OPERATIONAL EFFECTS AND SAFETY HAZARDS INVOLVED IN TRANSPORTING 14-FOOT WIDE LOADS IN VIRGINIA

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(The opinions, findings, and conclusions expressed in this report are those of the authors and not necessarily those of the sponsoring agencies.)

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SUMMARY

Since the early 1950's, highways have been designed in Virginia to carry 8-foot wide vehicles on 12-foot lanes. Extralegal width vehicles impose detrimental operational effects and safety hazards on other highway users. To minimize the hazards, the Highway and Transportation Commission places restrictions on the movement of all extralegal size vehicles through permit regulations. Currently in Virginia, frequent numbers of loads up to and including those 12 feet in width are allowed to be operated on the highway on a routine permit basis. Loads above 12 feet wide have been allowed infrequently, and only when alternative measures have been exhausted. Recently the Virginia Housing Study Commission endorsed a proposal to transport frequent numbers of 14-foot wide housing units on the state's highways. A 14-foot wide load exceeds the width of a standard 12-foot traffic lane and creates more hazards for the motorist than do 12-foot wide loads.

Based on studies of 14-foot wide loads conducted in California and Florida and by the Midwest Research Institute, and data obtained from the Virginia State Police and highway personnel, the significant findings of this study are:

1. Regardless of initial requests to have 14-foot wide loads traverse only the highest type roads, they must eventually traverse all types to reach their ultimate destinations.

2. An 18-foot traffic lane is needed for the safe movement of a 14-foot wide load. Thus, for standard 12-foot traffic lanes, encroachment by the 14-foot load onto the shoulder and the adjacent traffic lane is necessary.

3. Only 5% of Virginia's highway system mileage consists of 12-foot traffic lanes.

4. A 14-foot wide load could physically use approximately 45% of Virginia's highway mileage, provided traffic was restricted to a one-way operation.

5. Thirty percent of the highway mileage in Virginia consists of 7-foot traffic lanes that would physically restrict, if not preclude, the movement of a 14-foot wide load.

6. Motorists approach 14-foot wide loads more cautiously and with greater vehicle displacement than is the case for 12-foot loads.

7. Motorists are reluctant to pass 14-foot wide loads. This reluctance creates delay and inconvenience to the motoring public and reduces the level of service of the facility.

8. Motorists are more likely to encroach on the shoulder when passing 14-foot wide loads than when passing 12-foot loads.

9. Vehicles passing 14-foot wide loads on 4-lane undivided highways move to the left over the double yellow centerline and create potentials for head-on collisions.

10. A 14-foot wide load overhanging the shoulder area creates potential safety hazards for pedestrians and bicyclists.

11. At narrow structures the 14-foot wide load reduces travel momentarily to a one-way operation and creates abnormal speed changes and erratic maneuvers by other highway users.

12. It is extremely difficult to maneuver wide loads in urban areas.

13. Frequent flat tires on wide mobile homes create a potential safety hazard. Breakdowns are normally time-consuming to repair and often block portions of the traveled way. A serious hazard would be created if the unit were permitted on a narrow road with one-way traffic and a breakdown occurred that resulted in blocking the way of fire, police, and other emergency vehicles.

14. Accident records do not indicate that 12-foot wide loads are directly involved in an inordinate number of accidents. The additional 2 feet make the load width exceed existing lane widths and pose a different type of hazard.

ACKNOWLEDGMENTS

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INTRODUCTION

Highway transportation systems are designed to safely and efficiently accommodate vehicles which do not exceed legal size and weight limits, however, there is an occasional need to transport a vehicle or load that exceeds the legal limits.(1) To protect the motoring public from unnecessary hazards and inconveniences caused by extralegal vehicles, hauling or moving permits setting forth restrictions must be obtained before they are moved over the highway.(2)

One of the dimensions of vehicle size on which legal limitations are placed is the width. By Virginia statute, permits are required when the width of a vehicle and its load exceed 8 feet.(1) Under the current policy of the Highway and Transportation Commission, multiuse permits may be issued for the transportation of units up to 12 feet wide.(2)

In its 1975 report to the Governor and General Assembly of Virginia, the Virginia Housing Study Commission endorsed approval of the transportation of 14-foot wide housing units on Virginia highways.(3) The reasons for the Commission's endorsement were (1) the need to provide adequate housing for the state's growing population, and (2) the providing of parity for the Virginia mobile home and manufactured housing industry in its competition with the industries of other states.

The transportation of 14-foot wide units would require a change in the current load width policy. As 14-foot units would be 2 feet wider than the standard 12-foot traffic lane, these extralegal loads could not be confined to a single traffic lane and could involve operational problems and safety hazards greater than those encountered with the movement of 12-foot units.

The responsibility of the State Highway and Transportation Commission is to give primary consideration to the safety and convenience of the motoring public and to protect the highway systems of the state. Therefore, prior to considering any change in the load width policy, Commissioner Douglas B. Fugate of the Virginia Department of Highways and Transportation requested an assessment of the operational effects and safety hazards which might be anticipated in the transportation of 14-foot wide units in Virginia.

PURPOSE

The purpose of this study was to determine the detrimental operational effects and safety hazards of permitting 14-foot wide loads on Virginia highways. Since the Department of Highways and Transportation must issue permits and administer the program of transporting extralegal units over the highway system, it is appropriate that such operational effects and hazards be anticipated. Consideration of such factors as road and lane widths throughout the Commonwealth, dimensions of bridges and tunnels, and the proximity to the roadway of other appurtenances are but examples of some of the issues involved.

At present, 43 states permit the transportation of 14-foot wide loads. This rather widespread allowance of oversize loads does not necessarily mean, however, that the movement of the loads is not accompanied by significant problems to highway and transportation officials and to highway users. Moreover, many of the states that permit 14-foot wide loads bear little resemblance to Virginia in terms of topography and highway system characteristics. So the decision in question is not simply a matter of Virginia aligning herself with the majority view.

It should be emphasized also that the study did not attempt to balance the costs and benefits and reach a conclusion pro or con; it merely sought to identify the problems likely to be experienced without regard to their societal costs. The problems here identified should be weighed by decision makers against the likely benefits cited by the Housing Study Commission.

