



Federal Emergency Management Agency

Fact Sheet



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THE MAY 3, 1999, OKLAHOMA CITY/KANSAS TORNADOES REPORT

On the evening of May 3, 1999, an outbreak of tornadoes tore through parts of Oklahoma and Kansas, leveling entire neighborhoods. Within days, the Federal Emergency Management Agency (FEMA) deployed its Building Performance Assessment Team composed of wind and structural engineers, civil engineers, forensic engineers and architects to assess damage caused by the tornadoes.

The team's task was to evaluate the performance of buildings affected by the tornadoes and to identify successes and failures for buildings directly hit by vortex, those affected by winds near but outside of vortex and those affected by winds on periphery of the tornado path. Their goal was to determine if the damage to residential and non-residential buildings was preventable.

Residential Structures

The team saw significant damage to hundreds of single-family homes, multi-family housing and manufactured homes. They saw building failures that resulted from wind-borne debris and high winds that often produced forces on buildings not designed to withstand such forces. They also saw building failures that resulted from improper construction techniques, poor selection of construction materials and ineffective detailing of connections.

The team concluded that damage to residential structures, in some cases, could have been reduced or avoided if newer building codes and engineering standards that provided better guidance for high wind events had been adopted, followed and enforced. Many building failures could have been avoided with better construction techniques, better building materials and the effective use of connections.

Non-Residential Structures

Non-residential structures were found to be vulnerable to the same types of damages as conventionally built residential construction – failure of connections, roofs lifting up and walls collapsing. However, compared to residential buildings, the damage typically was not as complete or devastating.

The team concluded this probably resulted from the different construction methods and degree of engineering that is required by model building codes for non-residential buildings, and typically is not required for one and two family residential buildings.

Manufactured Housing

In general, manufactured housing did not resist wind forces as well as conventional site-built detached single-family dwellings for inflow winds of violent and strong tornadoes and vortex winds from all tornadoes. This primarily was because of inadequate resistance to uplift and overturning provided by anchorage and tie-downs used in the foundations.

However, the team found that the newer manufactured homes performed better than older models, especially the double-wide models installed on permanent foundations.

More information is available on FEMA's For the Media site, at www.fema.gov/media, and Fax-on-Demand at (202) 646-FEMA. For information on Project Impact: Building Disaster Resistant Communities, go to www.fema.gov/impact. Radio actualities are available from the FEMA Radio Network (1-800-323-5248).