1988 Ontario Commercial Vehicle Survey

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The Ontario Ministry of Transportation periodically undertakes on-highway surveys of commercial vehicles. In 1988, it surveyed some 19,000 trucks to obtain information for its highway planning and protection mandate. During the course of the survey, the characteristics of the vehicles were documented, and data collected on carriers, area of registration, load utilization, commodity type and weight, and trip origin and destination. As well, a profile of the Ontario truck driver was generated. Surveys were undertaken at 57 locations scattered throughout the province at permanent inspections stations, laybys and some border crossing points. At several of the stations, interviewing was done during each of the four seasons. An outline of the methodology used in the 1988 Ontario Commercial Vehicle Survey and some principal findings are presented in this paper.

The Ontario Ministry of Transportation periodically conducts roadside surveys of commercial vehicle and freight movements on the Ontario highway network to collect information for planning and operational purposes.

The primary objective of the 1988 Ontario Commercial Vehicle Survey was to provide a current profile of trucking activity in the Province for the planning, delivery, and evaluation of Ministry programs. Undertaking the survey during 1988 was done to continue providing trend information and identification on the basis of 5-year intervals (previous such surveys were done in 1978 and 1983).

Beyond the primary objective, the study was also aimed at gathering information on the

- Nature and extent of dangerous goods movement;
- Structure of the industry between private and for-hire carriers;
- Transborder movement of goods, particularly the degree and nature of traffic held by other provincial or U.S. carriers;
- Seasonal variations in transportation and commodity movements;
- Characteristics of commercial vehicle drivers regarding demographic and other considerations;
- Commodity and load characteristics; and
- Measures of efficiency and productivity on the basis of empty truck movements and ton-miles transported.

A survey consisting of 29 questions was composed, to be applied at truck inspection locations and border crossings situated along the principal intercity highway corridors in the province. The methodology used to undertake the survey and an outline of the general characteristics of the operating truck fleet found in the Province of Ontario are focused on in this paper.

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TRUCKING IN ONTARIO

Trucking is the principal means of transporting goods and services both in the Province of Ontario, and in Canada as a whole. Trucking accounted for 61 percent of total freight revenue in the province in 1987, compared with 20 percent for rail (Figure 1). On the order of 130 million tonnes of freight are moved by trucks in Ontario, compared with 70 million tonnes by rail (*1, p.9*).

The trucking industry employs on the order of 200,000 to 225,000 workers, or 4 to 5 percent of the provincial labor force, although this figure also includes nontrucking-related activities (e.g., retail, utilities, and government). Trucking's share of Canada's real domestic product and Ontario's gross provincial product is also approximately 4 to 5 percent (*1*,pp. 180–186).

There are some 158,000 trucks with a registered weight in excess of 4,500 kg (9,920 lb) in the province. Through license fees, corporate income, and diesel fuel taxes, the trucking industry makes a considerable contribution to provincial government revenue—close to $400 million. In contrast, the rail sector contributes only $27 million, but incurs other costs with respect to the maintenance of their own infrastructure (*2*).

On the order of 43 percent of Canada's exports and 57 percent of Canada's imports were transported by truck in 1989, together representing $136 billion worth of trade. In Ontario, the truck proportion of overall transportation of trade is much higher—59 percent of exports, and 68 percent of imports, representing $94 billion worth of trade (*3*).

In 1989, trucking was used to ship 66 percent of Ontario's $56 billion worth of exports to the United States, and 79 percent of its $48 billion worth of imports from the United States (Figure 2). Some 20 percent of Ontario trucking industry revenues are transborder related (*4*).

Ontario dominates Canadian trucking, accounting for about 40 percent of shipments, employment, vehicle fleet, operating expenses, and tonnes transported. The greater Toronto area alone is the generator or recipient of truck shipments and tonnes transported as much as the next three largest cities in Canada—Montreal, Vancouver, and Edmonton (Figure 3) combined (*1*, pp. 110–111).

A total of 47 truck inspection stations are strategically located throughout the Province of Ontario to monitor and control truck activity on both the principal and secondary intercity routes. As well, enforcement staff have the capability to inspect vehicles at dedicated roadside locations (laybys) along certain stretches of highways. All commercial vehicles are required to enter inspection stations. Information from these areas is supplemented with data derived from other sources (principally Statistics Canada) to assist in policy formulation and program delivery.

