Factors Related to Traffic Death Rates

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● CERTAIN states have low traffic death rates year after year. On the other hand, some states consistently have high rates year after year. This study is an effort, through statistical techniques, to determine the characteristics of the various states that are related to the traffic death rates. In other words what are the characteristics of states with high death rates compared to states with low death rates?

As a first step in this analysis, correlation coefficients were calculated between the traffic death rates for 1952 and 30 factors which it was felt might bear some relationship to the traffic death rate. The seven factors that gave the highest simple correlations with the death rate are listed below.

Factor	Correlation with the death rates
Percent of all roads and highways that is surfaced	-0.5992
Population density	-0.5849
Percent of total state highway mileage that is rural	+0.5710
Percent of population that is urban	-0.5159
Per capita consumption of malt beverages	-0.4785
Percent increase in motor vehicle registration	+0.4460
Percent of high schools with driver education	-0.4439

A multiple correlation coefficient between the death rate and the 12 factors most closely related to the traffic death rate was computed. The coefficient was 0.8800.

Since many of the factors contributed very little to the multiple correlation, another multiple correlation coefficient was computed using the six factors out of the twelve that contributed most to the multiple correlation coefficient. The multiple correlation coefficient using these six factors was 0.8343 indicating that 70 percent of the variability among the states in 1952 could be accounted for by these six factors alone. This same formula with 1953 data was used for predicting the 1953 traffic death rates. The correlation between the actual and predicted rates for 1953 was 0.90. These factors and the weight given each in predicting the traffic death rates are listed below.

Factor	Beta Coefficient	Percent of Total Weight
Percent of total state highway mileage that is rural	0.5215	30.6
Percent of increase in motor vehicle registration	0.3542	20.8
Extent of motor vehicle inspection	-0.2831	16.6
Percent of state administered highway mileage that is surfaced	-0.2597	15.3
Average yearly minimum temperature	0.1447	8.5
Income per capita	-0.1395	8.2
		100.0

From the above it is apparent that states with high traffic death rates also have: (1) a higher percentage of highway mileage that is rural, (2) a greater increase in motor vehicle registration, (3) less motor vehicle inspection, (4) a smaller percent of the state highways surfaced, (5) a higher temperature, and (6) a smaller income per capita.

This study provides a new and better criterion than the simple death rate for evaluating the effect of certain factors on the death rate.

The extraneous effect of these six factors on the death rate can now be eliminated by subtracting the actual rate from the predicted rate. This difference can then be correlated with some other factor, such as normal driving speeds in the various states, to get a measure of the effect of speed on the accident rate. This gives a better criterion

than correlating speeds with the simple death rate since the simple death rate is so seriously affected by the six factors previously mentioned.

INTRODUCTION

Traffic death rates (deaths per 100,000,000 vehicle miles) vary widely among the 48 states. This variation apparently is not the result of chance since some states consistently have low rates year after year, while other states have high rates year after year. Four examples are given below:

	High Rate States		Low Rate States	
Year	New Mexico	South Carolina	Massachusetts	Rhode Island
1945	15.1	17.2	7.2	6.6
1946	13.7	16.5	5.5	4.8
1947	11.8	12.4	5.2	4.7
1948	11.4	11.5	4.2	2.9
1949	10.1	11.0	4.2	3.0
1950	9.0	12.3	4.3	3.8
1951	12.9	12.0	3.9	3.0
1952	10.9	12.0	3.7	3.0
1953	11.7	8.2	3.8	2.4
1954	10.3	11.2	4.1	2.9

SOURCE: Accident Facts, National Safety Council

The same information is shown graphically in Figure 1. Further evidence that these differences are not due to chance is indicated by the correlation of state traffic death rates for one year with the rates for the following year. Correlations for several years are given below:

Years	Correlation Coefficient[a]
1949-50	0.9121
1950-51	0.9377
1951-52	0.9389
1952-53	0.9490

[a] 1.0000 indicates a perfect correlation in which the rates for one year would be exactly proportional to the rates for the following year. A "0" correlation would indicate no relationship.

