

# Mitigation Assessment Team Report Spring 2011 Tornadoes



Building Performance Observations, Recommendations,  
and Technical Guidance  
FEMA P-908 / May 2012



**FEMA**

Building Science Branch

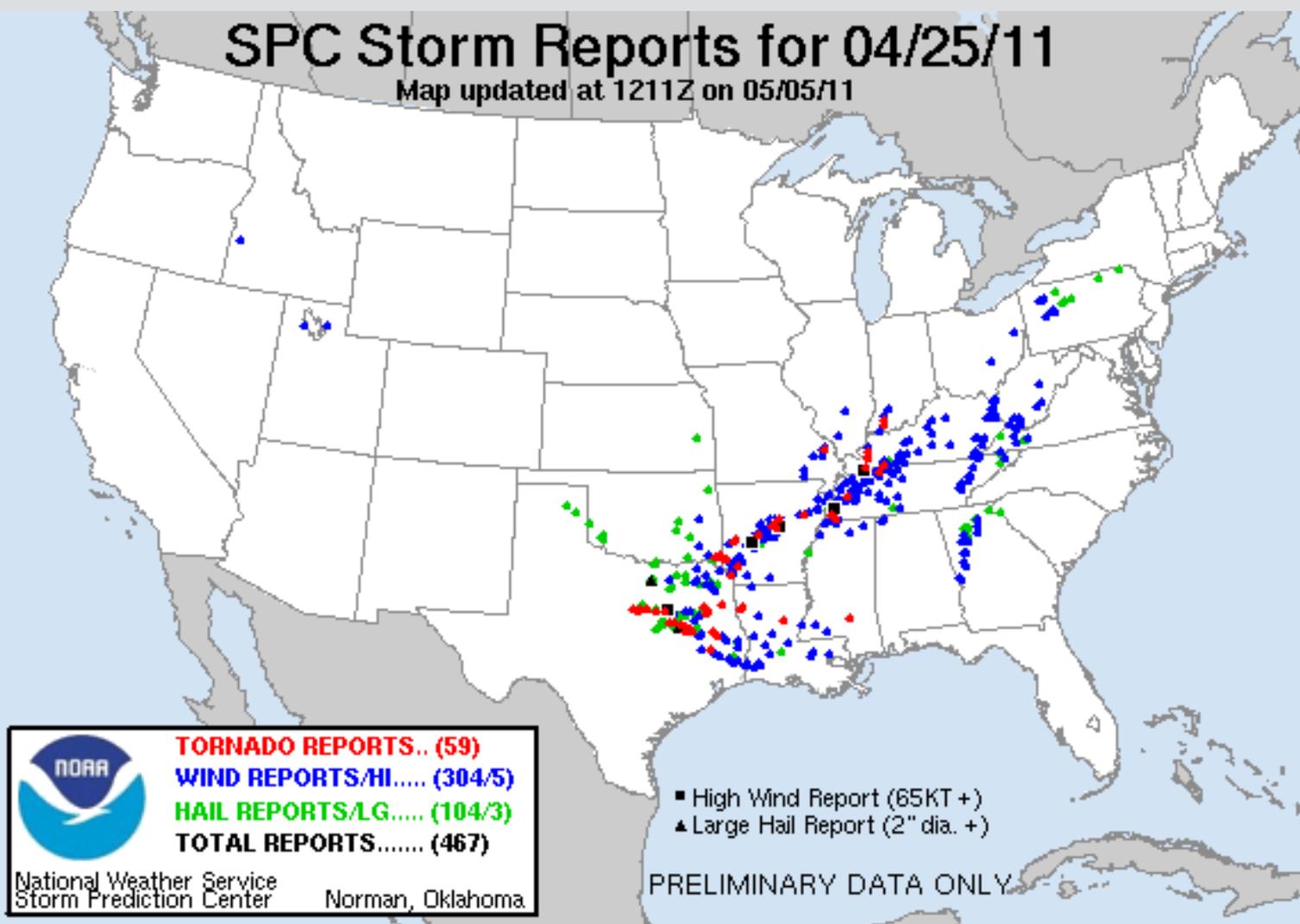
# Presentation Outline

- The tornado event and community impacts
- MAT mission objectives and applications
- Highlight key recommendations
- Translating results into action



