

New Tools for Earthquake Planning in the Central U.S.

Brian Blake

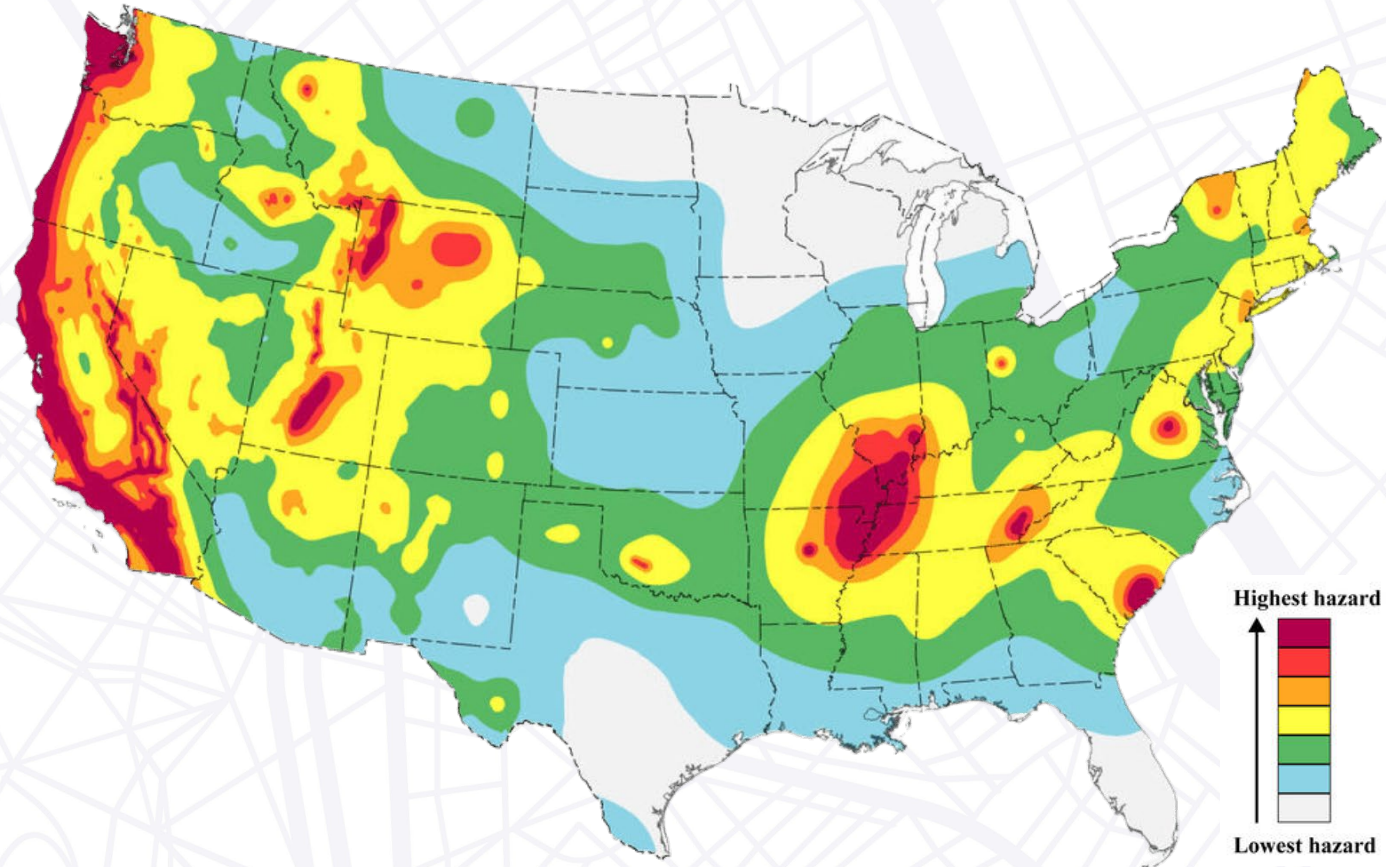
Executive Director

Central U.S. Earthquake Consortium

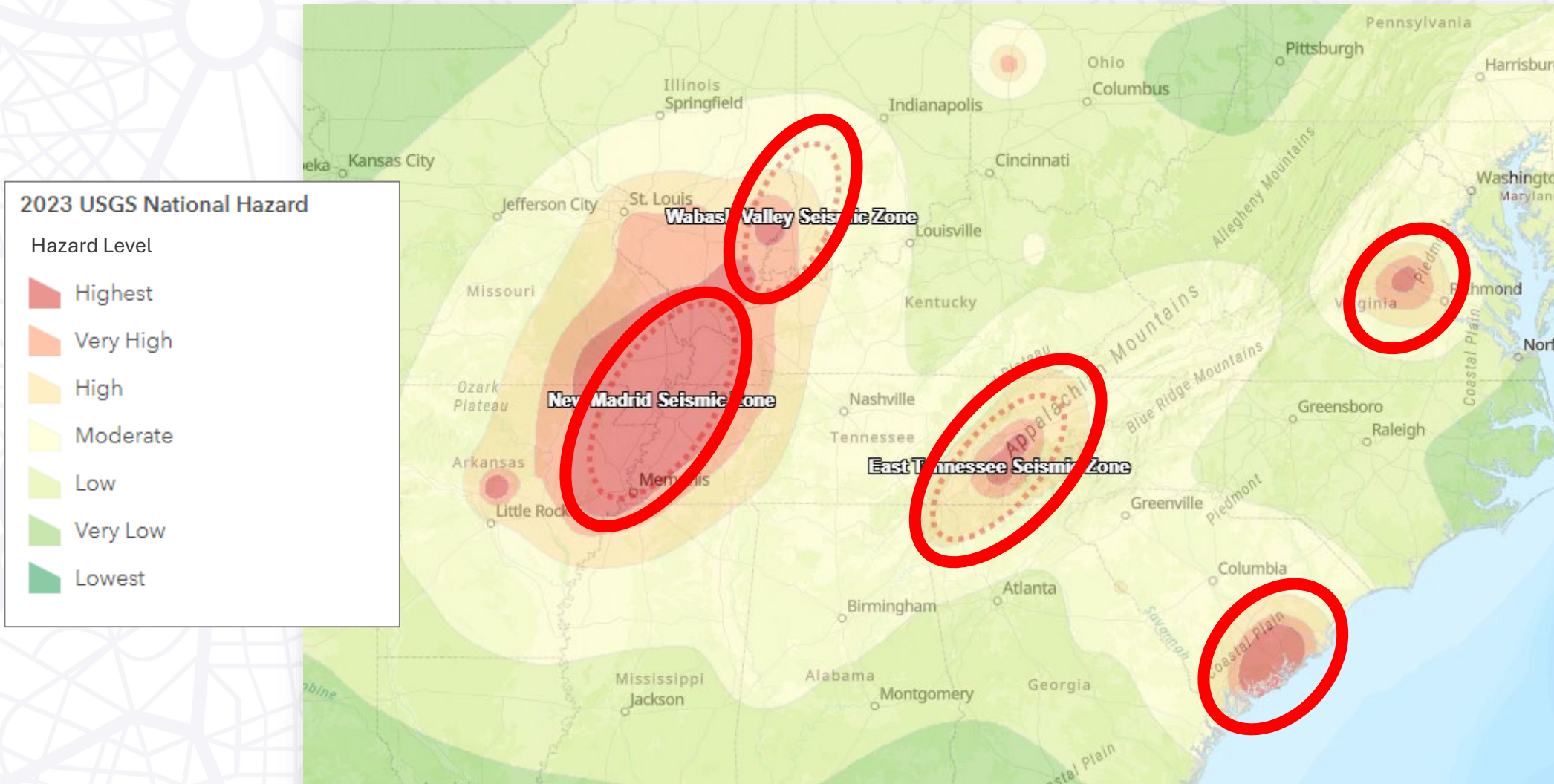


CUSEC: A partnership approach

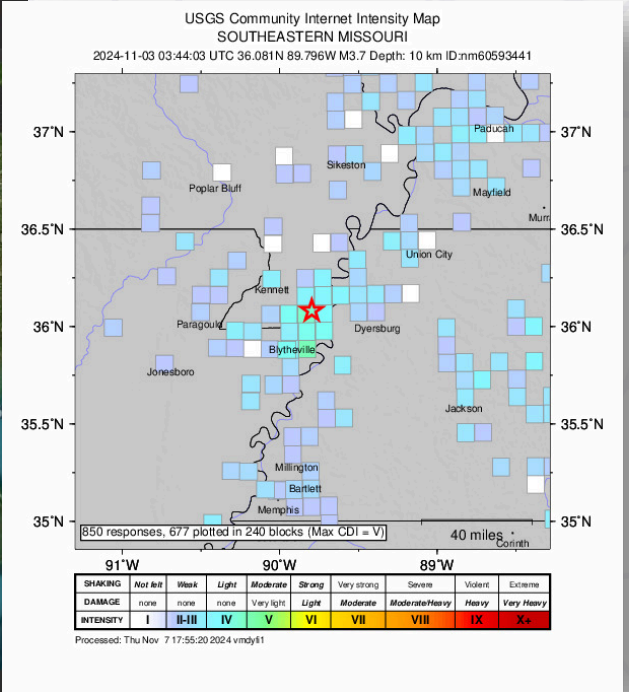
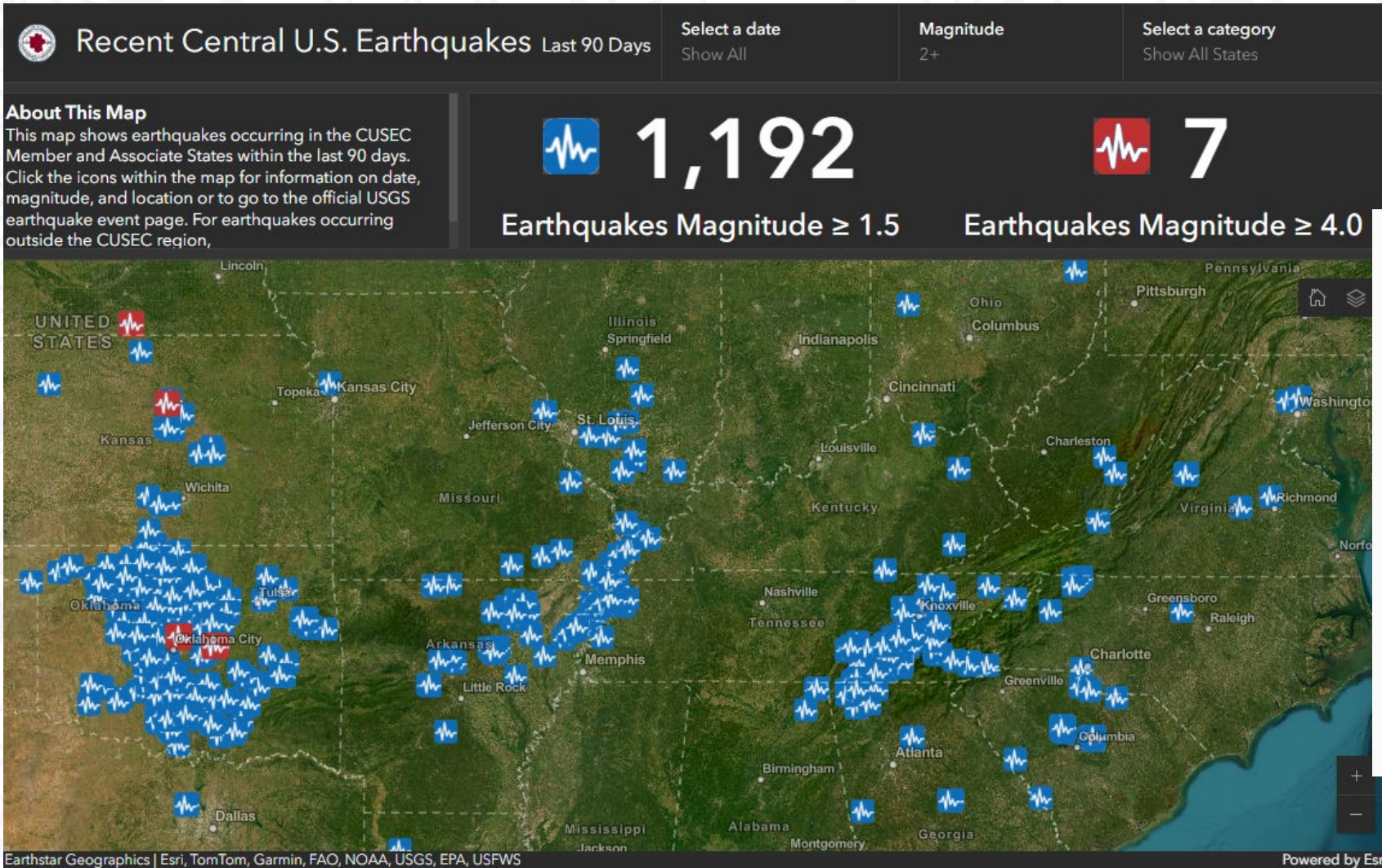
Mission: *“...the reduction of deaths, injuries, property damage and economic losses resulting from earthquakes in the central United States.”*



The Central U.S. is Earthquake Country...



Recent Central U.S. Earthquakes



