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Options for enhancing network-wide truck volume estimates in Manitoba

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Abstract

There is a persistent need to enhance the quality of network-wide truck volume estimates through improved traffic monitoring practices. Challenges exist because of uncertainties about sampling approaches that provide sufficient spatial and temporal coverage. This research addresses these challenges: (1) by conducting a class-specific investigation of the temporal variability of short-duration truck classification counts; and (2) by comparing truck volumes obtained from traffic counts with those obtained from probe-based data.

Government agencies rely on short-duration classification counts (SDCCs) to provide information about how trucks use the highway network. With the emergence of non-intrusive classification technologies and increased demand for classification data, questions arise about how to deploy SDCCs and retain disaggregated classification data throughout the volume estimation process. While the practice of estimating volume from an SDCC attempts to compensate for known periodicities, it does not account for the inherent random variability of the sample data. Past studies focused on the impacts of count duration on annual estimates of total traffic; however, little is known about the nature of this relationship for trucks. This research analyzes the inherent temporal variability of vehicle classification data by simulating SDCCs with durations of one to eight days using continuous count data from 55 bi-directional sites in Manitoba. For each count duration, the variability of total traffic, trucks, three aggregate truck classes, and Federal Highway Administration classes 4 to 13 was calculated. The results indicate that the variability decreased as the count period increased from one to seven days for all classes. The variability was more sensitive to count duration for trucks compared to total traffic and for low-volume classes compared to high-volume classes. The analysis revealed that a 7-day count of trucks had less variability than a 1-day count of total traffic for 75% of site-directions.

Beyond SDCCs, commercially-available probe-based data provides an alternative for improving network-wide truck volume estimates by increasing spatial and temporal traffic data coverage. Past research on the traffic volume estimates from a North American company called StreetLight Data (StL) was conducted in the United States and focused primarily on total traffic. However, StL now provides truck activity indices for medium-duty and heavy-duty trucks. This research assesses the accuracy of annual average daily total traffic, medium-duty truck traffic, and heavy-duty truck traffic volumes obtained using StL's traffic activity indices. The analysis was conducted using 2019, 2020, and 2021 continuous count data from 11 sites near Winnipeg, Manitoba. The results showed agreement between the ground truth and probe-based total traffic estimates with mean absolute percent errors (MAPEs) ranging from 8.8% to 22.1% across the study years. The medium-duty truck volume estimates had larger errors up to 37.5%. Despite having higher volumes than medium-duty trucks, heavy-duty truck estimates had the largest errors, likely due to StL's lower sample size. The errors of the truck estimates may preclude certain design applications but may be useful for planning applications on unmonitored roads where truck volume estimates are unavailable or of unknown quality.

Keywords: truck volume, traffic monitoring, vehicle classification, short-duration counts, temporal variation, probe-based data

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