

archive
43199

THE UNIVERSITY
OF MICHIGAN
HIGHWAY SAFETY
RESEARCH INSTITUTE

Impact of Vans on Highway Safety

Susanne Norton
James O'Day

SEPTEMBER 1979

SPONSORED BY
AAA FOUNDATION
FOR TRAFFIC SAFETY

UM-HSRI-79-58

Contents

| | |
|--|---|
| INTRODUCTION | 1 |
| PURPOSE OF REPORT | 2 |
| RESEARCH METHODOLOGY | 2 |
| LITERATURE REVIEW | 2 |
| How Did the Van Movement Get Started? | |
| What is Vanning? | |
| Who Buys Vans? | |
| What are the Uses of Vans? | |
| What are the Specific Advantages of Vans? | |
| What are the Specific Disadvantages of Vans? | |
| COMPUTERIZED ACCIDENT FILES | 4 |
| Accident Descriptions | |
| Vehicle Descriptions | |
| Van Occupants | |
| Summary of Accident Statistics | |
| CASE REVIEWS | 6 |
| CPIR Visibility Obstruction Cases | |
| Van/Pedestrian Fatal Accidents | |
| DRIVER SURVEY | 8 |
| Characteristics of Drivers | |
| Vehicle Ownership/Driving Experience | |
| Visibility Obstruction Opinions | |
| CONCLUSIONS | 9 |

Impact of Vans on Highway Safety

Introduction

Vans for personal use have constituted a substantial, growing sector of the automotive scene. Van sales alone reached 526,000 in 1977—five times sales in 1971. Predictions were that in 1979 one out of three new “cars” wouldn’t be a car at all but a van, pickup, or 4x4. The current energy crisis has modified the picture substantially. At this writing van and truck sales as personal vehicles have dropped,¹ and it is hard to predict now to what extent sales will rebound in the future.

A good travel van is about as versatile a vehicle as you can find—the honest answer to a veritable host of conflicting needs. A van is big enough to be a comfortable camper, yet small enough to double as a family car. The van is replacing the second vehicle in many families, with a growing number of van owners using their vehicles for general transportation about town as well as for recreational activities and vacation trips.

¹“Off the Road,” *Wall Street Journal*, June 6, 1979, p. 40.

Purpose of Report

With the increasing proportion of van bodies in the population today, a problem of concern and interest has been the changing mix of passenger vehicle weights from a unimodal distribution about a mode of 3500 pounds to a bimodal distribution consisting of small cars and relatively large vans and pickup trucks. Many of the problems of car-truck interactions (increased injury to the occupants of the smaller vehicle, visibility restrictions, disparate performance capabilities, etc.) will occur, albeit at a somewhat different scale, with a car-van mix.

Little if any research has been devoted to studying vans and their interactions with other vehicles on the highway today. Therefore, we have studied this area with three goals in mind:

1. To develop a useful set of descriptive statistics about vans: their numbers in the population; who van owners are; how and when vans are used; where vans are used geographically.
2. To determine the relative contribution of vans to accidents and injuries on the highway.
3. To quantify problems caused by the interaction of vans and other vehicles in the traffic stream, such as: blocking of vision; effect of performance limitations; etc.

Research Methodology

Our research methodology has consisted of the following:

1. Performing a *literature review* of material drawn largely from the HSRI library and from the special automotive collection at the Detroit Public Library.
2. Analyzing *computerized accident files*, drawing from the Fatal Accident Reporting System (FARS) files maintained for the entire country by the NHTSA's National Center for Statistics and Analysis and drawing from computerized files maintained for the states of Washington and Texas.

3. Reviewing *case reports* of pedestrian/van and pedestrian/car accidents for the states of Ohio and Michigan and reviewing in-depth Collision Performance and Injury Report (CPIR) accident reports which involved "visibility obstruction cases" at many points around the United States.
4. Conducting a *driver survey* from a random sampling of Toledo, Ohio, area drivers to determine their exposure to and attitudes towards vans on the highway today.