Clearly, there is an upper limit to the allowable width of vehicles which frequently travel the highway system beyond which the state can not or should not go. A system designed for 8-foot wide vehicles simply will not accommodate large numbers of vehicles in excess of that width. Whether that upper limit has been reached at 12 feet or will be reached at 14 feet or 16 feet is not clear. Nor is it clear how far the mobile home and industrialized housing industry will seek to go in this regard. Already some states permit 16-foot and 18-foot wide loads. Will the Virginia mobile home and industrialized housing industry face serious competition from firms in those states in the near future? If so, will the Commonwealth be faced with requests for the movement of vehicles 16 feet and 18 feet in width if 14-foot wide units are allowed? The answers to these questions are not available but some consideration of their future resolution is necessary.

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SCOPE

The scope of the assessment was restricted to a literature survey and a review of the experience of hauling 12-foot wide loads in Virginia, because of the one-month time limitation allowed for both data collection and report preparation. Data collected included accident reports provided by the Virginia state police and observations of operational problems and hazards provided by highway and State Police personnel.

Discussion in this report is directed at examining only the detrimental effects that could logically be expected if 14-foot wide loads were permitted on Virginia's highways. No effort has been made to weigh the detrimental effects against any possible benefits, because the social and economic benefits have already been cited in the Housing Study Commission report.(3)

Although this study addressed the problems associated with wide loads in general, it is recognized that a majority of 14-foot wide movements would consist of industrialized housing and mobile home units. Therefore, most of the comments in this report are directed toward these types of units.

The study methodology assumes the hypothetical case that 14-foot wide loads were permitted on the entire Virginia highway network and then examines the problems that could develop. Use of a hypothetical case rather than a field test was necessary primarily because of time restrictions; nevertheless, the problems suggested here in theory are supported by data collected during actual tests in California and Florida, and by other states and agencies, and referred to frequently throughout this report. Further insight into the problems created by wide loads was obtained by examining the experience with 12-foot wide loads in Virginia.

For purposes of simplifying the discussion, the report is subdivided into the following areas:

1. Literature Survey
2. Geometric and Structural Restrictions
3. Operational Effects and Safety Hazards
4. Other Problems.

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DISCUSSION

Literature Survey

A literature search conducted by the Highway Research Information Service* provided a basis for the literature survey. The primary findings in this study are based on the results of studies conducted by California, Florida, and the Midwest Research Institute.(4,5,6,7)

In the 1972 California study, a 14-foot wide trailer coach was driven over 1,000 miles of various types of state and local roads.(4) As a result of operational problems and potential safety hazards encountered during the demonstration, California decided against permitting routine movements of 14-foot wide housing units on its highway systems. In July 1973, California reviewed the feasibility of moving factory built housing units greater than 12 feet over their highways and again concluded not to routinely permit loads greater than 12 feet wide.(5) As of January 1, 1976, California highway officials were not aware of any developments in either the housing industry or state legislature that would cause them to reevaluate their prohibition of 14-foot wide units.

In August 1972, a study was conducted by the Florida Department of Transportation to determine if loads wider than 12 feet should be routinely permitted on the state's highways.(6) In the Florida study, a tractor-trailer unit with a 12-foot-9 inch module used in hotel construction was driven over a variety of primary and secondary highways. The study resulted in the recommendation that Florida prohibit loads wider than 12 feet on their highways because of the wide load's potential for damaging structures, causing accidents, and reducing highway capacity.

One of the most comprehensive studies of the problems created by wide housing units was conducted by the Midwest Research Institute in 1973 for the Federal Highway Administration. The project included photographic and visual observations of traffic in the vicinity of 12- and 14-foot wide housing units. Approximately 12,000 miles of wide load movement were studied during 63 trips in 20 states. In addition to collecting traffic data, study personnel interviewed approximately 3,000 motorists in an effort to determine public opinion concerning the transporting

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*Highway Research Information Service is a service of the Transportation Research Board, National Academy of Sciences, 2101 Constitution Avenue, N. W., Washington, D. C., 20418.

of wide housing units. The results of the study suggest that "the question is not a simple one and, unfortunately, the data obtained in this study do not clearly show that states should or should not allow 14-foot wide loads."(7) The researchers admitted that generally the data indicated that 14-foot loads caused more problems and greater impositions on other highway users than did 12-foot units, but felt the differences were not extreme. The study recommends that the problems be minimized by imposing greater restrictions on 14-foot units than are imposed on 12-foot loads.

Geometric and Structural Restrictions Imposed on 14-Foot Wide Loads in Virginia

From experience and research, the minimum lane width for safe operations of commercial or mixed traffic has been determined to be 12 feet.(8) This figure was determined by extensive speed placement tests conducted just prior to World War II. Research indicated that 8-foot vehicles operating at 55 mph required a normal weaving path of 10 feet. An additional foot on each side of the path was considered desirable to increase safety and reduce maintenance, especially on the shoulder. By the 1950's, the 12-foot lane was considered a national standard for legal size vehicles.(4)

Data collected during the California study indicated a 14-foot trailer with mirrors created an effective width of 14-1/2 to 15 feet and required an additional 4 feet of roadway to provide desirable safety.(4) Thus the 14-foot wide load actually required a minimum traveled way of 18 feet. As the standard lane width is only 12 feet, encroachment on the shoulder and into the adjacent lane was unavoidable.

Interstate highways designed with 12-foot lanes and paved shoulders provide ideal operating conditions for legal size vehicles. However, the primary system and especially the secondary system in Virginia have many sections of narrow roadways and narrow structures whose geometrics make it impossible to move 14-foot wide loads. A summary of the Virginia traffic lane widths and structures 14-foot wide or less is given in Table 1.

Some of the states that allow movement of 14-foot loads restrict travel to roadways that have 12-foot lanes. As noted in Table 1, in Virginia 90% of the roadway mileage has traffic lanes less than 12-feet wide. This figure does not reflect the fact that many divided highways use the old roadway to carry traffic in one direction and that in many cases these are less than 12 feet wide. For example, some noticeable cases of divided highways with 9-foot traffic lanes in one direction are sections of Route 60 in New Kent County, Route 29 in Prince William County, and Route 360 in Hanover County.

