- Critical Counties
- Interstates
- US Routes
- Rivers

0 10 20 40 60

Miles

Mid-America Earthquake Center

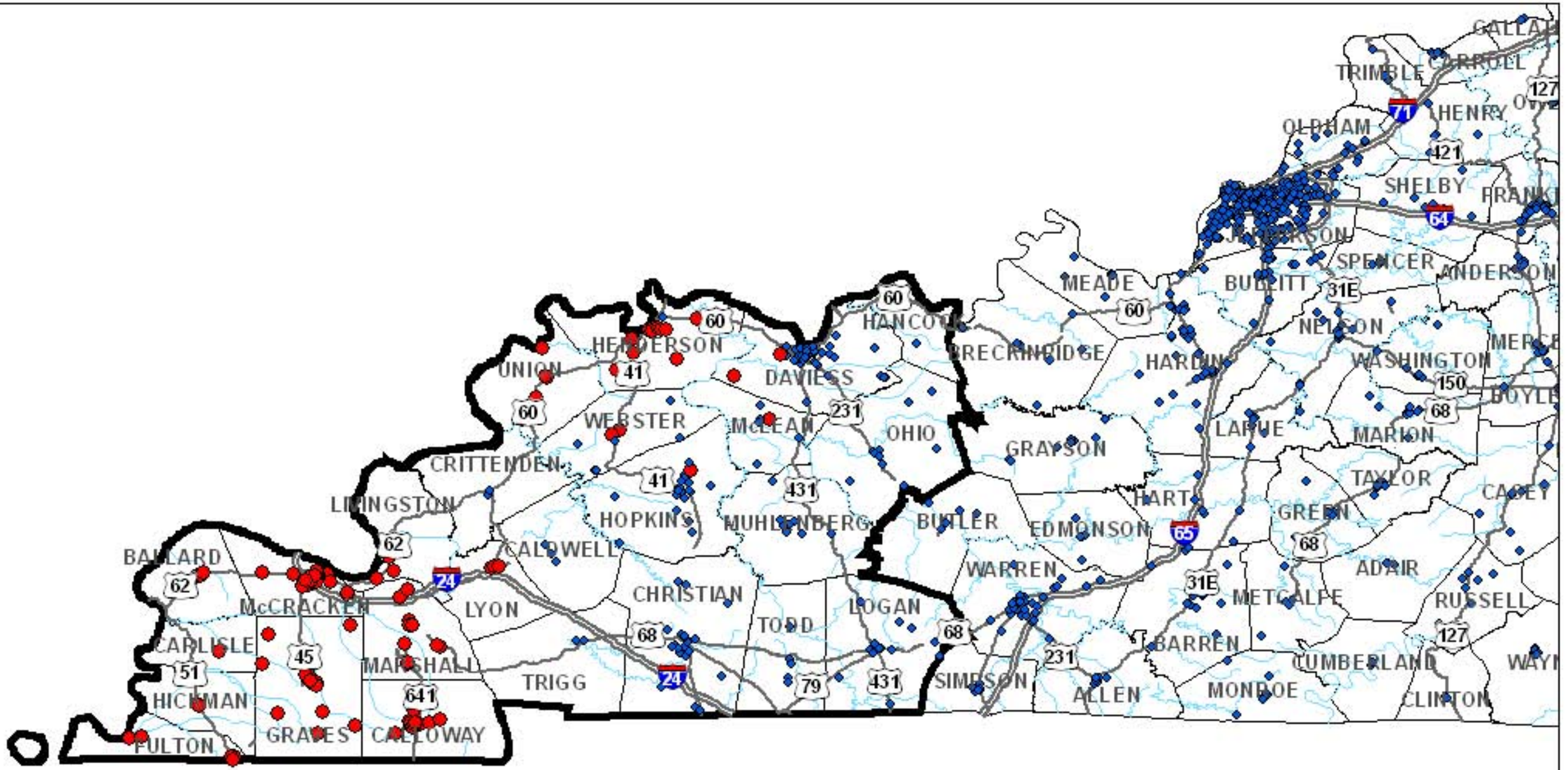
University of Illinois at Urbana-Champaign, Illinois, USA

Amr S. Elnashai, Project Principal Investigator

Therese Jefferson, Principal Investigator

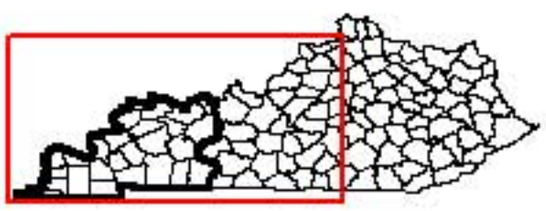
School Functionality at Day 1 - New Madrid Seismic Zone: M7.7 Event

