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The Truck Weight Problem

in

Highway Transportation

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(These Chapters were initially distributed as separate installments. The First Chapter was sent out on April 7, 1950 and the last Chapter on June 8, 1950.)

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Highway Research Board
2101 Constitution Avenue
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THE TRUCK WEIGHT PROBLEM IN HIGHWAY TRANSPORTATION

A Factual Summary

Some of the most serious and difficult problems in highway building and administration are caused by use of the highways by heavy, fast moving trucks. In order to provide basic information relating to these problems, the staff of the Highway Research Board has collected pertinent facts from all of the State highway departments, and has prepared them for dissemination.

Most of the data reported were obtained by personal visits to the State highway departments, where the problems were discussed with the chief engineers and their assistants. Everywhere, the importance of the problems and the need for thorough investigations are realized. An outstanding feature of the interviews was the willingness expressed by the highway administrators to cooperate in fact finding studies.

In order to facilitate reading and to help in orienting the various phases of the problem, the reports will be distributed in brief installments in the following order:

- Chapter 1. Historic Trends in Loading Practices.
- Chapter 2. Size and Weight Laws.
- Chapter 3. Overweight Permit Policy and Practices.
- Chapter 4. Enforcement Policy and Practice, Including Special Survey on Use and Acceptance of Portable Scales.
- Chapter 5. Correlation of Wheel Loads and Design Practices.
- Chapter 6. Suggested Research Projects and a Selected Bibliography.

As the result of this preliminary survey the existing general truck weight problem facts are reported and suggestions for research to fill the gaps in the present state of knowledge are made. The survey definitely shows the need for acquisition of new knowledge upon which to base sound structural design of highway facilities under present day traffic conditions and equitable legislation to govern highway operations.

CHAPTER I

Historical Trends in Loading Practices

General:

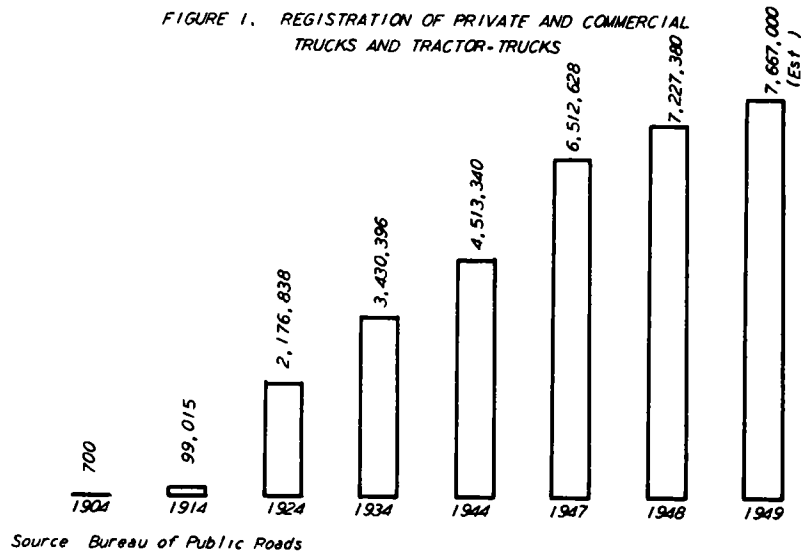
As background material for the consideration of the problem of heavy truck loads, this chapter is included to illustrate the tremendous increases which have taken place in truck registration and in truck loadings.

Registration

As shown in Figure 1, truck registrations increased from 700 in 1904 to almost 8 million in 1949. With the exceptions of 1931, 1932, 1938, 1942

and 1943, each year has seen an increase in truck registrations. It is especially significant that nearly 2 million more trucks were registered in 1947 than in 1944, followed by an increase of 714,752 registrations in 1948 and an estimated increase of 439,620 in 1949. In 1948, registrations of new motor trucks totaled 1,035,174¹. However the retirement of older vehicles during the year reduced the net increase to the figure given.

FIGURE 1. REGISTRATION OF PRIVATE AND COMMERCIAL TRUCKS AND TRACTOR-TRUCKS



Travel

Travel on main rural roads since 1936 is shown in Figure 2 and in greater detail in Table 1. Vehicle-mileage reached an all-time high in 1948 with almost 9 billion vehicle miles traveled by truck combinations and almost 32 billion by all trucks and combinations. Travel in 1947 by truck combinations increased 21 percent over 1946 while travel in 1948 increased 9 percent over 1947.

FIGURE 2 ESTIMATE OF TRAVEL BY TRUCK COMBINATIONS ON MAIN RURAL ROADS

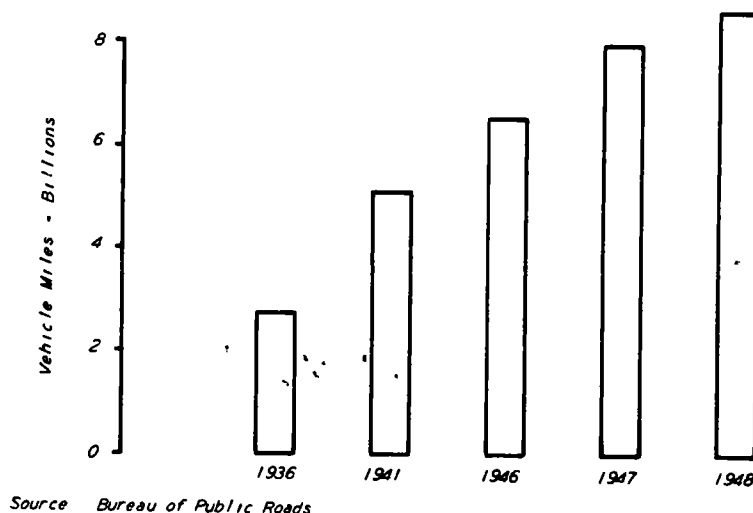


TABLE 1. ESTIMATE OF TRAVEL ON MAIN RURAL ROADS BY VARIOUS TYPES OF VEHICLES

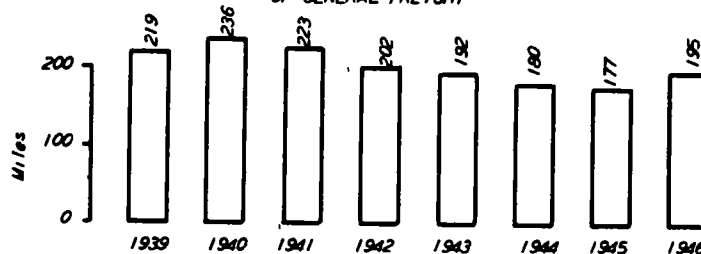
Year	Vehicle - Miles in Millions				
	All vehicles	Passenger cars and busses	All trucks and truck combinations	Single-unit trucks	Truck combinations
1936	88,412	73,005	15,407	12,650	2,757
1941	122,505	98,320	24,185	19,057	5,128
1946	124,149	99,803	24,346	17,838	6,508
1947	137,512	108,880	28,632	20,746	7,886
1948	147,597	115,837	31,760	23,138	8,622

Source: Bureau of Public Roads

Average Length of Haul

As indicated in Figure 3, the length of average haul during the past decade reached a peak of 236 miles in 1940 and then decreased to a low of 177 in 1945. A reversal of trend took place in 1946. Although data for subsequent years are not available, the present haul, based on a projection of the 1946 figure, would be close to the 1940 peak.

FIGURE 3. AVERAGE HAUL BY CLASS I COMMON CARRIERS OF GENERAL FREIGHT

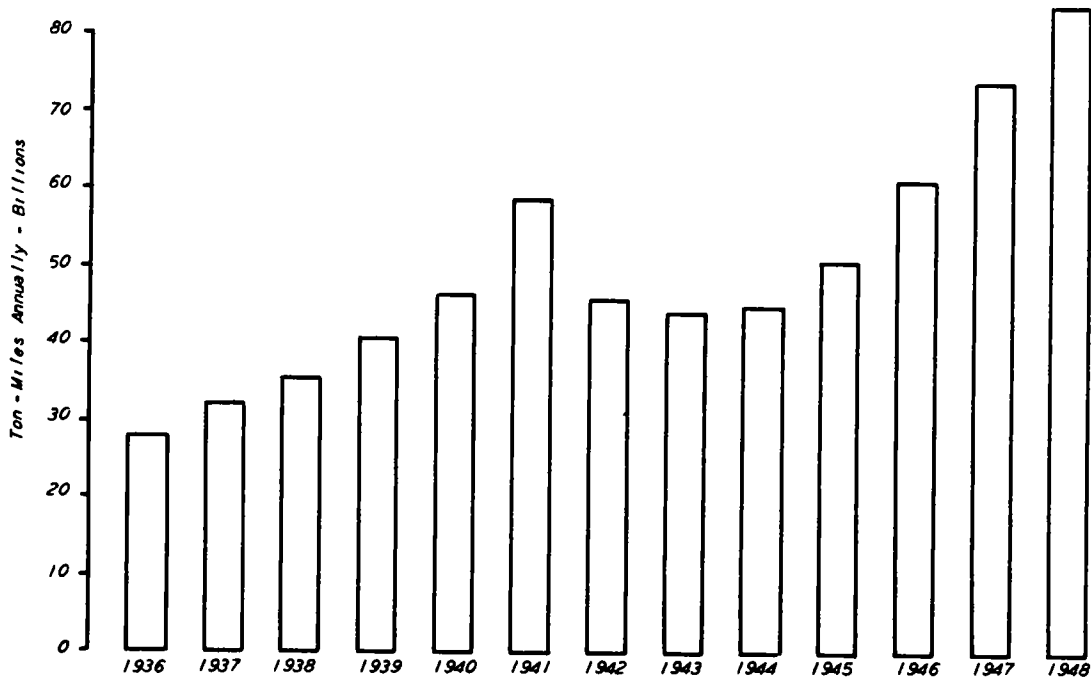


Source: American Trucking Associations

Ton-Mileage

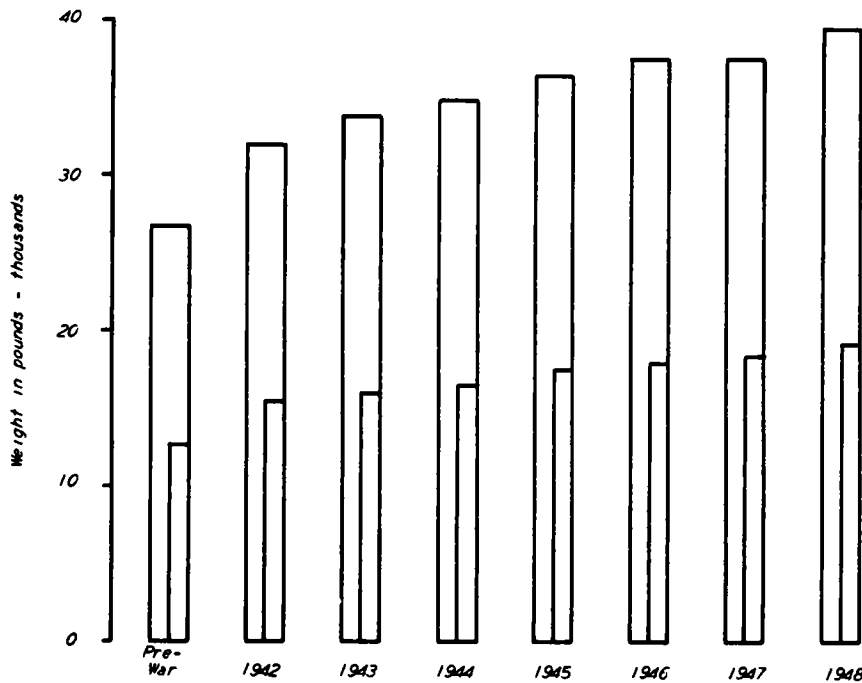
Figure 4 shows ton-miles of freight carried on main rural roads by trucks and truck combinations. This value reached a record high in 1948 of 84 billion ton-miles. Particularly notable is the sharp increase since 1944. Except for the war years of 1942 and 1943, ton-mileage has increased each year since 1936.

FIGURE 4. ESTIMATED TON-MILES CARRIED BY TRUCKS AND TRUCK COMBINATIONS ON MAIN RURAL ROADS

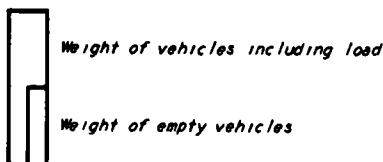


Source: Bureau of Public Roads

FIGURE 5. AVERAGE WEIGHTS OF LOADED AND EMPTY TRUCK COMBINATIONS ON MAIN RURAL ROADS



Source: Bureau of Public Roads



Average Weights of Commercial Vehicles

Figure 5 and Tables 2 and 3 show trends in the average weights of single-unit trucks and truck combinations, both empty and loaded, on main rural roads. Although the average weights of the single units were less in 1946, 1947 and 1948 than in 1945 the peak year, weights of the truck combinations increased each year to reach maxima in 1948 of 19,140 pounds per assembly, empty, and 39,455 pounds per assembly, loaded. Of special interest is the relatively sharp increase (1957 pounds) of the average weights of loaded combinations in 1948 over the average in 1947.

TABLE 2. AVERAGE WEIGHTS OF EMPTY TRUCKS AND TRUCK COMBINATIONS (UNITED STATES AVERAGE) ON MAIN RURAL ROADS

Year	All trucks and combinations	Single-unit trucks	Truck combinations
	lb.	lb.	lb.
1936	6,419	5,352	12,600
1942	7,765	5,790	15,393
1943	8,017	5,932	15,864
1944	8,190	6,231	16,417
1945	8,552	6,434	17,508
1946	8,201	6,104	17,793
1947	8,321	5,932	18,304
1948	8,481	5,976	19,140

Source: Bureau of Public Roads

TABLE 3. AVERAGE WEIGHTS OF LOADED TRUCKS AND TRUCK COMBINATIONS (UNITED STATES AVERAGE) ON MAIN RURAL ROADS

Year	All trucks and combinations	Single-unit trucks	Truck combinations
	lb.	lb.	lb.
Pre-war	12,892	9,857	26,822
1942	16,927	10,849	31,956
1943	17,918	11,137	33,879
1944	18,724	11,626	34,928
1945	19,539	11,890	36,409
1946	19,300	11,580	37,373
1947	19,047	10,897	37,498
1948	20,034	11,064	39,455

Source: Bureau of Public Roads

Occurrence of Heavy Axle Loads

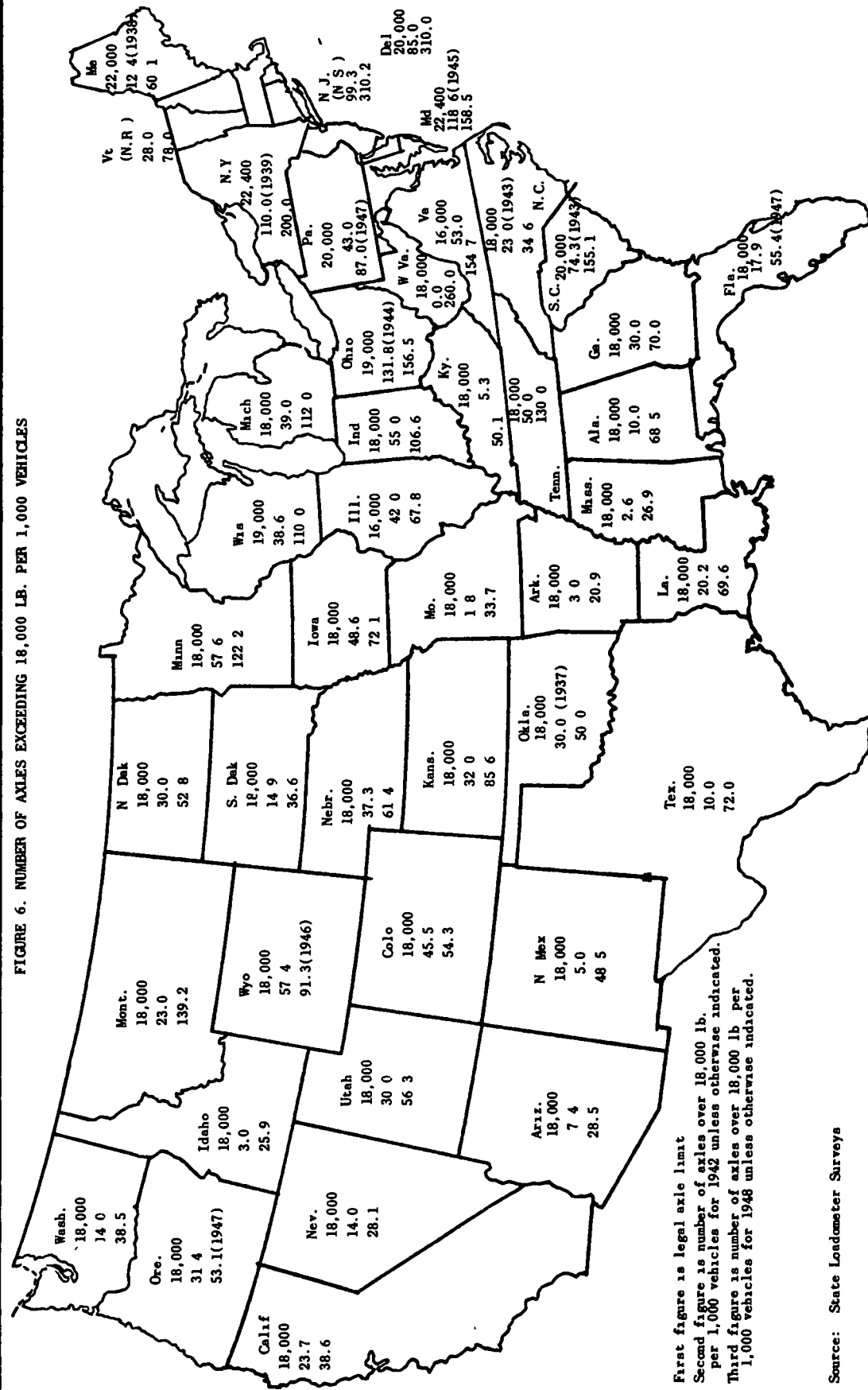
The yearly increases of the number of heavy axle loads are evident from Table 4. The sharp increase since 1946 is particularly striking. These figures, representing averages for the entire country, do not show the wide geographical variances. For example, in 1947 the eastern states had an average of 29 axles, per 1000 trucks and combinations, in excess of 22,000 pounds, while the western states' average was only 3 per 1000. Figure 6 shows the increase between 1942 and 1948 for each State of the number of axles exceeding 18,000 pounds. The values for 1948 are especially striking in Delaware, West Virginia, New York and New Jersey. Except for West Virginia, the higher axle limits no doubt affect the values for these States. (See Chapter 2 for legal axle limits).

TABLE 4. NUMBER OF HEAVY AXLE LOADS PER 1,000 LOADED AND EMPTY TRUCKS AND TRUCK COMBINATIONS (UNITED STATES AVERAGE)

Year	Number per 1,000 weighing -		
	18,000 lb. or more	20,000 lb. or more	22,000 lb. or more
Pre-war	13	5	2
1942	41	18	5
1943	49	17	6
1944	63	22	9
1945	67	23	9
1946	68	26	10
1947	76	33	14
1948	93	44	20

Source: Bureau of Public Roads

FIGURE 6. NUMBER OF AXLES EXCEEDING 18,000 LB. PER 1,000 VEHICLES



First figure is legal axle limit
 Second figure is number of axles over 18,000 lb.
 per 1,000 vehicles for 1942 unless otherwise indicated.
 Third figure is number of axles over 18,000 lb. per
 1,000 vehicles for 1948 unless otherwise indicated.

Source: State Loadmeter Surveys

Table 5 shows in somewhat greater detail the more recent trend in axle-overload frequency as referred to the 18,000-pound limit recommended by the AASHO. This Table indicates a 20 percent increase in loads exceeding the AASHO limit for 1948 for the entire nation. These figures are also subject to wide geographical variations.

TABLE 5. NUMBER OF AXLES, PER 1,000 LOADED AND EMPTY TRUCKS AND TRUCK COMBINATIONS, THAT EXCEEDED THE AXLE-LOAD LIMIT OF 18,000 POUNDS RECOMMENDED BY THE A.A.S.H.O. BY VARIOUS PERCENTAGES OF OVERLOAD (UNITED STATES AVERAGE)

Year	Number per 1,000 in excess of 18,000 lb.	Number per 1,000 in excess of 18,000 lb. by more than				
		5%	10%	20%	30%	50%
1947	66	49	33	15	7	1
1948	85	63	45	23	11	2

Source: Bureau of Public Roads

Occurrence of Heavy Gross Weights

As seen in Table 6 the number of gross weights exceeding 30,000 pounds has increased each year with the exception of 1946 and 1947. Those exceeding 40,000 pounds experienced a similar rise except for 1947.

TABLE 6. NUMBER OF HEAVY GROSS WEIGHTS PER 1,000 LOADED AND EMPTY TRUCKS AND TRUCK COMBINATIONS (UNITED STATES AVERAGE)

Year	Number per 1,000 weighing -		
	30,000 lb.	40,000 lb.	50,000 lb.
	or more	or more	or more
Pre-War	43	11	3
1942	111	33	12
1943	125	41	15
1944	134	47	19
1945	144	58	23
1946	132	60	26
1947	120	57	26
1948	140	77	37

Source: Bureau of Public Roads

The number of 50,000-pound and higher gross weights also increased except for 1947. Each group is characterized by a sharp rise in 1948 over 1947. Percentagewise, the increase throughout the entire period has been highest for the number of gross weights of 50,000-pounds or more, less for the 40,000-pound group, and smallest for the 30,000-pound group.

Table 7 shows the number of trucks and combinations in 1947 and 1948 exceeding the axle-group loads recommended by the AASHO. These values do not necessarily indicate violations since the AASHO table for axle-group loading is not used by all the States. The figures do indicate a rising trend in gross loads, however.

TABLE 7. NUMBER OF TRUCKS AND TRUCK COMBINATIONS, PER 1,000 LOADED AND EMPTY VEHICLES, THAT EXCEEDED THE PERMISSIBLE AXLE-GROUP LOADS RECOMMENDED BY THE A.A.S.H.O. BY VARIOUS PERCENTAGES OF OVERLOAD (UNITED STATES AVERAGE)

Year	Number per 1,000 exceeding A.A.S.H.O. Limit	Number per 1,000 exceeding A.A.S.H.O. limit by more than -				
		5%	10%	20%	30%	50%
1947	25	19	12	5	2	1
1948	30	22	16	7	3	1

Source: Bureau of Public Roads

Violations of Weight Limits

Table 8 shows that in 1947 there were 46 trucks and combinations per 1000 loaded and empty vehicles, which exceeded the state weight limits in one respect or another. In 1948 this ratio increased to 55.

TABLE 8. NUMBER OF TRUCKS AND TRUCK COMBINATIONS, PER 1,000 LOADED AND EMPTY VEHICLES, THAT EXCEEDED THE PERMISSIBLE AXLE, AXLE-GROUP, OR GROSS-WEIGHT LAWS IN EFFECT IN THE STATES BY VARIOUS PERCENTAGES (MAXIMUM) OF OVERLOAD (UNITED STATES AVERAGE)

Year	Number per 1,000 overloaded	Number per 1,000 overloaded more than-				
		5%	10%	20%	30%	50%
1947	46	34	23	10	4	1
1948	55	38	26	12	6	1

Source: Bureau of Public Roads

Summary

If the characteristics which have been cited in this chapter are taken as indices of the impact of truck transportation on our highway system, it will be seen that generally the trend has been phenomenally upward in the past decade or so and that unprecedented peaks were recorded in 1948 or 1949.

The nearly 8 million trucks and tractor-trucks now registered represent an increase of about 70 percent since 1944.

In 1948 travel of trucks and combinations on main rural roads approached 32 billion vehicle miles, the highest figure of record and 31 percent greater than the pre-war peak of 24 billion miles.

A new high of 84 billion ton-miles of freight was carried in 1948, representing an increase of 43 percent over the pre-war peak of 58 billion.

Loaded truck combinations averaged 39,455 pounds in 1948, an increase of 47 percent over the pre-war figure.

In 1948, 93 axles out of each 1,000 trucks and combinations weighed 18,000 pounds or more. This ratio was 7 times greater than the pre-war ratio. Ratios for axles weighing 20,000 pounds or more and 22,000 pounds or more are even greater.

In 1948, 140 out of each 1,000 trucks and combinations had a gross weight of 30,000 pounds or more. Before the war this ratio was 43. During the same period the ratio of gross weights of 40,000 pounds or more increased from 11 to 77. The ratio of gross weights of 50,000 pounds or more rose from 3 to 37 per thousand.

In 1948, 5.5 percent of the trucks and combinations exceeded the State legal weight limits, an increase of 20 percent over the weight violations in 1947.

THE TRUCK WEIGHT PROBLEM IN HIGHWAY TRANSPORTATION
HIGHWAY RESEARCH BOARD

CHAPTER II

Size and Weight Laws

General

This chapter summarizes those elements of the State motor vehicle laws concerning sizes and weights of vehicles. Frequent references for comparison are made to the recommendations of the "Policy Concerning Maximum Dimensions, Weights and Speeds of Motor Vehicles to be Operated over the Highways of the United States" published in 1946 by the AASHO. Figure 7 (A to G) illustrates some of the limitations recommended therein. Similar references are made to Act V of the Uniform Vehicle Code prepared by the National Conference on Street and Highway Safety and published by the Public Roads Administration.