# SPC Storm Reports for 04/25/11

Map updated at 1211Z on 05/05/11



 **TORNADO REPORTS.. (59)**  
**WIND REPORTS/HI..... (304/5)**  
**HAIL REPORTS/LG..... (104/3)**  
**TOTAL REPORTS..... (467)**

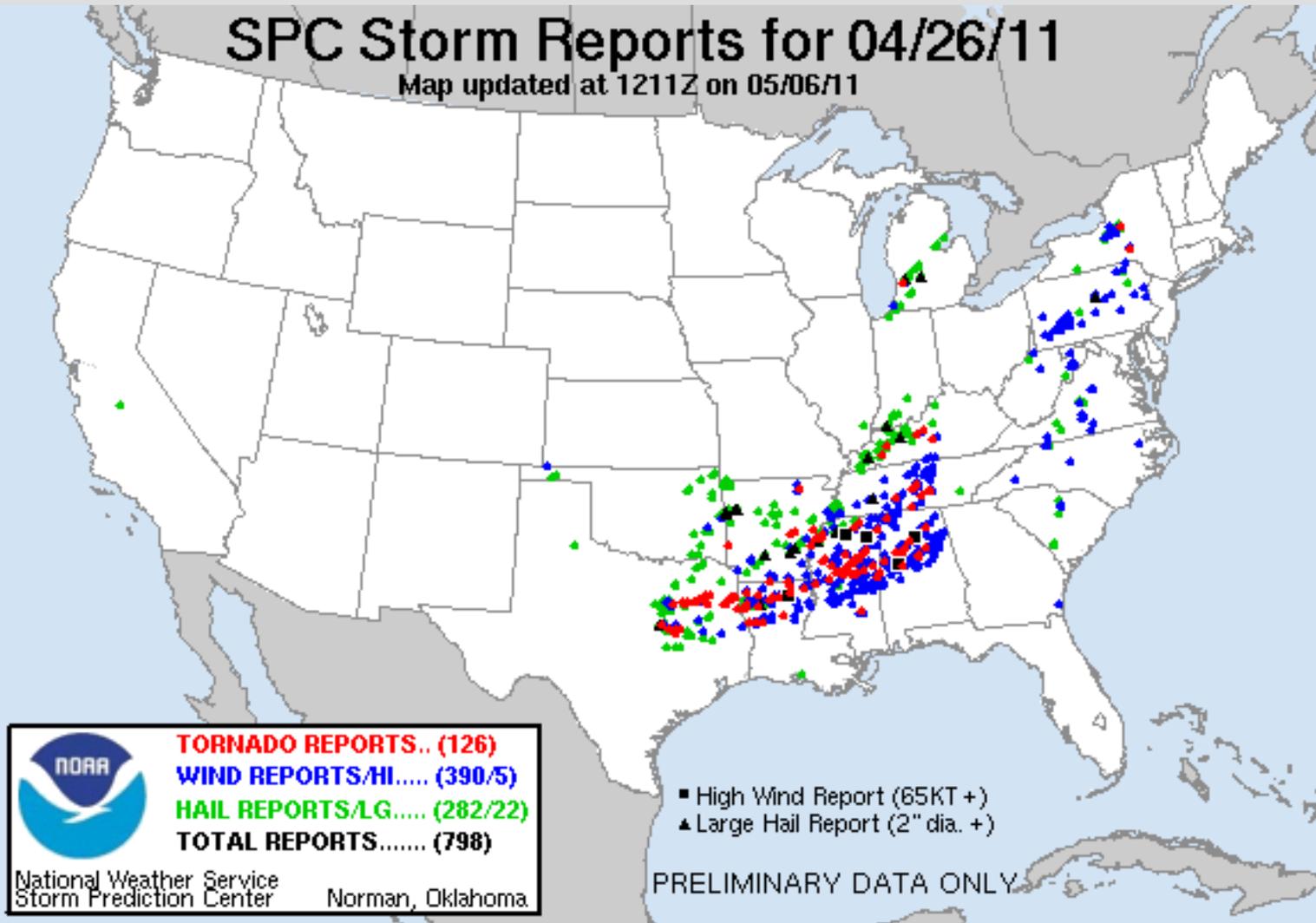
National Weather Service  
Storm Prediction Center      Norman, Oklahoma

- High Wind Report (65KT +)
- ▲ Large Hail Report (2" dia. +)

PRELIMINARY DATA ONLY

# SPC Storm Reports for 04/26/11

Map updated at 1211Z on 05/06/11



**TORNADO REPORTS.. (126)**  
**WIND REPORTS/HI..... (390/5)**  
**HAIL REPORTS/LG..... (282/22)**  
**TOTAL REPORTS..... (798)**

