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THE SAFETY OF FARM TRUCK OPERATIONS

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16. Abstract

This report examines the safety of Class 7 and 8 trucks operated by farmers with respect to fatal accidents. In accordance with the Motor Vehicle Safety Act of 1986, the Commercial Driver's License program has been established to test and license the operators of Class 7 and 8 commercial vehicles. Farmers are one of the groups to which the CDL may be applied.

The 1982 Trucks Involved in Fatal Accidents (TIFA) file produced by UMTRI was used to identify farm trucks involved in fatal accidents. The 1982 Truck Inventory and Use Survey (TIUS) file produced by the Bureau of the Census was used to determine exposure.

Farmers were found to constitute a very small proportion of fatal truck accidents. Only 93 of 3,991 Class 7 and 8 trucks involved in fatal accidents in 1982 were operated by farmers. Farmers were also found to be underinvolved in such accidents when their travel was taken into account. While farm trucks accounted for 2.3% of fatal-accident involved Class 7 and 8 trucks, farm trucks accounted for 5.8% of the travel of such trucks.

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THE SAFETY OF FARM TRUCK OPERATIONS

Introduction

Under the provisions of the Motor Vehicle Safety Act of 1986, the Commercial Driver's License (CDL) program has been established to test and license the operators of commercial vehicles. "Commercial motor vehicles" were defined, among other things, as those with a Gross Vehicle Weight Rating (GVWR) greater than 26,000 pounds, i.e., Class 7 and 8 trucks. Farmers are just one of the groups to which the CDL may potentially apply. The present paper examines the safety of the operation of farm trucks, to compare the experience of farmers with that of all other truck operators.

Two data sets were used to examine the accident experience of farmers. The Trucks Involved in Fatal Accident (TIFA) file produced by the University of Michigan Transportation Research Institute (UMTRI) was used to develop the accident statistics. This file provides a detailed description of all fatal accidents involving a truck with a Gross Vehicle Weight Rating (GVWR) over 10,000 pounds. The file covers the entire United States, with the exception of Alaska and Hawaii. It contains accident descriptor variables from the Fatal Accident Reporting System (FARS) along with detailed vehicle information gathered by UMTRI through telephone interviews. Because of the structure of the TIFA file, the statistics presented here are limited to the 48 contiguous states, excluding Alaska and Hawaii, and concern only fatal accidents.

The Truck Inventory and Use Survey (TIUS) was used for information on the vehicle registrations and travel of farm and other trucks. TIUS is conducted by the Bureau of the Census every five years. The sample is drawn from state files of truck registrations maintained by the R. L. Polk Company. The data are collected by means of a questionnaire mailed to the owners of the sample vehicles. Among the questions included in TIUS are the type of business in which the truck is used, and its typical operations, including miles traveled, over the previous 12 months. Thus, TIUS is a convenient source of information on the number of farm and other trucks in the country, as well as their annual travel. The TIUS data from the 1982 survey is the most recent available. The 1982 TIFA data set was used for comparability.

Overall, farmers were found to constitute a very small proportion of fatal truck accidents and to be significantly underinvolved in such accidents. Only 93 of the 3,991 Class 7 and 8 trucks involved in a fatal accident in 1982 were operated by farmers. Considering only the raw numbers, it seems clear that the bulk of the safety problem in truck operations lies elsewhere.

Farmers are also underinvolved when their travel is taken into account. Two measures of involvement were calculated. The first is the number of fatal involvements per 100 million miles. By this measure, the farm fatal accident rate was less than half that of all other trucks. Absolute estimates of a rate per miles traveled are sensitive, of course, to the way the travel component, the denominator, is estimated. The danger of calculating absolute accident rates is the temptation to compare such rates with others that may have used quite different estimates of travel, and to be led to incorrect conclusions.

A second, preferable measure of involvement rates is the involvement ratio. This measure is simply the percentage of involvements for a vehicle type divided by its percentage of travel. If truck tractors pulling a semitrailer account for 20% of the truck travel but only 10% of the trucks in fatal accidents, their involvement ratio would be .50, indicating they were half as likely to be involved as all other trucks. The rate for all trucks is normalized to 1.0 (100% / 100%), so the rate itself expresses the implicit comparison. And such a measure should be relatively, though not completely, insensitive to the source of the travel component of the calculation. By this measure as well, farmers were found to be

underinvolved in truck fatals. Among all Class 7 and 8 trucks, farmers had a normalized involvement rate of 0.40, compared to 1.04 for non-farm trucks. Since every effort was made to be as conservative as possible in making the estimates, it is seems clear that at the very least one can be confident that farmers are less likely to be involved in truck fatals than other drivers.

In the following two sections, the variables and procedures used in determining truck travel and involvements will be discussed. The two tables at the end of the paper display the results of the analysis.

