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Report 03169-IV

ACQUISITION OF INFORMATION ON EXPOSURE AND ON NON-FATAL CRASHES

Volume IV - Appendices

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16. Abstract

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APPENDIX A
STATEMENT OF WORK

The Contractor shall furnish all necessary qualified personnel, facilities, equipment and services, and in consultation with the Government, perform a study entitled "Acquisition of Information on Exposure and on Non-Fatal Crashes."

GUIDELINES

1. The collection of exposure data has been attempted at various times in the past, but the high cost involved has very much limited both the scope and the duration of these efforts. It is therefore expected that the contract for this study reflect knowledge of these past studies and inclination to learn from them.

2. One general aim in collecting information on exposure is to permit valid comparisons between the crash and injury experience of different classes of drivers and vehicles. These comparisons are frequently made by means of rates or ratios whose numerators are a measure of crash results, e.g. fatalities, and whose denominators are a measure of exposure, e.g. vehicle-miles. The crash experience of many different classes of drivers and vehicles is available from current data sources, but the corresponding exposure measurements for these classes are not available. Hence, the work under Tasks 1 and 2 should ensure that the classes for which exposure data is collected and the classes for which crash experience is collected will correspond and permit appropriate rates to be calculated.

3. It is the Bureau's intention to begin acquisition of basic exposure data as soon as practicable, and to refine the collection as indicated by this study. Hence, recommendations on collection of vehicle-mileage data should be given high priority.

4. There are three basic questions which this study should answer.

a. What data are needed?

b. What is a desired sample size considering cost involved and value of information derived?

c. What is the optimum data collection procedure?

The contract should dwell on these questions and provide workable answers.

SPECIFIC TASKS

Phase I - Exposure Information

Task 1. Determine the principal classes of drivers and vehicles and environments for which exposure measurements are needed. These should satisfy the following criteria:

a. each class is relatively homogeneous with respect to relevant exposure factors;

b. the definition of the classes can be used, in concept, for sampling purposes;

c. the measured exposures will be useful for studying the impact of safety countermeasures; that is, to the extent possible, exposure measurements should include situations to which major safety countermeasures apply.

Task 2. Determine and analyze procedures for exposure sample surveys to provide estimates of vehicle-mileage for meaningful classifications of the following:

a. driver characteristics.

b. vehicle type,

c. highway systems,

d. traffic characteristics.

Early effort should be directed towards procedures for currently used classifications, with subsequent effort directed towards refinements as indicated by findings

under Task 1, above. Combinations of categories for the purpose of designing sample survey methods that are economically feasible should take into consideration the criteria listed under Task 1.

Task 3. Determine the costs associated with the surveys as a function of accuracy and precision. Recommend procedures that will best fulfill Bureau requirements.

Task 4. Recommend field tests to evaluate procedures developed in Tasks 2 and 3 and, to the extent possible, describe in detail the field-testing procedures needed, their availability and the procedures to be followed.

Task 5. Develop appropriate indirect or proxy measures for those situations where direct determination or data collection is not practicable, or where significant advantages can be realized by using indirect methods of estimation. Analyze thoroughly the theoretical and practical implications of each indirect measure. This should include a discussion of relative costs and kind and size of errors.

Task 6. Make recommendations for future exposure data collection programs on the basis of need for and effort required in obtaining the exposure information.

Phase II - Information on Non-Fatal Crashes

Task 1. Analyze current sources of crash and injury statistics from the standpoint of their reliability and usefulness for estimating total numbers of crashes by type and the ratios of the numbers of injuries of specified severity to all crashes. Make quantitative estimates of effects of major biases and sources of inaccuracy.

Task 2. Determine and evaluate methods for elimination of effects of major biases and inaccuracies in current infomation. This might be done either through statistical

adjustments or through sampling or a combination thereof. This should include, among other things, a correction for the effects of price inflation upon reported numbers of property damage crashes. Investigate the cost and precision of the promising methods. Make recommendations for procedures to be followed by the Bureau.

Task 3. Determine the feasibility of using hospital records for estimating number and severity of serious injuries.

Phase III - Driving Exposure Survey

Task 1. Prepare detailed sampling plan and procedures for a nationwide driving exposure survey. Estimate cost, time and resources required.

Task 2. Provide documentation so the the organization which actually conducts the survey will have all the instructions needed to perform the job.

Task 3. Determine means to check the resultant exposure estimates by alternative collection methods so that a check can be made of the accuracy of the methods being used in the exposure survey. Incorporate these in the plan after consultation and approval by the National Highway Safety Bureau.

Task 4. Prepare a detailed plan for analysis of the data to be collected. This plan should specify the major analysis to be performed and estimate cost and resource requirements.

APPENDIX B

SURVEY QUESTIONNAIRES

PRELIMINARY-SURVEY QUESTIONNAIRE

Driving Exposure Research Project
Highway Safety Research Institute
The University of Michigan

CONFIDENTIAL INTERVIEW

COLUMN

1-5 _ _ _ _ _ Sequence

6

7-10 0 8 6 9 Study No.

11 1 Card No.

12

13-14 What is your age as of your nearest birthday? ____
Code _ _

15 Sex 1 ( ) Male
2 ( ) Female

RESIDENCE

16 Is your home a single family dwelling or a multiple family dwelling?
1 ( ) single family
2 ( ) multiple family

17 Do you live in your own house (apt.) or in your parents' residence, or what?
1 ( ) own house or apt.
2 ( ) parents' house or apt.
3 ( ) other (specify) _____

18 Is your residence located in a rural, suburban or urban area?
1 ( ) rural (farm or country)
2 ( ) Suburban (any built-up area outside city limits)
urban (inside city limits) - indicate population:
3 ( ) less than 2,500
4 ( ) 2,500-5,000
5 ( ) 5,000-10,000
6 ( ) 10,000-25,000
7 ( ) 25,000-50,000
8 ( ) 50,000-100,000
9 ( ) over 100,000

869-1

COLUMN

FAMILY

19 What is your marital status? Are you:

1 ( ) single
2 ( ) married
3 ( ) separated or divorced
4 ( ) widowed

20 Do you have one or more children living at home with you who is age 18 or younger?

1 ( ) yes
2 ( ) no

EMPLOYMENT

21 Did you work for pay during the past month?

No — Yes ⇓

If yes, did you work:

1 ( ) part-time (less that 30 hrs./ wk.)
2 ( ) full-time (more that 30 hrs./ wk.)
3 ( ) full-time plus another job

If no, do you consider yourself:

4 ( ) retired
5 ( ) unemployed
6 ( ) other (specify) _____

22-23 What is your normal occupation? _____

Code _ _

24 Do you drive as a regular part of your job? Do not include driving to and from work.

1 ( ) yes
2 ( ) no

25 What is your personal weekly or yearly income before taxes?

	YEARLY	WEEKLY
1 ( )	under $5,000	under $100
2 ( )	$5,000-$10,000	$100-$200
3 ( )	$10,000-$15,000	$200-$300
4 ( )	$15,000-$20,000	$300-$400
5 ( )	over $20,000	over $400
6 ( )	don't know	
7 ( )	no income	

COLUMN

EDUCATION

In school, what is the highest grade you have completed? (circle one)

1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 Post Grad.
(college or trade school)

Have you graduated from High School?

1 ( ) yes

2 ( ) no

Have you graduated from college or from trade or business school?

1 ( ) Junior college, trade or business school.

2 ( ) 4 yrs. college

Do you have an advanced degree (i.e. M.S., Ph. D., etc.)?

1 ( ) yes

2 ( ) no

Note: code answer below.

26 Education level (Check one only based on previous four questions.):

1 ( ) attended grade K-5

2 ( ) attended grade 6-8

3 ( ) attended grade 9-12

4 ( ) graduated from High School

5 ( ) attended junior college, college, trade or business school

6 ( ) graduated from junior college, trade or business school

7 ( ) graduated from college (four year degree)

8 ( ) has advanced degree

27 Have you completed a Driver Education Course?

1 ( ) yes

2 ( ) no

SEAT BELT USAGE

28 How often do you use seat belts when driving?

	fraction of time
1 ( ) always	1.0
2 ( ) most of the time	.75
3 ( ) about one-half of the time	$\frac{1}{2}$
4 ( ) occasionally or seldom	$\frac{1}{4}$
5 ( ) on trips (highway) only	
6 ( ) never	0

COLUMN

VEHICLES AND DRIVING

29 How many vehicles do you regularly drive?_____
Code___

The next several questions will deal with the vehicle(s) that you have driven most frequently during the past seven days.

	Vehicle 1 most frequently		Vehicle 2 next most frequently	
	COLUMN		COLUMN	
Estimate the percent of time you spent driving vehicle 1 and vehicle 2	30	____%	31	___
Vehicle type: Is this vehicle a	32		33	
Passenger car:	. . .	1 ( )	. . .	1 (
Small truck (pick-up, van)	. . .	2 ( )	. . .	2 (
Large truck (stake or flatbed or dump)	. . .	3 ( )	. . .	3 (
Tractor trailer or semi.	. . .	4 ( )	. . .	4 (
Taxi or limousine.	. . .	5 ( )	. . .	5 (
Passenger bus.	. . .	6 ( )	. . .	6 (
Other:_____		7 ( )		7 (
If either vehicle is a passenger car, indicate whether a standard, intermediate or compact size.	34		35	
Standard	. . .	1 ( )	. . .	1 (
Intermediate	. . .	2 ( )	. . .	2 (
Compact.	. . .	3 ( )	. . .	3 (
Non-passenger.	. . .	4 ( )	. . .	4 (
Don't know	. . .	5 ( )	. . .	5 (
How would you describe the style of this vehicle? Is it a	36-37		38-39	
(4-door.	. . .	1 ( )	. . .	1 ( )
(2-door.	. . .	2 ( )	. . .	2 ( )
CAR(Convertible or.	. . .	3 ( )	. . .	3 ( )
(sports car.	. . .	4 ( )	. . .	4 ( )
(station wagon	. . .	5 ( )	. . .	5 ( )
(Pick-up	. . .	6 ( )	. . .	6 ( )
Small(Panel	. . .	7 ( )	. . .	7 ( )
Truck(Step van(delivery).	. . .	8 ( )	. . .	8 ( )
(Van	. . .	9 ( )	. . .	9 ( )
Large(Semi.	. . .	10 ( )	. . .	10 ( )
Truck(Dump.	. . .	11 ( )	. . .	11 ( )
(Flat bed?	. . .	12 ( )	. . .	12 ( )

		Vehicle 1		Vehicle 2	
		COLUMN		COLUMN	
Who is the manufacturer of the vehicle? (Ford, Chev, Plymouth, etc.)		40-41	_____	42-43	_____
			__		__
What model vehicle is it? (Tempest, Charger, GTO, Electra, etc		44-46	_____	47-49	_____
			__		__
Year?		50-51	19__	52-53	19__
Is the vehicle equipped with:					
	power steering?	54		55	
	yes		1 ( )		1 ( )
	no		2 ( )		2 ( )
	don't know		3 ( )		3 ( )
	power brakes?	56		57	
	yes		1 ( )		1 ( )
	no		2 ( )		2 ( )
	don't know		3 ( )		3 ( )
	seat belts?	58		59	
	yes		1 ( )		1 ( )
	no		2 ( )		2 ( )
	don't know		3 ( )		3 ( )
Estimate the weight of the vehicle.			_____#		_____#
		60-61	__	62-63	__
How many cylinders in the engine?		64		65	
	3 or less		3 ( )		3 ( )
	4		4 ( )		4 ( )
	6		6 ( )		6 ( )
	8 or more		8 ( )		8 ( )
	don't know		0 ( )		0 ( )
Can you estimate the cubic inch displacement of the engine?			____ci		____ci
		66	—	67	—
Can you estimate the horsepower of the engine?			_____hp		_____hp
		68	—	69	—

	Vehicle 1 COLUMN	Vehicle 2 COLUMN
Who is the legal owner of the vehicle?	70	71
I am	1 ( )	1 ( )
Spouse	2 ( )	2 ( )
Son or daughter.	3 ( )	3 ( )
Parent	4 ( )	4 ( )
Other (specify)_____.	5 ( )	5 ( )
Don't know	6 ( )	6 ( )
What part of the time are you the principal operator of the vehicle?	72	73
Always	1 ( )	1 ( )
Most of the time	2 ( )	2 ( )
About 1/2 of the time.	3 ( )	3 ( )
Occasionally	4 ( )	4 ( )
Almost never	5 ( )	5 ( )
What is your best estimate of the odometer reading of your vehicle?	_____mi.	_____mi

End of Card 1

Begin Card 2

	Vehicle 1 driven most frequently COLUMN		Vehicle 2 driven nex most freq. COLUMN	
Estimate the number of miles you have driven each vehicle during the last 7 days.		____ mi.		____ mi.
	13	____	14	____
Are these vehicles used for personal or business driving or both?	15		16	
Personal		1 ( )		1 (
Business		2 ( )		2 (
Both		3 ( )		3 (

NOTE: Read entire question before getting answers.

For your driving during the last 7 days, estimate the number of miles you have driven:				
a) to and from work (commuting)	17-19	___	20-22	___
b) in and around town (excluding commuting)	23-25	___	26-28	___
c) total vacation miles	29-32	____	33-36	___
d) on other trips (excluding vacation)	37-40	____	41-44	___
e) other (specify) _____	45-47	___	48-50	___

NOTE: Read entire question before getting answers.

For your driving time during the last 7 days, estimate the percent of time spent on:				
a) City streets	51-53	___	54-56	___
b) suburban streets & roads	57-59	___	60-62	___
c) rural highways	63-64	__	65-66	__
d) rural roads, excl. highways	67-69	___	70-72	___
e) urban freeway inside city limits	73-74	__	75-76	__
f) rural freeway	77-78	__	79-80	__

End of Card 2

Begin Card 3

COLUMN DRIVING CONDITIONS

For your driving during the last 7 days, estimate the percent of time spent driving:

a) during the day & night

13-15 ___day

16-18 ___night

100%

b) during fog, rain, etc.

19-21 ___ fog

22-24 ___ rain

25-27 ___ wet pavement after rain

28-30 ___ dry pavement

100%

During the past 7 days estimate the percentage of time when driving with no passengers in the car, one passenger, 2 passengers, etc.

31-33 ___ no passengers

34-36 ___ one passenger

37-39 ___ two passengers

40-42 ___ 3 or more passengers

100%

43 Do you usually drive:

1 ( ) 5-10 miles per hour below speed limit

2 ( ) below the speed limit, but no slower than other cars (with traffic flow)

3 ( ) about at the speed limit regardless of other traffic

4 ( ) above speed limit but no faster than other cars (with traffic flow)

5 ( ) above speed limit and faster than other cars?

6 ( ) don't know

69-8

ACCIDENTS AND VIOLATIONS FOR THE PAST 3 YEARS
SINCE AUGUST, 1966:

Date: Month Year	ACCIDENT: Number of Cars Involved	ACCIDENT: $ Property Damage to your Vehicle	ACCIDENT: Personal Injury	ACCIDENT: Violation Issued	MOVING VIOLATION: Offense (List only if found guilty)	MOVING VIOLATION: Points
8/66						
TOTALS	Accid.___	$_____	Inj___ Kill___		No. of Violations ______	Points ___

COLUMN		
44-45	_ _	Total Accidents
46-49	_ _ _ _	Total dollars property damage to your property (vehicle)
50-51	_ _	Total number injured
52	_	Total number killed
53-54	_ _	Total violation
55-56	_ _	Total points
57	_	Total number of violations associated with Accidents

58 Have you driven after drinking during the past 12 months?

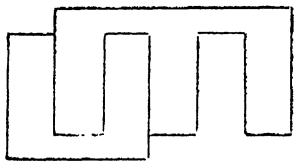
1 ( ) yes

2 ( ) no

End of Interview

PILOT-SURVEY QUESTIONNAIRE

FORM APPROVED
Budget Bureau No. 04-S70004



HIGHWAY SAFETY RESEARCH INSTITUTE
Institute of Science and Technology
Huron Parkway and Baxter Road
Ann Arbor, Michigan 48105

THE UNIVERSITY OF MICHIGAN

Winter, 1970

"Acquisition of Information on Driving Exposure"

Confidential Interview

The Highway Safety Research Institute of the University of Michigan is conducting an 18 state survey on the "Acquisition of Information on Driver Exposure." This project is sponsored by the National Highway Safety Bureau and the Department of Transportation. We hope to gather information about drivers, their vehicles, and the number of miles they drive so we may more accurately determine the driving patterns of all drivers in the United States.

By using scientific sampling techniques, you and a number of your fellow drivers in this area have been selected to participate in this survey. The information you may supply to us during the interview will be held in the strictest confidence and will at no time be seen by anyone except the research staff working on this project. Also, any information you supply to us will in no way affect the status of your driver's license or be seen by any of the licensing personnel.

Would you take 10 or so minutes of your time to answer some questions about yourself and your driving?

If person says yes, continue.

If person says no, terminate interview. Thank them for their time.

Instructions continued

It would be helpful if you would answer all questions. If there are any questions which you would rather not answer, feel free to do so. Participation is voluntary, of course.

Again, all answers are treated with strict confidence and no individual information is released, only statistical averages for groups.

If you have questions or concerns about this, please feel free to contact us.

Have you operated a motor vehicle on the streets or highways during the past 12 months?

If yes, continue

If no, terminate the interview, thank the person for their time.

Interviewer Note: Not necessary to read these names.

Philip S. Carroll
Project Director

Thomas L. McDole
Survey Director

The Highway Safety Research Institute
The University of Michigan
Ann Arbor, Michigan 48105
Phone: (313) 764-0248

Exposure Study
Confidential Interview

Study Number 0 1 7 0 — C01-C04
C05 blank
Location _ _ _ _ _ _ — C06-C11
C12 blank
Sequence Number _ _ _ _ _ — C13-C17
C18 blank
Card No. 1 — C19
C20 blank

* *

Residence Location

1. What county do you live in? _____
name

2. What is the name of the city, town, village or township where you live? *write name, then check pop. cat.*

a) City _____ *name*
b) Incorporated town _____ *name*
c) Incorporated village _____ *name*

Code population value

Population: C21
less than 2,500. . .( )1
2,500-5,000. . . . .( )2
5,000-25,000 . . . .( )3
25,000-50,000. . . .( )4
50,000-100,000 . . .( )5
100,000-500,000. . .( )6
over 500,000 . . . .( )7
don't know . . . . .( )8

d) Unincorporated village _____ *name* → rural. . . . . .( )0

e) Township _____ *name* → rural. . . . . .( )0

3. Would you point out the approximate location of your residence on this map. C22

Distance code (Value 1-7) . . . . ___
Location not on map . . . . . .( )7
Can't find location . . . . . .( )0

Education

4. What is the highest educational level you have completed? C23

Less than 7 grades	( )7
Completed 7, 8, or 9 grades	( )6
Completed 10 or 11 grades	( )5
High School graduation or equivalent	( )4
Completed Business or Trade school	( )3
Partial College training (completed 1, 2, or 3 years)	( )3
Four year college degree	( )2
Advanced degree(s)	( )1
Don't know	( )8

Occupation

5. Are you employed either full time or part-time at the present? C24

Yes - *see item 6*	( )1
No - *see item 7*	( )2

6. If YES: What is your present occupation. In other words, what kind of work do you do? *Give specific job title.*
DESCRIBE _____
_____.

continue to item 8, page 5

7. If NO: Are you: C25

a) A student? occupation planned after graduation _____	( )2
b) A Housewife? What is your husband's occupation? _____	( )3
c) Retired? What was your most recent occupation? _____	( )4
d) Temporarily Unemployed? What was your most recent occupation? _____	( )5
e) Or what? (Specify) _____	( )6
Don't know	( )8

Occupation code C26

do not code

Income

8. What is your total family income (yours plus that of your spouse, if married) before taxes?

Weekly	Yearly	C27
none.	none.	( )0
Under $100. . .	Under $5,000. . . .	( )1
$100-$200 . . .	$5,000-$10,000. . .	( )2
$200-$300 . . .	$10,000-$15,000 . .	( )3
$300-$400 . . .	$15,000-$20,000 . .	( )4
over $400 . . .	over $20,000. . . .	( )5
	don't know.	( )8

Driving Distances

9. The next few questions will deal with the driving you have done during the past 7 days. By driving, we mean the times that you were the operator of the motor vehicle. Do not include times when you were just a passenger. By past 7 days, we mean the 7 full calendar days just passed (ending last midnight) including the weekend and any holidays.

10. Earlier you indicated that you were *see below*.

y)	employed.	*go to item 11, page 6*
a)	a student	*go to item 19, page 7*
b)	a housewife	*go to item 25, page 8*
c,d,e)	retired, unemployed, or other.	*go to item 25, page 8*

y) Employed:

11. Do you sometimes drive to and from work? C28
No - *skip to item 14* . . . . . ( )2
Yes- . . . . . ( )1

12. If yes: What do you estimate as the number of driving MILES from your home to work and back again? (round trip) . . . . . C29-C31 ___mi
don't know . . . . . ( )800

AND

13. In the last 7 calendar days, how many TIMES did you make this round trip to work? . . . . . C32-C33 __
don't know. . . ( )80

14. Do you DRIVE REGULARLY as a part of your job, that is during working hours? C34
No - *skip to item 16* . . . . . ( )2
Yes. . . . . ( )1

15. If yes: What do you estimate as the number of MILES you have driven on the job (not back and forth to work) in the last 7 calendar days?. . . . C35-C38 ____mi
don't know . . . ( )8000

16. Excluding the trips you made to and from work, how many other TRIPS of all kinds (shopping, visiting friends, vacation, etc.,) did you make as a driver during the past 7 days? . . . . . C39-C41 ___
don't know . . ( )800

17. Again excluding the miles you drove to and from work, about how many other MILES did you drive for shopping, visiting friends, chauffering others, etc., in your local area in the past 7 days. Your local area would be distances of less than 50 miles one way from your home. . . . . C42-C45 ____mi
don't know . . . ( )8000

18. Still excluding the miles you drove to and from work, about how many MILES did you drive on longer trips (vacations, etc.) outside your local area during the last 7 days?. . . . C46-C49 ____mi
don't know. . . ( )8000

Skip to item 28, page 9

b) Student:

19. Do you sometimes drive to and from school? C50

No - *skip to item 22* . . . . . .( )2
Yes . . . . . .( )1

20. If yes: What do you estimate as the number of driving MILES from home to school and back again (round trip)? . . . . . ___mi. C51-C53

don't know . . . . . ( )800

AND

21. In the last 7 calendar days, how many TIMES did you make this round trip to school? . . . __ C54-C55

don't know. . . . . .( )80

22. Excluding the trips you made to and from school, how many other TRIPS of all kinds (shopping, visiting friends, vacaction, etc.) did you make as a driver during the past 7 days? . . . . . ___ C56-C58

don't know. . . . . ( )800

23. Again, excluding the miles you drove to and from school, about how many other MILES did you drive, as for shopping, visiting friends, chauffering others, etc. in your local area in the past 7 days. Your local area would be distances of less than 50 miles one way from your home?. . . . . ____mi C59-C62

don't know. . . . . .( )8000

24. Still excluding the miles you drove to and from school, about how many MILES did you drive on longer trips (vacation, etc.) outside your local area during the last 7 days? . . . . . ____mi C63-C66

don't know. . . . . .( )8000

Skip to item 28, page 9

c, d, e, Housewife, Retired, Unemployed, Other:

25. How many TRIPS of all kinds (shopping, visiting friends, vacation, etc.) did you make as a driver during the past 7 days? . . . . . ___ C67-C69

don't know. . . . . ( )800

26. About how many MILES did you drive for shopping, visiting friends, chauffering others, etc. in your local area in the past 7 days. Your local area would be distances of less than 50 miles one way from your home. . . . . ____mi C70-C73

don't know. . . . . ( )8000

27. About how many MILES did you drive on longer trips, vacations, etc.) outside your local area during the past 7 days? . . . . . ____mi C74-C77

don't know. . . . . ( )8000

end of Card 1

Card 2

C19
C20 blank

28. What would you estimate as the total number of miles you have operated a motor vehicle during the past 7 days? . . _ _ _ _ _ mi C21-C25

don't know . . . . .( )80000

29. During the last 7 days, did you drive more than, less than, or about the same number of miles as a typical week during the past month? C26

More than. . . . .( )1
Less than. . . . .( )2
About the same . .( )3
don't know . . . .( )8

30. As a driver, what do you estimate as your total driving mileage for the past MONTH?. . . . . _ _ _ _ _ mi C27-C31

don't know. . . . ( )80000

31. How many different vehicles have you driven in the last month which were owned either by yourself, a parent, friend or your employer? . . . . . C32-C34 _ _ _

don't know . . . ( )800

32. *Driven only one vehicle READ*
The following questions are about the vehicle you now drive. (continue to item 33)

Driven two or more vehicles READ
The following questions are about the vehicle you have driven the highest number of miles during the past 7 days. (continue to next item)

Vehicle

C35-C36

33. What is the model year of the vehicle? . . . . . 19 _ _

don't know . . . . ( )80

34. What type of vehicle is it? Is it a: C37

- Passenger car . . . . . ( )1
- Small Truck (only 2 axles, less than 18,000 # gross vehicle weight) . . . . . ( )2
- Large Truck (2 or more axles, greater than 18,000# gross vehicle weight) . . . . ( )3
- Truck-Trailer or Combination vehicle. . . . ( )4
- Taxi or Limousine . . . . . ( )5
- Bus . . . . . ( )6
- Other (specify) _____ . . . . . ( )7
- Don't know. . . . . ( )8

If the vehicle is not a passenger car, skip to item 40 , page 12

If the vehicle is a passenger car, answer the next group of questions: Begin with question 35 - next page.

Passenger Car Characteristics

35. What make is it? _____
write response here, then check below C38-C39

Ford	( )01	Pontiac	( )09
Mercury	( )02	Buick	( )10
Lincoln	( )03	Oldsmobile	( )11
Plymouth	( )04	Cadillac	( )12
Dodge	( )05	American Motors	( )13
Chrysler	( )06	Volkswagen	( )14
Imperial	( )07	Other car (specify) _____	( )15
Chevrolet	( )08	Don't know	( )80

36. What size car is it? C40

Full size	( )1
Intermediate	( )2
Compact	( )3
Sports	( )4
Other (specify) _____	( )5
Don't know	( )8

37. How many cylinders are there in the engine?
range 1-16_____ C41

Interviewer code response here based on above answer.

Person apparently knows	( )1
Person doesn't know	( )2

38. What is the displacement of the engine?

Choose one that fits response

Cubic Inches (Range 125-500)_____	
Cubic Centimeters (Range 50-4560)_____	*Foreign Cars Only*
Liters (Range .5-7.3)_____	

C42

Interviewer code response here based on above answer.

Person apparently knows	( )1
Person doesn't know	( )2

39. What is the horsepower rating of the engine? C43
range 25-450_____

Interviewer code response here based on above answer.

Person apparently knows	( )1
Person doesn't know	( )2

Vehicle Use

40. Do you usually drive this vehicle exclusively for personal use, for business purposes (on the job), or for both purposes? C44

Personal Use only. . . . . ( )1
Business Use only. . . . . ( )2
Both Personal and Business use. . . . ( )3
Don't know. . . . . ( )8

Roads and Weather

41. During the past 7 days, your driving in this vehicle may have been done under a variety of conditions such as rain, snow or darkness, etc.

42. Approximately what percentage of your driving was done during the daylight hours and what percentage during the nighttime-that is after dark? The percentages should total 100%. C45-C47

a) Day. . . . . _ _ _%
don't know. . . . . ( )800

C48-C50

b) Night. . . . . _ _ _%
don't know. . . . . ( )800

100%

43. Approximately what percentage of your driving was done on clear, dry roads, or on wet or snowy, or icy roads? The two percentages should total 100%. C51-C53

a) Clear, dry roads. . . . . _ _ _%
don't know . . . . . ( )800

C54-C56

b) Wet, and/or snowy, and/or icy roads _ _ _%
don't know . . . . . ( )800

100%

44. During the past 7 days, your driving in this vehicle may have been done on various types of roads such as:

a) Local Streets & Roads - normal streets & roads through business and residential areas inside city and village limits or in built up areas.

b) Urban Freeways & toll roads - Limited access divided highways through cities or built up areas.

c) Rural Freeways & toll roads - limited access divided highways through rural areas-generally connecting various towns and cities.

d) Other Rural Roads & Highways - not limited access roads, but state highways, county roads, rural roads, etc.

Approximately what percentage of your driving was done on each of these types of roads? The percentages should total 100%.

C57-C59

a) Local streets. . . . . ___%
don't know. . . . . ( )800

C60-C62

b) Urban freeways . . . . . ___%
don't know. . . . . ( )800

C63-C65

c) Rural freeways . . . . . ___%
don't know. . . . . ( )800

C66-C68

d) Rural roads. . . . . ___%
don't know. . . . . ( )800
100%

Accidents and Violations

45. The last few questions will deal with accidents and violations you might have had during the past 12 months while you were driving. By accident we mean any incident involving a motor vehicle where there was some property damage or personal injury (minor or major) regardless of which driver was at fault. Your answers will be held in strict confidence-of course.

46. During the time period from April , 1969 until now (approx. 12 months) were you involved in any accidents while driving? C69

No - *skip to item 49* . . . . . ( )2
Yes . . . . . ( )1

C70-C71

47. If yes, how many? . . . . . ___

don't know. . . . . ( )80

48. One of the objectives of our study is to determine approximately how many accidents occur and also the number of accidents where no record is made, i.e. unreported accidents.

For each accident you were involved in, we would like to know the month and year of occurrence. If you have been involved in more than three accidents since April , 1969, list only the three most severe. Also, please indicate to the best of your knowledge, whether or not a written report was made, i.e. police wrote down information for each of these accidents.

	Month	Year	Written Report: i.e. police wrote down information about accident
Accident A	_____	1969 (Circle 1970 one)	C72 Yes. . . . . ( )1 No . . . . . ( )2 Don't know . . . . . ( )8
Accident B	_____	1969 (Circle 1970 one)	C73 Yes. . . . . ( )1 No . . . . . ( )2 Don't know . . . . . ( )8
Accident C	_____	1969 (Circle 1970 one)	C74 Yes . . . . . ( )1 No . . . . . ( )2 Don't know . . . . . ( )8

49. During the 12 month period, did you receive any tickets for moving traffic violations regardless of whether they were paid or not (dismissed)? C75

No- *skip to item 53* . . . . . ( )2
Yes . . . . . ( )1
don't know. . . . . ( )8

C76-C77

50. If yes, how many? . . . . . _ _
don't know. . . . . ( )80

51. Of these tickets, were any received in connection with an accident? C78

No- *skip to item 53* . . . . . ( )2
Yes . . . . . ( )1
don't know. . . . . ( )8

C79-C80

52. If yes, how many? . . . . . _ _
don't know. . . . . ( )80

end of Card 2

53. During the three year time period from April, 1967 until now, how many accidents have you been involved in while driving a vehicle? . . . . . _ _
don't know ( ) 80

END OF INTERVIEW.

54. Thank you for your participation. Your cooperation will help to make this project a success.

SPECIAL PAGES FOR CERTAIN PILOT-SURVEY QUESTIONNAIRES

Accidents and Violations

45. The last few questions will deal with accidents and violations you might have had during the past 12 months while you were driving. By accident we mean any incident involving a motor vehicle where there was some property damage or personal injury (minor or major) regardless of which driver was at fault. Your answers will be held in strict confidence - of course.

46. During the time period from April, 1969 until now (approx. 12 months) were you involved in any accidents while driving? C69

No - *skip to item 49, page 15*. . . . . .( )2

Yes . . . . . .( )1

C70-C71

47. If yes, how many? . . . . . .__ __

don't know. . . . . .( )80

48. One of the objectives of our study is to determine approximately how many accidents occur and also the number of accidents where no record is made, i.e., unreported accidents.

For each accident occurring in Michigan where you were involved as a driver, we would like to know the following information about each occurrence. If you have been involved in more than three accidents since April, 1969, list only the three most severe. Also, please indicate to the best of your knowledge, whether or not a written report was made, i.e., police wrote down information for each of these accidents.

	Month	Year	Written Report: i.e., police wrote down information about accident C72
Accident A	_____	1969 (Circle 1970 one)	Yes. . . . . ( )1 No . . . . . ( )2 Dont' Know . . . . . ( )3

Anybody Injured?
( ) No
( ) Yes
( ) Don't Know

Any Vehicles Towed Away?
( ) No
( ) Yes
( ) Don't Know

Any Damage to Your Car?
( ) No
( ) Yes
( ) Don't Know

Estimated dollar damage to your vehicle . . . . $_____
( ) totaled
( ) don't know

Accident B

Month _____ Year 1969 1970 (Circle one)

Written Report: i.e., police wrote down information about accident C73
Yes . . . . . ( )1
No . . . . . ( )2
Don't Know. . . . . ( )3

Anybody Injured?
( ) No
( ) Yes
( ) Don't Know

Any Vehicles Towed Away?
( ) No
( ) Yes
( ) Don't Know

Any Damage to Your Car?
( ) No
( ) Yes
( ) Don't Know

Estimated dollar damage to your vehicle . . . . $_____
( ) totaled
( ) don't know

Accident C

Month _____ Year 1969 1970 (Circle one)

Written Report: i.e., police wrote down information about accident C74
Yes . . . . . ( )1
No . . . . . ( )2
Don't Know. . . . . ( )3

Anybody Injured?
( ) No
( ) Yes
( ) Don't Know

Any Vehicles Towed Away?
( ) No
( ) Yes
( ) Don't Know

Any Damage to Your Car?
( ) No
( ) Yes
( ) Don't Know

Estimated dollar damage to your vehicle . . . . $_____
( ) totaled
( ) don't know

TYPICAL FUTURE QUESTIONNAIRE

NATIONAL DRIVER SURVEY

PURPOSE:

The purpose of our survey is to learn more about the driving patterns of drivers, including the numbers of miles and types of roads driven on, and the numbers of trips taken by all drivers in the United States. Such information, when collected and analyzed, will yield valuable data useful in the planning and implementation of future transportation networks and in the vital field of highway safety.

You and a small number of your fellow drivers have been scientifically selected to represent all the registered drivers in this state, therefore your response is extremely valuable to us. A computer analysis of your response will help us to develop a clearer picture of the driving patters of all drivers. It is important, therefore, that you complete this survey in accordance with the following instructions. Again, it cannot be emphasized too strongly that all information you supply to us will remain confidential.

GENERAL DIRECTIONS:

You will note that the top of the form bears a date. All information you supply should be for that date only. The day listed begins at midnight and continues for the next 24 hours.

Any information supplied should apply only to you, the person to whom this form was addressed. Information can be recorded on the form by someone else, but should be described by and apply only to the addressee.

Pencil or pen may be used to complete the form. Most responses require only a check mark in the appropriate box or the recording of some sumbers. Examples are provided. The entire form should not require more than 15 minutes of your time to complete.

Definitions: In responding to the questions, please keep in mind these definitions.

DRIVER: The person who actually drove and controlled the operation of the vehicle and to whom this form is addressed. Do not report times when you were only a passenger.

VEHICLE: Any common vehicle operated on the road or highway including, but not limited to, passenger cars, trucks of all types, busses, ambulances, campers and motor scooters. Do not include off-road vehicles such as farm tractors and other farm equipment, bulldozers, road construction equipment, or bicycles.

TRIP: A journey or excursion made with substantially the same purpose in mind where a considerable amount of time lapses between stops. Intermediate stops to the ultimate destination are not counted as separate trips.

EXAMPLES: A trip is -

- -from home to school to pick up or drop off children and home again with a brief stop at a drug store.
- - from home to office or place of employment (return journey from work to home is a separate trip).
- - from office to several customers' place of business and return to office (a salesman's calls).
- - from home to relatives or friends for dinner (return journey counts as a separate trip).

BUSINESS: A trip made during the course of your employment. Driving to and from work is not classified as a business trip.

FORM APPROVED
Budget Bureau No.

NATIONAL DRIVER SURVEY

* *

PART I

* * * *SUPPLY INFORMATION FOR DRIVING DONE ON _____

SPECIAL NOTE* * * Be sure that the information you give in response to each of the items pertains to driving done only on the day specified above.

Are you currently a licensed driver (license not currently suspended or revoked)? [ ] YES
[ ] NO
[ ] Don't know

Did you drive on the day given above? [ ] YES continue with PART II, below
[ ] NO turn to page 4 and fill out PART IV

* *

PART II

For each vehicle that you drove on the day indicated above, answer the following questions in the appropriate column as in the example below. If you drove more than 3 vehicles, describe the 3 that you operated most.

	EXAMPLE	VEHICLE #1	VEHICLE #2	VEHICLE #3
What is the MAKE of the vehicle? (For example Ford, Chev.Impala, Dart,etc.)	(Ford)	(_____)	(_____)	(_____)
What YEAR is it?.....	19 69	19 __	19 __	19 __
What TYPE OF vehicle is it?				
a. Passenger Car (sedan, stat. wagon, micro-bus, sports car, etc.).....	(X)	( )	( )	( )
b. Small Truck (pick up, panel, flat bed, step van, etc.).....	( )	( )	( )	( )
c. Large Straight Truck (generally 18,000 lbs. or over).....	( )	( )	( )	( )
d. Truck-trailer or Combination Vehicle	( )	( )	( )	( )
e. Taxi or Limosine.....	( )	( )	( )	( )
f. Bus (school or commercial passenger)	( )	( )	( )	( )
g. Other (please specify).....	( )	( )	( )	( )

* *

PART III

For each trip that you took on the day indicated, record the information requested. See the example below. Include only times when you were actually driving the car.

Record the miles you list as whole numbers. EXAMPLE: 3 1/2 miles, record as 4 miles.

These definitions may help you describe the road types-

Local Streets and Roads - normal streets and roads through business and residential areas generally inside city and village limits or in built up areas outside cities and villages.

Freeways and Toll Roads - limited access divided highways through both cities and rural areas. EXAMPLE - Interstate or similar highways.

State Highways ---------- state numbered highways (2 or more lanes) which are not built like freeways.

Rural Roads ---------- numbered county roads, rural roads, local county and township roads, both paved and unpaved.

Continue PART III, next page...

PART III, *continued* . . .

TRIP RECORD SHEET for trips taken on _____
(from 12:01 AM to 11:59 PM)

TRIP NUMBER	VEHICLE USED	TRIP TYPE	TRIP STARTED IN	TIME OF DAY TRIP BEGAN	TOTAL NUMBER OF PASSENGERS *NOT* including driver	NUMBER OF MILES driven on different TYPES OF ROADS	TOTAL MILES DRIVEN THIS TRIP
EXAMPLE	[X] 1 [ ] 2 [ ] 3	[X]Personal [ ]Business [ ]Both	[X]Daylight [ ]Dawn or Dusk [ ]Night	[ ]AM [X]PM	[ ] 0 [ ] 1 [ ] 2 [ ] 3 [ ] 4+	3 Local Streets 2 Freeway ___State Highway ___Rural Road	5 miles
1	[ ] 1 [ ] 2 [ ] 3	[ ]Personal [ ]Business [ ]Both	[ ]Daylight [ ]Dawn or Dusk [ ]Night	[ ]AM [ ]PM	[ ] 0 [ ] 1 [ ] 2 [ ] 3 [ ] 4+	___Local Streets ___Freeway ___State Highway ___Rural Road	____ miles
2	[ ] 1 [ ] 2 [ ] 3	[ ]Personal [ ]Business [ ]Both	[ ]Daylight [ ]Dawn or Dusk [ ]Night	[ ]AM [ ]PM	[ ] 0 [ ] 1 [ ] 2 [ ] 3 [ ] 4+	___Local Streets ___Freeway ___State Highway ___Rural Road	____ miles
3	[ ] 1 [ ] 2 [ ] 3	[ ]Personal [ ]Business [ ]Both	[ ]Daylight [ ]Dawn or Dusk [ ]Night	[ ]AM [ ]PM	[ ] 0 [ ] 1 [ ] 2 [ ] 3 [ ] 4+	___Local Streets ___Freeway ___State Highway ___Rural Road	____ miles
4	[ ] 1 [ ] 2 [ ] 3	[ ]Personal [ ]Business [ ]Both	[ ]Daylight [ ]Dawn or Dusk [ ]Night	[ ]AM [ ]PM	[ ] 0 [ ] 1 [ ] 2 [ ] 3 [ ] 4+	___Local Streets ___Freeway ___State Highway ___Rural Road	____ miles
5	[ ] 1 [ ] 2 [ ] 3	[ ]Personal [ ]Business [ ]Both	[ ]Daylight [ ]Dawn or Dusk [ ]Night	[ ]AM [ ]PM	[ ] 0 [ ] 1 [ ] 2 [ ] 3 [ ] 4+	___Local Streets ___Freeway ___State Highway ___Rural Road	____ miles
6	[ ] 1 [ ] 2 [ ] 3	[ ]Personal [ ]Business [ ]Both	[ ]Daylight [ ]Dawn or Dusk [ ]Night	[ ]AM [ ]PM	[ ] 0 [ ] 1 [ ] 2 [ ] 3 [ ] 4+	___Local Streets ___Freeway ___State Highway ___Rural Road	____ miles
7	[ ] 1 [ ] 2 [ ] 3	[ ]Personal [ ]Business [ ]Both	[ ]Daylight [ ]Dawn or Dusk [ ]Night	[ ]AM [ ]PM	[ ] 0 [ ] 1 [ ] 2 [ ] 3 [ ] 4+	___Local Streets ___Freeway ___State Highway ___Rural Road	____ miles
8	[ ] 1 [ ] 2 [ ] 3	[ ]Personal [ ]Business [ ]Both	[ ]Daylight [ ]Dawn or Dusk [ ]Night	[ ]AM [ ]PM	[ ] 0 [ ] 1 [ ] 2 [ ] 3 [ ] 4+	___Local Streets ___Freeway ___State Highway ___Rural Road	____ miles
9	If you have taken more than eight trips during the day, give the total number of trips taken here _____ and estimate your total miles for the excess trips						____ miles

Continue to PART IV, next page . . .

PART IV

What would you estimate as the total number of miles you have operated a motor vehicle during the past 7 days? . . . . . _ _ _ _ miles
( ) did not drive

What would you estimate as the total number of miles you have operated a motor vehicle during the past MONTH (30 days)?. . . . . _ _ _ _ miles
( ) did not drive

For the following items, please indicate the information that pertains to the person to whom the questionnaire is addressed.

BIRTHDATE _ _/_ _/_ _ _ _ (mo. day year) SEX [ ] MALE [ ] FEMALE

DATE for which this information applies _ _/_ _/1 9 7 _ (mo. day)

Thank you for your cooperation. Please place this form in the envelope for return to us. The envelope is pre-addressed and needs no additional postage.

_ _/_ _ _ _ _/_ /_

Your comments are appreciated:

APPENDIX C
DETAILS OF THE PILOT SURVEY

This appendix provides further details of the pilot survey summarized in section 4 of Volume I. The purpose of the pilot survey was to provide a large sample of exposure data which could be subsequently analyzed for determination of unique driver-vehicle-road-environment classes.

The survey plan was for interviewing of a random sample of drivers appearing for license renewal in the licensing offices of the 24 states which required personal appearance for such renewal. The probability sample called for 10,000 applicants in 32 sampling areas within 18 of the 24 states. Permission was obtained from appropriate state and local licensing authorities, and 37 offices were designated in the 32 sampling areas.

Probability sampling requires that every member of the applicant population have an equal chance of being chosen, and therefore, it was necessary to control for variations in renewal volume among the various license offices and within each office. None of the offices has identical volumes nor were the volumes distributed uniformily throughout the day or week. By considering factors such as population, renewal volume by month at the offices, and license renewal period, it is possible to construct the sampling scheme for individuals consistent with requirements of the overall probability sample. The result is a selection ratio (1/n) where one in every n persons becomes eligible for an interview.

Additional restrictions are listed below. These were imposed on the sample either by design (to maintain randomness) or by request of the licensing authorities.

Type of renewal applicant desired:

Renewal operator or chauffeur license applicant

Type of person not desired -- applicants for:

- Change of name
- Change of address
- Other corrections to license including photo retakes
- Original operator or chauffeur license
- Duplicate license
- Temporary instruction permits
- Identification card applicants
- Vehicle registration or title transactions

Restrictions on interviewing:

- Cannot interrupt normal license procedure
- Cannot approach applicants prior to their beginning the license renewal process
- Cannot have people waiting in line for an interview
- Cannot have referral procedure complicated or place an undue burden on license personnel

Interviewing rate:

- Not greater than 3 per hour or one every 20 minutes

All these restrictions were met. The only difficulty was preventing waiting lines for interviews, which was handled in certain large offices by the use of a clerk to assist the interviewer.

Concurrent with the sample development was the task of developing and testing a questionnaire to be administered by personal interview to each respondent in the survey. Also developed were the necessary interviewer guidebooks, accessory forms and reporting devices necessary to execute the interviews.

The interviewing staff was furnished by various sub-contracted temporary-help organizations located in or near the interviewing cities. The interviewers were trained and supervised by a staff of five field managers from HSRI, under the supervision of a survey director.

At each specific interviewing location, the appropriate $n^{\underline{th}}$ person was referred to the interviewer by the office personnel after their license renewal process was completed. The prospective interviewee was asked by the interviewer if he would like to

participate in the survey. If the reply was affirmative, the interview proceeded, if negative the interviewee was free to leave

In ten locations, because of heavy volume or the physical layout of the station, it was necessary to employ a clerk in addition to the interviewer to approach the prospective interviewees and ask them to participate. Thus, the clerk relieved the local office personnel of performing the referral task. Additionally, provisions were made to follow-up on people who could not be interviewed because of a temporary overload on the interviewer.

In all, 8014 interviews out of 10,000 were attempted (80.14%) with 7145 accepting and 869 refusing (10.85%). The overall response was very good. People who refused usually gave reasons such as "not enough time", "too busy", or "on lunch hour!".

When the data collection was completed, in each office, the questionnaires were returned to HSRI for processing. Each questionnaire was reviewed for accuracy and legibility of responses, coded as required on several questions, and filed in the proper sequence for permanent storage. As large groups of the questionnaires became available, they were keypunched, verified, and built into a magnetic tape file for computer processing. When the entire file had been processed and constructed, it was checked for errors and made available for analysis.

The following sections provide further details of pilot survey development, the questionnaire, liaison, implementation, and data reduction.

QUESTIONNAIRE DEVELOPMENT

Based on the results of the preliminary survey, a list of variables was identified for use in the pilot survey (see Table 3 of Volume I). These variables, in addition to variables relating to accident and violation involvement and accident bias, served as the basis for the questionnaire.

Since the survey method chosen for the pilot survey was substantially the same as for the preliminary survey (driver license examining station interviews of driver license renewal applicants) a questionnaire format similar to that used in the preliminary survey was chosen. The two forms bear a marked resemblance to one another except that the questionnaire for the pilot survey had a smaller set of variables. Also, it was constructed so as to be largely self coding and self instructing. These changes were necessary due to the increased sample size, less opportunity for training of the interviewers, and a greatly increased interviewing staff. Also, because of the distances involved to many of the prospective interview locations, there was less opportunity for quality control checks.

Several iterations of the questionnaire were prepared and evaluated before arriving at the final form. Beginning with the preliminary survey questionnaire and the list of 21 predictor variables, the first pilot survey questionnaire was generated. This was accomplished by eliminating from the preliminary survey questionnaire those variables which were not selected for the pilot survey. The first draft was then evaluated and pre-tested for completeness and execution time. It was found that the questionnaire was fairly complete in terms of the variables, but required too much execution time. It also lacked the necessary continuity and precise format necessary for use by an interviewer. One major problem, both in format and execution time was the asking for information on two vehicles (as in the preliminary survey) and then attempting to order this in terms of the priority by use of the interviewee. Several attempts to rectify the problem were tried and a solution was found. However, in field trails of the second iteration, it was found that while the new questionnaire solved the problem of obtaining information on the second vehicle,

it was too complicated in terms of interviewing time and comprehension by the interviewer. Following a decision to drop the second vehicle requirement, a third iteration was prepared and tested. With the dropping of the second vehicle and necessary reformulating, the problems of time and complexity were solved. Copies of this new format were circulated among HSRI staff for comments. These were incorporated into the questionnaire and a final draft copy was prepared.

In cooperation with the local driver-license office of the Michigan Department of State, arrangements were made to permit us to set up a proto-type interviewing situation to test the questionnaire and procedures using real driver license applicants as subjects. Approximately fifteen persons were interviewed. This exercise served as a check on the questionnaire and on the basic survey plan. Several studies were made, including interview time, which ranged between 8 and 15 minutes with an average of about 10 minutes.

The questionnaire, as submitted for Bureau of the Budget approval, is reproduced in Appendix B.

Upon receipt of Bureau of Budget approval, 11,000 copies of the questionnaire were printed. As a part of the reproduction process, the sequence number was imprinted on each form, whereas the location number was added later by hand.

To facilitate the accident bias tasks, additional questions were added to the questionnaire used in Detroit. The altered questionnaire pages are shown in Appendix B. To further facilitate the accident bias task the driver license number was determined in four other states: South Carolina, Virginia, Colorado and Massachusetts.

Additional materials were developed to accompany the questionnaire and aid in its implementation, as described in a succeeding

section.

OVERALL SURVEY PLANNING

The task of developing the survey plan was undertaken concurrently with the questionnaire development. The survey method selected for the pilot survey was the same as the one used in the preliminary survey, namely, the interviewing of driver-license renewal applicants at licensing offices.

One objective of the pilot survey was to reach a sample as representative as possible of the national population of driver-vehicle-road-environment combinations. The reason for seeking representativeness of the broadest possible scope is to provide an opportunity for all unique subgroups to be identified. Thus, it was decided to include as many states as possible in the sample.

By a review of state licensing procedures, it was determined that 24 states required drivers to apply in person for driver license renewals, i.e. mail renewal was specifically prohibited or available only to servicemen or bona-fide residents absent from the home state for extended periods of time. The list of the 24 states and license renewal periods appears in Table 1. The geographic distribution of these states is shown in Figure 4 of Volume I.

A sample-size goal of 10,000 was chosen for the pilot survey. This would provide an average of 400 cases in each of 25 groups (a maximum postulated number of driver-vehicle-road-environment classes that can be reasonably expected to be identified in exposure surveys). The minimum number of cases per group, N, was estimated using the Tukey procedure[1]:

---

[1] Bowker, A. H. and G. J. Lieberman, Engineering Statistics, Prentice-Hall, Englewood Cliffs, New Jersey, 1959.

TABLE 1

STATES REQUIRING PERSONAL APPEARANCE FOR DRIVER LICENSE RENEWAL

	Renewal Period-Years
Alaska	3
Arizona	3
California	4
Colorado	3
Georgia	2 & 5, determined by the individual
Hawaii	4 except ages 15-24 and over 65 - every 2 years
Idaho	3
Indiana	2
Iowa	2
Kentucky	2
Louisiana	2
Massachusetts	4
Michigan	3
Nebraska	5 except over 65 - every 2 years
New Mexico	2
North Carolina	4
Ohio	3
South Carolina	4
South Dakota	4
Texas	2 & 4, conversion to 4 years underway
Utah	4
Virginia	3
Washington	2

$$N = K_g^2 \; S^2/D^2$$

where K_g is a factor computed by Tukey as a function of the degrees of freedom and number of groups, g, for a significance level of 0.95,

S is the estimated standard deviation of the distribution of vehicle miles per year, and

D is the minimum significant difference between mean values of exposure of any two groups.

For 25 groups the Tukey factor, K_g, is about 5.2.

From many studies, it has been found that the standard deviation of exposure estimates is of the same order of magnitude as the mean and thus S = 10,000 miles.

The minimum significant difference is taken as D = 2500 miles.

The resulting value of group size N is 433, which provides a good verification of the 400 case per group assumption and the 10,000 sample size goal.

The Survey Research Center of the Institute of Social Research at The University of Michigan performed the sample design. They constructed the sample of 10,000 within 32 sampling areas based on stratification by region and by equal-population county groups. One sampling area was chosen randomly from each stratum. By chance, six of the 24 states were not represented simply because their small populations resulted in few potential sampling areas. The sample thus generated is described in Table 2. The sample design report was prepared by the Survey Research Center of the University of Michigan.[1] A complete set of county maps showing each PSU was also prepared.

The subsample size for each location, thus identified, was calculated by dividing the Population Represented for each PSU (Primary Sampling Unit) by the Total Population Represented and multiplying by the total sample size. The formula is:

$$S_{PSU} = \frac{PR_{PSU}}{PR_T} \times 10{,}000$$

where

S_{PSU} = Subsample size to be calculated for each PSU

PR_{PSU} = Population represented for each PSU

PR_T = Total population represented

The vaulues necessary for the computations along with the resultant sub-sample sizes are shown in Table 2. The sample as calculated totaled to 9998 instead of 10,000 with the two cases lost in the rounding off process.

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[1] Hess, I., A Sample of Primary Areas for a Study of Information on Exposure to Nonfatal Crashes (internal report), Survey Research Center, The University of Michigan, January, 1970.

Table 2

SURVEY SAMPLE

State No.	State	Area No.	SMSA or County Group PSU (Primary Sampling Unit)	Area Population	Population Represented	Subsample Size
03	California	01	Los Angeles SMSA	6,038,771	6,037,771	691
		02	San Francisco SMSA	2,648,762	2,648,762	303
		26	Salinas-Monterey SMSA	198,351	2,673,807	306
		25	San Bernadino SMSA	809,782	2,781,525	319
04	Colorado	11	Pueblo SMSA	118,707	3,048,731	349
05	Georgia	12	Atlanta SMSA	1,017,188	2,148,384	246
		13	Spalding, Pike Co.	42,342	2,459,705	282
07	Idaho	28	Bearlake, Bingham, Caribou	41,342	3,239,798	371
08	Indiana	03	Indianapolis SMSA	944,475	2,590,591	297
		04	Benton, Jasper, Newton	42,256	3,076,147	352
09	Iowa	14	Dubuque SMSA	80,048	2,107,691	241
10	Kentucky	15	Boone, Campbell, Kenton	229,443	2,176,469	249
11	Louisiana	16	Terrebonne Co.	60,771	2,279,915	261
12	Massachusetts	31	Boston SMSA	2,595,481	2,595,481	297
		32	Plymouth, Barnstable Co.	244,445	2,553,097	292
13	Michigan	05	Detroit SMSA	3,762,360	3,762,360	431
		06	Jackson SMSA	131,994	2,432,293	278

Table 2 cont'd.

14	Nebraska	17	Chase, Dundy, Hayes Hitchcock, Frontier, Red Willow, Gosper Furnas	42,086	2,741,690	314
16	New Mexico	18	Chaves Co.	57,649	1,849,027	212
17	North Carolina	19	Jackson, Macon Co.	32,715	2,359,886	270
		24	Stanly Co.	40,873	2,392,983	274
18	Ohio	07	Akron SMSA	604,367	2,514,850	288
		08	Cincinnati SMSA	1,010,362	2,492,407	285
		09	Toledo SMSA	529,527	2,205,517	253
		10	Licking Co.	90,242	3,117,924	357
19	South Carolina	30	Newberry, Salvda Co.	43,970	3,455,442	396
21	Texas	20	El Paso SMSA	314,070	2,934,999	336
		21	Corpus Christi SMSA	266,594	3,101,676	355
		23	Houston SMSA	1,418,323	2,325,446	266
		22	McCulloch, Coleman, Concho, Runnels, Coke, Irion, Sterling Co.	45,910	2,194,663	251
23	Virginia	29	Norfolk SMSA	578,507	2,894,101	331
24	Washington	27	Seattle SMSA	1,107,213	2,140,224	245
				25,180,126	87,334,362	9998

SMSA (Standard Metropolitan Statistical Area) - 1967 definitions

Population - 1960 census

In most of the sampling areas, the interviewing was designed to be done at only one office over a two to four week period. In certain cases the time was extended to five weeks because of factors not known previously. In a few of the largest areas, the interviewing was designated to be done at two or three offices. On an average there were to be about 300 interviews in each PSU. In those PSU's where there was only one office to be used, one interviewer collected all the interviews. The expected time per interview (based on tests of the questionnaire) was between 10 and 15 minutes and the expected rate of interviewing per day was between 25 and 30.

Based on these preliminary time figures, interviewing time and cost estimates for the interviewing in each location (PSU) were made. These original estimates and the actual costs are compared in Table 3.

The cost per hour estimated and actual were very close ($3.85 and $3.74 respectively) but two factors not considered in the original estimate increased the actual cost considerably. First, we underestimated by 1732 hours the total interviewing time needed and second, the original estimates did not include travel costs by the interviewing staff nor the added expense of a clerk as needed in certain locations.

Comparisons of total costs and times are shown below:

Interviewing Hours	actual	4374.75	hours
	estimated	2641	
		1732.75	hours additional
Interviewing Cost Per Hour	actual	$4.68	(all costs)
	estimated	$3.85	
		.83	additional

TABLE 3

TIME AND COST ESTIMATES BY SURVEY LOCATION WITH ACTUAL COSTS

Location		Estimated hours of interviewing & training	Actual number of hours of interviewing & training	Estimated cost (col.(3) X $4.00)	Actual Costs			
State	Primary Sampling Unit (PSU)				Inter-viewing	Clerk	Travel plus misc.	Total (col. 6+7+8)
1	2	3	4	5	6	7	8	9
California	Los Angeles SMSA	177	250	$708	$1074.00	$591.75	$11.50	$1677.25
California	San Francisco SMSA	80	129	320	526.00	416.93		942.93
California	San Bernardino SMSA	84	139.5	336	576.00	432.00	17.75	1052.75
California	Salinas-Monterey SMSA	81	81.5	324	236.35			236.35
Colorado	Pueblo SMSA	92	156	368	627.00		122.00	749.00
Georgia	Atlanta SMSA	66	116.25	264	348.75			348.75
Georgia	Spalding Co. Group	75	82.75	300	331.00		55.00	386.00
Idaho	Bear Lake Co. Group	97	156.25	388	184.51		80.00	264.51
Indiana	Indianapolis SMSA	79	164.5	316	674.00			674.00
Indiana	Benton Co. Group	92	148.5	368	594.00		220.80	814.80
Iowa	Dubuque SMSA	65	134	260	434.00			434.00
Kentucky	Cincinnati SMSA	67	98	268	392.00		294.00	686.00
Louisiana	Terrebone Parish Co. Gr.	70	109.25	280	437.00			437.00
Massachusetts	Boston SMSA	79	155.5	316	530.50	289.00		819.50
Massachusetts	Plymouth Co. Group	77	128	308	512.00	2.58		514.58
Michigan	Detroit SMSA	112	283	448	1132.00	507.75		1639.75
Michigan	Jackson SMSA	74	80	296	460.00		60.00	520.00
Nebraska	Red Willow Co. Croup	83	110	332	232.00		52.00	284.00
New Mexico	Chaves Co. Group	57	160	228	400.00		17.88	417.88
North Carolina	Jackson Co. Group	72	70.5	288	282.00		63.75	345.75
North Carolina	Stanley Co. Group	73	113	292	453.00		144.00	597.00
Ohio	Licking Co. Group	94	104.5	376	418.00			418.00
Ohio	Akron SMSA	76	97	304	401.00			401.00
Ohio	Cincinnati SMSA	76	91.25	304	365.00			365.00
Ohio	Toledo SMSA	68	107.5	272	438.00			438.00
South Carolina	Newberry Co. Group	103	176.5	412	550.35		184.80	735.15
Texas	El Paso SMSA	88	137.5	352	557.00			577.00
Texas	Corpus Christi	93	226.5	372	910.00			910.00
Texas	McCullock-Coleman Co. Gr	67	155.5	268	622.00		151.25	773.25
Texas	Houston SMSA	71	143.5	284	574.00			574.00
Virginia	Norfolk SMSA	87	165	348	660.00			660.00
Washington	Seattle SMSA	66	98	264	393.00	393.00		786.00
		2641	4373.75	$10180.00	$16344.46	$2924.43	$1183.58	$20452.47

Interviewing Cost Per Hour	actual	$2.55	based on 8014
	estimated	$1.02	based on 10,000
		$1.53	additional

Each of the original 24 states was given a number to facilitate identification. Subsequently a location numbering scheme was developed to allow machine selection of a specific state's or PSU's data. The Location Number, as developed, contains six digits. The first two digits identify the state and the second two the PSU (area). The last two digits (usually 01 or 02) give a clue to the particular interviewing office.

