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Research Report

SMALL CAR ACCIDENT EXPERIENCE IN WASHINGTON STATE

FINAL REPORT
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Public Transportation and Planning Division

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SMALL CAR ACCIDENT EXPERIENCE IN

WASHINGTON STATE

Traffic Safety Section
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I. ABSTRACT

This small car accident study investigated accidents in Washington State in four passenger car categories: subcompact, compact, intermediate, and large. The primary purpose of the study was to evaluate the effects on safety of increases in the number of smaller cars on the highways. Traffic accident data for the period 1973-79 were analyzed to determine the accident severity for the different automobile classes, and this analysis showed that the smaller vehicles had a higher proportion of fatal and injury accidents than the other categories.

Then, accident data for 1980 were used to compare accident experience with regard to injury class of the occupants, roadway surface conditions, roadway character, light conditions, collision type, objects struck, and location of accident. Analysis showed that for total accidents per one thousand registered vehicles, the large cars had a higher rate (68) than either the subcompacts (43), compacts (45), or intermediate size vehicles (46). However, the subcompacts and compacts had higher percentages of fatalities and serious injuries to their occupants, and a higher proportion of such accidents occurred on wet, snowy, and icy surfaces. In addition, the smaller passenger vehicles had a higher incidence of overturning and rear-end accidents. The analysis suggests there will be significant increases in fatal and injury accidents in future years as the number of smaller vehicles increases. Thus, the report contains recommendations for changes in highway and vehicle design that will modify these adverse trends and reduce injuries and fatalities among automobile drivers and passengers.

Some of the recommendations can be implemented fairly quickly, but others will take longer. However, until changes are made, the accident severity for small cars will continue at a level above that for larger sized automobiles.

II. INTRODUCTION

Increases in the cost of fuel has caused the American motorist to seek smaller, lighter, more fuel-efficient vehicles. In 1976 small car sales represented 47 percent of total new car sales in the United States. Four years later (1980), 64 percent of new car sales were small cars. With a national fuel economy goal of 27.5 miles per gallon set for the 1985 motor vehicle fleet, strong growth in the number of smaller, lighter vehicles can be expected. The same fuel cost problem, which is increasing the use of small, light vehicles for personal use, is causing the trucking industry to increase truck size for carrying maximum loads. These two divergent trends are creating a hazardous situation on streets and highways. There seems little likelihood that this problem will be eliminated, particularly in the short- or medium-term.

Protection provided for the driver and occupants of the small vehicles is less than that provided by the large vehicles. The laws of physics indicate that if a small vehicle collides with a large vehicle, the small vehicle and its occupants will be subject to greater destructive forces. Thus it follows that the risk of injury and/or death due to an accident is greater in the small, light vehicle, especially if it hits or is hit by a large vehicle. Some research has been conducted into accidents affecting small vehicles, and this study continues work undertaken in other states and at the federal level.

The research has been started by involved individuals and organizations that have detected changes in accident patterns, which are reflected in the various fatality and injury statistics.

Nationally, for example, insurance industry statistics show that the death rate, calculated per registered vehicle, for subcompacts from 1978 to 1980, was more than twice that for full-sized cars. "It's starting to make my job a little more gruesome," says Sergeant Lester Austin, and accident investigator with the Michigan State Police.

Because of the increased number of smaller cars that appeared to be involved in accidents in Washington State, a research project was developed.

Washington State Department of Transportation (WSDOT) has an excellent accident reporting system, and this research report is based on accident records for the 1973-1980 period. The study covers accident trends by passenger vehicle size and evaluates the degree to which the vehicle mix and design standards are contributing to a growing traffic safety problem.

Washington State DOT is one of several organizations involved in research into this various important activity. In the following section, recent research by federal organizations is summarized. That was the starting point for this overall research effort.

III. CURRENT RESEARCH AT THE FEDERAL LEVEL

Highway accidents analysis and recommendations for improved safety measures are the responsibility of various state and federal organizations.

The National Highway Traffic Safety Administration (NHTSA) and the Federal Highway Administration (FHWA) have been active in accident research of the type completed in the WSDOT study. Their recent research efforts are described below.

National Highway Traffic Safety Administration (NHTSA)

Two recent reports of this organization are:

- Incompatibility of Standards Used in Qualifying Drivers, Building Highways and Designing Vehicles (Report #DOT *HS-805-476, October 1980)

- Safety Consequences in the Shift to Small Cars in the 1980's, prepared by William A. Bochly and Louis V. Lombardo.

The first report states as its basic hypothesis, that "...the incompatibility of the criteria or standards used to qualify drivers, construct highways, and manufacture vehicles is responsible for many of the crashes."

The report listed characteristics of the smaller vehicle likely to cause problems when coupled with current roadway standards. These include smaller mass and lower weight, lower driver eye height, decreased physical profile, and the shorter wheelbase of the small vehicle. The combination of these design features with a highway system built to accommodate larger vehicles results in incompatibility of traffic barriers, breakaway devices, reduced sight distances at hill crests and intersections, the need for readjusting passing distances, visibility of the smaller car in the rear view mirror of other larger automobiles, and reduced ground clearance.

The problem is intensified by the fact that highways in the United States have been developed to different service levels. Thus, the interstate system provides safe transportation facilities and operational conditions for most vehicles, and the same is true for most state highways. However, in many areas, county and local roads are not up to the standard that ensures safe operations, even for larger automobiles. This is of concern to many highway administrators and public works engineers. In such cases it is unlikely that substantial changes can be made to roads that are inadequate, at least in the short term.

The second report addresses the safety consequences of the continued shift to smaller vehicles and states:

> "Safety programs of the past have prevented increases in the death rates, but now the growing shift to small cars is creating additional safety hazards in the traffic environment. Small cars, as currently being produced, are less safe than large cars because in a crash with a larger, heavier vehicle, the small car and its occupants will be subjected to greater crash forces."

The paper recommends the practical application of safety technology and the installation of safety features such as improved structural components and airbags that are designed to reduce the risk of crash injury.

The findings of this paper support the fact that highway accident diagnosis and prevention requires considerable cooperation among all the involved parties. The cause and effect relationships which lead to death or injury on the highway are neither simple nor apparent. Most are the result of a complex series of interactions and circumstances in which the driver, the vehicle, the highway, or any combination of them can be at fault. By isolating the role of smaller vehicles in this interaction, some value insights can be gained into the total accident problem.

Federal Highway Administration (FHWA)

The Federal Highway Administration has prepared several proposals for research involving stopping sight distance, compatibility of highway and vehicle standards with driver characteristics, and those driver characteristics that affect highway design and operation.

One research proposal is entitled, "Driver Characteristics Impacting Highway Design and Operation." The premise for the project is that due to changing highway conditions, design standards should be reviewed periodically. With the increase of smaller and lighter vehicles traveling the highways and the larger proportion of women drivers, there is a need to obtain basic data on drivers and vehicles and relate them to highway design standards. The contract objectives call for the identification of design standards, traffic operations standards, regulations and guides that involve driver characteristics. Also, driver characteristics of the United States driver population and the sensitivity of standards to changes in driver characteristics specifications are selected for review.

These are appropriate items that should be studied as a better understanding of each will contribute to a solution.

A second proposal calls for research into the parameters affecting stopping sight distances. It points out that all motor vehicles have undergone mechanical and physical changes in the forty years since criteria for this standard were set, and goes on to state:

> "Because sight distance is a major factor in the cost and safety aspects of highway geometric design as well as traffic operations, there is a need to evaluate the impact of all significant parameters related to current roadway, vehicle, and driver characteristics."

A third proposal deals with the compatibility of highway and vehicle standards with driver characteristics. The objective is the development of cost effective alternatives to reduce the adverse impact of incompatible highway design and operation standards, vehicle design and safety standards, and driver characteristics. Improvements to any of them will enhance safety and mobility.

FHWA has long been a pioneer in accident and safety research and has endeavored to expand the concept of "safety consciousness" to the states. This has been particularly true in highway improvements. In 1978 FHWA was able to report that there had been a big improvement in this area during the past ten years. States had made substantial progress on new construction through the elimination of concrete pedestals, unprotected abutments, headwalls, and severe slopes. FHWA points out that safety was becoming more sophisticated and states had the computer capability to process accident data.

However, FHWA was aware that problems still existed.

> "The general safety upgrading of all highways, and especially non-Interstate, has been severely limited by resources. In general, only safety upgrading of the Interstate has received attention. In some states this has been minimal because available funds have been allocated to new constuction which was considered by the state to provide greatest impact on accident reduction. Availability of Interstate funds has encouraged states to give first attention to upgrading the safety of the Interstate System in lieu of other systems. This has drawn some public criticism because of the greater safety needs on non-Interstate and local routes."[1]

This statement suggests that research into small car accidents is a very worthwhile endeavor. It will assist policy-makers to determine what supplementary measures should be taken in order to improve highway safety.

It should be noted that the WSDOT District Administrators have been aware, for some time, that there has been an increase in the number of smaller cars involved in accidents. And they have reasons for this. Most District personnel suggested that the major accident factor is driver error which causes circumstances leading to a fatal accident. In some cases, however, death of the occupant might have been a direct result of the vehicle itself -- its size, weight, maneuverability, or design.