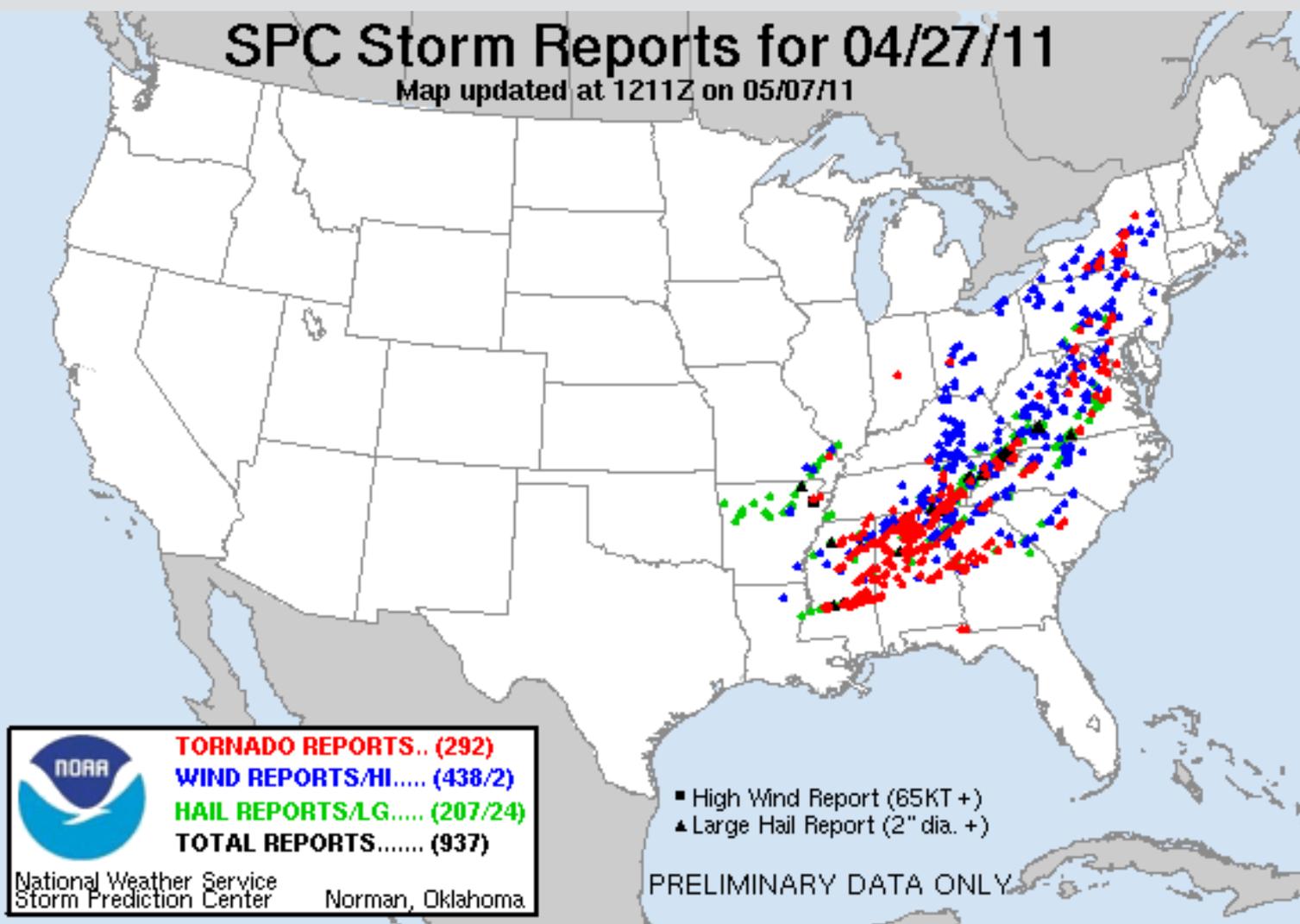
National Weather Service  
Storm Prediction Center Norman, Oklahoma

■ High Wind Report (65KT+)  
▲ Large Hail Report (2" dia.+)

