Comparison of Large-Truck Travel Estimates from Three Data Sources

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The number of miles traveled each year by the U.S. large-truck population is a topic of interest for many reasons, one of which is safety. Although the number of accidents involving large trucks may be easily calculated from accident data, it is often more informative to know their risk of accident involvement per mile of travel. This requires accurate travel data. Compared in this paper are three sources of truck travel data: the Truck Inventory and Use Survey conducted by the Bureau of the Census; the National Truck Trip Information Survey conducted by the University of Michigan Transportation Research Institute; and annual estimates published in *Highway Statistics* by the Federal Highway Administration. Each data source yields different estimates of annual travel by large trucks, which is to be expected considering the difficulty of collecting travel data. The overall conclusion, however, is that the Truck Inventory and Use Survey and the National Truck Trip Information Survey estimates are reasonably close to each other, whereas *Highway Statistics* estimates are significantly higher. The implication of this finding is that the procedures used by the states and the Federal Highway Administration to generate *Highway Statistics* data lead to artificially and systematically high estimates of travel by large trucks.

The Center for National Truck Statistics of the University of Michigan Transportation Research Institute (UMTRI) conducted a national survey of medium and heavy trucks beginning in January of 1985. Termed the National Truck Trip Information Survey (NTTIS), the study produced estimates of the national registered large-truck population and its annual travel. The methodology of NTTIS is described in detail in a companion paper (*1*). In this paper, estimates of large-truck travel from NTTIS and two other sources are compared. One purpose of the comparisons is to assess the degree of correspondence among the three travel estimates. Another is to illustrate the inherent difficulty in measuring truck travel and the benefit of considering multiple sources of travel data. Despite the difficulty and associated cost of collecting travel data, truck travel information is vitally needed in order to make informed decisions on a host of topics, particularly those concerning truck safety.

NTTIS AND TIUS COMPARISONS

The comparisons start with two sources of data, NTTIS and the Truck Inventory and Use Survey (TIUS). TIUS is conducted every 5 years by the Bureau of the Census as part of the Census of Transportation. NTTIS and TIUS begin with a common base, the R.L. Polk vehicle registration files. The sampling frame for NTTIS was formed from the July 1, 1983, Polk files. The two most recent TIUS surveys were drawn from the July 1, 1982, and July 1, 1987, versions of the Polk files respectively. NTTIS restricted its sample to trucks with a gross vehicle weight rating (GVWR) greater than 10,000 lb. All pick-up trucks, regardless of GVWR, were excluded from the sample, as were all passenger vehicles (such as passenger vans, recreational vehicles, ambulances, and buses of any type), farm tractors, and government-owned trucks. Similar to NTTIS, TIUS excluded ambulances, open utility vehicles, motor homes, buses, farm tractors, and government-owned vehicles. Unlike NTTIS, TIUS sampled trucks of any GVWR, including light trucks.

The implementation phase of NTTIS was carried out in January through May of 1985. As part of this phase, survey interviewers contacted truck owners and asked them how far they drove their power unit in a year. Phone interviewers also obtained descriptive information on the truck and the company at this time. The implementation phase produced data on 6,305 trucks. During the subsequent trip phase of NTTIS, truck owners were contacted by phone four times over the course of a year. Each time, interviewers sought information on all trips made by the truck in a specific 24-hr period. Detailed physical information on the truck and its cargo was collected, and the routes traveled by the truck were mapped according to road type, population area (rural/urban), and time of day (day/night).

TIUS is conducted through survey forms mailed to owners of selected trucks beginning in January of the year after the Polk sample is drawn. Owners characterize their trucks in terms of the typical configuration and use over the previous year. This includes an estimate of the number of miles traveled, as well as information on the number of trailers usually hauled, type of cargo usually carried, typical weight of a load, and so on. The 1982 TIUS collected data on a total of 84,334 trucks, including light trucks. The 1987 TIUS total was 104,606 trucks.

Before the completion of NTTIS, TIUS had been the only national data base concerning the use of large trucks. Therefore, it is important to consider whether major differences exist between NTTIS and TIUS, given that NTTIS sampled a smaller proportion of the national truck population than TIUS. Whenever possible, NTTIS data elements were designed to be compatible with TIUS in order to facilitate comparison between the two. This section will compare truck population and travel estimates derived from NTTIS with those from the two TIUS surveys.

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Truck Population

Estimates of the registered large-truck population in the continental United States by power unit type can be derived from both NTTIS and TIUS. The number of straight trucks is estimated at 2,534,973 by 1982 TIUS; 2,185,630 by NTTIS; and 3,230,210 by 1987 TIUS. The NTTIS estimate is about 14 percent lower than 1982 TIUS and 32 percent lower than 1987 TIUS. The number of truck-tractors is 900,884 according to 1982 TIUS; 919,702 according to NTTIS; and 1,038,130 according to 1987 TIUS. NTTIS estimates about 2 percent more tractors than 1982 TIUS and about 11 percent fewer tractors than 1987 TIUS.