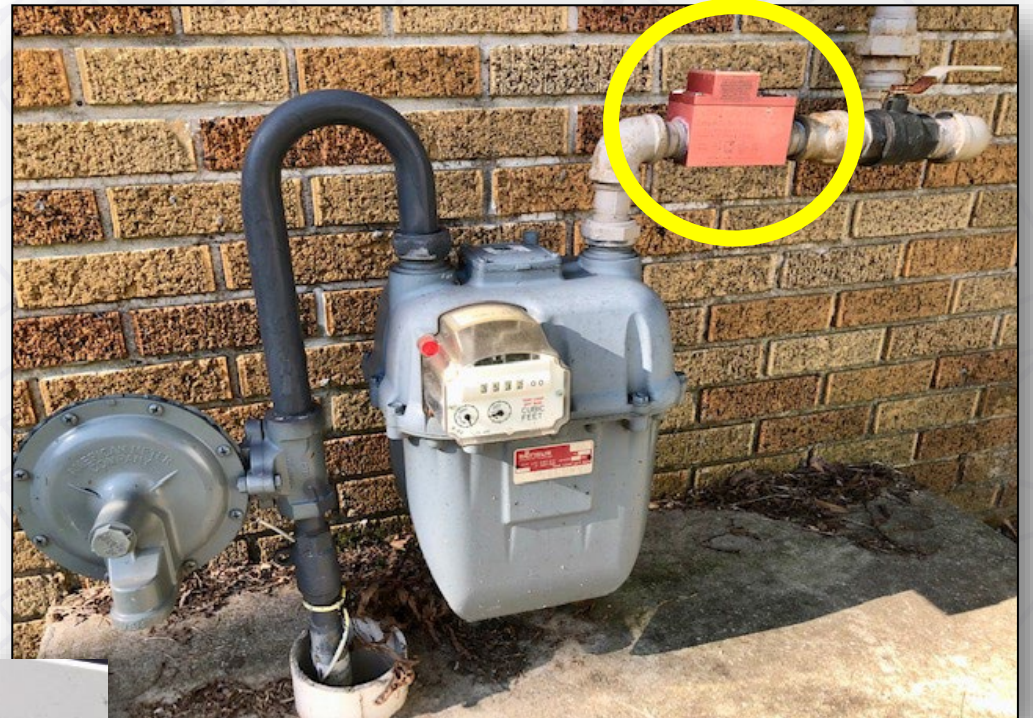
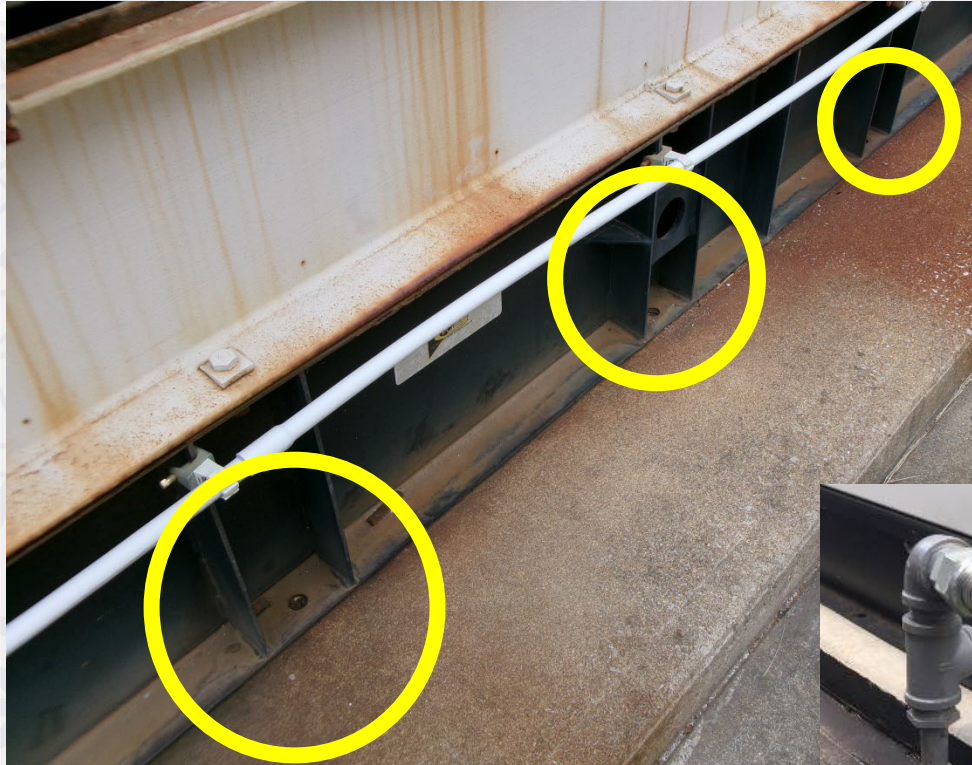
Example Facilities

- Fire Stations
- EOCs
- Police / Jail
- Schools & Shelters
- Healthcare / Hospitals
- Government Admin Buildings
- Public Works

1,000 + screened to date...

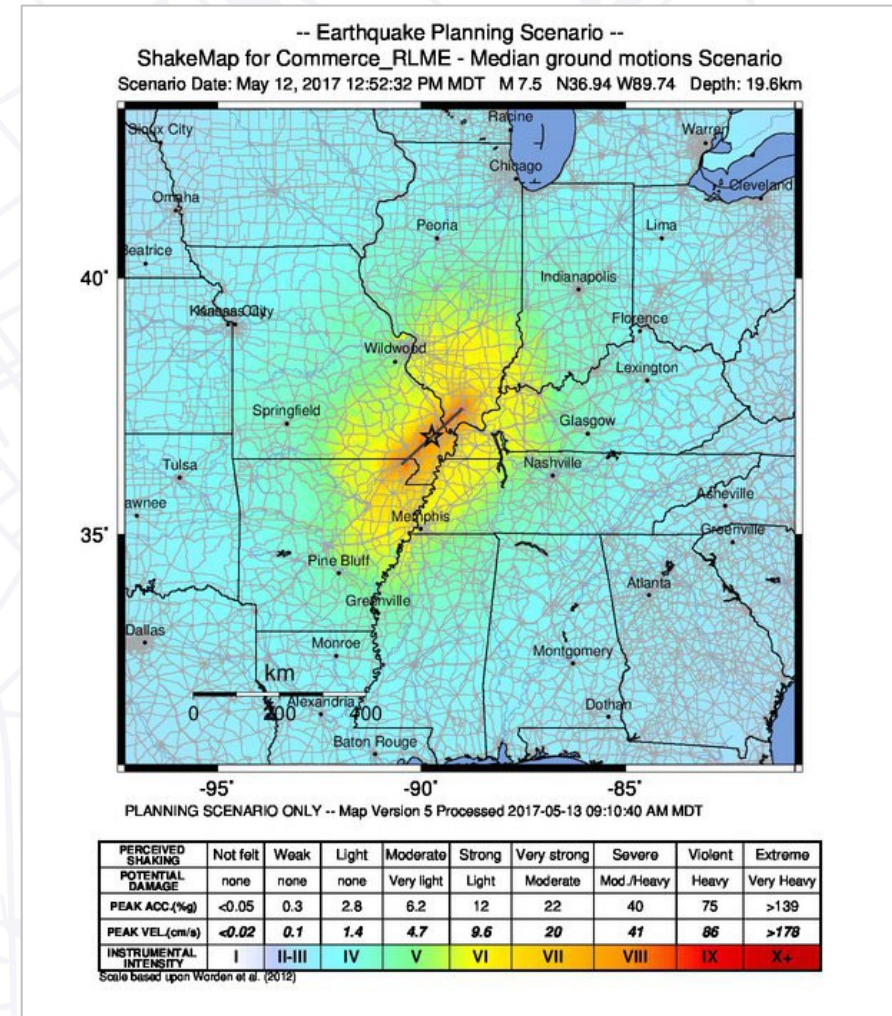


Includes Nonstructural



New Earthquake Scenario Planning Tool

- MAE Center Study - 2009
- Interactive dashboard
- USGS inputs → Hazus
- Multiple EQ scenarios
 - M7.7 - Marked Tree, AR
 - M7.5 - Sikeston, MO
 - M7.5 - Tipton Co., TN