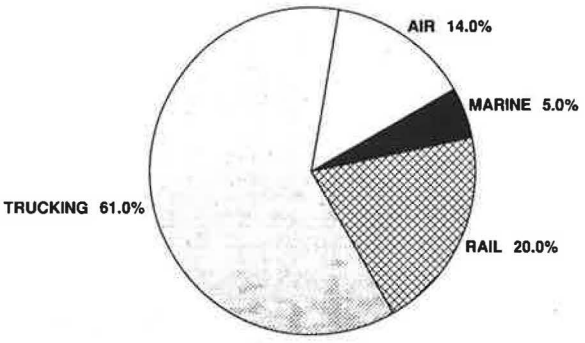


FIGURE 1 Freight revenue generation in Ontario, 1987.

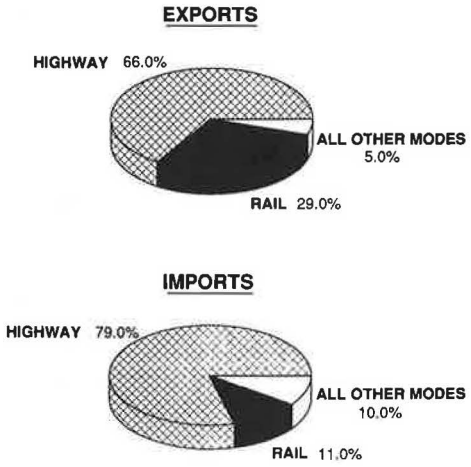


FIGURE 2 Value of Ontario's trade with the United States transported by respective freight modes, 1989.

METHODOLOGY

Roadside interviews were adopted to provide time series information consistent with that collected in 1978 and 1983. The survey was carried out during March to November 1988 inclusive, during a 23-week period. The survey was conducted at 57 locations along the principal intercity highway network. Interviews were undertaken on 100 days, but not necessarily for all of the day. In many instances, surveys were carried out at two different locations in the province during the same day. Where possible, surveys were carried out at the same 1983 survey location.

Permanent weighing facilities were available at 41 locations; portable weigh scales were deployed, where possible, at the remaining sites.

An attempt was made to route as many trucks as possible through the weigh scale platform at the vehicle inspection station. Depending on the respective sizes of the holding area and the interviewing crew, between 2 and 5 trucks would be directed into the station by inspectors. Other trucks were allowed to bypass the station until the interview process was completed, for safety reasons.

Once the trucks were on the scales, inspectors would record the axle weights of vehicles selected for interviewing while a member of the survey crew noted the vehicle plate number, the axle type, and the order of axle weighing. The inspector would then signal the driver to park in the reserved area. Before the actual interview commenced, the surveyor would record the individual truck body and style characteristics (up to 15 features) as shown on Figures 4 and 5.

The interviewer would then approach the trucker, explain the purpose of the survey, and request approval to carry on with the survey. Interviewers relied on the goodwill of drivers who gave generously of their time. Truckers refusing to be interviewed were free to proceed.

For the most part, outright refusals were largely a function of language translation difficulties (i.e., with Francophone drivers) or a cited lack of time by the driver, rather than apprehension at revealing information. After completion of the interview, the bill of lading and other documents related to the carriage of commodities were photocopied if permission was granted to do so. Fully completed interviews lasted between 8 and 12 min; slightly longer when portable scales were deployed.

Drivers were asked several questions pertaining to the vehicle itself: the tare and registered gross vehicle weight, type of fuel propulsion, and whether it was leased or had on-board

