

Direct Costs and Frequencies of 1958 Illinois Motor-Vehicle Accidents

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Accident experience of owners and operators of Illinois registered passenger cars and trucks during the study year 1958 is related, in terms of costs incurred and accident frequencies, to the various highway systems of the State and to the use of the systems by passenger cars and trucks of different sizes and weights.

A portion of the paper compares accident occurrence and costs in urban vs rural areas, and discusses the impact of the large metropolitan area of Chicago with respect to the total direct cost determination for the State.

An analysis of the various cost elements (property damage, injury treatment costs, value of time lost, legal fees, etc.) that make up the total direct costs of motor vehicle accidents is included.

• THIS PAPER discusses some of the principal findings of the Illinois motor-vehicle accident cost study, a cooperative project of the Illinois Division of Highways and the U. S. Bureau of Public Roads. The study, which was undertaken in 1959, was designed to measure the direct costs of accidents and incidents involving owners of Illinois registered passenger cars and trucks during calendar year 1958 and to relate such costs to the highway, the vehicle, and the persons involved.

The only distinction between a motor-vehicle accident and a motor-vehicle incident is the element of motion. In an incident, there is no motion on the part of the motor vehicle. In general, losses through motor-vehicle incidents include such events as storm damage, acts of vandalism, fires, mishaps occurring during the servicing and repair of a motor vehicle, and collisions of conveyances other than motor vehicles with parked or standing motor vehicles.

Many cost items can be associated with traffic accidents and other mishaps, but cooperative studies of the Bureau of Public Roads and State highway organizations undertaken to date have been concerned only with the "direct costs" of accidents and incidents¹. A broad but not quite accurate definition is that the Illinois study and previous studies have reflected only the "out-of-pocket" costs. Stated more precisely, the costs were those directly attributable to accidents, and the costs thus determined represented the use of resources that would have been available for other purposes had the accidents not occurred. Cost elements included in the study are discussed in subsequent sections of this paper.

Legal requirements in all States specify that owners must file a report of motor-vehicle accidents involving death or injury. The laws relating to property damage only accidents vary from State to State. In Illinois, the statutory requirement specifies that an accident report must be filed with the State for any motor-vehicle accident involving death or injury, and any accident in which damage to property of any one person exceeds \$100.

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¹Other cooperative studies with the year of survey are passenger car phase—Massachusetts (1953), New Mexico (1955), and Utah (1955); truck phase—Massachusetts (1955), New Mexico (1956), and Utah (1957).

With few exceptions, accident statistics published by various private and public organizations are based solely on official reports of accidents filed with State agencies. Data developed in cooperative studies undertaken by the Bureau of Public Roads have indicated that a substantial part of the accident problem is overlooked by relying only on official accident records. Many accidents occur for which no reports are filed, and although the events are usually minor happenings, they add significantly to the number and cost of accidents.

The Illinois study, as well as previous studies, was designed to determine the direct costs of accidents and incidents ranging from minor fender-denting collisions to the most serious accidents involving death or injury.

SAMPLING PROCEDURE

To attempt a study of statewide vehicle owners' accident experience for a one-year period dictated the use of the sampling method. Two sources were used: owners' accident reports filed with the Illinois Division of Highways, Bureau of Traffic; and registration lists of vehicle owners published by the office of the Secretary of State. Official accident reports filed with the State during 1958 represented the known "population" of motor vehicle accidents. Vehicle owners selected from registration lists represented the unknown area in determining accident and incident occurrence.

Following the procedures of previous State studies, the sampling unit for reported accidents was the license plate number of a privately owned passenger car or truck involved in an accident. Reports on file yielded 320,700 license numbers of Illinois registered passenger cars (or the equivalent thereof) involved in accidents and 26,200 trucks. These data were available on tabulating cards, thus permitting the selection of samples by machine method. The cards were grouped according to severity classes (fatal injury, nonfatal injury, and property damage only) and each group was systematically sampled. Truck involvements were further stratified on the basis of two major vehicle types: single units and truck combinations.

To explore the unknown area of accident and incident occurrence for which no owners' reports were on file with the State, approximately 14,000 license plate numbers, equally divided between passenger cars and trucks, were selected for mail interview from vehicle registration lists.

Passenger car license plate numbers were selected randomly with no consideration given to size or weight of vehicle; truck license plate numbers were stratified on the basis of light, medium, and heavy registered weights with different sampling rates applicable thereto. (In Illinois, a license plate remains with the owner and may be transferred to another vehicle in the event a vehicle is replaced.) The 14,000 vehicle owners thus selected were requested to enumerate their total accident and incident experience for 1958 involving the vehicle or vehicles bearing the designated license plate number.

Obviously, because owners selected from vehicle registration lists were requested to give total accident and incident experience, such events reported by owners had to be checked against the official accident records of the State to eliminate happenings that had a chance of being selected in samples of officially reported accidents. Accordingly, those events reported by owners in response to the mailed questionnaire for which a record could be found in the State's files were dropped from the study. The remaining unmatched groups of accidents and incidents were processed as "unreported" events. Details concerning sampling procedures, rates of return, data collection and processing methods have been described at considerable length in a previous report (1). In the aggregate the study produced 7,184 sample cases of passenger cars and trucks involved in an accident or other mishap.

Frequent mention is made throughout the paper of the cost of passenger car accidents as opposed to the cost of truck accidents. Although the passenger car and truck phases of the study were conducted concurrently, they were in effect two separate surveys. This approach was used because the two classes of vehicles represented different universes, not only from the standpoint of numbers of vehicles registered and frequencies of accidents, but also from the consideration of vehicle and vehicle-use characteristics.

DEFINITIONS

In general, the terms used conform with definitions given in "Uniform Definitions of Motor Vehicle Accidents," adopted by the National Conference on Uniform Traffic Accident Statistics. Some of the commonly used terms are defined:

Motor-Vehicle Traffic Accident.—Any accident occurring on a trafficway (street, road, highway), resulting in death, injury or property damage, and involving a motor vehicle in motion.

Motor-Vehicle Nontraffic Accident.—Any accident involving a motor vehicle in motion which occurs entirely on private property or in any place other than a trafficway, and results in death, injury, or property damage.

Motor-Vehicle Traffic Incident.—Any incident involving a motor vehicle not in motion which occurs on a trafficway and results in death, injury, or property damage.

Motor-Vehicle Nontraffic Incident.—Any incident involving a motor vehicle not in motion which occurs entirely on private property or in any other place that is not a trafficway, and results in death, injury, or property damage.

Involvement.—A vehicle involved in an accident is defined as an involvement. Because the sampling unit for the study was a license plate number of a vehicle involved in an accident, the cost data developed were the accumulation of costs surrounding selected vehicles involved in accidents or other mishaps. The costs thus determined were factored on the basis of sample selection rates with appropriate adjustments for incompleteness. The term "involvement" is a useful expression in describing the components of an accident; i. e., size and weight of vehicle involved, age of vehicle, age and sex of driver, etc.

Accidents as such were not sampled because of procedural difficulties inherent in sampling single vehicle accidents and multiple vehicle accidents, and in tracing the ownership of vehicles involved in multivehicular accidents.

SCOPE OF STUDY

Inasmuch as the primary purpose for undertaking studies of this type is to develop accident cost data, a discussion of cost concepts is necessary. The theory on which such studies are based, as developed by the Highway Research Board Committee on Economic Costs of Motor Vehicle Accidents over a decade ago (1949), may be stated briefly as those costs represented by the money value of damages and losses to persons and property. Money spent by persons involved in accidents may or may not be the same as the money value of damages or losses. Damage to property may not be repaired and losses may not be compensated, but such costs are included in the money value concept as they will be realized in the form of depreciated value or decreased earnings. Payment for damages and losses is not always made by the vehicle owner or person injured; the driver or owner of another vehicle may pay the costs; insurance companies may reimburse in full or in part for damages; hospitals, doctors, and others may furnish services and not be compensated fully; and courts may award damages in excess of or less than actual costs. No attempt is made to trace the transfer of money or to determine actual amounts of money spent, except to the extent that such expenditures measure the money value of damages or losses to persons and property.

Direct costs are composed of the money value of damage to property, ambulance use, hospital and treatment costs, doctor and dentist services, loss of use of vehicle costs, value of work time lost, legal and court fees, damage awards and settlements, and other miscellaneous items. The valuation of these direct costs was made on the basis of information supplied by persons whose vehicles were involved in accidents, by persons who were injured in accidents, relatives of injured persons, doctors and dentists, insurance agents and brokers, attorneys, police, and others. A detailed explanation of the various cost elements considered in the study is given in a previous publication (1).

Such items as loss of future earnings of persons killed or permanently injured in accidents are excluded from the direct cost phase of the study, except to the extent that damage awards or settlements made either in or out of court may compensate for such losses. Also, expenditures made by public and private agencies in the interest of accident prevention or to mitigate the economic burden of accidents, and the overhead cost of automobile and certain other types of insurance are not a part of the direct cost phase of this study.

TABLE 1
ACCIDENT AND INCIDENT DIRECT
COSTS, ILLINOIS, 1958

Type of Event	Cost (\$)	
	Passenger Cars	Trucks
Traffic accident	258,770,000	18,081,000
Nontraffic accident	8,514,000	1,951,000
Traffic incident	15,321,000	610,000
Nontraffic incident	8,064,000	2,174,000
Total	290,669,000	22,816,000

Table 1 gives an overall perspective of total direct costs of accidents and incidents occurring in Illinois during 1958 as determined in the study.

On adding the out-of-state accidents and incidents of Illinois vehicles to the data in Table 1, total direct costs would be as follows: passenger cars, \$309.5 million; and trucks, \$29.3 million. The costs thus determined in the study amounted to \$1/3 billion, or an average of \$928,000 per day.

To avoid possible misconceptions, the reader should bear in mind that the data do not include the cost of all accidents occurring on Illinois highways. Included in the study are direct costs to persons and property associated with accidents or in-

cidents involving privately owned Illinois-registered passenger cars and trucks. Specifically, the data are representative of the costs incurred by owners and occupants of Illinois passenger cars and trucks, and by pedestrians and other nonmotorists involved in such accidents. Excluded from the study are direct costs to persons and property associated with accidents involving the following:

1. Out-of-state registered motor vehicles of all types.
2. Publicly owned motor vehicles of all types.
3. Illinois-registered buses, motorcycles, motorized bicycles and scooters, and any other conveyance classified as a motor vehicle.

Costs incurred by owners and occupants of the three categories of vehicles just listed are excluded, even though such vehicles may have been involved in an accident with a privately owned Illinois passenger car or truck.

Although the study encompassed total accident and incident experience of Illinois passenger car and truck owners, regardless of whether the events occurred on or off the highway or in or out of State, subsequent discussion in this paper is restricted to traffic accidents occurring on Illinois highways and streets.

REPORTED AND UNREPORTED ACCIDENT INVOLVEMENTS

Table 2 gives the relationship of reported and unreported accident involvements and the corresponding costs. An unreported involvement refers to an event for which no record of an owner's report could be found in the accident report files maintained by the Illinois Division of Highways. Several factors could account for this, but the principal one would be that property damage costs were less than the legal reporting minimum. If the accident was of the "reportable" category and no record could be found, one of the following conditions might apply: the owner may have reported the accident to local authorities but not to the State; the owner may have failed to report the happening to any governmental authority; or through error the accident report may have been overlooked in the search of the State's accident files. Every effort was made to prevent the last possibility through a careful review of all reportable accidents.

Approximately 1.3 million Illinois passenger cars of private ownership were involved in traffic accidents on Illinois roads and streets during 1958. Direct costs of these accidents amounted to \$258.8 million or an average of \$196 per passenger car involved. Totals include all degrees of severity—fatal injury, nonfatal injury, and property damage only. Three-fourths of these events were not officially reported to the Illinois Division of Highways, and in the aggregate they accounted for over two-fifths of the total cost. The mean value for unreported passenger car involvements was \$110 and the median value was \$50.

