



# EAERTHEQUAKE SUMMIT 2022

**THURSDAY, MARCH 3  
SAINT LOUIS SCIENCE CENTER**

**#MOQUAKE2022**

# Missouri's S.A.V.E. Coalition

Rapid Building Evaluations After A Disaster

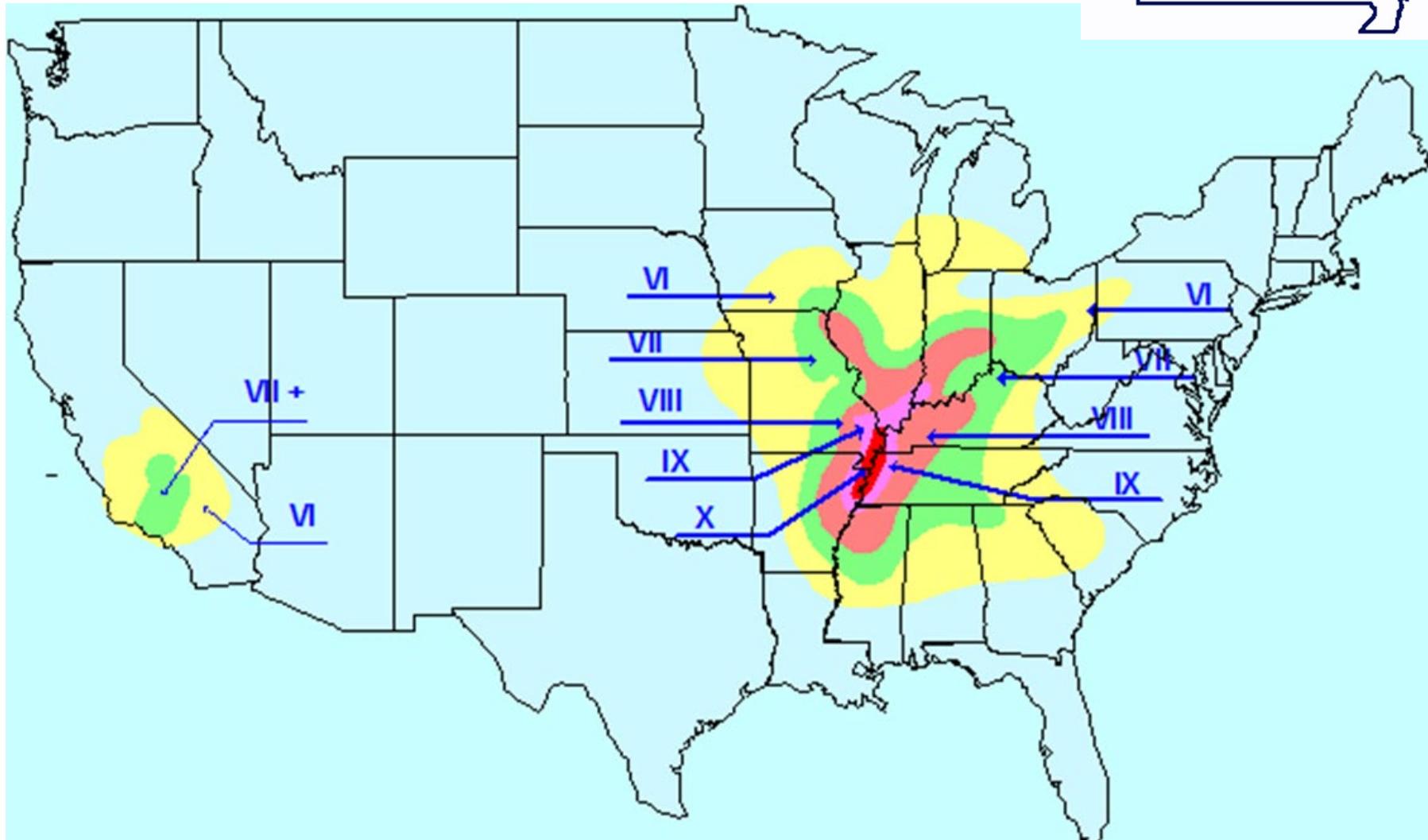
Earthquake Summit 2022

March 3, 2022





# 7.6 M Earthquake



# Modified Mercalli Intensity (MMI)

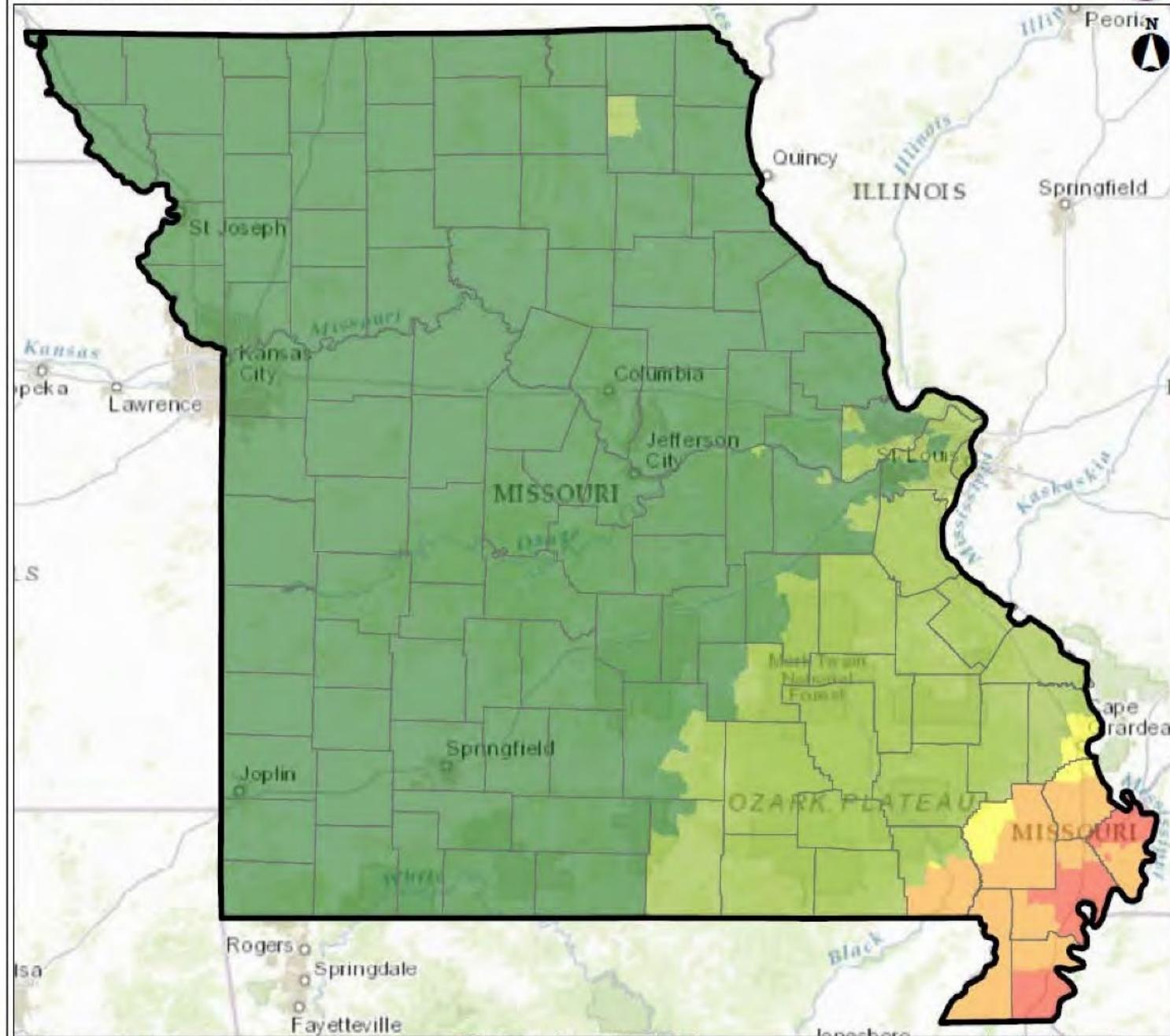
7.7 Earthquake in the Missouri Bootheel



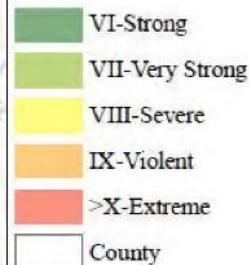
SEMA



FEMA



**Data Layer / Map Description:**  
Overview of the Modified Mercalli Intensity model for an 7.7 catastrophic earthquake along the NMSZ in Missouri based upon the 2009 MAE Center Phase II data.