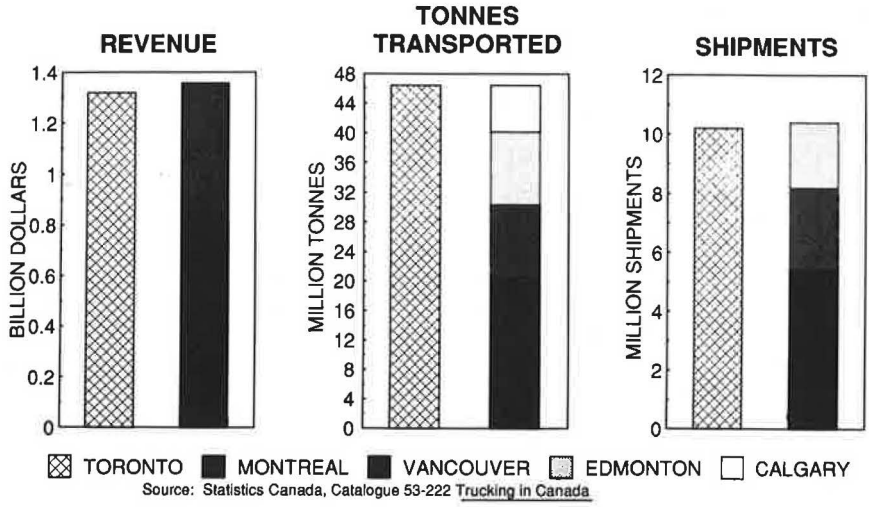


FIGURE 3 For-hire trucking, Canadian C.M.A. Rankings, 1987.

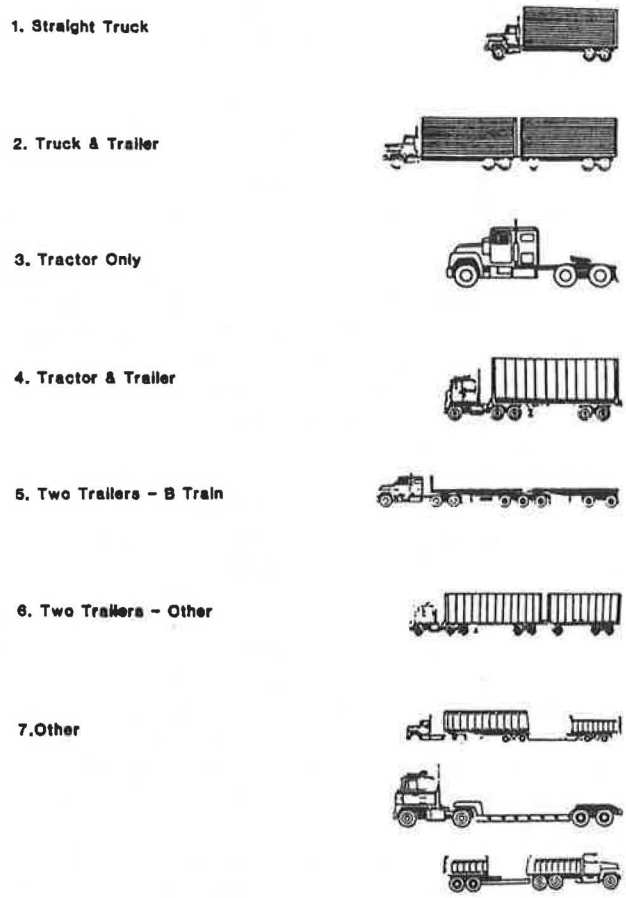


FIGURE 4 Truck types.

