Relationship of Accident Rate to Highway Shoulder Width

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● IN any discussion of the value of highway shoulders, their width always becomes a factor. The width requirement may be dependent on the presence of obstructions at the outer edge of the shoulder, such as guardrails and guide posts.

There is available, in the form of new tabulating punch cards, a summary of accident data for each control section of the state-maintained highway system in Connecticut. These punch cards include data on length of section, annual average daily traffic volume and annual vehicle miles; number of accidents, fatal accidents, fatalities and injuries, and amount of property damage; pavement, shoulder and median width and type, highway type and system; and miscellaneous items. With such information on punch cards, it is possible to compile many different tabulations in an attempt to show what relationship, if any, exists between these different factors. Since the data for four years (1951-1954) were available and since most of Connecticut's highways have paved shoulders, it was felt that there was a sufficient sample to establish the relationship of accident rate to shoulder width.

The next problem was to sort the punch cards prior to making tabulation listings, and it was done in the following manner: (1) the rural and urban sections; (2) by highway type such as two-lane, four-lane contiguous, four-lane divided with no control of access, four-lane expressways with full control of access, etc.; (3) by pavement surface width; (4) by shoulder type (grass and paved); and (5) by shoulder width. Separation by pavement surface type was not found to be significant. The great bulk of two-lane ce-

TABLE 1

ACCIDENT, MILEAGE AND TRAFFIC DATA AND ACCIDENT RATES BY VARIOUS PAVEMENT AND SHOULDER WIDTHS ON TWO-LANE CONNECTICUT HIGHWAYS (WITHOUT CONTROL OF ACCESS) FOR FOUR YEARS 1951-1954

Pavement surface width (ft)	Item	Paved shoulder width (feet)											Total or weighted average
		0	1	2	3	4	5	6	7	8	9	10	
14	No. of accidents	1	0	4	39	122	144	196	34	22			562
	Vehicle-miles[a]	0.002	0.011	0.023	0 181	0 706	0 734	0.593	0.129	0 075	0	0	2.454
	Avg daily traffic	200	700	400	500	1100	1500	1900	1200	1100			1200
	Accident rate[b]	500	0	170	220	170	200	330	260	290			230
16	No of accidents	11	2	17	43	116	66	55	138		6		454
	Vehicle-miles[a]	0 009	0 023	0.074	0 232	0 396	0 216	0.183	0.501	0	0 034	0	1 668
	Avg daily traffic	400	600	500	700	1200	1200	1300	3500		2100		1200
	Accident rate[b]	1200	90	230	190	290	310	300	280		180		270
18	No of accidents	13	23	43	254	410	455	127	52				1377
	Vehicle-miles[a]	0 022	0 097	0.166	1.009	1 456	1 818	0.438	0.253	0	0	0	5 259
	Avg daily traffic	400	600	600	1100	1500	2000	2300	4000				1500
	Accident rate[b]	590	240	260	250	280	250	290	210				260
20	No. of accidents	34	86	196	969	2321	3362	438	437	140	35		8018
	Vehicle-miles[a]	0.141	0 328	0 977	3.024	9.446	12 434	1 754	1 239	0 612	0.211	0	30.166
	Avg daily traffic	900	800	1000	1500	2500	4000	3300	5700	4600	5300		2700
	Accident rate[b]	240	260	200	320	250	270	250	350	230	170		270
22	No. of accidents	31	257	753	1536	834	194	187	144	670	85	142	4833
	Vehicle-miles[a]	0.155	1.034	2.944	5 927	2.725	0 901	0 489	0 523	2 462	0.449	0 510	18.119
	Avg daily traffic	800	1400	1200	1500	1600	3500	3200	2400	3800	6600	4500	1700
	Accident rate[b]	200	250	260	260	310	220	380	280	270	190	280	260
24	No of accidents	31	107	617	397	172			52	51		1	1428
	Vehicle-miles[a]	0 138	0.368	2 283	0.999	0 872	0	0	0.173	0.263	0	0.042	5.138
	Avg daily traffic	1100	1300	2100	3300	2300			5900	5100		4500	2300
	Accident rate[b]	220	290	270	400	200			300	190		20	280
Total or weighted average	No. of accidents	121	475	1630	3238	3975	4221	1003	857	883	126	143	16672
	Vehicle-miles[a]	0.467	1 861	6.467	11 372	15.601	16.103	3.457	2.818	3.412	0 694	0 552	62.804
	Avg daily traffic	800	1100	1300	1400	2000	3300	2600	3600	3800	5600	4500	2000
	Accident rate[b]	260	260	250	280	250	260	290	300	260	180	260	270

