Population Estimates From the National Truck Trip Information Survey

KENNETH L. CAMPBELL

ABSTRACT

The National Truck Trip Information Survey (NTTIS) is part of a research program at the University of Michigan Transportation Research Institute (UMTRI) to study the safety of large trucks (trucks with gross vehicle weight ratings greater than 10,000 lb) on the highway. The objective of the NTTIS is to provide descriptive information on the national population of large trucks and their use. This information will be combined with data from a companion survey of the fatal accident experience of all large trucks in the United States [called Trucks Involved in Fatal Accidents (TIFA)] to estimate involvement rates (fatal accident involvements per hundred million vehicle miles) for a broad range of truck configurations and use. Presented in this paper is a brief discussion of the overall methodology of the research program as background. The sampling frame, sample design, and survey methods are described, and preliminary estimates of the national population of large trucks are presented. The survey design and preliminary results are compared to the 1982 Truck Inventory and Use Survey conducted by the Bureau of the Census.

The National Truck Trip Information Survey (NTTIS) is part of the Truck Safety Research Program at the University of Michigan Transportation Research Institute. The objective of this survey is to provide population estimates and descriptive statistics on the national population of large trucks and their use. The overall objective of the Truck Safety Research Program is to identify from survey data on the truck population and its accident experience factors (characteristics of the driver, the vehicle, or its use) that are associated with accident involvement. Information on the fatal accident experience of all large trucks in the United States is being collected in a companion survey called Trucks Involved in Fatal Accidents (TIFA). The basic approach for this research program is to develop a data base with comparable scope and detail in both the accident and the exposure information. Vehicle mileage is used as the basic measure of exposure. With such a data base, multivariate statistical techniques can be used to identify factors associated with accident involvement. Incorporation of detailed information on the use of the vehicles is a major aspect of the overall program.

An overview of the Truck Safety Research Program is provided as background for the description of the National Truck Trip Information Survey. The description of the NTTIS includes discussion of the sampling frame, sample design, and survey method. Preliminary population estimates are presented, followed by a discussion of these results.

THE UMTRI TRUCK SAFETY RESEARCH PROGRAM

The basic analytic model for the accident process is the log-linear model for Poisson rates as described by Haberman (1). In fitting the accident frequencies, adjustments must be made for the exposure differences of the individual cells. In general, multivariate contingency table methods require fewer assumptions than other analytic approaches (2). Application of this method requires information on both the accident experience and the use of the vehicles with comparable coverage and detail. The scope of this research program includes all trucks with gross vehicle weight ratings greater than 10,000 lb. All pickup trucks and passenger vehicles are excluded. The current focus is on the relationship of vehicle configuration, size, weight, and use to the accident experience. Knowledge of the physical mechanisms involved and the relation of vehicle handling and stability to the configuration of the vehicle provide the basis for developing specific models and hypotheses to be tested with the survey data.

The handling and stability of various large truck configurations has been studied by conducting instrumented tests and through computer simulation. A summary of findings from this area that are pertinent to this analysis work is presented here. Most of this material is covered in three publications by Ervin et al. (3-5). Cab style and trailer length are relevant to the analysis in that shorter wheelbase units generally have poorer lateral stability than longer wheelbase units. This means that shorter wheelbase tractors (cab-over) are more likely to jackknife, for example. The number of axles also influences handling and stability. In general, tandem axles provide better lateral stability than single axles. Trailer body style, cargo, and weight are related to roll stability as follows. Roll stability is primarily determined by the height of the center of mass and the wheelbase. Combinations of cargo type and weight with trailer body style can serve as a surrogate for the height of the center of mass. Also, jackknife accidents are more likely to occur with empty vehicles because the drive axle is more likely to lock up during severe braking resulting in a loss of lateral stability.

The last of the three citations by Ervin (5) focuses on the amplification of lateral accelerations due to steering inputs in the last trailer of

University of Michigan, Transportation Research Institute, 2901 Baxter Road, Ann Arbor, Mich. 48109.

the combination. Significant variation in the rearward amplification ratio is observed for the various truck configurations currently in use. For example, the common five-axle tractor and semitrailer actually attenuates lateral accelerations with a rearward amplification ratio of less than one (0.8), whereas the lighter three-axle tractor and semitrailer is appreciably less stable with a rearward amplification ratio of about 1.4. By comparison, the double trailer combination with single-axle, 27-ft trailers has a rearward amplification ratio of 2.5.