Data Sources:  
FEMA, ESRI, MAEC



# Missouri S.A.V.E. Coalition



**SAVE Coalition  
Implemented by  
RSMo 44.023**

**SEMA Authorized to  
Establish Volunteer  
Inspection Program**



# Missouri SAVE Coalition



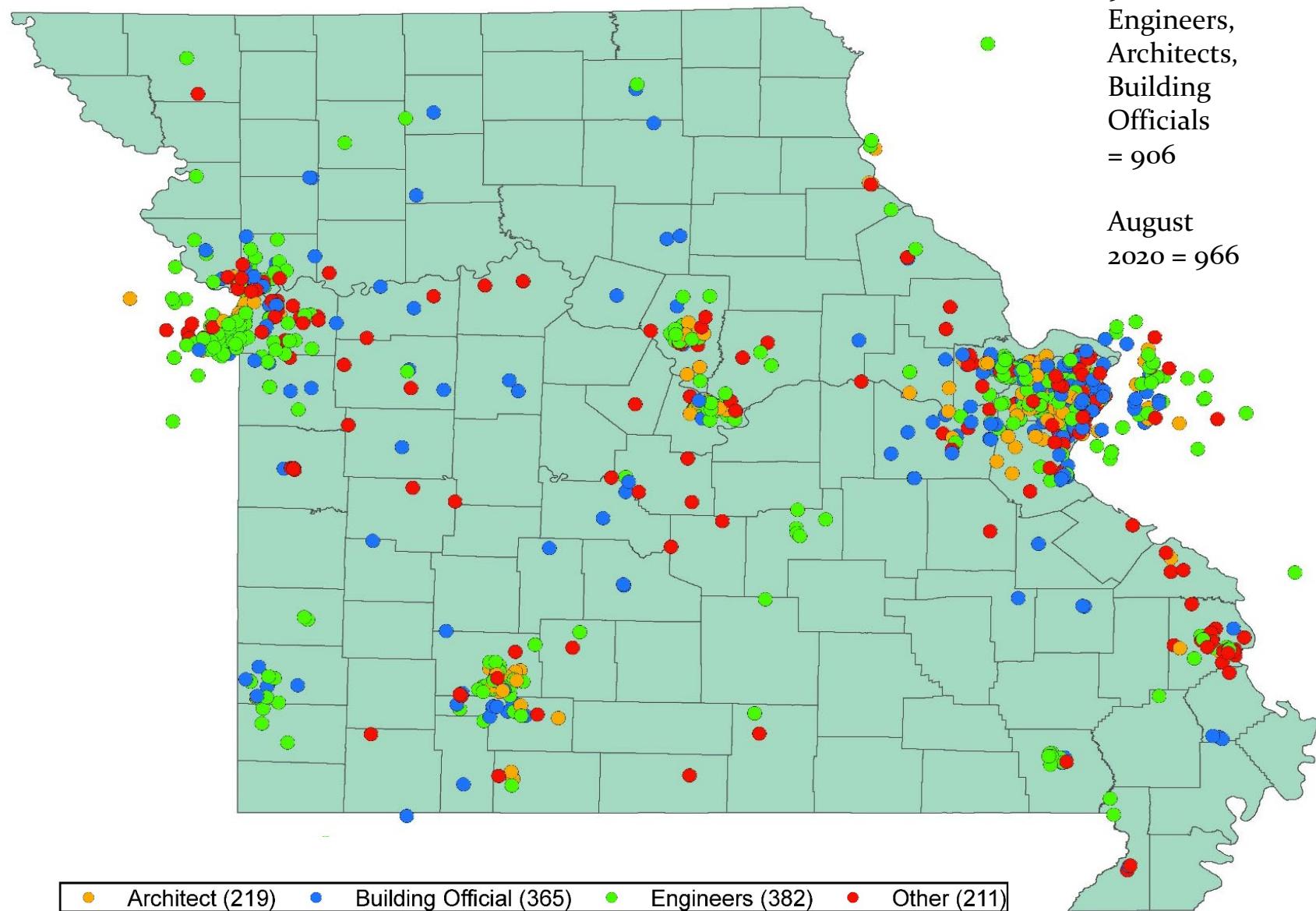
Around 1,000  
Current Members



It Starts With  
ATC-20/45  
Based Training

Source: SEMA

# Missouri SAVE Coalition Members by Occupation





# Missouri S.A.V.E. Coalition



**The S.A.V.E. Board of Directors Come From the  
Coalition's Participating Professional Organizations:**

- American Council of Engineering Companies/Missouri (ACEC/MO)
- American Institute of Architects/Missouri - (AIA/MO)
- American Society of Civil Engineers - (ASCE)
- Missouri Society of Professional Engineers - (MSPE)
- Structural Engineers Association of Kansas & Missouri - (SEAKM)
- Earthquake Engineering Research Institute - (EERI)
- Society of American Military Engineers/St. Louis - (SAME)
- Missouri Seismic Safety Commission - (MSSC)
- Missouri Association of Code Enforcement - (MACE)

# What S.A.V.E. Does

- Mostly Rapid Visual Inspections per ATC-20 and ATC-45
- Exterior Only, Structural Life Safety
- Public Information and Warning - Post Placards:

|   |  |
|---|--|
| UNSAFE  |  |
| DO NOT ENTER OR OCCUPY<br>(THIS PLACARD IS NOT A DEMOLITION ORDER)  |  |
| <p>This structure has been inspected, found to be seriously damaged and is unsafe to occupy, as described below:</p> <hr/> <hr/> <hr/> <hr/>            |  |
| <p>Date _____</p> <p>Time _____</p> <p>This facility was inspected under emergency conditions for:</p> <p style="text-align: right;">(Jurisdiction)</p> |  |
| <p>Inspector ID / Agency</p> <hr/> <hr/>  |  |
| <p>Facility Name and Address:</p> <hr/> <hr/>   |  |
| <p><b>Do Not Remove, Alter, or Cover this Placard<br/>until Authorized by Governing Authority</b></p>   |  |

# RESTRICTED USE

|   |   |
|---|---|
| <h1 style="text-align: center;">STRUCTURALLY INSPECTED</h1> <h2 style="text-align: center;">LAWFUL OCCUPANCY PERMITTED</h2> |   |
| <p>This structure has been inspected (as indicated below) and no apparent structural hazard has been found.</p>             |   |
| <input type="checkbox"/> <b>Inspected Exterior Only</b>   | <input type="checkbox"/> <b>Inspected Exterior and Interior</b> |
| <p>Report any unsafe condition to local authorities; reinspection may be required.</p>                                      |   |
| <p>Inspector Comments:</p> <hr/> <hr/> <hr/>  |   |
| <p>Facility Name and Address:</p> <hr/> <hr/> <hr/>   |   |
| <p>Date _____</p>   |   |
| <p>Time _____</p>   |   |
| <p><b>(Caution:</b> Aftershocks since inspection may increase damage and risk.)</p>   |   |
| <p>This facility was inspected under emergency conditions for:</p> <hr/>  |   |
| <p>(Jurisdiction)</p>   |   |
| <p>Inspector ID# / Agency</p> <hr/>   |   |

- Joplin EF-5 Deployment Data used by FEMA, Missouri National Guard, NIST, and ASCE Researchers



# How S.A.V.E. Activates



EVENT OCCURS  
(Local Agencies Overwhelmed)



Governor  
Declares Emergency



Local Government Requests Building  
Inspection Help from SEMA



S.A.V.E. Teams Begin Deployment



# Missouri S.A.V.E. Coalition



## S.A.V.E. Volunteer Service

**Duration** = 5 days

**Liability** = Willful & Gross  
Negligence Only

**Duty With** = Local Jurisdiction

**Expenses** = Local Jurisdiction  
Reimbursement

**Workers Compensation** = State



# Benefit to Missourians



Photo Credit: Ben Ross – S.A.V.E.

# Keeping People Safe





Ponce, Puerto Rico – 6.4 M  
Earthquake + 40 days



Ponce, Puerto Rico – 6.4 M  
Earthquake + 40 days



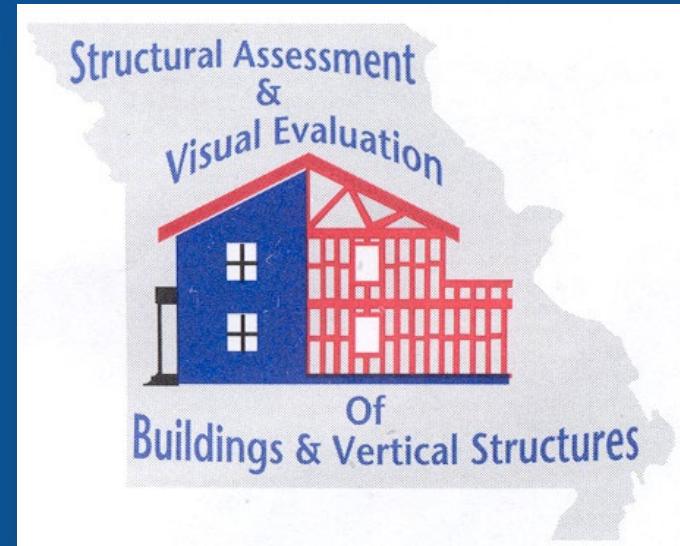
Ponce, Puerto Rico – 6.4 M  
Earthquake + 40 days