STATE LEVEL PARTICIPATION

For each of the states identified and selected as potential survey locations by the Survey Research Center, a file folder was set up to contain the pertinent information about the surveys and contacts in each state. Typical information included in each folder was a record of the contacts made by personal visit and telephone, maps of the state and PSU, and population information.

As the folders were established and the work of the Survey Reseach Center became available, telephone calls made to each of the 18 state driver-licensing authorities for the purpose of securing permission to conduct the survey in their state. The format followed in most of the phone calls is shown in Figure 1.

Usually at the end of the call, we had obtained tentative permission to conduct the survey in the particular state with final permission pending the arrival of a confirming letter of intent. The letter in draft is shown in Figure 2. The letter was personalized for each state as shown by the blanks.

Subsequent to the telephone and letter contacts, arrangements were usually made to personally visit the state and talk with the appropriate people. Such trips were made to 13 of the 18 states.

Figure 1

Telephone Contact Format

The University of Michigan (HSRI) is under a Federally sponsored contract with the National Highway Safety Bureau to perform "Acquisition of Information on Driving Exposure" (vehicle miles driven). We have developed the methodology of gathering information and are now beginning the field test phase. Our method involves interviewing of drivers at the time they renew their licenses. Our interviewer has a pre-tested questionnaire which is administered by personal interview at the licensing office.

The nationwide sample will total 10,000 driver locations and numbers of drivers to be interviewed were selected scientifically to be representative of the U.S. by the Survey Research Center (U of M). Eighteen states, 32 locations were selected to conduct our survey, _____ was one of these. Within your state, we would like authority to survey the _____ area as this region best meets our objective. We are interested in conducting approximately 300 interviews which will take between 3 and 4 weeks. We would provide the interviewing staff and materials and would request only the use of a table/desk and two chairs at the licensing office. If the state of _____ will cooperate, we would tentatively plan to begin our survey between March 1 and April 30.

Driver participation is voluntary and burden on your office personnel is minimal. Results of the survey will be made available.

States presently participating are: _____, _____, _____, _____, and _____.

QUESTIONS

1. Does each office handle both driver licenses and license plates?

2. About how much time is spent in the office for an individual renewing a drivers license?

3. Are pictures taken?

4. Does each office clerk handle the complete processing of renewal applicants?

5. What is the approximate volume of business at the offices?

6. How many offices are in the specific region of interest?

Figure 2

Letter to state driver licensing authorities seeking approval to conduct interviews in their state

Date_____

_____
_____
_____
_____

Dear_____:

Introductory Paragraph_____

_____

_____

_____

_____

_____

The Highway Safety Research Institute at the University of Michigan is under contract with the National Highway Safety Bureau to perform work on contract FH-11-7293, "Acquisition of Information on Exposure and Non-Fatal Crashes." The contract is in two parts as indicated by the title, and it is the first part, Acquisition of Information on Exposure (vehicle miles driven), with which we are currently concerned. Our task is to develop and field test a means of gathering information about driver exposure.

We have selected as a best means of gathering information about driver exposure the interviewing of drivers at the time they renew their licenses. Also, we have developed and pre-tested a questionnaire which is to be administered by personal interview to a nationwide sample of 10,000 drivers at the time they renew their license. The location of the interviews and the numbers of drivers interviewed were selected scientifically to be representative of the drivers in the U.S. This task of site selection and number of interviews per site was done by the Sampling Section of the Survey Research Center of the Institute for Social Research at the University of Michigan. Of the 24 states which require driver license renewal in person, the research staff selected 18 in which to conduct interviews. Within the 18 states total, 32 regions were also identified to provide us with a representative sample. The State of _____ was chosen and the region of the _____ SMSA (Standard Metropolitian Statistical Area) was identified as a potential survey location. This area was selected because the Survey Research Center felt that the _____ SMSA, (because of its representative population and degree of urbanization), would provide drivers

whose questionnaire results would be significant in terms of our objectives and hence contribute significantly to our study.

The _____ SMSA is defined for our study as the counties of _____ and _____. Within this area a driver licensing office (station) which has sufficient volume will be selected and an interviewer assigned there to interview a sample of the renewal driver license applicants. The interviewer will conduct about 300 interviews. We anticipate that this will take about 3 to 4 weeks and are prepared to begin survey work sometime between _____ and _____. The starting date is flexible and can be arranged to suit the best interest of all parties involved.

We will provide all the necessary interviewing staff and material and would only request the use of a desk or small table and two chairs at the location. The interviewer will be trained by a member of our staff,and in addition, we plan to provide field supervision and consultants to handle any problems that may arise.

I should further stress that driver participation in the interview is voluntary and that all information will be held in strictest confidence. Also we do not wish to be a burden in the local offices, and will make every effort to blend into the setting. We have arranged our interviewing techniques such that we conduct the interviews after the normal licensing procedures have been completed. We do not wish to interrupt before the applicant has completed renewing his license. During our preliminary trial in Ann Arbor, the local licensing office staff felt we did not hinder their work and were in fact, glad to have us.

Since we will be collecting information which is of potential use and of definite interest to the states involved in the survey, we will be glad to send you a summary of the results of the interviews conducted in _____. Some of the items which we will be collecting data on include, age, sex, types of vehicles driven, number of miles driven under various conditions, and self reported accident and violation data. The results gleaned from our preliminary study were very interesting, indeed!

We are hopeful you will look favorably upon our request and grant us approval to conduct our survey in _____.

If you have further questions or concerns, please feel free to contact me (call collect). Sometime in the near future I would welcome the opportunity to meet with you and your staff concerning our project and the proposed participation.

Thank you for your consideration in this matter.

Sincerely,

Thomas L. McDole
Research Associate
(313) 764-0248

It was felt that since we were asking each state for permission to invade and disrupt their driver license system, such a trip would help pave the way. In retrospect, we felt that these trips insured success in many of the locations. In the other 5 states, arrangements were successfully completed by telephone and letter, and trips were unnecessary.

SURVEY PLANNING WITHIN SAMPLING AREAS

Once the contact had been made with the state and permission granted for us to proceed it became necessary for us to gather data about the driver license practices of each state and specific information about the primary sampling units.

Each PSU contained at least one driver license station and usually more. One of the first tasks was to select particular driver license stations within the PSU. In those PSU's where only one driver license station serves the entire PSU, that one station was selected. For each of the multiple-station PSU's it was necessary to gather the names of the stations, their locations, and the volume of renewal applicants per month. Such information was requested in advance and made available during the personal visits. The method of selecting stations where the interviewing would take place is outlined in Figure 3.

Certain locations were excluded (Step 2) occasionally because physical limitations or political considerations prevented the survey from being conducted in that location.

In most areas it was determined that we would survey in only one driver license station. In those areas of large population and/or large geographic area, it was decided to survey in two or more locations. This had no bearing on the probability construction of the sample nor did it introduce any bias into the sample.

As the driver license stations were selected the decision was

Figure 3

Selection of License Stations within PSU's

1. List all stations and renewal volumes - arrange alphabetically
2. Place a * next to those which cannot be used
3. Compute cumulative total
4. Express volumes in ranges
5. Divide total by number of selections desired = I
6. Select random number, RN, from table of random numbers.
   Restriction: RN must be not greater than I
7. RN = first location
8. RN + I = 2nd location (if desired)
9. RN + I + I = 3rd location (if desired)
10. RN + I + I + ...+ I = Nth location (if desired)
11. If a * location is selected, reject it and repeat process using 2 or 3 stations geographically nearest it in a small selection exercise.

Example:

Station Location	Volume	Cum. Vol.	Range	Site Selected
City I	2548	2548	1-2548	0976
City II	2136	4684	2549-4684	
City III	3384	8068	4685-8068	6468
City IV	1285	9353	8069-9353	
*City V	1632	10985	9354-10985	
	10985			

No. of stations desired = 2

$$I = \frac{\sum V}{n} = \frac{10985}{2} = 5492$$

RN = 0976 = 1st location

RN + I = 0976 + 5492 = 6468 = 2nd location

NOTE: for locations with station volumes which are widely separated, i.e. some with volumes of 200-300/day and some with volumes of 10-50/day, reject those with volumes of under 30/day average prior to entire selection process.

checked with the appropriate licensing authorities. If they concurred, the named site became the survey location to be used. The lists of the cities chosen, central cities of the PSU's, and full location numbers are given in Table 4.

Once the specific survey location was known, additional information was gathered about it. Vital information such as street address, managers name, station hours, telephone number, etc. was recorded.

It should be noted that in a few cases the station selection was based on economic criteria. In certain areas, because of their low renewal volumes and/or large geographic area and general inaccessability, an office was chosen to yield the highest returns. For example, in North Carolina one of the PSU's is in the far western portion of the state. Here we had a choice of two renewal stations, both a considerable distance from a source of interviewer. Each station had a very low renewal volume. However, one had a slightly higher volume and was located adjacent to an Interstate Route coupling it to a larger city and source of interviewers. The other was via country roads from the same city. The former location was chosen because of a higher volume of renewal applicants and greater accessibility.

Once the specific sites were chosen, several were visited to gain first hand information about the physical layouts and specific licensing procedures used. Often these site visits were coupled with our visit to the state capitol as a part of the permission gathering process. In general three types of license station operations were found.

1. This station type requires people to proceed to a number of stops for processing various parts of the licensing procedure. The final stop before leaving the station is either the camera or cash register. This type of station sells drivers

TABLE 4

SPECIFIC INTERVIEWING LOCATIONS, LOCATION NUMBERS, AND INTERVIEWING RATIOS

State	PSU	Location #	Central City	Interviewing City	Interviewing Ratio Design	Actual
California	Los Angeles SMSA	030101	Los Angeles	Los Angeles #1	1/8	
California	Los Angeles SMSA	030102	Los Angeles	Los Angeles #2	1/8	
California	Los Angeles SMSA	030104	Los Angeles	Pasadena	1/12	
California	San Francisco SMSA	030201	San Francisco	San Francisco	1/5	
California	San Francisco SMSA	030202	San Francisco	Oakland	1/5	
California	San Bernardino SMSA	032501	San Bernardino	San Bernardino	1/5	
California	Salinas-Monterey	032601	Monterey	Monterey	1/3	Renewal Volume not available for ratio calculation
Colorado	Pueblo SMSA	041101	Pueblo	Pueblo	1/3	1/3.3
Georgia	Atlanta SMSA	051201	Atlanta	Atlanta	1/17	1/25.6
Georgia	Spalding Co. Group	051301	Griffin	Griffin	1/2	1/2.4
Idaho	Bear Lake Co. Group	072801	Blackfoot	Blackfoot	1/1	1/1.1
Indiana	Indianapolis SMSA	080301	Indianapolis	Indianapolis	1/4	1/4
Indiana	Indianapolis SMSA	080302	Indianapolis	Plainfield	1/2	1/2.1
Indiana	Benton Co. Group	080401	Rensselaer	Rensselaer	1/1	1/1.6
Iowa	Dubuque SMSA	091401	Dubuque	Dubuque	1/5	1/8.9
Kentucky	Cincinnati SMSA (Ky.)	101501	Covington	Covington	1/4-1/3	1/4.2
Louisiana	Terrebone Parish	111601	Houma City	Houma City	1/2	1/2.8
Massachusetts	Boston SMSA	123101	Boston	Boston	1/16	1/19.2
Massachusetts	Boston SMSA	123102	Boston	Framingham	1/8	1/9.5
Massachusetts	Plymouth Co. Group	123201	Brockton	Brockton	1/9	1/10.9
Michigan	Detroit SMSA	130501	Detroit	Detroit	1/5	1/6.1
Michigan	Detroit SMSA	130502	Detroit	Oak Park	1/8	1/9.5
Michigan	Jackson SMSA	130601	Jackson	Jackson	*	1/2.7
Nebraska	Red Willow Co. Group	141701	McCook	McCook	1/1	1/1.3
New Mexico	Chaves Co. Group	161801	Roswell	Roswell	1/3	1/2.3
North Carolina	Jackson Co. Group	171901	Sylva	Sylva	1/1	1/1
North Carolina	Stanley Co. Group	172401	Albemarle	Albemarle	1/1	1/1.1
Ohio	Licking Co. Group	181001	Newark	Newark	*	1/2.1
Ohio	Akron SMSA	180701	Akron	Akron	*	1/9.1
Ohio	Cincinnati SMSA	180801	Cincinnati	Cincinnati	*	1/3.9
Ohio	Toledo SMSA	180901	Toledo	Toledo	*	1/2.8
South Carolina	Newberry Co. Group	193001	Newberry	Newberry	1/1	1/1.2
Texas	El Paso SMSA	212001	El Paso	El Paso	1/3	1/5.4
Texas	Corpus Christi	212101	Corpus Christi	Corpus Christi	1/3	1/4.8
Texas	McCullock-Coleman	212201	Ballinger	Ballinger	1/1	1/1
Texas	Houston SMSA	212301	Houston	Houston	1/3	1/3.1
Virginia	Norfolk SMSA	23901	Norfolk	Portsmouth	1/4	1/4.2
Washington	Seattle SMSA	242701	Seattle	Seattle	1/6	1/7.7

*Denotes Special Procedure Used

licenses only.

2. This station type has clerks which are designated to handle specific types of transactions. They complete all phases of the procedure except photography or cash payment. Either of these functions is handled by a single person at the last stop. This type of operation may also sell plates in addition to driver licenses.

3. This station type has clerks which handle all types of transactions and all phases of these transactions including the taking of cash. No pictures are taken here.

It should be pointed out that while these represent three types of license stations most frequently found, other configurations exist which are geared to specific location and volume requirements. These range from one man operations with low volumes, possibly on a mobile basis, to huge volume operations with many windows or stops, and multiple cameras.

At this point it became apparent that wide variations in station types would complicate the initial interviewee selection plans.

Based on the questionnaire pre-tests it was determined that we could interview at a theoretical rate of not more than 3 interviews per hour. This figure was to become the basis for calculating the interviewing ratio.

To maintain a strict probability sample it is necessary to sample the renewal applicants at a rate consistent with the volume of the renewal station. The procedures (Reference 1) result in a sampling ratio such that one in every n persons is chosen to be interviewed. However, one of the assumptions necessary for the procedure is that the office volumes in the formula are accurate. Unfortunately, it was very difficult to determine the volume of renewal applicants per month for many of the locations.

Records of the number of renewal applications processed are kept by the state. However, there is usually a considerable delay in accumulating such records so that available figures are from one to 12 months out of date. Comparisons with previous years is also very difficult because past records are either not kept, unavailable, or the record keeping system was changed. Renewal records likewise may not be accurate or available at the station level because they keep count of only the total volume of business (e.g. including vehicle registration) or pass the information on daily to the state.

Driver license renewals are often controlled only loosely by the expiration date and by extended "grace" periods. Factors such as weather, politics, holiday periods, and the day of the week control the times that people may decide to renew their license. Thus the renewal volume figures frequently were guesses and hence inaccurate for the precise requirements of the formula. Studies were made of the volume of driver license renewals in selected stations and the random effects previously described were confirmed. The results of one of these studies are shown in Figure 4.

Also, it is assumed in the derivation of a selection ratio that a sufficient number of interviewers would be available to interview during the peak periods, or that people would be asked to wait. Since the former is impossible to predict and also too expensive, and the latter prohibited by the license personnel, a compromise procedure had to be devised for determining the ratio.

Based on the estimated number of interviews per hour (confirmed by a study in Jackson, Michigan: Figure 5) a method was devised whereby a selection ratio could be determined that would constitute a compromise but not introduce a substantial bias into the survey.

The method devised to calculate the ratio was based on the

Figure 4

A Selected Driver License Station Renewal Volume Summary

Station: Macomb (Michigan) 1

Renewals - Average, previous month, from state records

Monthly	3980
Weekly	947
Daily	189

Daily Volume for 7 days

Date	Day	Number of Renewals		
Feb. 2	M	246		
3	Tu	175		
4	W	185		
5	Th	131		
6	F	177		
			914	(average/day = 183)
9	M	192		
10	Tu	159		
			1265	(average/day - 7 day period = 180)

Figure 4 cont'd.

Hourly Breakdown

Hour	Volume			Renewal Rate		
	Observed on Feb. 10	Estimated from actual weekly average	Estimated for peak day Feb. 2	One renewal every ___ minute Feb. 10	weekly average	Feb. 2
8:30 - 9:00	5	5.8	7.8	6	5.2	3.8
9:00 - 10:00	12	13.8	18.6	5	4.3	3.2
10:00 - 11:00	16	18.4	24.8	3.75	3.3	2.4
11:00 - 12:00	14	16.1	21.7	4.28	3.7	2.8
12:00 - 1:00	19	21.9	29.5	3.15	2.7	2.0
1:00 - 2:00	27	31.0	41.9	2.22	2.0	1.4
2:00 - 3:00	24	27.6	37.2	2.5	2.2	1.6
3:00 - 4:00	13	15.0	20.2	4.6	4.0	3.0
4:00 - 5:00	29	33.4	45.0	2.1	1.8	1.3
Totals $8\frac{1}{2}$ hour day	159	183	246			
Average/hr	18.7	21.5	28.8	3.2	2.8	2.08

Figure 5

Jackson SMSA Interviewing Time Summary

Date	Questionnaire Numbers	Number Completed	Interviewing Day Time Begin	Interviewing Day Time End	Hours Interviewed	Interviewing Rate/Hour	Minutes per Interview
Jan. 26	1184-1209	26	10:05	6:25	8.33	3.1	19.4
27	1210-1234	25	8:35	4:55	8.50	2.9	20.6
28	1235-1261	27	8:40	5:05	8.50	3.2	18.8
29	1262-1293	32	9:35	5:00	7.50	4.3	14.0
30	1294-1328	35	8:40	5:05	8.50	4.1	14.6
Feb. 2	1329-1360	32	10:05	5:10	7.00	4.5	13.3
3	1361-1396	36	8:40	4:20	7.66	4.6	13.0
4	1397-1425	29	8:40	4:40	8.00	3.6	16.7
5	1426-1451	26	8:55	4:35	7.66	3.3	18.2
6	1452-1462	11	8:50	11:50	3.00	3.6	16.7
Total		279			74.65		
Averages		27.9/day			7.96/day	3.72/hr must be rounded to 3	16.5 min. interview

average renewal volume per hour using the latest available estimates from the station manager or the state authorities, according to whichever seemed more accurate. By dividing 3 (average number of interviews per hour) into the volume per hour, the correct ratio can be calculated. This number was rounded to the next highest whole number and became the sampling ratio, n.

Table 4 includes the calculated ratios along with "actual" ratios calculated after the interviewing period, using volume information collected during the interviewing period. Permission was given to the field managers to make adjustments in the design ratio should conditions warrant such changes. Also, if the interviewer determined that a problem existed in the ratio, she could make a recommendation that the ratio be changed.

SURVEY IMPLEMENTATION

Tasks accomplished prior to the data collection phase included preparation of the survey materials, packaging of the questionnaires and materials, development of record keeping systems, field manager training, interviewer recruitment and liaison with local driver-license station managers.

Using information generated earlier, each questionnaire and cover card was stamped with the proper location number and assembled by placing the cover card inside page one of the questionnaire. These assembled forms were then filed according to location number to await packaging prior to shipment to the particular interviewer locations. Each location group of questionnaires contained approximately the number of questionnaire forms as specified in the survey plan. Variations exist between the numbers required and the quantity actually prepared for each location because in some locations it became apparent that we would not make the required quota in the specified time period.

Additionally, several items were needed for each interviewing

location. These were distance code maps, population code guides, income cards and forms for use by the interviewer. The distance code maps were prepared for use by the interviewer as required to answer question number 3 of the questionnaire. Each map (example shown in Figure 6) was prepared using a standard road map of the region surrounding the interviewing city. The maps were mounted on a stiff backing and concentric circles drawn on them to correspond to the distance code values using the focal center of the city as the center of the circles.

Population guides were also prepared for each interviewing location to be used with question 2 of the questionnaire. Using 1960 census information, the population code value for each city, town, and village within the PSU was determined. An example population guide is shown in Figure 7.

Since question 8 of the questionnaire, Income, is considered sensitive by some, a small card was prepared giving the income ranges and corresponding codes and mounted on heavy cardboard for use by the respondents. Thus the interviewer could read the question and hand the card to the interviewee asking only for the code value corresponding to his response. The card is reproduced in Figure 8.

Since we were to deal with approximately 40 different people as interviewers during the course of the interviewing task, it became evident that a guidebook would be necessary. Such a book was prepared to serve as not only a training device but as a reference work for the interviewer and an aid to insure uniformity among the interviewers.

To assist in training and implementing the actual interviewing locations, four HSRI staff members were designated as Field Managers. In addition to the Survey Director, these people served also as the liaison between HSRI, the driver license station and the interviewer. Once the master schedule of interviewing was

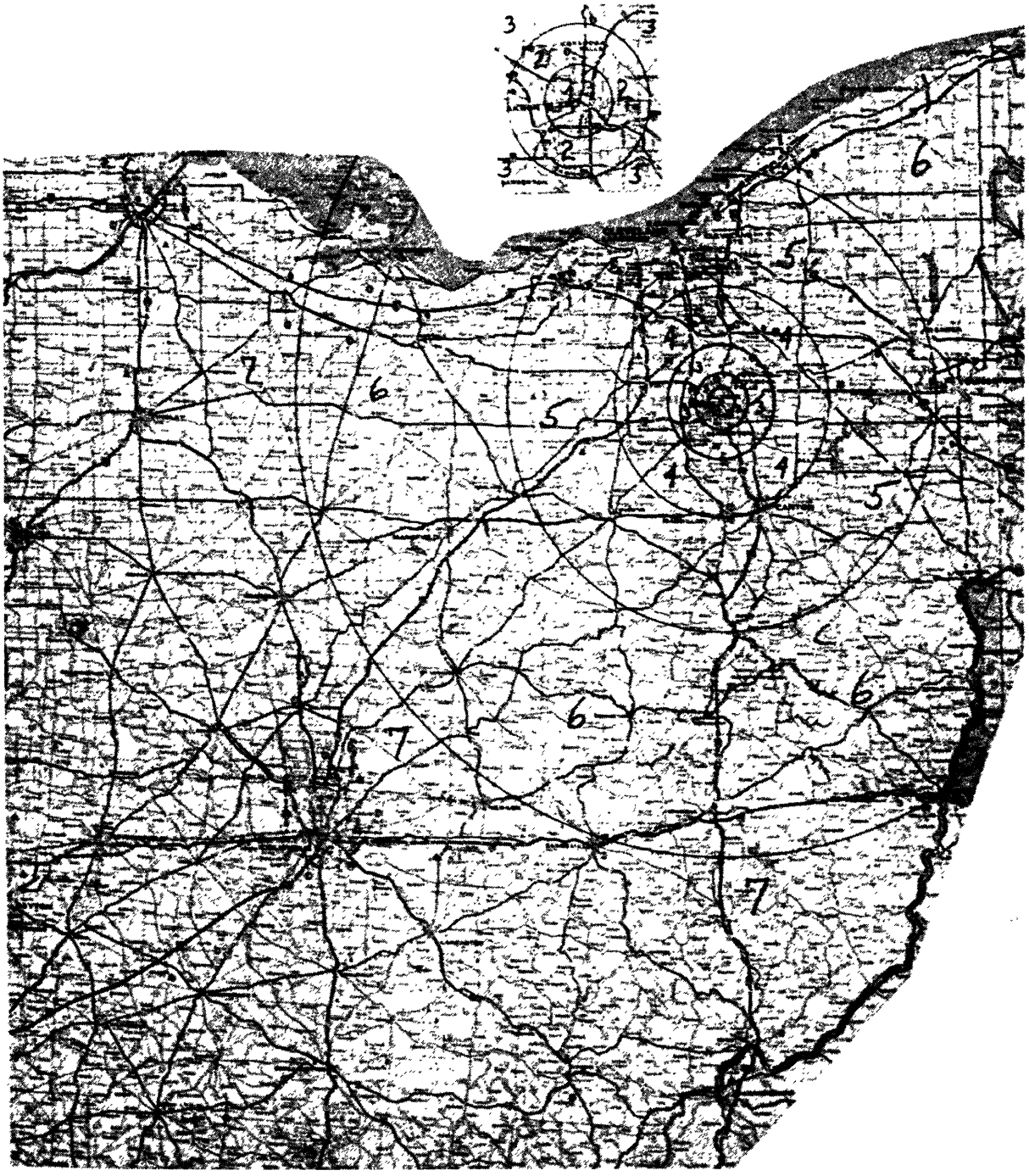


Figure 6

Interviewing Distance Code Map

Figure 7

Example Population Guide

Seattle SMSA

King Co.
Snohomish Co.

King County

Incorporated Cities	Codes
Algona	1
Auburn	3
Bellevue	3
Des Moines	1
Issaquah	1
Kent	3
Kirkland	3
Medina	1
Normandy Park	2
Renton	3
Seattle	7
Yarrow Point	1

Incorporated Towns and/or Villages	
Beaux Arts	1
Black Diamond	1
Bothell	1
Carnation	1
Clude Hill	1
Duvall	1
East Redmond	1
Enumchaw	2
Houghton	1
Hunts Point	1
North Bent	1
Pacific	1
Redmond	1
Snoqualmie	1
Tukwila	1

Snohomish County

Incorporated Cities	Codes
Edmonds	3
Everett	4
Lynnwood	3
Mountlake Terrace	3
Snohomish	2

Incorporated Towns and/or Villages	
Arlington	1
Darrington	1
East Stanwood	1
Gold Bar	1
Granite Falls	1
Index	1
Marysville	2
Monroe	1
Mukilteo	1
Stanwood	1
Sultan	1

Unincorporated Towns and/or Villages	
Beverly Park South	1
Fairmont	1
Intercity	1
Lake Stevens	1
Lowell	1
Pinehurst	2
Shoultes	2

Figure 8

Income Card

PERSONAL WEEKLY OR YEARLY INCOME
BEFORE TAXES

NUMBER	INCOME	
	yearly	weekly
1	under $5,000	under $100
2	$5,000-$10,000	$100-$200
3	$10,000-$15,000	$200-$300
4	$15,000-$20,000	$300-$400
5	over $20,000	over $400
8	don't know	
0	no income	

prepared, the field managers were assigned to specific interviewing locations. All tasks then concerned with the survey implementation and data collection at their locations became their responsibility. These tasks included contacting the local driver licensing station manager, arranging the specifics of the interviewing schedule, traveling to the survey location, transporting the survey materials to the specific locations, meeting the local driver license personnel, contacting and training the interviewer, supervising the first few interviews, and maintaining contact with with the interviewer once the survey was underway. A form was devised for recording the pertinent information about the survey location such that re-contact could be readily established. This form is shown in Figure 9.

It was determined that hiring our own interviewing staff would be a cumbersome and complicated task since the interviewing locations are spread over the entire country. Therefore it was decided to employ the services of the temporary help agencies located in or near the interviewing location. These agencies have the capability of providing talent from their pool of trained personnel to meet our requirements on a very short notice with the added advantage of relieving us of the burden of interviewing, hiring and paying the interviewers. Additionally the performance of these people is guaranteed.

Kelly Services Marketing Division was chosen as the major temporary help agency to supply our needs. This choice was made because of their nationwide availability, more flexible scheduling arrangement, and favorable rate. By working through their marketing division we were able to coordinate the arrangements for interviewers in 31 of the 37 locations. Kelly Services was able to furnish us with an interviewer on a one week notice in these 31 locations at a flat rate of $4.00 per hour straight time with pre-

Figure 9

Interviewing Log

State_____ Region_____

Location No._____ Interviewing City_____

Total Interviews Desired _____

Questionnaire Sequence From_____ to _____

Interviewing Location:

Station Name_____

Station Address_____

_____ Zip_____
city

Telephone _____ _____
area

Contact Person(s) _____Position_____

_____Position_____

Station Hours and Days: _____

Interviewer Kelly Office No._____( ) Non Kelly-see remarks

Name_____

Address _____

_____Zip_____
City

Telephone _____ _____ (home)
area

Remarks:

Training begun:(date) _____
Interviewing begun: (date) _____

INTERVIEWING RATIO; ratio date

mium hours and travel additional. This $4.00 figure included all costs of employment including wages, fringe benefits, insurance, etc. Also Kelly Services agreed to furnish clerks at $3.00 per hour when needed on almost an hour's notice.

Billing for all interviewing was once a week. The interviewers received constant supervision from the Kelly Services supervisors in the interviewing city.

In the other six locations it was necessary to find other sources of interviewers because Kelly Services did not have offices convenient to these locations.

For five of the six other locations we turned to temporary help offices in or near these cities. The arrangements were about the same as with Kelly Services. The specific organizations were Manpower, Inc., in Newberry, S. C., Dubuque, Iowa, and Blackfoot, Idaho; Western Girl in Monterey, California; and Professional Placement in Roswell, New Mexico.

In McCook, Nebraska no temporary help office was available. Therefore, we were forced to hire our own interviewer. By contacting the Nebraska State Employment Security Commission in McCook we were able to secure their assistance in recruiting a qualified employee.

In all, 38 interviewers and 10 clerks were used to gather the data. All but one of the interviewers were female.

DATA COLLECTION

The beginning of data collection in a typical survey location involved air travel to the city by a field manager, meetings with the license office manager and Kelly Services manager, training of the interviewer for 3 or 4 hours using the guidebook, and supervision of the first few hours of interviewing. All materials were brought by the field manager. In some cases, this involved

five large cardboard boxes of interview forms.

Periodic phone contacts were made during the survey period to see that everything was progressing according to plan.

The chart of Figure 10 shows the dates and durations of the surveys by location.

Complete questionnaires were returned to HSRI by mail as each boxfull was completed.

CODING

As each boxfull of questionnaires was received, it was checked for contents against the process control sheet used to prepare the questionnaires for the original shipment. The questionnaires were then filed to await the coding process.

Six coders were hired and trained in the coding techniques. To facilitate the coding process, a coding guide book was developed containing the population guides for each location, the occupation code guides, miscellaneous code guides, and general coding instructions. In addition the Rand McNally road atlas containing duplicate distance code maps was available. A U. S. Census atlas was used to locate places not easily found on the road atlas.

Each questionnaire was processed as follows. The coder removed the cover card from the questionnaire and tore off the top two pages of the form. The cover card was filed separately and the pages discarded. Each form was then reviewed for legibility of responses and the leading zeros were added where necessary. The proper responses to certain option questions were checked and the occupation was coded. If the responses to the population or distance questions were missing, these were also checked. The coders then initialed the form and returned it for re-filing.

The data collection and coding effort was concluded on June 17.

Of the 10,000 questionnaires sent out and returned, 8014 were

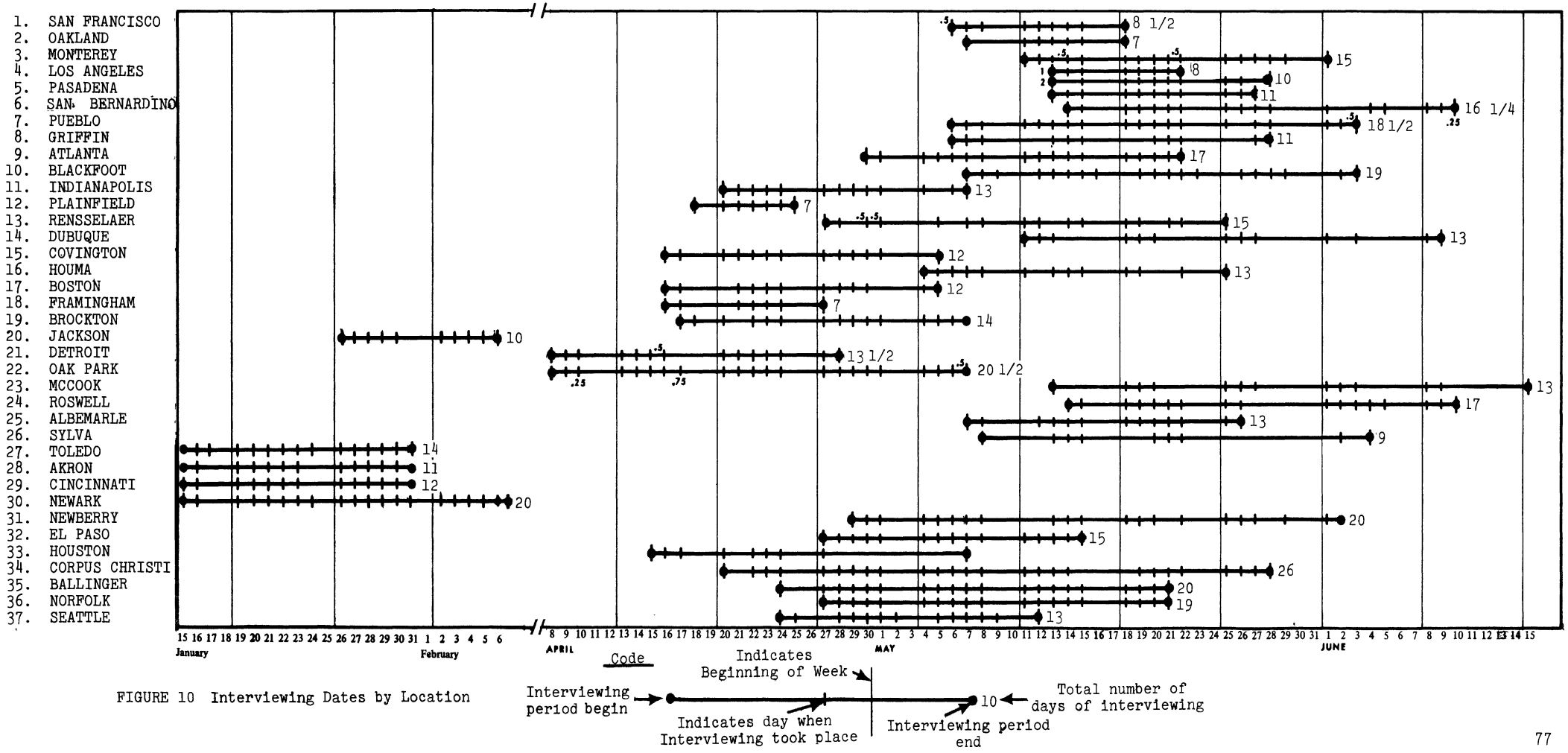


FIGURE 10 Interviewing Dates by Location

used and 1986 were returned blank. Of the 8014 people approached and asked to be interviewed, 7145 accepted and 869 refused.

Some of the reasons given for refusal to participate are given in Table 5.

DATA REDUCTION

The questionnaires were keypunched and verified in batches, by sampling area, as soon as they were coded. Each case was represented by three cards. Once verified, the sub-checks for each area were merged by card sorter. The keypunching operation was spread over a two month period as was the coding.

When approximately one third of the entire sample was keypunched, variable definition cards for a variable dictionary were prepared including variable name, number, and card location, and a file building process began. Using the definition cards, data cards, and appropriate program control cards, a magnetic tape file was built. This partial file was suitable for use in checking the accuracy of the data coding and punching processes and in testing programs for use in analyzing the entire file. The first output of the file was a means and marginals and a dictionary for the purposes of checking for errors.

By using the means and marginals output, the dictionary, and code guide, the task of checking for error began. The first check was to search the frequency distribution (marginal) for improper code values. Several such problems usually resulting from coding or keypunching error were detected. The tape file was then searched for the sequence number corresponding to the data sets in error using the HSRI Data Set List Program. Once the particular case numbers were known, the corresponding questionnaires and cards were checked and the correct response substituted in the master tape file. As additional groups of cases became available, the two remaining thirds of the file were built and error checked in

Table 5

Reasons for Refusal

%	
5.6	Have not been driving (no car, no license, ill, in service, etc.)
13.5	Due at or late for work, school, appointment, etc.
11.4	On lunch hour or break from job
5.3	Someone waiting (spouse, children, etc.)
6.2	Can't speak or understand English
28.7	No time, too busy, in a hurry, pressed for time
2.4	Have other duties and/or errands to attend to
4.9	Can't be bothered, not interested, refused without giving any reason
0.6	Not well at time of request
1.5	Parking meter expired or about to; double parked
2.0	Telephone follow-up which could not be reached at home
9.7	Missing data
8.2	Miscellaneous: Anti surveys; annoyed; belligerent; refused to even give name; completely ignored request; did not want to be called at home; government knows too much already; not any of your business; too nervous; too many interruptions in his motel business; bad mood; had license suspended; research people where he works; unable to participate for three days; had to go after more money; just looking for rest room; "surveys are a protest plot and ought to be banned."
100.0	

the same manner.

Once the entire file had been built in sections and checked as above, it was merged into one file containing all 8014 cases, sorted in numerical order. The master file, contained on one roll of tape was ready for further error checking and subsequent analysis.

In the three data reduction phases, the file was reduced from 128,244 sheets of paper (8014 cases x 16 pages per case) to 24,042 punched cards (3 per case) to about 232 feet of magnetic tape (0.348 inches per case). The magnetic tape will be retained for future reference.

Once the entire file was ready, a second means and marginals was prepared for the purpose of further file checking and error detection. This time more complicated checks were performed including searching for improper responses to branching questions, searches for very high responses to mileage questions, large numbers of accidents and violations, and for completeness and continuity of multiple response questions. The resultant file contained 8007 valid cases (7 were discarded as unusable for a variety of reasons).

FIGURE 11

INTERVIEWING SUMMARY

State	Location (Primary Sampling Unit)	Location #	Central City	Interviewing City	Referal clerk used	1960 Population 1	Population Represented by PSU 2	Desired Sample Size 3	Actual # of Questionaries Sent 4	# of Interviews Completed 5	# of Refusals 6	Total Interviews Attempted (5+6) 7	% of Total Desired (7) (4) 8	Refusal Rate % (6) (7) 9
California	Los Angeles SMSA	030101	Los Angeles	Los Angeles #1					250	139	11	150	60%	7.3%
California	Los Angeles SMSA	030102	Los Angeles	Los Angeles #2	*	6,038,771	6,038,771	691	250	133	16	149	59	10.7
California	Los Angeles SMSA	030104	Los Angeles	Pasadena	*				200 (700)	195 (467)	5 (32)	200 (499)	100 (71%)	2.5 (6.4%)
California	San Francisco SMSA	030201	San Francisco	San Francisco	*	2,648,762	2,648,762	303	150	117	33	150	100	22.0
California	San Francisco SMSA	030202	San Francisco	Oakland	*				150 (300)	145 (262)	5 (38)	150 (300)	100 (100%)	3.3 (12.6)
California	San Bernardino SMSA	032501	San Bernardino	San Bernardino	*	809,782	2,781,525	319	297	271	26	297	100	9.0
California	Salinas-Monterey SMSA	032601	Monterey	Monterey		198,351	2,673,807	306	300	240	60	300	100	20.0
Colorado	Pueblo SMSA	041101	Pueblo	Pueblo		118,707	3.048,731	349	350	289	32	321	91	9.9
Georgia	Atlanta SMSA	051201	Atlanta	Atlanta	*	1,017,188	2,148,384	246	250	213	37	250	100	14.8
Georgia	Spalding Co. Group	051301	Griffin	Griffin		42,542	2,459,705	282	285	275	10	285	100	3.5
Idaho	Bear Lake Co. Group	072801	Blackfoot	Blackfoot		41,342	3,239,798	371	350	158	12	170	48	7.0
Indiana	Indianapolis SMSA	090301	Indianapolis	Indianapolis		944,475	2,590,591	297	250	223	27	250	100	11.2
Indiana	Indianapolis SMSA	080302	Indianapolis	Plainfield					100 (350)	83 (306)	17 (44)	100 (350)	100 (100)	17.0 (12.8)
Indiana	Benton Co. Group	080401	Rensselaer	Rensselaer		42,256	3,076,147	352	251	236	15	251	100	5.9
Iowa	Dubuque SMSA	091401	Dubuque	Dubuque		80,048	2,107,691	241	250	128	58	186	74	30.6
Kentucky	Cincinnati SMSA (Ky.)	101501	Covington	Covington	*	229,443	2,176,469	249	250	166	82	248	99	33.0
Louisiana	Terrebone Parish	111601	Houma City	Houma City		60,771	2,279,915	261	275	231	44	275	100	16.0
Massachusetts	Boston SMSA	123101	Boston	Boston	*	2,595,481	2,595,481	297	251	234	17	251	100	6.7
Massachusetts	Boston SMSA	123102	Boston	Framingham					100 (351)	94 (328)	6 (23)	100 (351)	100 (100)	6.0 (6.5)
Massachusetts	Plymouth Co. Group	123201	Brockton	Brockton		244,445	2,553,097	292	300	284	16	300	100	5.3
Michigan	Detroit SMSA	130501	Detroit	Detroit		3,762,360	3,762,360	431	251	238	12	251	100	4.7
Michigan	Detroit SMSA	130502	Detroit	Oak Park	*				351 (602)	338 (576)	12 (24)	351 (602)	100 (100)	3.4 (3.9)
Michigan	Jackson SMSA	130601	Jackson	Jackson		131,994	2,432,293	278	279	279	0	279	100	0.0
Nebraska	Red Willow Co. Group	141701	McCook	McCook		42,086	2,741,690	314	275	156	4	160	58	2.5
New Mexico	Chaves Co. Group	161801	Roswell	Roswell		57,649	1,849,027	212	226	112	16	128	56	12.5
North Carolina	Jackson Co. Group	171901	Sylva	Sylva		32,715	2,359,886	270	250	102	3	105	42	2.8
North Carolina	Stanley Co. Group	172401	Albemarle	Albemarle		40,873	2,392,983	274	276	256	20	276	100	6.8
Ohio	Licking Co. Group	181001	Newark	Newark		90,242	3,117,924	357	359	222	17	239	66	7.1
Ohio	Akron SMSA	180701	Akron	Akron		605,367	2,514,850	288	288	86	0	86	29	0.0
Ohio	Cincinnati SMSA	180801	Cincinnati	Cincinnati		1,010,362	2,492,407	285	285	117	2	119	41	1.6
Ohio	Toledo SMSA	180901	Toledo	Toledo		529,527	2,205,517	253	253	113	0	113	44	0.0
South Carolina	Newberry Co. Group	193001	Newberry	Newberry		43,970	3,455,442	396	250	82	2	84	33	2.3
Texas	El Paso SMSA	212001	El Paso	El Paso		314,070	2,934,999	336	335	113	69	182	54	37.1
Texas	Corpus Christi	212101	Corpus Christi	Corpus Christi		266,594	3,101,676	355	355	230	124	354	99	35.0
Texas	McCullock-Coleman	212201	Ballinger	Ballinger		45,910	2,194,663	251	250	54	7	61	24	11.4
Texas	Houston SMSA	212301	Houston	Houston		1,418,323	2,325,446	266	275	244	32	276	100	11.5
Virginia	Norfolk SMSA	232901	Norfolk	Portsmouth		578,507	2,894,101	331	335	306	11	317	94	3.4
Washington	Seattle SMSA	242701	Seattle	Seattle	*	1,107,213	2,140,224	245	250	241	9	250	100	3.6
18 States	32 Locations			37 Interviewing cities 38 Interviewers	10 Clerks	25,180,126	87,334,362	9,998	10,000	7145	869	8014	80.14%	10.85%

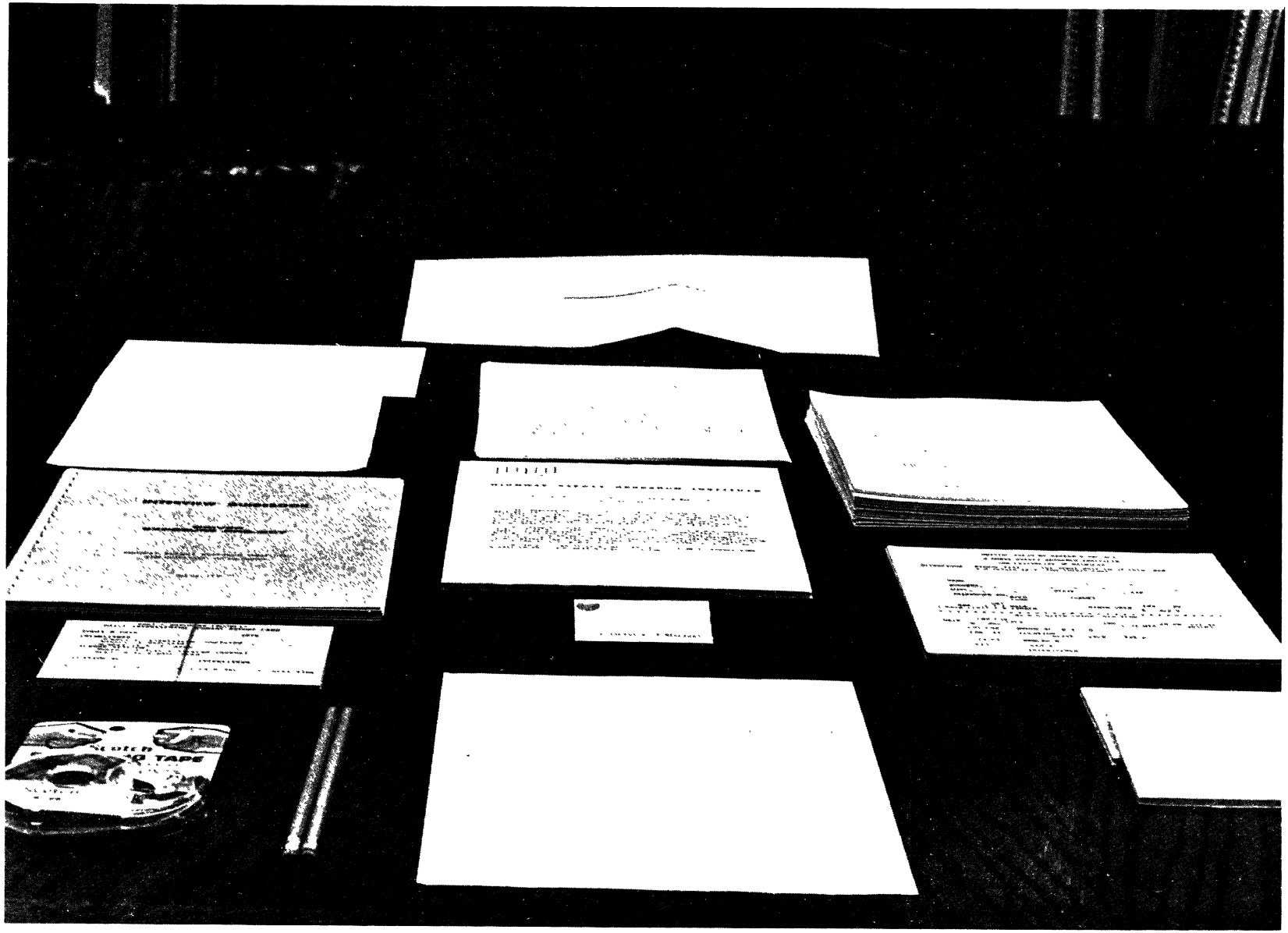


Figure 12 Interviewing Supplies

Figure 13 Typical Driver License Station

Figure 14 Typical Interviewing Scene

APPENDIX D

DERIVED SURVEY VARIABLES

SOCIO-ECONOMIC SCALE

This scale is based on work by Hollingshead[1] which presents a method for construction an analytical, numerical measure of an individual's socio-economic status, i.e. "social class", based on his occupation and education. Class 1 on the Hollingshead SES is the highest, and Class 5 is the lowest. Each class corresponds to a range of SES scores derived from rankings of occupation and education.

Occupation Class

1. Higher executives, proprietors of large concerns, major professionals.
2. Business managers, proprietors of medium sized business, lesser professionals.
3. Administrative personnel, proprietors of small independent businesses, minor professionals.
4. Clerical and sales workers, technicians, owners of little businesses.
5. Skilled manual employees.
6. Machine operators and semi-skilled employees.
7. Unskilled employees.

Education Class

1. Graduate or professional training.

---

[1]Hollingshead, A. B. and F. C. Redlick, Social Class and Mental Illness, John Wiley and Sons, New York, 1958.

2. Standard college or university graduation.
3. Partial college training.
4. High school graduates.
5. Partial high school.
6. Junior high school (partial or graduate).
7. Less than seven years of school.

The SES score is given by:

SES Score = 7x (Occupation Class) + 4x (Education Class)

The five social classes correspond to ranges of SES scores as follows:

Social Class	SES Score Range
1	11 - 17
2	18 - 27
3	28 - 43
4	44 - 60
5	61 - 77

KNOWLEDGE OF ENGINE INDEX

In the early analysis of data from the preliminary survey, it was found that while variables dealing with vehicle engine such as number of cylinders, cubic inches of displacement, and horsepower were of some use as predictors, larger differences among mileage estimates occurred between those who could answer these questions and those who could not.

From this analysis it was concluded that personal knowledge is not a good source of engine information, but that familiarity with the engine is a useful predictor, Therefore, a new driver variable, a "knowledge of engine index" was derived.

Structure of Knowledge of Engine Index

Variable Level	Definition
1	Subject did not know number of cylinders, cubic inches, or horsepower.
2	Subject knew the number of cylinders, but did not know cubic inches or horsepower.
3	Subject knew the number of cylinders and cubic inches but did not know horsepower.
4	Subject knew all three characteristics--number of cylinders, cubic inches, and horsepower.

URBANIZATION INDEX

The urbanization index was prepared as a potentially superior predictor to population of residence community, because it includes population of a central city and distance.

The index is given by:

$$U = P_c \times P_r/D$$

where: P_r is the population code (0 - 7) of the community of residence.
P_c is the population code of the central city,
D is the distance code (1 - 7) from residence to central city.

The ranges of index values corresponding to code values of the urbanization-index variable are as follows:

Range of Index	Code
0 - 7	0 - 7
8 - 20	8
21 - 49	9

APPENDIX E

ADDITIONAL AID CHARTS OF CLASSIFICATION ANALYSIS

This appendix presents seven additional AID charts to supplement the basic chart of Figure 7 in Volume I. The differences among charts are due to the use of a) different dependent variables and b) "reduced sets" of independent variables, which exclude those which refer to percent driving under certain conditions. $\bar{Y}$ is the mean value of a group and N is a group size. The notations under the N values indicate the variable levels included in the group.

CHARTS WITH 30 - DAY MILEAGE AS DEPENDENT VARIABLE

Figure 1 is an AID chart based on a 30 - day mileage estimate as the dependent variable and the "reduced set" of independent variables. (The use of the reduced set permits analysis of the effect of driver-vehicle variables, which are stronger predictors.)

The vehicle codes in the "Type of Vehicle" boxes are:

1. Passenger Car
2. Small Truck
3. Large Truck
4. Truck-Trailer Combination
5. Taxi or Limousine
6. Bus
7. Other
9. Missing Data

The engine knowledge codes are given in Appendix D (9 is missing data). By comparing Figure 1 with the basic AID chart in Figure 7 of Volume 1, it is seen that the three best predictors do not change, but model year, engine knowledge and number of vehicles driven are also revealed as good predictors.

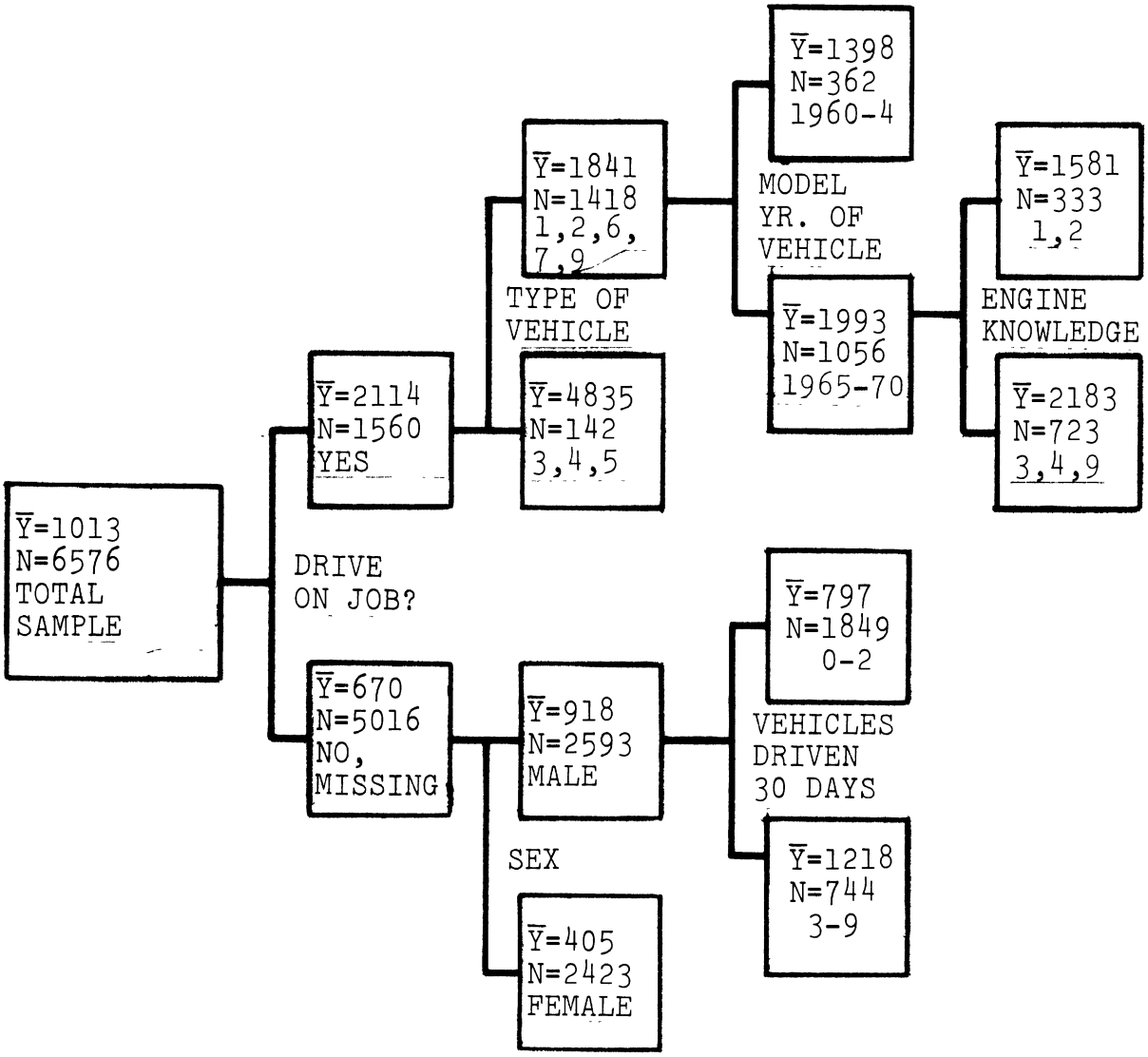


FIGURE 1

AID Chart: 30-day Mileage as Dependent Variable
Reduced Set of Independent Variables

CHARTS WITH LOGARITHM OF 30 - DAY MILEAGES AS DEPENDENT VARIABLE

Figures 2 and 3 are AID charts based on the natural logarithm of a 30 - day mileage estimate as the dependent variable. This is used to create a distribution which more closely approaches the normal. Figure 2 uses the full set of independent variables, and Figure 3 the reduced set. Both figures verify sex, drive on job and vehicle type as best predictors. Percentage driving at night and on streets are next best. When "percent driving" variables are removed, then number of vehicles driven, model year, income and passenger car size are revealed.

CHARTS WITH 7 - DAY MILEAGE AS DEPENDENT VARIABLE

Figures 4 and 5 are AID charts based on a 7 - day mileage estimate as the dependent variable. Figure 4 uses the full set of independent variables and Figure 5 the reduced set. Again, the three best predictors are verified (except sex appears two levels down in Figure 4). Percent driving on streets shows up stronger than in previous charts.

COMPARISON OF 7 - DAY AND 30 - DAY MILEAGE ESTIMATES

A comparison was made between reported 7 - day mileage estimates and reported 30 - day mileage estimates. This comparison used 6512 subjects who made both estimates. It is interesting to note that more subjects provided 7 - day mileage estimates as compared to those who provided 30 - day mileage estimates (6884 vs 6576), a response rate superiority of almost five percent. The correlation coefficient between the two estimates was 0.84, indicating a strong interdependency. The mean miles per week for all subjects was 271 compared to 276 miles obtained from the sample of drivers used in the preliminary survey. This difference is well within the observed random variability.