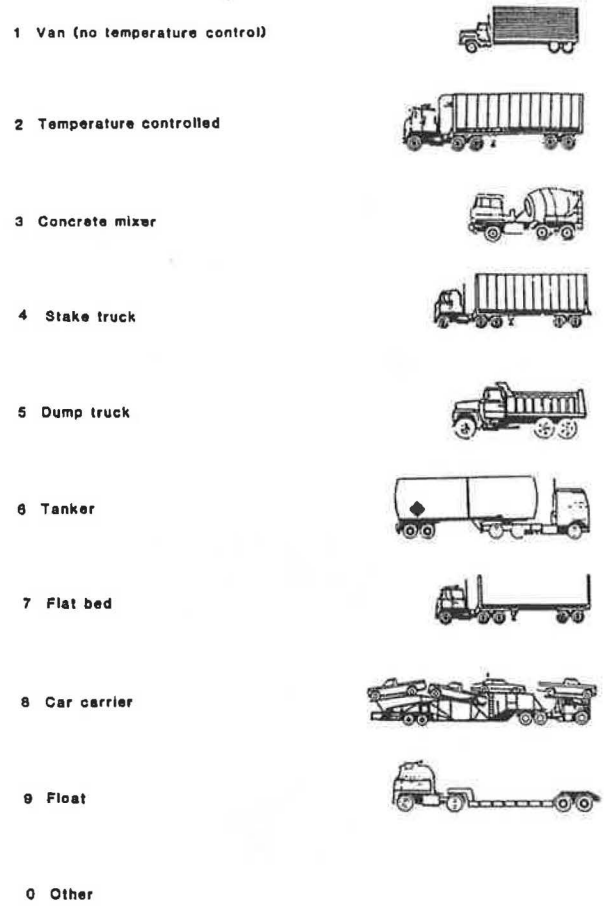


FIGURE 5 Truck body styles.

monitoring devices. Other questions were put forth with respect to the driver employment characteristics, specifically carrier type, union affiliation, method of renumeration, and employee category type.

Information was also collected about the commodities hauled, the degree of utilization level of the vehicle, and the origin and destination of the vehicle and the commodity. This data was crosschecked, where possible, through a review of photocopied waybills. The remaining questions dealt with drivers themselves: their age/sex characteristics, years of experience, recent training, and the number of hours they would be working and driving on the particular trip being surveyed. (A list of questions/variables is found in the appendix to this paper.)

During the duration of the survey, a classification count of vehicles passing by the interview location was also undertaken, to expand the sample to represent a daily average of vehicular movement.

It was planned that each location would be surveyed for 24 hr. At the laybys however, it was determined that because of safety considerations, surveying would be undertaken during daylight hours only. At three-quarters of the survey locations and times, crews were there (but not necessarily surveying) for a full 24-hr period.

All locations were not comprehensively surveyed for the entire intended period because of:

- Inclement weather,
- Heavy traffic that caused unsafe road conditions,
- Malfunctioning of the signalling system or of the portable scales,
- Absence of proper lighting for safe operation,
- Presence of detained vehicles transporting dangerous goods that were leaking that substance,
- Degree of enforcement practiced, and
- Problems associated with staffing logistics.

Fortunately, such incidents were of a minor nature, all things considered.

SAMPLE SIZE AND DATA ADJUSTMENT

In total 19,225 commercial vehicle drivers were interviewed over a period of 1,855 hr at 57 locations (Figure 6), representing an overall sampling rate of 8.6 percent. The sampling rate varied by location, depending on the time of day, and the degree of traffic passing by the respective location. It ranged from a low of 2.4 percent at stations near Toronto, where there were significant volumes, to a high of 100 percent in more remote northern stations.

During another 1,363-hr span, trucks were classified by vehicle type, but there was no truck survey because of weather considerations, absence of enforcement staff, problems as-

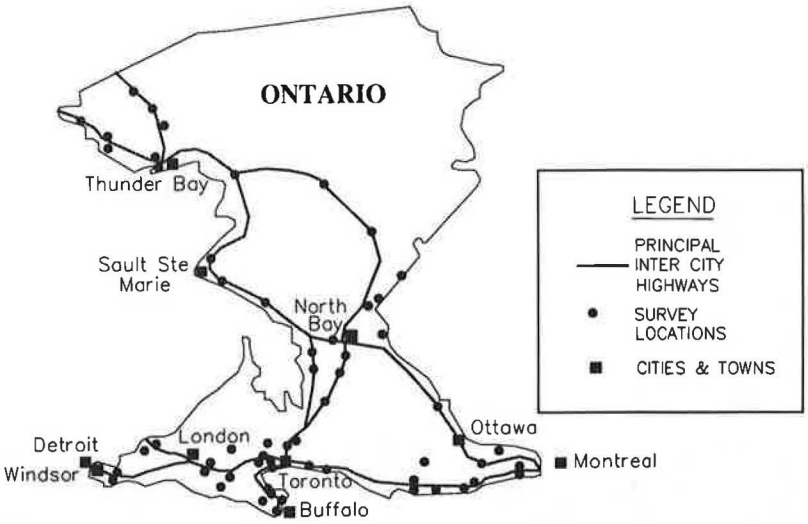


FIGURE 6 Location of survey stations.

sociated with equipment, no trucks for that period, and so on. In addition, to ascertain daily and hourly variations in trip travel, a 7-day, 24-hour classification count was undertaken at a pair of inspection stations west of Toronto.

