



Project Summary

Texas Department of Transportation

0-6637: Management Science Applications for TxDOT - Scoping Study

Background

Operations Research (OR) and Management Science (MS) make use of applied mathematics so as to aid decision makers in making better, more efficient decisions. Computational advances and the development of improved solution methods have allowed for implementation of increasingly rich and complex models. In spite of these advances, the full range of OR/MS solutions are seldom used in practice; implementation of these techniques have the potential to significantly improve efficiency, reduce costs, and make better use of existing resources.

The objective of this research project was to examine current TxDOT activities in order to determine not only specific opportunities for the implementation of OR/MS techniques, but also develop a systematic way to identify such opportunities in the future.

What the Researchers Did

The research effort undertaken as part of this project focused on a systematic view of the different domains within TxDOT where OR/MS techniques can offer substantial improvements. A hybrid approach was taken to identify such domains, as well as specific applications within. A comprehensive study of TxDOT's operations was undertaken based on existing documentation, which was complemented by a two-part survey of TxDOT personnel regarding issues such as efficiency, resource allocation, and need for analytical research. The two-part survey consisted of an online survey distributed to a list of 67 TxDOT professionals, and a follow-up survey given to a subset of those surveyed meant to focus on specific issues.

Using this approach, the team identified, through both established references and the experienced opinion of TxDOT personnel, both general themes (communication, resource allocation, etc.) and specific applications (right of way acquisition, forecasting staffing needs) where increased efficiencies are needed.

Research Performed by:

Center for Transportation Research (CTR),
The University of Texas at Austin

Texas Transportation Institute (TTI),
The Texas A&M University System

University of Texas at El Paso (UTEP)

Research Supervisor:

S. Travis Waller, CTR

Researchers:

David Fajardo, CTR

Leon Lasdon, CTR

William O'Brien, CTR

Natalia Ruiz-Juri, CTR

Hessam Sadatsafavi, TTI

John Walewski, TTI

Christine Yager, TTI

Carlos Chang, UTEP

Edith Montes, UTEP

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These responses were then classified according to general themes, or functional mappings, which can be considered to be common to a wide range of TxDOT organizational substructures (districts, divisions). These general themes were developed using the group's expertise in OR/MS modeling, and aimed to group and associate applications that share a common set of models and/or methods in the OR/MS literature. These general themes represent potential research avenues that have the potential to have wider impacts across TxDOT.

What They Found

The responses obtained from the online survey and follow-up interviews yielded 7 distinct areas of research, which were consistently identified as exhibiting potential for improvement from OR/MS analysis. The areas of research are: Utility accommodation and right of way acquisition; work load and productivity analysis for forecasting future staffing needs; workload analysis for performance-based compensation; right of way acquisition management; management of design and planning processes; project prioritization for financial allocation; and enhancement of internal communications.

These general areas of research were then refined into research problem statements according to TxDOT's standard format. The goal was to use the common attributed of individual issues to frame research problem statements, which have the potential to address a range or family of issues, thereby increasing the potential impact of the research.

What This Means

The method proposed provides TxDOT with a way to maintain a continued improvement system. Furthermore, the specific research opportunities identified using this method provide a concrete set of research problem statements. These research problem statements can serve as the initial effort of what will hopefully a systematic incorporation of OR/MS techniques, which have the potential to greatly improve TxDOT's decision support system.

For More Information:

Research Engineer - Duncan Stewart, TxDOT, 512-416-4730
Project Director - Ron Hagquist, TxDOT, 512-416-2061
Research Supervisor - S. Travis Waller, CTR, 512-471-4539

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Research and Technology
Implementation Office
P.O. Box 5080
Austin, Texas 78763-5080
512-416-4730

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