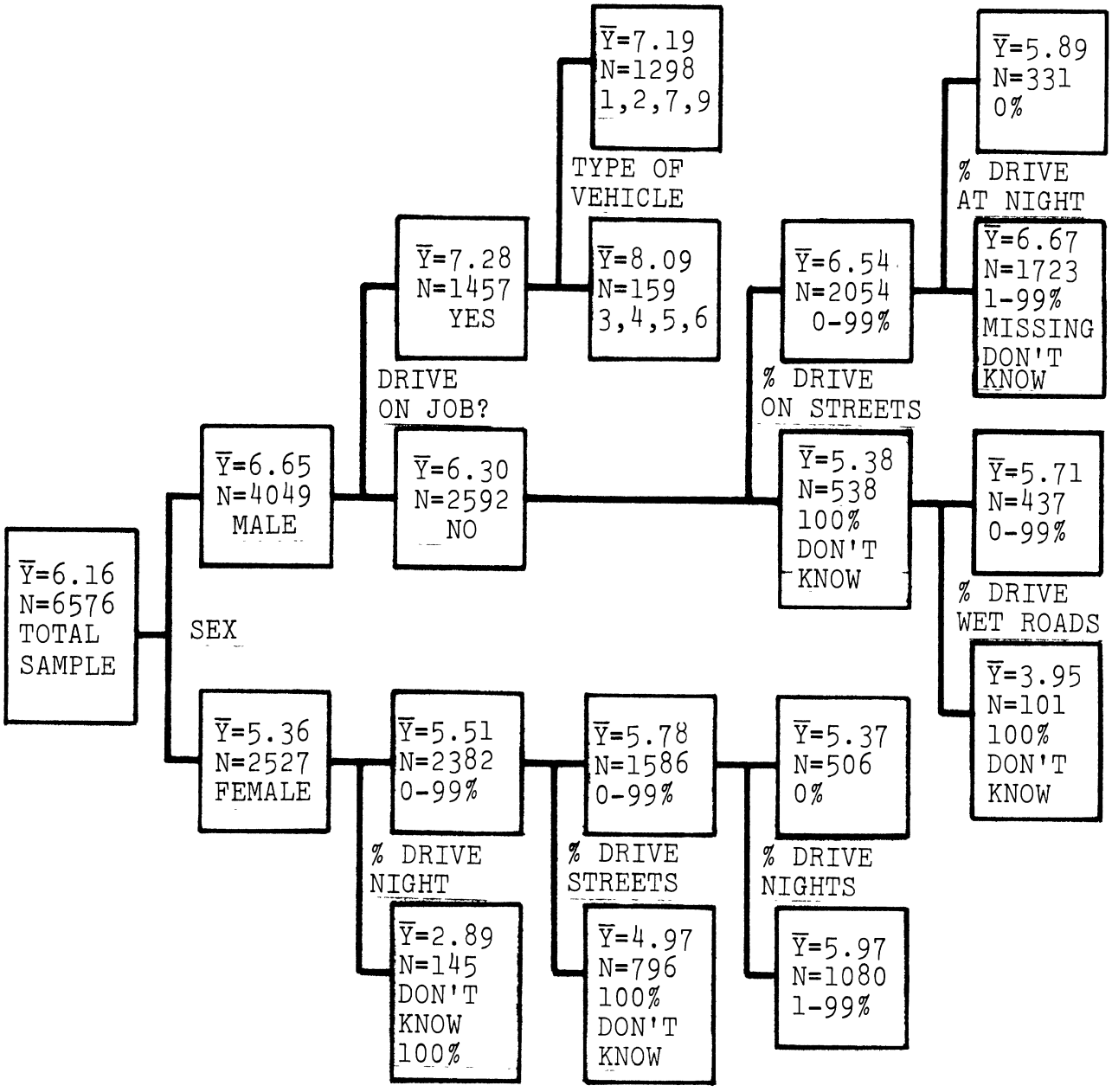


FIGURE 2

AID Chart: Logarithm of 30-day Mileage as Dependent Variable
Full Set of Independent Variables

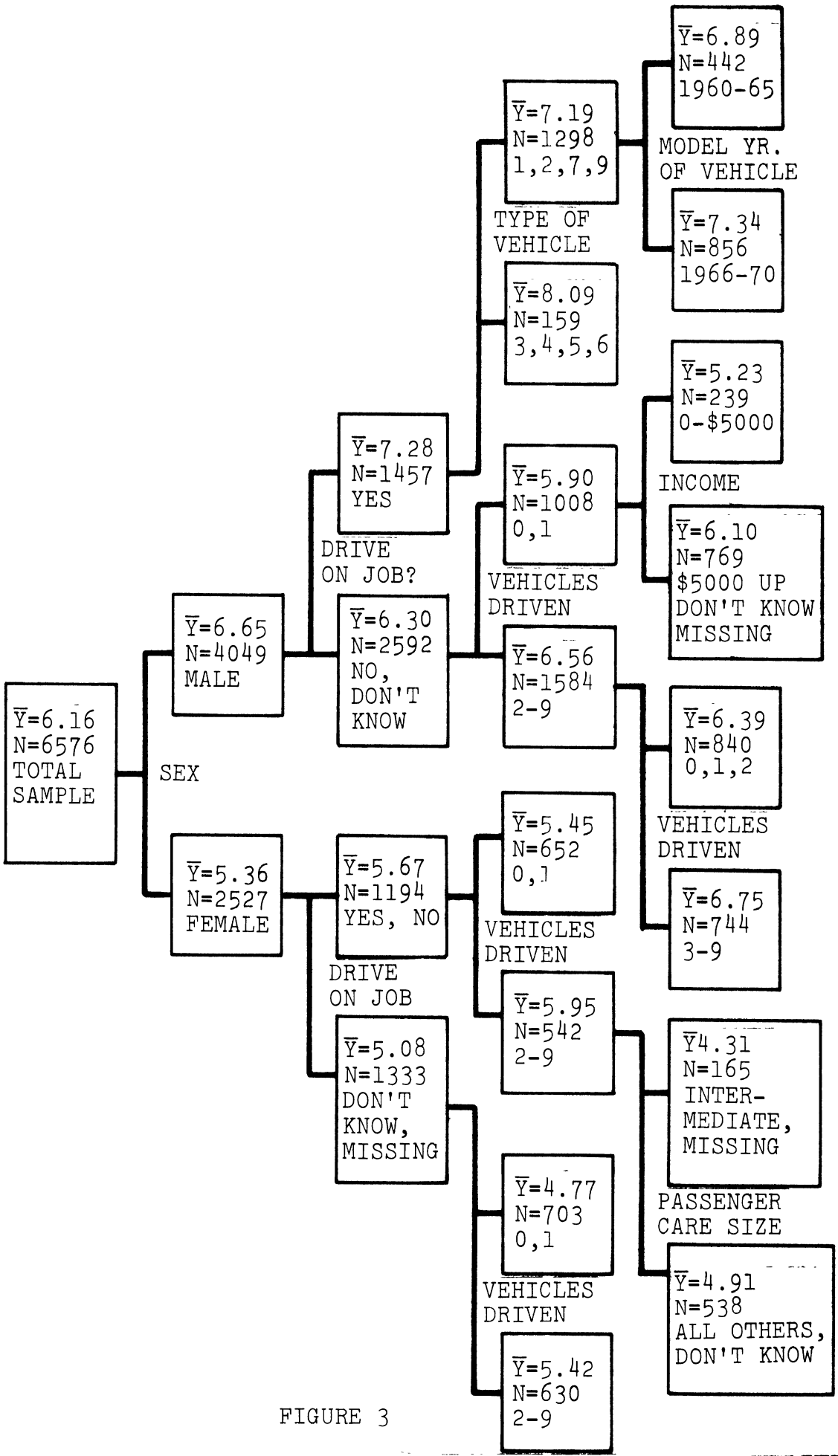


FIGURE 3

AID Chart: Logarithm of 30-day Mileage as Dependent Variable

Reduced Set of Independent Variables

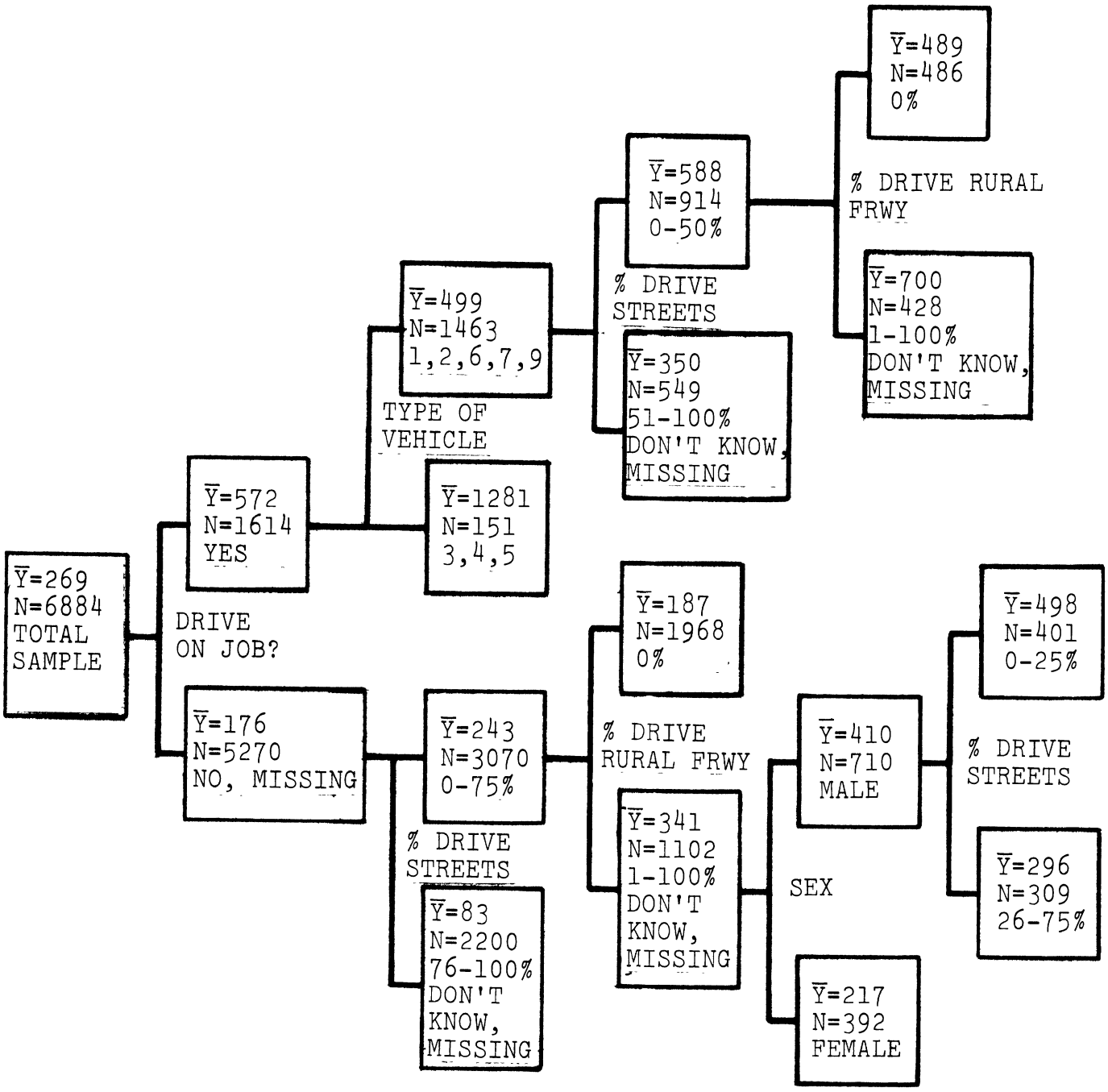


FIGURE 4

AID Chart: 7-day Mileage as Dependent Variable
Full Set of Independent Variables

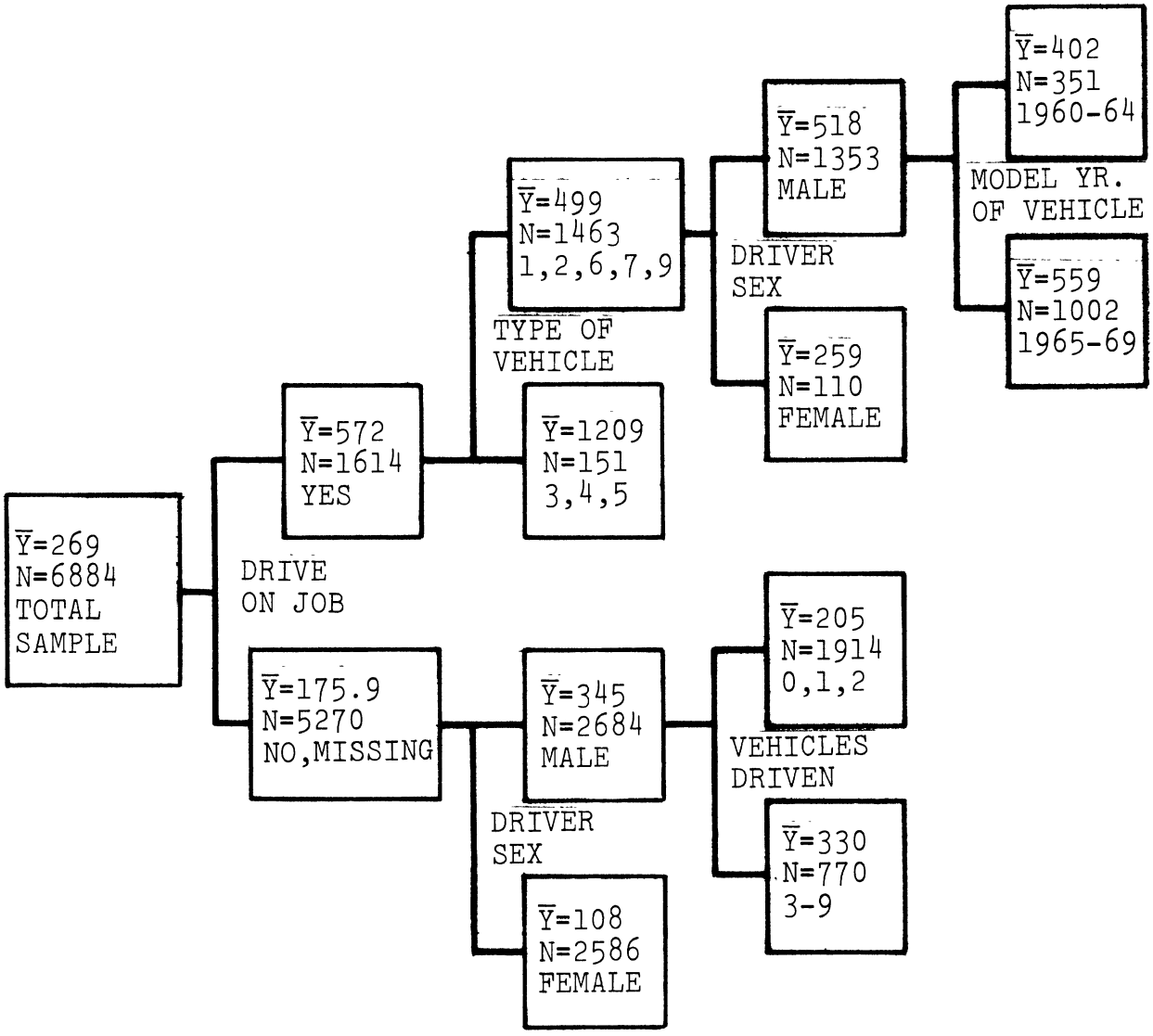


FIGURE 5

AID Chart: 7-day Mileage as Dependent Variable
Reduced Set of Independent Variables

The average mileage reported by 6512 subjects for 30 days was 1013, somewhat less than four times the 7 - day mileage of 269. Persons were asked to state whether or not their 7 - day driving was typical. The results of this question were: 61% reported typical, 23% reported they drove less than normal, and 15% reported that they drove more than normal. Thus, it appears that either the 30 - day estimates may be biased downward slightly (underestimation) or the 7 - day estimates may be biased upward slightly (overestimation).

The mean yearly mileages extrapolated from the 7 - day and 30 - day estimates are as follows:

Group	Yearly Mileage Based on 7-Day Estimate	Yearly Mileage Based on 30-Day Estimate
61%: Previous-week driving normal	13,600	12,600
15%: Previous-week driving more than normal	24,800	14,500
23%: Previous-week driving less than normal	7,800	9,560
100%: All subjects (6512)	14,000	12,200

These resulting yearly mileages are significantly different in a statistical sense at an $\alpha = 0.05$ level. Thus there is a definite bias in one or both estimates since presumably a driver's response to the miles-driven question represents a sampling of his yearly driving. In addition to this observed bias between 7 - day and 30 - day estimates, there is also a possible unmeasured seasonal bias. This could result from the study being conducted in the spring. In spite of the bias there is a consistency in the identification of variables predicting exposure and identification of subgroups having relatively homogeneous exposure (preliminary

survey data vs. pilot survey data). In addition, there is a consistency of the subgroups identified as having uniform exposure regardless of whether a 7 - day or a 30 - day estimate is used, as explained above with respect to Figures 4 and 5. Thus the bias between the 7 - day and the 30 - day mileage estimates appears to occur uniformly for all sub-groups.

CHARTS WITH ACCIDENTS AND ACCIDENT RATE AS DEPENDENT VARIABLE

Figure 6 is an AID chart based on the number of accidents in the last three years (admitted by the interviewee) as the dependent variable. Of the three best predictors identified in previous charts, only driver sex is verified in Figure 6. Driver age is introduced for the first time as a strong predictor.

The use of self-reported accident rates obtained by interview in a driver-licensing station raises some important questions of bias resulting from persons failing to recall or admit their crashes for the previous three years. This problem has been considered in Volume II, dealing with accident data bias. The bias question is crucial to the comparison of the two subgroups split according to socio-economic scale in Figure 6. Here it is shown that for a subgroup of male drivers aged 21 - 25, those in the lower socio-economic groups have fewer crashes per driver than those in the higher socio-economic groups. One might argue that the lower SES groups have lower exposure and this is supported in a weak sense by the mileage estimates. Another possible conclusion is that contrary to the traditional hypothesis that lower SES persons exhibit more deviant behavior and hence would be expected to have more crashes. Another possible explanation would be that lower SES persons are more reluctant to admit crashes in the official setting of a driver-licensing station. At this point it is not possible to reach a conclusion between these alternatives. A

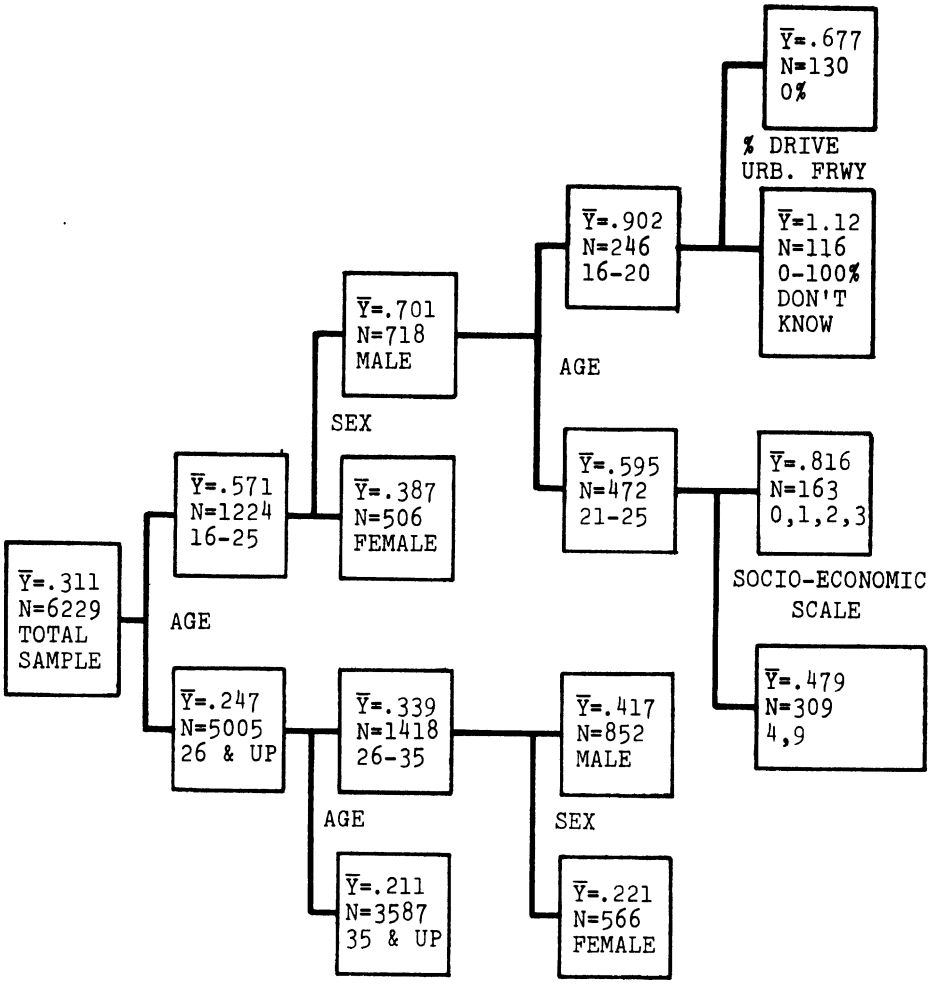


FIGURE 6

AID Chart: Number of Aecidents in 3 Years as Dependent Variable
Full Set of Independent Variables

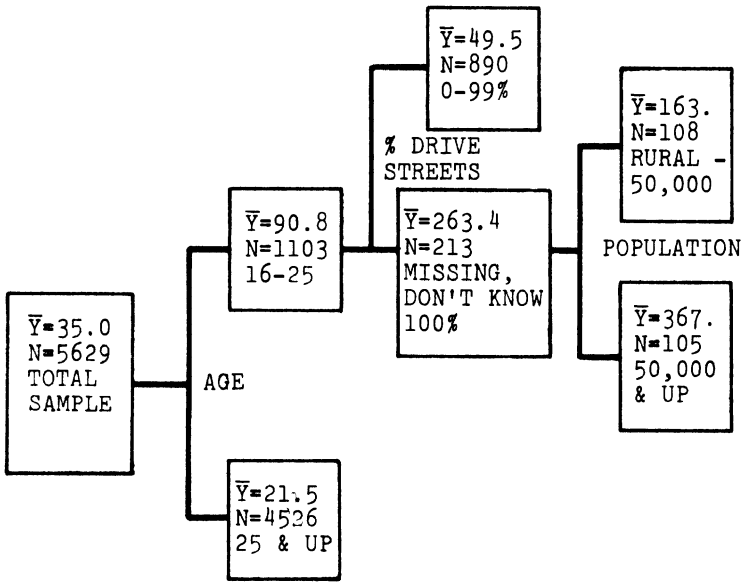


FIGURE 7

AID Chart: Accidents per Million Miles as Dependent Variable
Full Set of Independent Variables

reasonable test would be to study the official records for the particular subjects and determine if the differences continue to hold. If they do, it might lead to some useful partitioning of the young driver problem.

Figure 7 is an AID chart based on a derived accident rate as dependent variable (accidents per million miles). The three best predictors of previous charts do not appear, and only driver age coincides with Figure 6. The results are subject to question because the magnitude of the mean accident rates of the groups (derived by averaging the individual rates) are much different than the corresponding rates derived by dividing number of accidents in the group by total number of miles in the group.

APPENDIX F

STATISTICAL SIGNIFICANCE OF PILOT SURVEY DATA

UNIVARIATE ANALYSIS RESULTS

As noted in Section 4 of Volume I, the predictor variables Drive on Job? and Sex are so strong that it was decided to structure the analysis within three basic groups:

1. Subjects who drive on the drive,
2. Males who do not drive on the job,
3. Females who do not drive on the job.

The group of females who do drive on the job is so small (approximately 100) that it was assigned to group 1.

The results of univariate analyses of each candidate predictor variable vs. each of several dependent variables is presented in Tables 5-88 and Figures 10-72. Each predictor is presented in four tables and three graphs. All table formats are the same, with the first table for a given predictor variable presenting the total effect of the predictor, and the other three tables presenting the effect within the three major Drive-On-Job/Sex groups listed above. Four dependent variables (miles driven, logarithm of miles driven, accidents, accident rate) are presented in each table with the appropriate mean values for each of the levels of the given predictor variable. For each subject, estimated mileage for 30 days was transformed by obtaining its natural logarithm. This provided a statistic that was useful for significance testing as indicated previously. The F-test is based upon this variable. Examination of the relative standard deviations over the factor levels for the raw and transformed mileage indicates the effect of the transformation. The transformed variables have a more uniform standard deviation over the variable levels - a necessary condition for the F tests. The mean of accidents per dri-

ver is obtained from the subject's self-reported crashes for the past three years. The accident rate statistic (accidents/million miles) was obtained from the self reported crashes and self reported mileage for 30 days. It is important to note that accident rate was computed by dividing the total accidents for all persons in the subgroups by the total miles for all persons in the subgroup.

In addition there are some questions concerning the biases of self-reported crashes. Thus the reader should interpret the crash rates with caution. However, one should also be aware of the fact that these are in many cases the only crash-rate figures available on a national sample. Thus in a sense they represent the best estimates. After noting these qualifications, the potential user of the data can make adjustments concerning their usefulness for his particular application.

Each of the predictor variables is tested by means of the F test to determine if it has a significant predictive effect on the natural logarithm of miles driven. This is done for the total sample and for the major subgroups. In order to view these results in proper perspective the reader should understand that each significance test performed has a given probability of being incorrect (e.g., $\alpha = 0.01$). Thus, if enough tests are performed, some are going to be in error purely by the laws of probability. While we can be reasonably confident that any specific effect is significant (given a small) we cannot be confident that all of the results taken as a group are significant. For example, if each test is independent and has a probability of being significant of 0.99 ($\alpha = 0.01$), then the probability of 21 tests all being significant is .81 (e.g., $.99^{21}$). However, in spite of this loss of overall significance, the tests do provide an objective procedure for determining if a given variable is a useful predictor of exposure.

In addition to presenting the tabular data from the analysis of variance we have also included a graphical presentation in Figures 10 to 72. By studying the graphs in conjunction with the tables the reader can obtain an intuitive understanding of the relationship between each predictor variable and exposure. The data is presented in general form in order to provide maximum flexibility for the potential user, and as a reference for exposure analysis in evaluation and research.

BIVARIATE ANALYSIS RESULTS

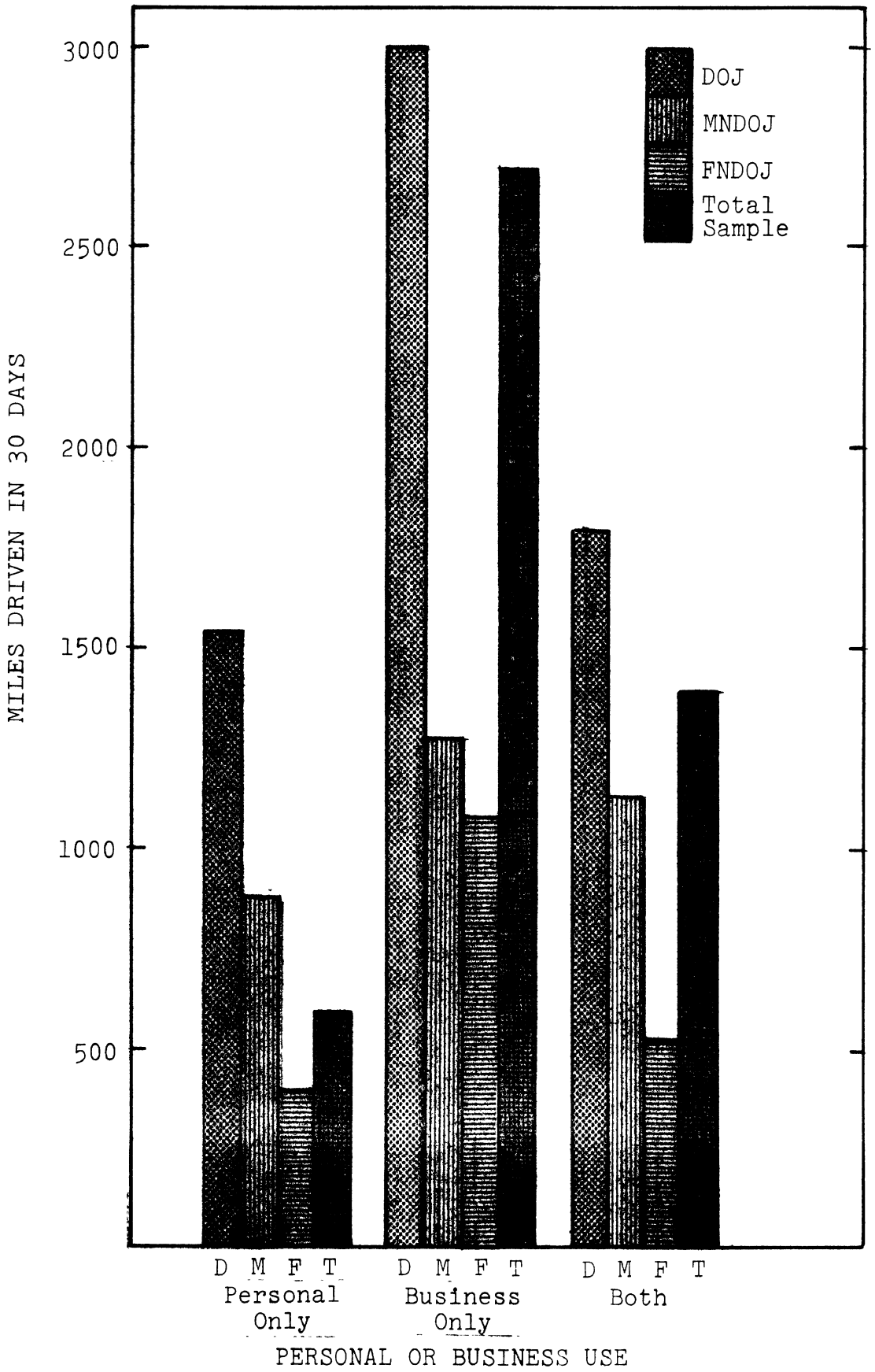
One of the objectives of this study is the identification of subgroups having relatively uniform or homogeneous exposure. A major problem in that task is the large unexplained variability that remains even after the effects of significant predictor variables have been removed. Thus when subgroups are identified which have "homogeneous" exposure the interpretation is that exposure in these subgroups is homogeneous only when compared to the total population of drivers. In statistical terms the subgroups are identified by variables which explain a significant portion of the variability. Thus by using subgroups of drivers a large step forward has been made in exposure analysis. However, within each of these subgroups there is still a wide distribution of reported mileage. The magnitude of this variability within subgroups can be seen by examining Tables 5 to 88.

As indicated previously there are three major subgroups which are always important as a control of exposure variability (drive on job, males who do not drive on job, females who do not drive on job). In this discussion we present two alternatives for further subdivision. Model I (Figure 73) identifies the two variables (under each major subgroup) which appear to minimize variance of exposure estimates; all of the candidate predictor variables were

considered, but five of the six choices were road-environmental variables. Model II (Figure 74) is structured similarly, but road-environment variables were eliminated from consideration; the result was the choice of driver-vehicle variables which relate more to life style than driving conditions.

Each model is structured by cross-classification of the two variables selected under each major subgroup. Each cell in a cross classification identifies a finer subgroup which has relatively homogeneous exposure. Mean value of exposure and number of subjects are indicated in each cell.

Tables 89 and 90 show the results of two-way analyses of variance performed within the major subgroups, and the significance level of each variable. As indicated previously, the significance tests are performed by using the natural logarithm transformation of the miles driven. However, the cell means presented in Figures 73 and 74 are computed from the raw data. The error term used for the significance tests is obtained from a combination of the individual cell variances. This procedure was used instead of the more conventional procedures because of the unequal number of observations per cell. The tests are performed on the direct effects of the predictor variables and on their interactions within the major subgroups. Alternative models could be constructed by using other combinations of predictors within the major subgroups. The potential predictability of such alternative models can be assessed by examining the one-way analysis of the predictors within the major subgroups as presented in Tables 5 to 88.



Exposure vs. Personal or Business Use

Figure 10

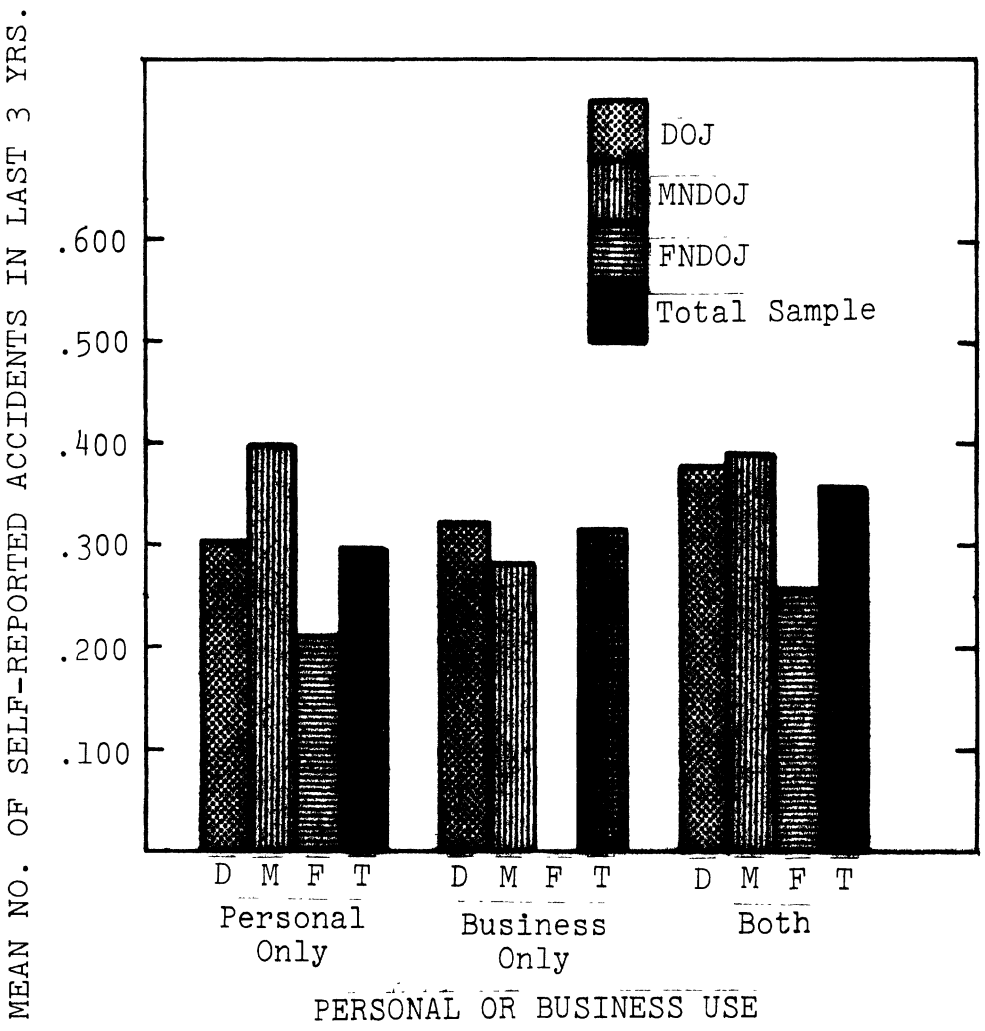


Figure 11

Accidents vs. Personal or Business Use

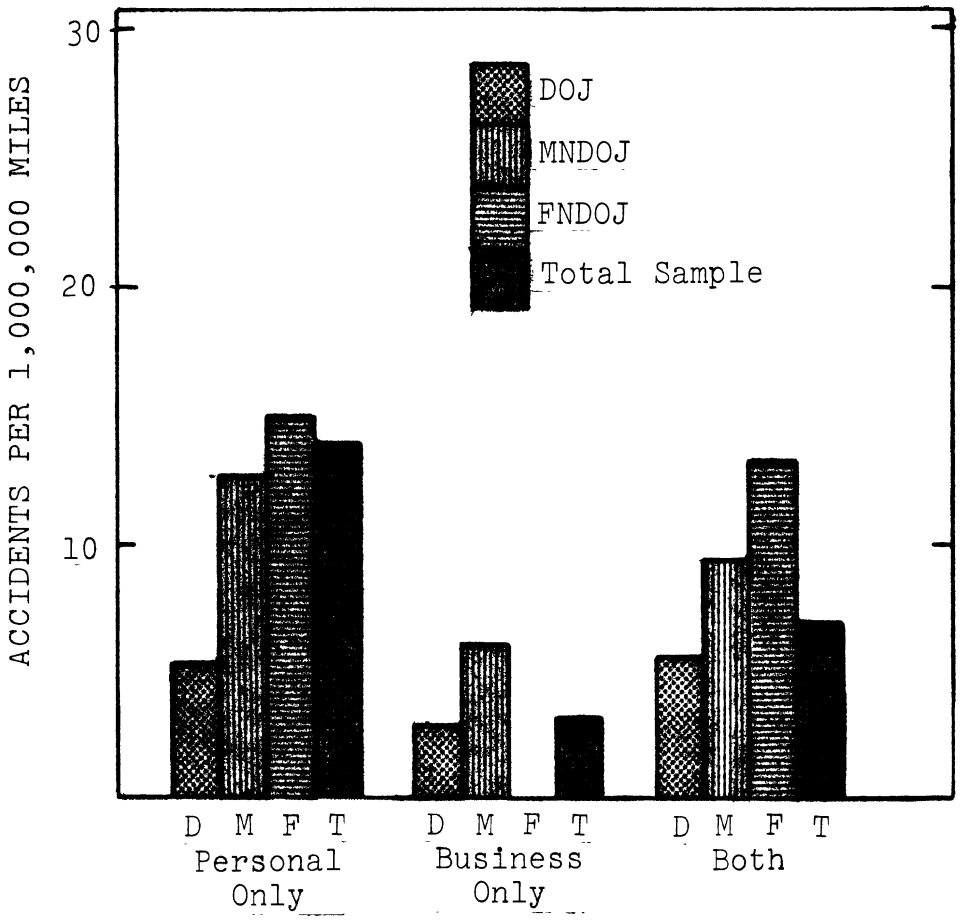


Figure 12

Accident Rate vs. Personal or Business Use

TABLE 5

PERSONAL OR BUSINESS USE VS. DEPENDENT VARIABLES

Total Sample

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days Mean	Natural log of miles driven 30 days Std. Dev.	Miles driven 30 days Mean	Miles driven 30 days Std. Dev.	Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles
1	Personal only	4490	5.857	1.376	690	951	0.294	11.8
2	Business only	598	7.462	1.057	2684	2681	0.313	3.2
3	Both	1395	6.805	1.049	1386	1401	0.356	7.1
8	Don't know	2	3.656	5.171	750	1061	0	0
	TOTALS	6485	6.208	1.401	1024	1439	0.309	8.4

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(3,6481)= 404.115

SIGNIFICANT AT ALPHA <.01

TABLE 6

PERSONAL OR BUSINESS USE VS. DEPENDENT VARIABLES

Subgroup: Drive On Job (DOJ)

ode	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
1	Personal use only	328	6.826	1.033	1533	2245	0.306	5.5
2	Business use only	511	7.621	0.926	2928	2765	0.322	3.1
3	Both	715	7.172	0;905	1810	1633	0.371	5.7
	TOTALS	1554	7.247	0.984	2119	2265	0.341	4.5

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(2,1551)= 75.523

SIGNIFICANT AT ALPHA <.01

TABLE 7

PERSONAL OR BUSINESS USE VS. DEPENDENT VARIABLES

Subgroup: Males Not Drive on Job (MNDOJ)

LEVELS OF PREDICTOR VARIABLE code		No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles
			Mean	Std. Dev.	Mean	Std. Dev.		
1	Personal use only	2003	6.269	1.239	867	853	0.391	12.5
2	Business use only	84	6.568	1.239	1262	1468	0.274	6.0
3	Both	465	6.681	0.932	1128	1001	0.381	9.4
	TOTAL	2552	6.354	1.200	928	915	0.385	11.5

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(2,2549)= 23.986

SIGNIFICANT AT ALPHA < .01

TABLE 8

PERSONAL OR BUSINESS USE VS. DEPENDENT VARIABLES

Subgroup: Females Not Drive On Job (FNDOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days Mean	Natural log of miles driven 30 days Std. Dev.	Miles driven 30 days Mean	Miles driven 30 days Std. Devs	Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles)
1	Personal use only	2159	5.327	1.336	397	472	0.212	14.8
2	Business use only	3	5.579	2.299	1077	1668	0	0
3	Both	215	5.856	1.045	531	498	0.255	13.3
	TOTALS	2377	5.375	1.322	410	479	0.215	14.6

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(2,2374)= 15.883

SIGNIFICANT AT ALPHA <.01

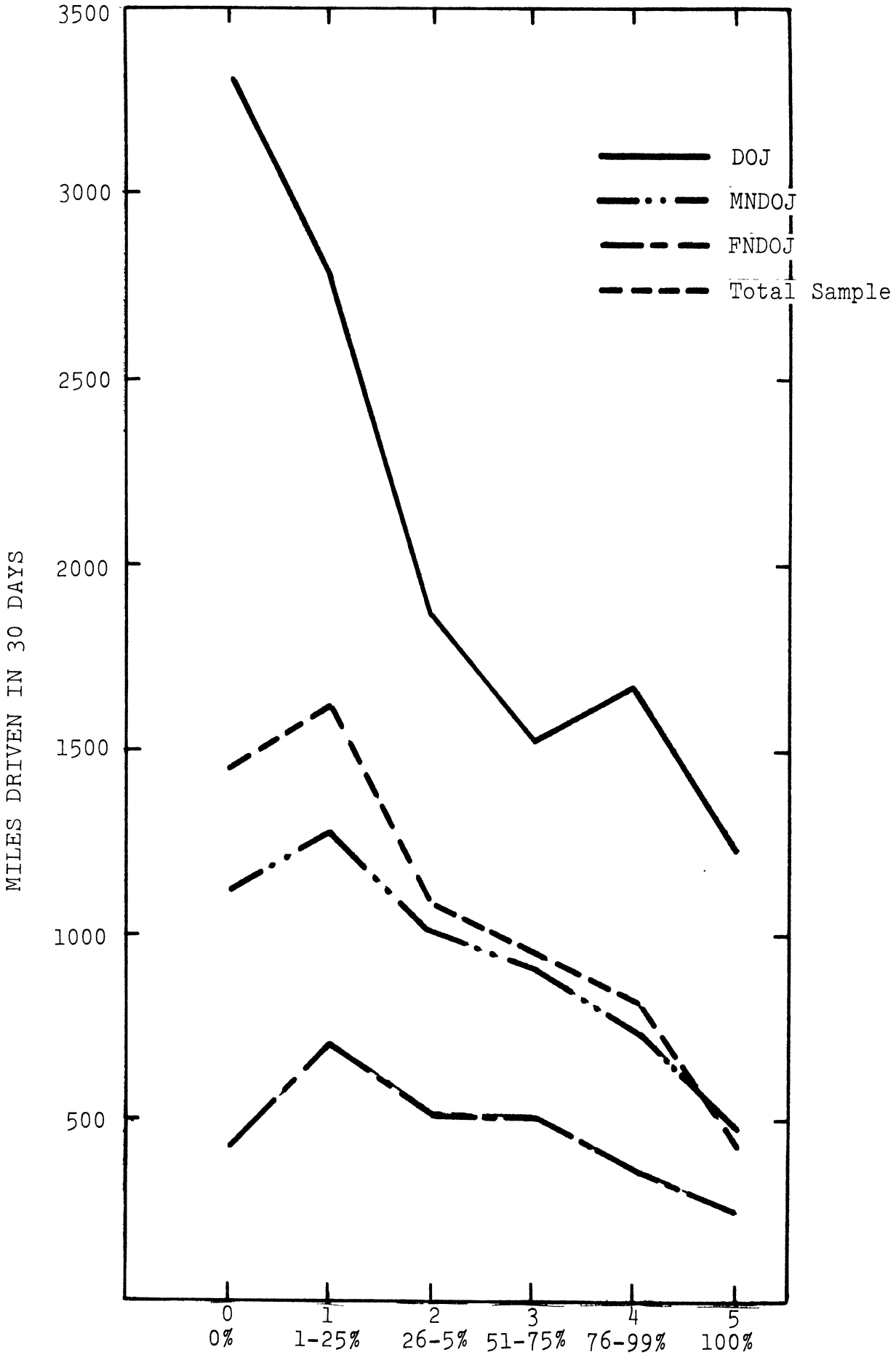

3500
3000
2500
2000
1500
1000
500
MILES DRIVEN IN 30 DAYS
DOJ
MNDOJ
FNDOJ
Total Sample
0
0%
1
1-25%
2
26-5%
3
51-75%
4
76-99%
5
100%
PERCENT DRIVING ON STREETS

Figure 13

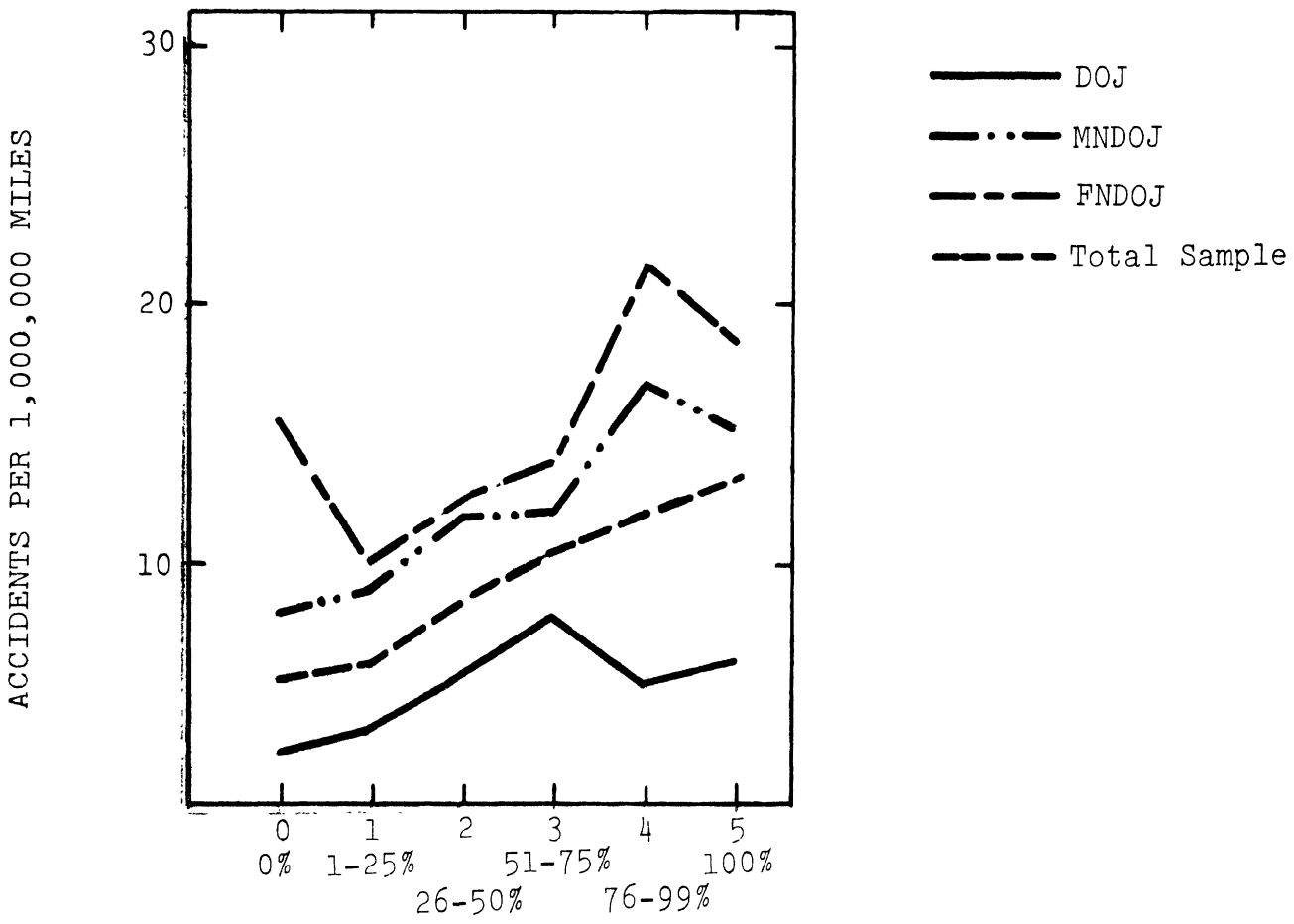


Figure 14

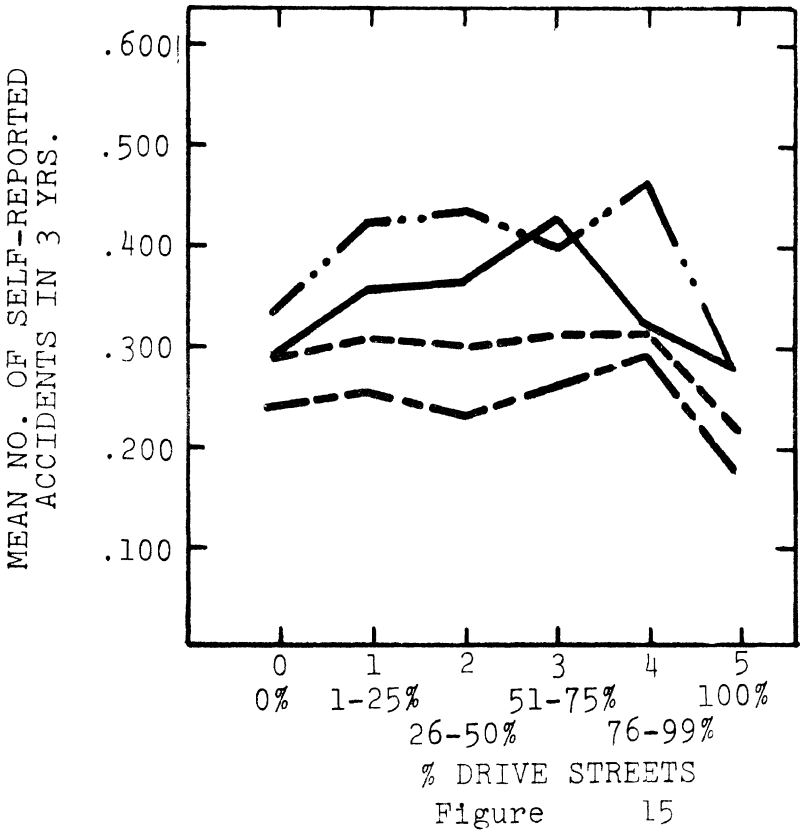


Figure 15

TABLE 9

PERCENT DRIVING ON CITY STREETS VS. DEPENDENT VARIABLES

Total Sample

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
0	0%	447	6.126	2.030	1431	2214	0.280	5.4
1	1-25%	1590	6.878	1.072	1597	1938	0.351	6.1
2	26-50%	1441	6.511	1.057	1068	1139	0.342	8.9
3	51-75%	633	6.410	1.010	931	928	0.355	10.6
4	76-99%	847	6.105	1.188	803	932	0.354	12.3
5	100%	1382	5.343	1.256	429	784	0.210	13.6
	TOTALS	6340	6.257	1.329	1038	1447	0.313	8.4

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(5,6334)= 259.407

SIGNIFICANT AT ALPHA <.01

TABLE 10

PERCENT DRIVING ON CITY STREETS VS. DEPENDENT VARIABLES

Subgroup: Drive On Job (DOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
0	0%	117	7.657	1.017	3299	3370	0.283	2.4
1	1-25%	509	7.565	0.852	2741	2769	0.350	3.6
2	26-50%	390	7.185	0.922	1835	1607	0.358	5.4
3	51-75%	173	7.115	0.659	1497	947	0.437	8.1
4	76-99%	195	7.069	0.899	1657	1383	0.316	5.3
5	100%	156	6.437	1.284	1216	1906	0.275	6.3
	TOTALS	1540	7.248	0.984	2122	2270	0.343	4.5

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(5,1534)= 43.259

SIGNIFICANT AT ALPHA <.01

TABLE 11

PERCENT DRIVING ON CITY STREETS VS. DEPENDENT VARIABLES

Subgroup: Males Not Drive on Job (MNDOJ)

LEVELS OF PREDICTOR VARIABLE code		No. of cases	Natural log of miles driven days Mean	Std. Dev.	Miles driven 30 days Mean	Std. Dev.	Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles
0	0%	171	6.033	2.120	1100	1193	0.324	8.2
1	1-25%	690	6.801	0.920	1268	1117	0.414	9.1
2	26-50%	603	6.601	0.852	988	780	0.423	11.9
3	51-75%	260	6.441	0.857	886	962	0.388	12.2
4	76-99%	330	6.225	0.965	731	590	0.454	17.3
5	100%	455	5.672	1.115	472	451	0.264	15.5
	TOTAL	2509	6.383	1.139	935	917	0.385	11.4

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(5,2503)= 72.403

SIGNIFICANT AT ALPHA < .01

TABLE 12

PERCENT DRIVING ON CITY STREETS VS. DEPENDENT VARIABLES

Subgroup: Females Not Drive On Job (FNDOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days Mean	Natural log of miles driven 30 days Std. Dev.	Miles driven 30 days Mean	Miles driven 30 days Std. Devs	Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles)
0	0%	159	5.100	1.797	413	479	0.234	15.7
1	1-25%	391	6.126	1.008	687	615	0.250	10.1
2	26-50%	448	5.806	0.970	508	524	0.228	12.5
3	51-75%	200	5.761	1.025	500	535	0.254	14.1
4	76-99%	322	5.398	1.090	360	361	0.285	22.0
5	100%	771	4.930	1.129	244	303	0.168	19.1
	TOTALS	2291	5.445	1.215	422	483	0.222	14.6

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(5,2285)= 76.288

SIGNIFICANT AT ALPHA < .01

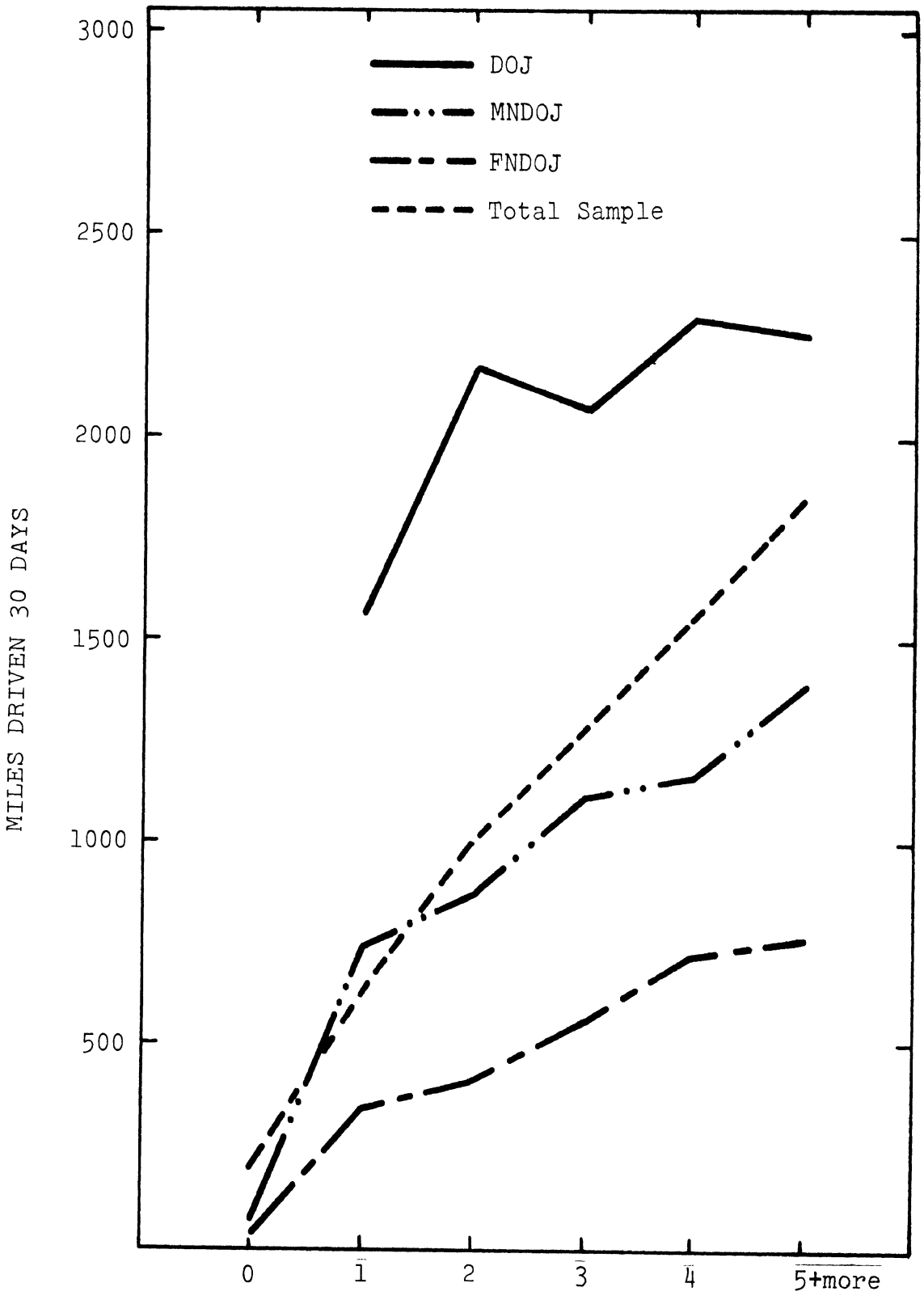

3000
2500
2000
1500
1000
500
DOJ
MNDOJ
FNDOJ
Total Sample
MILES DRIVEN 30 DAYS
0
1
2
3
4
5+more
VEHICLES DRIVEN

