

Research Report UKTRP-82-12
May 1982

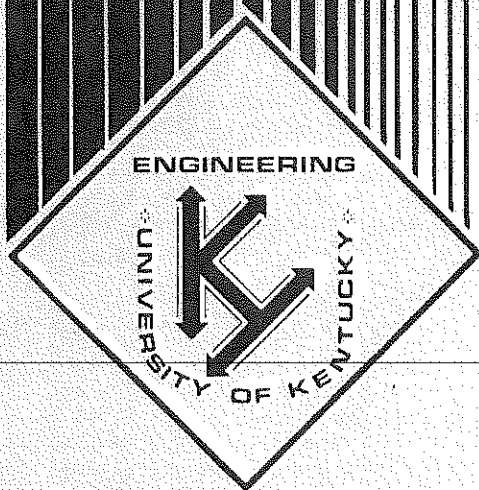
Accident Rates by Vehicle Type

by

Joseph D. Crabtree
Senior Research Engineer

and

Kenneth R. Agent
Chief Research Engineer



Kentucky Transportation Research Program

College of Engineering • University of Kentucky

Transportation Research Building

Lexington, Kentucky 40506-0043

1. Report No.		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle Accident Rates by Vehicle Type				5. Report Date May 1982	
				6. Performing Organization Code	
				8. Performing Organization Report No. UKTRP-82-12	
7. Author(s) Joseph D. Crabtree and Kenneth R. Agent				10. Work Unit No. (TRAIS)	
9. Performing Organization Name and Address Kentucky Transportation Research Program College of Engineering, University of Kentucky 533 South Limestone Lexington, Kentucky 40506				11. Contract or Grant No. KYHPR-81-84	
				13. Type of Report and Period Covered Final	
12. Sponsoring Agency Name and Address Kentucky Department of Transportation State Office Building Frankfort, Kentucky 40622				14. Sponsoring Agency Code	
				15. Supplementary Notes Prepared in cooperation with the US Department of Transportation, Federal Highway Administration. Study Title: Effects of Vehicle Characteristics on Highway Safety	
16. Abstract This report describes the calculation of accident rates for different vehicle types, using vehicle-miles travelled as the measure of exposure. Rates are reported for passenger cars, single-unit trucks, combination trucks, buses, and motorcycles on various highway types. Highway types are broken down by functional classification, administrative classification, number of lanes, and rural or urban location. Generally motorcycles had the highest rates and passenger cars had the lowest, although this varied by highway type.					
17. Key Words Vehicle Classification Trucks Vehicle Type Buses Highway Type Motorcycles Traffic Accidents Accident Rates				18. Distribution Statement	
19. Security Classif. (of this report)		20. Security Classif. (of this page)		21. No. of Pages	22. Price

Research Report
UKTRP-82-12

ACCIDENT RATES BY VEHICLE TYPE

by

Joseph D. Crabtree
Senior Research Engineer

and

Kenneth R. Agent
Chief Research Engineer

Kentucky Transportation Research Program
College of Engineering
University of Kentucky
Lexington, Kentucky

in cooperation with
Department of Transportation
Commonwealth of Kentucky

and

Federal Highway Administration
US Department of Transportation

The contents of this report reflect the views of the authors, who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the University of Kentucky, the Kentucky Department of Transportation, nor the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

May 1982

INTRODUCTION

Highways are populated by a large variety of sizes and types of vehicles, ranging from small lightweight motorcycles to large combination trucks. This variety is a major concern in highway safety. Different vehicle types have different operating characteristics that may affect their ability to avoid accidents. Vehicle size plays an important role in determining how well a vehicle survives a crash. Designs of highway safety devices are complicated due to this variation in sizes. In addition, recent shifts toward smaller cars and larger trucks have generated concern over the effects of those changes on the safety of highways. In an effort to analyze relative safety of different vehicle types, a study entitled "Effects of Vehicle Characteristics on Highway Safety" was initiated. One aspect of that study, described in this report, was the calculation of accident rates for different vehicle types, using vehicle-miles travelled as the measure of exposure.