March 2008



State of Kentucky - Critical Counties (25)

County	No. of Functional Facilities	Total No. of Facilities	County	No. of Functional Facilities	Total No. of Facilities
Ballard	0	7	Livingston	0	5
Caldwell	6	6	Logan	15	15
Calloway	0	13	Lyon	0	5
Carlisle	0	4	McCracken	0	28
Christian	27	27	McLean	5	6
Crittenden	3	3	Marshall	0	13
Daviess	43	45	Muhlenberg	12	12
Fulton	0	9	Ohio	12	12
Graves	0	18	Todd	7	7
Hancock	4	4	Trigg	5	5
Henderson	1	16	Union	0	7
Hickman	0	3	Webster	6	8
Hopkins	22	23			



Critical counties are those that experience the greatest probability of reaching the specified damage state. For definitions of 'Complete' and 'At Least Moderate' damage states please consult the attached document,"GUIDE FOR IMPACT ASSESSMENT TERMINOLOGY."

Legend

School Functionality

Day 1

- Not Functional
- Functional

US Routes

Interstates

Critical Counties

Rivers

0 10 20 40 60

Miles

Mid-America Earthquake Center

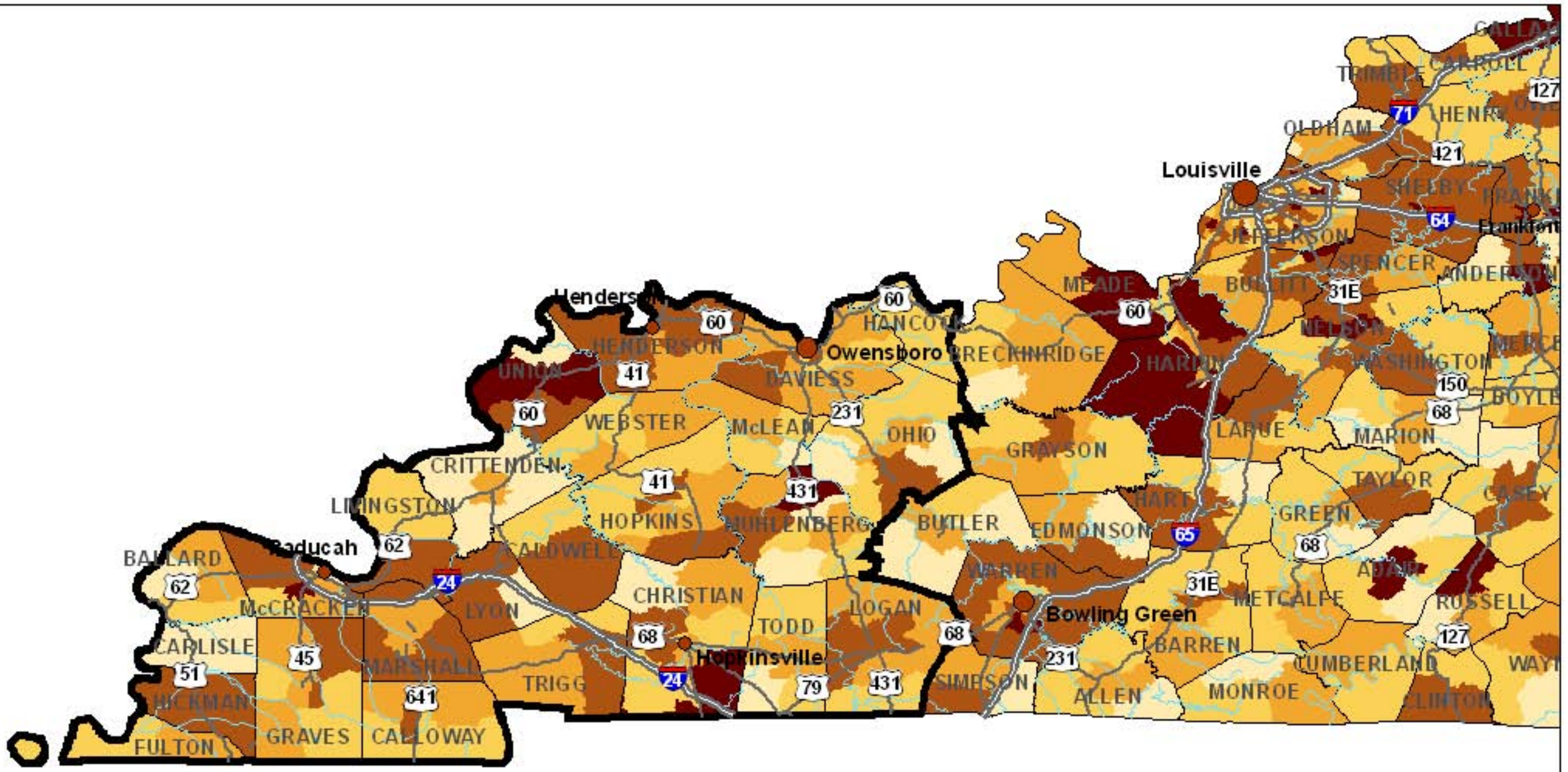
University of Illinois at Urbana-Champaign, Illinois, USA