New Madrid Seismic Zone (NMSZ) Scenario Dashboard

1. Select Earthquake Scenario
None

2. Select State
Selection required

3. Select County
Selection required

Earthquake Epicenter








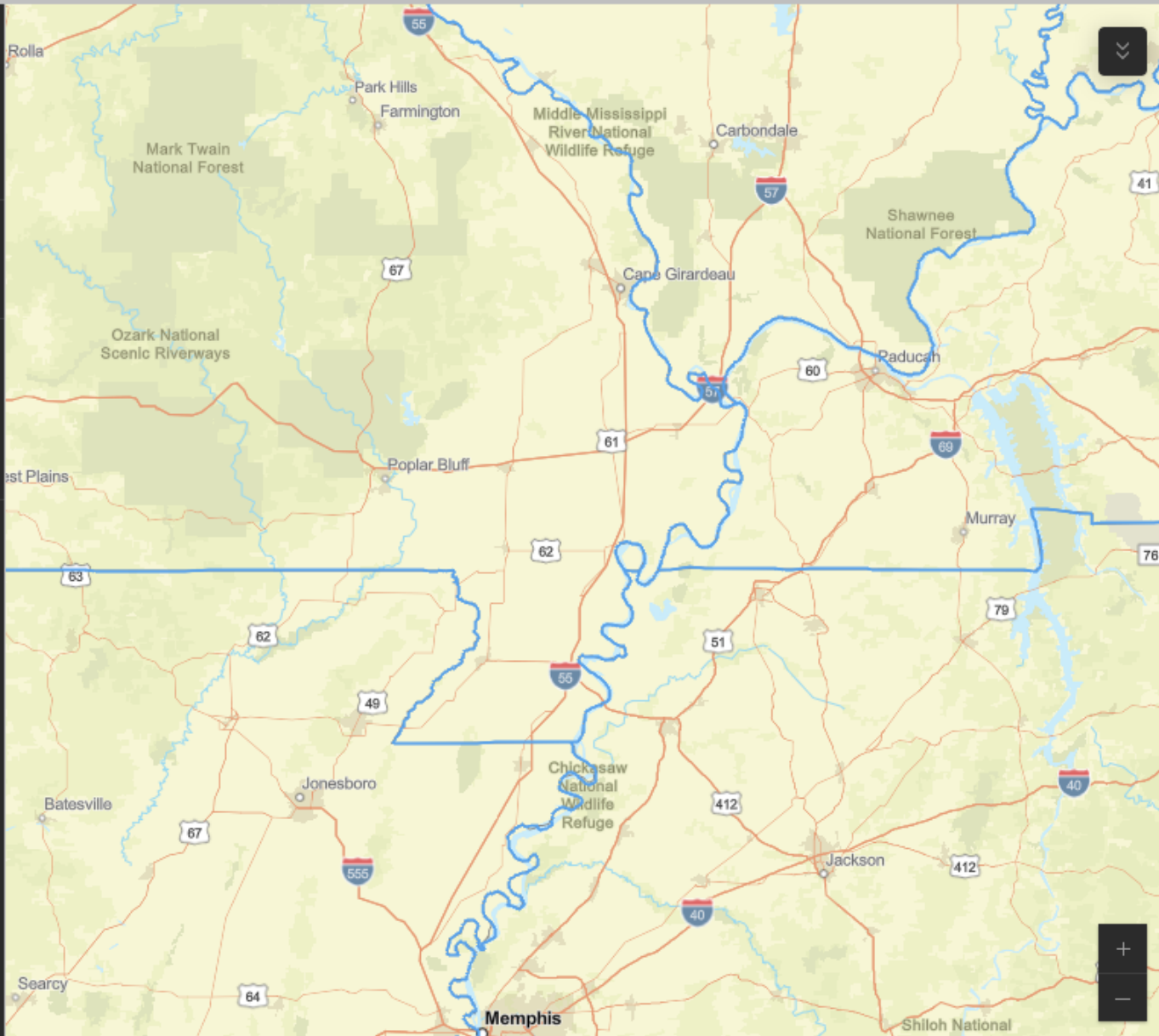
Ruptures

State Boundaries



Earthquake Shaking Intensity

-  Moderate
-  Strong
-  Very Strong
-  Severe
-  Violent



Missouri DNR, Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, NPS, USFWS | Sources: Esri; U.S. Department of Commerce... Powered by Esri

Select Scenario

Select Scenario, State, and County to view Population Exposed Data

Select Scenario, State, and County to view Fatality Data

Select Scenario, State, and County to view Hospitalization Data

Select Scenario, State, and County to view Displaced Household Data

Select Scenario, State, and County to view Essential Facility Data

Select Scenario, State, and County to view Building Damage Data

Select Scenario, State, and County to view Infrastructure Economic Loss Data

Select Scenario, State, and County to view Economic Loss Data





New Madrid Seismic Zone (NMSZ) Scenario Dashboard

1. Select Earthquake Scenario

2. Select State

3. Select County

one

Selection required

Selection required

Earthquake Epicenter

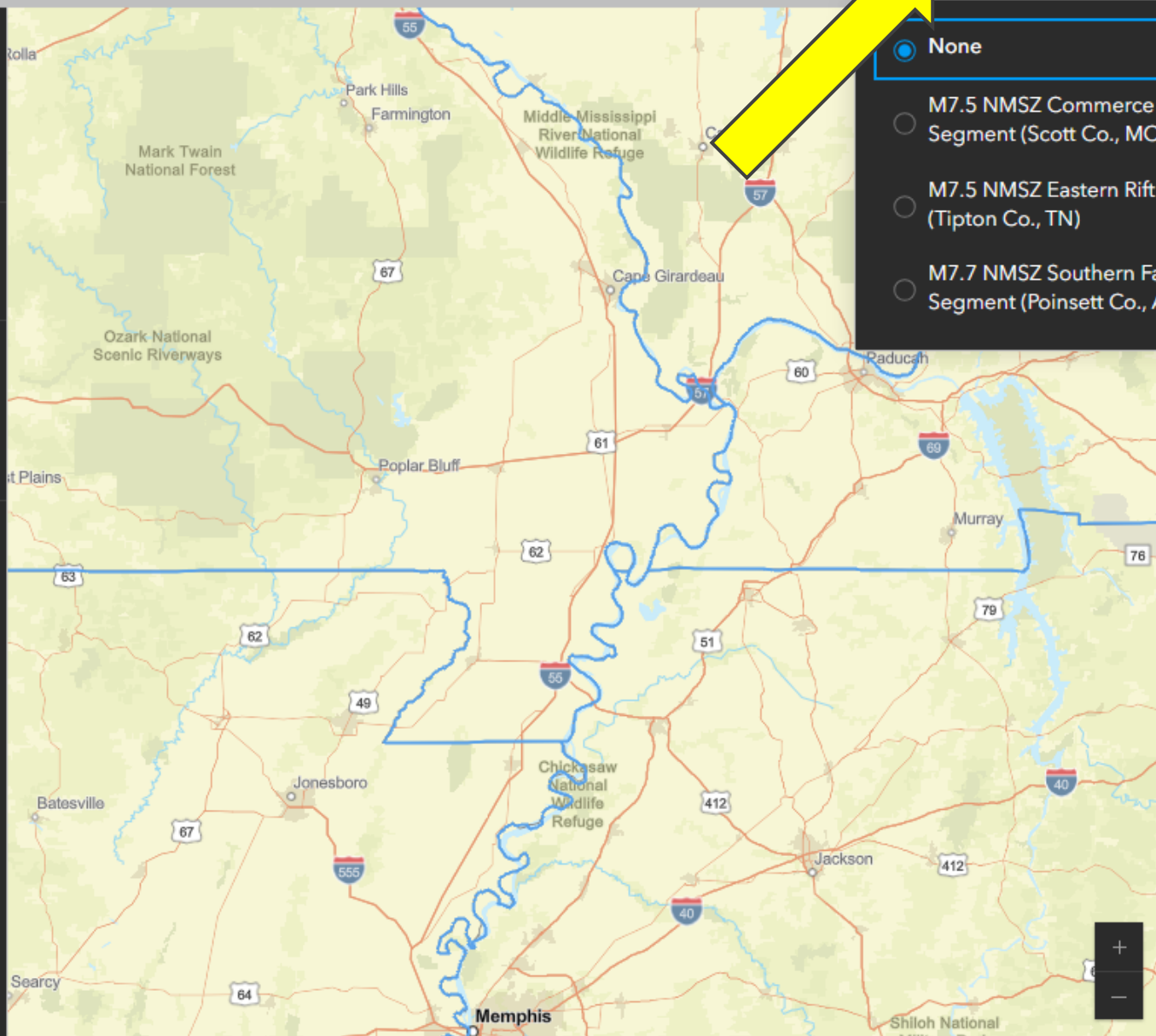


Ruptures

State Boundaries

Earthquake Shaking Intensity

- Moderate
- Strong
- Very Strong
- Severe
- Violent



- Select Scenario
- None
 - M7.5 NMSZ Commerce Fault Segment (Scott Co., MO)
 - M7.5 NMSZ Eastern Rift Margin (Tipton Co., TN)
 - M7.7 NMSZ Southern Fault Segment (Poinsett Co., AR)