Literature Review

A literature review of material from the automotive collections of the Detroit Public Library was performed, as well as a survey of relevant material from the Highway Safety Research Institute (HSRI) library. The literature review was oriented towards answering the following questions.

How did the van movement get started?

The van craze began in California in the early 60's and has been attributed to the VW microbus, the hippie movement, and the abundance of recreational time, all of which fell together. The VW van stimulated the desire for the versatility a van offers and symbolized the rejection of the "avaricious Cadillac culture."² Whatever happened in California soon happened in the remainder of the country.

What is vanning?

The van seems to be viewed as an escape and a way of life. "To van" is to get away from it all while going to great lengths to take it all with you. "Just as beads and gauze shirts began showing up on Beverly Hills lawyers and Des Moines insurance salesmen, vans began showing up in their driveways."³ The true vanner at heart is not fundamentally interested in getting anywhere, only in going. He, or she, may be the embodiment of the "American traveler."

Vanning should probably not be considered a fad because it so often serves a purpose. There are a number of basic functions that the

²"Van Culture," *Motor Trend*, July 1976, p. 52.

³"Up Front," *Motor Trend*, July 1976, p. 4.

vehicle can provide. Consequently, there are all kinds of people, with all kinds of backgrounds, driving vans. The van is the “supercar” of the 70’s, and, as such, constitutes a permanent part of the automotive scene.

Who buys vans?

A large part of van sales represents purchases by families who might once have bought station wagons. In 1975, the average buyer was 32 years old, married, and had small children.⁴ However, there are as many different types of vanners as there are types of vans. The van enthusiasts include “old coots” as well as young marrieds and adolescents. Van ownership makes a statement about the owner: Vans project a special “image” that marks the owner as right up on the latest in street transportation.

What are the uses of vans?

The van is a useful, comfortable, and quietly stylish piece of family transportation. In 1976, there was a 30% chance a van was being used for personal transportation rather than for hauling goods. The personal van has the potential of leading an extremely versatile life. It is a shopper—camper—commuter—race-viewing headquarters—people hauler—“go to the market and then haul the groceries one mile or 5000 everyday piece of transportation”⁵—or an expensive station wagon. However, it usually ends up limited to a fairly specific role.

Vanpooling has demonstrated that it is a better way to go. It is cheap and socially acceptable. In 1976 the Minnesota Mining and Manufacturing Company had 75 vans with 800 regular riders. Estimated cost was \$.54 for a vanpool ride versus \$3.71 for a private car, \$1.86 for a carpool, or \$1.76 for the bus.

Many vans are converted into campers by their owners. In 1974, 20,800 vans were converted by 50 major converters grossing \$127 million. The 1976 projection was a conversion of 31,400 vehicles grossing \$225 million in modifications.

⁴*Newsweek*, August 1975, p. 65.

⁵“Project Multi-Purpose.,” *Motor Trend*, July 1976, p.47.

What are the specific advantages of vans?

A van principally offers *versatility*—it can be anything you want it to be, and this versatility generally is not found in any other vehicle. In addition, vans apparently offer:

more room . . . more comfort . . . more pizzazz . . . practicality . . . commanding view of traffic ahead . . . customization . . . durability . . . greater traction when climbing hills . . . good design . . . careful balance . . . ability to carry a heavier load and take more abuse in everyday operation (the wheels, axles, suspension parts, brakes, steering, etc., are heavier and stronger than passenger car equivalents) . . . fuel economy on par with full-size station wagon . . . broad choice of body styles . . . more interior space in relation to outside dimensions than other types of commercial vehicles.

What are the specific disadvantages of vans?

The apparent disadvantages of vans are that they:

are pushed more by the wind . . . have dangerous blind spots along sides . . . cut driver’s view to rear . . . have limited traction when there is no load in rear . . . have a larger turning radius . . . are not as smooth riding . . . use more fuel than most passenger cars . . . are hard to justify on economic grounds alone . . . might need auxiliary heating or air conditioning systems . . . require a reorientation process to drive.

