MTC
MIDWEST TRANSPORTATION CONSORTIUM

IOWA STATE UNIVERSITY

Calculating Heavy-Truck VMT

tech transfer summary

RESEARCH PROJECT TITLE
Evaluation of Different Methods to Calculate Heavy-Truck VMT (MTC Project 2002-02)

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Objectives

Evaluate different methods to calculate heavy-truck annual average daily traffic (AADT) which can subsequently be used to estimate vehicle miles traveled (VMT).

Problem Statement

VMT and vehicle classification are vital inputs in the design and operation of an efficient transportation infrastructure system. In particular, heavy-truck VMT is important as the number of heavy vehicles on a road affects traffic operations, safety, and pavement performance. Research has revealed that current methods used in the estimation of heavy-truck VMT are often less accurate than those used for passenger vehicles. Therefore, the goal of this research was to evaluate existing methods used by state DOTs, identify deficiencies, and make recommendations on reducing uncertainties in heavy-truck VMT estimates.

Technique Description

Current heavy-truck AADT estimation methods were evaluated and compared. Although VMT is often the metric of interest, AADT was evaluated for this study since VMT is dependent on AADT estimates and can easily be derived once AADT is estimated.

Traffic data from continuous count stations were used to estimate AADT for two different truck groups (single-unit and multi-unit) using three methods. The first method, the truck expansion factor approach, developed monthly and daily expansion factors for each truck group. Truck AADT was calculated by applying truck expansion factors to short-term counts. The second method, the yearly truck percentage approach, and the third method, the count specific truck percentage approach, created general expansion factors for all vehicles. Truck AADT was calculated by multiplying short-term counts by generic expansion factors and truck percentages. Truck percentages for the second method were based on the annual

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Technique Description continued

percentage of trucks for each group from continuous count stations. The third method used daily truck percentages from short-term counts.

Accuracy of the three methods was compared using *n*-fold cross-validation. In *n*-fold cross-validation, data are split into *n* partitions, and data from the *n*th partition are used to validate the remaining data. Accordingly, data from continuous count stations were divided into four groups, and each group was reserved for one partition as the validation data set. Short-term counts were extracted from the validation data set and then AADT was estimated using each of the three methods. Actual AADT by truck group for each count station was compared to the estimated AADT by truck group for each method.

A comparison of the accuracy of the three methods was made using the estimates of prediction error obtained from cross-validation. The prediction error was determined by averaging the squared error between the estimated AADT and the actual AADT.

Key Findings

- For single-unit trucks, the truck expansion factor method performed the best in terms of minimum expected error.
- For multi-unit trucks, the truck expansion factor method also performed the best in terms of minimum expected error.
- The prediction error was the lowest for the method that developed expansion factors separately for the different truck groups for both single- and multi-unit trucks. This indicates that use of expansion factors specific to heavy trucks results in better estimates of AADT, and, subsequently, VMT, than using aggregate expansion factors and applying a percentage of trucks.

Implementation Benefits

- Accommodating such truck characteristics as larger size and heavier weight, less effective acceleration and maneuvering capabilities, and lower deceleration in response to braking than passenger vehicles in the geometric and pavement design of roadways will help to facilitate smooth traffic operation. Estimates of truck VMT therefore serve as vital input in geometric and pavement design of roadways.
- Truck VMT is also a key factor in traffic safety. VMT estimates by vehicle class are required to derive accident rates by vehicle class and compare accident rates across vehicle classes. A better understanding of where trucks are located on the highway system may assist in evaluating the causes of truck-related crashes and consequently minimize fatalities and injuries resulting from such crashes.
- Reliable estimates of heavy-truck VMT are important for creating accurate inventories of on-road emissions.