Since the rates vary greatly from state to state and since they are fairly consistent from year to year the question arises: Why do some states consistently have high traffic death rates while others consistently have low rates? This study is an effort to determine those factors whice are most highly related to the state death rates. These factors are generally of two types: (1) physical factors such as weather, population characteristics, etc, over which public and civic officials have little control and (2) education and enforcement programs which are aimed at controlling the driving and walking behavior of the individual.

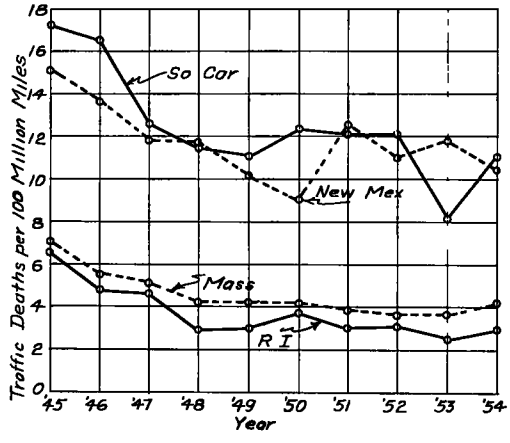

Figure 1. Some states consistently have high traffic death rates while others consistently have low death rates.

FACTORS RELATED TO TRAFFIC DEATH RATES

In this analysis a large number of factors were studied in an effort to determine which were most highly related to the death rate (see Table 1). A second analysis

TABLE 1

CORRELATION OF VARIOUS FACTORS WITH THE TRAFFIC DEATH RATE

Factor	Average	Correlation with 1952 Traffic Death Rate
Non-pedestrian death rate - 1952 (Non-pedestrians killed per 100,000 population - AAA and Accident Facts, 1953)	21.5 per 100,000 pop.	0.7631
Percent of all roads and highways that is surfaced - 1952. (Bureau of Public Roads, Table M-3, 1953)	60.6%	-0.5992
Population Density - 1950. (Persons per square mile)	110.1 per sq mile	-0.5849
Percent of total state highway mileage that is rural - 1952 (Bureau of Public Roads, Table M-3, 1953)	88.1%	0.5710
Percent of population that is urban - 1950	55.0%	-0.5159
Consumption of malt beverages - 1952 (Table 41, Brewer's Almanac, 1954)	14.7 gal. per capita	-0.4785
Percent increase in motor vehicle registration - 1951-52, (Bureau of Public Roads, Table MV-1, Sept. 1953)	3.1%	0.4460
Percent of high schools with driver education - 1952, (Report of Assn of Casualty and Surety Cos., Sept. 3, 1953)	45.4%	-0.4439
Rating of follow-up program on dangerous drivers (Larger figure represents better program. From "Changing Times," Kiplinger Magazine, March, 1951)	2.2	-0.4301
Percent of state administered highway mileage that is surfaced - 1952 (Bureau of Public Roads, Table SM-1, 1952)	93.7%	-0.4230
Pedestrian death rates - 1952 (Deaths per 100,000 pop.) Pedestrian Program, AAA	5.1 per 100,000	0.3949
Income per capita - 1952 (World Almanac) Hundreds of dollars	$14	-0.3911
Quality of driver testing ("Changing Times," Kiplinger Magazine, March, 1951, larger number indicates better testing program)	2.5	-0.3841
Amount spent per dangerous driver on follow-up program - 1950 (Source, "Changing Times," Kiplinger Magazine, March 1951)	$0.047 per driver	-0.3879
Average yearly minimum temperature, (Climatic Guide, AAA, Wash., D.C.)	44.1 degrees	0.3049
Driver education rating - 1952 (Assn of Casualty and Surety Cos, N.Y.C., N.Y. Higher number indicates a better rating.)	100.8	-0.3038
Extent of motor vehicle inspection - 1951 (The Book of the States, 1952-53) 10 indicates states requiring inspection 7 indicates states requiring partial inspec. 3 indicates states requiring spot inspec. 1 indicates states requiring no inspection	4.8	-0.2934

TABLE 1 (Continued)