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[1] FHWA - Highway Safety Review, Washington, D.C., December 1978, p. 2.

The District traffic engineers interviewed stated their views were subjective and that in order to gain a valid insight into the incompatibilities of small cars and current roadway design standards, a thorough empirical investigation should be made. This point has been recognized by the research team, and thus the qualitative information obtained from the Districts has not been used in this study. It might be noted that the District Administrators support this research study because they believe it will give them useful, objective information.

IV. CONTACTS WITH THE WESTERN STATES AND BRITISH COLUMBIA

The California Department of Transportation (Caltrans) is aware of the incompatibility of small cars with current roadway design standards. However, the Department is hampered in making any detailed analyses of accidents relating to smaller vehicles because of the accident report form currently used by the California Highway Patrol. This is a problem that is not experienced in Washington State.

Caltrans has completed testing of appurtenances to determine their effectiveness in protecting the smaller vehicle. The results are contained in two reports:

- Dynamic Tests of Breakaway Standards Using Smaller Automobiles (Final Report #CA *DOT *TL 6590-1-75-47, December 1975)

- Vehicular Tests of a Six Inch High Curbed Gore With and Without a Sound Barrel Crash Cushion (Final Report #CA *TL *79-10, May 1979)

Conducted by the Stuctural Materials Branch and the Transportation Laboratory of Caltrans, these reports help identify standards that are compatible with the changing vehicle mix. Results of these reports and other efforts have led to the proposal that the California Transportation Laboratory test all highway hardware with smaller vehicles.

The Idaho and Oregon Departments of Transportation have no studies on smaller cars, but are aware of the problems. They expressed interest in any research findings and recommendations that might emerge from this study.

The Roads and Transportation Association of Canada has a geometric design committee which concerns itself with roadside element design. One design standard change made with respect to the smaller wheelbase vehicle is the shift to the 32-inch "configuration F" median barrier on Highway 99 (major route from Blaine, Washington to Vancouver, B.C.). This barrier is a steeper modification of ones previously in place, and replacement of the old median barrier with this revised standard is planned throughout the highway system. Furthermore, the

Traffic Safety Engineer in Victoria, B.C. expressed concern with driver eye height being lower in the smaller vehicles, and suggested that further action would follow in this area.

V. MOTOR VEHICLE ACCIDENT DATA 1973-1979

In preparing necessary statistics the passenger automobile category was divided by weight into four classes:

- Subcompact : less than 2,400 pounds
- Compact : 2,401 to 3,000 pounds
- Intermediate : 3,001 to 3,600 pounds
- Large : greater than 3,600 pounds

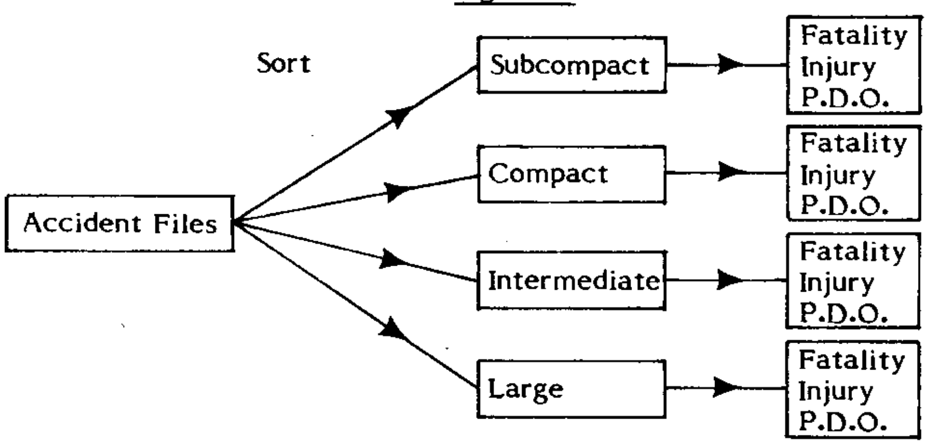
Because the Washington State DOT maintains a comprehensive ten-year file of accident records it was possible to develop reliable statistics. After making the classification shown above, accident involvement by vehicle type and severity was determined. Categories of accidents used were: fatal, injury or property damage only (PDO) accidents.

Totals for each accident type - fatal, injury or PDO - were calculated in each passenger car class. Data were compiled for the years 1973 to 1979 using this procedure.

Severity indices were calculated for each passenger car class from the data compiled in the above procedure. When comparing groups, the indices point out how serious is the vehicles groups accident involvement.

The basic steps that were followed are shown in Figure 1.

Figure 1



The use of computer technology made it comparatively easy to produce the data in any form desired and have them available for analysis and evaluation. By using the three major categories of accidents matched against four classes of automobiles, it was expected that some good cross-tabulations and interactions would be developed. This proved to be the case, and many of the assumed hypotheses were found to be correct. It was found, for example, that the size gap between a 4,000 pound car and the current 2,000 pound subcompact sets up much more lopsided confrontations on the road than were typical 15 years ago. For instance, in a nose-to-nose crash between two such cars, each traveling 40 mph, unrestrained occupants of the small car would be thrown against the interior with twice as much force as would the big car's occupants.

The information was arranged in appropriate tabulations and diagrams which are presented on the following pages:

TABLE 1

VEHICLES INVOLVED IN ALL ACCIDENTS 1973-79

Year	Subcompact (less than 2400 lbs)	Compact (2401-3000 lbs)	Intermediate (3001-3600 lbs)	Large (greater than 3600 lbs)	Total
1973	13,469	11,424	13,927	63,027	101,847
1974	13,628	12,345	14,376	59,525	99,874
1975	16,030	15,403	16,828	64,749	113,010
1976	17,295	16,858	18,083	62,590	114,826
1977	19,545	18,646	19,930	59,837	117,958
1978	19,897	19,647	12,464	55,637	107,395
1979	21,496	20,409	22,342	49,199	113,446
Percent Increase 1973-1979	60	79	60	-22	11

Table 1 shows the number of vehicles involved in all accidents from 1973 to 1979. Subcompact, compact, and intermediate vehicle groups show approximately a 5-10 percent yearly increase in accident involvement for the 1973 to 1979 period. The large cars show a decrease in accident involvement except in 1975. As drivers trade in their larger cars for the more fuel efficient smaller cars, this trend will continue.

The statistics are quite dramatic and highlight the basic theme. The three smaller categories show significant percentage increases during the period, whereas the large car category shows a decline. The statistics are presented graphically in Figure 2. The trend is clear, even though the large car accident total is the greatest absolute number.

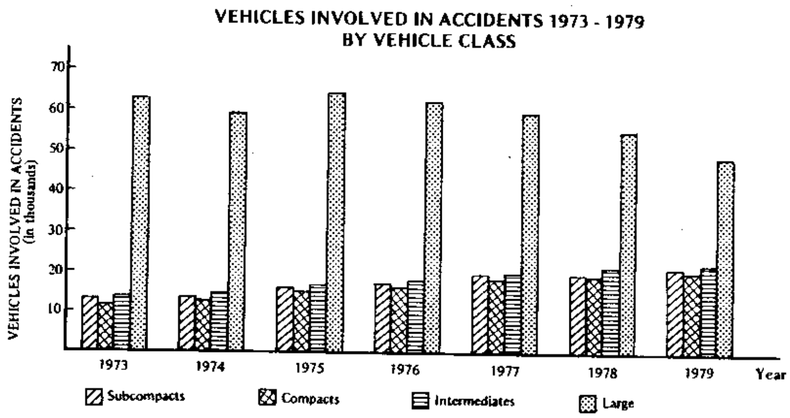


FIGURE 2

It is of interest to note that similar results were obtained in a comparison of truck accidents in several states. Light trucks experienced more fatalities and more injuries during accidents than was the case with heavy trucks. It is worth noting also that fatal accident rates for light and heavy trucks on controlled-access expressways were significantly greater than for passenger cars. And most of the fatalities occurred in smaller cars involved in accidents with trucks.

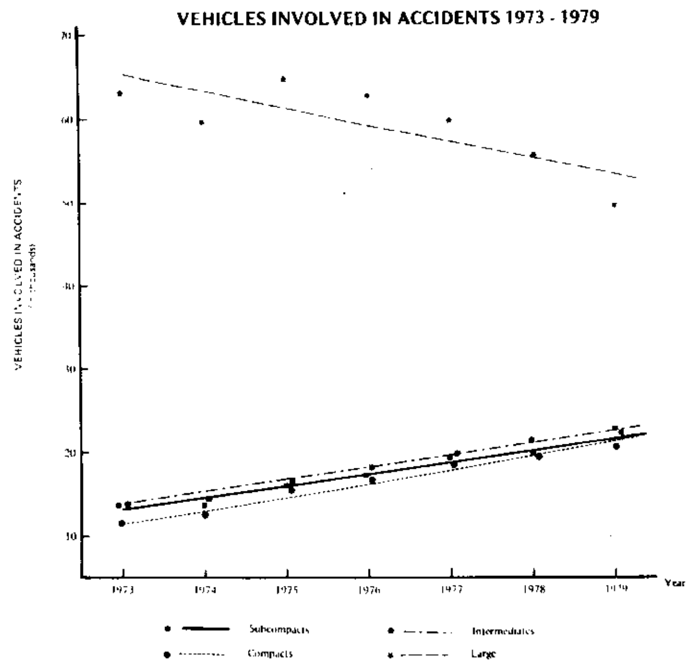


FIGURE 3

Figure 3 shows the linear relationship for the vehicles involved in accidents by weight class and year. The lines for each vehicle class were developed using the method of least squares.