Limits discussed in this chapter are those relating to size, speed and load. Table 9 compares some of the principal restrictions on size, weight and speed for each state. Brief digests of the State laws are given in the Appendix. The laws governing seasonal restrictions and the issuance of special oversize and overweight permits are discussed in Chapter III.

Width

The American Association of State Highway Officials recommends that "No vehicle, unladen or with load, shall have a total outside width in excess of 96 inches." Act V of the Uniform Vehicle Code has a similar limitation with the following exceptions: (a) "Incorporated cities and municipalities may by ordinance permit the operation within their respective jurisdictions of any motor bus or trackless trolley coach with a maximum outside width of not to exceed 102 inches." (b) "No motor bus or trackless trolley coach exceeding a total outside width of 96 inches shall be operated on any highway outside of an incorporated city or municipality, except that any motor bus or trackless trolley coach with a total outside width of not exceeding 102 inches may be operated upon any highway route or routes having traffic-lane widths of not less than 12 feet in suburban areas adjacent to municipalities."

As noted in Figure 8 the 8-ft. limit is generally uniform throughout the states. Six states permit a width of 102 in. but three of these restrict the body width to 96 in. Vehicles frequently excepted from the width limitation are implements of husbandry temporarily moving over the highway, farm tractors, loads of loose hay or straw, buses in or near urban areas, construction equipment, and loads of natural or manufactured products peculiar to a state or region.

Height

The AASHO has recommended that "no vehicle, unladen or with load, shall exceed a height of 12 ft. 6 in." This same figure is prescribed by the Uniform Vehicle Code. Of the 34 States which have a limit of $12\frac{1}{2}$ ft., five permit automobile transports a height of $13\frac{1}{2}$ ft. and one a height of 13 ft. Two States have a limit of 13 ft., seven a limit of $13\frac{1}{2}$ ft., two a limit of 14 ft., and three have no restriction on height. One State has a limit of 11 ft. but increases the limit for vehicles operating under permit on certain highways (See Figure 8). Vehicles frequently excepted from height limitations are implements of husbandry, loads of loose hay, straw and the like, and construction or maintenance equipment.

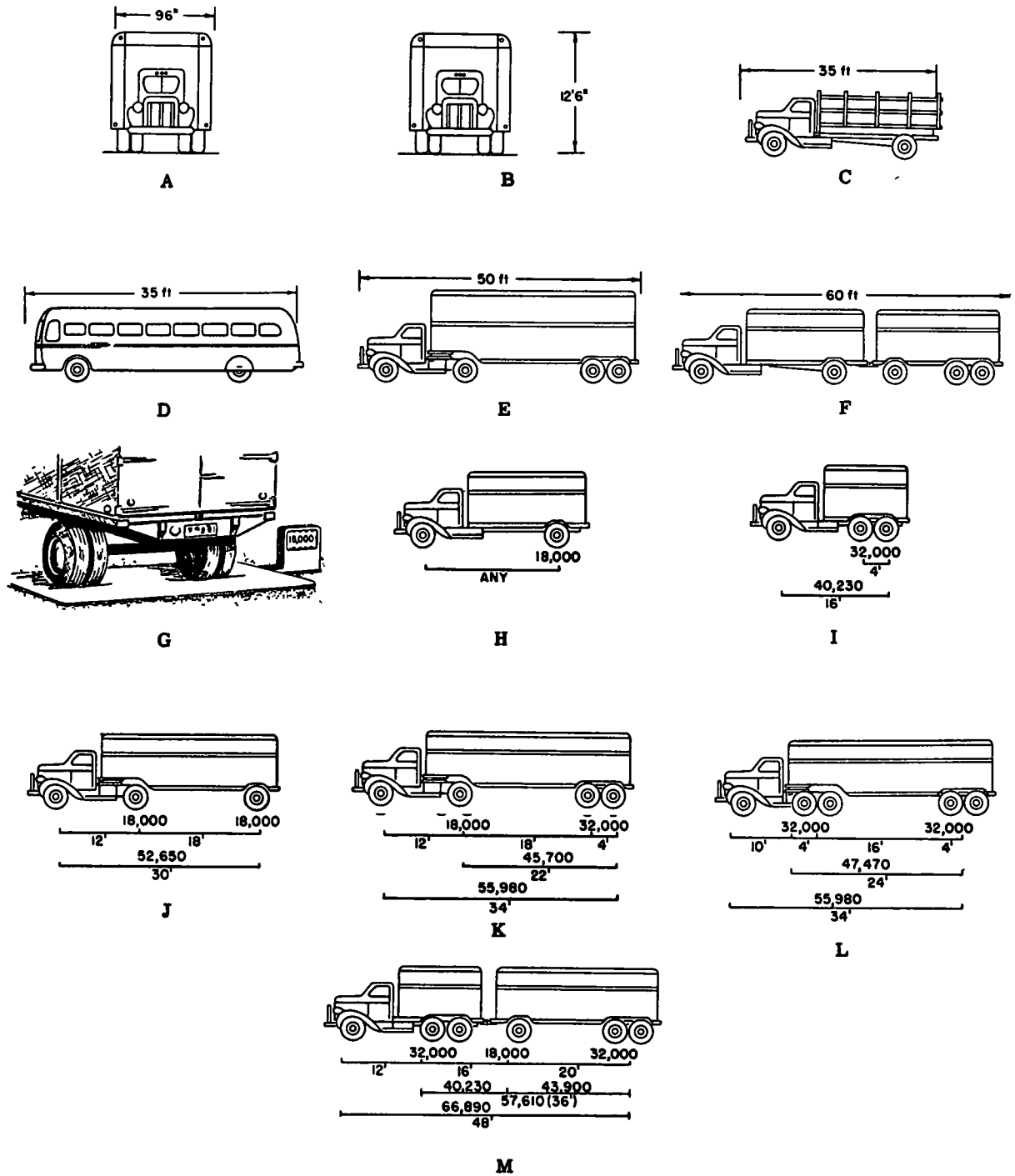


Figure 7. Maximum Dimensions and Weights Recommended by the AASHO.

TABLE 9 - STATE SIZE, WEIGHT AND SPEED RESTRICTIONS

State	Size Restrictions							Gross Weight Restrictions			Speed Restrictions (M.P.H.)		Footnotes - Table 9.
	Width (inches)	Height (feet)	Length (feet)			No. of Trailers Permitted (Semi-trailer= ½)	Minimum Tandem Axle Spacing (inches)	Maximum Axle Load (pounds)	Maximum Load Per Inch of Tire Width (pounds)	Formula for Axle Spacing			
			Single unit	Tractor-Semi-Trailer	Other combinations								
Alabama	96	12½ (4)	35	45	N.P.	½	40	18,000	600	W=700 (L+40)	40	N.S.	See Appendix for further details. N.S. - Not specified. N.P. - Not permitted. N.R. - No restriction. (1) Max. overall body width 96 in. (2) If over 96 in. max. speed 8 m.p.h. (3) 102 in. on designated highways. (4) Auto transports 13½ ft. (5) Load may extend 1½ ft. higher than vehicle. (6) Auto transports 13 ft. (7) 40 ft. over designated routes. (8) Bus 40 ft. but must have at least 3 axles if over 35 ft. (9) Any vehicle over 35 ft., except bus, shall have at least 3 axles. (10) Bus 40 ft. (11) Municipal bus 48 ft. (12) Bus 45 ft. (13) 55 ft. under permit on certain Group I highways. (14) 60 ft. under permit on Group I highways. (15) Must have at least 3 axles if over 35 ft. (16) Bus 35 ft. (17) Exclusive of coupling which shall not exceed 10 ft. (18) Semi-trailer 40 ft. (19) 18,000 if axles spaced < 6 ft. (20) 3 in. or less = 400; 3 in. - 5 in. = 600; 5 in. or more = 800. (21) 18,000 on designated highways by Highway Department. (22) 22,400 on designated highways by Highway Department. (23) 16,000 if axles are < 10 ft. apart. (24) 18,000 if axles are < 50 in. apart or if combination is other than tractor-semi-trailer. (25) This value is reduced if axle spacing is < 9 ft. or if seasonal restrictions are in effect. (26) 16,000 if surface is unpaved. (27) 500 if total tire width < 30 in. (28) 18,000 on designated routes. (29) Varies from 16,000 to 18,000 for different areas. (30) C= 800 except as follows: (1) If registered before 6-9-45 and L is 25 ft. - 45 ft. C=850. (2) if L= 18 ft. or less, C=700. (3) If registered before 1-1-45 and L=14 ft. - 18 ft., C=750. (31) If L<18 ft., C=650. If L = 18 ft. or more, C=750. (32) If L>18 ft., C=700. If L = 18 ft. or less, C=650. (33) For class H-20 bridges, C=1330; For class H-15, C=1000, for Class H-10, C=670. (34) W=16,000+600 L on CI B highway. (35) As recommended by A.A.S.H.O. (36) 45 if W<14,000; 40 if W>14,000. (37) 55 on dual-lane highway. (38) 48 in. on designated highways. (39) Where L>7 ft., C=700. Where L is 7 ft. or less, C=650.
Arizona	102 (1)	13½	35 (7)	65	65	1½	N.S.	18,000	700	W=C (L+40). See (30).	As Posted	N.S.	
Arkansas	96	12½	35 (8)	45	45	1 or ½	48	18,000	700	W=C (L+40). See (39).	45	(35)	
California	102 (1)	13½	35	60	60	N.R.	N.S.	18,000	N.S.	Table	55	N.S.	
Colorado	96	12½	35	60	60	2	40	18,000	500	W=800 (L+40)	60	N.S.	
Connecticut	102	12½	45	45	N.P.	½	N.S.	22,400(19)	N.S.	N.S.	45	N.S.	
Delaware	96	12½	35	50	60	1½	48	20,000	700	Table	45	(35)	
Florida	96	12½ (4)	40 (9)	50	50	1 or ½	40	18,000	550	Table	60	N.S.	
Georgia	96	13½	35	45	45	1 or ½	40	18,000	N.S.	W=700 (L+40)	55	N.S.	
Idaho	96	14	35	60	65	1½	N.S.	18,000	(20)	Table	45	N.S.	
Illinois	96	13½	42	45	45	1½	40	16,000(21)	800	N.S.	(36)	N.S.	
Indiana	96	12½ (4)	36	50	50	1½	40	18,000(22)	800	N.S.	N.S.	N.S.	
Iowa	96	12½	35 (8)	45	N.P.	½	40	18,000	N.S.	Table	50	N.S.	
Kansas	96	12½	35 (8)	50	50	1 or ½	40	18,000	N.S.	Table	N.S.	N.S.	
Kentucky	96	12½	35	45	N.P.	½	42	18,000	600	N.S.	45	N.S.	
Louisiana	96	12½	35 (8)	50	60	1 or ½	40	18,000	450	N.S.	60	N.S.	
Maine	96	12½ (5)	45	45	45	1 or ½	48	22,000(23)	600	Table	40	N.S.	
Maryland	96	N.R.	55	55	55	N.R.	N.S.	22,400(24)	600	W=750 (L+40)	50 (37)	N.S.	
Massachusetts	102 (1)	N.R.	35	45	N.P.	½	N.S.	22,400(19)	800	N.S.	40	N.S.	
Michigan	96	12½ (4)	35	50	50	1½	42	18,000(25)	700	N.S.	N.S.	N.S.	
Minnesota	96	12½	40	45	45	1 or ½	40	18,000	N.S.	W=C(L+40). See (31)	60	(35)	
Mississippi	96	12½	35	45	45	1 or ½	40	18,000	N.S.	Table	45	30	
Missouri	96	12½	35	45	45	1½	40	18,000	600	W=C(L+40). See (32)	25	N.S.	
Montana	96	13½	35 (10)	60	60	1 or ½	40	18,000	N.S.	A.A.S.H.O. Table	45	(35)	
Nebraska	96	12½	35	50	50	1 or ½	N.S.	18,000	N.S.	A.A.S.H.O. Table	50	(35)	
Nevada	96 (2)	N.R.	N.R.	N.R.	N.R.	N.R.	N.S.	18,000	N.S.	Table	N.S.	N.S.	
New Hampshire	96	13½	35	45	45	N.R.	48	N.R.	N.S.	N.S.	45 where posted	(35)	
New Jersey	96	12½	35	45	50	1 or ½	N.S.	Table	800	N.S.	40	N.S.	
New Mexico	96 (3)	12½	40	65	65	1 or ½	N.S.	18,000	600	Same as Minnesota	50	(35)	
New York	96	13	35	50	50	1 or ½	N.S.	22,400	800	30,000 + 750 L	50	N.S.	
North Carolina	96	12½	35	48	48	1 or ½	48	18,000	600	N.S.	45	(35)	
North Dakota	96	12½	35	45	45	1 or ½	48	18,000	550	Same as Minnesota	50	N.S.	
Ohio	96	12½ (4)	35 (11)	45	60	N.R.	N.S.	19,000	650	38,000 + 800 L but not to exceed 78,000	50	(35)	
Oklahoma	96	12½ (6)	35 (12)	50	50	1 or ½	40	18,000	650	Table	45	(35)	
Oregon	96	11	35	50(13)	50(14)	N.R.	40	18,000(26)	600(27)	Variable - See Appendix	45	(35)	
Pennsylvania	96	12½	35	45	50	1 or ½	36	20,000	800	N.S.	50	N.S.	
Rhode Island	102	12½	35 (10)	45	45	1 or ½	N.S.	22,400	800	Table	35	N.S.	
South Carolina	96	12½	40 (15)	50	50	1 or ½	40	20,000	N.S.	Table	55	N.S.	
South Dakota	96	13	35 (8)	50	50	1 or ½	40	18,000	600	Table	45	N.S.	
Tennessee	96	12½	35	45	45	1 or ½	40	18,000	N.S.	W=700(L+40) not to exceed 42,000	40	N.S.	
Texas	96	13½	35	45	45	1 or ½	40	18,000	650	W=700(L+40) not to exceed 48,000	45	N.S.	
Utah	96	14	45	60	60	2	40	18,000	N.S.	Table	60	(35)	
Vermont	96	12½	50	50	50	1 or ½	40	N.R.	600	N.S.	50	N.S.	
Virginia	96	12½	33 (16)	45	45(17)	1 or ½	40(38)	16,000(28)	650	N.S.	50	N.S.	
Washington	96	12½	35	60(18)	60	1 or ½	42	18,000	500	Table	40	(35)	
West Virginia	96	12½	35	45	45	N.R.	40	(29)	N.S.	W=C(L+40). See (33).	50	N.S.	
Wisconsin	96	12½	35	45	45	1 or ½	40	19,000Cl.A 12,000Cl.B	800	W=26000+1000L on Cl.A Hwy. (34)	65 Day 55 Night	(35)	
Wyoming	96	12½	40	60	60	1 or ½	40	18,000	N.S.	Table	50	N.S.	
District of Columbia	96	12½	35	50	50	1 or ½	40	22,000	N.S.	Table	As posted	N.S.	

Length

(a) The AASHO Policy limits the over-all length of a single truck, unladen or with load, to 35 ft. The Uniform Vehicle Code provides that "no vehicle including any load thereon shall exceed a length of 35 feet extreme over-all dimension, inclusive of front and rear bumpers, except that a bus or trackless trolley coach equipped with three axles shall not exceed an over-all length, inclusive of front and rear bumpers, of 40 feet." The lengths of single units are limited in 37 states to 35 ft. (See Figure 9). In these 37 states the following exceptions are noted: (1) in one state single units 40 ft. long may operate over designated routes; (2) in 5 states buses may have a length of 40 ft. provided that they have not less than 3 axles; in 2 states the limit is 40 ft. but all vehicles over 35 ft. long must have 3 axles; in one state buses only are permitted a length of 40 feet; in another buses only are permitted a length of 45 ft. In addition to the 37 states referred to above, one state has a limit of 36 ft., 3 states have a limit of 40 ft., another has a limit of 42 ft., 3 states have a limit of 45 ft., one a limit of 50 ft., and another a limit of 55 ft. One state has no restriction on the length of single units. Another state restricts the length to 33 ft. except for buses which are allowed 35 ft.

(b) The AASHO Policy and the Uniform Vehicle Code restrict the over-all length of a truck-tractor-semi-trailer combination to 50 ft. As seen in Figure 10, the state laws in this respect are less uniform. In 23 states the limit is 45 ft. In one state it is 48 ft. In 14 states the AASHO limit of 50 ft. applies; however, one of these states allows a length of 55 ft. to combinations operating under permit on certain highways. In another state the limit is 55 ft. In 7 states the limit is 60 ft.; however, one state in this group limits the length of the semi-trailer to 40 ft. In 2 states the limit is 65 ft. and in another there is no restriction.

(c) The over-all lengths of other combinations are limited by the AASHO Policy to 60 ft. and by the Uniform Vehicle Code to 50 ft. As shown in Figure 10, such combinations are prohibited in 5 states. Fifteen states have a length limit of 45 ft., one of which allows an additional length of not more than 10 ft. for the coupling. One state has a limit of 48 ft. and 14 states have a limit of 50 ft. One state in the latter group extends the limit to 60 ft. for combinations operating under permit on certain highways. A length of 55 ft. is allowed in one state. Nine states limit the length to 60 ft. and 3 to 65 ft. There is no restriction on length in another state.

Frequently noted exceptions to the designated length limits are loads of forest products, structural steel, piping, implements of husbandry and municipal buses.

[illegible]

LENGTH - SINGLE UNITS

[illegible]

A - Any vehicle over 35 ft. must have at least 3 axles.

B - Busses having at least 3 axles.

C - Bus

D - Over designated routes.

NR - No restriction

LENGTH - TRACTOR-SEMI-TRAILER (FT.)	
1	Ala.
2	Ariz.
3	Ark.
4	Cal.
5	Col.
6	Conn.
7	Del.
8	Fla.
9	Ga.
10	Idaho
11	Ill.
12	Ind.
13	Iowa
14	Kan.
15	Ky.
16	La.
17	Me.
18	Md.
19	Mass.
20	Mich.
21	Minn.
22	Miss.
23	Mo.
24	Mont.
25	Neb.
26	Nev.
27	N.H.
28	N.J.
29	N.M.
30	N.Y.
31	N.C.
32	N.D.
33	Ohio
34	Okla.
35	Ore.
36	Pa.
37	R.I.
38	S.C.
39	S.D.
40	Tenn.
41	Tex.
42	Utah
43	Vt.
44	Wa.
45	Wash.
46	W. Va.
47	Wis.
48	Wyo.
49	D.C.

	NR	65	60	55	50	48	45	NP
49								
48								
47								
46								
45								
44								
43							G	
42								
41								
40								
39								
38								
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3								
2								
1								

C - Exclusive of Coupling which shall not exceed 10 ft.
 NP - Not Permitted.
 NR - No Restriction.
 P - Under Permit on Group 1 Highways Only.

Number of Towed Units

The policy of the AASHO states that "No other combination (than the truck-tractor and semi-trailer combination) shall consist of more than two units." The Uniform Vehicle Code has a similar restriction. Twenty-seven states limit the number of towed units to one full trailer or one semi-trailer (see Figure 9). Six states permit one semi-trailer but prohibit the full trailer. Seven states permit one semi-trailer and one full trailer in combination. Two states permit two full trailers. Seven states have no restriction on the number of towed units.

Speed

(a) Minimum--The laws of 13 states contain substantially the AASHO minimum speed provision, i.e., that "no motor vehicle shall be unnecessarily driven at such a slow speed as to impede or block the normal and reasonable movement of traffic." One state limits the minimum speed to 30 miles per hour on designated federal highways. (See Table 9). The remainder of the state laws contain no minimum speed restrictions.

(b) Maximum - The AASHO Policy states that "no truck shall be operated at a speed greater than 45 miles per hour." Twelve states have a similar limit. (See Table 9). Six states have a 40-mph. limit and two have lower limits. Eleven states have a limit of 50 mph., three have a 55-mph. limit, and five have a 60-mph. limit. There is no limit in four states. In one state the limit is 65 mph. by day and 55 by night. Another has a limit of 55 mph. on dual-lane highways. Three states have limits as posted. In another the limit is 45 mph. if the gross weight is not greater than 14,000 lb. and 40 mph. if the gross weight exceeds 14,000 lb. In some states, when solid rubber or cushion tires are permitted, lower maximum speed limits are imposed on vehicles so equipped.

Permissible Loads

(a) Maximum Axle Load - The policy of the AASHO states that "No axle shall carry a load in excess of 18,000 lb." and defines an axle load as "the total load transmitted to the road by all wheels whose centers may be included between two parallel transverse vertical planes 40 in. apart, extending across the full width of the vehicle." The Uniform Vehicle Code is similarly worded in substance.

Some variations from the 18,000-lb. limit are found in the various state motor vehicle laws (see Figure 11). Two states have no axle-load restriction. Five states permit axle loads of 22,400 lb. In two of these, however, the limit is 18,000 if the axle spacing is less than 6 ft., in another the limit is reduced to 18,000 if the axle spacing is less than 50 in. or if a combination other than a tractor-semi-trailer is involved. Two states have a limit of 22,000 lb. In one of these, however, this limit is reduced to 16,000 lb. if the axle spacing is less than 10 ft. Three states permit 20,000-lb. axles. One permits 19,000-lb. axles and another does also on Class "A" highways; otherwise the limit is 12,000 lb. In 33 states the

FIGURE 11.- AXLE AND TIRE LOADS

		LEGAL MAXIMUM AXLE LOADS		LEGAL MAXIMUM LOADS PER INCH OF TIRE WIDTH	
		NR	Table*	NS	
1	Ala.				
2	Ariz.				
3	Ark.				
4	Cal.				
5	Col.				
6	Conn.				
7	Del.				
8	Fla.				
9	Ga.				
10	Idaho				
11	Ill.				
12	Ind.				
13	Iowa				
14	Kan.				
15	Ky.				
16	La.				
17	Me.				
18	Mass.				
19	Mich.				
20	Miss.				
21	Mont.				
22	Nebr.				
23	Nev.				
24	N.H.				
25	N.J.				
26	N.M.				
27	N.Y.				
28	N.C.				
29	N.D.				
30	Ohio				
31	Okla.				
32	Ore.				
33	Pa.				
34	R.I.				
35	S.C.				
36	S.D.				
37	Tenn.				
38	Tex.				
39	Utah				
40	Vt.				
41	Wash.				
42	W. Va.				
43	Wis.				
44	Wyo.				
45	D.C.				

* - Based on Tire Sizes.

A - If Axles are Spaced Less than 6 ft. apart.

B - If Axles are Spaced Less than 10 ft. apart.

C - If Axles are Less than 50 in. apart, or if combination is other than Tractor-Semi-Trailer.

D - On Designated Highways.

E - Reduced if Axle Spacing is Less than 9 ft. or if Seasonal Restrictions are in Effect.

F - On Class "A" Highways, 12,000 on Cl. "B" Highways.

NR - No Restriction.

V - If Surface is Unpaved.

A - For Tires More than 5 in. wide.

B - For Tires 3 in. to 5 in. wide.

C - For Tires Less than 3 in. wide.

D - If Total Tire Width is Less than 30 in.

NS - Not Specified.

limit is 18,000 lb. as recommended by the AASHO Policy. However, in three of these 33 states, this limit applies only to designated highways; on other roads the limit is 16,000 lb. In another state where the 18,000-lb. axle is permitted, the limit is reduced to 16,000 lb. if the road surface is not paved. The maximum limit in one state is 16,000 lb. and in another is based on a table of tire sizes.

The minimum allowable spacing of tandem axles (see Table 9) varies from 36 in. to 48 in., with 40 in. predominating. The laws of 11 states do not provide a minimum tandem axle spacing.

(b) Maximum Load per Inch of Tire Width - This restriction is not specified in the policy of the AASHO, in the Uniform Vehicle Code, nor in the laws of 17 states. However, the laws of 32 states have maximum limits which vary from 400 lb. to 800 lb. (See Figure 11). Nine states limit the load to 600 lb. per inch of width of tire and eight states to 800 lb. In comparing these values, it should be kept in mind that the place of measurement for determining the tire width is not uniformly defined in the state laws. Variations include: the outside cross section width of tire, the channel base, sidewall to sidewall, manufacturer's width, between flanges of rim, width in contact with the road surface, and the greatest width.

(c) Relation of Gross Load to Axle Spacing - In the policy of the AASHO this relation is established by means of Table 10. Application of this table to some typical vehicles is shown in Figure 7 (H to M).

Table 10

Distance in feet (L) between
the extremes of any group of axles.

Maximum load (W) in pounds
carried on any group of axles.

<u>L</u>	<u>W</u>	<u>L</u>	<u>W</u>	<u>L</u>	<u>W</u>
4	32,000	22	45,700	40	60,800
5	32,000	23	46,590	41	61,580
6	32,000	24	47,470	42	62,360
7	32,000	25	48,350	43	63,130
8	32,610	26	49,220	44	63,890
9	33,580	27	50,090	45	64,650
10	34,550	28	50,950	46	65,400
11	35,510	29	51,800	47	66,150
12	36,470	30	52,650	48	66,890
13	37,420	31	53,490	49	67,620
14	38,360	32	54,330	50	68,350
15	39,300	33	55,160	51	69,070
16	40,230	34	55,980	52	69,790
17	41,160	35	56,800	53	70,500
18	42,080	36	57,610	54	71,200
19	42,990	37	58,420	55	71,900
20	43,900	38	59,220	56	72,590
21	44,800	39	60,010	57	73,280

Values of W in Table 10 are obtained by applying the formula. $W = 1025 (L + 24) - 3 L^2$ to values of L between 8 and 57. W for values of L from 4 to 7, is arbitrarily set at 32,000 lb.

