PUBLIC ROADS

A JOURNAL OF HIGHWAY RESEARCH

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF PUBLIC ROADS

VOL. 16, NO. 1 ▽ MARCH 1935

YOSEMITE PARK FROM PORTAL OF WAWONA HIGHWAY TUNNEL

For sale by the Superintendent of Documents, Washington, D. C. - - - - - - - - - - - - - - See page 2 of cover for prices

PUBLIC ROADS ▸▸▸ *A Journal of Highway Research*

Issued by the

UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF PUBLIC ROADS

Volume 16, No. 1 March 1935

The reports of research published in this magazine are necessarily qualified by the conditions of the tests from which the data are obtained. Whenever it is deemed possible to do so, generalizations are drawn from the results of the tests; and, unless this is done, the conclusions formulated must be considered as specifically pertinent only to described conditions

In This Issue

Page

Broadening the Highway Program 1

A Study of the Lives of Brick-on-Concrete Pavements 3

The Rising Accident Rate 7

Regulation of Outdoor Advertising Upheld in Massachusetts Court Decision 12

THE BUREAU OF PUBLIC ROADS - - - - - - - - - Willard Building, Washington, D. C.

REGIONAL HEADQUARTERS - - - - - - - - - - - - - - - - Mark Sheldon Building, San Francisco, Calif.

▼

DISTRICT OFFICES

DISTRICT No. 1. Oregon, Washington, and Montana.
Post Office Building, Portland, Oreg.

DISTRICT No. 2. California, Arizona, and Nevada.
Mark Sheldon Building, 461 Market St., San Francisco, Calif.

DISTRICT No. 3. Colorado, New Mexico, and Wyoming.
237 Custom House, Nineteenth and Stout Sts., Denver, Colo.

DISTRICT No. 4. Minnesota, North Dakota, South Dakota, and Wisconsin.
907 Post Office Building, St. Paul, Minn.

DISTRICT No. 5. Iowa, Kansas, Missouri, and Nebraska.
Saunders-Kennedy Building, Omaha, Nebr.

DISTRICT No. 6. Arkansas, Louisiana, Oklahoma, and Texas.
Room 502, United States Courthouse, Fort Worth, Tex.

DISTRICT No. 7. Illinois, Indiana, Kentucky, and Michigan.
South Chicago Post Office Building, Chicago, Ill.

DISTRICT No. 8. Alabama, Georgia, Florida, Mississippi, South Carolina, and Tennessee.
Post Office Building, Montgomery, Ala.

DISTRICT No. 9. Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont.
Federal Building, Troy, N. Y.

DISTRICT No. 10. Delaware, Maryland, North Carolina, Ohio, Pennsylvania, Virginia, and West Virginia.
Willard Building, Washington, D. C.

DISTRICT No. 11. Alaska.
Room 419, Federal and Territorial Building, Juneau, Alaska.

DISTRICT No. 12. Idaho and Utah.
Federal Building, Ogden, Utah.

Because of the necessarily limited edition of this publication it is impossible to distribute it free to any person or institutions other than State and county officials actually engaged in planning or constructing public highways, instructors in highway engineering, and periodicals upon an exchange basis. At the present time additions to the free mailing list can be made only as vacancies occur. Those desiring to obtain PUBLIC ROADS can do so by sending $1 per year (foreign subscription $1.50), or 10 cents per single copy, to the Superintendent of Documents, United States Government Printing Office, Washington, D. C.

CERTIFICATE: By direction of the Secretary of Agriculture, the matter contained herein is published as administrative information and is required for the proper transaction of the public business

BROADENING THE HIGHWAY PROGRAM

By THOS. H. MACDONALD, Chief, Bureau of Public Roads [1]

TO AN AUDIENCE composed of those engaged in the actuality of highway improvement, including all of its phases, it is not necessary to call attention to the fact that the broadening of our national highway program is not a probability of the future but is a policy which has already attained definition and considerable stature.

Since July 1933, more than 11,000 individual projects have been placed under way in the Public Works highway programs. That 60 percent of these projects are off the Federal-aid highway systems of the States as they existed at the start of the program roughly measures the velocity attained in broadening the program through liberalizing the Federal highway policies. These projects off the Federal-aid highway system provide for its extension at both its extremes—on the one hand the feeder roads of the rural districts and on the other the principal thoroughfares of cities and towns. The addition of these two classes of roads and streets to the federally supported highway program is not the only element of this broadened highway policy structure. The elimination of grade crossings without railroad participation in the financing, the landscaping and planting of roadsides, and the building of footpaths, are other, but not all, of the worthy additions to the rapidly progressing highway policies.

Because of this constantly changing picture it becomes highly important to examine critically what we are doing, that we may project a course into the future, safeguarded from at least those hazards which experience has already uncovered. The easiest possible mistake is the failure to visualize the dimensions of a problem so vast as that of adequate road and street improvement in an area more than 2,000 miles wide and more than 3,000 miles long. The number of people alone that must be brought into a common and efficient operating organization goes far beyond ordinary conceptions. Here is a field in which faith, good will, and devotion to the public service will produce results beyond the reach of any other power.

The response that the Nation has had from highway officials, contractors, and material producers is of so high a quality generally that the departures stand out conspicuously as exceptions to a record of which the Nation can be proud.

Passing for the moment the employment aspect of the highway program, which is the cause underlying the enlarged undertakings in this field supported with Federal funds, it appears desirable to review briefly the experience of the years through which we have come to the present stage of highway development, that in the broadening of the program we may yet adhere to sound policies.

As a matter of history, between the time of abandonment of National and State projects undertaken in the early days before the advent of the railroads and about 1890 the localities were in control and there was no conception of planning highways on a State-wide basis.

The first State highway departments were established to assist the localities rather than to undertake, as a State policy, the building of a State highway system. In the Federal legislation of 1916 there was still no conception of the setting up of a plan of systematic highway improvement. The first requirement of this character in modern Federal legislation came with the legislation of 1921, when, as a first undertaking, the application of Federal funds was limited to a system of interstate and intercounty roads consisting of not more than 7 percent of the total rural road mileage.

In the decade and a half now intervening, marked by the improvement of some 200,000 miles of highways in part with the aid of Federal funds, this restricted system was rigidly maintained as a first objective. Year after year in both State and Federal legislative bodies there were innumerable drives to spread the application of the cooperative Federal and State funds more widely. Credit is due our law-making bodies that the principle was preserved intact for a period sufficient to establish communication over highways on this skeleton framework, consisting of a small percentage of our total highway mileage, but so carefully selected that it is now possible to travel from one end of the country to the other with a degree of speed and comfort—not that the building of long distance roads was the prime objective, for highway traffic is now and will remain primarily local.

TERMINATION OF PIONEER PHASE BRINGS NEW PROBLEMS IN ROAD BUILDING

Our long-distance highways have come as a by-product of the careful planning and coordination of the most important highways within and between the States. This deliberate policy of restriction has established reasonably universal communication over the roads within the minimum possible mileage. No other course would have made it possible, in so short a time, to create the main highway system capable of serving, if imperfectly, so large a part of the total of highway traffic. No other course would have so quickly joined with reasonably serviceable highways so many of our towns and cities, or placed a usable road within so short a distance of so many of our farms. No other course would have made it possible for the average American citizen and his family, with the modern moderately priced car, to become acquainted with neighboring States and with the more distantly located national parks and forests, or would have opened to him so many other recreational and educational opportunities.

No other course would, within this relatively short period, have brought us to the point where we are enabled to broaden the highway program soundly and with good effect. We can, and we unquestionably will continue the building of Federal roads extending from the improved main network into the farm communities. Every such road will bring to the land it serves not only its own important benefits but the multiplied benefits of the arterial system to which it becomes thus attached. Had the building of these feeders been undertaken before the improvement of the main system, such policy would have been comparable to the digging of the laterals of a drainage system before the opening of the outlet channel.

The principal difficulty which we encounter in this broadening of the highway program is the varying degrees or stages to which the several States have advanced. In certain States conservative highway

[1] Paper presented Jan. 22, 1935, at the 32d annual convention of the American Road Builders' Association held in Washington, D. C.

115947—35——1

officials may still point to the considerable mileage of the more important roads still inadequately improved. For these States the time to take on responsibility of an additional mileage will be at some future period when the main system is more fully improved. There are a considerable number of States in which this is undoubtedly the correct attitude at this time, and any future Federal legislation must be sufficiently flexible to take such situations into account.

The broadened program of the future must provide for the progressive development of the main roads in which we have now a tremendous investment. Otherwise, they will be found inadequate for the greater traffic which their very improvement has developed. Many things are yet undone on the main road systems, things which have been deliberately passed in the doing of the pioneer work that has engaged us up to now.

On a very large mileage of main roads the improvement of today must be regarded as providing only the minimum of service. Not only the density, but the speed of traffic has been so stepped up that the project designed for conditions existing not more than 5 years ago has now fallen below the acceptable and safe minimum. Such essential but in the past necessarily deferred details as the elimination of railroad grade crossings, replacement of narrow bridges, and the general construction of footpaths where justified, are important elements which must be continued in this broadened highway program.

The provision for the separation of more than 500 dangerous grade crossings is a real achievement of the present going program. Added to this is the construction of adequate roads around as well as through cities. Through the special highway-user taxes the people of the cities have contributed in some States the major part of the funds used for the upbuilding of our rural main road system. City residents can now with justice claim more attention.

All of these are essential concomitants of the necessary provision for our developing highway transportation, things which have been for the most part omitted from the simpler program of the past. Hence it is clear that the broadened national highway program consists not merely in the inclusion of additional mileage of local or feeder roads or city streets justifying improvement, but also includes a general lifting of the aim of the improvement effort to include objectives, the relative importance of which has increased as we have approached the first goal of "getting the traffic through" which has occupied so large a place in the past perspective.

To characterize most of what has been done thus far as a pioneer effort is not to detract from the magnificence and speed of the accomplishment that stands to the credit of the cooperative action of the State and Federal governments. It is desired only to place past accomplishments in their true relation to what remains to be done. A clear understanding of this relation suggests the answer to those whose conception has not yet been lifted to the new level of highway facility which has become possible and desirable. Even these suggestions do not touch upon the development which it is evident is not far around the corner, of highways conceived primarily upon the interstate or national basis in those sections where the population density and traffic, already developed on the inter-city roads, point to the necessity of new highways or parkways outside of the congested areas and high-priced suburban developments.

BALANCED PROGRAM MUST BE FORMULATED

In a moderate program of carefully conceived highways of this character lies not only the possibility of providing for recreational travel in a manner not possible upon our most heavily traveled roads, but the provision for the enlargement of recreational facilities within easy reach of our industrial population, and in some cases, as with the Shenandoah Parkway of the Blue Ridge Mountains, the providing of a new climate to a large population sweltering in the summer heat and humidity of the valleys. Here is an example of the possibility of bringing to the average citizen and his family the benefits of a cooler and more helpful climate and more beautiful surroundings by placing them within easy reach of his home. The flora in the higher elevations of the Smoky Mountains National Park is that of Labrador. Highways are the gateway to a climate otherwise denied to the majority who have neither the time nor the means to travel to the north country. So the ending of the pioneer period brings us to new and more difficult decisions. The question is not that of giving or denying highways to the rural districts or to the cities. It is the far more complex one of balancing the program within the reasonably supportable expenditures in such a ratio between these different and desirable objectives so that consistently there will be the greatest benefit to the greatest number.

The various classes of improvements, the extent to which each shall be undertaken, not only within the highway field itself but in the wider field of coordination of highways and other transportation facilities, all accent the complexity of our future policies and program, but there are many circumstances which determine that quite definite decisions shall be made. One of the principal of these is the transfer of complete authority over all highways to the highway departments, a movement that will doubtless progress with gathering momentum at the coming State legislative sessions. Of the benefits to be obtained by such transfer there is little doubt, but they bring with them a danger if transfer of responsibility is not accompanied by commensurate provision of income.

The tendency to divert from highway uses revenues intended for such purposes and no other is acute. The persistence of unemployment which has prompted large Federal appropriations has unfortunately been met by diversion from highway needs of the special revenues accruing from highway use. From the employment angle alone, nothing is gained by such diversion, since the dollar spent for highway work reaches as far to relieve unemployment as any other expenditures that could possibly be made.

Adjustments of the future highway program to meet changing economic conditions forced upon the railroads, and the improvement of the highways to fit the presumed program of the railroads which appears to contemplate faster and lighter trains, are as important as the development of highways to take over traffic where unprofitable branch line operations are abandoned.

Confronted by the unavoidable necessity of broadening the highway program in many directions and recognizing the demand for prompt decision on numerous questions, the inevitable conclusion is that further

(Continued on p. 11)

A STUDY OF THE LIVES OF BRICK-ON-CONCRETE PAVEMENTS[1]

ANALYSIS OF MORTALITY OF BRICK-ON-CONCRETE PAVEMENTS IN DES MOINES, IOWA

By ANSON MARSTON, Senior Dean of Engineering, Iowa State College

Owing to dearth of data of the actual service lives of different types of highway pavements, present estimates of their probable lives are based mostly on opinions instead of on facts.

This paper presents the results of a "mortality-curve" study of the actual service lives of brick-on-concrete pavements in the city of Des Moines, Iowa, as indicated by their actual mortality data during the years 1909–28, inclusive. The collection, arrangement, and calculation of the mortality data are explained and illustrated. The resulting "mortality curves" are given; and the method of using them to assist in estimating the probable lives of similar pavements still in service is explained.

Similar studies of rural-highway pavement actual service lives, in at least four different States, are being undertaken, in a cooperative highway research project, by the U. S. Bureau of Public Roads and the Iowa Engineering Experiment Station.

THERE is at present so nearly a complete lack of collected and studied reliable data of the actual service lives of different types of highway pavements that our knowledge of the probable lives of the billions of dollars worth of existing pavements is merely what we can surmise from the opinions of highway engineers. Even when collected by such respected authorities as the Interstate Commerce Commission, and even when expressed by such competent engineers as those employed by our State highway commissions and our large cities, engineering opinions upon pavement lives have a range of from about 10 to about 40 years for concrete, brick, and asphalt, with corresponding variations for other types. Manifestly, estimates based upon opinions which vary 400 percent cannot be considered reliable.