The graph illustrates very clearly the trend that has already been discussed and highlighted in the earlier statistical tables and diagram. In the case of the smaller cars the trend is upwards -- and continuous. In the case of the larger cars the trend is downwards -- and continuous.

TABLE 2

VEHICLES INVOLVED IN INJURY ACCIDENTS 1973-79

Year	Subcompact (less than 2400 lbs)	Compact (2401-3000 lbs)	Intermediate (3001-3600 lbs)	Large (greater than 3600 lbs)	Total
1973	6,214	4,892	5,788	26,457	43,351
1974	6,150	5,336	6,055	24,841	42,382
1975	6,988	6,599	6,927	26,565	47,079
1976	7,742	7,203	7,610	25,988	48,543
1977	9,248	8,448	8,637	25,950	52,283
1978	8,473	7,905	8,279	21,727	46,384
1979	9,193	8,178	8,817	19,555	45,743
Percent Increase 1973-1979	48	67	52	-26	6

Table 2 shows the number of vehicles involved in injury accidents by vehicle class from 1973 to 1979. Figures 4 and 5 display these numbers graphically.

The data in Table 2 confirm that shown in Table 1. The large cars have actually shown a proportionate decline in the period under review, while the smaller cars have shown a marked increase. It should be kept in mind that the large vehicles make up the biggest proportion of total registered vehicles, and it would thus be expected that they would account for the largest absolute total. But, in fact, it is the relative changes that are important in this context.

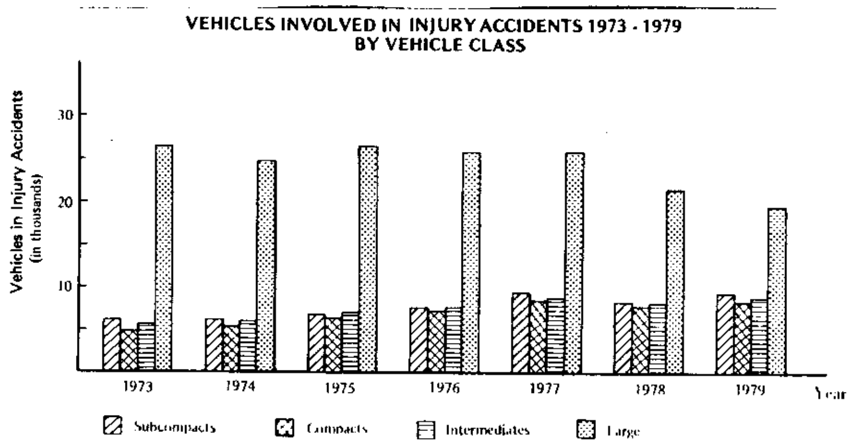


FIGURE 4

Figure 4 supports the statements that have already been made. The large cars provide the greatest number of vehicles involved in injury accidents, but a steady relative decrease is apparent. The reverse is true for all of the smaller car categories, which have shown an increase in injury accidents in each year since 1973. The trends seem likely to persist and will bring new problems.

VEHICLES INVOLVED IN INJURY ACCIDENTS 1973 - 1979

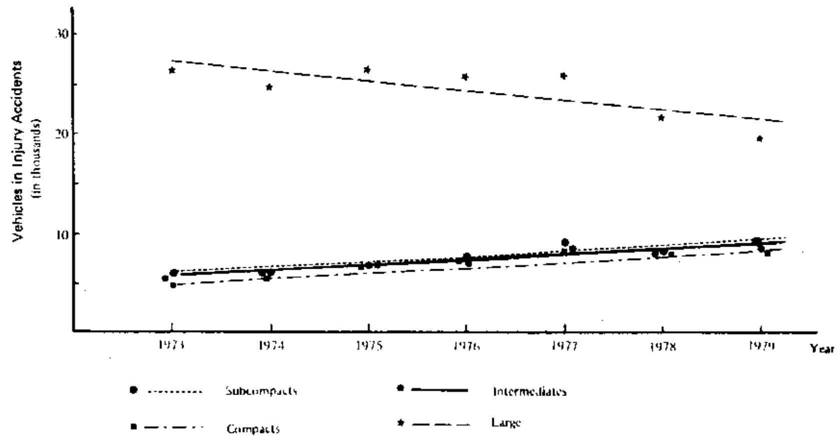


FIGURE 5

The trends discussed in relation to Figure 4 can be seen more clearly and more dramatically in Figure 5. The dotted line, representing the large cars, show a significant decline in the period 1973-1979. It is interesting to note that all of the smaller cars show steady increases, all at about the same rate. The subcompacts have the worst record, but there is really not much to choose between all three categories of smaller car.

TABLE 3

VEHICLES INVOLVED IN FATAL ACCIDENTS 1973-1979

Year	Subcompact (less than 2400 lbs)	Compact (2401-3000 lbs)	Intermediate (3001-3600 lbs)	Large (greater than 3600 lbs)	Total Passenger Vehicles
1973	94	58	96	342	590
1974	95	66	94	305	560
1975	98	67	84	306	555
1976	105	86	68	325	584
1977	117	114	118	325	674
1978	140	111	142	337	730
1979	183	126	135	303	747
Percent Increase 1973-1979	95	117	41	-11	27

Table 3 gives the number of vehicles by class and total passenger vehicles involved in fatal accidents for the years 1973 to 1979. These data are presented graphically in Figures 6 and 7.

This tabulation shows a more serious situation than that shown for vehicles involved in injury accidents. For subcompact cars the percentage increase shown in Table 3 is 95 percent, compared to 48 percent in Table 2. For compact vehicles the comparable figures are 117 and 67. The fatal accident relative increases for these smaller vehicles are significant -- and serious.

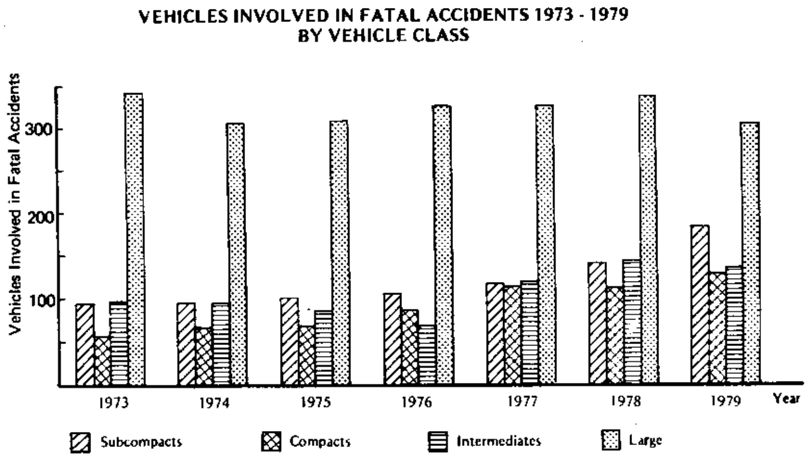


FIGURE 6

In Figure 6 the trends are apparent. For several years it seemed as if the large cars were involved in an increased number of fatal accidents, but that situation has now changed. It seems, however, that the situation with the subcompact cars is indeed one that merits careful attention. The increase in fatal accidents that has occurred is undeniable. A situation such as this one is alarming and will require very careful action if it is to be rectified.

The data presented to this point shows that several things happened in relation to the accidents that occurred in Washington State between 1973 and 1979.

There was

- an 11 percent increase in all accidents, but a 27 percent increase in fatal accidents.

- Subcompacts had a 60 percent increase in accidents with a 95 percent increase in fatal accidents.

- Compacts had a 79 percent increase in accidents with a 117 percent increase in fatal accidents.

- Intermediates had a 60 percent increase in accidents with a 41 percent increase in fatal accidents.

- Large cars had a 22 percent decrease in accidents with an 11 percent decrease in fatal accidents.

These statistics are rather self-evident in the conclusions that can be drawn from a careful evaluation of the facts. The trend for small car accidents is up - while that for largers cars is down. This is in spite of the fact that more than 20 percent of all federal-aid highway construction funds are spent annually on safety improvements. In fiscal year 1979, for example, there was approximately $8.5 billion obligated for all federal-aid programs administered by FHWA. Of this, rough indications are that $2.0 billion, or nearly 24 percent, was spent for safety improvements.

TABLE 4

1973-1979 ACCIDENT SEVERITY INDEX

Passenger Car Class	Fatal Severity Index	Injury Severity Index
Subcompact	6.9	445.0
Compact	5.5	423.0
Intermediate	5.8	410.0
Large	5.4	412.0

Fatal and injury severity indices were calculated using the preceding data and are presented in Table 4. (The indices were calculated by dividing the total number of fatal or injury accidents by the total number of accidents within each vehicle class and then multiplying by 1000.) These indices are one method that can be used to objectively compare accident experiences of various classes and determine if certain vehicle sizes are involved in more serious accidents.

