Using overpasses as shelter from tornado?

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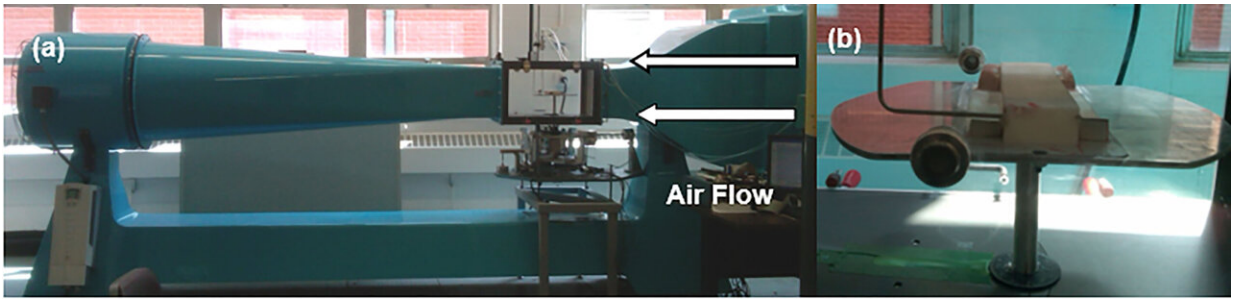

The wind tunnel and scaled model of the overpass. Credit: Alex Ensign

Meteorologists and emergency workers continue to contest the popular thinking that waiting out a tornado under an overpass is safe. According to the National Weather Service, doing so could actually increase the risk of death, in part because the wind from a tornado is thought to accelerate as it flows under the overpass, in what's known as the wind tunnel effect.

However, few experimental studies show exactly how this acceleration takes place or if it takes place at all. In *Physics of Fluids* researchers from the University of Rhode Island found no evidence of such acceleration.

"In our research, there is no one finding that would suggest one should or should not use an overpass for protection from a tornado as a last-resort shelter area," co-author D.M.L. Meyer said.

The researchers examined the pressure, velocity, and force fields of tornado-strength winds surrounding an overpass. Experiments were performed in a standard wind tunnel using a scaled geometry of an overpass. A large fan was used to draw air through the tunnel at a top speed of about 130 miles per hour.

The researchers found no wind tunnel effect in their experiments.

"However, that doesn't mean the effect doesn't take place at all, just not in the locations we focused on," Meyer said. "More data and analyses are needed to determine how complex tornado-strength winds interact with the environment underneath an overpass, and our paper provides a start."

An overpass may be a dangerous place for shelter regardless. Wind may not decelerate, depending on the location, and flying debris may reach areas of the overpass that appear to be protected from the wind.

The researchers studied four locations: immediately above the overpass, immediately below it, between the I-beams, and the center of the travel lane under the overpass. Velocity and dynamic pressure measurements were obtained independently at each location as the overpass was rotated 0-90 degrees at 10-degree increments about its vertical axis. Lift and drag forces were also measured.

Wind tunneling can be explained using a garden hose. Water traveling through the hose flows at a constant flowrate, because the diameter is constant throughout the hose length. Place a thumb partially over the hose opening, and the flow constricts, accelerating the water due to the smaller cross-section. This causes the water to spurt further than without the thumb.

More information: D.M.L. Meyer et al, Tornado-strength winds interacting with a highway overpass, *Physics of Fluids* (2021). DOI:

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