

Feasibility of a New Vehicle Classification System for Canada

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ABSTRACT

The Road Safety Directorate of Transport Canada is searching for a national vehicle classification system design that will permit the greatest number of vehicle type classifications without compromising the ability to produce realistic estimates of related on-road traffic exposure levels or other estimators. This paper presents results of research conducted for Transport Canada concerning the feasibility of and requirements for developing a more practical and useful vehicle classification system for Canada. More specifically, the paper:

- Reviews many of the vehicle classification systems used in Canada for traffic measurement/traffic exposure estimation by highway agencies.
- Reviews vehicle classification systems used in Canada in accident reporting/accident information systems.
- Proposes modifications to Canada's existing National Collision Database vehicle classification systems directed at normalizing vehicle classification assignment in the national database.
- Proposes vehicle classification categories for which comparative traffic exposure levels could be estimated for most jurisdictions on major highways, for key vehicle classes as derived from existing traffic monitoring programs.

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1. INTRODUCTION

Traffic-based exposure data is important for program evaluation, highway infrastructure management, safety analysis, resource allocation, traffic engineering, truck size and weight (TS&W) enforcement, and other applications. For many purposes, including traffic safety analysis, engineers and researchers would like to work with exposure data which not only includes numbers of vehicles per unit time, but also subdivides these volume estimates by vehicle class (passenger vehicles versus trucks, heavy trucks versus light trucks, among other things).

In an effort to improve traffic exposure information for road safety analysis, the Road Safety Directorate of Transport Canada is searching for a national vehicle classification system design for Canada that will allow the greatest number of vehicle type classifications and at the same time minimize error levels associated with estimates of related exposure levels. As part of this search, Transport Canada commissioned research directed at six objectives:

- Conduct a comprehensive literature review of the subject matter area.
- Review relevant databases (exposure to risk and consequence) and reporting forms (*e.g.*, police report forms, exposure report forms, others), both national and provincial/territorial, to identify possible consequence factors and characteristics of importance to the system design.
- Identify the most suitable option(s) available to Transport Canada for designing and implementing a national vehicle classification system.
- Demonstrate the option selected through its implementation with existing Canadian and provincial/territorial consequence databases.
- Provide advice, guidance and direction on the uses of the national classification system with respect to its linkage with exposure databases and the computation of road travel risk performance measure indicators, and support (as required) on their applications.
- Provide a report, including conclusions and recommendations for future work and/or analyses resulting from the feasibility study.

This paper presents results of the research concerning the following matters:

- A review of many of the vehicle classification systems used in Canada for traffic measurement/traffic exposure estimation by highway agencies.
- A review of vehicle classification systems used in Canada in accident reporting/accident information systems.
- Proposed modifications to Canada's existing National Collision Database vehicle classification systems directed at normalizing vehicle classification assignment in the national database.
- Proposed vehicle classification categories for which comparative traffic exposure levels could be estimated for most jurisdictions on major highways, for key vehicle classes, as derived from existing traffic monitoring programs.

2. VEHICLE CLASSIFICATION SYSTEMS USED IN TRAFFIC MONITORING IN CANADA

Most Canadian highways are built and managed under the authority of provincial, territorial, and municipal governments. There are no national standards specifying vehicle classification systems to be promoted or used in road traffic monitoring. Furthermore, the fleet characteristics vary significantly from jurisdiction to jurisdiction across the country because of differences in size and weight regulations, economic activity, physical environment, and other issues. This has led to a wide variety of vehicle classification systems used by highway agencies and municipal authorities in their traffic monitoring programs. These varying systems complicate efforts to develop traffic-based exposure data necessary for comparative analysis.

The following presents key aspects of the vehicle classification systems used by 7 of the 10 provincial highway agencies in Canada. Table 1 presents a summary of these classification systems.

Province of British Columbia. Vehicle classification counts are done visually using four vehicle types: passenger cars; pick-up trucks, vans, and other non-articulated single unit trucks; short combination trucks (articulated trucks with 1 trailer); long combination trucks (articulated trucks with 2 trailers). At the time of the research, the BCDOT was investigating the feasibility of installing 12 Automatic Vehicle Classifier (AVC) sites using the FHWA 13 classification scheme. Their complete traffic monitoring system is now under review.

