New study assesses risks of extreme weather to North Texas roads, runways

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UT Arlington Earth and Environmental Sciences Professor Arne Winguth serves as lead author on the study. Credit: UT Arlington

A new study by researchers at The University of Texas at Arlington

finds a high likelihood that extreme storms and higher precipitation will lead to transportation disruption and widespread damage to roads, railways and airport runways in the Dallas-Fort Worth region by the end of the 21st century.

The assessment found the risks to transportation infrastructure from storms are more likely to happen during the spring season. Researchers found a higher likelihood of heat-related risks for infrastructure, particularly during the summer season.

Arne Winguth, associate professor of earth and environmental sciences at UT Arlington, served as lead author of the study, "Climate Change/Extreme Weather Vulnerability and Risk Assessment for Transportation Infrastructure in Dallas and Tarrant Counties." The report was submitted in March to the North Central Texas Council of Governments, an association of counties, cities, school districts and special districts in a 16-county area which assists local governments in planning for common needs, cooperating for mutual benefit, and coordinating for sound regional development.

The Federal Highway Administration funded the 10-month study as a Type I Vulnerability Assessment Pilot study.

"The Federal Highway Administration wanted the study because this area is vulnerable to extreme weather," Winguth said. "Assessing future weather-related infrastructure disruption is important for developing adaptation strategies and prioritizing transportation planning efforts."

The report addressed three major points:

- It provided a compilation of historical climate data and projected future climate information for the Dallas-Fort Worth Metropolitan area, in order to assess the impact of climate

change.
- It provided an aggregate of existing infrastructure of the Dallas-Fort Worth area, together with flood maps, and ranked the importance of infrastructure assets using normalized traffic density maps from various sources.
- It evaluated the vulnerability of the area's transportation infrastructure to extreme weather and climate change, utilizing a vulnerability assessment matrix to estimate the likelihood of hazards and the magnitude of adverse consequences.

Winguth compiled weather and climate data from 1900 to 2010 to interpret historical trends in extremes and variability in temperature and precipitation. Climate prediction data suggests extreme temperatures of up to 125 degrees by the year 2100. The record high temperature for the Dallas-Fort Worth area is 113 degrees, set in 1980. A decrease in soil moisture and an increase in the length and severity of droughts in the region are also predicted for the coming decades. In addition, an increase in the likelihood of severe thunderstorms in the spring and tropical storm systems in the fall will lead to a higher risk of flooding.

"All of the fluctuations could lead to an increase in the type of infrastructure damage already familiar to anyone who drives on area roads - more cracks and potholes, even buckling and melting of asphalt roadways in extreme heat, and more wildfires. Large quantities of infrastructure are located in flood-prone areas," Winguth said.

The study team compiled an inventory of existing and future transportation infrastructure and ranked their importance of certain assets according to their capacity-based necessity. According to NCTCOG's Mobility 2035 Plan, which was amended in 2013, the population of the Dallas-Fort Worth region is expected to grow by 45 percent, from 6.7 million to 9.8 million, between 2013 and 2035. Vehicle miles traveled are expected to grow by 55 percent, from 181

million to 281 million. These factors will necessitate increases in infrastructure capacity and maintenance.

Passenger rail and airport travel also will be affected by climate change and severe weather. Researchers said railroad track and airport runways are subject to deterioration and buckling, while greater air density caused by extremely high temperatures can necessitate longer runways for aircraft takeoffs and landings.

Jeffrey Neal, program director for the Congestion Management and Innovative Project Delivery Team with NCTCOG, said the study is a valuable tool that will help administrators better understand how climate change and severe weather will affect the region's road, rail and air travel infrastructure in coming years.

"We knew the study would show the likelihood of substantial temperature increases, but the scale of the increases was particularly striking," Neal said. "We're the fastest-growing metropolitan area in the country, and the resources available from the federal government for infrastructure construction are going to continue to be limited. We're going to have to focus on maintenance of the existing systems, and this study will help us as we look for ways to build up our asset management program."

Winguth said that the report is a good start in addressing the need to weigh the effects of climate change and extreme weather on transportation infrastructure, but added that more in-depth study is needed.

"Future investigations are required for a more accurate assessment of asset vulnerability that can fully incorporate regionally relevant exposure, sensitivity and adaptive capacity measures," he said. "This will be necessary to determine exclusive risks and impacts for individual

facilities, identify potential mitigation strategies, and set action priorities through comparison of features with other needed projects."

Asset vulnerability relates to infrastructure that is adapted to climate change and extreme weather, such as the use of building materials designed for extreme temperature or higher elevated roads to prevent flooding.

The assessment team included members of the North Central Texas Council of Governments, the Fort Worth Transportation Authority, the City of Dallas Public Works Department, as well as Jun Hak Lee, a UT Arlington adjunct research professor in the UT Arlington Department of Earth and Environmental Sciences, and Yekang Ko, a UT Arlington assistant professor in the School of Urban and Public Affairs.

Provided by University of Texas at Arlington