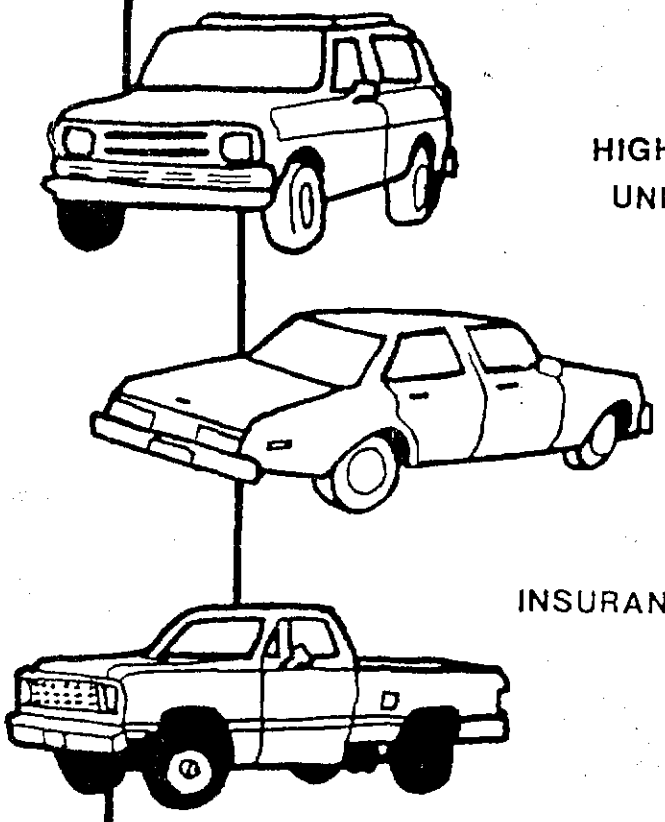
A Comparison of the Crash Experience of Utility Vehicles, Pickup Trucks and Passenger Cars



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September, 1981

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ACKNOWLEDGEMENTS

This study would not have been possible without the help of a number of people who provided the accident data and registration data. The authors would particularly like to express their appreciation to personnel in the North Carolina Division of Motor Vehicles and the Maryland Department of Motor Vehicles for providing the multi-year statewide accident data base used in this investigation.

In addition, the authors are especially grateful to both their programming staffs and their secretarial staffs at the Highway Safety Research Center and the Insurance Institute for Highway Safety for their valuable assistance in this study.

Although the report reflects the efforts of many, the authors are solely responsible for its contents, including whatever shortcomings there may be.

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CHAPTER I. INTRODUCTION

For some time it has been alleged that the small, multi-purpose military vehicles commonly referred to by millions of World War II servicemen as "jeeps" are more suceptible to rollover than other four-wheeled motor vehicles. In fact, in the early 1970's, the U.S. Army ended its practice of selling these surplus military vehicles to the public because of their "high rollover accident rates" (Department of Transportation, 1971). A variety of civilian modifications of these multi-purpose vehicles, referred to as utility vehicles, has become increasingly common on the highways. Of this type of vehicle, the most popular models have been the AMC Jeep CJ-5, the Ford Bronco, and the Chevrolet Blazer. With the crash experience of military "jeeps" as background, it is of interest to examine the crash experience of these civilian utility vehicles and to contrast it with the experience of other motor vehicles.

Although the technical literature is sparse in this area, Synder, McDole, Ladd, and Minahan (1980) have reported the on-road crash experience of civilian utility vehicles based on 1975-78 accident data from Arizona, Maryland, Michigan, New Mexico, New York, North Carolina, Texas and Washington. They concluded that utility vehicles "...experience rollover at a rate that is at least five times higher than that experienced by the average passenger car." The study also indicated that some individual utility vehicle models are more likely to overturn than others, and that the Jeep CJ-5 is the least stable of the models studied.

The purpose of the present study is to examine in detail the crash experience of leading utility vehicle models to determine the extent to which there are variations in their crash experience and whether specific models appear to have particular problems.