Province of Alberta. Alberta uses a vehicle classification system consisting of five classes: passenger cars; recreational vehicles; buses (including school buses and inter-city buses); single unit trucks; tractor trailer combination trucks. Based on the Alberta traffic database—vehicle-kilometers traveled (VKT) by the above 5 classes for all sections of primary and secondary highways in Alberta are estimated and seasonally distributed by summer (May 1 to September 30) and non-summer (by subtracting VKT for the summer from year round VKT).

Province of Saskatchewan. Vehicle classification data is produced in two sources. The basic traffic counting program collects vehicle classification data using the FHWA Class 13 scheme. In 1997, the annual/bi-annual truck surveys (designed to develop more detailed characteristics of truck activity) used two classification systems--one with 16 classes expanded out from the FHWA 13 class system, and the other with 10 classes.

Province of Manitoba. The FHWA Class 13 scheme is the basic vehicle classification system used in Manitoba. Estimates of annual average annual daily truck traffic (AADTT) are made on a yearly basis, based on percent truck estimates established at various AVC and weigh-in-motion (WIM) sites in the province, and visual observations of truck traffic in turning movement count (TMC) or other special surveys. Except in special studies, the AADTT estimates do not distinguish between truck classes, although reports are available on the distribution of truck classes at individual count stations.

Province of Ontario. Generally, annual average daily traffic (AADT) is the only traffic exposure measure calculated for Ontario. Truck percentage estimates are also available. These are based on 8-hour manual counts and may not be collected in the same year for which they are reported. The classification system used to obtain those truck percentages is based on 3 classes (cars, short trucks and long trucks). The FHWA Class 13 scheme is used at certain permanent count/enforcement locations, and in surveys conducted for specific purposes.

Province of New Brunswick. New Brunswick uses a length-based descriptive vehicle classification system in its traffic monitoring program. This classification system consists of four vehicle classes defined by vehicle length: 670 cm--passenger vehicle; 670-1460 cm--straight truck; 1460 -2100 cm--tractor trailer; 2100 cm or greater--truck train.

Prince Edward Island. Vehicle classification is based on the FHWA 13 class system. Estimates of AADTT are made from percent truck estimates developed for each control section. Percent truck estimates are determined by calculating the percentage of trucks belonging to FHWA Class 4 through 13.

3. VEHICLE CLASSIFICATION SYSTEMS USED IN ACCIDENT REPORTING IN CANADA

Similar to traffic monitoring programs, accident reporting systems in Canada are the responsibility of the provincial government agencies. Detailed requirements of these reporting systems, including the vehicle classes used, are determined by these agencies. Similar to the situation with traffic monitoring, this has led to a wide variety of vehicle classification systems used by highway agencies. The different highway agencies participate in the National Collision Database (NCDB), in which a vehicle classification system has been defined to reasonably accommodate most provincial vehicle classification systems.

The following presents key aspects of the vehicle classification systems used in accident reporting in Canada. The vehicle classification systems used in all provincial/territorial collision report systems were reviewed.

- All the classification systems are different.
- All the systems have been modified at different times and in different ways as new vehicle classes emerge in the fleet (*e.g.*, sport utility vehicles, variations in motorcycles, new truck configurations).
- All but one system uses combinations of factors to classify vehicles.
- Most of these sub-categorizing factors fall within one of three groups: (1) vehicle type; (2) type of trailer (or towed unit); and (3) vehicle use.
- Neither the factors themselves, nor the details within them, are consistent among jurisdictions.
- 93 different terms are used to describe "vehicle type" on Canadian collision report forms.

The most common vehicle type terminology used for motorized vehicles operating on public highways in most jurisdictions is the following:

Passenger car. All jurisdictions use the term "passenger car" or "automobile" (sometimes interchangeably), or some variation thereon (*i.e.*, "station wagon", "auto"). However, other vehicle type terms exist in various jurisdictions that create inconsistencies when comparing "passenger cars/automobiles" collisions. Examples are: "car and trailer"; "four wheel drive vehicle", "minivan", "multi-purpose van"; "4-wheel drive motor vehicle operated off-road", "light utility vehicle". The National Collision Database (NCDB) system defines "passenger car"--Class 01 as a unique class. The NCDB system also identifies two other unique categories involving passenger vehicles--"passenger van" (Class 02) and "light utility vehicle" (Class 03). These categories are inconsistently handled across the country, and the boundaries between them are increasingly blurred.