Approximately 128,000 trucks were involved in accidents costing \$18.1 million, or an average of \$141 for each event. Unreported involvements accounted for four-fifths

TABLE 2
REPORTED AND UNREPORTED TRAFFIC ACCIDENTS AND THEIR DIRECT COSTS, ILLINOIS, 1958

Vehicle Type	Involvement	Number of Vehicles Involved in Accidents	Percent of Total	Total Direct Cost (\$)	Percent of Total	Cost per Involvement (\$)	Involvements per 10 Million Vehicle-Miles ¹	Cost per Vehicle-Mile (\$)
Passenger car	Reported	317,100	24.1	149,198,000	57.7	471	119	0.0056
	Unreported	<u>1,000,600</u>	<u>75.9</u>	<u>109,572,000</u>	<u>42.3</u>	<u>110</u>	<u>374</u>	<u>0.0041</u>
	Total	1,317,700	100.0	258,770,000	100.0	196	493	0.0097
Truck: Single-unit	Reported	20,600	18.8	5,818,000	43.3	282	50	0.0014
	Unreported	<u>89,100</u>	<u>81.2</u>	<u>7,607,000</u>	<u>56.7</u>	<u>85</u>	<u>216</u>	<u>0.0019</u>
	Total	109,700	100.0	13,425,000	100.0	122	266	0.0033
Combination	Reported	4,500	24.5	2,367,000	50.8	526	54	0.0028
	Unreported	<u>13,900</u>	<u>75.5</u>	<u>2,289,000</u>	<u>49.2</u>	<u>165</u>	<u>167</u>	<u>0.0028</u>
	Total	18,400	100.0	4,656,000	100.0	253	221	0.0056
All	Reported	25,100	19.6	8,185,000	45.3	326	51	0.0016
	Unreported	<u>103,000</u>	<u>80.4</u>	<u>9,896,000</u>	<u>54.7</u>	<u>96</u>	<u>207</u>	<u>0.0020</u>
	Total	128,100	100.0	18,081,000	100.0	141	258	0.0036

¹Travel of Illinois-registered vehicles: passenger cars, 26,748,000,000 vehicle-miles; single-unit trucks, 4,124,000,000 vehicle-miles; and truck combinations, 832,000,000 vehicle-miles.

of the number and over one-half of the total cost. The mean and median values for unreported truck involvements were \$96 and \$20, respectively.

It should not be construed that all unreported involvements in which costs exceeded \$100 were in violation of the reporting law. The cost values include elements that do not enter into the legal reporting requirement of damage to property. For example, such elements as "time lost from work" or "loss of use of vehicle" are included when applicable in the cost values in Table 2.

The cost distribution of reported and unreported involvements is shown in Figure 1. It is clearly evident that a very high proportion of unreported involvements were relatively minor events. Of these unreported events, 92 percent cost less than \$300. The same percentage for officially reported involvements indicated costs of less than \$1,000.

ACCIDENT EXPOSURE

Accident involvement rates for passenger cars calculated on the basis of 10 million vehicle-miles of travel (Table 2) were nearly twice those for trucks, and the cost of accidents per vehicle-mile of travel approached \$0.01 for passenger cars or 2.7 times the rate found for trucks. When trucks are considered on the basis of single units and combinations, the data show a lower involvement rate for combinations but a higher cost per vehicle-mile. This relationship could logically be expected because operators of truck combinations would in most cases be more experienced and skillful drivers. Vehicle and vehicle-use characteristics should also be considered in such a comparison. On the other hand, when the heavy units are involved in accidents, they tend to be more severe and costly, particularly when cargo damage is involved. Among the single-unit trucks, panels and pickups accounted for 55 percent of the vehicles in use, 56 percent of the travel, and 53 percent of the vehicles involved in accidents. These two truck types are often used for personal transportation, and in many respects their operation is similar to that of passenger cars.

The number of privately owned Illinois vehicles registered and in use during 1958 and their average annual in-State travel per vehicle are given in Table 3 (2).

In relating vehicles in use to the number of vehicles involved in accidents, it was found that the probability of a passenger car being involved in a traffic accident was once in 26 months; for single-unit trucks, once in 39 months; and truck combinations, once in 15 months. Exposure to accidents, based on average annual travel, was three times greater for truck combinations as compared to single-unit trucks, and nearly four times that of passenger cars.

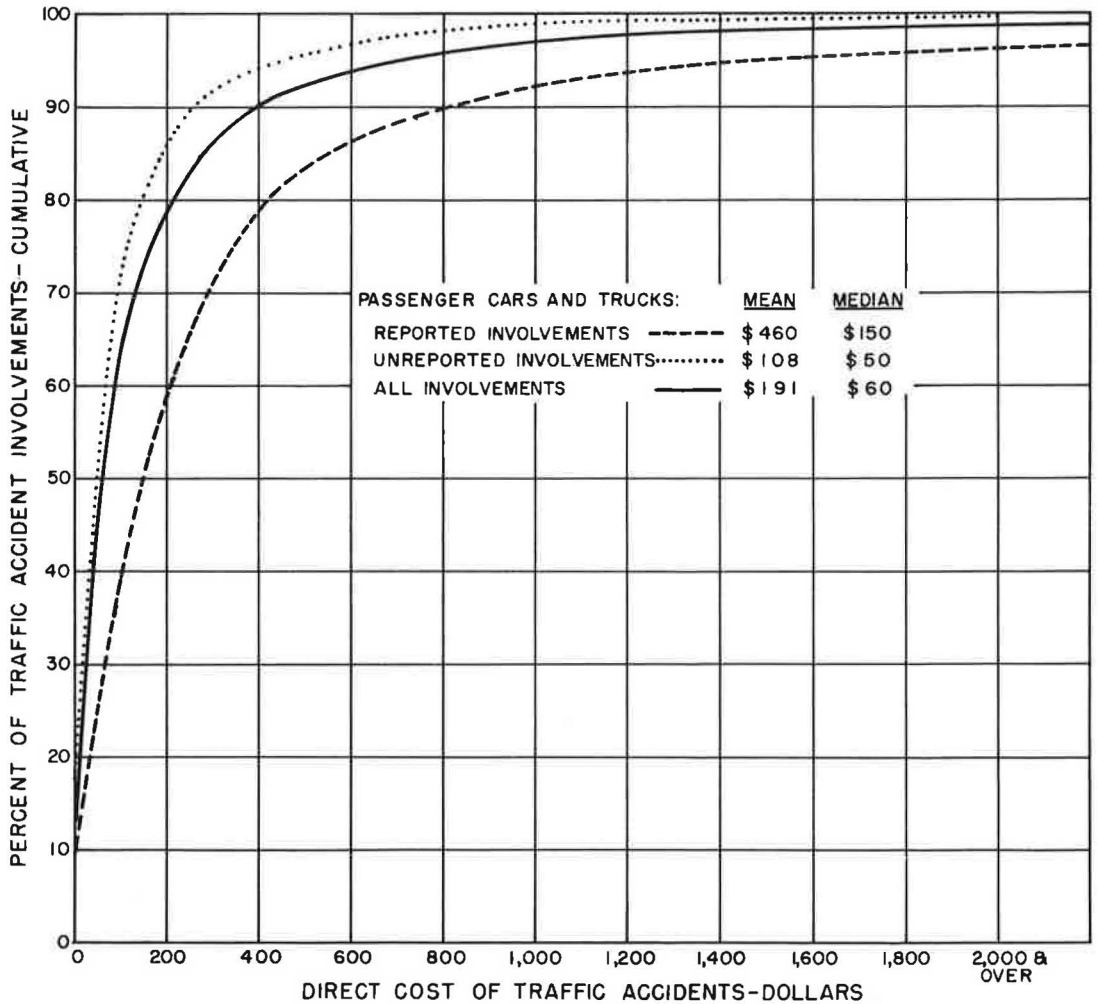


Figure 1. Cumulative percentage distribution of reported and unreported traffic accident involvements vs direct cost.

TABLE 3
VEHICLE REGISTRATION AND AVERAGE ANNUAL IN-STATE TRAVEL,
ILLINOIS, 1958

Type of Vehicle	No. of Vehicles in Use	Average Annual Travel per Vehicle (mi)
Passenger car	2,876,000	9,300
Single-unit truck		
Panel or pickup	194,400	11,950
Other 2-axle trucks	153,800	10,900
3-axle truck	6,600	19,140
Total	354,800	11,620
Truck combination:		
3-axle tractor semitrailer	12,000	24,850
Other truck combinations	11,300	47,340
Total	23,300	35,740

TABLE 4

NUMBER OF TRAFFIC ACCIDENT INVOLVEMENTS IN ILLINOIS INVOLVING VEHICLES OF ILLINOIS REGISTRY, 1958,
CLASSIFIED BY SEVERITY OF ACCIDENT AND COST ELEMENTS INCURRED

Cost Element	Passenger Car Accidents				Truck Accidents			
	Fatal Injury	Nonfatal Injury	Property Damage Only	Total	Fatal Injury	Nonfatal Injury	Property Damage Only	Total
Number of involvements with:								
Damage to vehicle	1,391	142,824	990,672	1,134,887	189	6,001	66,639	72,829
Damage to property in vehicle	75	2,708	12,929	15,712	44	384	2,158	2,586
Damage to objects struck by vehicle	85	2,067	17,252	19,404	18	195	3,295	3,508
Miscellaneous property damage	28	3,450	5,263	8,741	27	137	1,488	1,652
One or more property damage cost elements	1,391	143,259	1,000,539	1,145,189	193	6,087	68,539	74,819
Ambulance costs	625	7,224	--	7,849	55	761	--	816
Doctor and dentist fees	903	84,104	--	85,007	105	2,827	--	2,932
Hospital and treatment costs	940	64,188	--	65,128	93	2,089	--	2,182
Miscellaneous injury costs	334	6,885	--	7,219	27	261	--	288
One or more injury cost elements	1,067	94,703	--	95,770	119	2,967	--	3,086
Loss of use of vehicle costs	43	6,473	23,037	29,553	55	780	5,796	6,631
Value of time lost from work	653	77,368	22,817	100,838	94	2,428	3,612	6,134
Legal and court costs	734	37,296	10,108	48,138	90	1,342	644	2,076
Damage awards in excess of known costs	705	48,810	9,227	58,742	109	1,130	96	1,335
Summary of number of involvements:								
With one or more direct cost elements	1,532	155,057	1,003,041	1,159,630	232	6,718	69,882	76,832
With no costs incurred	28	9,534	148,466	158,028	5	2,955	48,293	51,253
Total	1,560	164,591	1,151,507	1,317,658	237	9,673	118,175	128,085

DIRECT COST ELEMENTS

The cost elements that make up the total cost figures in Table 2 are given in considerable detail in Tables 4, 5, and 6. Table 7 shows the relative number and cost of each of the three severity classes of accidents.

It is evident that fatal injury involvements accounted for a small proportion of the number and cost of accidents. Also, nonfatal injury accidents involving passenger cars represented a considerably higher proportion of the total costs than similar events involving trucks. Injuries to passengers would largely account for this difference. Trucks normally have only one occupant, the driver.

As mentioned earlier, the cost data do not include values for "loss of future earnings" of persons killed or permanently injured, except to the extent that awards or

TABLE 5

DIRECT COST OF TRAFFIC ACCIDENTS IN ILLINOIS INVOLVING VEHICLES OF ILLINOIS REGISTRY, 1958

Cost Element	Direct Cost of Passenger Car Accidents (\$)				Direct Cost of Truck Accidents (\$)			
	Fatal Injury	Nonfatal Injury	Property Damage Only	Total	Fatal Injury	Nonfatal Injury	Property Damage Only	Total
Property damage:								
Damage to vehicle	1,196,385	41,368,456	109,795,996	152,360,837	270,836	2,191,845	7,642,290	10,104,971
Damage to property in vehicle	8,225	160,670	645,458	814,353	38,222	80,001	171,903	290,126
Damage to objects struck by vehicle	23,218	406,368	1,688,634	2,118,220	2,368	164,805	704,232	871,405
Miscellaneous property damage	846	69,548	142,302	212,696	1,761	6,095	17,287	25,123
Subtotal	1,228,674	42,005,042	112,272,390	155,506,106	313,187	2,442,746	8,535,692	11,291,625
Treatment of injuries:								
Ambulance costs	19,317	173,300	--	192,617	1,495	17,234	--	18,729
Doctor and dentist fees	354,709	10,304,366	--	10,659,075	25,325	615,569	--	640,894
Hospital and treatment costs	686,858	9,415,140	--	10,101,998	32,178	339,578	--	371,756
Miscellaneous injury costs	29,845	318,974	--	348,819	1,246	11,395	--	12,641
Subtotal	1,090,729	20,211,780	--	21,302,509	60,244	983,776	--	1,044,020
Loss of use of vehicle costs	10,152	666,718	1,013,342	1,690,212	61,697	236,266	1,446,990	1,744,953
Value of time lost from work	636,239	17,274,842	846,022	18,757,103	63,436	1,688,287	129,008	1,880,731
Legal and court costs	1,557,909	23,301,020	1,091,790	25,950,719	146,509	542,818	28,056	717,383
Damage awards in excess of known costs	3,372,203	31,655,984	534,784	36,562,971	570,297	830,934	1,301	1,402,532
Total Cost	7,895,906	135,115,386	115,758,328	258,769,620	1,215,370	6,724,827	10,141,047	18,081,244

TABLE 6
MEAN VALUES FOR COST ELEMENTS FROM ILLINOIS TRAFFIC ACCIDENTS INVOLVING VEHICLES
OF ILLINOIS REGISTRY

Cost Element	Mean Cost Value for Each Element of Cost (\$)							
	Passenger Car Accidents				Truck Accidents			
	Fatal Injury	Nonfatal Injury	Property Damage Only	All	Fatal Injury	Nonfatal Injury	Property Damage Only	All
Property damage:								
To vehicle	860	290	111	134	1,433	365	115	139
To property in vehicle	110	59	50	52	869	208	80	112
To objects struck by vehicle	273	197	98	109	132	845	214	248
Miscellaneous	30	20	27	24	65	44	12	15
Mean cost value ¹	883	293	112	136	1,623	401	125	151
Treatment of injuries:								
Ambulance costs	31	24	--	25	27	23	--	23
Doctor and dentist fees	393	123	--	125	241	218	--	219
Hospital and treatment costs	731	147	--	155	346	163	--	170
Miscellaneous injury costs	89	46	--	48	46	44	--	44
Mean cost value ²	1,022	213	--	222	506	332	--	338
Loss of use of vehicle costs	236	103	44	57	1,122	303	250	263
Value of time lost from work	974	223	37	186	675	695	36	307
Legal and court costs	2,122	625	108	539	1,628	404	44	346
Damages awarded in excess of known costs	4,783	649	58	605	5,232	735	14	1,051
Mean cost value ³	5,154	871	115	223	5,239	1,001	145	235

¹For involvements in which one or more property damage cost elements were incurred.