At least three factors affect the degree of correspondence among the estimates from the three files. One is that the samples were drawn from three different registration years. Generally one would expect a small increase in the number of registered trucks from year to year, assuming favorable economic conditions. The other two factors are more complex and will be discussed in the next few paragraphs. One concerns identifying medium- and heavy-duty trucks in the TIUS data, and the other involves the time gap in NTTIS between drawing the sample and conducting the survey.

Large Trucks and GVWR

From the outset, the NTTIS survey was restricted to medium- and heavy-duty trucks, those with a GVWR over 10,000 lb. In contrast, TIUS samples all trucks, including light trucks. GVWR is encoded in the Vehicle Identification Number (VIN) for almost all trucks manufactured after 1980. R. L. Polk has developed decoding algorithms to extract this information from the VIN, and this code was included in the data supplied for the NTTIS survey. The Polk-derived GVWR is also included in the 1982 TIUS file but not in the 1987 version.

The VINs of some trucks, particularly those from model years before 1981, do not directly contain the GVWR. For many of these cases, the Polk-derived GVWR is based on the truck model as derived from the VIN, with the highest GVWR available for that model (as an option, for example) assigned. For many specific models, the majority of sales are at lower GVWRs. To improve the accuracy of the 10,000-lb GVWR cutoff when the NTTIS sample was drawn, UMTRI specified whether particular models should be included or excluded, in some cases overriding the Polk-derived GVWR. Models and series were identified for inclusion or exclusion based on sales information provided by the manufacturers. If the manufacturers indicated that the majority of sales were at a GVWR of 10,000 lb or less, then all of that specific model and series were excluded. The objective was to prevent the inclusion of an entire series when only a small fraction was actually rated over 10,000 lb. The models most influenced by this procedure were small step vans and pick-up truck models sold as a cab and chassis. The latter often have a flatbed or stake body added. To further ensure accuracy, GVWR was confirmed with the owner during the implementation phase of NTTIS.

Restricting the sample to trucks with GVWRs of more than 10,000 lb was not an issue for TIUS because light trucks are included in that survey. The Polk GVWR can be used to identify large trucks in the 1982 TIUS file, but for the reasons just stated some light trucks probably receive a Polk-derived GVWR over 10,000 lb. This would increase population estimates of medium-duty trucks, primarily straight trucks. The situation is worse for the 1987 TIUS file because that version does not include a GVWR variable. The file contains an average gross vehicle weight (GVW) variable based on the owner's estimate of the average weight of the vehicle when carrying a typical payload. GVW is only loosely related to GVWR, however, and rejecting all cases with average GVW below 10,001 lb would result in the exclusion of many medium-duty trucks. The 1987 TIUS population estimates presented in this paper exclude all vehicles identified as a pick-up, van, minivan, utility vehicle, or station wagon on truck chassis. In addition, a vehicle was excluded if the empty combination weight was 6,000 lb or less and the power unit was coded as having only four tires. This should ensure that only light-duty vehicles are excluded from the analysis. However, it is likely that not all light trucks in TIUS were excluded, thus inflating population estimates. Medium-duty straight trucks are the vehicles most likely to be overstated.

To summarize to this point, the difficulty of accurately identifying large trucks in TIUS data probably results in inflated estimates of straight trucks compared with NTTIS. The problem should be less severe for the 1982 file, because it contains a Polk-derived GVWR variable that should be only slightly less accurate than the GVWR determinations employed by NTTIS. The 1987 TIUS straight truck estimates are undoubtedly more affected because that file does not contain a GVWR variable. The GVWR problem is not thought to seriously affect population estimates of tractors in either TIUS file.

NTTIS Time Gap

The third major factor affecting vehicle population estimates between NTTIS and TIUS concerns a time delay in NTTIS between drawing the sample and implementing the survey. The sample was based on the July 1, 1983, R. L. Polk files, but the NTTIS implementation phase was not conducted until January through May of 1985. Vehicles that were junked or scrapped in the interim were removed from the sample, and there was no opportunity to replace them with vehicles that were purchased during that time. This means that NTTIS vehicle counts are low by about a model-year class and a half—those trucks bought during 1984 and the second half of 1983.

In the case of TIUS, the sample is drawn from registrations as of July 1 in a particular year, and survey forms are mailed out over several months of the following year. However, if a vehicle has been junked or scrapped in the meantime, it is still included in the survey. Thus TIUS population estimates refer to the date of the registration lists on which the sample was based, with no loss of cases. Other things being equal, TIUS population estimates should come closer to approximating the entire registered truck population on a given date.