Pavement life is one of the most essential of the factors whose numerical values must be known in order to determine the annual costs of highway systems and/or the costs of different classes of highway services. Correct records of both of these are especially important at the present time, in highway economics in deciding upon correct highway policies, and in highway accountancy in developing and using satisfactory uniform highway accounting systems.

The fact that quite a large mileage of rural highway pavements built since the World War has now reached service ages of 10 to 20 years combines with the need to substitute facts for guesses of pavement life to make the present an opportune time to collect and study, by the best and most advanced methods, a large amount of reliable data of the actual service lives of rural highway pavements.

ACTUAL RETIREMENTS OF BRICK-ON-CONCRETE PAVEMENTS AT DES MOINES, IOWA, STUDIED BY USE OF MORTALITY CURVES

In his paper on the "Engineering Valuation of Highway Systems",[2] presented one year ago, the author explained briefly the "mortality-curve" method of studying actual retirement data of different kinds of industrial property. From January to June 1934, Mr. J. Phil Starbuck,[3] of Ames, Iowa, a graduate student working under the direction of Mr. Robley Winfrey and the author, made a detailed study of the actual retirement data of all brick-on-concrete and brick-on-sand pavements in Des Moines, Iowa, using the "mortality curve" method. The newest brick-on-sand pavements found had been built in 1899, so that Mr. Starbuck's data did not include their retirements at ages of 1 to 9 years. For this reason, only the data for brick-on-concrete pavements will be presented in this paper.

By careful search of the city paving records, Mr. Starbuck obtained and tabulated for each year, 1909 to 1928, inclusive, data of:

1. The actual pavement retirements each calendar year, classified by service ages.
2. The total amounts of pavement of each age actually in service each calendar year.

The retirement data were tabulated, in square yards, as shown in table 1 for the years 1919 to 1928, inclusive; and were averaged to give the average annual retirements for each age. Similarly, the amounts of pavement of each service age in service during each calendar year were tabulated and averaged as shown in table 2. Finally, the averaged annual pavement retirements and pavements in service each calendar year were tabulated and calculated as shown in table 3, to give the calculated mortality survivor-curve data in columns 5 and 7—column 5 for the "annual rate method" and column 7 for the "individual unit method."

Computations corresponding to those illustrated in tables 1, 2, and 3, for 1919 to 1928 were made for the 1909–18 and the 1909–28 brick-on-concrete pavement mortality data.[4] The mortality "survivor-curve" data thus obtained by the "annual rate method" have been plotted and are shown in figure 1, herewith, together with the "individual unit" survivor curve for the period 1909–18.

The "annual rate method", the final computations by which are illustrated in columns 2, 3, 4, and 5 of table 3, is the correct method for computing mortality "survivor curves" of different classes of industrial property. It correctly takes into account all the pavement in service each year. The "individual unit method", whose final computations are illustrated in columns 6 and 7 of table 3, takes into account only

[1] Paper presented before annual meeting of the Highway Research Board at Washington, D. C., December 1934.

[2] Proceedings, Highway Research Board, vol. 13, p. 43.

[3] In his progress report to the author, June 1934, Mr. Starbuck acknowledged indebtedness for assistance to John M. Tippee, city engineer, and C. C. Green, office engineer, both of Des Moines, Iowa, to John C. Hultquist, a fellow graduate student, and to Robley Winfrey and E. R. Davis of the staff of the Engineering Experiment Station, Iowa State College.

[4] All Mr. Starbuck's tables and curves for brick-on-concrete pavements have been recomputed and corrected by Mr. E. R. Davis.

TABLE 1.—*Brick-on-concrete pavement retirements, Des Moines, Iowa, 1919–28*

Age interval, years	Square yards retired during each age interval											Average per year, square yards
	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	Total	
0–½												
½–1½												
1½–2½												
2½–3½												
3½–4½	649										649	64.9
4½–5½												
5½–6½												
6½–7½												
7½–8½					5,143						5,143	514.3
8½–9½					2,029						2,029	202.9
9½–10½	4,214				510						4,724	472.4
10½–11½			12,762								12,762	1,276.2
11½–12½	735										735	73.5
12½–13½												
13½–14½												
14½–15½												
15½–16½	1,006				577	2,951					4,534	453.4
16½–17½					2,624		6,150				8,774	877.4
17½–18½	518			7,846							8,364	836.4
18½–19½					1,156						1,156	115.6
19½–20½												
20½–21½									1,670		1,670	167.0
21½–22½	18,591							1,461			20,052	2,005.2
22½–23½												
23½–24½												
24½–25½				5,942	284						6,226	622.6
25½–26½	1,152										1,152	115.2
26½–27½												
27½–28½												
28½–29½												
29½–30½							1,947		11,103		13,050	1,305.0
30½–31½								1,916		9,016	10,932	1,093.2
31½–32½									1,122		1,122	112.2
32½–33½												

TABLE 2.—*Brick-on-concrete pavements in service, Des Moines, Iowa, 1919–28*

Age interval, years	Square yards in service at beginning of each age interval											
	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	Total	Average
0–½	65,014	37,342	31,643	51,636	11,451	78,741	90,499	99,054	46,444	67,315	579,139	57,913
½–1½	65,014	37,342	31,643	51,636	11,451	78,741	90,499	99,054	46,444	67,315	579,139	57,913
1½–2½	46,529	65,014	37,342	31,643	51,636	11,451	78,741	90,499	99,054	46,444	558,353	55,835
2½–3½	69,238	46,529	65,014	37,342	31,643	51,636	11,451	78,741	90,499	99,054	581,147	58,114
3½–4½	56,208	69,238	46,529	65,014	37,342	31,643	51,636	11,451	78,741	90,499	538,301	53,830
4½–5½	13,131	55,559	69,238	46,529	65,014	37,342	31,643	51,636	11,451	78,741	460,284	46,028
5½–6½	21,580	13,131	55,559	69,238	46,529	65,014	37,342	31,643	51,636	11,451	403,123	40,312
6½–7½	7,087	21,580	13,131	55,559	69,238	46,529	65,014	37,342	31,643	51,636	398,759	39,875
7½–8½	5,346	7,087	21,580	13,131	55,559	69,238	46,529	65,014	37,342	31,643	352,469	35,246
8½–9½	66,838	5,346	7,087	21,580	13,131	50,416	69,238	46,529	65,014	37,342	382,521	38,252
9½–10½	21,718	66,838	5,346	7,087	21,580	11,102	50,416	69,238	46,529	65,014	364,868	36,486
10½–11½	52,732	17,504	66,838	5,346	7,087	21,070	11,102	50,416	69,238	46,529	347,862	34,786
11½–12½	35,859	52,732	17,504	54,076	5,346	7,087	21,070	11,102	50,416	69,238	324,430	32,443
12½–13½	13,460	35,124	52,732	17,504	54,076	5,346	7,087	21,070	11,102	50,416	267,917	26,791
13½–14½	21,012	13,460	35,124	52,732	17,504	54,076	5,346	7,087	21,070	11,102	238,513	23,851
14½–15½	24,459	21,012	13,460	35,124	52,732	17,504	54,076	5,346	7,087	21,070	251,870	25,187
15½–16½	16,503	24,459	21,012	13,460	35,124	52,732	17,504	54,076	5,346	7,087	247,303	24,730
16½–17½	19,060	15,497	24,459	21,012	13,460	34,547	49,781	17,504	54,076	5,346	254,742	25,474
17½–18½	6,490	19,060	15,497	24,459	21,012	10,836	34,547	43,631	17,504	54,076	247,112	24,711
18½–19½	1,708	5,972	19,060	15,497	16,613	21,012	10,836	34,547	43,631	17,504	186,380	18,638
19½–20½	9,964	1,708	5,972	19,060	15,497	15,457	21,012	10,836	34,547	43,631	177,684	17,768
20½–21½	36,059	9,964	1,708	5,972	19,060	15,497	15,457	21,012	10,836	34,547	170,112	17,011
21½–22½	61,093	36,059	9,964	1,708	5,972	19,060	15,497	15,457	21,012	9,166	194,988	19,498
22½–23½	50,265	42,502	36,059	9,964	1,708	5,972	19,060	15,497	13,996	21,012	216,035	21,603
23½–24½	29,968	50,265	42,502	36,059	9,964	1,708	5,972	19,060	15,497	13,996	224,991	22,499
24½–25½	15,657	29,968	50,265	42,502	36,059	9,964	1,708	5,972	19,060	15,497	226,652	22,665
25½–26½	5,486	15,657	29,968	50,265	36,560	35,775	9,964	1,708	5,972	19,060	210,415	21,041
26½–27½		4,334	15,657	29,968	50,265	36,560	35,775	9,964	1,708	5,972	190,203	19,020
27½–28½	4,306		4,334	15,657	29,968	50,265	36,560	35,775	9,964	1,708	188,537	18,853
28½–29½		4,306		4,334	15,657	29,968	50,265	36,560	35,775	9,964	186,829	18,682
29½–30½			4,306		4,334	15,657	29,968	50,265	36,560	35,775	176,865	17,686
30½–31½				4,306		4,334	15,657	28,021	50,265	25,457	128,040	12,804
31½–32½					4,306		4,334	15,657	26,105	50,265	100,667	10,066
32½–33½						4,306		4,334	15,657	24,983	49,280	4,928
33½–34½							4,306		4,334	15,657	24,297	2,429
34½–35½								4,306		4,334	8,640	864
35½–36½									4,306		4,306	430
36½–37½										4,306	4,306	430
37½–38½												

TABLE 3.—*Calculation of survivor curve for brick on concrete pavements, Des Moines, Iowa, 1919–28*

Age interval	Annual rate method				Individual unit method[1]	
	Average retirements during age interval	Average area in service at beginning of age interval	Annual rate of retirement	Surviving at beginning of age interval	Sum of average retirements	Surviving at beginning of age interval
1	2	3	4	5	6	7
Years	*Sq. yds.*	*Sq. yds.*	*Percent*	*Percent*	*Sq. yds.*	*Percent*
0–½		57,913		100.00	10,307	100.00
½–1½		57,913		100.00	10,307	100.00
1½–2½		55,835		100.00	10,307	100.00
2½–3½		58,114		100.00	10,307	100.00
3½–4½	64.9	53,830	0.121	100.00	10,307	100.00
4½–5½		46,028		99.87	10,242	99.37
5½–6½		40,312		99.87	10,242	99.37
6½–7½		39,875		99.87	10,242	99.37
7½–8½	514.3	35,246	1.459	99.87	10,242	99.37
8½–9½	202.9	38,252	.530	98.42	9,728	94.38
9½–10½	472.4	36,486	1.295	97.90	9,525	92.41
10½–11½	1,276.2	34,786	3.669	96.63	9,052	87.82
11½–12½	73.5	32,443	.227	93.08	7,776	75.44
12½–13½		26,791		92.87	7,703	74.73
13½–14½		23,851		92.87	7,703	74.73
14½–15½		25,187		92.87	7,703	74.73
15½–16½	453.4	24,730	1.833	92.87	7,703	74.73
16½–17½	877.4	25,474	3.444	91.17	7,249	70.33
17½–18½	836.4	24,711	3.385	88.03	6,372	61.82
18½–19½	115.6	18,638	.620	85.05	5,536	53.70
19½–20½		17,768		84.52	5,420	52.58
20½–21½	167.0	17,011	.982	84.52	5,420	52.58
21½–22½	2,005.2	19,498	10.284	83.69	5,253	50.96
22½–23½		21,603		75.09	3,248	31.51
23½–24½		22,499		75.09	3,248	31.51
24½–25½	622.6	22,665	2.747	75.09	3,248	31.51
25½–26½	115.2	21,041	.547	73.02	2,625	25.47
26½–27½		19,020		72.62	2,510	24.35
27½–28½		18,853		72.62	2,510	24.35
28½–29½		18,682		72.62	2,510	24.35
29½–30½	1,305.0	17,686	7.379	72.62	2,510	24.35
30½–31½	1,093.2	12,804	8.538	67.26	1,205	11.69
31½–32½	112.2	10,066	1.115	61.52	112	1.08
32½–33½		4,928		60.84		
33½–34½		2,429		60.84		
34½–35½		864				
35½–36½		430				
36½–37½		430				

[1] The method will be understood if it is observed that column 6 represents cumulative totals of column 2 beginning at the bottom of the column. Column 7 represents the corresponding percentages, taking the total retirements observed as 100 percent.

those pavements actually retired, and hence gives entirely too small percentages of survivors at different service ages and entirely too small average life of pavements. For example, the average life for the years 1909–18 by the "individual unit method" was only 17 years; whereas the correct average life indicated by the mortality data was 22 years, as shown by the "annual rate method." It should be noted that estimates of average pavement lives based largely upon first or comparatively early retirements are quite likely to be too small.

Computations of average lives of pavements.—The average life of a pavement for which a mortality survivor curve like those in figure 1 is available must be found by computing the area under the survivor curve (usually divided for this purpose into strips each, except the first, 1 year wide) and dividing it by 100 (since the survivors are platted in percents).

As explained in the paper on the "Engineering Valuation of Highway Systems", already referred to, the Iowa Engineering Experiment Station has developed some 13 "mortality type curves", which seem to pretty well cover the usual range of the mortality characteristics of the different kinds of industrial property.

Four of these are "left mode" curves, designated L_1, L_2, L_3, L_4; five are "symmetrical", S_1, S_2, S_3, S_4, S_5; and four are "right mode", R_4, R_3, R_2, R_1.

By trial, it was found that the mortality data of brick-on-concrete pavements in Des Moines, 1909–18 fitted curve S_2, those for 1919–28 fitted S_1, and those for 1909–28 also fitted S_1, all as shown in figure 1. It therefore appears that mortality type curve S_1 is the one to use in estimating the probable life of any particular stretch of concrete-on-brick pavement still in service in Des Moines.