During the course of the survey, the sample rate varied by day of week as presented in Table 1. The greatest number of surveys were obtained, and vehicular traffic found, on Wednesdays. The Monday and Friday totals were somewhat surprising given a deliberate attempt, by schedule design, to minimize sampling on those two days. It is largely a function of the greater ability to capture truck traffic (given lower volumes generally) on those two days, as the sample rate shows.

The sample rate also varied by time of day (Table 2). Splitting each day into three 8 hour components, it was found that greater success was achieved in sampling trucks during those periods where volumes were less. Truck volumes were found to be highest in the 4:00 p.m. to midnight period.

Care should be used in interpreting this information, however, given the wide area of geographic coverage, and the mix of local versus intercity trips by station site.

Corrections to account for variations in traffic patterns were required to convert the information to an equivalent daily total. Adjustment factors consulted included time series average annual daily traffic information, truck movement trends at international boarder crossings, and the classification counts undertaken at the inspection site while the survey was in progress.

TABLE 1 SAMPLE RATE BY DAY OF WEEK

Day of Week	Surveys Collected	Percent of Total	Trucks Classified	Percent of Total	Sample Rate
Sunday	0	0.0	0	0.0	---
Monday	1,616	8.4	7,078	6.6	22.8
Tuesday	3,722	19.4	17,643	16.5	21.1
Wednesday	5,084	26.5	26,386	24.7	19.3
Thursday	4,542	23.6	33,111	31.0	13.7
Friday	3,623	18.8	20,394	19.1	17.8
Saturday	638	3.3	2,219	2.1	28.8
Total	19,225	100.0	106,831	100.0	18.0

TABLE 2 SAMPLE RATE BY TIME OF DAY

Time Period	Surveys Collected	Percent of Total	Trucks Classified	Percent of Total	Sample Rate
8 to 16	7,356	38.3	50,206	47.0	14.7
16 to 24	6,352	33.0	31,915	29.9	19.9
24 to 8	5,517	28.7	24,710	23.1	22.3
Total	19,225	100.0	106,831	100.0	18.0

The factoring process was undertaken on a individual hour basis, in concert with the 1983 experience, and was largely based on the observed flow of traffic at the individual station. At those stations which were surveyed in each of the four seasons, the factor represented an average of the individual seasons.

A review of the truck proportion of all traffic by hour identified that trucks accounted for between 10 and 58 percent of the vehicular traffic, depending on the hour surveyed (Figure 7). The highest levels were found in the early morning (3 to 5 a.m.). Overall, trucks constituted 17 percent of the total vehicular flow.

Combination vehicles were most prominent during the early morning hours, comprising as much as 85 percent of all trucks. Straight trucks were most in evidence during normal business hours accounting for as much as 22 percent of all trucks.

A 7-day classification count was undertaken as well, at a pair of inspection stations just west of Toronto. From this exercise it was found that Wednesdays had the highest proportion of truck traffic, Sundays the least, and there was a significant difference in volumes between days (Figure 8).

DATA LIMITATIONS

The prime limitation of the data related to the fact that they reflect, at most, a single day's movement of goods by truck during 1988. Unilaterally expanding the results by 250 days