These statistics tell much of the story - but not all of it. In transportation safety research, it is important to identify the accident risks for specific groups of persons as well as for persons who use different modes. Accident rates then become an important criterion by which to pinpoint the target groups at which transportation safety efforts should be aimed. Thus, the absolute number of accidents does not show the accident rates for specifc groups or modes. In order to determine different accident rates that can be used as the measure of the accident risk, different statistical indicators of accident risk must be taken into consideration. In other work by the Department, this has been done, and the age group 18-24 years has the highest accident rate of all groups surveyed. This suggests that a combination of this age group and subcompact cars is the worst possible combination of all.

TABLE 5

ACCIDENT AND FATALITY RATES 1973-1979

Year	Total Vehicles[1] Miles Traveled	Accident Rate[2]	Fatality Rate
1973	23.46	452.49	3.34
1974	22.59	469.39	3.35
1975	24.02	505.00	3.23
1976	25.93	473.93	3.23
1977	27.45	434.36	3.38
1978	29.38	403.60	3.47
1979	29.12	407.55	3.54

[1]Billions

[2]Accidents and Fatalities per 100,000,000 vehicle miles of travel.

Since 1973, smaller cars have become involved in more accidents. The increased frequency can be explained by the trend of the public to buy smaller cars, but the fact is that the smaller vehicles are involved in more injury and fatal accidents than the larger automobiles.

In the years ahead, the accident rate may remain the same, but the severity of these accidents is likely to increase. Table 5 supports this statement.

In 1978 and 1979, the accident rates are the lowest of the seven years but the fatality rates are the highest. Except for 1975 and 1976, the fatality rate appears to be increasing while the accident rates have decreased.

It seems clear that WSDOT and other organizations involved with highway safety must pay more attention to the obvious problems. An overall safety-improvement process will be necessary and should be a series of empirically based activities undertaken to effectively and economically improve the safety of the traveling public who use the nation's highways. These improvements will be implemented through activities that systematically identify and analyze problems, develop alternative solutions, apply the solutions, and then judge the success in solving the problem.

The transportation departments can take certain action to achieve the desired result, but they cannot do it alone. Preliminary analysis suggests that modifications to certain automobiles will be necessary if the number of fatalities is to be reduced.

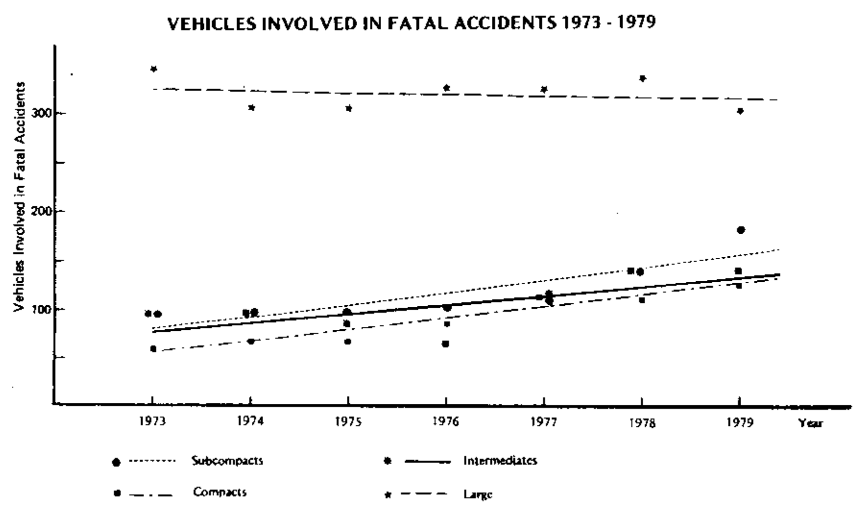


FIGURE 7

VI. ANALYSIS OF 1980 M.V. REGISTRATION AND ACCIDENT DATA

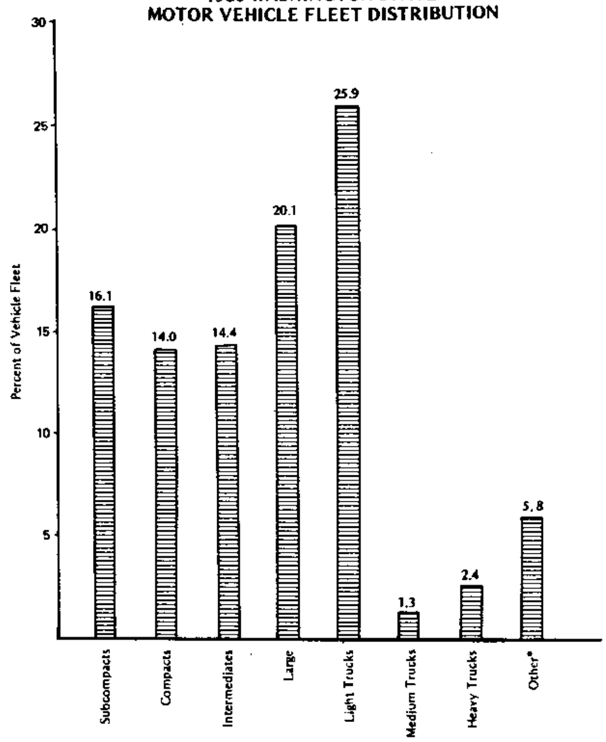
To support the 1973-1979 data, an in-depth review was made of the 1980 accident data. The procedure used to determine what problem areas certain vehicle classes might be experiencing in traffic safety went through the following steps:

- Determine the number of vehicles registered in the state of Washington for 1980 and group them into the four passenger car classes.
- Group the 1980 accident data by vehicle class.
- Compare the total number of accidents for each vehicle class to the total number of vehicles registered in that class for 1980.
- Calculate proportions by dividing the total number of accidents that occurred in 1980 for the vehicle class of concern into the number of accidents in that vehicle class for the specified characteristic.
- Set up contingency tables to compare the proportions of occurrences in each vehicle class to one another and is the proportion of one vehicle class significantly different from the proportion in another vehicle class.
- Make recommendations based on the findings.

Washington State Department of Licensing provided a random sample of motor vehicle registration data for the state of Washington for 1980. Ratios based on the sample were used to estimate the total number in each passenger car class. Table 6 shows the estimated number of vehicles registered in each passenger car class for 1980 in the state.

FIGURE 8

1980 WASHINGTON STATE
MOTOR VEHICLE FLEET DISTRIBUTION



*Other includes motorcycles, snowmobiles, motor homes, etc.

TABLE 6

PASSENGER CAR CLASSES - 1980

Passenger Car Class	Weight (pounds)	Number Registered
Subcompact	less than 2400	511,600
Compact	2400 - 3000	445,400
Intermediate	3001 - 3600	455,300
Large	greater than 3600	637,700

The surprising feature of this tabulation process is the large number of smaller cars that were registered in Washington State in 1980. They far outnumber the large vehicles and have been increasing steadily in recent years. The trend is a direct reflection of higher gasoline prices and more expensive automobiles. As these two key ingredients continue to increase in price it can be expected that the trend will intensify.

Having derived estimates of vehicles registered in each class and having tabulated the number of accidents, it was possible to compute accident rates (accidents per 1,000 registered vehicles) for each vehicle class. Table 7 shows the number of vehicles registered, accidents and accidents per 1,000 registered vehicles for 1980.

The data in Table 7 show that in 1980, large cars had a higher number of accidents per thousand vehicles than was the case with the smaller vehicles. However, if it had been possible to show these data in passenger miles, the comparisons would have been much closer.

TABLE 7

STATEWIDE 1980 ACCIDENTS PER REGISTERED VEHICLE

Vehicle Class	Registered	Accidents	Accidents per 1,000 Registered Vehicles
Subcompact	511,600	21,994	43
Compact	445,400	20,047	45
Intermediate	455,300	21,040	46
Large	637,700	43,423	68

These statistics are meaningful, but require further refinement. It should be noted that the data being studied relate to automobiles, and not drivers. This point was mentioned earlier but should be stressed. And it should be remembered that accident-prone drivers in smaller cars will have a higher incidence of accidents, irrespective of whether road conditions are favorable, or not. Some of these considerations tend to be hidden by the total statistical approach.

Table 8 gives details of the number and percentage of accidents for the various passenger car categories. Applicable accident definitions are:

Fatal - any injury that results in death

Disabling - any non-fatal injury which prevents the victim from walking, driving or other normal activity, i.e., broken bones.

Non-disabling - any evident injury which is not fatal or disabling, i.e., bruises, minor lacerations.

Possible - any reported or claimed injury which is not included above, i.e., momentary unconsciousness.