The van and safety

The van has certain characteristics which may affect safety on the highway. It has long been recognized that in a collision between a large and a small vehicle, the smaller vehicle (and its occupants) suffer the greater damage and injury. Passenger cars, which for many years had been increasing in average weight, have finally started on a decline—reducing the size disparity between “large” and “small” cars. But the increasing proportion of vans and pickup trucks on the road means that there is a

new group of large vehicles. The severe collisions between the minicar and the full-size sedan may be replaced by collisions between the downsized sedans and the vans.

Vans have been exempt from many of the NHTSA vehicle safety standards, and have had delayed implementation of others. Vans come under the general heading "multi-purpose passenger vehicles," and currently have the same requirements as do passenger cars for most of the "100" (accident prevention) series of Federal Motor Vehicle Safety Standards—covering such items as the transmission shift lever sequence, windshield washers and wipers, rearview mirror installation, etc.

In the "200" series of Federal Motor Vehicle Safety Standards (those concerned with injury prevention), vans are not currently covered by Standard 201 (which requires some of the interior surfaces of a car to be forgiving), 202 (which requires a head restraint to protect against whiplash injury in rear impact), 203 and 204 (which require an energy-absorbing steering column and limit the rearward displacement of the column in a crash), 212 (which requires retention of the windshield under certain crash conditions), 214 (a side door strength requirement intended to limit intrusion into the passenger compartment in a crash), and 216 (specifying a limit of roof crush in a roll-over).

Vans have been criticized for having limited visibility to the side and rear, and for being so large as to restrict other drivers' ability to see on the highway. In the next section of this report the safety aspects of the increasing van population will be considered in more detail.

Computerized Accident Files

A set of statistics about vans has been developed including: (1) identification of the kinds of accidents in which vans are over-represented, (2) characteristics of the damage and injuries associated with van involvement in accidents, and (3) description of the van occupants in accidents. Motor vehicle crash data files were searched by computer to obtain this information and included:

1. About 50,000 Fatal Accident Reporting System (FARS) crashes from 1977, including 1453 van involvements, which resulted in fatal injuries to one or more persons throughout the United States.

2. About 139,000 motor vehicle crashes (including 1824 vans) in the State of Washington during 1976.
3. About 500,000 crashes in the State of Texas during 1977, including about 20,000 vans.

The following observations came from analysis of the above three sources.