Farm Trucks and Travel in TIUS

The set of trucks operated by farmers was identified primarily from the "major use" variable in TIUS. If a truck owner chose "agricultural activities" as his response to that question, the vehicle was initially assigned to the farm category. Some farmers, however, occasionally operate for-hire, for example, during the slower winter season. Also, it is possible that a for-hire hauler of agricultural commodities would incorrectly indicate that agriculture was the major use of his truck, rather than for-hire transportation. However, a check of the "major use" variable against other TIUS variables that bear on company type shows it to be quite clean. For example, a two-way comparison of the "major use" variable with one covering the for-hire operations of the truck showed that less than 0.2% of those who claimed to be farmers on the major use variable also operated for-hire. In the group most likely to be for-hire haulers, Class 7 and 8 tractors, only 2.7% of the farmers indicated they also sometimes operated for-hire.

Nevertheless, those who indicated that they were motor-carriers or engaged in a mix of private and common carriage were deleted from the farm category and assigned to the non-farm category. This was done for two reasons. No one who operates as a for-hire transporter of goods will be exempted from the requirements of the Commercial Driver's License, whether or not they are farmers. So their experience is not strictly relevant to the farm truck issue. Moreover, in the accident data, the business type of the vehicle is fixed at the time of the accident. If a truck owner was acting as a farmer at the time of the accident, he was assigned to the farm category even if he occasionally operated for-hire. In comparing involvement frequencies with exposure, one would like to be sure that the definitions of both groups are identical. In this case, while one cannot be sure that none of the farmers as identified in the accident data ever operated for-hire, deleting such cases from the farm category on the exposure side ensures that if an error is made in estimating accident rates, it is on the conservative side.

The "vehicle type" variable was used to determine the number of straight trucks and truck tractors. That variable assigns vehicles to one of three categories: Straight truck, straight truck with a trailer, or truck tractor with a trailer. Owners who indicated that their truck was either a straight truck or a straight truck with a trailer were considered to be straight trucks. The truck tractor category was used to define the tractors.

The Polk GVWR variable was used to determine the subset of vehicles with a rated weight of over 26,000 pounds, the group to which the CDL will apply. The Polk variable is generated by the R. L. Polk Company, the supplier of the original sample of registrations to the Bureau of the Census, by means of a computer algorithm which decodes the Vehicle Identification Numbers (VIN's) of the sample trucks. In the experience of Statistical Research Group staff, the Polk GVWR variable, while not perfect, is much superior to any other means of determining GVWR's from the TIUS data. UMTRI recently completed a nationwide study of the operations of trucks, also using a sample supplied by R. L. Polk. As part of that study, editors decoded, by hand, the VIN's of over 8,000 trucks and compared the results to the Polk decoding. The Polk VIN decoding program handled the vast majority of the VIN's correctly. Since the CDL applies to trucks with rated weight of over 26,000

pounds, and since the Polk GVWR variable determines weight ratings directly from the VIN with accuracy, the Polk GVWR is preferred over any other variable in subsetting the Class 7 and 8 trucks.

Finally, TIUS data was employed to produce estimates of the on-road travel of farm and non-farm trucks. The "annual mileage" variable records the owner's estimate of his total travel over the previous 12 months. In another section of the TIUS questionnaire, the owner apportions that mileage among off-road use and on-road trips of different lengths. Now, a traffic accident can by definition only occur on a public roadway, so only truck travel that occurs on a public road is relevant. Accordingly, the estimates of total travel were reduced by the amount that occurred off-road to produce an estimate of on-road travel for farm and non-farm trucks.

In dealing with the "% off-road" variable, some assumptions were necessary. As it stands, the variable has 71.6% missing data. It appears, however, that the cases that were left blank should have had zeros entered for that variable. On the questionnaire, the owner is asked to enter the percent of his total travel that occurred off road and on trips of various lengths. The numbers are supposed to sum to 100%. It seems likely that most owners simply entered estimates only for the trips they most often took and left the rest blank. On that assumption, it makes sense to convert the blanks to zeros and then use the resulting variable. The results of this procedure are quite plausible. The travel of Class 7 and 8 farm straight trucks was reduced by about 10%, while the travel of the heavy tractors was reduced by less that 3%. It seems very unlikely that such heavy duty vehicles put on many more of their miles off-road.

Table 1 displays the results of this analysis. Population and travel estimates are shown for four groups of heavy trucks. The first group consists of Class 3 to 8 straight trucks and Class 7 and 8 tractors. Essentially, this group includes the whole population of medium and heavy-duty trucks; that is, those with a Gross Vehicle Weight Rating over 10,000 pounds. The practical reason for the exclusion of Class 3 to 6 tractors will be explained below, but one should note here that such trucks are less than 2% of the truck population and their exclusion has virtually no effect. The second group consists of all Class 7 and 8 trucks (GVWR over 26,000 lbs.), the type of truck to which the CDL will apply. The third and fourth sections break that group down into tractors and straight trucks. Within each group, farm trucks are separated from non-farm trucks. There was a tiny number of trucks with an unknown business type.

