Economic Cost of Traffic Accidents in Relation to Highway Planning

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This paper points up the value of traffic accident cost data to the highway planner in evaluating and scheduling highway improvement.

It also compares the frequencies and costs of traffic accidents in Utah in 1955 with the results found in the 1953 Massachusetts study. Despite dissimilarities in geographic characteristics and population densities, the relative distributions of accidents in the two States were quite consistent. As to costs, regardless of severity or type, accidents were more costly in Utah than in Massachusetts.

● TODAY, highway planners are seeking more scientific methods of evaluating existing highways and designing and programing new facilities. The highway administrator and planner realize as never before the importance of engineering tools that will permit them to schedule construction on the basis of need, allocate highway funds on a priority basis, select additions to the highway systems, change system classifications, select proper alternate routes or locations, and to cope effectively with public and private groups having vested interests in the processes of planning and programing.

Some states have employed sufficiency ratings to assist them in accomplishing these objectives. This method simply assigns a point rating to each section of road according to its ability to provide traffic service in a safe and efficient manner. Other states have employed economic analyses using factors such as highway costs, revenues, and benefits. In the main, this approach has been simplified to include only the benefit quotient which reflects primarily a savings to the motor-vehicle user in operating cost and time through improved alinement. Some states use both approaches.

In the methods generally in use, one important factor is too often omitted—traffic accident rates. Some states incorporate accident rates in their sufficiency ratings, but more do not. It is known that sections of highway having a good adequacy rating, as provided by the sufficiency rating system, sometimes may have a high traffic accident frequency.

Traffic accident rates normally are not included in economic analyses of the cost-benefit variety at all. The principal reason for the omission has been the unreliability of traffic accident data. Too many accidents are not reported; and for those that are, the reports often do not clearly indicate where the accidents occurred. But one of the greatest deterrents has been the lack of information on accident costs related to the types of vehicles, classes of highways, roadway features, types of accidents, and severity of accidents.

APPLICATION OF ACCIDENT COST FACTOR

Traffic accident data should be one of the highway planner's most important tools to justify street and highway improvements. Just to illustrate this point, a traffic accident study was made on State Street in Salt Lake City. The study section, 17 blocks in length, carried over 30,000 vehicles daily. During a 3-year period, more than 1,000

traffic accidents occurred on this street, and over 700 of them took place at intersections. The street is a 6-lane divided roadway with parallel parking on each side.

It is estimated that had this traffic been carried on a street of freeway design, slightly more than 200 accidents would have been expected instead of 1,000. An Interstate System improvement is being planned to parallel State Street, and the portion paralleling the 17-block study section is expected to carry 100,000 vehicles daily by 1975.

According to the Utah accident cost study, the direct cost for passenger-car accidents occurring on major urban arteries was 0.49 cent per vehicle-mile. Using Utah study data, it was estimated that the direct cost of accidents on the Interstate System would be only 0.13 cent per freeway vehicle-mile. Thus, there would be a savings in accident costs of 0.36 cent per vehicle-mile on streets of freeway design. Based on an estimated traffic volume of 100,000 vehicles daily by 1975, the savings in accident costs would approach $330,000 annually.

The significant point is that an accident cost savings of such magnitude should not be overlooked in justifying an investment of $20 million, as would be required in constructing a freeway parallel to State Street. Furthermore, the savings figure is on the conservative side because it does not include indirect costs relating to traffic accidents.

In this analysis, the reduction in traffic accidents on freeways was based on the California study ("The Economy of Freeways," by Lloyd Aldrich. City of Los Angeles, Street and Parkway Design Division (June 1953)) which indicated that there were five times fewer accidents on their freeways than on local streets. In addition, in the analysis, the accidents expected on the freeway were distributed as to type in accordance with those happening on the Detroit Expressway. This was done in order to isolate those types of accidents that could not occur on a freeway.

UTAH AND MASSACHUSETTS RESULTS COMPARED

The Utah State Road Commission has completed a study of the passenger-car phase of traffic accident costs. It was based on passenger cars registered by the Utah State Motor Vehicle License Bureau in 1955. A sample was selected from the registration list, a universe of 268,000 passenger cars. The registration sample was deemed to be of sufficient size to satisfactorily approximate the general accident experience of the motoring public, but in order to obtain more detailed information on fatal and nonfatal-injury accidents the state's accident files were sampled at a much higher rate than the registration list.