Figure 16

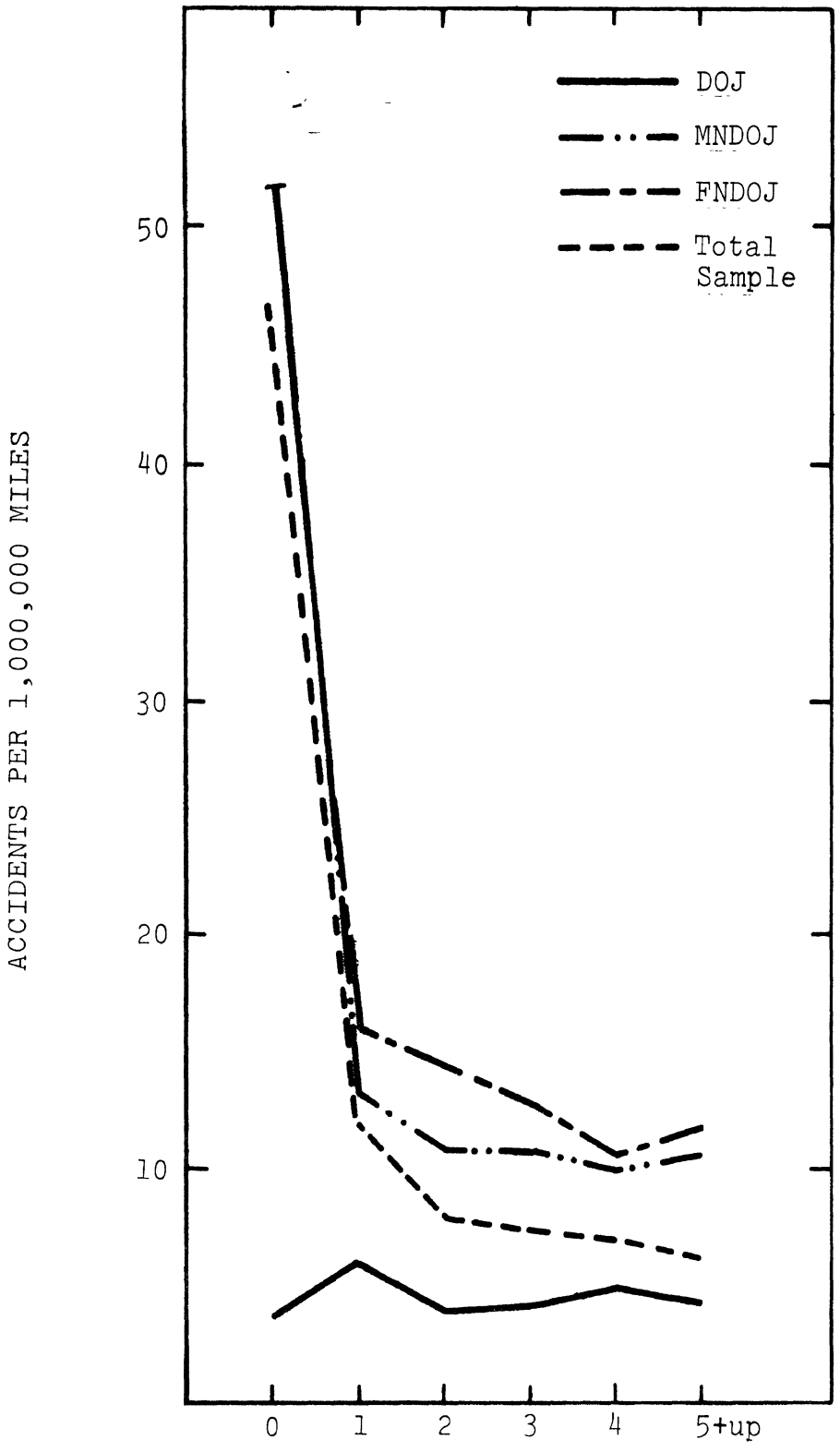

DOJ
MNDOJ
FNDOJ
Total Sample
50
40
30
20
10
ACCIDENTS PER 1,000,000 MILES
0
1
2
3
4
5+up
VEHICLES DRIVEN

Figure 17

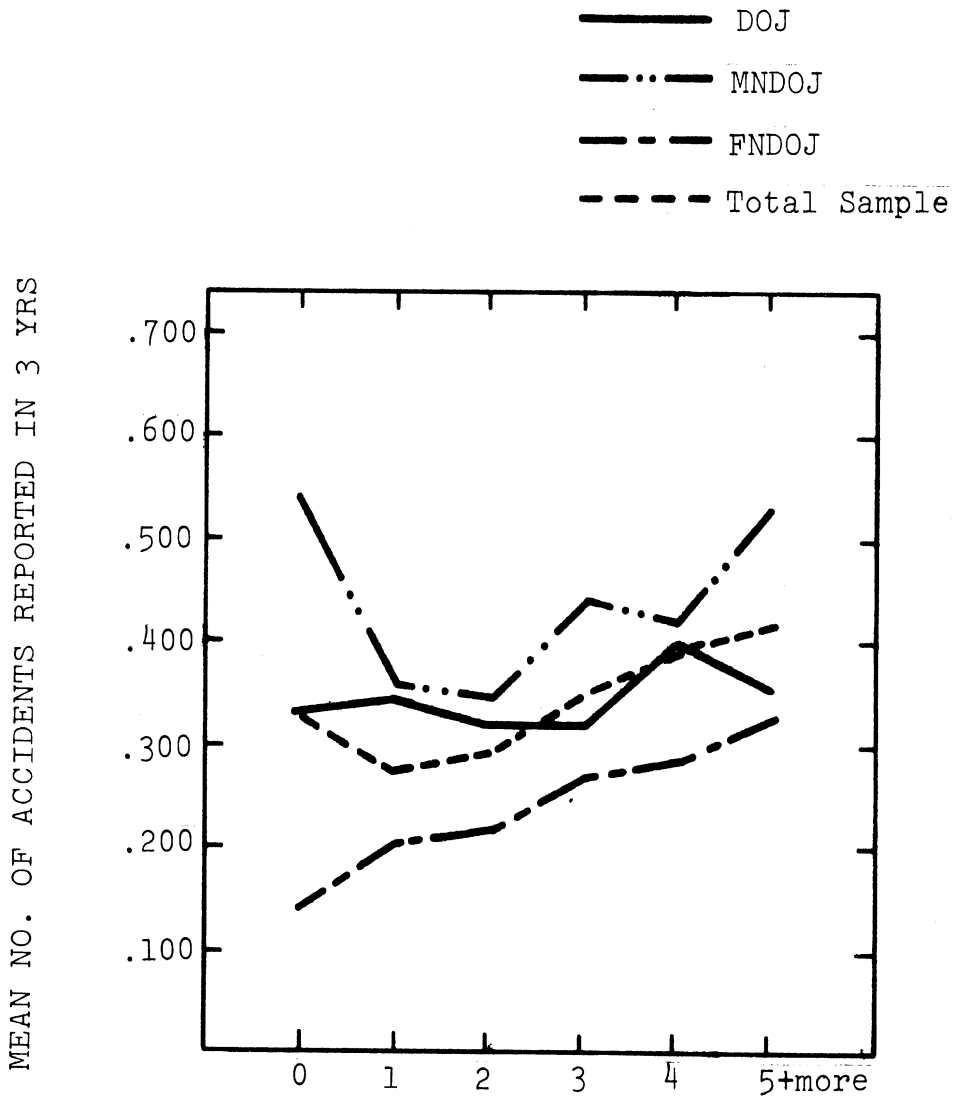

DOJ
MNDOJ
FNDOJ
Total Sample
MEAN NO. OF ACCIDENTS REPORTED IN 3 YRS
.700
.600
.500
.400
.300
.200
.100
0
1
2
3
4
5+more
VEHICLES DRIVEN

Figure 18

TABLE 13

NUMBER OF VEHICLES DRIVEN VS. DEPENDENT VARIABLES

Total Sample

Code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
0	Vehicles	84	0.518	1.833	196	1333	0.329	46.6
1		2496	5.727	1.364	637	968	0.276	12.0
2		2088	6.283	1.236	1019	1474	0.290	7.9
3		928	6.665	1.124	1291	1415	0.347	7.5
4		392	6.915	0.993	1569	1809	0.388	6.9
5 and above		462	7.126		1861		0.418	6.2
	TOTALS	6450	6.147	1.483	993	1388	0.308	8.6

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(11,6438)= 235.813

SIGNIFICANT AT ALPHA <.01

TABLE 14

NUMBER OF VEHICLES DRIVEN VS. DEPENDENT VARIABLES

Subgroup: Drive On Job (DOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles
			Mean	Std. Dev.	Mean	Std. Dev.		
0	Vehicles	4	2.348	4.696	3000	6000	0.333	3.1
1		267	6.820	1.189	1580	2067	0.343	6.0
2		491	7.289	0.915	2174	2428	0.319	4.1
3		310	7.308	0.855	2076	1864	0.318	4.3
4		158	7.362	0.889	2305	2437	0.403	4.9
5 and above		264	7.164		2260		0.357	4.4
	TOTALS	1483	7.230		1000		0.339	9.4

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(10,1472)= 17.291

SIGNIFICANT AT ALPHA .01

TABLE 15

NUMBER OF VEHICLES DRIVEN VS. DEPENDENT VARIABLES

Subgroup: Males Not Drive on Job (MNDOJ)

LEVELS OF PREDICTOR VARIABLE code	No. of cases	Natural log of miles driven 30 days Mean	Std. Dev.	Miles driven 30 days Mean	Std. Dev.	Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles)
0 Vehicles	39	0.505	1.785	73	331	0.538	204.7
1	969	6.113	1.173	751	798	0.359	13.3
2	840	6.389	1.021	885	803	0.343	10.8
3	360	6.714	0.851	1133	1008	0.439	10.8
4	178	6.745	0.883	1177	992	0.419	9.9
5 and above	165	6.893		1392		0.531	10.6
TOTAL	2551	6.298	1.309	910	898	0.384	11.7

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(11,2539)= 121.907

SIGNIFICANT AT ALPHA <.01

TABLE 16

NUMBER OF VEHICLES DRIVEN VS. DEPENDENT VARIABLES

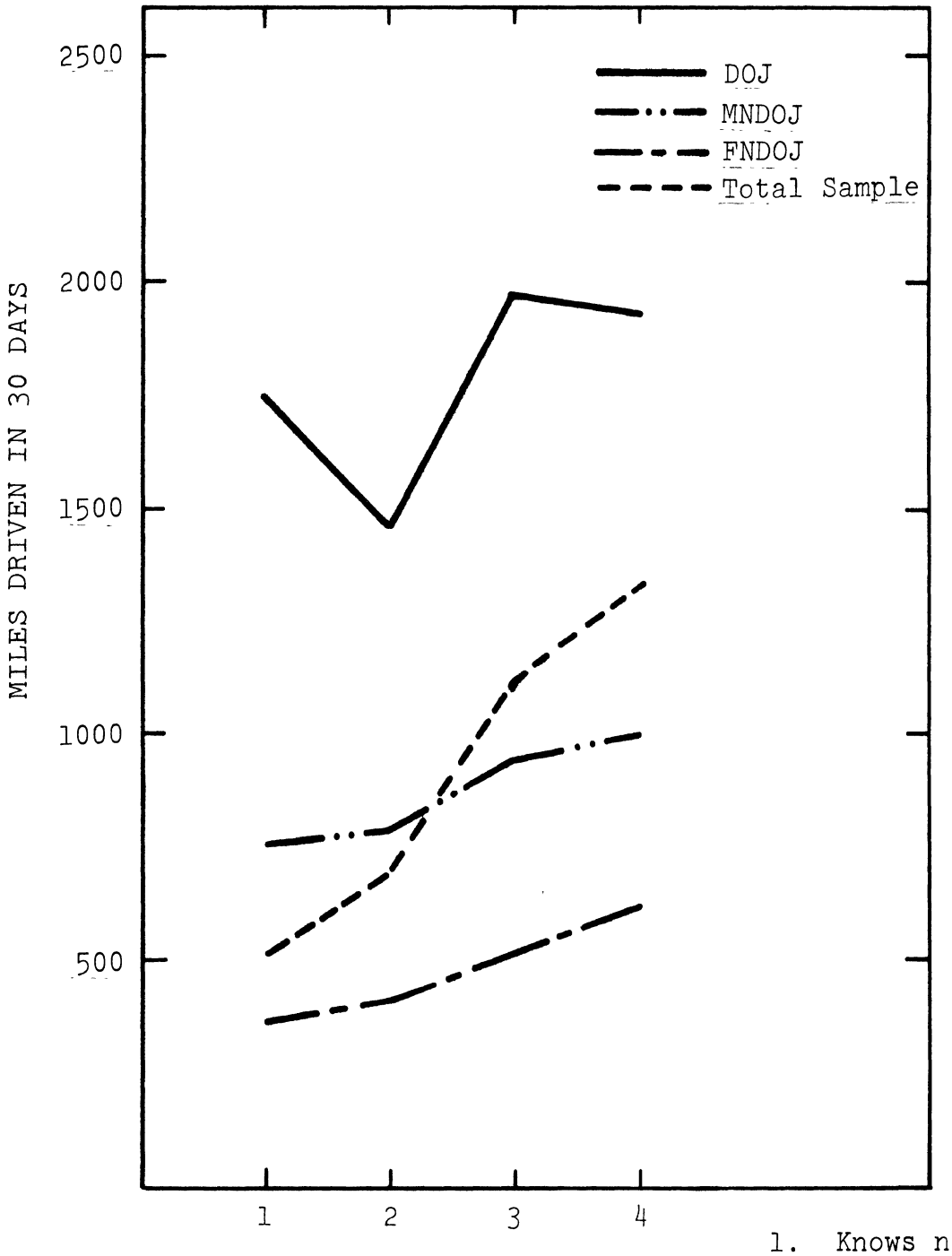
Subgroup: Females Not Drive On Job (FNDOJ)

LEVELS OF PREDICTOR VARIABLE code	No. of cases	Natural log of miles driven 30 days Mean	Std. Dev.	Miles driven 30 days Mean	Std. Devs	Mean no. of self reported accidents in the last 3 yrs	Accident ra (no. acc. p million mil
0 Vehicles	41	0.352	1.387	40	235	0.140	97.2
1	1260	5.201	1.297	350	426	0.203	16.1
2	757	5.514	1.114	418	461	0.218	14.5
3	258	5.824	1.196	568	567	0.263	12.9
4	56	6.192	1.022	734	609	0.281	10.6
5 and above	43	6.135		772		0.326	11.7
TOTALS	2413	5.322	1.411	405	476	0.217	14.9

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(7,2405)= 113.523

SIGNIFICANT AT ALPHA < .01



ENGINE KNOWLEDGE
Figure 19

1. Knows nothing
2. Knows cylinders
3. Knows cylinders + C.I.D.
4. Knows cylinders, C.I.D., + Horsepower

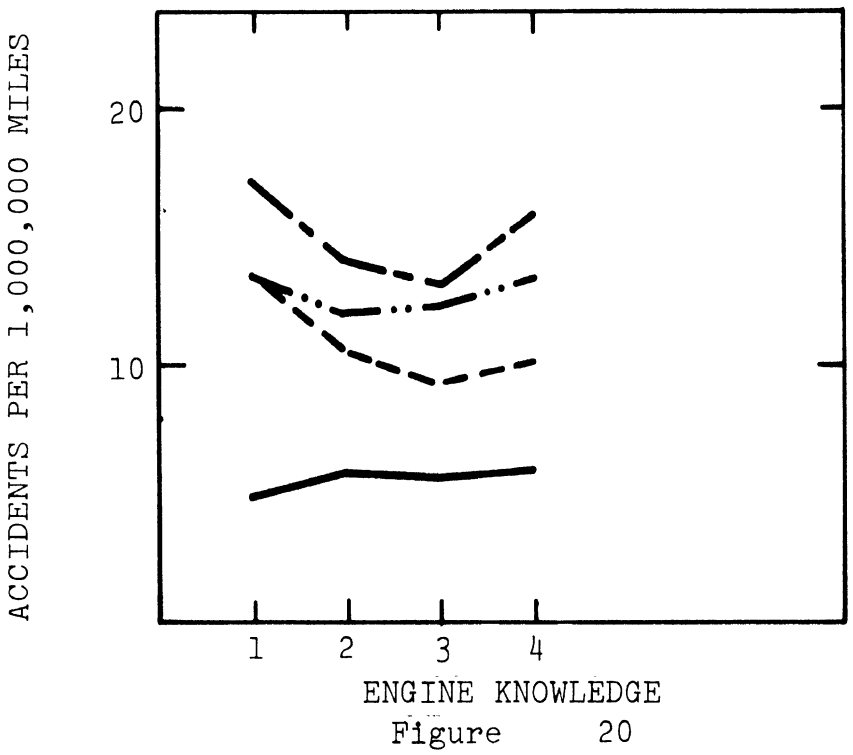


Figure 20

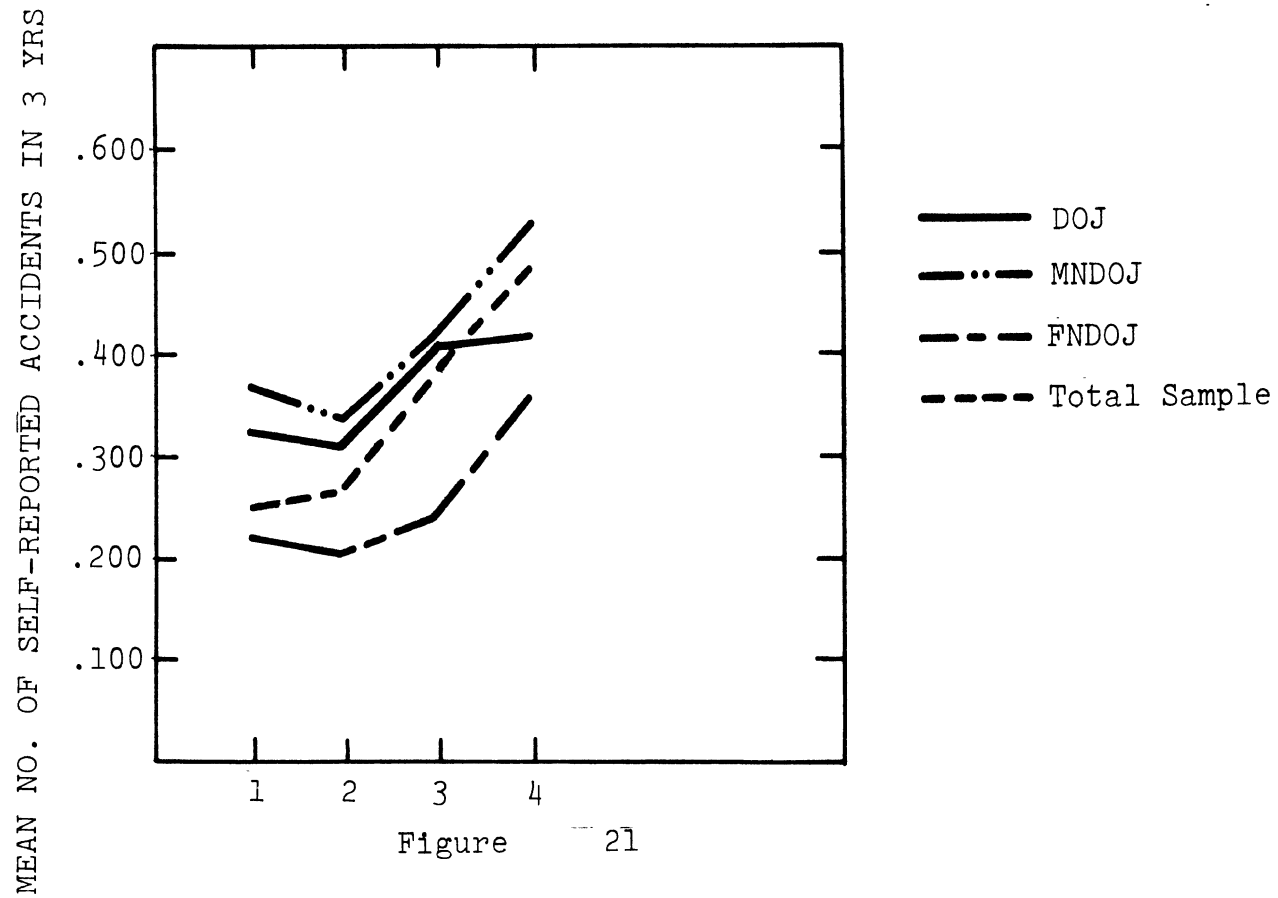


Figure 21

TABLE 17

ENGINE KNOWLEDGE VS. DEPENDENT VAREABLES

Total Sample

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
1	Knows nothing	840	5.428	1.420	510	1000	0.250	13.6
2	Knows # of cylinders	2826	5.880	1.349	692	871	0.265	10.6
3	Knows cylinders + CID	783	6.464	1.237	1121	1310	0.379	9.4
4	Knows cylinders, CID, and horsepower	1128	6.764	1.090	1318	1329	0.484	10.2
	TOTALS	5577	6.073	1.371	851	1103	0.319	10.4

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(3,5573)= 220.737

SIGNIFICANT AT ALPHA < .01

TABLE 18

ENGINE KNOWLEDGE VS. DEPENDENT VARIABLES

Subgroup: Drive On Job (DOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles
			Mean	Std. Dev.	Mean	Std. Dev.		
1	Knows nothing	57	6.897	1.066	1748	2980	0.322	5.1
2	Knows # of cylinders	418	6.874	1.066	1446	1369	0.311	6.0
3	Knows cylinders + CID	201	7.233	0.925	1964	1897	0.408	5.8
4	Knows cylinders, CID, + horsepower	338	7.245	0.834	1923	1869	0.419	6.1
	TOTALS	1014	7.070	0.982	1724	1787	0.364	5.9

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(3,1010)= 11.937

SIGNIFICANT AT ALPHA <.01

TABLE 19

ENGINE KNOWLEDGE VS. DEPENDENT VARIABLES

Subgroup: Males Not Drive on Job (MNDOJ)

LEVELS OF PREDICTOR VARIABLE code		No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
1	Knows nothing	107	6.062	1.286	755	896	0.365	13.4
2	Knows # of cylinders	962	6.139	1.246	781	847	0.336	12.0
3	Knows cylinders + CID	430	6.398	1.135	941	915	0.418	12.3
4	Knows cylinders, CID, + horsepower	738	6.608	1.082	1090	910	0.524	13.4
	TOTAL	2237	6.340	1.193	912	894	0.413	12.6

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

$F(3, 2233) = 24.528$

SIGNIFICANT AT ALPHA $< .01$

TABLE 20

ENGINE KNOWLEDGE VS. DEPENDENT VARIABLES

Subgroup: Females Not Drive On Job (FNDOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days Mean	Std. Dev.	Miles driven 30 days Mean	Std. Devs	Mean no. of self reported accidents in the last 3 yrs	Accident rat (no. acc. pe million mile
1	Knows nothing	676	5.203	1.361	367	471	0.227	17.2
2	Knows # of cylinders	1446	5.422	1.288	415	468	0.208	13.9
3	Knows cylinders + CID	152	5.637	1.273	516	580	0.241	13.0
4	Knows cylinders, CID, + horsepower	52	5.862	1.370	620	560	0.354	15.9
	TOTALS	2326	5.382	1.317	412	481	o.219	14.8

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(3,2322)= 8.864

SIGNIFICANT AT ALPHA <.01

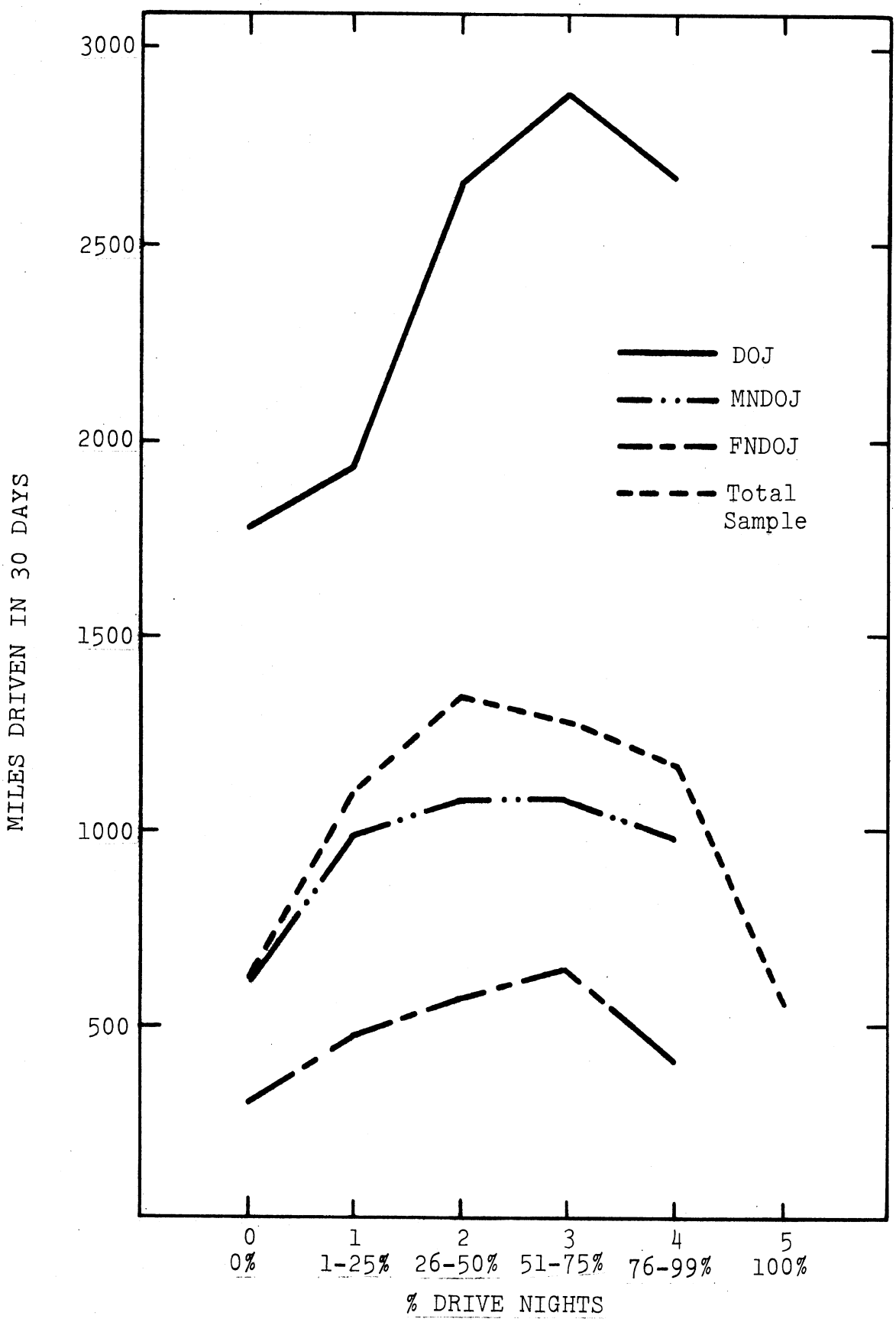

3000
2500
2000
1500
1000
500
MILES DRIVEN IN 30 DAYS
DOJ
MNDOJ
FNDOJ
Total Sample
0
0%
1
1-25%
2
26-50%
3
51-75%
4
76-99%
5
100%
% DRIVE NIGHTS

Figure 22

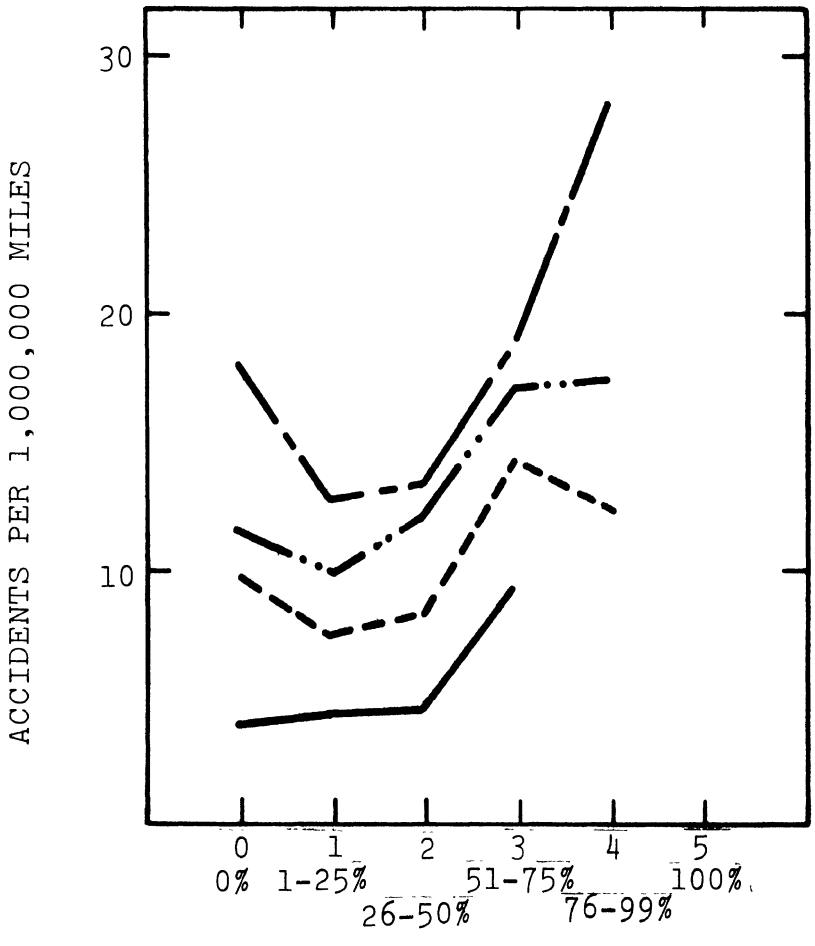

ACCIDENTS PER 1,000,000 MILES
30
20
10
0
1
2
3
4
5
0%
1-25%
26-50%
51-75%
76-99%
100%
% DRIVE NIGHTS

Figure 23

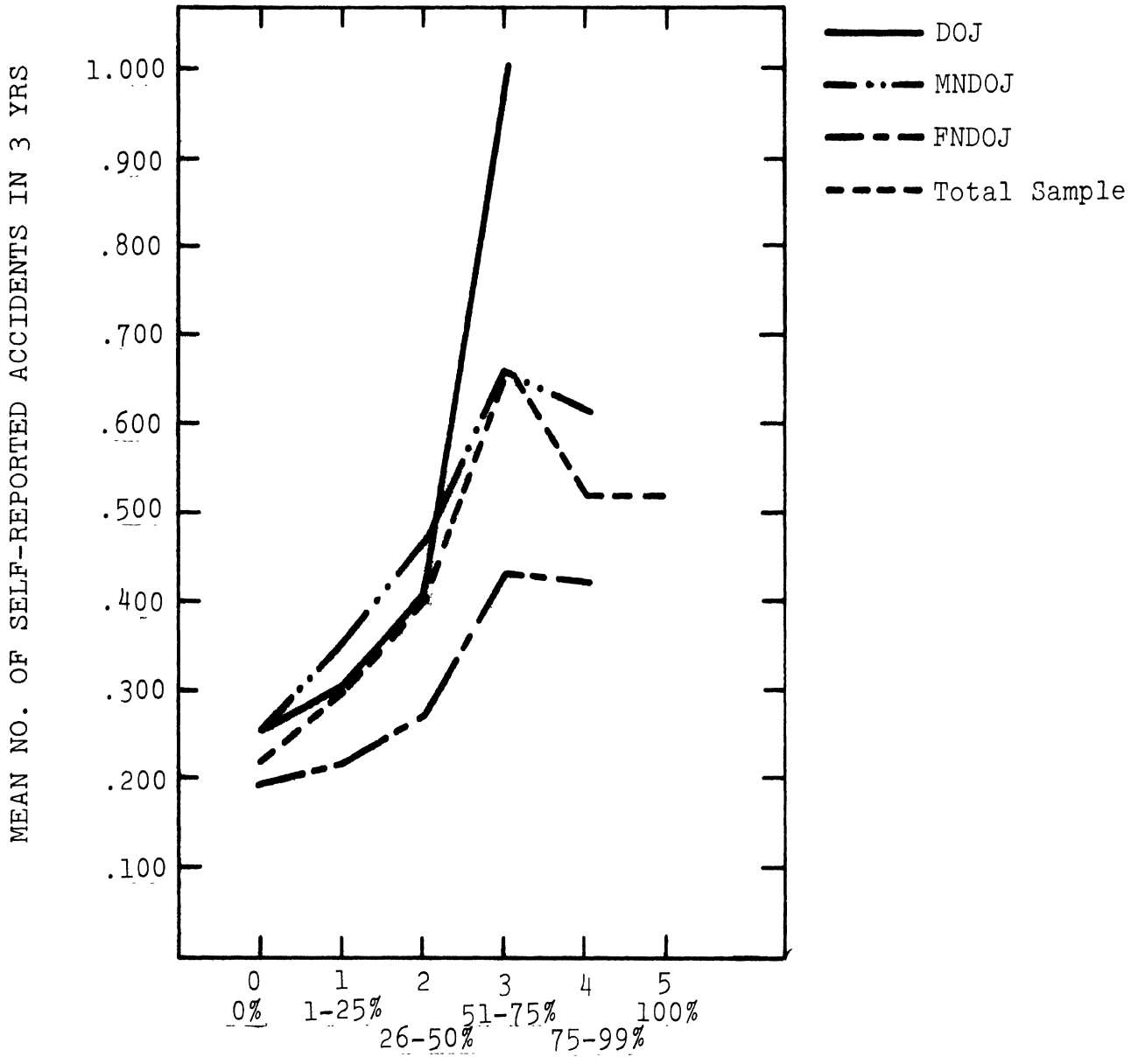

MEAN NO. OF SELF-REPORTED ACCIDENTS IN 3 YRS
1.000
.900
.800
.700
.600
.500
.400
.300
.200
.100
0
1
2
3
4
5
0%
1-25%
26-50%
51-75%
75-99%
100%
% DRIVE NIGHTS
DOJ
MNDOJ
FNDOJ
Total Sample

Figure 24

TABLE 21

PERCENT DRIVING AT NIGHT VS. DEPENDENT VARIABLES

Total Sample

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
0	0%	1665	5.582	1.499	631	948	0.220	9.7
1	1-25%	2907	6.480	1.130	1100	1251	0.293	7.4
2	26-50%	1341	6.579	1.184	1356	2008	0.405	8.3
3	51-75%	253	6.550	1.231	1293	1932	0.660	14.2
4	76-99%	164	6.385	1.310	1170	1567	0.517	12.3
5	100%	40	5.119	1.555	560	1328	0.517	25.6*
	TOTALS	6370	6.258	1.326	1038	1445	0.312	8.4

*n=less than 25

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(5,6364)= 141.196

SIGNIFICANT AT ALPHA < .01

TABLE 22

PERCENT DRIVING AT NIGHT VS. DEPENDENT VARIABLES

Subgroup: Drive On Job (DOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
0	0%	270	7.079	1.013	1780	1585	0.251	3.9
1	1-25%	850	7.247	0.891	1942	1725	0.304	4.4
2	26-50%	348	7.362	1.052	2659	3258	0.429	4.5
3	51-75%	44	7.471	0.936	2893	3836	1.000	9.6
4	76-99%	32	7.124	1.858	2673	2480	0.391*	4.1*
5	100%	4	7.172	1.609	2935	3599	0.667*	6.3*
	TOTALS	1548	7.247	0.985	2120	2266	0.342	4.5

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(5,1542)= 3.093

SIGNIFICANT AT ALPHA <.01

*n=less than 25

TABLE 23

PERCENT DRIVING AT NIGHT VS. DEPENDENT VARIABLES

Subgroup: Males Not Drive on Job (MNDOJ)

LEVELS OF PREDICTOR VARIABLE code		No. of cases	Natural log of miles driven 30 days Mean	Natural log of miles driven 30 days Std. Dev.	Miles driven 30 days Mean	Miles driven 30 days Std. Dev.	Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles)
0	0%	495	5.729	1.499	609	684	0.253	11.5
1	1-25%	1120	6.531	0.945	981	871	0.353	10.0
2	26-50%	646	6.582	0.974	1076	1057	0.466	12.0
3	51-75%	153	6.577	1.008	1072	948	0.651	16.9
4	76-99%	92	6.499	0.923	976	1072	0.609	17.3
5	100%	16	5.846	1.003	514	433	0.833*	45.0*
	TOTAL	2522	6.384	1.134	935	917	0.383	11.4

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(5,2516)= 46.380

SIGNIFICANT AT ALPHA <.01

*n=less than 25

TABLE 24

PERCENT DRIVING AT NIGHT VS. DEPENDENT VARIABLES

Subgroup: Females Not Drive On Job (FNDOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days Mean	Natural log of miles driven 30 days Std. Dev.	Miles driven 30 days Mean	Miles driven 30 days Std. Devs	Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles
0	0%	900	5.053	1.279	298	385	0.194	18.1
1	1-25%	937	5.726	1.039	479	457	0.215	12.5
2	26-50%	347	5.791	1.127	572	642	0.271	13.2
3	51-75%	56	5.750	1.456	640	702	0.431	18.7
4	76-99%	40	5.530	1.100	415	400	0.419	28.1
5	100%	20	4.126	1.178	121	194	0.214*	49.1*
	TOTALS	2300	5.456	1.217	422	482	0.222	14.6

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(5,2294)= 43.320

SIGNIFICANT AT ALPHA <.01

*n=less than 25

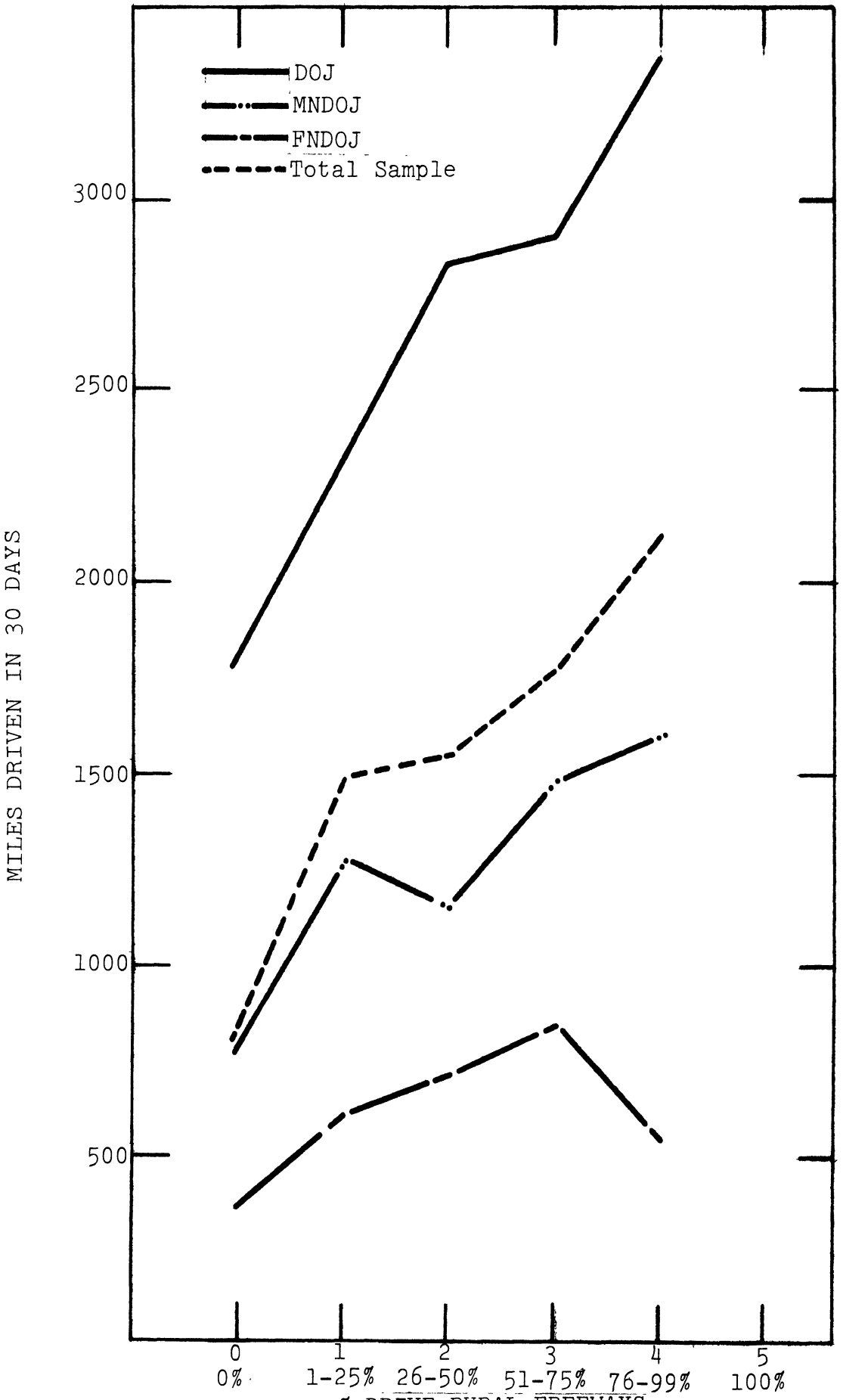

DOJ
MNDOJ
FNDOJ
Total Sample
3000
2500
2000
1500
1000
500
MILES DRIVEN IN 30 DAYS
0
1
2
3
4
5
0%
1-25%
26-50%
51-75%
76-99%
100%
% DRIVE RURAL FREEWAYS

Figure 25

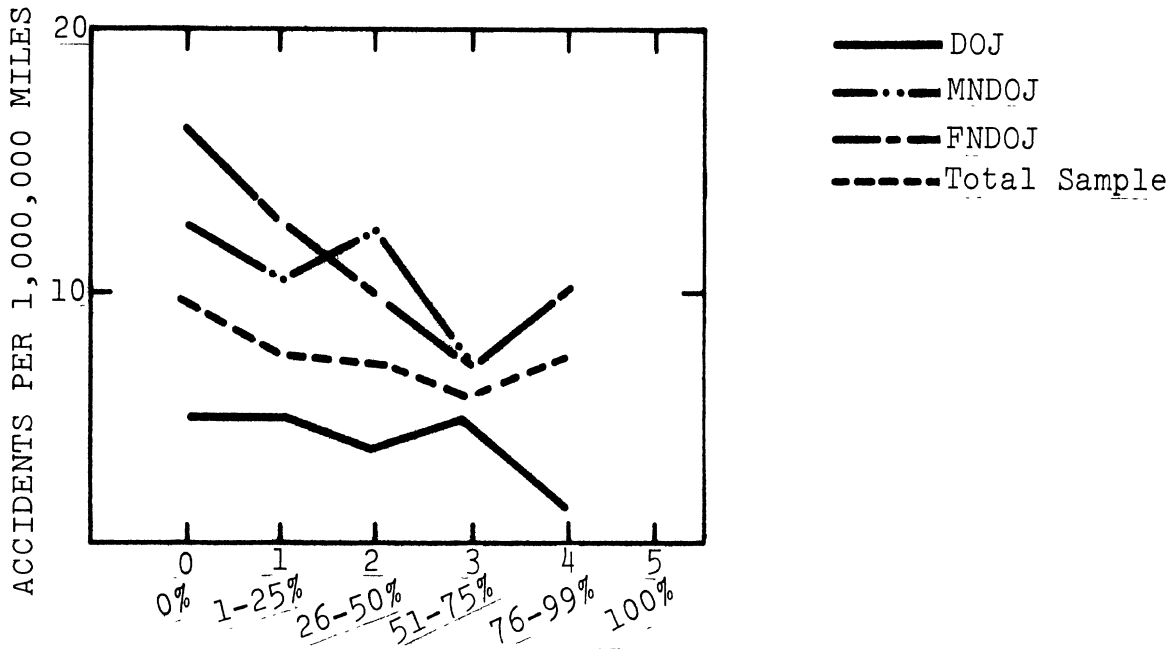


Figure 26

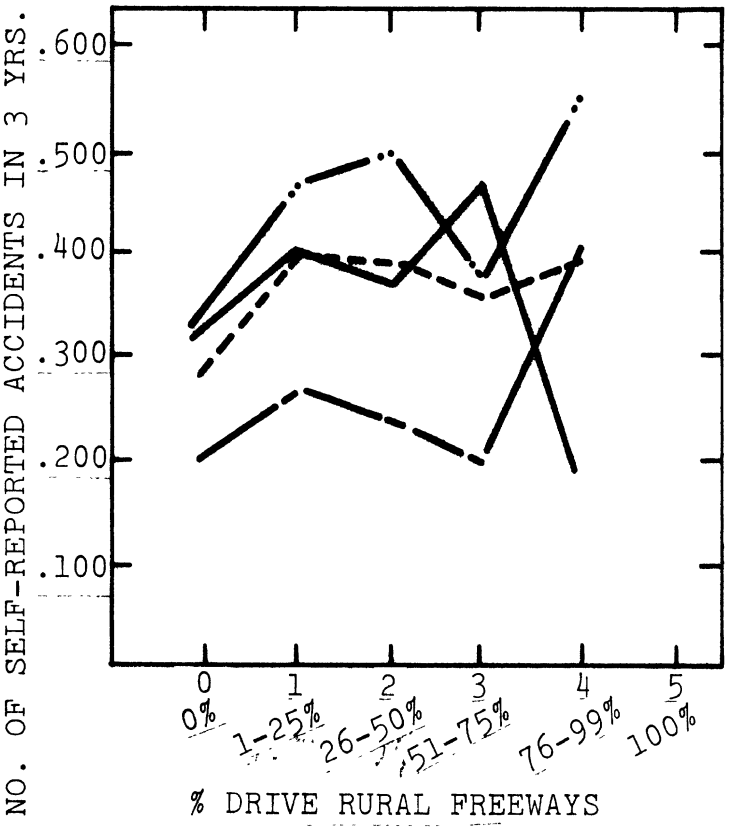


Figure 27

TABLE 25

PERCENT DRIVING ON RURAL FREEWAYS VS. DEPENDENT VARIABLES

Total Sample

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days Mean	Natural log of miles driven 30 days Std. Dev.	Miles driven 30 days Mean	Miles driven 30 days Std. Dev.	Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles)
0	0%	4586	6.013	1.338	822	1186	0.285	9.6
1	1-25%	838	6.824	1.048	1492	1797	0.400	7.5
2	26-50%	548	6.890	1.017	1554	1707	0.398	7.1
3	51-75%	208	7.005	1.161	1764	1925	0.367	5.8
4	76-99%	145	7.150	1.076	2128	2359	0.404	5.3
5	100%	13	6.792	1.617	2425	3169	0.286	5.3
	TOTALS	6338	6.257	1.327	1038	1447	0.314	8.4

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(5,6332)= 124.199

SIGNIFICANT AT ALPHA .01

TABLE 26

PERCENT DRIVING ON RURAL FREEWAYS VS. DEPENDENT VARIABLES

Subgroup: Drive On Job (DOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
0	0%	950	7.061	1.023	1788	2018	0.319	5.0
1	1-25%	299	7.411	0.849	2332	2398	0.409	4.9
2	26-50%	167	7.669	0.788	2836	2368	0.375	3.7
3	51-75%	62	7.641	0.784	2897	2774	0.478	4.6
4	76-99%	57	7.745	0.904	3368	3066	0.205	1.7
5	100%	5	8.357	0.881	5400	3362	0.600	3.1
	TOTALS	1540	7.248	0.987	2122	2270	0.343	4.5

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(5,1534)= 22.113

SIGNIFICANT AT ALPHA <.01

TABLE 27

PERCENT DRIVING ON RURAL FREEWAYS VS. DEPENDENT VARIABLES

Subgroup: Males Not Drive on Job (MNDOJ)

LEVELS OF PREDICTOR VARIABLE code		No. of cases	Natural log of miles driven 30 days Mean	Std. Dev.	Miles driven 30 days Mean	Std. Dev.	Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles
0	0%	1760	6.195	1.185	784	740	0.349	12.4
1	1-25%	335	6.788	0.888	1278	1281	0.474	10.3
2	26-50%	241	6.777	0.800	1154	882	0.512	12.3
3	51-75%	101	6.948	1.046	1479	1230	0.376	7.1
4	76-99%	65	7.033	0.926	1602	1292	0.566	9.8
5	100%	5	5.970	1.081	669	867	0	0
	TOTAL	2507	6.382	1.142	935	917	0.385	11.4

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(5,2501)= 35.169

SIGNIFICANT AT ALPHA <.01

TABLE 28

PERCENT DRIVING ON RURAL FREEWAYS VS. DEPENDENT VARIABLES

Subgroup: Females Not Drive On Job (FNDOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days Mean	Natural log of miles driven 30 days Std. Dev.	Miles driven 30 days Mean	Miles driven 30 days Std. Devs	Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles)
0	0%	1876	5.314	1.213	368	434	0.213	16.1
1	1-25%	204	6.025	1.001	611	531	0.275	12.5
2	26-50%	140	6.157	0.968	714	685	0.246	9.6
3	51-75%	45	6.258	1.362	843	684	0.211	7.0
4	76-99%	23	6.004	0.820	541	445	0.412	21.2
5	100%	3	5.555	1.299	393	330	0.250	17.7
	TOTALS	2291	5.455	1.219	422	483	0.222	14.6

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(5,2285)= 29.850

SIGNIFICANT AT ALPHA .01

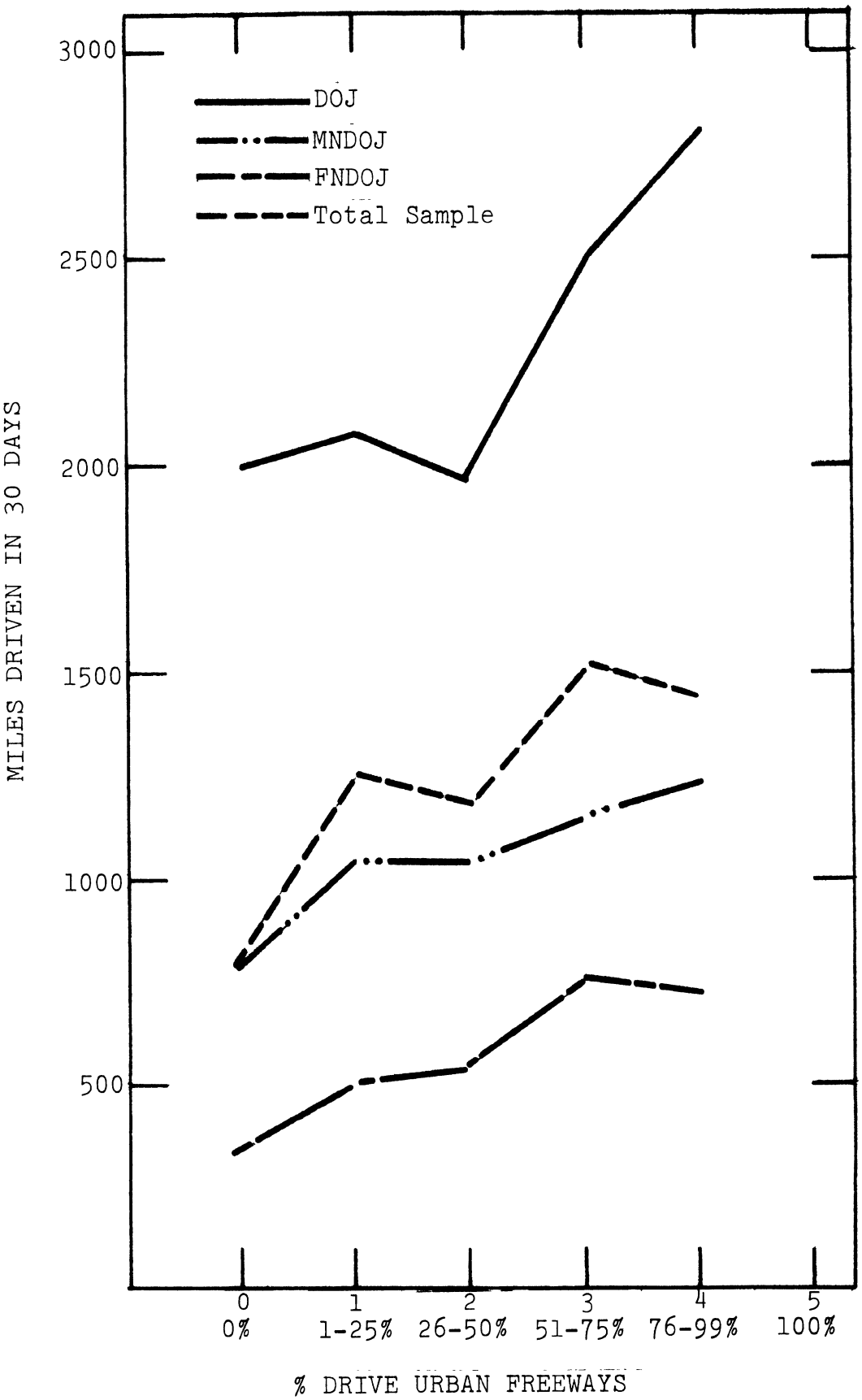

3000
2500
2000
1500
1000
500
DOJ
MNDOJ
FNDOJ
Total Sample
MILES DRIVEN IN 30 DAYS
0
1
2
3
4
5
0%
1-25%
26-50%
51-75%
76-99%
100%
% DRIVE URBAN FREEWAYS

Figure 28

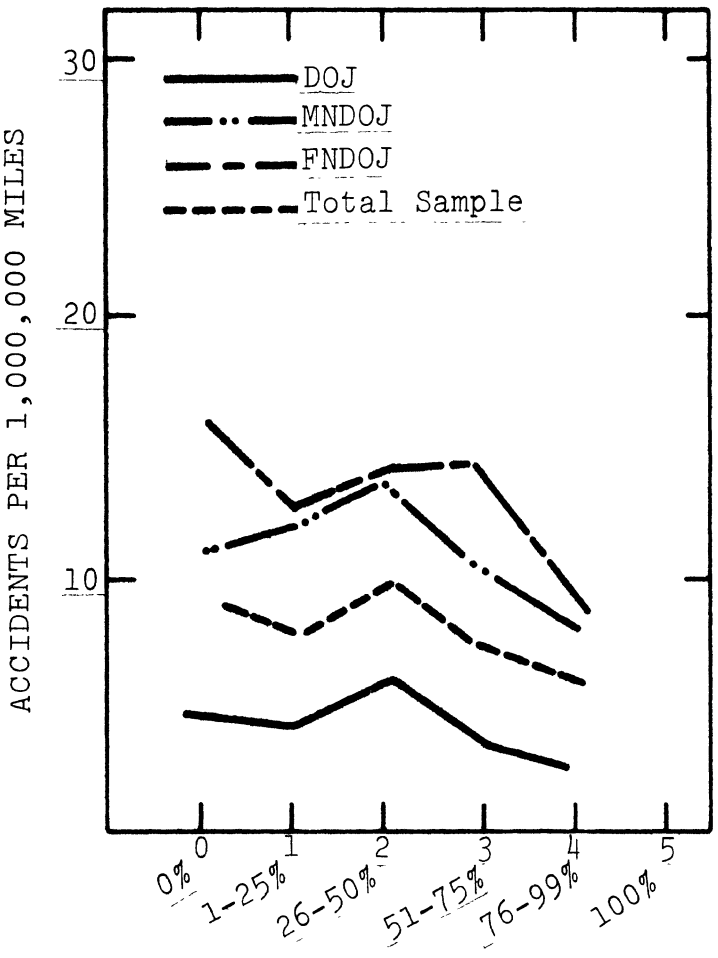

30
20
10
DOJ
MNDOJ
FNDOJ
Total Sample
ACCIDENTS PER 1,000,000 MILES
0
1
2
3
4
5
0%
1-25%
26-50%
51-75%
76-99%
100%
% DRIVE URBAN FREEWAYS

Figure 29

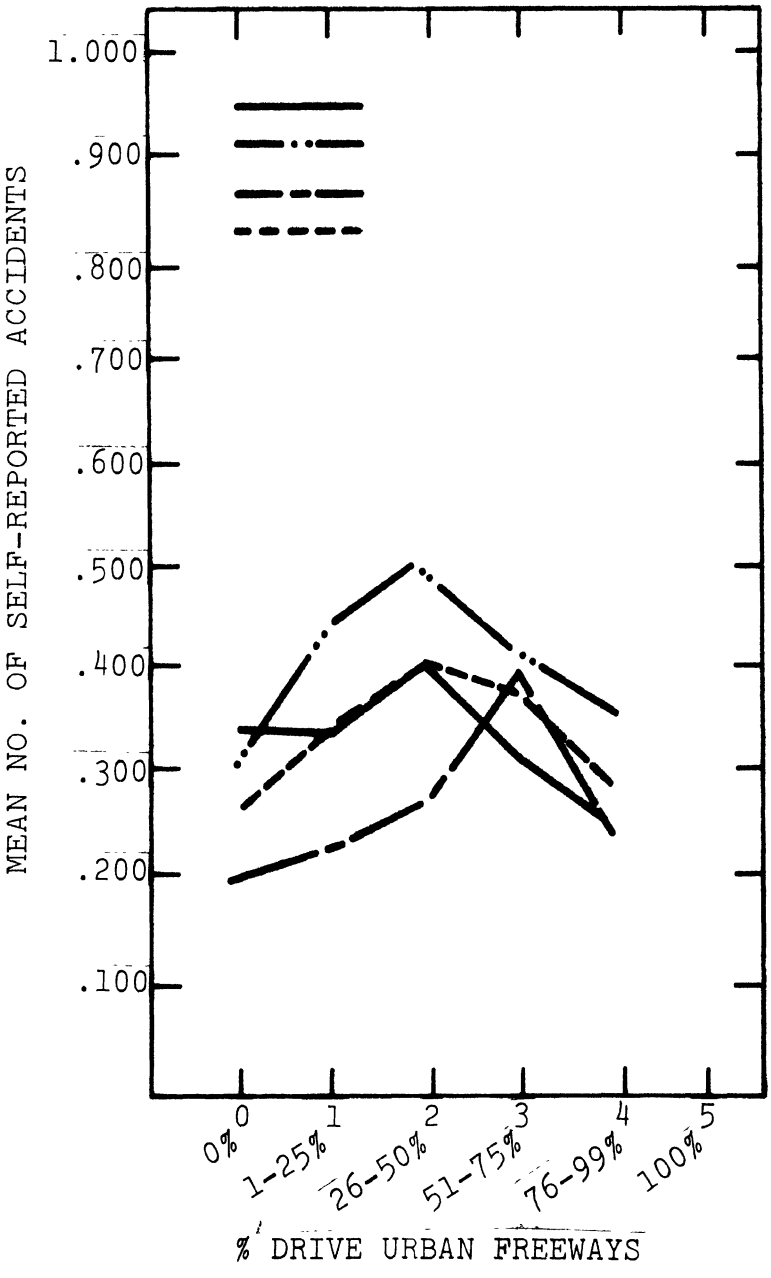

MEAN NO. OF SELF-REPORTED ACCIDENTS
1.000
.900
.800
.700
.600
.500
.400
.300
.200
.100
0
1
2
3
4
5
0%
1-25%
26-50%
51-75%
76-99%
100%
% DRIVE URBAN FREEWAYS

Figure 30

TABLE 29

PERCENT DRIVING ON URBAN FREEWAYS VS. DEPENDENT VARIABLES

Total Sample

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
0	0%	3311	5.919	1.421	820	1205	0.266	9.0
1	1-25%	1447	6.559	1.183	1250	1531	0.346	7.7
2	26-50%	922	6.603	1.031	1175	1410	0.408	9.7
3	51-75%	313	6.841	1.042	1516	2048	0.377	6.9
4	76-99%	326	6.788	0.985	1433	2111	0.294	5.7
5	100%	20	6.570	1.122	1449	2613	0.304	5.8
	TOTALS	6339	6.257	1.329	1038	1447	0.313	8.4

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(5,6333)= 100.264

SIGNIFICANT AT ALPHA ≤.01

TABLE 30

PERCENT DRIVING ON URBAN FREEWAYS VS. DEPENDENT VARIABLES

Subgroup: Drive On Job (DOJ)

LEVELS OF PREDICTOR VARIABLE code		No. of cases	Natural log of miles driven 30 days Mean	Natural log of miles driven 30 days Std. Dev.	Miles driven 30 days Mean	Miles driven 30 days Std. Dev.	Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles)
0	0%	621	7.154	1.064	1998	2015	0.339	4.7
1	1-25%	459	7.332	0.879	2173	2094	0.335	4.3
2	26-50%	276	7.213	0.890	1963	2094	0.408	5.8
3	51-75%	105	7.370	1.103	2489	3055	0.310	3.5
4	76-99%	75	7.434	0.987	2798	3793	0.250	2.5
5	100	3	8.102	1.177	5233	5896	0.333	1.8
	TOTALS	1539	7.248	0.985	2123	2271	0.344	4.5

