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Some Characteristics of Light-Truck Accidents in Texas

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Highway Safety Research Institute/University of Michigan

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16. Abstract

HSRI-maintained data for police-reported accidents in the State of Texas during calendar year 1973 were studied to establish some characteristics of light-truck accident involvements and to compare the accident experience of passenger cars and light trucks. Findings concerning light-truck accidents are presented in terms of temporal, roadway, weather, accident configuration, truck type, injury frequency and severity, and driver-related factors.

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SECTION 1
INTRODUCTION

This report describes an HSRI study designed to access existing accident data pertaining to light-truck accidents and supplements an earlier report that considered accidents involving large trucks.* The study was conducted during the months of June and July, 1975, with general research support funds contributed by the Motor Vehicle Manufacturers Association.

The study utilized accident data files for the State of Texas that are constructed and maintained by HSRI using police-reported data supplied by the Texas Department of Public Safety. Texas is an ideal data source for the study of light trucks, since pickup trucks in particular are involved more frequently in accidents in Texas than in other states.

Section 2 contains a summary of the study findings. Section 3 discusses the accident data concerning light-truck accidents. Section 4 presents a comparison of passenger car and light-truck accidents as they are defined by the Texas data.

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*Green, John A., "Characteristics of Large-Truck Accidents as Represented in Texas Accident Data at HSRI." UM-HSRI-SA-75-12, Highway Safety Research Institute, The University of Michigan, June, 1975.

SECTION 2
SUMMARY OF FINDINGS

The purpose of this study was to identify and describe the characteristics of light-truck accidents and compare them with passenger-car accidents. Light-trucks are defined here to mean pickup and panel (or small van) trucks. The characterization resulting from this study is presented below in summary form.

2.1 WHEN LIGHT-TRUCK ACCIDENTS OCCUR

Light-truck accidents are most likely to occur during the daytime on weekdays when exposure is greatest (i.e., Monday to Friday, 6 am. to 8 pm.). Proportionately more accidents occur on Friday when the normal work traffic and weekend travel traffic patterns overlap.

Single-traffic-unit, light-truck accidents deviate from the overall pattern significantly as a function of time of day, tending to increase in number throughout the day from an early morning (4 am.) minimum, to a late evening (10 pm.) maximum.

As a function of time, the proportions of light-truck and passenger-car accidents are very similar. There is, however, a small but statistically significant trend for light-truck accidents to occur more frequently than passenger-car accidents during the daytime on weekdays.

2.2 WHERE LIGHT-TRUCK ACCIDENTS OCCUR

The majority of light-truck accidents occur in cities or on trunkline highways on straight, level roads that are in good condition.

Single- and multiple-traffic-unit accidents display different occurrence patterns as a function of location variables. The fraction of single-traffic-unit accidents that occur on a curved, level section of roadway is more than twice as high as that found for multiple-traffic-unit accidents. In cities, the proportion of single- and multiple-traffic-unit accidents is the same. For non-city accidents, single-traffic-unit accidents are proportionately more frequent on state secondary roads while multiple-traffic-unit accidents are proportionately more frequent on trunkline highways.

Passenger-car and light-truck accidents have different occurrence frequencies as a function of location. The highest frequency of accidents occurs in cities for both vehicle categories. However, the proportion of light-truck accidents that occur there is about 7 percent less than the corresponding proportion of passenger cars (52.5 percent, 45.6 percent trucks). Light-truck accident frequencies are 3.7 percent greater on U.S. or state routes and about 1.5 percent higher on state secondary and county roads. Interstate highways record about the same proportion of passenger-car and light-truck accidents.

2.3 TYPES OF LIGHT-TRUCK ACCIDENTS

Ranking after "collision with another motor vehicle," the categories "collision with parked cars," "collision with fixed objects," and "run-off-the-road" accidents are the most commonly occurring light-truck accident types. With only minor differences in occurrence percentage, passenger cars follow the same pattern. About 16 percent (or 1/6) of the light-truck accidents are single vehicle.

"Collision with parked cars" is the most common type of single-vehicle accident.

About 40 percent of the light-trucks involved a collision between two vehicles travelling the same direction—37 percent of these involved collision with a stopped vehicle. Passenger cars, within a percent or two, have the same distribution on pre-crash maneuvers (side swipe, head-on, etc.) as light trucks. One difference is that 15 percent of light-truck accidents, but 19 percent of passenger-car accidents, involved a collision with a stopped vehicle going the same direction.

2.4 OCCUPANT INJURIES IN LIGHT-TRUCK ACCIDENTS

Occupants of light trucks sustained injuries in fewer accidents than passenger-car occupants. In 89.7 percent of the light-truck involvements studied, no occupant injuries were reported. The comparable value for passenger cars is 87.4 percent—a 2.3 percent difference. The percentage of light-trucks with fatally injured occupants is slightly higher than the passenger car proportion, however, so the accident severity reduction occurs at lower injury severity values.

For two-traffic-unit collisions in which a light truck was involved, the percentage of light trucks that had no injured occupants is the same as the corresponding percentage for "other" traffic units in the collision (about 91 percent). On the other hand, only 79 percent of the light trucks in single vehicle accidents had no reported injuries.

2.5 DRIVERS OF LIGHT TRUCKS

Drivers of light trucks tend, as a group, to be older than drivers of passenger cars. In the 15-24 year-old

age group, 39.5 percent of the passenger cars and 27.0 percent of the light trucks have drivers of this age. In the 25-29 year-old age group the percentage is about the same for both vehicle categories.

Light trucks are operated by male drivers in the large majority of cases—only 7.7 percent of the light trucks were driven by females. In contrast, 36.3 percent of the passenger cars had female drivers.

The distribution of police-reported violations is much the same for passenger cars and light trucks, with about 69 percent of the vehicles in each category having no reported violation. Failure to yield right of way is the most frequently occurring violation type.

SECTION 3
CHARACTERISTICS OF LIGHT-TRUCK ACCIDENTS

The HSRI 5% sample file for the State of Texas contains information describing a random sample of all accidents that occurred in the state for a full calendar year. Since accidents involving light trucks are common in Texas, the sample file contains a sufficient number of cases for this investigation (i.e., 4,456 pickups and 655 panel trucks in 1973).

Light trucks are defined in terms of Variable 60 (Vehicle Body Style) in the sample file. Panel trucks (or small vans) and pickup trucks are the two light-truck types reported in the Texas files. These have code values 29 and 30, respectively, for Variable 60.

In the investigation of large-truck accident data, the truck file contains information on all accidents in which at least one of the vehicles involved in the accident was a large truck. The corresponding vehicle file for these accidents therefore contains all of the traffic unit types as well as large trucks. This type of file was not available for light trucks, so that a somewhat different research methodology was required.

HSRI has constructed a two-vehicle accident file from the 1973 Texas 5% sample accident data, although this file is not part of the standard HSRI Accident Data System. By subsetting these data to include only those accidents where at least one of the two recorded traffic units was a light truck, data comparable to those used in the large-truck investigation were obtained.

Using the two-vehicle accident file, 4,785 accident cases involving at least one pickup or small van were

obtained. The distribution of accidents in terms of the number of vehicles involved is shown in Table 1.

TABLE 1

Characterization of Light Truck Accidents

Single Vehicle	802	16.8%
Light-Truck/Car	3343	69.9
Light-Truck/Light-Truck	311	6.5
Light-Truck/Other Truck	173	3.6
Light-Truck/Other Traffic Unit	109	2.3
Light-Truck/Unknown Traffic Unit	16	0.3
More than two Traffic Units	31	0.6
TOTAL	4785	100%