Accident Descriptions

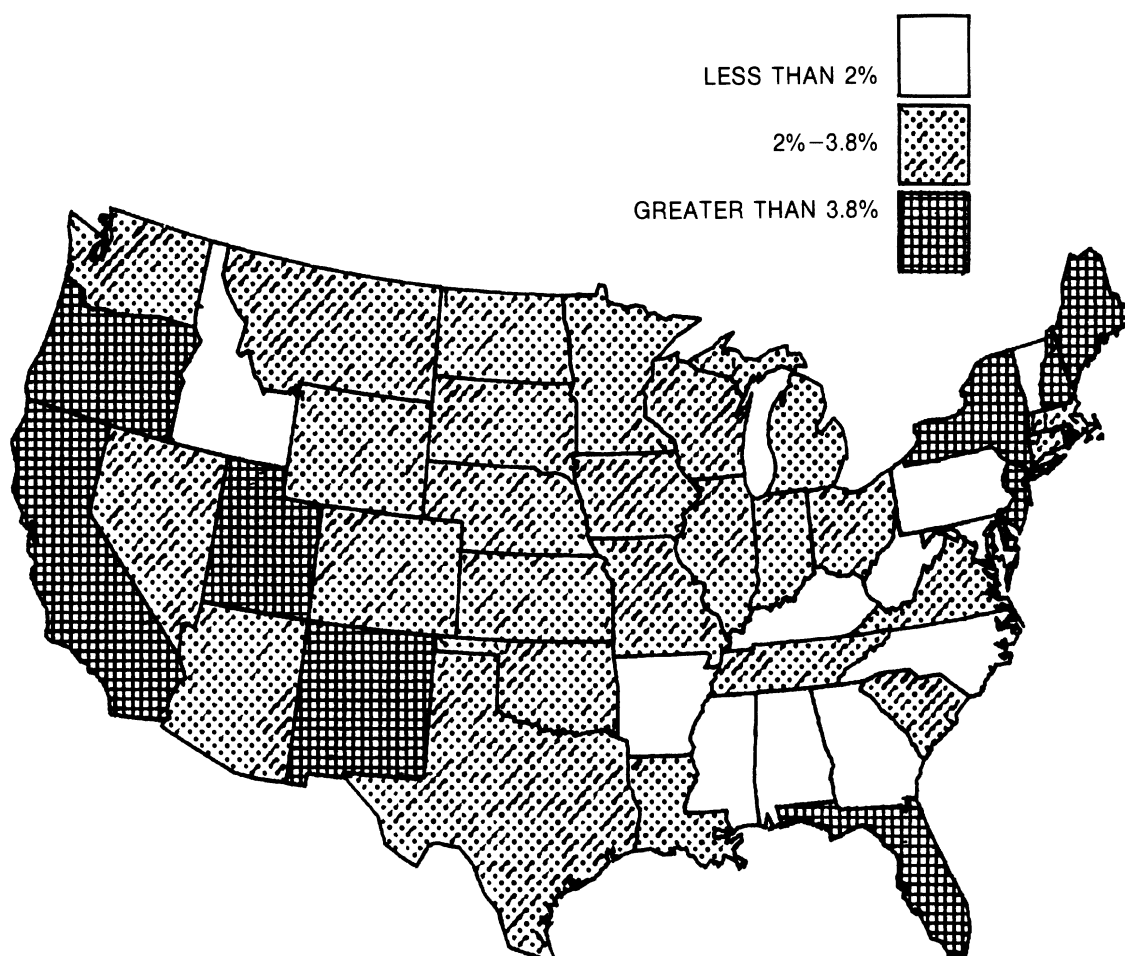
In the total accident population van drivers, in comparison with car drivers, have more accidents when *starting from a stopped position*, when *backing up*, when *parked*, or when *changing lanes*. Vans are occasionally blamed for causing accidents by creating a view obstruction (See Case Reviews). Also, in comparison with cars, vans are more likely to have accidents on weekdays, on interstates, in daylight, and during the autumn months . . . no doubt related to their exposure at those times and places.

The most frequent "first harmful event" in a van accident was hitting another motor vehicle in transport. The same is true for passenger cars. In fatal accidents, however, vans are considerably overrepresented in collisions with pedestrians. In 25% of all van-involvements in 1977 fatal accidents a pedestrian was killed, compared with 17% for passenger cars and 16% for pickup trucks.

The geographic distribution of van accidents is seen most readily in the FARS data, the only truly national data with the necessary detail. Although California has only 9.5% of the U.S. population, it accounts for 15% of the fatal accidents involving vans. Texas has 7% of the van fatal accidents (with 5.5% of the population), and New York 7% (with 9% of the population). Florida produces 6% of the fatal van accidents with only 3% of the U.S. population.

Figure 1 shows the percentage of each state's fatal accidents involving vans in three groups. It seems likely that van involvements should be roughly proportional to their number on the road, so that this map reflects the popularity of vans in various parts of the U.S. The states with the highest value of this statistic are Delaware, with 5.6%, New Jersey, with 5.5%, and (not shown on the map) Hawaii, with 5.3%.

FIGURE 1
Percentage of a State's Fatal Accidents That Involved a Van



Vehicle Descriptions_____

In comparison with cars, higher percentages of late model vans were involved in accidents. This indicates the growing van population over the last few years. In accidents vans are damaged less than cars. In the fatal accident data, the percentage of vans (54%) with no fatalities in the vehicle is higher than the percentage of cars (40%) and pickup trucks (47%) with no fatalities, partly explained by the over-involvement of vans with pedestrians.

Van Occupants_____

According to FARS data, 34% of van occupants are in the 21-30 age bracket, as compared with 27% of passenger car occupants. Also, 75% of van occupants are male, as opposed to 65% of car occupants. In comparison with cars, van drivers involved in accidents are more sober, and van occupants suffer less injury. In Texas accidents van drivers are more likely than car drivers to hold non-Texas driver's licenses, to be male, and to be in the 25-44 age bracket.