# SEMA S.A.V.E.

Structural Assessment and Visual Evaluation Coalition

Fredericktown, MO Flash Flood

1999

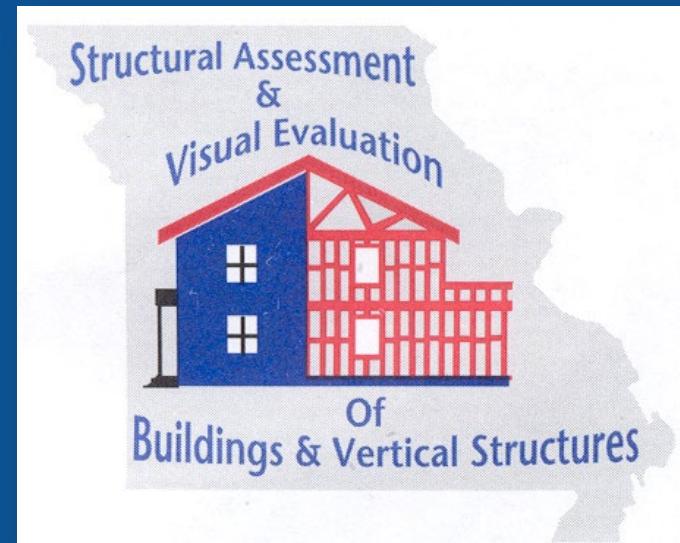


# SEMA S.A.V.E.

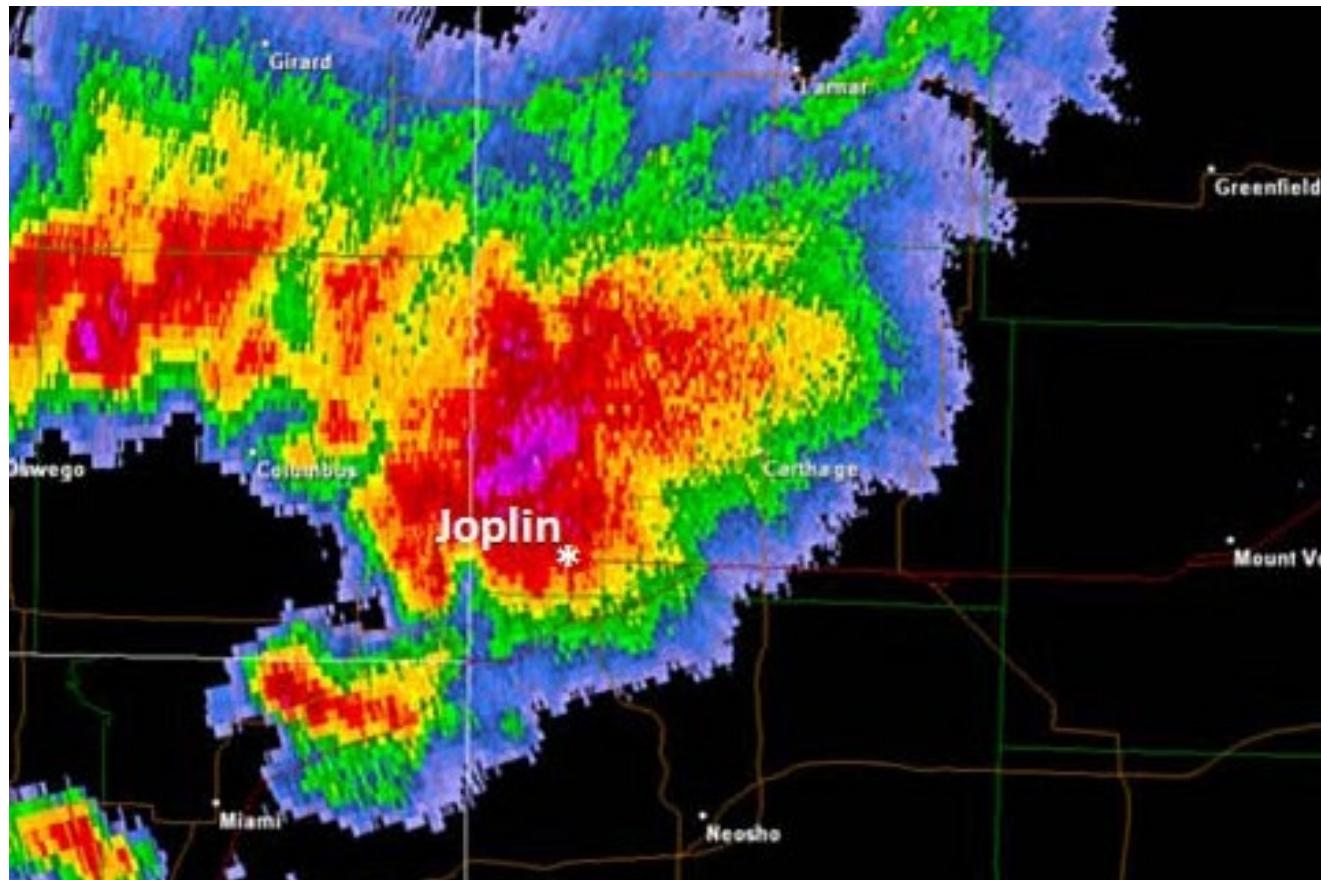
Structural Assessment and Visual Evaluation Coalition