Amr S. Elnashai, Project Principal Investigator

Therese Jefferson, Principal Investigator

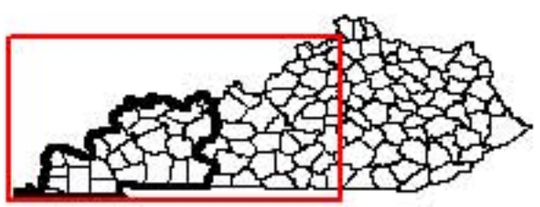
Total Population (2000) - New Madrid Seismic Zone: M7.7 Event

March 2008



State of Kentucky - Critical Counties (25)

County	Population	County	Population	County	Population
Ballard	8,286	Hancock	8,392	Marshall	30,125
Caldwell	13,060	Henderson	44,829	Muhlenberg	31,839
Calloway	34,177	Hickman	5,262	Ohio	22,916
Carlisle	5,351	Hopkins	46,519	Todd	11,971
Christian	72,265	Livingston	9,804	Trigg	12,597
Crittenden	9,384	Logan	26,573	Union	15,637
Daviess	91,545	Lyon	8,080	Webster	14,120
Fulton	7,752	McCracken	65,514		
Graves	37,028	McLean	9,938		



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Legend

Total Population (HAZUS - 2000)