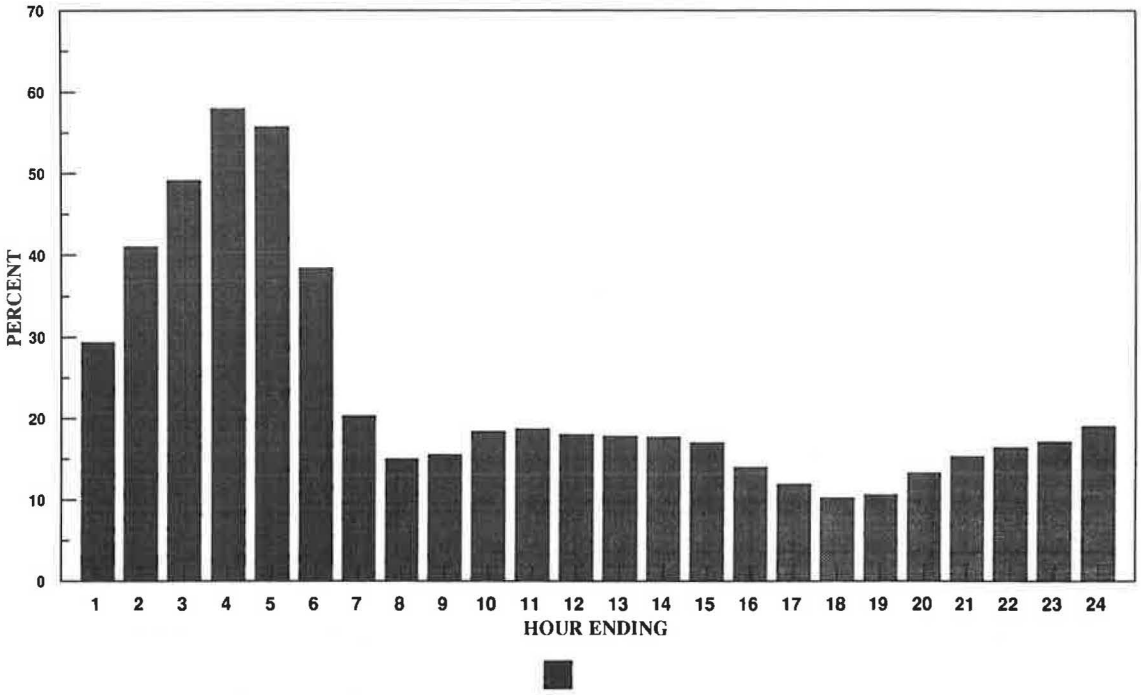
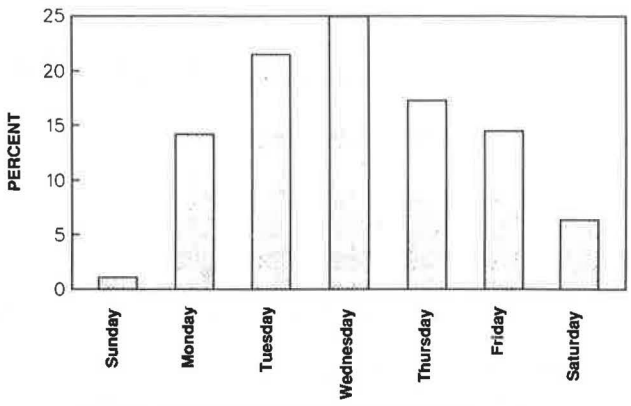


FIGURE 7 Truck percentage by time of day.



Source: Ontario Commercial Vehicle Survey

FIGURE 8 Week-long 24-hr truck classification, Trafalgar Stations, 1988.

or so to represent a yearly flow of truck traffic may present questionable results, and is not recommended given possible seasonal variations. Therefore, the data represent as typical a day as can be possibly surveyed, given observed traffic flows, the logistics of undertaking the survey, and the geographical coverage of sites.

The second limitation is a function of the placement of the interview locations at truck inspection sites: only trucks traveling on the major intercity routes were exposed to the survey. Because the principal purpose of the study was to sample major intercity traffic, this is not a major concern.

The survey does not purport to represent all trucking activity, although a considerable proportion of such rural freeway traffic has an urban origin or destination. There were additional sites on the major secondary routes, so the coverage of truck travel was expanded somewhat, compared with the 1983 survey, but less than was intended. The addition of these sites and expanded coverage at some stations was undertaken to lessen geographic biases.

A related concern with respect to station location citing was that vehicles not in compliance would bypass an open inspection station (and hence avoid being interviewed) because enforcement was being practiced during the duration of the survey. However, selected classification counts on known bypass routes undertaken during the survey found this not to be the case.

Third, only a small proportion of weekend traffic, on Saturdays, was captured. While a bias toward weekday traffic can thus be expected, the results of the week-long classification count at two inspection stations indicated that weekend truck levels were quite low. Saturday travel represented 6.4 percent of weeklong truck traffic; Sunday, a further 1.1 percent.

The fourth limitation reflects the degree of missing values in the survey universe resulting from refusals to divulge information, the provision of misinformation, the absence of a power supply to photocopy waybills, or all of these reasons. Minor variations in the statistical tabulations reflect this. When possible, attempts were made to fill in the blanks through a review of other surveyed information.