Only a small portion of the data collected in the Utah accident cost study is reported here (Tables 1-4) to provide a comparison of the number of traffic accidents and their costs in Utah and Massachusetts. (A discussion of the Massachusetts data may be found in the article "The Economic Costs of Motor-Vehicle Accidents," by Robie Dunman, HRB Bull. 208.) When comparing the values for the two states, it must be kept

TABLE 1

COMPARISON OF THE NUMBER OF MOTOR-VEHICLE TRAFFIC ACCIDENTS INVOLVING PASSENGER CARS IN UTAH DURING 1955 AND IN MASSACHUSETTS DURING 1953

Item of Comparison	Number of Accidents		Percent of Total		Number of Residents per Accident		Number of Registered Passenger Cars per Accident		Number of Licensed Operators per Accident		Number of Accidents per 100 Million Vehicle-Miles of Travel	
	Utah	Mass.	Utah	Mass.	Utah	Mass.	Utah	Mass.	Utah	Mass.	Utah	Mass.
Severity of accident:												
Fatal-injury	77	315	0.2	0.2	10,350	15,152	3,481	3,933	5,909	5,898	3.1	2.7
Non-fatal-injury	9,048	33,270	19.0	25.3	88	143	30	37	50	56	359	286
Property-damage-only	38,453	97,951	80.8	74.5	21	49	7	13	12	19	1,524	842
All accidents	47,578	131,536	100.0	100.0	17	36	6	9	10	14	1,886	1,131
Type of accident:												
Passenger-car collision with-												
Other motor vehicles	29,044	109,730	61.0	83.4	27	44	9	11	16	17	1,151	943
Pedestrians	1,792	5,848	3.8	4.5	445	809	150	210	254	315	71	51
Fixed objects	741	7,260	1.5	5.5	1,076	654	362	170	614	255	29	63
Other objects	11,921	6,464	25.1	4.9	67	746	22	194	38	290	473	55
Non-collision accidents	4,080	2,234	8.6	1.7	195	2,170	66	563	112	845	162	19
All accidents	45,578	131,536	100.0	100.0	17	36	6	9	10	14	1,886	1,131

TABLE 2

COMPARISON OF DIRECT COSTS OF MOTOR-VEHICLE TRAFFIC ACCIDENTS INVOLVING PASSENGER CARS IN UTAH DURING 1955 AND IN MASSACHUSETTS DURING 1953

Item of Comparison	Total Direct Cost		Percent of Total		Total Direct Cost: Per Accident		Per Capita		Per Passenger Car Registered		Per Licensed Operator		Per Mile of Road		Per 100 Million Vehicle-Miles of Travel	
	Utah	Mass.	Utah	Mass.	Utah	Mass.	Utah	Mass.	Utah	Mass.	Utah	Mass.	Utah	Mass.	Utah	Mass.
Severity of accident:	($1,000)	($1,000)													($1,000)	($1,000)
Fatal-injury	284	1,642	1.2	3.3	$3,690	$5,213	$ 0.36	$ 0.34	$ 1.06	$ 1.32	$ 0.62	$ 0.88	$ 9	$ 67	11	14
Non-fatal-injury	11,559	28,588	49 5	57.1	1,277	862	14.50	6.01	43.13	23.15	25.40	15.44	368	1,171	458	247
Property-damage-only	11,506	19,894	49.3	39.6	299	203	14.44	4.17	42.93	16.06	25.29	10.71	366	812	456	171
All accidents	23,349	50,224	100.0	100.0	491	382	29.30	10.52	87 12	40.53	51.31	27.03	743	2,050	925	432
Type of accident																
Passenger-car collision with—																
Other motor vehicles	17,401	41,816	74.5	83.3	599	381	21.83	8.76	64.93	33.75	38.24	22.50	554	1,707	690	360
Pedestrians	1,417	3,375	6.1	6.7	791	572	1.78	0.71	5.29	2.72	3.11	1.82	45	138	56	29
Fixed objects	271	3,023	1.2	6.0	366	414	0.34	0.63	1 01	2 44	0.60	1.63	8	123	11	26
Other objects	1,880	673	8.0	1.3	158	105	2.36	0.14	7.01	0.54	4.13	0.36	60	27	74	6
Non-collision accidents	2,380	1,337	10.2	2.7	583	606	2.99	0.28	8.88	1.08	5.23	0.72	76	55	94	11
All accidents	23,349	50,224	100.0	100.0	491	382	29.30	10.52	87.12	40.53	51.31	27.03	743	2,050	925	432