PROCEDURE

A computer analysis of 1978 accident data was performed to determine the numbers of accidents involving various vehicle types. Vehicle types identifiable from accident data are listed in Table 1. Breakdowns of numbers of accidents involving each of these vehicle types were performed for various highway types, using four different methods of classifying highways: 1) number of lanes and urban/rural location, 2) functional classification, 3) administrative classification, and 4) federal-aid classification.

To convert accident numbers into rates, it was necessary to determine the number of vehicle-miles travelled by each vehicle type on each type of highway in 1978. The number of total vehicle-miles by highway type was available from a previous report (1). Total vehicle-miles were then apportioned to different vehicle types based on percentages calculated from the Vehicle Classification File. The procedure used in summarizing the Vehicle

Classification File and results of that summary are presented in another report (2). Vehicle types contained in the Vehicle Classification File are listed in Table 2. These vehicle types did not match exactly with the vehicle types given in the accident data as shown in Table 1. Therefore, some grouping of vehicle types was required to obtain types for which both accident and volume data were available. The five basic types chosen were: 1) passenger car, 2) single-unit truck, 3) combination truck, 4) bus, and 5) motorcycle. Methods of combining the available vehicle types into these five basic groups are described in Table 3.

Accident rates were determined by dividing accident numbers by vehicle-miles travelled. Rates were expressed in terms of accidents per 100 million vehicle-miles.

RESULTS

Results of the calculations are presented in Tables 4 through 8. Table 4 presents accident rates for different vehicle types on each functional classification of highway. Motorcycles had the highest overall rate, followed by buses and single-unit trucks. The lowest overall rate was for combination trucks, followed by passenger cars. Motorcycles had the highest rates on rural and urban interstates, rural principal arterials, rural minor arterials, rural major collectors, and urban local routes. Buses had the highest rates on rural minor collectors, urban principal arterials and other freeways, and urban minor arterials. Combination trucks had the highest rates on rural local routes and urban collectors, while single-unit trucks had the highest rate on urban principal arterials (not including interstates or freeways). Passenger cars had the lowest rates on all but two highway types; rural interstates, where buses had the lowest rate, and rural minor collectors, where single-unit trucks had the lowest rate. It is interesting to note that combination trucks did not have the lowest rate on any of the individual highway types, but they had the lowest rate overall. This was due to the large

percentage of mileage driven by combination trucks on rural interstates and other high-type facilities, which are the safest routes. Although combination trucks had the lowest overall rate, it cannot be concluded they have the best accident record. The distribution of their miles driven by type of highway must be considered.

Accident rates by vehicle type for different federal-aid classifications are presented in Table 5. Overall rates for all highways are, of course, the same as in Table 4. Motorcycles had the highest rates on interstates, primary routes, and secondary routes; buses had the highest rates on federal-aid-urban and non-federal-aid routes. Combination trucks were lowest on interstates, single-unit trucks had the lowest rate on non-federal-aid routes, and passenger cars were lowest on the remainder of the routes.

The breakdown by administrative classification of the roadway is presented in Table 6. Motorcycles had the highest rates on primary, secondary, and rural secondary routes; combination trucks were highest on unclassified routes. Combination trucks had the lowest rate on primary routes, passenger cars were lowest on secondary and rural secondary, and buses were lowest on unclassified routes.

Accident rates on rural roads are presented by vehicle type and number of lanes in Table 7. The overall rates listed for rural roads only were lower for all vehicle types than the rates when all roads were considered. Accident rates for various vehicle types ranked in the same order for rural roads as for all roads. Motorcycles had the highest rate on each highway type. Passenger cars had the lowest rate on two-lane roads, single-unit trucks were lowest on four-lane divided highways (not including interstates and tollroads), combination trucks were lowest on four-lane undivided highways and tollroads, and buses had the lowest rate on interstates.

The corresponding rates, considering

only urban roads, are shown in Table 8. For all urban roads, passenger cars had the lowest overall rate, followed by combination trucks. Motorcycles had the highest rate, followed by buses. Buses had the highest rate on two-lane facilities, and motorcycles were highest on all others. Passenger cars had the lowest rates on all roads except tollroads, where single-unit trucks were lowest.

