UTC Project Information	
Project Title	MPC 459- Comparison between 1993 AASHTO Pavement Design Guide and Mechanistic-Empirical Pavement Design Guide with North Dakota Case Study
University	North Dakota State University
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Project Duration	3 Year
Brief Description of Research Project	The rapid growth of heavy truck traffic in the oil-impacted western counties of North Dakota poses unique challenges to the highway infrastructure of a historically low-volume rural region. Repeated heavy loads, combined with areas of weak subgrade and freeze-thaw cycles, have caused many roads to fail long before their intended design life (Governing, 2011). Oilfield pavement analyses conducted thus far have utilized the empirical design methods outlined in the 1993 AASHTO Guide for Design of Pavement Structures, based on the AASHO Road Test of the late 1950's. While the AASHTO 1993 Guide has proven an important tool for several decades, its empirical approach limits its effectiveness as a modern pavement design method (NCHRP 2004).

	Several studies have claimed that traffic is a controversial parameter in the 1993 AASHTO Guide. The fact that the guide relies on a single value (i.e. ESAL) to represent the overall traffic spectrum is questionable (Schwartz and Carvalho 2007). Zhang et al. (2000) have found that the ESAL, used to quantify damage equivalency in terms of serviceability or even deflections in the 1993 AASHTO Guide, is not enough to represent the complex failure modes of flexible pavements. Today it is widely accepted that load equivalency factor is not a sufficient technique for incorporating mixed traffic into design equations. In addition, the trucks used during the AASHO Road Test were modest in comparison to the trucks utilized in the oil industry today. The models developed and modified from the Road Test relate key pavement properties and traffic to performance but do not consider the range of climatic effects that can also contribute to pavement distress. In addition, the performance index used in the 1993 AASHTO Design Guide relies on an empirical assessment of the overall pavement surface quality. The pavement serviceability index (PSI) is the evaluation users give about the road surface condition, as defined during the AASHO Road Test. PSI cannot be measured and therefore it was correlated to ride quality and other smoothness indices in research done during the period of the mid-1980's to mid-1990's. Currently, distresses measured directly on the pavement surface are more accepted as performance measures. They provide a better representation of failure mechanisms and can be modeled directly using site-specific characteristics. To address some of the limitations of its original design guide, AASHTO in 2004 published the Mechanistic-Empirical Pavement Design Guide (MEPDG). This new design procedure incorporates mechanistic principles, including calculations of pavement stress, strain and deformation responses using site-specific climatic, material, and traffic characteristics. It replaces the 1993 guide's subjective-based performance index, PSI, with objective distress models for various modes of pavement failure and allows calibration of the distress models in order to allow the design method to represent each region's unique conditions. The new guide is a significant departure from traditional pavement design procedures and its implementation requires road agencies to overcome some challenges. However, in the current climate of increasingly urgent infrastructure needs and shrinking funding, it is important for agencies to identify cost effective and structurally adequate pavements that serve stakeholders for their full design life. It is also important for an agency to know, before undertaking a change in design method, whether MEPDG-designed pavements will indeed show performance benefits over their empirically-designed counterparts.

	Research Objectives: Fully understanding the performance and reliability of the new design guide is important for agencies wanting to use it. Moreover, understanding the design differences between the current design guide and the newer MEPDG is critical for agencies interested in making the switch. The primary objective of this project is to provide a critical comparison of performance predictions for pavement designed using the 1993 AASHTO Guide against pavements designed using the new design guide, in order to better assist North Dakota agencies in making the decision whether to switch to MEPDG.
Describe Implementation of Research Outcomes (or why not implemented) Place Any Photos Here	
Impacts/Benefits of Implementation (actual, not anticipated)	

Web Links • Reports • Project Website	