TABLE 1

VIRGINIA TRAFFIC LANE AND STRUCTURE WIDTHS

Traffic Lane Width	Highway System in Miles as of June 30, 1975				
	Interstate	Primary	Secondary	Total	% Total
6 ft. or less	0	18	10,899	10,917	21.13
7 ft. or less	0	64	15,512	15,576	30.15
8 ft. or less	0	284	30,921	31,205	60.40
less than 10 ft.	0	1,022	37,888	38,910	75.32
less than 12 ft.	0	5,036	41,429	46,465	89.94
Total miles in system	836	7,848	42,977	51,661	100.00
Structure Width*					
14 ft. wide or less	0	150	2,316	2,466	13.84
15 ft. wide or less	0	172	3,040	3,212	18.03
16 ft. wide or less	0	183	3,433	3,616	20.30
Total structures	1,722	5,021	11,070	17,813	100.00

*Includes bridges, underpasses, tunnels, etc. On the Secondary System approximately 100 pedestrian bridges are included in the figures.

A closer estimate of the mileage of highways with 12-foot lanes would be approximately 5% of the total mileage in Virginia.* Most of this mileage is on the interstate and arterial divided highways, which fact raises an important question as to whether it would be feasible for an industry to move 14-foot units even if it were allowed to do so. As shown in Figure 1, most of the major industrial housing manufacturers and suppliers are located in areas adjacent to the interstate and primary highways. However, it would be reasonable to assume that most of the market for the housing units would be in areas served by the secondary system. Essentially, this would mean that for 14-foot wide units to be economically feasible for most companies, they would have to be permitted on the majority of the highway system and not just the 5% of roads with 12-foot traffic lanes.

As noted in Table 1, approximately 20% of Virginia roadway mileage has traffic lanes 10 and 11 feet wide. Movement of 14-foot wide loads on these highways would be physically possible; however, extreme caution would be required of all motorists. In order for the movements to be made in safety, vehicle operating speeds would have to be substantially reduced. Furthermore, passing the wide loads would be nearly impossible and vehicles meeting them would have to use the shoulder.

Assuming that there were no horizontal and vertical alignment restrictions, or structures 14-foot wide or less, travel on approximately 45% of the system would be physically possible, provided that in most cases the roadway is reduced to one-way operation.

As noted in Table 1, the majority of geometric restrictions occur on the secondary system. The 30% of roadway mileage with 7-foot or less traffic lanes also has very narrow (1 to 2 foot) or no shoulders,** making travel of a 14-foot load practically impossible. This fact, of course, would mean that the road would have to be closed to all other traffic because the load would occupy practically the entire traveled way. Further restrictions are introduced by the fact that over 20% of the structures are only 16 feet wide or less.*** Additionally, there are numerous miles of road with 8- and 9-foot traffic lanes where horizontal and vertical alignments combine to create conditions that would physically prohibit movement of a 14-foot wide unit.

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*Based on adding the numbers of miles of 24-, 48-, and 72-foot pavement widths.

**Based on a review of shoulder widths on narrow roads in two Virginia counties.

***A 14-foot load does not include allowances for mirrors, etc., which usually make the total vehicle and load 14-1/2 feet wide. A 1-1/2 foot clearance is needed to safely maneuver the load without damaging the load or structure.

