PUBLIC ROADS

A JOURNAL OF HIGHWAY RESEARCH

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF PUBLIC ROADS

VOL. 16, NO. 3 ▽ MAY 1935

ROADSIDE STATION FOR DETERMINING WEIGHTS AND DIMENSIONS OF TRUCKS

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

Issued by the

UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF PUBLIC ROADS

Volume 16, No. 3 May 1935

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In This Issue

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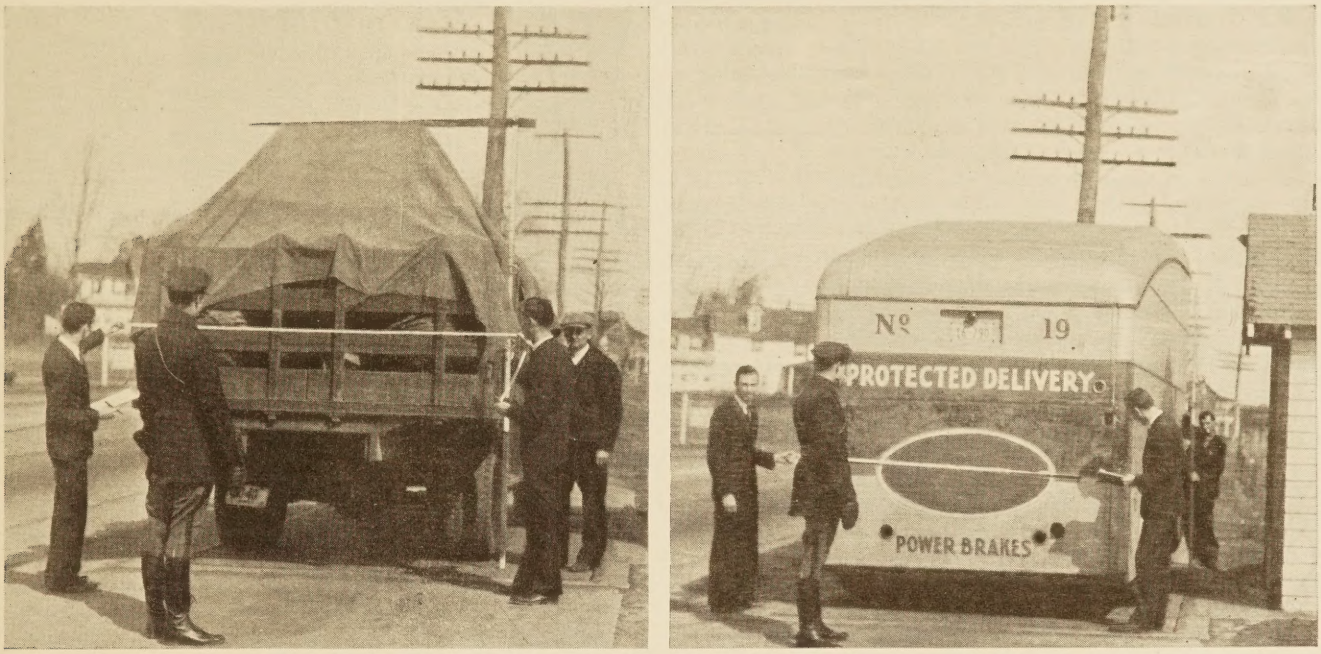
A STUDY OF THE WEIGHTS AND DIMENSIONS OF TRUCKS

Reported by J. T. THOMPSON, Highway Research Specialist, U. S. Bureau of Public Roads, and Professor of Civil Engineering, the Johns Hopkins University



DETERMINING THE WEIGHTS AND DIMENSIONS OF TRUCKS.

How do the over-all dimensions of loaded motor vehicles vary with manufacturer's rated capacity?

How are the gross loads of motor vehicles distributed to the various axles?

To what extent do operators exceed the manufacturer's recommended loading, and how does prevalency of this "overloading" vary with manufacturer's ratings?

To what extent are tires being similarly overloaded?

THESE ARE typical of the questions which should be answered by those who must consider dimensions and load concentrations in providing clearance and strength in the design of highways and highway bridges, by highway economists who would properly allocate highway costs to the various classes of vehicles, by manufacturers of both vehicles and tires, and by highway administrators and legislators who would intelligently restrict motor vehicle size and weight and legislate fair tax rates to sustain highway programs.

Those who have had to seek the answers to these and similar questions know that hitherto existing data, such as manufacturer's specifications, fail to provide them. So far as the writer knows, there is no way to obtain this information except by establishing roadside "clinics" where vehicles may be studied as they pass.

OBSERVATIONS MADE ON TWO MAIN TRUCK ROUTES

The following data have been obtained from just such clinics. During the summer and fall of 1934 the Bureau of Public Roads of the United States Department of Agriculture with the cooperation of the Johns Hopkins University, the Maryland State Roads Commission, and the Commissioner of Motor Vehicles of Maryland, operated two stations at which commercial vehicles were weighed and measured. One of these was located on Route U S 40, leading north from Baltimore toward Philadelphia, the other on Route U S 1 leading south from Baltimore toward Washington. These stations were operated alternately for periods of approximately 2 weeks from the middle of June to the middle of November. During the entire period 10,700 vehicles were observed, 7,100 when loaded and 3,600 when empty. It is believed that the data constitute a representative sample of truck traffic on main highways in this area. Further investigation is needed to determine if the data are representative of truck traffic on main highways generally.

The field party of 4 men consisted of a uniformed officer to direct traffic, a notekeeper, and 2 others who shared the duties of weighing and measuring. Aside from the scales no other special equipment was used. A cloth tape and a level-rod with a horizontal arm for calipering heights answered every purpose.

In order to avoid the recurrence of data relating to identical vehicles frequently passing the station, identification cards were issued to all operators and no vehicle was recorded more than once loaded and once empty when proceeding in each direction during any one 2-week period.

The procedure was as follows: All commercial vehicles were stopped. Identification cards, if presented, were examined. If a card were presented indicating that the vehicle, loaded or empty, had already

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been recorded when traveling in the same condition and in the same direction during the current 2-week period, the vehicle was permitted to pass. Otherwise it was run on the scales and weighed first with all wheels on the platform. It was then moved ahead by stages until, first the forward axle, and then each successive axle was off the platform, determining after each movement the weight carried on the axles remaining on the platform. At the same time the over-all length, height, width, and wheel base were determined; the manufacturer's marker and registration data were inspected for make of vehicle and manufacturer's rated capacity; and the license number was noted.

As the field reports came into the office the information contained in and derived from them was tabulated on large ruled master sheets, and these were used in segregating and analyzing the data. Where the data permitted, pay loads were determined by subtracting the measured empty weights of vehicles from their gross weights as measured on loaded trips. The determination was facilitated by preparing, for each vehicle initially observed, a file card, bearing the license number, on which was entered after each observation of the same vehicle a reference to the pertinent field data sheet.

Before proceeding to the remainder of this report, the reader should have in mind the size and weight restrictions of Maryland laws because of their influence upon the data. From the beginning of the study in June until the middle of October no attention was paid to violations of these laws nor were penalties of any kind imposed. This was done intentionally to encourage unrestricted operation. The number of observed weight violations was small—less than one percent. After the middle of October, at the insistence of State authorities, the laws were enforced and nine arrests were made for overweight, 1,500 weighings being recorded during the corresponding period.

The Maryland laws may be briefly summarized as follows:

Maximum dimensions

Width	96 inches.
Length	Unrestricted.
Height	Unrestricted.

Maximum gross weights

On solid tires	650 pounds per inch of tire width.
On pneumatic tires:	
Single unit, 4 wheels, 2 axles	25,000 pounds.
Single unit, 6 wheels, 3 axles	40,000 pounds.
Combination of 2 vehicles (tractor and semitrailer or tractor and full trailer) combined weight	40,000 pounds.[1]

GROSS WEIGHTS NOT IN PROPORTION TO RATED CAPACITIES

Reference will be made in this report to the term "manufacturer's rated capacity" as applied to both vehicles and tires. Applied to single vehicles and tires, the term as used means the carried load which the manufacturer recommends as safe and economical for the vehicle or tire in question. Applied to tractor-semitrailer combinations, it refers to the carried load of the semitrailer only.

[1] There is nothing in the Maryland law to prevent adding to these combinations of 2 vehicles an indefinite number of units weighing as much as 40,000 pounds each.

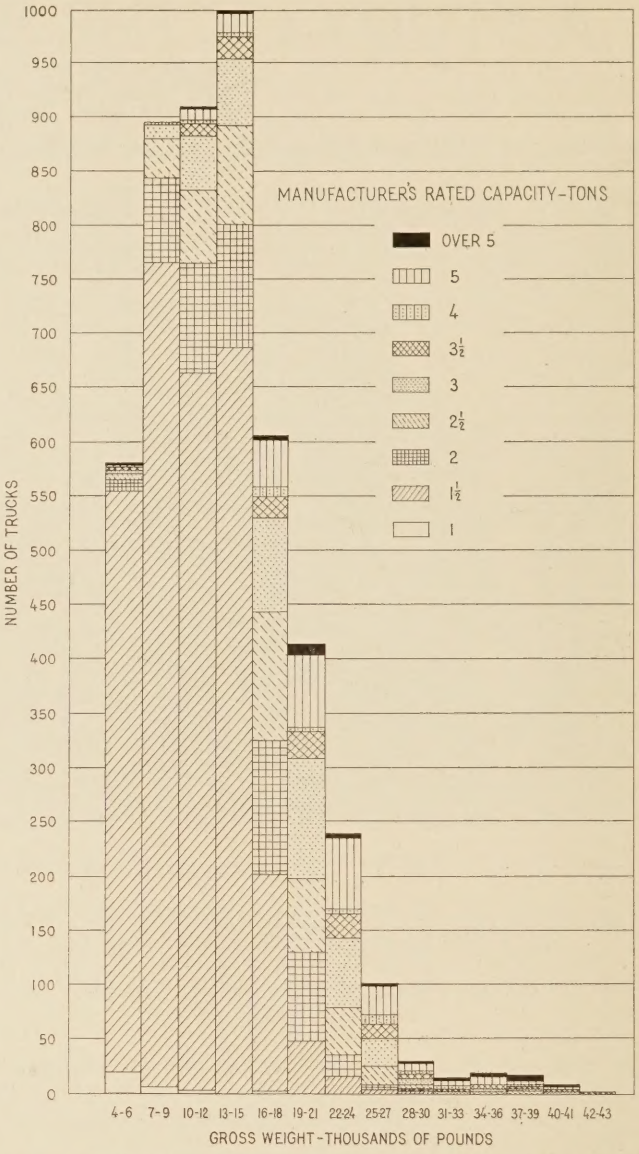

FIGURE 1.—FREQUENCY DISTRIBUTION BY GROSS WEIGHTS OF LOADED SINGLE VEHICLES.

Figure 1 and table 1 show the frequency distribution by the gross weights of loaded single vehicles, expressed in terms of numbers of vehicles and the percentages of the total number of loaded vehicles of each capacity class having gross weights falling within various class limits, defined to the nearest thousand pounds. In tables 2 and 3 these data are segregated respectively into 4-wheel and 6-wheel classes. As stated above, 4-wheel single vehicles may legally carry 25,000 pounds and 6-wheelers 40,000 pounds.

It is immediately evident that the gross loads of vehicles of small capacity are much greater in proportion to the rated capacity than are those of large capacity trucks. Comparing the 1½- and 5-ton classes in table 1, for example, the ratio of rated capacities is 3.33. If gross weight were proportional to capacity, 5-ton trucks would have an average gross weight of 3.33 by 10,500 equals 35,000 pounds; actually they average 21,600 pounds.

TABLE 1.—*Frequency distribution of gross weights of all loaded single vehicles, percentage of total observations in each capacity class*

Manufacturer's rated capacity	Average gross weight	Gross weight, 1,000 pounds														Total observations
		4–6	7–9	10–12	13–15	16–18	19–21	22–24	25–27	28–30	31–33	34–36	37–39	40–42	43–45	
	Pounds	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Number*
1 ton	6,400	70.0	20.0	6.7	-------	3.3	-------	-------	-------	-------	-------	-------	-------	-------	-------	30
1½ tons	10,500	18.4	26.1	22.6	23.7	6.9	1.7	0.4	0.1	0.1	-------	-------	-------	-------	-------	2,920
2 tons	14,400	1.9	14.5	19.3	21.1	23.1	15.4	3.8	.7	.2	-------	-------	-------	-------	-------	533
2½ tons	16,300	1.3	7.9	14.6	20.1	26.0	14.6	9.6	4.2	1.1	-------	0.2	0.4	-------	-------	458
3 tons	18,100	.2	3.3	11.7	15.0	20.4	26.2	14.8	5.6	1.2	0.7	.2	.5	0.2	-------	427
3½ tons	20,600	2.3	-------	7.6	15.3	14.5	19.0	17.6	11.4	3.1	1.5	5.3	.8	.8	0.8	131
4 tons	21,600	-------	2.9	8.6	8.6	22.8	5.6	8.6	22.8	8.6	8.6	-------	2.9	-------	-------	35
5 tons	21,600	.4	-------	4.2	6.9	16.8	25.6	25.6	9.5	3.1	1.5	3.0	2.3	1.1	-------	262
Over 5 tons	25,400	2.3	-------	4.7	4.7	11.6	23.2	9.3	9.3	2.3	4.7	4.7	13.9	9.3	-------	43

TABLE 2.—*Frequency distribution of gross weights of loaded 4-wheel single vehicles, percentage of total observations in each capacity class*

Manufacturer's rated capacity	Average gross weight	Gross weight, 1,000 pounds														Total observations
		4–6	7–9	10–12	13–15	16–18	19–21	22–24	25–27	28–30	31–33	34–36	37–39	40–42	43–45	
	Pounds	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Number*
1 ton	6,400	70.0	20.0	6.7	-------	3.3	-------	-------	-------	-------	-------	-------	-------	-------	-------	30
1½ tons	10,100	19.8	26.9	23.5	23.5	5.6	0.4	0.1	0.1	0.1	-------	-------	-------	-------	-------	2,695
2 tons	14,300	2.0	14.2	20.1	21.7	22.9	14.8	3.6	.7	-------	-------	-------	-------	-------	-------	511
2½ tons	16,000	1.4	8.4	15.2	20.5	25.6	14.9	9.8	4.0	.2	-------	-------	-------	-------	-------	429
3 tons	17,800	.3	3.3	11.4	15.7	20.4	27.6	15.4	5.3	.3	0.3	-------	-------	-------	-------	395
3½ tons	18,600	2.8	-------	9.4	17.0	17.9	20.8	18.9	12.3	.9	-------	-------	-------	-------	-------	106
4 tons	18,800	-------	-------	17.6	5.9	35.2	5.9	11.8	23.6	-------	-------	-------	-------	-------	-------	17
5 tons	20,100	.5	-------	5.1	7.9	18.1	28.1	28.2	10.7	.9	.5	-------	-------	-------	-------	216
Over 5 tons	19,200	4.3	-------	8.7	8.7	17.4	34.9	4.3	17.4	-------	4.3	-------	-------	-------	-------	23

TABLE 3.—*Frequency distribution of gross weights of loaded 6-wheel single vehicles, percentage of total observations in each capacity class*

Manufacturer's rated capacity	Average gross weight	Gross weight, 1,000 pounds														Total observations
		4–6	7–9	10–12	13–15	16–18	19–21	22–24	25–27	28–30	31–33	34–36	37–39	40–42	43–45	
	Pounds	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Number*
1 ton	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	0
1½ tons	14,900	2.2	12.9	12.9	25.7	23.1	17.8	4.9	0.5	-------	-------	-------	-------	-------	-------	225
2 tons	17,300	-------	13.7	4.5	9.1	27.3	31.8	9.1	-------	4.5	-------	-------	-------	-------	-------	22
2½ tons	21,200	-------	-------	6.9	13.8	31.0	10.3	6.9	6.9	13.8	-------	3.5	6.9	-------	-------	29
3 tons	22,100	-------	3.1	15.6	6.3	18.8	9.4	6.3	9.4	12.3	6.3	3.1	6.3	3.1	-------	32
3½ tons	29,100	-------	-------	-------	8.0	-------	12.0	12.0	8.0	12.0	8.0	28.0	4.0	4.0	4.0	25
4 tons	24,300	-------	5.6	-------	11.1	11.1	5.6	5.6	22.0	16.7	16.7	-------	5.6	-------	-------	18
5 tons	28,500	-------	-------	-------	2.2	10.9	13.0	13.0	4.3	13.0	6.6	17.4	13.0	6.6	-------	46
Over 5 tons	32,500	-------	-------	-------	-------	5.0	10.0	15.0	-------	5.0	5.0	10.0	30.0	20.0	-------	20

In tables 4, 5, and 6 vehicles of the heavier gross weights are analyzed according to rated capacity. Table 4 is a classification of all single vehicles of gross weights exceeding 21,000 pounds. Table 5 is a similar classification of the 4-wheel vehicles only, and table 6 deals similarly with 6-wheel vehicles only.