Joplin EF-5 Tornado Deployment

May 25 – 28, 2011

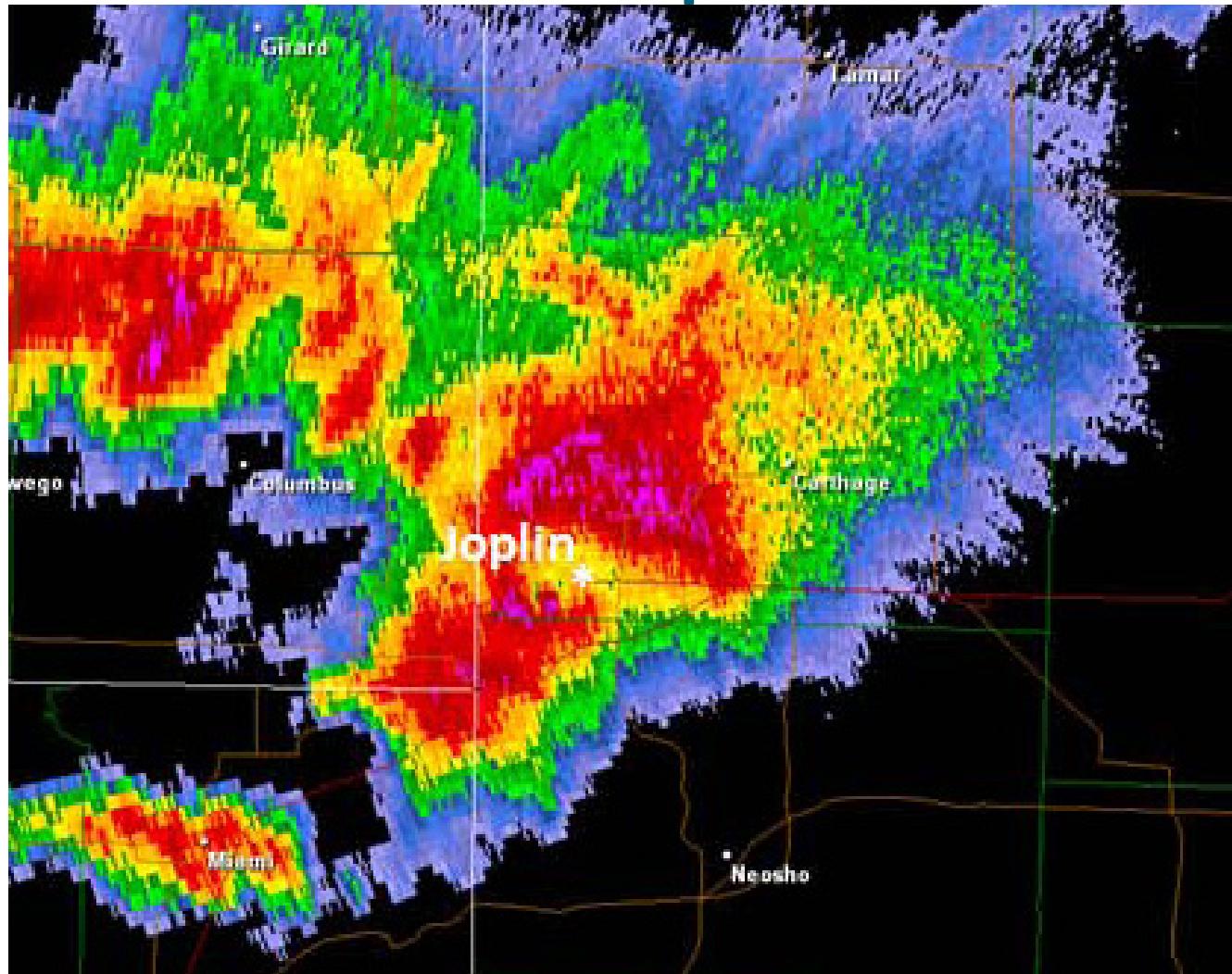


May 22, 2011  
5:29 pm



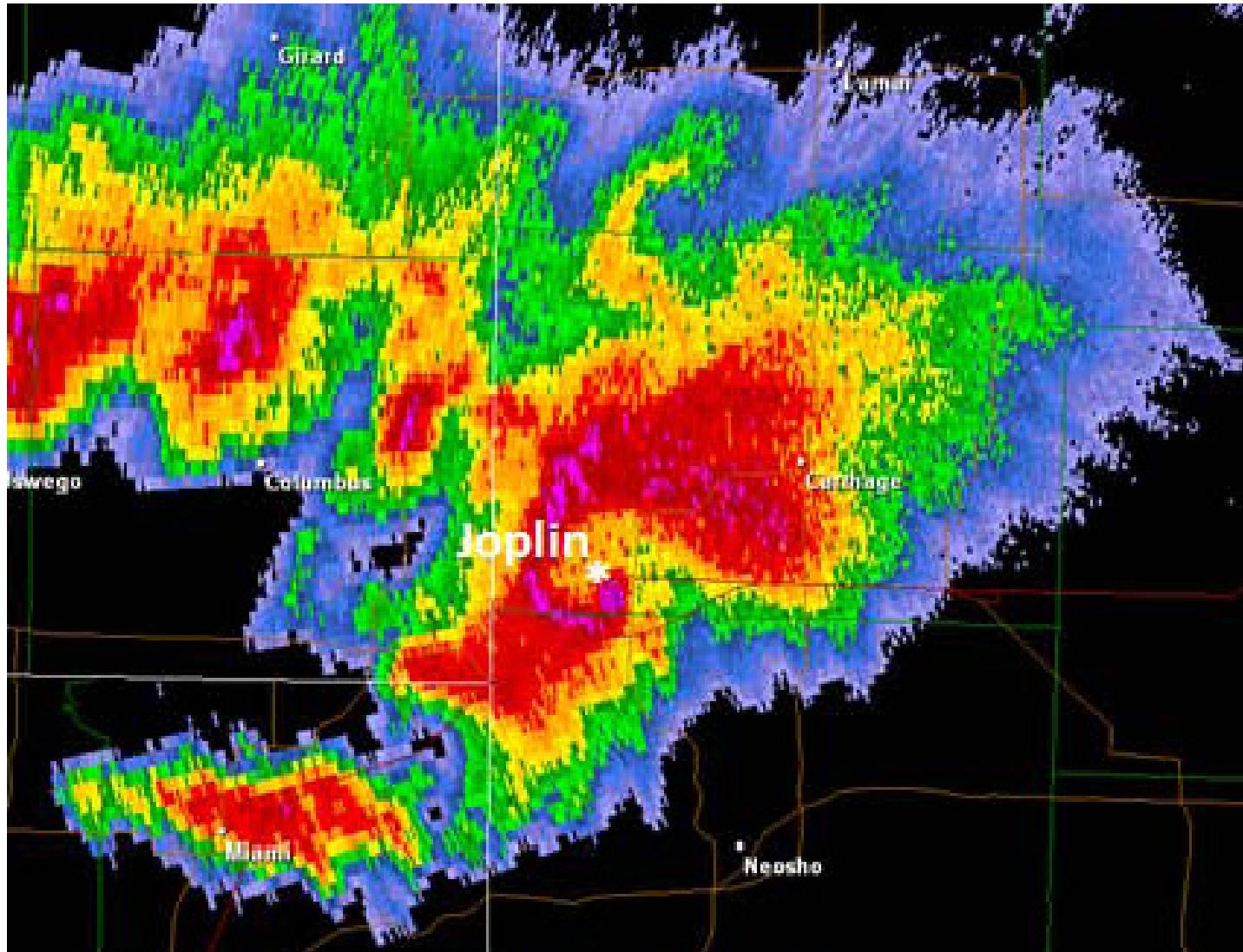
Source: National Weather Service

# 5:39 pm



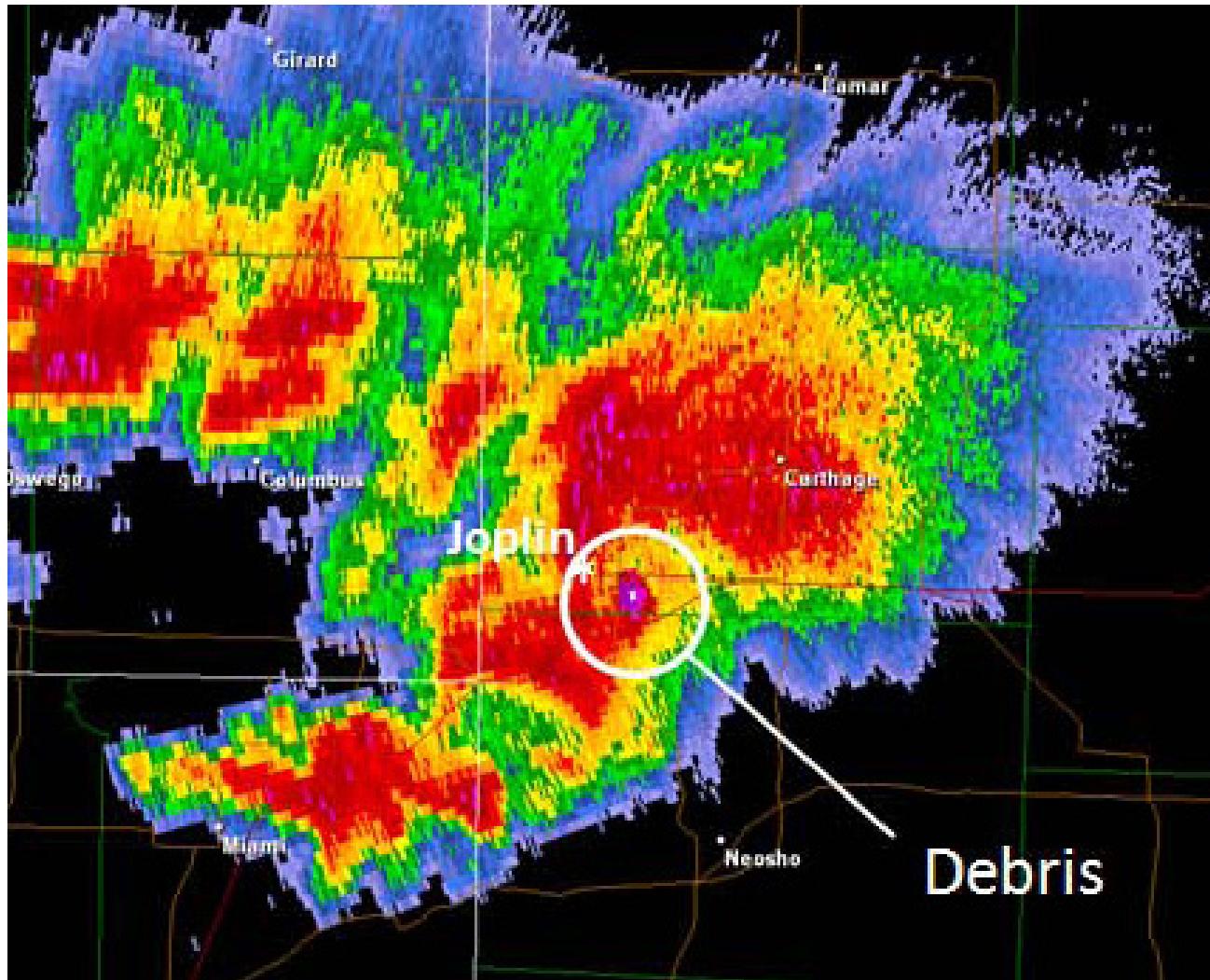
Source: National Weather Service

# 5:43 pm



Source: National Weather Service

# 5:48 pm



Source: National Weather Service



Photo Credit: Michael Goldschmidt, AIA – S.A.V.E.



Photo Credit: Jeff Hower – S.A.V.E.

# State of Emergency Declared

"As a state, we are deploying every agency and resource available to **keep Missouri families safe**, search for the missing, provide emergency medical care, and begin to recover."

Gov. Jay Nixon

# Joplin EF-5 Event Time Line

- May 22<sup>nd</sup> 5:41 pm Tornado Strikes
- May 22<sup>nd</sup> 5:42 pm Search and Rescue Efforts Begin
- May 23<sup>rd</sup> 8:10 am S.A.V.E. Regional Coordinators Begin Phone Tree Call Down
- May 24<sup>th</sup> 10:39 pm City of Joplin Requests Building Inspection Help from SEMA
- May 25<sup>th</sup> 10:19 am S.A.V.E. SW Regional Coordinator Deploys to Joplin
- May 26-28 S.A.V.E. Inspection Team Deployment

# Daily Briefing



Photo Credit: Ben Ross – S.A.V.E.

# S.A.V.E. Members in the Field



Photo Credit: Jeff Hower – S.A.V.E.

# Aftermath



Photo Credit: Ben Ross – S.A.V.E.

# Aftermath



Photo Credit: Ben Ross – S.A.V.E.

# Aftermath



**BEFORE**

Photo Credit: St. Mary's



**AFTER**

Photo Credit: CNS

# Posting Damaged Building



Photo Credit: Jeff Hower – S.A.V.E.

# Example Unsafe Building



Photo Credit: Ben Ross – S.A.V.E.

# Example Unsafe Building



Photo Credit: Ben Ross – S.A.V.E.

# Example Unsafe Building



Photo Credit: Ben Ross – S.A.V.E.

# Example Unsafe Building



Photo Credit: Ben Ross – S.A.V.E.