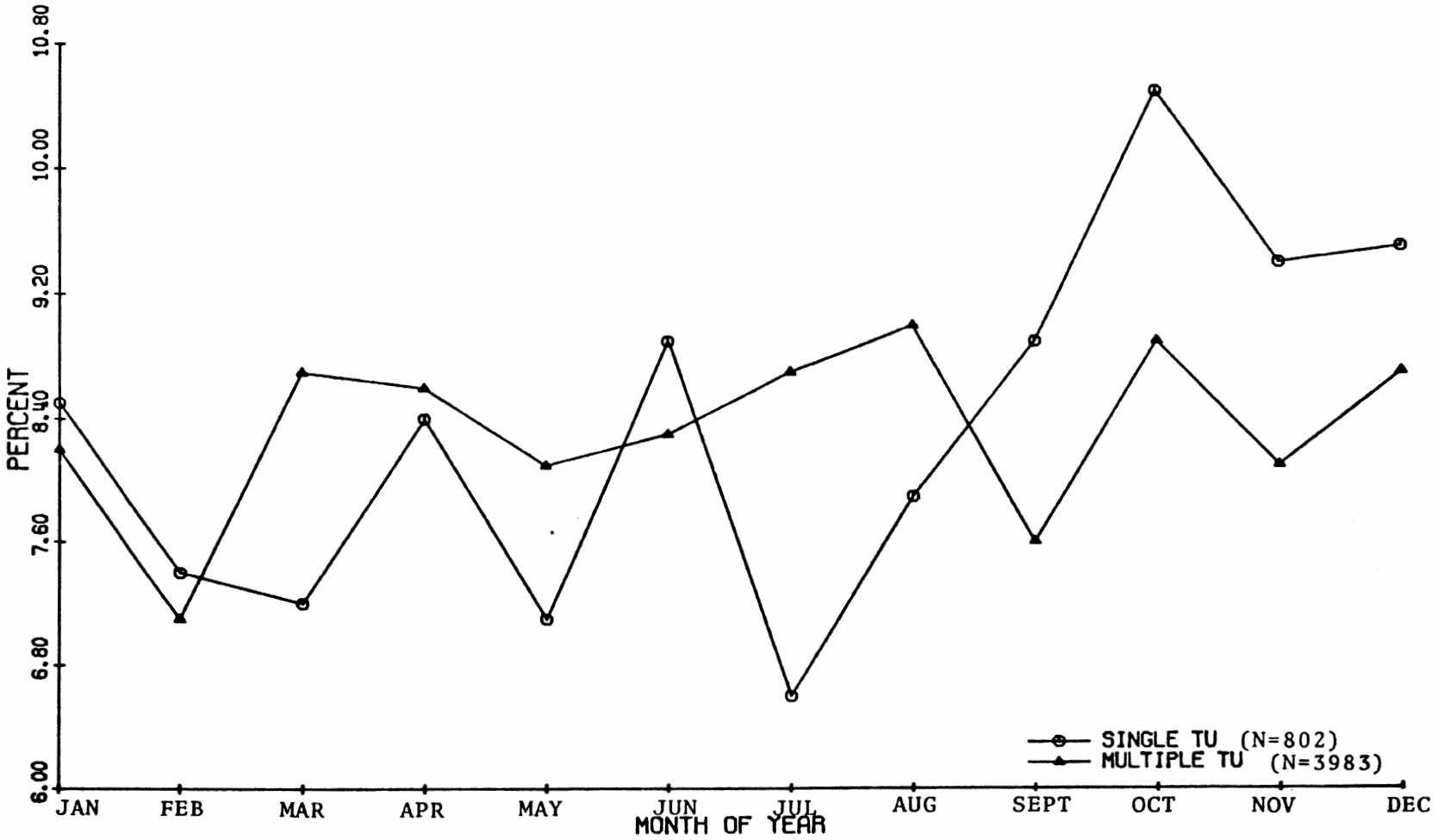
Distinctions between single- and multiple-traffic-unit accidents were investigated as a function of several variables defined in the Texas files:

1. Time of accident (Month, Day, Hour, etc.);
2. Site description factors (Weather, Road Surface, etc.);
3. Accident configuration (Type, Maneuvers, etc.);
4. Injuries sustained by vehicle occupants.

For conciseness, the term "traffic-unit" is denoted by "TU" in the remainder of this section.

3.1 TIME-OF-ACCIDENT FACTORS

Variations in the number of light-truck accidents by month, day, and hour of day are shown in Figures 1 to 3, respectively. There is no consistent difference between single- and multiple-TU accidents as a function of month of year.



LIGHT TRUCK ACCIDENTS BY MONTH

FIGURE 1

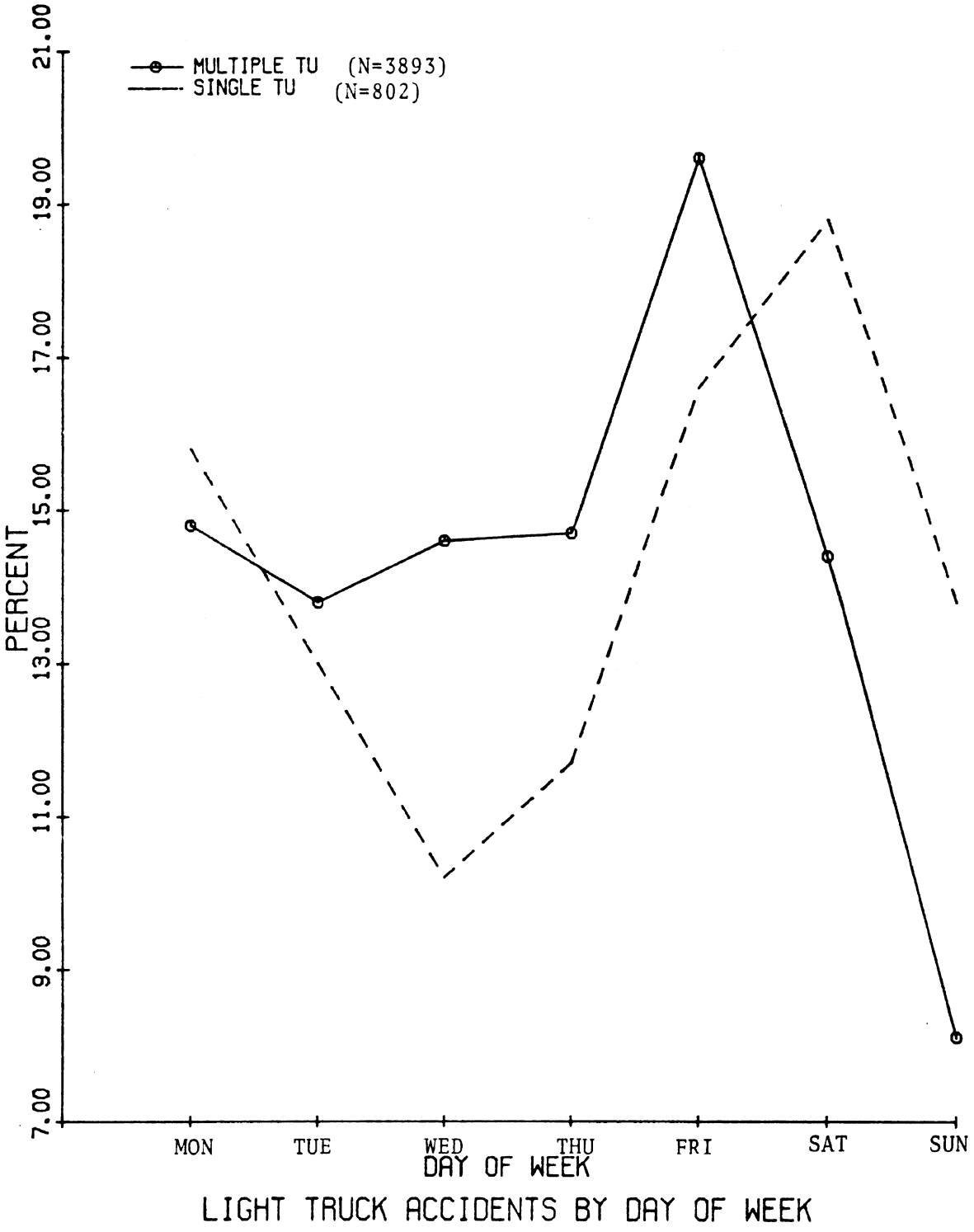
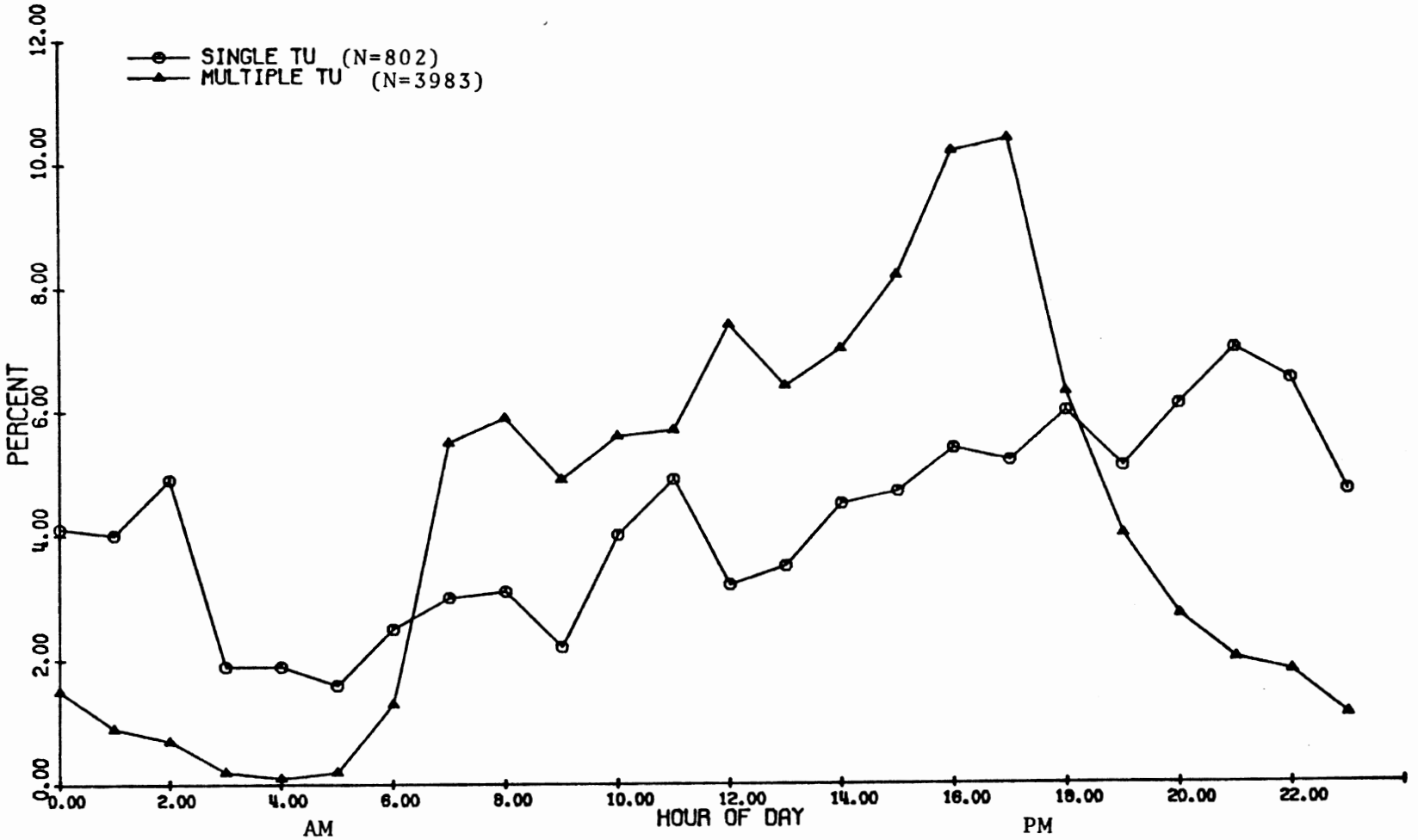