Table 4 shows that of 4,839 single vehicles observed 427 or 8.9 percent had gross weights in excess of 21,000 pounds. It is a common belief that such gross weights are associated mainly with vehicles of 5- and over-5-ton rated capacity. Actually, as shown by table 4, only 144 or a trifle over one-third of the 427 vehicles of gross weight exceeding 21,000 pounds were of these two largest rated-capacity classes. Over a fourth of the total number—112 out of 427—were vehicles of 2½ tons rated capacity or smaller, and 16 were trucks of 1½ tons rated capacity, sizes generally well within the common conception of medium vehicles.

Referring again to table 4, it will be seen that only 190 (4.0 percent) of all loaded vehicles were found to have gross weights in excess of 24,000 pounds, and that the number of these that were of the 5- and over-5-ton capacity classes was only 73 (38.4 percent). Again vehicles rated at 2½ tons capacity and less were found to constitute a very considerable percentage (18.4 percent) of the total, and still a few 1½-ton trucks were included.

As shown by table 1, it is not until gross weight rises in excess of 30,000 pounds that the last of the 1½- and 2-ton trucks disappear; but the 61 trucks, shown by table 4 to be in excess of that weight, include representatives of all rated-capacity classes from 2½ tons upward. In fact, not far from half of the number were rated at less than 5 tons capacity.

The final columns of table 4 show that 10 or about 0.2 percent of all observed loaded single vehicles weighed above 40,000 pounds. All of these were rated at 3-ton capacity or more and 7 of the 10 were of the 5- and over-5-ton classes. By comparison with table 6 it will be seen that all of these trucks were 6-wheel vehicles, and all were violators of the Maryland law which sets the limit for such trucks at 40,000 pounds;

TABLE 4.—*Classification of all heavy-loaded single vehicles according to manufacturer's rated capacity and gross weight*

Manufacturer's rated capacity	Total all loaded vehicles	Loaded vehicles having gross weights exceeding—							
		21,000 pounds		24,000 pounds		30,000 pounds		40,000 pounds	
	No.	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*
1 ton	30								
1½ tons	2,920	16	3.8	3	1.6				
2 tons	533	25	5.9	5	2.6				
2½ tons	458	71	16.6	27	14.2	3	4.9		
3 tons	427	99	23.2	36	19.0	7	11.5	1	10.0
3½ tons	131	54	12.6	31	16.3	12	19.7	2	20.0
4 tons	35	18	4.2	15	7.9	4	6.6		
5 tons	262	121	28.3	54	28.4	21	34.4	3	30.0
Over 5 tons	43	23	5.4	19	10.0	14	22.9	4	40.0
Total	4,839	427	100.0	190	100.0	61	100.0	10	100.0
Percentage of total loaded vehicles	100	8.9		4.0		1.2		0.2	

TABLE 5.—*Classification of heavy-loaded 4-wheel single vehicles according to manufacturer's rated capacity and gross weight*

Manufacturer's rated capacity	Total all loaded 4-wheel vehicles	Loaded 4-wheel vehicles having gross weights exceeding—					
		21,000 pounds		24,000 pounds		30,000 pounds	
	Number	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*
1 ton	30						
1½ tons	2,695	4	1.3	5	2.1		
2 tons	511	22	7.3	4	4.2		
2½ tons	429	60	19.8	18	18.7		
3 tons	395	84	27.7	23	23.9	1	33.3
3½ tons	106	34	11.2	14	14.6		
4 tons	17	6	2.0	4	4.2		
5 tons	216	87	28.8	26	27.1	1	33.3
Over 5 tons	23	6	2.0	5	5.2	1	33.4
Total	4,422	303	100.0	96	100.0	3	100.0
Percentage of total loaded 4-wheel vehicles	100	6.9		2.2		0.1	

TABLE 6.—*Classification of heavy-loaded 6-wheel single vehicles according to manufacturer's rated capacity and gross weight*

Manufacturer's rated capacity	Total all loaded 6-wheel vehicles	Loaded 6-wheel vehicles having gross weights exceeding—							
		21,000 pounds		24,000 pounds		30,000 pounds		40,000 pounds	
	No.	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*
1 ton									
1½ tons	225	12	9.7	1	1.0				
2 tons	22	3	2.4	1	1.1				
2½ tons	29	11	8.9	9	9.6	3	5.2		
3 tons	32	15	12.1	13	13.8	6	10.3	1	10.0
3½ tons	25	20	16.1	17	18.1	12	20.7	2	20.0
4 tons	18	12	9.7	11	11.7	4	6.9		
5 tons	46	34	27.4	28	29.8	20	34.5	3	30.0
Over 5 tons	20	17	13.7	14	14.9	13	22.4	4	40.0
Total	417	124	100.0	94	100.0	58	100.0	10	100.0
Percentage of total loaded 6-wheel vehicles	100	29.8		22.6		13.9		2.4	

yet in view of the fact that their heavier loads were carried on six wheels, many of these vehicles unquestionably made less demand upon the strength of the road than the heavier 4-wheel vehicles of gross weights between 21,000 and 24,000 pounds.

By comparing tables 4, 5, and 6, it will be seen that 58 of the 61 vehicles observed to have gross loads over 30,000 pounds were 6-wheelers. The three 4-wheel vehicles all weighed less than 40,000 pounds, and, as shown by table 5, represented the 3-, 5-, and over-5-ton rated-capacity classes.

In the larger groups of vehicles of gross weights exceeding 24,000 and 21,000 pounds the numbers of 4-wheel vehicles are relatively higher, made so by the preponderance of the lighter gross loads carried on 4 wheels.

VEHICLES OF ALL RATED CAPACITIES FOUND TO CARRY HEAVY LOADS

Table 7 and figure 2 show the gross-weight-frequency distribution for tractor-semitrailer combinations. The tendency to heavier loading of the smaller units in relation to capacity is again evident. If gross weights were proportional to semitrailer capacities, the 5-ton class would average 3.33 by 20,800 equals 69,200 pounds, whereas it actually averages 27,100 pounds.

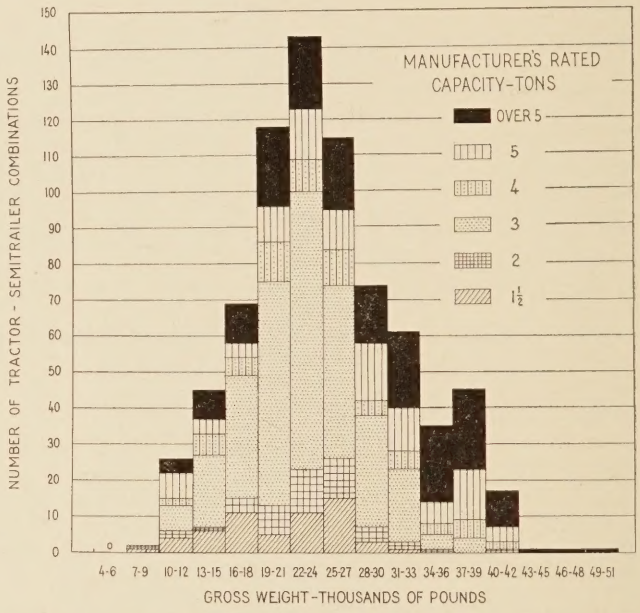

FIGURE 2.—FREQUENCY DISTRIBUTION BY GROSS WEIGHTS OF LOADED TRACTOR-SEMITRAILER COMBINATIONS.

Three cases of overloading, producing gross weights of over 42,000 pounds, are chargeable to the over-5-ton class. The group of gross weights between 40,000 and 42,000 pounds, which with the tolerance permitted by the State roads commission includes only legally loaded vehicles, shows a rated-capacity range of from 2 to over 5 tons.

In table 8 the heavier tractor-semitrailer combinations are shown in groups exceeding each of several gross-weight limits corresponding to those shown for single vehicles in tables 4, 5, and 6. These data show that the numbers of combinations exceeding the limits shown constitute a much larger percentage of the total number of such vehicles than in the case of either 4- or 6-wheel single vehicles. Nearly two-thirds of all semitrailer combinations observed exceed 21,000 pounds gross weight, and almost half weigh more than 24,000 pounds gross. While about one-fifth of the total number exceed 30,000 pounds, only 2.7 percent weigh more than 40,000 pounds. Here again it is apparent that the heavier gross loads are not by any means carried exclusively on vehicles of the larger rated-capacity classes. On the contrary the smaller rated-

TABLE 7.—*Frequency distribution of gross weights of loaded tractor-semitrailer combinations, percentage of total observations in each capacity class*

Manufacturer's rated capacity	Average gross weight	Gross weight, 1,000 pounds														Total observations
		7–9	10–12	13–15	16–18	19–21	22–24	25–27	28–30	31–33	34–36	37–39	40–42	43–45	46–48	49–51	
	Pounds	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Number*
1½ tons	20,800	1.8	7.0	10.5	19.3	8.7	19.3	26.3	5.3	1.8							57
2 tons	23,200	2.1	4.3	2.1	8.5	17.0	25.6	23.4	8.5	4.3	2.1		2.1				47
3 tons	22,900		2.3	6.5	11.1	20.2	25.1	15.6	10.1	6.5	1.3	1.3					307
4 tons	24,700		3.2	9.7	8.1	17.7	14.5	16.2	6.4	8.1	4.8	8.1	3.2				62
5 tons	27,100		6.9	3.9	3.9	9.8	13.7	10.8	15.7	11.8	5.9	13.7	3.9				102
Over 5 tons	28,200		2.2	4.5	6.2	12.4	11.2	11.2	8.9	11.8	11.8	12.4	5.6	0.6	0.6	0.6	178

capacity classes are represented by significant numbers of vehicles in each group up to the 30,000-pound limit.

TABLE 8.—*Classification of all heavy-loaded tractor-semitrailer vehicle combinations according to manufacturer's rated capacity and gross weight*

Manufacturer's rated capacity	Total all loaded vehicles	Loaded vehicles having gross weights exceeding—							
		21,000 pounds		24,000 pounds		30,000 pounds		40,000 pounds	
	No.	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*
1½ tons	57	30	6.1	19	5.4	1	0.6		
2 tons	47	31	6.3	19	5.4	4	2.5	1	5.0
3 tons	307	184	37.3	107	30.6	28	17.4		
4 tons	62	38	7.7	29	8.3	15	9.3	2	10.0
5 tons	102	77	15.6	63	18.0	36	22.4	4	20.0
Over 5 tons	178	133	27.0	113	32.3	77	47.8	13	65.0
Total	753	493	100.0	350	100.0	161	100.0	20	100.0
Percentage of total loaded vehicles	100	65.5		46.5		21.4		2.7	

Table 9 shows the gross-weight-frequency distribution of all loaded vehicles. Four- and six-wheel single vehicles and semitrailer combinations of all rated capacities are here classified according to gross weight irrespective of type or rated capacity. The most significant indication of this tabulation is the large percentage of all loaded vehicles that exceed 21,000 pounds gross weight. It is shown that 16.5 percent of all loaded vehicles had gross weights in excess of the amount commonly assumed to correspond to a rated capacity of 5 tons.

LIGHT TRUCKS CARRY GREATEST OVERLOADS

It was possible by the methods employed to determine the weight of the load carried by 1,429 single vehicles and 219 semitrailer combinations. Table 10 shows the frequency distribution on the basis of the ratio of load carried to manufacturer's rated capacity for the single vehicles. As previously indicated in the analysis of gross weight, it is here definitely shown that loading in excess of rated capacity is far more prevalent in the case of small trucks than of large ones. On the average, the 1½-ton trucks were found to carry one and two-thirds as much as the recommended load, while the 5-ton trucks averaged just about their rated-capacity load. In extremes, the smaller truck is loaded to 4, 5, and even 6 times its rated capacity; the larger one is seldom loaded more than twice its capacity.

TABLE 9.—*Frequency distribution of gross weights of loaded vehicles of all classes, percentage of total observations*

[Total number of vehicles observed, 5,592]

Gross weight	Percentage of total number of vehicles	Gross weight	Percentage of total number of vehicles
4,000–6,000 pounds	10.4	28,000–30,000 pounds	1.8
7,000–9,000 pounds	16.0	31,000–33,000 pounds	1.3
10,000–12,000 pounds	16.8	34,000–36,000 pounds	1.0
13,000–15,000 pounds	18.7	37,000–39,000 pounds	1.1
16,000–18,000 pounds	12.1	40,000–42,000 pounds	.5
19,000–21,000 pounds	9.5	43,000–51,000 pounds	.1
22,000–24,000 pounds	6.8		
25,000–27,000 pounds	3.9	Total	100.0

In figure 3 is shown a comparison of the numbers of loads of various weights carried by 1½- and 5-ton trucks respectively, on the basis of the total number of each class occurring in the gross weight analysis. It is significant that the 1½-ton truck appears in this graph as the carrier of loads between 6 and 10 tons more numerously than the 5-ton truck.

Table 11 shows an analysis of the loading of semitrailer combinations. Sufficient data could be obtained for only four capacity classes, but the evidence parallels that shown for single vehicles in table 10. Semitrailers of large rated capacity were found in practice to carry loads which, in the average, about equal the recom-

TABLE 10.—*Frequency distribution of capacity use of loaded single vehicles, percentage of total observations in each capacity class*

Manufacturer's rated capacity	Average ratio	Ratio of carried load to capacity																												Total observations
		0–0.25	0.25–0.50	0.50–0.75	0.75–1.00	1.00–1.25	1.25–1.50	1.50–1.75	1.75–2.00	2.00–2.25	2.25–2.50	2.50–2.75	2.75–3.00	3.00–3.25	3.25–3.50	3.50–3.75	3.75–4.00	4.00–4.25	4.25–4.50	4.50–4.75	4.75–5.00	5.00–5.25	5.25–5.50	5.50–5.75	5.75–6.00	6.00–6.25	6.25–6.60	
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Number*
1½ tons	1.66	9.6	10.1	8.1	7.5	7.6	6.5	7.8	6.2	5.3	5.5	7.1	5.9	3.6	3.9	1.7	0.5	1.3	0.5	0.2	0.4	0.1	0.2	0.2		0.1	0.1		837
2 tons	1.56	8.3	8.3	5.8	10.1	12.1	2.6	7.1	9.0	6.4	5.2	8.3	7.7	3.9	2.6	1.9	.6												156
2½ tons	1.45	6.0	11.3	6.5	7.2	8.3	10.7	11.3	10.7	12.5	6.5	4.2	2.4	.6		.6	.6							.6					168
3 tons	1.32	6.4	7.6	11.6	11.6	10.5	10.5	12.2	5.8	12.2	7.6	1.7		.6		.6			1.1										172
5 tons	.94	13.6	6.3	16.7	19.8	21.8	12.5	3.1	3.1	3.1																			96

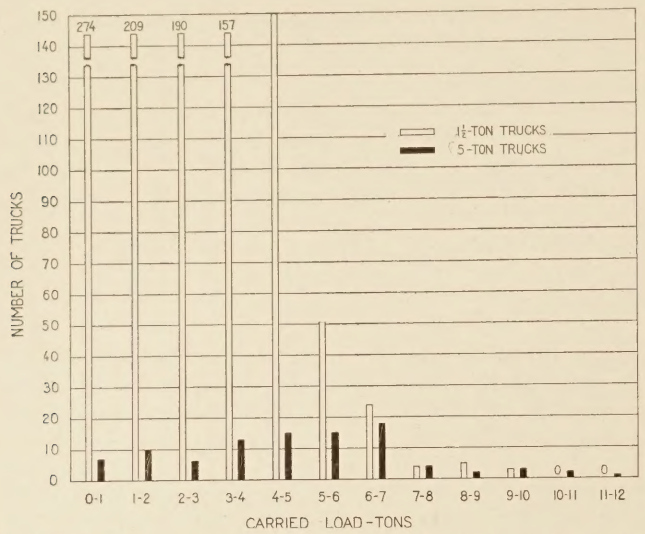

FIGURE 3.—TRUCKS OF 1½-TON AND 5-TON RATED CAPACITY CLASSED ACCORDING TO LOADS CARRIED.

mended load; the 1½-ton trailers were loaded even more heavily in excess of the rated capacity than the single vehicles of the same rating.