As seen in Table 9 all except 13 states have restrictions which limit gross loads to axle spacing. Only two states employ the AASHO table (Table 10) while 17 states have tables of a similar character but differing somewhat in load maxima. The remaining 17 states employ numerous variations of the well-known bridge formulas. In the latter group, the formula $W = C (L + 40)$ is used most frequently with values of the coefficient C ranging from 650 to 850.

APPENDIX

Brief Digest of Size and Weight Laws of All The States

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ALABAMA

Maximum Width - 8 ft.

Maximum Height - $12\frac{1}{2}$ ft. (Auto transports $13\frac{1}{2}$ ft.)

Maximum Length - Single vehicle 35 ft.

- Truck and trailer 45 ft.

- Loads of poles, logs, lumber, structural steel, piping, timber exempt from length limits.

Maximum Weights:

Wheel 8000 lb.

Axle 16,000 lb. (includes all axles 40 in. apart or less)

Per inch width of tire 600 lb.

Gross load 30,000 lb. (20,000 lb. on county roads)

Trucks hauling 50 bales or less of cotton are exempt of all regulations.

Special permits issued by State Highway Department (Secretary to Director) for movements of oversize and overweight loads. May specify route and other conditions. May require bond with or without surety.

Vehicles carrying milk or other perishables exempt from all of above limits until January 1, 1950.

Seasonal restrictions - Yes, by State Highway Department or local authorities.

Must post signs giving restrictions. Limit is 90 days per year.

Tires must be pneumatic.

Enforcement - Any peace officer can weigh and require removal of excess load.

Penalty for violation \$100 - \$500 and may also be imprisoned for 30-60 days.

Maximum truck speed - 40 mph.

ARIZONA

Sec. 66-127. Size of vehicles and loads.

Maximum total outside width allowed is 102 inches. Maximum overall body width 8 ft. Width of farm tractor shall not exceed 9 ft.

Maximum Height - $13\frac{1}{2}$ ft.

Maximum Length - 35 ft. of single vehicle - Highway Commission may authorize a length of 40 ft. for a single truck over designated routes.

- Maximum length of a combination of vehicles is 65 ft.

- May not carry a load extending over 3 ft. beyond front.

- Passenger vehicle may not carry load extending beyond fender line on left side nor more than 6 in. beyond fender line on right side.

- Exceptions: size limitations herein do not apply to implements of husbandry temporarily moved upon highway.

Sec. 66-129. Axle weight limits.

Maximum axle load 18,000 lb.

Maximum load on one end of an axle 9,500 lb.

Sec. 66-129 a. Ratio of weight to length.

- (a) Formula for maximum gross weight: $W = 800 (L + 40)$ where W = total gross weight in pounds, L = distance in feet between first and last axles of vehicle or combination of vehicles.
- (b) Exception: For vehicle or combination first registered prior to June 9, 1945 and having 25 ft. to 45 ft. between first and last axles, $W = 850 (L + 40)$.
- (c) Formula for maximum total gross weight imposed on highway by any two or more consecutive axles of any vehicle or combination, where distance between first and last axles thereof is 18 ft. or less: $W = 700 (L + 40)$ when W = total gross weight in lb. imposed by such group of axles.
- (d) Exception to (c): If vehicle or combination was registered prior to January 1, 1945, has a group of two or more axles, and $L = 14$ ft. - 18 ft., $W = 750 (L + 40)$.
- (e) This section does not apply to engines having movable flat tracks.
- (f) Any peace officer may weigh load and require driver to remove sufficient portion of load to conform to law.

Sec. 66-130. Permit for excessive size or weight; violation; penalty.

Written application showing good cause. Highway department may issue written permit to exceed size and weight limits. Permit will cover only a single trip, designate route, and other conditions. Permit to be carried in vehicle. Violator guilty of misdemeanor.

Sec. 66-131. Local authorities and department authorized to change weight limit.

City or county can increase maximum limits on streets and roads under their jurisdiction.

Highway department can increase maximum weight limit based on engineering study.

Sec. 66-132. Restrictions as to tire equipment.

Every solid rubber tire must have at least 1 inch rubber thickness above flange edge. No tire may have other than rubber protuberances on its periphery, except tire chains. Department may issue special permits to operate tractors having tracks with transverse corrugations or farm tractors or farm machinery.

Sec. 66-133. Trailers and towed vehicles.

Motor vehicle may pull semi-trailer and one full trailer. Draw bar connection must be 15 ft. or less.

ARKANSAS

Enforced Regulations

Maximum Width of vehicle, with or without load: 96 inches.

Maximum Height of vehicle, with or without load: 12½ feet.

Maximum Length:

- (a) Single truck, with or without load, bumper to bumper: 35 ft.
- (b) Single bus, with or without load, bumper to bumper: 40 ft. provided that bus over 35 ft. long must have not less than 3 axles.
- (c) Combination of truck-tractor and semi-trailer, with or without load, bumper to bumper: 45 ft.
- (d) No other combination shall consist of more than 2 units and total length, bumper to bumper, shall not exceed 45 ft.

Speed

- (a) Minimum. No motor vehicle shall be driven unnecessarily at such slow speed as to impede or block normal and reasonable movement of traffic unless reduced speed is necessary for safe operation or when vehicle or combination of vehicles is necessarily or in compliance with law or police direction proceeding at reduced speed.
- (b) Maximum. Truck: 45 miles per hour (mph).
Passenger vehicles: 55 mph.
Vehicles with solid rubber or cushion tires: 10 mph.

Permissible Loads^{1/}

- (a) No axle shall carry over 18,000 lbs.
- (b) No group of axles shall carry a load in pounds in excess of the value given in the following table corresponding to the distance in feet between extreme axles of the group, measured longitudinally to the nearest foot: (same as recommended by AASHO up to a maximum allowable 64,650 lb.).
- (c) Loads recommended in (a) and (b) are subject to reasonable reduction in the discretion of appropriate highway authorities during periods when road subgrades have been weakened by water saturation or other cause.
- (d) Special permit required from Highway Commission to exceed maximum weights and dimensions.

The Law:

- 1/ (b) Subject to the limitation imposed by the provided axle loads, no vehicle or combination of vehicles shall be operated whose total weight exceeds the following rating, given by the formula: $W-C (L \text{ plus } 40)$ where
- W = Total gross weight, including load, in pounds
 - C = 700 where the spacing of axles considered is more than seven (7) feet
 - C = 650 where the spacing of axles considered is not more than seven (7) feet
 - L = Distance in feet between the outer axles of the vehicle or combination of vehicles or of any group of consecutive axles that are under consideration.

CALIFORNIA

694. Width.

Total outside width of any vehicle or load thereon shall not exceed 96 inches.

Exceptions:

- (1) If vehicle has pneumatic tires, maximum width between outsides of wheels is 102 inches but body width shall not exceed 96 inches.
- (2) If vehicle carries loose hay or straw, 120 inches.
- (3) Implements of husbandry: No restriction when operated or towed. Limited to 25 mile trip when transported on truck or trailer.
- (4) Tractor trailers used by farmers in farming operations and only incidentally towed over a highway or to special mobile equipment: 120 inches.
- (5) Highway construction or maintenance equipment: 120 inches.
- (6) Motor or trolley coaches or busses operated in urban or suburban service; 104 inches.
- (7) Gantry trucks allowed 4 additional inches for safety guards.

697. Height.

With load or unladen, maximum 13½ ft. Exception: Implements of husbandry incidentally moved over a highway.

Length

Single vehicle: 35 ft. Exception: Vehicle in a combination when excess length is caused by auxiliary parts, etc. and not used for load space.

Combination of vehicles: 60 ft.

Exceptions:

Trolley coach: 40 ft.

Articulated trolley coach: 50 ft.

698. Length of loads.

3 ft. beyond front wheels or front bumper if it has a bumper.

2/3 of wheel base behind last point of support.

Overall length of load from front end of load or vehicle to rear end of load or vehicle: 75 ft.

699. Exceptions to length limitations.

- (1) Pole or pipe dollies used with a motor vehicle solely to transport poles or pipes provided that no pole or pipe shall exceed 100 ft. Permit required if 100 ft. exceeded.
- (2) Implements of husbandry incidentally moved over a highway.

704. Axle weight limits.

Gross weight imposed on highway by wheels on any one axle; Maximum 18,000 lb.
Gross weight imposed on highway by wheel (s) on any one end of axle: 9500 lb.

705. Ratio of weight to length.

- (a) Total gross weight imposed by any group of 2 or more consecutive axles of a vehicle or combination where L = 18 ft. or less shall not exceed the following:

Distance in ft. between first and last axles of group	Allowed load in lbs. on group of axles	Distance in ft. between first and last axles of group	Allowed load in lbs. on group of axles
4	32,000	11	35,700
5	32,000	12	36,400
6	32,200	13	37,100
7	32,900	14	43,200
8	33,600	15	44,000
9	34,300	16	44,800
10	35,000	17	45,600
		18	46,400

- (b) Total gross weight imposed by any vehicle or combination when L > 18 ft. shall not exceed the following:

L (ft.)	W (lb.)	L (ft.)	W (lb.)	L (ft.)	W (lb.)	L (ft.)	W (lb.)
18	46,400	28	57,800	38	66,300	48	70,400
19	47,200	29	58,650	39	67,150	49	71,200
20	48,000	30	59,500	40	68,000	50	72,000
21	48,800	31	60,350	41	68,000	51	72,800
22	49,600	32	61,200	42	68,000	52	73,600
23	50,400	33	62,050	43	68,000	53	74,400
24	51,200	34	62,900	44	68,000	54	75,200
25	55,250	35	63,750	45	68,000	55	76,000
26	56,100	36	64,600	46	68,800	56 or	
27	56,950	37	65,450	47	69,600	over	76,800

708. Gross weight per inch width on certain tires.

- (a) Solid tire: 600 lb. maximum.
 (b) Metal tire: 500 lb. maximum.

Exceptions: Traction engines or tractors propelled on a movable track having plane surfaces.

709. Officer may weigh vehicles and require removal of excess loads.

If scales are within 5 miles, officer may require driver to drive thereto. Driver refusing to comply guilty of misdemeanor.

710. Permits for increased size, weight, etc.

Written application showing good cause required. Application must describe vehicle (s), load, route, for single trip or continuous operation. Department of Public Works may issue special permit limiting number of trips. May limit as to time or season or other conditions.

711. After engineering investigation, department may increase weight limit.

City and/or county may increase weight limits on highways under their jurisdiction and may also decrease weight limits.

716. Liability for damage to highway or bridge.

If exceeding of maximum weight limits results in damage, such damages may be recovered in civil action.

COLORADO

Maximum Width - 8 ft.

Maximum Height - $12\frac{1}{2}$ ft.

Maximum Length -

Single vehicle: 35 ft.

Tractor and $\frac{1}{2}$ -trailer combination: 60 ft.

Truck and full trailer combination: 60 ft.

Tractor, $\frac{1}{2}$ -trailer, and full trailer: 60 ft.

Tractor-semi-trailer may draw one trailer or truck may draw 2-trailers.

Maximum weight

Single axle: 18,000 lb. (LOW PRESS) and 16,000 lb. (HIGH PRESS).

Gross weight on any 2-axle single vehicle: 30,000 lb.

Gross weight on any 3-axle single vehicle: 46,000 lb.

Gross weight on any 4-axle single vehicle: 46,000 lb.

Gross weight on any vehicle or combination = $800 (L + 40)$

Minimum Axle Spacing: 40 inches,

Maximum load per inch of tire width

Pneumatic 500 lb.

Solid Not permitted,

CONNECTICUT

Sec. 1560

1. Commissioner may grant a special registration limited or unlimited for the operation of heavy duty trailers for the transportation of heavy construction equipment from the railroad station or the storage yard to the construction job or from one construction job to another. Each such movement shall require a limited or unlimited written permit from the highway commissioner and each permit shall give the permit number, date of issue, and date of expiration.

Sec. 1477

The highway commissioner may grant a special permit for the operation of industrial trucks, tractors, trailers, and semi-trailers for the purpose of transporting goods, property or merchandise to and between buildings of the same industrial plant, provided the maximum distance on the public streets or highways over which such vehicle may be operated under such permit shall not exceed 1,500 ft.

Sec. 570 c

2. Permit for operating overweight commercial vehicles. Required when gross weight of vehicle and load exceeds gross weight as registered with the department of motor vehicles. Written permit from highway commissioner shall prescribe condition under which vehicle shall be operated. Violators shall be fined not more than \$500 or imprisoned not more than one year or both. Upon any conviction, commissioner may, in his discretion, demand of the owner a bond, with surety to state, of not less than \$500, which bond shall be forfeited upon a second conviction for violation of this section. Commissioner may revoke registration of any commercial vehicle and may refuse to issue registration during such time as he may deem reasonable.

Sec. 612 c

3. Tires. Each motor vehicle shall be equipped with tires of rubber or other elastic substance approved by the Highway commissioner. No metal part of wheels or tires, except non-skid devices, may contact road surface during motion. For 2-axled commercial vehicles, no axle shall carry less than 20 percent of gross weight of vehicle and load. Commercial motor vehicles with solid rubber tires shall not exceed 800 lb. of load per inch of rubber width when measured at the steel channel.

No solid rubber tire less than 5 in. wide shall be less than 7/8 in. thick.

No solid rubber tire 6 in.-8 in. wide shall be less than 1 in. thick.

No solid rubber tire more than 8 in. wide shall be less than 1-1/8 in. thick.

Any violator of this section shall be fined not more than \$50.00 for first offense and not more than \$100 for a subsequent offense.

Sec. 1645

4. Use of metal tires restricted. Operation of vehicle having metal tire or wheel resting on sliding shoe restricted if it materially cuts or damages surface of highway or bridge. Section does not apply to road-making machinery working on highways or to agricultural tractor necessarily traversing highway or bridge for access to agricultural lands or to a truck, tractor, trailer, or semi-trailer to which a permit shall have been granted by highway commission.

Sec. 393 i

5. Weight of vehicles and trailers. Gross weight of vehicle or combination of vehicle and trailer shall not exceed following limits:

26,000 lb. if a 4-wheeled vehicle with solid tires.

32,000 lb. if a 4-wheeled vehicle with pneumatic tires.

50,000 lb. if a vehicle with 3 axles or any combination of vehicle and trailer or semi-trailer with a total of 3 or more axles and having pneumatic tires, provided the weight on any axle shall not exceed 22,400 lb. If axles spaced less than 6 ft. apart, axle load shall not exceed 18,000 lb.

At least 10 tires, size 10:00-20, required if gross weight is 40,000-45,000 lb.

At least 10 tires, size 10:00-20 on steering axle and size 11:00-20 on others, required if gross weight exceeds 45,000 lb.

Maximum weight per wheel with rubber tires, motor vehicles excepted:

If tires are 3-in. wide	500 lb.
3½"	750 lb.
4"	1,000 lb.
4½"	1,350 lb.
5"	1,700 lb.
5½"	2,000 lb.
6"	2,200 lb.
7"	3,500 lb.
8"	4,500 lb.
9"	5,500 lb.
10"	6,500 lb.

Vehicle owner violating this chapter is liable for all damages to highway or bridge resulting from violation and damages may be recovered by legal action.

Sec. 394 i

6. Permits for vehicles of excessive weight. Highway commissioner authorized to issue permits for motor vehicles not conforming to provisions of section 393 i. Applications must be in writing. Permits shall be written and may limit the highways or bridges which may be used, time of use, maximum speed, and may contain any other conditions considered necessary. Permits granted prior to April 30, 1947, and still in effect will terminate April 30, 1952.

Sec. 1648

7. Operating vehicles of over 4 tons capacity on restricted highways. Highway commissioner may restrict use of commercial motor vehicles of over 4-tons capacity on any trunk line or state aid highway which would be seriously injured thereby. Violators fined not less than \$100 nor more than \$500.

Sec. 396 i

8. Width and length of vehicles. Permits.

Maximum allowable width of vehicle with load is 102 inches.

Vehicle loaded with hay or straw excepted.

Maximum length of vehicle or vehicle and trailer is 45 ft.

Length exceptions: Combination of passenger motor vehicle and camp trailer, vehicle loaded with poles, lumber, structural steel or iron, trailer designed and used only for transporting boats when gross weight of boats does not exceed 4,000 lb.

Other vehicles must have special written permit from highway commissioner specifying operating conditions.

Sec. 395 i.

9. Length of camp trailers. No combination of passenger motor vehicle and camp trailer shall exceed 50 ft. long. Highway commission may grant permit to operate any such combination longer than 50 ft. if registered in another state.

Sec. 546 e

10. Permit for trailer from highway commission. Permit required to operate 4-wheeled, 2-axle trailer outside city limits. Exceptions: trailer used for camping or recreation or for transportation of poles, lumber, structural steel, iron, farm products or farm equipment. Semi-trailers excepted.

Violators fined \$25 - \$100 for first offense and \$50 - \$200 for each subsequent offense.

Sec. 548 e

11. Special permits for trucks more than 12½ ft. in height are required from highway commission specifying period and conditions of operation. Exception: vehicle loaded with loose hay or straw.

Violators to be fined \$25.00 or less.

DELAWARE

Sec. 115. Size of vehicle and loads.

- a. Maximum width: 8 ft. except: farm tractor 9 ft. and except implements of husbandry temporarily moving on highway.
- b. Maximum height: 12½ ft.
- c. Maximum length: One vehicle 35 ft.
Tractor and semi-trailer 50 ft.
Other combinations 60 ft.
Minimum axle spacing: 48 inches
- d. Extension of load: 3-ft. beyond front of vehicle.
- e. Passenger vehicle:
Zero ft. beyond fender line on left side.
6-inches beyond fender line on right side.

Sec. 117. Weight of vehicles and loads.

- a. Motor vehicle with solid rubber tires - Gross weight 22,000 lb.
Motor vehicle with pneumatic tires and 2 axles: 26,000 lb.
Motor vehicle with pneumatic tires and 3 axles: 36,000 lb.
- b. Vehicle with solid tires - Axle load 16,000 lb.
- c. Motor vehicle or combination with pneumatic tires - axle load 700 lb. per inch tire width.
Motor vehicle or combination with pneumatic tires - axle load 20,000 lb.
- d. Gross weight trailer and load 22,000 lb.
- e. Trailer with metal tires - Gross load 6,000 lb.

- f. Gross weight motor vehicles or combination without power brakes - 36,000 lb.
- g. Gross weight 2-axle vehicle with power brake on each rear hub - 30,000 lb.
- h. Gross weight 3-axled vehicle, having each of the rear axles equipped with 2 hubs, with a power brake on each rear hub - 40,000 lb.
- i. Gross weight tractor and one-axled semi-trailer having power brake on each hub of rear axle - 48,000 lb.
- j. Gross weight tractor and 2-axled semi-trailer, having coupled axles spaced 48 inches or more apart with a power brake on each hub provided that axle weight does not exceed 18,000 lb., - 60,000 lb. and coupled axles on low bed trailers may be 36 inches or more apart.
- k. Axle load where coupled axles are spaced \leq 48 inches apart - 10,000 lb.

1. Table for Maximum Gross Weights

<u>Length (ft.)</u>	<u>Weight lb. (group of axles)</u>	<u>Length (ft.)</u>	<u>Weight lb.</u>
4	20,000	25	48,350
4-11	36,000	26	49,220
12	36,470	27	50,090
13	37,420	28	50,950
14	38,360	29	51,800
15	39,300	30	52,650
16	40,230	31	53,490
17	41,160	32	54,330
18	42,080	33	55,160
19	42,990	34	55,980
20	43,900	35	56,800
21	44,800	36	57,610
22	45,700	37	58,420
23	46,590	38	59,220
24	47,470	39 or $>$	60,000

Sec. 118. Enforcement. Peace officer may require driver to drive not more than 3 miles to scales, weigh, and remove excess load.

Sec. 119. Permits for excess size and weight. Written application showing good cause. State Highway Department issues written permit for single trip designating route and other conditions. Thirty (30) day blanket permits may be issued for piling or pole trailers.

Sec. 120. Seasonal restrictions, etc. State Highway Department may prohibit use of highway or lower limits up to 90 days. Must post signs accordingly.

Sec. 121. Restrictions on tire equipment.

- a. Rubber on solid tires at least 1 inch thick.
- b. Cleats, lugs, etc. other than rubber or chains not permitted.
- c. State Highway Department may issue permits for traction engines having corrugations on tracks.

Sec. 122. Trailers.

- a. Motor vehicle may draw only 1 vehicle except that a motor vehicle and one-half trailer may draw one other vehicle.
- b. Drawbar not \gt 15 ft.

Sec. 85. Maximum Speeds.

- I. Passenger cars and busses 50 mph on 2-lane roads
55 mph on 4-lane roads
- II. Trucks and truck tractors if more than 8000 lb. gross - 45 mph.

Minimum Speed. Not so slow as to impede normal flow of traffic.

DISTRICT OF COLUMBIA

Size Restrictions

Maximum Width - 8 ft. (106 inches if pneumatic tires and registered before 1932).
Maximum Height - $12\frac{1}{2}$ ft.
Maximum Length - 35 ft. for single vehicle and 50 ft. for combination (One trailer or semi-trailer allowed)

Minimum Axle Spacing - 40 inches

Weight Restrictions

Maximum Axle Load - 22,000 lb.

Maximum Gross Weight of Single Unit -
4 wheeled - 44,000 lb. if L = 21 ft. or more
6 wheeled - 60,000 lb.

Maximum Gross Weight of Tractor-Semi-Trailer - 65,400 lb.
Maximum Gross Weight of Other Combinations - 65,400 lb.
Maximum Gross Weight of any group of axles - Washington, D. C. has a table similar to AASHO table except (1) values of W are 38,000 from L = 4 to L = 13, (2) table stops with L = 46 and W = 65,400 lb.

FLORIDA

Extracted from H.B. 1211 which becomes a law on August 3, 1949.

Sec. 4. Maximum Width: 8 ft.

Maximum Height: $12\frac{1}{2}$ ft. except that auto transports may operate with $13\frac{1}{2}$ ft. height if clearances permit.

Sec. 5. Maximum Length: 40 ft. provided that any vehicle, except bus, if over 35 ft. must have at least 3 axles.

Combination of not more than 2 vehicles: 50 ft.

Exceptions: loads of poles, etc. by day and loads of poles, etc. by night, if hauled by Utility Company for emergency and with permit.

Sec. 6. Gross axle load: 18,000 lb. (AASHO definition for axle load).

Gross load on any axle group - same as AASHO table but stops with L = 45 and W = 64,650 lb.

Maximum Load per inch of tire width - 550 lb.

Sec. 9. Enforcement. Officer or agent of Motor Vehicle Department, Public Safety Department, or R.R. and Public Utility Commission may require driver to drive not more than 2 miles to weighing station. Can require driver to unload gross weight beyond (maximum limit + 6000 lb.). Tolerance of scales: 10 percent.

Damages for violations:

1¢ per lb. of excess weight over 1000 lb. if excess is 2000 lb. or less
2¢ per lb. of excess weight over 2000 lb. if excess is 3000 lb. or less
3¢ per lb. of excess weight over 3000 lb. if excess is 4000 lb. or less
4¢ per lb. of excess weight over 4000 lb. if excess is 5000 lb. or less
5¢ per lb. of excess weight if excess is over 5000 lb.

Violation is a misdemeanor.

Sec. 10. Special permits. Issued in writing by State Road Department. Application written - must show good cause and describe vehicle (s) and route. Permit may limit conditions.

Sec. 11. If seasonal, climatic, or other causes should demand, State Road Department may lower size and weight limits. Must post signs.

Sec. 12. Driver liable to damage by illegal operation.

Solid Tires - Maximum gross weight motor vehicle 8000 lb.
Maximum gross weight 4-wheeled trailer 3000 lb.

GEORGIA

Width: Total outside including load 96 inches

Height: 13½ ft. with or without load.

Length: Single vehicle: 35 ft.

Combination of not more than 2 units: 45 ft.

Exceptions: Loads of poles, logs, lumber, structural steel, piping and timber.

Permit may be issued by Public Service Commission to exceed limits on dimensions only (not weights).

Maximum Weights:

- (a) 9000 lb. per wheel if carrying low-pressure pneumatic tires
8000 lb. per wheel if carrying high-pressure pneumatic tires or solid tires.
18,000 lb. axle load.

- (b) Total gross weight: $W = 700 (L + 40)$.

NOTE: Smaller of (a) and (b) will prevail.

IDAHO

48-535. Size of vehicles and loads.

- (a) Maximum width: 8 ft.

Exceptions: Farm tractor 9 ft.

Implements of husbandry and load temporarily moved over highway.

- (b) Height: 14 ft. with or without load.

- (c) Length: Single vehicle: 35 ft.

Vehicle and semi-trailer: 60 ft.

Combination if not more than 2 units: 65 ft.

Exception: lumber, logging and pole-hauling vehicles equipped with semi-trailers shall constitute 2 units.

- (d) Length of load: Shall not extend more than 3 ft. beyond front of vehicle.

48-534. Violation of above is misdemeanor.