None - no injury

TABLE 8
INJURY CLASS BY VEHICLE SIZE (1980)
(Percents in Parenthesis)

INJURY CLASS	SUBCOMPACT Less than 2400 Lbs.	COMPACT 2401 - 3000 Lbs.	INTERMEDIATE 3001 - 3600 Lbs.	LARGE Greater than 3600 Lbs.	TOTAL
Fatal	124 *(0.6)*	100 *(0.5)*	69 *(0.3)*	153 *(0.4)*	446 *(0.4)*
Disabling	1,214 *(5.5)*	902 *(4.5)*	753 *(3.6)*	1,576 *(3.6)*	4,445 *(4.2)*
Non-disabling	3,082 *(14.0)*	2,447 *(12.2)*	2,285 *(10.8)*	4,250 *(9.8)*	12,064 *(11.3)*
Possible	2,922 *(13.3)*	2,374 *(11.8)*	2,308 *(11.0)*	4,354 *(10.0)*	11,958 *(11.2)*
None	14,652 *(66.6)*	14,224 *(71.0)*	15,625 *(74.3)*	33,090 *(76.2)*	77,591 *(72.9)*
TOTAL	21,994 *(100.0)*	20,047 *(100.0)*	21,040 *(100.0)*	43,423 *(100.0)*	106,504 *(100.0)*

Table 8 suggests that occupants of compacts and subcompacts are more likely to be injured in an accident than are drivers and passengers in larger automobiles. Because an accident may occur under four different roadway surface conditions -- dry, wet, snow, or ice -- a contingency table was created listing the frequency of each passenger-car-class accident occurring under each of these conditions, the proportion of each class occurrence within its class, and the total proportions of accidents occurring under the different roadway conditions. Because the frequency of accidents for each vehicle class is different due to the different number of vehicles in each class, the null hypothesis stated that the expected proportion of accidents of each group occurring under the different roadway conditions is the same. To test if the proportion of occurrences in one group is significantly different from the proportion in a second group, the "Z test" for proportions was used. Although this method of analysis points to problem areas, the available data allows for only a generalization of the causes of the accidents. The results are shown in Table 9.

TABLE 9

PROPORTION OF ACCIDENTS BY ROADWAY SURFACE CONDITION BY VEHICLE CLASS (1980)

Roadway Surface Condition	Subcompact under 2400 lbs	Compact 2400-3000 lbs	Intermediate 3001-3600 lbs	Large greater than 3600 lbs
Dry	.618	.613	.630	.638
Wet	.314	.321	.308	.305
Snow	.032	.029	.029	.029
Ice	.036	.037	.033	.028
Total Vehicular Accidents	21,994	20,047	21,040	43,423

Comparing the subcompacts to the large passenger cars, the proportions indicate that subcompacts have had a larger number of their accidents under adverse roadway conditions. A difference of .009 in the proportions indicates that a significant difference of between 400 and 1,000 more accidents per year would occur under wet roadway conditions with 100,000 or more accidents occurring every year.

Table 10 shows the proportion of accidents occurring under the specified road character for each vehicle class.

TABLE 10

1980 PROPORTION OF ACCIDENTS BY ROADWAY CHARACTER BY VEHICLE CLASS

Roadway Surface Condition	Subcompact under 2400 lbs	Compact 2400-3000 lbs	Intermediate 3001-3600 lbs	Large greater than 3600 lbs
Straight and Level	.651	.655	.679	.686
Straight at Grade	.175	.176	.161	.164
Straight at Hillcrest	.016	.018	.016	.016
Straight at Sag	.006	.007	.005	.006
Curve and Level	.076	.074	.072	.068
Curve and Grade	.069	.065	.061	.055
Curve and Hillcrest	.003	.003	.004	.003
Curve and Sag	.004	.002	.002	.002
TOTAL Vehicular Accidents	21,194	20,047	21,040	43,423

Large cars have a higher proportion of their accidents on straight and level roadways. The straight at grade (vertical alignment), curve and level (horizontal curve), and curve at grade (vertical and horizontal alignment) show significant differences among the vehicle-group accident experience. With decreasing automobile size, there is an increasing proportion of accidents on vertical and horizontal alignments.

No significant differences among the vehicle classes appeared with regard to accidents occurring during daylight, dusk, dawn or dark conditions. The proportions were approximately equal in each vehicle class for each different light condition.

A cross-tabulation of collision type by passenger car class was developed. Table 11 below shows each vehicle class collision type frequency and the proportion which that collision type represents of the total reported for that vehicle class.

TABLE 11

1980 ACCIDENTS BY COLLISION TYPE BY VEHICLE CLASS

Collision Type	Subcompact under 2400 lbs	Compact 2400-3000 lbs	Intermediate 3001-3600 lbs	Large greater than 3600 lbs
	Number/Proportion			
Entering at Angle	4,963 .255	4,574 .263	4,939 .274	10,356 .276
Rear End	4,602 .237	3,898 .224	3,963 .220	7,707 .205
Parking	2,197 .113	1,991 .115	2,309 .128	6,282 .167
Driveway	2,022 .104	1,921 .110	1,947 .108	3,944 .105
Left Turn	1,556 .080	1,471 .085	1,408 .078	2,730 .073
Vehicle Overturned	1,003 .051	583 .034	390 .022	620 .017
Head-on	272 .014	225 .013	270 .015	524 .014
Other	2,863 .146	2,714 .156	2,786 .155	5,369 .143
Total Collision Types Reported	19,478	17,377	18,012	37,532

Looking at the proportions of each vehicle-class-accident occurrence, a pattern quite similar to that found in the roadway character and condition contingency tables appear. Firstly, in rear-end collisions, there is an increasing proportion as vehicle size decreases. The same pattern appears in vehicle overturned and left-turn collisions, where there is an increasing proportion of these collision types as car size decreases.

Table 12 shows a further breakdown of the 1980 accidents by collision type by vehicle class and indicates the percent of the collisions in each vehicle class which resulted in fatalities (F) and disabling injuries (DI):

From a severity standpoint, the occupants of large cars faired much better than the occupants of the smaller cars in the same collision types. For example, of the 1,556 left-turn collisions in which subcompacts were involved, 6.9 percent resulted in disabling injuries to the occupants, whereas of the 2,730 left-turn collisions involving large cars, only 3.3 percent resulted in disabling injuries.

TABLE 12

1980 FATAL (F) AND DISABLING INJURY (DI) ACCIDENTS

BY COLLISION TYPE BY VEHICLE CLASS

Collision Type	Subcompact under 2400 lbs		Compact 2400-3000 lbs		Intermediate 3001-3600 lbs		Large greater than 3600 lbs	
	% F	% DI	% F	% DI	% F	% DI	% F	% DI
Entering at Angle	.2	5.2	.2	4.2	.1	3.3	.2	3.4
Rear End	.1	3.0	.1	2.6	.1	1.9	.0	2.0
Parking	.0	1.9	.0	1.2	.0	1.0	.0	1.2
Driveway	.1	3.5	.0	2.6	.1	2.1	.1	1.9
Left Turn	.1	6.9	.1	3.9	.1	2.9	.1	3.3
Vehicle Overturned	1.9	11.0	2.9	10.1	2.8	10.5	2.6	11.0
Head On	8.5	22.1	6.7	19.1	4.8	22.2	3.8	16.8

WSDOT is able to make detailed breakdowns for each accident. In addition, specific locations can be determined and appropriate classifications made. For example, accidents classified as either bridge-related or interchange-related are assigned to a specific bridge or interchange. By using this procedure, the number of accidents that occurred on each interchange and bridge can be obtained and compared with a critical number of accidents. This procedure was adopted for other features of the highway system and produced positive results.

Table 13 below is a list of objects struck, the number of vehicles in each class striking the object, and the proportion of each class.

TABLE 13

OBJECTS STRUCK

1980 Accidents by Object Struck By Vehicle Class

Number/Proportion

Collision Type	Subcompact under 2400 lbs	Compact 2400-3000 lbs	Intermediate 3001-3600 lbs	Large greater than 3600 lbs
Utility Pole	340 .135	416 .156	558 .184	1124 .190
Guardrail	290 .155	310 .117	312 .102	534 .092
Tree or Stump	229 .091	240 .090	301 .099	599 .101
Roadway Ditch	236 .094	206 .077	248 .082	450 .076
Over Embankment No Guardrail	244 .097	242 .091	239 .079	418 .071
Fence	168 .067	188 .070	237 .078	507 .086
Earth Bank or Ledge	215 .085	213 .080	175 .058	412 .070
Bridge Rail	89 .035	98 .036	121 .040	188 .040
Luminary Pole	69 .027	89 .033	107 .035	214 .036
Wood Sign Post	66 .026	54 .020	81 .027	161 .027
Concrete Barrier	57 .023	70 .026	46 .015	77 .013
Metal Sign Post	47 .019	23 .009	42 .014	102 .017
Guide Post	20 .008	16 .006	18 .006	28 .005
TOTAL Objects Struck	2524	2674	3038	5908

The information presented in Tables 11, 12 and 13 is indicative of the type of data that can be developed from WSDOT's comprehensive accident records. This information was used to make the detailed analysis necessary to reach the conclusions and recommendations combined in the next section.

Table 14 indicates the percentage of collisions that resulted in a fatality or disabling injury.