²For involvements in which one or more injury cost elements were incurred.

³For involvements in which one or more cost elements were incurred.

settlements may measure this loss. Awards or settlements are based primarily on the "fault" concept, and thus the victim or survivors may not have recourse to recover losses due to death or injury. This situation would apply particularly to single vehicle accidents.

Passenger car and truck involvements that occasioned no costs (or less than \$5.00) were quite numerous as shown in Table 4. Table 8 gives a comparison of such events.

The finding that approximately 2 percent of the fatal injury involvements were of the no-cost category might appear unreasonably high at the outset. A typical case would be a passenger car or truck colliding with a pedestrian. Under the conditions that the pedestrian was at fault, that the victim died instantly, that the vehicle was not damaged, that no time was lost from work by the vehicle owner or driver, and that a police vehicle was used to remove the victim from the scene, no costs would be assessed for this accident within the scope of the direct cost phase of the study. Funeral costs are not considered as an element of cost in connection with a motor-vehicle accident. Such costs are inevitable; an accident merely fixes the time when they are incurred.

Another example of a no-cost involvement applies to a multiple vehicle accident. In a two-car collision, one vehicle might be damaged and the bumper of the other vehicle

TABLE 7
RELATIVE NUMBER AND COST OF ACCIDENT TYPES

Type of Vehicle	Type of Accident	Percent of Vehicles Involved	Percent of Cost
Passenger cars	Fatal injury	0.1	3.1
	Nonfatal injury	12.5	52.2
	Property damage only	87.4	44.7
	Total	100.0	100.0
Trucks	Fatal injury	0.2	6.7
	Nonfatal injury	7.6	37.2
	Property damage only	92.2	56.1
	Total	100.0	100.0

absorbs the shock. Under the sampling procedure used in the study, either vehicle or both might be selected. A large proportion of the no-cost involvements were of the unreported accident category (Fig. 1). Trucks, in particular, were involved in a number of non-fatal injury and property damage only accidents in which no costs were incurred by the owner or occupants of the vehicle selected. This situation is explained partially by the fact that most truck accidents involved collisions with passenger cars. Conditions acting in favor of trucks from the cost standpoint were the lower occupancy rate (persons per vehicle) and vehicle capability to withstand impact. The severity classification is determined by the accident and not by what takes place in one of the vehicles involved.

In a study based on sampling techniques, it is obvious that the greater the detail provided in tabular form the greater the chance of exceeding the built-in limitations of sample size. As an indication of the strength of the data in Tables 4, 5, and 6, Table 9 gives a comparison of sample sizes and expanded totals.

The total cost figure of \$258.8 million for passenger car accidents (Table 5) is based on 3,383 completed sample cases, and the amount of \$18.1 million for trucks is based on 3,026 cases. The ratios of sample cases to the expanded number of involvements do not reflect the sampling rates as originally selected. As mentioned earlier, two sampling sources were used (official accident reports and registration lists) and different sampling rates applied. A full description of sampling procedures is given elsewhere (1).

Cost data in Table 5 are further illustrated in Figures 2 and 3. The top set of bars in Figure 2, arranged in order of magnitude, show the distribution of the accident dollar. Property damage accounted for 60 percent (or \$0.60 of the accident dollar) of the total cost of all passenger car traffic accidents, and 62 percent in the case of trucks (Fig. 3). Treatment of injuries, legal and court fees, and excess damage awards and settlements accounted for a larger proportion of the total cost of passenger car accidents than for trucks. On the other hand, costs related to "time loss" and "loss of use of vehicle" represented a larger proportion

TABLE 8
COMPARISON OF PASSENGER CAR AND
TRUCK INVOLVEMENTS OF NO COST

Type of Accident	No-Cost Involvements (% of total)	
	Passenger Cars	Trucks
Fatal injury	1.8	2.1
Nonfatal injury	5.7	30.5
Property damage only	12.9	40.9
Total	12.0	40.0

TABLE 9
COMPARISON OF SAMPLE SIZE AND EXPANDED NUMBER
OF INVOLVEMENTS

Type of Vehicle	Type of Accident	Number of Involvements	Number of Sample Cases
Passenger car	Fatal injury	1,560	332
	Nonfatal injury	164,591	1,761
	Property damage only	1,151,507	1,290
	Total	1,317,658	3,383
Truck	Fatal injury	237	200
	Nonfatal injury	9,673	1,270
	Property damage only	118,175	1,556
	Total	128,085	3,026

of the total cost for trucks than for passenger cars. The cost element "loss of use of vehicle" is not too significant in the case of passenger car owners because in most cases the use of the vehicle is not essential in earning a livelihood. The latter criterion is used in determining such costs.

In the case of truck owners, and particularly fleet operators, no "loss of use of vehicle" costs are included when standby equipment is available to replace the damaged vehicle. Only a portion of the cost of maintaining standby equipment could properly be charged to motor vehicle accidents as standby vehicles are brought into service for purposes other than accidents; i.e., peak operations, maintenance of equipment, etc. The pro rata share of the overhead cost of maintaining standby equipment to be charged to accidents would be included in the "indirect cost" phase of accident cost studies.

Damage awards and settlements in excess of known costs represented the greatest portion of the accident dollar for both passenger car and truck fatal injury accidents. In determining excess awards and settlements, compensation received by each injured person or survivor and by each vehicle owner was considered on an individual basis. Payments received by the injured person or vehicle owner from his own insurance company were not considered as awards or settlements, because such payments would simply represent a "return of capital." Damage awards and settlements include payments made by the other party, presumably the one found liable. Lump-sum payments under workmen's compensation were included also.

In the case of an injured person, known costs of ambulance use, hospitalization, doctor and dentist fees, time loss, legal fees, etc., were deducted from the award or settlement, and any surplus represented reimbursement for costs that could not be classified. A vehicle owner may also receive a settlement for damage to his vehicle, other property, time loss, loss of use of vehicle, etc., and the settlement may exceed the known costs. The surplus again was treated as an unclassified cost.

In the study procedure, awards and out-of-court settlements were recorded in total, regardless of whether the amounts were less than, equal to, or greater than the actual money value of damages and losses. Obviously, the total amount of an award or settlement could not be added to the previously determined money value of damages and losses because this procedure would duplicate all or part of the costs. For this reason, the amount of damage awards and settlements was ascertained, but only that portion in excess of the value of damages and losses was included in the cost of accidents. Such excess awards or settlements could represent compensation for pain and suffering, loss of future earnings of persons killed or permanently injured, future medical expenses, and other indeterminable costs.

Mean values for each element of cost incurred in passenger car and truck accidents (Table 6) are heavily influenced by high-cost accidents. Median values for each cost element would be substantially lower than the values reported. The positive skewness of the cost curves for each of the severity classes of accidents is shown later.

The final entry in Table 6 gives the average costs of accident involvements in which one or more cost elements were incurred. Truck involvements for each severity class averaged higher costs than was the case for passenger cars. Costs sustained in traffic accidents of all severity classes averaged \$223 for passenger car involvements and \$235 for trucks. After including involvements in which no costs were incurred (Table 4), the averages drop to \$196 and \$141, respectively.

SKEWNESS OF COST DISTRIBUTION

The difficulties of sampling the "universe" of traffic accident involvements for the purpose of determining cost data are apparent after viewing the cumulative percentage curves in Figures 4 through 7. Findings of the study show a range of costs per vehicle involvement from zero (or less than \$5) to \$136,800. Figure 4

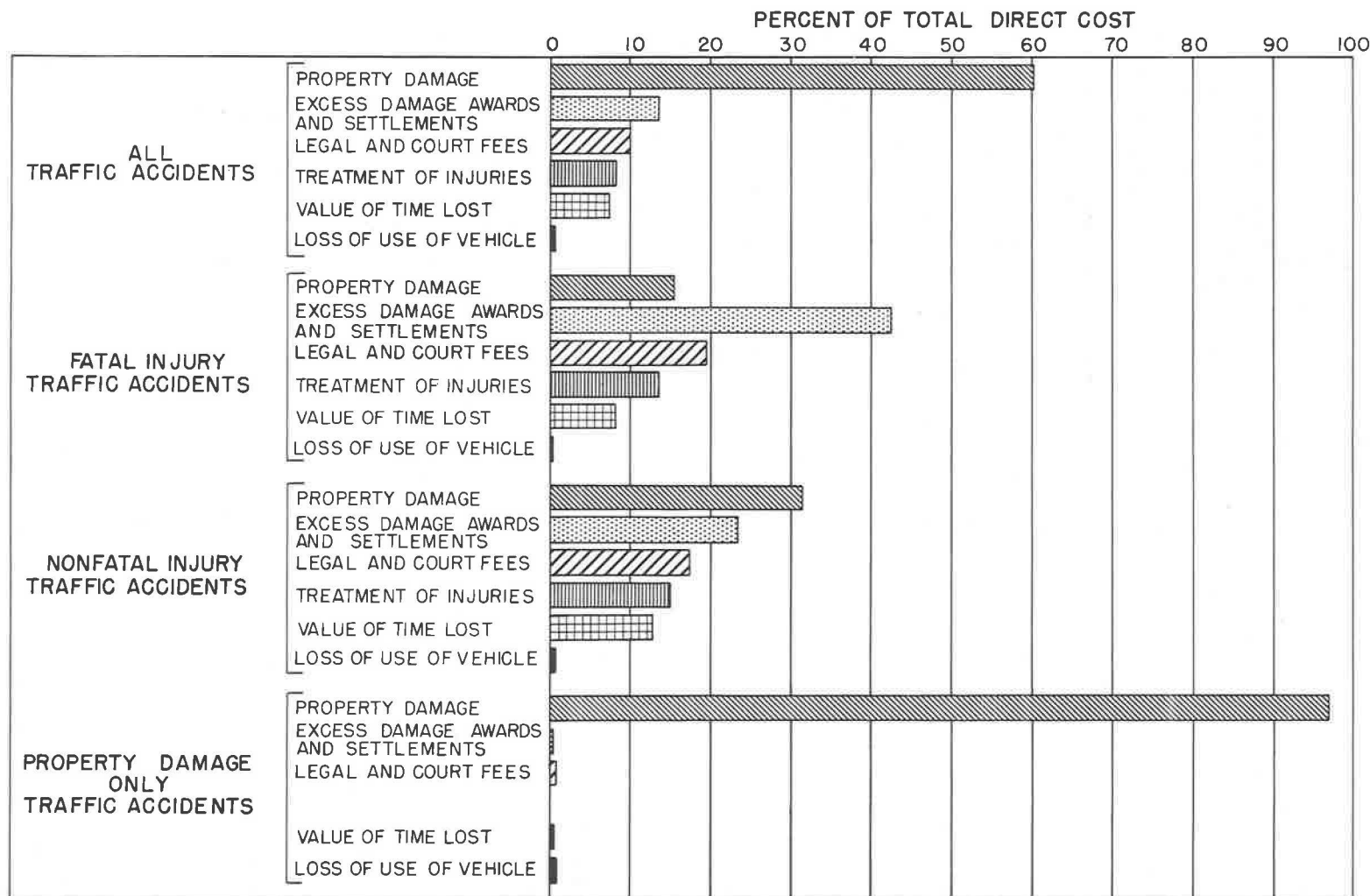


Figure 2. Percentage distribution of direct costs of passenger car traffic accidents, by cost element.