This study focuses on the three leading utility vehicles -- the AMC Jeep CJ-5, the Ford Bronco and the Chevrolet Blazer -- that represent well over half of the utility vehicles currently in use. For the Jeep CJ-5 the model years studied were 1972 to 1978; for the Chevrolet Blazer, 1973 to 1978 (prior to the 1973 model the Blazer was smaller); and for the Ford Bronco, 1972 to 1977 (the 1978 and later model Broncos were larger). Results were not obtained separately for other popular utility vehicles such as the Jeep CJ-7, which was not sold until 1978, or 1978 and later model Ford Broncos, because at the time there were not sufficient numbers of them on the highways for reliable results concerning their crash experience to be obtained although they are included in the "all utility vehicles" group.

For comparison purposes, the crash experience of a number of leading small (half-ton) pickup truck models was used. These were the Ford F-100 and F-150, the Chevrolet C-10 and K-10, and the smaller Toyota and Datsun pickup trucks. In addition, the crash experience of four passenger car size groups -- subcompacts, compacts, intermediate, and full-sized -- was examined.

The overall crash experience of these vehicles in Maryland and in North Carolina, together with the national fatal crash experience as recorded by FARS (the Fatal Accident Reporting System), were studied.

CHAPTER II. THE DATA

Background

In order to examine the accident and injury experience of drivers of utility vehicles, pickup trucks, and passenger cars, the following data was needed: crash data and some corresponding measure of exposure. Since vehicle-specific mileage was not available as a measure of exposure, registration frequencies provided by R. L. Polk & Co. were used as the best alternative source.

Mileage data would, of course, have been preferable because of the possibility of the annual mileage exposure of the different classes of vehicles differing significantly. To the extent that that occurred, utilizing registration data could have either obscured differences that actually existed or tended to show differences where they truly did not exist. For example, two vehicles could have had the same registration involvement rate; but if one vehicle class was only driven half as many miles per year as the other, then that would indicate that on a mileage basis one vehicle was much more involved in accidents than the other. Similarly, where considerable differences occurred, it could have happened that a vehicle that showed a higher accident rate per unit registration might in fact have had no truly higher accident rate because it was driven more miles per year. However, as was stated, this mileage data was not available and therefore registration data was the best available alternative.

For the crash data, the following data files were used: statewide police-reported crash data for North Carolina during 1973-1978; statewide police-reported crash data for Maryland during 1974-1978; and FARS (Fatal Accident Reporting System) data for the United States during 1978-1979.

Vehicle registration data was available from R. L. Polk & Co. for the period beginning with 1975. Thus, with the exception of the fatality rates which utilize only 1978 and 1979 national registration and fatality frequencies, crash rates based on registration counts used registration and crash data beginning with 1975.

As stated in Chapter I, the purpose of this study is to contrast the crash experience of several types of vehicles as well as the leading models or vehicle sizes within these groups. Half-ton pickup trucks were used as a comparison group for the utility vehicles, since they have somewhat similar vehicle characteristics such as wheelbase length and may also be used for similar trip

purposes. Passenger cars by size were used as an additional comparison group because of the general familiarity of the driving population with these vehicles. Thus, these three vehicle classes cover a range of use and exposure characteristics.

To select the specific makes, models, and model years of utility vehicles and pickup trucks needed for the analysis (see Appendix A for a detailed listing), Vehicle Identification Number (VIN) patterns were used to identify the various subgroups. For example, the Jeep CJ-5 VIN for the model years studied (1972-78) was a 13-character string with the following pattern:

Characters	Pattern
1-6	J _ _ 83 _
7-8	Alpha characters
9-13	Numeric production number sequence

For all study groups, additional checks were carried out to remove any vehicles with acceptable patterns but clearly incompatible make designations. The makes and models of utility vehicles and pickup trucks used in this study (see Appendix A) were extracted primarily by using such VIN pattern specifications.

Car size groups were defined by wheelbase length (subcompact < 102 in., compact 102-111 in., intermediate 112-120 in., full-size > 120 in.) which were determined from the VIN's using available VIN-decoding packages.

The following are details concerning the accident and registration data files used in this analysis.