48-537. Peace officer may weigh vehicle and require removal of excess load. Can make driver drive 2 miles or less to scales.

48-539. Truck tractor with one-half trailer may pull one other vehicle.

48-601. Allowable gross loads.

One axle: 18,000 lb.
One wheel: 9,000 lb.

- (a) Provides a table of loads on axle groups for values of L up to 18 ft. Table is similar in character to AASHO table but values of W are somewhat larger.
- (b) Provides a table of loads on axle groups for values of L over 18 ft. Maximum value of W is 72,000 lb.
- (c) If L is greater than 21 ft. but less than 31 ft., 10 percent overload is permitted, but total weight and overload may not exceed 56,000 lb. if combination has at least 4 axles or 60,000 lb. if combination has at least 5 axles.

48-602. Allowable loads per inch of tire.

800 lb. per inch for tires more than 5 inches wide.
600 lb. per inch for tires 3 in.-5 in. wide.
400 lb. per inch for tires 3 inches or less wide.

48-603. Speed limits.

- (a) Freight carrying vehicle or combination whose gross weight exceeds 10,000 lb.: 45 mph.
- (b) Other than pneumatic tires -
 - 10,000 lb. or less gross weight: 20 mph.
 - 10,000 lb. or more gross weight: 12 mph.
 - Metal (wholly or partially): 6 mph.

48-604. Restrictions as to tire equipment.

- (a) Solid rubber: must be at least 1 inch thick above flange.
- (b) No metal tires permitted with metal or wood lugs, cleats, etc. unless planks are laid.
 - Exception: Tractors with plane caterpillar treads.
 - Tractors with V-shaped cleats.
 - Arranged to be in continuous contact provided load does not exceed 500 lb. per inch of width when measured in direction of axle.

48-605. Permits for heavier or wider loads.

Written application to Commissioner of Public Works.
Written permit may allow heavier or wider loads, more than 1 trailer, increase weights per inch of tire width, use of corrugation on tracks.
Special permit may limit time and contain other conditions.
Special permit must be carried in vehicle.

- 48-606. By reason of climatic or other conditions, Commissioner of Public Works may reduce permissible weights, sizes, or speeds and post signs thereto.
- 48-607. State can recover damages to bridge or highway due to violation even though special permit issued.
- 48-609. Penalties for violations. Up to \$100 or 30 days, cancellation registration and license.
- 48-612. Granting permission for transportation of loads of logs, poles, pilings, and material from mines which has not been finally processed.

Commissioner of Public Works authorized to post highway (s) for this purpose in excess of width and length and weight limits. Posting shall state maximum length, width, weight and speed. Special permit not required.

ILLINOIS

125. Maximum Width. Vehicle & load: 8 ft.

Exceptions: Loads of loose hay, etc.

Agricultural implements of threshing machines.

Busses operating within cities and villages in counties having a population of 500,000 or more: 8 ft. 8 in.

Maximum Height. 13 ft. 6 in. busses operating over fixed routes are excepted until January 1, 1951.

127. Length.

(a) Single vehicle: 42 ft.

(b) Truck tractor and semi-trailer: 45 ft.

Truck tractor and semitrailer and trailer: 45 ft.

(c) No other combination shall exceed 2 vehicles or 45 ft. in length.

(d) Exceptions: Vehicles carrying poles, pipes, etc. in day time.

128. Planking pavement edge required for tractor or other metal tired vehicle weighing over 4 tons.

131. Wheel and axle loads and gross weights.

(a) Maximum axle load with pneumatic tires 16,000 lb.

Exception: 18,000 if pavement is concrete, brick or asphalt on concrete base. Designated as adequate by State Highway Department or obsolescent and requiring reconstruction.

If other than pneumatic tires, 800 lb. per inch of tire width or 16,000 lb. axle load.

Definitions: Axle load includes all wheels between 2 vertical transverse planes 40 inches apart.

Tandem axles are those whose centers are 40 in.-72 in. apart. Maximum axle load here is 16,000 lb.

(b) Gross weights.	<u>lb.</u>
2-axle motor vehicle	36,000
3 or more axle motor vehicle	41,000
3-axle tractor-semi-trailer combination	45,000
4 or more axle tractor-semi-trailer combination	59,000
4-axle truck and trailer combination ...	63,000
5 or more axle truck and trailer combination	72,000
5 or more axle tractor-semi-trailer combination when transporting loads that cannot reasonably be dismantled or disassembled	72,000
Trailers	36,000
Vehicles operating on caterpillar type tracks	40,000

132. Officers may weigh vehicles and require removal excess loads.
Enforcements under state police (Department of Public Safety).

133. Permits for excess size and weight.

- (a) Written or telegraphic application showing good cause required.
- (b) Application must describe vehicle load, and route.
- (c) State Highway Department issues permit in writing or by telegram.
May limit number of trips or prescribe seasonal or other conditions.
- (d) If permit for overweight is sought, application shall show that the load cannot reasonably be dismantled or disassembled.

134. Seasonal restrictions. Up to 90 days per year. Signs must be erected.
May set special weights.

135. Liability for damage to highway or structure. Driver and owner jointly liable.

49. Maximum speeds.

Vehicle gross weight 14,000 lb. or less pneumatic tires	45 mph.
Busses gross weight over 14,000 lb. pneumatic tires	45 mph.
Trucks gross weight over 14,000 lb. pneumatic tires	40 mph.
2 or more solid rubber tires	10 mph.

Minimum Axle Spacing: 40 inches.

INDIANA

Maximum Width - 8 ft.
Maximum Height - $12\frac{1}{2}$ ft. (Auto transports $13\frac{1}{2}$ ft.)
Maximum Length - 36 ft. for single vehicle
40 ft. for bus
50 ft. for combination
Truck tractor and semi-trailer may pull one other vehicle

Maximum Weights -

Gross 72,000 lb.
Tandem axle assembly - 16,000 lb. on each axle (not to exceed 18,000 lb. per axle on heavy duty highways when so designated by State Highway Commission).
Single axles - 18,000 lb. (not to exceed 22,400 lb. on highway duty highways when so designated by State Highway Commission).
Wheel weight - 800 lb. per inch of tire width.
Pneumatic tires generally required.

Enforcement of weight limits -

Penalty - 2¢ per lb. of excess for excess weight of 1000-2000 lb.
- 4¢ per lb. of excess for excess weight of 2000-3000 lb.
- 6¢ per lb. of excess for excess weight of 3000-4000 lb.
- 8¢ per lb. of excess for excess weight of 4000-5000 lb.
- 10¢ per lb. of excess for excess weight of 5000 lb. or more.

Unless specific penalty is provided, violator shall be fined up to \$500 first time; second time same fine plus 90 days or less registration suspension if court desires.

Any peace office can weigh and require removal of excess load.

Maintenance men may be deputized by State Highway Commission to do this also.

Special permits -

Issued by State Highway Commission or local authorities responsible for maintenance - single trip or up to 30 days - Applicant must apply in writing and show good cause. Permit may designate routes and other conditions. Permittee must furnish bond or otherwise demonstrate his responsibility.

Fee - 10¢ per mile when a heavy load but must not be less than \$10.00 or more than \$25.00.

District Engineers recommend permits.

Permits are issued at Central Office.

IOWA

Maximum Width: 8 ft.

Maximum Height: $12\frac{1}{2}$ ft.

Maximum Length:

- (a) Single truck 35 ft.
- (b) Single bus 40 ft. provided that bus over 35 ft. in length must have no less than 3 axles.
- (c) Combination of truck-tractor and semi-trailer 45 ft. Full trailer prohibited.

Maximum Axle Load: 18,000 lb. pneumatic and 14,000 lb. solid rubber.

Maximum Gross Weight on Group of Axles: Similar to AASHO table but stops with L = 40 ft. and Weight = 60,800.

Authority for Permits to Exceed Size and Weights: Written application - show good cause - issued by State Highway Department - not more than 25 miles distance - Exception: road machinery made in Iowa or to be used on Iowa roads may exceed 25 miles. Will not be issued if loads can be reduced in size or weight.

Permits may be for single trips or blanket up to 1 year.

Tolerance above maximum legal weight.

3 percent on any axle including tandem axles.

8 percent of gross weight on any group of axles.

Maximum Speeds:

50 mph. if pneumatic tires and gross weight $>$ 5,000 lb.

20 mph. if solid rubber and gross weight \leq 6 tons

12 mph. if solid rubber and gross weight $>$ 6 tons

55 mph. if bus by day

50 mph. if bus by night

Weighing vehicles and removal of excess.

Any peace officer can do.

KANSAS

Maximum Width: 8 ft.
Maximum Height: 12 ft. 6 inches.
Maximum Length: Vehicle or single truck 35 ft.
Single bus 2-axles 35 ft.
Single bus 3-axles 40 ft.
Tractor and one-half trailer 50 ft.
Combination of not more than 2 vehicles: 50 ft.
Exception: Load of poles, pipe etc. in day time
Load of poles, pipe etc. in night time.
Hauled by Utility Company in emergency.

Weight:

Maximum load in pounds carried on any group of axles.	Distance in ft. between extremes of any group of axles.
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(Table is same as AASHO table but stops with L = 44 ft. and W = 63,890 lb.)

Wheel weight for high pressure tires (100 lb. pressure or more):	8000 lb.
Wheel weight for low pressure tires (less than 100 lb.):	9000 lb.
Axle weight for high pressure tires	16,000 lb.
Axle weight for low pressure tires	18,000 lb.

KENTUCKY

Maximum Width: 8 ft.
Maximum Height: 12½ ft.
Maximum Length: Single vehicle 35 ft.
Tractor-semi-trailer 45 ft.
Other combinations not allowed.

Minimum Axle Spacing: 42 inches.

Maximum Load per inch of tire width: 600 lb. pneumatic tires

Maximum Gross Axle Load: Pneumatic tires 18,000 lb. (13,000 on Class "B" roads).

Maximum Gross Weight of Single Unit:

4 wheeled pneumatic	36,000 lb. (Class "B" 26,000)
6 wheeled pneumatic	42,000 lb. (Class "B" 30,000)

Maximum Gross Weight of Tractor-Semi-trailer

Pneumatic 42,000 lb. (Class "B" roads 30,000)

	<u>Class "A" Highway</u>	<u>Class "B" Highway</u>	<u>Others</u>
Width	96"	96"	96"
Height	12½'	12½'	11½'
Length			
Single vehicle	35'	35'	26½'
Tractor-semi-trailer	45'	45'	30'
Axle load (axles 10 ft. apart or over)	18,000 lb.	13,000 lb.	No restrictions
Gross weight			
2-axle vehicle	36,000 lb.	36,000 lb.	18,000 lb.
3 or more axle vehicle	42,000 lb.	30,000 lb.	18,000 lb.

LOUISIANA

Maximum Width: Vehicle and/or load: 8 ft.
Maximum Height: Vehicle and/or load: 12½ ft.
Maximum Length:
 Single unit truck 35 ft.
 2 axle bus 35 ft.
 3 axle bus 40 ft.
 Truck-tractor and semi-trailer combination 50 ft.
 Other combinations of not more than 2 units 60 ft.
 Load cannot extend beyond front of vehicle or combination or more than 8 ft. beyond rear.
 Number of trailers allowed: 1 semi-trailer only.

Maximum Weights.

Gross axle load: Solid rubber, cushion, a high pressure pneumatic tires (100 lb. or more): 16,000 lb.
 Low pressure pneumatic (less than 100 lb.): 18,000 lb.
Total gross weight of any trailer 36,000 lb.
Total gross weight on rear or load carrying axle of a tandem truck or tandem semi-trailer if load carrying axles are less than 8 ft. apart. 32,000 lb.
Ditto if axles are more than 8 ft. apart 36,000 lb.
Tire load - per inch of tire width 450 lb.

Exceptions: Farmer can tow two semi-trailers with tractor or truck from farm to mill or gin at 20 mph.

Seasonal restrictions: By reason of weather or other emergency, physical condition of highway, construction, or repairs, Highway Director may prohibit use of or decrease gross weights.

Special permits: Issued by Highway Department to exceed maximum weights or dimensions upon showing of good cause. Written application. Fee required.
Overload only.

Misdemeanor to violate.

MAINE

Sec. 85. Width.

Maximum: 96 inches. Exceptions: Motor vehicle or trailers hauling firewood, pulpwood, logs or bolts - load 102 inches.

Height: 12½ ft. for motor vehicle or trailer.

Exceptions: Load may extend 1½ ft. higher than vehicle.
Snowplows and construction equipment.
Loose hay, pea vines or cornstalks.

Sec. 15, III. Length.

Maximum - 45 ft. This includes motor vehicle, combination of tractor and semi-trailer, and passenger bus.

Load on any of above may not extend more than 18 inches beyond rear.

Sec. 100. Weight of commercial vehicles limited.

Maximum gross load on any group of axles is same as AASHO table for values of L up to 26 ft. Where L = 27 or over, W = 50,000 lb.

Vehicles having 2 axles may not exceed gross weight of 32,000 lb.

Maximum axle load: 22,000 lb.

16,000 lb. if only 2 axles and they are < 10 ft. apart.

Maximum tire load: 600 lb. per inch of width of tire.

Exception: Vehicle on tracks having plane surfaces.

Sec. 98. Speeds.

Pneumatic tires and registered to carry > 1 ton: 40 mph. rural
20 mph. urban

Solid tires (2 or more): 25 mph. rural and 15 mph. urban

Passenger bus (more than 7 passenger): 45 mph.

Sec. 89. Permits.

Issued by highway department.

Fee \$2 - \$10 depending on weight and dimensions.

May exceed limits on weight and dimensions.

Permits to be limited to time and purpose and other conditions.

Exceptions not requiring permits: transportation of poles.
light weight farm equipment.

Tractors, etc. with lugs, cleats on tracks require permit.

Sec. 91. Seasonal closing or restrictions.

Designated by highway commission.

Must post restrictions.

Sec. 93. Penalties for violations.

Fine \$10 - \$500 for first offense.

Responsible for damages to road or bridge.

MARYLAND

Maximum Width.

96 in. including vehicle and load except:

- (a) Load of forage crops in connection with harvesting operations being hauled less than 2 miles.
- (b) Traction engine 100 inches.

Maximum Height - No restriction but must not be a menace.

Maximum Length - 55 ft. for single vehicle or combination.

No. of Trailers Permitted - No restriction.

Maximum Weights.

- (a) Per inch of pneumatic tire width: 600 lb.
- (b) Per axle: 22,400 lb.

Exception: 18,000 lb. if coupled axles are spaced less than 50 inches apart. Vehicle having more than two such coupled axles prohibited. No combination of motor vehicles other than tractor and semi-trailer shall have axle load more than 18,000 lb.

- (c) Gross load of metal tired trailer 6000 lb.
- (d) Maximum Gross Weight: $W = 750 (L + 40)$.

Solid Tires.

Maximum load per inch of width: 650 lb.

Rubber to be not less than 1 inch thick.

Gross weight of vehicles with solid tires;

4 wheels 25,000 lb.

6 wheels 40,000 lb.

Carrying capacity 5 tons if 4 wheels.

Carrying capacity 10 tons if 6 wheels.

Special Permit to Exceed Size and Weight Limits.

\$10.00 fee. Written permit by State Road Commission designates time, route and other conditions.

Seasonal Restrictions. Up to 90 days. State Road Commission can close road or lower weight limits.

Speeds: Vehicle using solid tires and running over 10 mph. may draw only 1 trailer.

MASSACHUSETTS

MAXIMUM LIMITS OF DIMENSIONS, WEIGHTS & LOADS

1. DIMENSIONS, including load

Width - 96 inches. May be exceeded only by lateral projection of pneumatic tires beyond rims, but not to exceed an outside width of 102 inches.

Length - Truck or bus - 35 feet.

Other motor vehicles or trailers - 33 feet.

Semi-trailer units (tractor-semi-trailer) - 45 feet.

Vehicles carrying single units of lumber or metal - 60 feet.

Height - No statutory limit.

Bridge clearance on state highways - 12 feet (approx.)

2. WEIGHTS, including load

Motor vehicles having two axles - 18 tons.

Motor vehicles having three axles - 25 tons.

Semi-trailer units - 25 tons.

The above gross vehicle weights are subject to axle weight limitations, measured at the ground, as follows:

Single axle - 22,400 lb.

Tandem axles spaced less than six feet apart - 18,000 lb. each.

Per inch of tire width, pneumatic or solid: 800 lb.

3. TRAILERS, other than semi-trailers.

Use prohibited if carrying capacity in excess of 1000 lb., with the following exceptions:

- A. If used exclusively for agricultural purposes, may exceed 1000 lb. capacity, but not more than 2000 lb.
- B. Heavy duty platform trailers, especially constructed for transporting machinery, contractors' equipment, or other heavy or clumsy units, the top surface of the deck or platform of which is not more than 36 inches above the ground. — 2 axle, 15 tons; 3 axle, 20 tons (does not apply to semi-trailers of the heavy duty platform type, which are included in par. 2, "semi-trailer units.")
- C. Trailers used solely for the transportation of horses by the owners of such horses, under special permit from the Department of Public Works.
- D. Trailers drawn upon any way for a distance not exceeding one-half mile, if used exclusively for agricultural purposes, or for a distance not exceeding 300 yards, if used for industrial purposes, for the purpose of going from property owned or occupied by the owner of such trailer to other property owned or occupied by him.

- E. Trailers, other than semi-trailers: Trailers having a carrying capacity of not more than three thousand pounds and heavy duty single deck trailers having a capacity of not more than six thousand pounds, used exclusively for the transportation of tobacco in connection with the growing and producing thereof, may be registered and thereafter operated or drawn upon any way for a distance not exceeding five miles.

4. PERMITS

Statutory limits of dimensions, weights and loads may be exceeded only by permit from the board or officer having charge of the way over which the vehicle is operated or; in the case of state highways from the Department of Public Works, 100 Nashua Street, Boston. Permits are issued only for specific trips over designated routes.

Permits issued upon receipt and approval of written application.

SPEEDS.

If gross weight more than 4 tons and vehicle has metal tires: 4 mph.

SEASONAL RESTRICTIONS.

Public Works Department or local authorities (for roads under their jurisdiction) may reduce load limits.

MICHIGAN

Speed.

Maximum for trucks and trailers - 45 mph

35 mph during March, April, May when reduced loadings are being enforced.

Maximum width - 96"

108" for farm tractor

104" if hauling forest products

102" if pneumatic tires have been substituted for other types of tires.

Maximum height - 12½ ft.

13½ ft. if hauling motor vehicles.

Maximum length -

Single vehicle - 35 ft.

Combination of truck-tractor and trailer or semi-trailer 50 ft.

Truck or tractor may haul 1 trailer plus 1 semi-trailer.

Maximum axle load -

If axles spacing is 9 ft. or more, 18,000 lb. for high pressure pneumatic tires.

If axles spacing is 3½ ft.-9 ft. 13,000 lb. for high pressure pneumatic tires.

If axles spacing is less than 3½ ft., 18,000 lb. for both axles.

On designated roads (by State Highway Commission or local authorities), 16,000 lb. for each axle in one tandem assembly. If there are other tandem assemblies, maximum axles load is 13,000 lb. for each axle of the assembly.

Maximum load per inch of tire width - 700 lb.

Seasonal restrictions during March - May and at other times at discretion of State Highway Commission.

Axle load on concrete or concrete base pavements reduced 25 percent.

Axle load on other types of roads reduced 35 percent.

Maximum load per inch of tire width - 525 lb. on rigid pavements;

450 lb. flexible and gravel.

Local authorities and State Highway Commission may prohibit operation of trucks or reduce limits at their discretion at all times.

Enforcement - Any peace officer or authorized agent of State Highway Department may weigh and require removal of excess load. Violation is a misdemeanor.

Penalty - begins with \$00. - \$100 fine for driver through an increasing schedule of fines, imprisonment, fee based on weight of overload, and suspension of license and registration.

Special permit to exceed size and weight limits -

Issued by State Highway Department or local authorities. Written application and written permit. One trip only. No fee. State Highway Department can prescribe conditions, route, etc.

MINNESOTA

Size Restrictions

Maximum Width: 96 inches except: farm tractor (9 ft.); motor or trolley bus in or contiguous to cities (9 ft.); load of forest products (100 inches).

Height: 12½ ft.

Length: Single unit: 40 ft; combination: 45 ft.

Number of trailers permitted: 1 trailer or 1 semi-trailer.

Weight Restrictions.

Gross axle load: 18,000 lb. (pneumatic); 10,800 lb. (solid)

Gross wheel load: 9,000 lb. (pneumatic); 5,400 lb. (solid)

Gross weight formulae:

$W = 650 (L + 40)$ if $L < 18$ ft.

$W = 750 (L + 40)$ if $L = 18$ ft. or more.

Single axle defined as including all wheels whose centers are within 2 parallel transverse vertical planes 40 inches apart.

Permits for excess loads and sizes: Written application and written permit. Designate time, route (s), and conditions. Describes load.

Weighing: Police officer may stop and weigh vehicle or require driver to drive 2 miles or less to scales. Remove excess load. Refusal to comply is misdemeanor.

Seasonal load restrictions. State Highway Department or local authorities may prohibit use of lower load limits on roads. Signs required.

Speeds.

Maximum: 60 mph. by day
50 mph. by night

Minimum: Speed so slow as to impede normal traffic flow is prohibitive.

MISSISSIPPI

Maximum Speeds

Trucks and truck-trailer combinations.. 45 mph.
Bus 55 mph.
Others 60 mph.

Minimum Speed

30 mph. on federal designated highways unless police and/or safe driving requires lower speed.

Maximum Width: 8 ft. except: farm tractor (10 ft.)

Maximum Height: 12½ ft.

Maximum Length: Single vehicle: 35 ft.
Truck-tractor and semi-trailer combined or any other combination: 45 ft.
Truck may draw 1 semi-trailer or trailer.

Wheel and Axle Loads - Maximum.

Mississippi has a table of wheel and axle weights giving maximum allowable loads for various sizes of tires - single and double mounting. Largest values in this table are:

44 x 10 tires:	Single mounting	Dual mounting
	1 wheel 1 axle	1 wheel 1 axle
	6635 lb. 13270 lb.	9000 lb. 18,000 lb.

10 percent tolerance allowed provided that maximum axle load for that mounting is not exceeded and total wheel load and tolerance does not exceed 9000 lb.

Subject to above table, Mississippi also has a table of maximum loads for axle groups, where L ranges from 4 ft. to 30 ft. and greater, and W from 28650 lb. to 52650 lb.

State Highway Department may prohibit use of or reduce weight limits on any highway if weather or other hazards dictate. Board of supervisors may do likewise on county roads. Signs required showing limits.

Weighing - Police officer may stop and weigh vehicle or make driver drive up to 2 miles to scales. Reduce excess load. Refusal is misdemeanor.

Permits for excess sizes and weights. Written application to show good cause.

Describe load and operation, route, single trip or continuous operation.

State Highway Department issues permit specifying time and conditions.

Permittee liable for payment of damages.

MISSOURI

Maximum Width - 96 inches

Maximum Height - $12\frac{1}{2}$ ft.

Maximum Length - 35 ft. for single unit; 45 ft. for combination.

Tractor - semi-trailer may draw one trailer.

Special permit to exceed size and weights may be issued by State Highway Department - written application. Route, time, conditions designated. Single trip or period.

Maximum Gross Weight Formulae:

$W = (L + 40) 700$ when $L =$ more than 18 feet.

$W = (L + 40) 650$ when $L =$ 18 ft. or less

Maximum Axle load:

16,000 lb. for solid rubber, cushion, or high pressure pneumatic tires.

18,000 lb. for low pressure pneumatic tires.

Maximum Tire load per inch of width: 600 lb. solid or pneumatic.

Seasonal restrictions - Yes, by State Highway Department. No time limit.

Speed limits: Solid tires (rubber)

2 ton capacity - 20 mph

2-5 ton capacity - 15 mph

More than 5 tons capacity - 10 mph

Solid tires (metal) - 6 mph

Others 25 mph (prima facie)

MONTANA

Maximum Sizes - 8 ft. width; $13\frac{1}{2}$ ft. height;

Length: Single truck 35 ft.

Single bus 40 ft.

Truck-tractor and semi-trailer 60 ft.

Other combinations (not to exceed 2 units) 60 ft.

Speeds -

Minimum: Not so slow as to impede normal traffic movement.

Maximum: Trucks 45 mph. pneumatic tires
10 mph. solid rubber or cushion

Maximum Loads

Loads on single axle and groups of axles are same as AASHO recommends.

State Highway Department is authorized to reduce limits when conditions justify.

Violations of Size and Weight Limits.

Is misdemeanor.

Fines:

(1) First conviction: \$10-\$50 or imprisonment 5-25 days.

(2) Second conviction within 1 year thereafter: \$50-\$200 or 25-100 days imprisonment or both.

(3) Third conviction within 1 year after first: \$200-\$500 or 100-180 days imprisonment or both.

NEBRASKA

Size Restrictions

Maximum Width: 8 ft. except vehicles which had solid tires at enactment of law but now have pneumatic tires.

Maximum Height: 12½ ft.

Maximum Length: Single vehicle 35 ft.
Tractor - semi-trailer 50 ft.
Other combinations 50 ft.
A straight truck may draw one trailer.

Weight Restrictions

Maximum wheel load 9000 lb.

Maximum axle load 18000 lb.

Maximum axle group load: same as AASHO table.

Speeds - Maximum: Day 60 mph.
Night 50 mph.
If gross weight over 5 tons, 50 mph.
Solid tires 20 mph.