Reconciling Population Estimate Differences

It is possible to adjust NTTIS vehicle count estimates to account for the year and a half of missed model years. Distribu-

tions of 1982 and 1987 TIUS vehicle counts by power unit type and model year were examined to see what percent the newest year and a half of model years represent in those two files. Because TIUS samples were based on Polk vehicle lists made halfway through a calendar year, trucks of the newest model year represent about half of a model-year class in TIUS. The next most recent model year should represent a full model-year class. The newest model year and a half of straight trucks represent 4.6 percent of straight trucks in 1982 TIUS and 8.8 percent in 1987 TIUS. It is impossible to say exactly what percent the missed straight trucks in NTTIS represented of the entire straight-truck population when that survey was conducted. The size of model-year classes varies from year to year, as the two TIUS percentages illustrate, because of economic conditions and other factors. However, using the TIUS percentages to estimate a range of missed straight trucks results in an adjusted NTTIS population estimate of 2,291,017 to 2,395,678 vehicles. This is still 5 to 10 percent below the 1982 TIUS estimate and 26 to 29 percent below the 1987 TIUS estimate. Considering that the three surveys were conducted in different years, that it is problematic to identify large trucks in TIUS (especially the 1987 TIUS), and that the adjustment is a rough estimate, the agreement among surveys is not bad.

The newest model year and a half represents 10.5 percent of tractors in 1982 TIUS and 13.1 percent in 1987 TIUS. This results in NTTIS adjusted tractor counts of 1,027,600 to 1,058,755 vehicles. These estimates are 14 to 18 percent above 1982 TIUS tractor counts and between 1 percent below and 2 percent above 1987 TIUS tractor counts. This is also a fairly good agreement, and the adjustment to NTTIS may in fact be higher than is appropriate because of the variation in model-year class sizes.

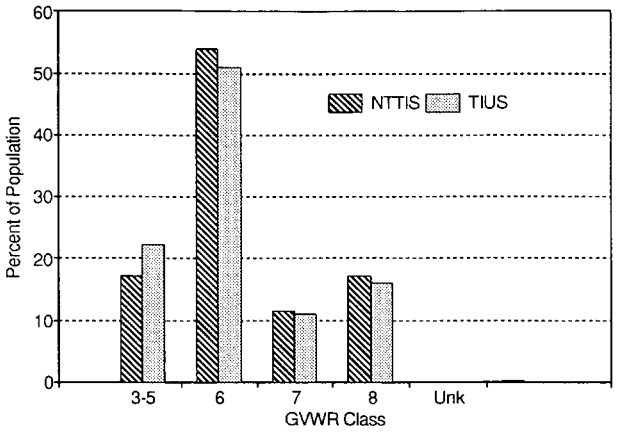

FIGURE 1 Straight trucks by GVWR in NTTIS and 1982 TIUS.

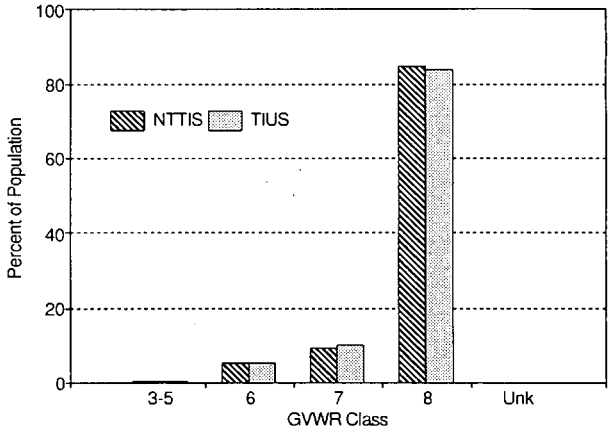

FIGURE 2 Tractors by GVWR in NTTIS and 1982 TIUS.

File Comparisons

Leaving aside the question of absolute vehicle population estimates, NTTIS and TIUS will be compared based on the distribution of several variables describing the large-truck population of each. Both surveys were designed to describe the U.S. registered truck population. Agreement between the two would indicate that they are characterizing the same basic population of vehicles. Although the surveys were conducted in different years, many aspects of the large-truck population change slowly enough that general agreement should be expected if both surveys are representative of the U.S. truck population.

GVWR provides a good basis of comparison between NTTIS and 1982 TIUS because GVWR was included in the original sample data provided by R. L. Polk to both surveys. Most of the other information collected by the two surveys came from respondents and is therefore subject to respondent error. A comparison of the distributions of the national truck population by GVWR from 1982 TIUS and NTTIS is shown for straight trucks in Figure 1 and for tractors in Figure 2. In general, the agreement is good, especially for tractors. The main difference is a somewhat higher proportion of GVWR Class 3 to 5 (10,001 to 19,500 lb) straight trucks in TIUS compared with NTTIS, possibly a result of misclassifications in the Polk-derived GVWRs used in the TIUS file.