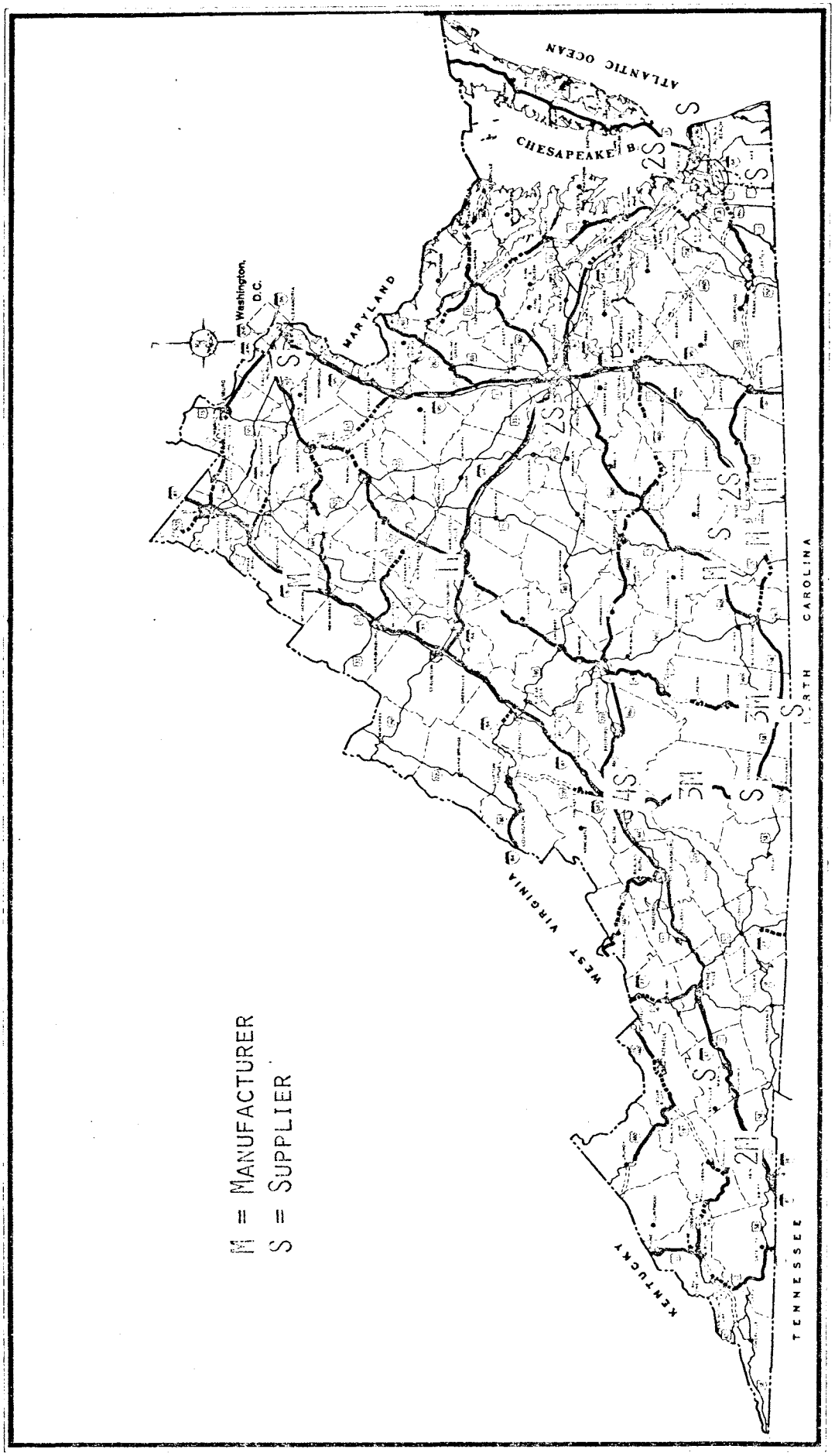

Figure 1. Locations of major mobile home and industrialized housing unit manufacturers and suppliers.

Operational Effects and Safety Hazards

Problems of 14-Foot Wide Loads Reducing Two-Way Roadways to a One-Way Operation

As mentioned, 45% of Virginia's highway mileage consists of lanes wider than 7 feet but less than 10 feet. Permitting 14-foot wide loads on these narrow lanes would mean the roadway would be temporarily reduced to a one-way status. The problems associated with reducing a two-way roadway to one-way operation for even a short period of time are numerous and indicate this procedure should be permitted only in case of emergency. Among the obvious problems are delay and inconvenience to the other highway users. Several persons in addition to those normally escorting wide loads would be needed to direct and control traffic, which would add to the cost of transporting the wide load. Perhaps the greatest danger would occur if the load broke down due to a flat tire or mechanical trouble and blocked the roadway. Research by the Midwest Research Institute has indicated that road repairs are often difficult and time-consuming.(7) Breakdowns would not only cause intolerable delay but could lead to much more serious consequences such as delaying fire, rescue squad, or other emergency vehicles. For the reasons discussed above, 14-foot wide loads should be discouraged from using any road on which they would block traffic and reduce the road to one-way operation. In the following discussion of operational problems, it is assumed that 14-foot wide units would not be allowed to travel on traffic lanes less than 10-foot wide.

Encroachment of 14-Foot Wide Loads on Adjacent Traffic Lanes

It has been shown through research that a wide load can often be transported on a 12-foot traffic lane without encroaching on the adjacent traffic lanes.(7) It is possible for the driver to position the load to overhang the shoulder even with a 14-foot wide load.(7) However, where there are obstacles on the shoulder, the driver must encroach on the adjacent traffic lane, which in most two-way, 2-lane traffic situations means that the load must use the entire traveled way. Even on interstate highways, where there are few roadside obstacles, tests indicate a frequent need to encroach on the adjacent lanes because of cars parked on the shoulders.(7) Naturally, the problem is somewhat more acute on the primary and secondary systems where shoulders and lane widths are narrower than those on interstate highways. Encroachment is also a problem at ramp connections, at narrow bridges, and through construction areas.

The need of the 14-foot wide load for an 18-foot traveled way and frequent encroachments on the adjacent traffic lanes creates numerous problems for oncoming and passing vehicles. Those problems will be discussed in detail later in this section.

Effects of 14-Foot Wide Loads on Other Highway Users

Studies have indicated that extralegal loads have measurable effects on the normal flow of traffic.[4,5,6] The Midwest Research Institute study concluded that the most prominent effects on traffic are:[7]

1. Slow moving wide loads create more traffic impedances and initiate driver responses of a more hazardous nature than do faster moving wide loads.

2. Traffic disruptions due to wide loads are more frequent and severe on two-lane roads than on divided highways.

3. Motorists approach 14-foot wide loads on two-lane roads more cautiously than they do 12-foot wide loads.

4. Motorists are more likely to encroach on the shoulder when passing 14-foot wide loads, as compared to 12-foot loads; few vehicles encroach on the shoulder when passing 12-foot loads on 12-foot lanes.

5. On 12-foot lanes lateral displacement is greater for vehicles meeting 14-foot loads than for 12-foot loads.

The California study indicated that on 4-lane undivided highways encroachment of the 14-foot load on the adjacent traffic lane caused passing motorists to move to the left over the double yellow centerline in order to pass the load.[4] On divided highways with more than 4 lanes, motorists used the median lane(s), thereby reducing the capacity and level of service of the highway substantially. Also noted was the fact that oncoming and passing motorists effected undesirable speed changes at narrow structures where the wide load used the entire roadway.

Although 14-foot wide loads create potentially dangerous conditions for oncoming and passing motorists, one of the most noticeable effects was delay caused by motorists not passing the wide load.(7) In fact, some drivers followed the wide load for a quarter hour or more.

The California researchers also noted that motorists were reluctant to pass the 14-foot wide load even when there was adequate room to make the passing maneuver.(4)

Problems in Urban Areas

Because of their width and length (70 foot is a common length) 14-foot wide loads cause numerous operational problems in urban areas. In the California and Florida studies, it was often necessary to block both directions of travel for the loads to make a left or right turn.(4) The maneuvers were made at low speeds and sometimes the time required to make the turn exceeded the green time at signalized intersections. In fact, at one intersection during the California test the coach driver had to stop in the road and block all traffic for approximately 5 minutes while he adjusted the mirror in order to clear a lamp pole.(4)

Permits issued by the Virginia Department of Highways and Transportation are valid for travel on only those roads maintained by the Department, however, in many cases, when the trip includes an urban area, local authorities approve of transportation under the Department's permit.(2) Because of the difficulties in maneuvering wide loads in urban areas, only a few selected routes in these localities have been approved for travel by 12-foot loads The wider and longer 14-foot load would, in most cases, require even greater restrictions of travel in urban areas. As demonstrated by the California test, in almost every intersection, dela inconvenience, and safety hazards were experienced by highway user as a result of the 14-foot wide load making a turning maneuver. I Virginia the same results could be expected.