The average lives, in years, indicated by the mortality survivor curves in figure 1 are 22 for the retirements of 1909–18, 36 for the retirements of 1919–28, and 28 for the entire 20 years retirements, 1909–28. Information is lacking about the traffic intensities, differences in design, changes in retirement policies, and other circumstances which would completely explain these variations in average life. It is permissible to point to the improvements in pavement design and construction in later years and to the probability that the heavy-traffic streets were more apt to be paved first, as circumstances which may partially explain the apparent increase in the average life of the pavements retired in the later years.

PAVEMENT MORTALITY CURVES USEFUL IN FORECASTING THE PROBABLE LIVES OF PARTICULAR EXISTING PAVEMENTS

The mortality type curves which fit the actual pavement mortality data of particular kinds of pavements (see fig. 1) can be of great service in forecasting the probable lives of particular existing pavements.

The mortality type curves are "generalized" by stating and platting their service ages in percents of average life.

Just as average life can be computed by dividing the entire area under the mortality curve by 100, so the expectancy of the average survivor at any age can be computed by dividing the area under the mortality curve to the right of the age ordinate by the percentage of survivors at the age. Expectancy plus service age is probable life; and "probable life curves", computed in this manner, can be platted on the same diagram as survivor curves.

Table 4 shows the results of computations of expectancies and probable lives of the average survivor at different service ages for mortality type curve S_1.

Figure 2 shows mortality type S_1, "survivor" and "probable life" curves platted on the same diagram and "generalized" by platting service ages in percentages of average life.

The use of figure 2 in forecasting the probable lives of particular pavements will be illustrated by two (imaginary) cases of brick-on-concrete Des Moines pavements, of which the average life has been found to be 28 years.

Case 1.—A brick-on-concrete pavement on an important business street. The service age is 21 years. The present physical condition is poor, in comparison with the average condition of 21 year-old brick-on-concrete pavments in the city. The traffic is much heavier than average traffic on such pavements.

In figure 2, follow the 75-percent age ordinate up to the survivor curve, proceed horizontally across to the probable-life curve and thence vertically down (all as indicated on fig. 2 by broken lines and arrows) and find that the probable life of the average survivor would be 119 percent of 28 years equals 33 years. But this pavement is in poorer condition than the average and its traffic is much heavier. Its probable life will be somewhere between 21 (its present age) and 33 (the probable life of the average survivor under average traffic). Taking these limits

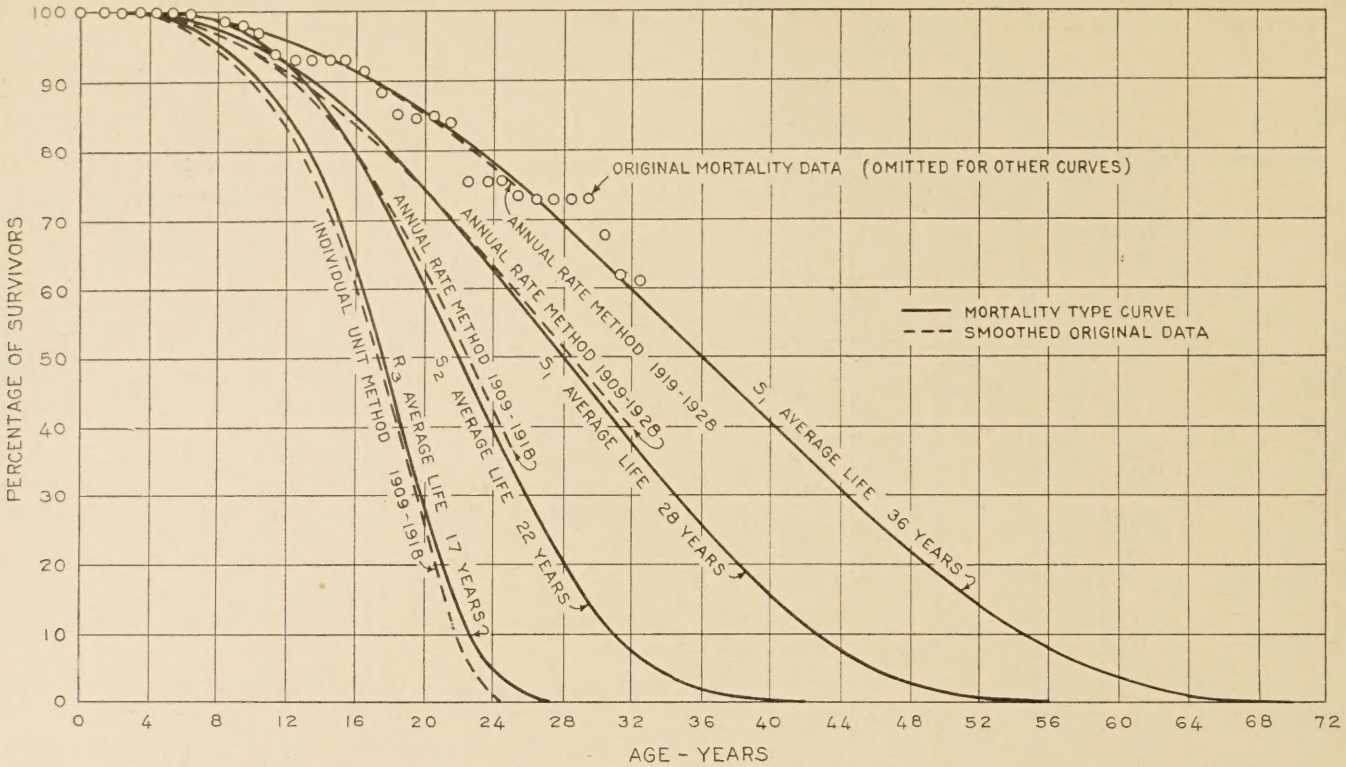


FIGURE 1.—MORTALITY CURVES FOR BRICK-ON-CONCRETE PAVEMENTS, DES MOINES, IOWA, 1909–1928.

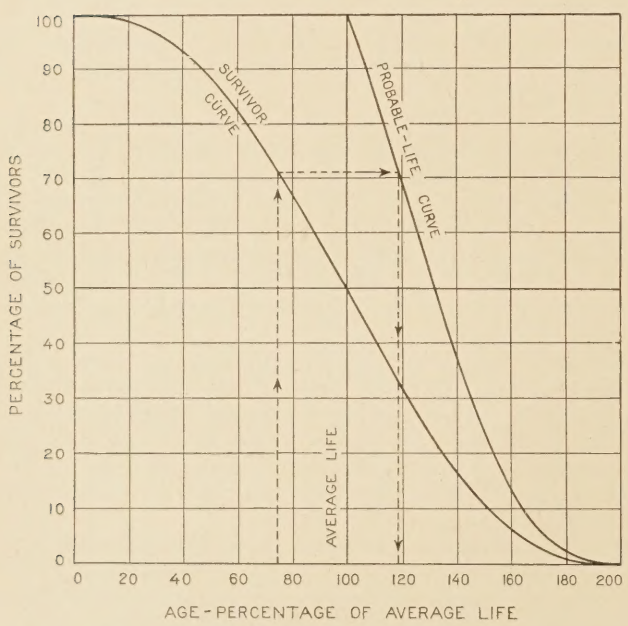


FIGURE 2.—S_1 MORTALITY TYPE CURVE.

and conditions into account, the engineer must forecast its probable life by judgment. It would probably be less than 27 and might be about 25 years.

Case 2.—A brick-on-concrete pavement on a street in a well-to-do residence section. Service age 21 years, as in case 1, but the present physical condition is considerably better than that of the average 21-year-old brick-on-concrete pavements in the city, and the traffic is lighter than the average on such pavements.

As in case 1, the probable life indicated in figure 2 for the average survivor is 33 years; and it may be noted further that only a negligible number of similar pavements have probable lives greater than 170 percent of 28 years equals 41 years. Hence the engineer, using his judgment in view of the actual conditions, would forecast the probable life of this pavement somewhere between 33 and 41 years (quite probably about 35 years).

TABLE 4.—*Numerical data of mortality type curve, S_1*

Age interval, percentage of average life	Renewal during age interval	Surviving at beginning of age interval	Expectancy as a percentage of average life	Probable life, percentage of average life
	Percent	*Percent*	*Percent*	*Percent*
0–10	0.1584	100.0000	100.00	100.00
10–20	.8872	99.8416	90.15	100.15
20–30	2.0108	98.9544	80.91	100.91
30–40	3.3294	96.9436	72.49	102.49
40–50	4.6964	93.6142	64.89	104.89
50–60	5.9971	88.9178	58.05	108.05
60–70	7.1408	82.9207	51.89	111.89
70–80	8.0578	75.7799	46.31	116.31
80–90	8.6971	67.7221	41.22	121.22
90–100	9.0250	59.0250	36.56	126.56
100–110	9.0250	50.0000	32.26	132.26
110–120	8.6971	40.9750	28.26	138.26
120–130	8.0578	32.2779	24.53	144.53
130–140	7.1408	24.2201	21.02	151.02
140–150	5.9971	17.0793	17.72	157.72
150–160	4.6964	11.0822	14.61	164.61
160–170	3.3294	6.3858	11.67	171.67
170–180	2.0108	3.0564	8.94	178.94
180–190	.8872	1.0456	6.52	186.52
190–200	.1584	.1584	5.00	195.00
200–210				200.00

As a further illustration of the possible use of mortality type curves in forecasting the probable lives of particular pavements, it may be said that the author and Mr. W. O. Price of the Iowa State Highway Commission staff are now beginning the preparation of a forecast of the probable amounts of State road pavement reconstruction which will be required from time to time during the next 15 years. Using county maps, on which the date and limits of each pavement construction contract are shown, we are making preliminary personal inspections of all existing primary road pavements, rating them tentatively as to present physical condition. Traffic conditions are to be ascertained by a State-wide traffic survey which is just being started

(Continued on p. 14)

THE RISING ACCIDENT RATE

By WILLIAM G. ELIOT, 3D, Highway Economist, Division of Highway Transport, Bureau of Public Roads[1]

MANY SERIOUS ACCIDENTS OCCUR ON WIDE AND STRAIGHT ROADWAYS WITH LANES MARKED. THE PRESENT TENDENCY IN DESIGNING 4-LANE ROADWAYS IS TOWARD SEPARATION OF TRAFFIC MOVING IN OPPOSITE DIRECTIONS BY A CENTER PARKWAY

STATISTICS of motor vehicle accidents for 1934 indicate that the year's fatalities were approximately 35,500, an increase of 13 percent over 1933. Both in absolute numbers and in percentage of increase, this establishes a new record—of which we are not proud. Not only does humanitarian instinct demand that something be done to check and reverse this trend, but we who are builders and keepers of the Nation's roads have a further personal stake in the matter. If public opinion wakes up in alarm and horror to the situation it may have serious repercussions on the highway engineering profession.

POSSIBLE CAUSES OF INCREASE IN ACCIDENTS CONSIDERED

How are we to account for this distinct upturn in the accident rate? Quite definitely we cannot attribute it to any decline in standards of highway design or maintenance. There are plenty of accidents for which highway defects may be at least partly responsible, but these defects certainly have not increased to cause the large jump in fatalities. Our highways are being built for greater safety every year. Relocations, widening, surfacing, grade separations, and similar projects are constantly correcting hazardous conditions. However, the pace at which these improvements have been provided on our large mileage of road has lagged behind the need for them due to changes in the character of use. Apparently, in spite of all our highway improvements, the margin of safety is actually being reduced by increases in vehicular speeds and volumes, or by other factors over which the highway engineer has no control.

The motor vehicles on the highway are also undergoing constant improvement in design. Lower centers of gravity, technical betterment of brakes, steering gears and tires, safety glass, steel bodies, and increased ease and certainty of control—all may properly be regarded as steps toward greater safety. The speed that goes with high-powered motors is the only important automotive feature that does not seem reconcilable with safety.

The persons who operate motor vehicles make up a large and very representative sample of human nature, and human nature is known to have remained pretty much the same for a long time. Reaction times, acuteness of vision, muscular coordination, and temperament have experienced no sudden change in the past 12 months. The only new factor possibly affecting the vehicle driver is the repeal of liquor prohibition, of which more is said in the following pages.

In seeking an explanation of the rising accident rate, we must also look into the accident "exposure." An increase in the use of motor vehicles, all other circumstances remaining unchanged, would be accompanied by a proportionate increase in accidents. Our best index of vehicle use is gasoline consumption, as revealed in tax data. Preliminary estimates indicate a marked rise in gasoline consumed in 1934 as compared with 1933, but it is not yet possible to determine the extent to which increased travel may account for the increase in accidents.

In this brief summary there are two items that stand out as new factors in the accident situation. One of these is the repeal of prohibition, and the other is the prevailing increase in vehicle speeds.

Repeal has not had all of the dire results that were predicted for it by some of its opponents. Scattered reports, however, do indicate a rise in the number of accidents chargeable, at least in part, to intoxication. Arrests for drunken driving have also increased. Detroit, for example, reports for the first 9 months of 1934 a 90 percent increase in the number of drinking

[1] Paper presented before the twenty-seventh annual meeting of the Mississippi Valley Conference of State Highway Departments, Chicago, Ill., Feb. 1, 1935.

HIGHWAY ACCIDENTS ARE INCREASING IN NUMBER IN SPITE OF IMPROVED ROAD CONDITIONS. IT IS EVIDENT THAT EFFECTIVE MEASURES MUST BE TAKEN TO REDUCE THE LOSS OF LIFE AND NUMBER OF INJURIES.

motorists involved in traffic accidents, and a 78 percent increase in motor vehicle injury accidents involving drinking drivers.[2]

There is no question that intoxicated drivers and intoxicated pedestrians must be kept off the roads. While the obvious answer is the strictest enforcement of existing laws against intoxicated driving, the practical difficulty is to determine when a man is actually, or legally, "under the influence." Research is now under way, both in this country and abroad, to develop simple physiological tests, based on alcohol concentration in certain body fluids, but it is too early to predict possible results. Such tests must be absolutely reliable or they will be worse than useless. There appears to be no way to detect the man who is not drunk, but who has had just enough to impair the faculties needed by a safe driver, until he has had an accident or violated some traffic regulation. Then, perhaps, we can prevent a repetition by depriving him of his driver's license, or by other suitable discipline.