The scope of the accident data collection program is all large trucks involved in fatal accidents in the contiguous 48 states and the District of Columbia. The objective of this program is to produce a single data file containing the data elements of both the National Highway Traffic Safety Administration (NHTSA) Fatal Accident Reporting System (FARS) file and the Bureau of Motor Carrier Safety (BMCS) accident file. The FARS file already contains a census of all fatal accidents in the United States, whereas the BMCS file provides a more detailed description of the involved truck. However, only trucks engaged in interstate commerce are required to file an accident report with the BMCS.

The truck accident program begins with the acquisition of the FARS and BMCS data tapes. These files are built in the appropriate formats for the necessary processing and analysis programs. A list of accidents involving medium and heavy trucks is sent to each of the states, and a copy of the police accident report is requested. Vehicles in the FARS file are then matched with the corresponding record in the BMCS file. About one-third of the trucks in the FARS file are matched with the BMCS report for the same vehicle and accident. For those trucks listed in the FARS file that are not matched with a corresponding BMCS report, the owner, as listed on the police report, is contacted by telephone or mail to obtain the BMCS data elements. For each truck hard copy files are assembled containing a summary listing of the FARS data elements, a copy of the police accident report, and either a summary listing from the matching report in the BMCS file, or the data form from the owner interview. The interview data are edited, keypunched, and added to the computerized files. In this way a national data file is produced with a record for every medium or heavy truck involved in a fatal accident and with the data elements of both the FARS and the BMCS files.

In order to carry out the planned analysis, information on the number of trucks in the United States and their use is required with the same level of detail as in the accident data. The Truck Inventory and Use (TIU) survey conducted by the Bureau of the Census every 5 years is the most detailed existing national exposure data for trucks. The 1982 survey results became available in fall 1985. The TIU survey data provide most of the necessary data elements that pertain to the description of the owner and the truck. However, necessary information on the day-to-day use of the truck such as road class, time of day, number of trailers, cargo weight, and length is lacking. The NTTIS is designed to provide these additional data elements.

SAMPLE DESIGN

The sample of trucks is a stratified simple random sample. Each state is a separate stratum, and within each state, straight trucks are sampled separately from tractors. Sample sizes were specified for each state roughly proportional to size, and an interval selection procedure was followed in each stratum. Survey dates were randomly assigned to each vehicle using a procedure to reduce intercluster correlations. The survey dates were organized into a sequence so that adjacent trucks are not surveyed on days close to each other and so that successive surveys of the same truck fall on different days of the week. A random start was selected, and the survey dates were then assigned in the specified sequence to the selected trucks (which were in selection order). The trip calls are being conducted over a 12-month period. Each truck will be surveyed on 1 randomly assigned day every 3 months, for a total of 4 survey days for each truck.

ESTIMATED SAMPLING ERRORS

The procedure used to determine the necessary sample sizes is described in this section. Information on the variance of truck mileage from previous surveys of truck use was used to estimate the sampling errors for the NTTIS. Tables 1 and 2 give the mean, sample size, standard deviation, and coefficient of variation for several categories of trucks. The figures given in Table 1 are taken from the FMVSS 121 safety impact evaluation (6) and are average daily mileages from a similar trip survey of 1977 model year trucks (conducted in 1978). Table 2 gives average annual mileages from the 1977 TIU survey (7). Examination of these tables illustrates that the standard deviations tend to vary in proportion to the mean, with categories having larger means also having larger standard deviations. The coefficient of variation is the ratio of the standard deviation to the mean, and it is somewhat more consistent than the standard deviations. Relatively homogeneous cat-

TABLE 1 Typical Means and Standard Deviations, Average Daily Mileages (6)

Category	N	Mean	Standard Deviation	Coefficient of Variation
Straight truck	638	76.5	99.8	1.30
Tractors	1,980	273.7	249.2	0.91
Straight truck–private	578	75.8	101.0	1.33
Straight truck–authorized	43	75.2	87.5	1.16
Straight truck–local use	459	62.5	47.1	0.75
Straight truck–short haul	138	102.3	115.7	1.13
Straight truck–long haul	37	148.8	158.2	1.06
Tractors–conventional cab	989	221.7	210.7	0.95
Tractors–cab-over	970	342.2	274.1	0.80
Tractors–private	941	261.9	239.3	0.91
Tractors–authorized	956	280.4	255.1	0.91
Tractors–exempt	61	380.1	301.5	0.79
Tractors–local use	289	105.1	143.7	1.37
Tractors–short haul	367	217.3	201.2	1.08
Tractors–long haul	1,307	328.5	260.3	0.79

TABLE 2 Typical Means and Standard Deviations, Annual Mileage–Tractors (7)