TABLE 3

COMPARISON OF THE NUMBER OF COLLISIONS BETWEEN PASSENGER CARS OR PASSENGER CARS AND OTHER MOTOR VEHICLES IN UTAH DURING 1955 AND MASSACHUSETTS DURING 1953, CLASSIFIED BY TYPE OF COLLISION

Type of Collision	Number of Collisions		Percent of Total		Number per 100 Million Vehicle-Miles of Travel	
	Utah	Mass.	Utah	Mass.	Utah	Mass.
Angle	9,911	53,320	34.1	48.6	393	458
Rear-end	10,580	22,501	36.4	20.5	419	193
Head-on	1,117	12,789	3.9	11.6	44	110
Sideswipe (same direction)	2,394	7,114	8.2	6.5	95	61
Sideswipe (opposite direction)	755	1,486	2.6	1.4	30	13
Turning movement	1,876	4,752	6.5	4.3	74	41
Parking maneuver and backing in traffic lane	2,411	7,768	8.3	7.1	96	67
All collisions	29,044	109,730	100.0	100.0	1,151	943

in mind that the base year of the Utah study was 1955, and for the Massachusetts study it was 1953. Because only a two-year difference was involved, no attempt was made to adjust the data to a common year.

The size of Utah is 82,346 sq mi, whereas in Massachusetts the area is 7,867 sq mi. In 1955, Utah had a population of 797,000; there were 268,000 registered passenger cars, 455,000 licensed drivers, 31,400 miles of highways and streets, and 2,523 million vehicle-miles of travel. During 1953, there were 4,773,000 persons living in Massachusetts, 1,239,000 registered passenger cars, 1,858,000 licensed drivers, 24,500 miles of highways and streets, and 11,628 million vehicle-miles of travel.

In comparing the accident rates and costs for the two states, it is quite evident that the results were influenced by such factors as population density, travel speeds, urban characteristics, etc. It is likely that many of the differences could be explained, but to interpret the accident experience of states so widely separated geographically and having such dissimilar characteristics is beyond the scope of this paper. Population density alone would be a major factor to consider in any analysis of traffic accidents. In Massachusetts there were 596 persons per square mile, as compared with 10 in Utah.

TABLE 4

COMPARISON OF DIRECT COSTS OF COLLISIONS BETWEEN PASSENGER CARS OR PASSENGER CARS AND OTHER MOTOR VEHICLES IN UTAH DURING 1955 AND MASSACHUSETTS DURING 1953, CLASSIFIED BY TYPE OF COLLISION

Type of Collision	Total Direct Cost		Percent of Total		Average Cost per Accident		Cost per 100 Million Vehicle-Miles of Travel	
	Utah	Mass.	Utah	Mass.	Utah	Mass.	Utah	Mass.
	($1,000)	($1,000)					($1,000)	($1,000)
Angle	6,596	17,386	37.9	41.6	$ 666	$ 327	261	150
Rear-end	6,058	10,842	34.8	25.9	573	482	240	93
Head-on	1,834	9,078	10.5	21.7	1,642	709	73	78
Sideswipe (same direction)	1,157	1,958	6.7	4.7	483	276	46	17
Sideswipe (opposite direction)	351	706	2.0	1.7	465	471	14	6
Turning movement	486	1,114	2.8	2.7	259	232	19	10
Parking maneuver and backing in traffic lane	919	732	5.3	1.7	381	94	36	6
All collisions	17,401	41,816	100.0	100.0	599	381	690	360

In spite of the dissimilarities of the two states, however, there is remarkable consistency in the relative distribution of accidents when classified according to severity and type. The most common method of comparison is to express the number of accidents and their cost in terms of 100 million vehicle-miles of travel. This is done in the last two columns of the tables. In general, accidents were costlier in Utah than in Massachusetts, regradless of severity or type of accident or type of collision.

An attempt to draw conclusions on the basis of the data presented here for two strikingly different states would not be justified, but certainly the results add significantly to the knowledge needed to develop national trends of traffic accidents.