MULTIPLE TU (N=3893)
SINGLE TU (N=802)
PERCENT
21.00
19.00
17.00
15.00
13.00
11.00
9.00
7.00
MON
TUE
WED
THU
FRI
SAT
SUN
DAY OF WEEK
LIGHT TRUCK ACCIDENTS BY DAY OF WEEK

FIGURE 2



LIGHT TRUCK ACCIDENTS BY HOUR OF DAY

FIGURE 3

However, Figures 2 and 3 indicate considerable differences as a function of the number of TU's involved in the accident. By day of week, light trucks in multiple-TU collisions show high involvement during the week peaking on Friday, and low on the weekend. In contrast, the involvement pattern for single-TU accidents is lowest on Wednesday and reaches a peak on Saturday.

By hour of day, the involvement patterns for single- and multiple-TU accidents are also different in character as shown in Figure 3. Again, multiple-TU accidents are frequent during the normal work day, and low at other times. Single-TU accidents, on the other hand, display a sawtooth-type pattern rising uniformly throughout the day from a 2-4 am. low to a 8-10 pm. peak.

3.2 ROADWAY AND WEATHER CONDITIONS

Single-TU light-truck accidents are somewhat more likely to occur under non-ideal conditions than multiple-TU collisions. The differences, however, are quite small. The percentages of single- and multiple-TU accidents that take place under ideal conditions are shown in Table 2. The data do not indicate any particular set of non-ideal conditions responsible for the generally higher involvement rate.

TABLE 2

Light-Truck Involvements Under Good Driving Conditions

	Single TU		Multiple TU	
	Freq.	%	Freq.	%
Clear/Cloudy Weather	671	83.7	3373	84.7
Dry Road Surface	632	78.8	3173	79.7
No Road Defects	742	92.5	3804	95.5

The classification of accidents by road alignment (i.e., straight/curved, level/hilly) shows that 95.8 percent of the multiple-TU accidents occurred on straight, level roads while only 90.1 percent of the single-TU accidents occurred in that configuration. The curved, level configuration accounts for much of the discrepancy with 8.7 percent of the single-TU and 3.4 percent of the multiple-TU accidents occurring under those conditions.

The distribution of single- and multiple-TU accidents by road classification is shown in Table 3. Single-vehicle involvements are more highly represented on County/State secondary roads while multiple-TU accidents are more frequent on primary routes. Cities have about the same involvement rates for both single- and multiple-TU accidents.

TABLE 3

Single/Multiple-Traffic-Unit Accidents
by Road Classification

	Single TU	Multiple TU
Interstate/US/State Highways	34.9%	45.0%
County & State Secondary Roads	19.8	8.7
City Roads	45.3	46.3
TOTAL FREQUENCY	802 (100%)	3983 (100%)

3.3 ACCIDENT CONFIGURATION

Of the 802 single-TU accidents investigated (see Table 1), 68.6 percent involved the collision of a light truck with a fixed object, 0.1 percent with a pedestrian or bicyclist, 2.9 percent with an unidentified other object, while 28.4 percent involved loss-of-control.

A total of 3,952 two-vehicle cases was investigated.

Of this total 3,468 were classified as light-truck/other-TU, 311 were light-truck/light-truck, and 173 were light-truck/large-truck. A total of 31 of the 4,785 accidents involved three or more vehicles.

The Vehicle Mix variable in the Texas 5% sample two-vehicle accident file was used to compare the accident frequency and casualty rates* for cars and light trucks in accidents involving any combination of these vehicle types. The results are shown in Table 4. Casualty rates indicate that light-truck/light-truck accidents produce the greatest number of injured and killed per accident for all collision types followed closely by car/car collisions. Car/car collisions have the highest casualty rate in a given configuration with a value of 0.51 in head-on collisions. Car/light-truck accidents have the lowest casualty rate overall (0.24).

3.4 TRUCK TYPE

In the description of accident-related factors presented above, 4,785 cases were used in the analysis. In 31 of these cases, three or more vehicles were involved in the accident. Using the two-vehicle accident file, there is recorded information on only two vehicles in these accidents. Consequently, in the discussion of vehicle-related factors presented in the remainder of this section, only accidents involving one or two TU's are considered.

The relative involvement of light-truck types in accidents resulting in fatality or injury to the occupants of the light truck was determined for single- and

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*Casualties include fatalities and all injury levels.

multiple-vehicle accidents. Table 5 shows the percentages of each light-truck type whose occupants suffered injuries or fatality. Investigation of fatalities in light trucks would require a data sample considerably larger than that used in this study.

TABLE 4

Casualty Rate by Vehicle Mix and Collision Configuration for Passenger Cars and Light Trucks

		Angle	Head on	Side-Swipe	Rear-end	Other	TOTAL
CAR/CAR	Freq.	3484	1280	680	3875	377	9796
	Row %	35.6	13.1	6.9	40.6	3.8	100.0
Casualty	Rate*	.37	.51	.10	.18	.01	.28
CAR/LIGHT-TRUCK	Freq.	1064	438	301	1267	131	3201
	Row %	33.2	13.7	9.4	39.6	4.1	100.0
Casualty	Rate*	.29	.43	.07	.19	.05	.24
LIGHT-TRUCK/LIGHT-TRUCK	Freq.	129	60	19	99	4	311
	Row %	41.5	19.3	6.1	31.8	1.3	100.0
Casualty	Rate*	.34	.37	.21	.24	.00	.30

$$*\text{Casualty Rate} = \frac{\text{Total Number Injured} + \text{Total Number Killed}}{\text{Total Number of Accidents}}$$

Single-vehicle light-truck involvements are far more serious to the occupants of the light truck, with respect to injury severity, than are multiple-vehicle accidents. In single-vehicle involvements, 1.5 percent of all light trucks (802) experienced a fatality,

compared to 0.2 percent for multiple-vehicle involvements. Considering non-fatal injuries only, 19.5 percent of the 802 light trucks in single-TU accidents and 7.6 percent of the 4,263 light-trucks in multiple-TU accidents recorded an injured occupant. A total of 24 vehicles in multiple-TU collisions involved fatal injuries to an occupant; 29.2 percent (7) of these vehicles were light trucks.