Minimum: Cannot block normal traffic movement.

Special Permit to exceed size and weight limits - Issued by State Highway Department for not more than 10 days.

Seasonal Restrictions - Yes, by State Highway Department or local authorities.
May reduce limits or prohibit use.

Violations of Size and Weight Limits - Misdemeanor. \$10-\$100 for each offense and/or 1-30 days imprisonment.

NEVADA

Maximum axle load - 18,000 lb.

Nevada has a table of axle-group loads similar to the AASHO table but permitting somewhat higher loads than AASHO table.

Enforcement. Any peace officer shall require driver to reduce excess load.

Violation. Misdemeanor. Penalty \$100 - \$500 fine.

Maximum Width. No restriction except vehicles over 96 inches to be operated at 8 mph. or less.

Maximum Height. No restriction.

Maximum Length. No restriction - single or in combination.
No restriction on No. of trailers allowed.

Maximum load per inch of tire width. Not specified

Minimum axle spacing. Not specified.

NEW HAMPSHIRE

Maximum Speed: 45 where posted

Minimum: Not so slow as to impede normal traffic movement.

Maximum gross weight:

Vehicle with 4 wheels 30,000 lb.

Vehicle with 10 wheels 40,000 lb.

Vehicle with 3 axles with drive on 2 rear axles and rear
axles not less than 48 inches apart 47,500 lb.

Vehicle and semi-trailer or trailer 50,000 lb.

(certified by mfg.)

No axle weight restriction.

Maximum Width: 8 ft. (102 inches when low-pressure pneumatic tires have been substituted for other types)

Maximum Length: Single vehicle 35 ft.
Combination 45 ft.
Exception: Loads of logs, poles, timbers, or metal.
No restriction on number of units.

Maximum Height: 13½ ft.

Special permit to exceed weight and dimensions issued by State Highway Department with approval of Motor Vehicle Department. Permit for one move. May require bond to cover damages.

NEW JERSEY

Size Restrictions

Maximum Width - 8 ft.

Maximum Height - $12\frac{1}{2}$ ft.

Maximum Length - Single unit 35 ft.; tractor-semi-trailer 45 ft.; other combination 50 ft. Vehicles transporting poles, etc. 70 ft.

Number Trailers allowed - One trailer or semi-trailer.

Weight Restrictions

Maximum Gross Weight Single Unit: 4 wheels: 30,000 lb;
6 wheels: 3 axles 40,000 lb.

Maximum Gross Weight Tractor-semi-trailer: 60,000 lb.

Maximum Gross Weight Other Combinations: 60,000 lb.

Maximum Weight per inch of tire width: 800 lb.

Table I of gross wheel loads for vehicles with solid tires varies depending on size tire, single or dual, diameter of wheel. Range: 1000 lb. for a 2-inch tire on single 30 inch wheel to 9800 lb. for a 7 inch tire on dual 42 inch wheels.

Table II for high-pressure type tires. Tire varies from 5 in.-10 in. Wheel diameter from 30 in.-42 in. Load from 2800 lb.-13,750 lb.

Table III for balloon type. Tires vary from 6 inches to $13\frac{1}{2}$ inches. Wheels from 20 in.-24 in. Loads from 2800 lb.-21,500 lb.

Maximum Speed - Trucks, etc. 40 mph.

NEW MEXICO

Speed Restrictions

Minimum - Not so slow as to impede normal traffic movement.

Maximum - Trucks 50 mph.

Vehicles with solid rubber tires 10 mph.

Vehicles with metal tires 6 mph.

Size Limitations

Width - 8 ft. (Highway Commission may designate highways or section on which vehicles 102 inches may operate)

Farm tractor 9 ft.

Farm implements temporarily moved excepted.

Height - $12\frac{1}{2}$ ft.

Length - Single 40 ft. Truck and trailer or truck-tractor and semi-trailer 65 ft. Only one trailer or semi-trailer allowed.

Weight Limitations

Wheel Loads - Pneumatic tires 9000 lb; solid rubber 8000 lb.

Axle Loads - Pneumatic tires 18,000 lb; solid rubber 16,000 lb.

Gross Weight of vehicle or combinations.

$W = 650 (L + 40)$ if $L = 18$ or less

$W = 750 (L + 40)$ if $L > 18$ ft.

This also applies to any group of axles.

Tire Loads - Metal 500 lb. per inch of width.

Rubber 600 lb. per inch of width.

Weight Exceptions - Vehicles hauling New Mexico products may exceed 20 percent.

Enforcement - Peace officers or designated employees of State Highway Department may weigh and require unloading of excessive weights.

Special Permits - State Highway Department may issue for excess weight for one trip only. Specifies route. In case of emergency, period may be increased to one year. Permit may designate route and other conditions.

Seasonal Restrictions - Not more than 90 days and by local authorities. Solid rubber tires must have one inch thickness.

NEW YORK

Maximum Width - 96 inches

Exceptions: School busses 98 inches.

106 inches at rear tires if pneumatic and registered before 1933.

Height - 13 ft.

Length - Single vehicle 35 ft.; combination 50 ft.

Number Trailers Permitted - 1 trailer or 1 semi-trailer.

Maximum Weight per inch of tire - 800 lb.

Maximum Wheel Weight - 11,200 lb.

Maximum Axle Weight - 22,400 lb.

Maximum Weight on any two consecutive axles: < 14 ft. apart 36,000 lb.

Maximum Weight on any three consecutive axles: 30,000 lb. + 750 L

Maximum Weight on any number of axles: 30,000 lb. + 750 L

Absolute Maximum for vehicles other than semi-trailers:

4 wheels 36,000 lb.

6 wheels 44,000 lb.

8 wheels 50,000 lb.

Solid tires may carry not over 80 percent of weight allowed for pneumatic.

Metal tires may carry not over 40 percent of weight allowed for pneumatic.

Special Permits issued by State Highway Department to exceed weight and size.

Written application to show good cause, indicate route, describe vehicle and load, date. Permit will not be issued if loads can be reduced to legal weights or dimensions.

Fee for insurance premium required.

Seasonal restrictions - Yes, at discretion of State Highway Department.

Speeds: Maximum: 50 mph.
Minimum: Not specified.

NORTH CAROLINA

Maximum Width - 96 inches

Maximum Height - 12½ ft.

Maximum Length - Single vehicle 35 ft.

Combinations 48 ft. (Truck-tractor may draw one semi-trailer
or one trailer.)

Maximum Gross Weight Limitations (subject to 5 percent tolerance):

	<u>Solid or High Pressure Tires</u>	<u>Low Pressure Tires</u>
Per wheel	8,000 lb.	9,000 lb.
Per axle	16,000 lb.	18,000 lb.
Per inch of tire in contact	600 lb.	
2-axle vehicle	30,000 lb.	
3-axle vehicle or combination	44,000 lb.	
4 (or more) axle vehicle or combination	56,000 lb.	

No axle is considered unless equipped with adequate brakes.

When 2 axles are 48 inches or less center to center they are considered as 1-axle.

Special Permit to exceed above - Written application describing vehicle and load required.

Seasonal Restrictions - Yes, by State Highway Department. Up to 90 days. May prohibit use or reduce weight limits due to climatic conditions.

Enforcement - Peace officer can weigh and require excess load be removed.

Speeds: Maximum 45 mph.
Minimum Not so slow as to impede traffic unless safety demands.

NORTH DAKOTA

Maximum Width - 8 ft.

Maximum Height - $12\frac{1}{2}$ ft.

Maximum Length - Single vehicle 35 ft.

Combination 45 ft.

Maximum of 2 units allowed (truck and semi-trailer considered as 2 units)

Maximum Axle Load 18,000 lb.

Maximum Wheel Load 9,000 lb. but not $>\frac{1}{2}$ axle load.

Maximum Tire Load 550 lb. per inch of tire width.

Axles 40 inches or less center to center considered as one.

Axles > 40 inches and < 8 ft.: 15,000 lb. per axle.

Gross Weight - $W = 750 (L + 40)$ if $L = > 18$ ft.

$W = 650 (L + 40)$ if $L = 18$ ft. or less.

Enforcement - Peace officers may weigh and remove excess load.

Violation is misdemeanor - Not $>$ \$100 fine and/or 30 days imprisonment.

Special permit: Issued by State Highway Department on written application showing good cause. Specifies time, date, load, route, etc.

Seasonal restrictions: State Highway Department may restrict use or reduce load limits due to climatic or other conditions. Erect signs.

State and local authorities may classify highways as to weight & local capacities.

Speed limits: Maximum 50 mph. for trucks.

OHIO

Maximum Dimensions

(Either Unladen or with Load)

Width - 8 ft. (Exceptions: Traction engine 11 ft.; Municipal bus 104 inches.)

Height - $12\frac{1}{2}$ ft. (except $13\frac{1}{2}$ ft. motor vehicle carrier.)

Length - Single vehicle 35 ft.

- Municipal bus 48 ft.

- Truck-tractor and semi-trailer 45 ft.

- Any other combination 60 ft.

	<u>Maximum Weights (lb.)</u>	<u>Pneumatic Tires</u>	<u>Solid Rubber</u>
On one axle		19,000	16,000
On 2 axles spaced 4 ft. or less center to center..		24,000	19,000
On 2 axles spaced 4 ft.-8 ft. center to center....		31,500	24,000
On 2 axles spaced 8 ft. or more center to center..		38,000	28,000
Total weight of vehicle and load		38,000 + 800 L	28,000 + 600 L

"L" is distance in feet between centers of front and rearmost axles of the vehicle or combination of vehicles.

Maximum total weight of vehicle and load 78,000 61,600

Wheel load shall not exceed 650 lb. per inch of tire width.

Special permit to exceed above limits may be issued by State Highway Department on receipt of written application. Permit specifies route, date, and other conditions and describes load and vehicle.

Speeds - Maximum 50 mph.

Minimum not so slow as to impede normal traffic movement.

Seasonal Restrictions - State Highway Department may reduce loads and speeds on State highways due to climatic conditions not $>$ 25 percent reduction. County Commissioners on other roads not $>$ 50 percent reduction. Must erect signs.

Enforcement - Any police officer may weigh vehicle and require driver to reduce load. Violation is misdemeanor.

OKLAHOMA

Maximum Width - 8 ft.

Maximum Height - $12\frac{1}{2}$ ft. Exception: Automobile transport 13 ft.

Maximum Length - Single truck 35 ft.

Single bus 45 ft.

Truck-tractor and semi-trailer 50 ft.

Other combinations 50 ft.

Number of trailers allowed - 1 semi-trailer or 1 full trailer.

Maximum loads:

Gross weight of vehicle or combination 60,000 lb.

Maximum weight per inch of tire width 600 lb. (high pressure tires)

650 lb. (low pressure tires)

Maximum axle load 18,000 lb. (includes all wheels whose centers fall between 2 parallel transverse vertical planes 40 inches apart).

Maximum load on any group of axles: (same as AASHO table but stops with L = 39 ft. and W = 60,000 lb.)

Seasonal Restrictions - State Highway Director may prohibit use of or reduce weight limits if climatic or other conditions justify. Appropriate signs must be posted.

Special Permits to exceed Size and Weight Limits:

- (a) Commissioner of Public Safety, with approval of State Highway Commission, may issue special written permit to exceed gross weight limit. Axle load limit of 18,000 lb. may not be exceeded however. Permit is limited to one trip and may impose other conditions such as route, date, hours, etc.
- (b) Commissioner of Public Safety may issue oversize permits for vehicles whose loads cannot be divided. Period is limited to expiration of vehicle's registration. Permit may prescribe hours, route, or other conditions.

Permit charge: \$5.00 plus \$5.00 for each 1000 lb. of excess load.

Enforcement of Weight Limits:

Any officer of Public Safety Department, Oklahoma Tax Commission, or any sheriff or salaried deputy sheriff may stop, weigh, and require removal of excess load. Loads of livestock or perishable merchandise may be driven to nearest practical unloading point.

Violation is misdemeanor. Penalties:

- (a) First violation or for a violation occurring more than one year after first violation \$50 - \$200 fine and/or imprisonment up to 30 days.
- (b) Subsequent violation less than one year later \$100 - \$200 fine and/or up to 30 days imprisonment.
- (c) Subsequent violation less than one year later \$250 - \$500 fine and/or up to 6 months imprisonment.

Speeds

Maximum for truck or combination if W = 48,000 lb. or less: 50 mph.
Maximum combination if W = \geq 48,000 lb. 40 mph.
Maximum for bus: 55 mph.
Maximum for vehicle having hard rubber tires and gross weight 6 tons or more: 10 mph.

OREGON

OREGON STATE HIGHWAY COMMISSION PERMIT DEPARTMENT

PERMISSIBLE DIMENSIONS AND WEIGHTS AUTHORIZED BY STATUTE (Or Allowed by Highway Commission Under Statutory Authority Shown)

Equipment Classification, General	Equipment Operatin under Basic Statute				
Statute Authority	Sec. 115-145, 115-147 & 115-150, O.C.I.A.				
Highways Permitted	All Highways except those restricted by the Highway Commission				
Commodity Specified	Any Commodity (Special Permit required from PUC)				
Equipment Permitted or Required	Solo Truck Combination Truck Tractor Tractor & Trailer Tractor & Semi-trailer				
DIMENSIONS - Feet					
Width	8	8	8	8	8
Height - without permit	11	11	11	11	11
Height - with permit from Highway Commission	12 1/2	12	12	12	12
Length, Overall - Single Unit	35	35	(Controlled by Permit)		
Length, Overall - Combination	50	-	(O/L Permit from Hwy. Comm. required when over 50 feet)		
Rear Overhang (W.B. = Overall Wheelbase)	Solo 1/2 W.B., 1/3 W.B. Comb. 1/3 W.B.	1/2 W.B.	1/3 W.B.	1/3 W.B.	1/3 W.B.
WEIGHT - Pounds (including tolerances)					
Per inch of tire width (total under 30 inches)	500	500 + 10%	500 + 10%	500 + 10%	500 + 10%
Per inch of tire width (total over 30 inches)	600	600 + 10%	600 + 10%	600 + 10%	600 + 10%
Single Axle	14,000	19,000	19,000	19,000	19,000
Truck Axle (minimum spacing 40 inches)	36,000	38,000	38,000	38,000	38,000
Gross Vehicle Weight 1/	54,000	57,000	57,000	61,000	72,000 2/
G. V. W. as limited by formula	50,000	55,000	55,000	61,000	72,000 2/
2/ Formula factor (W = Factor x (L + 40))	700	700 + 10%	700 + 10%	700 + 10%	750 + 10%
1/ Subject in all cases to axle limitations and formula where applicable. L = Maximum Gross Weight of Vehicle or Combination. W = Maximum Gross Weight of Vehicle or Combination. L = Distance between first and last axle of vehicle or combination. 2/ O. V. W. subject also to limitation of formula W = 650 x (L + 40) + 10% applied any group of axles spaced 18 ft. or less apart. 3/ Except for trucks - allowed 7/8 R. O. with minimum of 25% of O.V.W. on front axle.					
MISCELLANEOUS REQUIREMENTS					
Hauling Hours Permitted	Unrestricted				(4 A.M. - 5 P.M. w/ lights required during hours of darkness. Sat. P.M. only from Sept. 8 to May 23. No Sundays or Holidays)
Maximum Speed - M.P.H.	45	45	45	45	45
Flat open curves	45	45	45	45	45
Sharp curves or bridges	45	45	45	45	45
5/ Statutory limit 45 - Restricted by Hwy. Comm. on O/L Permits to 55. 6/ Statutory limit 45 - Restricted by P.U.C. Permit regulations to 15.					
R.R.S. 8/10/19					

Equipment Operating under Continuing Permit from Highway Commission	Chapter 150, Oregon Laws 1949	Group I Highways (Shown on Permit)	Group II Highways (Shown on Permit)
Commodity	Any	Any	Any
Combinations of Truck & Trailer or Tractor & Semi-trailer	Combinations of Commodity	Commodity	Commodity
8	8	8	8
12	12	12 1/2	12 1/2
35	35	35	35
50	50	60	60
1/3 W.B.	1/3 W.B.	1/3 W.B.	1/3 W.B.
500	500	500	500
600	600	600	600
14,000	14,000	14,000	14,000
32,000	32,000	32,000	32,000
66,000	72,000	72,000	75,000
No formula applicable - weight limited according to axle spacing and A.A.S.D. table of weights, plus 5% tolerance, within above maximum.			
Regulated	Regulated	Regulated	Regulated
45	45	45	45
45	45	45	45
45	45	45	45
45	45	45	45

Equipment Operating under Special Permit from Highway Commission	Sec. 115-145, O.C.L.A.	Specific Routes as shown by permit	Any Commodity not readily dimensioned normally 5-axle tractor and Semi Combination	All Combinations - normally 5-axle tractor and Semi Combination
As allowed by permit, subject to limitations of overhauled structures, width of surface, etc. Permits issued for single movements only. Bond & insurance required.	1/3 W.B.			
500				
600				
19,000				
37,000				
80,000				
80,000				
{ 1,000 - up over 18 ft. 650 - up 18 ft. or less				
{ Daylight hours only - { No. Sat. P.M., Sundays or Holidays				
45				
45				
45				
45				

PENNSYLVANIA

Maximum Width - 96 inches
Maximum Height - $12\frac{1}{2}$ ft.
Maximum Length - Single vehicle 35 ft.
- Tractor-semi-trailer 45 ft.
- Other combinations 50 ft.

Number trailers permitted: 1 trailer or semi-trailer

Axle spacing - Minimum 36 inches between 2 rear axles of 6 wheeler.

Weight Restrictions

Maximum load per inch of tire width: 800 lb. pneumatic or solid.

Maximum axle load: 20,000 lb. pneumatic or solid. Exception: 18,000 lb. for any one of rear axles of a 6-wheeled single unit.

Maximum Gross Weight of Single Unit - Pennsylvania has tables wherein gross weights are related to chassis weights.

Maximum values of W in these tables is 30,000 lb. for a 4-wheeled unit and 40,000 lb. for a 6-wheeled unit.

Maximum Gross Weight of Tractor-semi-trailer: 45,000 lb. pneumatic or solid tires.

RHODE ISLAND

Maximum Length - Single vehicle 35 ft. except jitneys or buses, 40 ft.
Combination 45 ft.

Number of trailers allowed: 1 trailer or 1 semi-trailer allowed.

Maximum Width: 102 inches.

Maximum Height: $12\frac{1}{2}$ ft.

Maximum Axle Loads

10,000 lb. metal tires 22,400 lb. rubber tires
On 2 axles < 6 ft. apart: 32,000 lb. (both axles)

Maximum Load per inch of rubber tire width: 800 lb.

Maximum Load per inch of metal tire width: 500 lb.

Special permit to exceed size and weight limits issued by State Highway Department. Operator must also pay \$100 for registration certificate for such vehicles.

Maximum Speeds

<u>Gross Weight</u>	<u>Pneumatic Tires</u>	<u>Solid Rubber</u>	<u>Steel Tires</u>
4,000 lb. or less	35 mph.	25	15
4,000 - 6,000	35 mph.	20	12
6,000 -13,500	35 mph.	20	10
Over 13,500	35 mph.	15	6

Gross vehicle loads

- 2 axle vehicle where $L \leq 6$ ft. - 32,000 lb.
- 2 axle vehicle where $L \leq 12$ ft. - 36,000 lb.
- 3 or more axle vehicle where $L \leq 16$ ft. = 40,000 lb.
- 3 or more axle vehicle where $L \leq 20$ ft. = 44,000 lb.
- 3 or more axle vehicle where $L \leq 22$ ft. = 46,000 lb.
- 3 or more axle vehicle where $L \leq 25$ ft. = 50,000 lb. (after April 1, 1955)
this value for L shall not be ≤ 27 ft.)

SOUTH CAROLINA

Maximum Width - 96 inches

Maximum Height - $12\frac{1}{2}$ ft.

Maximum Length - Single vehicle 35 ft. if 2 axles; 40 if 3 or more axles.
Combination of not more than 2 units: 50 ft.

Gross Weights - On 1 wheel: 8,000 lb. solid; 10,000 pneumatic.
On 1 axle: 16,000 lb. solid; 20,000 pneumatic.
On axle group: same as AASHO table. L stops at 50 ft.
Maximum load per inch of tire width = 300 lb. for solid rubber tires.

Weighing vehicles and loads - Officer or agent of State Highway Department may require driver to stop and be weighed. Must unload excess load. Ten (10) percent tolerance allowed.

Seasonal restrictions - State Highway Department or local authority may reduce speed and load limits or prohibit use if climatic conditions justify.

SOUTH DAKOTA

Maximum Width - 8 ft.

Maximum Length - Single truck 35 ft.

Single bus 40 ft. (If \geq 35 ft. must have at least 3 axles).

Combination 50 ft. (one trailer or semi-trailer).

Maximum Height - 13 ft.

Maximum Loads

	<u>1-Wheel</u>	<u>1-Axle</u>
If low-pressure pneumatic tires and axles 8 ft. or more apart,	9000 lb.	18,000 lb.
If high-pressure pneumatic tires and axles 8 ft. or more apart,	8000 lb.	16,000 lb.
If pneumatic tires and axles less than 8 ft. apart,	8000 lb.	16,000 lb.
If solid rubber or cushion tires, 60 percent of the wheel load for pneumatic tires.		

Maximum load on any group of axles is same as AASHO table except that table stops with L = 45 ft. and W = 64,650 lb.

Maximum load per inch of pneumatic tire width = 600 lb.

If axles are \leq 40 inches apart they are considered as 1 axle.

Maximum load per inch of solid rubber tire width = 400 lb.

Seasonal restrictions on loads:

- (1) From March 1 - April 30, 65 percent of axle or group load for gravel or bituminous surface.
- (2) March 1 - April 30, 75 percent for concrete surface.
- (3) State Highway Department may lower limits if necessary, and may remove seasonal limits if weather conditions warrant.
- (4) Local authorities may lower limits or prohibit use.

Special permit - to exceed size and weight limits. Single trip - issued by person charged with maintenance (State or County) - written permit - designate route and other conditions.

Enforcement - County highway superintendent has authority of peace officer re weights, etc. Can stop, weigh, and arrest. Peace officers may do likewise and remove excess load.

Speeds: Maximum 45 mph. pneumatic tires.
20 mph. solid tires.

TENNESSEE

Maximum Axle Load - 18,000 lb. (axles less than 40 inches apart considered as 1 axle.)

*Gross Weight of Vehicle and Load = $W = 700 (L + 40)$ } whichever is smaller.
Gross Weight of Vehicle and Load = 42,000 lb.

Special permit to exceed weight limit - issued by Commissioner of Safety for occasional movements on commodities and equipment which cannot be reduced in weight reasonably.

Commissioner of Highways authorized to reduce limits on secondary roads.

Violation a misdemeanor - \$25-\$300 fine.

Maximum Length - Single vehicle 35 ft.
Tractor with trailer or semi-trailer 45 ft.

Maximum Width - 8 ft.
Maximum Height - $12\frac{1}{2}$ ft.

Speeds - Maximum - 40 mph. for trucks

*Full trailers limited to gross weight 3500 lb.

TEXAS

Maximum Height - $13\frac{1}{2}$ ft.
Maximum Width - 8 ft.
Maximum Length - Single vehicle 35 ft.
Combination 45 ft. (Trailer or semi-trailer allowed).

Gross Weight - 48,000 lb. or $700 (L + 40)$ whichever is smaller.
Axle Load - 18,000 lb. (low pressure tires)
Axle Load - 16,000 lb. (high pressure tires)

Per inch of tire load (low pressure tires) = 650 lb.)
Per inch of tire load (high pressure tires) = 600 lb.) } never exceeded even by permit.
Per wheel (low pressure tires) 9,000 lb.
Per wheel (high pressure tires) 8,000 lb.

Special permits to exceed weight and size limits.

- (1) Issued by each of 25 district engineers.
- (2) For 1 trip only except for overlength may get 30, 60, or 90 day permits.
- (3) \$5.00 per single trip permit, \$10.00 for 30 days, \$15.00 for 60 days,
\$20.00 for 90 days.
- (4) Single trip bond required (\$500-\$1000)* or annual permit bond (\$5,000).
- (5) Written application and permit.

*Amount of single trip bond set by District Engineer usually \$1,000.00.

Minimum axle spacing 40 inches (i.e. 2 axles less than 40 inches apart counted as 1).

Enforcement:

Any license and weight inspector of Public Safety Department or any highway patrolman or any sheriff may weigh vehicle (s) and cause driver to reduce excess load unless livestock or perishables.

Violator is fined up to \$200

Speed - Maximum 45 mph.

Seasonable Restrictions - State Highway Department or local authorities may close road or reduce load limits if they deem it necessary due to wet weather or other conditions.

Violator may be fined up to \$200.

UTAH

Maximum Height - 14 ft.

Maximum Width - 8 ft.

Maximum Length - Single vehicle 45 ft.
Combination 60 ft. (2 trailers or 1 trailer and semi-trailer permitted.)

Gross Weight

One axle 18,000 lb. (2 axles \leq 40 inches apart considered as 1).

One wheel 9,500 lb.

Gross weight may not exceed four times unladen weight.

Maximum load on groups of axles covered by table in which L varies from 4 to 54 ft. and over and W from 33,000 to 79,900 lb.