[a] hundred millions
[b] per hundred million vehicle-miles

ment concrete pavements are in the 20-ft pavement surface width group with shoulder widths of from 4 to 9 ft. The great majority of the other groups are made up of various black-top pavements. It is significant to note that all shoulders except grass shoulders are paved in Connecticut, and that the mileage of grass shoulders is small.

After running off a tabulation listing of all four years, it was found that sufficient samples for a variety of shoulder widths existed only in the rural, two-lane highway grouping. The size of the sample available for various combinations of pavement and shoulder widths is shown in Table 1. The first two values in each block of the table are the total number of accidents and the total number of vehicle-miles, respectively. The accident rate per hundred million vehicle-miles has been computed and is shown as the fourth value in each block. The average daily traffic volume during the four-year period is also shown. It can be seen that this average volume generally increases with both the pavement and shoulder width, which is perhaps a reflection of design standards being related to the traffic volume over the past years.

TABLE 2

ACCIDENTS, MILEAGE AND TRAFFIC DATA AND ACCIDENT RATES BY TOTAL SURFACE WIDTH ON TWO-LANE CONNECTICUT HIGHWAYS (WITHOUT CONTROL OF ACCESS) FOR FOUR YEARS 1951 THROUGH 1954

Total surface width (feet)	Total number of accidents	Total vehicle-miles (hundred millions)	Average daily traffic volume	Accidents per hundred million vehicle-miles
14	1	0 002	200	500
16	11	0 020	500	550
18	19	0 068	400	280
20	113	0 493	600	230
22	325	1 587	900	200
24	998	4 288	1,200	230
26	2,501	8 601	1,400	290
28	5,018	19 786	2,000	250
30	4,880	17 172	3,100	280
32	856	3 780	3,100	230
34	630	1 762	4,600	360
36	284	1 135	3,300	250
38	757	2 846	4,000	270
40	136	0 712	6,000	190
42	142	0 510	4,500	280
44	1	0 042	4,500	20
Total or weighted average	16,672	62 804	2,000	270

Table 1 shows that there is no definite relationship of accident rates to shoulder widths. The accident rates vary (in the neighborhood of 270) and do not in any case follow a consistent trend. The same is true of the relationship of the accident rate to the pavement width.

To determine if some other relationship exists, Table 2 was prepared to show the relationship of the accident rate to the total surface width (pavement plus shoulders). The values in Table 2 are a summary of values in Table 1 but arranged in different order. Again, no significant trend or continuous relationship exists among those values which have a substantial amount of data.

It can be seen that while the average daily traffic volumes have a general relationship to the pavement, shoulder, and total surface widths, there is no relationship with the accident rate. Of course that rate is already related to the traffic volume.

In conclusion, this data shows no significant relationship between accident rate and shoulder width. Accident rates may be dependent on other factors, such as side friction, alignment, pavement condition or crown, or other factors not available in these records. More data on 8-, 9-, and 10-ft shoulders is necessary to find a trend. Further breakdown of the data only reduces the size of samples to the point of no significance. The records show that side friction is an important factor, since a definite relationship between accident rate and control of access has been established. Perhaps human behavior on highways overshadows all design factors.

It appears from this data that further analysis by type of accident would be necessary in an effort to establish optimum shoulder width solely from the standpoint of accidents. Shoulders may be partially justified by increased roadway capacity and mental ease for the driver, but those considerations have not been treated in these inconclusive statistics.