TABLE 14

1980 Fatal (F) and Disabling Injury (DI) Accidents

by Objects Struck by Vehicle Class

Object Struck	Subcompact % F	Subcompact % DI	Compact % F	Compact % DI	Intermediate % F	Intermediate % DI	Large % F	Large % DI
Utility Pole	2.9	16.8	1.4	13.7	.5	9.0	.9	10.8
Guardrail	1.0	8.6	1.6	8.1	1.6	7.7	1.3	9.6
Tree or Stump	2.6	16.2	2.9	15.4	1.7	8.6	2.5	16.0
Roadway Ditch	0	8.9	0	10.2	0	5.6	.2	6.2
Over Embankment No Guardrail	2.5	16.8	1.2	8.3	1.3	9.2	2.2	8.1
Fence	0	8.3	1.1	7.4	0	4.6	.6	4.3
Earth Bank	3.7	10.2	.9	10.8	.6	11.4	1.0	13.1
Bridge Rail	2.2	9.0	1.0	9.2	0	11.6	2.7	7.4
Luminary Pole	1.4	14.5	2.2	13.5	0	7.5	.9	5.6
Wood Sign Post	1.5	6.1	0	0	1.2	2.5	.6	6.2
Concrete Barrier	1.8	8.8	0	10.0	0	8.7	1.3	7.8
Metal Sign Post	0	8.5	0	4.3	0	4.8	0	6.9
Guide Post	10.0	10.0	12.5	0	0	0	0	7.1

Utility poles are the most common object struck. It appears that large cars strike poles more often, but the smaller cars have more fatalities and disabling injuries in collisions with poles.

The smaller cars have a higher propensity to strike a guardrail or concrete barrier, run off the road into a ditch, or over an embankment. The guardrail collision appears equally severe for all vehicle classes, but smaller vehicles going into a roadway ditch or over an embankment are more likely to result in a fatality or disabling injury.

VII. CONCLUSIONS AND RECOMMENDATIONS

The analysis shows that the smaller automobiles are experiencing increased numbers of accidents. This is important because, in the future, the smaller lighter cars will represent a greater percentage of the vehicle population, and an increase in deaths and serious injuries can be expected unless countermeasures are taken. Specifically, the study shows that smaller vehicles are experiencing the following problems:

- A higher percentage of fatal and injury accidents
- A greater proportion of accidents occurring on wet, snowy, and icy roadways, and on horizontal and vertical alignments
- A high frequency of overturning and rear-end collisions
- A high percentage of fatalities and injuries resulting from striking poles and going over an embankment

The following conclusions and recommendations have been developed for use by persons involved in this field.

Conclusions: On wet, snowy or icy roadways, a lighter vehicle will have less traction than a heavier vehicle, so some improvements should be made to lessen the effect of this difference.
Recommendations: Freer draining pavements and better traction tires can be provided. There are a number of sections of highways where the Washington State DOT has increased the void area in the asphalt concrete pavement, thus creating a freer draining pavement. A before and after accident evaluation of these sections would be worthwhile. Advances in vehicle design, such as front wheel drive, are proving to be effective in the automobile's ability to negotiate snow on the roadway.

Conclusion: The subcompacts had a higher proportion of "roadway ditches" and "over an embankment" type accidents than other vehicular groups.
Recommendation: More traversible sideslopes would reduce the severity of these unfortunate happenings; research should be conducted to determine if the current standards need to be revised.

Conclusion: The smaller vehicles are experiencing a higher proportion of accidents on vertical and horizontal alignments.

Recommendation: The existing standards of eye height of 3.75 feet with an object height of 0.5 feet should be changed to a driver's eye height of 3.50 feet and object height of .25 feet, and new design standards should be developed for future construction and for improving existing deficient facilities. The .25 feet for the object height is more realistic due to the ground clearance of the newer vehicles. Adopting these values would provide approximately 25 percent greater length of stopping-sight distance. This recommendation is not to be interpreted to mean that every existing vertical alignment has to be reduced in grade but that improved pavement markings and signing for passing zones and advanced warning used to alert motorists. Rear-end and head-on collisions could be reduced due to this type of improvements.

Conclusion: Collisions occur because either one vehicle is traveling faster that the other or is following too closely or is stopped or backing up. Aside from driver error, unusual signal timing, insufficient stopping sight distance, or advance warning and poor pavement friction can contribute to rear-end collisions.

Recommendation: Improved geometrics, signing and signal coordination can reduce rear-end collisions not only for the smaller vehicle but for all motor vehicles. Vehicle design engineers should also consider raising the height of taillights as this has been shown to reduce rear-end collisions.

Conclusion: The extremely high number of subcompacts overturning presents a great danger. The short wheelbase and small tires of the newer vehicles contribute to overturning.

Recommendation: A large majority of the vehicles overturning occur in rural areas where it should be economically feasible to provide guardrails and/or gentle sideslopes especially at identified or potential hazardous locations.

Conclusion: In looking at the severity of the collision types and objects struck among the vehicle groups, the smaller vehicles have a higher percentage of fatalities and disabling injuries. The highway design engineer and the motor vehicle designers should work together to improve this situation.

Recommendation: Occupant restraints have proved to be effective in reducing injury in crashes, and their use should be encouraged more vigorously. Rigid passenger compartments are another effective deterrent to driver and passenger injury and should be included in the newer vehicles.

The transportation engineer and the vehicle designer should work as a team to alleviate the problems caused by the sudden influx of small vehicles into a street and highway system not specifically designed for them and which carries other much larger and heavier vehicles. The transportation community should design new facilities, and upgrade the existing system to make it safer. While some of the improvements can be made now and will have an immediate effect, the total solution is essentially long-run. The vehicle designer can make required structural changes to the vehicle and assist in making the entire vehicle population compatible within ten years. Many of the changes needed are relatively straightforward, such as taillights located higher on the rear of the vehicle and automatic restraints. Other changes are needed in the structural integrity of the passenger compartments.

VIII. APPENDICES

PASSENGER CAR CLASSES GROUPED ACCORDING TO MAKE AND MODEL BY WEIGHT

MAKE	MODEL SUBCOMPACT Less Than 2400 Pounds	COMPACT 2401-3000 Pounds	INTERMEDIATE 3001-3600 Pounds	LARGE Greater Than 3600 Pounds
Alfa Romeo		all models		
American Motors		American, Spirit, Gremlin, Rambler, Concord 1980 and after AMX 1979 and after	Pacer, Eagle, Hornet Javelin, Rebel, Concord 1979 and before AMX 1978 and before Matador, all models up to 1966	Jeep Wagoneer Jeep Cherokee Ambassador
Audi	4000, Fox	5000, 1000 LS		
Austin	Marina, Healy, all other models			
BMW		320i, 2002, 2002A	528i, 733i, 530i, 3.0Si, 633CSi, 530iA, 3.0SiA, Bavaria	
Buick		Skyhawk Skylark 1980 and after	Apollo, Century 1978 and after Regal 1978 and after LeSabre 1977 and after Skylark 1979 and before	Electra, Riviera, Wildcat, Century 1977 and before Regal 1977 and before LeSabre 1976 and before all models before 1966
Cadillac				Seville, De Ville, Eldorado, Fleetwood all models incl. before 1966
Capri		all models		
Checker				Marathon

	MODEL			
MAKE	SUBCOMPACT Less Than 2400 Pounds	COMPACT 2401-3000 Pounds	INTERMEDIATE 3001-3600 Pounds	LARGE Greater Than 3600 Pounds
Chevrolet	Chevette	Citation, Monza, Vega, Corvair, Chevy II	Camaro, Corvette, Nova, Malibu 1978 and after Monte Carlo 1978 and after, Impala 1977 and after, Caprice 1977 and after	Biscayne, Bel-Air, Station Wagon, Monte Carlo 1977 and before, Impala 1976 and before, Caprice 1976 and before, Malibu 1977 and before all models before 1966
Chrysler			Cordoba 1980 and after LeBaron 1978 and after	Cordoba 1979 and before LeBaron 1977 and before Newport, New Yorker, all models before 1977
Datsun	210, B210, 510, 1200, PL610, PL510, 240Z, F10, all models before 1974	200SX, 810, 280Z, 280ZX, 620, 710, 610		
Dodge	Omni, Colt	Challenger, Dart	Aspen, Diplomat, Mirada, Charger	St. Regis, Magnum, Monaco, Royal Monaco, Coronet, Polara, all models before 1966
Fiat	Strada, X1/9, 124, 128, 850	Brava, 131		
Ford	Cortina, Fiesta	Pinto, Fairmont, Mustang, Maverick, Falcon, Thunderbird 1955-57	Granada, Fairlane, Thunderbird 1980 and after	Custom, Galaxie, Elite, LTD, Torino, Station Wagon, Thunderbird 1958-79 all models before 1966 except Thunderbird
Honda	Civic, Accord, Prelude, CVCC, all models			
Imperial				all models