Category	N	Mean	Standard Deviation	Coefficient of Variation
Cab-over	4,519	65,861	48,199	0.73
Short conventional	2,191	35,632	36,744	1.03
Cab forward	432	29,070	33,598	1.16
Sleeper cab	3,620	70,262	45,636	0.65
One power axle	4,907	34,672	39,683	1.14
Three or more	189	44,145	43,127	0.98
Single trailer	11,480	49,046	51,912	1.06
Double trailer	318	66,175	50,591	0.76
Local	4,143	21,609	24,910	1.15
Long haul	3,379	85,853	45,079	0.53
Private	5,854	39,433	55,088	1.40
Common	2,804	64,836	49,908	0.77
Contract	1,221	66,594	40,743	0.61

egories with high means tend to have somewhat lower coefficients of variation. A coefficient of variation of 1.0 has been selected as typical from these tables, and it will be used to estimate the sampling errors given in the tables that follow.

Statistics will be computed at both the "truck" and the "day" levels. The effect of weighting on the variance will be ignored for these estimates because the weights will not vary greatly (straight trucks will have greatly different weights from tractors, but these groups will not be combined for analysis). Estimated sampling errors are presented here for proportions at the truck level and subclass means at both the truck and the day levels. Other statistics that will be computed include subclass population totals, ratios of means, and ratios of population totals at both the truck and day levels.

The variance of a proportion for a simple random sample is given by

$$\mathrm{Var}(p) = p(1 - p)/(n - 1) \qquad (1)$$

The approximate 95 percent confidence interval is given by plus and minus two times the square root of the variance. Table 3 gives the 95 percent confidence intervals for various proportions and sample sizes. The data in this table illustrate the expected accuracy for percentages at the truck level (percent cab-over, or percent operated by authorized carriers).

The variance of a subclass mean, $\bar{y}_m$, is given by

$$\mathrm{Var}(\bar{y}_m) = \mathrm{Sum}(y_m - \bar{y}_m)^2/m(m - 1) \qquad (2)$$

where the summation is over the subclass, m.

The data in Tables 4 and 5 illustrate the expected accuracy of subclass means at the truck and day levels, respectively. As for the proportions, the approximate 95 percent confidence interval is given by plus and minus two times the square root of the variance. In these tables, the figure shown is one-half the confidence interval (or twice the standard deviation) divided by the subclass mean, $\bar{y}_m$, and multiplied by 100. This may be considered as a percent error in the mean. The same information is presented in Table 5 for sample sizes and subset sizes appropriate for subclass means at the day level. The sample of days is a cluster sample of equal size for each truck. The influence of this clustering has been neglected in these estimates because the effect is not expected to be large. Statistics will not be computed for a single cluster (truck), but for subclasses made up of many trucks.

On the basis of data in Tables 3 through 5, target sample sizes of 4,000 tractors and 2,000 straight trucks were selected. Tractors operating with two trailers are expected to comprise about 5 percent of the tractor combinations. Accuracy for a subclass of this size would be about 14 percent at the truck level and 6 percent at the day level. Assuming a 20 percent nonresponse for the straight trucks and a 27 percent nonresponse rate for tractors, the required sample sizes increase to 2,500 straight trucks and 5,500 tractors. A higher nonresponse rate was assumed for the tractors because of some concern about the accuracy of the frame processing described in the next section.

TABLE 3 95 Percent Confidence Intervals on Proportions Versus Sample Size

	N			
P	2,000	3,000	4,000	5,000
0.001	±0.001	±0.001	±0.001	±0.001
0.01	±0.004	±0.004	±0.003	±0.003
0.10	±0.013	±0.010	±0.009	±0.009
0.20	±0.018	±0.015	±0.013	±0.011
0.30	±0.020	±0.017	±0.014	±0.013
0.40	±0.022	±0.018	±0.015	±0.014
0.50	±0.022	±0.018	±0.016	±0.014

TABLE 4 Percent Error in Average Annual Mileage Versus Subset Proportion and Sample Size

	Total Sample Size							
	2,000		3,000		4,000		5,000	
Category Proportion	N	$2S_{\bar{x}}/\bar{x}$ (%)	N	$2S_{\bar{x}}/\bar{x}$ (%)	N	$2S_{\bar{x}}/\bar{x}$ (%)	N	$2S_{\bar{x}}/\bar{x}$ (%)
0.25	500	8.9	750	7.3	1,000	6.3	1,250	5.7
0.10	200	14.1	300	11.5	400	10.0	500	8.9
0.05	100	20.0	150	16.3	200	14.1	250	12.6
0.01	20	44.7	30	36.5	40	31.6	50	28.3
0.005	10	63.2	15	51.6	20	44.7	25	40.0
0.001	3	115.5	4	100.0	5	89.4	2	141.4