Factor	Average	Correlation with 1952 Traffic Death Rate
Percent of increase in gas consumption 1952 over 1951 (Bureau of Public Roads, Table G-2, 1952)	5.62%	0.2699
Percent of increase in population 1950 over 1940	14.6%	0.2254
Average annual precipitation (Climatic Guide, AAA)	33.6 inches	-0.2105
State disbursements for safety education 1952, (Bureau of Public Roads, Table SF-4, 1953)	$0.027 per capita	0.2087
State disbursements for highway construction - 1952 (Bureau of Public Roads, Table SF-4, 1953)	$15.81 per capita	0.2316
Disbursements for highway maintenance 1952 (Bureau of Public Roads, Table SF-4, 1953)	$5.54 per capita	0.1858
Total state population - 1950	3,072,910	-0.1839
Wine consumption - (Wine Institute Bulletin No. 710, May 28, 1954)	0.71 gal. per capita	-0.1127
Disbursements for state highway police 1952 (Bureau of Public Roads, Table SF-4, 1953)	0.71 per capita	0.1069
Percent of population that is non-drivers 1952 (Automobile Facts and Figures, 34th Ed., 1954)	53.0%	-0.0863
State highway police per 100,000 population - 1951 (The Book of the States, 1952-53)	10.6 per 100,000 pop.	-0.0837
Consumption of distilled spirits - 1952 (1953 Annual Statistical Review, The Distilled Spirits Industry)	1.18 gal. per capita	-0.0555
Expenditure for Testing for Driver's License - 1950 ("Changing Times," Kiplinger Magazine, March, 1951)	$0.108 per driver	-0.0313

was made to determine the combination of factors most closely related to the death rate.

The simple correlation coefficients in Table 1 do not tell the whole story. If several important factors are put together their over-all relationship to the traffic death rate will be greater than that of any individual factor. Below are listed the factors most highly related to the traffic death rate:

Factor	Correlation with Traffic Death Rate	Beta Coefficient	Percent of Total Weight
Percent of all roads and highways that is surfaced	-0.5992	-0.1075	4.3
Population density	-0.5849	0.1077	4.0
Percent of total highway mileage that is rural	0.5710	0.6061	24.0
Percent of population that is urban	-0.5159	0.1140	4.5
Consumption of malt beverages	-0.4785	0.1560	6.2
Percent increase in motor vehicle registration	0.4460	0.3359	13.3
Percent of high schools with driver education	-0.4439	-0.0023	0.1

Factor	Correlation with Traffic Death Rate	Beta Coefficient	Percent of Total Weight
Follow-up program on dangerous drivers	-0.4301	-0.1743	6.9
Percent of state administered highway mileage that is surfaced	-0.4230	-0.3013	11.9
Income per capita	-0.3911	-0.2375	9.4
Average yearly minimum temperature	0.3049	0.1968	7.8
Extent of motor vehicle inspection	-0.2934	-0.1909	7.6
			100.0

By the process of multiple correlation it is possible to determine the weight which should be given to each of these factors to obtain the highest correlation with the traffic death rate. The Beta Coefficient represents the relative weight assigned to each factor. If these weights are used then the multiple correlation between these factors and the traffic death rate becomes 0.8800.

SIX FACTORS ACCOUNT FOR 70 PERCENT OF VARIATION IN TRAFFIC DEATH RATES

In looking over the weights given to the various factors it is evident that a number of factors contribute very little to the multiple correlation coefficient. In an effort to simplify any prediction formula another multiple correlation coefficient was computed, using only the following six factors which are given the most weight:

Factors	Correlation with Traffic Death Rate	Beta Coefficient	Percent of Total Weight
Percent of total highway mileage that is rural	0.5710	0.5215	30.6
Percent of increase in motor vehicle registration	0.4460	0.3542	20.8
Percent of state administered highway mileage that is surfaced	-0.4230	-0.2597	15.3
Income per capita	-0.3911	-0.1395	8.2
Average yearly minimum temperature	0.3049	0.1447	8.5
Extent of motor vehicle inspection	-0.2934	-0.2831	16.6
			100.0

This information is shown graphically in Figure 2.