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(5,1533)= 3.217

SIGNIFICANT AT ALPHA ≤.01

TABLE 31

PERCENT DRIVING ON URBAN FREEWAY VS. DEPENDENT VARIABLES

Subgroup: Males Not Drive on Job (MNDOJ)

LEVELS OF PREDICTOR VARIABLE code		No. of cases	Natural log of miles driven 30 days Mean	Std. Dev.	Miles driven 30 days Mean	Std. Dev.	Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles)
0	0%	1227	6.119	1.290	790	833	0.314	11.0
1	1-25%	584	6.544	0.985	1043	1022	0.447	11.9
2	26-50%	390	6.654	0.828	1034	834	0.501	13.5
3	51-75%	146	6.724	0.842	1139	1017	0.418	10.2
4	76-99%	151	6.801	0.844	1230	1052	0.354	8.0
5	100%	11	6.675	0.743	1028	870	0.385	10.4
	TOTAL	2509	6.382	1.141	935	917	0.385	11.4

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

$F(5, 2503) = 28.424$

SIGNIFICANT AT ALPHA $< .01$

TABLE 32

PERCENT DRIVING ON URBAN FREEWAYS VS. DEPENDENT VARIABLES

Subgroup: Females Not Drive On Job (FNDOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days Mean	Std. Dev.	Miles driven 30 days Mean	Std. Devs	Mean no. of self reported accidents in the last 3 yrs	Accident rat (no. acc. pe million mile
0	0%	1463	5.228	1.243	344	411	0.201	16.2
1	1-25%	404	5.689	1.121	503	566	0.230	12.7
2	26-50%	256	5.868	0.983	541	538	0.275	14.1
3	51-75%	62	6.217	0.939	758	724	0.391	14.3
4	76-99%	100	6.285	0.897	717	460	0.242	9.4
5	100%	6	5.610	0.767	327	166	0.143	12.2
	TOTALS	2291	5.455	1.217	422	483	0.222	14.6

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(5,2285)= 35.735

SIGNIFICANT AT ALPHA <.01

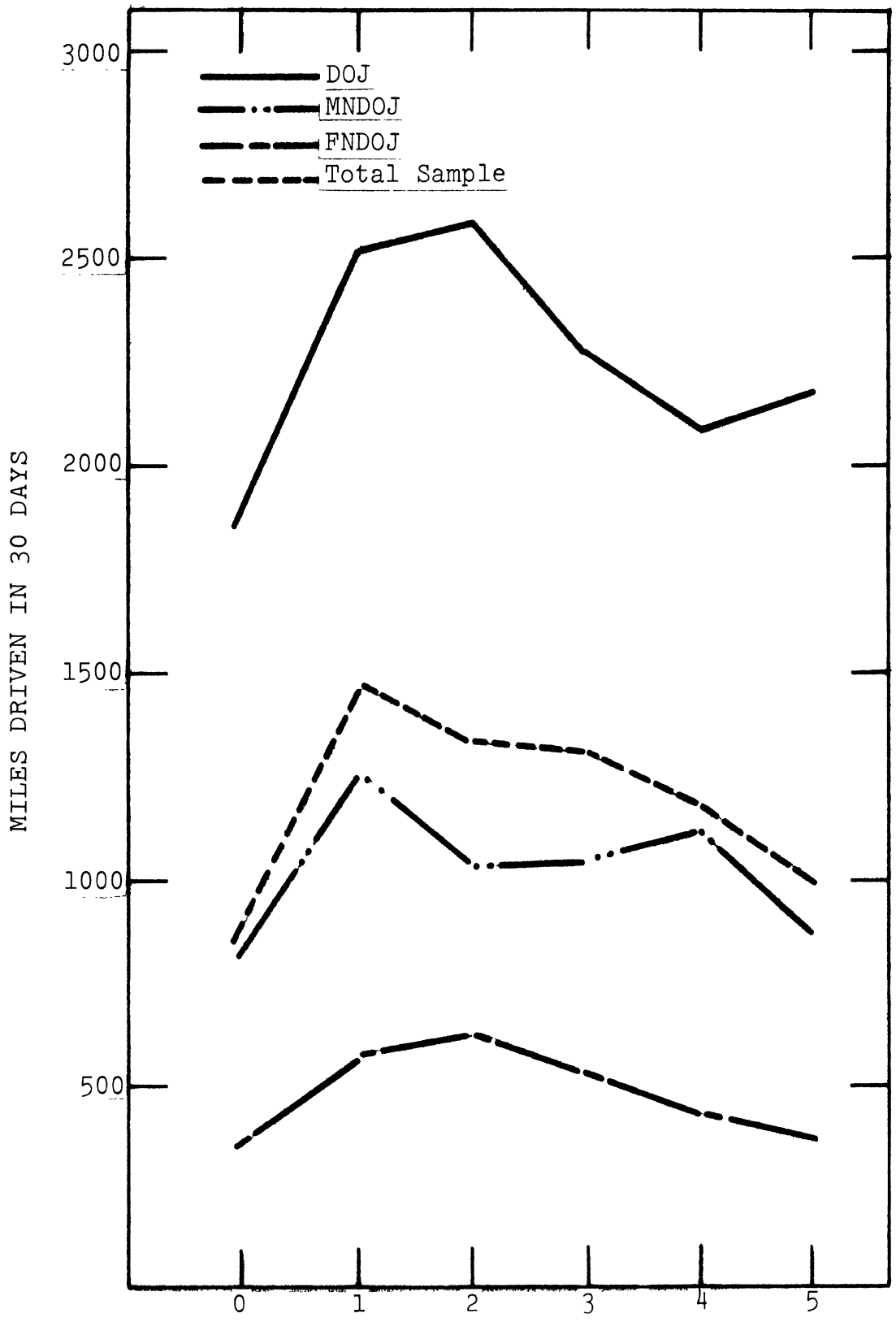

3000
2500
2000
1500
1000
500
DOJ
MNDOJ
FNDOJ
Total Sample
MILES DRIVEN IN 30 DAYS
0
1
2
3
4
5
% DRIVE RURAL ROADS

Figure 31

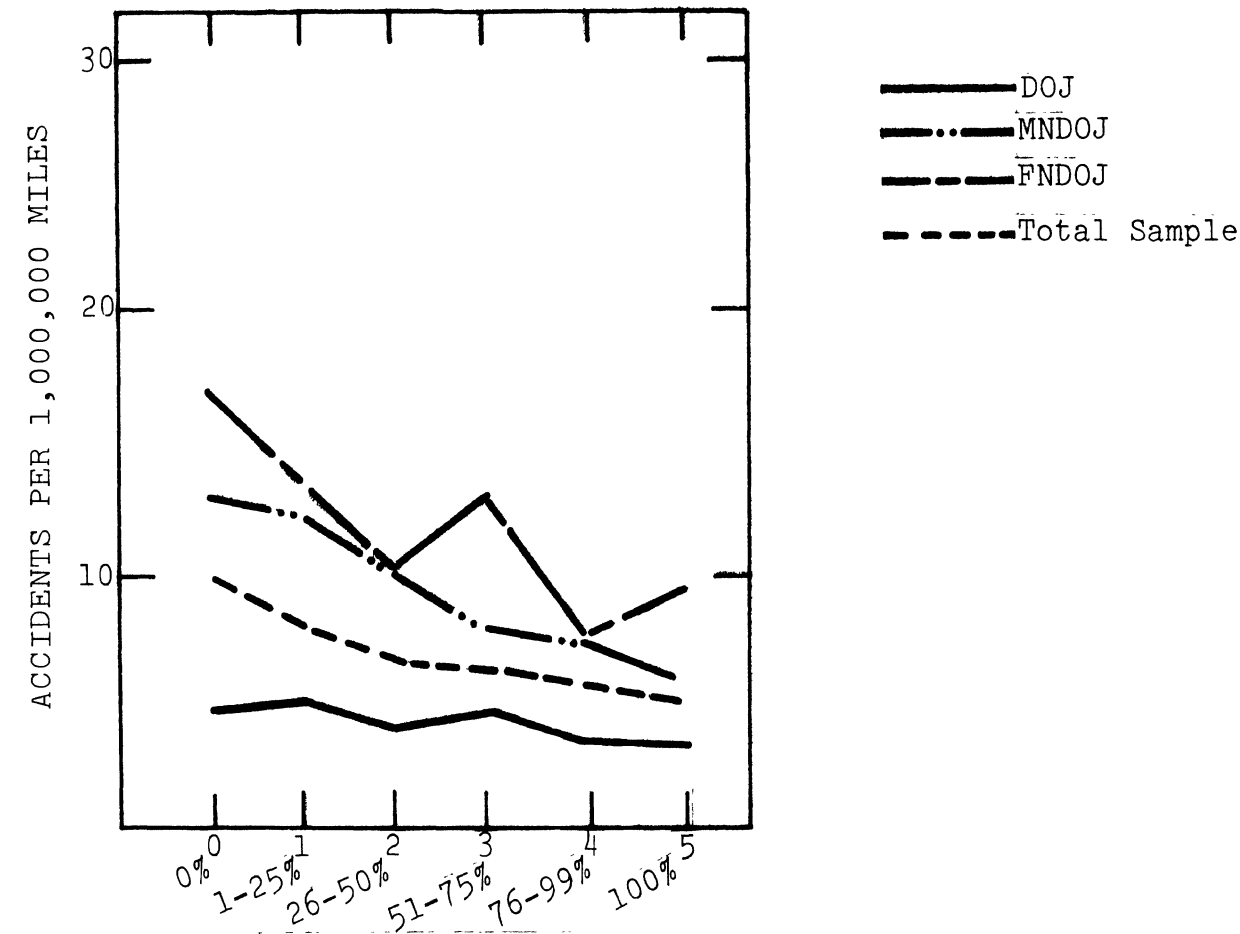


Figure 32

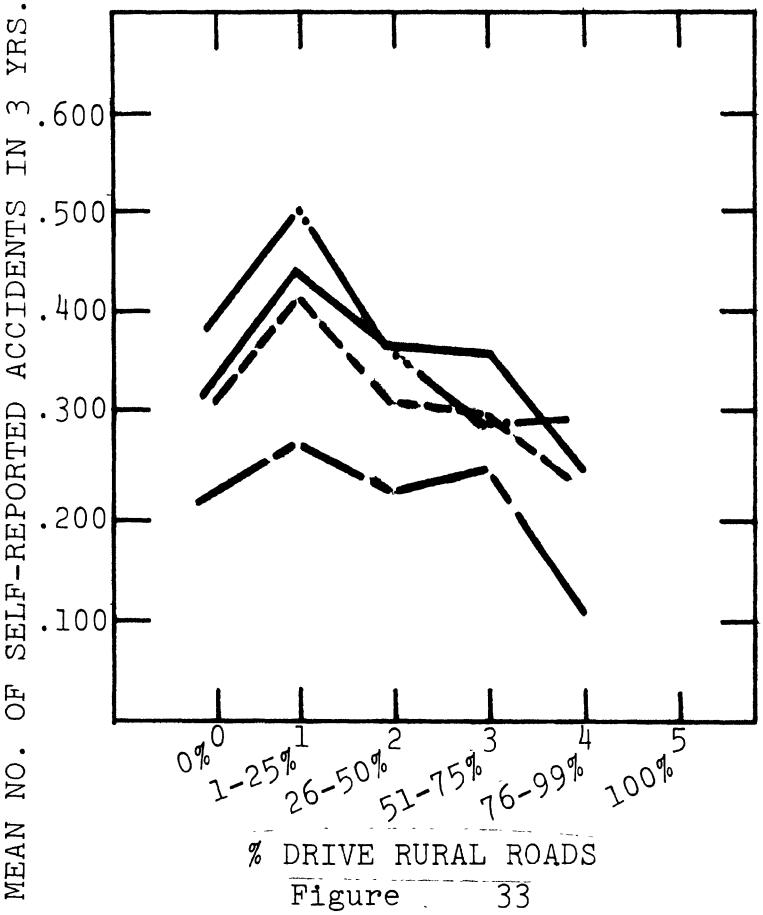


Figure 33

TABLE 33

PERCENT DRIVING ON RURAL ROADS VS. DEPENDENT VARIABLES

Total Sample

Code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
0	0%	4003	6.040	1.372	865	1258	0.304	9.8
1	1-25%	992	6.742	1.122	1465	1875	0.419	7.9
2	26-50%	621	6.625	1.125	1321	1724	0.313	6.6
3	51-75%	218	6.720	1.028	1298	1337	0.301	6.4
4	76-99%	328	6.519	1.130	1177	1252	0.234	5.5
5	100%	178	6.107	1.455	990	1394	0.176	4.9
	TOTALS	6340	6.527	1.327	1038	1448	0.313	8.4

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(5,6334)= 69.358

SIGNIFICANT AT ALPHA <.01

TABLE 34

PERCENT DRIVING ON RURAL ROADS VS. DEPENDENT VARIABLES

Subgroup: Drive On Job (DOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs	Accident rat (no. acc. pe million mile
			Mean	Std. Dev.	Mean	Std. Dev.		
0	0%	848	7.081	1.057	1874	2130	0.320	4.7
1	1-25%	315	7.480	0.837	2518	2663	0.442	4.9
2	26-50%	173	7.484	0.878	2577	2618	0.364	3.9
3	51-75%	71	7.474	0.760	2255	1648	0.358	4.4
4	76-99%	87	7.373	0.820	2078	1326	0.256	3.4
5	100%	46	7.265	0.996	2165	2124	0.250	3.2
	TOTALS	1540	7.248	0.986	2122	2270	0.343	4.5

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(5,1534)= 11.772

SIGNIFICANT AT ALPHA <.01

TABLE 35

PERCENT DRIVING ON RURAL ROADS VS. DEPENDENT VARIABLES

Subgroup: Males Not Drive on Job (MNDOJ)

ode	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
0	0%	1584	6.232	1.204	820	776	0.381	12.9
1	1-25%	399	6.737	0.955	1254	1218	0.507	11.2
2	26-50%	234	6.612	0.992	1032	840	0.364	9.8
3	51-75%	87	6.660	0.820	1045	965	0.288	7.7
4	76-99%	149	6.568	1.000	1116	1218	0.294	7.3
5	100%	56	6.237	1.352	872	808	0.182	5.8
	TOTAL	2509	6.382	1.142	935	918	0.385	11.4

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(5,2503)= 17.648

SIGNIFICANT AT ALPHA <.01

TABLE 36

PERCENT DRIVING ON RURAL ROADS VS. DEPENDENT VARIABLES

Subgroup: Females Not Drive On Job (FNDOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days Mean	Natural log of miles driven 30 days Std. Dev.	Miles driven 30 days Mean	Miles driven 30 days Std. Devs	Mean no. of self reported accidents in the last 3 yrs	Accident ra (no. acc. p million mi
0	0%	1571	5.285	1.250	366	429	0.224	17.0
1	1-25%	278	5.916	1.032	574	540	0.270	13.1
2	26-50%	214	5.945	1.035	621	692	0.228	10.2
3	51-75%	60	5.913	0.933	533	448	0.245	12.8
4	76-99%	92	5.631	0.911	424	453	0.115	7.5
5	100%	76	5.310	1.258	365	383	0.122	9.3
	TOTALS	2291	5.455	1.218	422	483	0.222	14.6

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(5,2285)= 24.497

SIGNIFICANT AT ALPHA < .01

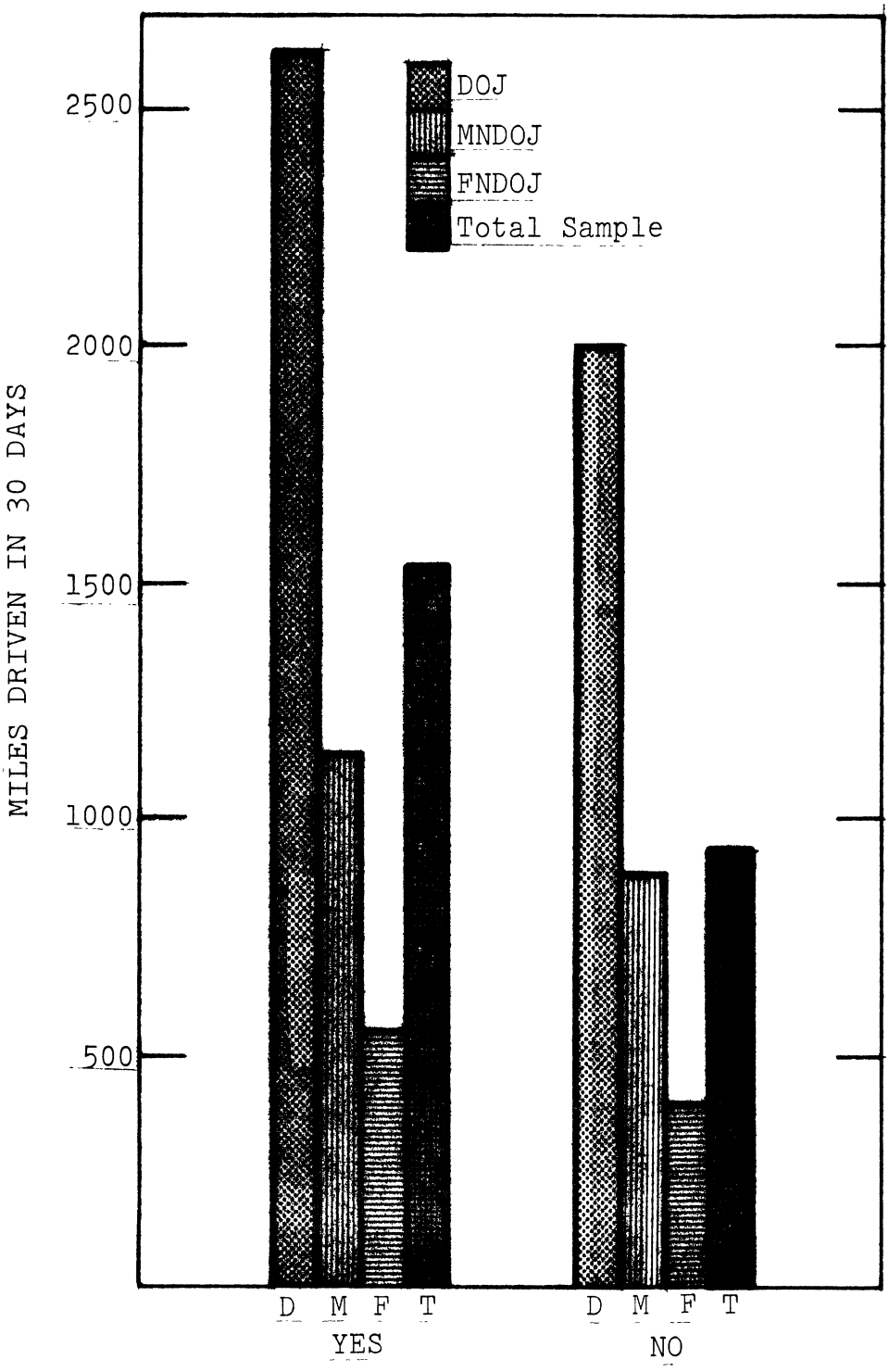

2500
2000
1500
1000
500
MILES DRIVEN IN 30 DAYS
DOJ
MNDOJ
FNDOJ
Total Sample
D M F T
YES
D M F T
NO
MOVING VIOLATIONS?

Figure 34

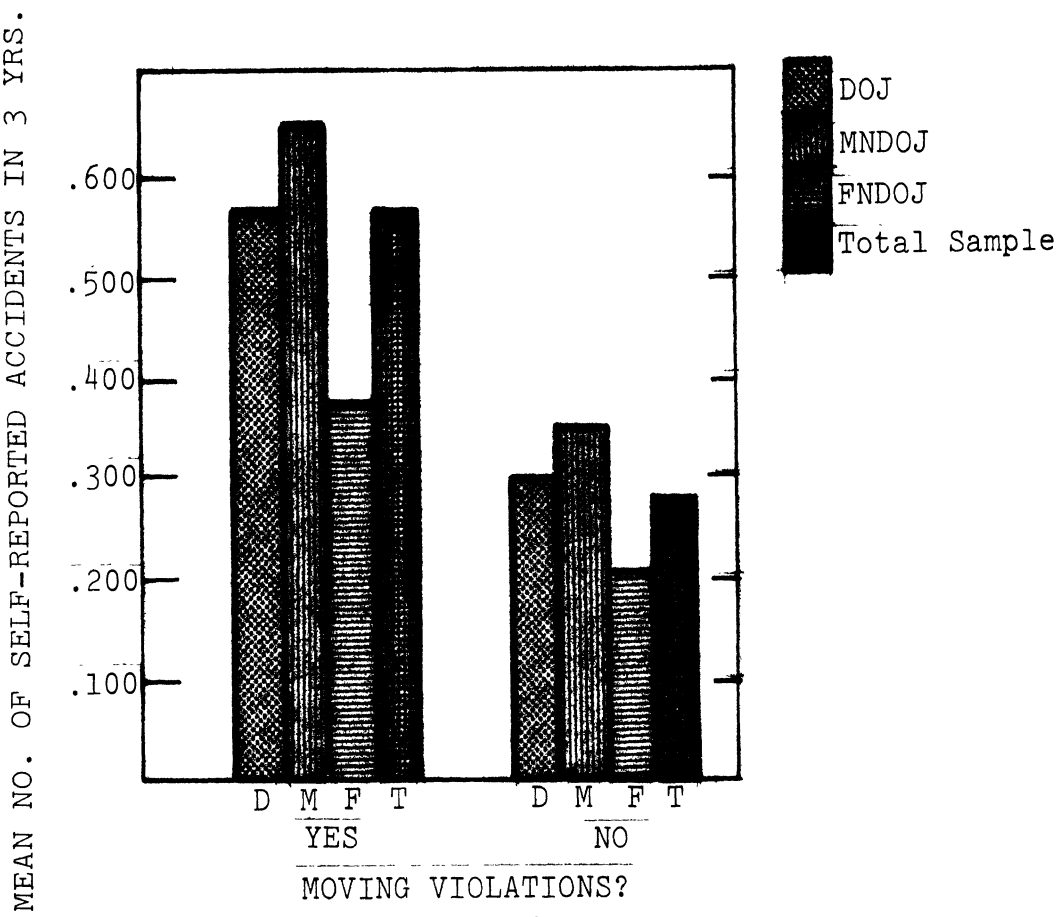


Figure 35

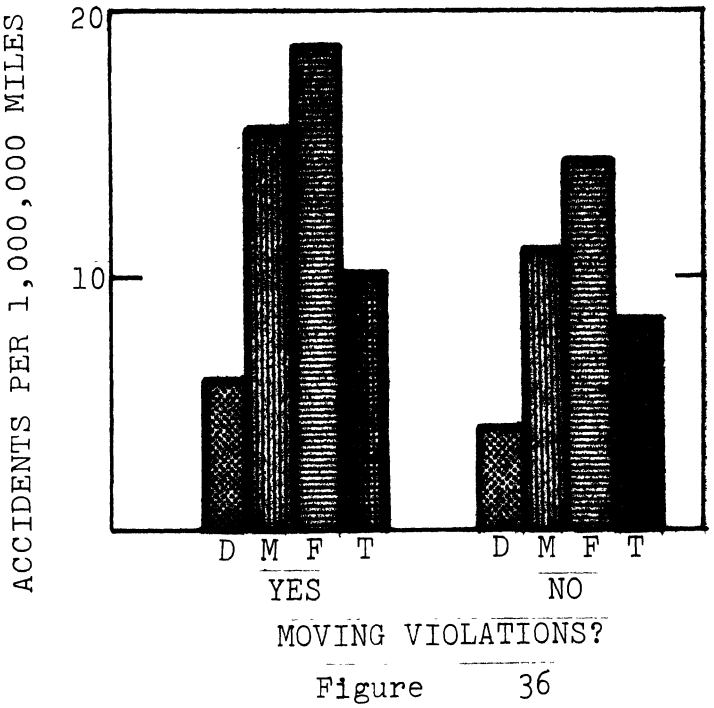


Figure 36

TABLE 37

ANY MOVING VIOLATIONS? VS. DEPENDENT VARIABLES

Total Sample

LEVELS OF PREDICTOR VARIABLE code		No. of cases	Natural log of miles driven 30 days Mean	Natural log of miles driven 30 days Std. Dev.	Miles driven 30 days Mean	Miles driven 30 days Std. Dev.	Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles)
1	Yes	819	6.726	1.263	1533	1967	0.563	10.2
2	No	5734	6.079	1.495	937	1320	0.276	8.2
8	Don't know	6	6.414	3.246	2330	1839	0.800	9.5
	TOTAL	6559	6.160	1.485	1013	1432	0.311	8.5

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(2,6556)= 69.354

SIGNIFICANT AT ALPHA .01

TABLE 38

ANY MOVING VIOLATIONS? VS. DEPENDENT VARIABLES

Subgroup: Drive On Job (DOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles
			Mean	Std. Dev.	Mean	Std. Dev.		
1	Yes	278	7.473	1.008	2632	2677	0.564	6.0
2	No	1273	7.180	1.023	1995	2144	0.291	4.1
8	Don't know	4	7.721	1.046	2995	1789	1.000	9.3
	TOTALS	1555	7.234	1.026	2112	2260	0.340	4.5

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(2,1552)= 9.471

SIGNIFICANT AT ALPHA .01

TABLE 39

ANY MOVING VIOLATIONS? VS. DEPENDENT VARIABLES

Subgroup: Males Not Drive on Job (MNDOJ)

LEVELS OF PREDICTOR VARIABLE code		No. of cases	Natural log of miles driven 30 days Mean	Natural log of miles driven 30 days Std. Dev.	Miles driven 30 days Mean	Miles driven 30 days Std. Dev.	Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles)
1	Yes	385	6.560	1.177	1139	1233	0.648	15.8
2	No	2198	6.265	1.314	881	842	0.345	10.9
8	Don't know	2	3.800	5.375	1000	1414	0.500	13.9
	TOTAL	2585	6.307	1.304	920	915	0.389	11.8

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(2,2582)= 12.212

SIGNIFICANT AT ALPHA .01

TABLE 40

ANY MOVING VIOLATIONS? VS. DEPENDENT VARIABLES

Subgroup: Females Not Drive On Job (FNDOJ)

LEVELS OF PREDICTOR VARIABLE code		No. of cases	Natural log of miles driven 30 days Mean	Std. Dev.	Miles driven 30 days Mean	Std. Devs	Mean no. of self reported accidents in the last 3 yrs	Accident rat (no. acc. pe million mile
1	Yes	156	5.806	1.102	545	553	0.370	18.9
2	No	2263	5.282	1.439	395	470	0.206	14.5
	TOTALS	2419	5.315	1.425	405	477	0.217	14.9

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(1,2417)= 14.329

SIGNIFICANT AT ALPHA .01

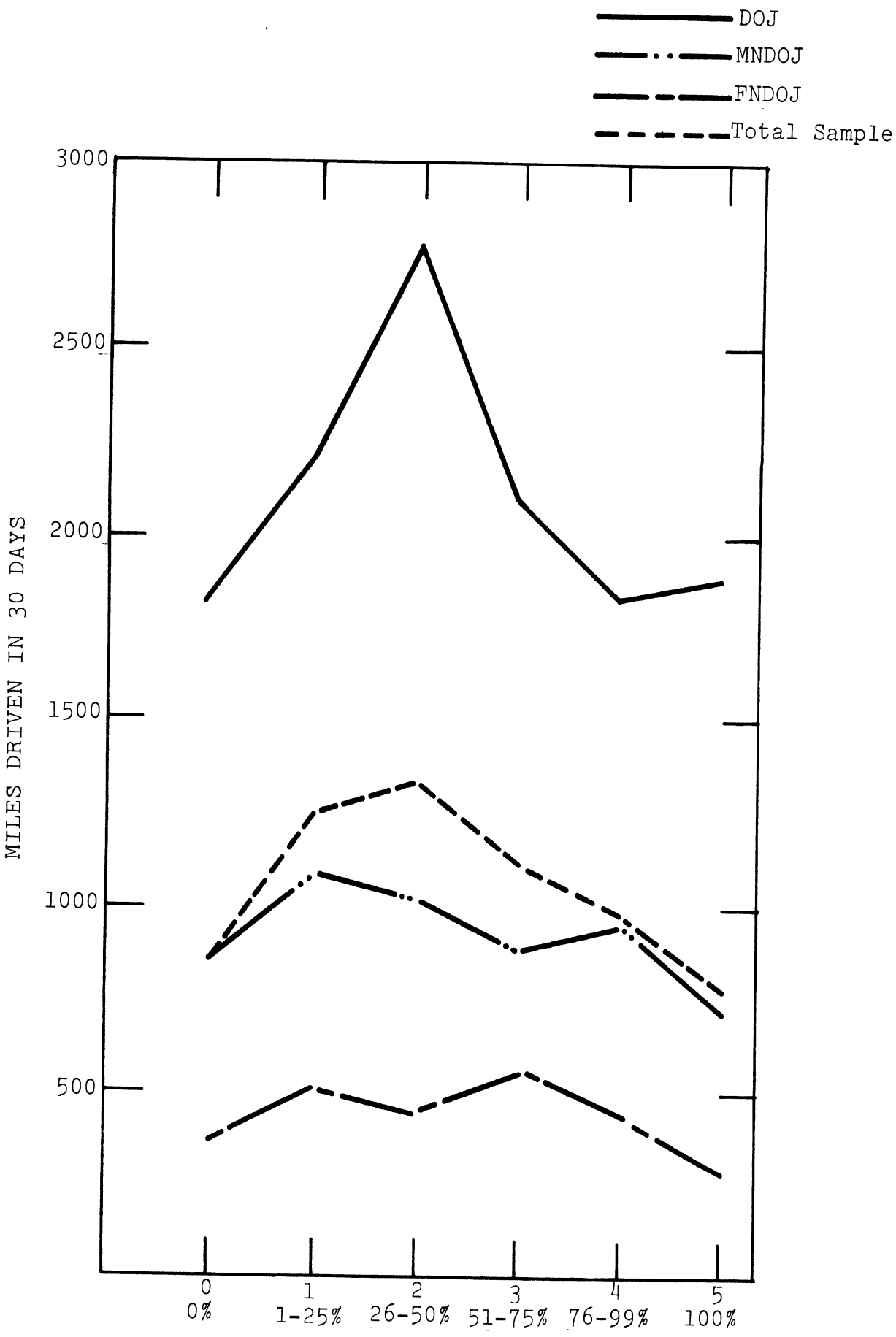

DOJ
MNDOJ
FNDOJ
Total Sample
3000
2500
2000
1500
1000
500
MILES DRIVEN IN 30 DAYS
0
0%
1
1-25%
2
26-50%
3
51-75%
4
76-99%
5
100%
% DRIVE WET ROADS

Figure 37

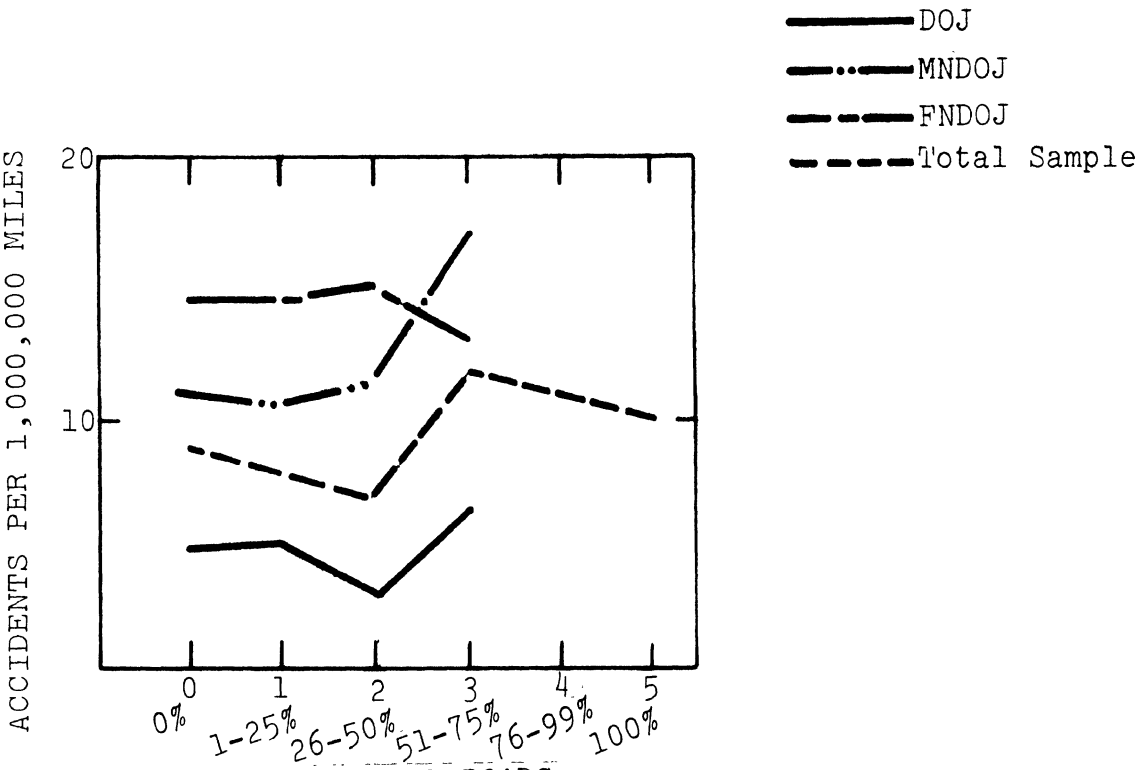


Figure 38

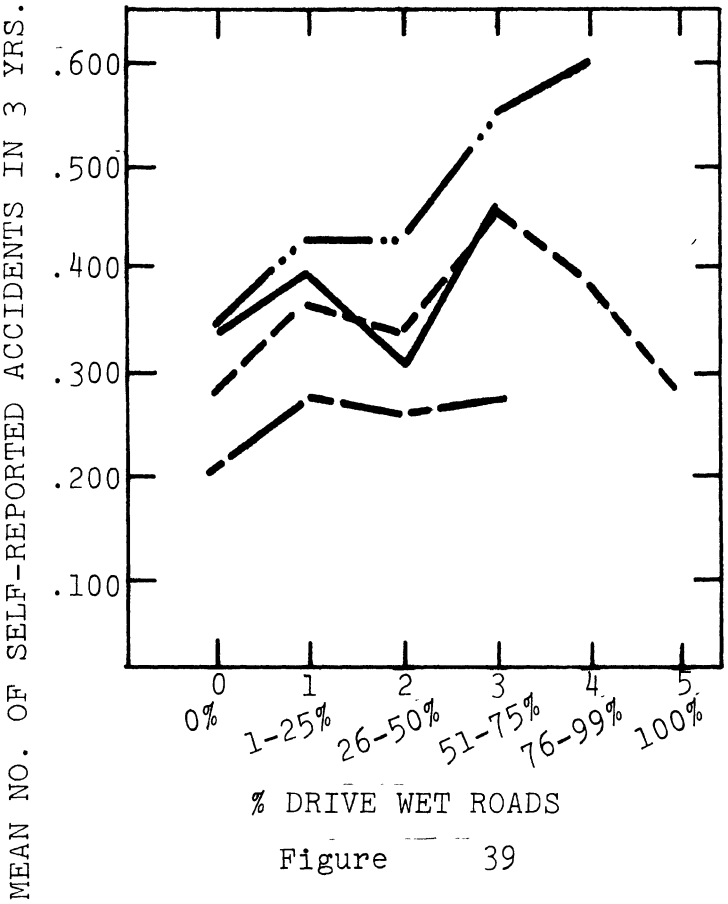


Figure 39

TABLE 41

PERCENT DRIVING ON WET ROADS VS, DEPENDENT VARIABLES

Total Sample

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
0	0%	3069	6.025	1.410	857	1117	0.277	9.0
1	1-25%	1601	6.533	1.183	1248	1653	0.363	8.1
2	26-50%	959	6.525	1.220	1324	2024	0.333	7.0
3	51-75%	219	6.545	1.003	1112	1251	0.445	11.8
4	76-99%	246	6.400	1.072	969	937	0.379	10.9
5	100%	208	5.822	1.408	763	1209	0.271	9.9
	TOTALS	6302	6.256	1.327	1037	1450	0.313	8.4

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(5,6296)= 49.294

SIGNIFICANT AT ALPHA .01

TABLE 42

PERCENT DRIVING ON WET ROADS VS. DEPENDENT VARIABLES

Subgroup: Drive On Job (DOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
0	0%	644	7.105	1.023	1828	1738	0.326	5.0
1	1-25%	476	7.292	0.987	2226	2398	0.393	4.9
2	26-50%	259	7.509	0.925	2784	3198	0.294	2.9
3	51-75%	57	7.350	0.814	2092	1767	0.467	6.2
4	76-99%	49	7.299	0.684	1833	1225	0.231*	3.5*
5	100%	42	7.067	1.027	1887	2150	0.214*	3.2*
	TOTALS	1527	7.246	0.989	2126	2279	0.343	4.5

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(5,1521)= 7.033

SIGNIFICANT AT ALPHA .01

TABLE 43

PERCENT DRIVING ON WET ROADS VS. DEPENDENT VARIABLES

Subgroup: Males Not Drive on Job (MNDOJ)

LEVELS OF PREDICTOR VARIABLE code		No. of cases	Natural log of miles driven 30 days Mean	Natural log of miles driven 30 days Std. Dev.	Miles driven 30 days Mean	Miles driven 30 days Std. Dev.	Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles)
0	0%	1159	6.223	1.268	839	790	0.339	11.2
1	1-25%	632	6.578	0.993	1086	1100	0.420	10.7
2	26-50%	406	6.549	0.943	1016	997	0.424	11.6
3	51-75%	105	6.446	0.845	880	823	0.540	17.1
4	76-99%	121	6.477	0.964	952	793	0.593	17.3*
5	100%	73	6.106	1.233	719	628	0.750*	29.0*
	TOTAL	2496	6.384	1.134	934	916	0.384	11.4

*n=less than 25

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(5,2490)= 11.411

SIGNIFICANT AT ALPHA .01

TABLE 44

PERCENT DRIVING ON WET ROADS VS. DEPENDENT VARIABLES

Subgroup: Females Not Drive On Job (FNDOJ)

LEVELS OF PREDICTOR VARIABLE code		No. of cases	Natural log of miles driven 30 days Mean	Std. Dev.	Miles driven 30 days Mean	Std. Devs	Mean no. of self reported accidents in the last 3 yrs	Accident rat (no. acc. pe million mile
0	0%	1226	5.296	1.290	379	459	0.200	14.7
1	1-25%	493	5.745	1.063	511	534	0.269	14.6
2	26-50%	294	5.627	1.096	462	506	0.251	15.1
3	51-75%	57	5.923	0.927	559	566	0.267	13.1
4	76-99%	76	5.696	0.965	440	363	0.167*	10.5*
5	100%	93	5.037	1.187	291	344	0.045*	4.3*
	TOTALS	2279	5.454	1.217	421	482	0.221	14.6

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(5,2273)= 16.056

SIGNIFICANT AT ALPHA .01

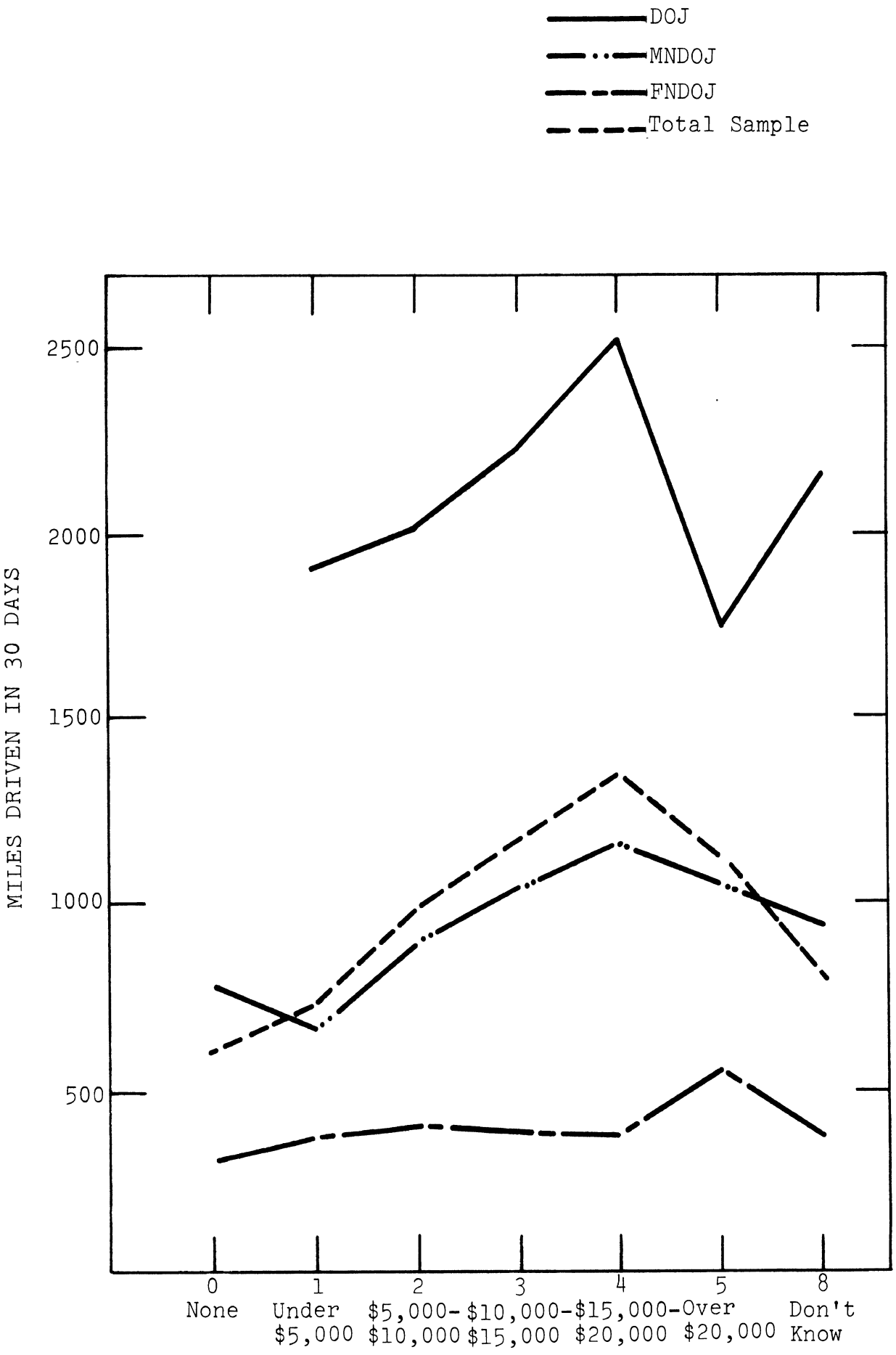

DOJ
MNDOJ
FNDOJ
Total Sample
MILES DRIVEN IN 30 DAYS
2500
2000
1500
1000
500
0
None
1
Under $5,000
2
$5,000-$10,000
3
$10,000-$15,000
4
$15,000-$20,000
5
Over $20,000
8
Don't Know
INCOME

Figure 40

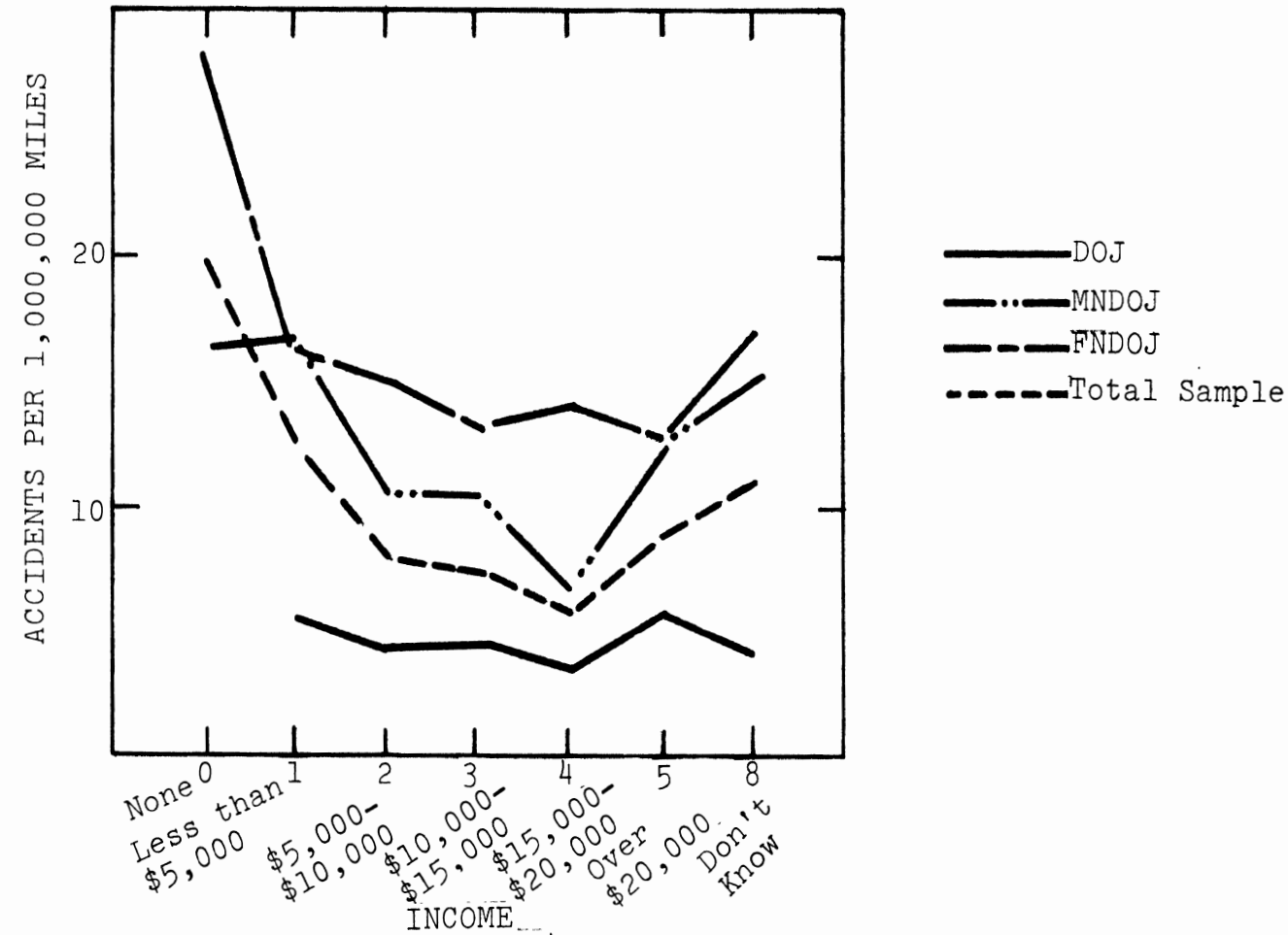


Figure 41

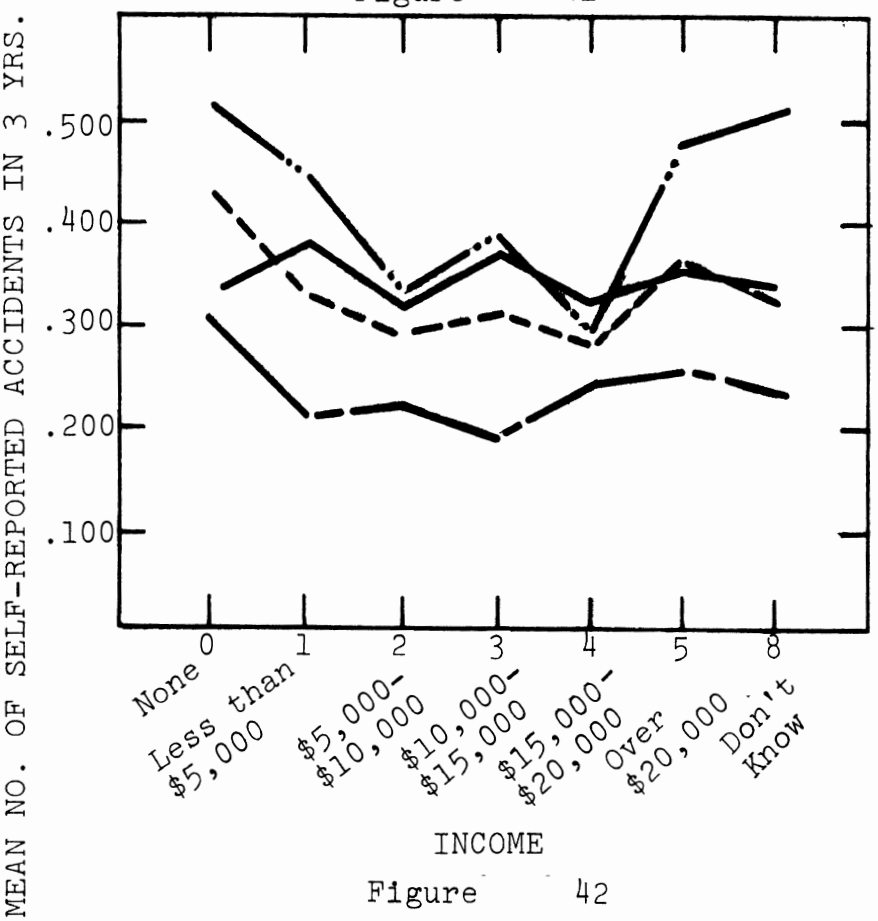


Figure 42

TABLE 45

INCOME VS. DEPENDENT VARIABLES

Total Sample

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
0	0	116	5.564	1.685	603	713	0.432	19.9
1	Less than $5000	966	5.658	1.678	735	1277	0.332	12.6
2	$5000-$10,000	2288	6.159	1.452	989	1393	0.290	8.2
3	$10,000-$15,000	1610	6.390	1.349	1165	1526	0.310	7.4
4	$15,000-$20,000	641	6.531	1.419	1352	1849	0.282	5.8
5	Over $20,000	403	6.507	1.310	1133	1204	0.367	9.0
8	Don't know	278	5.683	1.717	806	1318	0.325	11.2
	TOTALS	6302	6.170	1.499	1026	1452	0.310	8.4

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(6,6295)= 43.938

SIGNIFICANT AT ALPHA <.01

TABLE 46

INCOME VS. DEPENDENT VARIABLES

Subgroup: Drive On Job (DOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
0	0	2	5.756	1.628	550	636	0.333	16.8
1	Less than $5000	153	6.888	1.412	1912	2476	0.381	5.5
2	$5000-$10,000	545	7.177	1.004	2017	2214	0.319	4.4
3	$10,000-$15,000	462	7.337	0.972	2230	2212	0.364	4.5
4	$15,000-$20,000	203	7.444	1.008	2525	2699	2.324	3.6
5	Over $20,000	130	7.182	0.779	1755	1660	0.357	5.7
8	Don't know	43	7.188	1.101	2164	2166	0.333	4.3
	TOTALS	1538	7.230	1.040	2118	2274	0.343	4.5

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(6,1531)= 6.086

SIGNIFICANT AT ALPHA <.01

TABLE 47

INCOME VS. DEPENDENT VARIABLES

Subgroup: Males Not Drive on Job (MNDOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days Mean	Natural log of miles driven 30 days Std. Dev.	Miles driven 30 days Mean	Miles driven 30 days Std. Dev.	Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles)
0	0	72	5.914	1.661	779	816	0.515	18.4
1	Less than $5000.	398	5.722	1.643	659	840	0.441	18.6
2	$5000-$10,000	938	6.295	1.264	892	877	0.336	10.5
3	$10,000-$15,000	613	6.567	1.028	1036	930	0.386	10.4
4	$15,000-$20,000	213	6.651	1.142	1151	995	0.286	6.9
5	Over $20,000	154	6.484	1.408	1055	832	0.472	12.4
8	Don't know	76	6.281	1.144	935	1304	0.511	15.2
	TOTAL	2464	6.301	1.323	921	917	0.382	11.5

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(6,2457)= 21.917

SIGNIFICANT AT ALPHA <.01

TABLE 48

INCOME VS. DEPENDENT VARIABLES

Subgroup: Females Not Drive On Job (FNDOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days Mean	Natural log of miles driven 30 days Std. Dev.	Miles driven 30 days Mean	Miles driven 30 days Std. Devs	Mean no. of self reported accidents in the last 3 yrs	Accident ra (no. acc. p million mil
0	0	42	4.954	1.588	304	344	0.310	28.3
1	Less than $5000	415	5.145	1.550	375	474	0.216	16.0
2	$5000-$10,000	805	5.316	1.416	407	490	0.221	15.1
3	$1,000-$15,000	535	5.373	1.256	393	450	0.188	13.3
4	$15,000-$20,000	225	5.593	1.395	483	465	0.242	13.9
5	Over $20,000	119	5.798	1.269	555	503	0.254	12.7
8	Don't know	159	4.490	1.718	378	547	0.234	17.2
	TOTALS	2300	5.321	1.434	409	480	0.219	14.9

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(6,2293)= 6.680

SIGNIFICANT AT ALPHA <.01

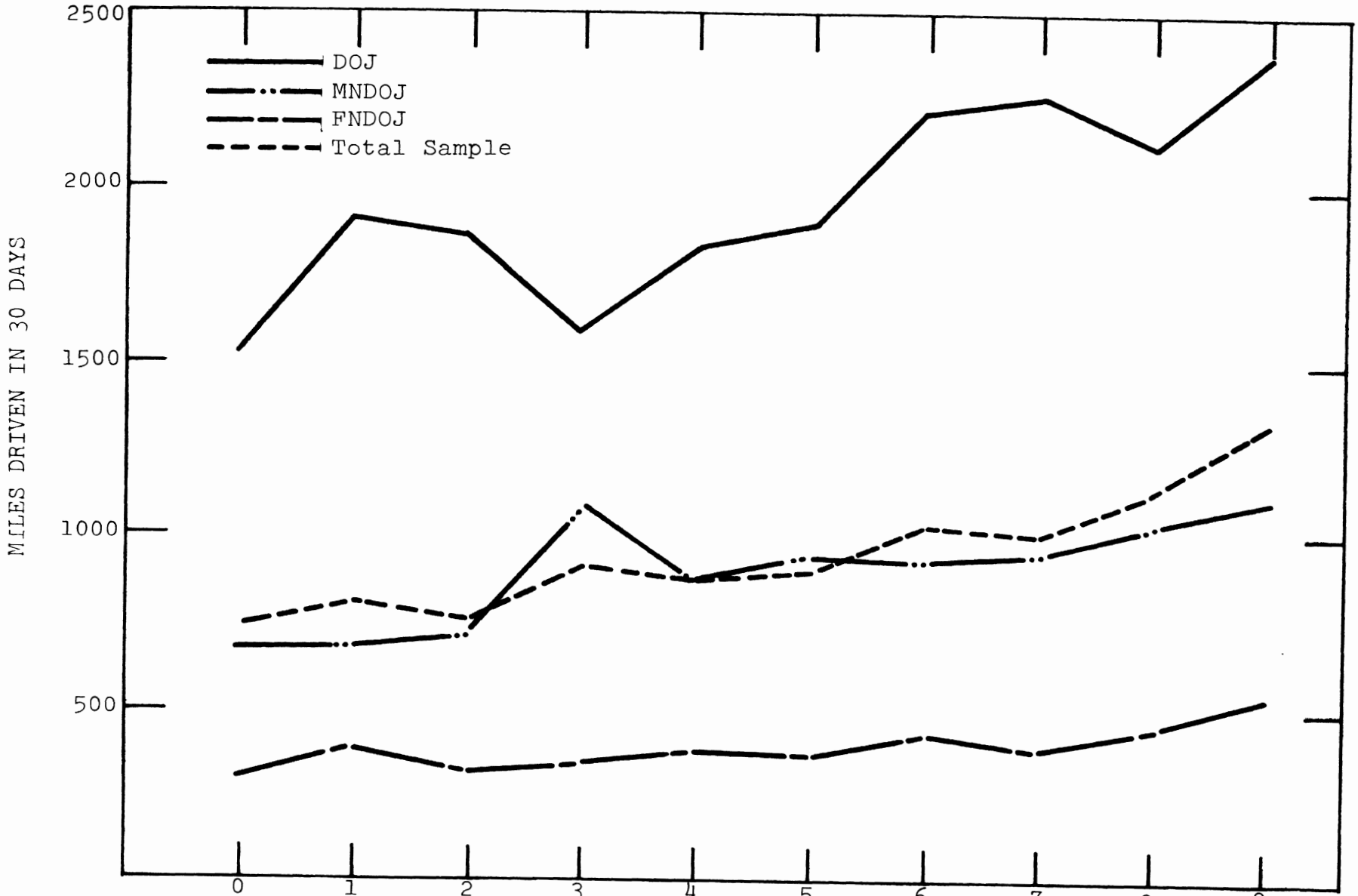

2500
2000
1500
1000
500
DOJ
MNDOJ
FNDOJ
Total Sample
MILES DRIVEN IN 30 DAYS
0
1960
1
61
2
62
3
63
4
64
5
1965
6
66
7
67
8
68
9
69+70
MODEL YEAR VEHICLE