MAKE	MODEL SUBCOMPACT Less Than 2400 Pounds	COMPACT 2401-3000 Pounds	INTERMEDIATE 3001-3600 Pounds	LARGE Greater Than 3600 Pounds
Jaguar		XK150, XK100	420, XKE	XJ6, XJ12, Sedan
Lancia		Beta, all models		
Lincoln				Versailles, Continental, Mark, all models
Mazda	GLC, 808, 616, RX2, RX3, RX4	626, RX7		
Mercedes Benz		200, 230SL	230, 240, 280, 300	
Mercury		Bobcat, Capri, Zephyr	Monarch, Cougar, Cyclone, Comet, Marquis 1980 & after	Montego, Monterey, all models before 1966
MG	B, B/GT, A, all models			
Oldsmobile		Starfire, Omega 1980 and after	Cutlass 1978 and after Delta 88 1977 and after Omega 1979 and before F-85	98, Toronado, Delmont, Cutlass 1977 and before Delta 88 1976 and before all models before 1966
Opel	all models			
Peugeot		304, 403, 404	504, 505, 604	
Plymouth	Arrow, Champ, Cricket Horizon	Sapporo	Valiant, Volare, Barracuda, Sattelite Belvedere	Fury, Grand Fury, all models before 1966
Pontiac		Sunbird, Astre, Phoenix 1980 and after	LeMans, Firebird, Ventura, Tempest, Grand Prix 1978 and after, Phoenix 1978 and after	GTO, Grand Ville, Grand Prix 1977 and before Cataline, Bonneville
Porsche	912, 914, 356	911, 924, 930	928	

MAKE	MODEL SUBCOMPACT Less Than 2400 Pounds	COMPACT 2401-3000 Pounds	INTERMEDIATE 3001-3600 Pounds	LARGE Greater Than 3600 Pounds
Renault	Le Car, 1229, R-12, 15, 16	Gordini		
Rootes	Sunbeam, all models			
Rover			all models	
Saab		all models		
Simca	all models			
Sonnett	all models			
Subaru	all models			
Toyota	Tercel, Corolla, Supra	Corona, Celica, Crown, Mark II, Cressida		Land Cruiser
Triumph	all models, TR2-7			
Volkswagen	Rabbit, Jetta, Dasher, Scirocco, Beetle, Bug			
Volvo		all models		

WSP 159 (REV. 1-80)

STATE OF WASHINGTON

POLICE TRAFFIC COLLISION REPORT

PAGE ___ OF ___

☐ TRAFFICWAY
☐ PRIVATE WAY

No.

POLICE COMPLAINT NUMBER

DATE OF COLLISION: MO DAY YR | DAY OF COLLISION: SUN MON TUES WED THURS FRI SAT | TIME (USE 2400 HOUR) | COUNTY

COUNTY NO. | CITY NO. | FHWA ☐ URBAN ☐ RURAL

MILES ☐ N ☐ S ☐ E ☐ W ☐ IN ☐ OF | CITY OR TOWN | NAME & NO. OF STREET OR HIGHWAY | ON

FCT CLS | ADM CLS | PREFIX | ROUTE OR STREET CODE | SECTION

INTERSECTING WITH: STREET OR ROAD | NON INTERSECTION | BETWEEN ___ STREET & ___ STREET

PREFIX | EQ. | MILE POST

DISTANCE & DIRECTION FROM REFERENCE, CROSS STREET OR NEAREST MILE POST: ☐ MILES ☐ FEET | N ☐ S ☐ E ☐ W ☐ | OF

ACCIDENT MILEAGE CODE (MILES IN HUNDREDTHS)

RAMP | DIAGRAM DATA

COLLISION INVOLVED: TOTAL NO. OF VEHICLES ☐ | SEVERITY: NO. KILLED ______ NO. INJURED ______ ☐ PROPERTY DAMAGE ONLY | ☐ FUEL SPILLAGE ☐ FIRE RESULTED | ☐ HIT & RUN ☐ STOLEN VEHICLE

INTER | NON INTER | X-RD CLS | INTERSECTING STREET OR ROAD OR REFERENCE CROSS STREET OR ROAD

OBJECT STRUCK (NAME OF OBJECT STRUCK AND OWNER'S NAME) | EST. DAMAGE $

SPECIAL CODING USE

UNIT NO. 1	UNIT NO. 2 ☐ VEHICLE ☐ PEDESTRIAN ☐ PEDALCYCLIST
DRIVER'S NAME: LAST FIRST MIDDLE	DRIVER'S NAME: LAST FIRST MIDDLE
STREET ADDRESS	STREET ADDRESS
CITY / STATE / ZIP CODE / PHONE NO.	CITY / STATE / ZIP CODE / PHONE NO.
DRIVER'S LICENSE NO. / STATE / SEX / DATE OF BIRTH MO DAY YR	DRIVER'S LICENSE NO. / STATE / SEX / DATE OF BIRTH MO. DAY YR
OCCUPATION / FIRM NAME & PHONE NO. / EYES / WEIGHT / HEIGHT	OCCUPATION / FIRM NAME & PHONE NO. / EYES / WEIGHT / HEIGHT
☐ CHECK (✓) IF OPERATOR WAS DRIVING A COMMERCIAL VEHICLE AS AN EMPLOYEE OF ANOTHER.	☐ CHECK (✓) IF OPERATOR WAS DRIVING A COMMERCIAL VEHICLE AS AN EMPLOYEE OF ANOTHER.
CODES ▶ + 3 INJURY CLASS / 4 RESTRAINT SYSTEM / 5 EJECTION / 6 MOTORCYCLE SAFETY	CODES ▶ + 3 INJURY CLASS / 4 RESTRAINT SYSTEM / 5 EJECTION / 6 MOTORCYCLE SAFETY
NATURE OF INJURIES	NATURE OF INJURIES
REMOVED FROM SCENE BY: ☐ AMBULANCE ☐ POLICE CAR ☐ HELI-COPTER ☐ PRIVATE VEHICLE ☐ NOT TRANSP.	REMOVED FROM SCENE BY: ☐ AMBULANCE ☐ POLICE CAR ☐ HELI-COPTER ☐ PRIVATE VEHICLE ☐ NOT TRANSP.
VEH. YEAR / MAKE (DODGE-CHEV.) / MODEL (DART-NOVA) / STYLE (2 DR.-CONV.)	VEH. YEAR / MAKE (DODGE-CHEV.) / MODEL (DART-NOVA) / STYLE (2 DR.-CONV.)
VEH. COLOR / LICENSE PLATE NO. / STATE / TRAILER PLATE NO. / STATE	VEH. COLOR / LICENSE PLATE NO. / STATE / TRAILER PLATE NO. / STATE
VEHICLE IDENTIFICATION NO.	VEHICLE IDENTIFICATION NO.
REGISTERED OWNER: LAST FIRST MIDDLE / PHONE NO.	REGISTERED OWNER: LAST FIRST MIDDLE / PHONE NO.
ADDRESS OF OWNER	ADDRESS OF OWNER
NAME & ADDRESS OF INSURANCE CO. OR AGENT	NAME & ADDRESS OF INSURANCE CO. OR AGENT

DRIVER / VEHICLE / OWNER

UNIT NO. 1		UNIT NO. 2
SHADE IN DAMAGED AREA (1–8; 9 TOP, 10 BOTTOM) / VEH. DAMAGE ☐ DISABLING ☐ FUNCTIONAL ☐ OTHER DMGE. / CITATION NO. / CHARGE	ENFORCEMENT ACTION	CITATION NO. / CHARGE / VEH. DAMAGE ☐ DISABLING ☐ FUNCTIONAL ☐ OTHER DMGE. / SHADE IN DAMAGED AREA (1–8; 9 TOP, 10 BOTTOM)
EST. DAMAGE $ / ☐ DRIVEN AWAY ☐ TOWED AWAY BY: ☐ REMAINED	VEHICLE REMOVAL	☐ DRIVEN AWAY ☐ TOWED AWAY BY: ☐ REMAINED / EST. DAMAGE $

DIAGRAM OF COLLISION: (USE SUPPLEMENTAL SHEET IF NECESSARY) INDICATE NORTH BY ARROW (N)

DESCRIPTION OF COLLISION: (USE SUPPLEMENTAL SHEET IF NECESSARY)

NAME, ADDRESS & INJURIES OF PERSONS INVOLVED OCCUPANTS / WITNESSES (USE SUPPLEMENTAL SHEET FOR ADDITIONAL NAMES)

		+ CODES: SEX / AGE / 1 STATUS / — IN VEH NO. / 2 SEAT POSIT / 3 INJ CLASS / 4 RESTR. / 5 EJECT / 6 MTCY SAFETY
NAME: / ADDRESS	PHONE NO. / NATURE OF INJURIES	REMOVED FROM SCENE BY: ☐ AMB ☐ POLICE CAR ☐ HELI-COPTER ☐ PRIV VEH ☐ NOT TRANSP
NAME: / ADDRESS	PHONE NO. / NATURE OF INJURIES	REMOVED FROM SCENE BY: ☐ AMB. ☐ POLICE CAR ☐ HELI-COPTER ☐ PRIV VEH ☐ NOT TRANSP
NAME: / ADDRESS	PHONE NO. / NATURE OF INJURIES	REMOVED FROM SCENE BY: ☐ AMB. ☐ POLICE CAR ☐ HELI-COPTER ☐ PRIV VEH ☐ NOT TRANSP

X INVESTIGATING OFFICER'S NAME & RANK	BADGE OR ID. NO.	AGENCY	UNIT OR DIST. & DET	POLICE DISPATCHED 2400 HRS.	POLICE ARRIVED 2400 HRS.	DATE OF REPORT	APPROVED BY	DATE

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+ SEE COVER FOR CODE DEFINITIONS

PLEASE PRINT - PRESS DOWN FIRMLY

THE OPERATOR OR OWNER OF ANY MOTOR VEHICLE INVOLVED IN AN ACCIDENT WITHIN THIS STATE, IN WHICH ANY PERSON IS INJURED OR IN WHICH ANY PERSON'S PROPERTY INCLUDING HIMSELF, SUSTAINS DAMAGES ... TO THE DIVISION OF FINANCIAL RESPONSIBILITY, OLYMPIA, WASHINGTON.