Compared in Figure 3 is the distribution of cab style for tractors only in NTTIS and 1982 TIUS. This information is obtained from the survey respondent, and the categories used were cabover, short conventional, medium conventional, and long conventional. (Conventional cabs were not subdivided in the 1987 TIUS, so no distribution is included.) The agreement between 1982 TIUS and NTTIS is very good. This is particularly gratifying in view of the lack of a precise definition of what constitutes a short, medium, or long conventional cab.

The last comparison presented here is carrier type for tractors only, shown in Figure 4. Again, this information is supplied by the respondent in both surveys. Carrier types are defined according to whether the company operates interstate or intrastate and whether it is private or for hire. Private carriers operate close to 50 percent of the tractors in both of the TIUS files, and about 53 percent in NTTIS. In NTTIS, a further breakdown of private carriers is made into interstate and intrastate carriers (not shown in Figure 4). Interstate private carriers operate 32.5 percent of all tractors and intrastate 19.9 percent in NTTIS. The remainder of the vehicles in NTTIS and TIUS are for hire in one way or another. For-

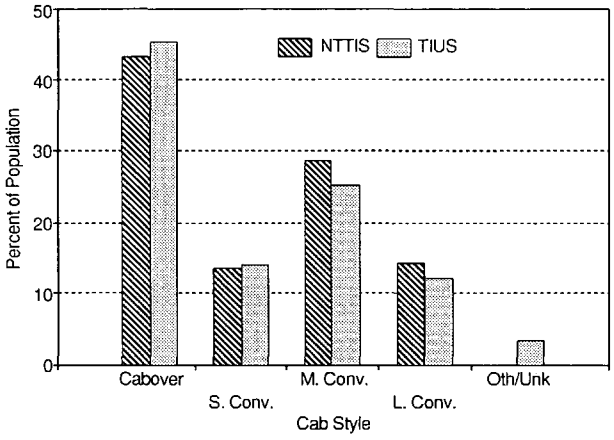

FIGURE 3 Tractors by cab style in NTTIS and 1982 TIUS.

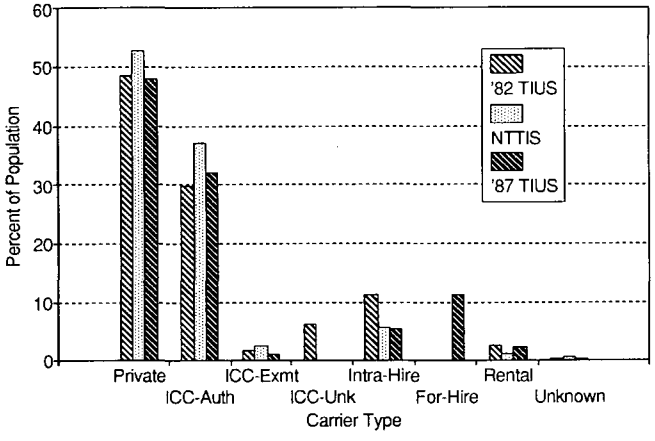

FIGURE 4 Tractors by carrier type in NTTIS and 1982 and 1987 TIUS.

hire vehicles are further subdivided in both NTTIS and TIUS into interstate for-hire, in which case they are subject to Interstate Commerce Commission regulations, and intrastate for-hire, where they are governed by state public service commission regulations. Interstate for-hire vehicles are also separated into authorized carriers—the common and contract carriers—and those hauling exempt commodities. The small group of unknown ICC-regulated carriers in 1982 TIUS are those instances in which respondents did not specify whether they were authorized or exempt carriers. If these cases were distributed between authorized and exempt carriers, it would bring the 1982 TIUS survey into fairly good agreement with NTTIS.

A category of just "for-hire" carriers is included for the 1987 TIUS file. These are cases in which the respondent indicated that the company was for hire but did not specify whether it was subject to ICC regulations. The "for-hire" cases would be distributed among the ICC-authorized, ICC-exempt, and intrastate for-hire categories. This redistribution of cases would probably result in NTTIS having a slightly lower proportion of intrastate for-hire carriers than either TIUS file. NTTIS shows relatively fewer daily rental trucks as well. The owners in both of these categories are usually small carriers and difficult to reach except at night and on weekends. These response problems may be partly responsible for the smaller proportion of trucks operated by intrastate for-hire carriers or in daily rental in NTTIS. Overall, however, the agreement between NTTIS and TIUS on carrier type is quite good.

