

UTC Project Information	
Project Title	MPC-387 – Comprehensive GIS-Based Rural Regional Transportation Planning Models
University	North Dakota State University
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Agency ID or Contract Number	DTRT12-G-UTC08
Project Cost	\$300,000
Start and End Dates	January 1, 2012 – December 31, 2014
Project Duration	3 Years
Brief Description of Research Project	<p>Research Needs</p> <p>The provision of a cost-effective high-performance transportation infrastructure and efficient freight transportation network to support continued energy development is essential to economic performance and energy independence. However, proactive asset management and optimal lifecycle costs can only be achieved if the locations of energy production and impacted routes can be forecast 15 to 20 years into the future based on drilling phases and time-varying production intensities. Well output is variable, building to a peak during the first five years and flattening afterward. Inputs to the oil industry (especially sand and fresh water used in shale fracturing) and undesirable outputs (such as saltwater) must also be modeled, including the locations and potential quantities of water and sand suppliers and saltwater disposals sites. The sustainability of water supplies and access to future water resources is a key issue that may constrain future production. While time series traffic counts are useful, they lag production growth curves during the early phases of energy production. Moreover, in the case of oil production,</p>

truck counts collected during the early phases tend to over-predict future traffic on certain routes, potentially resulting in inefficient investments.

For these reasons, a comprehensive Geographic Information System (GIS) is necessary to accurately forecast future production levels and predict the routes trucks will take to and from wells. Such a model must include origins and destinations for both inbound and outbound movements. Inbound movements include origins for freshwater at aquifer or river locations, sand from rail trans-load facilities, pipe and supplier from cities and rail trans-load sites, and rig specific movements from well site to well site. Outbound movements include time-phased movements from producing wells to rail and pipeline trans-load facilities. Moreover, as oil development densities increase in certain areas, above ground small diameter pipelines are constructed to minimize the transportation cost of crude oil to major pipeline collection points and saltwater to disposal wells. For these reasons, the model must be fully multimodal with detailed levels of resolution. Because of recent advances in CUBE and its transportation modeling, rural regional transportation models can be developed that are much more disaggregate and specific in nature than existing models based on aggregate transportation analysis zones. An outcome of this project will be a CUBE-based rural regional transportation planning model modeling energy production locations and intensities at fine geographic levels (i.e., individual land sections and clusters of wells) so that truck, rail and collector pipeline flows and routes can be predicted with unprecedented levels of accuracy on a broad geographic scope.

Moreover, the specialized trucks used in the oil industry today are vastly different from the traditional ones used to transport grain and other commodities produced in rural regions. Oilfield pavements were initially designed without knowing the results of the oil boom with sudden increases of oil daily production in North Dakota from 150,000 BOPD (barrels of oil per day) in 2009 to almost 500,000 BOPD at 2010. The state's oil boom is bringing unanticipated traffic growth related to increased oil production and population growth. Some parts of the region's population base increased by an estimated 13% from 2009 to 2010 (Ryan-Holeywell, 2011), causing growth-related issues in the region, including shortages of housing and infrastructure needs. Rapid increases in the number of workers and construction activities are exacerbating traffic increases in the region due to building activities and Recreational Vehicle movements.

When too much traffic is transmitted through a road network, congestion occurs. Traffic related to oil work has resulted in congestion-related problems in many areas. With slow-moving trucks traveling narrow, two-lane roads, commuters may be forced to slow down when following trucks (i.e., the time percent following heavy vehicles increases and queues start to build). Moreover, commuters may be delayed as roads undergo frequent maintenance and are reduced to single lanes. For these reasons, the CUBE-based rural regional

	<p>transportation planning models should fully consider the impacts of increased oil traffic's on rural road congestion and maintenance. The outcome of the objective will be a traffic congestion impact model over time that reflects specific production locations.</p> <p>Research Objectives: With these new CUBE-based rural regional transportation planning models, research should address the main objective: to develop CUBE-based transportation planning model to predict truck routes accommodate with traffic congestion conditions for ND rural roads.</p>
Describe Implementation of Research Outcomes (or why not implemented) Place Any Photos Here	
Impacts/Benefits of Implementation (actual, not anticipated)	
Web Links <ul style="list-style-type: none"> • Reports • Project Website 	