Figure 43

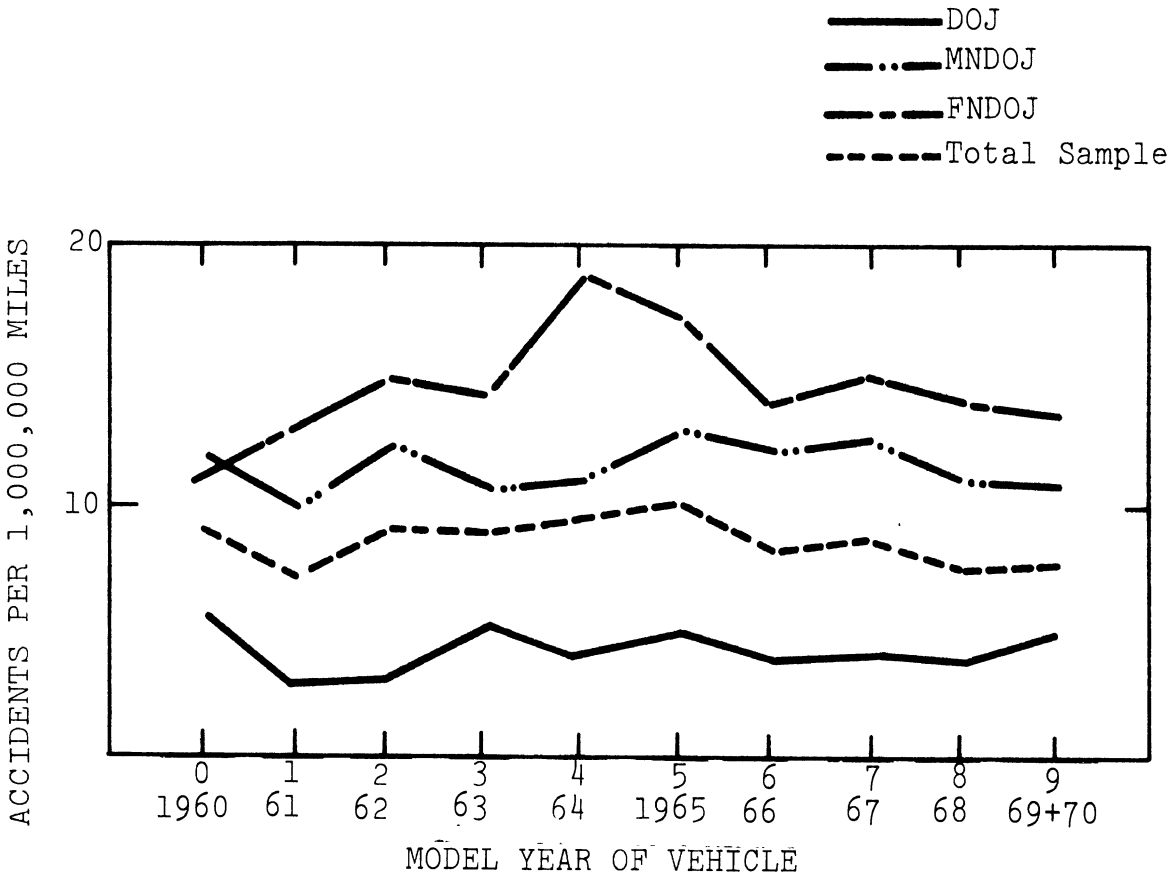


Figure 44

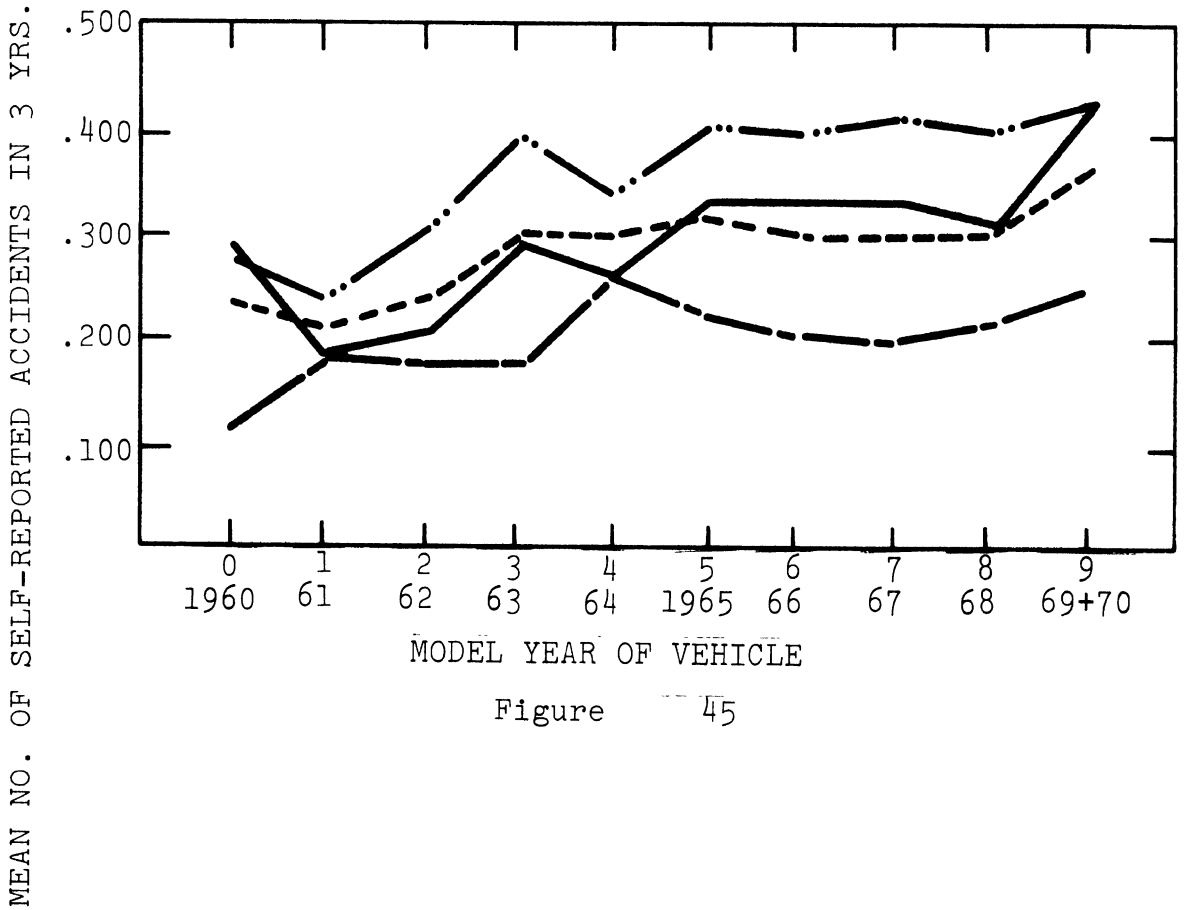


Figure 45

TABLE 49

MODEL YEAR OF VEHICLE VS. DEPENDENT VARIABLES

Total Sample

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
0	1960 or older	571	5.851	1.467	733	939	0.234	8.9
1	1961	186	5.954	1.321	805	1239	0.210	7.3
2	1962	337	5.878	1.378	747	1262	0.241	9.0
3	1963	457	6.100	1.390	908	1246	0.294	9.0
4	1964	508	6.054	1.400	871	1269	0.294	9.4
5	1965	670	6.102	1.307	897	1440	0.326	10.1
6	1966	717	6.228	1.362	1029	1483	0.312	8.4
7	1967	727	6.161	1.424	999	1425	0.314	8.7
8	1968	867	6.367	1.316	1131	1540	0.311	7.6
9+up	1969+1970	710	6.560		1332		0.374	7.8
	TOTALS	6459	6.217	1.385	1024	1435	0.310	8.4

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(10,6448)= 19.908

SIGNIFICANT AT ALPHA < .01

TABLE 50

MODEL YEAR OF VEHICLE VS. DEPENDENT VARIABLES

Subgroup: Drive On Job (DOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles
			Mean	Std. Dev.	Mean	Std. Dev.		
0	1960 or older	114	6.760	1.411	1523	1495	0.299	5.5
1	1961	35	6.850	1.301	1913	2324	0.194	2.8
2	1962	56	7.078	0.896	1865	2525	0.207	3.1
3	1963	93	7.002	0.887	1586	1769	0.295	5.2
4	1964	99	7.015	1.089	1828	2197	0.268	4.1
5	1965	133	7.082	0.991	1891	2617	0.333	4.9
6	1966	161	7.293	0.947	2234	2479	0.333	4.1
7	1967	152	7.341	0.952	2267	2293	0.332	4.1
8	1968	236	7.345	0.852	2221	234	0.311	3.9
9 + up	1969-1970	464	7.455		2388		0.427	5.0
	TOTALS	1543	7.244	0.985	2114	2260	0.340	4.5

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(10,1532)= 8.061

SIGNIFICANT AT ALPHA <.01

TABLE 51

MODEL YEAR OF VEHICLE VS. DEPENDENT VARIABLES

Subgroup: Males Not Drive on Job (MNDOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
0	1960 or older	294	5.956	1.262	666	653	0.280	11.7
1	1961	85	6.140	1.025	674	530	0.241	9.9
2	1962	149	6.035	1.278	704	714	0.311	12.3
3	1963	191	6.480	1.128	1081	1235	0.409	10.5
4	1964	219	6.293	1.191	862	871	0.342	11.0
5	1965	267	6.379	1.174	939	926	0.432	12.8
6	1966	279	6.419	1.117	933	825	0.410	12.2
7	1967	286	6.350	1.254	947	964	0.428	12.6
8	1968	298	6.550	1.079	1034	886	0.414	11.1
9	+ up 1969+1970	482	6.611		1104		0.438	11.0
	TOTAL	2550	6.367	1.171	932	916	0.386	11.5

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(10,2539) = 8.902

SIGNIFICANT AT ALPHA < .01

TABLE 52

MODEL YEAR OF VEHICLE VS. DEPENDENT VARIABLES

Subgroup: Females Not Drive On Job (FNDOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days Mean	Natural log of miles driven 30 days Std. Dev.	Miles driven 30 days Mean	Miles driven 30 days Std. Devs	Mean no. of self reported accidents in the last 3 yrs	Accident rat (no. acc. pe million mile
0	1960 and older	163	5.025	1.418	300	376	0.120	11.1
1	1961	66	5.239	1.315	387	566	0.182	13.1
2	1962	132	5.192	1.254	322	342	0.178	15.4
3	1963	173	5.194	1.369	352	406	0.180	14.2
4	1964	190	5.278	1.361	382	473	0.259	18.8
5	1965	270	5.344	1.130	366	419	0.228	17.3
6	1966	277	5.419	1.295	425	483	0.211	13.8
7	1967	289	5.354	1.285	384	456	0.206	14.9
8	1968	333	5.512	1.227	445	522	0.225	14.0
9 + up	1969+1970	473	5.636		528		0.260	13.7
	TOTALS	2366	5.386	1.312	412	479	0.216	14.6

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(10,2355)= 4.379

SIGNIFICANT AT ALPHA <.01

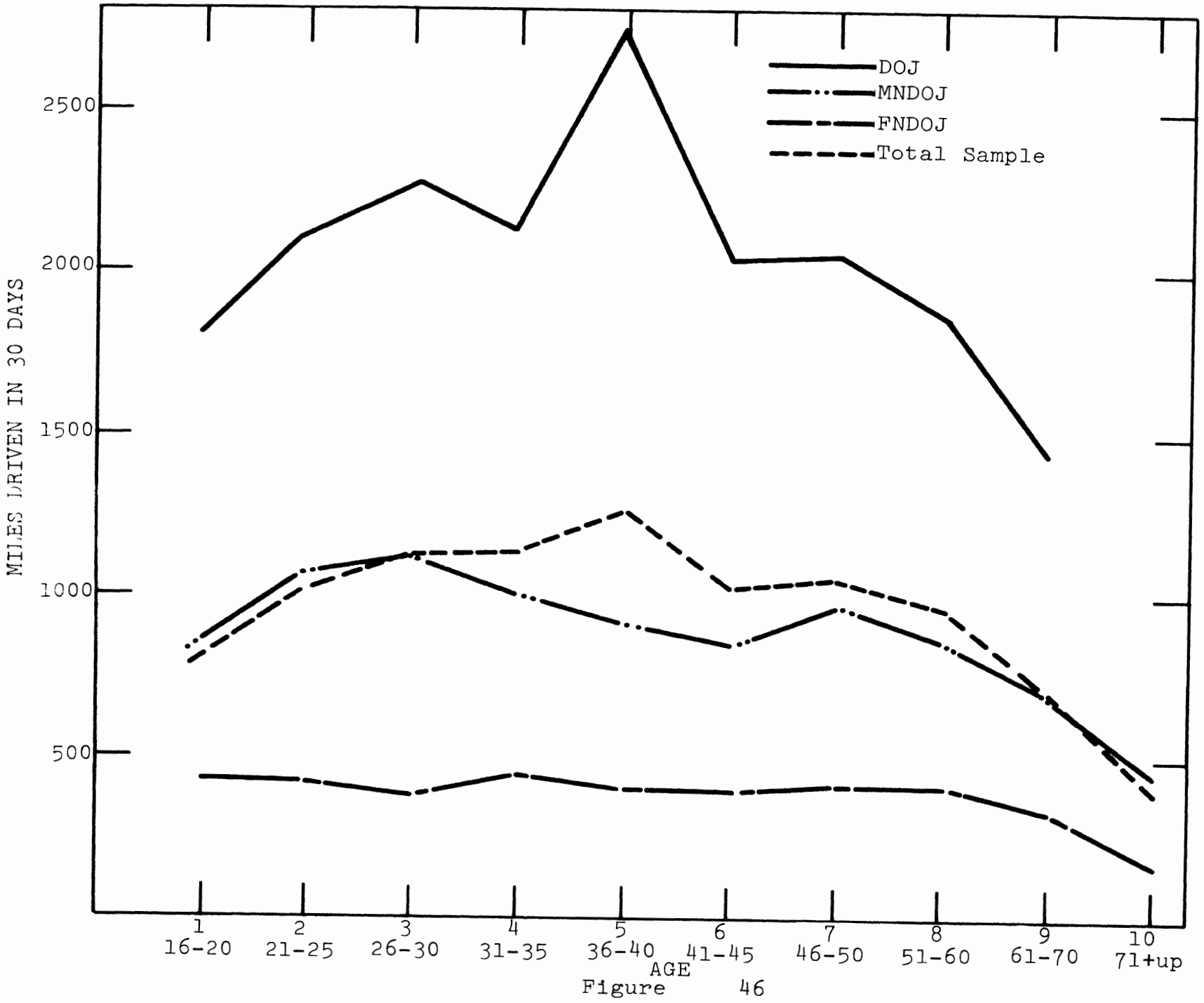

DOJ
MNDOJ
FNDOJ
Total Sample
MILES DRIVEN IN 30 DAYS
2500
2000
1500
1000
500
1
16-20
2
21-25
3
26-30
4
31-35
5
36-40
6
41-45
7
46-50
8
51-60
9
61-70
10
71+up
AGE

Figure 46

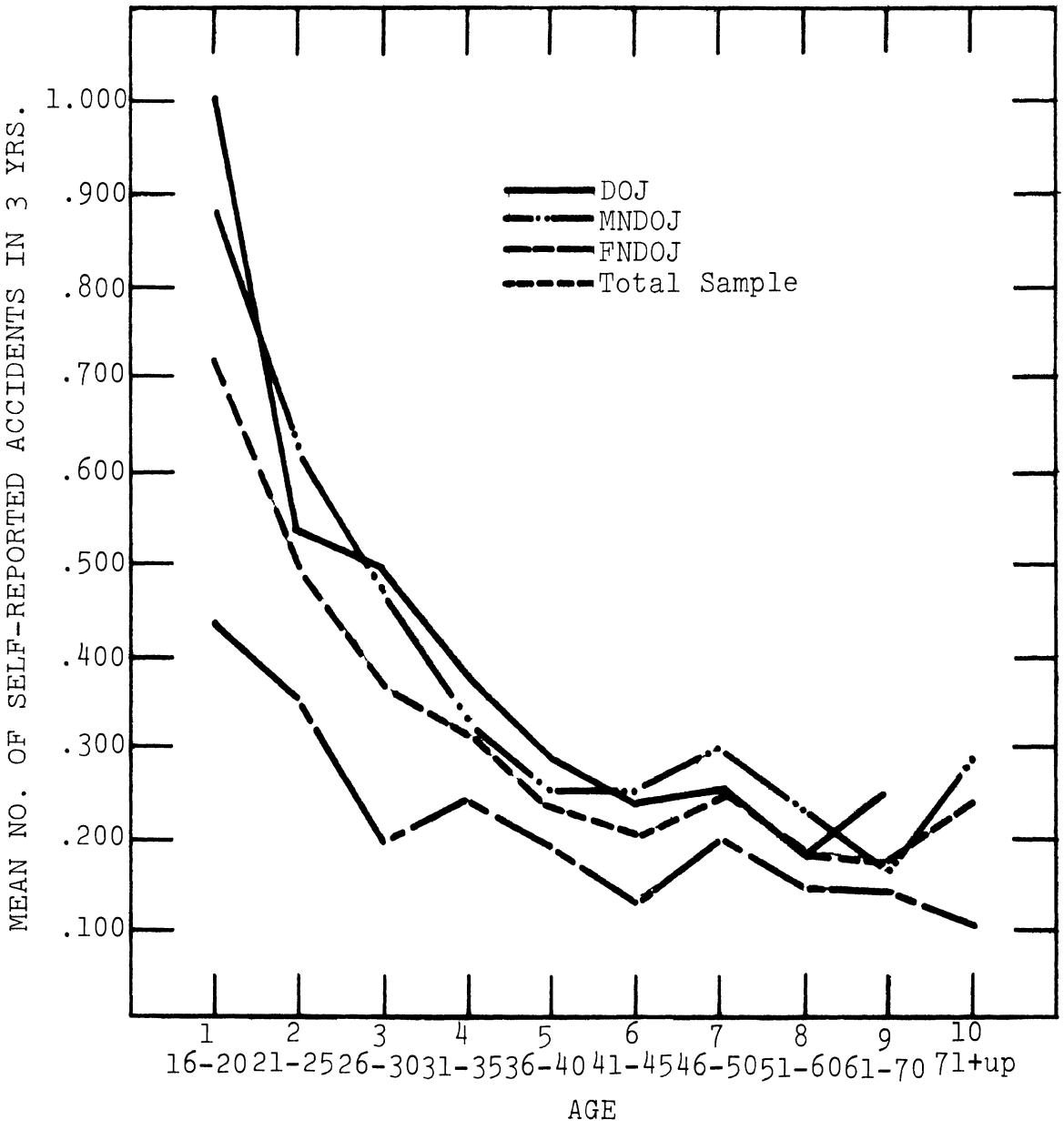

MEAN NO. OF SELF-REPORTED ACCIDENTS IN 3 YRS.
1.000
.900
.800
.700
.600
.500
.400
.300
.200
.100
DOJ
MNDOJ
FNDOJ
Total Sample
1
2
3
4
5
6
7
8
9
10
16-20
21-25
26-30
31-35
36-40
41-45
46-50
51-60
61-70
71+up
AGE

Figure 47

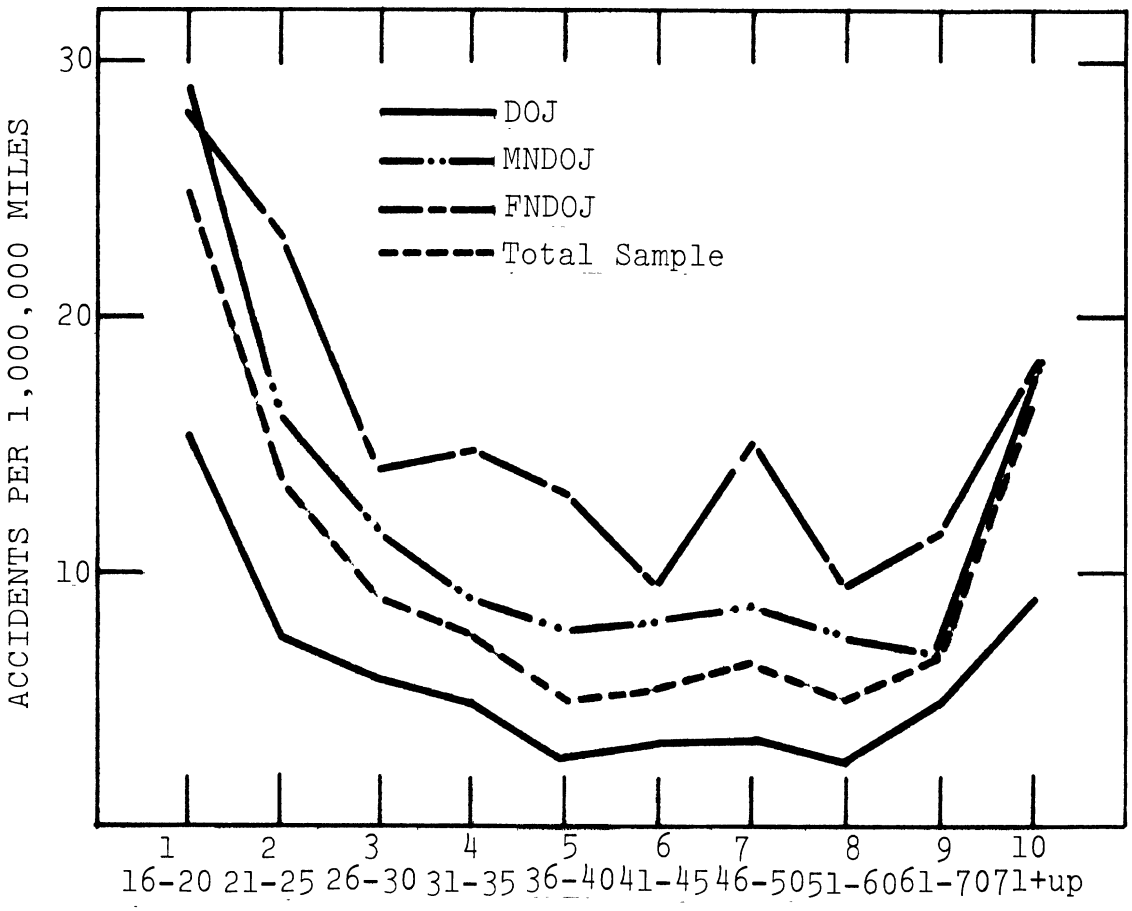

30
20
10
ACCIDENTS PER 1,000,000 MILES
DOJ
MNDOJ
FNDOJ
Total Sample
1
2
3
4
5
6
7
8
9
10
16-20
21-25
26-30
31-35
36-40
41-45
46-50
51-60
61-70
71+up
AGE

Figure 48

TABLE 53

DRIVER AGE VS. DEPENDENT VARIABLES

Total Sample

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles
			Mean	Std. Dev.	Mean	Std. Dev.		
1	16-20 years	441	5.941	1.409	796	1146	0.720	25.1
2	21-25	899	6.058	1.675	1007	1497	0.496	13.7
3	26-30	822	6.266	1.498	1125	1588	0.364	9.0
4	31-35	713	6.317	1.441	1136	1501	0.310	7.6
5	36-40	665	6.362	1.424	1263	1939	0.237	5.2
6	41-45	706	6.273	1.347	1022	1245	0.202	5.5
7	46-50	641	6.252	1.417	1054	1400	0.246	6.5
8	51-60	947	6.155	1.464	966	1315	0.182	5.2
9	61-70	533	5.804	1.570	706	897	0.173	6.8
10	70 and up	151	5.189	1.554	402	570	0.236	16.3
	TOTALS	6518	6.151	1.499	1010	1435	0.310	8.5

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(9,6508)= 15.533

SIGNIFICANT AT ALPHA <.01

TABLE 54

DRIVER AGE VS. DEPENDENT VARIABLES

Subgroup: Drive On Job (DOJ)

ode	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
1	16-20 years	48	7.037	0.980	1798	2055	1.000	15.5
2	21-25	159	7.120	1.215	2115	2797	0.538	7.5
3	26-30	197	7.342	0.907	2290	2474	0.487	5.9
4	31-35	205	7.262	1.066	2137	2173	0.378	4.9
5	36-40	196	7.517	0.904	2740	2918	0.285	2.9
6	41-45	204	7.278	0.908	2051	1727	0.241	3.3
7	46-50	177	7.210	1.099	2065	2052	0.253	3.4
8	51-60	258	7.101	1.073	1880	1994	0.177	2.6
9	61-70	93	6.866	1.144	1436	1352	0.247	4.8
0	71 and up	7	6.932	0.953	1386	955	0.444	8.9
	TOTALS	1544	7.227	1.041	2112	2270	0.340	4.5

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(9,1534)= 4.199

SIGNIFICANT AT ALPHA <.01

TABLE 55

DRIVER AGE VS. DEPENDENT VARIABLES

Subgroup: Males Not Drive on Job (MNDOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs.	Accident rat (no. acc. pe million mile
			Mean	Std. Dev.	Mean	Std. Dev.		
1	16-20 years	228	6.141	1.291	849	1076	0.883	28.9
2	21-25	395	6.415	1.494	1069	953	0.619	16.1
3	26-30	321	6.564	1.213	1116	1083	0.465	11.6
4	31-35	261	6.395	1.287	1005	978	0.330	9.1
5	36-40	227	6.342	1.235	904	843	0.249	7.7
6	41-45	234	6.372	1.061	842	707	0.248	8.2
7	46-50	207	6.463	1.184	975	902	0.300	8.6
8	51-60	333	6.310	1.204	846	743	0.229	7.5
9	61-70	263	5.881	1.512	694	786	0.169	6.8
10	71 and up	96	5.454	1.360	446	582	0.287	17.9
	TOTAL	2565	6.296	1.320	915	911	0.386	11.7

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(9,2555)= 10.392

SIGNIFICANT AT ALPHA <.01

TABLE 56

DRIVER AGE VS. DEPENDENT VARIABLES

Subgroup: Females Not Drive On Job (FNDOJ)

Code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days Mean	Natural log of miles driven 30 days Std. Dev.	Miles driven 30 days Mean	Miles driven 30 days Std. Devs	Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles)
1	16-20 years	165	5.347	1.410	432	530	0.438	28.2
2	21-25	345	5.162	1.613	424	552	0.352	23.1
3	26-30	304	5.255	1.454	380	434	0.193	14.1
4	31-35	247	5.449	1.344	444	508	0.238	14.9
5	36-40	242	5.445	1.253	403	407	0.190	13.1
6	41-45	268	5.421	1.291	396	400	0.134	9.4
7	46-50	257	5.421	1.304	421	484	0.198	13.1
8	51-60	356	5.325	1.465	418	540	0.145	9.6
9	61-70	177	5.133	1.520	342	377	0.143	11.6
10	70 and up	48	4.404	1.621	170	188	0.111	18.1
	TOTALS	2409	5.308	1.430	403	477	0.217	15.0

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(9,2399)= 3.803

SIGNIFICANT AT ALPHA <.01

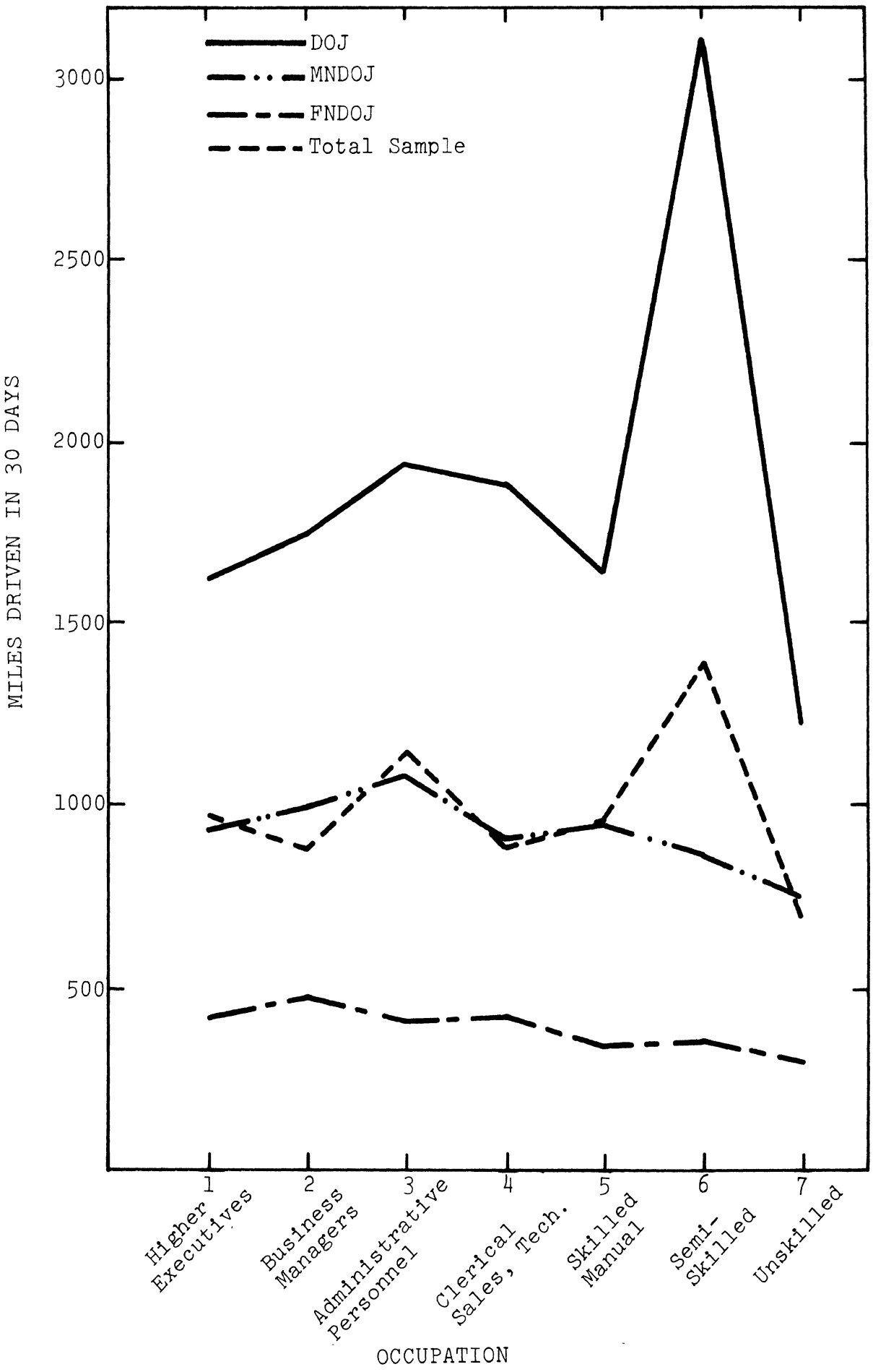
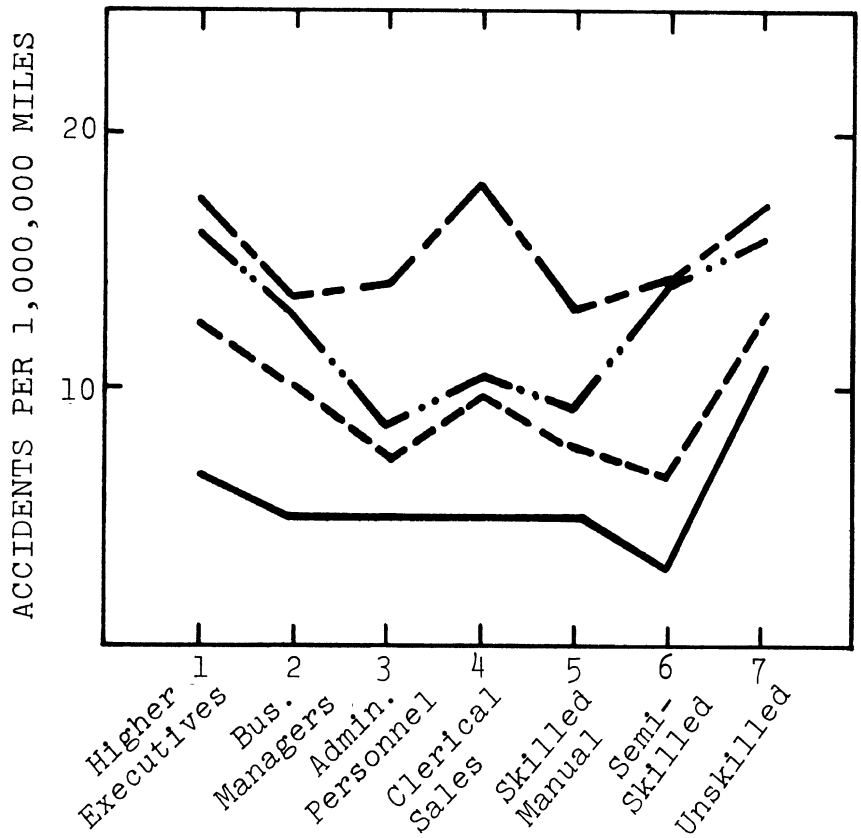
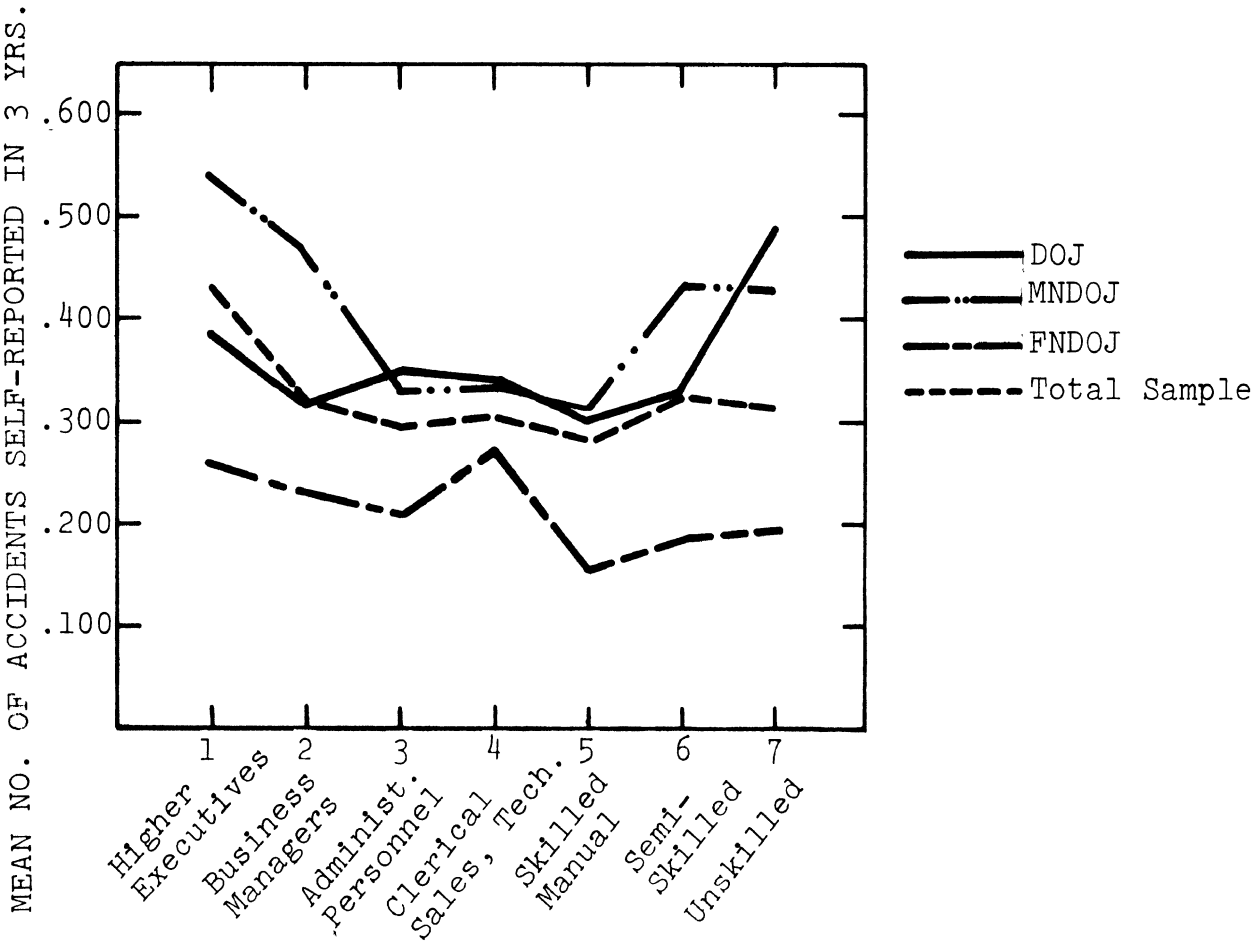

DOJ
MNDOJ
FNDOJ
Total Sample
MILES DRIVEN IN 30 DAYS
3000
2500
2000
1500
1000
500
1
2
3
4
5
6
7
Higher Executives
Business Managers
Administrative Personnel
Clerical Sales, Tech.
Skilled Manual
Semi-Skilled
Unskilled
OCCUPATION

Figure 49



OCCUPATION

Figure 50



OCCUPATION

Figure 51

TABLE 57

OCCUPATION VS. DEPENDENT VARIABLES

Total Sample

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
1	Higher executives,etc.	416	6.353	1.266	968	1038	0.433	12.4
2	Business managers,etc.	747	6.145	1.379	875	955	0.321	10.2
3	Administrative pers.	889	6.443	1.281	1145	1366	0.296	7.2
4	Clerical,sales,tech.	1374	6.059	1.484	882	1056	0.307	9.7
5	Skilled manual	1161	6.169	1.474	962	1202	0.266	7.7
6	Semi-skilled, machines	1247	6.257	1.696	1399	2275	0.327	6.5
7	Unskilled	388	5.752	1.572	681	889	0.315	12.9
8	Don't know	13	5.580	1.286	668	1330	0.333	13.9
	TOTALS	6235	6.184	1.489	1030	1447	0.312	8.4

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(7,6227)= 11.620

SIGNIFICANT AT ALPHA <.01

TABLE 58

OCCUPATION VS. DEPENDENT VARIABLES

Subgroup: Drive On Job (DOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
1	Higher executives,etc.	95	7.039	1.081	1626	1530	0.378	6.5
2	Business managers,etc.	133	7.188	0.808	1750	1341	0.319	5.1
3	Administrative pers.	288	7.276	0.804	1941	1801	0.349	5.0
4	Clerical, sales, tech.	300	7.219	0.886	1890	1524	0.343	5.0
5	Skilled manual	293	7.031	0.971	1643	1733	0.299	5.1
6	Semi-skilled, machines	373	7.486	1.294	3121	3370	0.336	3.0
7	Unskilled	46	6.579	1.346	1230	1216	0.488	11.0
	TOTALS	1528	7.226	1.041	2106	2258	0.338	4.5

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(6,1521)= 9.491

SIGNIFICANT AT ALPHA <.01

TABLE 59

OCCUPATION VS. DEPENDENT VARIABLES

Subgroup: Males Not Drive on Job (MNDOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles
			Mean	Std. Dev.	Mean	Std. Dev.		
1	Higher executives,etc.	219	6.475	1.110	938	773	0.540	16.0
2	Business managers,etc.	247	6.421	1.315	992	882	0.468	13.1
3	Administrative pers.	314	6.571	1.104	1085	1027	0.333	8.5
4	Clerical, sales,tech.	380	6.319	1.351	910	801	0.336	10.3
5	Skilled manual	554	6.342	1.307	950	914	0.314	9.2
6	Semi-skilled, machines	522	6.162	1.410	868	996	0.434	13.9
7	Unskilled	219	5.986	1.429	759	937	0.432	15.8
8	Don't know	8	5.965	1.447	974	1656	0.333	9.5
	TOTAL	2463	6.316	1.318	930	924	0.382	11.4

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(7,2455)= 5.525

SIGNIFICANT AT ALPHA <.01

TABLE 60

OCCUPATION VS. DEPENDENT VARIABLES

Subgroup: Females Not Drive On Job (FNDOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days Mean	Std. Dev.	Miles driven 30 days Mean	Std. Devs	Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles)
1	Higher executives, etc.	102	5.454	1.245	419	495	0.260	17.2
2	Business managers, etc.	367	5.583	1.309	479	493	0.233	13.5
3	Administrative pers.	288	5.472	1.193	412	448	0.209	14.1
4	Clerical, sales, tech.	693	5.415	1.406	430	461	0.277	17.9
5	Skilled manual	314	5.061	1.464	346	506	0.160	12.9
6	Semi-skilled, machine	352	5.099	1.575	363	467	0.185	14.2
7	Unskilled	123	5.025	1.622	310	315	0.192	17.2
8	Don't know	5	4.964	0.728	178	135	0.333	52.0
	TOTALS	2244	5.330	1.418	406	469	0.224	15.3

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(7,2236)= 6.452

SIGNIFICANT AT ALPHA <.01

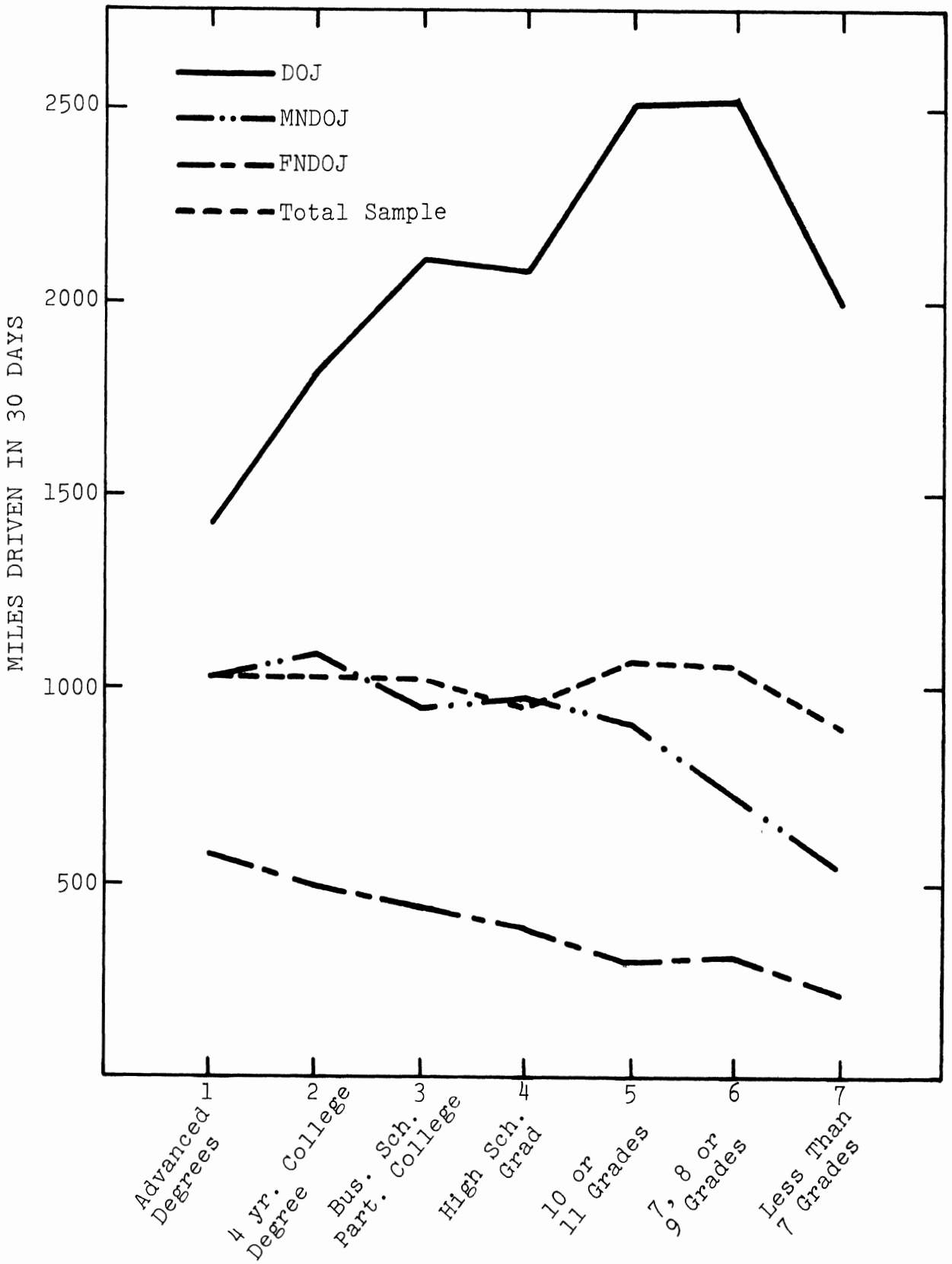

DOJ
MNDOJ
FNDOJ
Total Sample
2500
2000
1500
1000
500
MILES DRIVEN IN 30 DAYS
1
2
3
4
5
6
7
Advanced Degrees
4 yr. College Degree
Bus. Sch. Part. College
High Sch. Grad
10 or 11 Grades
7, 8 or 9 Grades
Less Than 7 Grades
EDUCATION LEVEL

Figure 52

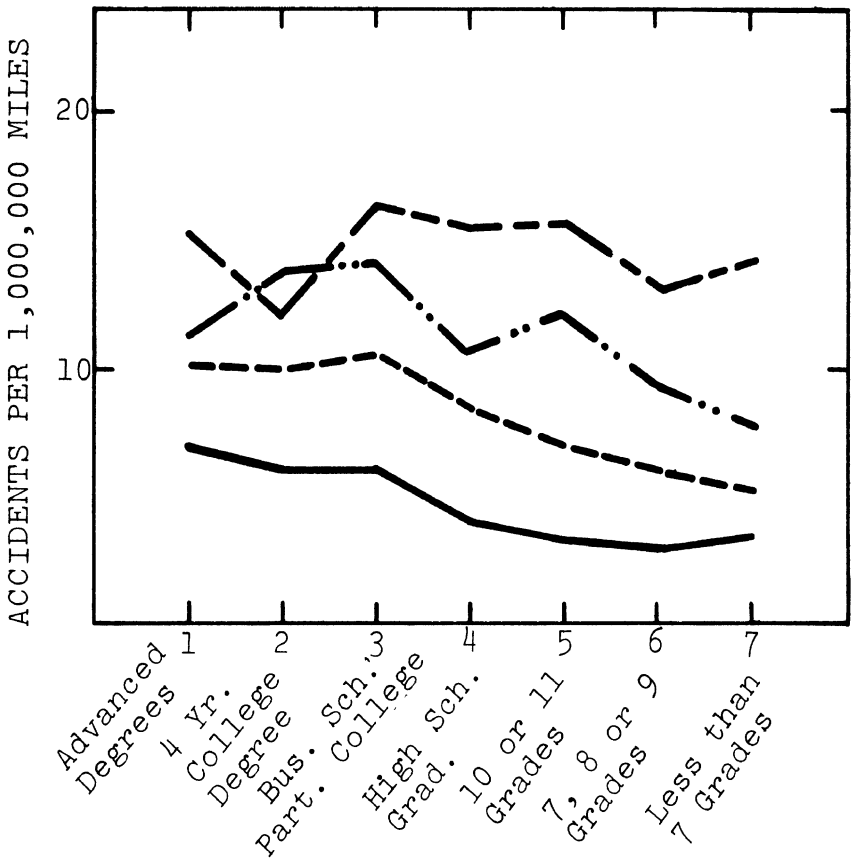


Figure 53

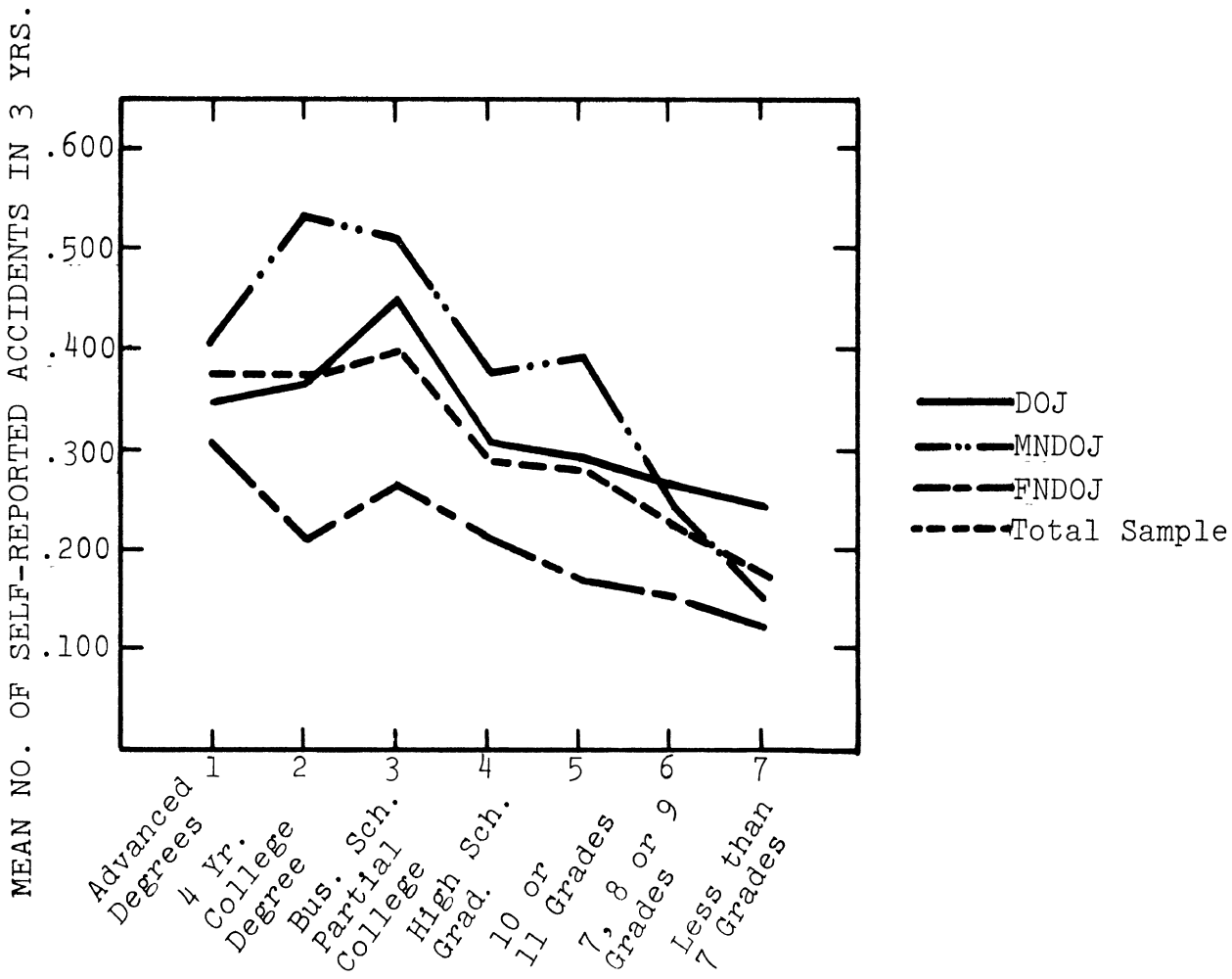


Figure 54

TABLE 61

EDUCATIONAL LEVEL VS. DEPENDENT VARIABLES

Total Sample

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days Mean	Natural log of miles driven 30 days Std. Dev.	Miles driven 30 days Mean	Miles driven 30 days Std. Dev.	Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles
1	Advanced degree(s)	359	6.436	1.293	1036	977	0.372	10.0
2	4 year college degree	599	6.441	1.210	1039	1050	0.369	9.9
3	Bus./trade school	1575	6.277	1.415	1035	1270	0.396	10.6
4	High school graduate	2254	6.079	1.516	965	1418	0.290	8.4
5	10 or 11 grades	752	6.009	1.640	1076	1780	0.280	7.2
6	7, 8 or 9 grades	714	6.042	1.640	1067	1843	0.225	5.9
7	Less than 7 grades	306	5.868	1.636	916	1419	0.176	5.3
8	Don't know	3	6.738	0.753	1033	839	0.250	6.7
	TOTALS	6562	6.158	1.498	1014	1435	0.312	8.6

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(7,6554)= 10.612

SIGNIFICANT AT ALPHA ≤.01

TABLE 62

EDUCATIONAL LEVEL VS. DEPENDENT VARIABLES

Subgroup: Drive On Job (DOJ)

ode	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
1	Advanced degree(s)	96	6.942	0.932	1421	1023	0.348	6.8
2	4 year college degree	152	7.121	0.992	1708	1410	0.362	5.9
3	Bus./trade school	378	7.353	0.789	2109	1910	0.452	6.0
4	High school graduate	482	7.257	0.953	2091	2305	0.315	4.2
5	10 or 11 grades	185	7.280	1.231	2525	2799	0.296	3.3
6	7, 8 or 9 grades	176	7.192	1.342	2530	3113	0.270	3.0
7	Less than 7 grades	90	7.017	1.357	2003	2077	0.245	3.4
8	Don't know	1	7.601	0.0	2000	0	0.0	0
	TOTALS	1559	7.229	1.039	2113	2264	0.341	4.48

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(6,1552)= 3.219

SIGNIFICANT AT ALPHA <.01

TABLE 63

EDUCATIONAL LEVEL VS. DEPENDENT VARIABLES

Subgroup: Males Not Drive on Job (MNDOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles
			Mean	Std. Dev.	Mean	Std. Dev.		
1	Advanced degrees(s)	183	6.467	1.346	1037	1002	0.413	11.1
2	4 year college degree	238	6.684	0.882	1087	862	0.532	13.6
3	Bus./trade school	585	6.366	1.388	949	796	0.508	14.9
4	High school graduate	800	6.348	1.309	979	1015	0.377	10.7
5	10 Or 11 grades	271	6.236	1.308	920	1102	0.394	11.9
6	7, 8 or 9 grades	348	6.071	1.344	730	696	0.248	9.4
7	Less than 7 grades	158	5.679	1.335	547	671	0.153	7.8
8	Don't know	2	6.306	0.129	550	71	0.333	16.8
	TOTAL	2585	6.301	1.320	920	916	0.390	11.8

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(7,2577)= 10.501

SIGNIFICANT AT ALPHA <.01

TABLE 64

EDUCATIONAL LEVEL VS. DEPENDENT VARIABLES

Subgroup: Females Not Drive On Job (FNDOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days Mean	Natural log of miles driven 30 days Std. Dev.	Miles driven 30 days Mean	Miles driven 30 days Std. Devs	Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles)
1	Advanced degree(s)	80	5.757	1.257	572	599	0.307	14.9
2	4 year college degree	209	5.671	1.270	498	506	0.211	11.8
3	Bus./trade school	612	5.531	1.274	454	491	0.264	16.2
4	High school graduate	972	5.276	1.437	395	481	0.216	15.2
5	10 or 11 grades	296	5.007	1.506	313	376	0.172	15.3
6	7, 8 or 9 grades	190	4.926	1.636	328	452	0.152	12.9
7	Less than 7 grades	58	4.602	1.648	237	298	0.129	15.1
	TOTALS	2417	5.314	1.431	405	477	0.217	14.9

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(6,2410)= 13.277

SIGNIFICANT AT ALPHA <.01

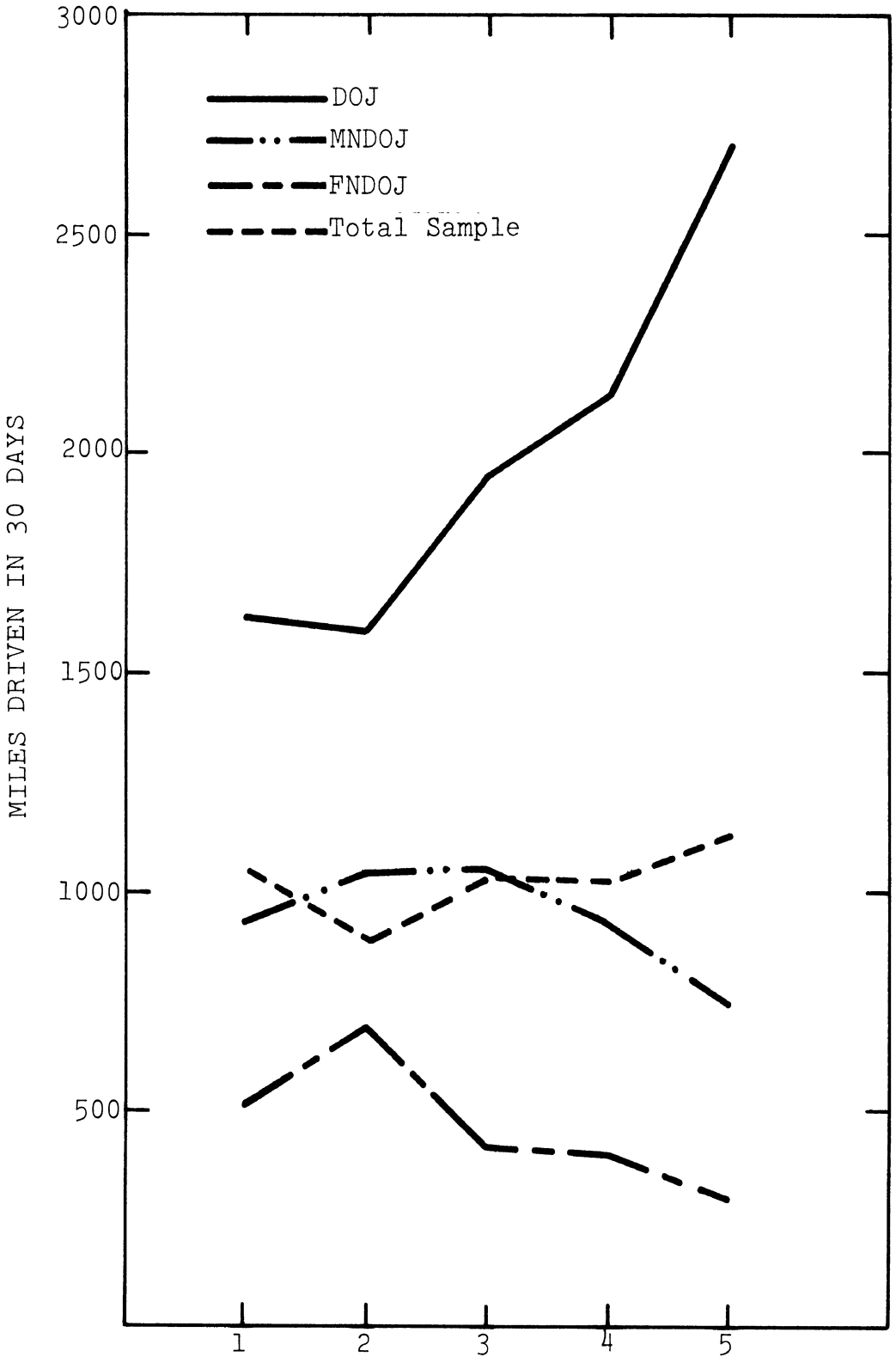

3000
2500
2000
1500
1000
500
DOJ
MNDOJ
FNDOJ
Total Sample
MILES DRIVEN IN 30 DAYS
1
2
3
4
5
HOLLINGSHEAD SCALE

Figure 55

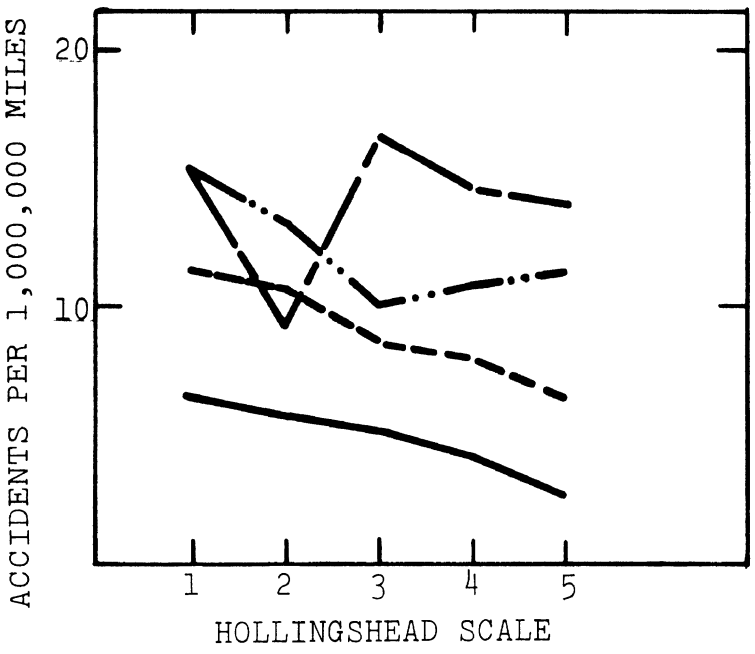


Figure 56

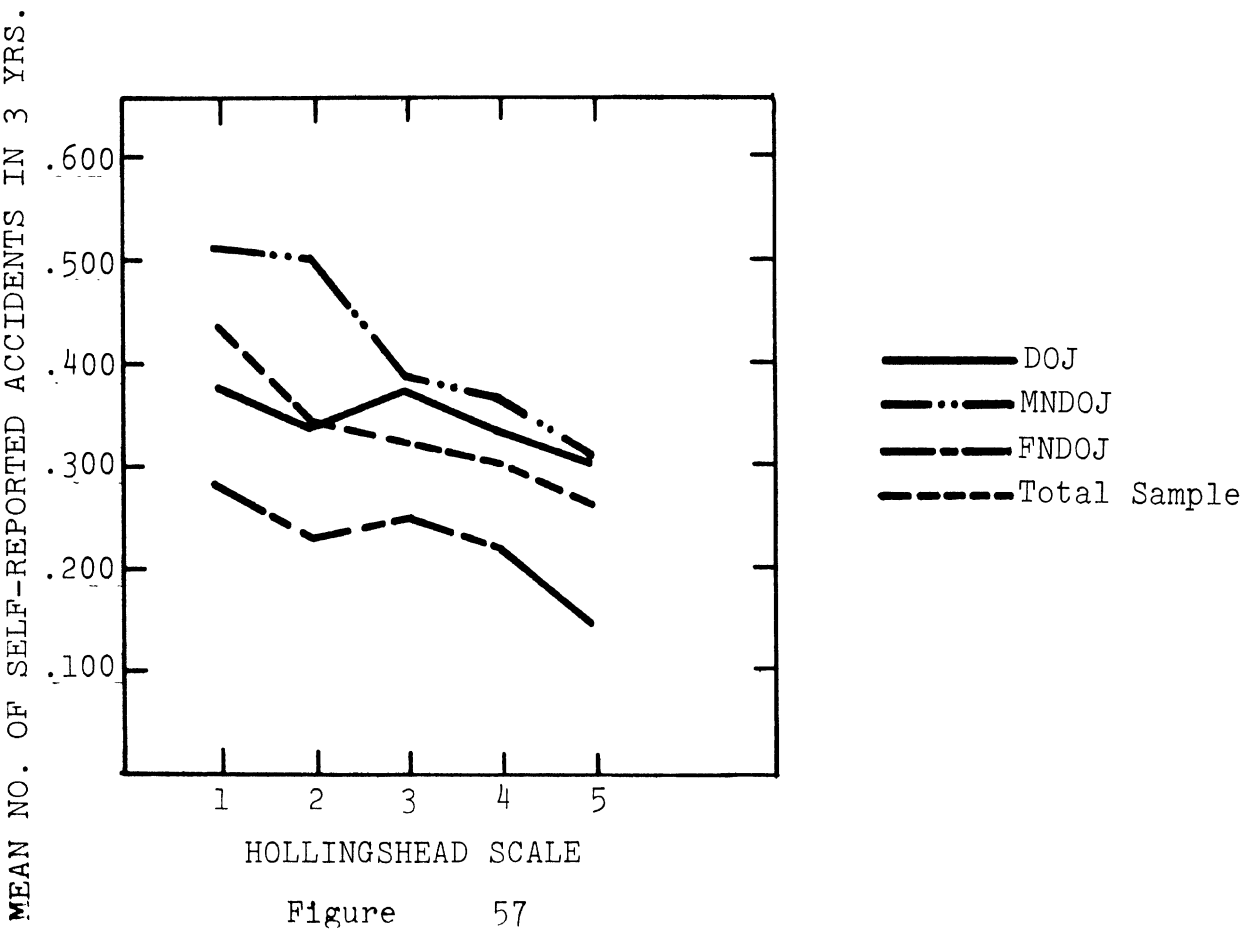


Figure 57

TABLE 65

SOCIO-ECONOMIC SCALE VS. DEPENDENT VARIABLES

Total Sample

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
1	Class I	305	6.502	1.159	1055	1107	0.437	11.5
2	Class II	747	6.205	1.358	886	887	0.341	10.7
3	Class III	1462	6.281	1.373	1033	1244	0.323	8.7
4	Class IV	2650	6.152	1.536	1030	1487	0.305	8.2
5	Class V	1048	6.029	1.672	1128	1934	0.262	6.5
	TOTALS	6212	6.185	1.490	1031	1448	0.312	8.4

