



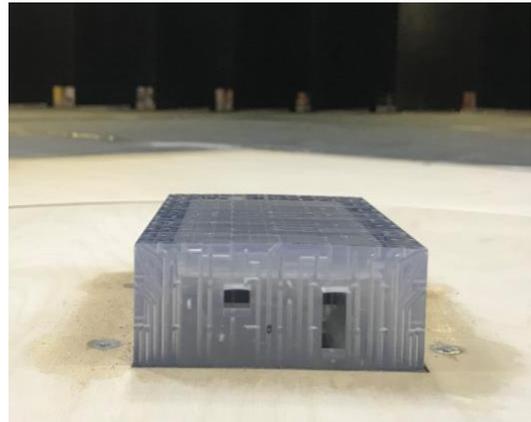
Tornadic Loading on Low-Rise Buildings

By: Delong Zuo

Tornadoes are among the most devastating natural hazards, and their impact on society has not subsided even with today's rapid advancements in science and technology. As evidenced by the aftermaths of the 2011 Joplin tornado and the 2013 Moore tornado, these storms leave behind long trails of destruction, large numbers of fatalities and traumatic effects that often take the affected communities years to recover from. Indeed, according to the Storm Events Database of the National Oceanic and Atmospheric Administration (NOAA),

tornadoes are responsible for nearly 900 fatalities and more than \$19B of property damage in the U.S. in the past decade alone.

Most of the life and property losses caused by tornadoes can be directly or indirectly attributed to failures of low-rise buildings such as residential houses. This result is primarily because our understanding of tornadic loading on this type of structure remains limited and, as a result, most low-rise buildings are not designed for tornadoes. At the National Wind Institute, we're using both experimental and numerical approaches to study tornadoes and their loading on low-rise buildings. With a grant from the National Science Foundation ([CMMI-1663363](#)), we are currently working to study the difference between the loading on low-rise buildings caused by tornadoes relative to other wind storms such as hurricanes. This study utilizes data from experiments in VORTECH, one of the world's largest tornado simulators, as well as the wind tunnel at the University of Florida, to better understand the critical factors that influence the loading by these two types of wind. In another National Science Foundation supported study ([CMMI-1763109](#)), we are collaborating with a research team at University of Arkansas to validate numerical simulations with data from experiments in VORTECH and use the validated simulations to study tornadic loading on low-rise buildings.



A low-rise building model installed in VORTECH for testing.

The studies of tornadic loading on low-rise buildings at NWI will enable more accurate assessment of the performance of low-rise buildings exposed to tornado hazards. As the results are integrated into building codes and standards, the understanding from these studies will help improve the safety and performance of low-rise buildings and significantly contribute to the reduction of windstorm impact on society.

About the Author



Delong Zuo is an Associate Professor of Civil Engineering and the Technical Director of Wind Engineering at the National Wind Institute. Dr. Zuo has developed an internationally recognized research program that utilizes analytical, numerical, and experimental approaches to understand wind and its interaction with structures. He particularly specializes in the study of wind-induced vibration of slender structures and its control, as well as tornadic loading of buildings and other structures.