The first two columns in the table show population estimates and the respective percentage each major use forms of the particular truck type. The second two columns show the on-road travel estimates in billions of miles, and their associated percents. Overall, while farmers own a significant fraction of the trucks in all categories, they tend to drive them far fewer miles on the road. Among all medium and heavy duty trucks, it appears that farmers own over 25% of the trucks, but accumulate less than 8% of the travel. In the categories of greater interest, the proportion of the travel is more in line with their proportion of truck registrations. But even so, farmers tend to drive their trucks fewer miles than other truck owners. Farmers own 6.9% of the Class 7 and 8 tractors but account for only 5.0% of the travel, and 17.4% of the Class 7 and 8 straight trucks with only 9.1% of the travel.

Farm Truck Involvements in TIFA

While the TIFA file includes company description variables for the area of operation and type of carrier, as the file currently stands there are no variables to show the major use of the vehicle as in TIUS. However, the hard copy of the interview form includes a description of the business of the owner of the sample vehicle. Accordingly, to identify the set of farmer-operated trucks in TIFA, the original interview form was examined by an

editor for all cases in which the owner was not for-hire to determine if the owner was a farmer. A total of 2,022 cases in the 1982 TIFA data set were reviewed: 880 straight trucks and 1,142 tractors. The editor identified farm trucks in a way that would be compatible with the definition in TIUS. A farmer was defined as one directly involved in the growing, raising, or production of agricultural commodities. This encompassed all the usual farming and ranching activities, even including one catfish farm, but excluded such businesses as sod producers, co-ops, feed lots, and nurseries.

When the farm trucks were identified, a new version of the 1982 TIFA data set was created which included a variable indicating the farming status of the owner. Of the 2,022 cases examined by UMTRI staff, 178 farm trucks were discovered, 113 straight trucks and 65 tractors. There were 4,719 trucks involved in fatal accidents in 1982, so farmers amounted to 3.5% of that number. This total includes all trucks with a GVWR over 10,000 pounds.

For the purposes of the Commercial Drivers' License rulemaking, the subset of interest consists of Class 7 and 8 vehicles (26,001 lb. and over GVWR). An attempt was made to identify this subset using the FARS GVWR variable. This variable is generated by FARS using their own computer program to extract the GVWR from the Vehicle Identification Number (VIN). Unfortunately, the FARS GVWR variable for the 1982 data has about 54% missing data. In other words, in 54% of the cases, the FARS program was unable to extract GVWR information from the VIN. This is unacceptably high, and it was decided to correct the variable as much as possible.

For straight trucks this was straightforward. The VIN's of every straight truck with an unknown GVWR were listed. An editor decoded the VIN and, where possible, assigned a GVWR. Then the corrections were made to the file. This reduced the missing data rate on the GVWR variable for straight trucks from 32.5% to 6.4%. The missing data rate for tractors was much higher, however. The algorithm FARS used in 1982 was developed to decode the VIN's of automobiles, and consequently it had greater difficulty with the VIN's of manufacturers that make only heavy trucks. Roughly 62% of the tractors had unknown GVWR's, which was too great a number to do by hand. However, the overwhelming majority of tractors are Class 7 or 8 vehicles. Only about 6% of all tractors have GVWR's less than 26,001 lbs. Moreover, in examining the makes of tractors with unknown GVWR's in the 1982 TIFA file, roughly three-quarters were made by manufacturers who do not produce trucks under Class 7. Consequently it was decided to exclude from the analysis all tractors that are Class 6 and below and to assign all tractors with unknown GVWR's to the group of Class 7 and 8. This procedure eliminates a tiny proportion of the tractors and quite reliably assigns the unknowns to their proper classes.

Table 2 below shows the numbers of farm trucks thus determined and the corresponding percents. The first group in the table closely approximates the set of all farm trucks (Class 3 and above). It includes Class 3 to 8 straight trucks and Class 7 and 8 tractors and excludes trucks with an unknown GVWR. There were 165 such trucks in the 1982 TIFA data, or 3.7% of the relevant total. The next section of Table 2 shows that of 3,898 trucks with a GVWR over 26,000 lbs. involved in fatal accidents in 1982, only 93 were operated by farmers. When farm trucks with a GVWR over 26,000 lbs. are broken down by power unit type, one finds only 62 tractors and 31 straight trucks, which account for 1.8% and 5.1% of their respective categories. It appears that very few farm trucks are involved in fatal accidents.