Potential Safety Hazards Created by the Transportation of 14-Foot Wide Loads

The potential safety problems associated with 14-foot wide loads can be divided into two basic categories (1) problems inherent in the transportation of the load itself, and (2) problems the load creates for other traffic on the highway.

Safety Hazards Inherent in the Transportation of Wide Loads

The major problems encountered by the transporters of 14-foot wide loads result from faulty tires and brakes, frame deficiencies, and the wind. In the Midwest Research Institute study, flat tires were noted on 11 of 59 trips.(7) On 4 of the trips, multiple flat tires occurred. In fact, flat tires were so common that the researchers developed the graph shown in Figure 2 to determine if heavier loads lead to frequent flat tires.

It is obvious that a flat tire on a 14-foot wide load can cause hazards that could lead to damage to both the unit and other traffic. The hazards could be even greater if the loads are permitted on the narrow secondary roads previously discussed. Aside from potential safety hazards are inconveniences created by delaying traffic or restricting flow while the tire is being changed.

The Midwest Research Institute study indicated that wide load drivers complained of inoperative, inadequate, or unbalanced brakes when pulling mobile homes. However, since no incidents concerning faulty brakes were reported in the literature, faulty brakes apparently are not a serious problem.

Several studies report that structural deficiencies create a serious safety hazard for 14-foot wide mobile and modular housing units. California, for example, noted that due to flexing of the frame during the test run, constant repair of the aluminum side panels was necessary. In one incident which occurred on a freeway, emergency repairs to the panels were necessary to prevent them from being blown off. The Midwest Research Institute reported one incident of a wheel coming off the load and causing motorists to commit several evasive maneuvers to avoid it. One of 8 accidents reported by the Virginia State Police resulted from a deficiency in the frame (see page 18).

Perhaps the most frequently discussed problem concerning the structural design of wide loads is created by wind. There have been cases in which trailers have disintegrated due to severe winds. In fact, most states and some of the major carriers of housing units have policies regarding movement during windy conditions. Mobile home units are more sensitive to wind than the heavier modular units, because of their relatively low densities. The most dangerous winds are the gusty or unexpected cross winds that creat a maneuverability problem for the operator of a wide load.*

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*A review of the Virginia permit manual reveals that wind related restrictions have not been placed on the transportation of mobile homes. It should be noted that 2 of the 8 accidents reported by the Virginia State Police listed strong winds as causal factors. It is, therefore, recommended that the hauling and moving permit be revised to prohibit the movement of mobile or industrialized housing units when weather reports indicate wind velocities will exceed 20 mph.

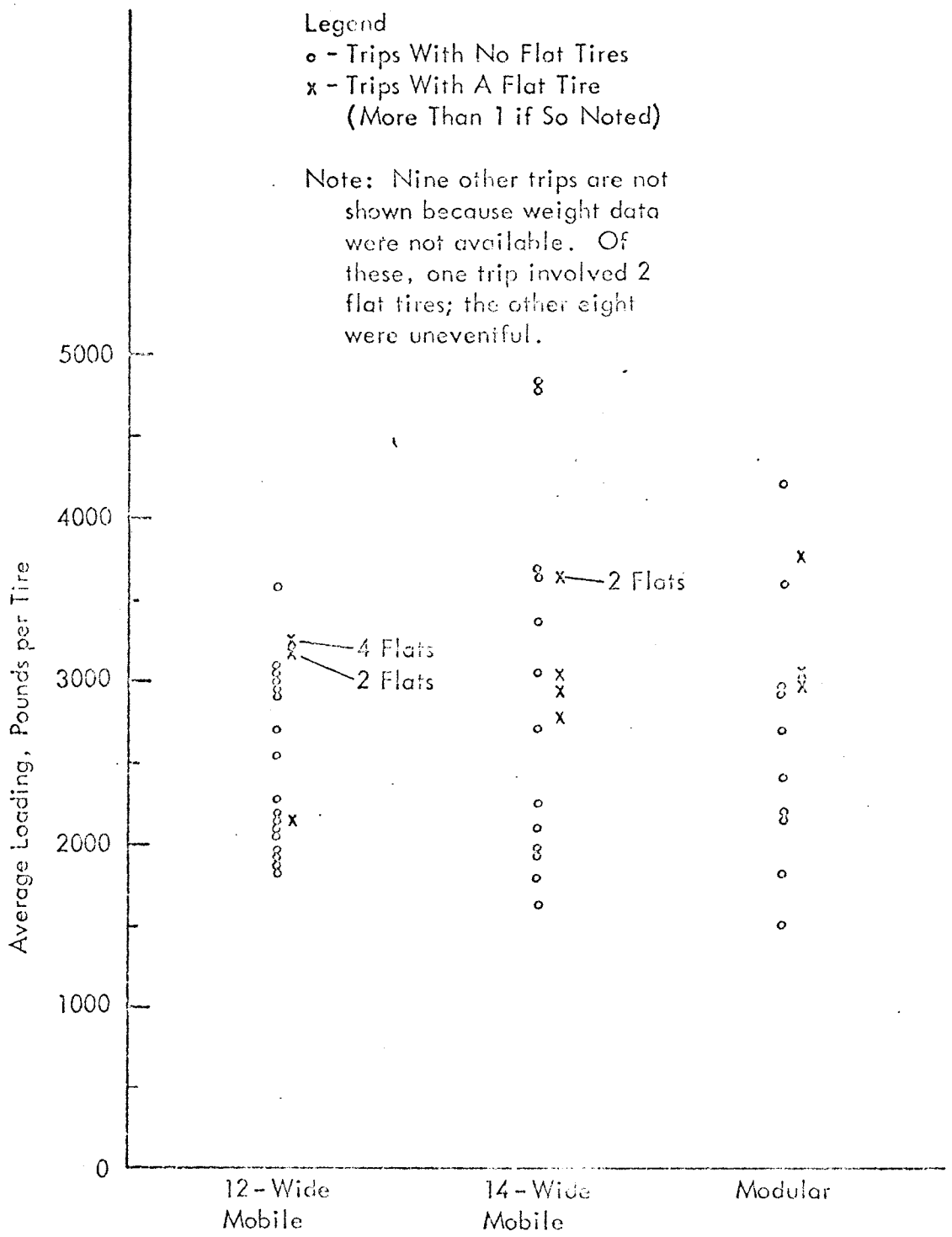

Figure 2. Tire loading of wide loads. (From reference 7.)