# Example Unsafe Building

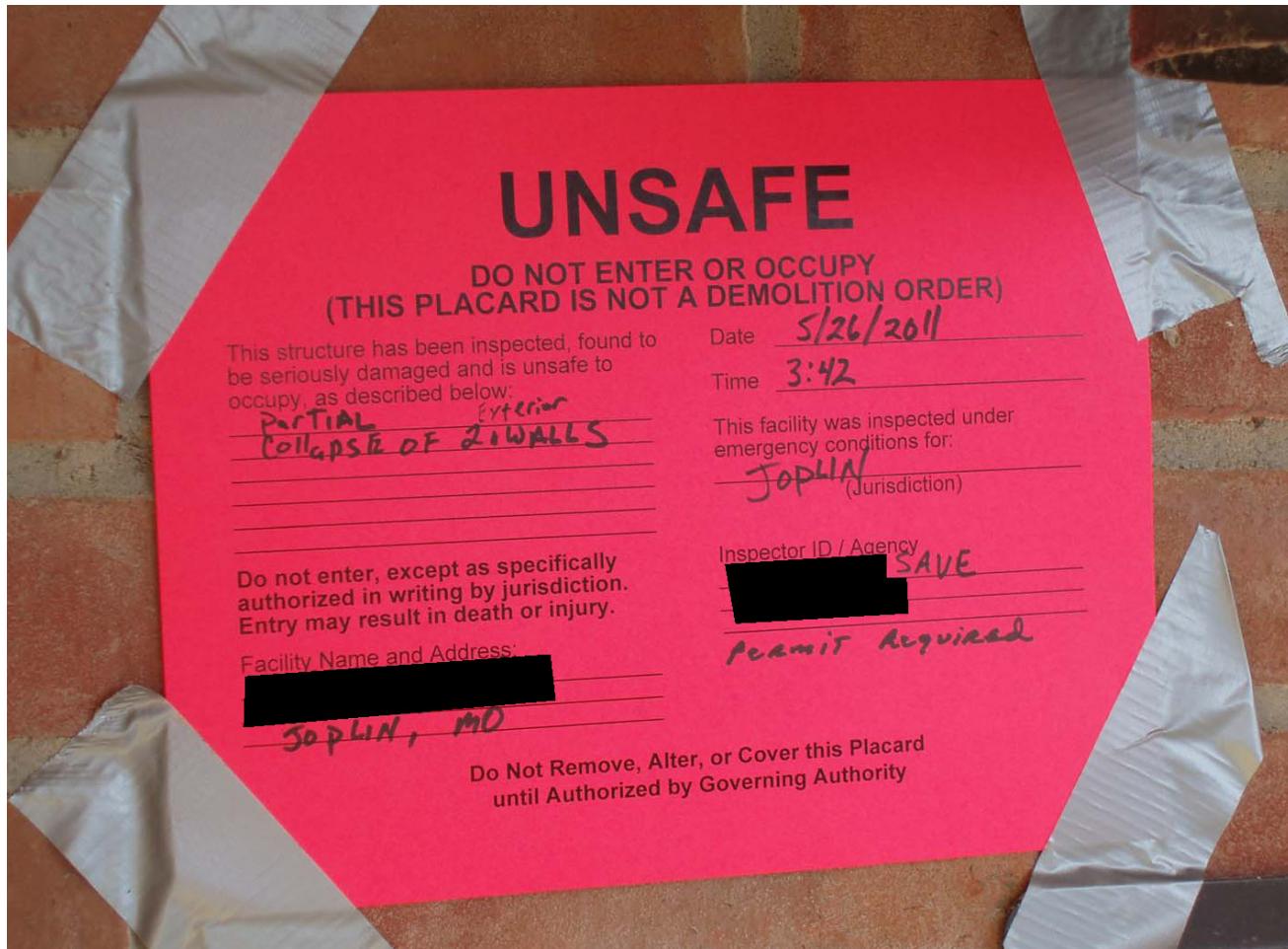


Photo Credit: Ben Ross – S.A.V.E.

# Progress Board – End of Day 2

| AREA | 16 / 46              | 27 MAY '11           | 1840 |
|------|----------------------|----------------------|------|
| 1    | 10-1<br>10-2<br>10-3 | DONE<br>DONE<br>DONE | -    |
| 2-1  | 11-1<br>11-2         | 20%<br>50%           | 2    |
| 2-2  | 11-3                 | 0% mostly Green      | 41   |
| 3-1  | 11-4                 | 0% mostly Green      |      |
| 3-2  | 11-A                 | NOT Assigned         |      |
| 4-1  | 12-1                 | 10% Done             |      |
| 4-2  | 12-2                 | Assigned             |      |
| 5-1  | 12-3                 | DONE-All Red         |      |
| 5-2  | 12-4                 | DONE-All Red         |      |
| 6-1  | 13-1                 | NOT ASSIGNED         |      |
| 6-2  | 13-2                 |                      |      |
| 6-3  | 14-1                 |                      |      |
| 7-1  | 15-1                 |                      |      |
| 7-2  | 15-2                 |                      |      |
| 8-1  | 15-3                 |                      |      |
| 8-2  | 15-4                 |                      |      |
| 8-2  | 15-5                 |                      |      |
| 9-1  | 15-6                 |                      |      |
| 9-2  | 16-1                 |                      |      |
| 9A-1 | 16-2                 |                      |      |
| 9A-2 | 16-3                 |                      |      |
| 9A-3 |                      |                      |      |
| 9A-A |                      |                      |      |

Photo Credit: Ben Ross – S.A.V.E.

# S.A.V.E. Members Stayed at Ozark Christian College in Joplin



Photo Credit: Ben Ross – S.A.V.E.

# Example Unsafe Building



Photo Credit: Ben Ross – S.A.V.E.

# Example Unsafe Building?



Photo Credit: Ted Pruess – S.A.V.E.

# Example Unsafe Building?



Photo Credit: Ted Pruess – S.A.V.E.

# Example Unsafe Building?



Photo Credit: Ben Ross – S.A.V.E.

# Example Unsafe Building



Photo Credit: Ben Ross – S.A.V.E.

# Example Restricted Use Building



Photo Credit: Ben Ross – S.A.V.E.

# Example Inspected Building



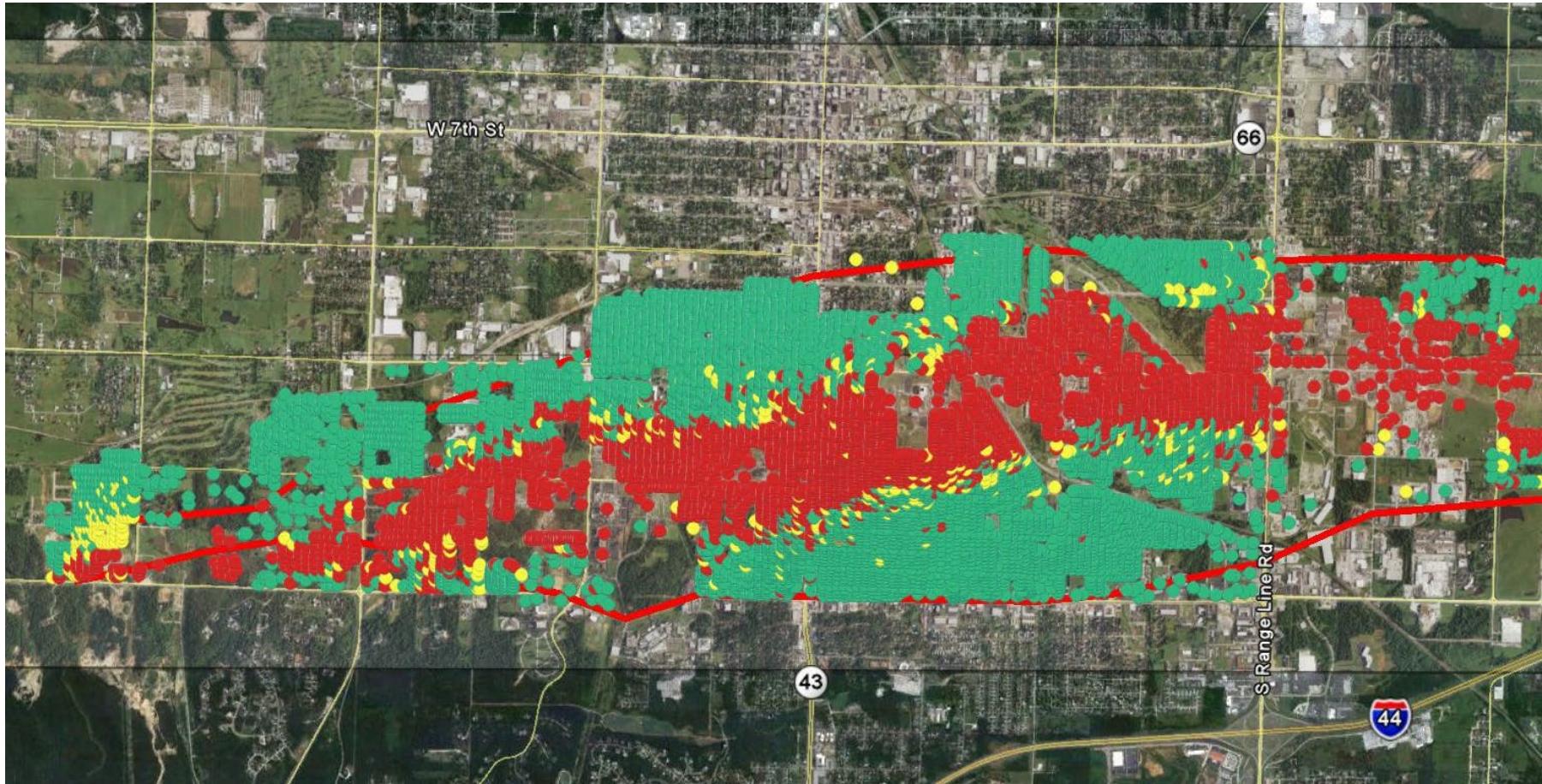
Photo Credit: Ben Ross – S.A.V.E.