TABLE 5

Percentage of Light Trucks with Fatalities and Injuries

	Fatalities			
	Single TU		Multiple TU	
Panel	2	(16.7%)	0	(0.0%)
Pickup	10	(83.3)	7	(100)
TOTAL FREQUENCY	12		7	

	Injuries			
	Single TU		Multiple TU	
Panel	25	(16.0%)	28	(8.6%)
Pickup	131	(84.0)	297	(91.4)
TOTAL FREQUENCY	156		325	

3.5 FREQUENCY AND SEVERITY OF INJURIES

The distribution of single- and multiple-vehicle light-truck accidents by accident severity is shown in Table 6. Fatal accidents account for 1.5 percent of single-vehicle light-truck accidents but only 0.6 percent of multiple-vehicle accidents.

TABLE 6

Percentages of Single and Multiple Traffic Unit Accidents at Different Accident Severity Levels

	Single TU	Multiple TU
Fatal	1.5%	0.6%
A Injury	5.4	3.2
B Injury	11.0	6.9
C Injury	3.1	5.7
No Injury	79.1	83.5
Frequency	802 (100%)	3983 (100%)

3.6 OCCUPANT INJURY

Occupant injury in light trucks and "other" vehicles involved with light trucks is reported here by vehicle. Single-vehicle accident injuries, involving only a light truck, are reported separately from multiple-vehicle injuries. In addition, injuries received in multiple-vehicle accidents are reported for light trucks and the "other" vehicle separately.

3.6.1 OCCUPANT INJURY IN "OTHER" VEHICLES

Table 7 shows the distribution of occupant injuries by vehicle type for vehicles involved in light-truck/ "other" vehicle accidents. The row percents indicate the relative involvements at each injury severity level. Many of the categories have fewer than 100 involvements and these are likely to show large chance variations from year to year within the different injury severity levels.

TABLE 7

Most Serious Injury in Other Vehicle in
Light-Truck/Other Vehicle Two-Vehicle Accidents

	No Injury	K	A	B	C	Frequency
Coach	91.4	2.2	1.4	2.4	2.5	1204
2-Door Hardtop	93.0	1.1	0.8	3.1	2.0	357
2-Door Coupe	90.5	4.8	0.0	4.8	0.0	21
4-Door Sedan	91.5	2.1	1.6	2.1	2.8	1219
4-Door Hardtop	94.1	1.0	1.0	4.0	0.0	101
Station Wagon	89.4	0.0	0.0	3.4	6.9	29
Convertible	33.3	0.0	66.6	0.0	0.0	3
Minibus	100.0	0.0	0.0	0.0	0.0	2
Ambulance	100.0	0.0	0.0	0.0	0.0	1
Hearse						
Large Truck	100.0	0.0	0.0	0.0	0.0	55
Motor Home	33.3	33.3	0.0	33.3	0.0	3
Wrecker	100.0	0.0	0.0	0.0	0.0	2
Road Machinery	100.0	0.0	0.0	0.0	0.0	2
Bus (Commercial)	100.0	0.0	0.0	0.0	0.0	9
Bus (School)	100.0	0.0	0.0	0.0	0.0	7
Motorcycle	36.8	26.3	23.7	10.5	2.6	38
TOTAL PERCENT	91.0	2.3	1.6	2.5	2.6	100.0
TOTAL FREQUENCY	3026	78	54	82	86	3,326

3.6.2 OCCUPANT INJURIES IN LIGHT TRUCKS IN MULTIPLE TRAFFIC-UNIT ACCIDENTS

Occupant injuries in light trucks involved in multiple-vehicle accidents are shown in Table 8. The "no injury" rates are higher for light trucks than for the passenger cars they were involved with and the fatality rates are considerably lower.

3.6.3 OCCUPANT INJURIES IN LIGHT TRUCKS IN SINGLE-VEHICLE ACCIDENTS

Table 9 shows the distribution of light trucks by the most serious injury in the vehicle for single-vehicle accidents.

TABLE 8

Most Serious Injury in Light Trucks Involved in Multiple-Traffic-Unit Accidents

	Panel	Pickup	Total Frequency
Fatal	0.0	0.2	7
A Injury	0.9	1.4	58
B Injury	2.3	3.5	142
C Injury	2.1	3.1	125
No Injury	94.7	91.8	3931
TOTAL FREQUENCY	533	3730	4263

TABLE 9

Most Serious Injury in Light Trucks in Single-Vehicle Accidents

	Panel	Pickup	Total Frequency
Fatal	1.7%	1.5%	12
A Injury	4.2	5.6	43
B Injury	11.9	10.8	88
C Injury	5.1	2.8	25
No Injury	77.1	79.4	634
TOTAL FREQUENCY	118	684	802

SECTION 4

A COMPARISON OF LIGHT-TRUCK AND PASSENGER-CAR INVOLVEMENTS

The 5% sample file for the State of Texas maintained by HSRI records 22,531 accidents and 39,164 traffic units for the year 1973. Since this file documents a random sample of all accidents that occur in the state, it represents a useful source of information to compare the characteristics of light trucks involved in accidents with the corresponding characteristics of other traffic units.

The definition of light truck and passenger car categories in the Texas files is given in Table 10.

TABLE 10

Vehicle Categories in the Texas Files

Code*	Vehicle Body Style
	Passenger Cars:
01	Coach (2-Door Conventional)
02	2-Door Hardtop
03	2-Door Coupe
04	4-Door Sedan
05	4-Door Hardtop
06	Station Wagon
07	Convertible
	Light Trucks:
29	Panel (Small Van)
30	Pickup

*Codes refer to values of Variable 60 (Vehicle Body Style) in the Texas Sample File. The restriction that Variable 61 (Specific Vehicle Type) have the value 1, 2, or 3 is also used in the definition for passenger cars.

With these indicated groups included there are a total of 34,502 vehicles: 23,391 passenger cars (85.2 percent) and 5,111 light trucks (14.8 percent).

To determine the difference between trucks and passenger cars in accidents, the percentage of trucks involved in accidents was calculated as a function of selected variables. An overinvolvement factor Ω has been defined as a comparative measure equal to the difference in the percentage of trucks involved at a given variable code value to the percentage of trucks for all non-missing code values of the variable. That is:

$$\Omega(i) = \left\{ \frac{f_t(i)}{f_t(i) + f_c(i)} - R \right\} \cdot 100,$$

where:

$f_t(i)$ = frequency of trucks at code value i,

$f_c(i)$ = frequency of passenger cars at code value i,

$$F_t = \sum_i f_t(i),$$

$$F_c = \sum_i f_t(i),$$

$$R = \frac{F_t}{F_t + F_c},$$

and, the sums are taken for non-missing code values only. With the definition used here, the overinvolvement Ω may have a positive or negative value. A negative Ω then is equivalent to an underinvolvement. This terminology will be used throughout this section.

The statistical validity of variations in overinvolvement was determined by means of a standard analysis of variance technique using a dichotomous dependent variable.

4.1 TEMPORAL FACTORS

Light-truck overinvolvement has been investigated as a function of month, day of week, and hour of day. The data for these factors are shown in Figures 4 to 6. Variations by day of week and by hour of day were found to be statistically significant at a 5 percent level but variations by month were not. Figure 4, showing the overinvolvement by month, is included for completeness.

Light trucks were overinvolved on weekdays and underinvolved on weekends as shown in Figure 5. Table 11 shows the vehicle involvement by day of week for both cars and trucks. It is evident from Table 11 that accident involvement for cars and trucks has the same pattern as a function of day of week, but that the involvement of trucks is slightly higher than cars during the week and lower on weekends.

TABLE 11

Vehicle Involvements by Day of Week

Day	Cars*	Trucks*
Monday	13.5%	15.1%
Tuesday	13.5	13.7
Wednesday	13.7	13.9
Thursday	13.6	14.1
Friday	18.5	18.9
Saturday	16.2	15.3
Sunday	10.9	8.9
TOTAL FREQUENCY	29,391	5,111

*Percentage of Total Involved vehicles of the given type.