PRELIMINARY DATA ONLY

# SPC Storm Reports for 04/27/11

Map updated at 1211Z on 05/07/11



 **TORNADO REPORTS.. (292)**  
**WIND REPORTS/HI..... (438/2)**  
**HAIL REPORTS/LG..... (207/24)**  
**TOTAL REPORTS..... (937)**

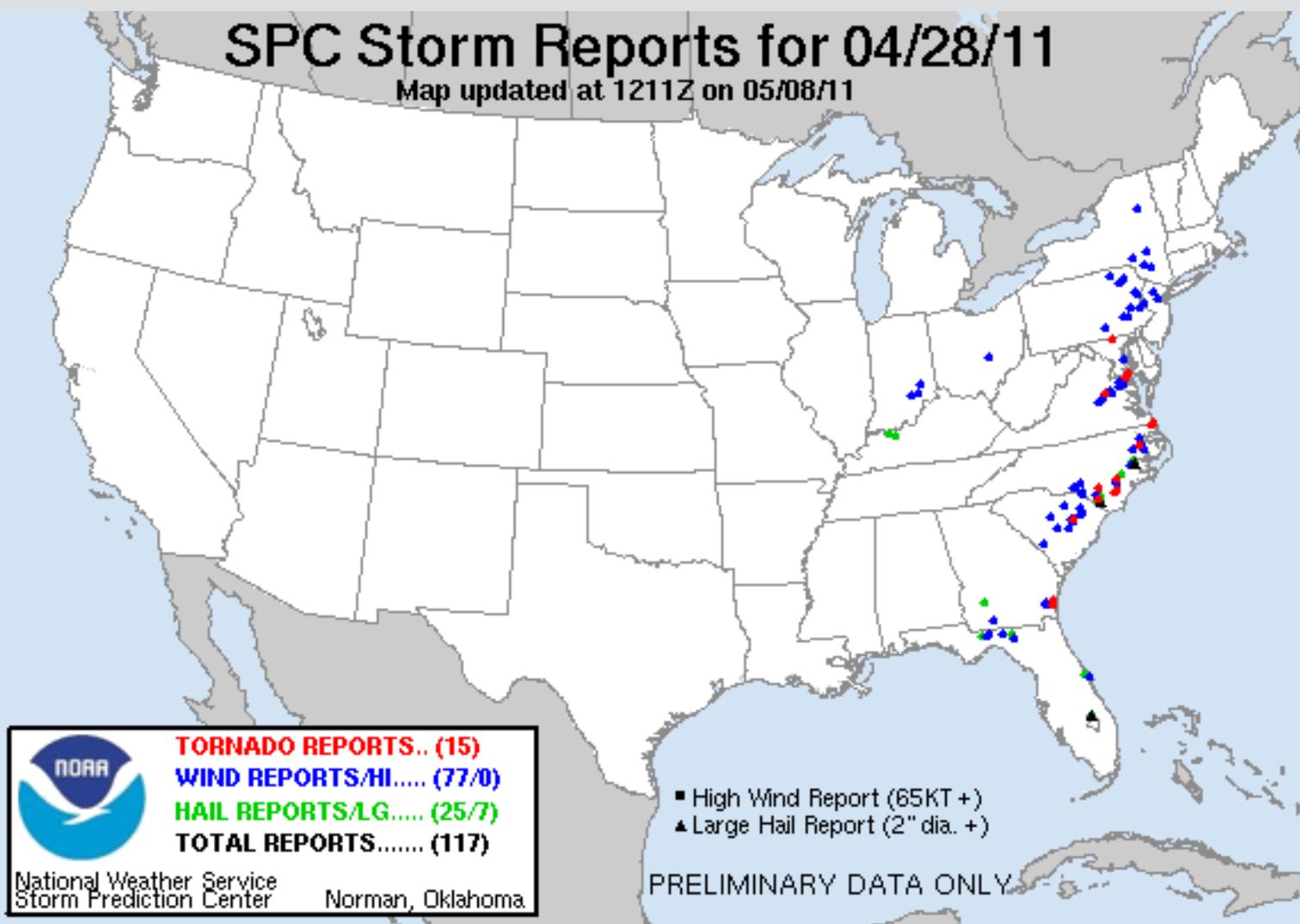
National Weather Service  
Storm Prediction Center Norman, Oklahoma

- High Wind Report (65KT+)
- ▲ Large Hail Report (2" dia. +)