Motorcycle. All jurisdictions use the term and unique category "motorcycle" (sometimes combined with other terms). All except Nova Scotia utilize at least one additional term--that while varying among jurisdictions--involves the idea of a lower speed 2-wheel vehicle. Potential inconsistencies/ambiguities may arise from the following alternative terms: "moped (50cc)"; "mini bike", "motorcycle/scooter"; "moped", "power bicycle", "scooter", "off-road motorcycle", "motorized cycle", "motorcycle-speed limited".

School bus. All jurisdictions use the term and unique category "school bus" (or an obvious equivalent). Potential inconsistencies/ambiguities may arise from the following alternative terms: "standard large type"; "van type", "other school bus", "school van"; "other school vehicle/bus". The NCDB system defines two vehicle classes in this area: "school bus"--Class 09 and "smaller school bus"--Class 10. Most provincial/territorial collision report forms utilize only one category.

Transit bus. Eleven jurisdictions (all but Quebec) use the term and unique category "transit bus" (or an obvious equivalent). Potential inconsistencies/ambiguities may arise from the following alternative terms: "bus-local transit", "paratransit bus"; "bus-other", "municipal transit bus"; "bus-other", "bus"; "minibus", "urban transit bus". The NCDB system defines "urban transit bus"--class 11 as a unique vehicle class.

Intercity bus. Eleven jurisdictions (all but Quebec) use the term and unique category "intercity bus" (or an obvious equivalent). Potential inconsistencies/ambiguities may arise from the following alternative terms: "bus-other", "bus". The NCDB system defines "inter-city bus"--Class 12 as a unique vehicle class.

Motorhome. Ten jurisdictions (all but Quebec and NWT) use the term and unique category "motorhome" (or an obvious equivalent). Potential inconsistencies/ambiguities may arise from the following alternative terms: "motorhome and trailer", "mobility vehicles", "recreational vehicle". The NCDB system defines "purpose built motorhome"--Class 18 as a unique vehicle class.

Farm equipment. Nine jurisdictions (all but Ontario, Quebec, Yukon) use the term and unique category "farm equipment" (or an obvious equivalent). Potential inconsistencies/ambiguities may arise from the following alternative terms: "farm tractor, combine, thresher", "unregistered farm equipment", "farm tractor"; "other farm vehicle"; "off-road 4 wheels"; "off-road (other)",

"equipment vehicle", "off highway vehicle". The NCDB system defines "farm equipment"--Class 19 as a unique vehicle class.

Pick-up truck <= or < 4500 kg. Eight jurisdictions use the term "pick-up truck <= or < 4500 kg", although not always in a unique category. Potential inconsistencies/ambiguities may arise from the following alternative terms: "single unit truck/light"; "truck/camper"; "truck camper and trailer"; "truck/camper"; "truck (other)"; "light truck"; "delivery truck"; "pick-up truck"; and variations in the weight break. The NCDB system defines "pick-up trucks <= 4536 kg GVWR"--Class 04 as a unique vehicle class. The NCDB also defines two other unique categories of small trucks ("panel/cargo van"--Class 05 and "other trucks and vans"--class 06) using the same GVWR qualifier of <= 4536 kg (10000 pounds).

Trucks >= or > 4500 kg. Eight jurisdictions use the term "trucks >= or > 4500 kg" as a unique category. Potential inconsistencies/ambiguities may arise from the following alternative terms: "single unit truck/heavy", "tow truck"; "truck/camper"; "truck (other)"; "delivery van"; "tow truck"; "truck-open"; "truck-closed"; "truck-tank"; "truck-dump"; "truck-car carrier"; "off-road 4 wheels"; "truck-other"; "truck"; "delivery truck"; "dangerous goods truck"; "utility vehicle"; "unit truck > 4500 kg"; and "off-road vehicle". The NCDB system defines "unit trucks > 4536 kg GVWR"--Class 07 as a unique vehicle class.