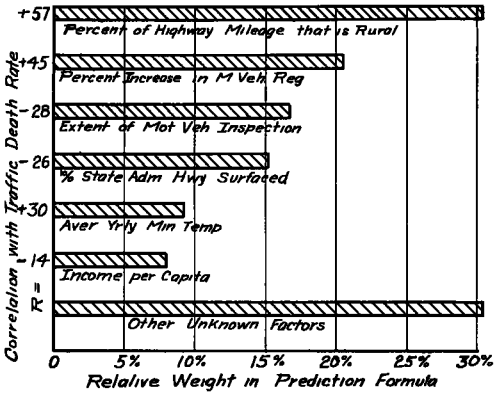

Figure 2. Six factors accounted for 0.70 percent of the variation in traffic death rates among states during 1952.

FORMULA FOR PREDICTING DEATH RATES

From the beta coefficients in the above table a formula was developed for predicting the 1952 traffic death rate using these six factors. This formula becomes:

Traffic Death Rate = 3 481		Sample Computation For Rhode Island
+0 105	Percent of highway mileage that is rural	4 317
+0 274	Percent increase in motor vehicle registration	1 123
-0 0624	Percent of state administered highway mileage that is surfaced	-6 114
-0 000863	Income per capita	-1 381
+0.03659	Average yearly minimum temperature	1 500
-0 14651	Extent of motor vehicle inspection	-0 146
		2 780

This formula was used to compute the expected rate for 1952. Both the actual and expected rates for 1952 are given in

TABLE 2

INTERCORRELATIONS OF FACTORS RELATED TO TRAFFIC DEATH RATES

Factor	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1 Total traffic mileage death rate (1952)	x																					
2 Non-pedestrian population death rate (1952)	7631	x																				
3 Percent of all highways that is surfaced	- 5982	- 6771	x																			
4 Population density	- 5849	- 5414	5854	x																		
5 % of total hwy mileage that is rural	8710	8581	- 5390	- 9137	x																	
6 % of population that is urban	- 8159	- 3392	4893	- 6631	- 7161	x																
7 Consumption of malt beverages	- 4785	- 1371	4070	4205	- 3889	6806	x															
8 % increase of motor vehicle reg '51 - 52	4460	3628	- 3025	0324	- 0632	0370	- 1548	x														
9 % of schools with driver education	- 4439	- 3092	3682	5149	- 4567	6405	5843	- 0681	x													
10 Follow-up programs on dangerous drivers	- 4301	- 2567	2574	3959	- 3962	4513	2828	0316	5018	x												
11 % of state adm hwy mileage surfaced	- 4230	- 3226	3628	1357	- 1797	3669	3076	- 2129	- 0503	- 1502	x											
12 Pedestrian death rate	3949	2269	0831	0643	- 0912	2979	0722	6138	1270	0563	- 3430	x										
13 Income per capita	- 3911	0138	3203	3744	- 3920	6431	6138	0068	5688	3309	1619	2113	x									
14 Money spent for follow-up on dangerous drivers	- 3879	- 1453	1978	3058	- 1905	2105	2737	- 0012	3665	5064	- 0825	- 1501	2990	x								
15 Rating on quality of driver testing	- 3841	- 3310	2319	3158	- 3642	3242	0349	0404	3485	7647	- 0808	0687	1550	4029	x							
16 Average yearly minimum temperatures	3049	- 0584	0162	- 0329	- 1964	- 0352	- 4528	3974	- 3824	- 1037	- 6217	3472	- 3655	- 2450	1961	x						
17 Driver education program rating	- 3038	- 0627	2508	2809	- 1404	4078	4443	- 1017	6809	4450	- 0397	- 8032	5887	3744	2922	- 2610	x					
18 Extent of auto inspection	- 2934	- 2741	2584	1052	- 0097	0702	0017	- 0456	0191	4615	- 1115	0605	0251	3063	3806	- 1013	0848	x				
19 % of increase in gas consumption '51-'52	3699	2525	- 0326	0159	- 1108	1138	0136	6320	1065	1864	- 2735	5833	0707	0313	2283	4642	0790	0704	x			
20 Disbursements for new hwy construction	2316	5796	- 3909	- 2373	3024	- 1295	1388	3523	1051	0959	- 2074	0639	8561	1586	0031	- 2662	1899	1269	0851	x		
21 % of increase in population '40-'50	2264	3274	- 0399	- 0598	- 1195	3870	3698	6968	2093	2784	- 0745	6533	4206	0634	2899	2617	1336	0321	5685	2963	x	
22 Average yearly total precipitation	- 2105	- 5943	5360	3342	- 3685	0227	- 2415	0135	- 1597	- 0017	0947	- 0435	- 2933	0137	1796	6006	- 3453	1361	0228	- 4183	- 3020	x
23 Disbursements for safety education	2087	3109	- 1118	- 1498	1039	0725	- 0351	0861	- 0081	2986	- 1302	1589	0472	1750	2039	- 1352	1394	2112	0694	4 2645	2272	- 3396