Potential Safety Hazards 14-Foot Wide Loads Impose on Other Highway Users

Many operational effects of transporting 14-foot loads create potential accident hazards. For example, encroachment of the 14-foot wide load onto adjacent traffic lanes create potential for sideswipe accidents for oncoming and passing vehicles. Because drivers use the shoulder to avoid a sideswipe accident, the potential for a run-off-the-road or fixed object type accident is increased.

Due to their increased width, length, and weight, 14-foot loads were found to travel 5 to 10 mph slower than 12-foot loads.(7) This difference in speed creates a potential for accidents.

The slow speed of the 14-foot loads and the long delays due to turning at intersections, commercial driveways, etc., also create potential accident hazards for the highway user. They would be expected to cause rear end and angle type accidents.

The operators on 14-foot wide loads try to position the load to encroach on shoulders rather than the adjacent roadway lane, and this practice creates a hazard for pedestrians and bicyclists. A pedestrian would not expect to encounter a load encroaching as much as 3 or 4 feet onto the shoulder.

Motorists using the shoulder when meeting and passing 14-foot loads not only create accident potentials, but increase the required maintenance of the shoulder area. In addition, dirt and dust blown up from the shoulder cause safety problems for following cars.

Another hazard created by 14-foot loads is that they restrict visibility of the roadway, including signs and signals, for other highway users to a greater degree than do 12-foot wide loads.

Accidents Involving 14-Foot Wide Loads

While 14-foot loads create operational and safety hazards for motorists, reported accidents in states which allow these units are rare. The California and Midwest Research Institute studies suggest low accident frequencies for wide loads. Although there is no substantiating evidence, it can be theorized that the low rates are attributable to the safety restrictions placed on the loads and the fact that most states require that professional drivers be used in the transport of wide units.

Accident History of 12-Foot Wide Loads in Virginia

To determine if wide loads have created an accident problem in Virginia, the State Police contacted each of its division offices and requested that their officers furnish copies of accident reports involving wide loads for calendar years 1974 and 1975. Only 8 reports were received and it is difficult to ascertain whether or not these accurately reflect the magnitude of the accident problem. This method of data collection is suspect; however, computer analysis is not feasible because wide load accidents are not separately coded and an accurate tabulation would involve a lengthy, time-consuming manual process. Contacting the division headquarters was the only process that could be accomplished in a short period of time, however, transfers within the Department of State Police, and officers on vacation, sick leave, etc., are all circumstances that would tend to create errors in this method of data collection. Even if a manual tabulation of wide load accidents had been feasible, it is doubtful if the magnitude of the accident problem could be ascertained as it is conceivable that wide loads create causal factors that lead to accidents in which the wide load is not directly involved. For example, an oncoming motorist could run off the road when meeting a wide load and strike a guardrail or other fixed object. In this case, the wide load may have been a causal factor but was not directly involved in the crash. Although there is a serious doubt as to whether or not the 8 accidents reported by the State Police accurately represent the magnitude of the wide load accident problem in Virginia, the summary of the accidents shown in Table 2 indicates that some of the operational problems and potential safety hazards mentioned above do lead to accidents. In the accidents shown there were no fatalities, 2 persons were injured, and property damage was $38, 133.

Perhaps the most comprehensive study of accidents involving mobile homes in Virginia was conducted by W. B. Shelton.[9] The results of the study are shown in Table 3. During 1969, 24 accidents involving mobile homes were found on facilities under the jurisdiction of the Department. In these accidents there were no fatalities, 6 persons were injured, and property damage amounted to $17,500.

Of the types of accidents listed in Tables 2 and 3, 14-foot wide units would most likely increase the probability of angle accidents occurring as a result of improper turns, sideswipes due to encroachment on traffic lanes, and fixed object accidents due to the load hitting structures such as toll booths.

TABLE 2

SUMMARY OF 12-FOOT WIDE ACCIDENTS REPORTED BY STATE POLICE
(1974 AND 1975)

Accident Description	Causal Factor	No. Accidents
Angle	Truck brake failure	1
	Wide load making improper right turn	1
Overturned Modular Unit	Towing frame broke	1
Overturned by wind	Strong wind	2
Hit Toll Booth	Load too wide, driver not careful	2
Sideswipe	Skidded on gravel shoulder to give wide load more room	1

TABLE 3

TRAFFIC ACCIDENTS INVOLVING MOBILE HOMES TOWED BY CONTRACT HAULERS THAT OCCURRED ON FACILITIES UNDER THE JURISDICTION OF THE VIRGINIA DEPARTMENT OF HIGHWAYS AND TRANSPORTATION

Study Period: January 1, 1969 through December 31, 1969

Accident Type	Accident Severity						
	Fatal Accidents	Number Killed	Injury Accidents	Number Injured	Property Damage Accidents	Amount Property Damage	Total Accidents
Rear End	0	0	0	0	1	$ 200	1
Angle	0	0	0	0	1	385	1
Sideswipe - Same Direction	0	0	3	4	6	7,675	9
Sideswipe - Opposite Direction	0	0	0	0	4	4,540	4
Fixed Object - In Road	0	0	0	0	2	1,900	2
Pedestrian or Cycle	0	0	1	1	0	0	1
Overturned	0	0	0	0	1	550	1
Miscellaneous	0	0	1	1	1	0	2
Fixed Object - Off Road	0	0	0	0	3	2,250	3
Total	0	0	5	6	19	$17,500	24

Source: Reference 9

Other Problems

Enforcement Problems

One problem discussed in the literature and frequently mentioned as a problem with wide loads in Virginia is that operators of wide load vehicles often violate the restrictions specified in their permits, or in some cases even fail to obtain a permit. To determine the magnitude of this problem, data on permit violations for fiscal year 1974-1975 were obtained from P. A. Sensabaugh, Jr., Permit Engineer for the Virginia Department of Highways and Transportation.

