Traffic Monitoring Practices Guide: Addressing urban traffic monitoring challenges

TAC Traffic Monitoring Practices Guide

Published in 2017, the *Guide* provides the first national-level guidance on the planning, design, and implementation of traffic monitoring programs for Canadian provinces and municipalities. The primary objectives of this *Guide* are to promote uniformity in the approach and techniques used to deliver traffic monitoring programs in Canada and to improve the quality of the traffic data provided by these programs.

The scope of this *Guide* encompasses all functions within a traffic monitoring program, namely: program design and evaluation, data collection, data analysis, and reporting traffic data. In addition to providing specific guidance for non-motorized modes, the *Guide* also addresses the unique issues and challenges associated with monitoring interrupted traffic flow conditions, which are common in urban environments.

Urban Traffic Monitoring Challenges

The urban environment is characterized by high traffic volumes, multiple travel lanes, interrupted traffic flow conditions (variable speed, stop-and-go traffic), dense roadway networks, and high non-motorized traffic volumes. As a result:

- Traffic monitoring equipment has difficulty identifying vehicles and classifying them due to variable vehicle speeds and small headways.
- There is a lack of continuous count data that system-wide traffic monitoring programs rely on to create traffic ratios to expand short-duration counts.
- Sampling the entire roadway network is not possible due to the density of the network and the increased variability along consecutive roadway segments because of rapidly changing land uses.
- Non-motorized traffic must be considered as the role of urban transportation system is to move its people.

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Detecting Vehicles in Urban Environments

Congested, slow moving (i.e., interrupted) traffic flow conditions are problematic for nearly all traffic counting technologies. Axle counting technologies specifically have difficulty converting axle counts to meaningful summary statistics due to unpredictable vehicle speed. Frequent lane changing and tailgating can cause sensors to miss or combine vehicle counts. Sensor configurations are available for congested flow conditions; however, they often require multiple devices and careful calibration which results in high costs and time commitment. Agencies that are unable to commit resources to these sensor configurations may consider:

- using video cameras where lighting is sufficient to conduct short-duration counts;
- purchasing more affordable equipment and accepting a lower level of accuracy; or
- placing traffic data collection equipment at the access and egress ramps of the congested facility, along with a counter located off the congested roadway (differentials between these counts can be used to estimate volumes at any section of the congested roadway).

System-Wide Traffic Monitoring

The most important function of a jurisdiction's traffic monitoring program is to provide system-wide estimates of traffic statistics. This functionality relies on well-designed continuous and short-duration count programs.

The continuous count program provides the data foundation for most traffic monitoring programs. The short-duration count program requires substantial level of effort and generally comprises two types of counts: scheduled counts and requested counts. Scheduled short-duration counts provide the geographical coverage to monitor a roadway network.

Developing a system-wide traffic monitoring program involves:

- developing TPGs;
- determining the number of continuous count locations;
- selecting continuous count locations;
- assigning short-duration counts to TPGs; and
- determining the location, frequency, and duration of short-duration counts.

Most urban jurisdictions have not developed TPGs based on temporal factors because continuous traffic data has traditionally been unavailable. However, it is possible to develop TPGs based on hourly variations using short-duration counts if the objective is to estimate daily volume from partial day counts.

The relatively high density of roadway intersections in urban jurisdictions typically precludes the assumption of homogeneity for an extended roadway segment. Consequently, if 100 percent sampling were envisioned, a very large number of short-duration counts would be required to monitor the entire network. Urban jurisdictions have generally defined their system-wide coverage as their major arterial and expressway network.

Monitoring Non-Motorized Traffic

Non-motorized traffic monitoring is a relatively new practice when compared to the numerous and extensive motorized traffic monitoring programs currently found across Canada. The lack of pedestrian and cycling traffic data is one of the most significant barriers to explicitly considering these users of the transportation system in planning, design, operations, and maintenance programs. The fact that the monitoring of non-motorized traffic has not been systematic or wide-spread creates a knowledge gap that needs to be addressed before much progress is made in the safe accommodation of pedestrians and cyclists in transportation infrastructure. As public expectation for the implementation of active transportation infrastructure continues to grow, identifying and closing knowledge gaps concerning non-motorized user activity become increasingly urgent. Implementation of monitoring programs that specifically account for key differences between non-motorized and motorized traffic plays a key role in achieving this. Generally, key differences include physical characteristics, behavioural characteristics, and data applications.

The performance of non-motorized traffic monitoring equipment is affected by a variety of issues. Depending on the type of equipment being used, practitioners should be aware of the following potential sources of data inaccuracy: occlusion, environmental conditions, and detection zone.

The quality assurance procedures applied to non-motorized TME are different than those applied to motorized TME. Non-motorized traffic monitoring programs do not currently require similar levels of count accuracy as motorized traffic monitoring programs so it is difficult to justify investing in the expensive equipment necessary to provide highly accurate non-motorized counts. As such, jurisdictions often deploy non-motorized TME that have known systematic inaccuracies. Correction factors are developed to reduce these systematic inaccuracies associated with non-motorized TME. These systematic inaccuracies can be caused by occlusion, poor environmental conditions, and counter bypassing due to a poor TME installation site. Correction factors are used to adjust raw count data to more accurately reflect the ground truth volume of non-motorized traffic.