Construction and maintenance equipment. All jurisdictions use the term "construction" equipment/vehicle--sometimes combined with another term (*i.e.*, maintenance). Potential inconsistencies/ambiguities may arise from the following alternative terms: "road construction"; "general construction"; when used under "trailer" rather than "vehicle type". The NCDB system defines "construction equipment"--Class 20 as a unique vehicle class.

Emergency vehicle. Seven jurisdictions use the term "emergency vehicle" (or an obvious equivalent). In addition, two jurisdictions provide unique classes for "ambulance", "police", and "fire". The NCDB system defines "fire engine"--Class 21 as a unique vehicle class.

Trucks using a truck-tractor, typically in combination. Seven jurisdictions use the term "truck tractor" (or an obvious equivalent such as "power unit"--sometimes for semi-trailers, or "road tractor", or "truck tractor--bobtail", or "semi-trailer--power unit"). To determine whether or not the truck tractor is operating on its own (as a bobtail) or in combination, typically requires linking the vehicle type element to a subsequent vehicle(s) (depending on jurisdiction, called "attachments", "trailer type", "towed unit", "trailer use", or "trailer"). There is a wide range of descriptors used across the country to characterize the nature of the subsequent vehicle(s)--sometimes by number of trailer(s), by type of trailer(s), by trailer connection(s), or by "overdimensional". The NCDB system defines "road tractor (with or without a semi-trailer)"--Class 08, as a unique class.

4. PROPOSED MODIFICATIONS TO THE VEHICLE CLASSIFICATION SYSTEMS

The study looked at vehicle classification systems used in traffic monitoring programs and in accident reporting in Canada. This section summarizes the conclusions and proposals which arose from this research concerning both national perspectives on vehicle classification categories for exposure analysis and for accident reporting.

Traffic Monitoring

For Canada, there are many vehicle categories of interest to many users for which traffic monitoring programs cannot produce satisfactory traffic exposure estimates. Examples are: school buses, motor homes, motorcycles, SUV versus standard passenger vehicles, and emergency vehicles, A-train versus B-train double trailer combinations, heavy truck and trailer combinations versus tractor-semitrailer combinations.

From consideration of the many and varied vehicle classification systems used in traffic-monitoring systems across Canada, and equipment used in that monitoring, the development of traffic-based exposure estimates relating to the following two basic vehicle classes as part of all vehicles AADT would be feasible in effectively all jurisdictions on major highways:

- passenger vehicles (covering FHWA classes 1-4)
- trucks (covering FHWA classes 5-13)

For most jurisdictions and major highways, further sub-categorization to the following levels is feasible:

- passenger vehicles (covering FHWA classes 1-4 inclusive)
- single unit trucks (covering FHWA classes 5-7 inclusive)
- tractor-single trailer combinations (covering FHWA classes 8-10 inclusive)
- tractor-multiple trailer combinations (covering FHWA classes 11-13 inclusive)

For several jurisdictions and major highways, categorization at the FHWA 13 scheme is feasible.

Table 1 compares existing traffic monitoring vehicle classification systems used in several Canadian jurisdictions with the above proposed four class system.

In urban areas, traffic monitoring systems in Canada use highly individualized vehicle classification systems tailored to individual needs and past practices. Nonetheless, with some work, fitting the results of these individualized systems into a basic four class system (passenger vehicles, single unit trucks, single trailer combinations, and double trailer combinations) would appear feasible--and could facilitate/enhance national level exposure-related estimates and analysis.

Accident Reporting Systems

The following are proposed modifications to the existing vehicle classification system used in Canada's National Collision Database. These recommendations are directed at simplifying and normalizing practices and improving comparability among Canadian jurisdictions relating to accident databases. They are also directed at adding valuable new information particularly regarding to large trucks.