PRELIMINARY DATA ONLY

# SPC Storm Reports for 04/28/11

Map updated at 1211Z on 05/08/11



 **TORNADO REPORTS.. (15)**  
**WIND REPORTS/HI..... (77/0)**  
**HAIL REPORTS/LG..... (25/7)**  
**TOTAL REPORTS..... (117)**  
National Weather Service  
Storm Prediction Center Norman, Oklahoma

- High Wind Report (65KT +)
- ▲ Large Hail Report (2" dia. +)

PRELIMINARY DATA ONLY

# SPC Storm Reports for 05/22/11

Map updated at 1212Z on 06/01/11



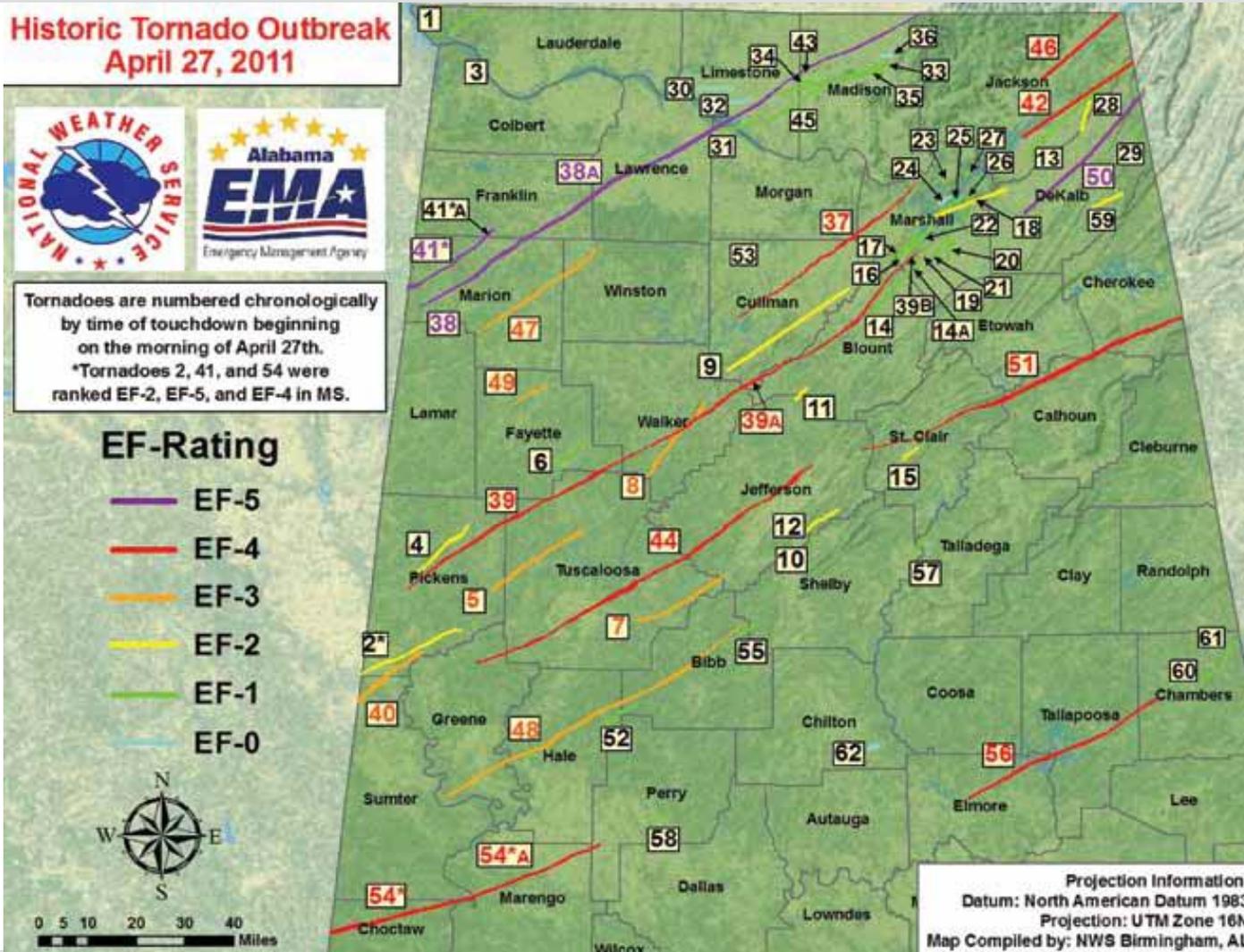
**TORNADO REPORTS.. (75)**  
**WIND REPORTS/HI..... (359/5)**  
**HAIL REPORTS/LG..... (409/50)**  
**TOTAL REPORTS..... (843)**