# Field Copies of Damage Area Maps



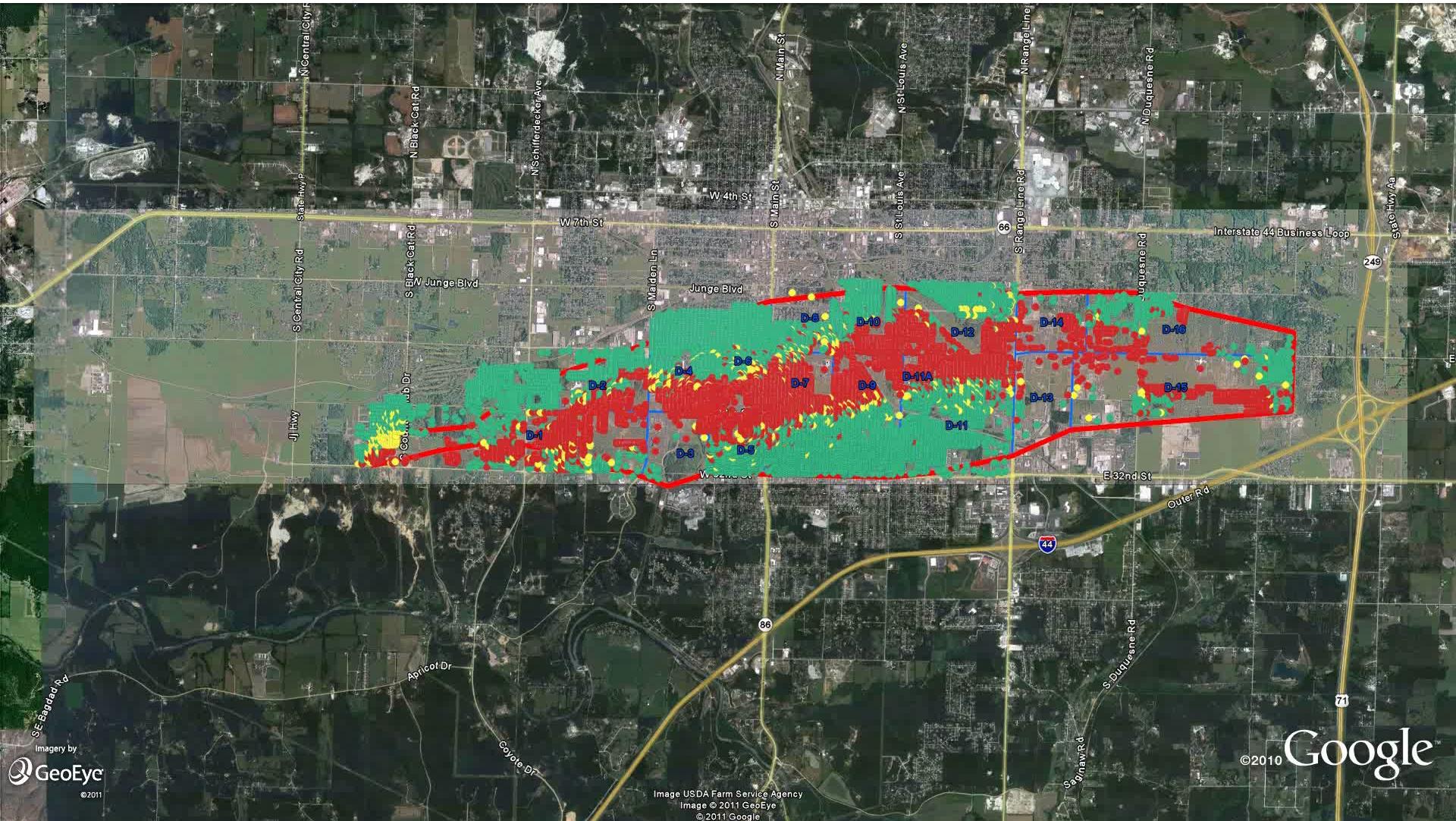
Photo Credit: Ben Ross – S.A.V.E.

# S.A.V.E. Data in City of Joplin GIS



Courtesy City of Joplin

# Tornado's Eye View



# Results

- More than 7,700 Structures Evaluated/Inspected



- 36% Unsafe



- 6% Restricted Use



- 58% Did Not Present Life Safety Problems

# Joplin Building Official Steve Cope Thanking S.A.V.E. Members



Photo Credit: Ben Ross – S.A.V.E.

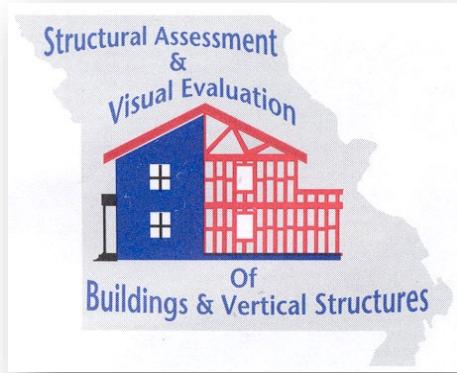
# Lessons Learned

- S.A.V.E. Program Worked Well
- An Automated Volunteer Communication System is Needed
- Automated Data Collection is Needed
- Better Transportation
- Formal SAVE Leader Training

# SAVE Goal: Develop Relationship with Missouri National Guard



# 2015 Exercise Planning Team



# Jefferson Barracks Site



# Historic Building with Real Damage



# April 2015 Planning Site Visit



# Senior Leadership Support

“What most impressed me was the teamwork. We had folks from many states working together to organize this drill, inspect the buildings and report the findings, and they did a great job.” - Ron Walker, SEMA Director



# Check-In and Team Assignments





# Real 3.4M Earthquake in New Madrid

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## Two quakes rattle parts of Southeast Missouri

Monday, October 19, 2015

By DAVID SILVERBERG ~ Daily American Republic

Many residents of Butler, Ripley and Carter counties in Missouri felt the earth shake at 3:26 p.m. Friday or heard what sounded like a sonic boom.

The U.S. Geological Survey said it was a 3.4-magnitude earthquake, followed 24 minutes later by a 3.2-magnitude aftershock.

There were no reports of damage, but concerned people called area law enforcement to find out what was going on.

Robbie Myers, director of the Butler County Emergency Management Agency, was told the epicenter was 29 miles west of Poplar Bluff, Missouri, or a few miles west of Grandin, Missouri.

Myers reported a woman, who lives on Butler County Road 450, told a dispatcher at the sheriff's department "it felt like the front porch was going to shake off the house."

Lance Pigg, director of the Ripley County Emergency Management Agency, did not receive damage reports, but people said "it felt like a fairly strong earthquake."

Noah Cross was sitting in his office at Ozark Meats five miles east of Grandin when the tremor occurred.

"I realized the whole place was shaking. I saw the freezer door shaking," Cross said. "

"All of a sudden, a picture fell off the wall. We didn't know what had happened," Orr said.

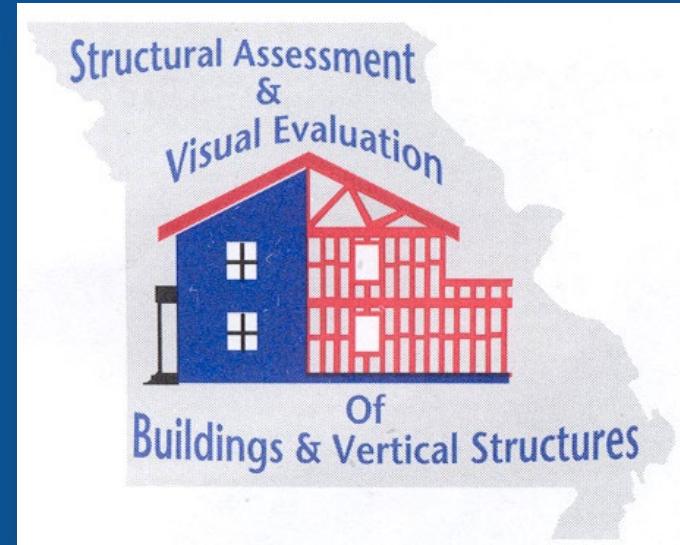
Myers said the earthquake occurred just one day after EMA officials had participated in the annual Great Central U.S. ShakeOut drill at area schools.

"This earthquake is a reminder one can happen at any time. That is why we practice earthquake drills," Myers said.

# SEMA S.A.V.E.

## Carter Co. / Van Buren, Missouri Flash Flood Deployment

May 3, 2017



# SEMA S.A.V.E.

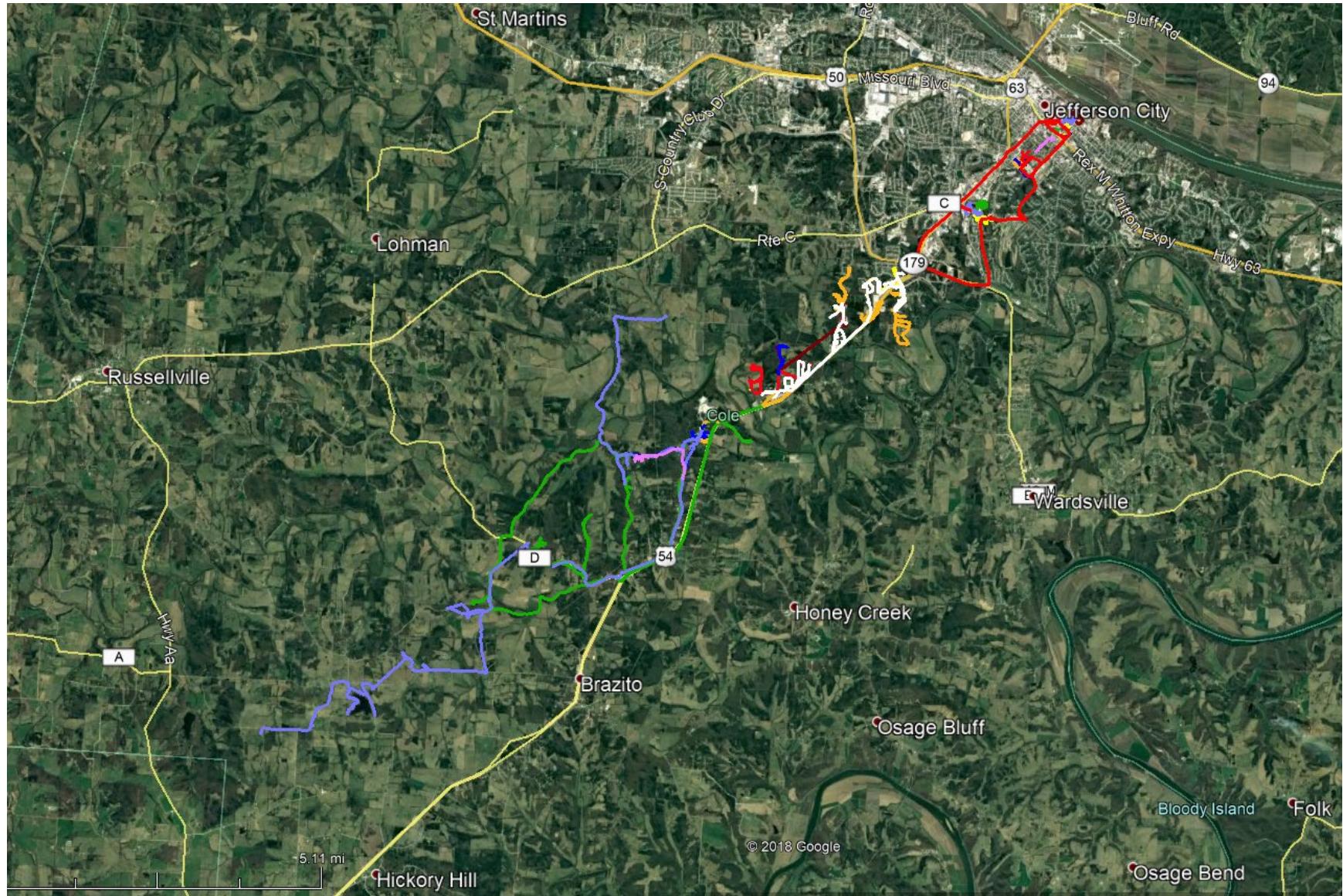
Structural Assessment and Visual Evaluation Coalition