Summary of Accident Statistics_____

In summary, a number of differences can be cited between van accidents and car accidents. In comparison with cars, vans:

- Have a higher proportion of their accidents on weekdays, on interstates, in daylight, and during autumn months
- Have a higher proportion of fatal pedestrian collisions
- Have a higher proportion of their accidents when starting up, backing up, or changing lanes
- Have fewer fatalities (per involvement) and less injury to occupants of their own vehicle
- Are more likely to have more occupants in the 21-30 age bracket
- Are more likely to have male occupants
- Are more likely to have sober drivers

Case Reviews_____

While the analysis of accident data files points up some major characteristics of van accident involvement, the level of detail in the computerized data is often not sufficient to get a complete understanding of the circumstances. For this reason individual case reviews of accident reports were performed on the following material:

1. A group of 352 visibility obstruction cases drawn from the Collision Performance and Injury Report (CPIR) data files, which represent a compilation of individual clinical studies of special-interest accidents investigated by more than 30 teams.
2. Twenty Michigan and eighteen Ohio Official Traffic Accident Reports for 1976 and 1977 FARS *van*/pedestrian fatal accidents; and a comparison set of 25 Michigan Official Traffic Accident Reports for 1977 FARS *car*/pedestrian fatal accidents.

The following observations came from the individual case reviews.

CPIR Visibility Obstruction Cases_____

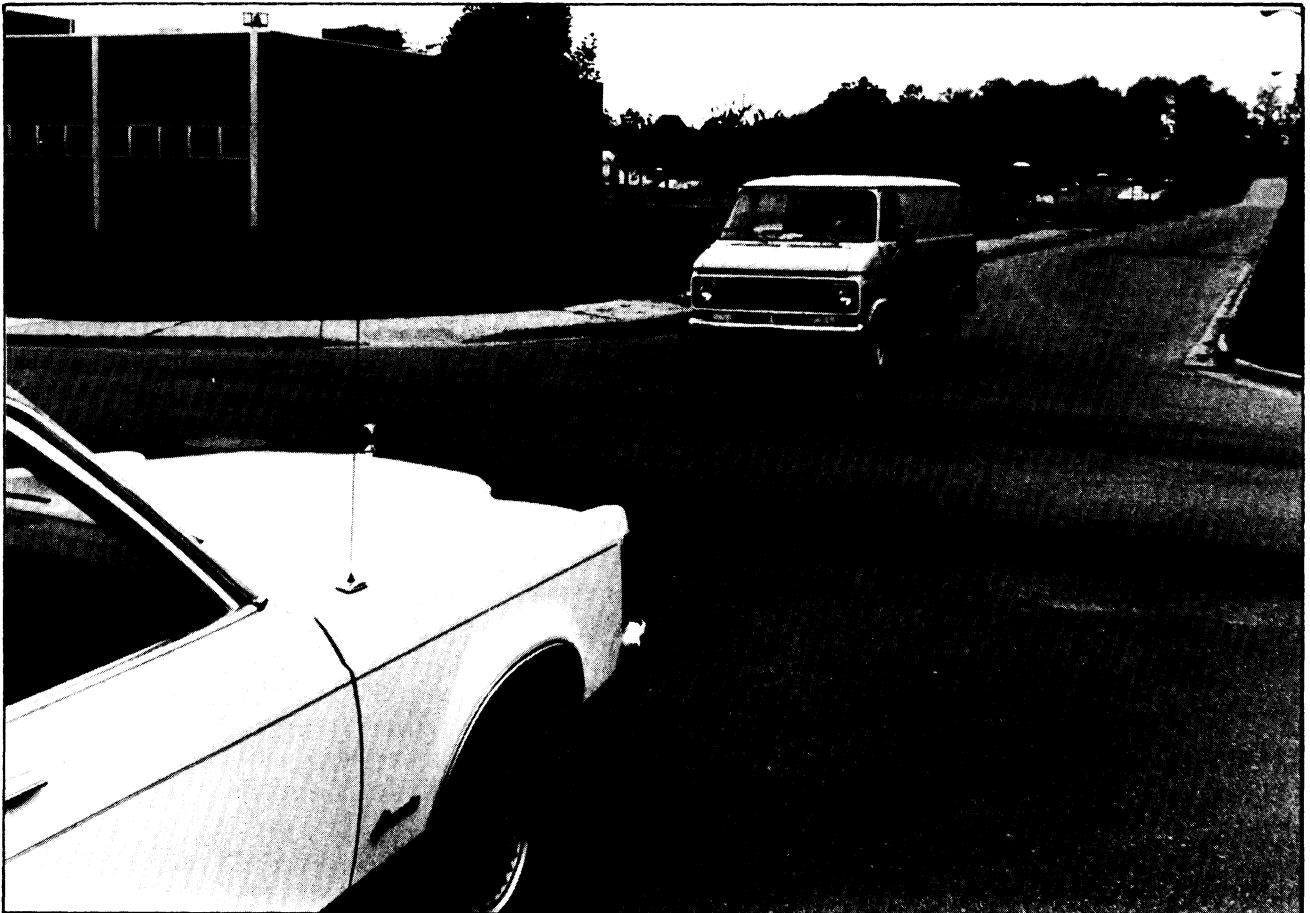
Vans have been cited as causing visibility obstructions for other motorists. Of over 9000