AXLE DISTRIBUTION OF GROSS WEIGHTS OF LOADED VEHICLES DISCUSSED

Tables 12, 13, and 14 show the frequency distribution of the percentage of gross weight of loaded vehicles carried by the rear axles of single trucks, tractors, and semitrailers. From them it may be concluded that, in the case of single vehicles, the weight carried on the rear axle averages approximately three-fourths of the gross load. Vehicles having gross loads less than 10,000 pounds carried an average of only 68 percent on the rear axle. The gross weight groups above 10,000 pounds all had an average of close to 75 percent for weight on the rear axle. Included among these vehicles were many partially loaded trucks, and the low average percentage of load on the rear axle is doubtless due to greater proportionate effect of the engine and the tendency to carry partial loading in the forward part of the truck body. There is a striking spread in the percentages for all gross-weight classes ranging from about 45 to 95 percent.

In the case of tractor-semitrailer combinations, it may be seen that about 45 percent of the entire gross weight of the combination is carried on the rear ends of both tractor and semitrailer, leaving about 10 percent for the front wheels of the tractor.

TABLE 11.—*Frequency distribution of capacity use of loaded tractor-semitrailer combinations, percentage of total observations in each capacity class*

Manufacturer's rated capacity	Average ratio	Ratio of carried load to capacity																								Total observations
		0–0.25	0.25–0.50	0.50–0.75	0.75–1.00	1.00–1.25	1.25–1.50	1.50–1.75	1.75–2.00	2.00–2.25	2.25–2.50	2.50–2.75	2.75–3.00	3.00–3.25	3.25–3.50	3.50–3.75	3.75–4.00	4.00–4.25	4.25–4.50	4.50–4.75	4.75–5.00	5.00–5.25	5.25–5.50	5.50–5.75	6.00–6.25	6.25–6.50	
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Number*
1½ tons	3.96	-----	5.6	-----	-----	5.6	5.6	-----	5.6	-----	5.6	5.6	-----	-----	5.6	5.6	-----	-----	5.6	5.6	10.9	5.6	-----	16.3	5.6	5.6	-----	18
3 tons	1.94	3.1	5.5	4.7	2.4	9.5	11.8	4.7	7.1	11.0	8.7	11.8	7.1	0.8	6.3	3.1	0.8	1.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	127
5 tons	1.36	4.8	14.2	4.8	-----	23.8	9.5	9.5	23.8	-----	4.8	4.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	21
Over 5 tons	.98	7.5	17.0	11.3	15.1	18.9	18.9	5.6	3.8	-----	-----	-----	1.9	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	53

TABLE 12.—*Frequency distribution of percentage of gross weight [1] of loaded single vehicles carried on rear axle, percentage of total observations in each gross-weight class*

Gross weight	Average	Percentage carried on rear axle—												Total observations
		40	45	50	55	60	65	70	75	80	85	90	95	
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Number*
Under 10 1,000 pounds	68.0	0.2	0.2	0.7	4.5	15.3	26.7	28.0	16.2	7.3	1.4	0.3	0.2	1,737
10, under 20 do	75.3	.1	.1	.5	.7	4.3	9.8	16.4	21.4	32.4	12.5	1.6	.2	2,816
20, under 30 do	74.2	-----	.2	.4	.4	2.7	8.1	25.1	35.6	18.8	7.0	1.5	.2	669
30, under 40 do	76.7	1.3	1.3	-----	-----	-----	-----	11.5	35.9	38.4	10.3	1.3	-----	78

[1] In the case of 3-axle, 6-wheel trucks the "gross weight carried on rear axle" is actually carried on 2 axles and 4 wheels.

TABLE 13.—*Frequency distribution of percentage of gross weight of loaded tractor-semitrailer combinations carried on tractor rear axles, percentage of total observations in each gross-weight class*

Gross weight	Average	Percentage carried on rear axle—											Total observations
		25	30	35	40	45	50	55	60	65	70	75	
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Perent*	*Percent*	*Percent*	*Number*
10, under 20 1,000 pounds	45.2	-----	1.0	5.0	25.8	40.0	18.9	6.2	1.7	0.7	0.7	-----	403
20, under 30 do	44.3	0.1	.9	7.4	24.9	44.8	16.4	4.1	.9	.4	-----	0.1	772
30, under 40 do	44.5	.3	.5	3.8	25.1	48.9	17.1	3.8	.5	-----	-----	-----	398
Over 40 do	43.6	-----	-----	9.3	25.6	51.2	11.	2.3	-----	-----	-----	-----	43

TABLE 14.—*Frequency distribution of percentage of gross weight of loaded tractor-semitrailer combinations carried on semitrailer rear axle ,[1] percentage of total observations in each gross-weight class*

Gross weight	Average	Percentage carried on rear axle—											Total observations
		20	25	30	35	40	45	50	55	60	65	70	
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Number*
10, under 20 1,000 pounds	39.7	0.7	2.9	14.2	21.0	23.7	23.9	10.2	2.5	0.7	0.2		419
20, under 30 do	44.2	.3	1.0	4.2	9.6	20.2	33.6	24.0	5.1	1.4	.5	0.1	771
30, under 40 do	42.5		.8	1.8	7.8	39.9	36.8	11.1	1.8				396
Over 40 do	43.2				7.3	39.0	41.5	7.3	4.9				41

[1] In the case of semitrailers with 2 rear axles, 4 wheels, the "percentage of gross weight carried on rear axle" is actually carried on 2 axles and 4 wheels.

TABLE 15.—*Frequency distribution of rear-wheel loads of loaded single vehicles, percentage of total observations in each capacity class*

Manufacturer's rated capacity	Average wheel load	Rear wheel load, 1,000 pounds															Total observations
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
	Pounds	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Number*
1 ton	2,220	14.6	63.5	12.2	7.3		2.4										41
1½ tons	3,760	5.3	22.0	21.0	17.5	15.8	14.7	3.2	0.3	0.1	0.1						2,841
2 tons	5,230	.8	7.2	12.6	17.1	16.9	18.8	12.6	10.7	2.7	.6						515
2½ tons	5,760		3.9	10.6	15.9	16.5	17.4	15.0	9.1	8.5	2.0	0.9	0.2				460
3 tons	6,310	.2	1.5	7.9	11.2	13.9	15.4	20.4	16.4	8.7	3.7	.5			0.2		403
3½ tons	6,550	.8		7.7	10.0	12.4	17.8	16.3	16.3	11.6	4.7	1.6	.8				129
4 tons	6,050		2.7	10.8	5.4	16.2	29.8	13.5	8.1	10.8		2.7					37
5 tons	6,910		.8	4.1	7.8	9.0	16.1	20.6	19.4	17.3	3.7	1.2					243
Over 5 tons	6,050		5.6	8.3	11.1	8.3	27.8	5.5	27.8	2.8	2.8						36

TABLE 16.—*Frequency distribution of the rear-wheel loads of loaded tractors, percentage of total observations in each capacity class*

Manufacturer's rated capacity[1]	Average wheel load	Rear wheel load, 1,000 pounds											Total observations
		1	2	3	4	5	6	7	8	9	10	11	
	Pounds	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Number*
1½ tons	4,690	0.1	3.0	13.8	29.3	25.6	22.3	4.4	1.4	0.1			726
2 tons	5,510		2.1	5.6	17.8	25.8	23.3	16.0	8.0	1.0	0.4		287
2½ tons	6,400		1.0	2.4	12.9	19.1	17.2	16.7	16.3	12.9	1.0	0.5	209
3 tons	6,740			6.0	7.8	9.5	17.2	22.4	19.8	13.8	3.5		116
3½ tons	7,000				7.8	13.7	13.7	17.7	27.4	17.7	2.0		51
4 tons	7,000				11.1	16.7	5.6	22.2	27.7	5.6	11.1		18
5 tons	7,600				2.6	9.2	11.8	17.1	30.3	21.1	7.9		76
Over 5 tons	9,300						12.5		12.5	37.5		37.5	8

[1] Refers to capacity of the semitrailer.

TABLE 17.—*Frequency distribution of rear-wheel loads of loaded semitrailers, percentage of total observations in each capacity class*

Manufacturer's rated capacity	Average wheel load	Rear wheel load, 1,000 pounds													Total observations
		1	2	3	4	5	6	7	8	9	10	11	12	13	
	Pounds	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Number*
1½ tons	4,680		14.6	10.9	18.2	23.6	20.0	7.3	3.6	1.8					55
2 tons	5,130	2.2	4.5	6.7	22.2	24.4	17.8	15.5	4.5	1.1	1.1				45
3 tons	5,010	.3	5.3	9.6	20.9	24.2	24.8	10.9	3.7	.3					302
4 tons	5,460		6.5	6.5	16.1	17.7	24.2	17.7	9.7	1.6					62
5 tons	5,570	.9	10.0	7.3	10.0	15.4	22.7	16.4	10.0	6.4	.9				110
Over 5 tons	5,960		4.2	11.3	14.3	13.7	13.1	17.2	14.9	8.3	1.8	0.6		0.6	168

Similar distribution data were also prepared for single vehicles and combinations without segregation into gross weight classes. These are not presented here as they have the same general characteristics as the data given in tables 12, 13, and 14. They show the following averages: For single trucks 72.8 percent; for tractors 44.6 percent; and for semitrailers 42.5 percent.

DATA ON WHEEL LOADS ANALYZED

Tables 15, 16, and 17, and figures 4, 5, and 6, show frequency distributions of rear-wheel loads of single vehicles, tractors, and semitrailers of various rated capacities. Average rear-wheel loads of single vehicles are shown to range from a minimum of 2,220 pounds for trucks of 1-ton rated capacity to a maximum of 6,910 pounds for 5-ton trucks. Again it is found that the loads of the larger vehicles are not as great in relation to those of smaller vehicles as differences in rated capacity would suggest. The average of 6,910 pounds for 5-ton trucks, for example, is only 1.84 times the 3,760-pound average for 1½-ton trucks instead of 3.33 times as it would be if wheel loads were proportional to rated capacity. It is also apparent, particularly in relation to single vehicles (table 15), that the greatest wheel loads are not always found on vehicles of the largest capacity.

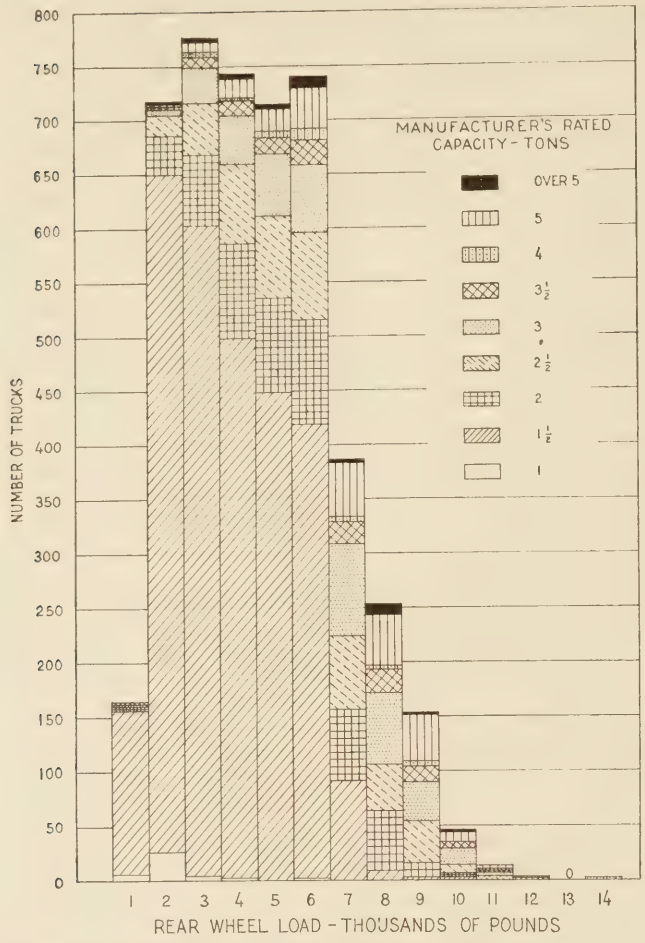

FIGURE 4.—FREQUENCY DISTRIBUTION OF REAR-WHEEL LOADS FOR LOADED SINGLE VEHICLES.

TABLE 18.—*Classification of all loaded single vehicles with heavy wheel loads according to manufacturer's rated capacity and rear-wheel loads*

Manufacturer's rated capacity	Total all loaded vehicles	Rear-wheel loads exceeding—							
		7,000 pounds		8,000 pounds		9,000 pounds		10,000 pounds	
	No.	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*
1 ton	41								
1½ tons	2,841	13	2.8	4	1.9	2	3.3		
2 tons	515	72	15.5	17	8.0	3	5.0		
2½ tons	460	95	20.4	53	25.0	14	23.3	5	33.3
3 tons	403	119	25.6	53	25.0	18	30.0	3	20.0
3½ tons	129	45	9.7	24	11.3	9	15.0	3	20.0
4 tons	37	8	1.7	5	2.4	1	1.7	1	6.7
5 tons	243	101	21.7	54	25.5	12	20.0	3	20.0
Over 5 tons	36	12	2.6	2	.9	1	1.7		
Total	4,705	465	100.0	212	100.0	60	100.0	15	100.0
Percentage of total loaded vehicles	100.0	9.9		4.5		1.3		0.3	

In table 18 rear-wheel loads exceeding certain limits are classified according to the rated capacity of the vehicles on which they were observed. The limits chosen were 7,000, 8,000, 9,000, and 10,000 pounds. It is shown that of 4,705 loaded vehicles observed, only 465—less than 10 percent—had rear-wheel loads in excess of 7,000 pounds. Of these 465 vehicles only 113 or less than 25 percent were of 5 tons rated capacity or larger, and 180 or nearly 39 percent were of 2½ tons capacity or smaller.

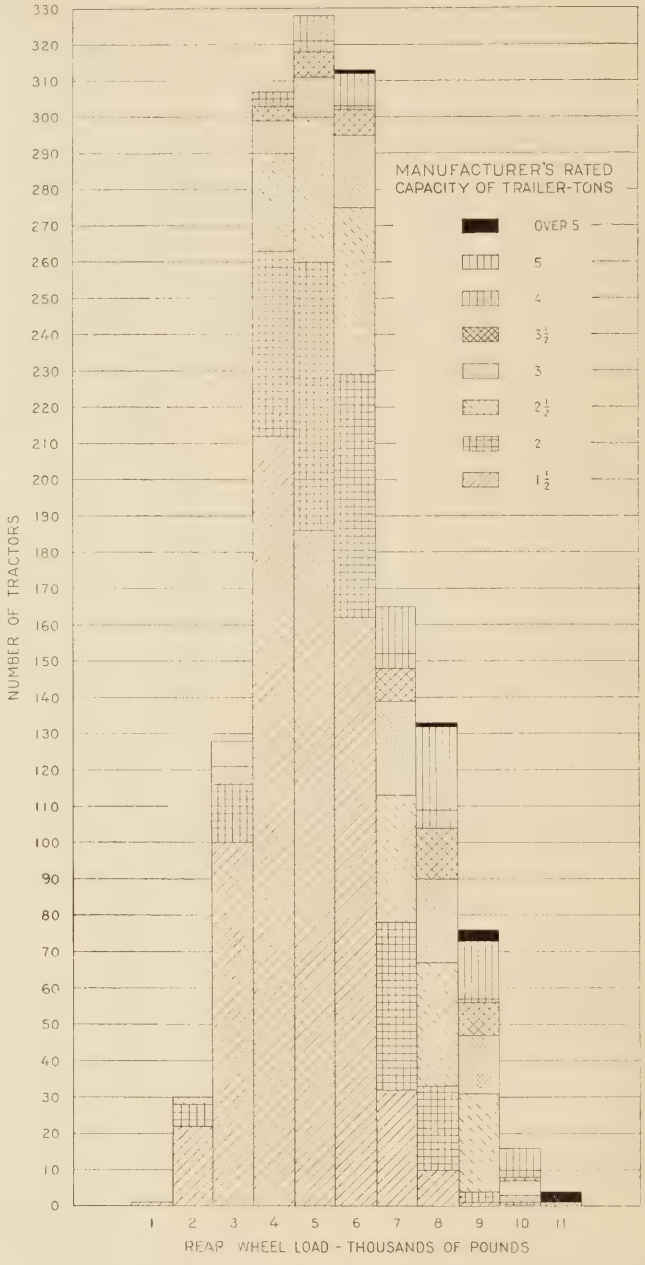

FIGURE 5.—FREQUENCY DISTRIBUTION OF REAR-WHEEL LOADS OF LOADED TRACTORS.