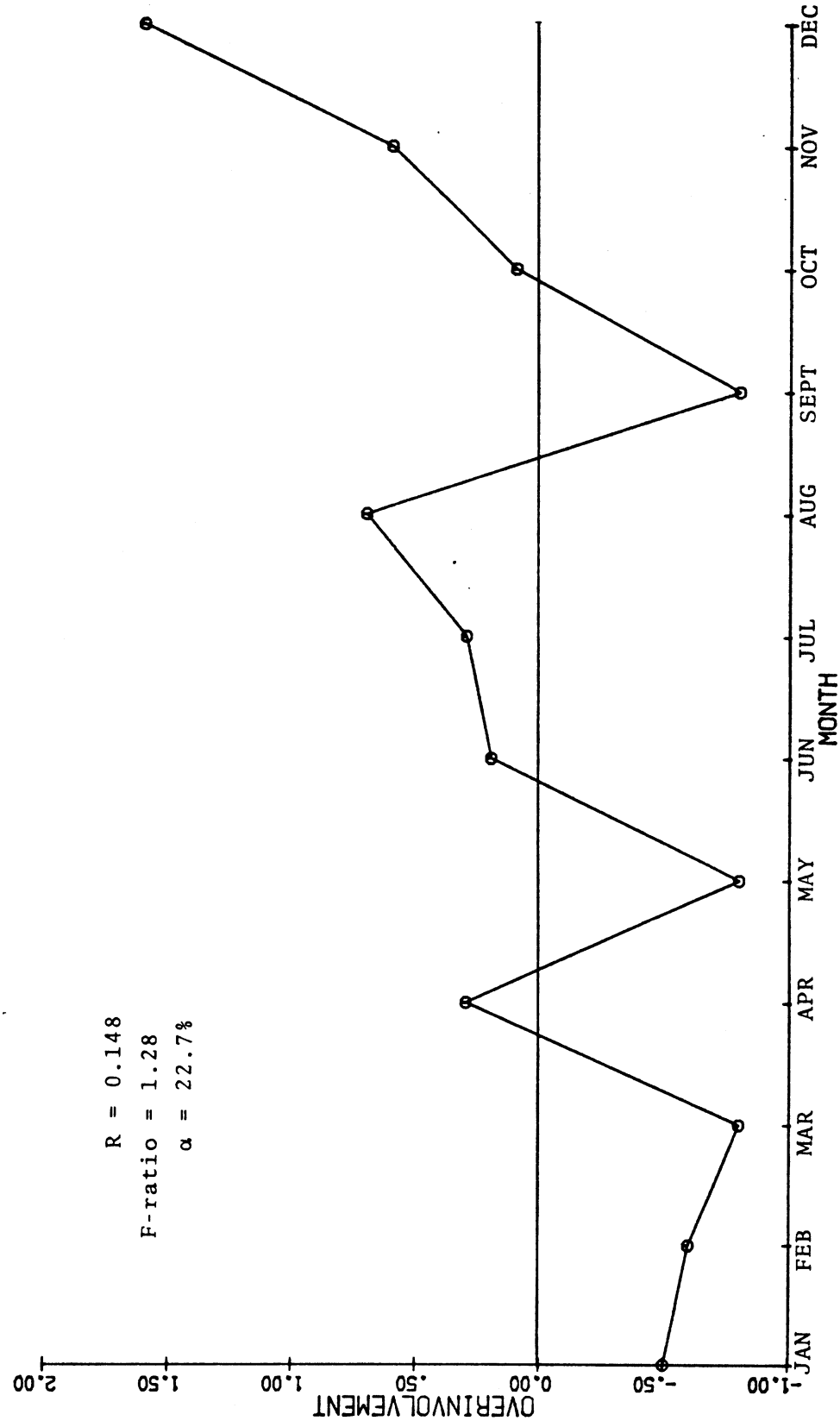
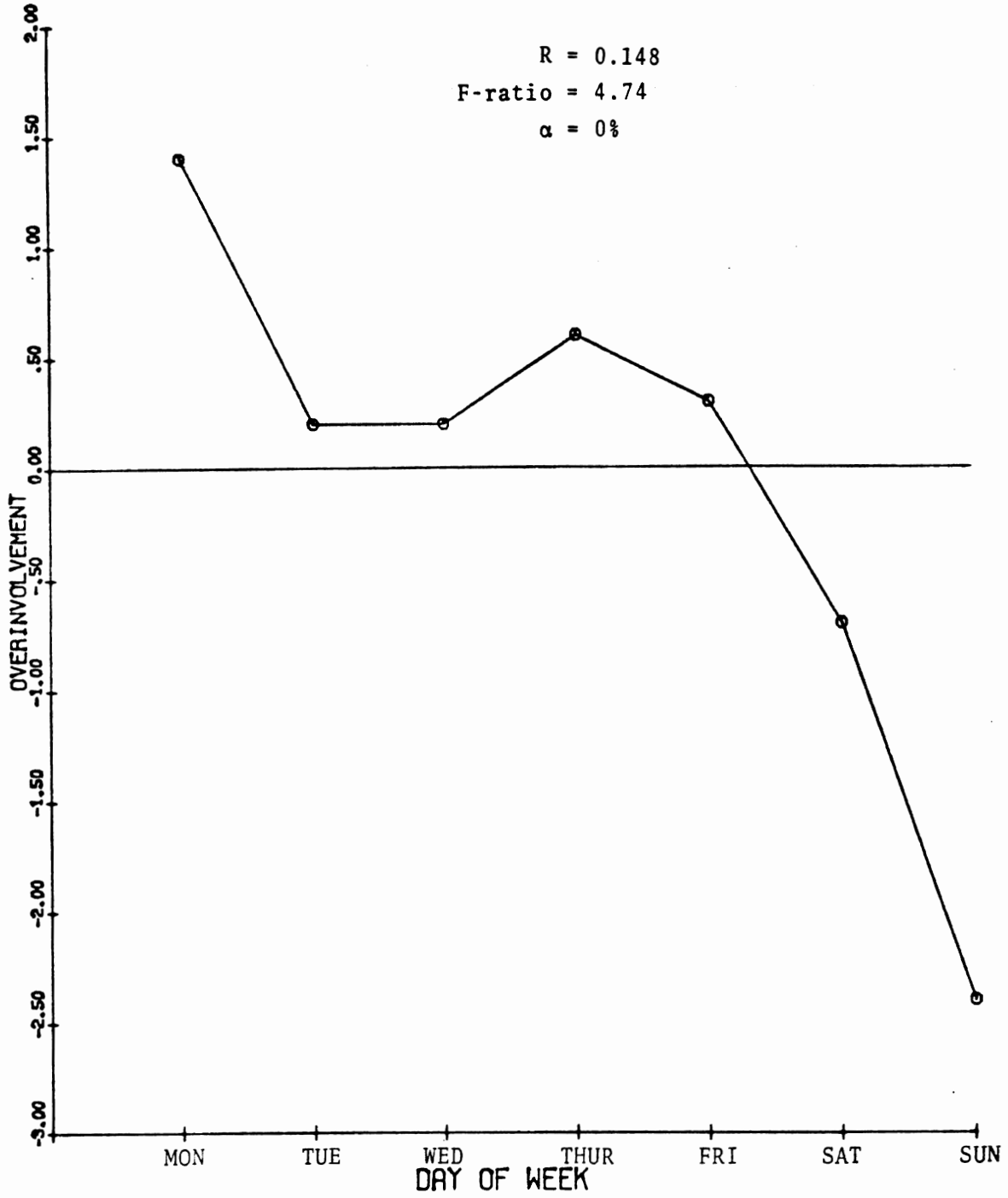

LIGHT TRUCK OVERINVOLVEMENT BY MONTH
OVERINVOLVEMENT
2.00
1.50
1.00
.50
0.00
-.50
-1.00
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEPT
OCT
NOV
DEC
MONTH
R = 0.148
F-ratio = 1.28
α = 22.7%