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(4,6207)= 8.232

SIGNIFICANT AT ALPHA <.01

TABLE 68

SOCIO-ECONOMIC SCALE VS. DEPENDENT VARIABLES

Subgroup: Drive On Job (DOJ)

de	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
1	Class I	83	7.011	1.135	1627	1599	0.372	6.4
2	Class II	137	7.138	0.752	1593	1033	0.333	5.8
3	Class III	398	7.276	0.820	1945	1705	0.371	5.3
4	Class IV	639	7.239	1.001	2128	2377	0.333	4.4
5	Class V	270	7.230	1.446	2702	3056	0.301	3.1
	TOTALS	1527	7.225	1.042	2107	2259	0.339	4.5

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

NOT SIGNIFICANT

TABLE 67

SOCIO-ECONOMIC SCALE VS. DEPENDENT VARIABLES

Subgroup: Males Not Drive on Job (MNDOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles
			Mean	Std. Dev.	Mean	Std. Dev.		
1	Class I	173	6.491	1.060	934	762	0.513	15.3
2	Class II	261	6.480	1.329	1044	941	0.502	13.4
3	Class III	458	6.527	1.177	1055	969	0.387	10.2
4	Class IV	1064	6.302	1.382	934	900	0.366	10.9
5	Class V	493	6.014	1.328	748	940	0.308	11.4
	TOTAL	2449	6.318	1.320	931	922	0.383	11.4

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(4,2444)= 11.390

SIGNIFICANT AT ALPHA <.01

TABLE 68

SOCIO-ECONOMIC SCALE VS. DEPENDENT VARIABLES

Subgroup: Females Not Drive On Job (FNDOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days Mean	Natural log of miles driven 30 days Std. Dev.	Miles driven 30 days Mean	Miles driven 30 days Std. Devs	Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles)
1	Class I	49	5.676	1.064	510	631	0.279	15.2
2	Class II	349	5.633	1.296	690	487	0.232	9.3
3	Class III	606	5.445	1.281	417	437	0.250	16.7
4	Class IV	947	5.252	1.465	397	499	0.225	15.7
5	Class V	285	4.921	1.627	295	339	0.151	14.2
	TOTALS	2236	5.331	1.421	407	469	0.224	15.3

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(4,2231)= 12.567

SIGNIFICANT AT ALPHA <.01

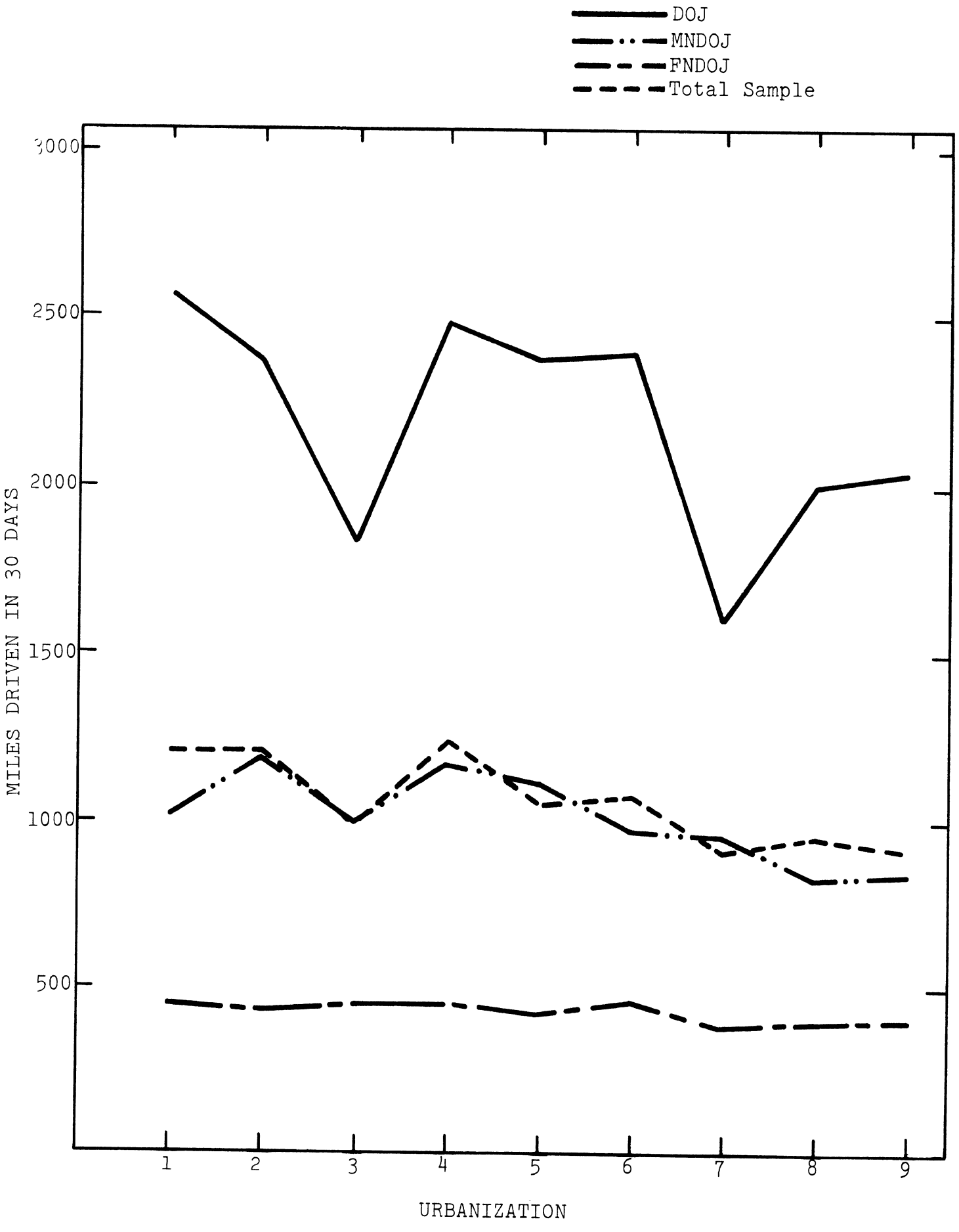

DOJ
MNDOJ
FNDOJ
Total Sample
3000
2500
2000
1500
1000
500
MILES DRIVEN IN 30 DAYS
1
2
3
4
5
6
7
8
9
URBANIZATION

Figure 58

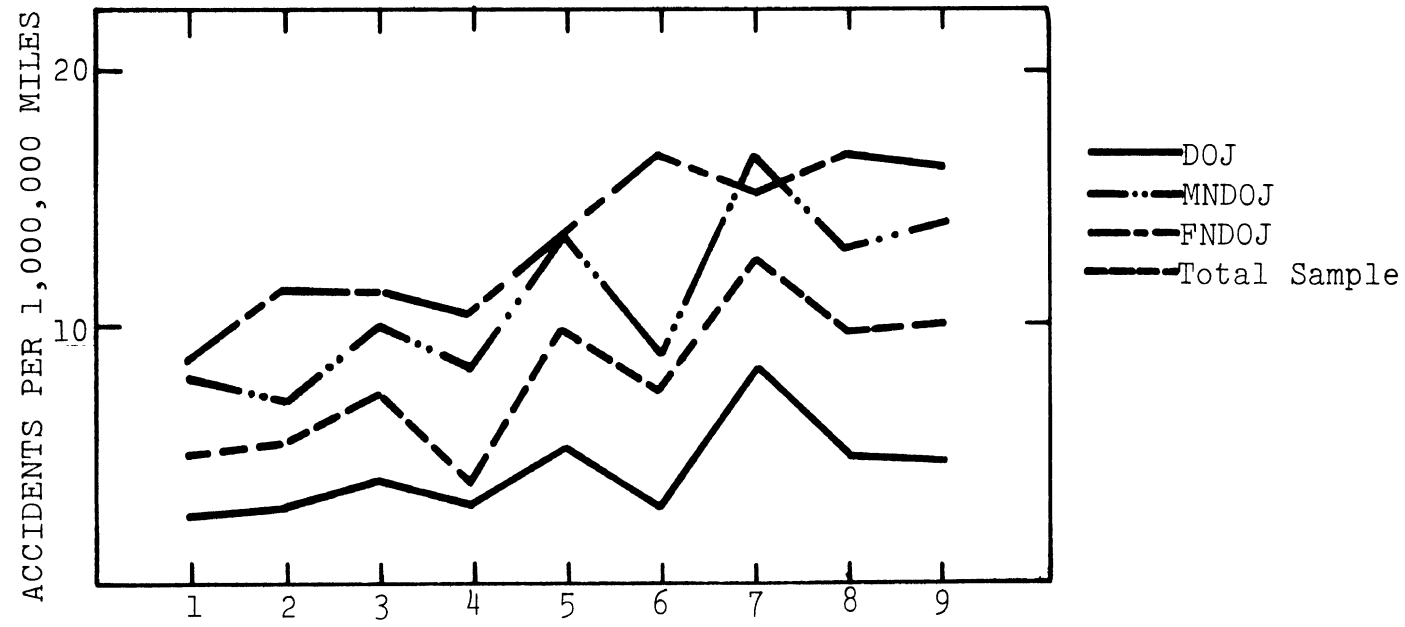


Figure 59

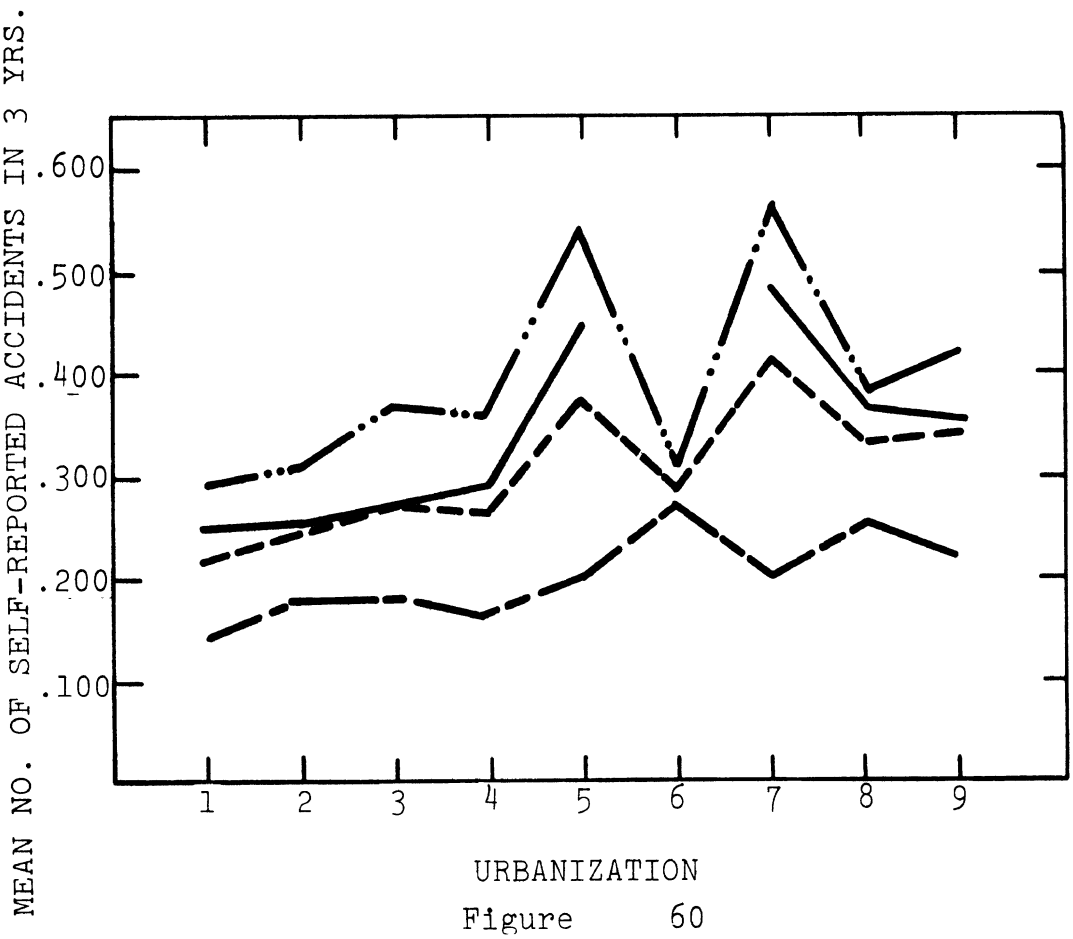


Figure 60

TABLE 69

URBANIZATION INDEX VS. DEPENDENT VARIABLES

Total Sample

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs.	Accident rat (no. acc. pe million mile
			Mean	Std. Dev.	Mean	Std. Dev.		
1	Level 1 *	935	6.330	1.504	1207	1680	0.220	5.1
2	Level 2	465	6.392	1.422	1217	1489	0.241	5.5
3	Level 3	229	6.164	1.494	991	1120	0.268	7.5
4	Level 4	311	6.352	1.472	1239	1829	0.265	4.0
5	Level 5	291	6.296	1.369	1046	1360	0.370	9.8
6	Level 6	84	6.312	1.363	1069	1516	0.287	7.5
7	Level 7	479	6.254	1.241	906	959	0.410	12.6
8	Level 8	2535	6.081	1.490	942	1376	0.329	9.7
9	Level 9	1226	5.958	1.617	907	1410	0.334	10.2
	TOTALS	6555	6.156	1.494	1012	1435	0.311	8.5

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(8,6546)= 7.946

SIGNIFICANT AT ALPHA <.01

* Urbanization index varies from Level 1 (lowest degree of urbanization) to Level 9 (highest degree of urbanization).

TABLE 70

URBANIZATION INDEX VS. DEPENDENT VARIABLES

Subgroup: Drive On Job (DOJ)

ode	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days Mean	Std. Dev.	Miles driven 30 days Mean	Std. Devs	Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles)
1	Level 1 *	241	7.424	1.079	2564	2536	0.247	2.7
2	Level 2	123	7.466	0.827	2366	1921	0.256	3.0
3	Level 3	58	7.148	0.978	1832	1449	0.271	4.1
4	Level 4	78	7.203	1.359	2474	2959	0.287	3.2
5	Level 5	56	7.476	0.711	2336	2267	0.448	5.3
6	Level 6	16	7.361	0.891	2386	2847	0.267	3.1
7	Level 7	123	7.100	0.755	1577	1309	0.480	8.5
8	Level 8	619	7.157	1.047	1982	2219	0.362	5.1
9	Level 9	242	7.126	1.125	2026	2421	0.351	4.8
	TOTALS	1556	7.229	1.039	2113	2265	0.340	4.5

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(8,1547)= 3.283

SIGNIFICANT AT ALPHA <.01

* Urbanization Index varies from Level 1 (lowest degree of urbanization) to Level 9 (highest degree of urbanization).

TABLE 71

URBANIZATION INDEX VS. DEPENDENT VARIABLES

Subgroup: Males Not Drive on Job (MNDOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs.	Accident rat (no. acc. pe million mile
			Mean	Std. Dev.	Mean	Std. Dev.		
1	Level 1 *	354	6.389	1.381	1012	1005	0.286	7.9
2	Level 2	170	6.546	1.197	1179	1283	0.306	7.2
3	Level 3	82	6.505	0.970	992	908	0.361	10.1
4	Level 4	120	6.473	1.493	1163	1127	0.354	8.5
5	Level 5	110	6.603	1.147	1105	922	0.537	13.5
6	Level 6	41	6.391	1.371	960	787	0.308	8.9
7	Level 7	189	6.466	1.086	942	732	0.560	16.5
8	Level 8	982	6.226	1.272	821	759	0.382	12.9
9	Level 9	536	6.115	1.421	835	955	0.419	13.9
	TOTAL	2584	6.303	1.309	918	915	0.390	11.8

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(8,2575)= 4.382

SIGNIFICANT AT ALPHA <.01

* Urbanization index varies from Level 1 (lowest degree of urbanization) to Level 9 (highest degree of urbanization).

TABLE 72

URBANIZATION INDEX VS. DEPENDENT VARIABLES

Subgroup: Females Not Drive On Job (FNDOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days Mean	Natural log of miles driven 30 days Std. Dev.	Miles driven 30 days Mean	Miles driven 30 days Std. Devs	Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles)
1	Level 1 *	340	5.494	1.360	446	489	0.140	8.7
2	Level 2	172	5.472	1.372	432	435	0.177	11.4
3	Level 3	89	5.208	1.620	441	597	0.180	11.3
4	Level 4	113	5.636	1.151	447	468	0.167	10.4
5	Level 5	125	5.496	1.283	416	380	0.204	13.6
6	Level 6	27	5.571	1.150	453	477	0.269	16.5
7	Level 7	167	5.391	1.161	372	402	0.204	15.2
8	Level 8	934	5.271	1.435	381	481	0.257	18.7
9	Level 9	448	5.142	1.614	389	491	0.227	16.2
	TOTALS	2415	5.310	1.429	403	476	0.216	14.9

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(8,2406)= 3.515

SIGNIFICANT AT ALPHA <.01

* Urbanization Index varies from Level 1 (lowest degree of urbanization) to Level 9 (highest degree of urbanization).

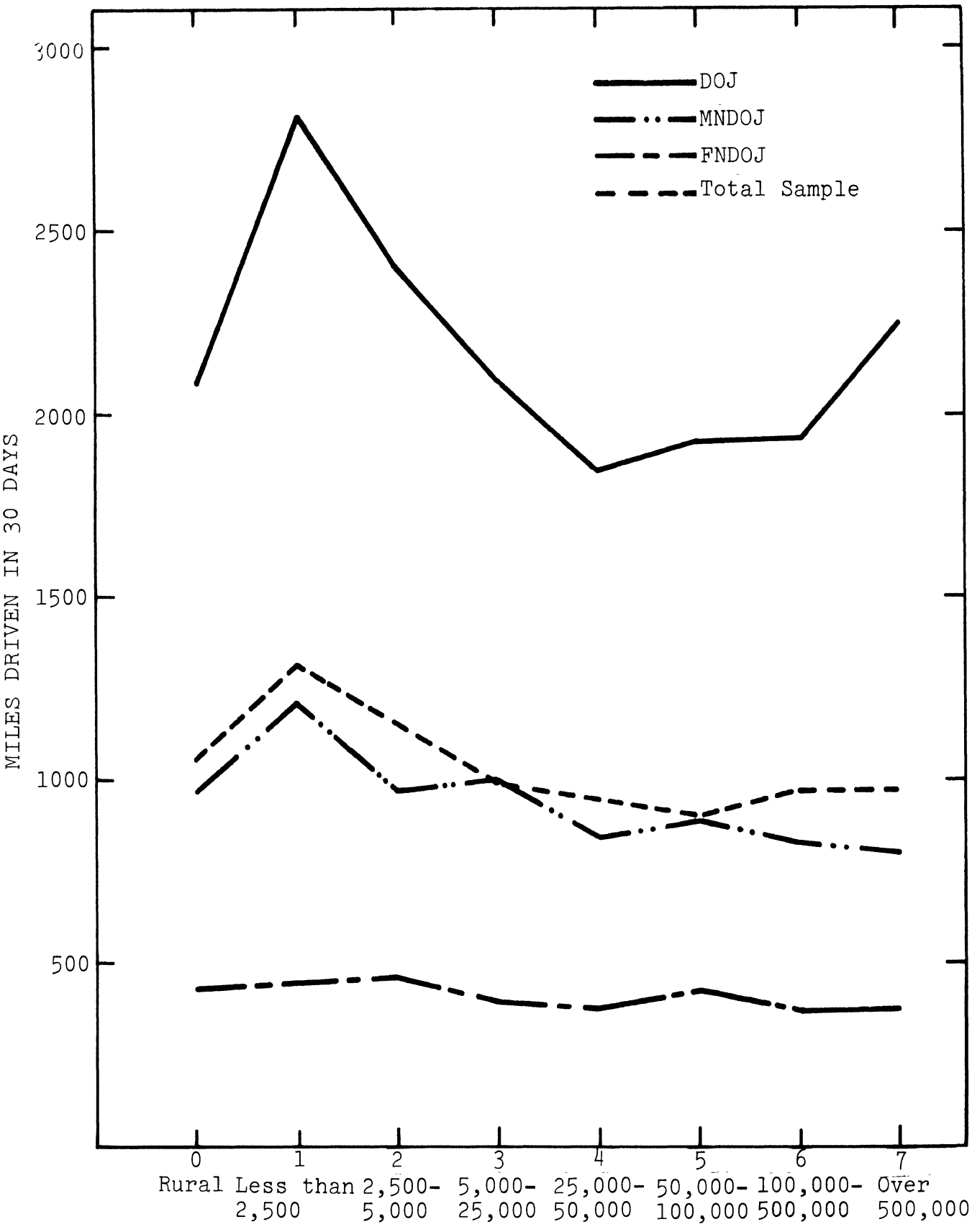

3000
2500
2000
1500
1000
500
MILES DRIVEN IN 30 DAYS
DOJ
MNDOJ
FNDOJ
Total Sample
0
1
2
3
4
5
6
7
Rural
Less than 2,500
2,500- 5,000
5,000- 25,000
25,000- 50,000
50,000- 100,000
100,000- 500,000
Over 500,000
POPULATION

Figure 61

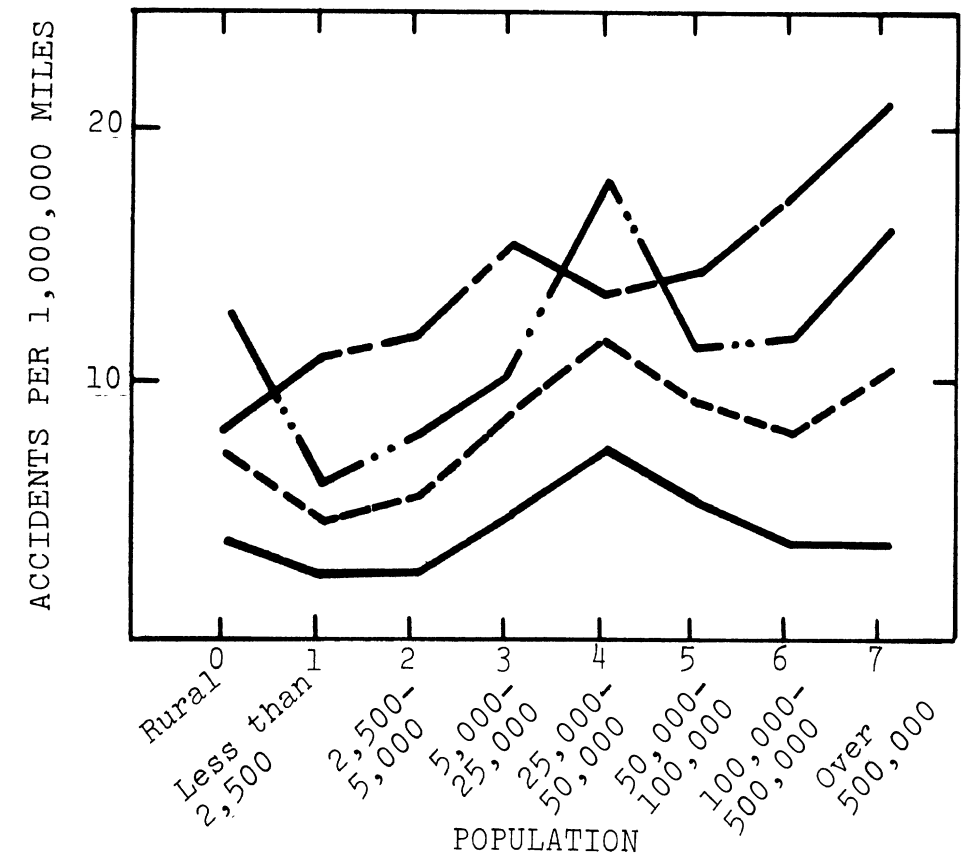


Figure 62

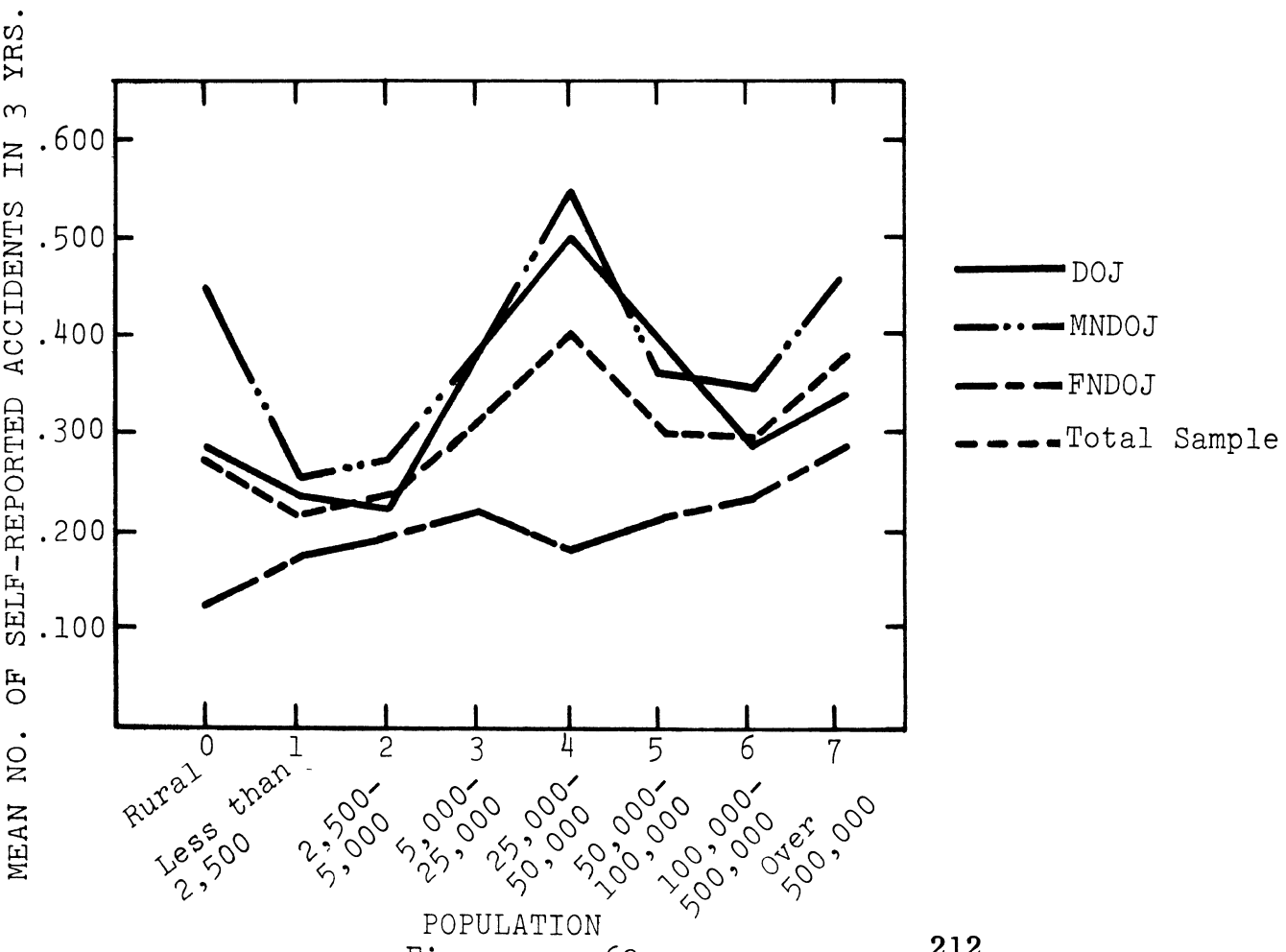


Figure 63

TABLE 73

POPULATION VS. DEPENDENT VARIABLES

Total Sample

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
0	Rural	549	6.327	1.282	1055	1230	0.275	7.2
1	Less than 2500	642	6.436	1.608	1301	1820	0.220	4.7
2	2500-5000	370	6.253	1.563	1155	1577	0.231	5.6
3	5000-25,000	1166	6.151	1.463	994	1448	0.313	8.8
4	25,000-50,000	757	6.235	1.278	950	1136	0.403	11.8
5	50,000-100,000	1032	6.056	1.473	902	1229	0.307	9.5
6	100,000-500,000	964	6.057	1.576	973	1489	0.290	8.3
7	Over 500,000	1076	6.060	1.597	972	1504	0.373	10.7
	TOTALS	6556	6.157	1.494	1012	1435	0.311	8.54

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(7,6548)= 4.971

SIGNIFICANT AT ALPHA <.01

TABLE 74

POPULATION VS. DEPENDENT VARIABLES

Subgroup: Drive On Job (DOJ)

ode	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
0	Rural	142	7.343	0.831	2079	1629	0.283	3.8
1	Less than 2500	161	7.435	1.184	2714	2738	0.235	2.4
2	2500-5000	95	7.328	1.064	2399	2401	0.224	2.6
3	5000-25,000	256	7.194	1.103	2082	2407	0.382	5.1
4	25,000-50,000	207	7.229	0.778	1840	1619	0.500	7.6
5	50,000-100,000	207	7.146	0.961	1918	2009	0.389	5.6
6	100,000-500,000	257	7.047	1.211	1936	2332	0.284	4.1
7	Over 500,000	231	7.291	0.999	2248	2572	0.338	4.2
	TOTALS	1556	7.229	1.039	2113	2265	0.340	4.5

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(7.1584)= 2.755

SIGNIFICANT AT ALPHA <.01

TABLE 75

POPULATION VS. DEPENDENT VARIABLES

Subgroup: Males Not Drive on Job (MNDOJ)

LEVELS OF PREDICTOR VARIABLE code		No. of cases	Natural log of miles driven 30 days Mean	Std. Dev.	Miles driven 30 days Mean	Std. Dev.	Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles
0	Rural	201	6.425	1.138	971	937	0.446	12.8
1	Less than 2500	245	6.531	1.405	1203	1237	0.257	5.9
2	2500-5000	142	6.294	1.480	974	933	0.277	7.9
3	5000-25,000	439	6.478	1.081	1001	942	0.381	10.6
4	25,000-50,000	284	6.317	1.104	842	694	0.544	18.0
5	50,000-100,000	396	6.290	1.241	886	854	0.364	11.4
6	100,000-500,000	383	6.171	1.416	834	891	0.348	12.0
7	Over 500,000	494	6.094	1.480	801	829	0.459	15.9
	TOTAL	2584	6.303	1.308	918	915	0.390	11.8

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(7,2576)= 4.855

SIGNIFICANT AT ALPHA <.01

TABLE 76

POPULATION VS. DEPENDENT VARIABLES

Subgroup: Females Not Drive On Job (FNDOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days Mean	Natural log of miles driven 30 days Std. Dev.	Miles driven 30 days Mean	Miles driven 30 days Std. Devs	Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles)
0	Rural	206	5.532	1.140	432	488	0.126	8.1
1	Less than 2500	236	5.412	1.524	439	464	0.176	11.1
2	2500-5000	133	5.441	1.478	460	526	0.195	11.8
3	5000-25,000	471	5.281	1.444	396	472	0.220	15.4
4	25,000-50,000	266	5.375	1.168	374	407	0.183	13.6
5	50,000-100,000	429	5.315	1.473	426	545	0.221	14.4
6	100,000-500,000	324	5.138	1.486	372	490	0.235	17.6
7	Over 500,000	351	5.203	1.526	375	397	0.284	21.0
	TOTALS	2416	5.310	1.429	403	476	0.216	14.9

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

NOT SIGNIFICANT

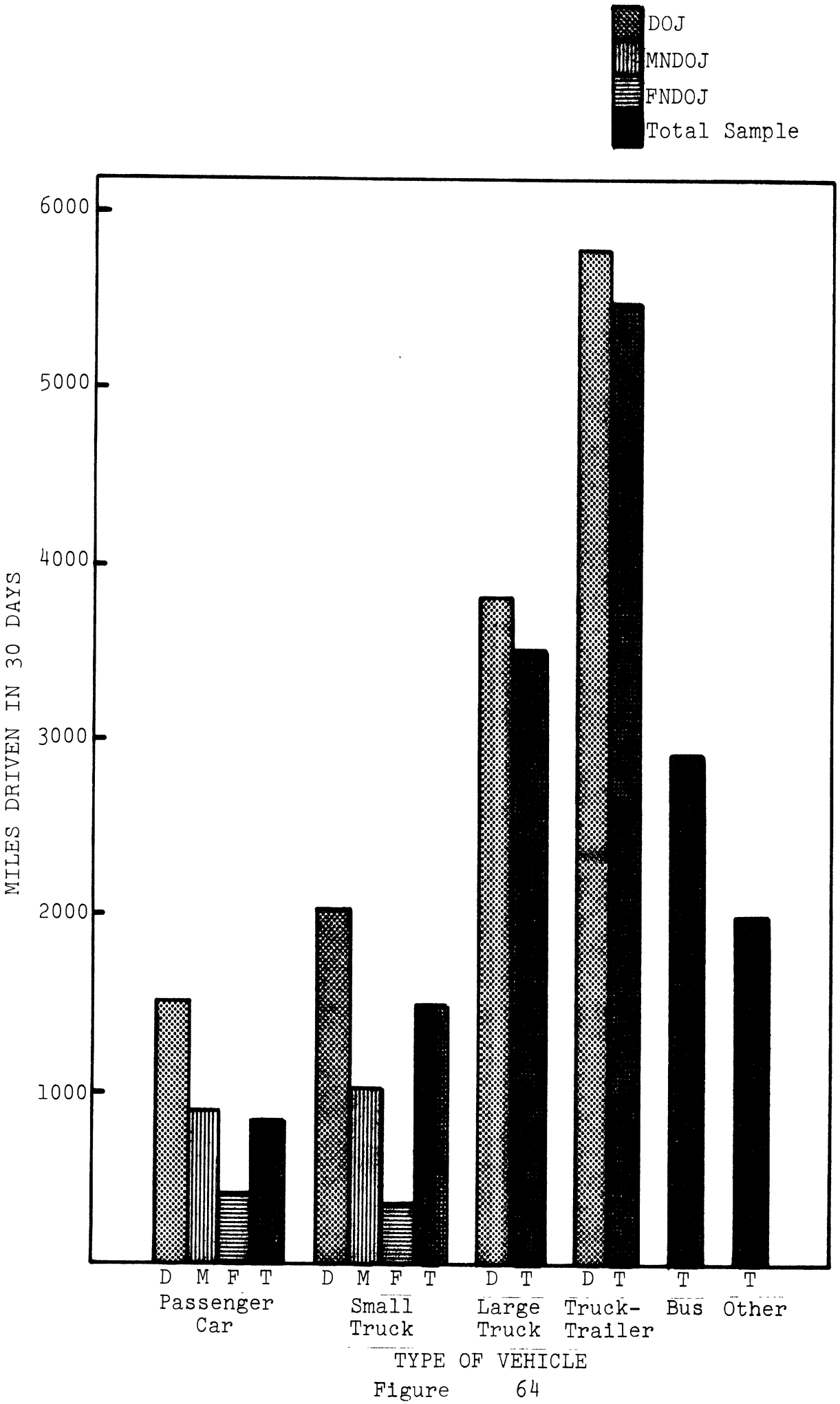

DOJ
MNDOJ
FNDOJ
Total Sample
6000
5000
4000
3000
2000
1000
MILES DRIVEN IN 30 DAYS
D M F T
Passenger Car
D M F T
Small Truck
D T
Large Truck
D T
Truck-Trailer
T
Bus
T
Other
TYPE OF VEHICLE

Figure 64

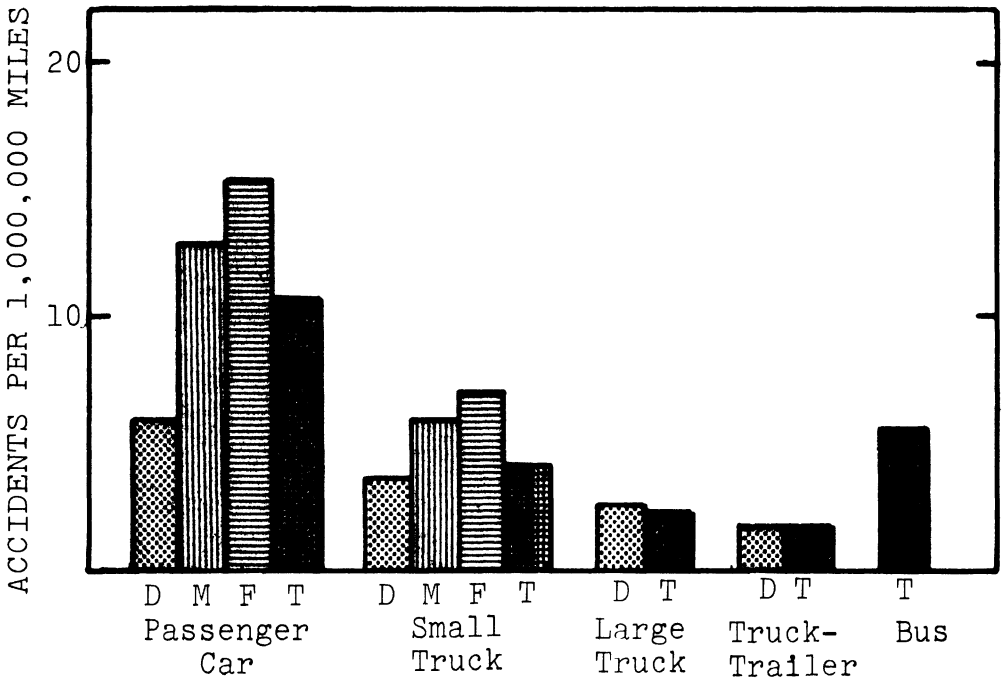


Figure 65

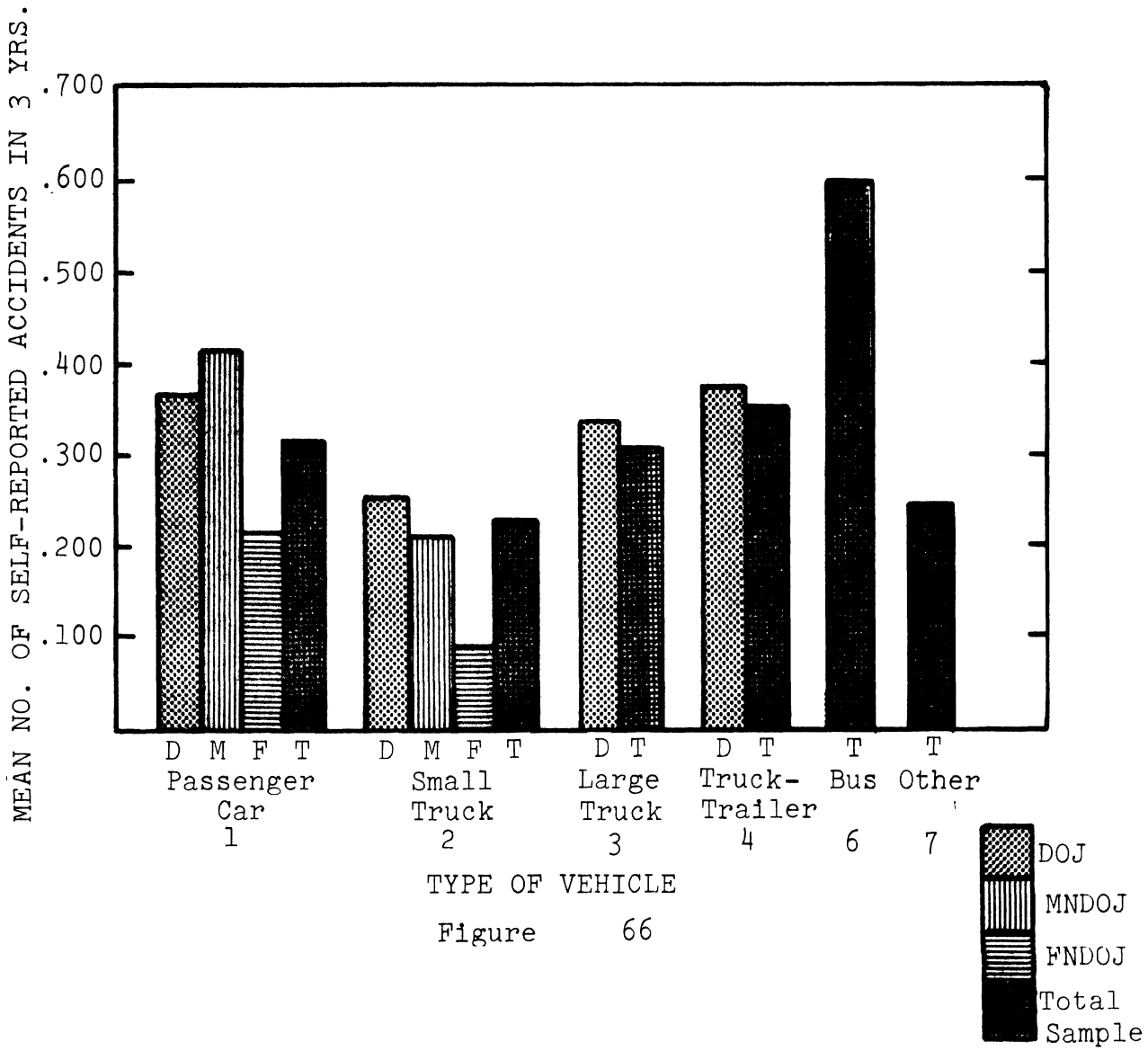


Figure 66

TABLE 77

TYPE OF VEHICLE VS. DEPENDENT VEHICLE

Total Sample

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
1	Passenger car	5577	6.072	1.369	851	1103	0.314	10.4
2	Small truck	684	6.876	1.090	1511	1515	0.228	4.2
3	Large truck	75	7.689	1.167	3718	3812	0.313	2.3
4	Truck-trailer, comb.	67	8.236	1.169	5488	3770	0.354	1.8
5	Taxi or limousine	9	8.281	0.998	5444	4179	0.556	2.8
6	Bus	28	7.742	0.690	2934	2558	0.600	5.7
7	Other	40	6.987	1.171	2008	2348	0.250	3.5
8	Don't know	3	1.276	2.211	15	27	0.250	463.0
	TOTALS	6483	6.212	1394	1024	1439	0.311	

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(7,6475)= 84.155

SIGNIFICANT AT ALPHA <.01

TABLE 78

TYPE OF VEHICLE VS. DEPENDENT VARIABLES

Subgroup: Drive On Job (DOJ)

Code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
1	Passenger car	955	7.069	0.987	1725	1787	0.364	5.8
2	Small truck	347	7.349	0.757	2034	1715	0.256	3.5
3	Large truck	62	7.758	1.111	3832	3851	0.339	2.5
4	Truck-trailer, comb.	61	8.435	0.763	5808	3657	0.377	1.8
5	Taxi or limousine	8	8.567	0.545	6075	3984	0.500	2.3
6	Bus	21	7.842	0.650	3165	2660	0.714	6.3
7	Other	21	7.570	1.132	3249	3027	0.190	1.6
	TOTALS	1475	7.246	0.987	2119	2265	0.342	4.5

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

F(6,1547)= 32.067

SIGNIFICANT AT ALPHA <.01

TABLE 79

TYPE OF VEHICLE VS. DEPENDENT VARIABLES

Subgroup: Males Not Drive on Job (MNDOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles
			Mean	Std. Dev.	Mean	Std. Dev.		
1	Passenger car	2237	6.339	1.194	912	894	0.413	12.6
2	Small truck	282	6.505	1.106	1033	1023	0.215	5.8
3	Large truck	4	6.464	1.648	1690	2556	0	0
4	Truck-trailer, comb.	2	6.652	0.619	850	495	0	0
5	Taxi or limousine	1	5.991	0	400	0	1.000	69.4
6	Bus	3	7.290	0.756	1800	1473	0	0
7	Other	21	6.628	0.948	1129	1044	0.318	7.8
8	Don't know	1	0	0	0	0	1.000	0
	TOTAL	2549	6.631	1.184	930	916	0.387	11.5

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

NOT SIGNIFICANT

TABLE 80

TYPE OF VEHICLE VS. DEPENDENT VARIABLES

Subgroup: Females Not Drive On Job (FNDOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days Mean	Natural log of miles driven 30 days Std. Dev.	Miles driven 30 days Mean	Miles driven 30 days Std. Devs	Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles)
1	Passenger car	2326	5.382	1.319	412	481	0.219	14.8
2	Small truck	45	5.448	1.077	364	318	0.091	6.9
4	Truck-trailer, comb.	2	3.545	1.499	56	62	0	0
6	Bus	1	6.685	0.0	800	0	0	0
7	Other	2	5.806	1.928	693	859	0	0
8	Don't know	2	1.914	2.708	23	33	0	0
	TOTALS	2377	5.379	1.320	411	479	0.216	14.60

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

NOT SIGNIFICANT

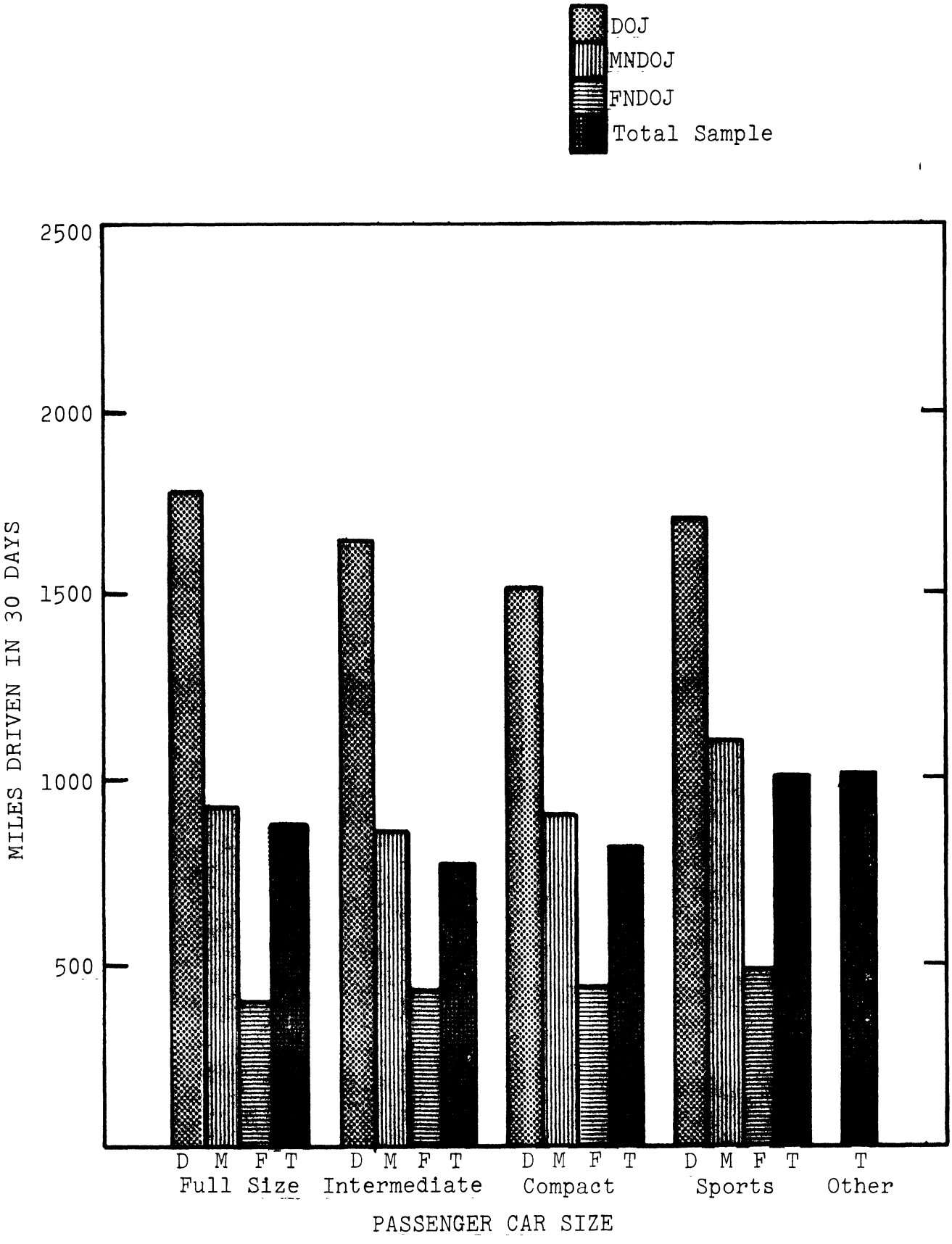

DOJ
MNDOJ
FNDOJ
Total Sample
2500
2000
1500
1000
500
MILES DRIVEN IN 30 DAYS
D M F T
Full Size
D M F T
Intermediate
D M F T
Compact
D M F T
Sports
T
Other
PASSENGER CAR SIZE

Figure 67

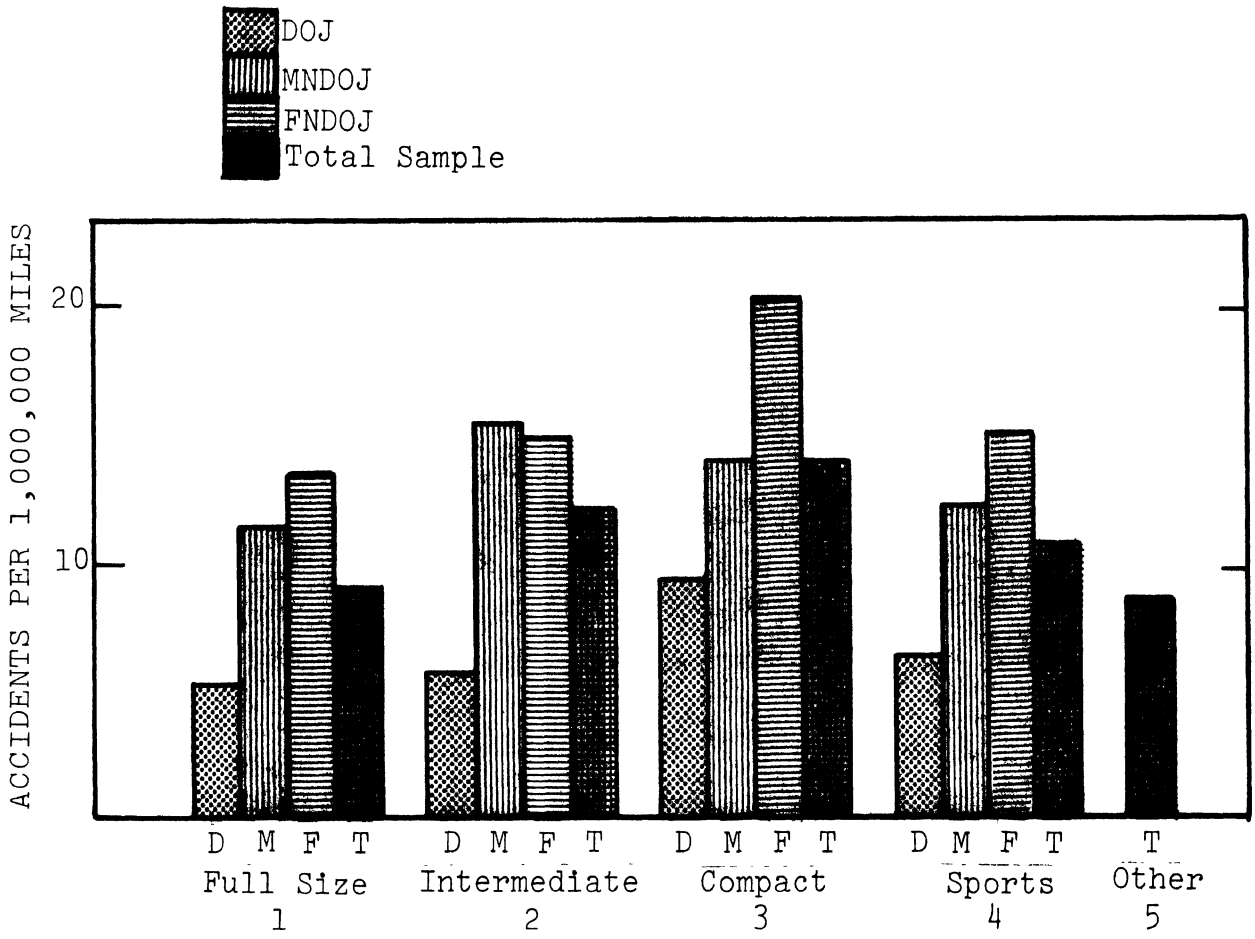


Figure 68

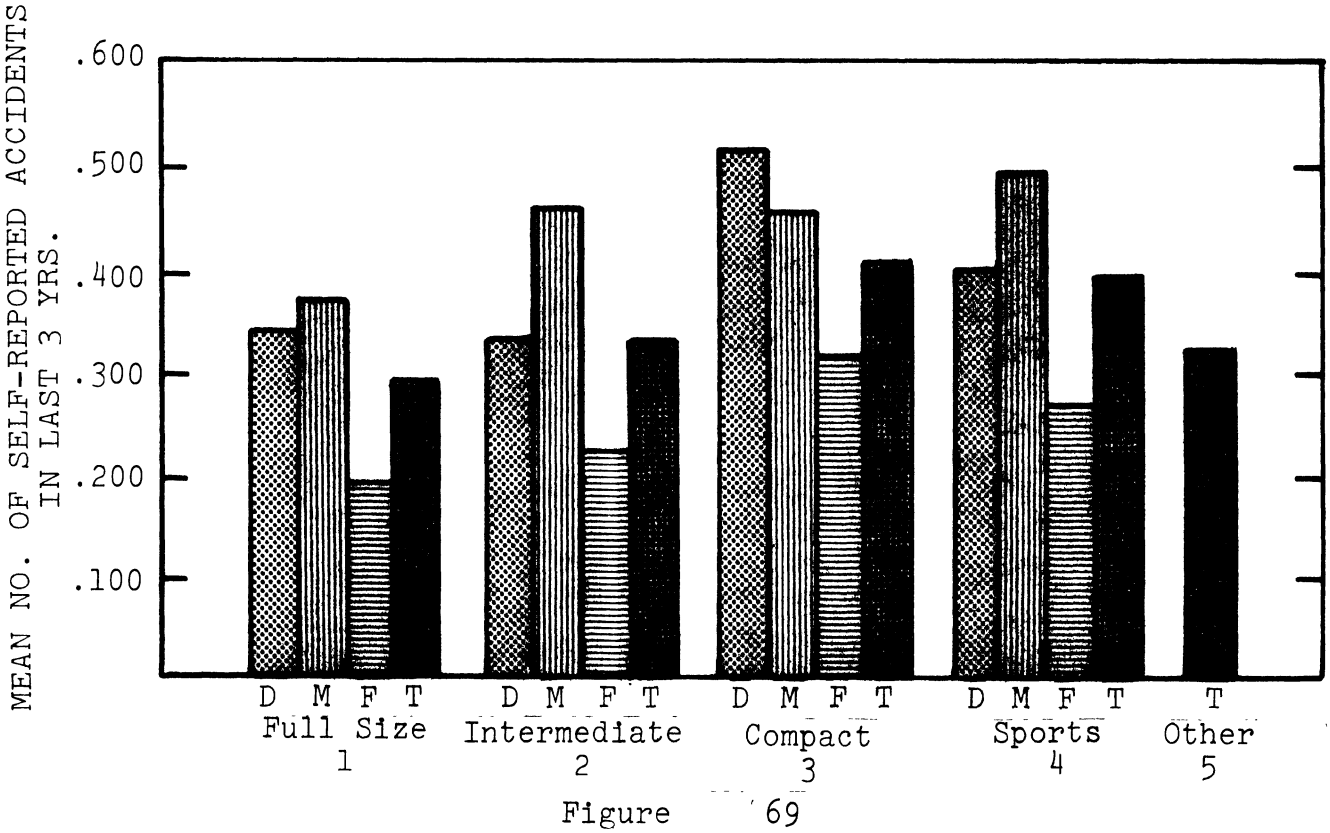


Figure 69

PASSENGER CAR SIZE

TABLE 81

PASSENGER CAR SIZE VS. DEPENDENT VARIABLES

Total Sample

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
1	Full size	3496	6.064	1.412	874	1130	0.290	9.2
2	Intermediate	959	5.978	1.350	766	1084	0.336	12.2
3	Compact	822	6.159	1.223	806	789	0.412	14.2
4	Sports	212	6.300	1.264	1011	1519	0.399	11.0
5	Other	48	6.324	1.146	1017	1246	0.325	8.9
8	Don't know	10	4.196	1.959	335	437	0.067	5.6
	TOTALS	5547	6.073	1.371	851	1098	0.319	10.4