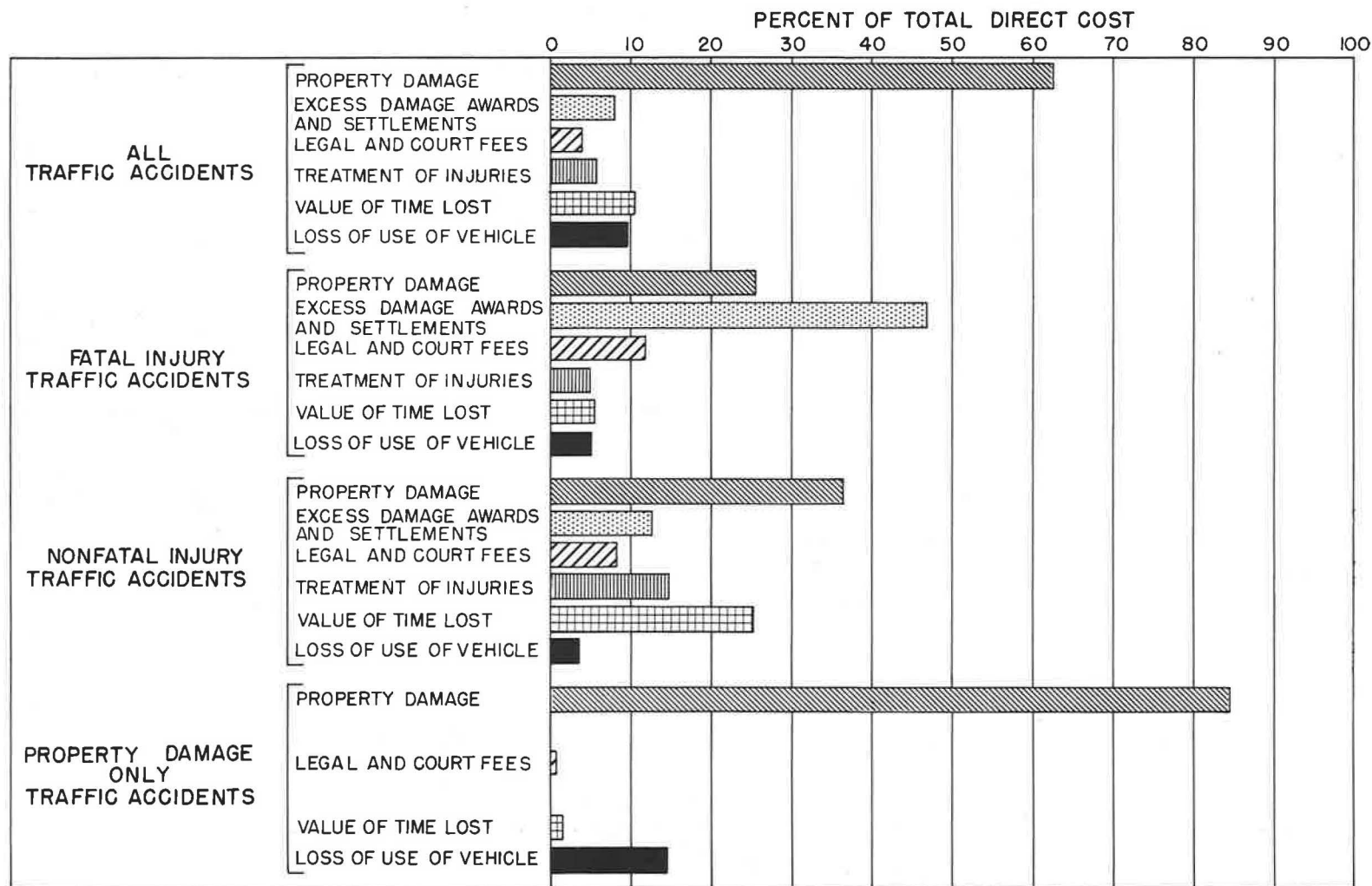


Figure 3. Percentage distribution of direct costs of truck traffic accidents, by cost element.

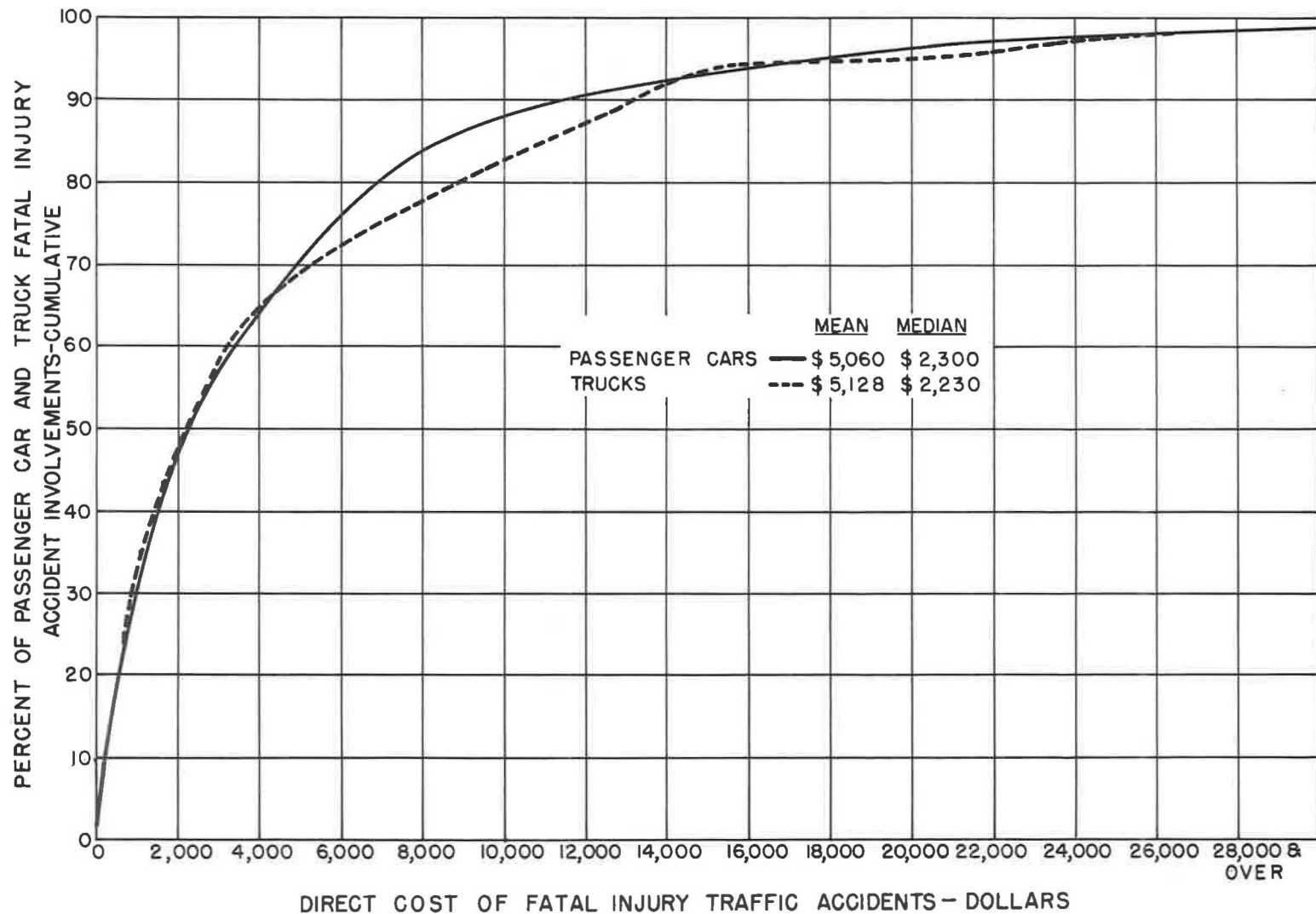


Figure 4. Cumulative percentage distribution of passenger car and truck fatal injury traffic accident involvements vs direct cost.

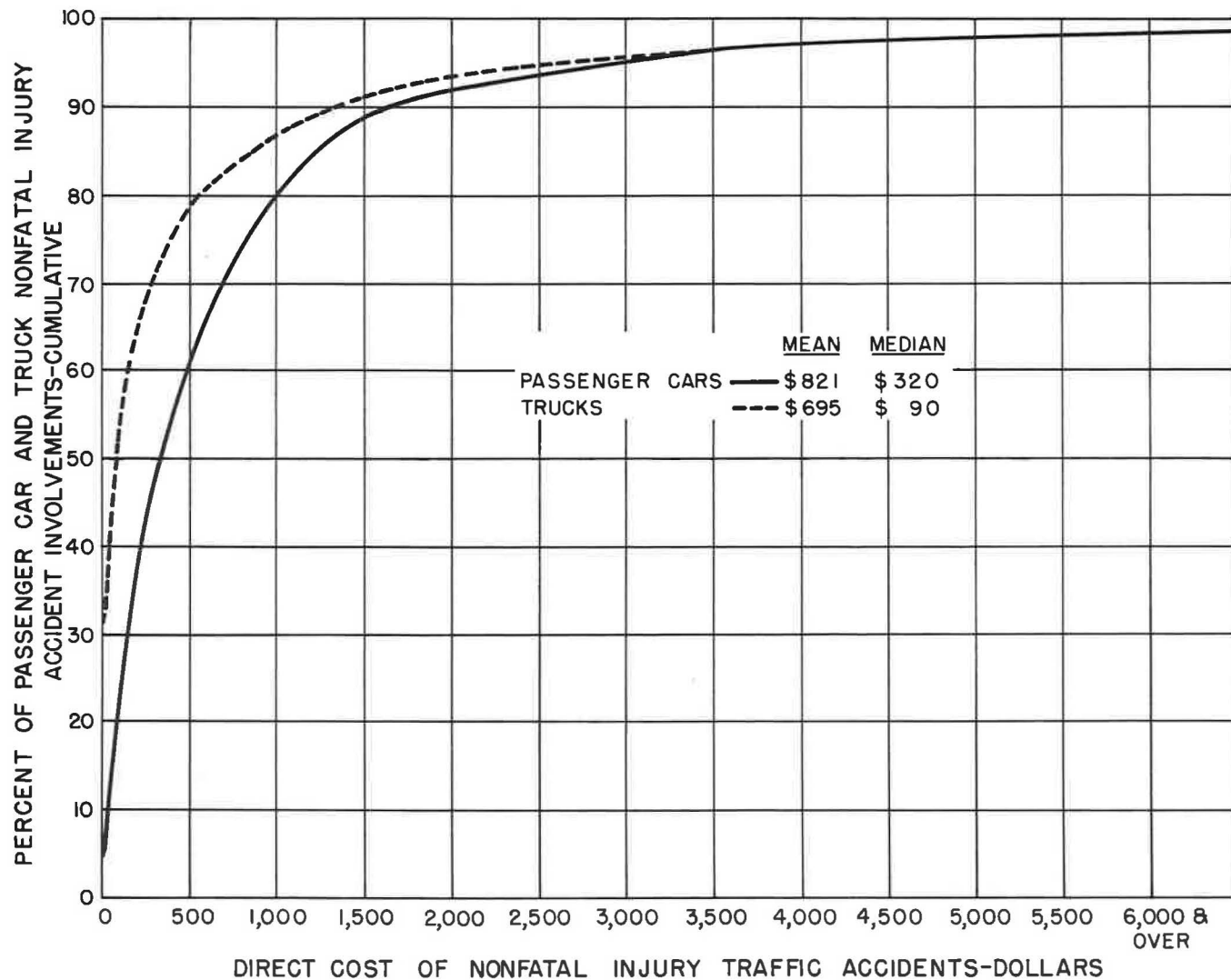


Figure 5. Cumulative percentage distribution of passenger car and truck nonfatal injury traffic accident involvements vs direct cost.