Enforcement: Peace officer can weigh and require removal of excess load

Special permits - Issued by State Highway Department and local authorities - written application - show good cause - describe route, load, vehicles - single trip or blanket period.

Seasonal restrictions - 90 days by State Highway Department or local authorities - must erect signs - can close road or reduce weight limits.

Speeds: Maximum - 60 mph. daytime
- 50 mph. night time

Minimum - not so slow as to impede normal flow of traffic.

VERMONT

Size Restrictions

Maximum Width 8 ft.

Maximum Height - $12\frac{1}{2}$ ft.

Maximum Length - 50 ft. Single vehicle or combination. One trailer or semi-trailer allowed.

Axle Spacing - Minimum 40 inches.

Weight Restrictions

Maximum load per inch of tire width: 600 lb. pneumatic or solid.

Maximum gross weight on 1 axle: Not restricted. Must be enough on front axle to insure safe operation.

Maximum gross weight of 1 vehicle (see footnote):

4 wheels 16,000 lb. A
20,000 lb. B
30,000 lb. C

6 wheels 16,000 lb. A.
20,000 lb. B
40,000 lb. C

Maximum gross weight of tractor - semi-trailer or other combinations:

16,000 lb. A
20,000 lb. B
50,000 lb. C

Seasonal restrictions - Yes - applied to lb. per inch of tire width.

Enforcement - By State Police - weigh and require removal of excess load.
Fines up to \$100.

Footnote: A = Other than state and state-aid highways
B = State-aid highways
C = State highways

VIRGINIA

Maximum Width - 8 ft.
Maximum Height - 12½ ft.
Maximum Length - 33 ft. single vehicle (bus 35 ft.)
45 ft. combination (exclusive of coupling which must not exceed 10 ft.)
Not more than two vehicles permitted in combination.

Minimum axle spacing - 40 inches, except on designated highways where minimum spacing is 48 inches.

Solid tires prohibited.

<u>Gross Weight Limitations</u>	<u>Non Designated Routes</u>	<u>Designated Routes</u>
Any 2-axle 4-wheel vehicle	24,000 lb.	24,000 lb.
3-axle 6-wheel vehicle	35,000 lb.	40,000 lb.
Any combination of vehicles	35,000 lb.	50,000 lb.
Any single axle	16,000 lb.	18,000 lb.
Per inch of tire width	650 lb.	650 lb.
Any 4-axle 8-wheel combination	35,000 lb.	50,000 lb.

Special permits to exceed size and weight limits.

Issued by State Highway Department up to 90,000 lb. bond required, Route designated. For single trip 35 mph. Define load. Daylight only unless overweight only. Week-end and holiday permits out. Fee: 10¢ per mile, on Virginia Licensed vehicles only.

Seasonal restrictions - Yes. By State Highway Department or local authorities. 90-day limit. Reduced limits posted.

Maximum Speed: 50 mph.

Violation - \$2.00 per 100 lb. excess, as a penalty if convicted of overweight violations in addition to any fine which may be imposed.

Enforcement - by State police. Can require removal of excess loads.

WASHINGTON

Solid rubber tires prohibited.

Maximum Width - 8 ft.
Maximum Height - 12½ ft.
Maximum Length - Single vehicle 35 ft.
Combination 60 ft.
Semi-trailer 40 ft.
One trailer or semi-trailer permitted.

Minimum Axle Spacing - 42 inches.

Maximum Weight -

Axle groups - similar table to AASHO table but larger values of W.

Single axle - 18,000 lb.

Gross weight truck or truck-trailer having 2-axles - 28,000 lb.

Gross weight trailer or semi-trailer having 2-axles - 32,000 lb.

Gross weight vehicle having 3 or more axles - 36,000 lb.

If 2 axles are \leq 7 ft. apart, they must be constructed to provide oscillation between the 2 axles and neither axle can take $>$ 18,000 lb.

Gross weight per inch of tire width 500 lb.

5 percent tolerance on legal gross weight table for 3-axle tractors and 2-axle semi-trailers engaged in log hauling.

Seasonal restrictions - Yes for not $>$ 100 days. Imposed by State Highway Department or local authorities.

Enforcement by State Patrol. Penalty: First offense \$25-\$50; Second offense \$50-\$100; and court may suspend registration for not more than 30 days; Third offense not less than \$100 plus 30 day suspension or more.

Special Permits: State Highway Department and local authorities may issue permit to exceed size and weight. Written application showing good cause. Permits limited to 22,000 axle load; 41,000 lb. on axle group where $L \leq 10$ ft.

Single trips oversize only \$4.00. 30-day permits for oversize may be issued.

Fees: \$25 for 30 day overwidth and overheight only. \$10.00 for 30 day overlength only. Overweight: \$5.00 to \$150.00 depending on weight over legal and distance travelled.

Combination of Tractor, Semi-trailer and full trailer permitted under special permit on certain designated highways. Fees: \$4.00 single; \$10.00 month; \$40.00 - 6 months; \$60.00 per year.

Speeds -

Maximum: 10 mph. for solid rubber tires when used under permit.
40 mph. if gross load is $>$ 10,000 lb.

Minimum: not so slow as to impede normal traffic movement.

WEST VIRGINIA

Maximum Length - Single vehicle 35 ft.
Combination 45 ft. (No restriction on number of trailers).

Maximum Width - 8 ft.

Maximum Height - $12\frac{1}{2}$ ft.

Minimum Axle Spacing - 40 inches.

Maximum Axle and Wheel Loads:

Metropolitan Areas: 22,000 lb. solid and pneumatic; 11,000 lb. wheel.

Major highways in industrial areas: 18,000 lb. pneumatic (wheel 9,000 lb.);

80 percent of this on solid tires are 14,400 axle (wheel 7,200).

Major highways in agricultural areas 16,000 lb. pneumatic (wheel 8,000 lb.);

10,800 lb. solid (wheel 6,400)

Secondary highways in any designated area: 16,000 lb. pneumatic (wheel

8,000 lb.); 8,000 lb. solid (wheel 4,000 lb.)

Industrial areas have been designated by the State Road Commission as primary highways.

Gross vehicle or combination weights subject to above axle and wheel loads:

Gross weights in metropolitan areas fixed within safe capacity of bridges.

Major highways in industrial or agricultural areas:

Class H-20 bridges: 1330 (L + 40)

Class H-15 bridges: 1000 (L + 40)

Class H-10 bridges: 670 (L + 40)

Special Permits to exceed weight and size limits issued by Maintenance Engineer and 10 District Engineers. Can specify conditions, routes, etc.

Fees: Unlicensed vehicle - \$5.00 + 2¢ per ton mile for round trip, laden or unladen.

Overweight vehicle - \$1.00 + 2¢ per ton mile while overloaded.

Overlength vehicle - \$1.00 per trip.

Overwidth vehicle - \$1.00 per trip.

Overheight vehicle - \$1.00 per trip.

Blanket permits issued annually to utility companies moving poles, pipes, etc. Fee \$2.00 per vehicle.

WISCONSIN

Maximum Width - 8 ft.

Exception: Pulpwood loads 100 inches

Urban busses and trackless trolleys 104 inches

Farm tractors 108 inches

Maximum Height - $12\frac{1}{2}$ ft..

Maximum Length - Single vehicle 35 ft.
Vehicle and trailer 45 ft.

Maximum Draw Bar Length - 12 ft.

Minimum Axle Spacing - 40 inches.

Solid tires prohibited, except for specified vehicles in limited classifications.

Gross Weight Restrictions

	<u>Class "A" Highway</u>	<u>Class "B" Highway</u>
Gross Axle Weight*	19,000 lb.	12,000 lb.
Gross Wheel Weight	9,500 lb.	6,000 lb.
Weight per inch of tire width	800 lb.	800 lb.
Gross weight formulas	$W = 26,000 + 1000 L$	$W = 16,000 + 600 L$
Formulas are maximum for any combination of axles as well as for overall wheelbase.		

Exceptions to General Gross Weight Restrictions: Apply only to Vehicle Registered before July 5, 1949, and expire June 30, 1951.

<u>Vehicle Type</u>	<u>Class "A" Highway</u>	<u>Class "B" Highway</u>
Dump truck	26,000 + 2,000 L (1)	16,000 + 1,200 L (1)
Milk tanker	26,000 + 2,000 L (2)	26,000 + 1,000 L (3)

- (1) Not to exceed a total of 25 tons.
- (2) Not to exceed a total of $28\frac{1}{2}$ tons.
- (3) Not to exceed a total of $22\frac{1}{2}$ tons.

* 2 axles 40 inches apart considered as 1 axle.

Seasonal Restrictions on Weight Limits

Policy (Class "A" highways when posted are reduced to Class "B" loadings.)
(Class "B" highways when posted are reduced to 50 percent of Class "B" loadings.)

The above policy is subject to review, change, and exception as the State Highway Commission may determine.

Imposed by Maintenance Department.

Speed restrictions: Metal or solid rubber tires 15 mph.
All vehicles 65 mph. daytime - 55 mph. night time.

Penalty for weight violation: First time - \$50 to \$100 fine. Second time - \$100 to \$200 and/or 10-30 days imprisonment.

Special Permits to exceed Maximum Size and Weight Limits - For single trip or annual permit covering single articles which cannot be reasonably divided. Issued by State Highway Department. Annual permits may be issued for trailers. Routes designated. State Highway Department may impose necessary conditions, require certain forms bond or insurance. Local authorities may do likewise for roads and streets under their jurisdiction.

WYOMING

Tires - Unless operated at \leq 10 mph., wheels of all vehicles must have pneumatic tires.

Maximum Loads - 9,000 lb. per wheel if tires are pneumatic
18,000 lb. per axle if tires are pneumatic
8,000 lb. per wheel if tires are solid rubber or cushion
16,000 lb. per axle if tires are solid rubber or cushion

Axle load is defined as load on all wheels whose centers are included between 2 parallel vertical planes 40 inches apart.

Maximum load on any group of axles: Wyoming has a table which is identical to AASHO table with exception of the last 5 values of L:

<u>W</u>	<u>L</u>
70,550	53
71,400	54
72,250	55
73,100	56
73,950	57

Weight for solid tires must be reduced 1/9 from those as shown in table.

Maximum Gross Weights (subject to AASHO table)

Of single unit - 4 wheeled pneumatic 36,000 lb.
Of single unit - 6 wheeled pneumatic 50,000 lb.
Of tractor-semi-trailer - pneumatic 54,000 lb.
Of other combinations - pneumatic 73,950 lb.

Special Permits

Issued by State Highway Department. Fee: \$1.00 for oversize load - \$5.00 for overweight - \$6.00 for both oversize and overweight.

Seasonal Restrictions - State Highway Department may reduce limits as load conditions require.

Violations - Considered as misdemeanors. Fine \$50-\$100 and/or imprisonment up to 60 days. In Wyoming, Division of Motor Vehicles and State Safety Patrol are under State Highway Department.

Maximum Width - 8 ft.

Maximum Height - $12\frac{1}{2}$ ft.

Maximum Length - Single unit 40 ft.
Tractor-semi-trailer 60 ft.
Other combinations 60 ft.

Number of trailers permitted: 1 trailer or semi-trailer.

Maximum Speed:

All commercial vehicles, other than busses and vehicles under 4,500 pounds unladen weight shall not exceed a speed of 50 miles per hour.

The driver of any motor truck or bus or motor trucks drawing another vehicle shall not follow within 1,000 feet of another motor truck.

THE TRUCK WEIGHT PROBLEM IN HIGHWAY TRANSPORTATION
HIGHWAY RESEARCH BOARD

CHAPTER III

Overweight Permit Policies and Practices

The survey has shown that since the war the majority of the states have made a concerted effort to control movement of overweight and size of loads. This has been accomplished by revising old and enacting new legislation requiring special authorization from the designated authorities before such loads may be transported. The survey has also revealed a wide variance among the states regarding load limitations, practice of issuing special permits and manner in which the laws are enforced.

Authorities Issuing Permits

The motor vehicle laws, in all but 2 states, require the issuance of special permits for the movement of loads in excess of the legal maximum size or weight over the state highway system. There are 42 states and the District of Columbia in which the highway departments issue these permits. The Public Safety Commission has charge in 2 states while the Public Service Commission and the Registry of Motor Vehicles operate in the remaining 2 states. See Table No. 11 for complete tabulation.

The movement of excess size and weight loads over the secondary or local highway system is not so well provided for in the laws. There are 17 states in which no provisions are made for such movements.

In general, special permits are issued only upon written application by letter or on an application form provided by the issuing agency. In cases of emergency, telephone or telegraph requests may be honored in some states provided the necessary information is given. While many make no charge for issuing permits, others collect a fee for this service. Some states have a flat rate, ranging up to 10 dollars while others assess a flat rate plus a stipulated amount per 1000 lb. above the legal limit. Other methods are also employed.

There is considerable variance among the states as to policy followed in granting permits. Some states require certified scale weights before issuing an overload permit, while others accept the applicants' statement of weights. Gross weights are given prime consideration with disregard to axle loads in a few states, while others issue permits for over gross loads provided the axle limitations are not exceeded. Still others issue permits for both over gross and over axle limitations. Generally permits will not be issued for loads which can be broken down into smaller units. There is also considerable variance as to the maximum allowable limits beyond which overload permits will not be granted. The bridges and structures are generally the controlling factors in establishing these limits. In this connection some states publish maps showing the location of

bridges which carry load restrictions. Height and width limitations of bridges and structures are also shown. One state keeps a record book of straight line diagrams showing the structural capacity of the highway system by sections. As overweight permits are issued, they are entered in the book diagrammatically under the straight line diagram. A complete record is thus kept of permitted overweight transportation by routes including the following items, bridge number, maximum span, capacity in tons, horizontal and vertical clearances.

Reference to Table No. 9 (Chapter II) giving size and weight restrictions in the states clearly shows the differences in allowable axle loads. It has been found that practically the same variances are prevalent with regard to permit practice for overload. Thus it is apparent that considerable lack of uniformity exists among the state regarding permit policy.

1. Type of Permit Issued

The oversize and overweight permits issued may be classified into two types as follows:

1. Trip permits.
2. Blanket permits.

Trip permits are usually limited to single movements, however when repeated trips with similar loads are to be made over the same route, the permit is occasionally extended to cover them all.

Blanket permits are more commonly issued for over-sized loads and are generally limited as to time allowed for the movement rather than by the number of trips. Utility companies, contractors using heavy construction equipment and equipment manufacturers are the most frequent grantees of this type of permit. Time limitations range from 30 days to 1 year.

The number of states issuing permits for over-size and over-weight loads are tabulated as follows:

Trip permits only	26 states
Trip and blanket permits	20 states
Blanket permits only	1 state
No provision	2 states

(NOTE: District of Columbia treated as a state in all compilations).

2. Time Limitations

Time limitations for moving over-weight and over-size loads are stipulated on the trip permits in 41 states. In 4 states it is optional and in 4 there is no provision made. Movements are generally authorized only during daylight hours, excluding Saturday, Sunday and holidays.

3. Bonds

The applicant for a permit in 9 of the states is required to furnish a bond or liability insurance to cover any damages which might occur to the highway. In 26 states the requirement is optional while in 13 states the law makes no provision. The District of Columbia collects 50 dollars for this purpose at the time the permit is issued, which is refunded on proper application after it has been determined no damages have occurred. In most states however the permit contains a clause to the effect that the grantee will hold the state harmless from any damage to the highway and will reimburse the state for any expenditures made for damages caused by the movement.

4. Routing

There are 40 states which stipulate the routing of the movement. In 7 states it is optional whether the route is designated and in 2 the law does not provide this authority.

5. Carrying Permits

In 40 states the law provides that the permit must be carried on the vehicle described on the application while no mention is made in the laws of 9 states.

Sample Application and Permit Forms

Exhibits 1 to 7 are the type of application and permit forms used in Iowa, Minnesota and Pennsylvania and may be considered examples of good practice.

Load Restrictions on Highways

In order to preserve the road surface during critical seasons of the year, when the bearing power of the subgrade may be lowered, most states have laws which permit imposing load restrictions during this period. These restrictions are imposed only in a very few states however, mainly located in the frost belt.

There are 46 states including the District of Columbia in which the law provides authority for limiting the loads over state or county highways. In 3 states there are no such provisions, while the authority is vested with only the county officials in 1 state. A summary shows the authority as follows:

<u>No. of States</u>	<u>Authority on</u>
35	State and local highway
10	State highways only
1	Local highways only
3	No provision

There are 16 states in which the load restriction cannot extend beyond 90 days in any one year. In 33 states there are no time limits specified.

LOAD PERMITS AND WEIGHT RESTRICTIONS ON HIGHWAYS - TABLE No. 11

STATE	Permits For Over-Size and Over-Weight										Weight Restrictions on Highways (Seasonal or Otherwise)		
	Authorities Issuing Permits		Type of Permit Issued	Time Limitation	Bond Req'd	Route Designated	Must Carry Permit	Exemptions from Restrictions	Remarks	State Authorities	Local Authorities	Time Limitation	Days
	State	Local	1 Trip - (T) 2 Blanket - (B)										
Alabama	Highway Director	N	T & B	90	Opt	Opt	Yes	State & Gov't owned vehicles, Farm Impl, Perishables		Yes	Yes	90	90
Arizona	Dep't of Highways	Yes	T	N	N	Yes	Yes			Yes	Yes	90-1	90-1
Arkansas	State Hwy Commission	Yes	T & B	S	Opt	Yes	Yes			Yes	Yes	N	N
California	Dep't of Public Works	Yes	T	Opt.	Opt	Opt	Yes	Gantry Truck 100" Motor Coach 104", Farm Impl		Yes	Yes	90-1	90-1
Colorado	State Highway Department	Yes	T	15	Opt	Yes	Yes	Fire Appr, Road Equip, Farm Impl	No permit over 14 ft width, one or more trips within time limit	Yes	Yes	90	90
Connecticut	Highway Commissioner	Yes	T	Opt	Opt	Opt	Yes	Hay or straw, Pass car & Trailer, Poles Lmbtr, or Str Steel		Yes-2	N	N	N
Delaware	State Highway Department	Yes	T & B	T-S B-30	Yes	Yes	Yes		Blanket Permit for Piling or Pole Trailers	Yes	Yes	90	90
Florida	State Road Department	N	T	S	Opt	Yes	Yes	Poles, Logs, Lmbtr, Str Steel, Piping, and Timber		N	N	N	N
Georgia	Public Service Commission	N	T	S	N	Opt	N		Permits issued for oversize only	Yes	N	N	N
Idaho	Commissioner of Public Works	Yes	T	S	Opt	Opt	Yes	Logs, Poles & Piling, over designated routes		Yes	Yes	90-1	90-1
Illinois	Division of Highways	Yes	T	S	Opt	Yes	Yes	Fire Appr & Farm Impl		Yes	Yes	90	90
Indiana	State Highway Commission	Yes	T & B	30	Opt	Yes	Yes	Constr & Maint Equip, Govt Veh, Farm Impl		Yes	Yes	N	N
Iowa	State Highway Commission	Yes	T & B	S	Opt	Yes	Yes			Yes	Yes	90	90
Kansas	State Highway Commission	Yes	T & B	Opt	Opt	Yes	Yes			Yes	Yes	90	90
Kentucky	Department of Highways	N	T & B	S	Yes	Yes	Yes	State & Govt owned trucks		Yes	Yes	N	N
Louisiana	Director of Highways	N	T & B	30	Opt Dm. Yes-Q-Lgth	Opt	Yes			Yes	N	N	N
Maine	State Highway Commission	Yes	T	S	N	Yes	N	Poles & Farm Impl		Yes	Yes	N	N
Maryland	State Roads Commission	N	T & B	S	N	Yes	Yes			Yes	N	90	90
Massachusetts	Department of Public Works	N	T	S	N	Yes	Yes			Yes	Yes	N	N
Michigan	State Highway Commissioner	Yes	T	S	N	Yes	Yes	Farm Impl		Yes	Yes	N-8	N-8
Minnesota	Commissioner of Highways	Yes	T	S	Opt	Yes	Yes			Yes	Yes	N-3	N-3
Mississippi	State Highway Commissioner	Yes	T & B	S	Yes	Yes	Yes			Yes	Yes	N	N
Missouri	State Highway Commission	Yes	T & B	S	N	Yes	N		No permit issued for Axle Wt over 18,000 lbs except for short distances	Yes	N	N	N
Montana	State Highway Commission	Yes	T & B	T-S B-90	Opt	Yes	Yes			Yes	Yes	N	N
Nebraska	Dept of Roads & Irrigation	N	T	10	Opt	Yes	Yes	Farm Impl, Constr' Equip & Materials		Yes	Yes	N	N
Nevada	N	N	T	N	N	N	N			Yes	N	N	N
New Hampshire	State Highway Comm'r or Motor Vehicle Commissioner	N	T	S	Opt.	Yes	N			N	N	N	N
New Jersey	N	N	N	N	N	N	N	Livestock and Products of N M Mines, Forests, Agr & Oil fields, Farm Impl	No provision in law for vehicles exceeding gross wt. limits Oversize permits issued by Dar of Motor Vehicles	N	N	N	N
New Mexico	State Highway Commission	Yes	T & B	S	Opt	Yes	Yes		Blanket permits issued in emergency.	Yes	Yes	90	90
New York	Sup't of Public Works	Yes	T	S	Opt	Yes	Yes			Yes	Yes	N	N
North Carolina	State Highway Commission	N	T	S	N	Yes	Yes			Yes	Yes	90	90
North Dakota	State Highway Commissioner	Yes	T	S	Opt	Yes	Yes	Grantee responsible for all damages		Yes	Yes	N	N
Ohio	Director of Highways	Yes	T	S	Yes	Yes	Yes	Amy Equip, Interstate Commerce not exceeding 20 miles inside state Str Materials of Tel and Tel Co's		Yes-4	Yes-5	N	N
Oklahoma	Commissioner of Public Safety	N	T & B	S	N	Yes	Yes	Fire Appr, Poles, Pipe & Well Drilling Equip		Yes	N	N	N
Oregon	State Highway Commission	Yes	T & B	T-7 B-S	Yes	Opt	Yes	Farm Impl		Yes	Yes	N	N
Pennsylvania	Secretary of Highways	Yes	T	S	Opt.	Yes	Yes	Logs, poles or piling allowed a 10 percent tolerance		Yes	Yes	90	90
Rhode Island	Registry of Motor Vehicles	Yes	T & B	S	Opt	Opt	N		Blanket permits on Quarry equip Limit 1/2 mile	Yes	N	N	N
South Carolina	State Highway Department	Yes	T	S	Opt	Yes	Yes	Fire Appr, Govt Veh & Arms, Road Equip & Farm Impl	This legal function of Reg of h. Veh (has always been delegated to Dept of Pub Works, Div of Roads & Bridges)	Yes	Yes	N	N
South Dakota	State Highway Commission	Yes	T	Opt	Opt	Yes	Yes			Yes	Yes	N	N
Tennessee	Commissioner of Safety	N	T	N	N	Yes	Yes	City, County, State & Govt owned vehicles, Farm Impl		Yes	N	N	N
Texas	State Highway Department	Yes	T	90	Yes	Yes	Yes	Farm Impl, Water well Drilling Constr & Maint Equip		Yes	Yes	N	N
Utah	State Road Commission	Yes	T & B	S	Opt	Yes	Yes	Farm Impl, poles & pipes	Oversize permits issued by State Highway Patrol	Yes	Yes	90	90
Vermont	State Highway Commissioner	N	B	Mar 31	Yes	Yes	N	Maint Equip & Constr Equip on Projects		Yes-6	Yes-6	N	N
Virginia	State Highway Commission	Yes	T & B	S	Yes-7	Yes	Yes	Farm Impl		Yes	Yes	90	90
Washington	Director of Highways	Yes	T	S	Opt	Yes	Yes		30 day permits issued for over-size	Yes	Yes	N	N
West Virginia	State Road Commission	N	T	S	Opt	Yes	Yes	Farm trucks & Impl, Fire Appr, Snow Plows & Street Sweepers	Blanket permits issued annually to Utility Co's for poles, pipes, etc	Yes	Yes	90-1	90-1
Wisconsin	State Highway Commission	Yes	T & B	S	Opt	Yes	Yes			Yes	Yes	N	N
Wyoming	State Highway Superintendent	Yes	T	S	N	Yes	Yes			Yes	N	N	N
District of Columbia	Director of Highways	N	T & B	S	\$50	Yes	Yes			Yes	N	N	N

N - Not specified in the law Opt - Optional S - Stated on permit 1 - Local authorities only 2 - Commercial vehicles over 4 tons 3 - Town & County Roads Mar 20 to May 15 4 - Not over 25 percent 5 - Not over 50 percent
6 - Not less than 20,000 lbs 7 - Over-weight Loads only 8 - During Mar April and May or when conditions warrant maximum allowable axle load shall be reduced by 25% on concrete pavements or pavements with concrete base, on all other types by 35%

The amount of the load that may be transported is left to the discretion of the authorities in most states. In one state, however, the law establishes a minimum limit of 4 tons for commercial vehicles, in another a 20,000 lb. limit is prescribed, while still another state provides a reduction not to exceed 25 percent on state roads and not over a 50 percent reduction on the county system.

See Table No. 11 for complete tabulation by States of load permits and load restrictions on highways.