INCREASED SPEED AN IMPORTANT FACTOR

The second new factor in the accident problem is the increasing speed for which cars are now being designed. Within the last 2 or 3 years, the lowest-priced cars have been designed for performance almost equal to that of the most expensive ones. The maximum brake horsepowers of the 1930 models of three of the most popular low-priced cars were 40, 46, and 45, respectively. For the 1933 models the corresponding figures were 65, 65, and 70, and for the 1934 models 92, 80, and 77 horsepower, respectively. This development in the cars that make up so large a proportion of automobile sales has had a controlling effect on the general average. Anyone who buys a car now can travel at speeds reserved only a few years ago for a select few.

Raising or removal of legal speed limits in recent years reflects changing driving habits, but in no way measures the change. In fact, we have very few data as to average highway speeds until very recently, though our personal experience testifies that they have been markedly stepped up. As far back as 1925 the State of Rhode Island began making stop-watch speed observations which have been carried on more or less continuously since. The earlier records show an average speed (for uninterrupted travel) of 25.6 miles per hour. Incomplete analysis of studies made by the Bureau of Public Roads on a number of highways in eastern Massachusetts during the past summer indicates an average speed of only about 33 miles per hour on those roads. At one point well away from any settled community an average of 39 miles was observed for vehicles of all classes. The figures seem surprisingly low. We are accustomed to think of travel at speeds consistently over 40 or even 50 miles per hour, yet observations in a number of States have rarely shown averages exceeding 40 miles. It is likely that in States where travel distances are greater and where there are fewer settled areas to prevent a building up of speed the averages will run somewhat, but not a great deal, higher.

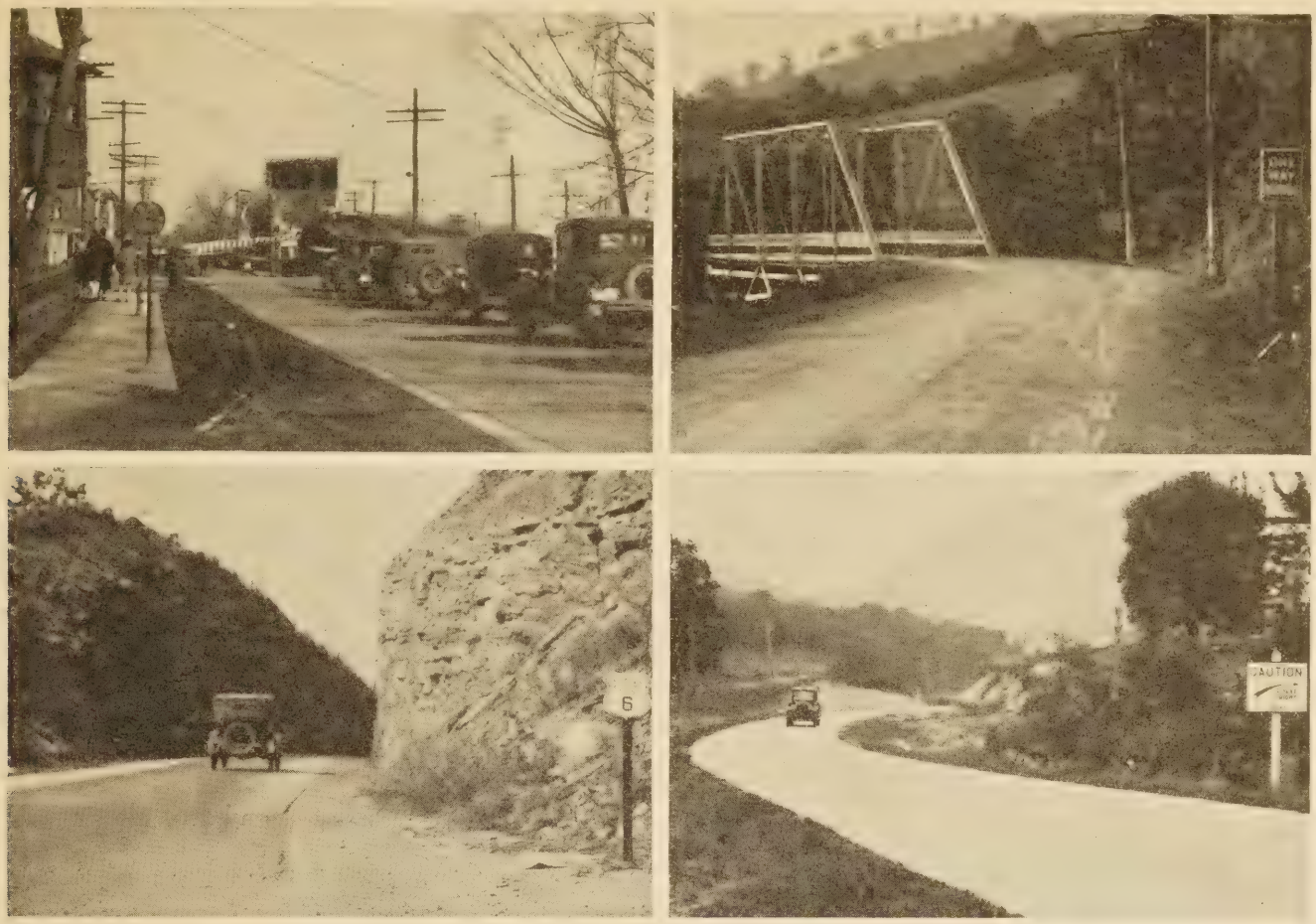
From the safety standpoint the average speed tells only a part of the story. The danger in the rising average is in the increase of speed at the upper end of the scale. There are always some drivers who try to take full advantage of the top speeds of which their cars are capable, and many who are not happy except when they are in a hurry to get somewhere. Generally speaking, it is these higher speeds that cause trouble, not only in themselves, but also because any lower speeds deceptively seem safe. One of the problems of small-town traffic regulation is that drivers coming in from the open highway fail to reduce speed to a safe degree. Thirty or 35 miles per hour seems like crawling after many miles at 60 or better.

WARNING SIGNS AND ROAD-MARKING ARE IMPORTANT FACTORS IN ACCIDENT PREVENTION. CONSPICUOUS PROGRESS HAS BEEN MADE IN STANDARDIZING AND PLACING SIGNS AND MARKINGS.

We have too long evaded the issue by such sophistry as the familiar assertion that "Speed in itself is not a cause of accidents." Eighty miles per hour in the right place is safer, we have argued, than 20 miles under unfavorable circumstances. True, but it gets us nowhere. By the same method of argument, we can easily prove that any other dangerous condition is not "in itself" a cause of accidents. Speed is a cause of accidents, and we might as well admit it frankly.

The present generation demands fast travel even at its high cost in life, limb, and property. We cannot, of course, arbitrarily reduce all speed to a safe pace for all, regardless of differing highway conditions and differing abilities of operators. For the most part we can only continue along present lines, with redoubled effort toward safety.

[2] Public Safety, December 1934, p. 18.



THE INCREASED SPEED AND VOLUME OF TRAFFIC HAVE MADE NECESSARY A LARGE AMOUNT OF WORK IN FURTHER IMPROVING EXISTING SURFACES. GRADE CROSSINGS NEED TO BE ELIMINATED, BRIDGES WIDENED, SIGHT DISTANCES INCREASED, AND NARROW SURFACES WIDENED.

SAFER HIGHWAYS AND CHECKS ON EXCESSIVE SPEED NEEDED TO REDUCE ACCIDENTS

In the first place, we shall have to go on improving road design and eliminating danger points. This needs no discussion in a gathering of highway engineers. The difficulty is not a lack of knowledge of how we should do it. It is the impossibility of finding within any reasonable time the almost unlimited funds that would be needed for a really satisfactory program of highway improvement. Divided highways and grade separations, essential for the safe movement of traffic in congested areas, and desirable for safety everywhere, must be adopted more generally as funds can be made available. Adequate highway lighting is being urged for safety, but satisfactory standards have not yet been agreed upon, and its cost would probably prevent any widespread program of rural lighting. Wide shoulders for parking and footpaths for pedestrians will prevent many accidents and are relatively inexpensive as compared with most safety features.

Improvement of sight distances, necessary for the safety of high-speed travel, can often be accomplished at small cost by the reduction of horizontal or vertical curvature.

For the assistance of the motorist in recognizing hazardous conditions, adequate signs and markers are of great importance. The latest word on this subject can be found in the newly revised manual recently produced by a joint committee of the American Association of State Highway Officials and the National Conference on Street and Highway Safety.

Traffic signals for the orderly control of traffic are also part of the safety program, where traffic is heavy and grade separation is not practicable.

So much for what the highway engineer as such can do. He does not and cannot assume the entire responsibility for safety. It would be very pleasant if we could design and build our highways so that traffic would be wholly self-regulating, but that is asking too much. Some curb on dangerous driving is necessary by legal regulation.

In checking excessive speed by regulation, there are three courses open—a definite speed-limit law, a redesigning of motor vehicles for lower top speeds (by means of governors or by a more fundamental motor change), or a much stricter selection of motor vehicle operators on the basis of their ability to handle cars safely and at properly controlled speeds.

The speed-limit law here referred to would be aimed only at the higher speeds and would be absolute, not "prima facie". It would be justified on grounds similar to those on which we now defend the limiting of vehicle sizes and weights. In proposing uniform maximum dimensions and gross loads, we are setting up a standard to which our roads shall be built. If we concede the right to limit sizes and weights in the interests of safety and economy of design, we must recognize also the logic of restricting speed to a maximum which can reasonably

115947—35——2

be provided for in the design. Traffic that must move at a faster pace should be diverted to rail or air. What should this legal speed be? I do not know. Even if it were set no higher than 60 miles per hour it would cause possible annoyance to only a relatively small proportion of the drivers on the road. Studies on Maryland highways, reported at the 1933 meeting of the highway research board by Dean A. N. Johnson of the University of Maryland, showed only 2 percent of the observed vehicles traveling in excess of 55 miles per hour on open highways where the general speed limit of 40 miles applied.

Regulating the mechanical design of vehicles so that none would be capable of exceeding a reasonable speed would have the same shortcoming as the imposition of a highway speed limit; namely, that it would affect only top speeds. In order not to be an intolerable inconvenience, it would have to set the limit at a speed exceedingly dangerous for any but very favorable circumstances. Unless the limit on top speed could be achieved without sacrific of acceleration and power, it would be most unpopular with American drivers, who expect "snappy" performance. It is doubtful if this proposal would find any considerable public support, therefore—at least not until we are ready to think more of economy of operation than of acceleration and speed. The enormous price we are paying for "performance" is to be measured in terms of excess horsepower, inefficient load factor, rapid mechanical depreciation, and, of course, accidents.

Enforcement of Highway Regulations Is a Necessary Step in Accident Control.

LICENSING DRIVERS AN EFFECTIVE SAFETY MEASURE

In the end, the safe use of motor vehicles depends mostly upon the operator himself. No law or regulation can determine in advance what speed is "too fast for conditions" in every situation that may arise. A safe driver is one whose alertness and judgment can be depended upon to keep him from traveling in excess of a safe speed.

The reckless or otherwise incompetent driver can be disciplined, instructed, or eliminated through two agencies—a State highway police and an adequate system of licensing drivers. The presence of uniformed motorcycle police on a highway is a powerful influence for good driving, and incidentally, but frequently, a great help to motorists in trouble. Licensing of drivers provides an opportunity for testing their capabilities as drivers and their knowledge of motor vehicle regulations before they are permitted to use the public highways. Even more important, perhaps, is the power reserved by the State to suspend or revoke these licenses for cause. Driver's license examinations do not now, and perhaps never can, reveal all of the hidden flaws of recklessness, slow muscular or nervous coordination, indulgence in intoxicants, and the like. However, just as soon as a licensed driver begins to develop a bad record, either in accidents or law violations, the State can bring him promptly to account by depriving him of his right to drive. Often a hearing and a warning are sufficient.

The value of a license law is effectively demonstrated by an analysis recently published by the National Safety Council. The States were classed according to whether they had a standard license law and administration, a substandard license law and/or administration, and those having no license law, the last class being subdivided into several groups of neighboring States.

> From 1926 to 1933 the motor vehicle death rate (per 10,000,000 gallons of gasoline consumed) in standard license law States dropped 25 percent, while the rate in other States increased 14 percent. * * * In the seven States with substandard law and/or administration the death rate in 1933 was 7 percent above 1926. Among seven midwestern nonlicense States there was an advance of 12 percent. In 10 southern nonlicense States the rate rose 26 percent. For five western nonlicense States there was an increase of 15 percent.[3]

Act II of the Uniform Vehicle Code drafted by the National Conference on Street and Highway Safety is a model, standard license law, tested by wide experience, and ready for adoption by any State. As a safety measure, no single piece of legislation, adequately administered, seems more likely to accomplish its purpose.

STUDY OF ACCIDENT CAUSES NECESSARY FOR PROPER CORRECTIVE MEASURES

So much for the specific attack on some of the more urgent elements of the accident problem. To the extent that we can make the highway, by proper design, safe for reasonable speed; to the extent that we can enforce that speed; and to the extent that we can weed out the unfit driver, we shall achieve safer highways.

These remarks have therefore been directed toward a general safety program, though emphasizing only the recent developments in the accident situation. Some of the statements made here have been rather broad and over-simplified. As a matter of fact, we still have much to learn about accidents, and especially why they are happening in any particular State or locality. Since accident prevention must be achieved one step at a time, the more we know about detailed causes, the more intelligently we can go about organizing our campaign and selecting our immediate objectives. For every accident we should know exactly where it occurred, who was involved, and what conditions contributed to it.