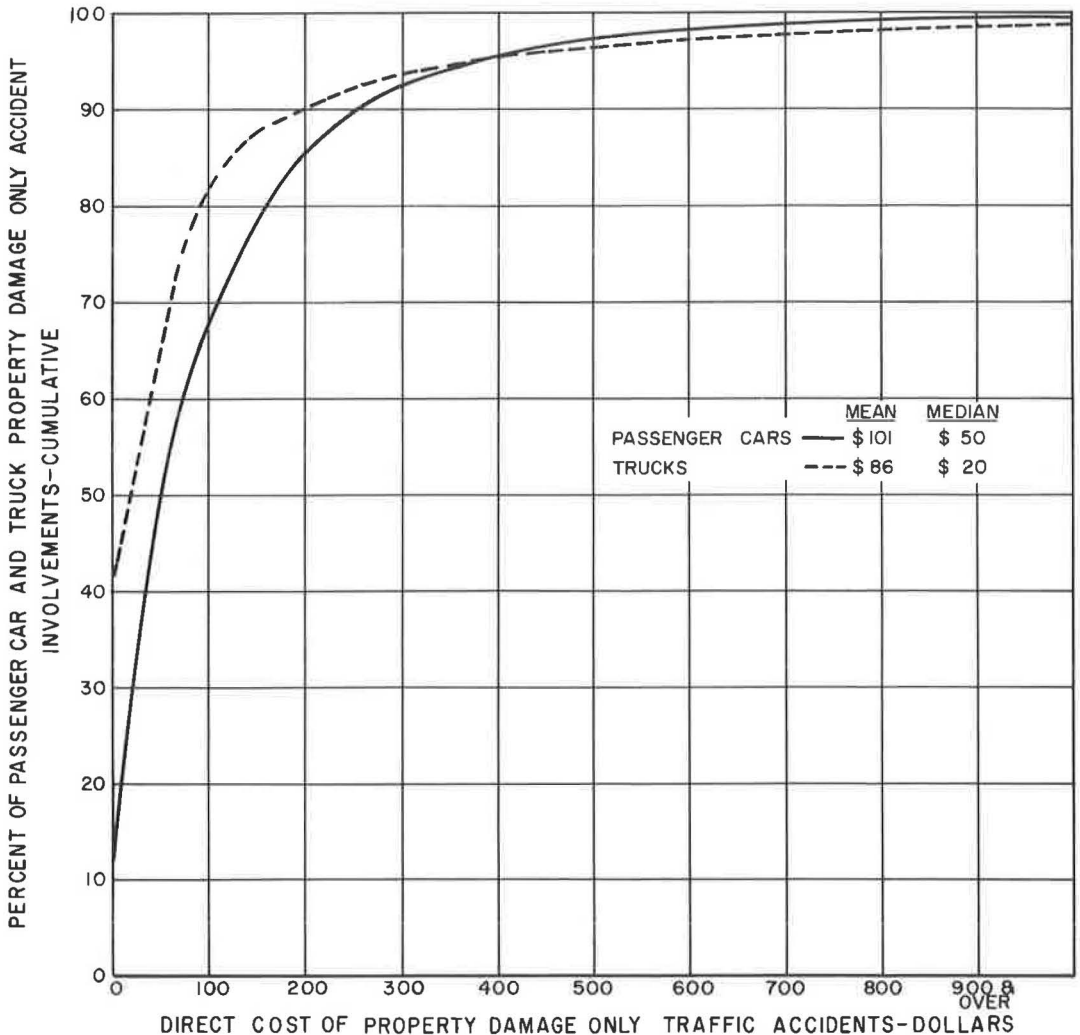


Figure 6. Cumulative percentage distribution of passenger car and truck property damage on only traffic accident involvements vs direct cost.

shows the case in point. Ninety percent of the fatal injury passenger car involvements fell within the cost range of \$11,600 or less; a similar percentage for trucks indicated a range of \$13,200 or less. The remaining 10 percent of the fatal injury passenger car involvements accounted for 48 percent of the total direct costs of fatal injury accidents. For trucks, the same proportionate group accounted for 45 percent of the total direct costs of fatal injury accidents. The extreme plotting interval in Figure 4 of \$28,000 and over was representative of only $1\frac{1}{2}$ percent of the total fatal injury involvements for both passenger cars and trucks, and yet this remote class accounted for nearly 19 percent of the costs of fatal injury passenger car accidents and nearly 12 percent of the total in the case of trucks.

The cumulative percentage curves for nonfatal injury accident involvements are shown in Figure 5. Again, the extreme plotting interval of \$6,000 and over was

representative of $1\frac{1}{2}$ percent of both passenger car and truck nonfatal injury involvements. This group, however, accounted for 26 percent of the total cost of nonfatal injury passenger car involvements and 22 percent of the total in the case of trucks.

As would be expected, the range in costs of property damage only involvements was less extreme than that for fatal and nonfatal injury involvements. There are exceptional cases though. A heavily damaged passenger car usually results in injury to the driver or a passenger. Trucks, on the other hand, may run off the highway, overturn, and cause excessive damage to vehicle and load, but the driver may escape unscathed. The plotting interval of \$900 and over, shown in Figure 6, accounted for 0.5 percent of the passenger car involvements and slightly over 1 percent for trucks. Costs represented by these small groups accounted for 5 percent of the total for passenger cars and 25 percent of the total for trucks.

As a further indication of the extreme cost values found in the study, fatal injury involvements ranged from zero to \$136,800 for passenger cars and from zero to \$46,200 for trucks. Nonfatal injury involvements ranged from zero to \$73,300 for passenger cars and \$53,700 for trucks. Property damage only involvements reached a maximum of \$1,400 for passenger cars and \$30,100 for trucks.

High-cost accident cases found in the Illinois study pointed to the need for further refinement in sample design. The extent of such refinement in sample design depends largely on the data available on tabulating cards in a given State's files of officially reported accidents. Of necessity, the sampling procedures in the past have been adapted to existing records.

Figure 7 shows composite involvement and aggregate cost curves for all severity classes of involvements. The average or mean value for passenger car involvements was \$196 and \$141 for trucks. The mid-values of medians were considerably less—\$60 and \$20. The cost interval of \$2,000 and over, plotted at the extreme right of Figure 7, represents only 1 percent of the total of 1.3 million passenger car involvements and 30 percent of the total direct costs of \$258.8 million. An identical comparison for trucks indicates that $1\frac{1}{2}$ percent of the 128,100 involvements fell within the cost interval of \$2,000 and over, and this group accounted for 44 percent of the \$18.1 million total.

By selecting the cost interval of \$10,000 and over, generally the lower limit for bodily injury and liability insurance, it was found that 0.1 percent or 1,339 passenger car involvements out of the total of 1,317,700 fell into this cost interval, and 0.07 percent or 90 truck involvements out of a total of 128,100. These relatively few involvements, however, accounted for 10 and 11 percent, respectively, of the total direct cost of passenger car and truck accidents.

On the basis of the preceding statewide comparison, and assuming that Illinois owners' 1958 experience was typical, the chance of a passenger car owner being involved in an accident in which the costs associated with his vehicle would amount to \$10,000 or more would be about 1 in 1,000; for truck owners, the probability of such an event would be about 1 in 1,400. As indicated previously in the paper, 2,876,000 Illinois passenger cars were driven the equivalent of 26.7 billion vehicle-miles in 1958. By referring again to the 1,339 passenger car involvements in which costs equaled or exceeded \$10,000, it is evident that the frequency of such an occurrence would be 5.0 involvements per 100 million vehicle-miles, or 1.0 involvement per 20 million vehicle-miles. On this basis, one of approximately 40 passenger car owners in a lifetime of vehicle ownership would be expected to experience an accident in which the costs associated with his vehicle would equal or exceed \$10,000.

Figures 8, 9, and 10 show the cost distribution of fatal, nonfatal, and property damage only involvements on the basis of the number of involvements rather than

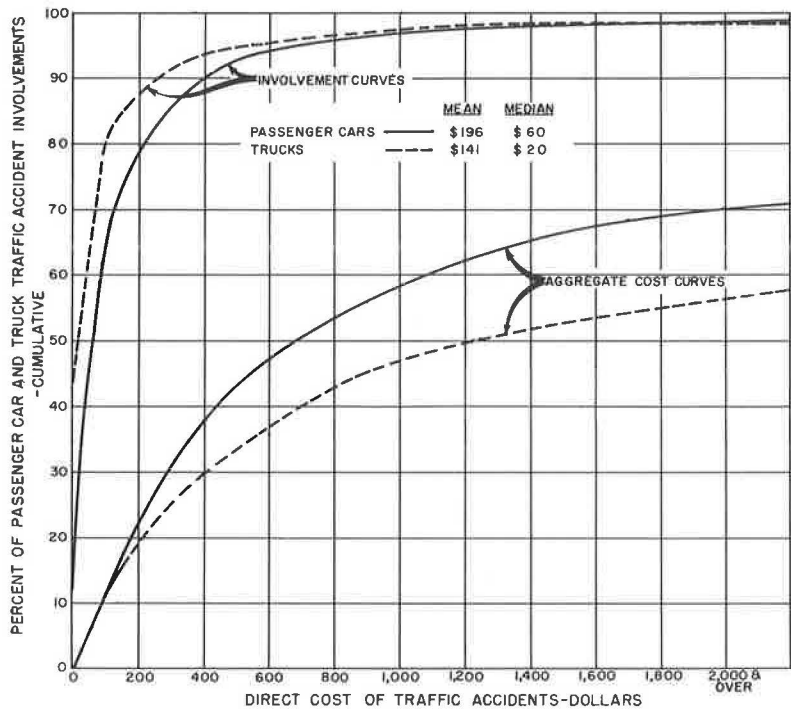


Figure 7. Cumulative percentage distribution of passenger car and truck traffic accident involvements and aggregate costs vs direct cost.

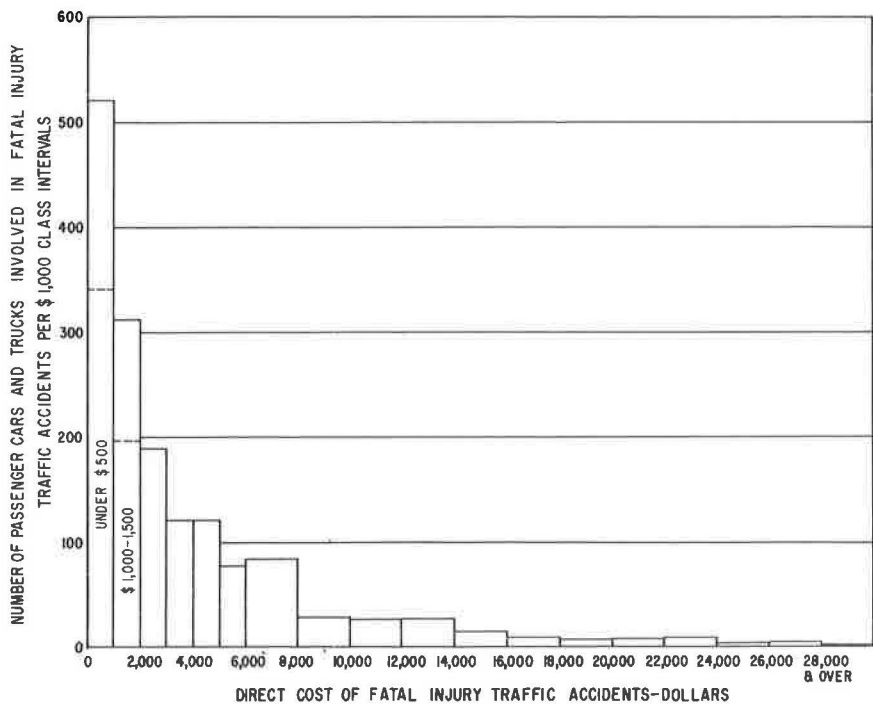


Figure 8. Number of passenger cars and trucks (combined) involved in fatal injury accidents, distributed according to direct costs of involvements.

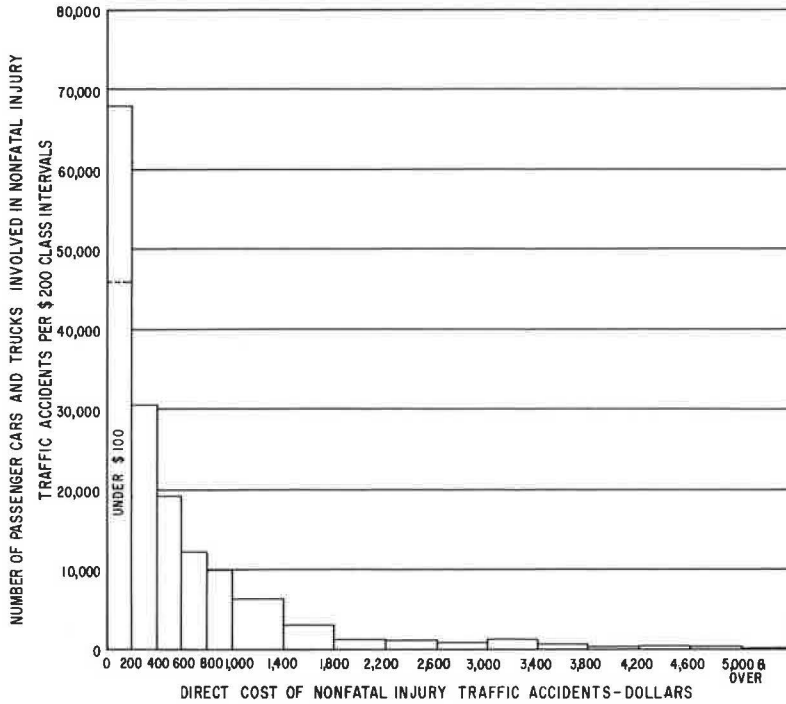


Figure 9. Number of passenger cars and trucks (combined) involved in nonfatal injury traffic accidents, distributed according to direct costs of involvements.

