Summary of Progress on Implementation of Recommendations from the Joplin Tornado Investigation

August 30, 2018
NCST Advisory Committee Meeting

NOTE – Summaries of the recommendations are included in the following slides for context. The complete recommendations are available in the final report of the NIST Technical Investigation of the Joplin Tornado, at https://dx.doi.org/10.6028/NIST.NCSTAR.3

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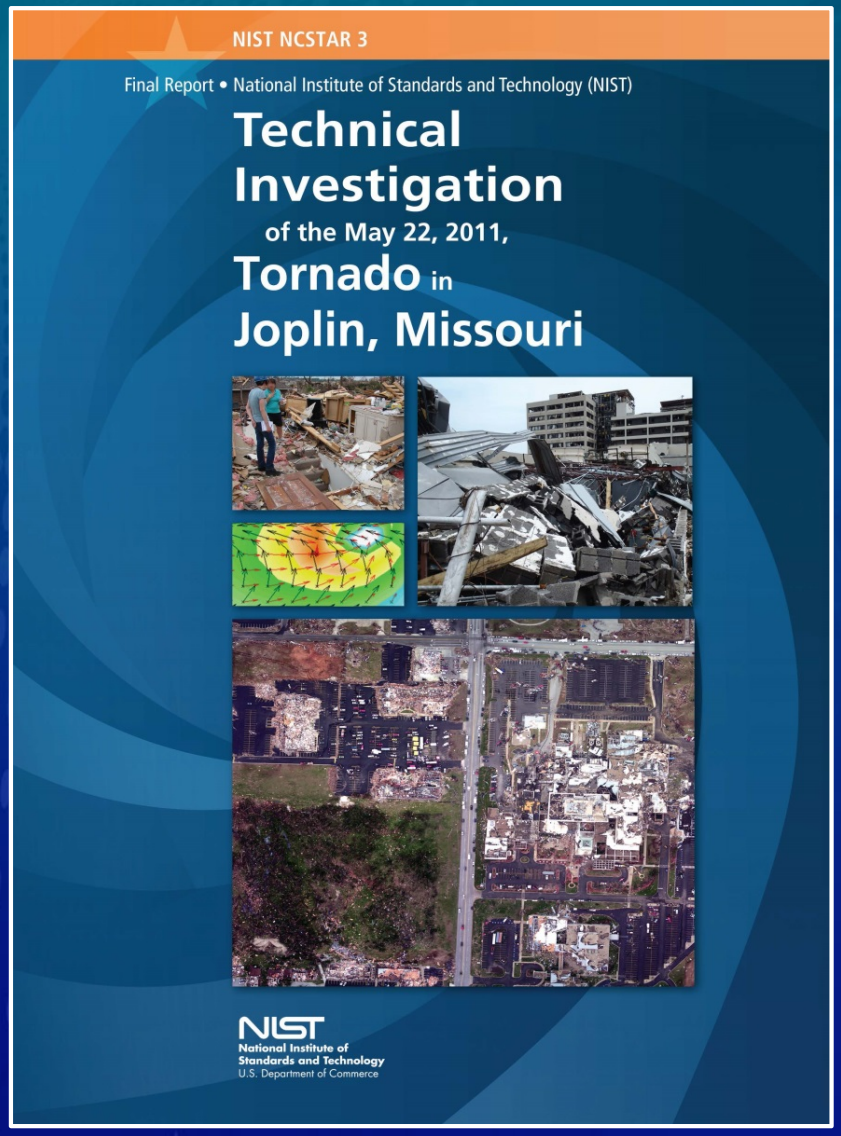
NIST Joplin Tornado Investigation



The first study to include storm characteristics, building performance, emergency communication and human behavior - with assessment of the impact of each on fatalities

- **16 recommendations for improving:**
  - Tornado hazard characterization
  - How buildings and shelters are designed and constructed in tornado–prone regions
  - Emergency communications that warn of threats from tornadoes.

http://dx.doi.org/10.6028/NIST.NCSTAR.3

List of Joplin Recommendations

	R #	RECOMMENDATION SUMMARY
Hazard Characteristics	1	Development and deployment of technology to measure tornado wind fields
	2	Archival of tornado event data
	3	Development of tornado hazard maps
	4	Improvement of EF Scale; means for continued improvement; adoption by NWS
Buildings, Shelters, Designated Safe Areas, and Lifelines	5	Development of performance-based standards for tornado-resistant design
	6	Development of performance-based tornado design methodologies
	7	a) Development of tornado shelter standard for existing buildings; b) Installation of tornado shelters in more buildings in tornado-prone regions
	8	Development of guidelines for public tornado sheltering strategies
	9	Development of guidelines for selection of best available refuge areas
	10	Prohibition of aggregate roof coverings and ballast in tornado-prone regions
	11	Development of requirements for enclosures of egress systems in critical facilities
	12	a) Development of tornado vulnerability assessment guidelines for critical facilities; b) Performance of vulnerability assessments by critical facilities in tornado-prone
Emergency Communication	13	Development of codes, standards, and guidance for emergency communications; Development of joint plan by emergency mgrs/media/nws for consistent alerts
	14	Deployment of “push” technologies for transmission of emergency information
	15	Research to identify factors to enhance public perception of personal risk
	16	Develop technology for real-time, spatially-resolved tornado threat information

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Highlights of Implementation Activities and Successes since 2/18 Meeting

- ASCE/SEI/AMS Standard on Wind Speed Estimation in Tornadoes and Other Windstorms Standard Committee is well into subcommittee balloting of draft chapters (R2 and R4)
- Continued significant progress on development of tornado hazard maps, with workshop to roll out of draft maps planned for January 15, 2019 (R3)
- NIST is leading the new ASCE Tornado Task Committee charged with developing tornado load provisions for ASCE 7-22 (R5 and R6)
- Published NIST Technical Note on alerting guidance (R13)
- Proposed incorporation of guidance on public alerts and warnings into NFPA 1600 (R13)

R&D Project on Tornado Loading (1/2)

Award under NIST Disaster Resilience Research Grants Program[1], announced August 2017, is informing development of wind load design methods.

Development of Tornado Design Criteria for Buildings and Shelters Subject to Tornado Induced Loads (ARA, Inc.)

- Experimental and modeling research to develop tornado loading criteria
- Experimental work uses the University of Western Ontario's atmospheric boundary layer wind tunnel to study effect of tornado vertical wind and Tornado Simulator to study effect of tornado size relative to building size and atmospheric pressure change (APC) on internal wind pressures.
- Modeling work aims to capture key insights on tornado-induced pressures (including APC) and to develop (1) fragilities that relate tornado wind speed to the probability of damage and (2) recommended loads for tornado-resistant design.

[1] https://www.nist.gov/news-events/news/2017/08/nist-funds-12-projects-make-communities-more-resilient-disasters

R&D Project on Tornado Loading (2/2)

- Wind tunnel and tornado simulator experiments completed
- Analysis of data is underway to
  - Validate and update tornado wind load model
  - Develop fragility models
  - Perform sensitivity studies
  - Develop recommendations for estimation of tornado loads