Overall, the refusal rate for all of the survey was low (3.5 percent), although moderately higher than was experienced in 1983 (1 percent). This was anticipated because of both the longer survey and the inclusion of potentially controversial questions.

Nonresponses varied considerably by question type and are a function of language translation problems, refusals, misinformation, and in some instances, unawareness. Typically, they were on the order of 9 to 14 percent for each question. There was a higher level of nonresponses pertaining to tare

weight (35 percent for nonresident drivers) and driver license identification (44 percent for resident drivers) questions.

PRINCIPAL SURVEY FINDINGS

Structural and operational commercial vehicle fleet information is important for provincial policy formulation, planning and design, and enforcement. The principal survey findings are as follows.

The predominant type of truck in evidence during 1988 was the tractor-trailer combination unit, at 77 percent of the surveyed population. Straight trucks were the next most frequently used truck type at about 16 percent of the surveyed population. Tractors with two trailers only accounted for a further 5 percent of the total, in part a reflection of the greater attractiveness of tractor and semitrailer units (Figure 9).

The van body style accounted for about 60 percent of the truck-trailer units. Two-thirds of all vans were the standard variety, the remainder were temperature controlled (Figure 10). Other frequently occurring identified body types were flat beds (14 percent), and more specialized vehicles such as dump trucks (5 percent) and tankers (8 percent). There were seven body styles that each accounted for less than 2 percent of the overall truck population. The high occurrence of van body styles is a reflection of its operational flexibility, particularly for use in the transportation of general freight. Other body styles reflect a specialized-use or commodity type, which cannot normally be adapted for general use.

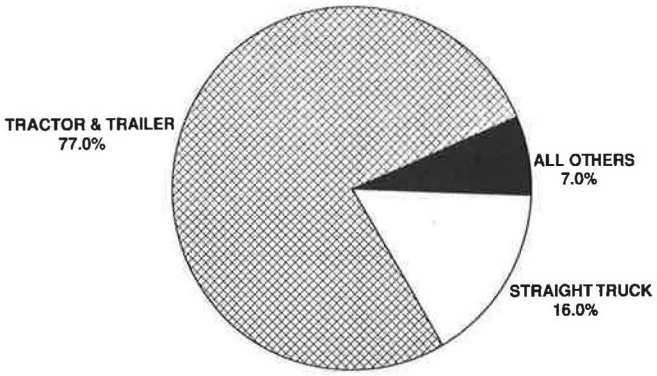


FIGURE 9 Truck types.

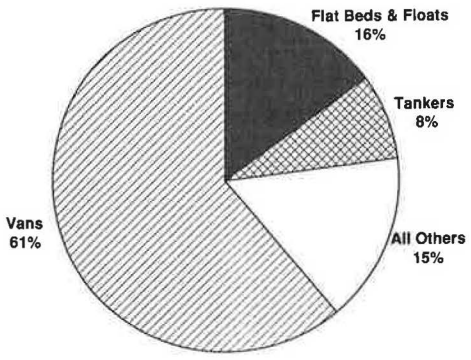


FIGURE 10 Body styles.

An analysis of vehicles by number of axles found that the 5-axle tractor-trailer unit is by far the most numerous vehicle, at about 57.0 percent of the total; the 2-axle straight truck (10.7 percent), and the 6-axle tractor trailer (10.3 percent) represent the two next most frequently used categories of trucks.

An examination of the distribution of trucks by number of axles with the carrier type revealed a greater preference by the for-hire carrier industry for larger vehicles with 6 or more axles. The proportion of for-hire vehicles in this category was 24 percent, compared with 19 percent by private carriers.

To achieve better fuel economy, some trucks are equipped with devices designed to reduce wind resistance to motion. Generally, bubble-type devices are fitted on trailers and van-style straight trucks, while roof-mounted air deflectors and side fairings are installed on the power-tractor units. Results indicated that 38 percent of the vehicles had energy saving devices.

The registered gross vehicle weight (RGVW) of a vehicle is the total weight that the vehicle is registered and licensed to carry within the Province of Ontario under its Highway Traffic Act; it is licensed against the power unit. The maximum RGVW for a vehicle is 63,500 kg (139,990 lb). It was found that the average RGVW of vehicles used in the industry was 39,660 kg (87,430 lb) in 1988. Private carriers used lighter vehicles than for-hire carriers, a function of their different demand pattern.