TABLE 3

DATA FOR PREDICTING 1952 TRAFFIC DEATH RATES

State	% of state highway mileage that is rural	% of increase in motor vehicle reg	% of state highway mileage surfaced	Income per capita ($100)	Average yearly minimum temp	Extent of motor vehicle inspection	Traffic Death Rates 1952 Predicted	1952 Actual	1953 Predicted	1953 Actual
Alabama	89	8 8	89	10	56	7	9 9	9 7	10 3	9 5
Arizona	94	12 7	93	14	56	1	11 7	10 6	10.6	9 8
Arkansas	93	1 6	97	9	53	1	8 7	9 1	9.5	8 3
California	84	4 6	98	20	52	1	7 5	7.4	7 8	6 6
Colorado	94	3 8	85	16	37	10	7 6	6.9	7 0	5 8
Connecticut	69	3 5	100	20	41	3	4.8	3.2	5 0	3 6
Delaware	87	4 5	82	22	45	10	7 0	6 0	8 2	7 5
Florida	77	8 4	99	13	64	1	8 8	7.8	9 3	7 5
Georgia	90	6 2	88	11	54	1	10 0	9 1	9.7	7 9
Idaho	96	4 1	92	14	39	1	9 1	8 9	9.1	7 5
Illinois	83	2 1	100	19	43	7	5 5	7 3	6.0	7 2
Indiana	88	1 0	100	16	44	1	6 9	8 0	7 8	7 4
Iowa	91	-1 4	100	15	40	7	5 6	5 2	6 7	5 7
Kansas	94	2 7	97	16	44	1	8 1	7 3	8 6	7 0
Kentucky	94	4 4	99	11	48	1	9 1	10 0	9 5	10 4
Louisiana	86	2 8	100	12	62	1	8 2	9 2	9 5	9 1
Maine	95	2 9	98	13	33	10	6 8	4 5	6 3	5 3
Maryland	86	6 0	100	17	47	10	6 7	7 0	6.4	6 5
Massachusetts	73	2 5	100	17	42	10	4 2	3 7	4.4	4 0
Michigan	87	0 3	99	18	36	1	6 2	7 3	8.1	7 4
Minnesota	90	-0 8	94	14	36	7	6 0	5 2	7 3	5 9
Mississippi	94	2 9	100	8	56	10	7 8	8 4	8 7	7 5
Missouri	89	0 8	100	15	45	1	7 0	6 5	7 8	6 4
Montana	97	2 4	93	16	33	7	7.4	9.3	8 7	8 4
Nebraska	95	1 1	99	15	41	1	7 7	5.8	7 9	5 9
Nevada	98	8 8	86	22	36	1	10 1	11.7	11.4	10 3
New Hampshire	91	1 6	100	15	33	10	5 7	4 4	6.8	4 9
New Jersey	59	4 0	95	19	43	10	3 3	4 7	3.5	4 1
New Mexico	97	5 5	75	13	41	10	9.4	10 9	11 0	11 5
New York	79	1 6	91	20	41	1	6.2	5 9	6.9	6 0
N. Carolina	89	3 5	78	10	51	10	8 5	8.5	9.3	8 2
N Dakota	98	0 7	95	12	29	1	7 9	8 1	8.4	7 6
Ohio	84	3 0	100	18	43	1	6.8	6 8	7.0	6 5
Oklahoma	92	2 7	97	12	49	1	8 5	7 1	8 8	6 3
Oregon	92	3 3	91	17	44	7	7.5	6.8	7.8	6 0
Pennsylvania	84	2 5	90	17	44	10	6 1	5.5	6 4	5.1
Rhode Island	41	4 1	98	16	41	1	2.8	3 0	2.8	2 8
S Carolina	92	4 8	69	10	54	1	11.1	12 0	10 7	11 0
S Dakota	98	-0 6	97	12	35	1	7 7	7 4	8 3	6 5
Tennessee	93	2 4	99	11	51	7	7 6	8 4	10 3	8.3
Texas	88	-0 2	100	14	57	7	6.3	7 2	8.0	6 6
Utah	88	2 5	87	14	38	10	6 7	8 8	7 6	7 3
Vermont	94	1 6	100	13	36	10	6 3	5.1	6 3	5 8
Virginia	92	5 4	93	13	50	10	8 1	8 3	7 9	7 5
Washington	89	1 7	99	18	45	10	5 8	6 2	7.0	5 1
W Virginia	92	0 9	61	12	41	3	9 6	8 1	10.3	8 7
Wisconsin	90	0 3	100	16	39	1	6.7	7 5	7.9	7.1
Wyoming	97	3 4	99	16	30	1	8.0	9.2	8.3	9 1