Accident Data

FARS (Fatal Accident Reporting System). This file is a census of fatal motor vehicle accidents occurring throughout the United States. A fatality is defined as death within 30 days resulting from a motor vehicle crash. FARS assembles and standardizes information from police accident reports, driver licensing files, motor vehicle registration files, state and federal highway department files, and medical files. Of particular importance to this study is that FARS includes VIN information.

North Carolina Data. This file is a data base of recorded accidents during the years 1973 to 1978.* Accidents involving three vehicle types--utility vehicles (multi-purpose vehicles usually designed for both on-road and off-road use), pickup trucks, and passenger cars--were identified.

The North Carolina study file was created from the State's accident files by using VIN patterns and model years as criteria for identifying accidents involving the utility vehicle and pickup truck groups of interest. An edit check was performed to identify any mismatches between the vehicle make or type and the VIN pattern. When discrepancies were found, vehicles were removed from the study file. With such cases removed, the study file consisted of accidents involving the three leading utility vehicles (Jeep CJ-5, pre-1978 Ford Bronco, and Chevrolet Blazer) and four groups of half-ton pickup trucks (Ford F-series, Chevrolet C-series, Toyota, and Datsun). The 1978 Ford Bronco was included in the Other Utility Vehicle group as it has undergone considerable design changes. Appendix A provides a more detailed listing of these vehicle groups, as well as information on the model years included and the registration counts.

Because most of the utility vehicles and pickup trucks included in the study file were from model years 1972 to 1978, the passenger cars included in this study were selected for the same model year range. Passenger cars were also grouped by wheelbase length as follows: subcompact (< 102 inches), compact (102 - 111 inches), intermediate (112 - 120 inches) and full-size (>120 inches). Due to the large number of passenger car accidents in the file, a systematic sample of one in three single vehicle passenger car accidents and one in six multi-vehicle passenger car accidents were selected. Single vehicle car accidents were over-sampled because of the special interest in single vehicle accidents and their lower frequency compared to multi-vehicle accidents. All pickup truck accidents and utility vehicle accidents were used in the analysis.

The variables extracted from the North Carolina accident files for analyses included the following officer-reported factors: crash type (including rollover and non-collision overturn in road), driver injury, age, and belt usage.

Crash type (that is, whether the officer characterized the accident as single vehicle or multi-vehicle) was created by counting the number of vehicles

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*In North Carolina, any accident resulting in death or injury or total property damage in excess of $200 must be reported to the State (see Appendix B for a copy of the North Carolina Accident Report Form).

involved in each accident. Single vehicle accidents included all accidents involving only one vehicle, while multi-vehicle accidents were defined as collisions of motor vehicles with at least one other vehicle(s), excluding collisions involving pedestrians, bicycles, or trains.

"Rollover" is one of the events coded under the variable, "point of initial contact" (see Appendix B). A check box is provided on the accident form for officers to indicate whether rollover occurred. If this box is not marked, it is necessarily assumed that rollover did not occur.

"Non-collision overturn in road" is one of the accident types coded on the North Carolina accident form. Since it applies to non-collision events only, the overturn-in-road analysis was performed only for single vehicle crashes. However, because there is no separate code for overturn off the road, it could be that some off-road rollovers are recorded by the officers as overturns in the road. Thus, caution should be exercised when interpreting the data concerning the "overturn in road" variable.

In North Carolina, driver injury is coded as follows (see ANSI D16.1, National Safety Council, 1976):

K = killed

A = incapacitating injury, that is, any injury other than a fatal injury which prevents the injured person from walking, driving or normally continuing the activities he was capable of performing before the injury occurred

B = non-incapacitating injury other than K or A injury evident at the scene

C = no visible sign of injury but complaint of pain, momentary unconsciousness

O = not injured

In addition, North Carolina makes a distinction between "driver not present" and injury "not stated." In all computations involving the driver injury variable, cases which had been indicated by the investigating officer as "driver not present" or for which injury information was "not stated" were excluded.

Like driver injury information, belt usage by drivers is recorded by the officer at the scene. Belt usage can be classified into seven categories: no belt, lap belt, lap and shoulder belts, shoulder belt, child restraint, driver not present, and not stated. For the present analyses, "driver not present" and "not stated" were eliminated from the computations and the remaining categories were combined into two groups -- "not belted" and "belted".