

DEVELOPMENT OF A RESIDENTIAL TORNADO DAMAGE DATABASE

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Analysis of building damage data from past tornadoes could be very useful in understanding the influence of specific building and tornado characteristics on building performance. Once better understood, this analysis could lead to significant improvements in the damage-based Enhanced Fujita (EF) Scale and help mitigate future damage through building designs that address vulnerabilities identified through such research. The May 22, 2011 tornado in Joplin, MO was chosen to create a detailed database documenting the pre-tornado building characteristics and post-tornado observed damage to single family residential structures. Several research teams collected data, including Texas Tech University (TTU) and the National Institute of Standards and Technology (NIST), yielding a significant amount of ground-based and aerial imagery for this event. A wind field model of the tornado based on tree fall patterns was developed at NIST and enhanced at the University of Illinois and Urbana-Champaign (UIUC). This model provides an independent estimate of wind speeds throughout most of Joplin.

The database was constructed in Microsoft Access and populated with information from multiple sources of imagery taken before and after the tornado. Pre-storm building geometry was obtained using Google and Pictometry aerial overhead imagery, Pictometry oblique imagery, and Google Street View. Post-storm conditions were assessed using Surdex aerial overhead imagery and TTU drive-by photos. Certain characteristics of the residential structures and tornado were collected to be analyzed for their influence on the building performance. Building characteristics include roof shape and roof slope; the presence of dormers, porches, decks, attached garages or integrated carports; the number of stories; building plan shape; siding materials; and other architectural features. Also included in the database is tax assessor data such as year built and square footage. Tornado characteristics from the wind field model include time histories of peak wind speed and wind direction. The database currently has information on about 3,000 residential structures, out of the approximately 7,500 that were damaged or destroyed. A publication describing the methodology used to construct the database is nearing completion, and the database itself will be published for public use once data entry for the Joplin tornado and the associated quality assurance is completed.

Preliminary analysis has led to the development of empirical fragility curves for the probability of exceeding the Degree of Damage (DOD) levels for the EF Scale Damage Indicator (DI) for one- and two-family residential structures. Investigation of differences in performance associated with specific building characteristics (e.g., 1-story vs 2-story homes) is just beginning.