A report of every motor-vehicle accident involving personal injury or serious property damage should be required by law, to be made to the nearest police agency or directly to the State authorities. For uniform and complete reporting it is essential that a standard form be used. Even an experienced observer will omit significant details unless he has an outline to guide him. The form adopted by the National Safety Council is recommended for its completeness and its simplicity.

[3] Public Safety, August 1934.

LITTLE PROGRESS HAS BEEN MADE IN CONSTRUCTING FOOTPATHS IN SPITE OF THE OBVIOUS NEED FOR THEM IN MANY LOCATIONS. THE DEATH TOLL OF PEDESTRIANS IS LARGE AND BRIDGES ARE PARTICULARLY DANGEROUS.

A METHOD OF INCREASING SIGHT DISTANCE ON SHARP CURVES. IN THIS CASE CONDITIONS ARE IMPROVED BUT ARE STILL DANGEROUS.

From an adequate record of place of occurrence, we can discover the "sore" spots in our highway systems, and after careful analysis of the accident data and diagnosis of the trouble, we can prescribe the remedy. From our record of motor-vehicle operators involved in accidents, we may hope to remove "accident-prone" drivers from the road. From the circumstances most frequently attending these accidents, law enforcement agencies and highway administrators may plan their campaigns against special hazards wherever found.

As a means of concentrating public attention upon these matters, it is suggested that a governor's commission be appointed in each State, empowered to inquire into the extent and causes of highway accidents. Full publicity should be given to its studies, and any weakness in existing accident records or law enforcement should be brought to light. Causes of accidents as revealed by its findings should be stressed by the press in an educational campaign for better and safer driving. Without public opinion behind us, we cannot progress far, since safety costs money on the one hand, and, on the other, demands a certain surrender of personal liberty. With an aroused public sentiment for safety, however, the driver who causes accidents becomes an offender against the State, not merely an unfortunate victim of circumstance.

(Continued from p. 2)

development of a coherent plan sufficiently broad to encompass the major needs here touched upon is one of the prime essentials of the immediate operations of each State highway department. In the absence of existing authority on the part of the State highway departments to undertake such planning, I have urged that legislative sanction be sought. The Federal highway legislation has already recognized the benefits to be obtained through studies and has provided for Federal cooperation in them.

Studies of this sort cannot be of a perfunctory nature. They must contemplate the formulation of a comprehensive plan for the development of a fully adequate highway transportation system consistent with modern economic and social trends. The facts obtained must be sufficient to indicate the relative importance of both rural and urban roads which for economic or social reasons may be considered eligible for inclusion in the improvement program. The special problem of approaches to cities and the connections through and around them needs the attention necessary to plan such improvements in anticipation of their undertaking.

An inventory of the entire existing highway plant is imperatively needed, and a careful estimate of the financial provision necessary for its preservation, renewal, and progressive development should be made. This extends to all major parts such as the examination and rating of the condition and capacity of bridges and the fixing of priority for the elimination of existing grade crossings of railroads in which we should, of course, seek the opinions and plans of railroad managements.

The final object should be the conception and formulation of a composite plan for the development of all highways, regardless of their present legal classification or condition, and an estimate of the probable cost. The study also should indicate the benefits which are to be realized from such improvements, considering the direct users, the landowners, and others who benefit indirectly. On the basis of such information, intelligently consolidated, there need be no hesitation in undertaking the broadened highway program with faith that the growth of population, the promotion of the safety and economy of highway transportation, and the enlarged social and recreational benefits to be secured, will justify and maintain the cost if the plan is laid with intelligence and faith in the future.

REGULATION OF OUTDOOR ADVERTISING UPHELD IN MASSACHUSETTS COURT DECISION

THE AUTHORITY of the Massachusetts Department of Public Works to regulate outdoor advertising on public highways and the Federal constitutionality of the act under which regulation has been attempted have been sustained in a decision of the Supreme Judicial Court of Massachusetts in an opinion filed January 10, 1935. The following statements are based on the printed opinion.[1]

The constitution of Massachusetts was amended on November 5, 1918, in these words: "Advertising on public ways, in public places, and on private property within public view may be regulated and restricted by law." Following this constitutional amendment legislation was enacted requiring the State department of public works to make "rules and regulations for the proper control and restriction of billboards, signs, and other advertising devices * * * on private property within public view of any highway, public park, or reservation", with an exception not material to this review. The legislation further provides that such rules and regulations may require that the billboards, signs, and other devices be licensed and that fees be prescribed. The department of public works has power to amend or repeal regulations.

Cities and towns may further regulate and restrict billboards and other devices within their respective limits by ordinances or by laws not inconsistent with State regulation or laws.

REGULATIONS DESIGNED TO PROTECT NATURAL BEAUTY AND SAFETY OF TRAVEL

The rules and regulations now in force were adopted by the department of public works to be in effect on and after January 24, 1924.

The substance of those rules and regulations is as follows: Provision is made requiring all those engaged in outdoor advertising to be licensed by the department of public works, such licenses to be in force for 1 year unless sooner revoked. The fee for such license and for renewal thereof is $50. No one may engage in the business of outdoor advertising without permits for each advertising device for which two annual fees of $2 each are exacted, one for examination and the other for inspection, subject to various regulations as to details, and to revocation for cause.

Provision is made for advertising devices within public view from any highway, public park, or reservation by persons not engaged in the business of outdoor advertising. In general, outdoor advertising within any public way is forbidden. "No permits will be issued for outdoor advertising in any location which is within 300 feet of any public park or reservation, if within view of any portion of the same" with an exception not here material, and permits may be granted for the location of electrical display signs on buildings under such restrictions as the department of public works may impose. "No outdoor advertising shall be painted or affixed upon any fence or pole within 50 feet of any public way nor directly on the wall of any building."

Dimensions and material of all outdoor advertising devices may be prescribed by the department of public works, and objectionable matter may be required to be removed. No renewal permit will be granted for advertising devices unless the front, back, braces, anchors, and lattice work thereof are painted and kept in proper condition. Advertising devices and the ground about them must be kept free from all rubbish or any materials objectionable in the opinion of the department of public works.

Section 6 of the regulations is entitled "Restrictions" and is in these words: "A. No permit will be granted for the location or maintenance of billboards, signs or other advertising devices near certain public ways where, in the opinion of the division, having regard to the health and safety of the public, the danger of fire, and the unusual scenic beauty of the territory, signs would be particularly harmful to the public welfare. B. No permit will be granted for the location, erection or maintenance of any billboard, sign or other advertising device within a radius of 150 feet from the point where the center lines of two or more public ways intersect. This provision shall not apply to districts which the division may determine are of a business character. C. No billboard, sign or other advertising device shall be erected, displayed or mantained in any block in which one-half of the buildings on both sides of the street are used exclusively for residential purposes, except that if the written consent of the owners of a majority of the frontage on both sides of the street in such block is obtained and is attached to the application for a permit to erect, display or maintain such billboard, sign or other advertising device the division may permit the erection, display or maintenance of the same. D. No permit will be granted for the erection or maintenance of any billboard, sign or other advertising device if said billboard, sign or advertising device is to be located: (1) Nearer than 50 feet to the boundary line of any public way; (2) Nearer than 100 feet to the boundary line of any public way, if within view of any portion of the same, if said billboard, sign or other advertising device exceeds an area of 32 square feet; (3) Nearer than 300 feet to the boundary line of any public way, if within view of any portion of the same, if said billboard, sign or other advertising device exceeds a length of 25 feet or a height of 12 feet; (4) In any event if said billboard, sign or other advertising device exceeds a length of 50 feet or a height of 12 feet; except that the division may permit the erection of billboards, signs or other advertising devices which do not exceed 40 feet in length and 15 feet in height if not nearer than 300 feet to the boundary line of any public way. Provided, however, that this paragraph shall not apply to districts which the division may determine are of a business character. E. No permit shall be granted for the erection of a billboard, sign or other advertising device which will, in the judgment of the division, obstruct the visibility of another sign. F. No billboards, signs or other advertising devices shall be located nearer to other billboards, signs or other advertising devices than 50 feet, unless said billboards, signs or other advertising devices are placed back to back. Provided, however, that this provision shall not apply to districts which the division may determine are of a business character."

Section 7 of the regulations required that all advertising devices whether erected before the adoption of the rules and regulations or not should be removed by

[1] Published by Wright & Potter Printing Co., 32 Derne Street, Boston.

July 1, 1925, provided that extension might be granted to not later than July 1, 1927, unless maintained under a permit issued in accordance with the regulations.

A form of ordinance or bylaw was set forth, which, if adopted by a city or town, would be approved by the department of public works. Such a bylaw was adopted by the town of Concord.

COURT DECISION BASED ON HEARINGS AND THOROUGH STUDY

Fifteen suits in equity were brought by individuals, firms, and corporations engaged in outdoor advertising as plaintiffs; 14 suits were against the commissioners of the department of public works as defendants, and 1 suit was against the officers of the town of Concord. The object of the suits was to obtain decrees to the effect that all and certain parts of the rules and regulations adopted by the department of public works and the bylaw adopted by the town of Concord are void, unconstitutional, and of no effect.

Pending the final disposition of the suits an injunction was issued against the disturbance of signs, billboards, and other advertising devices of the plaintiffs.

The cases were consolidated into a single cause for hearing and were referred to a master under a rule "to hear the parties and their evidence, and to report his findings * * * together with such facts and questions of law and portions of the testimony as any party may in writing request." The master heard the parties and their evidence on 114 days and took a view of signs, billboards, and advertising devices in different sections of the Commonwealth, traveling approximately 1,000 miles with counsel for that purpose. The record consists of five large printed volumes. The master filed a comprehensive report comprising many hundreds of printed pages. The plaintiffs filed 78 numbered objections. After receipt of the copy of a draft of the master's report, the plaintiffs filed a large number of requests for report of facts, questions of law, and portions of testimony, covering about 22 pages of the record. They then filed a motion that the report be recommitted to the master. It contained many divisions, referred to divers of their objections, and requested a report of evidence concerning numerous findings, and of rulings. The motion was accompanied by a considerable number of requests for rulings of law.

Decree was entered that this motion to recommit be "granted as matter of discretion, without ruling upon any question of law." Pursuant to this decree further hearings were held by the master and a supplemental report filed. The plaintiffs filed objections filling approximately 240 pages of the record. They filed a second motion to recommit the case to the master, together with many requests for rulings. From an interlocutory decree denying this motion as a matter of discretion without any rulings of law, the plaintiffs appealed. The defendants moved to confirm the master's reports and to enter final decrees and the case was reserved for determination by the full court.

The master found that the estimated market value as of January 1, 1924, of the combined plants of the plaintiffs, including outdoor advertising devices, interests in land, structures, equipment, and shops was $5,000,000. Full compliance with the rules and regulations promulgated would have required the removal or relocation of 75 to 90 percent of the outdoor advertising signs then existing in the State.

REGULATIONS FOUND TO BE A JUSTIFIABLE USE OF POLICE POWER

The opinion of the Supreme Judicial Court of Massachusetts in which it is held that the plaintiffs are not entitled to relief, discusses the various points at issue at some length.

The constitutional right asserted by the plaintiffs to conduct outdoor advertising without interference by the enforcement of rules and regulations was denied. The only real value of a sign or billboard lies in its proximity to the public thoroughfare within public view. The object of outdoor advertising in the nature of things is to proclaim to those who travel on highways that which is on the advertising. It does not appeal alone to the desire or consent of such persons; it is forcibly thrust upon the attention of all such persons, whether willing or averse. For those who strongly wish to avoid advertising there is no escape; they cannot enjoy their natural and ordinary rights to proceed unmolested. It is illusory to suggest that a traveler may close his eyes and mind to the advertising matter displayed. One cannot well travel upon the highway with any enjoyment or with safety to himself or others with his eyes shut.

The rules and regulations as promulgated, although they operate as a severe limitation upon the business of the planitiffs, are found to be justified as a police measure for protection of travel. Advertising devices on private land manifestly are designed to attract the attention of motorists. The opinion of the executive head of the department of public works that billboards have a distractive effect upon the drivers of automobiles and that they constitute traffic hazards except in business sections was considered as entitled to weight. The danger arising from the operation of automobiles is very great. The toll of life and suffering of human beings exacted by this cause is appalling. Rules and regulations of advertising devices, even to the extent of prohibition, having a reasonable tendency to prevent obstructions to traffic or to facilitate safety of travel are permissible.

Another basis for the rules and regulations is that they tend to protect travelers from the intrusion of the public announcements thrust before their eyes by signs and billboards. The people of the State by the adoption of the constitutional amendment and subsequent legislation have declared that signs and billboards within public view may be regulated and restricted. One permissible and reasonable ground for such regulation is that travelers may be free from annoyance. This is not a mere matter of banishing that which in appearance may be disagreeable to some. It is protection against intrusion by foisting words and emblems of signs and billboards upon the mass of the public against their desire. To adjust the conflicting interests of the public and of the individual is a proper legislative function.

PRESERVATION OF SCENIC BEAUTY SUFFICIENT BASIS FOR REGULATION

It was urged by the plaintiffs that the rules and regulations, so far as they relate to the preservation of scenic beauty and the exercise of taste and fitness in the location of billboards, are void because they rest on aesthetic considerations. Massachusetts decisions were cited in which it was held "that aesthetic considerations alone or as the main end do not afford sufficient foundation for imposing limitations upon the use of property under the police power." The phrase "aesthetic considerations", in the opinion of the court has commonly

been applied to regulations as to the character, form and appearance of constructions to be erected. The rules and regulations in question have a different aim. They are designed to promote safety of travel, to shield travelers from the unwelcome obtrusion of business appeals, to protect property from depreciation and to make the commonwealth attractive to visitors from other States. Grandeur and beauty of scenery contribute highly important factors to the public welfare of a State. To preserve such landscape from defacement promotes the public welfare and is a public purpose. It is held that "Even if the rules and regulations of billboards and other advertising devices did not rest upon the safety of public travel and the promotion of the comfort of travelers by exclusion of undesired intrusion, we think that the preservation of scenic beauty and places of historical interest would be a sufficient support for them. Considerations of taste and fitness may be a proper basis for action in granting and in denying permits for locations for advertising devices."