Because of the small number of farm trucks in the TIFA data set, it was not feasible to break down the data further to look at distributions of accidents by variables of interest. There are simply too few farm truck accidents to get meaningful cell sizes. For example, there were no farm trucks in the 1982 TIFA data that carried hazardous cargo, and there were only seven straight trucks pulling a trailer of any kind. There were only three Class 7 or 8 straight trucks with a tank cargo body.

Summary and Conclusion

When the relevant numbers from Tables 1 and 2 are compared, it appears that farmers are under represented in fatal accidents. For example, of Class 7 and 8 tractors, farmers own 7.1% of the vehicles and put on 5.4% of the miles, yet they operate only 1.8% of the vehicles involved in fatal accidents. Similarly for straight trucks, farm trucks amount to 17.4% of all Class 7 and 8 straights and accumulate 9.7% of the miles, but only account for 5.1% of the vehicles in fatal accidents. Accident rates per 100 million miles are presented in the third column of Table 2, and the fourth column shows normalized involvement ratios for each vehicle and business type. The involvement rates of farmers are dramatically lower than those of non-farmers in every category.

The under-involvement of farm trucks in fatal accidents is somewhat unexpected. Farm vehicles are probably older, operate overloaded more often, with younger, less experienced drivers than the truck population as a whole. TIUS will not allow mileage to be broken down by road type, but it also seems likely that farm vehicles operate more often on non-limited access, rural roads, which are the least safe roads. So why are farmers under-involved in fatal accidents? It seems likely that the answer lies in the way farm trucks are typically used. First of all, the analysis here concerns fatal accidents, which often result from high speed collisions. Typical farm use involves shorter trips and slower travel. Thus, while farm vehicles may be involved in accidents as often as other vehicles, a question not considered here, the accidents are less likely to be sufficiently energetic to cause a fatality. A second possibility is that the traffic density on the roads farmers primarily use is very low. The "rural, non-limited access" road type mentioned above is a very broad category. It could be that much of farm travel is on local, county roads with very low traffic density, which would decrease the risk of a fatal collision. For the moment, however, such explanations must remain hypothetical.

Nevertheless, this analysis has shown that farm trucks account for only a small proportion of the fatal accidents involving trucks and that their probability of involvement in an accident is low compared to other similar trucks. Relative to the problem of fatal truck accidents as a whole, the farm proportion is quite small.

TABLE 1
Registrations and Total Miles for Selected Truck Types
Farm Use and Non-Farm Use
1982 TIUS Data

Major Use	Vehicles	Percent	Total Miles (10^9)	Percent
Class 3–8 Straights and Class 7–8 Tractors				
Farm	844,472	25.1%	5.589	7.9%
Non-Farm	2,519,272	74.9	65.243	92.1
Unknown	343	0.0	0.006	0.0
Total	3,364,087	100.0%	70.837	100.0%
All Trucks Over 26,000 lb. GVWR				
Farm	175,990	11.6%	3.307	5.8%
Non-Farm	1,343,216	88.4	53.732	94.2
Unknown	79	0.0	0.005	0.0
Total	1,519,285	100.0%	57.044	100.0%
Tractors Over 26,000 lb. GVWR				
Farm	58,316	6.9%	2.303	5.0%
Non-Farm	783,578	93.1	43.725	95.0
Unknown	79	0.0	0.005	0.0
Total	841,973	100.0%	46.033	100.0%
Straight Trucks Over 26,000 lb. GVWR				
Farm	117,596	17.4%	1.003	9.1%
Non-Farm	559,637	82.6	10.007	90.9
Unknown	0	0.0	0.0	0.0
Total	677,234	100.0%	11.010	100.0%

Excludes Alaska and Hawaii

TABLE 2
Involvements in Fatal Accidents for Selected Truck Types Farm Use and Non-Farm Use 1982 TIFA Data

Major Use	Involvements	Percent	Involve. Per 10^8 Miles	Norm. Rate[a]
Class 3–8 Straights and Class 7–8 Tractors				
Farm	165	3.7%	2.95	0.47
Non-Farm	4,334	96.3	6.64	1.05
Total	4,499	100.0%	6.35	1.00
All Trucks Over 26,000 lb. GVWR				
Farm	93	2.3%	2.81	0.40
Non-Farm	3,898	97.7	7.25	1.04
Total	3,991	100.0%	7.00	1.00
Tractors Over 26,000 lb. GVWR				
Farm	62	1.8%	2.69	0.36
Non-Farm	3,324	98.2	7.60	1.03
Total	3,386	100.0%	7.36	1.00
Straight Trucks Over 26,000 lb. GVWR				
Farm	31	5.1%	3.09	0.56
Non-Farm	574	94.9	5.74	1.04
Total	605	100.0%	5.50	1.00

Excludes Alaska and Hawaii.

[a]Calculated by dividing the percentage of involvements by the percentage of travel.