TABLE 5 Percent Error in Average Daily Mileage Versus Subset Size and Sample Size

	Total Sample Size							
	8,000		12,000		16,000		20,000	
Category Proportion	N	$2S_{\bar{x}}/\bar{x}$ (%)	N	$2S_{\bar{x}}/\bar{x}$ (%)	N	$2S_{\bar{x}}/\bar{x}$ (%)	N	$2S_{\bar{x}}/\bar{x}$ (%)
0.25	2,000	4.5	3,000	3.7	4,000	3.2	5,000	2.8
0.10	800	7.1	1,200	5.8	1,600	5.0	2,000	4.5
0.05	600	8.2	800	7.1	1,000	6.3	400	10.0
0.01	80	22.4	120	18.3	160	15.8	200	14.1
0.005	40	31.6	60	25.8	80	22.4	100	20.0
0.001	8	70.7	12	57.7	16	50.0	20	44.7

SAMPLING FRAME

The sample of trucks was obtained from R.L. Polk, the same source as used by the Bureau of the Census for the Truck Inventory and Use survey. R.L. Polk maintains files of registered vehicles for every state except Oklahoma. The versions of these files reflecting registrations as of July 1, 1983 were used. In addition, Kansas, Maryland, Nevada, Oregon, Virginia, and Washington restrict the use of the information provided to R.L. Polk. Permission was obtained from each of these states to use the R.L. Polk data. Finally, the R.L. Polk data for California does not include trucks with model years before 1973. Hence, the NTTIS sampling frame includes the contiguous 48 states plus the District of Columbia, except for Oklahoma and pre-1973 model-year trucks in California.

Trucks included in the survey are straight trucks with gross vehicle weight ratings (GVWR) greater than 10,000 lb and all road tractors. Excluded are all pickup trucks (regardless of GVWR); all passenger vehicles (such as passenger vans, recreational vehicles, ambulances, and buses of any type); farm tractors; and government-owned trucks. An important feature of the selection procedure was the elimination of duplicate registrations from state to state. These duplicates could not be eliminated for the TIU survey because the frame is too large (about 34 million trucks as compared to an estimated 4 million trucks greater than 10,000 lb GVWR). R.L. Polk carried out extensive processing of the registration data in preparation for the sampling procedure. The objective of this processing was to identify the desired sampling strata: straight trucks with gross vehicle weight ratings greater than 10,000 lb and all tractors in each state. The algorithm used included extensive vehicle identification number (VIN)-decoding procedures supplied by UMTRI. It was hoped that this processing would produce accurate strata counts. In particular, the final sample sizes were based on an assumption that at least 90 percent of the trucks in the tractor strata would be tractors, and that negligible numbers of tractors would be in the straight truck stratum. The results of the implementation phase presented later in this paper show some of these assumptions to have been too optimistic.

The sampling frame totals obtained from R.L. Polk after processing the registration information and final sample sizes are given in Table 6. The unknown stratum is for trucks determined to have gross vehi-