REGULATION DOES NOT VIOLATE CONSTITUTIONAL RIGHTS

With regard to the contention that the rules and regulations prohibit rather than regulate the business of outdoor advertising the court says:

> If, however, it be assumed in favor of the plaintiffs that their business on the lines heretofore conducted will not be profitable when conducted in conformity to the regulations, that does not, in all the conditions disclosed, entitle them to relief. The practical operation and effect of a statute, bylaw, or ordinance is sometimes an important factor in determining its constitutionality. * * * The scope of that principle, however, is much narrowed when the subject matter is indubitably within legislative competency. The power to regulate outdoor advertising on private land within public view is established by article 50. The circumstance that the practical effect of the regulations may render the business as heretofore conducted by the plaintiffs unprofitable does not brand the regulations as invalid.

It was contended by the plaintiffs that the rules and regulations as interpreted and applied violated the rights guaranteed by the fourteenth amendment to the Constitution of the United States in that they are deprived of their property without due process of law and are denied the equal protection of the laws. In expressing the opinion that this contention cannot be sustained the court says:

> It must, in our opinion be regarded as settled by these decisions of the Supreme Court of the United States that billboard and like advertising devices upon private property have such demonstrated potentialities for harm to the general welfare that they may be prohibited in certain localities by public authority. The principle has become so thoroughly established that billboards are mentioned as illustrations of an appropriate subject for regulation and restriction. Advertising devices such as those of the plaintiffs relate to the promotion of trade and commerce. The exclusion of them from regions of natural scenic beauty and historic interest does not exceed the reasonable bounds of the police power. The circumstance that in the cases at bar there have been few instances where billboards have been used to the public harm by the evil-minded is not decisive.

(Continued from p. 6)

cooperatively by the Iowa State Commission and the Iowa Federal Emergency Relief Administration. We expect to have the assistance of the best judgment of the commission's own district and other engineers and to use mortality type curves, about as explained above, to aid in applying their judgments and our own.

INVESTIGATION OF THE ACTUAL SERVICE LIVES OF RURAL HIGHWAY PAVEMENTS INAUGURATED

The author is much gratified to be able to announce the immediate start of active work in a cooperative project of the United States Bureau of Public Roads and the Iowa Engineering Experiment Station for the collection, study and publication of extensive data of the actual service lives of rural highway surfaces of various types in several States. It was the original plan that this should be a joint project of the United States Bureau of Public Roads and the Highway Research Board. Some technical difficulties have made the other set-up necessary, but the director of the board has promised his active assistance and the subcommittee on pavement mortality of the board's committee on transportation economics will be asked to participate actively in planning and guiding the work. Cooperation is sought from highway commission and other highway officials and engineers in the several States.

CURRENT STATUS OF UNITED STATES PUBLIC WORKS ROAD CONSTRUCTION

AS PROVIDED BY SECTION 204 OF THE NATIONAL INDUSTRIAL RECOVERY ACT (1934 FUNDS) AND BY THE ACT OF JUNE 18, 1934 (1935 FUNDS)

CLASS 1.—PROJECTS ON THE FEDERAL-AID HIGHWAY SYSTEM OUTSIDE OF MUNICIPALITIES

AS OF FEBRUARY 28, 1935

STATE	APPORTIONMENTS		COMPLETED				UNDER CONSTRUCTION				APPROVED FOR CONSTRUCTION			BALANCE OF FUNDS AVAILABLE FOR NEW PROJECTS	
	Sec. 204 of the Act of June 16, 1933 (1934 Fund)	Act of June 18, 1934 (1935 Fund)	Total Cost	1934 Public Works Funds	1935 Public Works Funds	Mileage	Estimated Total Cost	1934 Public Works Funds	1935 Public Works Funds	Mileage	1934 Public Works Funds	1935 Public Works Funds	Mileage	1934 Public Works Funds	1935 Public Works Funds
Alabama	$ 3,947,753	$ 2,129,921	$ 5,595,178	$ 3,029,941	$ 35,889	304.6	$ 2,354,828	$ 841,326	$ 828,175	140.1		$ 422,187	19.1	$ 76,485	$ 843,669
Arizona	3,878,555	1,338,712	4,352,582	3,697,024	55,699	291.0	1,023,303	162,379	821,290	70.8	$ 1,057	330,885	28.8	18,094	130,838
Arkansas	3,334,167	1,714,000	3,004,272	2,393,539	137,100	154.9	1,851,377	798,211	787,910	73.8	39,563	212,948	5.6	102,854	576,041
California	7,912,928	3,713,643	9,109,588	6,830,077		277.2	3,801,118	1,076,204	1,471,100	72.7		929,490	65.8	6,647	1,313,053
Colorado	3,437,265	2,424,504	3,889,817	3,366,958	440,498	181.0	1,888,170	60,627	1,692,148	90.2	9,680	291,858	11.4		
Connecticut	1,404,213	607,500	797,613	795,279		14.5	1,324,901	608,934	453,399	21.7		154,100	1.8		1
Delaware	892,544	461,697	910,189	869,662	36,177	38.2	429,141		413,964	10.7	8,734			14,149	11,557
Florida	2,519,011	1,116,600	2,986,534	2,180,563		108.9	1,066,981	264,471	734,958	42.4		55,579	.4	73,977	326,063
Georgia	5,045,592	2,556,745	3,640,506	3,447,388		252.7	2,127,680	1,393,826	698,854	98.9	41,770	990,756	61.4	162,608	867,135
Idaho	2,166,858	1,131,910	2,143,015	1,974,315	97,326	184.1	543,662	171,151	360,316	30.0	21,392	162,097	17.7		512,171
Illinois	4,442,467	3,060,041	1,994,740	1,958,990	19,269	38.5	3,010,696	2,421,646	589,050	34.6	36,045	1,064,927	21.7	25,787	1,386,734
Indiana	5,018,921	2,843,478	3,250,269	3,222,226		107.2	1,806,095	1,691,931	113,453	40.4	58,760	1,980,538	126.9	46,004	749,487
Iowa	5,027,830	2,217,361	4,819,401	4,601,240	54,420	288.6	1,820,178	380,600	1,342,273	111.8	9,800	507,064	24.7	36,190	313,604
Kansas	5,044,802	2,354,131	5,310,444	4,931,898	171,368	542.7	1,602,827	56,400	1,546,427	165.9		636,336	46.3	56,504	
Kentucky	3,751,605	1,527,324	3,622,609	3,353,251	33,571	243.9	642,576	289,920	300,503	50.6	94,476	501,843	47.1	13,958	691,406
Louisiana	2,711,152	1,380,419	1,756,275	1,752,495		73.9	1,891,991	905,474	472,715	12.6	45,353	698,353	19.5	7,830	209,351
Maine	1,617,560	793,644	1,361,991	1,326,424		43.7	802,573	239,455	563,118	13.5	12,524	197,402	6.8	39,157	33,124
Maryland	1,782,263	289,609	791,624	778,132	3,843	15.1	886,878	774,460	115,418	20.0	39,135	97,729	1.7	193,536	72,620
Massachusetts	1,101,716	1,632,874	1,409,030	1,016,079		37.4	562,032	52,687	457,524	9.2		552,128	10.1	32,950	623,222
Michigan	6,051,532	3,226,284	4,790,228	4,693,839		223.4	2,742,825	1,348,200	1,379,825	101.8		1,627,975	69.9	9,494	218,484
Minnesota	4,561,011	2,642,244	5,637,753	4,344,165	1,192,164	864.7	924,069	179,056	686,213	130.1		576,987	69.9	37,789	186,879
Mississippi	3,489,337	2,301,148	4,346,833	2,332,709	87,605	224.1	2,108,174	974,048	339,905	116.9	32,821	1,050,906	54.6	149,759	822,732
Missouri	5,237,532	2,132,426	4,660,917	4,126,069		187.9	2,489,372	1,065,079	1,203,173	70.4		726,674	24.2	46,385	202,579
Montana	4,463,849	2,714,208	5,493,149	4,459,720	466,873	426.3	1,752,771	4,129	1,679,685	170.3		309,616	34.2		258,034
Nebraska	3,914,481	1,982,182	5,141,415	3,892,837	54,009	373.4	1,560,207	21,644	1,192,183	75.4		692,946	32.5		43,044
Nevada	2,909,387	1,350,356	2,833,939	2,704,502	76,039	268.7	750,483	108,771	641,712	100.9	17,734	14,755	2.6	78,379	617,850
New Hampshire	692,119	484,731	638,684	612,389		10.8	425,572	79,730	324,780	11.2		116,767	1.3		43,185
New Jersey	3,173,019	951,379	1,711,231	1,691,699		31.6	1,686,118	1,472,042	24,919	16.7		332,908	3.5	9,279	593,552
New Mexico	2,846,648	1,676,769	3,033,052	2,760,948	128,175	297.5	1,258,400	85,700	1,101,806	96.6					446,788
New York	10,465,672	3,748,600	10,178,868	8,394,638	53,000	210.3	7,632,928	2,010,070	2,391,600	134.8		928,820	11.7	60,965	375,180
North Carolina	4,761,147	2,040,068	4,637,100	3,584,367	209,578	581.6	1,278,683	604,315	403,141	136.0	249,644	132,465	31.8	322,821	1,294,884
North Dakota	2,902,224	1,469,484	3,129,885	2,645,348	58,556	1,023.9	366,775	52,853	239,860	133.0	47,825	550,401	285.7	156,199	620,666
Ohio	7,277,758	3,539,256	7,474,205	7,059,927		192.4	1,935,620		1,698,610	45.4		1,345,575	22.9	217,831	495,070
Oklahoma	4,608,399	2,342,590	3,815,675	3,714,071	14,570	278.4	2,317,780	885,837	1,310,267	98.4		497,898	21.2	8,492	519,855
Oregon	3,053,448	1,452,741	3,339,481	3,039,829	8,928	183.0	1,143,245	13,619	1,072,626	50.4		214,490	9.8		156,698
Pennsylvania	6,691,194	4,554,082	5,802,997	5,504,616	98,425	123.1	4,077,450	1,098,013	2,766,261	68.7	865	1,507,768	29.2	87,699	181,627
Rhode Island	979,367	464,572	968,005	899,627		20.5	542,465	46,205	414,131	13.6		25,194	.7	33,535	25,248
South Carolina	2,729,583	1,385,477	2,200,772	2,180,097		194.1	929,956	427,424	462,879	75.2	20,920	778		101,142	921,820
South Dakota	3,005,739	1,523,821	2,763,620	2,246,737	34,870	454.9	696,181	564,746	119,781	173.4	137,949	891,604	145.8	56,307	477,567
Tennessee	4,246,309	2,105,453	4,428,459	3,741,850	64,152	175.2	1,021,521	411,795	513,324	33.1	56,807	737,471	24.9	35,856	790,507
Texas	11,588,643	6,858,253	11,328,976	10,835,799		981.4	3,614,322	724,808	2,849,863	283.4	17,681	1,506,940	124.2	10,355	2,501,450
Utah	2,367,205	1,066,345	2,762,634	2,279,074	365,500	237.8	791,275	84,632	496,100	61.6		8,000	.2	3,499	196,745
Vermont	928,184	466,042	970,709	909,613	28,464	47.9	277,219	10,670	249,114	13.9		142,265	5.3	7,901	46,199
Virginia	3,708,379	1,882,693	3,556,591	3,324,966	18,172	151.2	1,282,297	76,416	1,121,250	48.3	130,485	445,811	33.6	176,512	297,461
Washington	3,057,934	1,553,206	2,771,879	2,556,090	196,077	99.4	1,603,419	434,930	1,007,442	27.6	30,664	82,427	2.8	36,250	267,260
West Virginia	2,013,405	1,140,167	1,947,430	1,875,902	60,892	71.2	554,218	111,669	425,657	20.0		284,743	9.2	25,834	368,875
Wisconsin	4,697,518	1,865,947	4,437,423	4,316,380	3,324	213.1	802,396	239,441	462,624	42.8	134,823	785,901	37.5	6,868	614,098
Wyoming	2,250,663	1,692,907	2,310,490	2,035,483	85,400	476.8	1,231,302	209,202	995,932	144.1		448,728	92.2	5,977	162,847
District of Columbia															
Hawaii	1,683,956	598,778	349,204	250,764		12.4	1,826,261	1,428,169		27.2				5,023	598,778
TOTALS	185,392,844	94,506,322	178,207,281	154,539,536	4,389,933	11,835.1	79,060,311	26,959,915	41,337,258	3,631.1	1,296,512	25,773,033	1,698.2	2,596,881	23,006,098

CURRENT STATUS OF UNITED STATES PUBLIC WORKS ROAD CONSTRUCTION

AS PROVIDED BY SECTION 204 OF THE NATIONAL INDUSTRIAL RECOVERY ACT (1934 FUNDS) AND BY THE ACT OF JUNE 18, 1934 (1935 FUNDS)