- The three categories used to classify passenger vehicles in the NCDB should be combined into one category called "passenger vehicles (other than buses)"
- The two categories used in the NCDB concerning school buses should be combined into one category called "school bus (any bus other than a transit bus or an intercity bus)".
- The three light truck categories used in the existing NCDB should be combined into one category called "light trucks" ≤ 4536 kg.
- The fire engine class used in the existing NCDB should be replaced by an expanded category called "emergency vehicle".
- The large truck classification system used in the existing NCDB (road tractor--with or without a semitrailer") should be expanded into four separate categories as follows: truck-tractor (bobtail); truck-tractor plus single semitrailer; truck-tractor plus double trailer; and truck-tractor plus triple trailer.
- Other terms should be simplified or normalized to reflect more consistency with source data terminology coming from jurisdiction-based accident reporting systems.

Table 2 shows the summary of the existing NCDB vehicle classification system compared to the proposed system incorporating the above proposals.

5.0 REFERENCES

The information for the research was provided by traffic and transportation engineering officials from the Ministries of Transportation of each province, and by officials from 8 major urban areas in Canada.

Table 1: Comparison of Existing Vehicle Classification Systems used in Provincial Traffic Monitoring Programs with a Simplified 4-Class System

Provincial Jurisdiction	Existing Vehicle Classification System for Exposure Data	Proposed Vehicle Classification System for Exposure Data
British Columbia	Passenger cars	Passenger vehicles
	Pick-up trucks, vans, and other non-articulated single unit trucks	
	Short combination trucks (articulated trucks with 1 trailer)	Tractor-single trailer combinations
	Long combination trucks (articulated trucks with 2 trailers)	Tractor-multiple trailer combinations
Alberta	Passenger cars	Passenger vehicles
	Recreational vehicles	
	Buses	
	Single unit trucks	Single unit trucks
	Tractor trailer combination trucks	Tractor-single trailer combinations Tractor-multiple trailer combinations
Manitoba Saskatchewan Prince Edward Island	Cycles (FHWA Class 1)	Passenger vehicles
	Cars (FHWA Class 2)	
	2A-4T (FHWA Class 3)	
	Buses (FHWA Class 4)	
	2A-SU (FHWA Class 5)	Single unit trucks
	3A-SU (FHWA Class 6)	
	4A-SU (FHWA Class 7)	
	4A-ST (FHWA Class 8)	Tractor-single trailer combinations
	5A-ST (FHWA Class 9)	
	6A-ST (FHWA Class 10)	
	5A-MT (FHWA Class 11)	Tractor-multiple trailer combinations
	6A-MT (FHWA Class 12)	
	Other (FHWA Class 13)	
Ontario	Cars	Passenger vehicles
	Short trucks	Single unit trucks
	Long trucks	Tractor-single trailer combinations
		Tractor-multiple trailer combinations
New Brunswick	Passenger vehicle	Passenger vehicles
	Straight truck	Single unit trucks
	Tractor trailer	Tractor-single trailer combinations
	Truck train	Tractor-multiple trailer combinations

Table 2: Comparison of Existing Vehicle Classification system used in NCDB with the Proposed System

Current Vehicle Classification System in National Collision Database		Proposed Vehicle Classification System for Collision Data
Code	Description	Description
01	Passenger Car	Passenger vehicles
02	Passenger Van	
03	Light utility vehicles	
04	Pick-up trucks <= 4536 kg.	Light Unit trucks <= 4536 kg.
05	Panel/cargo van <=4536 kg.	
06	Other trucks and vans <=4536 kg.	
07	Unit trucks > 4536 kg.	Unit trucks > 4535 kg.
08	Road tractor	Truck-tractor (bobtail)
		Truck-tractor plus single
		Truck-tractor plus double
		Truck-tractor plus triple
09	School bus	School bus
10	Smaller school bus	
11	Urban transit bus	Transit bus
12	Inter-city bus	Inter-city bus
13	Bus	
14	Motorcycle	Motorcycle
15	Limited speed motorcycle	Limited speed motorcycle
16	Off road vehicles	Off road vehicles
17	Bicycle	Bicycle
18	Purpose-built motorhome	Motorhome
19	Farm equipment	Farm equipment
20	Construction equipment	Construction equipment
21	Fire engine	Emergency vehicle
22	Snowmobile	Snowmobile
23	Street car	
NN	Data element is not applicable	
QQ	Choice is other than the preceding values	
UU	Unknown	
XX	Jurisdiction does not provide this data element	