Table 3. The correlation between these two sets of figures was 0. 8343.

With a multiple correlation coefficient of 0. 83 it is evident that about 70 percent of the variation in traffic death rates among the various states can be accounted for by the six factors considered. A high correlation coefficient does not necessarily mean that one factor is the cause of another. Both factors may be the result of a third factor.

This relationship is further illustrated in Figure 3.

As a matter of interest, the correlation between the predicted rate for 1952 and the actual rate for 1953 was 0. 8475 indicating that factors highly related to traffic death rates in 1952 were at least as closely related to the death rates in 1953.

The death rate for 1953 was also predicted by using the above formula but substituting 1953 information that was available. This included the following: (1) percent of total state mileage that is rural, (2) percent of increase in motor vehicle registration 1952-53, (3) percent of state administered highway mileage that is surfaced, and (4) income per capita.

The correlation between the actual and predicted rates for 1953 was 0. 90 indicating that about 80 percent of the variation among the states could be accounted for by these six factors (see Figure 4).

The use of this formula in predicting expected rates can best be illustrated by taking two extreme cases illustrated in Figure 3. Rhode Island had an actual rate of 3. 0 in 1952, the lowest of all 48 states. The predicted rate based on the six factors in the formula was 2. 8. In other words, Rhode Island had about the death rate that would be expected.

On the other hand, South Carolina had the highest actual rate 12. 0 and the second highest predicted rate, 11. 1. Why are these two states on opposite ends of the scale? This question is answered by comparing the two states on the six factors included in the formula for predicting traffic death rates.

	Rhode Island	South Carolina
Percent of state administered highways that is rural	+41%	+92%
Percent increase in motor vehicle registration	+41	+48
Extensiveness of motor vehicle inspection	- 1	- 1
Percent of state administered highway mileage that is surfaced	-98	-69
Average yearly minimum temperature	+41	+54
Income per capita (hundreds of dollars)	-16	-10

Plus factors are those which tend to increase the predicted rate

In each case, except motor vehicle inspection, Rhode Island has the advantage. Even though the actual death rate of South Carolina is four times as great as Rhode Island both rates are about what you would expect from the character of the two states with respect to the six factors considered. In other words a high death rate does not necessarily indicate that the state is doing a poor job.

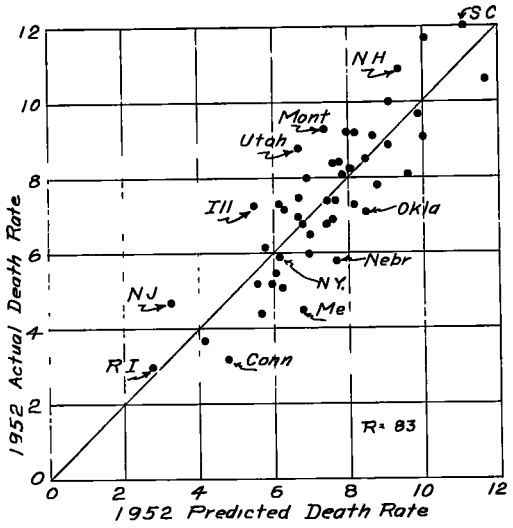

Figure 3. For 1952 the correlation between the actual and predicted traffic death rate was 0.83.

