



# Technical Investigation of the May 22, 2011, Tornado in Joplin, MO

December 10, 2013  
NCST Advisory  
Committee Meeting

## Recommendations

*Joplin Team*

# Recommendations Related to Tornado Hazard Characteristics and Associated Wind Field

# Recommendation 1--

NIST recommends that a capacity be developed and deployed that can measure and characterize actual near-surface tornadic wind fields for use in the engineering design of buildings and infrastructure. This would require enhancement and widespread deployment of advanced technologies, including weather radar.

## Recommendation 2 --

NIST recommends that information gathered and generated from tornado events (such as the Joplin tornado) should be stored in publicly available and easily accessible databases to aid in the improvement of tornado hazard characterization.

## Recommendation 3 --

NIST recommends that tornado hazard maps for use in the engineering design of buildings and infrastructure be developed considering spatially based estimates of the tornado hazard instead of existing point-based estimates that produce significantly lower tornado probability of occurrence and subsequent risk.

## Recommendation 4 --

NIST recommends that new damage indicators (DIs) be developed for the Enhanced Fujita tornado intensity scale to distinguish between the most intense tornado events. Methodologies used in the development of DIs and associated degrees of damage should be, to the extent possible, scientific in nature with quantifiable results. As new information becomes available, a committee comprised of public and private entities should be formed with the ability to propose, accept, and implement changes to the EF Scale. The improved EF Scale should be adopted by NWS.

# Recommendations Related to the Performance of Buildings, Shelters/Designated Safe Areas, and Lifelines



# Recommendation 5--

NIST recommends that nationally accepted performance-based standards for the tornado-resistant design of buildings and infrastructure be developed in model codes and adopted in local regulations to ensure the resiliency of communities to tornado hazards. The standards should encompass tornado hazard characterization, performance objectives, and evaluation tools. The standards shall require that critical buildings and infrastructure such as hospitals and emergency operations centers are designed so as to remain operational in the event of a tornado.

The standards would:

- Prescribe “tornado-prone areas”
- Specify “design tornadoes”
- Prescribe “building performance objectives”

Tornado Intensities	Performance Objectives			
	Operational	Repairable Occupancy	Life Safe	Collapse Prevention
EF1 (86-110 mph)				
EF2 (111-135 mph)				
EF3 (136-165 mph)				
EF4 (166-200 mph)				
EF5 (> 200 mph)				

- (1) Hardened area, shelter-in-place.
- (2) Public shelter.
- \* Based on ASCE 7-10.

# Recommendation 6--

NIST recommends the development of risk–consistent, performance–based tornado design methodologies to ensure that all building components and systems meet the same performance objectives when subjected to tornado hazards.

# Recommendation 7--

NIST recommends that: (a) model building codes for new buildings require that tornado shelters be designed in accordance with the ICC 500 standard; (b) model building codes develop and adopt a tornado shelter standard specific for existing buildings; and (c) tornado shelters be installed in new and existing multi-family residential buildings, mercantile buildings, and buildings with assembly occupancies located in tornado hazard areas identified in the performance-based standards required by Recommendation 5.

# Recommendation 8--

NIST recommends the development and implementation of uniform national guidelines that enable communities to create the safest and most effective public sheltering strategies. The guidelines should address planning for, siting, designing, installing, and operating public tornado shelters within the community.

# Recommendation 9--

NIST recommends that uniform guidelines be developed and implemented nationwide for conducting tornado risk assessments and designating best available tornado refuge areas as an interim measure within buildings until permanent measures fully consistent with Recommendations 5 and 7 are implemented.

# Recommendation 10--

NIST recommends that aggregate, gravel, or stone be prohibited as roof surfacing material or roof ballast for buildings of any height in tornado-prone areas. that aggregate, gravel, or stone be prohibited as roof surfacing material or roof ballast for buildings of any height in tornado-prone areas.

# Recommendation 11--

NIST recommends that enclosures of egress systems (elevators, exits) in critical facilities in tornado-prone areas be designed to maintain their functional integrity when subjected to tornado hazards.

# Recommendation 12--

NIST recommends that owners and operators of existing critical facilities in tornado-prone areas perform tornado vulnerability assessments and take steps to ensure the functionality of (1) backup power supplies (harden the protection of emergency backup power, as region-wide losses of power due to damage to power transmission infrastructure occur frequently in tornadoes), (2) vertical movement within the building (elevator equipment and shaft enclosures), and (3) means of egress illumination (battery-powered lighting in addition to backup power), in a tornado event.

# **Recommendations Related to the Pattern, Location, and Cause of Fatalities and Injuries, and Associated Performance of Emergency Communications Systems and Public Response**

# Recommendation 13 --

NIST recommends the development of national codes and standards and uniform guidance for clear, consistent, and accurate emergency communications, encompassing alerts and warnings, to ensure safe, effective, and timely responses among individuals, organizations, and communities in the path of storms having the potential to create tornadoes.

NIST also recommends that emergency managers, the NWS, and the media develop a joint plan and take steps to ensure that accurate and consistent emergency alert and warning information is communicated in a timely manner to enhance the situational awareness of community residents, visitors, and emergency responders affected by an event.

# Recommendation 14 --

NIST recommends that the full range of current and next-generation emergency communication “push” technologies (e.g., GPS-based mobile alerts and warnings, reverse 9-1-1, outdoor siren systems with voice communication, NOAA weather radios) be widely deployed and utilized, to maximize each individual’s opportunity to receive emergency information and respond safely, effectively, and in a timely fashion.

# Recommendation 15 --

NIST recommends research to identify the factors that will significantly enhance public perception of personal risk and how such knowledge can be better used to rapidly and effectively respond during tornadic events.

# Recommendation 16 --

NIST recommends that tornado threat information be provided to emergency managers, policy officials, and the media on a spatially resolved real-time basis by frequently updating gridded probabilistic hazard information that is merged with other GIS information to supplement the currently deployed binary warn/no warn system.