FORM 564-16M-3-49-8613

IOWA STATE HIGHWAY COMMISSION

Single Trip Permit for Construction Equipment and Materials or for Equipment Manufactured Within the State of Iowa

Permit Engineer
Division Maint. Engr., or
Resident Engineer
Iowa State Highway Commission

.. . . . , Iowa

Dear Sirs:

Application is hereby made for a single trip permit to cover the movement of vehicle or combination of vehicles and load as follows:

VEHICLE Owned by of

Make	Model	License No. 19 . . .	Class of License

TRAILER or SEMI-TRAILER Owned by of

Make	Model	License No. 19 . . .	Class of License

LOAD Owned by of

Make Kind Model







(Show kind, dimensions, quantity, etc. If mounted on own chassis indicate number of axles, tire equipment, whether loaded or towed)

Application is made for movement over the following route Move will be completed prior to 19 . . .

Road No.	From	To	No. Road	From	To

a total distance of miles Travel Time Required for the Trip Hours.

OVERALL DIMENSIONS Width Ft Height Ft Length Ft

	Axle 1	Axle 2	Axle 3	Axle 4	Axle 5	Axle 6
Tire Size						
Tire Type Pneum or Solid						
Axle Spacing						

Gross Weight. Lbs. (Including vehicle and trailer.)

I, the
Name of Individual Official Title

for of
Name of Hauling Contractor Address of Hauling Contractor

do solemnly swear that I have read the foregoing application and all statements and data contained herein are true and correct.

Signature of Authorized Agent

Subscribed and sworn to before me this day of , 19

TO WHOM IT MAY CONCERN: Permission is hereby granted
for the operation of vehicle described on the reverse side of this permit and over the route also described there. This permit allows non-compliance with Chapter 134, Acts of the 47th General Assembly as amended, in the following respects:

Maximum width Ft. Maximum height Ft. Maximum length Ft.

Front end projection Ft.

Gross load on axle No to axle No. inclusive. Lbs. Gross load on all axles Lbs.

Permission for above gross load (in excess of maximum load permitted by Section 321.463, Code 1946) shall not be construed as permission to operate a vehicle not properly licensed.

For operation of four-wheel trailer (Yes or no) Metal Tires (Yes or no)

This permit shall expire at sunset , 19

Approved , 19

IOWA STATE HIGHWAY COMMISSION.

By
Division Maint. Engr.
Resident Engineer.
Permit Engineer.

Approval of this permit is granted subject to compliance with the following stipulations:

1. Approval of the application conveys no authority for movement over any extension of any primary road; over any other city or town or over any secondary road.
2. Maintain proper licenses on all vehicles for which licenses are required.
3. Maintain in good working condition, all lights and brakes as provided by law.
4. Maintain and operate all equipment and loads covered by this permit in accordance with all requirements of the Motor Vehicle Law and all other laws which may be applicable thereto.
5. Comply with all the rules and regulations of the Iowa Highway Commission which have been or which may be hereafter adopted relative to the use of primary roads for the movement of special vehicles or objects.
6. No movement will be made on Saturday, Sunday or holidays or between sunset and sunrise
7. That the State and the Iowa State Highway Commission shall assume no responsibility for the applicant's property.
8. That during the moving of said object, the applicant shall take all reasonable precaution to protect and safeguard the lives and property of the traveling public and adjacent property owners and shall save the State and the Iowa State Highway Commission harmless of any damage or losses that may be sustained by the traveling public or adjacent property owners on account of such moving.
9. That the applicant shall hold the State and the Iowa Highway Commission harmless from any damages that may result to said highway because of the moving of said object and shall reimburse the State or the Iowa State Highway Commission for any expenditure that the State or Iowa State Highway Commission may have to make on said highway on account of said applicant's moving operations.
10. That nothing in this permit shall be construed as waiving any load limitation which has been, or which might be, established on any bridge.
11. That nothing in this permit shall be construed as waiving any load limitation which has been, or which might be, established by the posting of embargo signs on any road.

This application must be filed in triplicate with the Div. Maint. Engr., or Resident Engr. of the Iowa State Highway Commission. Original copy for applicant, one for Permit Engineer, and one for Div. Maint. Engr.

Permit No.

IOWA STATE HIGHWAY COMMISSION
Blanket Permit for
Construction Equipment and Materials or for
Equipment Manufactured Within the State of Iowa or for
Objects of a Uniform Nature

Suspended.....

Revoked.....

Reinstated.....

Iowa State Highway Commission

Ames, Iowa

Dear Sirs:

Application is hereby made for a blanket permit to cover the movement over any primary road in Iowa of the following vehicle or combination of vehicles and load entirely owned by the undersigned:

TRUCK-TRACTOR: Make..... Model.....

License Data	Year.....	Period.....	Number.....	Class.....
	Year.....	Period.....	Number.....	Class.....
	Factory No.		Motor No.	

TRAILER: Make..... Model.....

License Data	Year.....	Period.....	Number.....	Class.....
	Year.....	Period.....	Number.....	Class.....
	Type of Trailer.....			

LOAD:

Overall Dimensions: Width..... Ft. Height..... Ft. Length..... Ft.

Empty Weight..... Lbs. Maximum Pay Load..... Lbs. Gross Weight..... Lbs.

	Axle 1	Axle 2	Axle 3	Axle 4	Axle 5	Axle 6
Tire Type						
Brake Type						
Axle Spacing						

I, the
Name of Individual Official Title
for of
Name of Company Address of Company

do solemnly swear that I have read the foregoing application and all statements and data contained herein are true and correct.

.....
Signature of Authorized Representative

Subscribed and sworn to before me this..... day of....., 19.....

.....
Notary Public in and for..... County

TO WHOM IT MAY CONCERN: Permission is hereby granted-----
for the operation of vehicles described on the reverse side of this permit, and allows non-compliance with Chapter 134, Acts of the 47th General Assembly as amended, in the following respects.

Maximum width Ft. Maximum height Ft. Maximum length Ft.

Gross load on axle No. to axle No. inclusive Lbs. Gross load on all axles Lbs.

Permission for above gross load (in excess of maximum load permitted by Section 5035.12) shall not be construed as permission to operate vehicle not properly licensed

Front end projection Ft. For operation of four-wheel trailer Metal Tires (Yes or no) (Yes or no)

This permit shall expire at sunset , 19 .

IOWA STATE HIGHWAY COMMISSION

Approved-----, 19-----

By-----
Chairman
Permit Engineer

Approval of this permit is granted subject to compliance with the following stipulations:

1. Approval of this application conveys no authority for movement over any extension of any primary road; over any other city or town street or over any secondary road.
2. Maintain proper licenses on all vehicles for which licenses are required.
3. Maintain in good working condition, all lights and brakes as provided by law.
4. Maintain and operate all equipment and loads covered by this permit in accordance with all the requirements of the Motor Vehicle Law and all other laws which may be applicable thereto.
5. Comply with all the rules and regulations of the Iowa State Highway Commission which have been or which may be hereafter adopted relative to the use of primary roads for the movement of special vehicles or objects
6. No movement will be made on Saturday, Sunday or holidays or between sunset and sunrise.
7. That the State and the Iowa State Highway Commission shall assume no responsibility for the applicant's property.
8. That during the moving of said object, the applicant shall take all reasonable precaution to protect and safeguard the lives and property of the traveling public and adjacent property owners and shall save the State and the Iowa State Highway Commission harmless of any damages or losses that may be sustained by the traveling public or adjacent property owners on account of such moving.
9. That the applicant shall hold the State and the Iowa State Highway Commission harmless from any damages that may result to said highway because of the moving of said object and shall reimburse the State or the Iowa State Highway Commission for any expenditure that the State or Iowa State Highway Commission may have to make on said highway on account of said applicant's moving operations.
10. That nothing in this permit shall be construed as waiving any load limitation which has been, or which might be established on any bridge.
11. That nothing in this permit shall be construed as waiving any load limitation which has been, or which might be, established by the posting of embargo signs on any road

This application must be filed in duplicate with the Iowa State Highway Commission at Ames, Iowa. Original copy for applicant, duplicate for Highway Commission.

IOWA STATE HIGHWAY COMMISSION

Single Trip Permit for Buildings

Iowa State Highway Commission

....., Iowa

Dear Sirs:

Application is hereby made for a single trip permit to cover the movement of vehicle or combination of vehicles and load as follows

VEHICLE TRUCK or TRACTOR. Owned by of

Make	Model	License No. 19----	Class of License	Tires Indicate Which)	
				Solid Pneumatic	Smooth Steel Steel with Lugs

TRAILER or SEMI-TRAILER. Owned by of

Make	Model	License No. 19----	Class of License	Tires	
				Solid Pneumatic	

BUILDING Owned by of

Kind of Building Size No Stories No. Rooms
(Dwelling, Garage, Store, etc.)

HOUSE MOVING TRUCKS: Owned by of

Application is made for movement over the following route

Road No.	From	To	Road No.	From	To

a total distance of Miles. Time Required for Trip Hours. Move will be completed prior to, 194.....

Show Special Provisions Below

I, the
Name of Individual Official Titlefor of
Name of Moving Contractor Address of Moving Contractor

do solemnly swear I have read the foregoing application and all statements and data contained herein are true and correct.

.....
Signature of House Mover

Subscribed and sworn to before me this day of 19.....

Approved, 19.....

Notary Public in and for County

IOWA STATE HIGHWAY COMMISSION

By
Div Maint. Engr
Permit Engineer

(Seal)

Notary Public

Approval of this permit is granted to compliance with the following stipulations:

1. Approval of the application conveys no authority for movement over any extension of any primary road; over any other city or town street or over any secondary road.
2. Maintain proper licenses on all vehicles for which licenses are required.
3. Maintain in good working condition, all lights and brakes as provided by law.
4. Maintain and operate all equipment and loads covered by this permit in accordance with all requirements of the Motor Vehicle Law and all other laws which may be applicable thereto
5. Comply with all the rules and regulations of the Iowa State Highway Commission which have been or which may be hereafter adopted relative to the use of primary roads for the movement of special vehicles or objects
6. No movement will be made on Saturday, Sunday or holidays or between sunset and sunrise.
7. That the State and the Iowa State Highway Commission shall assume no responsibility for the applicant's property.
8. That during the moving of said object, the applicant shall take all reasonable precaution to protect and safeguard the lives and property of the traveling public and adjacent property owners and shall save the State and the Iowa State Highway Commission harmless of any damages or losses that may be sustained by the traveling public or adjacent property owners on account of such moving.
9. That the applicant shall hold the State and the Iowa State Highway Commission harmless from any damages that may result to said highway because of the moving of said object and shall reimburse the State or the Iowa State Highway Commission for any expenditure that the State or Iowa State Highway Commission may have to make on said highway on account of said applicant's moving operations.
10. That nothing in this permit shall be construed as waiving any load limitation which has been, or which might be, established on any bridge.
11. That nothing in this permit shall be construed as waiving any load limitation which has been, or which might be, established by the posting of embargo signs on any road.

BUILDING SPECIFICATIONS

(Must be used for all buildings over 14 feet in width)

This application must be filed in triplicate with the Iowa State Highway Commission, Ames, Iowa. Original copy for applicant, two copies for Highway Commission.

EXHIBIT 3-A (Back of Form 564C)

Form 1055 Rev 7/64M 4-49

SUBMIT ALL COPIES FOR PERMIT

STATE OF MINNESOTA
DEPARTMENT OF HIGHWAYS

*REGISTRATION NO'S.

Truck	Trailer
Load	Trailer Equip
Not Registered	Check

APPLICATION FOR TRANSPORTATION PERMIT

TO, COMMISSIONER OF HIGHWAYS

(MUST BE FILLED OUT BY APPLICANT—PRINT OR TYPE)

Permission is hereby requested to move the following described vehicle or combination of vehicles of size or weight of vehicle or load exceeding legal limitations or otherwise not in conformity with the Highway Traffic Regulation Act.

VEHICLE AND LOAD INFORMATION

VEHICLE OR TOWING VEHICLE				TOWED VEHICLE		NATURE OF LOAD OR TRAILED EQUIPMENT	
CHECK TYPE	Truck	Truck Tractor	Tractor	Semi-Trailer	Trailer	Object or Material or Trailed Equipment	
Name and Capacity				Name and Capacity		Type and Model Number—Capacity	
Type of Brakes				Type of Brakes		Weight of Load or Trailed Equipment	
License Number				License Number		Type of Brakes on Trailed Equipment	
Empty Weight				Empty Weight			

Proposed Method of Movement (Check)—Loaded ☐ Trained ☐ Load Consist of Pieces

DIMENSION INFORMATION (Show Dimensions Which Exceed Legal Limitations)

VEHICLE OR TOWING VEHICLE		TOWED VEHICLE OR TRAILED EQUIPMENT		OVERHANG				OVERALL DIMENSIONS VEHICLE & LOAD		
	Feet	Inches	Feet	Inches	Feet	Inches	Feet	Inches	Feet	Inches
Width					Left	Right				
Height										
Length					Front	Rear				

WEIGHT - SPACING - TIRE INFORMATION - (BY AXLES)

VEHICLE OR TOWING VEHICLE		TOWED VEHICLE OR TRAILED EQUIPMENT						
		GIVE ALL DATA FOR TOWING VEHICLE AND TOWED OR TRAILED VEHICLE—FRONT TO REAR						
Axles		1	2	3	4	5	6	7
Type & Number of Tires								
Tires—Size								
Lbs.—Empty	Must Be Given if Overweight							
Lbs.—Loaded								
Spacing Between Axles								

I (we) request permission to move the above described vehicle(s) or vehicle or load which exceed the following legal limitations or are otherwise not in conformity with the Highway Traffic Regulation Act. (See Legal Dimensions and Weight Limitations Reverse Side Blue Copy.)

(Check) Overwidth Overheight Overlength Overhang Overweight Unequal Distribution of Weight No Brakes Towing Others—Describe

Movement to be from to

Via Trunk Highway Numbers

Total No. Miles

Movement to Be During Dates of

Hours of Day

A.M.
P.M.

I (we) understand that a permit does not authorize or does not in any way apply to the use of license plates and has no effect on the motor vehicle registration or motor vehicle tax laws.

If granted this permit I (we) do hereby agree to comply with provisions of the permit to take all necessary and reasonable precautions to maintain the safety of this movement and to be responsible for all liability for personal injury or property damage which may occur in connection with this movement, and in the event any claim is made against the State of Minnesota or division, officer, or employee thereof, through, by reason of, or in connection with any such act or omission applicant shall indemnify and hold them and each of them harmless from such claim.

Further, if granted this permit, I (we) do hereby agree to repair at my (our) own expense and to the satisfaction of the Commissioner of Highways, damage to the highways or structures thereon. Work of repair may be done by the Department of Highway forces at the option of the Commissioner of Highways. Cost is to be borne by the applicant.

I (we) also do hereby agree to comply with all regulations, provisions, and limitations which apply to this movement if permission is granted.

*Permission for movement over roads other than trunk highways must be obtained from local authorities under whose jurisdiction such roads come.

Owner of Moving Equip

Address

Applicant

(Signature)

Owner of Load

Address

Address

(APPLICANT DO NOT WRITE BELOW THIS LINE)

Dist. No.

TRANSPORTATION PERMIT

Permit No.

(PERMIT NOT VALID UNLESS BEARING SIGNATURE AND NUMBER)

PERMISSION FOR THIS MOVEMENT IS HEREBY GRANTED TO:

Subject to compliance with the provisions of the Minnesota Highway Traffic Regulation Act and under the terms, conditions, and restrictions contained below and on the reverse side of this permit and is subject to revocation upon non-compliance.

(Dimensions which exceed legal limitations and/or Total Weight MUST be given—)

Overwidth	Overheight	Overlength	Overhang	Overweight	Unequal Distribution of Weight	No Brakes	Towing	Others—Describe
								A.M. _____ P.M. _____, 19____

On dates and routes shown on application or as indicated

Via Trunk Highways

Special Requirements. (As Indicated or Checked on Reverse Side.)

THIS PERMIT TO BE CARRIED ON VEHICLE DURING THE ABOVE MENTIONED MOVEMENT

MINNESOTA DEPARTMENT OF HIGHWAYS

Dated _____, 19____, at _____ A.M.
P.M.

Authorized by

SEE REVERSE SIDE FOR REGULATIONS AND REVERSE SIDE OF BLUE COPY FOR APPLICATION LIMITATIONS.

Copies to be distributed as follows: White Copy to Applicant, Yellow, Central Office, Blue, Patrol; Pink, Dist Maint Engineer.

**PERTINENT REGULATIONS UNDER HIGHWAY TRAFFIC ACT
(PUBLIC SAFETY)**

1. **SAFETY OF OTHER TRAFFIC**—Care should be taken at all times to protect the traveling public.
2. **RIGHT OF WAY**—Yielding of right of way—When being passed by vehicles traveling in either direction no portion of equipment or vehicles shall extend beyond the center line of pavement or traveled way.
3. **PARKING ON HIGHWAY**—In case of a breakdown of vehicles or equipment the same shall be moved off of the highway right of way. In the event breakdown is such that they cannot be moved flags and flares must be placed as required by law.
4. **STOP AT RAILROAD CROSSINGS**—Complete stop required at all railroad grade crossing approaches by vehicles having in tow any other vehicle or any vehicle of the tractor or caterpillar type.

SPECIAL PROVISIONS—(PUBLIC SAFETY)

5. **PROTECTION ON BRIDGES OR NARROW ROADS**—When crossing bridges or when traveling on narrow roads where it is not possible to permit movement of two-way traffic flagmen shall be stationed ahead and behind of equipment to warn and direct approaching traffic.
6. **INCLEMENT WEATHER AND HIGHWAY SURFACE CONDITIONS**—Movement shall not be commenced if visibility is poor or if highway surfaces are continuously slippery. If movement has been started and the above mentioned conditions develop movement must be stopped until the condition becomes alleviated or permission to proceed has been obtained.
7. **DAYTIME MOVEMENT**—Movement shall be during daylight hours only unless specifically stated on the face of this permit.
8. **SATURDAY-SUNDAY-HOLIDAY MOVEMENT**—Unless specifically stated on the face of this permit there shall be no movement on Saturday, Sunday, or holidays.
9. **TRAILER HITCH**—Trailers are to be hitched so that they track on turns and do not whip.
10. **CLEANING UP AFTER MOVEMENT**—After movement has been completed and especially where it has been necessary to plank structure floors or where movement has been made over railroad crossings with tractor type equipment all foreign materials must be removed from the highway right of way or from railroad tracks.
11. **OVERHANG**—In case of overwidth of material loaded the same is to be placed on the vehicle as far as possible to the right so as to present the minimum hazard to traffic.
12. **FLAGS - FLARES - LIGHTS AND REFLECTORS**—Must comply with legal requirements.
 - A. On all loads extending 4 feet in rear of vehicle—display red flags at least 16 inches square.
 - B. On all chain, rope or cable connections—display white flag 12 inches square.
 - C. On all overwidth loads and on disabled vehicles—display orange or yellow flags 24 inches square.
13. **BRAKE REQUIREMENTS**—All requirements as to brakes and method of use to be complied with in accordance with the Highway Traffic Act except as otherwise stated on the face of the permit.

**PERTINENT REGULATIONS UNDER HIGHWAY TRAFFIC ACT
(ROADWAY AND BRIDGES)**

14. **RESPONSIBILITY FOR STRUCTURES**—(Bridges or underpasses)—The permittee shall comply with all rules posted on any bridges or underpasses over or under which he shall travel, and shall assume all risks relative thereto. When a power shovel is moved under its own power over asphaltic surface bridges, running planks of sufficient strength to protect the surface must be used under the shovel tracks.
15. **RESTRICTED ROADS**—Movement over restricted roads in excess of posted limits not permitted.
16. **TRAILED EQUIPMENT OR MACHINERY**—In trailing plows, discs and similar equipment or machinery care shall be used that implements do not cut or damage the road surface.

RESPONSIBILITY

17. **LIABILITY FOR DAMAGES**—The permittee is responsible for all liability for personal injury or property damage which may occur in connection with this movement, and in the event any claim is made against the State of Minnesota, or any department, officer, or employee thereof, through, by reason of, or in connection with any act or omission, permittee shall defend, indemnify and hold them and each of them harmless from any claim.
18. **REPAIR OF DAMAGE**—In accepting this permit, the permittee agrees to repair at his (their) own expense and to the satisfaction of the Commissioner of Highways any damage to highways or structures. Work or repair may be done by the Division of Highway forces at the option of the Commissioner of Highways. Cost of such work is to be borne by the permittee.
19. **LICENSE PLATES AND MOTOR VEHICLE REGISTRATIONS**—Vehicles shall be licensed in accordance with the laws of the State of Minnesota.

TIME LIMIT

20. Time of movement shall be during the dates as specified on the face of this permit. If extension of time is necessary in order to permit completion of movement, written authorization of such extension of time must be obtained. This permit must be carried on the towing vehicle at all times during movement and is subject to inspection.

APPLICATION FOR SPECIAL HAULING PERMIT

Special Hauling Permit Fees

County _____	Issuance	\$ 5.00
Route No(s). _____	Ton-mile or fraction @ \$ 02	\$ _____
	Total	\$ _____
	*Credits applied (credit No. _____)	\$ _____
	Check or money order	\$ _____

Pennsylvania Department of Highways

** _____, Pa. _____ Date _____ 19____

Application is hereby made by _____
(name of applicant)of _____, to haul or move _____
(post office address) (material to be moved or hauled)on _____ beginning _____ 19____
(truck, trailer, semi-trailer or combination)

and ending _____ 19____ (not to exceed five days) from _____

to _____ via _____ being a distance

of _____ miles, over State highway route(s) _____ in the county of

_____, based upon the following facts:

Weight of load _____ lbs.; weight of truck _____ lbs.; weight of tractor _____ lbs.

weight of trailer _____ lbs.; weight of semi-trailer _____ lbs.; combined weight of vehicles

and load _____ lbs.

Truck or tractor license number _____; registered in the state of _____

Trailer license number _____; registered in the state of _____

Semi-trailer license number _____; registered in the state of _____

Width of empty trailer or semi-trailer _____ inches.

Maximum over-all dimensions: Length _____ feet; height _____ inches, width _____ inches.

Under and subject to all and every the conditions, restrictions and regulations prescribed by "The Motor Code" and/or "The Tractor Code," their supplements and amendments, which form a part hereof, and under and subject to the general and special conditions, restrictions, and regulations of the Pennsylvania Department of Highways in such cases made and required.

I, the undersigned, hereby certify that I have read the rules and regulations printed on the reverse of this form, and have made satisfactory arrangements with the proper authorities to cross all structures not under the jurisdiction of the Department of Highways and which are located on the State highway routes described above.

(Name of the applicant in full)

* Credit memorandum must be attached to the application

** Use mailing addresses shown on reverse

Where oversize equipment is to carry the load for part of the distance only, give particulars in the space above

If a round trip permit is desired, this must be stated in the space above

GENERAL CONDITIONS

1 The authority conferred by any special hauling permit will not give the holder thereof the right to move over highways or bridges under the jurisdiction of the county, city, borough, or township officials, nor over railroads or railways, except as hereinafter provided, nor to use or damage private property in any way. The permittee shall comply with all rules posted on any bridge or road traversed. Any damage caused directly or indirectly to the improved road surface, or to any bridge or other structure maintained by the Department of Highways, by the operation of the vehicle shall be restored by the Department of Highways at the expense of the permittee.

2 Nothing contained in the special hauling permit shall be construed to confer authority upon the permittee to cross or attempt to cross any bridge or other structure other than those under the control and jurisdiction of the Department of Highways, and for which the Commonwealth is responsible for construction and maintenance; nor the right to cross any bridge or structure, or any railroad or railway tracks, at grade, until after due and sufficient notice of such proposed crossing shall have been given to the authorities responsible for the construction and maintenance of the bridge or structure, or to the track supervisor or other authorized agent of the railroad or railway company and proper arrangements made for such crossing, provided, however, that any damage caused to any such bridge or other structure by the operation of the vehicle shall be the responsibility of the permittee.

3 The special hauling permit, white copy marked Original, shall be carried in the vehicle to which it refers, and shall be open for inspection by any peace officer or employee of the Department of Highways of this Commonwealth, or person having collision with vehicle.

4 Permittee shall give strict attention to safety and rights of public travel and shall yield right of way to passing vehicles in either direction. When crossing narrow bridges or on narrow roads and the equipment or load extends over center line of road, a flagman shall be posted behind and ahead properly to warn and direct approaching traffic.

5 The treads of heavy equipment are to be kept at least two feet from the edge of the pavement. Steel-rimmed equipment weighing more than thirteen tons and less than twenty tons moving under its own power shall be moved on two-inch plank mats at least six inches wider than the treads of the wheels or caterpillars of the equipment. Equipment weighing twenty tons and over shall be moved on mats not less than three inches in thickness and at least twelve inches wider than the treads.

6 Saturday afternoon, Sunday, and holiday movements are prohibited except in emergency cases.

7 The special hauling permit granted restricts the movement of the equipment to the highways mentioned in the permit and is good for only a single trip in one direction between points designated, and does not include the return of the vehicle to its place of starting unless a round trip permit was requested and issued in the first instance. Otherwise an additional permit will be required for the return of an oversize vehicle. The authorized movement shall be made within the allotted time unless extended by the Department of Highways.

8 The fees for a special hauling permit shall be Five (\$5.00) Dollars, plus Two (\$.02) Cents a ton of two thousand (2,000) pounds or fraction thereof of gross weight of vehicle and load in excess of the legal carrying capacity for which such vehicles or combination of vehicles have been properly registered for each mile or fraction thereof of length of haul.