FIGURE 4



LIGHT TRUCK OVERINVOLVEMENT
BY DAY OF WEEK

FIGURE 5

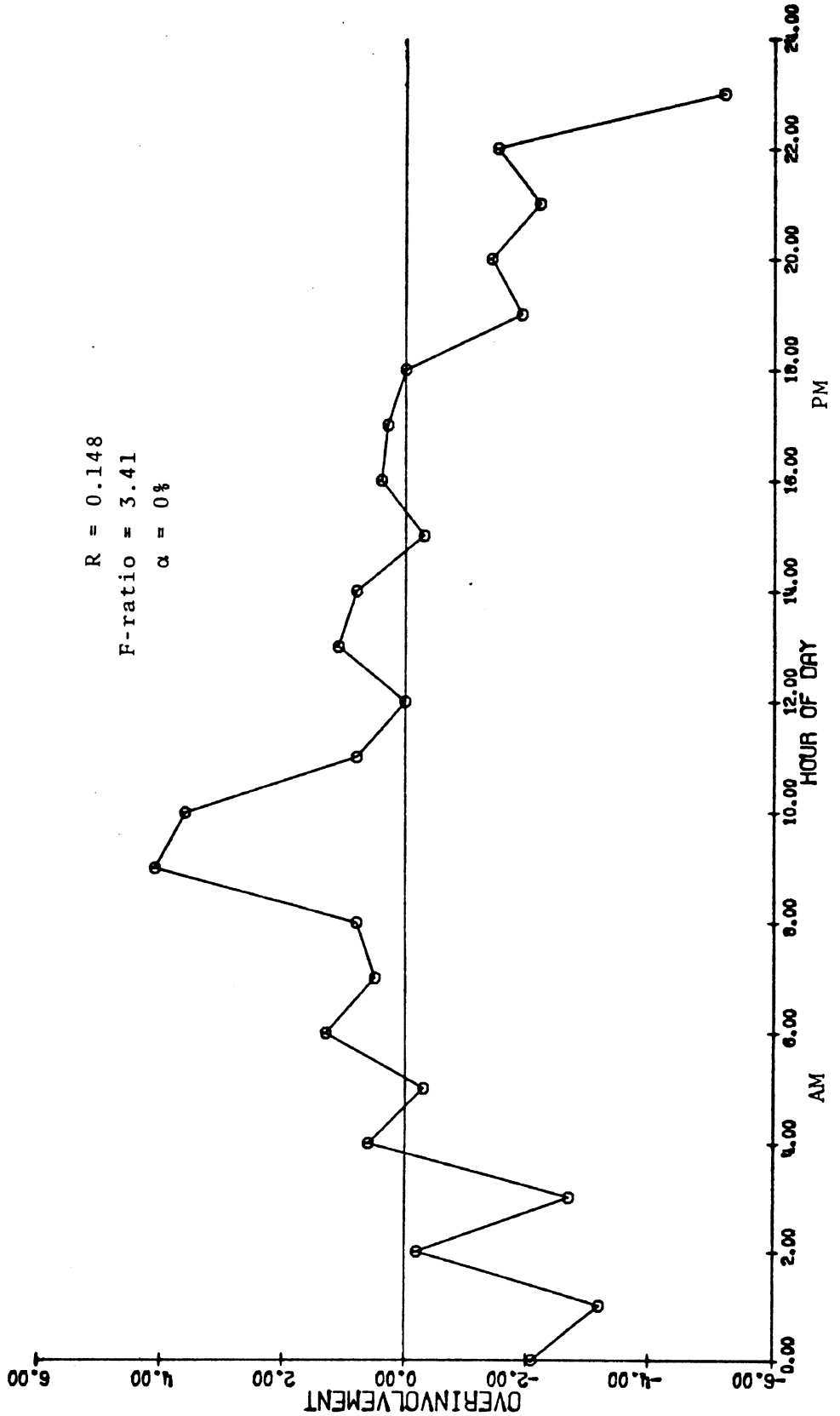

R = 0.148
F-ratio = 3.41
α = 0%
OVERINVOLVEMENT
6.00
4.00
2.00
0.00
-2.00
-4.00
-6.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
22.00
24.00
AM
PM
HOUR OF DAY
LIGHT TRUCK OVERINVOLVEMENT
BY HOUR OF DAY

FIGURE 6

Light-truck overinvolvement by time of day is shown in Figure 6. Positive values of overinvolvement occur during the normal daytime working hours, i.e., 6 am. to 5 pm. A peak in overinvolvement occurs at 9-11 am. Figures 7 and 8 show the light-truck and passenger-car involvements, respectively, as a percentage of all vehicles of that type for the day.

A comparison of Figures 7 and 8 shows that the involvement patterns for light trucks and cars is very similar. The peak in overinvolvement arises from a decrease in both passenger car and truck involvements after the morning rush hour, with the drop off in passenger cars being larger.

4.2 ROADWAY AND WEATHER CONDITIONS

Variations in the overinvolvement factor Ω that result from changes in weather, road surface, road condition, and intersection type were investigated. Only the weather factor did not produce statistically significant variations at a five percent confidence level.

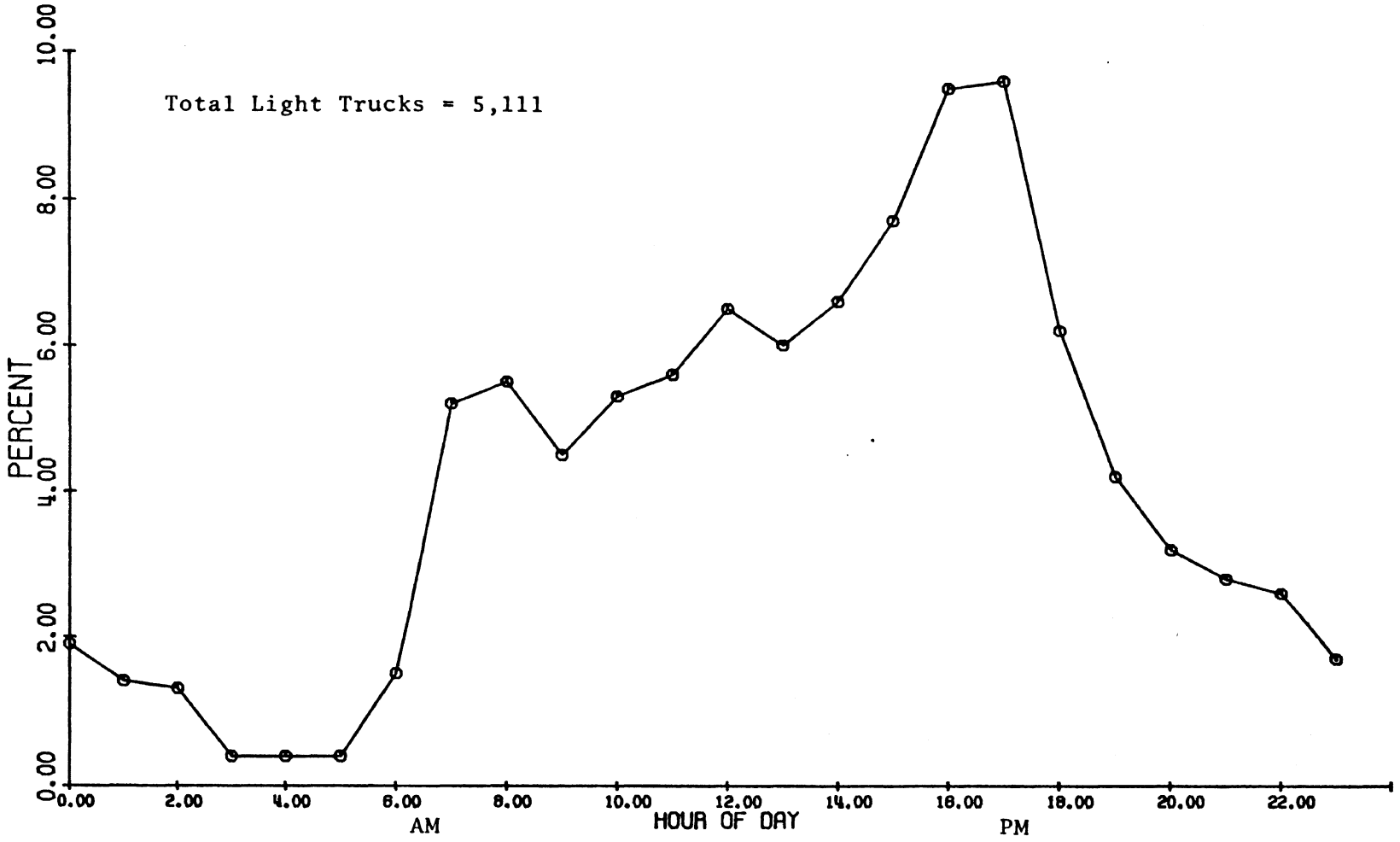
Light trucks are overinvolved on dry, muddy, and snowy road surfaces and underinvolved on wet or icy surfaces. The actual percentage involvement of each vehicle type is shown in Table 12.