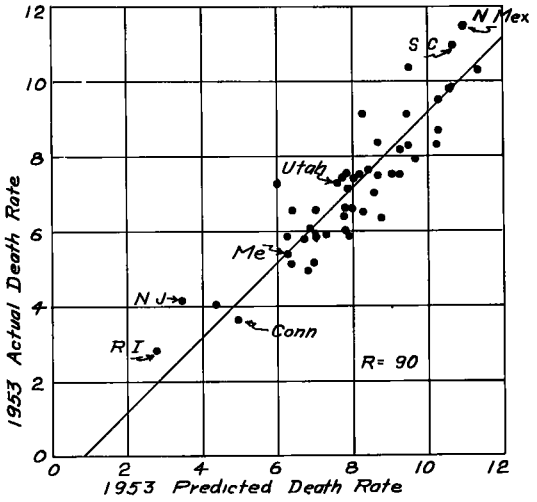

Figure 4. For 1953 the correlation between the actual and predicted traffic death rate was 0.90.

Figure 4 above is based on the following information:

A. Percent of highway mileage that is rural - 1953,

B. Percent increase in motor vehicle registration - 1952-53,

C. Percent of state administered highway mileage that is surfaced - 1953,

D. Income per capita - 1953,

E. Average yearly minimum temperature,

F. Extent of motor vehicle inspection - 1951.

TABLE 4

RANKING OF STATES BY ACTUAL DEATH RATES COMPARED TO EXPECTED RATES

Rank	State	Predicted Rate Minus Actual Rate
1	Maine	+2.3
2	Nebraska	+1.9
3	Connecticut	+1.6
4	West Virginia	+1.5
5	New Hampshire	+1.3
6	Arizona	+1.1
7	Delaware	+1.0
7	Florida	+1.0
8	Georgia	+0.9
9	Kansas	+0.8
9	Minnesota	+0.8
9	Vermont	+0.8
10	Colorado	+0.7
11	Oregon	+0.7
11	Oklahoma	+0.6
12	Pennsylvania	+0.6
13	Massachusetts	+0.5
13	Missouri	+0.5
14	Iowa	+0.4
15	New York	+0.3
15	South Dakota	+0.3
16	Alabama	+0.2
16	Idaho	+0.2
17	California	+0.1
18	North Carolina	0
18	Ohio	0
19	North Dakota	-0.2
19	Rhode Island	-0.2
19	Virginia	-0.2
20	Maryland	-0.3
21	Arkansas	-0.4
21	Washington	-0.4
22	Mississippi	-0.6
23	Tennessee	-0.8
23	Wisconsin	-0.8
24	Kentucky	-0.9
24	South Carolina	-0.9
24	Texas	-0.9
25	Louisiana	-1.0
26	Indiana	-1.1
26	Michigan	-1.1
27	Wyoming	-1.2
28	New Jersey	-1.4
29	New Mexico	-1.5
30	Nevada	-1.6
31	Illinois	-1.8
32	Montana	-1.9
33	Utah	-2.1

USE OF THE PREDICTED RATES

Death rates are frequently used for comparative purposes. For example, it may by desirable to obtain some measure of the relationship between speed limits and the death rate. Erroneous conclusions will result if the actual death rate only is considered. In such a study all states would be considered, but for illustrative purposes we may compare two states. Oklahoma has a speed limit of 65 and a death rate of 7.1. Massachusetts has a speed limit of 40 and a death rate of 3.7. On the surface it looks like a lower speed limit is associated with a lower death rate. Actually, however, by means of the prediction formula, we find that Massachusetts and Oklahoma both had a rate below that expected when the six factors in the formula are considered. Massachusetts has a rate 0.5 below that expected and Oklahoma, 1.3 below that expected. Therefore, when other factors are taken into consideration, Oklahoma has a better record than Massachusetts. The data do not substantiate the original conclusion that a lower speed limit is associated with a lower death rate.