Vehicles with wheel loads exceeding 8,000 pounds numbered only 212 or 4.5 percent of the total of 4,705 vehicles observed and again the number of vehicles rated at 5 tons or more was less than the number of 2½-ton and smaller vehicles. Sixty or 1.3 percent of the total number of vehicles had wheel loads exceeding 9,000 pounds, and only 15 or about 0.3 percent had wheel loads greater than 10,000 pounds. In these two groups, as in the larger groups with wheel loads above 7,000 and 8,000 pounds, vehicles of the larger capacities were not the most numerous but were, on the contrary, exceeded in number by vehicles of 2½-tons capacity and smaller.

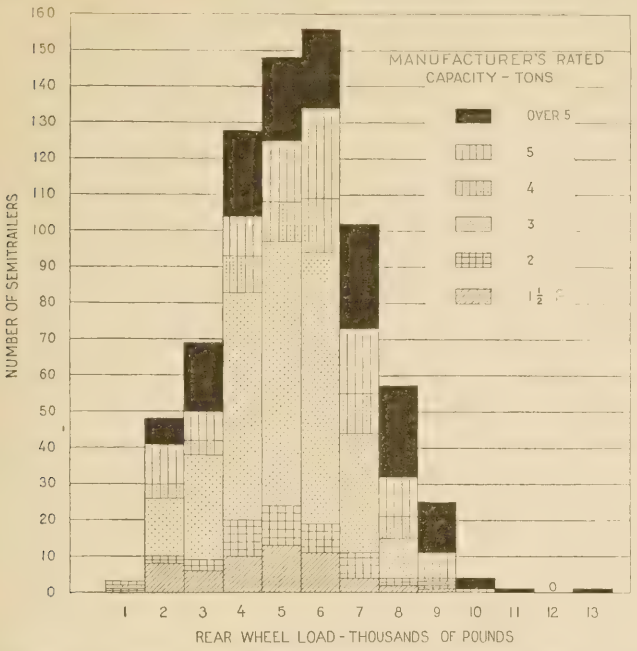

FIGURE 6.—FREQUENCY DISTRIBUTION OF REAR-WHEEL LOADS OF LOADED SEMITRAILERS.

TABLE 19.—*Classification of all loaded tractors with heavy wheel loads according to manufacturer's rated capacity and rear-wheel loads*

Manufacturer's rated capacity	Total all loaded vehicles	Rear-wheel loads exceeding—							
		7,000 pounds		8,000 pounds		9,000 pounds		10,000 pounds	
	No.	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*
1½ tons	726	11	4.8	1	1.0				
2 tons	287	27	11.8	4	4.2	1	5.0		
2½ tons	209	64	27.9	30	31.3	3	15.0	1	25.0
3 tons	116	43	18.8	20	20.8	4	20.0		
3½ tons	51	24	10.5	10	10.4	1	5.0		
4 tons	18	8	3.5	3	3.1	2	10.0		
5 tons	76	45	19.6	22	22.9	6	30.0		
Over 5 tons	8	7	3.1	6	6.3	3	15.0	3	75.0
Total	1,491	229	100.0	96	100.0	20	100.0	4	100.0
Percentage of total loaded vehicles	100.0	15.4		6.4		1.3		0.3	

In tables 19 and 20, the numbers of loaded tractors and semitrailers, respectively, with rear-wheel loads exceeding the several limits are shown to be approximately as numerous in relation to the totals of such vehicles as were the single vehicles similarly loaded. The tables show, however, that the heavier wheel loads on tractors and semitrailers are more frequently found on combinations of the larger capacities.

TIRE CAPACITY NOT EXCEEDED TO SAME EXTENT AS VEHICLE CAPACITY

In table 21 is shown the frequency distribution of the ratio of actual tire loads to the manufacturer's rated carrying capacity of the tires. Again the tendency for the smaller vehicles to carry loads out of proportion to their capacity is evident in the more frequent overloading of the smaller sizes of tires commonly found on such vehicles. It is to be remarked, however, that the tires are not as greatly overloaded as the vehicles, a fact that is doubtless due to the use of oversized tires on many of the smaller vehicles. Whereas, in extreme

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TABLE 20.—*Classification of all loaded semitrailers with heavy wheel loads according to manufacturer's rated capacity and rear-wheel load*

Manufacturer's rated capacity	Total all loaded vehicles	Rear-wheel loads exceeding—							
		7,000 pounds		8,000 pounds		9,000 pounds		10,000 pounds	
	No.	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*
1½ tons	55	3	3.4	1	3.2				
2 tons	45	3	3.4	1	3.2				
3 tons	302	12	13.6	1	3.2				
4 tons	62	7	8.0	1	3.2				
5 tons	110	19	21.6	8	25.8	1	16.7		
Over 5 tons	168	44	50.0	19	61.4	5	83.3	2	100.0
Total	742	88	100.0	31	100.0	6	100.0	2	100.0
Percentage of total loaded vehicles	100.0	11.9		4.2		0.8		0.3	

cases, 1½-ton trucks were found to carry loads up to six times their rated capacity and more, the extreme overloading of the smallest class of tires did not exceed 2.75 times the rated load of the tires. In the case of the largest tires—those rated at more than 4,000 pounds—the extreme overload observed was only 1.5 times rated capacity, and the number of loads in excess of rated capacity was only about 6 percent of the total.

The data presented in table 21 relate to both high-pressure and low-pressure tires indiscriminately. Similar distributions were made for the two classes separately, but as they were very similar to the distribution of the combined groups they are not included in this report.

VALUE OF *C* IN GROSS-WEIGHT FORMULA DISCUSSED

For the purpose of limiting the gross weight of vehicles and combinations of vehicles the American Association of State Highway Officials has recommended use of the formula, $W=C(L+40)$, in which W is the gross weight, C a coefficient, and L the length in feet between the centers of the extreme forward and rear axles of the vehicle or combination. The association recommended a value of 700 as the lowest value of C to be adopted as a limit in any State.

It has been definitely determined that limitation of gross weight is not needed as a measure of pavement or road surface protection. Tests have shown that the stress in rigid pavements caused by vehicular loads is a function of the wheel load rather than the gross load. If axles are spaced no closer than 3 feet between centers, it has been determined that the maximum stress caused by the combined wheel loads does not exceed that caused by each wheel load separately. As spacing closer than 3 feet is impracticable, the maximum wheel load of vehicles is the critical factor in design of pavements; and it is wheel load rather than gross load that must be limited for pavement protection.

On bridges the effects of loading are different. All wheel loads of a vehicle or combination of vehicles that can come upon the structure at one time are effective in producing stress, and the stress produced increases with the sum of the loads applied within a given length. For bridge protection, therefore, limitation of wheel load is not sufficient; limitation of gross load is also required. But the form of limitation to be adopted should give proper recognition to the length over which the load is applied. The formula recommended by the American Association of State Highway Officials is of that character; and the value of $C=700$, recommended as the

TABLE 21.—*Frequency distribution of capacity use of tires on loaded vehicles, percentage of total observations in each capacity class*

[High-pressure and low-pressure tires combined]

Manufacturer's rated capacity of tires	Average ratio	Ratio of total load on tire to tire capacity										Total observations
		0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Number*
1-2 ..... 1,000 pounds	1.09	0.4	10.3	20.4	23.4	22.8	15.2	4.4	2.2	0.7	0.1	0.1	2,023
2-3 ..... do	1.07	1.0	10.1	17.6	25.2	26.5	16.8	2.1	.5	.1	.1	----	4,169
3-4 ..... do	.93	1.6	13.1	23.9	38.2	20.0	2.7	.4	.1	----	----	----	1,867
Over 4 ..... do	.81	3.6	19.0	35.6	35.6	4.4	1.8	----	----	----	----	----	225

lowest limit to be adopted, has been found to give, for vehicles and combinations commonly employed, values of the gross load, W, that do not unduly overstress bridges designed for the association's standard H–15 loading.

Heretofore, determinations of the value of C corresponding to various types and combinations of vehicles have been based upon assumptions of probable or maximum permissible wheel loads. In this study values of C have been determined for vehicles of various types and sizes, as actually loaded, and frequency distributions of these values for single vehicles and for tractor-semitrailer combinations are given in table 22.

To understand the significance of the values of C in table 22, it is necessary to keep in mind that the gross-load limit derived from the formula is an upper limit normally associated with fully loaded or overloaded vehicles of the high-capacity classes. The large percentage of small values of C shown in the table is due to the inclusion of low-capacity vehicles and vehicles partly loaded, and these would rarely be affected by a gross-load limitation. Also, it is intended that the gross-load limit given by the formula be used in conjunction with an axle-load or wheel-load limit. In nearly all cases of 4-wheel trucks, the limit on axle or wheel load, not the gross-load formula, will control the gross load.

TABLE 22.—*Frequency distribution of values of C in the gross-load formula, percentage of total observations*

[Loaded vehicles only]

Group	Total observations	Value of C							
		Under 100	100 to 200	200 to 300	300 to 400	400 to 500	500 to 600	600 to 700	Over 700
	Number	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Single vehicles	4,956	5.9	33.6	36.1	17.1	5.5	1.1	0.5	0.2
Tractor - semitrailer combinations	1,551	.1	5.2	23.1	35.4	23.6	11.4	1.1	.1

In view of these circumstances it is interesting to observe that only 0.2 percent of all observed single vehicles and 0.1 percent of all semitrailer combinations had gross weights corresponding to values of C above 700. For single vehicles the highest value was 770; but, discarding the 50 highest values (1 percent of the total observed number) the maximum is reduced to 550. For semitrailer combinations the highest observed value was 750, a maximum that would be lowered to 560 by elimination of the highest 1 percent of observed values.

Of the 4,956 single vehicles observed only 10 had gross weights and wheel-base lengths corresponding to values of C in excess of 700, the value recommended by the American Association of State Highway Officials as the lowest to be adopted as a limit in any State. Of these 10 trucks, 8 were definitely allocable to manufacturer's rated capacity classes, 2 to the 5-ton class, and 6 to the over-5-ton class. All of these vehicles were 6-wheel vehicles and were the property of a single owner. For trucks of large rated capacity, they had very short wheel bases, ranging from 14 to 15 feet. All were used in the local delivery of crushed stone from a nearby quarry. As they were all 6-wheel vehicles and their wheel loads did not in any case exceed 9,000 pounds they would not have been excluded by wheel-load limitations such as have been recommended by the American Association of State Highway Officials.

Twenty-five of the single vehicles had gross weights and lengths of wheel base resulting in values of C over 600 and not more than 700. Of these, 17 could be definitely allocated to rated-capacity classes, as follows: 2½-ton capacity, 2; 3-ton capacity, 1; 3½-ton capacity, 3; 4-ton capacity, 1; 5-ton capacity, 7; over 5-ton capacity, 3.

Of the 1,551 tractor-semitrailer combinations observed only one had gross weight and length resulting in a value of C over 700. This was the heaviest combination observed during the study. Its gross weight was 51,500 pounds and the distance, L, between its foremost and rearmost axles was 28.9 feet.

Values of C between 600 and 700 were found to correspond to 17 semitrailer combinations of which only 5 were classifiable by capacity, one in the 5-ton and the other 4 in the over-5-ton group.

WEIGHTS OF EMPTY VEHICLES AND RATED CAPACITY COMPARED

It is sometimes necessary to know average and extreme weights of empty vehicles of the several capacity classes. It is difficult to obtain this information from manufacturer's records because the weight of the assembled empty vehicle depends upon the type of body used. The manufacturer of the vehicle generally lists the chassis weights only. It has been a common assumption that there is an approximate equality between the weight of single empty vehicles and their rated carrying capacity. The average and distributed weights of empty vehicles of the several classes as observed in this investigation, given in table 23, will show how far from correct this assumption is. Similar data for semitrailer combinations are given in table 24.

CAPACITY OF TRUCK NO INDICATION OF OVER-ALL WIDTH

In the absence of precise information the assertion has been made that motor trucks of the larger capacity classes are commonly wider than those of smaller capacity and consequently require a greater width of pavement for their accommodation. Factors other than the width of the vehicles themselves bear upon the question of pavement width required, including the speed of the vehicles and the driving habits of their operators.

TABLE 23.—*Frequency distribution of the weights of empty single vehicles, percentage of total observations in each capacity class*

Manufacturer's rated capacity	Average empty weight	Weight empty, 1,000 pounds													Total observations
		2	4	6	8	10	12	14	16	18	20	22	24	26	
	Pounds	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Number*
1½ tons	5,690	1.8	23.8	65.3	7.6	1.1	0.4								1,642
2 tons	7,690		.6	34.1	48.7	14.0	2.3		0.3						3
2½ tons	10,010			8.2	27.3	36.9	17.1	6.2	1.9	1.6	0.8				257
3 tons	10,720			2.6	19.8	39.4	25.5	5.7	4.4	2.2	.4				228
3½ tons	12,060			3.0	4.5	17.9	46.2	19.4	7.5	1.5					67
5 tons	14,150			1.0	3.8	7.7	33.6	21.1	11.5	10.6	5.8	2.9	1.0	1.0	104

TABLE 24.—*Frequency distribution of the weights of empty tractor-semitrailer combinations, percentage of total observations in each capacity class*

Manufacturer's rated capacity	Average empty weight	Weight empty, 1,000 pounds											Total observations
		6	8	10	12	14	16	18	20	22	24	26	
	Pounds	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Number*
3 tons	10,890	0.8	25.4	37.3	31.4	4.0	5.5	4.0		1.6			126
5 tons	13,270		15.1	39.4	9.1	3.0	9.1	9.1	6.1	3.0		6.1	33
Over 5 tons	14,320		2.6	15.8	19.7	17.1	22.4	14.5	7.9				76

TABLE 25.—*Frequency distribution of the over-all widths of loaded single vehicles, percentage of total observations in each capacity class*

Manufacturer's rated capacity	Average width	Over-all width in feet																				Total observations
		5.0	5.2	5.4	5.6	5.8	6.0	6.2	6.4	6.6	6.8	7.0	7.2	7.4	7.6	7.8	8.0	8.2	8.4	8.6	8.8	9.0	
	Feet	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Number*
1½ tons	7.0	0.1	0.3	0.7	2.2	2.6	2.7	3.6	4.4	7.6	12.6	12.1	12.5	17.0	10.8	5.7	3.6	0.7	0.4	0.3	0.1		2,992
2 tons	7.4				.8		.8	1.1	.9	3.0	6.9	11.4	15.4	12.0	20.6	14.4	8.3	2.4	.6	.6	.6	0.2	533
2½ tons	7.5				.2	.2	.4	.6	1.1	2.1	4.3	7.9	14.1	12.9	15.8	16.9	15.6	4.5	2.1	.9	.4		468
3 tons	7.7							.2	.2	.5	.7	2.9	4.3	11.2	24.5	21.4	23.0	7.7	1.5	1.2	.5	.2	413
3½ tons	7.7								.7		1.5	1.5	5.2	12.0	20.9	20.1	25.4	9.0	3.7				134
5 tons	7.9							.4			.4	.4	2.4	3.2	12.1	23.0	36.3	10.9	7.7	1.6	1.2	.4	248

TABLE 26.—*Frequency distribution of the over-all widths of loaded tractor-semitrailer combinations, percentage of total observations in each capacity class*

Manufacturer's rated capacity	Average width	Over-all width in feet												Total observations
		6.4	6.6	6.8	7.0	7.2	7.4	7.6	7.8	8.0	8.2	8.4	8.6	
	Feet	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Number*
1½ tons	7.5			1.8	3.6	12.8	23.7	30.8	20.0	7.3				55
2 tons	7.7					4.7	20.9	27.9	25.6	16.3	2.3	2.3		43
3 tons	7.7	0.3	0.6	1.6	2.9	4.2	16.1	31.4	19.7	14.2	6.8	1.9	0.3	310
4 tons	7.7				4.8	6.5	11.3	27.4	14.5	21.0	12.9	1.6		62
5 tons	7.8			1.0	1.0	1.0	7.8	18.4	26.2	34.9	7.8	1.9		103
Over 5 tons	7.9		.6		.6	.6	2.2	5.1	11.8	21.3	45.4	10.7	1.1	.6	178

To the extent that width of the vehicle and its load influence the decision, some light is thrown upon the question by the classifications of over-all widths of observed single vehicles and combinations given in tables 25 and 26, respectively. Figures 7 and 8 are presented to sharpen the comparison between the 1½-ton and 5-ton classes. In the former it will be seen that the 1½-ton trucks were more numerous than the 5-ton vehicles in each width class up to and including the legal limit, 8 feet. Among the law-violating single vehicles the 5-ton trucks are slightly more numerous, and a single 5-ton truck 9 feet wide exceeds the 8.8-foot width of the widest 1½-ton truck.