Where multiple vehicle registrations (including Ontario) were identified, the interviewers were instructed to record the Ontario plate, and not the other jurisdiction. The data indicate that the proportion of Ontario registered trucks/tractors was 81 percent in 1988. The percentage of vehicles registered in the United States was 7 percent.

Although the largest numbers of U.S. vehicles were from the adjacent states of New York and Michigan, the vagaries of U.S. licensing fees, carrier operating practices, and leasing arrangements had resulted in a large proportion of U.S. registered vehicles coming from the states of Vermont and Nevada, while few trips were actually to or from those states. With respect to vehicles registered in other Canadian provinces, those from Quebec and Alberta were the most prominent.

On-board monitoring devices record the timing of movements, distance traveled, and vehicle speeds. They are placed on vehicles to keep track of the trip location, both for clients and for dispatchers. Examples of such devices include logbooks, tachographs, on-board computers, and sophisticated satellite tracking devices.

Logbooks are the principal trip recording devices (53 percent of all vehicles), followed by tachographs (32 percent), and on board computers (4 percent).

Logbooks are the preferred method of record keeping primarily because of cost and because tachographs are not themselves a sufficient substitute for logbooks.

Recent estimates are that approximately 63 percent of the dangerous goods tonnage in the Province of Ontario, or about 25 million tonnes, is being hauled by trucks (Transport Canada, Dangerous Goods Directorate & Ontario Ministry of Transportation, unpublished). In total, about 5 to 6 percent of all truck trips surveyed involved the carriage of dangerous goods. The percentage of trucks engaged in the carriage of

dangerous goods varied considerably by individual station but in no instance did it exceed 12 percent on a daily basis.

The most frequently transported dangerous good by truck was flammable liquids (47 percent). Compressed gases (24 percent) and corrosive substances (20 percent) followed. All other commodities were hauled in relatively minute amounts.

SUMMARY

The extent and scope of data collected during the course of the 1988 Ontario Commercial Vehicle Survey were only briefly touched on in this paper. The characteristics of the vehicles themselves and the methodology used to undertake the survey were focused on.

The information collected will be of immediate use. It will precede provincial evaluation of the geometric design of roads, highways and ramps, pavement and structure rehabilitation planning and scheduling, reciprocity arrangements with adjacent jurisdictions, dangerous goods regulation and enforcement efforts, and driver education programs. It will also provide useful information for private sector interests on market opportunities, fleet construction and disposition, and so on.

The reporting of the remainder of the data will be the subject of future papers.

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APPENDIX
SURVEY QUESTIONS/VARIABLES

- *Record identification*: record number, location, hour ending, date, direction.
- *Observations:* plate number, base province/state of registration, name on power unit, vehicle configuration (truck type), tractor style, trailer/body style.
- *Features*: roof shield/side fairings/sleeper roof/bubble/headlights on/supersingle tires/dangerous goods placards/lift axle/dimensional load/55 mph decal.
- *Weigh scale data*: vehicle configuration, total axles, raised axles, base length or axle measurement, weight by axle.
- *Questions: vehicle*. Registered gross vehicle weight and tare weight (for non-Ontario plated vehicles), leasing incidence, fuel use. *Features*: logbook/tachograph/on board computer/dimensional load permit/cab accessible lift axle.
- *Questions: carrier*. carrier type, driver employment type, method of renumeration, union/work association membership, energy conservation driving bonus.
- *Questions: commodity*. Waybill existence, commodity type, shipments carried, commodity weight, volume/space utilization, dangerous good class and PIN.
- *Questions: origin/destination*. Community origin and destination of 1st truck/trailer and 2nd trailer, longest trip point in a shuttle trip, number of pickups and deliveries, establishment type at origin and destination, sole driver versus two drivers, commodity origin/destination (if different from the truck).
- *Questions: driver*. Years driven commercially, hours working today, hours driving today, time driving before a break is taken, drivers license number (Ontario drivers only), driver age group and sex, awareness of ministry "trucksave" program. Undertaking of: defensive driver course/first aid course/dangerous goods training course.

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