- 0 - 2,000
- 2,001 - 3,500
- 3,501 - 5,000
- 5,001 - 7,500
- 7,501 - 15,400

Major Cities

- 25,000 - 40,000
- 40,001 - 60,000
- 60,001 - 271,000

- US Routes
- Interstates
- Rivers
- Critical Counties

0 10 20 40 60

Miles

Mid-America Earthquake Center

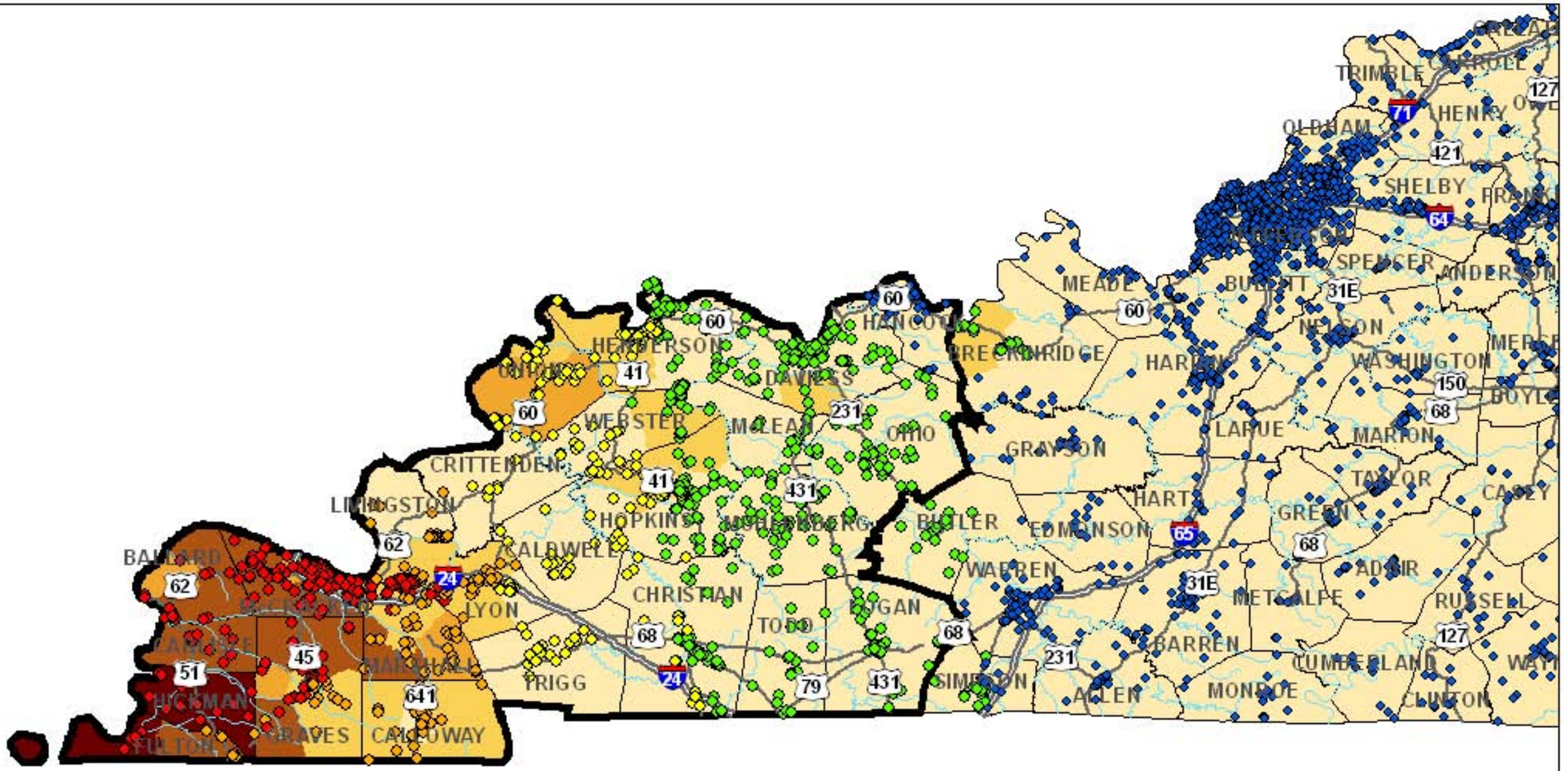
University of Illinois at Urbana-Champaign, Illinois, USA

Amr S. Elnashai, Project Principal Investigator

Theresa Jefferson, Principal Investigator

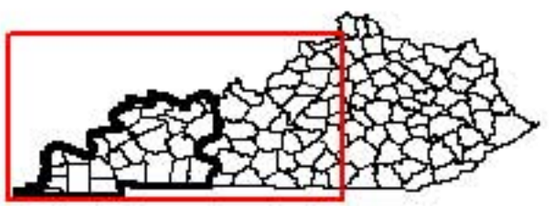
Waste Water System Damage - New Madrid Seismic Zone: M7.7 Event

March 2008



State of Kentucky - Critical Counties (25)

County	Total No. of Facilities	At Least Moderate Damage	Complete Damage	County	Total No. of Facilities	At Least Moderate Damage	Complete Damage
Ballard	22	22	12	Livingston	51	51	0
Caldwell	16	0	0	Logan	45	0	0
Calloway	40	40	0	Lyon	33	24	0
Carlisle	16	16	0	McCracken	147	147	69
Christian	83	0	0	McLean	19	0	0
Crittenden	11	2	0	Marshall	125	125	0
Daviess	162	0	0	Muhlenberg	89	0	0
Fulton	15	15	0	Ohio	102	0	0
Graves	57	57	0	Todd	20	0	0
Hancock	82	0	0	Trigg	28	0	0
Henderson	165	0	0	Union	51	0	0
Hickman	24	24	0	Webster	59	0	0
Hopkins	99	0	0				



Critical counties are those that experience the greatest probability of reaching the specified damage state. For definitions of 'Complete' and 'At Least Moderate' damage states please consult the attached document,"GUIDE FOR IMPACT ASSESSMENT TERMINOLOGY."

Legend

Waste Water Facility Damage

At Least Moderate

- Highly Unlikely
- Unlikely
- Moderate Likelihood
- Highly Likely
- Certain

Waste Water Distribution Lines

No. of Leaks

- 0 - 10
- 11 - 50
- 51 - 100
- 101 - 500
- 501 - 800

- US Routes
- Interstates
- Critical Counties
- Rivers

0 5 10 20 30

Miles

Mid-America Earthquake Center

University of Illinois at Urbana-Champaign, Illinois, USA

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Nicholas Nelson, Principal Investigator