in-depth case studies in the CPIR files, there were 352 occurrences of a "visibility obstruction involving a vehicle other than the one which crashed." While in a majority of these cases a large truck was the source of the visibility problem, in ten cases the "cause" was attributed to a van obstruction. Typical accident descriptions were:

1. "A van shielded the traffic signal from Vehicle 2 which entered the intersection against the signal. The van also shielded Vehicle 2 from Vehicle 1." (Utah No. 71070)
2. "Driver of Vehicle 1 stated that he was not able to see the overhead signal because a large van was in front of him, restricting his sight distance." (Rochester University No. 137)
3. "Vehicle 1 was making a left turn. His vision was blocked by a large van in the opposite turning lane. Vehicle 1 struck Vehicle 2 after initiating the left hand turn. The large van created severe sight limitations and was a major causation factor in this case." (Univ. of Utah No. 70167-1)

From the accident descriptions it is apparent that vans occasionally cause view obstructions (1) when they make left turns and block the view of oncoming traffic, (2) when they stand between a car and overhead signals, (3) when they are parked along a street, and (4) when they are traveling in front of a car attempting to pass on a two-lane highway. The accompanying photographs illustrate a potential accident situation in which a van contributes by blocking the view between the drivers of two passenger cars (similar to case 3 above). In the first picture the van and both cars are clearly visible, but in the second picture, the view from the white car to the small car behind the van is blocked. The driver of the small car also has his view shielded by the van.

As noted above, the large majority of the vision-blocking vehicles were trucks, but vans were specifically cited in 10 of the 352 vision-blocking cases. The data in the CPIR file cover a period from about 1968 to 1977, and it seems likely that the number of vans on the road was smaller than it is today. With the increase in both the number of vans and the number of small cars, this is a problem which may be expected to increase.



Van/Pedestrian Fatal Accidents_____

Because police investigations of fatal accidents are usually quite thorough, reading of the original reports can often provide further insight as to how the accident or fatality occurred. During 1976 and 1977 in Michigan there were twenty occasions in which a van was reported to have struck and killed a pedestrian. In four of the twenty cases it was clear that the van knocked down and ran over the pedestrian. Using a comparison sample of 25 car/pedestrian accidents from the same source, in only one case was the pedestrian run over.

Ohio accident reports were also reviewed, and, although there was less detail available, seemed to substantiate these findings.