Among semitrailers there is greater difference between the widths of vehicles of the two capacity classes, as shown in figure 7. No 1½-ton semitrailer combination was observed with over-all width in excess of 8 feet; and the widest 5-ton combination observed was only 8.4 feet wide.

Tables 27 and 28 show for single vehicles and semitrailer combinations, respectively, the number of units observed in excess of certain widths. Table 27 shows that 64.5 percent of all single vehicles observed had over-all widths in excess of 7 feet and nearly 50 percent of the wider vehicles were 1½-ton trucks. Only 4.6 percent of the total number of vehicles were over 8 feet in width and nearly a fourth of this group were of 5-ton capacity, but a greater number were of the 1½- and 2-ton capacities. Less than 1 percent of all the vehicles were more than 8½ feet in width and among them all capacity classes were represented with little difference in number, those of the 1½-ton class still exceeding the 5-ton trucks.

Table 28, similarly reviewing the width data for semitrailer combinations, shows that 96.3 percent of all combinations were more than 7 feet wide; 9.5 percent were more than 8 feet; and only 0.3 percent were wider than 8½ feet. Among these wide vehicles the 1½-ton

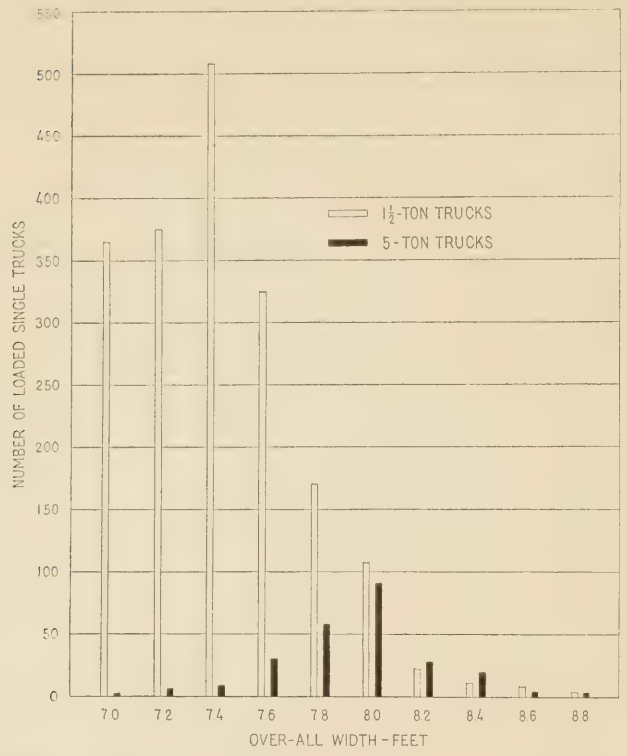

FIGURE 7.—COMPARISON OF NUMBERS OF LOADED 1½-TON AND 5-TON TRUCKS (RATED CAPACITY) OF VARIOUS OVER-ALL WIDTHS.

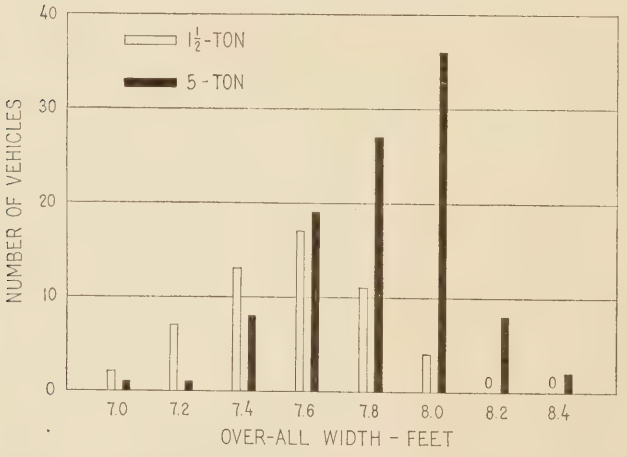

FIGURE 8.—COMPARISON OF NUMBERS OF LOADED 1½-TON AND 5-TON TRACTOR-SEMITRAILER COMBINATIONS (RATED CAPACITY OF SEMITRAILER) OF VARIOUS OVER-ALL WIDTHS.

size was not so strongly represented as among the single vehicles, but the several classes from 3-tons to over 5-tons capacity were represented with little distinction.

DATA ON HEIGHTS OF LOADED VEHICLES DISCUSSED

Tables 29, 30, 31, and 32 show the distribution of loaded vehicles according to over-all height in a manner corresponding to the previous analysis of width. The average height of the 1½-ton class is shown to be about one foot less than the average height of all trucks of other capacity classes. This is due to the presence in the smaller capacity group of large numbers of low trucks and not to the absence in that group of high vehicles. As shown by table 31, over 56 percent of all single trucks higher than 11 feet were of 1½-tons capacity and so likewise were 63 percent of all trucks over 12 feet in height. The observations included only 3 trucks over 12½ feet high and 2 of these were of 1½-tons capacity.

TABLE 27.—*Classification of all wide single vehicles according to manufacturer's rated capacity and over-all width*

Manufacturer's rated capacity	Total all loaded vehicles	Loaded vehicles having over-all widths exceeding—					
		7 feet		8 feet		8½ feet	
	Number	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*
1½ tons	2,992	1,528	49.5	44	19.9	11	27.5
2 tons	533	400	13.0	23	10.4	7	17.5
2½ tons	468	389	12.6	37	16.8	6	15.0
3 tons	413	394	12.8	46	20.8	8	20.0
3½ tons	134	129	4.2	17	7.7	----	----
5 tons	248	245	7.9	54	24.4	8	20.0
Total	4,788	3,085	100.0	221	100.0	40	100.0
Percentage of total loaded vehicles	100.0	64.5	----	4.6	----	0.8	----

TABLE 28.—*Classification of all wide tractor-semitrailer vehicle combinations according to manufacturer's rated capacity and over-all width*

Manufacturer's rated capacity	Total all loaded vehicles	Loaded vehicles having over-all widths exceeding—					
		7 feet		8 feet		8½ feet	
	Number	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*
1½ tons	55	52	7.2	----	----	----	----
2 tons	43	43	5.9	2	2.8	----	----
3 tons	310	293	40.5	28	39.4	1	50.0
4 tons	62	59	8.2	9	12.7	----	----
5 tons	103	101	14.0	10	14.1	----	----
Over 5 tons	178	175	24.2	22	31.0	1	50.0
Total	751	723	100.0	71	100.0	2	100.0
Percentage of total loaded vehicles	100.0	96.3	----	9.5	----	0.3	----

Comparison of tables 31 and 32 shows that the number of semitrailer combinations of the greater heights was a larger proportion of the total than in the case of single vehicles; and again, as in the matter of width, the small-capacity semitrailer is less numerously represented than the small-capacity truck among the extremely high vehicles.

Figures 9 and 10 show graphically the composition by capacity classes of the numbers of trucks and semitrailer combinations of several of the greater-height groups.

OVER-ALL LENGTHS OF VEHICLES REPORTED

Tables 33, 34, 35, and 36 contain analyses of the over-all lengths of single vehicles and semitrailer combinations similar to those previously presented with regard to other characteristics of the vehicles.

The largest single vehicle observed, the capacity of which could be definitely determined, was 35 feet long. Four larger vehicles were measured, the largest 38 feet long, but these were of indeterminate rated capacity. Of the single vehicles of determinable capacity only 8 exceeded 33 feet in over-all length and 121, or 2.6 percent of the total number observed, exceeded 30 feet. In this connection it is desirable to emphasize that the length recorded was the over-all length of vehicle and load. It included the bumpers and projections of the load if any existed.

The longest semitrailer combination of determinable capacity was 52 feet long. Three that could not be classified by capacity were longer, the longest being 59 feet in length. Only 1 of the 728 semitrailer combi-

TABLE 29.—*Frequency distribution of the over-all heights of loaded single vehicles, percentage of total observations in each capacity class*

Manufacturer's rated capacity	Average height	Over-all height in feet—														Total observations
		6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0	11.5	12.0	12.5	13.0	
	Feet	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Number*
1½ tons	8.4	2.2	9.8	13.0	10.6	10.8	12.4	14.7	11.0	6.6	3.6	2.2	1.5	1.0	0.5	0.1	2,985
2 tons	9.0	.7	1.7	12.4	5.4	9.5	7.8	12.4	16.8	16.5	8.7	4.3	1.7	1.7	.4	-------	539
2½ tons	9.3	-------	.9	5.4	4.9	12.9	8.1	9.2	17.2	20.0	14.8	3.2	.9	2.1	.4	-------	466
3 tons	9.4	-------	1.0	4.1	9.7	8.7	6.8	10.2	13.4	17.4	18.8	4.8	2.9	1.0	1.0	.2	412
3½ tons	9.7	-------	-------	1.5	5.4	7.8	11.6	3.1	11.6	21.7	21.0	9.3	4.7	1.5	.8	-------	129
5 tons	9.4	.4	-------	.8	3.2	13.4	16.9	8.3	9.7	23.2	15.4	7.1	1.6	-------	-------	-------	254

TABLE 30.—*Frequency distribution of the over-all heights of loaded tractor-semitrailer combinations, percentage of total observations in each capacity class*

Manufacturer's rated capacity	Average height	Over-all height in feet—														Total observations
		6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0	11.5	12.0	12.5	13.0	
	Feet	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Number*
1½ tons	9.6	1.8	1.8	5.5	5.5	9.1	9.1	3.6	14.6	12.7	12.7	10.9	3.6	7.3	1.8	-------	55
2 tons	10.2	2.6	-------	2.6	-------	2.6	-------	-------	15.4	28.1	17.9	17.9	2.6	5.1	2.6	2.6	39
3 tons	10.2	.3	-------	3.0	3.4	4.4	2.0	5.8	9.9	17.3	18.7	13.9	12.2	5.8	3.0	.3	295
4 tons	10.7	-------	-------	-------	-------	-------	1.5	4.5	13.4	13.4	13.4	23.9	16.4	10.5	1.5	1.5	67
5 tons	10.6	-------	-------	1.0	-------	1.0	-------	3.9	1.0	22.6	29.4	25.6	12.7	2.9	-------	-------	102
Over 5 tons	10.6	-------	-------	.6	1.1	.6	3.4	1.7	2.8	12.4	30.8	31.4	11.8	2.8	.6	-------	178

TABLE 31.—*Classification of all high, single vehicles according to manufacturer's rated capacity and over-all height*

Manufacturer's rated capacity	Total all loaded vehicles	Loaded vehicles having over-all heights exceeding—					
		11 feet		12 feet		12½ feet	
	Number	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*
1½ tons	2,985	91	56.5	17	63.0	2	66.7
2 tons	539	20	12.4	2	7.4	-------	-------
2½ tons	466	16	9.9	2	7.4	-------	-------
3 tons	412	21	13.1	5	18.5	1	33.3
3½ tons	129	9	5.6	1	3.7	-------	-------
5 tons	254	4	2.5	-------	-------	-------	-------
Total	4,785	161	100.0	27	100.0	3	100.0
Percentage of total loaded vehicles	100.0	3.4	-------	0.6	-------	0.1	-------

TABLE 32.—*Classification of all high loaded tractor-semitrailer vehicle combinations according to manufacturer's rated capacity and over-all height*

Manufacturer's rated capacity	Total all loaded vehicles	Loaded vehicles having over-all heights exceeding—					
		11 feet		12 feet		12½ feet	
	Number	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*
1½ tons	55	7	5.1	1	6.2	-------	-------
2 tons	39	5	3.6	2	12.5	1	33.3
3 tons	295	63	45.6	10	62.5	1	33.3
4 tons	67	20	14.5	2	12.5	1	33.4
5 tons	102	16	11.6	-------	-------	-------	-------
Over 5 tons	178	27	19.6	1	6.3	-------	-------
Total	736	138	100.0	16	100.0	3	100.0
Percentage of total loaded vehicles	100.0	18.8	-------	2.2	-------	0.4	-------

TABLE 33.—*Frequency distribution of the over-all lengths of loaded single vehicles, percentage of total observations in each capacity class*

Manufacturer's rated capacity	Average length	Over-all length in feet																					Total observations
		15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	
	Feet	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Number*
1½ tons	20.8	2.0	2.7	5.6	7.9	4.6	11.0	36.4	13.6	5.3	3.5	2.8	1.9	1.0	0.4	0.5	0.3	0.2	0.3	------	------	------	2,953
2 tons	23.5	------	.2	1.5	1.9	2.1	3.7	11.6	14.4	14.4	19.4	13.1	6.5	3.6	3.0	1.9	1.3	.7	.7	------	------	------	536
2½ tons	24.0	.2	.4	.6	2.4	4.3	5.4	7.3	12.3	12.1	14.4	10.6	10.8	5.2	5.4	3.2	2.8	.9	1.7	------	------	------	463
3 tons	25.8	------	.2	.2	1.2	1.7	2.0	2.5	4.9	6.6	11.8	14.2	15.2	12.6	9.6	4.7	3.2	4.2	2.5	2.5	0.2	------	407
3½ tons	26.3	------	------	.8	3.1	2.4	4.7	1.6	4.7	4.7	9.4	10.3	11.8	8.8	9.4	4.7	6.3	5.5	6.3	3.1	------	2.4	127
5 tons	25.6	------	------	1.2	.4	1.6	3.6	3.1	2.0	12.6	18.6	14.3	7.1	9.5	4.3	7.9	3.5	5.1	2.4	1.2	1.6	------	253

TABLE 34.—*Frequency distribution of the over-all lengths of loaded tractor-semitrailer combinations, percentage of total observations in each capacity class*

Manufacturer's rated capacity	Average length	Over-all length in feet														Total observations
		26	28	30	32	34	36	38	40	42	44	46	48	50	52	
	Feet	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Number*
1½ tons	33.2	1.6	8.1	16.1	30.6	17.8	8.1	12.9	1.6	1.6	1.6	-------	-------	-------	-------	62
2 tons	33.5	2.3	13.6	20.5	20.4	11.4	6.8	9.1	4.5	6.8	4.5	-------	-------	-------	-------	44
3 tons	33.0	3.4	10.0	21.0	21.6	13.8	11.0	7.5	2.7	1.4	5.2	2.1	0.3	-------	-------	291
4 tons	36.7	-------	4.8	12.7	12.7	7.9	14.3	19.1	6.3	11.1	3.2	6.3	-------	1.6	-------	63
5 tons	33.7	7.2	16.5	8.2	9.3	15.5	23.7	10.3	3.1	2.1	2.1	1.0	-------	-------	1.0	97
Over 5 tons	34.3	.6	4.1	8.8	21.0	33.9	15.2	6.4	4.1	1.2	2.3	1.2	1.2	-------	-------	171

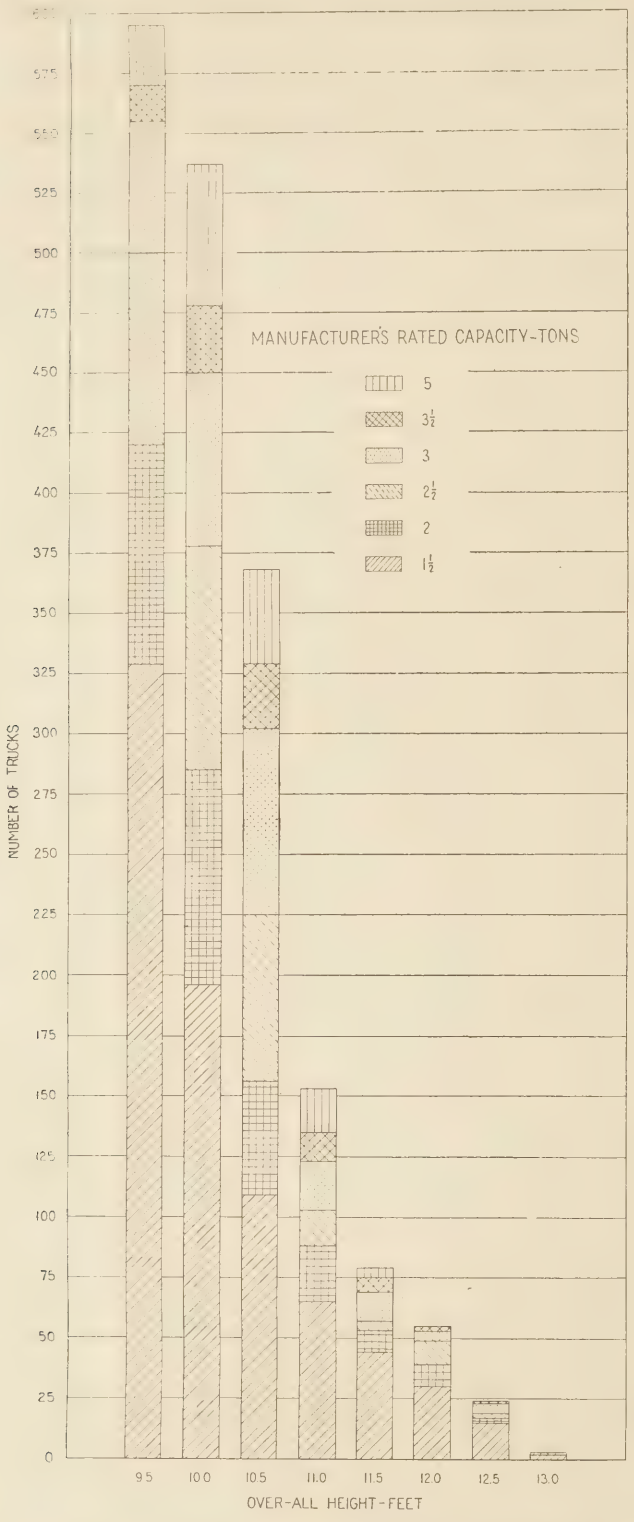

FIGURE 9.—LOADED TRUCKS IN HEIGHT CLASSIFICATION FROM 9½ TO 13 FEET GROUPED ACCORDING TO RATED CAPACITY.

nations that could be classified by capacity was more than 50 feet in length. Eighteen, or 2.5 percent of the total, were over 45 feet long; and 63, or 8.7 percent, were over 40 feet in length. More than one-third—253 of the 728 loaded semitrailer combinations classifiable by capacity—were more than 35 feet long over-all.