Truck Travel

Self-Reported Average Annual Mileage Comparisons

NTTIS estimated average annual travel of trucks in three ways: owners' estimates, odometer readings, and mapped mileage from survey calls (*1*). TIUS relies only on estimates from respondents, so NTTIS owner estimates will be used to compare average annual mileage between the two surveys. Both surveys asked owners essentially the same question about how far their truck is driven in a year. Comparisons are based on average annual mileage per vehicle rather than total miles logged by the entire registered large truck population so that the different vehicle population estimates produced by NTTIS and TIUS will not affect the evaluation of mileage estimates.

As shown in Figure 5, the overall agreement in owner-reported average annual travel between the surveys is quite good. The NTTIS straight truck figure is about 18 percent higher than 1982 TIUS and about 13 percent higher than 1987 TIUS. The estimates for tractors are closer, with NTTIS 4 percent higher than 1982 TIUS and 2 percent lower than 1987 TIUS. It is interesting to note that there is a higher degree of correspondence between the files for tractors than for straight trucks. This may be related to the inclusion of some light trucks in the TIUS straight-truck estimates. Light trucks would be expected to travel less in a year, thus lowering the straight truck average.

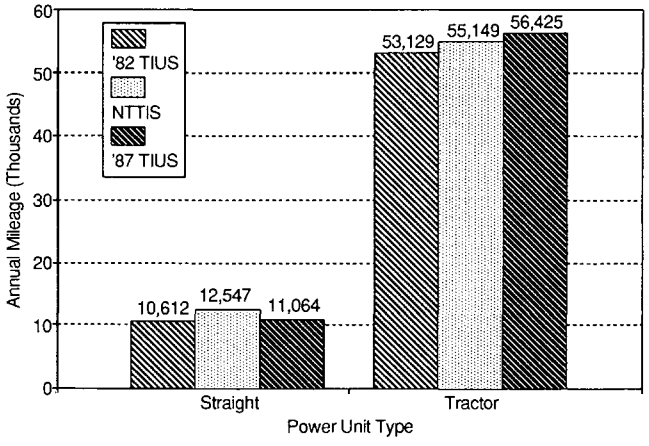

FIGURE 5 Owner-reported average annual mileage by power unit type in NTTIS and 1982 and 1987 TIUS.

Total Annual Mileage

Total mileage estimates by power unit type may also be compared between NTTIS and TIUS. Earlier the degree of undercounting of vehicles in NTTIS because of missed model years was estimated. The corresponding lost travel may be calculated in a similar manner. Straight trucks of the newest model year and a half represent 10.3 percent of the total mileage of 1982 TIUS straight trucks and 15.7 percent of the straight truck mileage in 1987 TIUS. Making the corresponding adjustment to NTTIS raises NTTIS straight-truck mileage from 26,700 million mi to the range of 29,750 to 31,672 million mi (Figure 6). This places NTTIS straight-truck mileage estimates between the 1982 and 1987 TIUS estimates, as would be expected because NTTIS was intermediate in time between the two TIUS surveys. The adjusted NTTIS estimates are 11 to 18 percent above the 1982 TIUS estimate and 11 to 17 percent below the 1987 TIUS estimate.

The newest model year and a half account for 16.3 percent of total tractor mileage in 1982 TIUS and 19.3 percent in 1987 TIUS. This adjustment raises the NTTIS tractor mileage estimate from 49,921 million mi to the range of 59,632 to 61,879 million mi (Figure 7). This places estimated tractor mileage in NTTIS 25 to 30 percent above 1982 TIUS and 2 to 6 percent above 1987 TIUS. The adjusted NTTIS mileage is higher than expected, possibly because the missed model years in NTTIS represented a lower proportion than was calculated using the TIUS files.

Discussion of NTTIS and TIUS

Estimates of national truck population and travel from NTTIS were compared with 1982 and 1987 TIUS. The comparisons covered power unit type, GVWR class, cab style, carrier type, and owner-reported annual mileage. Overall, there is a good correspondence between the two surveys. Some of the differences observed may be because of the different years of registration files from which the samples were drawn, the 18-month period between the sample year and the survey in NTTIS, and the probable classification of some straight trucks

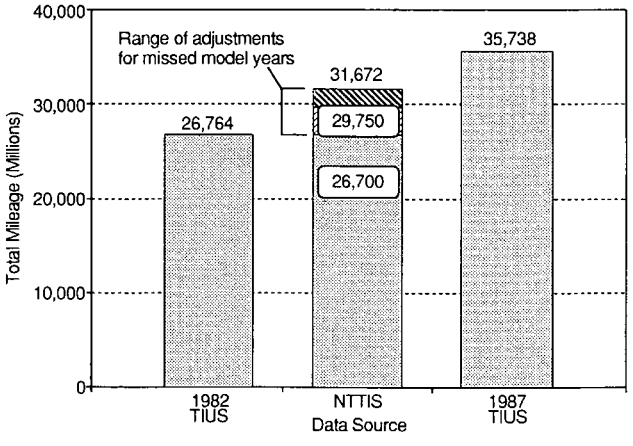

FIGURE 6 Total annual mileage for straight trucks in NTTIS and 1982 and 1987 TIUS.