Jefferson City and Cole County  
EF-3 Tornado Deployment

May 24 – 25, 2019



# Extent of Damage



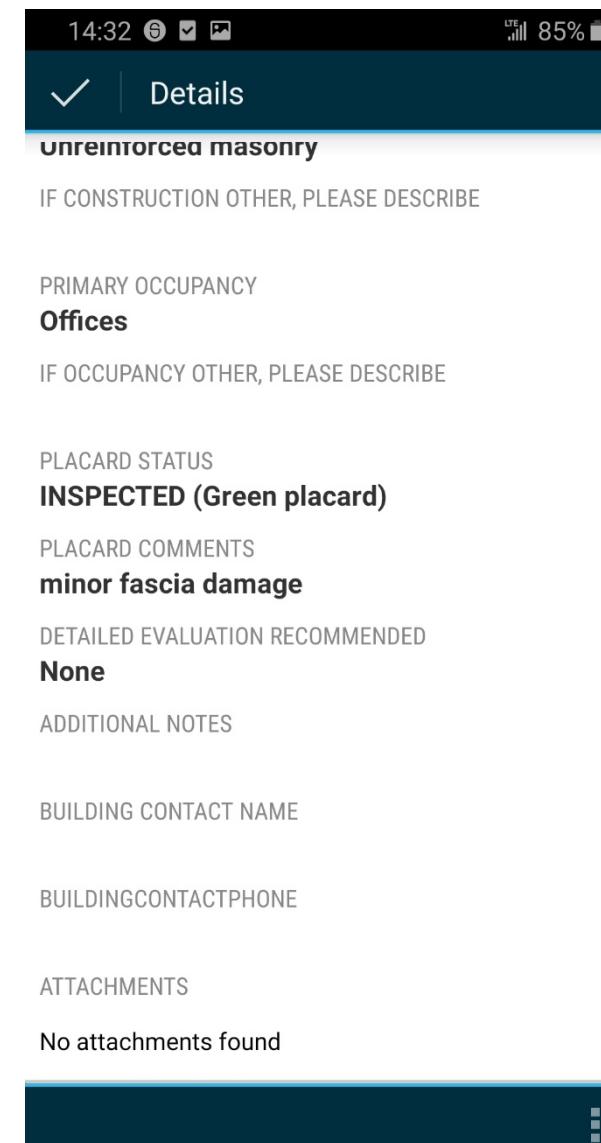
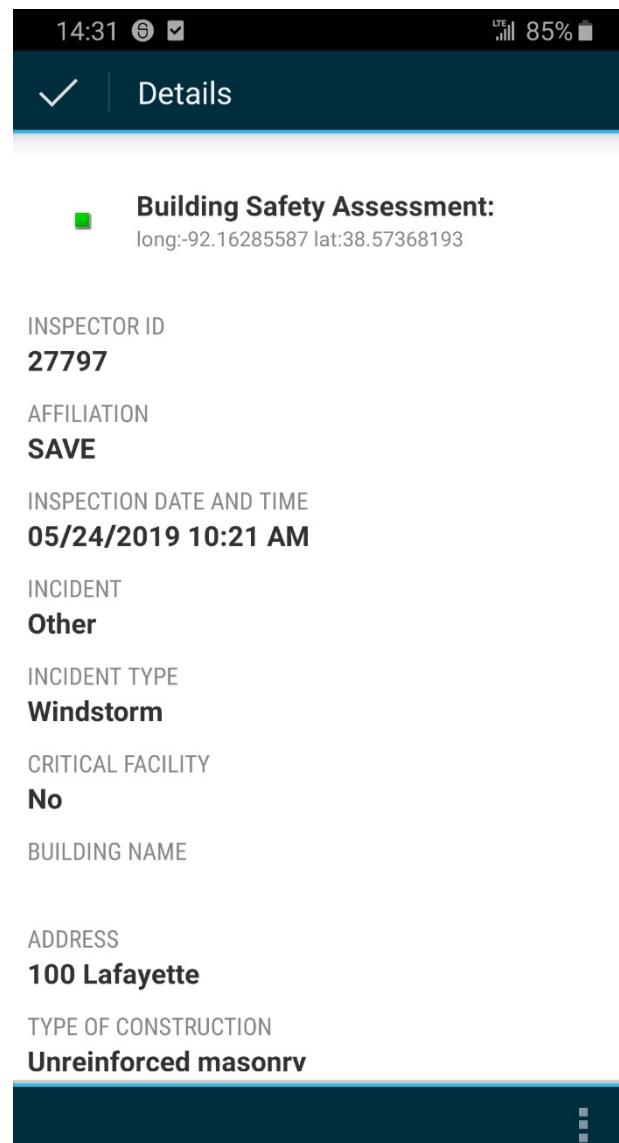
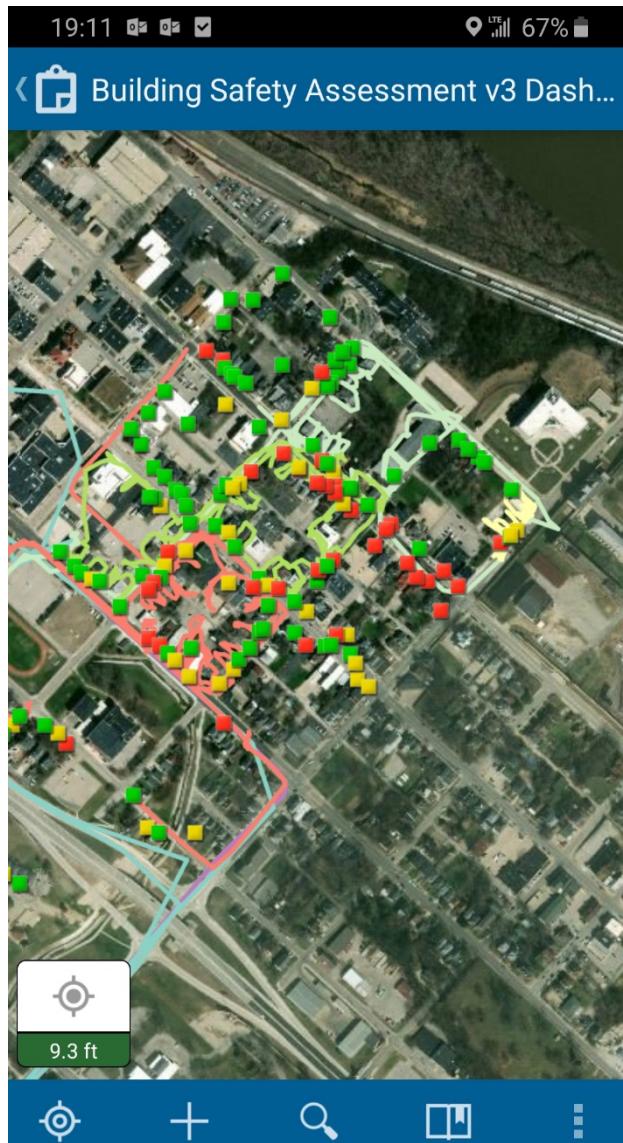
# Data Collection Methods