CLASS 2.—PROJECTS ON EXTENSIONS OF THE FEDERAL-AID HIGHWAY SYSTEM INTO AND THROUGH MUNICIPALITIES

AS OF FEBRUARY 28,1935

STATE	APPORTIONMENTS		COMPLETED				UNDER CONSTRUCTION				APPROVED FOR CONSTRUCTION			BALANCE OF FUNDS AVAILABLE FOR NEW PROJECTS	
	Sec. 204 of the Act of June 16, 1933 (1934 Fund)	Act of June 18, 1934 (1935 Fund)	Total Cost	1934 Public Works Funds	1935 Public Works Funds	Mileage	Estimated Total Cost	1934 Public Works Funds	1935 Public Works Funds	Mileage	1934 Public Works Funds	1935 Public Works Funds	Mileage	1934 Public Works Funds	1935 Public Works Funds
Alabama	$ 2,389,928	$ 1,064,961	$ 1,322,462	$ 1,322,463	$ 8,996	35.3	$ 1,035,694	$ 920,479	$ 115,215	31.9		$ 137,191	2.3	$ 146,987	$ 812,555
Arizona	807,982	305,191	629,986	619,479		12.3	59,340	20,500	28,309	1.6	$ 129,322		.2	38,682	267,886
Arkansas	1,964,534	857,025	1,538,614	1,440,230		40.3	428,128	401,851	25,949	5.7	101,076	247,361	7.9	21,376	583,714
California	4,213,986	2,219,360	3,901,155	3,402,117		46.7	2,054,421	789,009	956,282	15.0		150,350	5.1	22,860	1,112,728
Colorado	1,718,633	190,000	1,765,127	1,700,547	13,406	35.9	5,717		5,717	1.2		170,877	2.0	18,085	
Connecticut	802,407	426,500	809,508	798,075	6,892	10.3	137,740		137,740	1.2				4,331	281,868
Delaware	477,680	230,849	474,326	466,045		7.4	54,180		54,180	.6	4,323		.7	7,313	176,669
Florida	1,410,008	501,200	1,639,226	1,398,151		18.5	87,633		87,633	2.5		9,883	.2	11,857	403,684
Georgia	2,724,620	1,278,373	1,499,273	1,490,222		57.7	842,228	806,580	35,648	16.9	238,197	284,090	12.1	189,622	958,635
Idaho	1,197,829	321,126	1,158,808	1,120,140	2,643	19.4	67,654	45,372	22,282	1.4		5,095	.5	32,317	291,106
Illinois	7,476,075	2,515,835	5,904,491	5,807,985		63.4	1,988,729	1,593,239	395,490	10.0	57,163	703,041	3.7	17,688	1,417,304
Indiana	4,287,050	2,035,585	2,944,801	2,896,840		60.9	1,159,142	1,124,013	34,951	10.1	213,658	566,958	16.4	52,538	1,433,677
Iowa	2,614,472	1,311,000	1,930,257	1,839,364	7,085	53.8	762,607	629,108	96,989	8.8	146,000	418,135	11.1		788,792
Kansas	2,522,401	1,432,949	2,232,396	2,221,567	2,442	38.7	934,839	275,108	514,877	9.7		915,630	8.2	25,726	
Kentucky	1,927,828	954,578	1,351,479	1,329,509		30.8	636,470	503,813	128,329	4.7	94,506	253,155	7.3		573,094
Louisiana	1,718,577	744,560	680,143	679,010		17.6	944,729	861,500	56,548	11.6	162,272	286,200	8.0	15,795	401,813
Maine	909,878	490,045	845,836	840,043		16.4	47,071	47,071		.4		105,066	.8	22,764	384,979
Maryland	891,132	452,515	388,284	384,134		4.1	911,650	98,129		.4	54,838		.2	354,031	452,515
Massachusetts	5,007,199	847,600	1,915,107	1,873,562		12.3	3,073,328	2,996,104	52,248	5.4		172,541	1.3	137,533	622,811
Michigan	3,500,638	1,613,142	3,211,863	3,063,989	101,950	39.0	1,349,600	412,750	898,950	8.8	14,950	406,800	10.5	8,949	205,442
Minnesota	3,719,143	1,421,494	3,245,306	3,018,514	195,446	108.1	370,010	155,856	205,954	10.1		173,198	6.5	544,773	846,897
Mississippi	1,744,669	885,056	654,198	614,044	27,695	24.5	775,721	668,228	78,493	21.9	324,748	58,100	9.1	137,649	720,768
Missouri	4,019,501	1,617,451	2,125,410	2,055,053		48.7	2,024,272	1,814,926	151,712	14.0	26,513	42,197	1.2	123,009	1,423,542
Montana	1,115,962	113,092	1,053,554	1,050,439		32.4	65,264	34,716	5,994	4.5	8,796	65,686	3.2	22,010	41,412
Nebraska	1,957,240	991,091	2,087,182	1,947,051	122,489	35.9	280,685		280,685	4.2	121	455,955	9.6	10,069	131,961
Nevada	500,051	100,000	494,565	474,754		8.8	65,438	16,107	49,331	1.5		1,000		9,190	49,668
New Hampshire	740,335	242,366	726,187	668,776	54,054	15.9	203,382	71,559	131,613	4.8					56,699
New Jersey	3,117,921	1,809,500	2,457,304	2,327,022		21.0	1,260,270	764,347	381,132	6.0		196,988	.5	26,552	1,231,380
New Mexico	1,674,158	529,506	1,381,103	1,381,103		31.3	373,264	193,167	180,097	8.9	8,234	69,432	1.7	91,655	279,977
New York	8,255,661	3,756,621	6,244,829	5,886,964		53.2	4,348,403	2,296,556	1,886,900	24.5		1,145,600	7.2	72,141	724,121
North Carolina	2,380,573	1,210,236	2,064,467	2,024,858	31,970	74.4	260,570	160,768	61,408	9.4	160,316	411,315	9.1	34,632	705,543
North Dakota	1,451,112	734,742	1,020,206	1,013,982		43.1	197,078	121,828	75,250	7.2	287,300	152,859	26.7	28,002	506,633
Ohio	4,335,686	2,359,503	4,531,914	4,019,218	15,000	57.8	999,430	226,500	677,980	10.7		1,027,230	10.6	89,968	639,293
Oklahoma	2,304,200	1,171,295	1,756,877	1,723,097		38.3	670,541	551,113	115,462	10.4		485,409	5.5	29,989	570,424
Oregon	1,526,724	867,977	1,484,039	1,460,758		27.8	187,504	53,905	112,979	2.6	518	462,181	9.7	11,543	292,816
Pennsylvania	4,854,988	2,397,703	3,509,074	3,279,974	84,056	55.0	1,788,530	1,480,091	226,563	15.4	32,000	1,456,307	15.0	62,923	630,777
Rhode Island	579,625	255,000	527,914	527,015		7.4	36,001		36,001	.6		68,999	.9	52,610	150,000
South Carolina	1,364,791	692,738	971,452	970,032		32.2	306,577	300,628	5,949	12.0	22,715	64,645	1.9	71,416	622,144
South Dakota	1,502,870	761,911	1,050,815	1,050,814		35.0	113,093	111,732	1,361	6.4	99,383	101,328	6.0	240,940	659,222
Tennessee	2,123,155	1,121,790	1,567,518	1,559,283		22.9	650,511	450,120	200,391	6.0	106,005	228,141	3.5	7,747	693,258
Texas	6,642,863	1,795,000	4,430,592	4,324,781		108.0	2,245,677	2,031,432	49,955	17.6	125,527	290,639	17.5	161,123	1,454,406
Utah	778,826	533,173	748,473	649,487	65,900	20.2	200,559	124,000	71,000	2.3	5,130	245,000	6.3	209	151,273
Vermont	500,509	240,611	418,799	403,261		11.9	185,602	97,248	77,285	3.9		84,715	1.4		78,611
Virginia	2,008,458	941,347	1,327,270	1,235,161	62,582	25.7	868,532	458,925	214,185	6.6	39,713	183,075	4.1	274,660	481,505
Washington	1,977,260	776,603	1,964,391	1,908,303	37,128	32.7	387,884		387,884	10.3	36,458	142,478	2.4	32,499	209,113
West Virginia	1,342,270	570,085	875,234	861,676	13,293	16.1	493,653	453,304	14,816	5.3		16,863	.6	27,289	525,113
Wisconsin	2,596,143	1,293,455	2,505,029	2,445,283	15,575	52.3	377,558	116,488	261,070	7.0		277,525	7.1	34,373	739,284
Wyoming	1,125,332	22,877	1,020,569	1,018,231		22.3	114,311	107,101	6,629	2.5		10,287	.7		5,961
District of Columbia	968,235	243,460	930,696	704,305	226,391	6.5	250,164	250,164		.2				13,765	17,070
Hawaii															
TOTALS	115,771,118	49,248,077	89,318,109	85,296,711	1,094,993	1,690.2	36,681,384	24,635,435	9,595,416	384.7	2,499,782	12,749,525	266.5	3,339,190	25,808,143

CURRENT STATUS OF UNITED STATES PUBLIC WORKS ROAD CONSTRUCTION

AS PROVIDED BY SECTION 204 OF THE NATIONAL INDUSTRIAL RECOVERY ACT (1934 FUNDS) AND BY THE ACT OF JUNE 18, 1934 (1935 FUNDS)

CLASS 3.—PROJECTS ON SECONDARY OR FEEDER ROADS

AS OF FEBRUARY 28, 1935

STATE	APPORTIONMENTS		COMPLETED				UNDER CONSTRUCTION				APPROVED FOR CONSTRUCTION			BALANCE OF FUNDS AVAILABLE FOR NEW PROJECTS	
	Sec. 204 of the Act of June 16, 1933 (1934 Fund)	Act of June 18, 1934 (1935 Fund)	Total Cost	1934 Public Works Funds	1935 Public Works Funds	Mileage	Estimated Total Cost	1934 Public Works Funds	1935 Public Works Funds	Mileage	1934 Public Works Funds	1935 Public Works Funds	Mileage	1934 Public Works Funds	1935 Public Works Funds
Alabama	$ 2,032,452	$ 1,064,960	$ 847,621	$ 847,621		63.4	$ 1,442,247	$ 1,139,933	$ 302,314	103.0		$ 317,170	21.1	$ 44,898	$ 445,477
Arizona	525,423	998,032	530,237	517,610		42.3	337,581	7,813	285,282	22.9		56,348	7.3		656,401
Arkansas	1,449,634	857,024	1,107,252	1,103,900		140.1	367,359	267,263	99,454	38.6	$ 5,473	187,863	29.0	72,998	569,707
California	3,480,440	1,999,203	3,583,430	2,984,134		164.3	1,179,445	494,605	568,455	33.2		409,978	12.6	1,700	1,020,769
Colorado	1,718,632	871,502	1,754,711	1,608,632	$ 43,447	167.2	984,976	110,000	470,277	155.7		80,093	4.4		277,685
Connecticut	659,120	420,868					887,796	659,120	222,880	19.0		11,129	.4		186,859
Delaware	448,864	230,849	295,307	218,551	72,707	26.7	381,126	230,313	118,329	33.0					39,813
Florida	1,302,815	1,043,543	1,282,679	1,274,108		74.8	373,252		373,252	22.0		280,390	13.1	28,708	389,901
Georgia	2,320,973	1,278,373	1,202,043	1,199,035		86.7	1,038,291	916,123	122,168	70.3	33,126	133,143	17.6	172,689	1,023,062
Idaho	1,121,562	824,450	1,310,667	1,108,790	60,449	156.1	434,438		429,147	49.3		30,000	3.2	12,772	304,854
Illinois	5,652,228	3,345,525	1,948,518	1,932,204		124.0	5,188,701	3,610,926	1,577,775	278.5	99,933	1,765,332	80.1	9,165	2,419
Indiana	731,872	209,900	404,572	404,572		44.2	272,102	272,102		40.7	48,449	106,780	14.2	6,749	103,120
Iowa	2,413,358	1,590,000	2,058,296	1,931,498	67,450	295.1	1,261,008	424,850	675,200	208.4		643,150	147.8	57,010	204,200
Kansas	2,522,401	1,330,595	1,953,975	1,876,926	65,466	202.0	1,283,516	637,717	645,799	82.0	7,758	619,330	31.1		
Kentucky	1,837,926	1,336,409	1,812,919	1,720,166	16,263	210.0	819,299	107,202	700,434	87.6		619,712	95.3	10,558	
Louisiana	1,398,862	838,953	960,666	959,844		45.3	372,393	315,225	57,168	15.6	123,793	377,090	26.3		404,695
Maine	842,479	427,897	1,064,725	841,082	146,555	89.0	277,470		256,412	20.9		16,526	.7	1,397	8,404
Maryland	891,132	1,067,934	661,949	640,929		49.8	447,350	224,250	223,100	25.5	20,419	413,720	12.1	5,534	431,113
Massachusetts	488,185	870,000	469,741	469,741		15.2						115,370	5.5	18,443	754,631
Michigan	3,184,057	1,613,142	2,869,111	2,836,656	16,400	205.6	1,032,877	341,727	676,250	40.6		863,850	43.0	5,674	56,642
Minnesota	2,376,415	1,361,813	2,324,738	2,210,097	68,916	256.7	987,215	155,444	699,671	104.4		325,120	31.7	10,875	268,107
Mississippi	1,744,669	354,023	725,584	725,584		86.2	879,472	879,472		71.5	64,884		3.1	74,729	354,023
Missouri	2,923,273	2,423,863	2,871,931	2,687,722	109,686	584.5	836,646	158,005	633,388	189.3	77,546	887,618	127.1		793,171
Montana	1,859,937	942,434	1,809,318	1,795,045	12,644	226.5	294,173		294,173	18.3		556,610	63.7	64,892	79,007
Nebraska	1,957,240	991,091	2,108,619	1,957,240	147,789	402.5	536,114		536,114	42.6		227,036	43.8		80,151
Nevada	1,136,479	852,000	1,242,422	1,117,890	75,273	140.1	274,671		274,671	25.9		55,784	19.1	18,589	446,273
New Hampshire	477,385	242,365	543,721	447,963	51,459	27.9	114,607	29,000	82,590	5.9		57,479	3.4	422	50,837
New Jersey	55,099	460,000	56,528	55,099		.5						111,963	1.7		348,037
New Mexico	1,272,129	735,425	1,226,434	1,226,434		207.4	464,767	45,695	419,072	62.3		172,911	16.5		143,443
New York	3,608,768	3,822,700	3,320,216	2,955,796	28,200	83.8	3,743,820	625,700	2,318,900	171.8		1,172,328	115.0	27,272	303,272
North Carolina	2,380,573	1,590,637	2,155,446	2,154,669		224.3	1,062,973	215,387	847,586	111.4		431,154	57.7	10,517	311,896
North Dakota	1,451,112	734,741	903,913	903,913		280.1	263,581	263,581		73.2	220,451	245,691	132.2	63,167	489,051
Ohio	3,871,148	1,966,253	3,987,074	3,720,866	10,200	299.2	542,460	73,810	466,650	77.0		839,470	26.5	76,472	649,933
Oklahoma	2,304,199	1,171,295	1,821,283	1,719,586		224.9	1,263,439	576,850	584,502	74.6	5,479	183,973	15.3	2,285	402,820
Oregon	1,526,724	777,096	1,710,431	1,507,198	23,904	112.0	628,496	19,526	568,588	46.0		167,003	13.2		17,601
Pennsylvania	7,344,822	2,639,003	6,405,695	6,184,822	81,302	542.9	2,866,950	1,160,000	1,672,149	204.7		686,602	18.0		198,950
Rhode Island	439,716	295,000	414,120	404,637		33.2	262,140		262,140	6.7				35,078	32,860
South Carolina	1,364,791	692,739	1,116,509	1,060,256	56,254	119.6	750,079	255,654	450,646	97.3		185,839	25.0	48,882	
South Dakota	1,502,870	761,911	1,188,476	1,140,303	48,151	333.5	335,694	310,785	24,909	94.1	51,782	104,547	69.6		584,304
Tennessee	2,123,155	1,075,748	1,352,642	1,314,948		111.9	1,064,687	729,642	335,045	53.8	4,503	120,771	5.4	74,061	619,932
Texas	6,012,518	3,638,000	5,995,221	5,528,540		753.6	1,610,472	456,546	1,149,778	92.6		865,256	99.4	27,431	1,622,966
Utah	1,048,677	533,173	1,185,881	955,732	114,800	185.6	357,024	92,945	198,373	61.1		93,000	11.8		127,000
Vermont	438,880	241,354	474,394	436,802	16,569	37.2	118,931		113,646	8.4		111,102	8.0	2,078	37
Virginia	1,699,920	941,347	1,598,958	1,536,980	8,753	210.8	380,878	114,349	255,347	21.9	11,450	306,706	39.7	37,141	370,540
Washington	1,080,673	776,603	1,071,774	1,043,594	7,095	63.7	389,538	36,153	342,156	40.7		258,502	7.7	926	168,850
West Virginia	1,118,559	570,083	733,482	701,270		41.9	404,913	359,084	45,829	15.2	25,237	128,831	5.5	32,968	395,423
Wisconsin	2,431,220	1,782,435	2,315,893	2,153,100	48,583	170.4	508,381	202,460	249,763	14.6	68,000	519,916	35.4	7,660	964,172
Wyoming	1,125,332	571,928	1,080,501	1,061,742		149.1	149,276		149,274	15.5	27,126	161,648	34.2	36,464	261,006
District of Columbia	950,234	730,382	1,051,683	911,763	139,920	8.7	234,139		234,139	2.6		147,150	1.6	38,471	209,173
Hawaii	187,106	351,000	177,718	177,718		4.9								9,389	351,000
TOTALS	92,836,038	56,245,601	79,089,024	74,273,308	1,538,235	8,125.4	39,706,763	16,519,257	21,012,795	3,150.2	895,409	16,170,984	1,596.1	1,148,064	17,523,587