In fiscal year 1974-1975, 10,408 permits for loads between 10 feet 4 inches and 12 feet wide were issued in Virginia. Of these, approximately 950 were blanket permits issued to the mobile home and industrialized housing industry. During the year, 306 violations of hauling and moving permits were reported by the State Police. Of these, 58 were given to 55 operators of mobile home and housing unit carriers transporting units between 10 feet 4 inches and 12 feet wide. A summary of the violations is given in Table 4. While speeding was the violation with the greatest frequency of occurrence, violations of not using pilot vehicles and traveling after permitted hours probably create more serious hazards for other motorists.

Although it was not possible to obtain a reasonable estimate of the annual number of wide load movements made by the housing industry, it would appear that with the rather limited patrolling enforcement officers can make in rural areas, the violation rate is higher than desirable. Also, it is suspected that many permit violators are not apprehended. Violations of current permit regulations lead to needless endangering of the motoring public. With the even greater restrictions that would be necessary for 14-foot wide loads, it can be expected that the violation rate would increase.

Motorists' Opinions

In a 1972 poll, 24% of the American Automobile Association (AAA) members surveyed listed large house trailers as major annoyances on the highways.(10) The Midwest Research Institute conducted a public opinion survey by means of the two-part questionnaire given in the Appendix. In the survey, the motorists, in many cases, had just encountered a wide load. Unlike the AAA survey, the Institute study did not ask the motorists their opinions of wide loads but asked if they had been delayed by anything. Motorists who had passed a wide load rarely stated that they had encountered a delay or safety hazard. One finding of the survey was that motorists felt mobile homes were twice as troublesome on 2-lane roads as they were on divided highways.

TABLE 4

SUMMARY OF VIOLATIONS OF PERMITS REQUIREMENTS
BY MOBILE HOME AND MODULAR HOUSE CARRIERS
WIDTHS (10 FEET 4 INCHES TO 12 FEET)

Violation	Mobile Home	Modular House	Total
Speeding	20	2	22
No pilot vehicle	9	6	15
After permitted hours	5	1	6
Over permitted length	5		5
Traveling in rain or snow	2		2
Expired permit	2		2
Oversize	1		1
No flags	2		2
No sign on pilot vehicle	1		1
Travel in convoy	1		1
Improper driving	1		1
Total	49	9	58

Requests for Transporting Units Larger Than 14 Feet

One concern about permitting 14-foot wide housing units on the highways is that this action will generate requests from other industries to move similarly wide loads or from the housing industry to move even wider loads. A study of the history of the mobile home industry indicates there is no evidence to support a belief that manufacturers would stop with the request to permit movement of the 14-foot wide mobile home. For example, the results of a study conducted by Roy Jorgensen and Associates indicate that in 1956, 91% of all mobile homes were 8 feet wide.(11) In 1958, 10-foot wide units were replacing the 8-foot units. In 1962, 12-foot wide units replaced the 10-foot homes. In 1976, requests for 14-foot wide houses are received. If, as one must expect, the historical trend is followed, the 14-foot unit, if allowed over the highways, would entirely replace the 12-foot home. As of July 1975, 43 states permitted routine transportation of 14-foot wide mobile and modular housing units. In 1969, when the Jorgensen study was published, only 6 states permitted 14-foot wide units.(11) Also in 1969, Delaware permitted a 16-foot wide unit, Kansas a 16 foot-6 inch-unit, Wyoming an 18-foot unit, and Texas a 20-foot unit.(11) These data indicate that given approval of the 14-foot unit, requests for even wider units are likely.

Problems Experienced in Virginia with 12-Foot Wide Loads

In a telephone survey, highway district and residency personnel cited the problems listed below as ones they feel are due to the movement of 12-foot wide loads. In addition, the principal researcher for this study followed several 12-foot mobile and modular units on 2-lane and 4-lane divided highways in both urban and rural areas to determine problems created by these units. The problems encountered are included in the summary below and are illustrated in Figures 3-6.

1. Wide loads can completely block traffic, especially on secondary roads.

2. Breakdowns of wide loads cause additional problems and delay.

3. Wide loads blow down signs in highway maintenance areas.

4. Wind affects the movement of wide loads.

5. Queues of 30 to 50 vehicles caused by wide loads have been observed.

Figure 3. Motorists frequently use the shoulder when meeting wide loads.

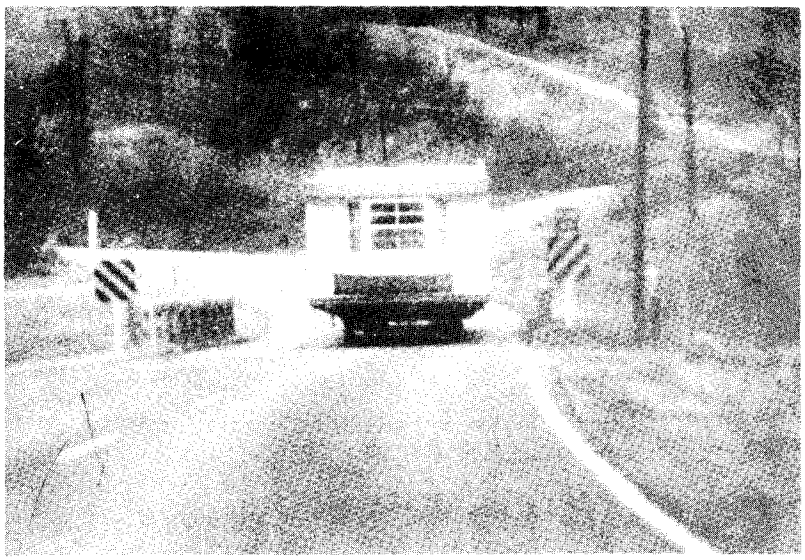

Figure 4. Wide loads restrict traffic to one-way movement at narrow structures.