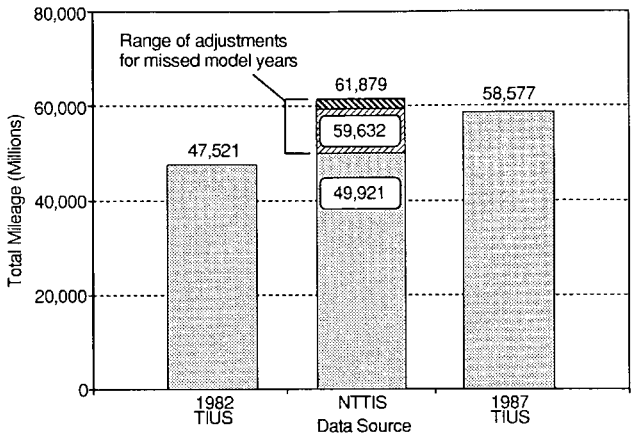

FIGURE 7 Total annual mileage for tractors in NTTIS and 1982 and 1987 TIUS.

with GVWRs below 10,000 lb as Class 3 or higher in TIUS. Aside from these known discrepancies, there is no indication of systematic differences between NTTIS and TIUS.

COMPARISONS WITH FHWA *HIGHWAY STATISTICS*

Each year the Federal Highway Administration (FHWA) publishes *Highway Statistics*, a tabulation of national transportation statistics based on data submitted by the states. *Highway Statistics* categorizes travel for different classes of vehicles on different types of roads. This section compares national estimates of the number of registered large trucks and their annual mileage from *Highway Statistics* with NTTIS and TIUS estimates.

Data Sources

Highway Statistics categorizes large trucks as single units and combination vehicles. Single units essentially include straight trucks alone, straight trucks hauling utility trailers, and bobtails (tractors without a trailer). Combinations include tractors hauling one or more trailers, as well as straight trucks hauling full trailers. *Highway Statistics* is published annually, and estimates from one year are revised in the following year's edition. The data cited here come from the 1986 and 1988 editions of *Highway Statistics*, Table VM-1 (*2*), representing the revised estimates for the 1985 and 1987 large truck populations respectively. *Highway Statistics* 1985 will be compared with NTTIS, and *Highway Statistics* 1987 will be compared with 1987 TIUS. Numbers for single units were not available for 1982 *Highway Statistics*, so no comparisons will be made with 1982 TIUS.

The *Highway Statistics* data include government-owned vehicles and vehicles registered in Alaska and Hawaii. These vehicles should be excluded for purposes of comparison with NTTIS and TIUS estimates. Because the published *Highway Statistics* data for trucks do not indicate the percentage of government vehicles or the distribution of vehicles by state,

estimates were made using other sources of information. The Alaska and Hawaii adjustments for vehicle counts were made based on the state distribution in 1987 TIUS. The Alaska and Hawaii travel estimate adjustments relied on several years of raw and adjusted state-reported mileage figures submitted to FHWA (*3*, *4*). It was more difficult to estimate the percentage of government-owned vehicles because they are not included in TIUS or NTTIS. The vehicle count adjustments for government trucks were made based on an UMTRI data base of large trucks involved in fatal accidents (*5*), and the mileage adjustments took into account figures cited by Mingo (*4*).

The NTTIS vehicle count and mileage estimates used for the comparisons are based on the adjusted figures that account for the missed model year and a half of trucks. The midpoint of the adjusted range was used in each instance. Estimates were produced following *Highway Statistics'* single-unit and combination vehicle classification system. NTTIS mileage figures are based on owner-reported estimates. The TIUS 1987 data were also made consistent with the *Highway Statistics* classification system, but this was slightly more difficult because TIUS produces no estimates for bobtails. Adjustments were made using configuration distributions from NTTIS.

Vehicle Count and Mileage Comparisons

Vehicle count estimates of single-unit trucks are 2,367 million for NTTIS, 3,709 million for 1985 *Highway Statistics* (HS), 3,206 million for 1987 TIUS and 3,668 million for 1987 HS. As noted earlier, the 1987 TIUS straight truck estimate is believed to be too high because of the inadvertent inclusion of light trucks. Given this, it is significant to observe that both HS estimates are even higher than the 1987 TIUS figure. HS estimates more than 14 percent more single-unit trucks than TIUS for 1987.