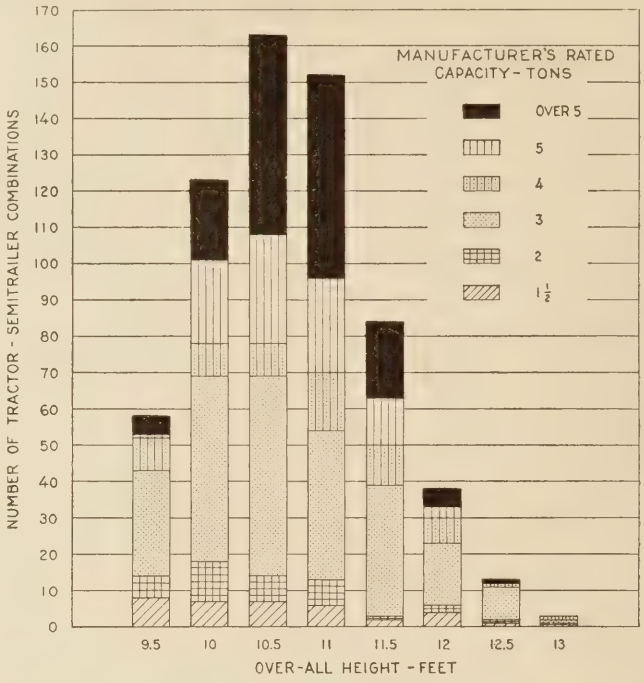

FIGURE 10.—LOADED TRACTOR-SEMITRAILER COMBINATIONS IN HEIGHT CLASSIFICATIONS FROM 9½ TO 13 FEET GROUPED ACCORDING TO RATED CAPACITY.

TABLE 35.—*Classification of all long, loaded, single vehicles according to manufacturer's rated capacity and over-all length*

Manufacturer's rated capacity	Total all loaded vehicles	Loaded vehicles having over-all lengths exceeding—					
		25 feet		30 feet		33 feet	
	No.	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*
1½ tons	2,953	135	17.4	15	12.4	-----	-----
2 tons	536	95	12.3	8	6.6	-----	-----
2½ tons	463	139	18.0	12	9.9	-----	-----
3 tons	407	222	28.7	38	31.4	1	12.5
3½ tons	127	74	9.6	22	18.2	3	37.5
5 tons	253	108	14.0	26	21.5	4	50.0
Total	4,739	773	100.0	121	100.0	8	100.0
Percentage of total loaded vehicles	100.0	16.3	-----	2.6	-----	0.2	-----

TABLE 36.—*Classification of all long, loaded, tractor-semitrailer vehicle combinations according to manufacturer's rated capacity and over-all length*

Manufacturer's rated capacity	Total all loaded vehicles	Loaded vehicles having over-all lengths exceeding—									
		30 feet		35 feet		40 feet		45 feet		50 feet	
	No.	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*
1½ tons	62	46	8.7	16	6.3	2	3.2	-----	-----	-----	-----
2 tons	44	28	5.3	14	5.5	5	7.9	-----	-----	-----	-----
3 tons	291	191	36.0	88	34.8	26	41.3	7	38.9	-----	-----
4 tons	63	52	9.8	39	15.4	14	22.2	5	27.8	-----	-----
5 tons	97	66	12.4	42	16.6	6	9.5	2	11.1	1	100.0
Over 5 tons	171	148	27.8	54	21.4	10	15.9	4	22.2	-----	-----
Total	728	531	100.0	253	100.0	63	100.0	18	100.0	1	100.0
Percentage of total loaded vehicles	100.0	72.9	-----	34.8	-----	8.7	-----	2.5	-----	-----	-----

As shown by tables 33 and 34, the longest vehicles and combinations were of large and intermediate capacity classes. The largest single vehicles of the 1½-, 2-, and 2½-ton classes were 32 feet long; the longest 1½- and 2-ton semitrailer combinations were 44 feet long.

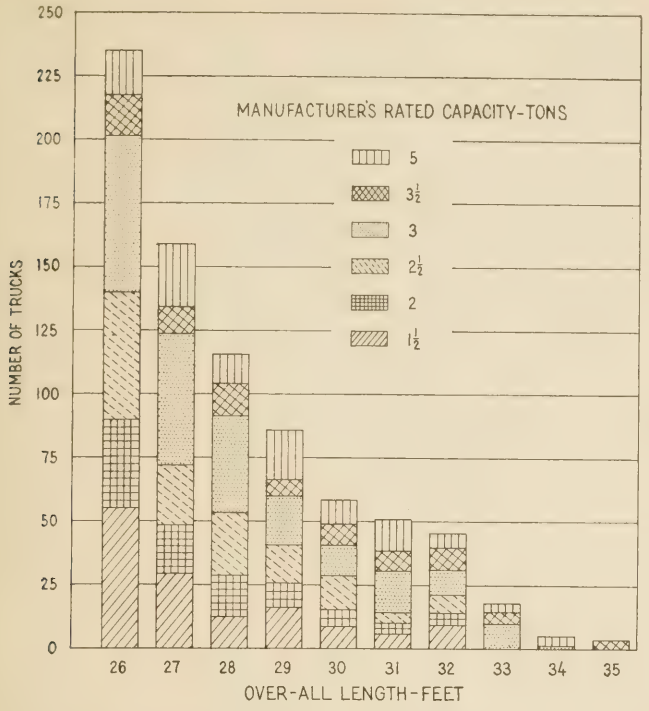

FIGURE 11.—LOADED SINGLE VEHICLES GROUPED ACCORDING TO OVER-ALL LENGTH AND WITHIN GROUPS ACCORDING TO RATED CAPACITY.

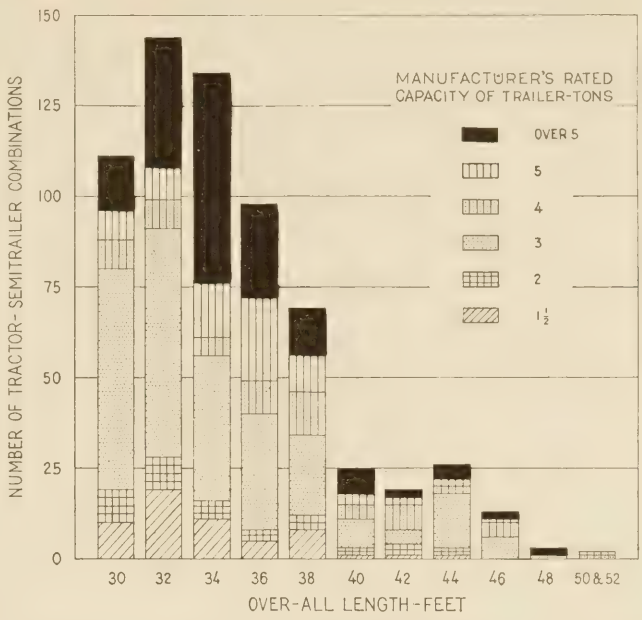

FIGURE 12.—LOADED TRACTOR-SEMITRAILER COMBINATIONS GROUPED ACCORDING TO OVER-ALL LENGTH AND WITHIN GROUPS ACCORDING TO RATED CAPACITY.

TABLE 37.—*Weights and dimensions of combinations that included full trailers*

Combination no.	Type of combination	Manufacturer's rated capacity	Gross weight of combination	Gross weight	Rear axle load	Percentage of gross weight carried on—					Tire arrangement [1]	Rear-wheel load	Ratio of tire load to tire capacity	Over-all height	Over-all width	Over-all length	Over-all wheel base	Ratio of over-all wheel base to over-all length	Value of "C" in formula $W=C\ (L+40)$	Character of load	Origin and destination
						Truck rear axle	Tractor rear axle	Semi-trailer axle	Full trailer												
									Front axle	Rear axle											
		Tons	*Lbs.*	*Lbs.*	*Lbs.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*		*Lbs.*	*Pct.*	*Feet*	*Feet*	*Feet*	*Feet*				
1	Truck		77,080	38,520	32,140	42					6 D	8,035	101	9.5	7.8	58.7	49.7	1.18	860	Gasoline	Maryland to Delaware.
	Full trailer			38,560	25,760				17	33	6 D	6,440	80								
2	Tractor		31,400	15,700	9,240		29				4 D	4,620	59	11.0	7.7	53.0	47.0	1.13	360		Do.
	Semitrailer				8,000			25			2 D	4,000	40								
	Full trailer	5		7,700	3,800				12	12	4 D	1,900	37								
3	Truck	3	39,800	24,425	18,770	47					4 D	9,385	130	9.4	7.1	42.7	38.1	1.12	500	Paper	Maryland to District of Columbia.
	Full trailer			15,375	7,330				39	18	4 D	3,665	83								
4	Truck	1½	11,700	9,200	7,150	41					4 S	3,575		10.0	6.4	37.6	34.0	1.11	160	Furniture	New York to Florida.
	Full trailer			2,500	1,275				10	11	4 S	638									
5	Truck	2½	36,800	18,500	14,740	40					4 D	7,370	145	11.8	7.7	42.4	37.4	1.13	490	Agricultural products.	North Carolina to New York.
	Full trailer			18,300	9,000				25	24	4 S	4,500	125								
6	Truck	3½	39,375	25,200	16,450	42					4 D	8,225	105	11.8	7.7	48.8	44.3	1.21	470	Produce	North Carolina to Maryland.
	Full trailer			14,175	6,600				19	17	4 DD	3,300	100								
7	Truck	1½	25,540	15,180	12,370	43					4 D	6,185	149	8.0	7.0	37.8	33.0	1.15	350	Fruit	Florida to Pennsylvania.
	Full trailer			10,360	5,300				20	21	4 S	2,150									
8	Tractor	3½	30,600	12,700	8,100		26				4 D	4,050	51	11.0	8.0	53.6	48.8	1.10	340	Freight	Delaware to Maryland.
	Semitrailer	10			6,200			20			2 D	3,100	48								
	Full trailer	5		11,700	5,300				21	17	4 D	2,650	34								
9	Truck	2½	58,700	38,100	30,300	52					6 D	7,575	97	10.5	7.8	53.5	48.4	1.10	660	Soy beans	Do.
	Full trailer	5		20,600	10,300				18	18	4 DD	5,150	79								
10	Truck	3	39,300	24,000	18,300	47					4 D	9,150	127	9.5	7.2	42.6	38.0	1.12	500	Paper	District of Columbia to Maryland.
	Full trailer			15,300	7,500				20	19	4 DD	3,750	85								

[1] The number designates the number of wheels on each unit. The letter indicates arrangement of tires on wheels carried by rear axle. D indicates dual tires and S indicates single tires. On full trailers DD means that wheels on both front and rear axles carry dual tires.

Figures 11 and 12 show graphically the relative numbers of single vehicles and semitrailer combinations of the several capacity classes in each of the larger length groups. It will be observed that single vehicles of low rated capacity were an important part of each length group up to 32 feet—the greatest length observed for such vehicles. In the case of semitrailer combinations, those of the lower rated capacities are an unimportant part of the total above the length of 38 feet.

WEIGHTS AND DIMENSIONS OF FULL-TRAILER COMBINATIONS GIVEN

Only 10 combinations having full trailers were observed during the course of the survey. The weights, dimensions, and other characteristics of these vehicles are given in table 37. In general their characteristics are similar to those of the tractor-semitrailer combinations which have been discussed in detail, but one should be noted particularly as the longest and heaviest combination observed during the period. This combination, with a gross load of 77,000 pounds and a length of 58.7 feet, had a value of C in the gross-load formula recommended by the American Association of State Highway Officials of 860. This is the largest value noted in the period of observation and exceeds the next largest value observed by nearly 100. This combination consisted of a tank truck and a tank trailer and was used to transport gasoline.

REPORT ON TAXATION OF MOTOR VEHICLES IN 1932 AVAILABLE

The full report on the study of motor vehicle taxation in 1932 by the United States Bureau of Public Roads is now available. The survey was begun in 1933 and completed in 1934 and is the broadest in scope yet attempted. The report includes not only State taxes but also Federal excise taxes, county and municipal taxes, personal-property taxes on motor vehicles imposed by State, county, and municipal jurisdictions, and public bridge tolls. The data are analyzed so that the numbers and contributions of various classes of vehicles may be determined.

A digest of the report was published in Public Roads, October 1934. The full report, entitled "The Taxation of Motor Vehicles in 1932", consists of 270 pages and is for sale by the Superintendent of Documents, Government Printing Office, Washington, D. C., for 35 cents. There is no supply for general free distribution. Orders should be sent direct to the Superintendent of Documents at the above address.