National Weather Service  
Storm Prediction Center      Norman, Oklahoma

- High Wind Report (65KT +)
- ▲ Large Hail Report (2" dia. +)

PRELIMINARY DATA ONLY

# Alabama Swath Map





# MAT Mission

## Objectives and Applications

At the invitation of Alabama, Georgia, Missouri, Mississippi & Tennessee:

- Assess building performance
- Investigate safe room and shelter performance
- Provide recommendations mitigate future tornado damage
- Advocate mitigation during recovery
- Support FEMA/FIMA Strategic Plans, PPD-8 & NDRF

# MAT Timeline



**TORNADO DISASTERS**  
April 27 and May 22, 2011

**SAFER AL SUMMIT**  
June 2011

**RECOVERY ADVISORIES**  
June–August 2011



**R&D, RECOMMENDATIONS**  
August 2011–April 2012

**JOPLIN TRAININGS**  
April–May 2012

**MAT REPORT**  
May 2012



Congressional Briefing / Displays and Animations / Exhibits / Multimedia  
National Conferences / Publications / Guidance for Regions

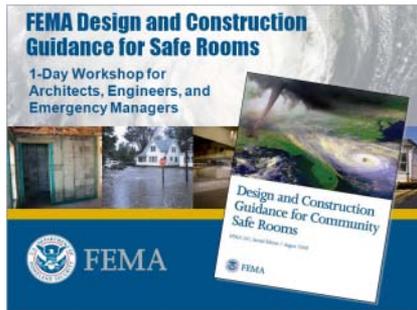


**AL AND GA TRAININGS**  
May–Sept 2011

**CODE PROPOSALS**  
January 2012

**CODE HEARINGS**  
April 2012

**eGOV DELIVERY**  
May 18, 2012



Bring awareness of MAT results to groups for outreach



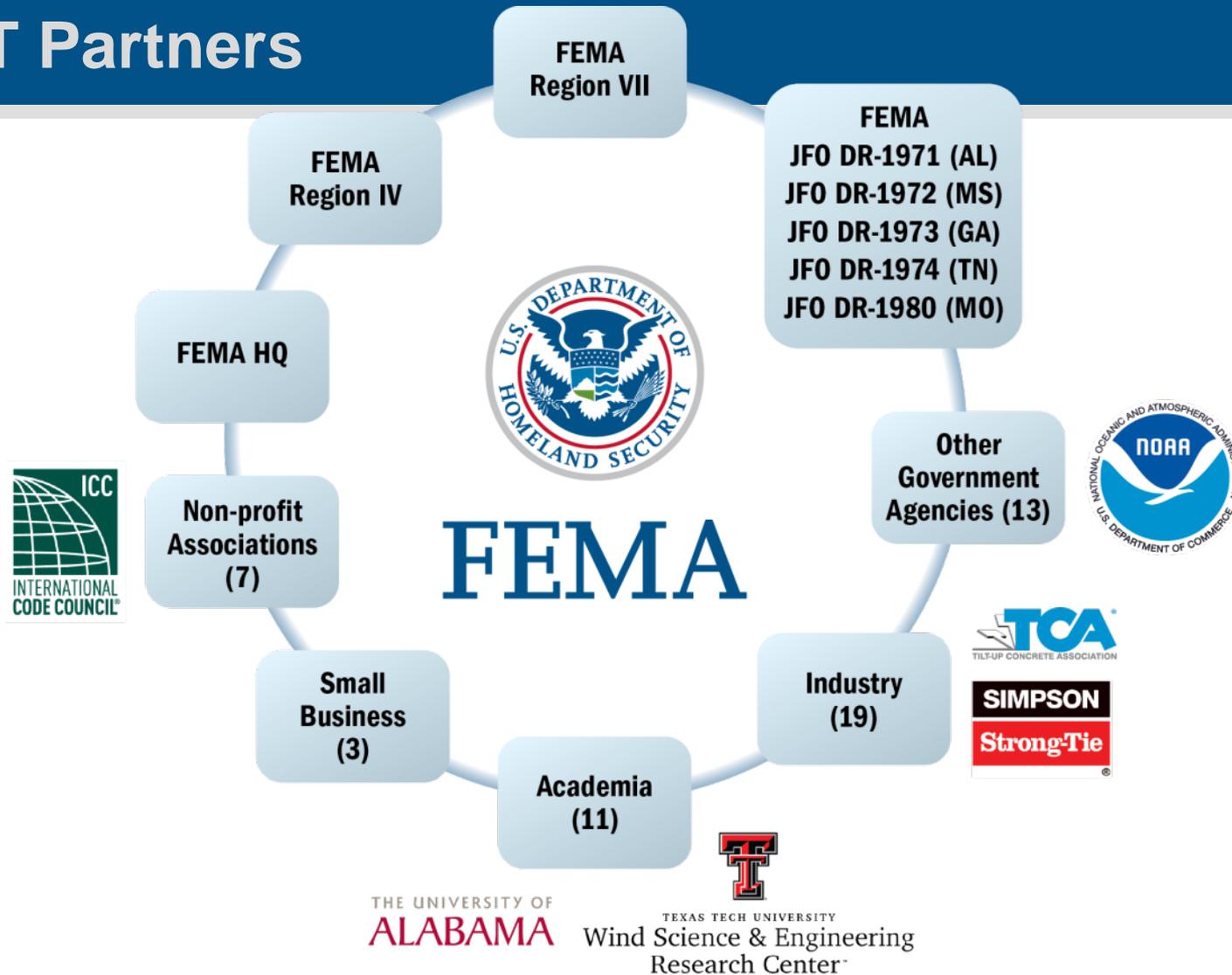
**DR -1971**  
**Alabama**  
awarded grants  
for 2937 private  
and 109 public  
saferooms