Select Scenario	
Select Scenario, State, and County to view Population Exposed Data	Select Scenario, State, and County to view Fatality Data
Select Scenario, State, and County to view Hospitalization Data	Select Scenario, State, and County to view Displaced Household Data
Select Scenario, State, and County to view Essential Facility Data	Select Scenario, State, and County to view Building Damage Data
Select Scenario, State, and County to view Infrastructure Economic Loss Data	Select Scenario, State, and County to view Economic Loss Data





New Madrid Seismic Zone (NMSZ) Scenario Dashboard

1. Select Earthquake Scenario
M7.5 NMSZ Commerce Fault ...

2. Select State
None

3. Select County
Selection required

Earthquake Epicenter



Ruptures








State Boundaries

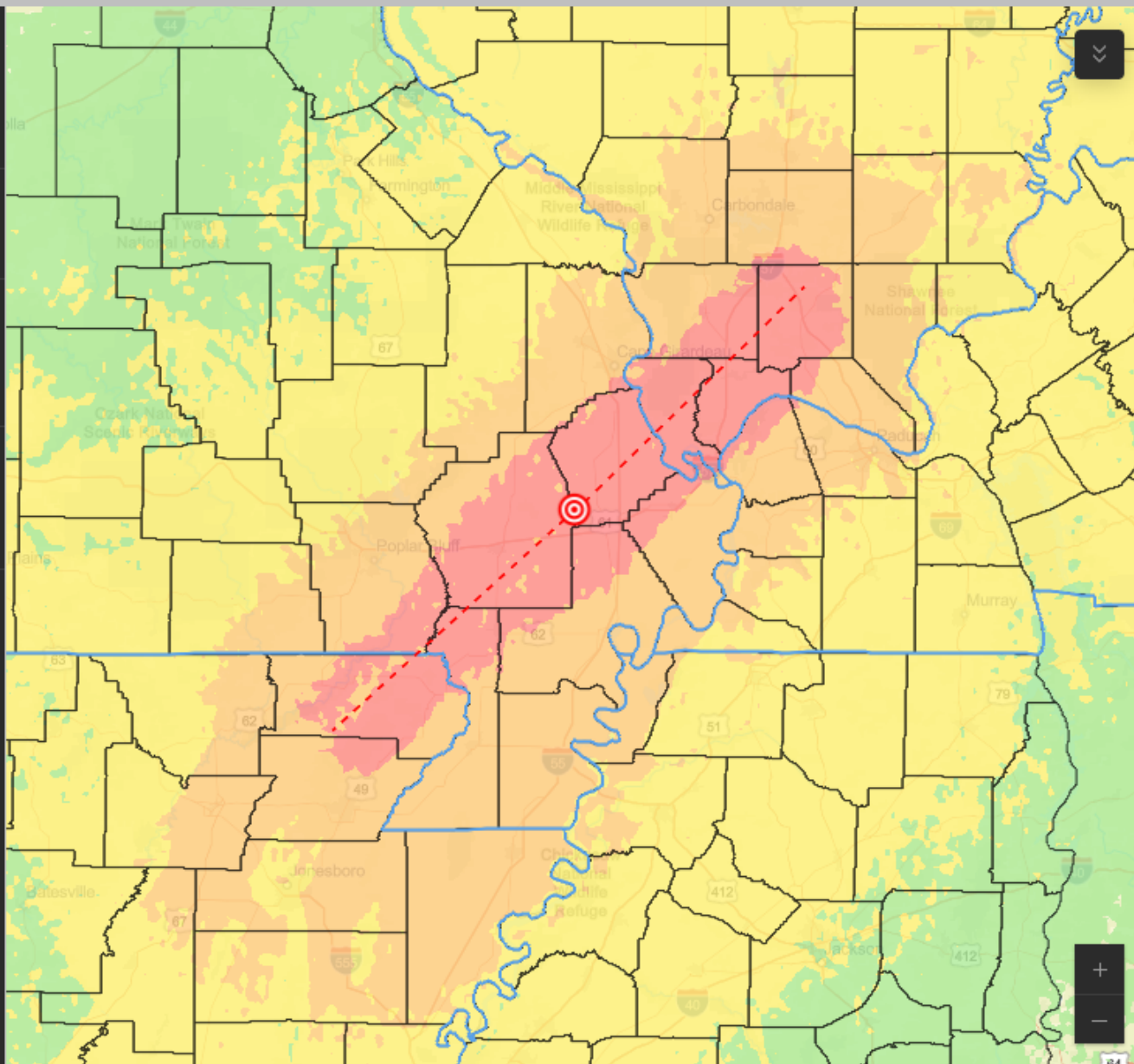


Impacted Counties



Earthquake Shaking Intensity

-  Moderate
-  Strong
-  Very Strong
-  Severe
-  Violent



M7.5 NMSZ Commerce Fault Segment (Scott Co., MO)

Estimated Population Exposed

811,897

To At Least Very Strong Shaking

Estimated Fatalities

533

2:00 PM Earthquake

Injuries

2,445

Requiring Hospitalization

Displaced Households

20,862

Essential Facilities

1,131

w/Reduced Functionality

Buildings

152,264

At Least Moderately Damaged

Infrastructure Economic Loss

\$35.7 Billion

Total Economic Loss

\$75.8 Billion

Missouri DNR, Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, NPS, USFWS | Sources: Esri; U.S. Department of Co... Powered by Esri





New Madrid Seismic Zone (NMSZ) Scenario Dashboard

1. Select Earthquake Scenario
M7.5 NMSZ Commerce Fault ...

2. Select State
Missouri

3. Select County
None

Earthquake Epicenter



Ruptures



State Boundaries

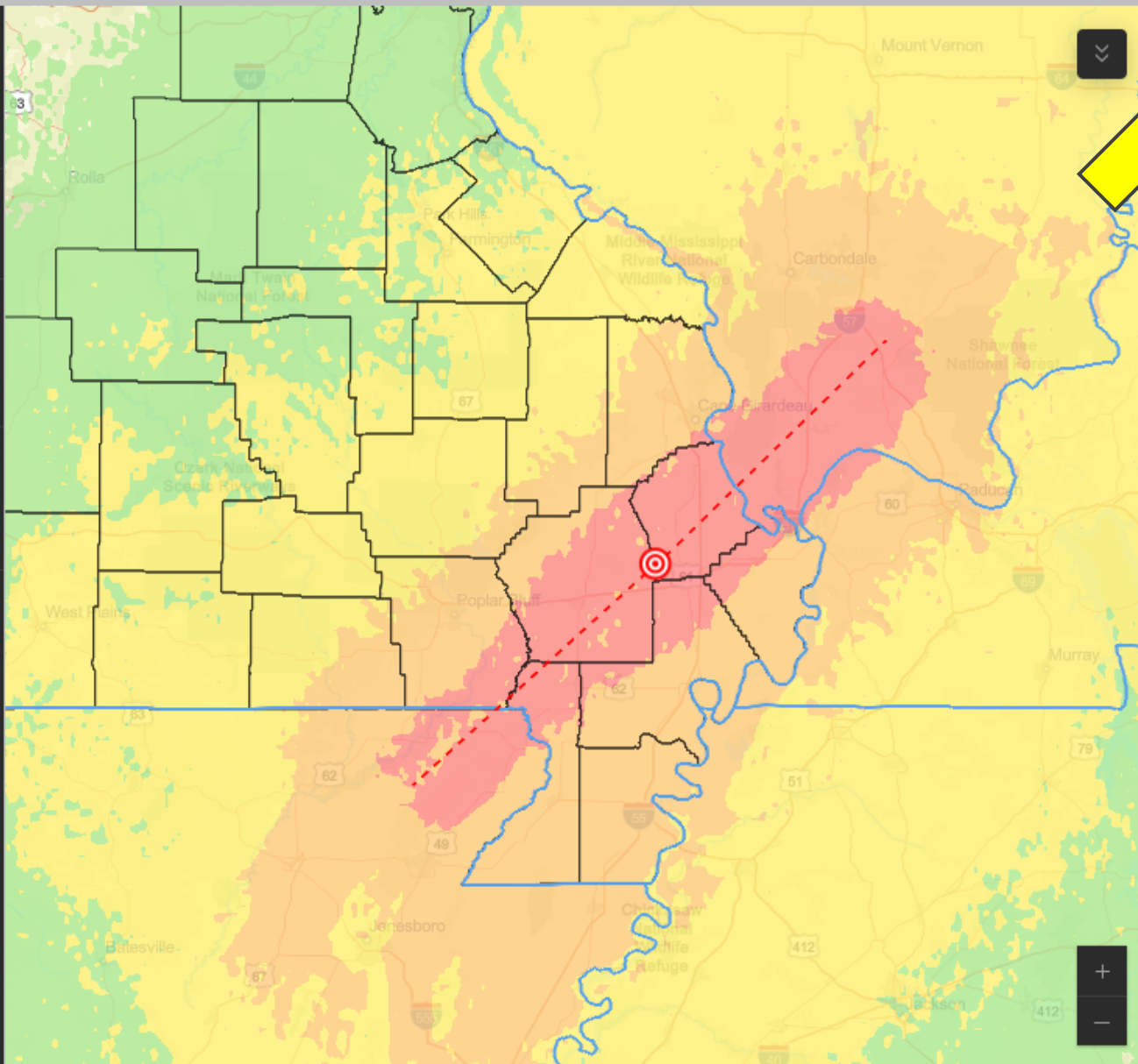


Impacted Counties



Earthquake Shaking Intensity

- Moderate
- Strong
- Very Strong
- Severe
- Violent



M7.5 NMSZ Commerce Fault Segment (Scott Co., MO)