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 APRIL 30, 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	$ 5,778,739	$ 3,132,239	$ 35,890	312.1	$ 2,566,548	$ 729,230	$ 1,237,976	151.8	$ 78,001	$ 196,641	12.2	$ 8,283	$ 659,414
Arizona	3,878,555	1,338,712	4,552,883	3,697,024	245,934	314.9	1,183,412	160,262	968,606	75.3		65,041	.4	21,269	59,131
Arkansas	3,334,167	1,714,000	3,141,122	2,466,590	150,703	155.7	1,726,430	694,108	821,095	76.0	39,563	495,944	27.9	133,907	246,258
California	7,912,928	3,713,643	9,306,642	6,966,585	2,200	277.6	4,346,155	946,148	2,113,995	132.9		842,490	26.6	195	754,958
Colorado	3,437,265	2,424,504	4,092,855	3,314,321	675,146	192.4	1,973,938	122,944	1,733,560	94.8		4,973			10,825
Connecticut	1,404,213	607,500	797,613	795,279		14.5	1,451,228	608,934	579,726	23.4					27,774
Delaware	877,566	461,697	1,052,958	868,470	177,572	42.0	296,479	8,734	274,891	6.8		5,858		362	3,377
Florida	2,469,370	1,116,600	3,108,167	2,247,168	31,410	117.4	943,790	194,891	698,743	34.1		142,641	3.8	27,310	243,807
Georgia	5,045,592	2,556,745	3,693,105	3,493,273		254.4	2,760,461	1,381,647	1,343,814	143.7	64,972	287,641	23.4	105,700	925,290
Idaho	2,166,858	1,131,910	2,139,228	1,965,578	107,294	186.0	719,704	200,496	506,290	45.8				784	518,326
Illinois	4,442,467	3,060,041	1,994,240	1,941,129	19,269	38.2	3,978,753	2,454,691	1,524,062	66.1	3,000	358,704	3.5	43,647	1,158,005
Indiana	5,018,921	2,816,687	3,296,771	3,215,100		106.3	2,795,719	1,689,012	1,071,492	70.9	77,951	1,630,836	113.7	36,858	114,359
Iowa	5,027,830	2,217,361	4,775,953	4,637,430	54,420	288.6	2,608,914	390,400	1,987,905	137.9		137,324	13.0		37,712
Kansas	5,044,802	2,354,131	5,367,382	4,963,354	266,535	587.3	2,142,297	56,400	2,040,651	166.4		46,945	5.2	25,048	
Kentucky	3,751,605	1,527,324	3,601,224	3,334,508	33,571	244.1	879,836	384,396	419,773	72.2		697,752	32.6	32,701	376,228
Louisiana	2,693,135	1,380,419	1,851,671	1,826,016	19,599	75.4	2,178,364	830,877	833,686	15.8	36,242	287,440	14.7		239,694
Maine	1,567,012	793,644	1,345,616	1,315,837		43.8	802,094	243,876	558,218	13.5	4,618	204,636	6.8	2,681	30,791
Maryland	1,782,263	289,609	808,265	791,495	16,517	15.3	1,001,994	797,232	204,762	21.5				193,536	68,331
Massachusetts	1,101,716	1,632,874	1,423,764	1,030,789		37.4	913,806	52,687	809,298	12.5		181,433	6.9	18,240	642,144
Michigan	6,051,532	3,226,284	4,922,459	4,767,686		225.4	3,546,825	1,250,600	2,281,425	134.3		690,750	37.5	33,247	254,109
Minnesota	4,561,011	2,642,244	5,633,297	4,253,085	1,240,277	891.3	824,609	179,056	613,153	103.7		523,878	70.1	128,870	264,935
Mississippi	3,489,337	2,832,182	4,574,660	2,398,442	187,599	237.1	2,669,310	908,666	1,023,840	144.3	157,543	938,109	64.8	24,687	622,633
Missouri	5,237,532	2,132,426	4,711,323	4,173,675		188.7	2,933,364	989,027	1,723,216	85.8		233,456	8.6	74,830	175,754
Montana	4,463,849	2,714,208	5,923,705	4,429,840	960,838	482.6	1,566,328	4,129	1,493,241	134.9		107,931	18.5	29,879	152,198
Nebraska	3,914,481	1,982,182	5,087,171	3,871,728	54,009	366.8	2,241,220	25,924	1,813,460	100.0	3,918	71,690	7.9	12,912	43,022
Nevada	2,909,387	1,350,356	2,858,941	2,669,138	131,852	272.1	1,216,669	179,532	975,827	150.1	17,734	19,855	2.6	42,982	222,823
New Hampshire	692,119	484,731	638,684	612,389		10.8	524,341	79,730	422,873	12.5		18,673			43,184
New Jersey	3,173,019	951,379	1,777,937	1,758,405		31.6	1,726,150	1,405,336	131,657	18.0		439,718	3.0	9,278	380,004
New Mexico	2,846,648	1,676,769	3,286,054	2,760,948	381,177	317.3	1,005,398	85,700	848,804	76.9		173,173	15.1		273,615
New York	10,465,672	3,748,600	10,617,113	8,715,879	168,930	214.4	8,130,743	1,631,070	3,085,180	142.5		326,100	4.4	118,723	168,390
North Carolina	4,761,147	2,040,068	4,684,107	3,501,810	305,933	584.8	1,472,608	848,161	362,335	160.3	159,106	295,513	21.9	252,069	1,076,287
North Dakota	2,902,224	1,469,484	3,119,028	2,615,891	57,900	1,023.9	505,218	54,095	350,908	208.4	65,172	446,432	223.7	167,066	614,243
Ohio	7,277,758	3,539,256	7,431,032	7,040,880		191.3	3,341,740	93,600	2,922,590	70.4	101,298	26,720	2.2	41,980	589,946
Oklahoma	4,608,399	2,342,590	4,284,045	4,085,173	66,604	304.3	2,311,486	513,197	1,585,774	90.0	10,029	317,624	13.1		372,587
Oregon	3,053,448	1,452,741	3,448,551	2,971,548	144,622	186.0	1,159,167	10,790	1,123,115	57.0	69,800	22,000	1.4	1,310	163,004
Pennsylvania	6,691,194	4,554,082	5,910,420	5,495,190	170,304	124.4	5,489,477	1,143,622	4,126,664	95.1	2,126	56,082	1.4	50,256	201,032
Rhode Island	979,367	474,772	968,005	899,627		20.5	560,592	79,740	464,572	14.3					10,200
South Carolina	2,729,583	940,954	2,346,397	2,258,083	27,818	199.1	809,210	374,583	434,627	71.5	36,876	1,637	2.2	60,041	476,871
South Dakota	3,005,739	1,523,821	2,715,606	2,207,574	46,543	458.5	1,326,697	653,701	646,319	246.8	87,403	740,756	123.8	57,061	90,203
Tennessee	4,246,309	2,105,453	4,653,371	3,950,708	64,152	182.5	1,626,631	249,628	1,280,602	53.3	9,488	213,044	7.5	36,484	547,656
Texas	11,588,643	6,858,253	11,860,198	11,164,929	168,682	1,011.7	4,858,166	336,994	4,333,239	382.2	86,720	1,314,516	106.2		1,041,816
Utah	2,367,205	1,066,345	2,807,441	2,277,220	364,113	237.8	810,926	84,632	514,884	61.7		32,000	3.5	5,353	155,349
Vermont	928,184	466,042	967,516	902,837	28,464	47.9	347,973	10,670	309,279	15.4		113,807	4.2	14,677	14,493
Virginia	3,708,379	1,882,693	3,756,192	3,356,653	170,305	159.3	1,692,244	205,323	1,356,584	66.1	52,625	156,182	19.1	93,779	199,623
Washington	3,057,934	1,553,206	2,806,744	2,587,440	198,794	99.4	1,603,910	435,526	1,007,336	29.5	1,485	209,908	1.2	33,483	137,168
West Virginia	2,013,405	1,140,167	1,930,305	1,851,481	60,891	71.2	659,234	111,669	530,673	23.5	23,589	182,332	5.6	26,666	366,270
Wisconsin	4,697,518	1,751,970	4,287,975	4,115,451	8,236	207.5	1,631,168	491,836	996,098	71.7	182	685,428	24.2	90,049	62,208
Wyoming	2,250,663	1,686,368	2,540,830	2,038,070	337,236	499.3	1,187,179	209,202	951,812	164.7		349,516	68.9	3,391	47,603
District of Columbia															
Hawaii	1,693,344	598,778	419,600	273,974		13.6	1,763,640	1,412,579		26.0				6,791	598,778
TOTALS	185,269,048	94,455,726	183,096,905	156,007,939	7,181,339	12,164.5	94,812,145	26,005,283	57,438,630	4,372.1	1,189,441	14,353,129	1,153.3	2,066,385	15,482,628

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 APRIL 30, 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	$ 1,624,889	$ 1,583,983	$ 39,465	39.4	$ 842,275	$ 657,876	$ 184,399	29.0	$ 131,223	$ 208,328	5.1	$ 16,845	$ 632,768
Arizona	807,982	305,191	644,776	609,590	24,120	13.3	59,104	20,500	13,185	.9	129,322	95,500	.7	48,571	172,386
Arkansas	1,964,534	857,025	1,571,476	1,454,286	17,953	41.1	600,425	395,400	204,475	10.2	101,076	271,224	6.0	13,771	363,374
California	4,213,986	2,219,360	4,050,368	3,459,880	12,000	47.8	2,236,062	739,196	1,190,932	20.5		793,544	4.9	14,910	222,884
Colorado	1,718,633	190,000	1,770,072	1,664,935	13,406	35.9	156,005		156,005	4.1				53,698	20,590
Connecticut	802,407	426,500	809,564	798,075	6,949	10.3	140,239		140,239	1.2		143,909	1.7	4,331	135,403
Delaware	460,409	230,849	513,762	460,282	44,973	7.2	6,570		6,570	.1		38,235	1.8	126	141,072
Florida	1,459,648	501,200	1,727,318	1,398,151	70,889	20.6	31,938		31,938	.6	2,898	157,696	1.4	58,600	240,677
Georgia	2,724,620	1,278,373	1,578,644	1,566,701		59.4	1,231,985	978,037	253,948	26.1		269,915	6.0	179,883	754,511
Idaho	1,197,829	321,126	1,162,534	1,119,507	2,643	19.4	71,867	45,372	26,495	1.9		209,525	.2	32,950	82,463
Illinois	7,476,075	2,515,835	6,004,604	5,757,379		63.5	2,372,581	1,566,225	806,356	11.3	57,163	425,336	3.3	95,308	1,284,144
Indiana	4,287,050	2,136,306	2,959,435	2,860,685		60.3	1,601,321	1,262,896	335,961	18.1	138,381	1,031,047	20.6	25,088	769,298
Iowa	2,614,472	1,311,000	1,977,158	1,891,868	7,085	54.0	1,289,041	721,565	486,115	17.4	1,000	217,735	6.8	39	600,065
Kansas	2,522,401	1,432,949	2,253,006	2,207,201	34,017	39.4	1,730,329	275,108	1,295,065	16.4		103,867	1.3	40,092	
Kentucky	1,927,828	954,578	1,402,627	1,366,429		31.3	841,127	525,577	305,699	8.5	30,000	212,124	4.8	5,822	436,754
Louisiana	1,708,577	744,560	739,639	703,819	34,048	19.0	1,212,312	922,541	263,091	16.4	82,217	149,761	4.3		297,660
Maine	960,426	490,045	835,547	829,154		16.4	99,446	47,071	52,375	.5	83,948	98,817	2.6	253	338,853
Maryland	891,132	452,515	390,127	384,134		4.1	911,650	98,129		.4	150,828		.5	258,041	452,514
Massachusetts	5,007,199	847,600	2,125,586	2,084,041		13.4	3,126,137	2,876,372	224,789	5.7		51,225	.9	46,787	571,587
Michigan	3,500,638	1,613,142	3,245,466	3,056,216	104,400	38.8	1,635,650	412,750	1,185,000	14.6	14,950	128,000	4.7	16,721	195,742
Minnesota	3,719,143	1,421,494	3,232,379	3,000,538	195,923	108.1	503,754	172,113	323,440	12.2	516,059	3,879	5.8	30,433	867,251
Mississippi	1,744,669	354,022	713,564	672,600	27,695	26.1	1,039,885	858,440	135,888	27.2	182,215	75,122	8.7	31,414	115,318
Missouri	4,019,501	1,617,451	2,840,268	2,769,719		51.4	1,297,755	1,105,442	146,476	11.2	23,343	65,197	1.2	120,997	1,405,778
Montana	1,115,962	113,092	1,033,290	1,024,038		33.2	99,549	34,716	40,279	5.2	28,667	31,863	2.9	28,541	40,949
Nebraska	1,957,240	991,091	2,139,593	1,943,547	166,420	37.0	607,903		607,903	10.4		79,919	2.1	13,693	136,849
Nevada	500,051	100,000	479,800	473,901		9.4	57,842		57,842	1.4				26,150	42,158
New Hampshire	740,335	242,366	721,984	668,776	49,851	15.9	131,823	71,559	60,055	3.0					132,460
New Jersey	3,117,921	1,809,500	2,580,387	2,450,104		21.4	1,190,747	641,264	434,690	5.7		208,357	.8	26,553	1,166,453
New Mexico	1,674,158	529,506	1,568,730	1,395,399	173,331	35.3	271,016	194,818	76,198	6.5	3,119			80,822	279,977
New York	8,255,661	3,756,621	7,002,521	6,277,447	299,400	55.9	5,007,781	1,829,357	2,959,290	29.1		143,200	1.3	148,857	354,731
North Carolina	2,380,573	1,210,236	2,200,334	2,091,279	101,308	78.1	590,748	142,205	398,091	15.4	91,217	432,801	12.3	55,872	278,037
North Dakota	1,451,112	734,742	1,020,946	1,013,739		42.9	289,153	202,959	86,194	10.7	210,262	250,251	27.1	24,153	398,296
Ohio	4,335,686	2,359,503	4,507,040	4,017,456	14,575	57.8	1,872,280	226,500	1,539,130	20.7	46,900	281,150	3.1	44,830	524,648
Oklahoma	2,304,200	1,171,295	1,983,657	1,870,145	50,805	42.3	810,380	398,184	409,009	10.7	35,871	339,737	5.2		371,743
Oregon	1,526,724	867,977	1,524,596	1,458,079	30,424	29.4	514,053	66,635	439,409	8.6	518	226,716	4.2	1,492	171,428
Pennsylvania	4,854,988	2,397,703	3,541,570	3,276,755	110,906	55.4	2,530,867	1,480,091	935,512	24.3	33,889	719,302	5.7	64,253	631,983
Rhode Island	579,625	285,760	519,889	518,991		7.4	141,760		141,760	1.5				60,634	144,000
South Carolina	1,364,791	488,000	1,061,039	1,059,079		33.8	347,035	241,028	106,007	12.7	64,684	71,628	3.6		310,365
South Dakota	1,502,870	761,911	1,042,346	1,041,308	808	35.8	190,966	123,944	67,022	7.8	115,858	125,648	7.9	221,760	568,433
Tennessee	2,123,155	1,121,790	1,697,413	1,642,201	37,444	24.0	759,732	469,994	289,738	7.3		184,393	1.9	10,960	610,214
Texas	6,642,863	1,795,000	5,010,219	4,862,342	37,599	114.1	2,032,785	1,484,599	363,895	31.5	18,745	450,359	10.7	277,177	943,147
Utah	778,826	533,173	778,597	649,146	65,900	20.2	332,584	129,130	187,706	4.5		204,500	7.4	550	75,067
Vermont	500,509	240,611	438,659	399,070		11.9	217,197	97,248	105,285	4.0		107,326	2.7	4,191	28,000
Virginia	2,008,458	941,347	1,379,573	1,256,944	92,998	26.7	1,081,522	571,646	300,947	8.2	67,775	306,492	6.8	112,093	240,910
Washington	1,977,260	776,603	2,073,550	1,913,253	139,163	36.5	454,715	56,928	437,787	9.9	3,957	171,774	2.2	3,121	27,879
West Virginia	1,342,270	570,085	1,017,695	968,033	13,293	16.7	359,679	344,863	14,816	4.7	29,374	72,008	2.7		469,968
Wisconsin	2,596,143	1,348,513	2,491,867	2,407,243	15,575	52.3	491,512	113,026	378,486	8.7		848,723	13.5	75,875	105,729
Wyoming	1,125,332	29,416	988,667	982,691	2,784	22.5	155,723	141,009	14,132	3.0				1,632	12,500
District of Columbia	946,445	243,460	922,671	696,281	226,390	6.5	250,164	250,164		.2					17,070
Hawaii															
TOTALS	115,822,245	48,705,383	93,899,442	88,056,420	2,264,540	1,742.6	43,846,974	22,992,477	18,219,624	510.2	2,395,459	10,037,133	217.4	2,377,889	18,184,086