In studying other factors to determine their relationship to or affect on the death rate, it seems much more reasonable to use as a basis the amount the actual rate is below or above the expected rate rather than the actual death rate by itself. By doing this the effect of extraneous factors can be reduced and the net effect of the special factor studied can be more accurately determined.

In Table 4 the states have been ranked in order by subtracting the actual rate from the predicted rate. States with a large positive difference are at the top of the list, indicating that their actual rates were much below the expected rates, the expected rates being based on the six factors previously mentioned.

In making an evaluation of the relationship to or affect on the death rate of a given program, it would seem more reasonable to use the rankings of the states in Table 4 rather than the ranking of states based on the actual death rates.

MISCELLANEOUS RELATIONSHIPS

In this analysis 253 simple correlation coefficients were computed (see Table 2).

Some of the relationships are quite substantial and of considerable interest. Some of the more significant relationships are briefly summarized below:

1. A high non-pedestrian death rate is associated with:
    a. a high total traffic death rate
    b. a small percentage of highways surfaced
    c. a low population density
    d. a high percentage of highway mileage that is rural
    e. a high expenditure of funds for new highway construction
    f. a low precipitation
2. A high percentage of the highways that is surfaced is associated with:
    a. a low non-pedestrian death rate
    b. a low population density
    c. a high percentage of state highways that is rural
    d. a high per capita cost for highway construction
    e. a low annual precipitation
3. A high population density is associated with:
    a. a low non-pedestrian death rate
    b. a high percentage of highways that is surfaced
    c. a low percentage of state highways that is rural
    d. a high percentage of population that is urban
    e. a high percentage of schools with driver education
4. States that have a high percentage of state mileage that is rural also have:
    a. A higher non-pedestrian death rate
    b. a lower percentage of highways surfaced
    c. a lower population density
    d. a smaller percentage of population that is urban
5. States that have a high percentage of population that is urban also have:
    a. a greater population density
    b. a lower percentage of highways that is rural
    c. a greater per capita consumption of malt beverages
    d. a larger percentage of schools with driver education
6. States that have a high per capita consumption of malt beverages also have:
    a. a higher percent of the population that is urban
    b. a larger percentage of schools with driver education
    c. a greater income per capita
7. States with the greatest increase in motor vehicle registration also have:
    a. a higher pedestrian death rate
    b. a greater increase in gasoline consumption
    c. a greater increase in population
8. States with a higher percentage of schools giving driver education also have:
    a. a greater population density
    b. a greater percent of population that is urban
    c. a greater per capita consumption of malt beverages
    d. a greater income per capita
9. States with better follow-up programs on dangerous drivers also have:
    a. a higher percentage of schools with driver education
    b. more money spent on follow-up of dangerous drivers
    c. a better driver testing program
10. States with a high pedestrian death rate also have:
    a. a greater increase in motor vehicle registration
    b. a poorer driver education program
    c. a greater increase in gasoline consumption
    d. a greater increase in population
11. States that spend more to follow up dangerous drivers also have:
    a. a better follow-up program on dangerous drivers
12. States with better driver testing programs also have:
    a. better follow-up programs on dangerous drivers

13. States that have warmer climate also have:
    a. more precipitation
14. States with a better driver education program also have:
    a. better follow-up programs for dangerous drivers
    b. a lower pedestrian death rate
    c. more income per capita
15. States with the greatest increase in gasoline consumption also have:
    a. a greater increase in motor vehicle registration
    b. a higher pedestrian death rate
    c. a greater increase in population
16. States that spend more per capita for new highway construction also have:
    a. a higher non-pedestrian death rate
17. States with the greatest increase in population also have:
    a. a greater increase in motor vehicle registration
    b. a higher pedestrian death rate
    c. a greater increase in gasoline consumption
18. States with heavier precipitation also have:
    a. a lower non-pedestrian death rate
    b a higher percentage of highway that is surfaced
    c. a higher average temperature