Estimated Population Exposed

263,526

To At Least Very Strong Shaking

Estimated Fatalities

317

2:00 PM Earthquake

Injuries

1,376

Requiring Hospitalization

Displaced Households

11,660

Essential Facilities

336

w/Reduced Functionality

Buildings

54,308

At Least Moderately Damaged

Infrastructure Economic Loss

\$11.2 Billion

Total Economic Loss

\$28.9 Billion

Missouri DNR, Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, NPS, USFWS | Sources: Esri; U.S. Department of Co... Powered by Esri





New Madrid Seismic Zone (NMSZ) Scenario Dashboard

1. Select Earthquake Scenario
M7.5 NMSZ Commerce Fault ...

2. Select State
Missouri

3. Select County
Scott County

Earthquake Epicenter



Ruptures

Essential Facilities

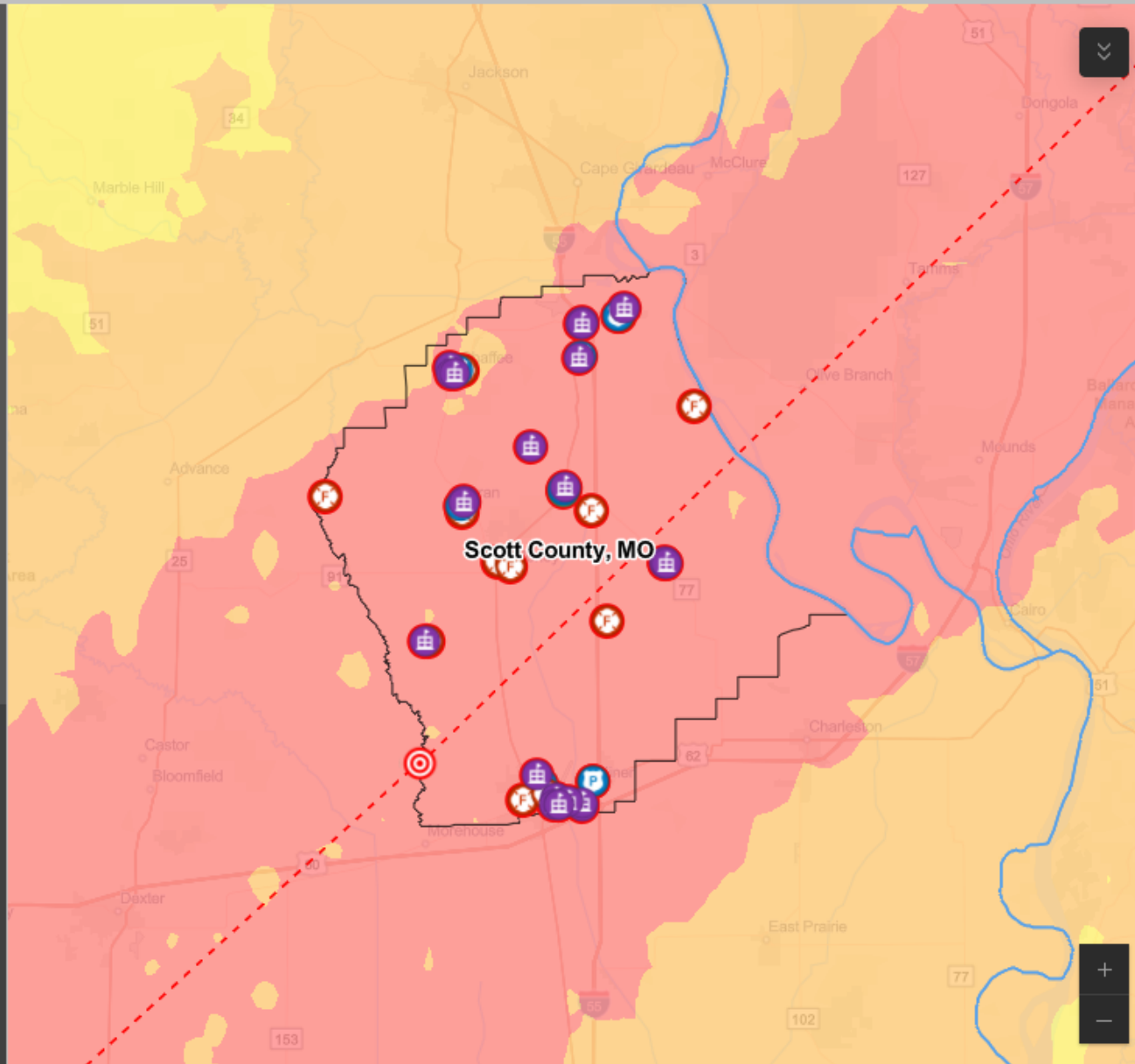
- Emergency Operations Center
- Hospital
- Fire Station
- Police Station
- School

% Functional After Day 3

Percentage

- 0% - 32.9%
- 33% - 66.9%
- 67% - 100%
- Unknown

State Boundaries



M7.5 NMSZ Commerce Fault Segment (Scott Co., MO)

Estimated Population Exposed

38,059

To At Least Very Strong Shaking

Estimated Fatalities

93

2:00 PM Earthquake

Injuries

376

Requiring Hospitalization

Displaced Households

2,561

Essential Facilities

49

w/Reduced Functionality

Buildings

10,436

At Least Moderately Damaged

Infrastructure Economic Loss

\$1.8 Billion

Total Economic Loss

\$5.3 Billion

Missouri Dept. of Conservation, Missouri DNR, Esri, TomTom, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, N... Powered by Esri





New Madrid Seismic Zone (NMSZ) Scenario Dashboard

1. Select Earthquake Scenario
M7.5 NMSZ Commerce Fault ...

2. Select State
Missouri

3. Select County
Scott County

Earthquake Epicenter



Ruptures

Essential Facilities

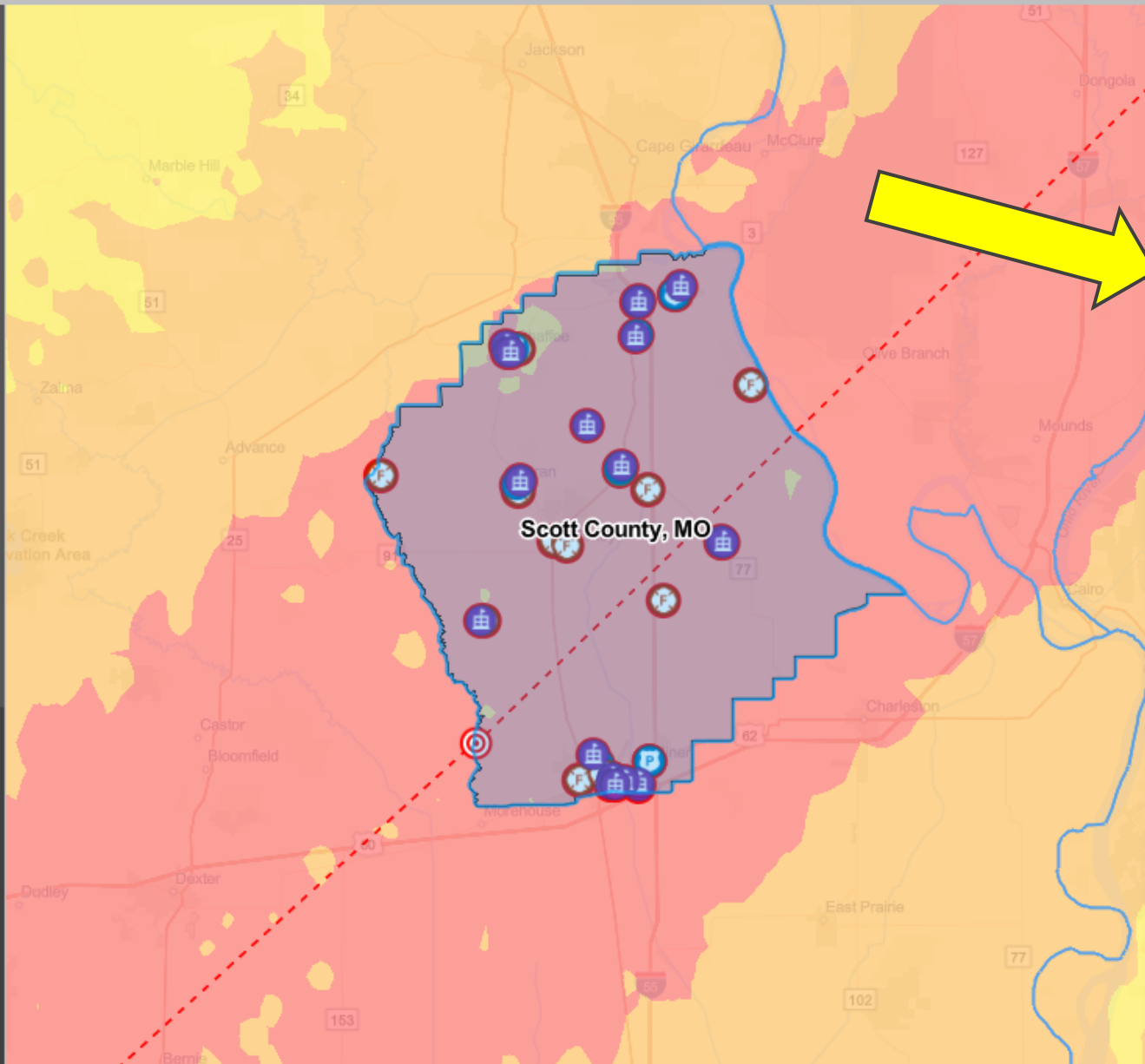
- Emergency Operations Center
- Hospital
- Fire Station
- Police Station
- School

% Functional After Day 3

Percentage

- 0% - 32.9%
- 33% - 66.9%
- 67% - 100%
- Unknown

State Boundaries



Scott County, Missouri

Zoom to Pan

Scott County, Missouri is 426 square miles and contains 11 census tracts. There are **15,306** households in the county with a total population of **38,059** people.