SUMMARY

Motorcycles -- Considering all accidents, motorcycles had the highest accident rate. They consistently had either the highest or one of the highest accident rates when the various highway classifications were analyzed.

Combination Trucks -- Combination trucks had the lowest accident rate when all highways were included. This finding is related to the high percentage of miles driven by combination trucks on interstates and tollroads, which have the lowest accident rates. Combination trucks had some of the highest rates on rural and urban local roads and other classifications with less stringent design standards.

Passenger Cars -- Passenger cars had the second lowest accident rate when all data were considered. They had the lowest accident rate for several highway classifications and never had the highest rate in any instance. They had the lowest rate when urban roads were analyzed.

Single-Unit Trucks -- Generally, single-unit trucks had neither the highest nor lowest accident rates.

Buses -- This category included both commercial and school buses. Buses had the lowest accident rate on rural interstates. Bus traffic on rural interstates would consist largely of commercial buses. They had one of the highest accident rates for most of the other highway classifications and had the second highest overall accident rate.

REFERENCES

1. Agent, K. R.; "Traffic Accident Experience in Kentucky (1978)," UKTRP-81-9, University of Kentucky, Transportation Research Program, June 1981.
2. Crabtree, J. D.; "Summary of Vehicle Classification File," UKTRP-82-10, University of Kentucky, Transportation Research Program, August 1982.

TABLE 1. VEHICLE TYPES AVAILABLE
FROM ACCIDENT DATA

VEHICLE TYPE NO.*	DESCRIPTION
1	Passenger Car
2	Single-unit Truck
3	Combination Truck
4	Motorcycle
5	Bus
6	School Bus
7	Public Vehicle
8	Emergency Vehicle
9	Farm Tractor
10	Taxi
11	Other

* Numbers here are for reference
purposes only.

TABLE 2. VEHICLE TYPES ON THE VEHICLE CLASSIFICATION FILE

VEHICLE TYPE	DESCRIPTION
1	In-state standard and compact passenger cars
2	In-state subcompact passenger cars
3	Out-of-state standard and compact passenger cars
4	Out-of-state subcompact passenger cars
5	Pickup trucks
6	2-axle, 4-tire trucks greater than 1 ton
7	2-axle, 6-tire trucks
8	3-axle single-unit trucks
9	4-axle single-unit trucks
10	3-axle combinations: tractor and semi-trailer
11	4-axle combinations: tractor and semi-trailer
12	5-axle combinations: tractor and semi-trailer
13	6-axle combinations: tractor and semi-trailer
14	7-axle combinations: tractor and semi-trailer
15	8-axle combinations: tractor and semi-trailer
16	5-axle combinations: tractor and semi-trailer plus full trailer
17	6-axle combinations: tractor and semi-trailer plus full trailer
18	4-axle combinations: tractor plus full trailer
19	5-axle combinations: tractor plus full trailer
20	Commercial buses
21	School and other buses
22	Motorcycles
23	Coal trucks (trucks counted here are also counted in one of the categories above)

TABLE 3. METHODS OF COMBINING VEHICLE TYPES
INTO FIVE BASIC GROUPS

VEHICLE TYPES INCLUDED (SEE TABLES 1 AND 2)

BASIC GROUP	VEHICLE CLASSIFICATION DATA	ACCIDENT DATA
Passenger Car	1,2,3,4,5	1,10
Single-unit Truck	6,7,8,9	2
Combination Truck	10-19	3
Bus	20,21	5,6
Motorcycle	22	4

TABLE 4. ACCIDENT RATES (ACCIDENTS PER 100 MILLION VEHICLE-MILES)
BY VEHICLE TYPE BY FUNCTIONAL CLASSIFICATION OF HIGHWAY

