Identifying Number MPC-357

Project Title:

Freight Railway Track Maintenance Cost Model

University:

North Dakota State University

Principal Investigators:

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Description of Research Problem:

Track maintenance is critically important to railway performance and safety. In 2008, Class I railroads spent $7.52 billion on track maintenance. For internal purposes, freight railroads use proprietary models to predict track deterioration and maintenance for specific segments. However, many of the publicly available studies are outdated at a time when increased emphasis is being placed on railway investments from a multimodal perspective. For example, the equated mileage factors published by the American Railway Engineering & Maintenance of Way Association (AREMA, 2008)[1] have been an important source of track cost factors. The equated factors allow planners to quickly compare the expected maintenance costs of tracks of different designs (e.g., rail weights), configurations (e.g., number of tracks), and annual densities (e.g., gross tons) under different traffic conditions (e.g., axle loads and unit trains per day).

Although useful the AREMA factors were initially published in 1994. Another publicly-available model is the Speed Factored Gross Tonnage model (SFGT) which has been used in STB cases. However, it was originally developed in 1975. Similarly, the widely used TOPS model was originally developed in 1976.[2]

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[1] See: *Manual for Railway Engineering*, Volume 4 by the American Railway Engineering & Maintenance of Way Association.

[2] *Procedures for Analyzing the Economic Costs of Railway Roadway for Pricing Purposes*. John Williams, et al.,

for TOPS On-Line Service. A Report to the Federal Railroad Administration, U.S. Department of Transportation, Contact No. DOT-FR-30028, June, 1976.

Other studies present the results of track models, but do not show the actual functions or underlying equations, making them unsuitable for publicly-funded projects where the methods must be transparent. The essential purpose of this project is to provide more information about the relative importance of track maintenance cost factors and a publicly available model which would have applicability in sketch planning and in comparing the maintenance costs of various types of track with different traffic conditions.

Research Objectives:

The objectives of the project are to: (1) assess the utilities of existing track models, (2) formulate track maintenance models for freight railways, (3) estimate the model from publicly available data, and (4) publish the models and equations, as well as the results, so they can be used for planning and comparison. The models will be estimated from Class I railway data reported to the Surface Transportation Board over a 25-year period with expenditures averaged over three-year intervals to control for variations in scheduled track maintenance. Maintenance expenditures will be modeled as a function of gross ton-miles, unit train frequency, speed, rail weight, class of track, and other key variables. Appropriate statistical techniques will be used to glean information from the cross-sectional/time-series (panel) dataset. A simple model will be developed that can be applied at a system level. More detailed models will be developed that can be applied in more specific situations when information about rail weights and trains speeds are available.

MPC Critical Issues Addressed by Research: Infrastructure Longevity and Economic Analysis of Investments and Impacts

Contributions/Potential Applications of Research:

The Surface Transportation Board is contemplating a re-estimation of the cost equations underlying the Uniform Railroad Costing System (URCS). Because track maintenance functions yield some of the greatest proportions of fixed cost they strongly affect the percent variable. Most of the models developed in this project will be more complicated than the URCS function. Nevertheless, they will provide background information for URCS redevelopment. In addition, the more detailed models developed in this project will provide capabilities to quickly analyze the relative costs of various types of tracks and traffic conditions, and could potentially be used in benefit-cost analysis of publicly-funded rail projects. Because graduate students will participate in this project it will provide opportunities for future researchers to learn more about railway transportation and develop statistical modeling skills.

Potential Technology Transfer Benefits:

In addition to the report, a worksheet model including the coefficients of the equations will be available from the MPC website.

Time Duration:

July 1, 2010 to June 30, 2011

Total Project Cost:

$118,388

MPC Funds Requested:

$82,500

Source of Matching Funds:

North Dakota State University will match the project through contributed time of the MPC director and other contributed resources.
$35,888