TABLE 12

Vehicle Involvement by Road Surface Factors

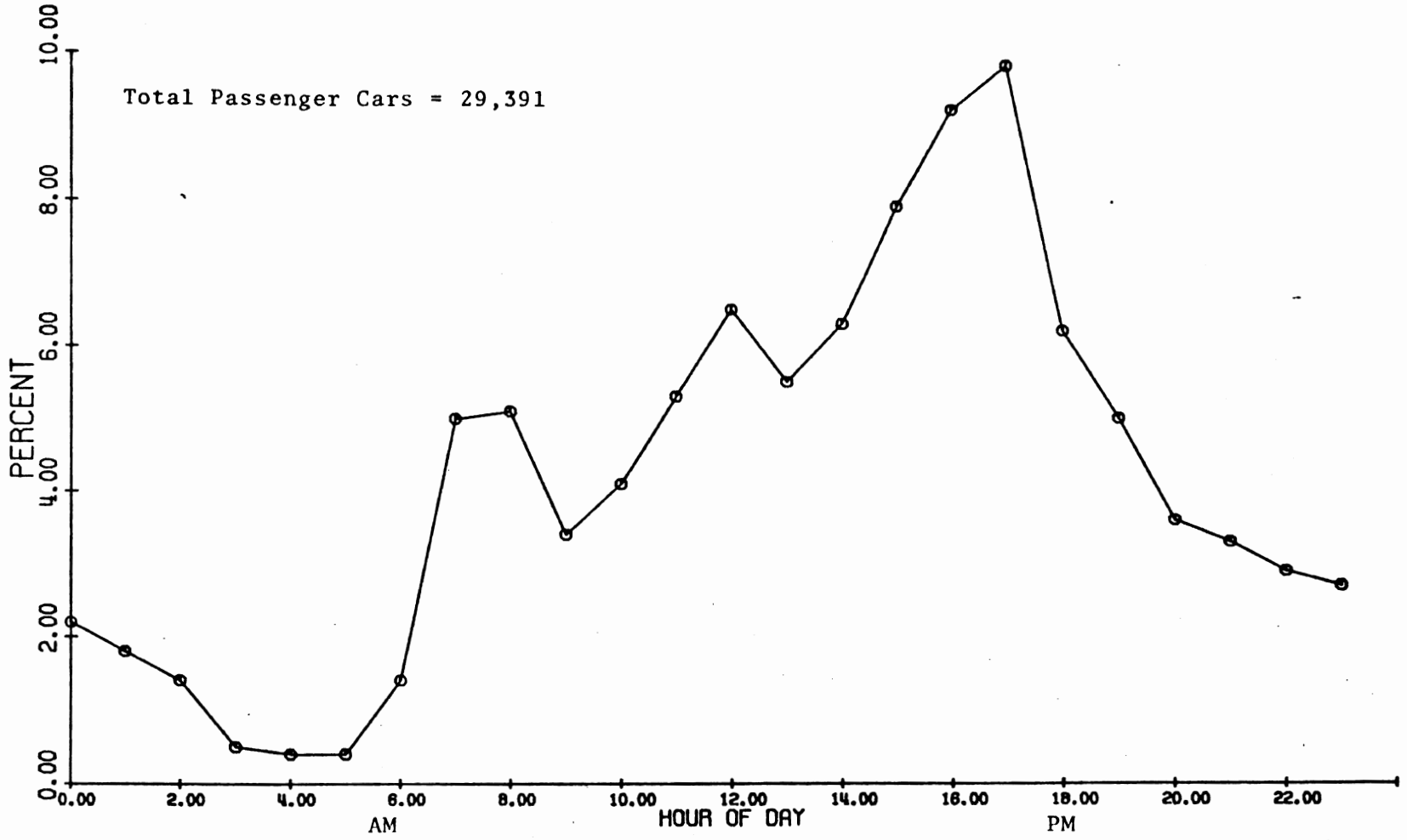
Road Surface	Ω	Cars*	Trucks*
Dry	0.3	78.0%	79.6%
Wet	-1.0	19.8	18.2
Muddy	11.5	0.05	0.1
Snowy	4.1	0.4	0.6
Icy	-0.6	1.7	1.6
TOTAL FREQUENCY		29,391	5,111

*Percentage of total vehicles of the given type.



LIGHT TRUCK INVOLVEMENTS BY HOUR OF DAY

FIGURE 7



PASSENGER CAR INVOVEMENTS BY HOUR OF DAY

FIGURE 8

Over 95 percent of the vehicles investigated were involved in accidents where no road defect was noted. Although the variations by road condition were statistically significant, many of the defect categories contain too few cases to attribute any positive physical dependence. In categories containing more than 100 vehicles, light trucks were overinvolved in accidents on roads with a slick surface or where construction or maintenance activities were taking place.

4.3 VEHICLE DEFECTS AND VEHICLE DAMAGE

Over 98 percent of the vehicles investigated in this study had no reported vehicle defect. Of the 560 vehicles with listed defects, light trucks showed a positive overinvolvement in every category except defective brakes and missing windshield wipers. The number of involved cars and light trucks and the overinvolvement for all defect types are shown in Table 13.

TABLE 13

Overinvolvement by Vehicle Defect

Defect	Ω	Cars	Trucks
Brakes	-2.6	288	40
Steering	13.8	20	8
Lights	8.3	10	3
Windshield Wiper	-14.8	1	0
Tires	7.1	89	25
Trailer Equipment	42.3	15	20
Stop/Turn Signal	6.3	15	4
Wheel Came Off	7.9	17	5
Other/Missing Data		47	5
No Defect		28,889	5,001
TOTAL		29,391	5,111

The trailer equipment category is probably more generally applicable to light trucks than to passenger cars

so that the high positive overinvolvement in that category is not unexpected. The problem of wheels coming off is not as noteworthy in light-truck accidents as it is in those involving large trucks, but steering defects are the cause of significant overinvolvement for all truck types studied.

Vehicle damage in Texas accidents is recorded by the TAD method.* The TAD scale records both the vehicle damage area, and a numerical indication of damage severity. Overinvolvement by damage area is given in Table 14. For passenger cars, 3,331 or 11.3 percent of the vehicles had missing damage area data. For light trucks the corresponding missing data values are 848 vehicles comprising 16.6 percent of the total. Missing data for light trucks is thus only about one-half of the percentage found for large trucks.

In Table 14, the damage areas are listed in terms of decreasing overinvolvement. Side and top damage represent areas of heavy overinvolvement.

Overinvolvement as a function of the TAD damage extent scale is shown in Figure 9. The actual involvement of cars and light trucks is shown in Table 15.

4.4 DRIVER FACTORS

A number of driver-related factors were utilized in the comparison of light trucks and passenger cars. Driver age, driver sex, and police-reported violation will be discussed below. The effects of driver impairment (bad eyesight or hearing, fatigue, etc.) were considered also, but variations in involvement due to this factor were not statistically significant.

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*"Vehicle Damage Scale for Traffic Accident Investigators," TAD Project Technical Bulletin Number 1, Traffic Accident Data Project, National Safety Council, Chicago, 1971.