PLEASE BE SURE TO COMPLETE THE LIABILITY INSURANCE INFORMATION ON VEHICLE NO. 1

STATE OF WASHINGTON MOTOR VEHICLE COLLISION REPORT

NO.

DATE OF COLLISION: MO | DAY | YR — DAY OF COLLISION: SUN MON TUES WED THUR FRI SAT — HOUR — TIME OF COLLISION MINUTES ☐ AM ☐ PM — COUNTY

CITY OR TOWN — NAME & NO. OF STREET OR HIGHWAY

ON

INTERSECTING WITH STREET OR ROAD — NON-INTERSECTION — BETWEEN — STREET & STREET

IF NOT AT INTERSECTION: FEET ☐ N ☐ S ☐ E ☐ W OF

COLLISION INVOLVED TOTAL NO. OF VEHICLES ▶

[redacted]

DRIVER'S LAST NAME — FIRST NAME — MIDDLE

IF MORE THAN TWO CARS WERE INVOLVED IN THIS COLLISION OR MORE THAN TWO PERSONS WERE INJURED USE A SEPARATE COLLISION REPORT FORM

[redacted]

DRIVER'S LAST NAME — FIRST NAME — MIDDLE

STREET ADDRESS — ROUTE NO. AND BOX NO.

CITY — STATE — ZIP — DRIVER'S OCCUPATION

DRIVER'S LICENSE NO. — STATE — SEX M F — DATE OF BIRTH MO DAY YR — AGE

VEHICLE YR. — MAKE — MODEL — BODY STYLE

LICENSE PLATE NO. — STATE — TRAILER PLATE NO. — STATE

VEHICLE IDENTIFICATION NO.

REGISTERED OWNER (LAST-FIRST-MIDDLE NAME) — DRIVER'S LICENSE NO.

OWNER'S ADDRESS — STREET, CITY AND STATE — DATE OF BIRTH MO DAY YR

PARTS OF VEHICLE DAMAGED — $

LIABILITY INSURANCE INFORMATION-VEHICLE NO. 1 · WAS THERE AUTOMOBILE LIABILITY INSURANCE COVERAGE IN EFFECT FOR THIS ACCIDENT ON YOUR CAR ☐ YES ☐ NO

NAME AND ADDRESS OF LIABILITY INSURANCE POLICY HOLDER — CITY — STATE — ZIP — NAME OF LIABILITY INSURANCE COMPANY

NAME AND ADDRESS OF LIABILITY INSURANCE AGENT — CITY — STATE — ZIP — LIABILITY POLICY NUMBER

1ST INJURY: NAME — ADDRESS — AGE — SEX M F — NATURE AND EXTENT OF INJURIES — DID INJURIES REQUIRE EXAMINATION BY A DOCTOR? — DOCTOR'S NAME

TOTAL INJURED

2ND INJURY: NAME — ADDRESS — AGE — SEX M F — NATURE AND EXTENT OF INJURIES — DID INJURIES REQUIRE EXAMINATION BY A DOCTOR? — DOCTOR'S NAME

STATUS OF INJURED: ☐ DRIVER ☐ PASSENGER ☐ PEDESTRIAN — IN VEHICLE NO. — KILLED ☐ — DISABLING INJURY (SEVERE) 5☐ — NON-DISABLING INJURY (MINOR) 6☐ — POSSIBLE INJURY P.E. COMPLAINT OF PAIN ETC. 7☐

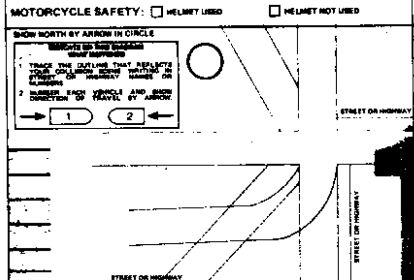
MOTORCYCLE SAFETY: ☐ HELMET USED ☐ HELMET NOT USED

MOTORCYCLE SAFETY: ☐ HELMET USED ☐ HELMET NOT USED

SHOW NORTH BY ARROW IN CIRCLE

1. TRACE THE OUTLINE THAT REFLECTS YOUR COLLISION SCENE WRITING IN STREET OR HIGHWAY NAMES OR NUMBERS
2. NUMBER EACH VEHICLE AND SHOW DIRECTION OF TRAVEL BY ARROW

→ 1 — 2 ←



DESCRIBE BELOW WHAT HAPPENED: (REFER TO VEHICLES BY NUMBER)

VEHICLES POSITIONS BEFORE COLLISION

VEHICLE N S E W — ON STREET OR HIGHWAY NAME OR NO. — NO. OF LANES IN ONE DIRECTION — VEHICLE LEGALLY STANDING YES NO — VEHICLE LEGALLY PARKED YES NO — IF PARKED WAS VEHICLE OCCUPIED YES NO — INVESTIGATED BY: ☐ STATE PATROL ☐ OTHER POLICE ☐ CITY POLICE ☐ NO INVESTIGATION ☐ SHERIFF

ALONG — OR CROSSING — FROM — TO

PEDESTRIAN/PEDAL CYCLIST WAS USING: 1☐ SIDEWALK 2☐ WALKWAY 3☐ SHOULDER 4☐ MARKED CROSSWALK 5☐ UNMARKED CROSSWALK 6☐ OTHER 7☐ DESIGNATED BIKE ROUTE 8☐ ROADWAY

PEDESTRIAN/PEDAL CYCLIST CLOTHING COLOR: 1☐ DARK 2☐ LIGHT 3☐ MIXED 4☐ RETRO-REFLECTIVE 5☐ OTHER REFLECTIVE APPAREL, SHOES, PATCHES, ETC.

ROAD SURFACE (CHECK ONE): 1 DRY, 2 WET, 3 SNOW, 4 ICE, 5 OTHER SPECIFY

WEATHER: 1 CLEAR OR CLOUDY OR OVERCAST, 2 RAINING, 3 SNOWING, 4 FOG, 5 OTHER (SPECIFY)

LIGHT CONDITIONS: 1 DAYLIGHT, 2 DAWN, 3 DUSK, 4 DARK-STREET LIGHTS ON, 5 DARK-STREET LIGHTS OFF, 6 DARK-NO STREET LIGHTS, 7 OTHER SPECIFY

TRAFFIC CONTROL (CHECK ONE): 1 SIGNALS, 2 STOP SIGN, 3 YIELD SIGN, 4 FLASHING RED, 5 FLASHING AMBER, 6 RR SIGNAL, 7 OFFICER/FLAGMAN, 8 OTHER, SPECIFY, 9 NO TRAFFIC CONTROL

TYPE OF ROAD (CHECK ONE OR MORE): 1 ONE WAY, 2 TWO WAY, 3 REVERSIBLE ROAD, 4 INTERCHANGE (LOOP/RAMP), 5 ALLEY, 6 TWO WAY LEFT TURN LANES, 7 DRIVEWAY — ROAD SEPARATION: 2 DIVIDED, 3 UNDIVIDED

DRIVER/VEHICLE ACTIONS (CHECK ONE OR MORE): 1 GOING STRAIGHT AHEAD, 2 OVERTAKING AND PASSING, 3 MAKING RIGHT TURN, 4 MAKING LEFT TURN, 5 MAKING U-TURN, 6 SLOWING, 7 STOPPED FOR TRAFFIC, 8 STOPPED AT SIGNAL OR STOP SIGN, 9 STOPPED IN ROADWAY, 10 STARTING IN TRAFFIC LANE, 11 STARTING FROM PARKED POSITION, 12 MERGING (ENTERING TRAFFIC), 13 BACKING, GOING WRONG WAY, OTHER SPECIFY

ROADWAY CHARACTER: STRAIGHT & LEVEL, STRAIGHT IN GRADE, STRAIGHT AT HILL CREST, STRAIGHT IN SAG, CURVE & LEVEL, CURVE IN GRADE, CURVE AT HILL CREST, CURVE IN SAG

ROADWAY SURFACE TYPE: CONCRETE, GRAVEL, BLACKTOP, DIRT, OTHER, UNKNOWN

DID COLLISION OCCUR IN A CONSTRUCTION OR ROAD MAINTENANCE AREA? ☐ YES ☐ NO

WITNESS NAME — ADDRESS — AGE

1

2

CHECK (✓) IF YOU WERE DRIVING A COMMERCIAL VEHICLE AS AN EMPLOYEE OF ANOTHER.

(RCW DEFINITION OF A COMMERCIAL VEHICLE IS ANY VEHICLE THE PRINCIPAL USE OF WHICH IS THE TRANSPORTATION OF COMMODITIES, MERCHANDISE, PRODUCE, FREIGHT, ANIMALS OR PASSENGERS FOR HIRE.)

SIGNATURE OF PERSON COMPLETING REPORT — ADDRESS — DATE OF REPORT MO DAY YEAR

X

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