CENTER FOR TRANSPORTATION RESEARCH

PROJECT SUMMARY

Texas Department of Transportation

0-6850: Texas Transportation Planning for Future Renewable Energy Projects

Background

Renewable energy production facilities in Texas will significantly increase. Constructing wind farms requires the transport of wind turbine components, which will increase loads on rural roads and bridges not typically designed for such loads, resulting in a greater burden on the transportation infrastructure in Texas.

Given the upward trend in wind energy production, the Texas Department of Transportation (TxDOT) is planning for the impacts of renewable energy projects on roads while facilitating the development of renewable projects in and around Texas. The research team created an operational planning tool that can be used to propose routes for wind turbine components traveling along Texas roads, to develop recommendations for planning construction of new wind farms, and to create maintenance strategies for the roads.

What the Researchers Did

- Mapped existing and under-construction wind farms and estimated the number of new wind farms that will be constructed in Texas each year through 2025.
- Identified the main manufacturers of wind turbine components that have delivery points in Texas and surveyed component transporters about their needs in relation to load size/weight and route.
- Reviewed all the parameters used by TxDOT for routing oversize and overweight loads, and revisited those parameters for the special case of wind turbine components.
- Searched the literature for models and empirical relations between pavement damage and the characteristics and dimensions of loads and trucks.
- Created a TransCAD network using four different datasets: a map of the Texas road system, bridge characteristics (height and weight limitations), critical vertical clearance data for signboards, and pavement characteristics.
- Developed a transCAD add-in that, given the size and weight of a truck and its load for any of the wind turbine components, generates the optimal route for a desired origin and destination pair, and checks restrictions due to bridge clearances and postings. The criteria to decide the best route must be defined by the user and can include any of the following options or combinations: total travel distance, number of turns, and potential pavement damage.
- Identified and delivered a list of the optimal routes for the wind turbines (minimizing both potential for road damage and driver delay)

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for the whole state from 2016 to 2025 (using the predicted amount of energy that will be installed in Texas), the tool, and detailed knowledge of the wind energy production industry and related supply chain.
- Developed and used a set of "what-if" scenarios to propose changes in Texas road infrastructure and to study in detail potential new trends in the wind energy industry.
- Conducted a workshop with TxDOT personnel to present the tool and related methodology.

What They Found

- Texas will see a significant increase in wind energy production facilities. The Panhandle will have the largest increase, and among the areas where wind turbines will be installed, West Texas the smallest increase. Central Texas and North Texas are other areas with a relevant amount of wind energy installed in future years.
- Transportation of long and wide turbine blades is difficult around turns, through narrow passages, and under overhead obstructions on roads and railways. Additionally, companies face regulatory challenges, shortages of specialized drivers, and new challenges due to the increasing size of wind turbine components.
- Wind turbine components are shipped from out-of-state (Arkansas, Louisiana, New Mexico, and Oklahoma), through ports (Houston, Galveston, Corpus Christi, Freeport, and Beaumont), and from in-state production facilities (Coleman and Fort Worth). The total Texas area can be subdivided into 19 smaller zones based on possible trip origins (ports of entry and equipment manufacturers) and possible trip destinations (based on current installations and predictions).
- The researchers identified ten main routes across Texas that trucks will use to transport the wind turbine components needed to satisfy demand and identified the most important sections of highways for the route plan.
- The researchers identified infrastructure that could be modified to improve the transportation planning of the wind turbine components.

What This Means

The tool and related methodology contribute in two ways: (1) improving route planning not only for distance but also for number of turns and pavement damage, and (2) extending beyond route planning to collectively represent a multi-faceted planning system that can predict what transportation infrastructure will be needed, based on systematically researched predictions of wind energy growth. The methodology and associated tool can be used by shippers that want to create the best routes for their needs and preferences, by transportation agencies looking to strategize infrastructure repair and construction, and by any public or private entity wanting to optimize planning of wind energy projects at the statewide level.

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