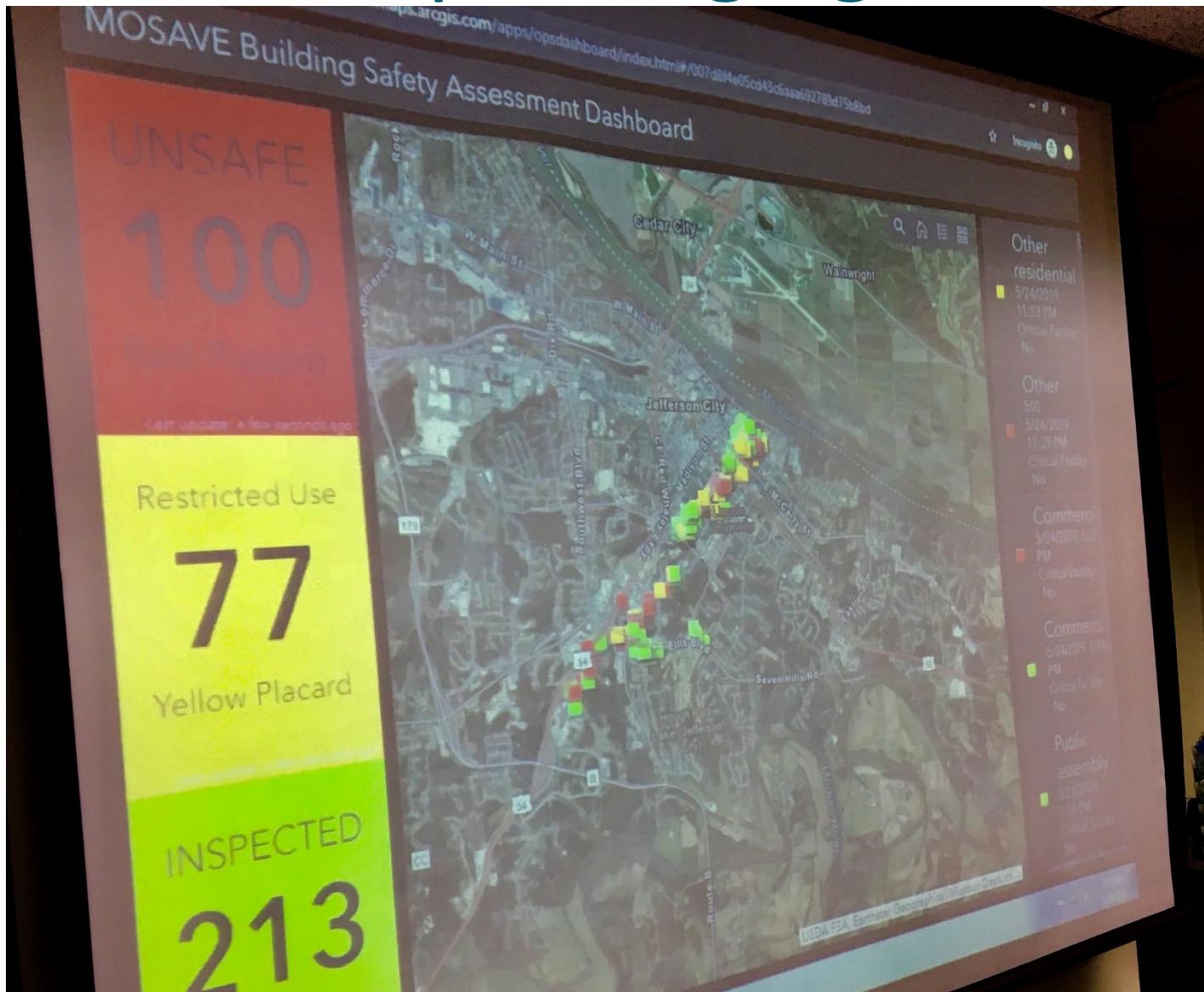
# S.A.V.E. GPS Track



# ESRI Collector App



# “Why do those numbers keep changing?”



# S.A.V.E. Technical Supervisor Visits Team in the Field



Photo Credit: Ben Ross – S.A.V.E.

# Law Enforcement Support



# Law Enforcement Support



Photo Credit: Ben Ross – S.A.V.E.

# Example Unsafe Building



# Non-Event Damage



# Blue Tarp – Training Validation



# Blue Tarp – Training Validation



# Training Validation



# Training Validation



# Training Validation



# Training Validation



# Training Validation – Walk Around the Building



# Media Coverage



Missouri Governor — Michael L. Parson

Office of Communications

## FOR IMMEDIATE RELEASE

May 24, 2019

### Missouri Reports Strong Progress in Recovery Following Storms; Building Assessments Underway in Jefferson City

*Governor Parson urges Missourians to be prepared to take protective measures this weekend in which severe weather, flooding are*

**(JEFFERSON CITY, MO) – Governor Mike Parson** this afternoon commended the efforts of state and local government, utility companies, and other partners to help residents and businesses recover from the severe weather and flooding that occurred on May 22.

In Jefferson City, a team of volunteer engineers, architects, building inspectors, and other professionals today began assessing the estimated 500 homes and buildings that suffered damage to determine which are safe and which should be evacuated. On Saturday, the Missouri Structural Assessment and Visual Evaluation (S.A.V.E.) Coalition is expected to evaluate structures in Cole County that are reported to have been damaged.

Of the first 321 structures reviewed today, the S.A.V.E. Coalition reported that:

- 78 Unsafe (Severely damaged and cannot be occupied – Red placard)
- 60 Restricted Use (A portion of the building is unsafe – Yellow placard)
- 183 Safe for Reentry (Structurally safe to occupy – Green placard)

The S.A.V.E. team, which works under the Missouri State Emergency Management Agency, is assisting the Jefferson City Building Department.



HOME NEWS WEATHER VIDEO SPORTS LIFESTYLE MARKETPLACE PLAY FOX

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Local News

### Building inspectors survey storm-damaged properties in Jefferson City

Jefferson City residents might notice a red, yellow or green placard on their front doors in the coming days.

by Nicole Roberts May 24 2019 @ 5:55pm



Building inspector Davi Brown, of Columbia, places a notice of structural inspection on a door Friday May 24, 2019 deeming the Jefferson City house on Capitol Avenue safe for reentry. The Missouri Structural Assessment and Visual Evaluation (SAVE) Coalition

Jefferson City residents might notice a red, yellow or green placard on their front doors in the coming days.

The City Building Department and a State Emergency Management Agency volunteer organization are working to inspect buildings damaged by Wednesday's tornado.



#### Recommended For You

Teenager hurt in single-vehicle crash in Morgan County

Lady Jays down Helias in volleyball for first time since 2013

Fatima gets early lead, holds off Lady Jays for 5-3 win

Missouri football focused on finishing games

Missouri men at Kentucky for SEC hoops opener

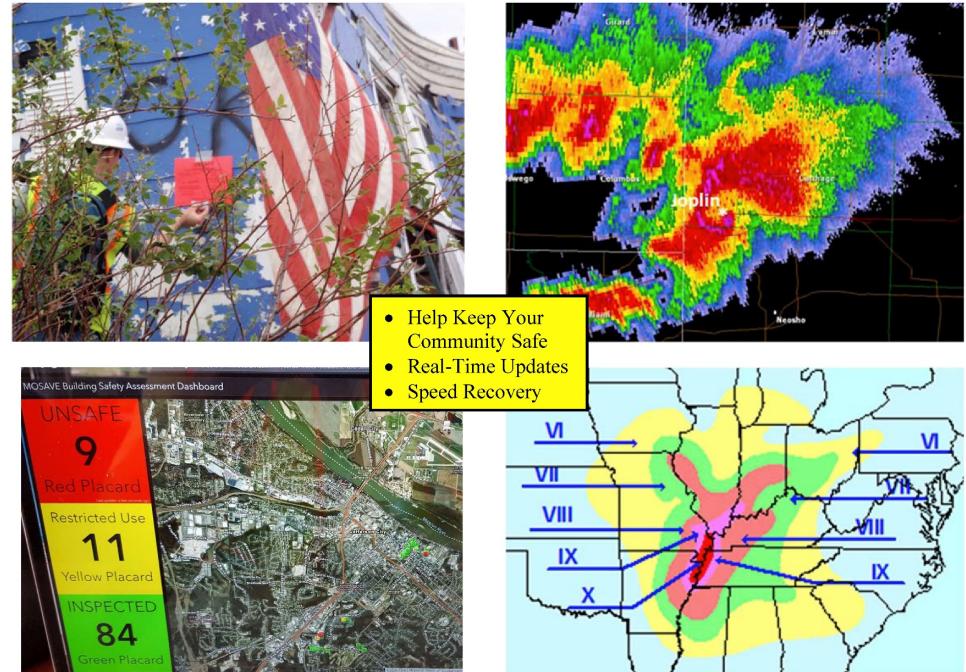
Related Article

# Lessons Learned/Learning

- Pre-Deployment Coordination
- Logistical Support
- GIS Support (City, State, Federal)
- FEMA Urban Search and Rescue Data
- Law Enforcement Support
- S.A.V.E. Leader Training Validated
- S.A.V.E. Program Worked Well

# LPA Guide to Utilizing SAVE

Local Public Agency Guide to Utilizing Missouri's  
**S.A.V.E. Coalition**  
to Perform Post-Disaster Building Safety Evaluations



Missouri  
State Emergency Management Agency

and the

Structural Assessment and  
Visual Evaluation  
(SAVE) Coalition



December 4, 2020

# 2021 Missouri Shakeout Earthquake Exercise



# Exercise Planning Team



With Local  
Fire Services



635<sup>th</sup> FEST

# PhotoShop Damage

## DAMAGED BUILDING PHOTOS AREAS 1-4



2021 Missouri ShakeOut  
Earthquake Exercise



AREA 3 - BUILDING #46—PHOTO #1



# More MONG Participants





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## Missouri SAVE Coalition

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Missouri SAVE Coalition

Ensuring Building Safety In a Disaster



The Missouri Structural Assessment and Visual Evaluation (SAVE) Coalition is a group of volunteer engineers, architects, building inspectors and other trained professionals that assists the Missouri State Emergency Management Agency with

# Questions?



Photo Credit: Jeff Hower – S.A.V.E.

Benjamin A. Ross, P.E.  
*Engineering Surveys & Services*  
573.449.2646