Vehicle count estimates for combination vehicles are 1,019 million for NTTIS; 1,393 million for 1985 HS; 1,062 for 1987 TIUS; and 1,409 million for 1987 HS. For 1985, HS is about 37 percent higher than NTTIS, and for 1987, HS is 33 percent higher than TIUS. These estimates suggest good agreement between NTTIS and TIUS and a substantial overestimation by *Highway Statistics*.

Total annual mileage estimates are shown in Figures 8 and 9. There is considerable variation in the single-unit travel estimates, with NTTIS showing 29.5 billion mi and 1987 HS estimating 48.3 billion mi of travel (Figure 8). The HS 1985 estimate is 56 percent higher than NTTIS, and the HS 1987 estimate is 37 percent higher than TUIS. The situation is similar for combination travel (Figure 9). HS 1985 estimates 28 percent more mi than NTTIS, whereas HS 1987 estimates 45 percent more travel than TIUS.

Discussion of *Highway Statistics* Estimates

The vehicle count and travel estimates published in *Highway Statistics* are based on data provided by the states. The aggregate statistics are calculated by FHWA using procedures that are intended to provide comparability of values among states. In a recent discussion of *Highway Statistics* large-truck travel estimates, Mingo (*4*) cited several indications that the

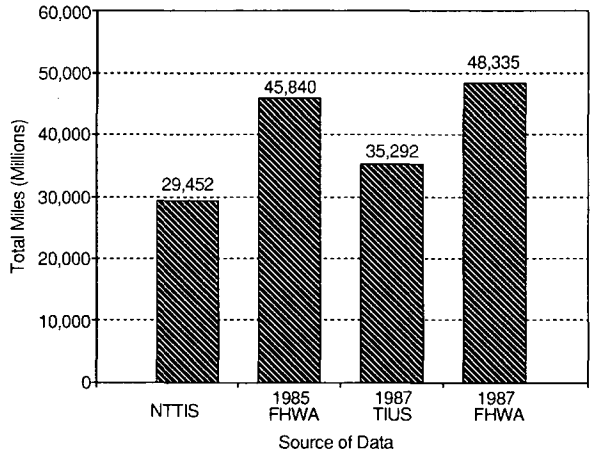

FIGURE 8 Total annual mileage for single-unit vehicles in NTTIS, 1985 and 1987 *Highway Statistics*, and 1987 TIUS.

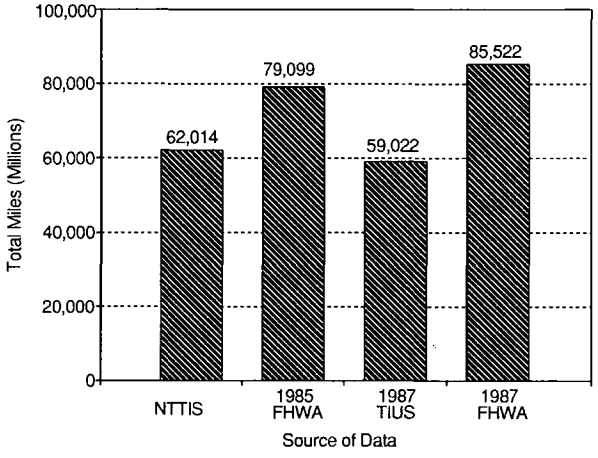

FIGURE 9 Total annual mileage for combination vehicles in NTTIS, 1985 and 1987 *Highway Statistics*, and 1987 TIUS.

estimates are too high. Mileage data submitted by states are based on traffic counts of 13 vehicle classes on selected segments of 12 types of roads. Most states use manual and automatic vehicle counting procedures, both of which are problematic. Human error in manual counting often results in the misclassification of vehicle types. With automatic classification, detector deficiencies can result in closely spaced separate vehicles being counted as a single combination vehicle or in the unintended counting of vehicles in adjacent lanes. Because large trucks represent a small proportion of vehicles overall, counting errors can lead to large percentage errors in vehicle class estimates, especially if there is a systematic bias in the miclassifications. Aside from these problems, states do not all employ the same vehicle type classification system. A particular difficulty is straight trucks with trailers, which, depending on state and trailer type, may be classified as either single-unit or combination vehicles.

Another major source of error is that most states count trucks only on weekdays. Generally no correction is made for the fact that truck travel is heavier on weekdays than week-

ends. Compounding the problem is the fact that counting sites frequently occur on routes with a large volume of heavy trucks.

In addition to these methodological problems, Mingo described other inaccuracies and inconsistencies in state reporting procedures. State estimates in various travel categories have a low level of precision, with mileage figures sometimes reported with only a single significant digit. In most of the states, vehicle-type classifications are entirely omitted for at least some of the road-type breakdowns. Mingo observed many instances of tremendous annual variation in travel estimates within states, including one state that reported an annual increase of more than 500 percent in combination travel.