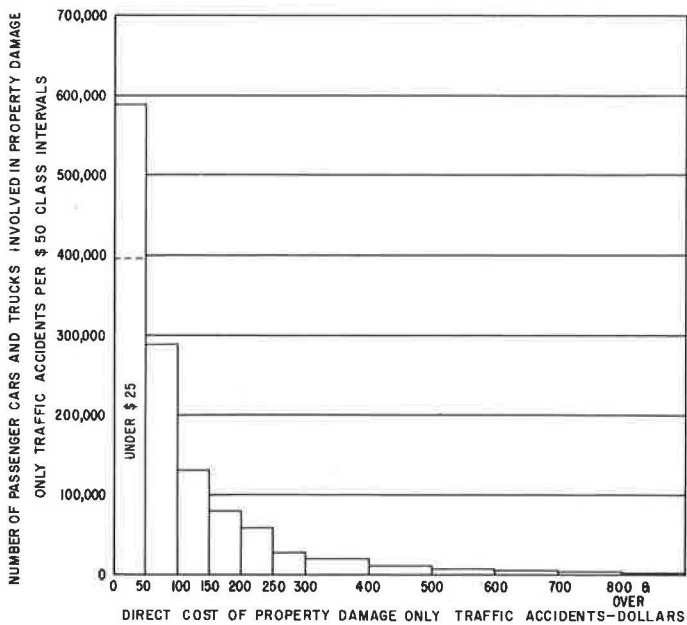


Figure 10. Number of passenger cars and trucks (combined) involved in property damage only traffic accidents, distributed according to direct costs of involvements.

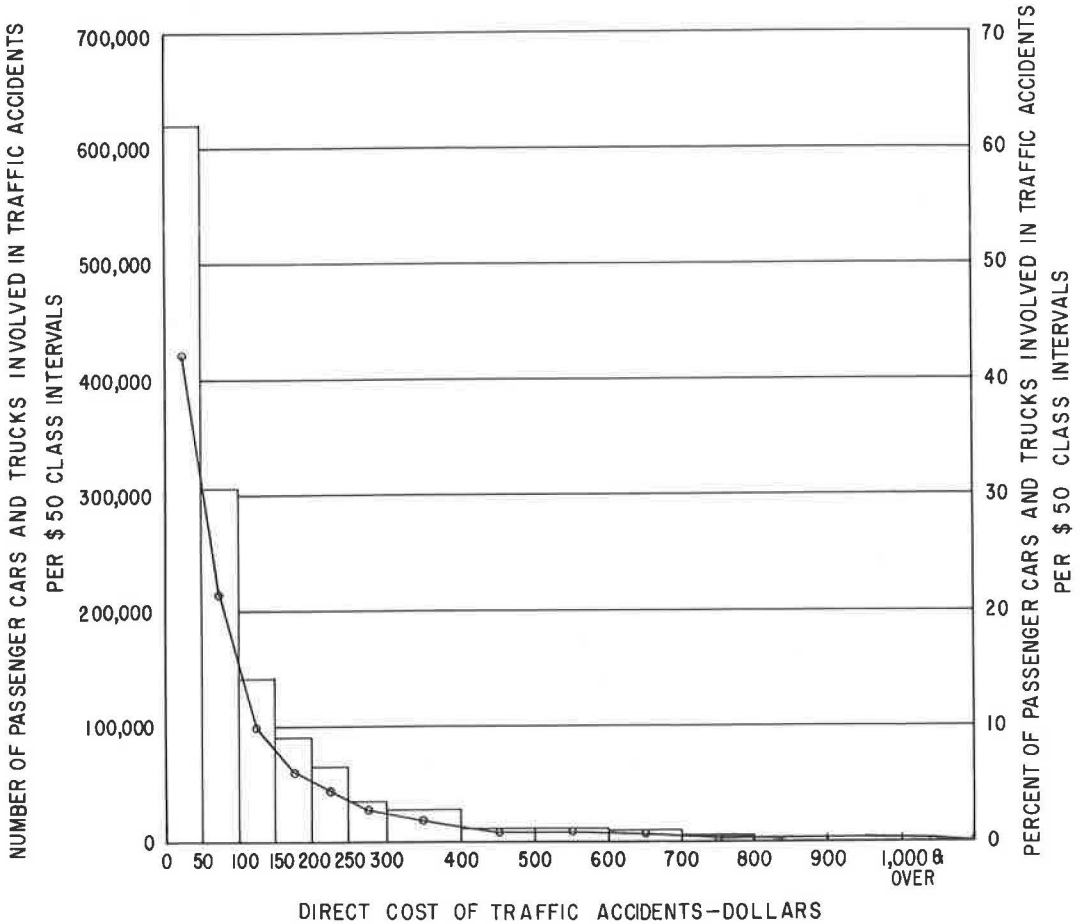


Figure 11. Number and percent of passenger cars and trucks (combined) involved in traffic accidents, distributed according to direct costs of such involvements.

percent of involvements as shown in Figures 4 through 7. The bars in Figures 8, 9, and 10 are representative of the combined number of passenger car and truck involvements. Figure 11 shows a composite distribution for all severity classes of involvements. Many of the characteristics of the cost distribution for each of the severity classes have already been mentioned and need no further emphasis. The bar charts, however, illustrate more forcefully the positive skewness of accident cost curves and emphasize the inherent problems in sampling the universe of accident involvements for the purpose of determining costs. Obviously, the high-cost involvements are subject to considerable sampling variability.

FREQUENCIES AND COSTS OF ACCIDENT INVOLVEMENTS

Related to Accident Location

The usual approach in determining accident exposure is to relate the number of accidents to vehicle-miles of travel. Fortunately, the motor-vehicle use study, conducted by the Illinois Division of Highways during 1958, complements the motor-vehicle accident cost study. The availability of this information is an invaluable aid in relating accidents to highway and vehicle-use characteristics.

Tables 10 and 11 give the basis for determining the frequencies and costs of accident involvements occurring in rural areas and in municipalities. The term "municipality" is used to denote incorporated places regardless of population size. Unincorporated places are included in the rural classification.

Numbers of vehicles involved in traffic accidents and the corresponding costs are not too meaningful unless such events can be related to exposure. Involvement and cost rates per 10 million vehicle-miles of travel are given in Table 12 for passenger cars and major classes of trucks. Passenger car involvement rates ranged from 191 per 10 million vehicle-miles of travel in rural areas to 672 in municipalities of all population sizes, or a ratio of 1 accident involvement in rural areas for every 3.5 involvements in municipalities. For single-unit trucks, the ratio was 1 to 4.8; for truck combinations, 1 to 6.4.

TABLE 10
NUMBER OF VEHICLES INVOLVED IN AND DIRECT COST OF TRAFFIC ACCIDENTS

Vehicle Type	Rural Areas	Municipalities				Total
		Under 5, 000	5, 000- 24, 999	25, 000- 125, 000	1, 000, 000 and Over	
(a) Number of Vehicles Involved in Accidents						
Passenger car	190, 975	77, 463	234, 189	302, 828	512, 203	1, 126, 683
Single-unit truck:						
Panels and pickups	9, 376	7, 539	6, 663	11, 412	22, 095	47, 709
Other	13, 172	2, 345	5, 806	9, 985	19, 789	37, 925
Total	22, 548	9, 884	12, 469	21, 397	41, 884	85, 634
Truck combinations	3, 781	1, 049	1, 797	3, 220	8, 506	14, 572
Unknown truck type	487	--	102	493	468	1, 063
All trucks	26, 816	10, 933	14, 368	25, 110	50, 858	101, 269
(b) Direct Cost of Accidents (\$)						
Passenger car	60, 981, 882	11, 324, 294	29, 745, 538	45, 289, 744	111, 428, 162	197, 787, 738
Single-unit truck:						
Panels and pickups	4, 046, 099	552, 199	507, 201	1, 025, 711	1, 494, 471	3, 579, 582
Other	2, 991, 158	291, 468	305, 192	832, 470	1, 309, 983	2, 739, 113
Total	7, 037, 257	843, 667	812, 393	1, 858, 181	2, 804, 454	6, 318, 695
Truck combinations	2, 059, 289	522, 112	516, 291	347, 532	1, 211, 188	2, 597, 123
Unknown truck type	9, 963	--	3, 057	40, 528	15, 332	58, 917
All trucks	9, 106, 509	1, 365, 779	1, 331, 741	2, 246, 241	4, 030, 974	8, 974, 735

TABLE 11
VEHICLE-MILES OF TRAVEL IN ILLINOIS BY VEHICLES OF DIFFERENT TYPES
BY LOCATION OF TRAVEL¹

Vehicle Type	Vehicle-Miles of Travel (×1,000)					
	Rural Areas	Municipalities				Total
		Under 5,000	5,000- 24,999	25,000- 125,000	1,000,000 and Over	
Passenger car	9,986,084	1,984,221	3,012,843	4,064,738	7,700,420	16,762,222
Single-unit truck:						
Panels and pickups	1,239,747	176,595	236,846	246,216	422,536	1,082,193
Other	1,072,841	125,410	144,528	149,807	309,226	728,971
Total	2,312,588	302,005	381,374	396,023	731,762	1,811,164
Truck combinations	521,188	63,672	60,389	42,480	144,929	311,470
All trucks	2,833,776	365,677	441,763	438,503	876,691	2,122,634

¹Data represent travel of Illinois-registered vehicles in use (2).

TABLE 12
NUMBER OF VEHICLES INVOLVED IN AND DIRECT COST OF TRAFFIC
ACCIDENTS PER 10 MILLION VEHICLE-MILES OF TRAVEL

Vehicle Type	Rural Areas	Municipalities				Total
		Under 5,000	5,000-24,999	25,000-125,000	1,000,000 and Over	
(a) Number of Vehicles Involved in Accidents per 10 Million Vehicle-Miles						
Passenger Car	191	390	777	745	665	672
Single-unit truck:						
Panels and pickups	76	427	281	463	523	441
Other	123	187	402	667	640	520
Total	98	327	327	540	572	473
Truck combination	73	165	298	758	587	468
All trucks	95	299	325	573	580	477
(b) Direct Cost of Accidents per 10 Million Vehicle-Miles (\$)						
Passenger Car	61,067	57,072	98,729	111,421	144,704	117,996
Single-unit truck:						
Panels and pickups	32,636	31,269	21,415	41,659	35,369	33,077
Other	27,881	23,241	21,116	55,569	42,363	37,575
Total	30,430	27,936	21,302	46,921	38,325	34,887
Truck combination	39,511	82,000	85,494	81,811	83,571	83,383
All trucks	32,136	37,349	30,146	51,225	45,979	42,281

Direct costs of accident involvements per 10 million vehicle-miles of travel are shown in the right half of Table 12. On the basis of relative exposure, the cost of passenger car involvements ranged from \$61,100 per 10 million vehicle-miles in rural areas to \$118,000 in municipalities. Similar comparisons for single-unit trucks indicated a range of \$30,400 to \$34,900; truck combinations, \$39,500 to \$83,400.

The comparison of involvement and cost rates in rural areas vs municipalities points to the fact that many of the accidents in cities were relatively minor events. For all classes of vehicles considered in the study, involvement rates ranged from 170 per 10 million vehicle-miles of travel in rural areas to 650 in municipalities, or a ratio of 1 to 3.8. Cost rates, on the other hand, ranged from \$54,700 per 10 million vehicle-miles in rural areas to \$109,500 in municipalities, or a ratio of 1 to 2.

An analysis of the types of accidents shows that nearly one-half of all accidents in municipalities were collisions with parked vehicles and rear-end collisions. These two types of accidents accounted for only 15 percent of the total direct costs of accidents in municipalities. But regardless of the severity or costs of specific types of accidents, the fact still remains that a large part of the accident problem is concentrated in cities, and prevailing vehicle insurance rates for urban residents reflect that condition. Eighty-five percent of the accident involvements occurring in the State during the study year took place in municipalities, and those events accounted for 75 percent of the total direct costs of accidents.