Based on the scenario currently selected, parts of the county are expected to experience **severe** levels of shaking. Earthquake impacts to **Scott County** are estimated to include:

- **38,059** people exposed to at least strong levels of shaking
- **93** fatalities
- **376** hospitalizations, including **69** life-threatening injuries
- **2,561** displaced households
- **1,525** people seeking short-term shelter
- **100%** of households are without water (day 1)
- **95%** of households are without power (day 1)

Additionally, the following impacts are expected because of the earthquake

- **14,863** buildings damaged
- **1,940** buildings destroyed
- **49** essential facilities impacted with reduced functionality (at day 1)
- **\$1.6 billion** utility infrastructure losses
- **\$159.8 million** transportation infrastructure losses
- **\$5.3 billion** direct economic loss

Missouri Dept. of Conservation, Missouri DNR, Esri, TomTom, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS, USFWS | Sources: E





New Madrid Seismic Zone (NMSZ) Scenario Dashboard

1. Select Earthquake Scenario
M7.5 NMSZ Commerce Fault ...

2. Select State
Missouri

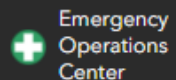
3. Select County
Scott County

Earthquake Epicenter



Ruptures

Essential Facilities



Emergency Operations Center



Hospital



Fire Station



Police Station



School

% Functional After Day 3

Percentage

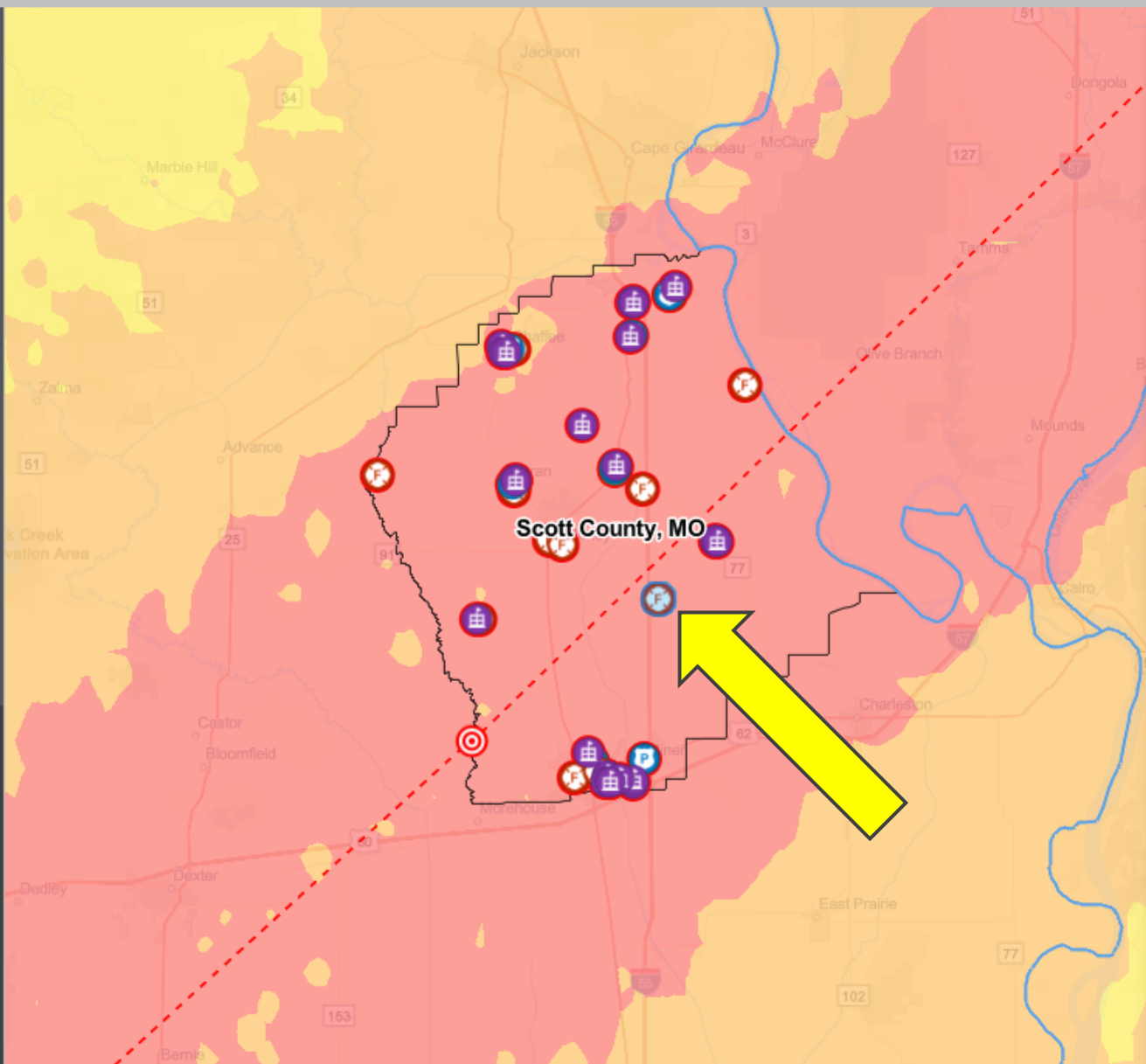
0% - 32.9%

33% - 66.9%

67% - 100%

Unknown

State Boundaries



Scott County Rural Fire Protection Di...



Zoom to Pan

Facility Name: Scott County Rural Fire Protection Di...

Address: 220 North Hawkins Street

City, State, Zip: Sikeston, Missouri 63801

Facility Type: Fire Station

Building Construction Type: Reinforced Masonry Bearing Walls

Based on the current scenario, this facility is estimated to have **moderate to extensive** levels of damage.

After the earthquake, functionality levels for this facility are estimated to be:

Day 1: 0% functional

Day 3: 0% functional

Day 7: 3% functional





New Madrid Seismic Zone (NMSZ) Scenario Dashboard

1. Select Earthquake Scenario
M7.5 NMSZ Commerce Fault ...

2. Select State
Missouri

3. Select County
None

Earthquake Epicenter



Ruptures



State Boundaries

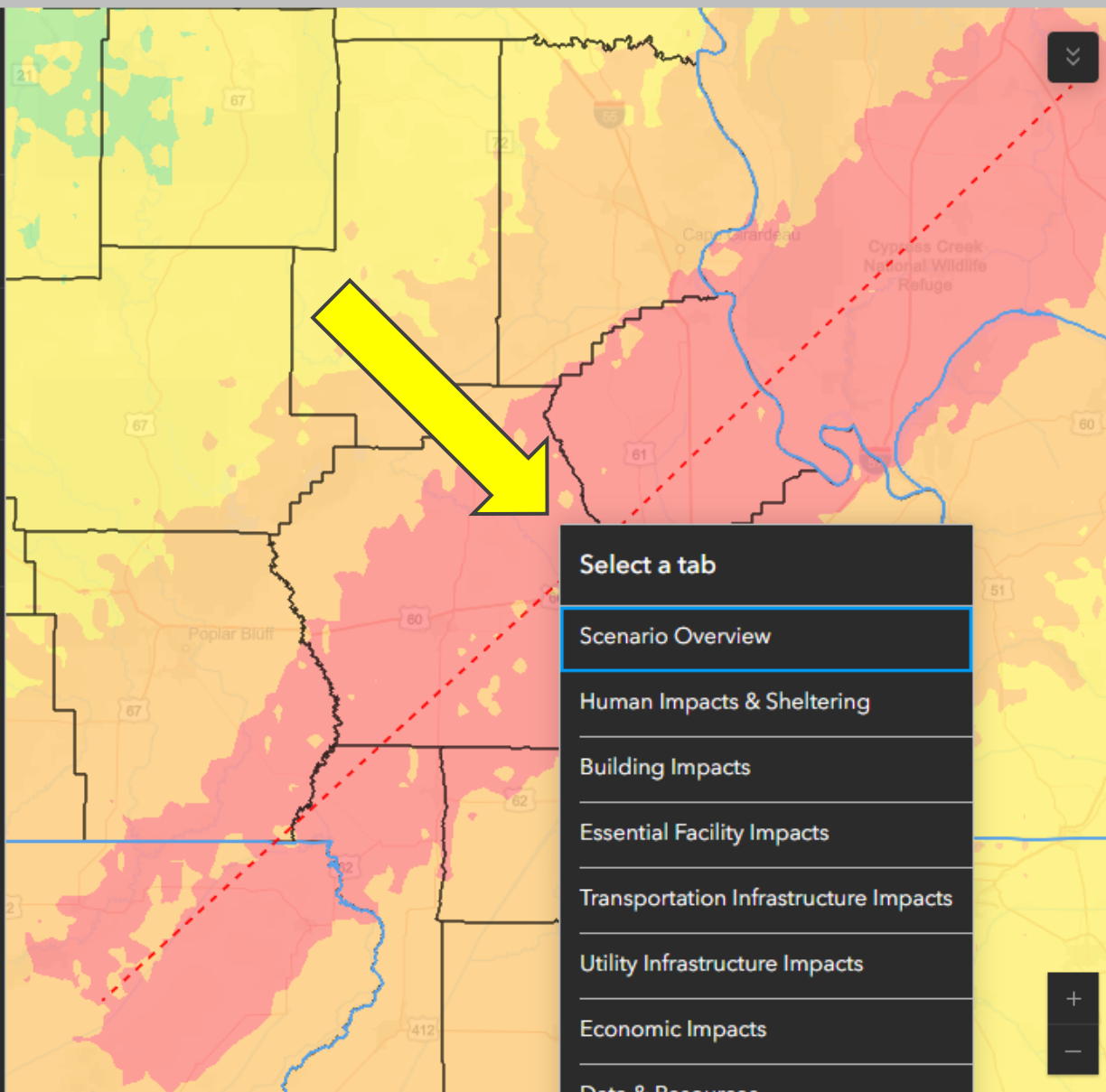


Impacted Counties



Earthquake Shaking Intensity

- Moderate
- Strong
- Very Strong
- Severe
- Violent



Missouri DNR, Esri, TomTom, Garmin, SafeGraph, FAO, METI/NA

- Select a tab
- Scenario Overview**
 - Human Impacts & Sheltering
 - Building Impacts
 - Essential Facility Impacts
 - Transportation Infrastructure Impacts
 - Utility Infrastructure Impacts
 - Economic Impacts
 - Data & Resources