FUNCTIONAL CLASSIFICATION	VEHICLE TYPE					ALL TYPES
	PASS. CAR	SINGLE-UNIT TRUCK	COMB. TRUCK	BUS	MOTOR- CYCLE	
1 (rural interstate)	77	115	92	56	328	86
2 (rural principal arterial)	200	250	266	261	1,007	218
6 (rural minor arterial)	329	373	414	519	1,046	350
7 (rural major collector)	355	381	609	758	1,226	383
8 (rural minor collector)	349	337	507	1,347	1,081	374
9 (rural local)	307	353	757	705	509	337
11 (urban interstate)	239	819	363	834	932	292
12&13 (urban prin. art. and other frwys.)	156	205	307	1,193	597	173
14&15 (urban principal arterials)	856	1,706	1,305	1,268	1,692	944
16 (urban minor arterials)	826	1,495	2,631	3,458	3,443	920
17 (urban collectors)	664	1,314	3,302	1,216	2,549	737
19 (urban local)	379	959	1,771	1,771	2,361	437
All Highways	393	489	284	892	1,248	414

TABLE 5. ACCIDENT RATES (ACCIDENTS PER 100 MILLION VEHICLE-MILES)
BY VEHICLE TYPE BY FEDERAL-AID CLASSIFICATION OF HIGHWAY

FEDERAL-AID CLASSIFICATION	VEHICLE TYPE					
	PASS. CAR	SINGLE-UNIT TRUCK	COMB. TRUCK	BUS	MOTOR- CYCLE	ALL TYPES
1 (FA interstate)	146	331	127	239	436	161
2 (FA primary)	412	478	473	627	1,343	438
3 (FA urban)	814	1,670	3,002	3,929	3,307	915
4 (FA secondary)	356	379	559	751	1,214	382
8 (non-federal-aid)	343	338	557	1,175	1,012	369
All Highways	393	489	284	892	1,248	414

TABLE 6. ACCIDENT RATES (ACCIDENTS PER 100 MILLION VEHICLE-MILES) BY
VEHICLE TYPE BY ADMINISTRATIVE CLASSIFICATION OF HIGHWAY

ADMINISTRATIVE CLASSIFICATION	VEHICLE TYPE					
	PASS. CAR	SINGLE-UNIT TRUCK	COMB. TRUCK	BUS	MOTOR- CYCLE	ALL TYPES
1 (primary)	343	468	183	720	1,082	348
2 (secondary)	498	558	688	1,450	1,513	538
6 (rural secondary)	429	676	1,181	1,444	1,883	476
7 (unclassified)	405	979	4,583	136	2,855	454
All Highways	393	489	284	892	1,248	414

TABLE 7. ACCIDENT RATES (ACCIDENTS PER 100 MILLION VEHICLE-MILES)
ON RURAL ROADS BY VEHICLE TYPE BY NUMBER OF LANES

HIGHWAY TYPE	VEHICLE TYPE					
	PASS. CAR	SINGLE-UNIT TRUCK	COMB. TRUCK	BUS	MOTOR- CYCLE	ALL TYPES
2-lane	335	377	442	670	1,116	360
4-lane divided (not interstate or toll)	211	198	218	401	735	218
4-lane undivided	422	327	203	777	1,900	416
Interstate	77	114	92	56	329	86
Tollroads	95	132	70	209	250	95
All rural roads	264	301	206	557	917	276

TABLE 8. ACCIDENT RATES (ACCIDENTS PER 100 MILLION VEHICLE-MILES)
ON URBAN ROADS BY VEHICLE TYPE BY NUMBER OF LANES

HIGHWAY TYPE	VEHICLE TYPE					
	PASS. CAR	SINGLE-UNIT TRUCK	COMB. TRUCK	BUS	MOTOR- CYCLE	ALL TYPES
2-lane	793	1,247	1,095	6,375	2,390	873
4-lane divided (not interstate or toll)	688	1,162	1,603	1,137	1,762	751
4-lane undivided	955	1,977	1,868	2,517	2,649	1,064
Interstate	240	822	364	837	936	293
Tollroads	111	47	137	--- *	220	116
All urban roads	634	1,253	748	1,608	1,984	707

* Insufficient data for calculation of a meaningful rate.