A rather unusual finding of the study was the doubling of the accident cost rate for truck combinations in cities vs rural areas. A similar relationship did not hold for single-unit trucks. As shown in Table 7, the cost of approximately 0.8 cent per vehicle-mile for combinations was quite uniform for all city size groups. A further analysis of these data indicated that the rates for combinations were influenced to a considerable extent by the occurrence of a limited number of fatal and nonfatal injury accidents in which the costs exceeded \$10,000 per involvement.

TABLE 13
NUMBER OF MUNICIPALITIES AND
POPULATION FOR VARIOUS
POPULATION GROUPS

Population Group	Number of Cities	1958 Population
Urban:		
Under 5,000	1,026	1,135,700
5,000 - 24,999	138	1,399,500
25,000 - 125,000	33	1,750,100
1,000,000 and over	1	3,614,100
Subtotal	1,198	7,899,400
Rural	--	1,762,700
Total	1,198	9,662,100

As a matter of interest, Table 13 shows the number of municipalities and population for each city size group given in Tables 10, 11, and 12 and total population.

The population group of 1,000,000 and over obviously applies to Chicago. Incorporated places surrounding the corporate area of Chicago (such as Evanston, Oak Park, Berwyn, and Cicero) were included in the lesser population groups. Forty-six percent of the accident involvements and 56 percent of the total costs of accidents occurring in municipalities of the State were traceable to the corporate area of Chicago. This finding was not unusual, as 46 percent of the urban population of the State resided in the one city, and 45 percent of the statewide municipal travel was performed there. In relating the costs of

passenger car and truck accidents to travel of these vehicles in Chicago, the rate per vehicle-mile was found to be \$0.035.

A recent publication of the Chicago Area Transportation Study (CATS) provides useful comparisons of accident costs and rates for streets and highways of the Greater Chicago area (3). (Data for the study were based on the statewide accident cost study.) The area covered in the analysis included Cook and Du Page Counties, the confines of which were nearly equivalent to the perimeters of the CATS study.

The locations of traffic accidents occurring in Cook and Du Page Counties during 1958 were classified on the basis of three systems: expressways, arterials, and local streets. Accident rates and costs developed in the analysis are given in Table 14.

The cost of accidents per vehicle-mile of travel on all street systems of the two counties was calculated as \$0.0132, which was slightly less than the rate of \$0.0135 for the corporate area of Chicago. Of primary interest is the range in costs per vehicle-mile by street systems: expressways, \$0.0031; arterials, \$0.0107 and local streets, \$0.0309. Frequency rates were based on the number of accidents per 10 million vehicle-miles rather than involvements, and thus direct comparisons cannot be made with the data in Table 12. (In the CATS analysis, a conversion factor of 1.89 involvements per traffic accident was used.) Results show that the chance of being involved in a traffic accident on a local street was 20 times greater than on an expressway; on arterial streets, the accident rate was nearly 5 times that of expressways.

Related to Highway Systems

Tables 15 and 16 provide the necessary information to appraise the major highway systems of the State on the basis of accident frequencies and costs. The same limitations apply to this series of tables as those mentioned in connection with Tables 4, 5, and 6. Sampling variability should be kept in mind when viewing the detailed information. Values shown for subtotals and totals obviously are supported by a greater number of sample cases than the component values that make up the totals. Table cells believed to have too few sample cases to provide significant comparisons are indicated by the footnote to Table 17. No estimates of sampling error have been computed, however.

TABLE 14
ACCIDENT RATES AND COSTS, COOK
AND DU PAGE COUNTIES, 1958

Street System	Rate per 10 Million Vehicle-Miles	
	Number of Accidents	Direct Cost (\$)
Expressways	51	30,800
Arterials	243	107,200
Local streets	1,021	309,400
All systems	347	132,400

TABLE 15
NUMBER OF VEHICLES INVOLVED IN AND DIRECT COSTS OF TRAFFIC ACCIDENTS
BY MAJOR VEHICLE TYPE AND HIGHWAY SYSTEM

Highway System	Illinois-Registered Passenger Cars			Single-Unit Trucks ¹			Truck Combinations			Trucks, All Types		
	Rural	Municipal	Total	Rural	Municipal	Total	Rural	Municipal	Total	Rural	Municipal	Total
(a) Number of Vehicles Involved in Accidents												
Federal-aid primary and State highways	88,809	221,656	310,465	10,855	17,485	28,340	3,082	5,257	8,339	13,937	22,742	36,679
Federal-aid secondary:												
State highways	19,876	5,928	25,804	788	667	1,455	36	33	69	824	700	1,524
Local roads	14,166	4,135	18,301	1,714	24	1,738	38	--	38	1,752	24	1,776
Subtotal	34,042	10,063	44,105	2,502	691	3,193	74	33	107	2,576	724	3,300
Non-Federal-aid:												
State highways	9,330	111,402	120,732	1,534	12,165	13,699	252	2,025	2,277	1,786	14,190	15,976
Local roads	58,794	783,562	842,356	8,144	56,356	64,500	373	7,257	7,630	8,517	63,613	72,130
Subtotal	68,124	894,964	963,088	9,678	68,521	78,199	625	9,282	9,907	10,303	77,803	88,106
All roads and streets:												
State highways	118,015	338,986	457,001	13,177	30,317	43,494	3,370	7,315	10,685	16,547	37,632	54,179
Local roads	72,960	787,697	860,657	9,858	56,380	66,238	411	7,257	7,668	10,269	63,637	73,906
Total	190,975	1,126,683	1,317,658	23,035	86,697	109,732	3,781	14,572	18,353	26,816	101,269	128,085
(b) Direct Cost of Accidents with Illinois-Registered Vehicles (\$)												
Federal-aid primary and State highways	34,089,866	45,582,939	79,672,805	4,543,900	1,305,646	5,849,546	1,510,563	1,743,175	3,253,738	6,054,463	3,048,821	9,103,284
Federal-aid secondary:												
State highways	3,292,274	1,270,202	4,562,476	144,672	95,649	240,321	4,641	788	5,429	149,313	96,437	245,750
Local roads	4,611,364	327,622	4,938,986	429,755	231	429,986	315,935	--	315,935	745,690	231	745,921
Subtotal	7,903,638	1,597,824	9,501,462	574,427	95,880	670,307	320,576	788	321,364	895,003	96,668	991,671
Non-Federal-aid:												
State highways	2,963,087	28,358,274	31,321,361	337,210	1,146,764	1,483,974	98,502	298,835	397,337	435,712	1,445,599	1,881,311
Local roads	16,025,291	122,248,701	138,273,992	1,591,683	3,829,322	5,421,005	129,648	554,325	683,973	1,721,331	4,383,647	6,104,978
Subtotal	18,988,378	150,606,975	169,595,353	1,928,893	4,976,086	6,904,979	228,150	853,160	1,081,310	2,157,043	5,829,246	7,986,289
All roads and streets:												
State highways	40,345,227	75,211,415	115,556,642	5,025,782	2,548,059	7,573,841	1,613,706	2,042,798	3,656,504	6,639,488	4,590,857	11,230,345
Local roads	20,636,655	122,576,323	143,212,978	2,021,438	3,829,553	5,850,991	445,583	554,325	999,908	2,467,021	4,383,878	6,850,899
Total	60,981,882	197,787,738	258,769,620	7,047,220	6,377,612	13,424,832	2,059,289	2,597,123	4,656,412	9,106,509	8,974,735	18,081,244

¹Includes 1,550 trucks of unknown type involved in traffic accidents; 487 of which were involved in rural accidents and 1,063 in municipal accidents.

Accident involvement and cost rates (Table 17) point to the fact that passenger car drivers traveling on local rural roads and on city streets (principally of the residential class) experienced more accidents on a vehicle-mile basis than when driving on State highways. Rates on rural State highways were 173 involvements per 10 million vehicle-miles as compared to 232 involvements on local roads, or a ratio of 1 accident involvement on State highways for every 1.3 involvements on local roads. In municipalities, the rates per 10 million vehicle-miles were 519 and 770, respectively, or a ratio of 1 to 1.5. Costs per vehicle-mile for passenger car involvements ranged from \$0.0059 on rural State highways to \$0.0066 on local rural roads. A similar comparison for municipalities indicated costs of \$0.0115 and \$0.0120. Involvement ratios were somewhat greater in the State-local comparisons than were the cost ratios, which indicates that accidents on the local systems tended to be less severe or costly.

Involvement rates for trucks of all types were higher on local roads and streets than on State highways, but costs per vehicle-mile indicated an inverse relation.

A comparison of involvement and cost rates on the basis of the three classes of highways (Federal-aid primary, Federal-aid secondary, and non-Federal-aid) is not too conclusive. However, the emphasis placed on improving the design of major highways shows some benefits from the standpoint of accident frequencies and costs. One principal observation is that the roads and streets not a part of the Federal-aid systems should not be overlooked in accident reduction programs. This class of roads and streets, composed largely of county and township roads in rural areas and residential streets in municipalities, is representative of 82 percent of the road and street mileage of the State. During the year of the study, these facilities accounted for 51 percent of the travel, 73 percent of the accident involvements, and 64 percent of the total direct costs of accidents.

The percentage distribution of travel, accident involvements, and accident costs is shown in Figure 12 for the three classes of highways. The system classifications used in the study are fairly realistic from the standpoint of vehicle usage, particularly in rural areas. A

TABLE 16
IN-STATE TRAVEL OF ILLINOIS-REGISTERED PASSENGER CARS AND TRUCKS, DISTRIBUTED BY HIGHWAY SYSTEMS¹

Highway System	In-State Travel (thousands of vehicle-miles)					
	Passenger Cars			Truck Combinations		
	Rural	Municipal	Total	Rural	Municipal	Total
Federal-aid primary and State highways	5,844,957	4,985,517	10,830,474	1,292,470	560,818	1,853,288
Federal-aid secondary highways:						
State highways	409,629	137,276	546,905	78,716	18,874	97,590
Local roads	1,055,522	133,976	1,200,498	223,545	14,263	237,808
Subtotal	1,476,151	271,252	1,747,403	302,261	33,137	335,398
Non-Federal-aid highways:						
State highways	596,552	1,403,184	1,999,736	126,168	155,565	281,733
Local roads	2,078,424	10,102,269	12,180,693	591,539	1,061,644	1,653,183
Subtotal	2,664,976	11,505,453	14,170,429	717,657	1,217,209	1,935,066
All roads and streets:						
State highways	6,841,138	6,525,977	13,367,115	1,497,354	735,257	2,232,611
Local roads	3,144,946	10,236,245	13,381,191	815,234	1,075,907	1,891,141
Total	9,986,084	16,762,222	26,748,306	2,312,588	1,811,164	4,123,752
Trucks, All Types						
Rural						
Municipal						
Total						
Federal-aid primary and State highways						
State highways						
Local roads						
Subtotal						
Non-Federal-aid highways:						
State highways						
Local roads						
Subtotal						
All roads and streets:						
State highways						
Local roads						
Total						

¹Data source (2).

TABLE 17
NUMBER OF VEHICLES INVOLVED IN AND DIRECT COSTS OF TRAFFIC ACCIDENTS PER
10 MILLION VEHICLE-MILES OF TRAVEL, BY MAJOR VEHICLE TYPE AND HIGHWAY SYSTEM

Highway System	Passenger Cars			Single-Unit Trucks			Truck Combinations			Trucks, All Types		
	Rural	Municipal	Total	Rural	Municipal	Total	Rural	Municipal	Total	Rural	Municipal	Total
(a) Number of Illinois-Registered Vehicles Involved in Accidents per 10 Million Vehicle-Miles												
Federal-aid primary and State highways	152	445	287	84	312	153	65	323	131	79	314	147
Federal-aid secondary:												
State highways	485	432	472	100	-- ¹	149	-- ¹	-- ¹	-- ¹	97	-- ¹	144
Local roads	133	-- ¹	152	77	-- ¹	73	-- ¹	--	-- ¹	77	-- ¹	73
Subtotal	231	371	252	83	-- ¹	95	-- ¹	-- ¹	-- ¹	82	-- ¹	94
Non-Federal-aid:												
State highways	159	794	607	122	782	486	-- ¹	613	395	118	752	471
Local roads	283	776	692	138	531	390	-- ¹	645	617	141	542	406
Subtotal	256	778	680	135	563	404	-- ¹	638	546	137	571	416
All roads and streets:												
State highways	173	519	342	88	412	195	67	369	152	83	403	185
Local roads	232	770	643	121	524	350	-- ¹	642	591	123	535	366
Total	191	672	493	100	479	266	73	468	220	95	477	258
(b) Direct Cost of Accidents per 10 Million Vehicle-Miles (\$)												
Federal-aid primary and State highways	58,324	91,431	73,564	35,157	23,281	31,563	31,877	107,021	51,099	34,277	42,128	36,559
Federal-aid secondary:												
State highways	80,372	92,529	83,424	18,379	-- ¹	24,626	-- ¹	-- ¹	-- ¹	17,615	-- ¹	23,170
Local roads	43,237	-- ¹	41,141	19,225	-- ¹	18,081	-- ¹	--	-- ¹	32,569	-- ¹	30,587
Subtotal	53,542	58,906	54,375	19,004	-- ¹	19,985	-- ¹	-- ¹	-- ¹	28,528	-- ¹	28,339
Non-Federal-aid:												
State highways	50,517	202,099	157,415	26,727	73,716	52,673	-- ¹	90,389	68,915	28,900	76,638	55,432
Local roads	77,103	121,011	113,519	26,901	36,070	32,788	-- ¹	49,292	55,287	28,549	37,336	34,355
Subtotal	71,252	130,901	119,683	26,870	40,881	35,683	-- ¹	58,629	59,619	28,619	42,776	37,735
All roads and streets:												
State highways	58,974	115,249	86,448	33,564	34,655	33,924	31,985	102,982	52,021	33,166	49,173	38,257
Local roads	65,618	119,747	107,026	24,796	35,594	30,939	-- ¹	49,010	77,051	29,655	36,870	33,900
Total	61,067	117,996	96,742	30,473	35,213	32,555	39,511	83,383	55,922	32,136	42,281	36,481

¹ Sample too small to provide significant data (20 or less sample cases).