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

NOT SIGNIFICANT

TABLE 82

PASSENGER CAR SIZE VS. DEPENDENT VARIABLES

Subgroup: Drive On Job (DOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
1	Full size	691	7.100	1.027	1790	1746	0.344	5.3
2	Intermediate	141	6.954	1.004	1646	2172	0.336	5.7
3	Compact	126	7.116	0.665	1519	1006	0.521	9.5
4	Sports	41	6.883	1.038	1710	2842	0.405	6.6
5	Other	10	6.966	0.874	1364	799	0.111	2.3
8	Don't know	1	7.313	0.0	1500	0	1.000	18.6
	TOTALS	1009	7.072	0.985	1728	1790	0.365	5.9

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

NOT SIGNIFICANT

TABLE 83

PASSENGER CAR SIZE VS. DEPENDENT VARIABLES

Subgroup: Males Not Drive on Job (MNDOJ)

codc	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
1	Full size	1350	6.322	1.219	914	914	0.374	11.4
2	Intermediate	391	6.252	1.219	828	716	0.465	15.6
3	Compact	361	6.444	0.998	900	740	0.459	14.2
4	Sports	99	6.500	1.276	1103	1044	0.493	12.4
5	Other	24	6.490	1.090	1148	1461	0.556	13.5
8	Don't know	2	2.995	4.236	200	283	0	0
	TOTAL	2227	6.336	1.195	907	871	0.411	12.6

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

NOT SIGNIFICANT

TABLE 84

PASSENGER CAR SIZE VS. DEPENDENT VARIABLES

Subgroup: Females Not Drive On Job (FNDOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days Mean	Natural log of miles driven 30 days Std. Dev.	Miles driven 30 days Mean	Miles driven 30 days Std. Devs	Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles
1	Full size	1455	5.335	1.349	401	474	0.195	13.5
2	Intermediate	427	5.407	1.298	419	494	0.227	15.1
3	Compact	335	5.493	1.246	438	472	0.322	20.4
4	Sports	72	5.695	1.128	487	477	0.269	15.3
5	Other	14	5.582	1.078	544	1015	0.154	7.9
8	Don't know	7	5.123	0.726	207	146	0	0
	TOTALS	2310	5.383	1.317	413	482	0.220	1480

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

NOT SIGNIFICANT

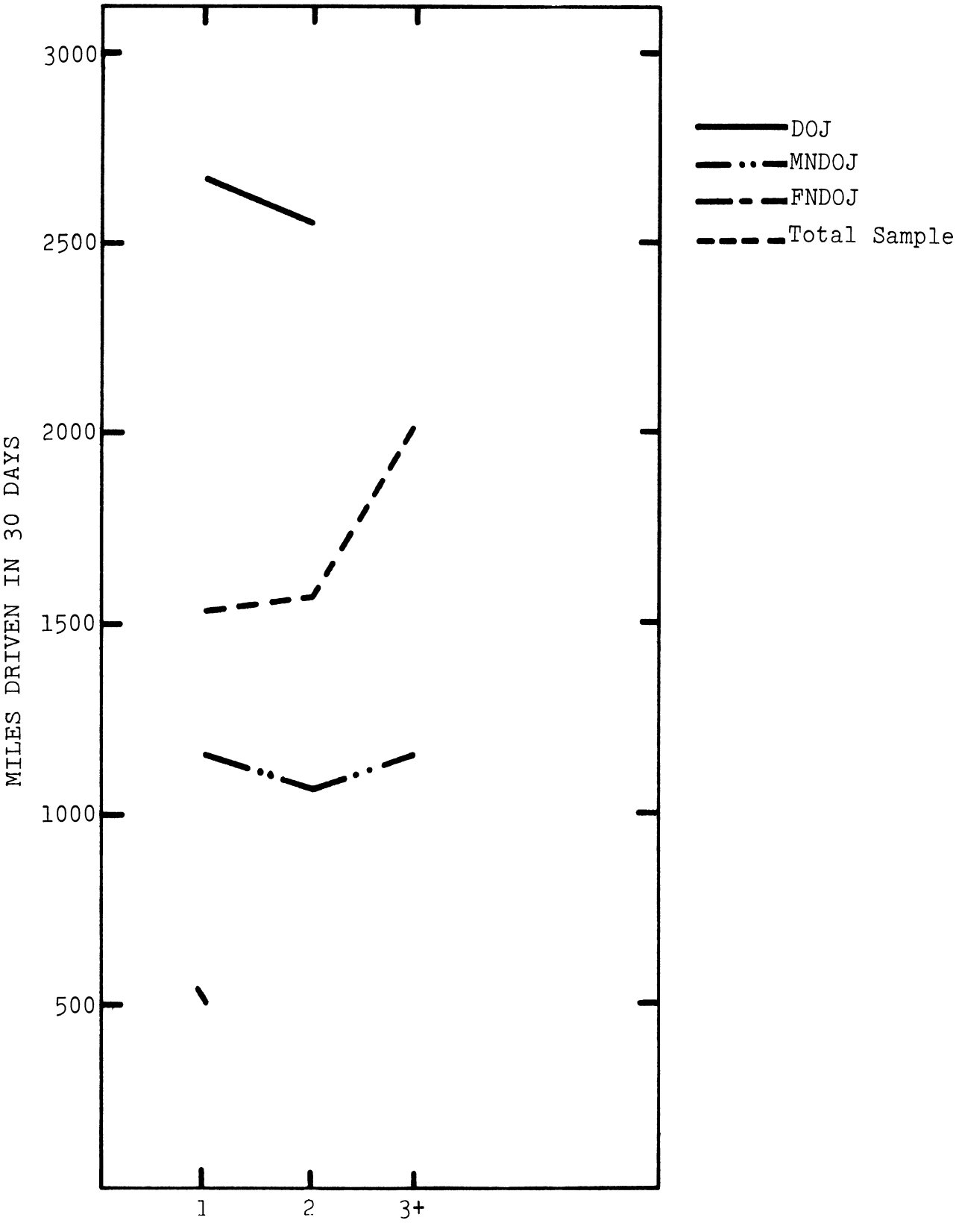

3000
2500
2000
1500
1000
500
MILES DRIVEN IN 30 DAYS
1
2
3+
NUMBER OF MOVING VIOLATIONS
DOJ
MNDOJ
FNDOJ
Total Sample

Figure 70

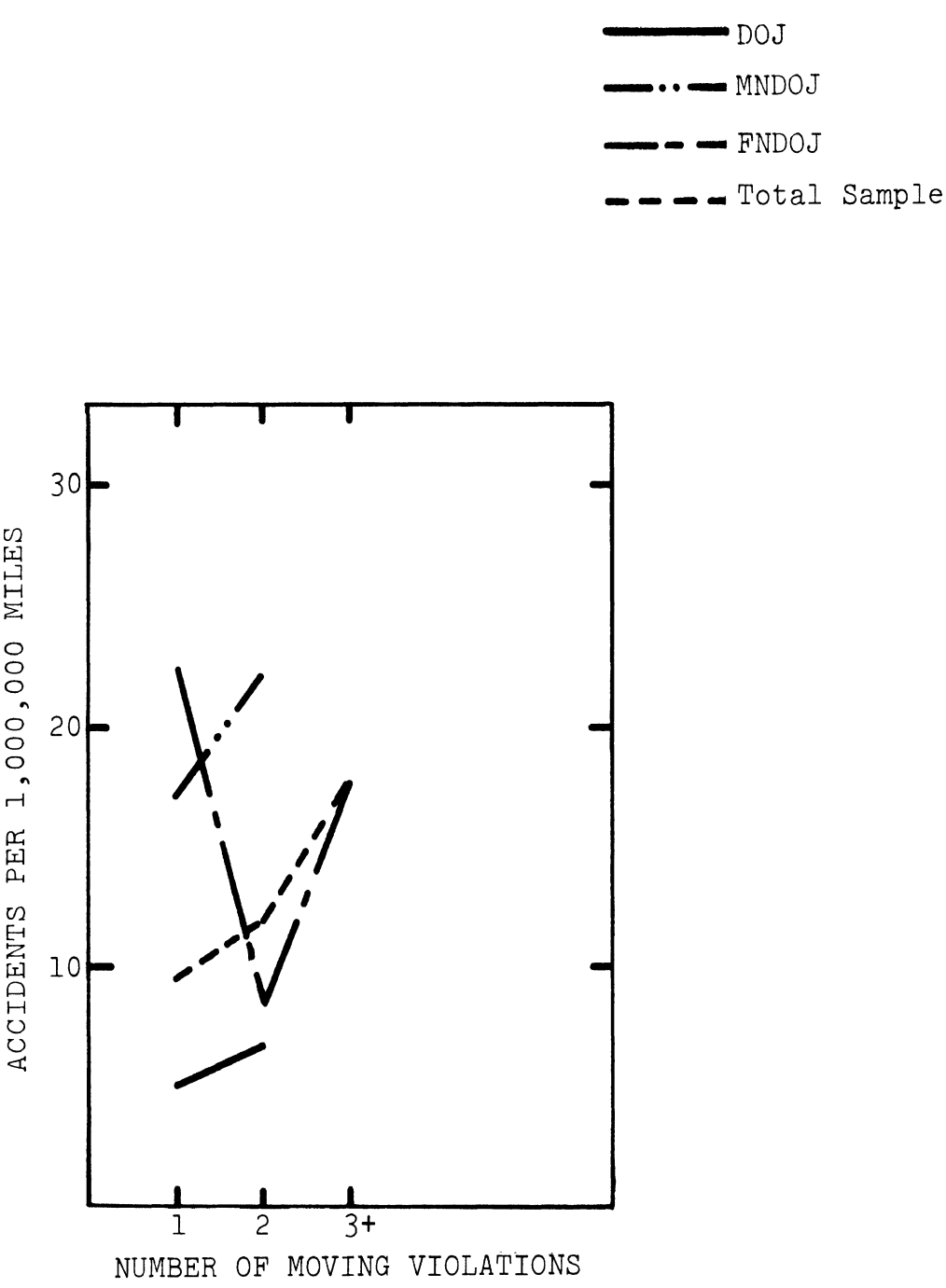

DOJ
MNDOJ
FNDOJ
Total Sample
30
20
10
ACCIDENTS PER 1,000,000 MILES
1
2
3+
NUMBER OF MOVING VIOLATIONS

Figure 71

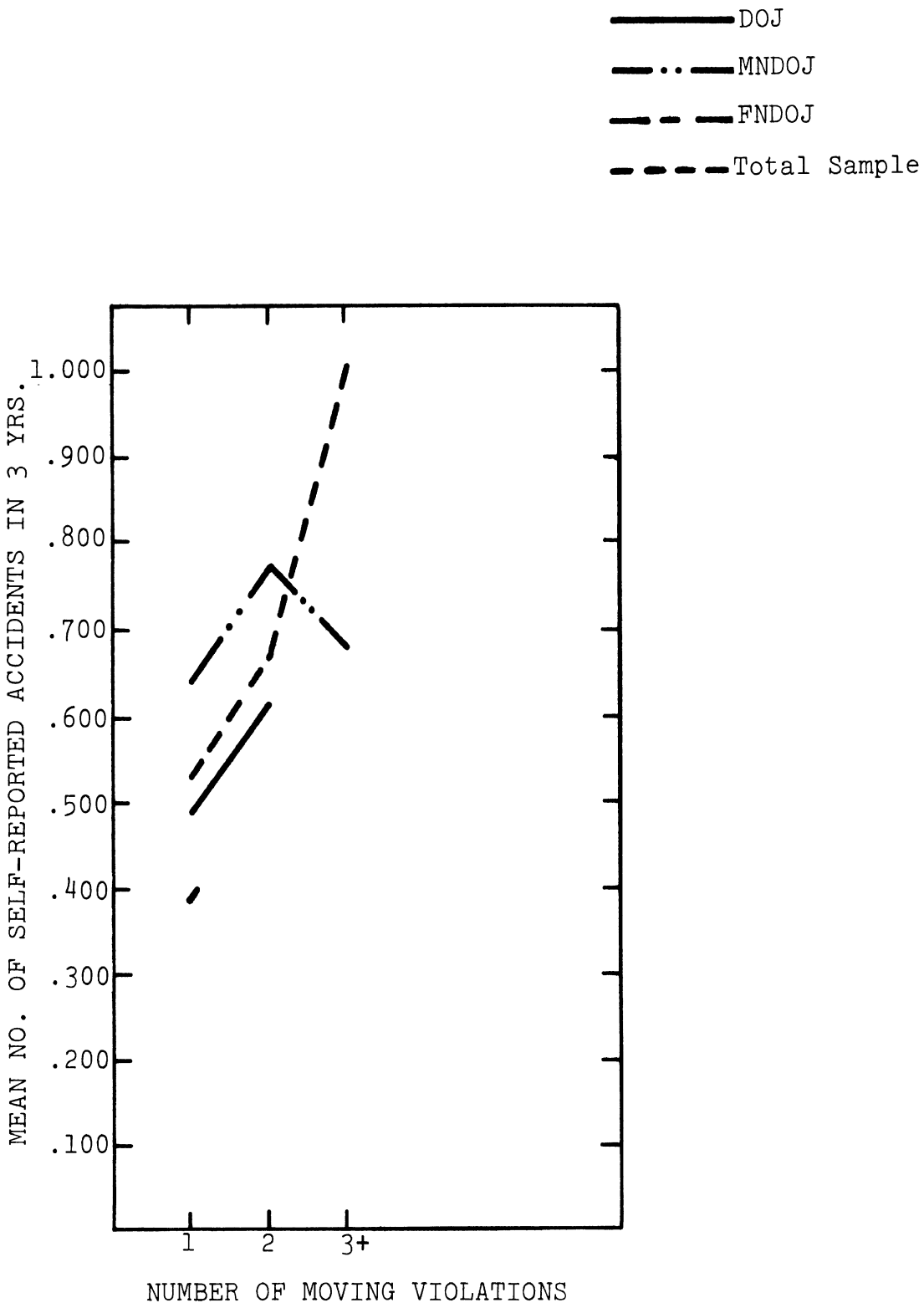

DOJ
MNDOJ
FNDOJ
Total Sample
MEAN NO. OF SELF-REPORTED ACCIDENTS IN 3 YRS.
1.000
.900
.800
.700
.600
.500
.400
.300
.200
.100
1
2
3+
NUMBER OF MOVING VIOLATIONS

Figure 72

TABLE 85

NUMBER OF MOVING VIOLATIONS VS. DEPENDENT VARIABLES

Total Sample

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
1	One	645	6.713	1.267	1536	1985	0.528	9.6
2	Two	100	6.821	1.171	1567	2041	0.670	11.9
3	Three	24	6.897	1.034	1496	1225	1.316	24.4
4	Four	8	7.345	1.172	2975	4013	0.875	8.2
5	Five	4	7.266	0.746	1700	963	1.500	24.5
6	Six	4	7.133	0.786	1500	808	0.500	9.3
9	Missing	1	7.601	0	2000	0	0	0
	TOTALS	786	6.744	1.245	1554	1994	0.576	10.3

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

NOT SIGNIFICANT

TABLE 86

NUMBER OF MOVING VIOLATIONS VS. DEPENDENT VARIABLES

Subgroup: Drive On Job (DOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days Mean	Natural log of miles driven 30 days Std. Dev.	Miles driven 30 days Mean	Miles driven 30 days Std. Devs	Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles)
1	One violation	220	7.475	1.038	2666	2710	0.485	5.1
2	Two	35	7.540	0.743	2557	2651	0.618	6.7
3	Three	9	7.293	1.123	2067	1314	2.000	26.9
4	Four	3	8.311	1.273	6200	5524	0.333	1.5
5	Five	2	7.625	0.441	2150	919	1.500	19.4
6	Six	1	7.696	0	2200	0	1.000	12.6
9	Missing	1	7.601	0	2000	0	0	0
	TOTALS	269	7.487	1.005	2667	2707	0.565	5.9

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

NOT SIGNIFICANT

TABLE 87

NUMBER OF MOVING VIOLATIONS VS. DEPENDENT VARIABLES

Subgroup: Males Not Drive on Job (MNDOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs.	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
1	One violation	286	6.588	1.146	1159	1224	0.640	15.3
2	Two	57	6.441	1.232	1064	1429	0.776	20.3
3	Three	15	6.660	0.934	1154	1067	0.700	16.8
4	Four	5	6.765	0.688	1040	666	1.200	32.1
5	Five	2	6.908	0.980	1250	1061	1.500	33.3
6	Six	3	6.945	0.846	1267	808	0.333	7.3
	TOTAL	368	6.575	1.141	1144	1238	0.674	16.3

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

NOT SIGNIFICANT

TABLE 88

NUMBER OF MOVING VIOLATIONS VS. DEPENDENT VARIABLES

Subgroup: Females Not Drive On Job (FNDOJ)

code	LEVELS OF PREDICTOR VARIABLE	No. of cases	Natural log of miles driven 30 days		Miles driven 30 days		Mean no. of self reported accidents in the last 3 yrs	Accident rate (no. acc. per million miles)
			Mean	Std. Dev.	Mean	Std. Dev.		
1	One violation	139	5.766	1.100	523	525	0.387	20.6
2	Two	8	6.380	0.766	813	898	0.250	8.5
	TOTALS	147	5.799	1.091	539	551	0.379	19.5

Result of F test of the dependency between the predictor variable and the natural logarithm of estimated miles driven:

NOT SIGNIFICANT

Figure 73

Exposure Predictor Model Including Environmental Variables
Model 1

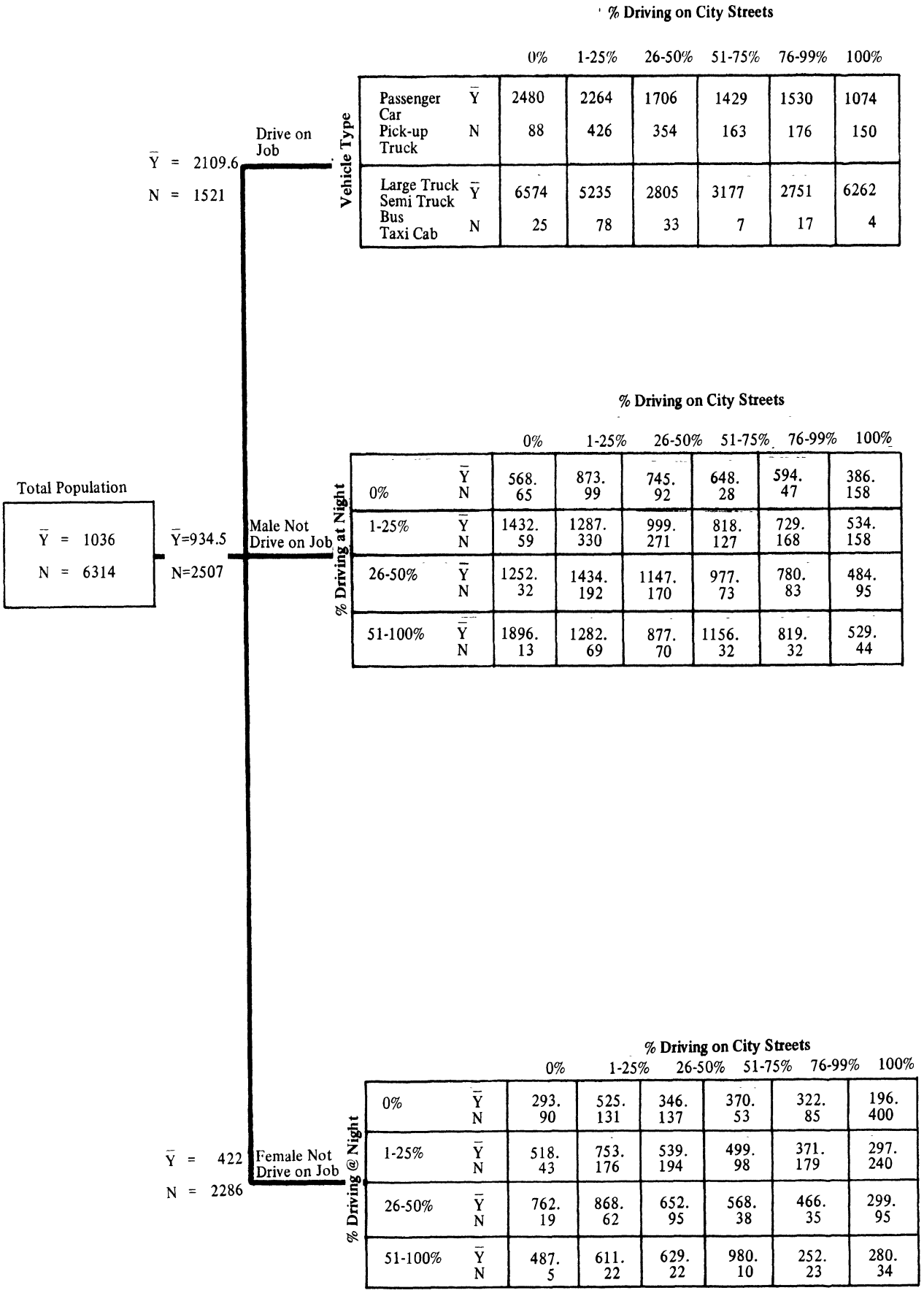


Figure 74

Exposure Prediction
Model 2

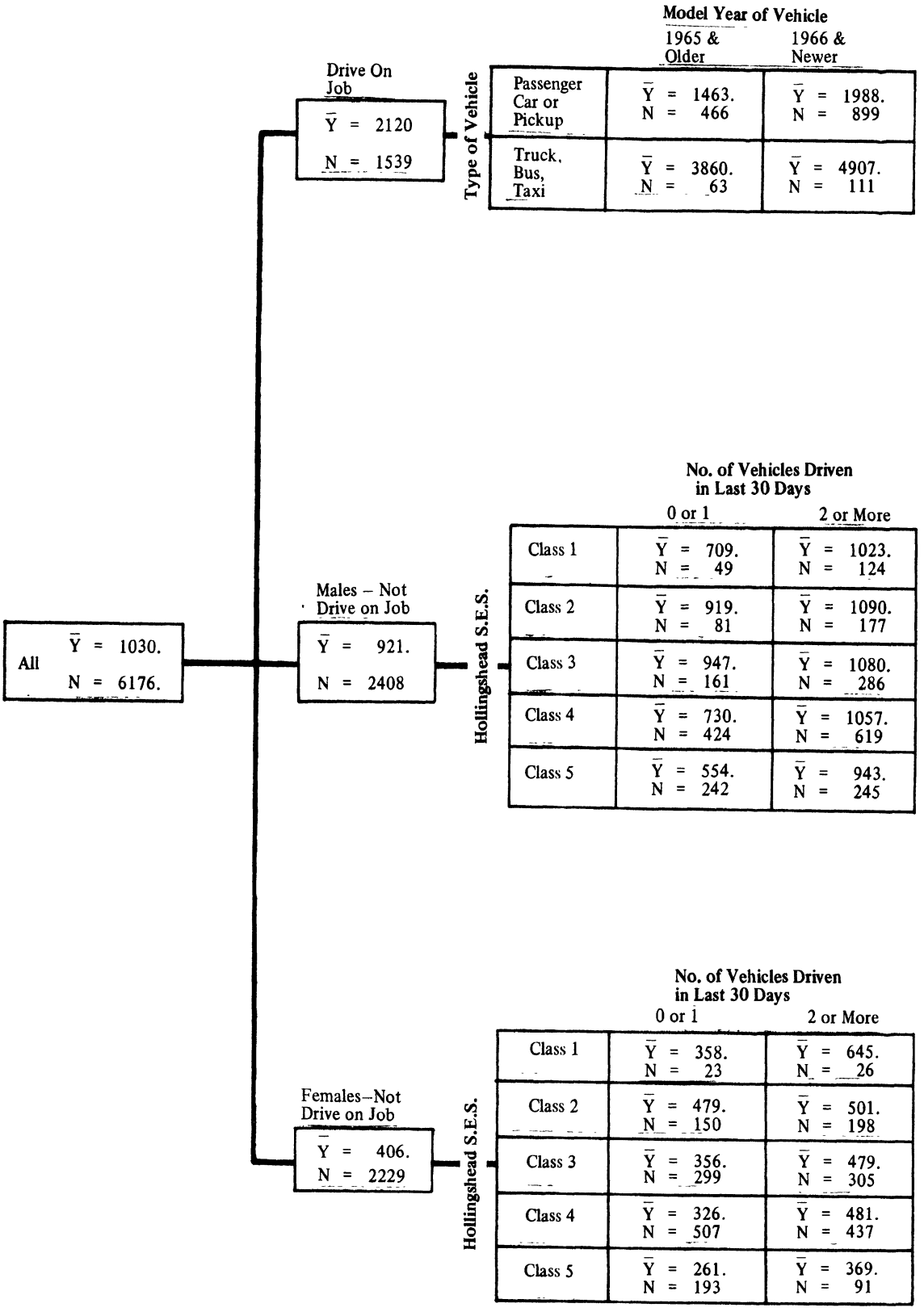


Table 89

Analysis of Variance for Exposure Predictor Model #1 Using Natural Logarithm of Miles Driven in 30 days as the Dependent Variable

Subgroup I Subjects who drive on the job

Effect	Sum of Squares	Degrees of Freedom	Mean Square	F Statistic	Remark
Vehicle Type	0.70	1	0.70	4.69	Significant $\alpha = 0.05$
Percent Driving on City Streets	1.03	5	0.20	1.38	Not Significant
Interaction	2.84	5	0.56	3.81	Significant $\alpha = 0.05$
Total	4.58	11			

Mean Square Error	0.149
Grand Mean	7.243
Total Observations	1521
Degrees of Freedom	1509

Subgroup II Male subjects who do not drive on the job

Effect	Sum of Squares	Degrees of Freedom	Mean Square	F Statistic	Remark
Percent Driving at Night	0.50	3	0.16	8.29	Significant $\alpha = 0.05$
Percent Driving on City Streets	0.86	5	0.17	8.55	Significant $\alpha = 0.05$
Interaction	5.65	15	0.37	18.69	Significant $\alpha = 0.05$
Total	7.02	23			

Mean Square Error	0.020
Grand Mean	6.384
Total Observations	2507
Degrees of Freedom	2483

Subgroup III Female subjects who do not drive on the job

Effect	Sum of Squares	Degrees of Freedom	Mean Square	F Statistic	Remark
Percent Driving at Night	0.34	3	0.11	2.12	Not Significant
Percent Driving on City Streets	1.05	5	0.21	3.90	Significant α=0.05
Interaction	5.64	15	0.37	6.95	Significant α=0.05
Total	7.03	23			

Mean Square Error	0.054
Grand Mean	5.457
Total Observations	2286
Degrees of Freedom	2262

Table 90

Analysis of Variance for Exposure Prediction Model #2 Using Natural Logarithm of Miles Driven in 30 Days as the Dependent Variable

Subgroup I Subjects who drive on the job

Effect	Sum of Squares	Degrees of Freedom	Mean Square	F Statistic	Remark
Model Year of Vehicle	0.09	1	0.09	14.23	Significant α=.05
Type of Vehicle	0.62	1	0.62	95.14	Significant α=.05
Interaction	0.60	1	0.60	91.11	Significant α=.05
Total	1.32	3			

Mean Square Error	0.006
Grand Mean	7.244
Total Observations	1539
Degrees of Freedom	1535

Subgroup II Male subjects who drive on the job

Effect	Sum of Squares	Degrees of Freedom	Mean Square	F Statistic	Remark
# of Vehicles Driven in Past 30 days	0.23	1	0.23	18.03	Significant α=0.05
Hollingshead Socio-Economic Scale	0.20	4	0.05	3.85	Significant α=0.05
Interaction	0.80	4	0.20	15.40	Significant α=0.05
Total	1.24	9			

Mean Square Error	0.013
Grand Mean	6.315
Total Observations	2408
Degrees of Freedom	2398

Subgroup III Female subjects who do not drive on the job

Effect	Sum of Squares	Degrees of Freedom	Mean Square	F Statistic	Remark
# of Vehicles Driven in past 30 days	0.15	1	0.15	9.88	Significant α =0.05
Hollingshead Socio-Economic Scale	0.40	4	0.10	6.28	Significant α =0.05
Interaction	0.64	4	0.16	9.95	Significant α =0.05
Total	1.21	9			

Mean Square Error	0.016
Grand Mean	5.340
Total Observations	2229
Degrees of Freedom	2219

APPENDIX G

ANALYSIS OF PRECISION IN PILOT SURVEY ESTIMATES

The use of personal estimates of driving mileage raises an important question concerning the precision of these estimates. For example, one investigator of exposure data reported that individuals tend to estimate monthly mileages to the nearest 1000 miles (see Reference 2, Volume I). In this study, the individual mileage estimates of the pilot survey were sampled and analyzed in order to determine their precision. The results of this analysis for both the 7-day and the 30-day estimate are presented in Table 1. The precision of each estimate was arbitrarily assigned by examing the number of significant digits in the mileage estimate. Thus a response with a zero in the units position and a non-zero in the tens position was assumed to be estimated to the nearest 10 miles. Obviously this is a worst-case analysis because an exact, true mileage could actually be divisible by 10. In this case we would be understanding the precision of the estimate, by concluding that its precision was the nearest ten miles rather than the nearest mile. The cumulative percent is the most useful statistic on the table since it indicates the fraction of the population that estimated to a particular precision or better.

In the case of the 30-day estimate, 78% of the population estimated to a precision of 100 miles or better. It should be pointed out that the average mileage for all subjects was 1013 miles in 30 days. Thus if a subject's driving was near this expected value and if he estimated to the nearest 100 miles he would in fact have estimated 1000 miles. This would have placed him in the category of subjects whose precision was the nearest 1000 miles, using our method of estimating precision. Thus we conclude that a minimum of 78% of the population expressed their mileage

Table 1

Percentage of Mileage Estimates in Precision Categories

Precision Category	7 day estimate		30 day estimate	
	Percent	Cumulative Percent	Percent	Cumulative Percent
1. Subject Estimated 0 miles	3.8	3.8	1.8	1.8
2. Subject Estimated to the nearest mile	7.7	11.5	1.0	2.8
3. Subject Estimated to the nearest five miles	15.7	27.2	2.5	5.3
4. Subject Estimated to the nearest 10 miles	40.9	68.1	22.6	27.9
5. Subject Estimated to the nearest 100 miles	30.6	98.7	50.2	78.1
6. Subject Estimated to the nearest 1000 miles	1.3	100.0	21.9	100.0

to a precision of 100 miles. If 100 is used as the precision of subjects estimated then the maximum rounding error is 50 miles for a monthly estimate. This is 5% of the average monthly estimate of 1000 miles. Since the standard deviation of the monthly estimates is over 1400 miles, the maximum possible contribution of rounding error to total error is negligible (50/1400 i.e. less than 4%).

CHECK ON SURVEY RESULTS

The mean value of 1013 miles per driver per month in the data of the pilot survey (early 1970) may be compared with mileage estimates produced by the Federal Highway Administration (FHWA). For 1968, the FHWA estimate of mileage per driver for the whole year was 9520 miles, equivalent to 793 miles per month. Although data was not available for 1969 or 1970 at this writing, it is possible to predict what the equivalent FHWA estimate would be for early 1970. The increase from 1967 to 1968 was 4%. On this basis, a 6% increase is predicted from the 1968 average to the early 1970 average. Thus, the equivalent FHWA estimate for early 1970 is predicted as 841 miles per driver per month. This is about 17% less than the 1013 miles per month result of the pilot survey.

The 17% discrepancy might be explained by:

1. Biases in the pilot survey
    a. Overestimates by survey subjects
    b. An upward bias due to a low percentage of new drivers (who have lower than average mileage) in the survey sample
    c. Disproportionately high percentage of high-mileage states in sample
    d. Early months of year may have higher average mileage
    e. Drivers who refused survey interviews probably have lower exposure

2. Biases in the FHWA estimates
   a. Low estimates of gasoline sales by states
   b. Inaccurate adjustments of gasoline sales due to losses and non-travel uses
   c. Inaccurate estimate of miles traveled per gallon of gasoline
   d. Inaccurate estimates of number of licensed drivers, and hence, number of active drivers.

APPENDIX H

ADVANTAGES AND DISADVANTAGES OF SURVEY ALTERNATIVES

OFFICE INTERVIEW - ADVANTAGES

1. Easy sampling
2. Personal contact
3. Official setting
4. All states will have offices eventually because of federal standards
5. People who renew are currently in the area being sampled
6. Low to medium cost
7. Office space is probably rent free
8. No mailings
9. No car transportation
10. Low refusal rate
11. Interviews can be done over a fairly short period of time

OFFICE INTERVIEW - DISADVANTAGES

1. Bias due to 16 to 18 year olds who don't have to renew.
2. Office space is required.
3. There is usually a periodicity of three years in renewal ages.
4. The sample interval in the office is often in error due to poor volume estimates.
5. There is no way to sample revoked drivers who are still driving.
6. A small percentage of mail renewers is missed.
7. Biases due to choice of time of appearance is influenced by weather, office hours, etc.
8. Bias due to type of refusal, such as "in a hurry".
9. Fear that data will be put in driver's record.
10. Unusual variations in peak periods of renewal activity due to state changeovers, etc.
11. Some offices are open only a few days a week.
12. Slow interviewers and interviewees bias the succeeding interval.
13. There is no advance notice to people to help improve their estimation accuracy.
14. Liaison is required at two to three levels.
15. There are communication and cooperation problems with some managers.
16. No interviews on weekends.
17. The sample doesn't include non-residents who have moved into the area permanently or temporarily or who are driving through.
18. Only 24 to 34 states require renewal in person.
19. It is not feasible to phase the interviews in one office over a long time period.
20. Interviewees get impatient to leave.
21. There is a bias against long trips by virtue of the person being at the office.
22. Over-representation of permanent residents.

HOME INTERVIEW - ADVANTAGES

1. Sample of all drivers.
2. Personal contact.
3. A familiar setting for the interviewee.
4. No office space is required.
5. Time of interview is random.
6. Low refusal rate.
7. Dissociation from official record agency.
8. Not dependent on license renewal time.
9. Interviews are possible on weekends.
10. Interview speed is no problem.
11. Warning in advance by letter helps to improve estimation accuracy.
12. Liaison is required at only one level, the state.
13. Revoked drivers are included.
14. Can be easily spread out in time period if desired for seasonal variation.
15. The interviewees are not impatient to leave because they're home.
16. Home is a better base point for presenting triplogs.
17. Unbiased age and sex distribution.
18. The method doesn't miss mail renewers.
19. Sampling can be done either by place of residence or from the driver list.

HOME INTERVIEW - DISADVANTAGES

1. Higher cost.
2. Car travel to homes is required.
3. Return calls are required for many cases.
4. Daytime is not a good interview time for employed drivers.
5. Many people move without changing their address within the state on their record.
6. Address changes take a long time to be inserted into driver's records.
7. Special training is required for interviewers.
8. In states with only hard-copy files, sampling by age or by issuance date is difficult.
9. It is hard to complete all of the interviews in a short time period.
10. The sample is over-represented with stay-at-home type people.
11. Return visits are hard to fit into random time groups.
12. Sample doesn't include non-residents.
13. There is a bias against long trips by virtue of the people being at home.
14. Some cases in the files have died or moved from state.
15. Homes are too far apart in rural areas.
16. Samplings from driver lists requires county groupings.

MAIL QUESTIONNAIRE - ADVANTAGES

1. Low cost.
2. Persuasive value of the signature of a high official.
3. Sample of all drivers.
4. No office space is needed.
5. No car transportation needed.
6. Letters can be sent in precise group sizes at desired times.
7. Questionnaires are completed in a familiar setting, the home.
8. Questionnaires can be done at one's convenience.
9. Dissociation from an official setting.
10. The sample is not dependent on renewal time.
11. Designated day can be on week-end.
12. Liaison is necessary at only one level, the state.
13. Revoked drivers can be included.
14. The sample can be easily spread for seasonal variation.
15. Unbiased age and sex distributions.
16. Only one sampling level within a state.
17. People can spend adequate time thinking about their estimates.
18. No bias against men who work during the day.
19. No training of interviewers.
20. Bias against long trips is partly overcome by setting a specific day for the trip log.

MAIL QUESTIONNAIRE - DISADVANTAGES

1. Low initial response rate.
2. A follow-up is necessary to increase the response rate.
3. No personal contact is possible.
4. No personal explanation of the triplog is possible.
5. There is a bias due to variations in appreciation of the survey importance.
6. Fear of use of the data in driver records if the request is on state stationary.
7. There is no assurance that person hasn't moved.
8. No advance warning to improve estimates.
9. Doesn't include non-residents.
10. Address changes take a long time to get into the record.
11. In states with hard-copy files, sampling by age or date of issue is difficult.
12. The sample is over-represented by good readers.
13. Follow-ups are hard to fit into a random time phase.
14. Some cases have died or moved out of the state.
15. People in the sample may hand the questionnaire over to a spouse thus creating a bias.

TELEPHONE INTERVIEW - ADVANTAGES

1. No mailings required
2. No car transportation required
3. Not dependent on license renewal time
4. Interviews are possible on weekends
5. Liaison is required at only one level, the state
6. Can be easily spread out in time period if desired for seasonal variation
7. The method doesn't miss those who renew licenses by mail.
9. Some people who move retain their old phone number

TELEPHONE INTERVIEW - DISADVANTAGES

1. Trip log method is not possible
2. Trip reconstruction method is difficult
3. Office space is required for telephoning
4. Bias due to type of refusal, such as "invasion of privacy"
5. Long distance calls
6. The sample doesn't include new residents or transients
7. There is a bias against long trips due to the person being at homeat time of call
8. Auxiliary survey is necessary for drivers without telephones or unlisted numbers
9. Over-representation of permanent residents
10. High cost
11. Many return calls are necessary
12. Most calls must be in evening
13. Telephone numbers must be sought from auxiliary source
14. Unrecorded address changes hinder phone number search
15. Special training required for interviewers
16. Over-representation of stay-at-home people
17. Return calls are hard to fit into random-time sampling groups
18. Some cases have died or moved from state

APPENDIX I
SURVEY REMINDER LETTERS

Letterhead

Dear Driver,

Recently a questionnaire was mailed to you requesting information relating to your driving habits.

Since, for economy reasons, only a small number of people were chosen to participate nationwide, your response is vital if we are to achieve accurate information -- and accurate information is vital if the National Highway Safety Bureau is to achieve success in its highway safety programs.

With this in mind, would you kindly take a few minutes to fill out our questionnaire and return it to us in the envelope provided.

As stated in our first letter, the answers which you supply will, of course, be held in the strictest confidence. They will be used only for counting the number of responses to each question. Only total group averages, using no names, will be utilized in our analysis.

Again, it is your reply which we need, regardless of whether you are currently licensed, or whether you have done any driving on the day appointed at the beginning of the questionnaire.

We are most anxiously awaiting your reply!

Sincerely yours,

Official Signature

(Official signature)

(Title)

TYPICAL FIRST REMINDER LETTER

Letterhead

Dear Driver,

You may have forgotten about us, but we haven't forgotten about you. We are very serious when we tell you that we <u>really</u> need your help.

You may think that one questionnaire more or less will not affect the results of a large nationwide survey. This is not exactly true. Because we have scientifically selected a few drivers to represent the entire nation, <u>your</u> reply is extremely important if we are to obtain an accurate picture of our national driving patterns.

Won't you please take a few moments to answer the questions on the enclosed questionnaire? You may rest assured that your individual answers will be held in the strictest confidence by our research staff, and can in no way affect the status of your driver's license.

Hoping to hear from you soon, I am

Sincerely yours,

Official Signature

(Official signature)

(Title)

P.S. In order to keep us from troubling you again with another reminder letter, won't you please reply promptly?

TYPICAL SECOND REMINDER LETTER

APPENDIX J

STATE CODES AND SUBJECT NUMBER RANGES

No.	State	Subject No. begins	No.	State	Subject No. begins
01	Alabama	01000-	28	Nevada	33000-
02	Alaska	02000-	29	New Hampshire	34000-
03	Arizona	03000-	30	New Jersey	35000-
04	Arkansas	04000-	31	New Mexico	37000-
05	California	05000-	32	New York	38000-
06	Colorado	08000-	33	North Carolina	41000-
07	Connecticut	09000-	34	North Dakota	42000-
08	Delaware	10000-	35	Ohio	43000-
09	Florida	11000-	36	Oklahoma	45000-
10	Georgia	13000-	37	Oregon	46000-
11	Hawaii	14000-	38	Pennsylvania	47000-
12	Idaho	15000-	39	Rhode Island	49000-
13	Illinois	16000-	40	South Carolina	50000-
14	Indiana	18000-	41	South Dakota	51000-
15	Iowa	19000-	42	Tennessee	52000-
16	Kansas	20000-	43	Texas	53000-
17	Kentucky	21000-	44	Utah	55000-
18	Louisiana	22000-	45	Vermont	56000-
19	Maine	23000-	46	Virginia	57000-
20	Maryland	24000-	47	Washington	58000-
21	Massachusetts	25000-	48	West Virginia	59000-
22	Michigan	26000-	49	Wisconsin	60000-
23	Minnesota	28000-	50	Wyoming	61000-
24	Mississippi	29000-	51	Washington D.C.	62000-
25	Missouri	30000-			
26	Montana	31000-			
27	Nebraska	32000-			

APPENDIX K
ALTERNATIVE DATA ANALYSIS MODEL

This appendix presents an alternative analysis model (Volume III, section 4) to be used in determining the statistical significance of differences in mean values between variable levels, e.g. male vs female. The model uses linear combinations of "cell means" (i.e., means of the 26 classes), thus removing effects of other variables and their interactions in the computation of error variance. The result is a more sensitive procedure for statistical significance testing.

The model below applies to the 24 cells or classes (Table 9, Volume III) defined by sex, road type, day/night, and driver age. For each cell, i, the mean value of mileage is:

$$Y_i = U + \Delta X_1 + \Delta X_2 + \Delta X_3 + \Delta X_4 + e_i$$

where U is the base mileage

ΔX_1 is the effect of sex (value zero for male, ΔF for female

ΔX_2 is the effect of road type (value zero for streets, ΔR for other roads)

ΔX_3 is the effect of day/night (value zero for day, ΔN for night)

ΔX_4 is the effect of driver age (value zero for 16 - 25, ΔA_1 for 26 - 60, ΔA_2 for over 60)

e_i is unexplained error.

The estimated variance for each cell is σ_i^2.

The cell mean vector and cell variance vector for the total population in the 24 cells are:

$$\bar{Y} = (Y_1, Y_2, \cdots Y_{24})$$
$$\bar{\sigma}^2 = (\sigma_1^2, \sigma_2^2, \cdots \sigma_{24}^2)$$

With this structure, contrast vectors are derived for each variable:

$$\bar{C}_1 = (C_{1,1}, C_{1,2}, \cdots C_{1,24}) \text{ : sex } (\Delta X_1 = \Delta F)$$
$$\bar{C}_2 = (C_{2,1}, C_{2,2}, \cdots C_{2,24}) \text{ : road type } (\Delta X_2 = \Delta R)$$
$$\bar{C}_3 = (C_{3,1}, C_{3,2}, \cdots C_{3,24}) \text{ : day/night } (\Delta X_3 = \Delta N)$$
$$\bar{C}_4 = (C_{4,1}, C_{4,2}, \cdots C_{4,24}) \text{ : age } (\Delta X_4 = \Delta A_1)$$
$$\bar{C}_5 = (C_{5,1}, C_{5,2}, \cdots C_{5,24}) \text{ : age } (\Delta X_4 = \Delta A_2)$$

where the first subscript of each component indicates the variable (1-5) and the second subscript indicates number or class (1-24). The component values are assigned according to the number of cells in which the variable appears, and the signs are assigned ($\pm$) according to variable level. The cell mean equations and contrast vector component values are presented in Table 1.

The effects of the four variables are determined from the following scalar products, where superscript t indicates the vector transpose from row to column form.

$$\Delta X_1 = \Delta F = \bar{C}_1 \cdot \bar{Y}^t = \sum_{i=1}^{24} C_{1,i} Y_i$$
$$\Delta X_2 = \Delta R = \bar{C}_2 \cdot \bar{Y}^t = \sum_{i=1}^{24} C_{2,i} Y_i$$
$$\Delta X_3 = \Delta N = \bar{C}_3 \cdot \bar{Y}^t = \sum_{i=1}^{24} C_{3,i} Y_i$$
$$\Delta X_4 = \Delta A_1 = \bar{C}_4 \cdot \bar{Y}^t = \sum_{i=1}^{24} C_{4,i} Y_i$$
$$\Delta X_4 = \Delta A_2 = \bar{C}_5 \cdot \bar{Y}^t = \sum_{i=1}^{24} C_{5,i} Y_i$$

The corresponding variance of the ΔX estimates are

$$\sigma^2_{\Delta F} = \sum_{i=1}^{14} C^2_{1,i}\,\sigma^2_i$$

$$\sigma^2_{\Delta R} = \sum_{i=1}^{14} C^2_{2,i}\,\sigma^2_i$$

$$\sigma^2_{\Delta N} = \sum_{i=1}^{14} C^2_{3,i}\,\sigma^2_i$$

$$\sigma^2_{\Delta A_1} = \sum_{i=1}^{14} C^2_{4,i}\,\sigma^2_i$$

$$\sigma^2_{\Delta A_2} = \sum_{i=1}^{14} C^2_{5,i}\,\sigma^2_i$$

Using the variances above, standard significance testing may be applied to the unbiased differences (ΔX's) between levels of each of the variables (sex, road type, day/night, age). As mentioned earlier, the effects of other variables and their interactions are removed in each test. If desired, the model may be extended to provide the actual unbiased estimates for each variable level with weighting factors derived from sample sizes in each cell.

The model may also be extended to provide variances of unbiased estimates of differences between cell means. This may be accomplished by generating further contrast vectors applied to interactions among the four variables. Another modification could use weighting factors derived from age and sex distributions in the total driving population, thus correcting any biases of these variables in the sample.

Table 1

Cell Mean Equations and Contrast Vector Components

	Equations						Components				
Class	Mean	Base	Sex	Road	Day/Night	Age	C_1	C_2	C_3	C_4	C_5
1	$\bar{Y}_1$	= U	+ 0	+ 0	+ 0	+ 0	-1/12	-1/12	-1/12	-1/8	-1/8
2	$\bar{Y}_2$	= U	+ 0	+ 0	+ 0	+ ΔA_1	-1/12	-1/12	-1/12	+1/8	0
3	$\bar{Y}_3$	= U	+ 0	+ 0	+ 0	+ ΔA_2	-1/12	-1/12	-1/12	0	+1/8
4	$\bar{Y}_4$	= U	+ 0	+ 0	+ ΔN	+ 0	-1/12	-1/12	+1/12	-1/8	-1/8
5	$\bar{Y}_5$	= U	+ 0	+ 0	+ ΔN	+ ΔA_1	-1/12	-1/12	+1/12	+1/8	0
6	$\bar{Y}_6$	= U	+ 0	+ 0	+ ΔN	+ ΔA_2	-1/12	-1/12	+1/12	0	+1/8
7	$\bar{Y}_7$	= U	+ 0	+ ΔR	+ 0	+ 0	-1/12	-1/12	-1/12	-1/8	-1/8
8	$\bar{Y}_8$	= U	+ 0	+ ΔR	+ 0	+ ΔA_1	-1/12	-1/12	-1/12	+1/8	0
9	$\bar{Y}_9$	= U	+ 0	+ ΔR	+ 0	+ ΔA_2	-1/12	-1/12	-1/12	0	+1/8
10	$\bar{Y}_{10}$	= U	+ 0	+ ΔR	+ ΔN	+ 0	-1/12	-1/12	+1/12	-1/8	-1/8
11	$\bar{Y}_{11}$	= U	+ 0	+ ΔR	+ ΔN	+ ΔA_1	-1/12	-1/12	+1/12	+1/8	0
12	$\bar{Y}_{12}$	= U	+ 0	+ ΔR	+ ΔN	+ ΔA_2	-1/12	-1/12	+1/12	0	+1/8
13	$\bar{Y}_{13}$	= U	+ ΔF	+ 0	+ 0	+ 0	+1/12	+1/12	-1/12	-1/8	-1/8
14	$\bar{Y}_{14}$	= U	+ ΔF	+ 0	+ 0	+ ΔA_1	+1/12	+1/12	-1/12	+1/8	0
15	$\bar{Y}_{15}$	= U	+ ΔF	+ 0	+ 0	+ ΔA_2	+1/12	+1/12	-1/12	0	+1/8
16	$\bar{Y}_{16}$	= U	+ ΔF	+ 0	+ ΔN	+ 0	+1/12	+1/12	+1/12	-1/8	-1/8
17	$\bar{Y}_{17}$	= U	+ ΔF	+ 0	+ ΔN	+ ΔA_1	+1/12	+1/12	+1/12	+1/8	0
18	$\bar{Y}_{18}$	= U	+ ΔF	+ 0	+ ΔN	+ ΔA_2	+1/12	+1/12	+1/12	0	+1/8
19	$\bar{Y}_{19}$	= U	+ ΔF	+ ΔR	+ 0	+ 0	+1/12	+1/12	-1/12	-1/8	-1/8
20	$\bar{Y}_{20}$	= U	+ ΔF	+ ΔR	+ 0	+ ΔA_1	+1/12	+1/12	-1/12	+1/8	0
21	$\bar{Y}_{21}$	= U	+ ΔF	+ ΔR	+ 0	+ ΔA_2	+1/12	+1/12	-1/12	0	+1/8
22	$\bar{Y}_{22}$	= U	+ ΔF	+ ΔR	+ ΔN	+ 0	+1/12	+1/12	+1/12	-1/8	-1/8
23	$\bar{Y}_{23}$	= U	+ ΔF	+ ΔR	+ ΔN	+ ΔA_1	+1/12	+1/12	+1/12	+1/8	0
24	$\bar{Y}_{24}$	= U	+ ΔF	+ ΔR	+ ΔN	+ ΔA_2	+1/12	+1/12	+1/12	0	+1/8

APPENDIX L

ABBREVIATED INJURY SCALE (AIS)
American Medical Association

The following scale was used for evaluating the severity of injuries of crash victims from information contained in hospital medical records.*

* From Personal communication with Harold A. Fenner, M.D., 700 North Shipp Street, Hobbs, New Mexico 88240, Sept. 1969.

Injury Category	Description	Severity Code
No Injury	None	Zero
MINOR	General	
	Aches all over	
	Minor lacerations, contusions, and abrasions.	
	All 1^{o} or small 2^{o} or 3^{o} burns.	
	Head and Neck	
	Cerebral injury with headache; dizziness; no loss of consciousness.	
	"Whiplash" complaint with no anatomical or radiological evidence.	
	Abrasions and contusions of ocular apparatus (lids, conjunctiva, cornea, uveal injuries); vitreous or retinal hemorrhage.	
	Fracture of the nose.	
	Chest	
	Muscle ache or chest wall stiffness.	
	Abdominal	
	Muscle ache; seat belt abrasion; etc.	
	Extremities	
	Minor sprains and fractures and/or dislocation of digits.	
MODERATE	General	2
	Extensive contusions; abrasions; large lacerations; avulsions (less than 3" wide).	
	10-20% body surface 2^{o} or 3^{o} burns.	
	Head and Neck	
	Cerebral injury with or without skull fracture, less than 15 minutes unconsciousness, no post-traumatic amnesia.	

Injury Category	Description	Severity Code
	Undisplaced skull or facial bone fractures.	
	Compound fracture of the nose.	
	Lacerations or the eye and appendages; retinal detachment.	
	Disfiguring lacerations.	
	"Whiplash"-severe complaints with anatomical or radiological evidence	
	Chest	
	Simple rib or sternal fractures.	
	Major contusions of chest wall without hemo- or pneumothorax, or respiratory embarrassment.	
	Abdominal	
	Major contusion of abdominal wall.	
	Extremities	
	Compound fractures of digits.	
	Undisplaced long bone or pelvic fractures.	
	Major sprains of major joints.	
SEVERE (not life-threatening)	General	3
	Extensive contusions; abrasions; large lacerations exceeding involvement of two extremities, or large avulsions (greater than 3" wide).	
	20-30% body surface 2^{o} or 3^{o} burns.	
	Head and Neck	
	Cerebral injury with or without skull fracture, with unconsciousness more than 15 minutes; without severe neurological signs; brief post-traumatic amnesia (less than 3 hours).	
	Displaced closed skull fractures without unconsciousness or other signs of intracranial injury.	

Injury Category	Description	Severity Code
	Loss of eye, or avulsion of optic nerve.	
	Displaced facial bone fractures, or those with antral or orbital involvement.	
	Cervical spine fractures without cord damage.	
	Chest	
	Multiple rib fractures without respiratory embarrassment.	
	Hemo or pneumothorax.	
	Rupture of diaphragm.	
	Lung contusion.	
	Thoracic spine fracture without neuro-involvement.	
	Abdominal	
	Contusion of abdominal organs.	
	Extraperitoneal bladder rupture.	
	Retroperitoneal hemorrhage.	
	Avulsion of ureter.	
	Laceration of urethra.	
	Lumbar spine fractures without neurological involvement.	
	Extremities	
	Displaced simple long-bone fractures, and/or multiple hand and foot fractures.	
	Single open long-bone fractures.	
	Pelvic fracture with displacement.	
	Dislocation of major joints.	
	Multiple amputations of digits.	
	Lacerations of the major nerves or vessels of extremities.	

Injury Category	Description	Severity Code
SEVERE (life-threatening, survival probable)	General	
	Severe lacerations and/or avulsions with dangerous hemorrhage.	4
	30-50% body surface 2^{o} or 3^{o} burns.	
	Head and Neck	
	Cerebral injury with or without skull fracture, with unconsciousness of more than 15 minutes, with definite adnormal neurological signs; post-traumatic amnesia 3-12 hours.	
	Compound skull fracture.	
	Chest	
	Open chest wounds; flail chest, pneumomediastinum; myocardial contusion without circulatory embarrassment; pericardial injuries.	
	Thoracic spine fracture with paraplegia	
	Abdominal	
	Minor laceration of intra-abdominal contents (to include ruptured spleen, kidney, and injuries to tail of pancreas).	
	Intraperitoneal bladder rupture.	
	Avulsion of the genitals.	
	Lumbar spine fractures with paraplegia.	
	Extremities	
	Multiple closed long-bone fractures.	
	Amputation of limbs.	

Injury Category	Description	Severity Code
CRITICAL (survival uncertain)	General Over 50% body surface 2^{o} or 3^{o} burns.	5
	Head and Neck Cerebral injury with or without skull fracture with unconsciousness of more than 24 hours; post-traumatic amnesia more than 12 hours; intracranial pressure (decreasing state of consciousness, bradycardia under 60, progressive rise in blood pressure or progressive pupil inequality).	
	Cervical spine injury with quadriplegia.	
	Major airway obstruction.	
	Chest Chest injuries with major respiratory embarrassment (laceration of trachea, hemomediastinum etc.).	
	Aortic laceration.	
	Myocardial rupture or contusion with circulatory embarrassment.	
	Abdominal Rupture, avulsion, or severe laceration of intra-abdominal vessels or organs, except kidney, spleen or ureter.	
	Extremities Multiple open limb fractures.	
FATAL (within 24 hours)	Fatal lesions of single region of body, plus injuries of other body regions of severity Code 3 or less.	6

Injury Category	Description	Severity Code
FATAL (within 24 hours)	Fatal lesions of single region of body regions of severity Code 4 or 5.	7
FATAL	2 fatal lesions in 2 regions of body.	8
FATAL	3 or more fatal injuries.	9

APPENDIX M

CLASSIFICATION OF INJURY

The recently recommended scale for classification of motor vehicle accident injuries which will ultimately replace the scale presently used by many law enforcement agencies is given below in its entirety. See Reference 12 of Volume II.

Injury Classification

Fatal Injury is any injury that results in death within twelve months of the motor vehicle traffic accident.

Incapacitating Injury is an injury, other than fatal, which prevents the injured person from walking, driving, or normally continuing the activities which he was capable of performing prior to the motor vehicle traffic accident.

Nonincapacitating Evident Injury is any injury, other than fatal and incapacitating; which is evident to any person other than the injured at the scene of the accident.

Possible Injury is any injury reported or claimed which is not a fatal, incapacitating or nonincapacitating evident injury.

No Injury is a situation in which there is no reason to believe that the person received any bodily harm from the motor vehicle traffic accident in which he was involved.