# Sites Visited by the MAT





# MAT Partners

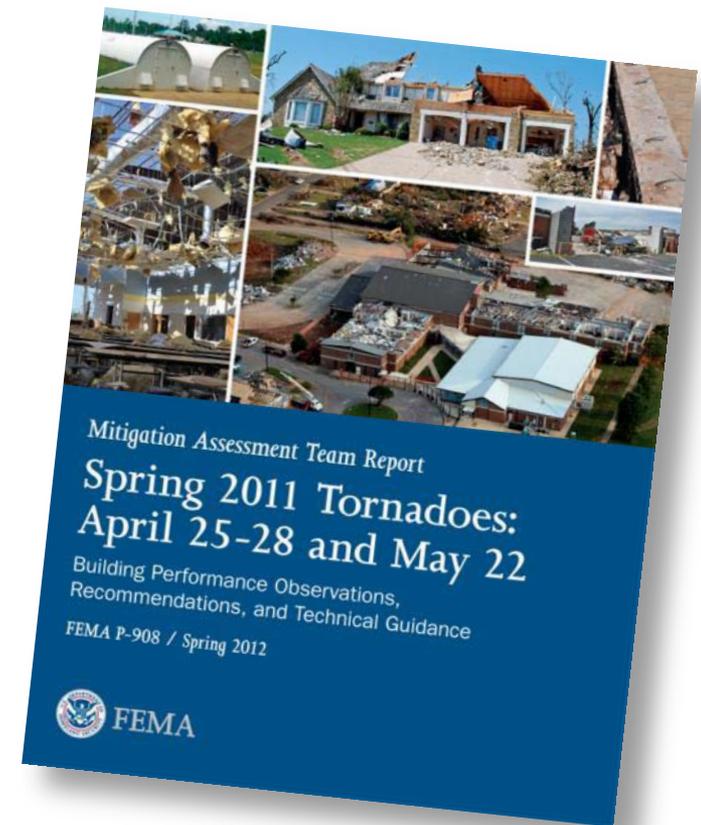


Numbers represent organizations or other agencies, including team members, reviewers, and other acknowledged parties

# Key Recommendations

Observations → Conclusions → Recommendations

- 3. Design and Construction Considerations
- 4. Residential Buildings
- 5. Commercial and Industrial Buildings
- 6 & 7. Schools & Critical Facilities
- 8. Infrastructure
- 9. Sheltering & Safe Rooms
- App F. Recovery Advisories
- App G. One- and Two-Family Residences



# Residential Buildings: Above-Code Best Practices



**Conclusion:** Voluntary implementation of better design and construction practices could mitigate damage

**Recommendation:** Implement voluntary best practices to mitigate damage to one- and two-family residential buildings

Reference MAT Report Appendix G

# Commercial and Industrial Buildings: Long Spans and Large Footprints



## **Conclusion:**

Current codes and standards are insufficient to manage building performance in wind overload events