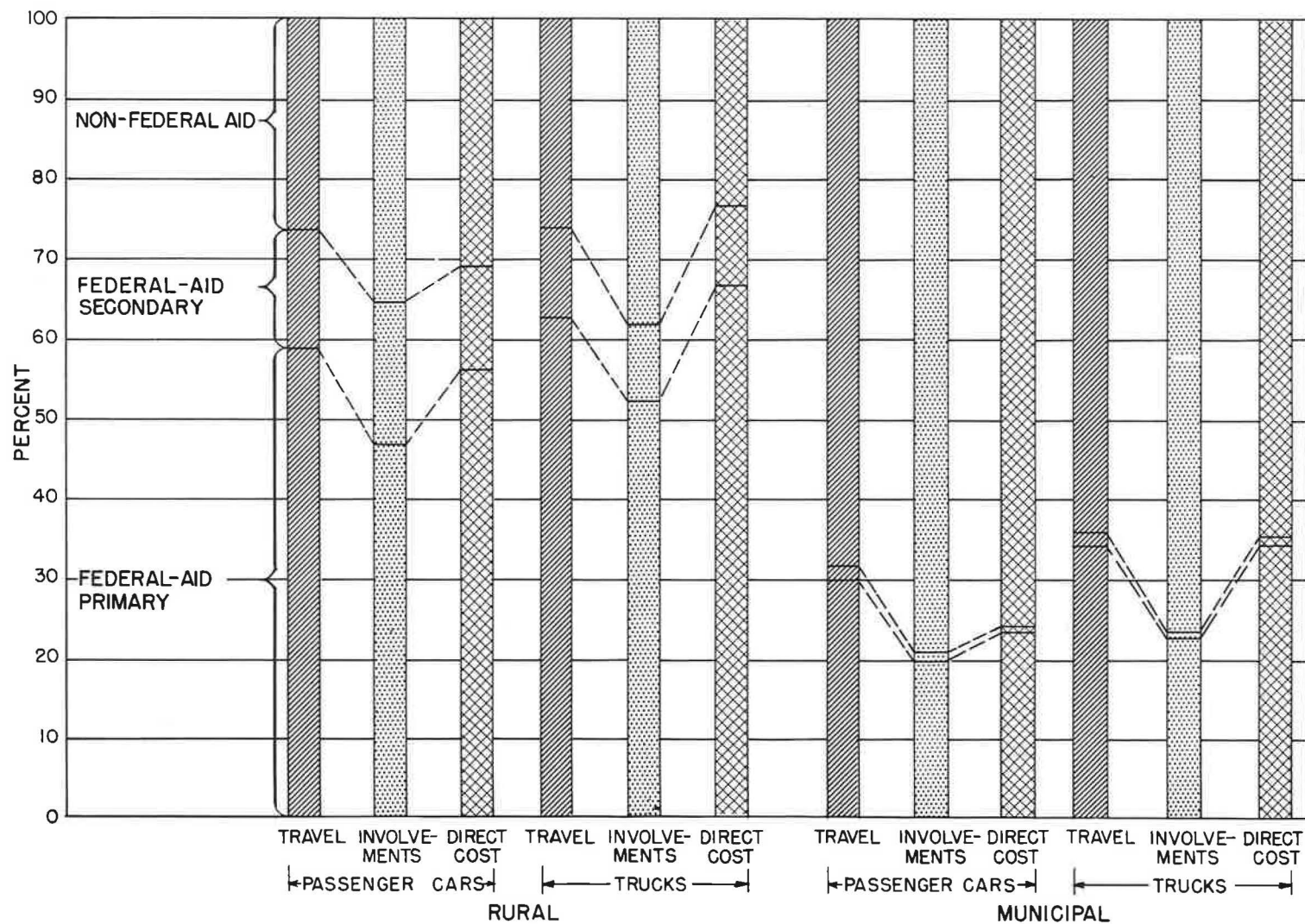


Figure 12. Percentage distribution of travel, accident involvements, and accident costs on basis of major vehicle type, rural and municipal location, and highway system.

TABLE 18
IN-STATE TRAVEL OF ILLINOIS-REGISTERED PASSENGER CARS AND TRUCKS, DISTRIBUTED
BY HIGHWAY SYSTEMS AND AVERAGE DAILY TRAVEL PER MILE OF ROAD OR STREET

Item of Comparison	Federal-Aid Primary and State Highways	Federal-Aid Secondary Highways			Non-Federal-Aid Highways			All Roads and Streets		
		State Highways	Local Roads	Total	State Highways	Local Roads	Total	State Highways	Local Roads	Total
(a) Travel in Rural Areas										
Miles of rural roads	8,625	1,618	10,050	11,668	2,391	79,503	81,894	12,634	89,553	102,187
Passenger car travel:										
Annual (1,000 v-m)	5,844,957	409,629	1,066,522	1,476,151	586,552	2,078,424	2,664,976	6,841,138	3,144,946	9,986,084
Average daily (1,000 v-m)	16,014	1,122	2,922	4,044	1,607	5,694	7,301	18,743	8,616	27,359
Average daily per mile of road	1,857	693	291	347	672	72	89	1,484	96	268
Truck travel:										
Annual (1,000 v-m)	1,766,344	84,767	228,958	313,725	150,763	602,944	753,707	2,001,874	831,902	2,833,776
Average daily (1,000 v-m)	4,839	233	627	860	413	1,652	2,065	5,485	2,279	7,764
Average daily per mile of road	561	144	62	74	173	21	25	434	25	76
(b) Travel in Municipalities										
Miles of streets	1,498	203	209	412	988	18,192	19,180	2,689	18,401	21,090
Passenger-car-travel:										
Annual (1,000 v-m)	4,985,517	137,276	133,976	271,252	1,403,184	10,102,269	11,505,453	6,525,977	10,236,245	16,762,222
Average daily (1,000 v-m)	13,659	376	367	743	3,844	27,678	31,522	17,879	28,045	45,924
Average daily per mile of street	9,118	1,852	1,756	1,803	3,891	1,521	1,643	6,649	1,524	2,178
Truck travel:										
Annual (1,000 v-m)	723,700	21,296	14,910	36,206	188,626	1,174,102	1,362,728	933,622	1,189,012	2,122,634
Average daily (1,000 v-m)	1,983	58	41	99	516	3,217	3,733	2,557	3,258	5,815
Average daily per mile of street	1,324	287	195	241	523	177	195	951	177	276
(c) Total Travel										
Miles of roads and streets	10,123	1,821	10,259	12,080	3,379	97,695	101,074	15,323	107,954	123,277
Passenger car travel:										
Annual (1,000 v-m)	10,830,474	546,905	1,200,498	1,747,403	1,989,736	12,180,693	14,170,429	13,367,115	13,381,191	26,748,306
Average daily (1,000 v-m)	29,673	1,498	3,289	4,787	5,451	33,372	38,823	36,622	36,661	73,283
Average daily per mile of road and street	2,931	823	321	396	1,613	342	384	2,390	340	594
Truck travel:										
Annual (1,000 v-m)	2,490,044	106,063	243,868	349,931	339,389	1,777,046	2,116,435	2,935,496	2,020,914	4,956,410
Average daily (1,000 v-m)	6,822	291	668	959	929	4,869	5,798	8,042	5,537	13,579
Average daily per mile of road and street	674	160	65	79	275	50	57	525	51	110

preferred classification for major cities would be expressways, arterials, and residential streets. Streets of the Federal-aid secondary classification represent a very small portion of the total municipal mileage, as shown in Table 18.

Table 19 shows average daily travel of Illinois passenger cars and trucks on the three systems during 1958.

SUMMARY OF FINDINGS

The major findings of the Illinois accident cost study, as discussed herein, were as follows:

1. Direct costs of motor vehicle accidents and incidents involving Illinois-registered passenger cars during 1958 totaled \$309.5 million. For Illinois trucks, such costs amounted to \$29.3 million. These events, occurring both on and off the highways and in and out of Illinois, resulted in costs to persons and property totaling \$1/3 billion, or an amount equivalent to three-fifths of the total outlay of funds by State, Federal, and local governments for the construction and maintenance of Illinois roads and streets during 1958.

The \$1/3 billion figure represented an average cost of \$928,000 per day—\$104 per vehicle in use, \$84 for each person with a permit to drive, and \$35 per capita.

2. Approximately 1.3 million Illinois passenger cars were involved in traffic accidents on Illinois highways which resulted in costs of \$258.8 million, or an average of \$196 per event; similarly, 128,000 trucks were involved in traffic accidents costing \$18.1 million, or an average of \$141 per event. A further comparison on the basis of exposure indicated costs of \$0.0097 per passenger-car mile and \$0.0036 per truck-mile.

Three-fourths of the 1.3 million passenger car involvements and four-fifths of the 128,000 truck involvements were not recorded in the official accident files of the State. Although most of these events were minor happenings in which property damage costs were below the legal reporting minimum, they accounted for 42 percent of the total direct costs of passenger car accidents and 55 percent in the case of truck accidents.

3. The distribution of the accident cost dollar for all severity classes of accidents was as follows: property damage, \$0.60; treatment of injuries, \$0.08; loss of use of vehicle, \$0.01; value of work time lost, \$0.08; legal and court fees, \$0.10; and damage awards and settlements in excess of known costs, \$0.13.

4. The problems inherent in sampling the "universe" of traffic accidents for the purpose of determining costs were made evident by the wide range in costs found for the different severity classes of accidents. Extreme cost values for individual sample cases were as follows: fatal injury involvements, \$136,000; nonfatal injury, \$73,000; and property damage only, \$30,000. In contrast, median cost values were \$2,280 for fatal injury involvements, \$310 for nonfatal injury, and \$50 for property damage only involvements.

5. Passenger car owners were involved in accidents within municipalities 3½ times as often as in rural areas. For truck owners, the ratio was 1 involvement in rural areas for every 5 involvements in municipalities. Costs per passenger-car mile ranged from \$0.0061 in rural areas to \$0.0118 in municipalities; similarly, costs per truck-mile ranged from \$0.0032 to \$0.0042, respectively.

6. Comparisons made of accident frequencies and costs by major highway systems indicated that roads and streets of a local character had the least desirable rates. Many of the accidents that took place on residential streets were relatively minor events, but when considered in the aggregate they represented a sizeable portion of the total direct costs of traffic accidents.

TABLE 19
AVERAGE DAILY TRAVEL, ILLINOIS
PASSENGER CARS AND TRUCKS, 1958

System	Vehicles per Day per Mile of Road or Street	
	Rural	Municipal
Federal-aid primary	2,418	10,442
Federal-aid secondary	421	2,044
Non-Federal-aid	114	1,838
All	344	2,454

REFERENCES

1. "Cost of Motor Vehicle Accidents to Illinois Motorists, 1958." State of Ill. Dept. of Public Works and Buildings, Div. of Highways (July 1962).
2. "Motor Vehicle Use Study." State of Ill. Dept. of Public Works and Buildings, Div. of Highways (Oct. 1961).
3. Jorgenson, D. P., "Accident Costs and Rates on Chicago Area Streets and Highways." CATS' Res. News, 4:2-11 (March 30, 1962).