CURRENT STATUS OF UNITED STATES PUBLIC WORKS ROAD CONSTRUCTION

AS PROVIDED BY SECTION 204 OF THE NATIONAL INDUSTRIAL RECOVERY ACT (1934 FUNDS) AND BY THE ACT OF JUNE 18, 1934 (1935 FUNDS)

SUMMARY OF CLASSES 1, 2, AND 3.

AS OF FEBRUARY 28,1935

STATE	APPORTIONMENTS		COMPLETED				UNDER CONSTRUCTION				APPROVED FOR CONSTRUCTION			BALANCE OF FUNDS AVAILABLE FOR NEW PROJECTS	
	Sec. 204 of the Act of June 16, 1933 (1934 Fund)	Act of June 18, 1934 (1935 Fund)	Total Cost	1934 Public Works Funds	1935 Public Works Funds	Mileage	Estimated Total Cost	1934 Public Works Funds	1935 Public Works Funds	Mileage	1934 Public Works Funds	1935 Public Works Funds	Mileage	1934 Public Works Funds	1935 Public Works Funds
Alabama	$ 8,370,133	$ 4,259,842	$ 7,765,261	$ 5,200,024	$ 35,889	403.4	$ 4,832,769	$ 2,901,738	$ 1,246,704	275.0		$ 876,548	42.5	$ 268,370	$ 2,101,701
Arizona	5,211,960	2,641,935	5,512,805	4,834,113	64,696	345.6	1,420,223	190,692	1,134,881	95.3	$ 130,379	387,234	36.3	56,776	1,055,125
Arkansas	6,748,335	3,428,049	5,650,138	4,937,669	137,101	335.3	2,646,864	1,467,326	913,313	118.1	146,112	648,173	42.4	197,228	1,729,462
California	15,607,354	7,932,206	16,594,173	13,216,328		488.3	7,034,983	2,359,819	2,995,838	120.9		1,489,818	83.5	31,207	3,446,550
Colorado	6,874,530	3,486,006	7,409,654	6,676,138	497,351	384.0	2,878,863	170,627	2,168,142	247.1	9,680	542,829	17.7	18,085	277,685
Connecticut	2,865,740	1,454,868	1,607,120	1,593,354	6,892	24.8	2,350,437	1,268,054	814,019	41.9		165,229	2.2	4,331	468,728
Delaware	1,819,088	923,395	1,679,822	1,554,257	108,883	72.2	864,448	230,313	586,473	44.3	13,056		.7	21,462	228,039
Florida	5,231,834	2,661,343	5,908,439	4,852,821		202.2	1,527,866	264,471	1,195,844	67.0		345,852	13.7	114,542	1,119,648
Georgia	10,091,185	5,113,491	6,341,822	6,136,646		397.1	4,008,199	3,116,529	856,670	186.1	313,092	1,407,988	91.2	524,919	2,848,832
Idaho	4,486,249	2,277,486	4,612,489	4,203,245	160,418	359.7	1,045,754	216,522	811,745	80.6	21,392	197,192	21.4	45,089	1,108,131
Illinois	17,570,770	8,921,401	9,847,750	9,699,179	19,269	225.9	10,188,126	7,625,811	2,562,315	323.1	193,141	3,533,300	105.5	52,640	2,806,517
Indiana	10,037,843	5,088,963	6,599,642	6,523,638		212.3	3,237,339	3,088,046	148,404	91.2	320,868	2,654,275	157.5	105,291	2,286,284
Iowa	10,055,660	5,118,361	8,807,954	8,372,101	128,955	637.4	3,843,794	1,434,558	2,114,462	328.9	155,800	1,568,349	183.5	93,200	1,306,596
Kansas	10,089,604	5,117,675	9,496,816	9,030,391	239,277	783.3	3,821,181	969,225	2,707,102	257.7	7,758	2,171,296	85.6	82,230	
Kentucky	7,517,359	3,818,311	6,787,007	6,402,927	49,834	484.7	2,098,345	900,934	1,129,266	142.9	188,982	1,374,710	149.8	24,516	1,264,500
Louisiana	5,828,591	2,963,932	3,397,085	3,391,349		136.8	3,209,113	2,082,199	586,431	39.7	331,418	1,361,642	53.8	23,625	1,015,859
Maine	3,369,917	1,711,586	3,272,553	3,007,549	146,555	149.2	1,127,115	286,526	819,530	34.7	12,524	318,993	8.3	63,318	426,507
Maryland	3,564,527	1,810,058	1,841,856	1,803,195	3,843	69.0	2,245,878	1,093,839	338,518	45.9	114,392	511,450	14.0	553,101	956,248
Massachusetts	6,597,100	3,350,474	3,793,878	3,359,383		65.0	3,635,361	3,048,791	509,772	14.7		840,038	16.9	188,926	2,000,664
Michigan	12,736,227	6,452,568	10,871,201	10,594,483	118,350	468.0	5,125,302	2,102,677	2,955,025	151.2	14,950	2,898,625	123.4	24,117	480,568
Minnesota	10,656,569	5,425,551	11,207,797	9,572,776	1,456,525	1,229.5	2,281,294	490,356	1,591,838	244.6		1,075,304	108.1	593,437	1,301,883
Mississippi	6,978,675	3,540,227	5,726,616	3,672,338	115,300	334.7	3,763,366	2,521,747	418,398	210.4	422,453	1,109,006	66.8	362,137	1,897,523
Missouri	12,180,306	6,173,740	9,658,258	8,868,843	109,686	821.1	5,350,290	3,038,009	1,988,273	273.7	104,060	1,656,488	152.5	169,394	2,419,292
Montana	7,439,748	3,769,734	8,356,020	7,305,204	479,518	685.2	2,112,208	38,846	1,979,852	193.1	8,796	931,912	101.1	86,902	378,453
Nebraska	7,828,961	3,964,364	9,337,216	7,797,128	324,288	811.9	2,377,007	21,644	2,008,983	122.3	121	1,375,937	86.0	10,069	255,156
Nevada	4,545,917	2,302,356	4,570,926	4,297,146	151,311	417.6	1,090,592	124,878	965,714	128.4	17,734	71,539	21.7	106,158	1,113,791
New Hampshire	1,909,839	969,462	1,908,592	1,729,128	105,513	54.7	743,561	180,288	538,983	21.9		174,246	4.7	422	150,721
New Jersey	6,346,039	3,220,879	4,225,064	4,073,819		53.0	2,946,388	2,236,389	406,050	22.7		641,860	5.7	35,831	2,172,969
New Mexico	5,792,935	2,941,700	5,640,589	5,368,485	128,175	536.2	2,096,431	324,562	1,700,975	167.8	8,234	242,343	18.2	91,655	870,208
New York	22,330,101	11,327,921	19,743,912	17,237,397	81,200	347.3	15,725,151	4,932,326	6,597,400	331.1		3,246,748	134.0	160,378	1,402,573
North Carolina	9,522,293	4,840,941	8,857,013	7,763,894	241,549	880.3	2,602,226	980,470	1,312,134	256.8	409,960	974,935	98.5	367,970	2,312,323
North Dakota	5,804,448	2,938,967	5,054,005	4,563,243	58,556	1,347.1	827,434	438,262	315,109	213.4	555,575	948,951	444.7	247,368	1,616,350
Ohio	15,484,592	7,865,012	15,993,193	14,800,011	25,200	549.5	3,477,510	300,310	2,843,240	133.1		3,212,275	60.0	384,271	1,784,296
Oklahoma	9,216,798	4,685,180	7,393,835	7,156,754	14,570	541.5	4,251,760	2,013,799	2,010,231	183.4	5,479	1,167,280	42.1	40,766	1,493,099
Oregon	6,106,896	3,097,814	6,533,951	6,007,786	32,831	322.8	1,959,243	87,050	1,754,193	99.0	518	843,674	32.7	11,543	467,115
Pennsylvania	18,891,004	9,590,788	15,717,766	14,969,412	263,783	721.0	8,732,931	3,738,104	4,684,974	288.8	32,865	3,650,677	62.1	150,622	1,011,354
Rhode Island	1,998,708	1,014,572	1,910,039	1,831,280		61.1	840,606	46,205	712,271	20.9		94,193	1.6	121,223	208,108
South Carolina	5,459,165	2,770,954	4,288,734	4,210,385	56,253	346.0	1,986,612	983,706	919,474	184.6	43,635	251,262	26.9	221,440	1,543,964
South Dakota	6,011,479	3,047,643	5,002,910	4,437,854	83,020	823.4	1,144,968	987,263	146,051	273.9	289,114	1,097,479	221.4	297,247	1,721,093
Tennessee	8,492,619	4,302,991	7,348,618	6,616,081	64,152	310.0	2,736,718	1,591,558	1,048,760	92.9	167,316	1,086,383	33.8	117,664	2,103,697
Texas	24,244,024	12,291,253	21,754,790	20,689,120		1,843.0	7,470,470	3,212,786	4,049,596	393.5	143,208	2,662,835	241.1	198,909	5,578,822
Utah	4,194,708	2,132,691	4,696,988	3,884,292	546,200	443.6	1,348,857	301,578	765,473	124.9	5,130	346,000	18.3	3,708	475,018
Vermont	1,867,573	948,007	1,863,902	1,749,676	45,033	97.0	581,752	107,918	440,045	26.2		338,082	14.6	9,979	124,847
Virginia	7,416,757	3,765,387	6,482,819	6,097,107	89,507	387.6	2,531,708	649,689	1,590,782	76.7	181,648	935,593	77.6	488,313	1,149,506
Washington	6,115,867	3,106,412	5,808,044	5,507,987	240,300	195.8	2,380,842	471,083	1,737,482	78.6	67,122	483,407	12.9	69,675	645,223
West Virginia	4,474,234	2,280,335	3,556,146	3,438,849	74,185	129.2	1,452,784	924,058	486,302	40.5	25,237	430,436	15.2	86,091	1,289,411
Wisconsin	9,724,881	4,941,837	9,258,345	8,914,763	67,483	435.7	1,688,335	558,390	973,458	64.4	202,828	1,583,343	80.0	48,901	2,317,554
Wyoming	4,501,327	2,287,712	4,411,560	4,115,457	85,400	648.2	1,494,888	316,303	1,151,835	162.1	27,126	620,663	127.1	42,441	429,814
District of Columbia	1,918,469	973,842	1,982,379	1,616,069	366,310	15.2	484,303	250,164	234,139	2.8		147,150	1.6	52,236	226,243
Hawaii	1,871,062	949,778	526,922	428,481		17.3	1,826,261	1,428,169		27.2				14,412	949,778
TOTALS	394,000,000	200,000,000	346,614,414	314,109,555	7,023,161	21,650.7	155,448,458	68,114,607	71,945,469	7,166.0	4,691,703	54,693,542	3,560.8	7,084,135	66,337,828