Driver Survey

Toledo, Ohio, is considered a typical American city of moderate size (with the 1976 Standard Metropolitan Statistical Area population of 780,000). A random telephone survey of Toledo area driver's license holders was conducted in May, 1979. A sample of 95 respondents was obtained. Toledo, including suburbs, has approximately 50 telephone exchanges, and approximately two numbers were selected at random from each exchange. (An exchange represents a distinct geographical area.) The survey was conducted to determine if there were perceived visibility problems associated with vans, to determine public attitudes towards vans on the highway today, and to obtain descriptive information about van owners.

Characteristics of Drivers_____

56% of the drivers lived in Toledo, with the remainder in the suburbs. 58% were female and 42% were male. 25% were under 30 years of age, 48% were between 30 and 50 years of age, and 27% were over 50. In regards to education, 17% had less than a high school diploma, 39% were high school graduates with no college, 31% had one to four years of college, and 13% had graduate school education. 64% of the respondents were employed at the time of the survey.

In comparison with non-van owners, van owners are younger, somewhat more educated, and more likely to be employed. About the same percentage of van owners as non-van

owners lived within the city limits of Toledo. 73% of past and present van owners had children living at home at the time of van ownership.

Vehicle Ownership/Driving Experience

At the time of the survey, 85% of the respondents owned only cars, 8% owned vans, and 3% owned trucks. The rest did not presently own a vehicle. However, 16% had owned a van at some time in their lives. Most of the current van owners had purchased their vans within the past year.

75% of all respondents had ridden in a van within the last year, and 47% of these had ridden in the last 30 days. 20% of the respondents who had never owned a van stated they had at some time considered buying one. 48% of all respondents stated they would be interested in riding in a vanpool to work (and this was prior to the most recent energy crisis).

In comparison with non-van owners, van owners are, of course, more likely to have ridden in a van in the last 30 days and much less likely to have used a van for the sole purpose of going for a ride with a friend or relative. They are more likely to have used a van last for a work-related function. Both van owners and non-van owners used vans equally for recreational trips. Non-van owners were more interested in riding in a vanpool to work than van owners. Van owners spend more time driving on freeways than non-van owners.

Visibility Obstruction Opinions_____

In response to the question "Are you bothered by other vehicles blocking your vision?",⁶ 50% said they were not bothered, 24% said trucks block their vision, 13% said vans block their vision, and 7% said cars block their vision. In response to the direct question "Have you noticed any problems with vans, especially as they interact with traffic on the highway today?", 17% of the respondents said they "obstruct view" or have other visibility problems. About the same percentage of van owners as non-van owners say there are no particular problems with vans as they interact with other traffic on the road today.

⁶This question was asked without prompting, and before the respondent knew this was a survey about vans.

Of those who have at some time driven a van, 44% say the visibility from inside the van is better, 39% say visibility is worse, and 14% (mostly van owners) say visibility is *both* better and worse! This reflects the opinion that forward visibility is better, while visibility to side and rear is worse. More van owners than non-van owners cited blind spots to side/rear as a major visibility hindrance for vans. When visibility is blocked by another vehicle, van drivers report they are more conservative, are more likely to do nothing, stay back, and not try to pass.

Conclusions

The van as a passenger vehicle has come into its own just in the 1970's. There are many functions that the van can provide, including being a shopper, a people-hauler, a cargo-carrier, an over-the-road traveler, a camper, or simply serving as a large (and moderately expensive) station wagon. Such versatility is not found in any other vehicle, and consequently there are people from many walks of life who own or want to own vans.

With the increasing proportion of van-type bodies on the highway today, many of the problems of car-truck interactions may intensify. Given an accident between a van and a passenger car (and particularly in the present shift toward smaller and smaller cars), there is likely to be an increase in injury to the occupants of the lighter vehicle. Vans, as seen above, are overrepresented in pedestrian fatal accidents. Finally, vans on the road lead to visibility problems for drivers of smaller vehicles as well as for the van driver who must cope with blind spots.

In spite of the fact that the profusion of vans on the road has created some safety problems, and in spite of their relatively poor fuel economy, it seems likely that the van movement is here to stay. One might borrow the old phrase, "If you can't live without them, you had better learn to live with them." Certainly, the American motorist will have to recognize the effects of vans on the road and be educated to adjust to the safety hazards that they pose.