TABLE 14

Light-Truck Overinvolvement by Vehicle Damage Area

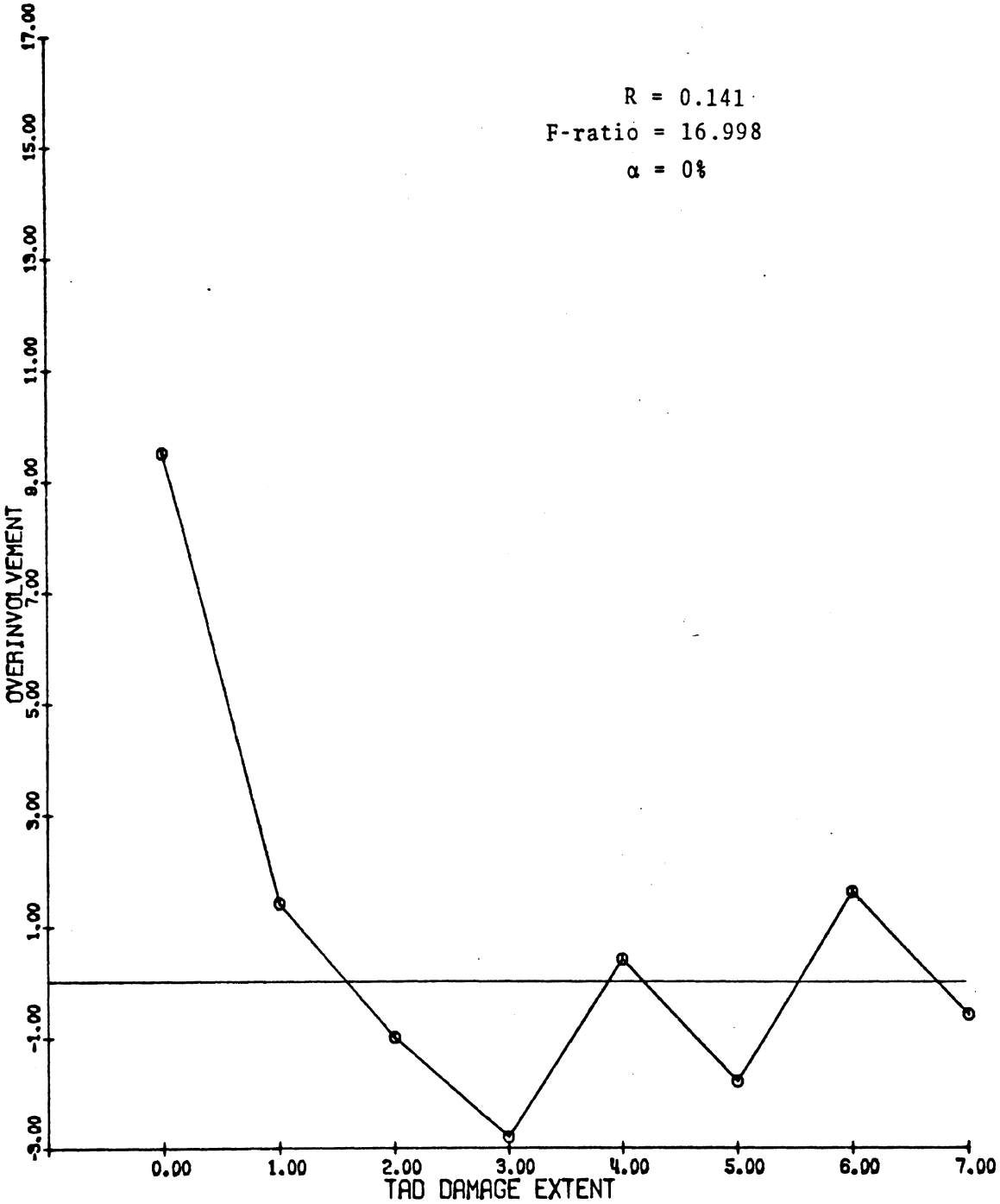
Area	Ω	Cars	Light Trucks
Right Side and Top	14.3	159	63
Left Side and Top	12.4	161	58
Left Side Distributed	2.9	508	104
Front Right	2.2	2646	517
Back Left	2.1	864	167
Right Side Distributed	1.9	602	115
Front Left	1.2	2548	462
Back Right	0.5	843	144
Left Passenger Compartment	0.2	1026	171
Front Center	0.0	1162	190
Right Side - Back Quarter	-0.1	1301	211
Right Passenger Compartment	-0.6	1115	174
Right Side - Front Quarter	-0.7	2241	346
Front Distributed	-1.2	4485	667
Left Side - Back Quarter	-1.6	1341	191
Back Distributed	-3.1	2801	346
Missing Data		3331	848
TOTAL FREQUENCY		29,391	5,111

TABLE 15

Vehicle Involvements by TAD Damage Scale

TAD Damage Scale	Cars*	Trucks*
0	2.1	3.9
1	38.2	42.8
2	28.8	26.6
3	19.7	15.4
4	6.1	6.4
5	2.4	2.0
6	1.6	1.8
7	1.1	1.1
	100%	100%
Total Frequency	26,060	4,263
(Missing Data)	(3,331)	(848)

*Percentage of the total vehicles of the given type, excluding missing data.



LIGHT TRUCK OVERINVOLVEMENT
BY TAD DAMAGE EXTENT

FIGURE 9

The variation of overinvolvement with driver age is shown in Figure 10. From these data, it is evident that trucks are overinvolved for drivers aged between 30 and 75 years. The large overinvolvements at 10 years and at 85 years are associated with small numbers of drivers and will not be discussed further here. The underinvolvement at ages 15-25 is caused by the large percentage of passenger car accidents with drivers in this age group.

Of the 4,888 light trucks for which driver sex information was available, 8.0 percent were driven by females. This compares to 37.4 percent for passenger cars.

Up to two violations are coded for each driver in the Texas Sample file but most drivers had no violation coded. Of passenger car drivers 68.6 percent had no violation while of light truck drivers 69.4 percent had no violation. The most common types of violations for drivers of both vehicle types were turning errors.

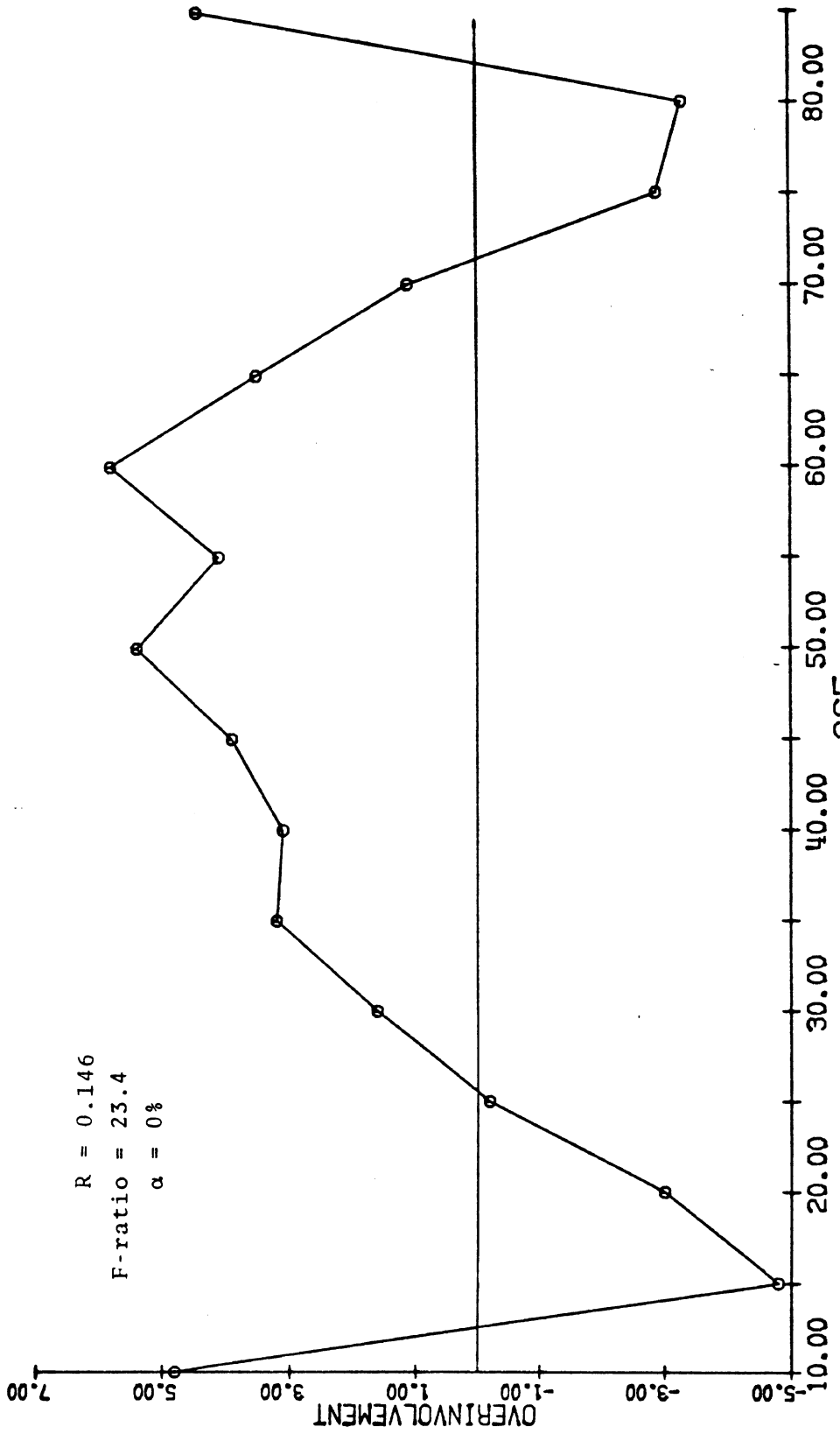
4.5 OCCUPANT INJURY

Light-truck involvement as a function of the most serious injury sustained by the occupants of the vehicle is compared with passenger car involvements in Table 16. Light trucks are overinvolved in both fatal and no-injury accidents are underinvolved in injury accidents.

TABLE 16

Overinvolvement by Most Severe Injury

Injury	Ω	Cars	Light Trucks
Fatal	2.3	97	20
A Injury	-0.8	645	105
B Injury	-1.6	1586	242
C Injury	-4.4	1367	158
No Injury	0.3	25,696	4586
TOTAL FREQUENCY		29,391	5,111



LIGHT TRUCK OVERINVOLVEMENT
BY DRIVER AGE

FIGURE 10