TABLE 6 Frame Totals and Sample Sizes—1983 NTTIS

	Straight Trucks		Tractors		Unknown	
State	Frame	Sample	Frame	Sample	Frame	Sample
Alabama	42,481	56	29,140	91	1	0
Arizona	12,144	30	9,679	60	1	0
Arkansas	27,699	37	23,409	73	–	–
California	38,318	51	79,238	495	–	–
Colorado	30,980	41	18,211	60	–	–
Connecticut	14,625	30	11,793	60	96	2
Delaware	6,146	30	6,926	60	–	–
District of Columbia	600	30	487	60	–	–
Florida	59,137	78	63,306	198	2	0
Georgia	50,787	67	33,023	103	6,263	125
Idaho	11,289	30	11,512	60	46	1
Illinois	82,648	109	88,942	278	2	0
Indiana	61,777	82	61,554	192	2	0
Iowa	43,429	58	40,125	125	94	2
Kansas	82,622	109	29,544	92	–	–
Kentucky	56,651	75	22,168	69	–	–
Louisiana	32,699	43	29,211	91	3	0
Maine	12,501	30	7,715	60	1	0
Maryland	29,120	38	19,701	61	20	0
Massachusetts	28,974	38	27,073	85	13	0
Michigan	34,886	46	40,135	314	–	–
Minnesota	63,353	84	41,399	129	11	1
Mississippi	21,592	30	21,042	66	968	18
Missouri	56,462	75	33,946	106	–	–
Montana	25,214	33	11,482	60	8	0
Nebraska	43,255	57	24,590	77	18	1
Nevada	5,443	30	4,070	60	–	–
New Hampshire	5,992	30	6,607	60	1	0
New Jersey	30,148	40	45,161	141	1	0
New Mexico	13,626	30	11,719	60	–	–
New York	60,296	81	55,720	174	–	–
North Carolina	64,948	86	47,610	149	–	–
North Dakota	51,749	69	13,899	60	–	–
Ohio	68,867	91	57,247	235	3	0
Oklahoma	–	–	–	–	–	–
Oregon	18,848	30	22,567	70	–	–
Pennsylvania	71,012	94	66,994	209	–	–
Rhode Island	4,133	30	4,199	60	1	0
South Carolina	20,639	30	15,857	60	–	–
South Dakota	21,630	30	10,264	60	1	0
Tennessee	36,651	48	30,231	94	1	0
Texas	90,870	120	115,555	361	3	0
Utah	13,455	30	13,496	60	–	–
Vermont	5,269	30	3,732	60	–	–
Virginia	45,272	60	29,983	93	–	–
Washington	26,786	35	22,615	71	2	0
West Virginia	13,173	30	9,359	60	–	–
Wisconsin	42,529	56	36,917	115	10	0
Wyoming	9,297	30	10,741	60	21	0
Total	1,691,022	2,497	1,437,894	5,497	7,593	150

cle weight ratings greater than 10,000 lb that could not be assigned to either of the first two stratum with the algorithm used. Sample sizes were taken in proportion to the frame totals except that a minimum sample of 30 straight trucks and 60 tractors was imposed. After selection, the final sample sizes were 2,497 from the straight truck stratum, 5,497 from the tractor stratum, and 150 from the unknown stratum, for a total sample of 8,144 trucks.

PROTOCOL

Survey interviewing was conducted by telephone whenever possible. Mail versions of the interviews were used only when the interview could not be completed by telephone. The survey work was divided into five phases. The first, or implementation, phase is the initial contact with the owner. On the initial contact, owner cooperation must be secured, vehicle identification confirmed, descriptive information on the company and truck obtained, and arrangements made for acquisition of the detailed mileage information on the survey date. The remaining four phases correspond to the four survey dates for the detailed mileage information, one every 3 months for each truck. Sample survey data forms are shown in Figures 1 and 2.

RESULTS

The implementation phase was initiated the first week of January 1985 and was not completed until the middle of May. The overall response rate was 75.1 percent, including partial completions. About 6 percent of the trucks selected were found to be nonsample vehicles. Of these, two-thirds had been destroyed, and 12 percent were no longer registered. Another 8.2 percent of the nonsample vehicles were trucks with gross vehicle weight ratings of 10,000 lb or less, while 6.2 percent were not trucks. Excluding nonsample vehicles, the response rate was 80 percent. As expected, inability to locate the owner was the major problem, accounting for 84 percent of the nonresponse. For many of these vehicles, the registration information obtained from R.L. Polk appeared to be out of date. The listed owner would indicate that he had sold the truck; however, sometimes a follow-up check with the state department of motor vehicles would show him to still be the registered owner. Refusals were encountered on only 3 percent of the selected vehicles, making up the remaining 14 percent of the nonresponse.

Preliminary analysis of the information collected in the implementation interviews reveals that about 40 percent of the trucks selected from the tractor stratum were found to be straight trucks. Table 7 gives the R.L. Polk frame totals versus the survey responses. The column totals are the sampling frame stratum totals, whereas the row totals show the results of the survey responses. Vehicles shown in the "tractor" column were selected from the tractor stratum in the sampling frame. The row entries show the survey responses for these vehicles. Nonresponse on the question of power unit type is shown as the "unknown" row on this table, and is only 12 percent of the total. The straight truck stratum was relatively clean, containing only about 4 percent tractors. As mentioned earlier, only about 6 percent of the selected vehicles were found to be nonsample. Overall, the frame processing was quite accurate except for the straight trucks in the tractor stratum.