FHWA attempts to compensate for some of the problems in the state data by adjusting the estimates. For example, a citation on Table VM-1, *1988 Highway Statistics*, indicates that the "stratification of the truck figures is based on the 1982 Truck Inventory and Use Survey (TIUS)." The problem of making these adjustments is compounded because the more recent 1987 TIUS data did not become available until nearly January 1991. The authors cannot evaluate the FHWA adjustment procedures because they have not had the opportunity to review them. Mingo concludes that FHWA's efforts to correct state-reported data contribute to an overestimation of large-truck travel.

The point here is that the *Highway Statistics* figures systematically overestimate large-truck travel. This is a matter of concern because *Highway Statistics* figures are widely used, both in virtually all FHWA studies requiring truck travel data and in many other studies as well. The following example illustrates the relevance of accurate travel information to traffic safety studies. Since 1980 UMTRI has conducted the Trucks Involved in Fatal Accidents (TIFA) survey. The survey combines information from Fatal Accident Reporting System (FARS) cases, Office of Motor Carriers accident reports, and telephone interviews to produce a file of detailed descriptions of all large trucks in the continental United States involved in fatal accidents. In Figure 10 the annual number of fatal involvements of combination vehicles has been plotted for the 7 years from 1982 through 1988 (5). The frequency of fatal involvements has remained relatively stable over this period, with a low of 3,376 in 1982 and a high of 3,762 in 1985. On the same graph, the original *Highway Statistics* estimates of the total mileage of combination vehicles for each year have been plotted (2). *Highway Statistics* mileage estimates have risen every year. The 90,149 million mi estimated for 1988 represent a nearly 50 percent increase over the 60,310 million mi estimated for 1982. The combination of the substantial increases in estimated travel and the comparatively steady number of fatal involvements results in a sharply declining fatality rate. This is also plotted in Figure 10, against the *y*-axis on the right edge of the graph. According to the *Highway Statistics* numbers, the fatal involvement rate of combination vehicles/100 million mi of travel has declined from 5.60 in 1982 to 4.12 in 1987, a drop of 26 percent.

Although such a dramatic decrease in the fatal involvement rate would be encouraging news, it is possible that much of this trend is an artifact of systematic error in the *Highway Statistics* travel estimates. It is reasonable to believe that large-truck travel has increased from year to year, with the overall expansion of the economy. However, TIUS estimates only a

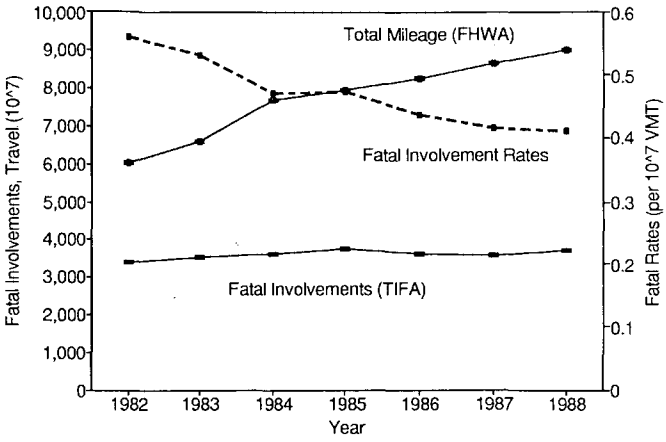

FIGURE 10 Fatal involvement rate of combination vehicles, 1982–1988.

23 percent rise in tractor travel from 1982 to 1987, whereas *Highway Statistics* estimates a 43 percent increase in combination vehicle travel during the same time span. Furthermore, *Highway Statistics'* 1982 figure was only 27 percent higher than the 1982 TIUS estimate, whereas in 1987 the *Highway Statistics* figure was 47 percent above TIUS. This suggests that cumulative error in the *Highway Statistics* large-truck travel estimates increases the amount of overestimation over time. If the *Highway Statistics* mileage figures are too high, then fatal involvement rates based on those figures will be too low.

CONCLUSIONS

Accuracy of large-truck travel estimates is clearly an important issue. Evaluating the safety of particular classes of vehicles requires information on both the number of accidents they experience and how many miles they accumulate, so that accident rates per mile of travel may be calculated and compared with other kinds of vehicles. Travel estimates that are too high will produce accident rates that are too low. Compared in this paper are large-truck travel estimates from three sources. The comparisons are not as straightforward as desired because of the different times the data were collected and the different methodologies used by each source. However, the overall conclusion is that estimates produced by TIUS and NTTIS show much closer agreement to each other than either survey does to estimates published in *Highway Statistics*. Ideally, more nationally representative surveys of large-truck travel will be conducted in the coming years so that their results may be included in similar travel comparisons. With more independent studies, the accuracy of *Highway Statistics* estimates can be better evaluated.

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