Figure 5. In urban areas, encroachment substantially reduces road's capacity and level of service.

Figure 6. The 12-foot wide loads frequently encroach on the adjacent traffic lane.

6. Wide loads cause maintenance problems on shoulders.

7. One case of a wide load restricted by a horizontal curve was reported; and in another case, bridge handrails were removed on an 11-foot bridge to accommodate a 12-foot load.

8. Opposing traffic is forced off the road onto the shoulder.

9. Traffic is temporarily restricted to one-way movement at narrow structures.

10. Capacity and level of service are reduced by wide loads.

There is reason to believe that these problems would be exacerbated and others would evolve if 14-foot wide loads were permitted in Virginia.

Several years ago and again during the past few months, the Virginia State Police filmed the movements of 12-foot wide mobile and modular homes on divided and 2-lane highways throughout Virginia. Most of the film was taken by following the loads, but included are several aerial shots. The following is a list of problems observed in a viewing of the film.

1. Wide loads frequently cause oncoming vehicles to run off the road onto the shoulder.

2. Wide loads restrict passing on 2-lane highways, thus causing vehicles to form moving queues that delay the flow of traffic.

3. Wide loads reduce traffic momentarily to one-way operation at narrow structures.

4. It is time-consuming and difficult to maneuver wide loads at grade intersections.

5. One case was filmed where a 12-foot wide mobile home broke down at a point on the highway where the vertical sight distance was restricted. The breakdown resulted from the loss of a wheel.

Alternative to 14-Foot Wide Loads

One firm, Ingroup, Inc., of Woodland, California, has solved the problem of transporting 14-foot wide units by constructing 14-foot wide by 9-foot high steel frame housing units, and tilting them on the flat bed of a truck to create 9-foot wide loads. Undoubtedly, the 15- to 16-foot high load, however, would still create some clearance problems in certain areas.

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10. Brady, Charles N., "Safety Aspects of Wide Loads on the Highway," A paper presented to the 59th Annual Meeting of American Association of State Highway Officials, Los Angeles, California, November 14, 1973.

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APPENDIX

MOTORIST SURVEY — PART A

3744-E(3) PERSONAL INTERVIEW

Good Morning! We are conducting a brief traffic survey for the Federal Highway Administration. Could you tell me--

1. Is this a business or non-business trip?
   (Possible answers--Business, Non-business)

2. About how long have you been driving today?
   (Less than an hour, 1 to 3 hours, More than 3 hours)

3. About how many miles per year do you drive?
   (Under 1,000, 1-3,000, 3-10,000, 10-20,000, more than 20,000)

4. Is most of your driving for business or non-business reasons?
   (Business, Non-business)

5. What kinds of roads do you drive most often? (Read answers!)
   (Local streets, Two-lane rural highways, High-speed freeways)

6. Have you encountered anything along the road today that has caused you any delay, even if only briefly?
   (Yes, No)
   a. (If yes) What was it?
      (Accident, Traffic congestion, Slow moving vehicle, Construction, Other (specify)
   b. (If slow vehicle) What type of vehicle was it?
      (Truck, Mobile home, Bus, Car, Other)

7. Have you encountered anything along the road today that you felt was a safety hazard?
   (Yes, No)
   a. (If yes) What was it?
      (Accident, Traffic congestion, Slow moving vehicle, Construction, Other (specify)
   b. (If slow vehicle) What type of vehicle was it?
      (Truck, Mobile home, Bus, Car, Other)

8. In general--not just on this trip--is there any particular type of vehicle which causes you problems in terms of delay or safety?
   (Truck, Mobile home, Bus, Car, Other)

9. Did you notice any wide loads such as mobile homes being transported on this trip?
   (Yes, No)
   a. (If yes) Was it moving in your direction?
      (Yes, No)
   b. (If yes) Did it (they) cause you any problems?
      (Yes, No)
   c. (If yes) Why did it cause you a problem?
      (Hard to see around, Moving too slow, Couldn't pass, Taking two lanes, Other (specify)

Thank you very much for helping us in this traffic safety survey. We would certainly appreciate your opinions on the traffic questions on this form. Please fill it out at your convenience and drop it in the mail. No postage is needed.

Source: Reference No. 7

APPENDIX (Cont.)

MOTORIST SURVEY—PART B

PART B - MAIL-BACK QUESTIONNAIRE

PLEASE CHOOSE YOUR ANSWERS FROM THIS LIST
(See back of page for examples)

A. Passenger sedans
B. Sports cars
C. Self-contained motorized campers (such as motor homes, Winnebagos)
D. Large single-unit trucks (such as dump trucks)
E. Large mobile homes transported by truck
F. Large multi-unit trucks (such as semis or tractor-trailers)
G. Passenger buses
H. Cars towing trailers (such as tent trailers and small boats)
I. Other (please describe)
J. None

PLEASE ANSWER THE FOLLOWING QUESTIONS

1. a. Which vehicles do you feel are a safety hazard on the Interstate Highway System? _____
   b. Which vehicles do you feel are a safety hazard on two-lane highways? _____

2. a. Which vehicles most often cause you delay on the Interstate Highway System? _____
   b. Which vehicles most often cause you delay on two-lane highways? _____

3. a. Which vehicles do you think should be limited in their use of the Interstate Highway System to restricted hours, weather conditions, etc.? _____
   b. Which vehicles do you think should be limited in their use of two-lane highways to restricted hours, weather conditions, etc.? _____

4. a. Which vehicles do you think should not ever be allowed to use the Interstate Highway System? _____
   b. Which vehicles do you think should not ever be allowed to use two-lane highways? _____

5. Which vehicles do you now own? _____

6. Which vehicles have you ever driven often? _____

7. In general, which vehicles cause the most problems for other drivers? Please list them with those causing the most problems first, and those causing the least problems last. _____

THANK YOU.

Please use back of page if you wish to make any additional comments.