Finding that 40 percent of the trucks selected as tractors are actually straight trucks has a direct influence on the resulting population estimates. This has also reduced the number of tractors in the sample from the target sample size of 4,000 to about 2,500. The data in Table 8 compare the NTTIS population estimates with figures derived from the 1982 Truck Inventory and Use survey public use tape (8) that was recently received from the Bureau of the Census. For this table, the survey nonresponse has been distributed to the straight truck and tractor categories. This was done by first dividing the nonresponse into 24 categories based on sampling strata, manufacturer, model year, and the R.L. Polk body style derived from the original registration information. Survey responses were used to determine the proportion of straight trucks and tractors in each of the 24 categories, and the nonresponse was distributed according to these proportions. Although the sampling frame totals indicated a national population of 1,437,894 tractors, the survey responses indicate a tractor population of only 873,732.

These figures are not comparable to FHWA (9) counts because the FHWA figures include some pickup trucks, some utility (passenger) vehicles, and other trucks with GVWR of 10,000 lb or less. For the NTTIS, large trucks are defined as trucks that have a gross vehicle weight rating greater than 10,000 lb. For purposes of comparison, trucks registered in Alaska, Hawaii, and Oklahoma are excluded from Table 8 as well as pre-1973 model-year trucks in California.

In general, the agreement between the 1982 TIU survey and the 1983 NTTIS is good. The frame processing for the NTTIS included elimination of duplicate registrations from state to state. This was not done for the TIU survey sample. For the NTTIS, the GVWR was determined from the vehicle identification number and then confirmed when the owner was contacted in the implementation phase. Only 0.5 percent of the selected trucks were found to have GVWR of 10,000 lb or less. In comparison, the gross vehicle weight code in the 1982 TIU survey data is based on the owner's estimate of the average weight of the vehicle when carrying a typical payload during the past year. The use of VIN information followed by confirmation by the owner in the NTTIS would appear to provide a more accurate identification of trucks that have a manufacturers' gross vehicle weight rat-

TABLE 7 Estimated U.S. Large Truck Population, R. L. Polk Frame Totals Versus Survey Responses

	Polk Frame Totals			
Survey Data	Straight Truck	Tractors	Unknown	Survey Total
Straight truck	1,349,256	459,973	3,397	1,812,626
Tractor	49,321	693,820	50	743,191
Unknown	179,383	199,234	1,521	380,138
Nonsample	113,062	84,867	2,625	200,554
Polk totals	1,691,022	1,437,894	7,593	3,136,509

TABLE 8 Estimates of the U.S. Large Truck Population[a]

	Source	
Truck Type	1982 TIU	NTTIS
Straight truck	2,393,173	2,062,223
Tractors	863,385	873,732
Total	3,256,558	2,935,956

[a] Excluding Alaska, Hawaii, Oklahoma, and trucks with model years before 1973 in California.

COMPANY DESCRIPTION

OPERATING AUTHORITY:

Is this a daily rental truck? YES[ ]7
Is this truck govt. owned? YES[ ]6 — SKIP to Power Unit Description below.
(city/county/state/federal) 8

Do any of your trucks ever carry goods interstate (across state lines)?

[ ]1 YES → Are you
- PRIVATE [ ]1 *(Carry own goods)* → [ ]1
- FOR HIRE [ ]2 *(Carry other people's goods)* → ICC Authorized (common/contract) [ ]2 / Exempt [ ]3 → Is the owner also the driver? YES [ ]1 NO [ ]2

[ ]2 NO → Are you
- PRIVATE [ ]1 *(Carry own goods)* → [ ]4
- FOR HIRE [ ]2 *(Carry other people's goods)* → [ ]5 (11) → Is the owner also the driver? YES [ ]1 NO [ ]2

[ ]9 UNKNOWN (9) →
- PRIVATE [ ]1
- FOR HIRE [ ]2 (10) → Is the owner also the driver? YES [ ]1 NO [ ]2 (12)

POWER UNIT DESCRIPTION

Verify the make, model year, and VIN, and ask for the model name and company unit number.

1. Make ____________ Year: 19__ __ VIN ____________
2. Model Name ____________ Company Unit Number ____________
3. *EDITOR:* Code the base state of operation __ __ (13 14)
4. POWER UNIT TYPE
   Tractor [ ]8
   Straight Truck [ ]1 (15)