## **Recommendations:**

Change risk category for large-footprint commercial structures with long-span roofs to Risk Category III in ASCE 7-10

Install a storm shelter or safe room or identify best available refuge areas in large-footprint buildings

# Schools: Code Requirements



**Conclusion:** IBC-compliant facilities can be susceptible to building damage

**Recommendation:** Propose IBC code change to require FEMA 361 or ICC 500-compliant safe room/storm shelter in new K-12 schools in areas where shelter design wind speed is 250mph

# Other Critical Facilities: Code Requirements



**Conclusion:** IBC-compliant facilities can be susceptible to building damage

**Recommendation:** Propose IBC code change to require FEMA 361 or ICC 500-compliant safe room/storm shelter in new critical facilities



# Refuge and Safe Rooms: Usage



## Conclusions:

People traveled excessive distances to community shelters and safe rooms

Guidance for identifying how to communicate where community-wide protection is lacking

## Recommendations:

Research travel time to, and use of, safe rooms and storm shelters

Locate safe rooms or storm shelters close to people who will use them

# Refuge and Safe Rooms: Labeling and Signage



**Conclusion:** There is a lack of proper labeling and signage for areas where people seek refuge from tornadoes

**Recommendation:** Submit proposal for code change to IBC regarding identification of best available refuge areas

# Refuge and Safe Rooms: Vulnerability



## Conclusion:

Tornado refuge areas located in large, single-story buildings performed poorly

## Recommendations:

Identify best available refuge areas  
Perform vulnerability assessments

# Recommendation Summary

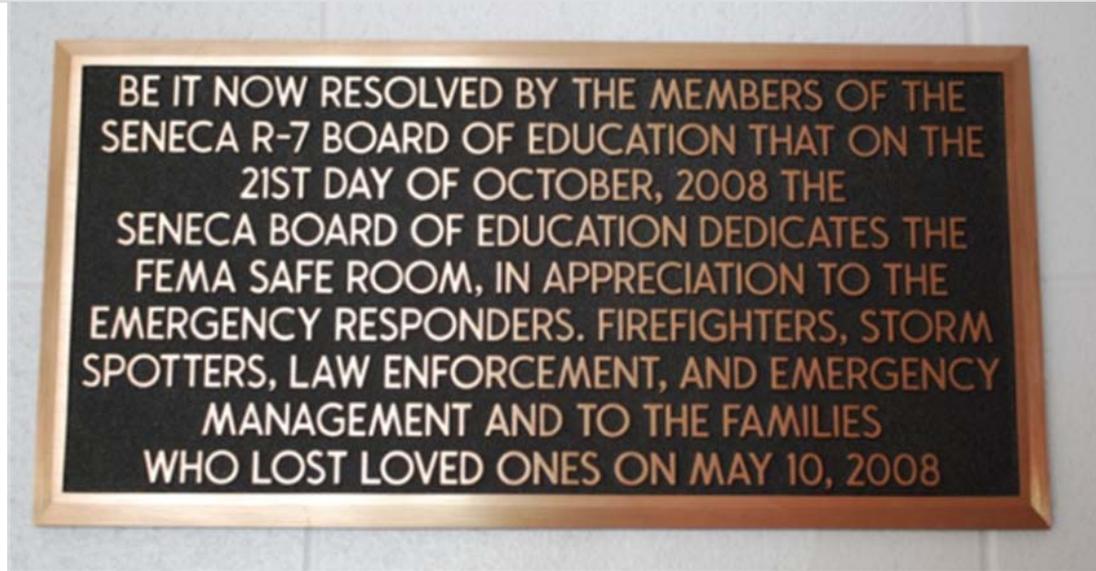
Topic	49 Total Recommendations
Codes and Standards	14
Residential Construction	1
Commercial and Industrial Buildings	9
Critical Facilities	5
Infrastructure Facilities	4
Tornado Refuge Areas, Hardened Areas, and Safe Rooms	8
EF Scale	5
Post-Tornado Imagery	3

# Putting results into action:

- Recovery advisories
- Training
- Summit
- Video
- Interviews
- Models
- Codes advocacy
- Structures Congress
- Peer reviewed journal articles
- FEMA Administrator's Award



# Key Successes



ICC 500 compliant shelters in **school facilities with 50 or more occupants** and **all first-responders facilities**

**May 2012: passed the 2015 IBC first public I-code hearing unanimously**