Powered by Esri

M7.5 NMSZ Commerce Fault Segment (Scott Co., MO)

Estimated Population Exposed

263,526

To At Least Very Strong Shaking

Estimated Fatalities

317

2:00 PM Earthquake

Injuries

1,376

Requiring Hospitalization

Displaced Households

11,660

Essential Facilities

336

w/Reduced Functionality

Buildings

54,308

At Least Moderately Damaged

Infrastructure Economic Loss

\$11.2 Billion

Total Economic Loss

\$28.9 Billion





New Madrid Seismic Zone (NMSZ) Scenario Dashboard

1. Select Earthquake Scenario
M7.5 NMSZ Commerce Fault ...

2. Select State
Missouri

3. Select County
None

Earthquake Epicenter



Ruptures

State Boundaries



Impacted Counties (Displaced Households)



% Displaced

> 7

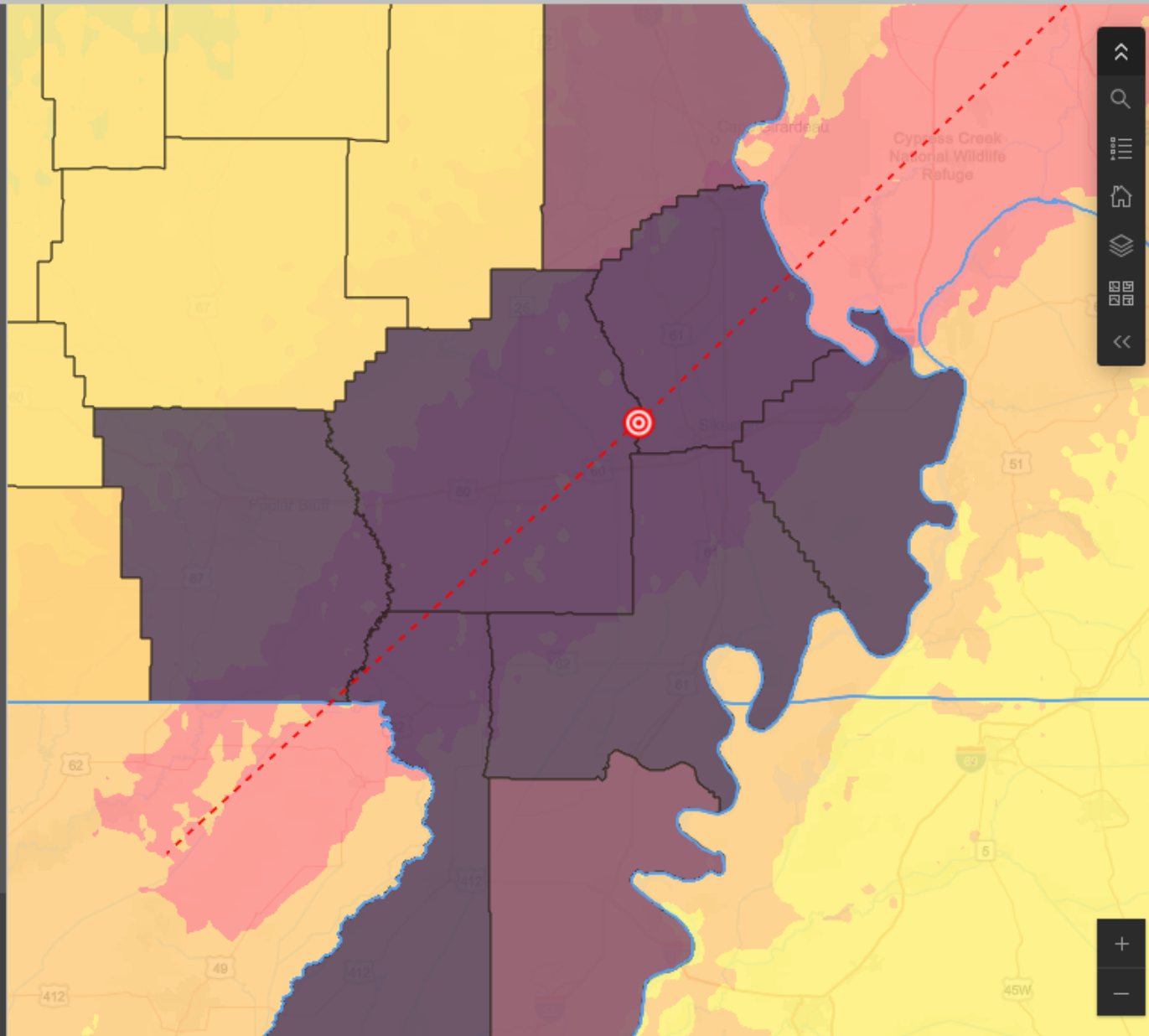
3.56

< 0

Shake Intensity

Moderate

Strong



M7.5 NMSZ Commerce Fault Segment (Scott Co., MO)

Estimated Fatalities

317

2:00PM Earthquake

Injuries

1,376

Requiring Hospitalization

Impacted Residential Structures

37,504

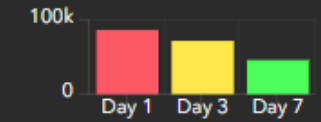
Destroyed Residential Structures

6,209

Households w/out Water



Households w/out Power



Displaced Households

11,660

Shelter Requirements

7,307

People Seeking Short-Term Shelter

Residential Economic Loss

\$6.2 Billion





New Madrid Seismic Zone (NMSZ) Scenario Dashboard

1. Select Earthquake Scenario

M7.5 NMSZ Commerce Fault ...

2. Select State

Missouri

3. Select County

None

Earthquake Epicenter



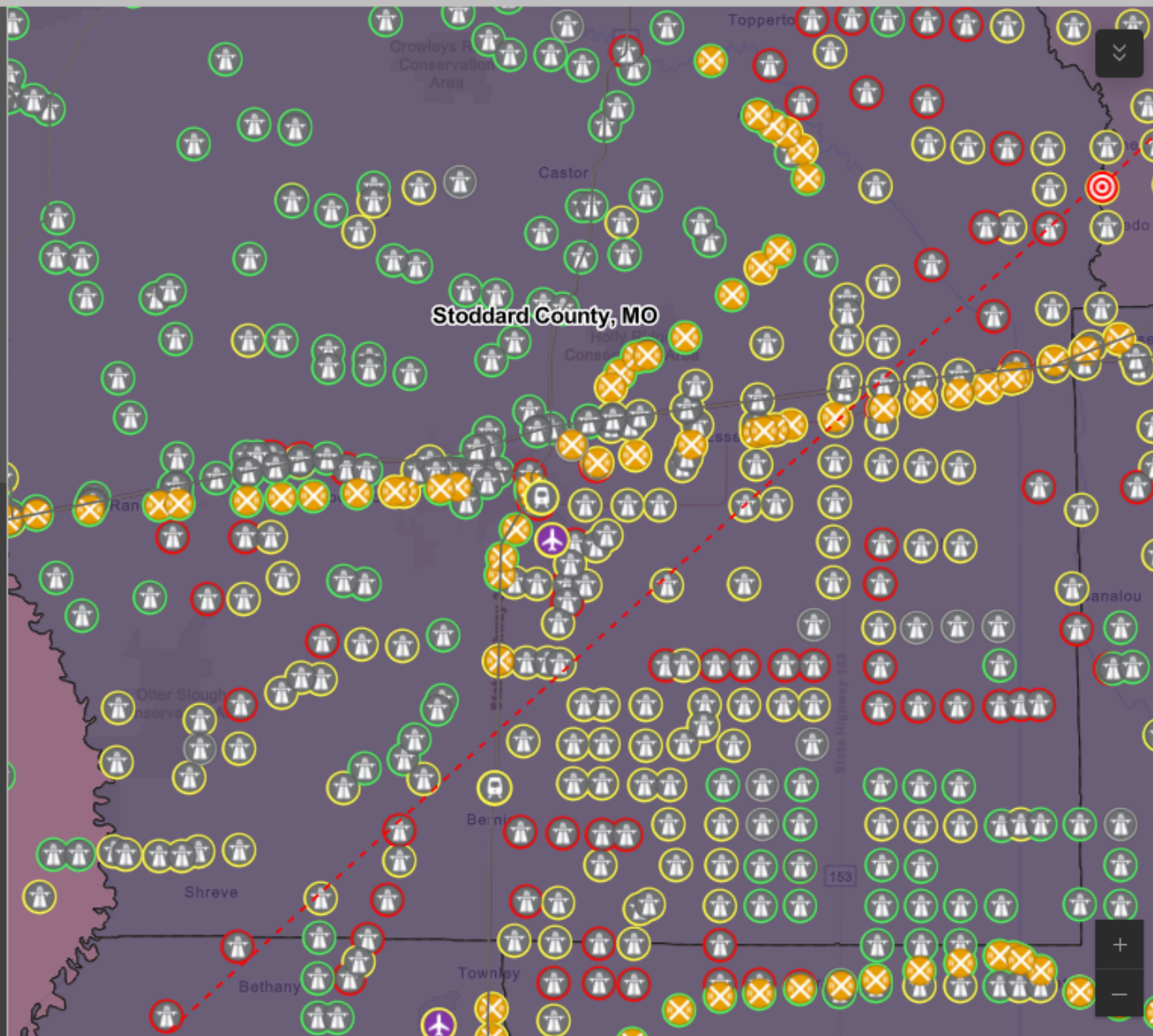
Ruptures

Transportation Facilities

- Airport
- Bus Station
- Ferry
- Light Rail Facility
- Port
- Rail Facility

Facilities % Functional After Day 3

- % Functional D
- 33% - 66.9
 - 67% - 100
 - Unknown



M7.5 NMSZ Commerce Fault Segment (Scott Co., MO)