   STRAIGHT TRUCK BODY STYLE:
   Van [ ]1
   Flatbed [ ]2
   Tanker [ ]3
   Refrig. [ ]5
   Dump [ ]6
   Refuse [ ]7
   Other [ ]8 (16)
   ____________ *(Specify)*
5. NUMBER OF AXLES
   Two [ ]2
   Three [ ]3
   Four + [ ]4 (17)
6. CAB STYLE
   Cab Forward [ ]1
   Cab Over [ ]2
   Short Conventional [ ]3
   Med. Conventional [ ]4
   Long Conventional [ ]5 (18)
7. FUEL
   Gas [ ]1
   Diesel [ ]2
   Other ____________ [ ]3 (19)
   (Specify)
8. Power Unit EMPTY WEIGHT: __ __ __ __ __ __ (20 21 22 23 24 25)
9. Power Unit LENGTH: __ __ __ (26 27 28)
10. Estimated Annual Mileage *for this power unit:* __ __ __ __ __ __ (29 30 31 32 33 34)
11. Percent of annual mileage for each trip type *for this power unit:*
    - Local *(Pickup and delivery, with 50 mile radius)* __ __ __% (35 36 37)
    - Short Haul *(Intercity, one-way, distance 50-200 miles)* __ __ __% (38 39 40)
    - Long Haul *(Intercity, one-way, distance 200+ miles)* __ __ __% (41 42 43)

    (Total=100%)
12. Does this power unit ever pull twin trailers?
    [ ] Yes Percent of annual mileage with twin trailers: __ __ __% (44 45 46)
    [ ] No *(Enter 000.)*
13. Odometer Reading __ __ __ __ __ __ (47 48 49 50 51 52) Date of Reading __ __/__ __/__ __ (53 54 55 56 57 58)

FIGURE 1 NTTIS company and power unit description.

WAS THIS VEHICLE IN USE ON THE SURVEY DAY? No[ ]*00* 8-9

TRIP 01 8-9

VEHICLE, CARGO, AND DRIVER

1. OPERATING AUTHORITY (Private Carriers only)
   Were you operating for-hire (e.g., on backhaul)?
   [ ]*1* No
   [ ]*2* Yes Was it as? ICC (common/contract) [ ]*2*
   10 Exempt (interstate hauling only) [ ]*3*
   Intrastate for-hire [ ]*5* 11

2. DRIVER AGE: ____ Yrs. (12-13) 3. DRIVER YEARS WITH COMPANY: ____ Yrs. (14-15)

4. CONFIGURATION: Any trailers? No [ ]*1*
   Yes [ ]*2* 16

	Power Unit	1st Trailer	2nd Trailer	3rd Trailer
Type:	↓	Semi [ ]*1*		
		Full [ ]*2*	Full [ ]*2*	Full [ ]*2*
		Utility [ ]*3*	Utility [ ]*3*	Utility [ ]*3*
		Other [ ]*4*	Other [ ]*4*	Other [ ]*4*
		None [ ]*5* 17	None [ ]*5* 18	None [ ]*5* 19
Body:		Van [ ]*1*	Van [ ]*1*	Van [ ]*1*
		Flatbed [ ]*2*	Flatbed [ ]*2*	Flatbed [ ]*2*
		Tank [ ]*3*	Tank [ ]*3*	Tank [ ]*3*
		Auto C. [ ]*4*	Auto C. [ ]*4*	Auto C. [ ]*4*
		Dump [ ]*6*	Dump [ ]*6*	Dump [ ]*6*
		Other [ ]*8* 20	Other [ ]*8* 21	Other [ ]*8* 22
		(Specify)	*(Specify)*	*(Specify)*
No. Axles Used:	23	24	25	26
Lengths *(Ft)*:	27-29	30-32	33-35	36-38
Empty Wts *(Lbs)*:		39-44	45-50	51-56
5. CARGO:	[ ] 57-58	[ ] 59-60	[ ] 61-62	[ ] 63-64
Cargo Wt *(Lbs)*:	65-70	71-76	77-82	83-88
Hazardous Cargo	Yes [ ]*1* No [ ]*2* 89	Yes [ ]*1* No [ ]*2* 90	Yes [ ]*1* No [ ]*2* 91	Yes [ ]*1* No [ ]*2* 92

6. GROSS COMBINATION WEIGHT for the trip *(Lbs)*: ____ 93-98 [1] 99 DUP 1-9

MILEAGE

1. Starting Point ____ *(City)* ____ *(State)* Time: ____ AM[ ] PM[ ]
2. End Point ____ *(City)* ____ *(State)* Time: ____ AM[ ] PM[ ]
3. Via ____
   (Describe route/give road nos., etc.)
4. Total Miles for Trip: ____ 10-13
5. Breakdown of Mileage:

	LIMITED ACCESS		US/STATE/MAJOR ARTERY		OTHER	
	Day *(6am-9pm)*	Night *(9pm-6am)*	Day *(6am-9pm)*	Night *(9pm-6am)*	Day *(6am-9pm)*	Night *(9pm-6am)*
Rural:	14-17	18-21	22-25	26-29	30-33	34-37
Sm Urban: *(Pink & Orange)*	38-41	42-45	46-49	50-53	54-57	58-61
Lg Urban: *(Yellow)*	62-65	66-69	70-73	74-77	78-81	82-85

6. Specific Large Urban Area: ___ ___ 86 87 [2] 99

FIGURE 2 NTTIS survey day trips.

