Transportation's Vulnerability to Weather Extremes

By Ann Drumm and Dr. Yekang Ko

Traffic jams, road closings, airport delays, iced light rail power lines – we tolerate these inconveniences as inherent in a complex transportation system. But what if changing weather makes such disruptions more frequent and costly? How do we think about transportation planning in a context of weather extremes?

Our vast network of roads, growing rail system, and airports are critical engines of the regional economy. But a new assessment of weather-related vulnerabilities of this infrastructure points to an increasing risk of damage and disruption.

The report was prepared as part of a federal pilot study of the vulnerability of transportation assets to weather extremes. Researchers projected climate trends for the area; identified critical roads, rails and airports; and evaluated their vulnerabilities to 100-year floods, increased heat, and drier soil.

Their conclusion is that public safety, protection of taxpayer investments, and the region's economic health demand that transportation planning include better evaluation of weather-related risks and identification of responses.

Cities tend to be warmer than surrounding rural areas because of the urban heat island effect. Because cities both make their own heat and absorb the sun's heat, projections of atmospheric warming actually understate the amount of heat stress that cities will experience in coming decades.

The report assumes the "business as usual" trend of atmospheric warming and projects an August mean temperature of 92° F in DFW by mid-century and a maximum temperature of 120° F. Compare that to the summer of 2011, when we suffered for weeks under triple-digit temperatures reaching 110° F.

Even if the world avoids the worst-case scenario and pushes the warming trend line downward, we need to understand the projections for North Texas and implications for transportation infrastructure.

The dangers of extreme heat on roads include pavement failure, wildfires along highways, heat-induced stress on bridges, and heat-related accidents resulting from vehicle breakdowns and heat-related driver stress. On railroads, extreme heat causes bucking of rails, switches and signal failures and sagging of power lines. Airports can experience heat buckling of runways, and airplanes may not be able to get sufficient lift to take off. All transportation vehicles will struggle to maintain cooling systems.

Many miles of existing and planned roads and rails lie in 100-year flood zones. Predicted increases in intensity and frequency of flooding, erosion and runoff threaten infrastructure both within and adjacent to those zones. Flooding can cause both operational and structural problems, affect emergency response, and force closures for extended periods of time.

All of these stresses have potential to decrease the lifespans of roadways, rails, and runways, substantially increasing maintenance and replacement costs.

Engineering guidelines for transportation infrastructure must reflect the risks of extreme weather. We need to improve the monitoring of weather-related stresses on infrastructure, enhance maintenance, incorporate the increased costs into project planning, and protect public safety.

The study is a first step in developing adaptation strategies that ensure access and mobility in the DFW region while also considering economic, social, and environmental needs. More work is needed for a comprehensive assessment of regional transportation vulnerability.

The report is “Climate Change/Extreme Weather Vulnerability and Risk Assessment for Transportation Infrastructure in Dallas and Tarrant Counties.” Dr. Arne Winguth of the University of Texas at Arlington led the team with the North Central Texas Council of Governments, the Dallas Public Works Department, and the Fort Worth Transit Authority. Find it at www.uta.edu.

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