Earthquakes can cause significant damage to transportation infrastructure – roads, bridges, and railways, for example – leading to widespread disruptions in the movement of goods and people. Impacts to these critical networks can impede initial response and post-earthquake recovery efforts, and earthquakes can also cause high levels of economic losses to transportation infrastructure and facilities.

of Bridges

634

w/Reduced Functionality

of Facilities

34

w/Reduced Functionality

Economic Loss
\$1.5 Billion

Missouri Dept. of Conservation, Missouri DNR, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, ... Powered by Esri





New Madrid Seismic Zone (NMSZ) Scenario Dashboard

1. Select Earthquake Scenario
M7.5 NMSZ Commerce Fault ...

2. Select State
Missouri

3. Select County
None

Earthquake Epicenter



Ruptures

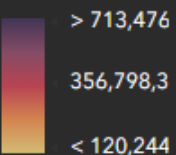
State Boundaries



Impacted Counties

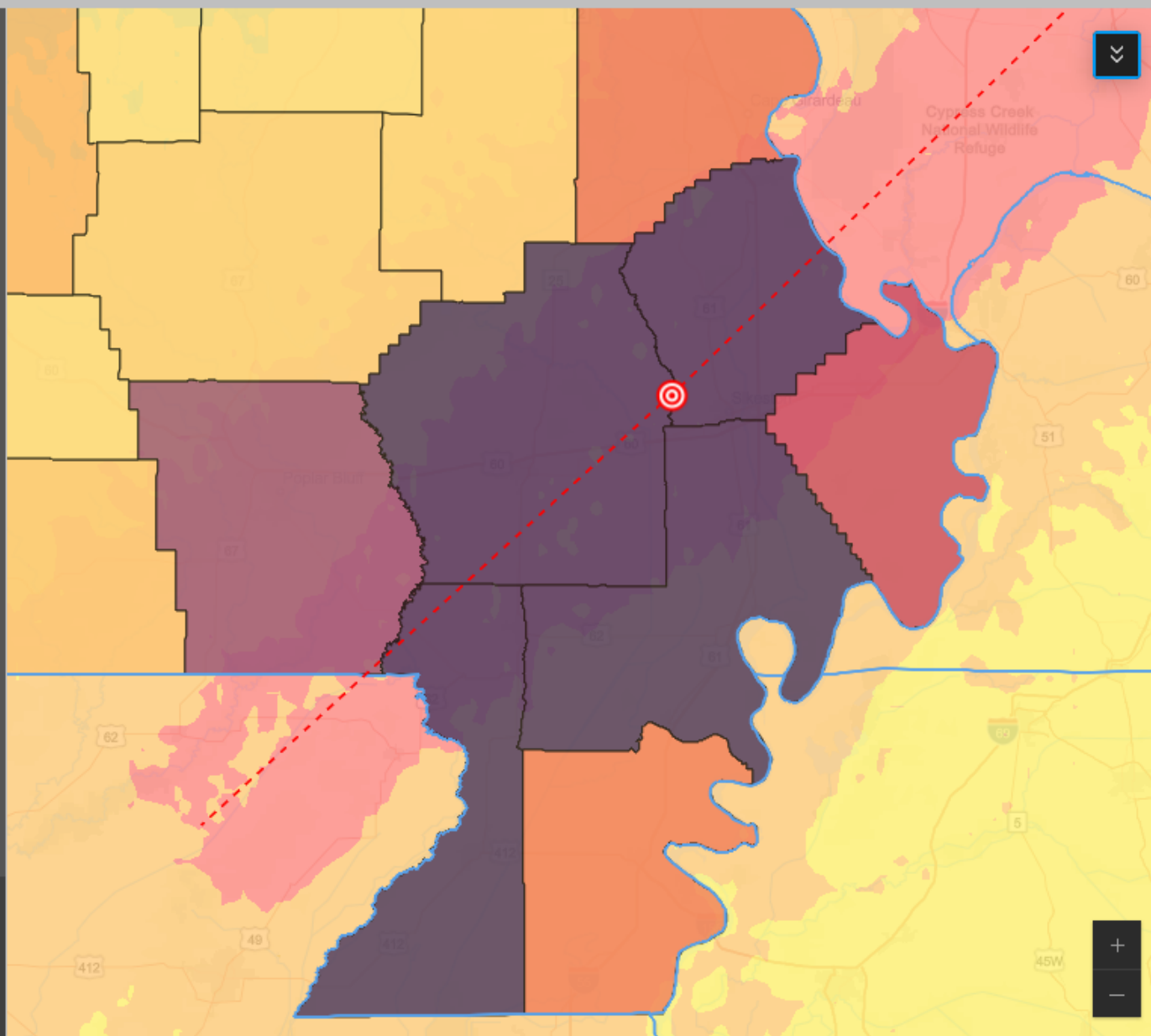


Direct Econom Loss (\$)



Earthquake Shaking Intensity

Moderate



M7.5 NMSZ Eastern Rift Margin (Tipton Co., TN)

Due to their destructive nature, earthquakes can cause significant economic losses by damaging homes, buildings and infrastructure, which may be costly to repair or rebuild. For instance, the 1994 Northridge earthquake in Los Angeles led to over \$40 billion in damages (more

Total Economic Loss \$28.9 Billion

Residential Structural Damages
\$946.2 Million

Other Residential Losses
\$5.3 Billion
(Nonstructural, contents, etc.)

Business Structural Damages
\$1.4 Billion

Other Business Losses
\$10.1 Billion
(Inventory, Contents, Wages, etc.)

Transportation Economic Loss
\$1.5 Billion

Utility Economic Loss
\$9.7 Billion

Missouri DNR, Esri, TomTom, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS, USFWS | Sources: Esri; U.S. Depart... Powered by Esri



Additional Remarks



This **tool is for planning** & many variables will determine actual impacts



Hazus uses **best available data** and inventory from various sources



1811-12 New Madrid quakes were a “**sequence event**”



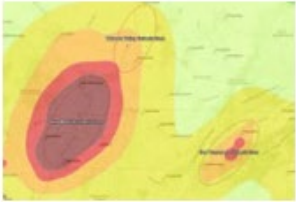
Plan to expand to other scenarios, seismic zones and hazards



CUSEC

A partnership to mitigate disasters and save lives...

Home Earthquake Info



Central U.S. Earthquake Hazards

Depicts central U.S. seismic zones and the simplified USGS National Seismic Hazard Map (2% probability in 50 years, 2018).

Source: [U.S. Geological Survey](#)

OPEN

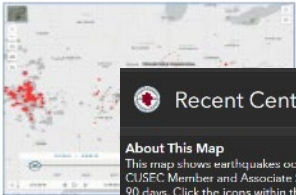


Recent Earthquakes Map

Map showing recent earthquakes, M1.5 or greater, occurring in the CUSEC Member and Associate States.

Source: [U.S. Geological Survey](#)

OPEN



Recent Central U.S. Earthquakes Last 90 Days

Select a date: Show All

Magnitude: 2+

Select a category: Show All States

About This Map
This map shows earthquakes occurring in the CUSEC Member and Associate States within the last 90 days. Click the icons within the map for information on date, magnitude, and location or to

1,510 Earthquakes Magnitude ≥ 1.5

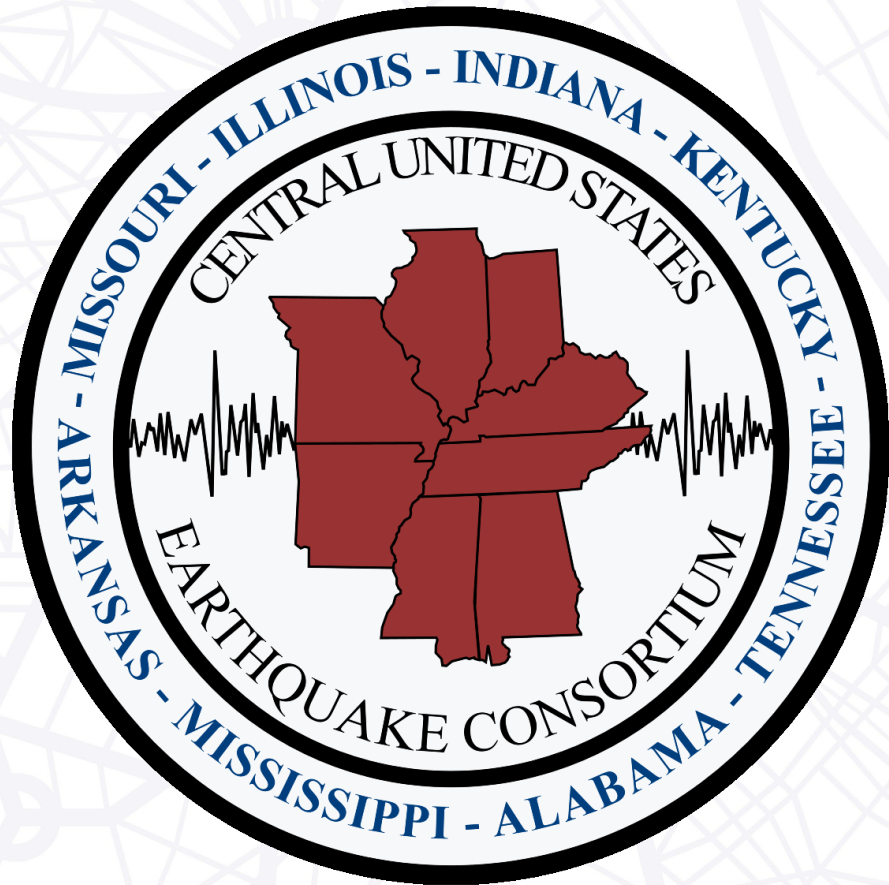
6 Earthquakes Magnitude ≥ 4.0

Earthstar Geographics | Esri, HERE, Garmin, FAO, NOAA, USGS, EPA | Powered by Esri

CUSEC Resources

- Earthquake Hazard Maps
- Liquefaction Maps
- Recent Earthquakes
- Publications
- Regional Information Sharing Platform (RISP)
- **NEW** Earthquake Planning Tool

Available at www.cusec.org



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Scan for Dashboard Access