VEHICLE, CARGO, AND DRIVER

1. OPERATING AUTHORITY (Private Carriers only)
Were you operating for-hire (e.g., on backhaul)?
[ ]1 No
[ ]2 Yes Was it as? ICC (common/contract) [ ]2
10 Exempt (interstate hauling only) [ ]3
Intrastate for-hire [ ]5 11

2. DRIVER AGE: ____ Yrs. (12-13) 3. DRIVER YEARS WITH COMPANY: ____ Yrs. (14-15)

4. CONFIGURATION: Any trailers? No [ ]1 Yes [ ]2 (16)

	Power Unit	1st Trailer	2nd Trailer	3rd Trailer
Type:	↓	Semi [ ]1		
		Full [ ]2	Full [ ]2	Full [ ]2
		Utility [ ]3	Utility [ ]3	Utility [ ]3
		Other [ ]4	Other [ ]4	Other [ ]4
		None [ ]5 (17)	None [ ]5 (18)	None [ ]5 (19)
Body:		Van [ ]1	Van [ ]1	Van [ ]1
		Flatbed [ ]2	Flatbed [ ]2	Flatbed [ ]2
		Tank [ ]3	Tank [ ]3	Tank [ ]3
		Auto C. [ ]4	Auto C. [ ]4	Auto C. [ ]4
		Dump [ ]6	Dump [ ]6	Dump [ ]6
		Other [ ]8 (20)	Other [ ]8 (21)	Other [ ]8 (22)
		____ *(Specify)*	____ *(Specify)*	____ *(Specify)*
No. Axles Used:	____ 23	____ 24	____ 25	____ 26
Lengths *(Ft)*:	____ 27-29	____ 30-32	____ 33-35	____ 36-38
Empty Wts *(Lbs)*:		____ 39-44	____ 45-50	____ 51-56
5. CARGO:	____ [ ] 57-58	____ [ ] 59-60	____ [ ] 61-62	____ [ ] 63-64
Cargo Wt *(Lbs)*:	____ 65-70	____ 71-76	____ 77-82	____ 83-88
Hazardous Cargo	Yes [ ]1 No [ ]2 (89)	Yes [ ]1 No [ ]2 (90)	Yes [ ]1 No [ ]2 (91)	Yes [ ]1 No [ ]2 (92)

6. GROSS COMBINATION WEIGHT for the trip *(Lbs)*: ____ 93-98 [1] 99 DUP 1-9

MILEAGE

1. Starting Point ____ *(City)* ____ *(State)* Time: ____ AM[ ] PM[ ]

2. End Point ____ *(City)* ____ *(State)* Time: ____ AM[ ] PM[ ]

3. Via ____
(Describe route/give road nos., etc.)
____

4. Total Miles for Trip: ____ 10-13

5. Breakdown of Mileage:

	LIMITED ACCESS		US/STATE/MAJOR ARTERY		OTHER	
	Day (6am-9pm)	Night (9pm-6am)	Day (6am-9pm)	Night (9pm-6am)	Day (6am-9pm)	Night (9pm-6am)
Rural:	14-17	18-21	22-25	26-29	30-33	34-37
Sm Urban: *(Pink & Orange)*	38-41	42-45	46-49	50-53	54-57	58-61
Lg Urban: *(Yellow)*	62-65	66-69	70-73	74-77	78-81	82-85

6. Specific Large Urban Area: __ __ [2] (86 87 99)

FIGURE 2 (continued)

ing greater than 10,000 lb. Despite these differences, the agreement between the population estimates from the NTTIS and the 1982 TIU survey is reassuring. This is the first time that an independent national survey has been conducted to corroborate the TIU survey results. The combination of these two surveys substantially reduces the range of estimates of the U.S. large truck population.

ACKNOWLEDGMENT

The work described in this paper is part of a long-term truck safety research program at the University of Michigan Transportation Research Institute sponsored by the Motor Vehicle Manufacturers Association, the American Trucking Associations, Inc., the Western Highway Institute, the Truck Safety Equipment Institute, Freightliner Corporation, and the National Highway Traffic Safety Administration. The author is grateful for the opportunity to contribute to the knowledge of truck safety that this kind of continuing support makes possible.

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Publication of this paper sponsored by Committee on Motor Vehicle Technology.