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 APRIL 30, 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	$ 1,074,572	$ 1,073,654	$ 101,099	81.6	$ 1,487,169	$ 908,870	$ 578,299	99.1		$ 238,167	20.9	$ 49,929	$ 248,495
Arizona	525,423	998,032	642,741	516,393		52.6	687,377	9,030	603,790	57.2		58,169	8.7		234,974
Arkansas	1,449,634	857,024	1,223,026	1,217,347		149.0	458,917	156,240	301,561	59.5		296,237	32.4	76,047	259,226
California	3,480,440	1,999,203	3,590,636	2,984,134		164.3	1,493,714	494,605	868,356	45.0		492,620	24.1	1,700	638,227
Colorado	1,718,632	871,502	1,940,267	1,605,435	97,447	196.0	1,029,409	110,000	610,298	127.5	$ 3,197	75,032	5.0		88,726
Connecticut	659,120	420,868	160,282	160,282		3.1	740,403	498,838	235,769	16.4					185,099
Delaware	481,113	230,849	314,981	218,550	90,382	29.4	362,480	262,563	99,683	30.3		39,000	11.7		1,783
Florida	1,302,816	1,043,543	1,511,453	1,283,665	217,222	83.4	397,137		397,137	23.0		336,849	16.6	19,150	92,334
Georgia	2,320,973	1,278,373	1,367,881	1,364,873		106.4	896,693	770,461	126,232	54.9		306,570	32.2	135,638	845,571
Idaho	1,121,562	824,450	1,328,724	1,101,360	56,671	156.1	489,003		483,712	54.1		95,000	13.6	20,202	189,067
Illinois	5,652,228	3,345,525	2,231,124	2,198,495		134.1	6,020,232	3,443,885	2,576,347	314.6	9,848	769,178	36.7		
Indiana	731,872	135,970	393,706	388,288		44.2	325,333	310,433	14,900	43.4		113,139	12.3	33,152	7,931
Iowa	2,413,358	1,590,000	2,148,139	1,930,791	164,500	320.6	1,708,567	481,860	1,101,475	290.5		314,400	82.0	707	9,625
Kansas	2,522,401	1,330,595	2,195,510	2,113,655	74,572	219.0	1,287,748	381,253	906,495	89.0	27,493	349,528	6.5		
Kentucky	1,837,926	1,336,409	1,858,708	1,715,113	41,263	214.0	1,147,628	107,202	1,024,165	135.4		270,981	40.6	15,611	
Louisiana	1,426,879	838,953	967,569	963,328		47.9	542,816	308,877	233,939	20.6	127,387	575,867	30.1	27,287	29,147
Maine	842,479	427,897	1,074,290	842,479	146,816	86.7	275,022		256,302	20.9		19,278	.7		5,500
Maryland	891,132	1,067,934	735,179	692,648		52.1	564,266	172,531	391,735	28.6	20,419	211,449	5.7	5,535	464,750
Massachusetts	488,185	870,000	477,470	469,741		15.2						115,370	5.5	18,443	754,630
Michigan	3,184,057	1,613,142	2,899,613	2,822,085	16,400	205.5	1,409,527	341,727	1,052,900	59.4		502,675	34.7	20,245	41,167
Minnesota	2,376,415	1,361,813	2,384,797	2,189,842	143,394	266.7	1,207,137	155,444	919,593	117.4		228,132	14.7	31,129	70,695
Mississippi	1,744,669	354,023	961,631	961,631		101.6	717,351	717,351		58.4	22,312	101,740	24.0	43,374	252,283
Missouri	2,923,273	2,423,863	2,957,393	2,687,722	193,380	634.0	1,376,118	235,551	1,095,313	217.8		772,549	165.8		362,621
Montana	1,859,937	942,434	1,874,716	1,754,032	116,145	237.7	644,011		644,011	62.2		91,140	8.6	105,905	91,138
Nebraska	1,957,240	991,091	2,110,304	1,952,560	147,789	402.5	726,186		726,186	82.8		36,964	3.6	4,680	80,151
Nevada	1,136,479	852,000	1,290,773	1,113,354	151,347	148.6	469,768		469,768	61.3				23,126	230,385
New Hampshire	477,385	242,365	526,497	402,961	77,387	24.8	114,607	29,000	82,590	5.9		82,388	3.8	45,425	
New Jersey	55,099	460,000	56,528	55,099		.5						111,963	1.7		348,037
New Mexico	1,272,129	735,425	1,322,677	1,235,198	87,479	231.8	537,768	36,931	500,837	60.0		49,388	7.4		97,721
New York	3,608,768	3,822,700	3,401,689	3,038,326	28,089	84.3	4,374,470	515,500	3,059,750	247.4		524,500	44.8	54,942	210,362
North Carolina	2,380,573	1,590,637	2,288,022	2,130,201	153,794	250.1	1,441,278	223,812	1,217,466	155.4		60,000	12.8	26,560	159,377
North Dakota	1,451,112	734,741	899,550	898,931		275.4	409,971	321,903	88,068	106.8	169,959	196,749	119.9	60,319	449,925
Ohio	3,871,148	1,966,253	3,977,509	3,704,933	14,300	299.4	1,254,130	73,810	1,176,520	95.5		350,400	14.1	92,404	425,033
Oklahoma	2,304,199	1,171,295	2,002,195	1,889,014		252.1	1,271,601	411,491	695,789	59.9		321,215	21.7	3,694	154,291
Oregon	1,526,724	777,096	1,698,447	1,507,131	29,332	113.2	822,180	19,526	704,005	55.8		38,062	5.6	67	5,696
Pennsylvania	7,344,822	2,639,003	6,441,096	6,216,317	81,028	543.6	3,523,019	1,128,505	2,306,191	213.5		114,181	5.6		137,603
Rhode Island	439,716	254,040	449,748	439,716		33.2	212,563		212,563	6.7					41,478
South Carolina	1,364,791	1,342,000	1,074,980	1,074,418		115.5	1,094,312	239,531	815,745	132.2	49,827	478,054	49.9	1,015	48,201
South Dakota	1,502,870	761,911	1,222,360	1,174,187	48,151	346.5	371,342	310,094	61,248	110.5	16,937	247,851	88.4	1,653	404,661
Tennessee	2,123,155	1,075,748	1,425,481	1,369,013		112.6	1,096,305	672,589	423,716	56.5	4,503	395,520	21.9	77,051	256,512
Texas	6,012,518	3,638,000	6,569,615	5,952,080	167,508	773.3	1,901,492	43,305	1,858,187	168.3		1,242,217	80.7	17,132	370,088
Utah	1,048,677	533,173	1,223,305	954,655	134,800	182.7	468,943	94,022	289,373	75.0		80,675	8.7		28,324
Vermont	438,880	241,354	499,957	437,125	16,569	37.2	199,930		191,498	13.8		33,250	2.5	1,755	37
Virginia	1,699,920	941,347	1,627,065	1,565,087	8,753	211.1	622,968	101,973	508,727	52.9	16,817	147,140	21.4	16,043	276,727
Washington	1,080,673	776,603	1,075,591	1,044,520	7,095	63.7	735,754	36,153	688,372	52.7					81,137
West Virginia	1,118,559	570,083	745,430	701,270		41.9	547,924	386,859	161,065	20.6	25,237	131,528	6.4	5,193	277,490
Wisconsin	2,431,220	1,841,354	2,327,342	2,149,288	48,583	170.4	1,126,704	270,460	671,989	46.1		640,840	12.1	11,472	479,942
Wyoming	1,125,332	571,928	1,142,722	1,047,459	74,683	157.2	99,718	27,126	72,591	12.9	50,747	381,277	105.6		43,377
District of Columbia	972,024	730,382	1,102,078	972,024	130,054	8.7	324,587		324,587	3.8		65,390	.4		210,350
Hawaii	177,718	351,000	178,209	177,718		4.9									351,000
TOTALS	92,908,707	56,838,891	82,993,578	76,458,128	2,866,032	8,486.4	49,015,578	14,809,311	31,828,843	3,921.6	544,683	12,102,622	1,272.1	1,096,585	10,041,394

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Any of the following publications may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C. As his office is not connected with the Department and as the Department does not sell publications, please send no remittance to the United States Department of Agriculture.

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Federal Legislation and Regulations Relating to Highway Construction. 10 cents.

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SEPARATE REPRINT FROM THE YEARBOOK

No. 1036Y . . Road Work on Farm Outlets Needs Skill and Right Equipment.

TRANSPORTATION SURVEY REPORTS

Report of a Survey of Transportation on the State Highway System of Ohio (1927).

Report of a Survey of Transportation on the State Highways of Vermont (1927).

Report of a Survey of Transportation on the State Highways of New Hampshire (1927).

Report of a Plan of Highway Improvement in the Regional Area of Cleveland, Ohio (1928).

Report of a Survey of Transportation on the State Highways of Pennsylvania (1928).

Report of a Survey of Traffic on the Federal-Aid Highway Systems of Eleven Western States (1930).

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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 APRIL 30, 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	$ 8,478,199	$ 5,789,877	$ 75,355	433.0	$ 4,895,992	$ 2,295,975	$ 2,000,675	279.9	$ 209,224	$ 643,135	38.3	$ 75,057	$ 1,540,677
Arizona	5,211,960	2,641,935	5,840,400	4,823,006	371,153	380.7	1,909,893	189,792	1,585,580	133.4	129,322	218,711	9.9	69,840	466,491
Arkansas	6,748,335	3,428,049	5,935,624	5,138,222	168,656	345.9	2,785,773	1,245,748	1,327,130	145.7	140,639	1,063,405	66.3	223,725	868,858
California	15,607,354	7,932,206	16,947,646	13,410,599	14,200	489.7	8,075,931	2,179,950	4,173,283	198.5		2,128,654	55.5	16,805	1,616,069
Colorado	6,874,530	3,486,006	7,803,194	6,584,691	785,998	424.2	3,159,352	232,944	2,499,863	226.3	3,197	80,004	5.0	53,698	120,141
Connecticut	2,865,740	1,454,868	1,767,458	1,753,636	6,949	27.8	2,331,871	1,107,773	955,734	41.0		143,909	1.7	4,331	348,276
Delaware	1,819,088	923,395	1,881,701	1,547,303	312,926	78.7	665,530	271,296	381,145	37.1		83,092	13.5	488	146,232
Florida	5,231,834	2,661,343	6,346,938	4,928,984	319,521	221.4	1,372,866	194,891	1,127,818	57.7	2,898	637,186	21.8	105,060	576,818
Georgia	10,091,185	5,113,491	6,639,629	6,424,848		420.2	4,889,139	3,130,145	1,723,993	224.7	64,971	864,125	61.7	471,221	2,525,372
Idaho	4,486,249	2,277,486	4,630,487	4,186,445	166,607	361.5	1,280,575	245,868	1,016,498	101.8		304,525	13.7	53,936	789,856
Illinois	17,570,770	8,921,401	10,229,969	9,897,003	19,269	235.8	12,371,566	7,464,801	4,906,765	391.9	70,011	1,553,218	43.5	138,955	2,442,149
Indiana	10,037,843	5,088,963	6,649,913	6,464,073		210.9	4,722,373	3,262,341	1,422,353	132.4	216,332	2,775,022	146.6	95,098	891,588
Iowa	10,055,660	5,118,361	8,901,249	8,460,089	226,005	663.2	5,606,522	1,593,825	3,575,495	445.7	1,000	669,459	101.7	746	647,402
Kansas	10,089,604	5,117,675	9,815,898	9,284,210	375,125	845.7	5,160,372	712,761	4,242,209	271.7	27,493	500,341	13.1	65,140	
Kentucky	7,517,359	3,818,311	6,862,560	6,416,050	74,834	489.5	2,868,592	1,017,175	1,749,637	216.2	30,000	1,180,857	78.0	54,134	812,982
Louisiana	5,828,591	2,963,932	3,558,878	3,493,163	53,647	142.3	3,933,493	2,062,294	1,330,716	52.9	245,847	1,013,068	49.2	27,287	566,501
Maine	3,369,917	1,711,586	3,255,453	2,987,470	146,816	146.8	1,176,562	290,947	866,895	34.8	88,566	322,731	10.1	2,934	375,144
Maryland	3,564,527	1,810,058	1,933,571	1,868,277	16,517	71.5	2,477,909	1,067,892	596,497	50.6	171,247	211,449	6.2	457,112	935,595
Massachusetts	6,597,100	3,350,474	4,026,820	3,584,571		66.1	4,039,943	2,929,059	1,034,087	18.2		348,027	13.2	83,470	1,968,361
Michigan	12,736,227	6,452,568	11,067,537	10,645,987	120,800	469.7	6,592,002	2,005,077	4,519,325	208.4	14,950	1,321,425	76.9	70,213	491,018
Minnesota	10,656,569	5,425,551	11,250,473	9,443,465	1,579,594	1,266.1	2,535,500	506,613	1,856,186	233.3	516,059	786,890	90.6	190,432	1,202,881
Mississippi	6,978,675	3,540,227	6,249,855	4,032,673	215,294	364.8	4,426,546	2,484,457	1,159,727	230.0	362,070	1,174,971	97.5	99,475	990,234
Missouri	12,180,306	6,173,740	10,508,984	9,631,116	193,380	874.1	5,607,236	2,330,020	2,965,005	314.8	23,343	1,071,202	175.6	195,827	1,944,153
Montana	7,439,748	3,769,734	8,831,712	7,207,910	1,076,983	753.6	2,309,888	38,846	2,177,532	202.3	28,667	230,935	30.0	164,325	284,285
Nebraska	7,828,961	3,964,364	9,337,068	7,767,835	368,219	806.3	3,575,309	25,924	3,147,550	193.1	3,918	188,574	13.6	31,285	260,022
Nevada	4,545,917	2,302,356	4,629,513	4,256,393	283,199	430.1	1,744,279	179,532	1,503,437	212.8	17,734	19,855	2.6	92,258	495,866
New Hampshire	1,909,839	969,462	1,887,165	1,684,126	127,239	51.6	770,771	180,288	565,518	21.4		101,061	3.8	45,425	175,644
New Jersey	6,346,039	3,220,879	4,414,852	4,263,607		53.5	2,916,897	2,046,600	566,347	23.7		760,038	5.5	35,831	1,894,494
New Mexico	5,732,935	2,941,700	6,177,461	5,391,546	641,986	584.4	1,814,182	317,448	1,425,840	143.4	3,119	222,561	22.5	80,822	651,313
New York	22,330,101	11,327,921	21,021,323	18,031,652	496,419	354.6	17,512,994	3,975,927	9,104,220	419.1		993,800	50.6	322,522	733,483
North Carolina	9,522,293	4,840,941	9,172,462	7,723,291	561,034	913.1	3,504,633	1,214,178	1,977,892	331.2	250,323	788,314	46.9	334,501	1,513,701
North Dakota	5,804,448	2,938,967	5,039,524	4,528,561	57,900	1,342.2	1,204,342	578,957	525,171	325.8	445,392	893,432	370.8	251,538	1,462,464
Ohio	15,484,592	7,865,012	15,915,582	14,763,269	28,875	548.4	6,468,150	393,910	5,638,240	186.6	148,198	658,270	19.4	179,214	1,539,627
Oklahoma	9,216,798	4,685,180	8,269,896	7,844,331	117,410	598.7	4,393,467	1,322,874	2,690,573	160.6	45,900	978,576	39.9	3,694	898,621
Oregon	6,106,896	3,097,814	6,671,594	5,936,759	204,379	328.5	2,495,399	96,951	2,266,529	121.3	70,318	286,778	11.1	2,869	340,128
Pennsylvania	18,891,004	9,590,788	15,893,086	14,988,262	362,237	723.4	11,543,363	3,752,217	7,368,368	333.0	36,015	889,565	12.7	114,509	970,618
Rhode Island	1,998,708	1,014,572	1,937,643	1,858,334		61.1	914,914	79,740	818,895	22.5				60,634	195,678
South Carolina	5,459,165	2,770,954	4,482,416	4,391,579	27,818	348.3	2,250,557	855,142	1,356,379	216.4	151,388	551,319	55.7	61,056	835,437
South Dakota	6,011,479	3,047,643	4,980,312	4,423,069	95,502	840.7	1,889,005	1,087,739	774,588	364.8	220,198	1,114,256	220.2	280,474	1,063,297
Tennessee	8,492,619	4,302,991	7,776,265	6,961,922	101,596	319.1	3,482,668	1,392,210	1,994,056	117.1	13,992	792,956	31.4	124,495	1,414,382
Texas	24,244,024	12,291,253	23,440,032	21,979,351	373,789	1,899.1	8,792,443	1,864,899	6,555,321	582.0	105,466	3,007,092	197.6	294,309	2,355,051
Utah	4,194,708	2,132,691	4,809,343	3,881,020	564,813	440.7	1,612,453	307,785	991,962	141.3		317,175	19.6	5,903	258,740
Vermont	1,867,573	948,007	1,906,133	1,739,032	45,033	97.0	765,099	107,918	606,062	33.3		254,383	9.4	20,623	42,530
Virginia	7,416,757	3,765,387	6,762,830	6,178,683	272,056	397.1	3,396,735	878,943	2,166,257	127.2	137,216	609,814	47.2	221,915	717,260
Washington	6,115,867	3,106,412	5,955,885	5,545,214	345,052	199.6	2,834,379	528,607	2,133,495	92.1	5,442	381,682	3.4	36,604	246,184
West Virginia	4,474,234	2,280,335	3,693,430	3,520,784	74,185	129.8	1,566,837	843,391	706,554	48.9	78,199	385,868	14.7	31,859	1,113,728
Wisconsin	9,724,881	4,941,837	9,107,185	8,671,982	72,394	430.2	3,249,384	875,321	2,046,573	126.5	182	2,174,991	49.7	177,396	647,879
Wyoming	4,501,327	2,287,712	4,672,219	4,068,220	414,703	679.1	1,442,620	377,337	1,038,535	180.6	50,747	730,793	174.5	5,023	103,680
District of Columbia	1,918,469	973,842	2,024,749	1,668,305	356,444	15.2	574,751	250,164	324,587	3.9		65,390	.4		227,420
Hawaii	1,871,062	949,778	597,809	451,692		18.5	1,763,640	1,412,579		26.0				6,791	949,778
TOTALS	394,000,000	200,000,000	359,989,925	320,522,487	12,311,911	22,393.5	187,674,697	63,807,071	107,487,097	8,803.9	4,129,583	36,492,884	2,642.8	5,540,859	43,708,108