9 The gross weight is the combined weight of the vehicle or combination of vehicles and its or their load or loads.

10 Where a combination of units consists of a licensed truck-tractor and an over-sized or unlicensed semi-trailer, only the legal gross carrying capacity of the truck-tractor shall be deducted from the gross weight of the combination of vehicles and the load in determining the excess weight. An over-sized or unlicensed semi-trailer, when moved without load, shall be considered as a single unit, and in computing the special hauling permit fee, the per ton mile rate shall be based on the unladen weight of the semi-trailer, without any deduction for the legal gross weight carrying capacity of the licensed truck-tractor.

11 The requirements of the motor or tractor code shall be complied with in all particulars, except as herein provided.

GENERAL INSTRUCTIONS

Only one application is required for each movement. Allow two days from date of mailing to provide time needed for investigation.

The prescribed fee shall accompany the application. The payment of fee shall be made by certified check or money order and shall be made payable to the Pennsylvania Department of Highways. Postal money orders shall be made payable at the Harrisburg Post Office.

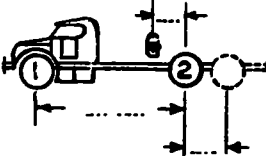
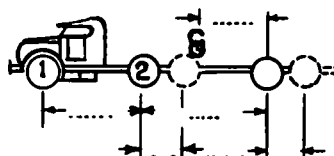
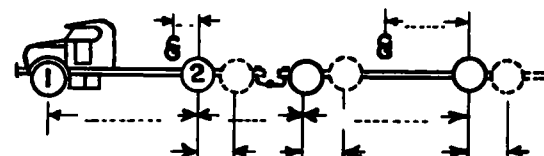
MAILING INSTRUCTIONS

All applications shall be forwarded to the mailing addresses shown as follows:

For Permits in County of	Use Mailing Address Number	For Permits in County of	Use Mailing Address Number	For Permits in County of	Use Mailing Address Number
Adams	8	Elk	2	Montgomery	8
Allegheny	11	Erie	1	Montour	8
Armstrong	10	Fayette	12	Northampton	8
Beaver	11	Forest	1	Northumberland	8
Bedford	9	Franklin	8	Perry	8
Berks	5	Fulton	9	Philadelphia	6
Blair	9	Greene	12	Pike	4
Bradford	4	Huntingdon	9	Potter	2
Bucks	6	Indiana	10	Schuylkill	5
Butler	10	Jefferson	10	Snyder	8
Cambrid	9	Junata	8	Somerset	12
Cameron	2	Lackawanna	4	Sullivan	8
Carbon	8	Lancaster	8	Susquehanna	4
Centre	2	Lawrence	1	Tioga	8
Chester	6	Lebanon	8	Union	8
Clarion	10	Lehigh	5	Vanango	1
Clearfield	2	Luzerne	4	Warren	1
Clinton	2	Lycoming	8	Washington	12
Columbia	8	McKean	2	Wayne	4
Crawford	1	Mercer	1	Westmoreland	11
Cumberland	8	Mifflin	9	Wyoming	4
Dauphin	5	Monroe	8	York	8
Delaware	6				

MAILING ADDRESSES

1. Pa. Dept. of Highways, Galena Bldg., Liberty & 80 Park Ave., Franklin, Pa.
2. Pa. Dept. of Highways, Clearfield Trust Building, Clearfield, Pa.
3. Pa. Dept. of Highways, Heyman Bldg., 28 E. Third Street, Williamsport, Pa.
4. Pa. Dept. of Highways, 959 Wyoming Ave., Scranton, Pa.
5. Pa. Dept. of Highways, Lyric Theatre Bldg., 25 N. 6th St., Allentown, Pa.
6. Pa. Dept. of Highways, 7 E. Lancaster Ave., Ardmore, Pa.
7. Pa. Dept. of Highways, 21st & Herr Sts., Harrisburg, Pa.
8. Pa. Dept. of Highways, Stultz Bldg., 226 Allegheny St., Hollidaysburg, Pa.
9. Pa. Dept. of Highways, Savings Trust Bank Bldg., Indiana, Pa.
10. Pa. Dept. of Highways, Wabash Bldg., Liberty Ave. & Ferry St., Pittsburgh, Pa.
11. Pa. Dept. of Highways, Fayette Title & Trust Bldg., Main & Pittsburgh Sts., Uniontown, Pa.
12. Pa. Dept. of Highways, Fayette Title & Trust Bldg., Main & Pittsburgh Sts., Uniontown, Pa.

Form 936-A(Suppl.) Commonwealth of Pennsylvania	SUPPLEMENTAL DATA TO ACCOMPANY APPLICATION FOR SPECIAL HAULING PERMIT WHEN GROSS LOAD IS IN EXCESS OF FORTY (40) TONS	Department of Highways				
Application of _____ <div style="display: flex; justify-content: space-around; width: 100%;"> (Name of Applicant) (Address) </div>						
to move _____ (Describe object to be hauled. Give make and model of equipment)						
Weighing _____ pounds, from _____ (Manufactures' Shipping Weight)						
to _____ over the following Pennsylvania State Highway Routes: _____ (Give destination on each route)						
Vehicle(s) to be used _____ (Truck, truck and trailer, tractor and semi-trailer)						
<p style="text-align: center;">THE OBJECT OR OBJECTS TO BE MOVED ON THE VEHICLE OR COMBINATION OF VEHICLES AS INDICATED ON SKETCH BELOW (G = APPROXIMATE CENTER OF GRAVITY OF OBJECT)</p> <div style="display: flex; justify-content: space-around; align-items: flex-end;">    </div> <p>Select sketch most nearly conforming to the type of vehicle or combination of vehicles to be used. Number the axles consecutively, front to rear, giving spacing in dimension lines provided. Show the approximate location of the center of gravity of the object with respect to axles. Mark out sketch or parts thereof not applicable.</p>						
Axle Number (See sketch)	Axle Weight Due to vehicle only (pounds)	Axle Weight Due to object only (pounds)	Total Axle Weight due to Vehicle and Object(pounds)	Number of Wheels	Tire Data	
					Size	Tire Width Per Axle
1						
2						
3						
4						
5						
6						
TOTALS						
Tabulate information relative to weights on axles and tire sizes. All wheels in a straight transverse line constitute an axle.						

The undersigned hereby certifies that the data submitted in the foregoing are correct to the best of his knowledge and belief.

Date _____ 19 ____ Signature _____
 EXHIBIT 6 (Title)

**COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF HIGHWAYS
SPECIAL HAULING PERMIT**

Receipt is acknowledged of special hauling permit fees paid as follows:

County	Issuance	\$ 5.00
Route No(s).	Ton-mile or fraction @ \$.02	\$
	Total	\$
	Credits applied (credit No.)	\$
	Check or money order	\$

Permission is hereby granted to

(Name of Permittee)

of

(Post Office Address)

to haul or move

(Material to be Moved or Hauled)

on

(Truck, Trailer, Semi-trailer or Combination)

beginning

19

and ending

19

(not to exceed five days) from

to

via

being a distance

of

miles, over State highway route(s)

in the county of

, based upon the following facts:

Weight of load lbs.; weight of truck lbs.; weight of tractor lbs.
weight of trailer lbs.; weight of semi-trailer lbs.; combined weight of vehicles
and load lbs.
Truck or tractor license number ; registered in the state of
Trailer license number ; registered in the state of
Semi-trailer license number ; registered in the state of
Width of empty trailer or semi-trailer inches.
Maximum over-all dimensions: Length feet; height inches; width inches.

Under and subject to all and every the conditions, restrictions, and regulations prescribed by "The Motor Code" and/or "The Tractor Code," their supplements and amendments, which form a part hereof, and under and subject to the general restrictions and regulations of the Department of Highways in such cases made and required, and under and subject to the following special conditions:

The Secretary of Highways, or his duly appointed representative, may at any time revoke and annul this permit for non-performance of, or non-compliance with any of the conditions, restrictions and regulations hereof.

COMMONWEALTH OF PENNSYLVANIA

Secretary of Highways

Date

By

(Name and Title)

This copy cannot be used as authority to move any equipment or load of excess size or weight. It is for record purposes only. White copy marked Original must be furnished the permittee.

EXHIBIT 7 (Front of Form 936-P)

GENERAL CONDITIONS

1. The authority conferred by this permit does not give the holder thereof the right to move over highways or bridges which are under the jurisdiction of the county, city, borough, or township officials, nor over railroads or railways, except as hereinafter provided, nor to use or damage private property in any way. The permittee shall comply with all rules posted on any bridge or road traversed. Any damage caused directly or indirectly to the improved road surface or to any bridge or other structure maintained by the Department of Highways by the operation of the vehicle shall be restored by the Department of Highways at the expense of the permittee.

2. Nothing herein contained shall be construed to confer authority upon the permittee to cross or attempt to cross any bridge or other structure other than those under the control and jurisdiction of the Department of Highways and for which the Commonwealth is responsible for construction and maintenance; nor the right to cross any bridge or structure or any railroad or railway tracks, at grade, until after due and sufficient notice of such proposed crossing shall have been given to the authorities responsible for the construction and maintenance of the bridge or structure, or to the track supervisor or other authorized agent of the railroad or railway company and proper arrangements made for such crossing; provided, however, that any damage caused to any such bridge or other structure by the operation of the vehicle under this permit shall be the responsibility of the permittee.

3. The white copy of this permit marked Original shall be carried in the vehicle to which it refers, and shall be open for inspection by any peace officer or employe of the Department of Highways of this Commonwealth or person having collision with vehicle.

4. Permittee shall give strict attention to safety and rights of public travel and shall yield right of way to passing vehicles in either direction. When crossing narrow bridges or on narrow roads and the equipment or load extends over center line of road, a flagman shall be posted behind and ahead properly to warn and direct approaching traffic.

5. The treads of heavy equipment are to be kept at least two feet from the edge of the pavement. Steel-rimmed equipment weighing more than thirteen tons and less than twenty tons moving under its own power shall be moved on two-inch plank mats at least six inches wider than the treads of the wheels or caterpillars of the equipment. Equipment weighing twenty tons and over shall be moved on mats not less than three inches in thickness and at least twelve inches wider than the treads.

6. Saturday afternoon, Sunday, and holiday movements are prohibited except in emergency cases.

7. The permission granted restricts the movement of the equipment to the highways mentioned in the permit and is good for only a single trip in one direction between points designated, and does not include the return of the vehicle to its place of starting. An additional permit will be required for the return of an oversize vehicle.

8. The requirements of the motor or tractor code shall be complied with in all particulars, except as herein provided.

THE TRUCK WEIGHT PROBLEM IN HIGHWAY TRANSPORTATION
HIGHWAY RESEARCH BOARD

CHAPTER IV

Enforcement Policies and Practices, Including
Special Survey on Use and Acceptance of Portable Scales

Enforcement can complement or contravene the efforts of the engineer to provide structurally adequate and durable roads for their intended legal usage. In this respect enforcement policies and practices are as relevant to the problem of overweight vehicles as are the design policies. Because of the highly significant part that enforcement plays in the overweight problem it is deemed advisable to include a survey of policies and practices of the several state enforcement agencies with respect to overloads and overweights of commercial vehicles.

From the survey, which covered the whole of the United States, the most pertinent and significant facts are presented herewith. This report does not attempt to chart the multitudinous policies and practices of the several individual states, but rather attempts to summarize and analyze the data brought together.

CHIEF ENFORCEMENT AGENCY

In the majority of the states the agency upon which law enforcement pertaining to overloads and overweights devolves is the State police department, or as named in some States, the highway patrol. It is customary to delegate authority for enforcement to any peace officer but usually any sustained program of enforcement depends upon action at the state level. In some four or five States enforcement is committed to the motor vehicle department, which is primarily concerned with violation of registration laws, commonly called "overload violations" rather than with violation of maximum axle or gross load laws, commonly called "overweight violations."

METHOD OF APPREHENDING VIOLATORS

Thirty-five States weigh trucks at permanent weight stations placed at strategic locations on main trunk highways, such as at ports of entry and at natural gateways. In some instances stations are operated daily, but in most cases the stations are operated on an intermittent and irregular schedule, sometimes during the day, sometimes at night. Perhaps a station will be operated several days both day and night. It usually requires a minimum of four officers, or attendants, to operate a weight station with dispatch which poses a real problem to most State police departments.

In addition to weight station checking, virtually every State makes selected spot and selected hour checks. These so-called "spontaneous" checks are designed to give wide geographic coverage. Usually conducted by roving parties, either on a regional or state-wide basis, they inject the surprise element into enforcement and have been effective when used on a sustained basis.

In using either permanent weight stations or selected spot checks, some enforcement agencies spread out a cordon of portable weight stations on "escape routes" to prevent by-passing of the main station. These are referred to as "cordon stations," and are considered effective by these agencies.

Weigh bill checking in lieu of weighing is used by some enforcement agencies; however, this method is the exception rather than the usual.

In some States, in lieu of a program of systematic weighing, patrolmen make visual check of trucks along with their other routine duties and stop for weighing those which appear from load size or operating behaviour to be overweight. The patrolmen may then conduct the truck to state or commercial pit scales, or weigh it by portable scales.

EQUIPMENT USED IN APPREHENSION

A majority of the States are operating permanent weight stations employing pit scales. (See Figures 12, 13 and 14). One State operates 53 of these stations on a sustained basis, another State is equipping 20 pit scales for a sustained program of enforcement. Three States operate 15 stations daily. One State conducts an intensive program with 14 weight stations and another with 9 stations. The balance of the States have 8 or less permanent weight stations equipped with pit scales.

To supplement State owned pit scales most States use commercial pit scales as required. It is of interest to note that a limitation is set by law in a number of States with respect to the distance an officer may require a truck to be driven to a commercial pit scale. Nine States limit this distance to two miles, one State to three miles, while one specifies a five-mile limitation.

Thirty-nine States also use portable scales (loadometers) for weighing trucks. (See Figure 15). For detailed discussion of the extent of use and acceptance of portable scales see Appendix of this report. Some States have provided "loadometer pits" in the pavement at strategic locations as part of their enforcement program. (See Figure 16). A recent innovation is the use of two loadometers in a pit with a structural metal beam connecting the two scales and serving as a complete axle platform scale. (See Figure 17). The majority of loadometer operations are carried on by roving parties, however, and these parties, or details, work on irregular schedules, some on a regional, some on state-wide basis. The loadometer stations complement the permanent pit scale operations in obtaining a more comprehensive geographical coverage of the road system. One State reports 19 roving details, another 15. A few have questioned acceptance of the loadometer by the courts as a weighing device, and some enforcement agencies have complained of the irksome manual labor required in weighing truck combinations by portable scales. One jurisdiction is reluctant to make intensive use of portable scales because of the hazards of handling them around heavy trucks, and in another State it was stated that the use of portable scales had been discontinued due to the fact that an adjustment was required by the State Bureau of Weights and Measures after each day's use.

A portable one-axle type platform pit scale is now being manufactured. At the time this report was being compiled no State highway department had reported its use.



Figure 12 - Scale House in Operation on U. S. 24 near Erie, Monroe County, Michigan.
(Print furnished by Michigan State Highway Department.)

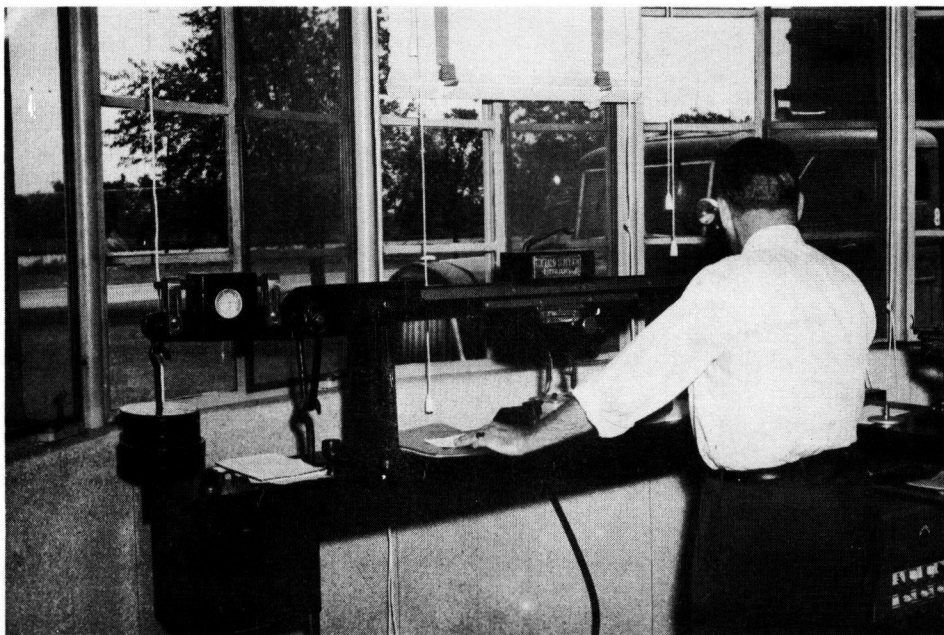


Figure 13 - Scale House (interior) in Operation on U. S. 24 near Erie, Monroe County, Michigan.
(Print furnished by Michigan State Highway Department.)

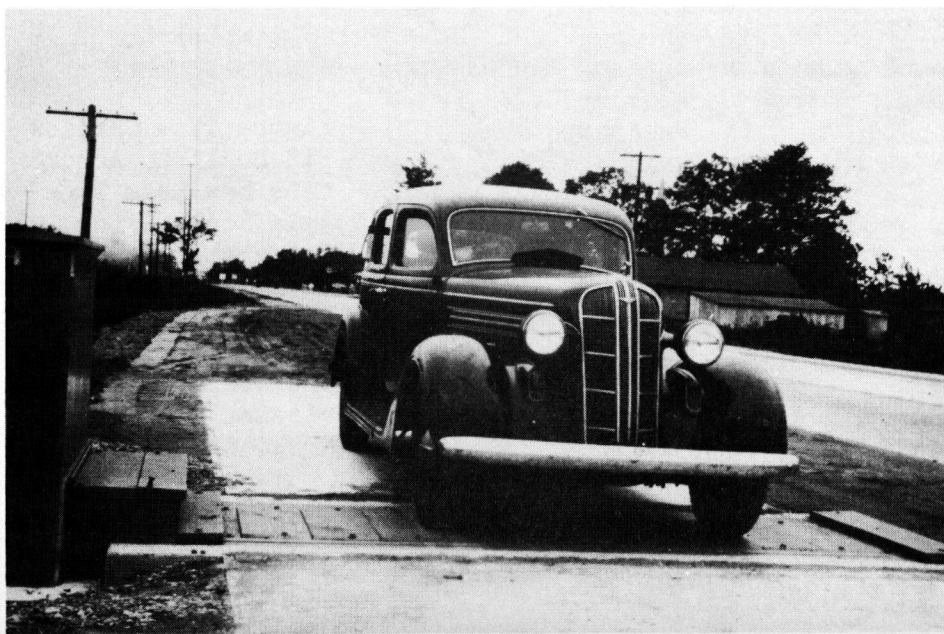


Figure 14 - Pit Scale for Weighing Axle Loads on U.S. 58, 3 miles East of Suffolk, Virginia.
Note concrete apron.
(Print furnished by Bureau of Public Roads.)



Figure 15 - Loadometer Party at Work in Pennsylvania. Simultaneous Weighing of Three Wheels. (Print furnished by Pennsylvania State Highway Department.)



Figure 16 - New-type Loadometer Installed in Shallow Pit for Weighing Wheel Loads at Ground Level. Route U. S. 60, West Corina, California. (Print furnished by Bureau of Public Roads.)

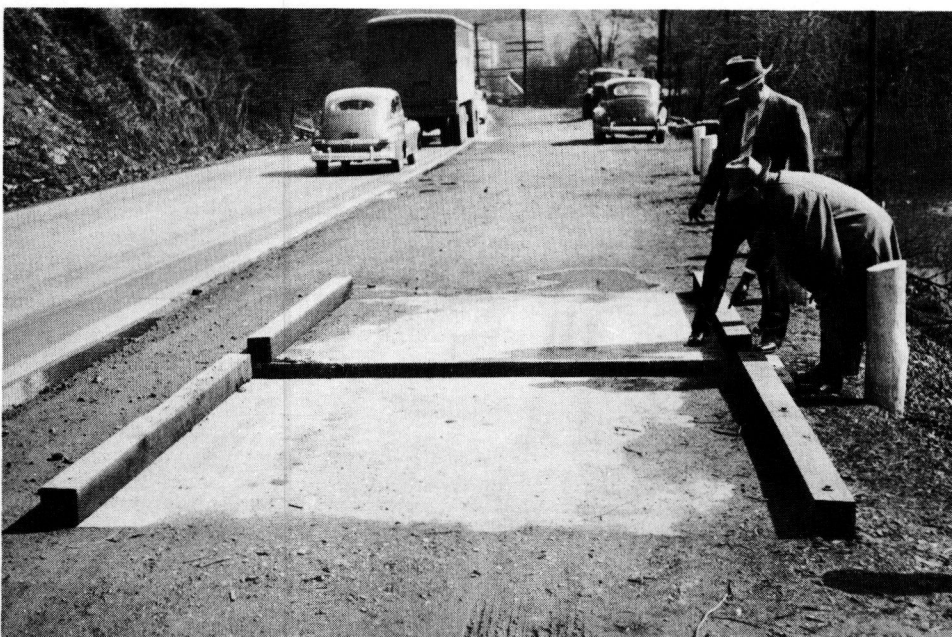


Figure 17 - Shallow Pit Built to Accommodate New Beam Type Axle Scale Using Two Loadometers. Route U. S. 119, Marmet, West Virginia. (Print furnished by the State Road Commission of West Virginia.)

TOLERANCES ALLOWED

Enforcement agencies in six States stated that no tolerance was allowed, and seven advised that for evident reasons no stated tolerance was published. Some few advised that judgment was used, and allowance is made by some states for accumulations of mud and ice. Thirty-two of the States, some by statutory authority and some by their own delegated authority, allow stipulated tolerances. These tolerances range from 0.5 to 10 percent with limitations on maximum allowable load. (See page 97 of Appendix for additional discussion of tolerances).

DISPOSITION OF EXCESS WEIGHT

The laws of most States provide for removal of weight exceeding the legal maximum or detention of the overweight truck. In some States exemptions of certain commodities are made; in some, the police officer is allowed to exercise judgment, and in some States the law is silent upon this matter. In most cases requiring removal of overweight, discretion in time and place of unloading the excess is allowed so that the owner will not suffer loss of unloaded commodities, such as perishables, or live stock.

DISPOSITION OF TRUCK OPERATOR, OR OWNER

There is no well defined pattern of procedure for handling the operator or owner of the truck which is violating the overweight laws. In four States the owner is specifically regarded as responsible together with the operator, and in one State the owner is made solely responsible for a violation. The law in most jurisdictions expressly states that the offense is a misdemeanor, and provides for the handling of a violation of the weight law in the same manner as other misdemeanor cases are handled, either by arrest or summons. In a few States arrest appears mandatory.

STATUTORY PENALTIES

The widest divergence of legislation is found in stipulated penalties for overweight violation. In most States evidence of damage to road or bridge due to overweight is cause for action for recovery under laws of tort. In several States the violation of overweight law is stated to be a misdemeanor, and penalties for misdemeanors apply. In most States the penalty is written into the law covering size and weight limitations. In 13 jurisdictions graduated penalties are provided for first, second and third or subsequent, convictions within a stipulated period, usually a year. There seems to be no pattern in amount of fine or imprisonment provided. Some States stipulate only maximum fines or imprisonment or both. For the first offense the lowest minimum stipulated fine noted is \$1.00, the lowest maximum stipulated fine is \$25.00. For a third offense, the highest minimum fine noted is \$250.00, and highest maximum fine noted is \$500.00, except that one State provides a \$1000 maximum whether for first or subsequent conviction.

An increasing number of States provide penalties scaled to the excess weight carried and the number of repetitions of violation. One State provides a flat penalty of \$2.00 per cwt. of overweight, but others provide a graduated scale of penalties according to amount of overweight.

A few States allow the owner to increase his registration fee to cover loads carried in excess of declared gross weight for which truck is registered up to the maximum legal gross weight or axle weight. These increased registrations may be purchased in lieu of penalization by fine or imprisonment.

In addition to the imposition of fines the law in six States provides for temporary suspension of registration of the violating truck. In two states this penalty may be imposed for a first conviction, in another for a second conviction and in the remainder upon a third or subsequent conviction. In two states it becomes mandatory to suspend registration upon a third conviction. And in one state the law provides for impounding the violating truck until the imposed fine is paid.

Imprisonment in lieu of fine, or in addition thereto, may be imposed in most jurisdictions. The minimum imprisonment noted is five days in case of a first offense, and the maximum imprisonment noted is six months for a third or subsequent offense, except that one state provides for a one year maximum imprisonment for any conviction, first or subsequent.

PENALTIES IMPOSED

Again there is no outstanding pattern. The fines imposed reveal state averages of \$15.00, \$20.00, \$25.00, \$40.00. In one State, however, the average fine amounted to \$167.00 and in another to \$293.31. The magnitude of the overweight problem is indicated in the record of total fines of \$254,681.10, reported by one State for the fiscal year 1948-49. In one State no convictions could be obtained from weighings by loadometers.

STATISTICS ON WEIGHINGS AND ARRESTS

Complete statistics on weighings, arrests, and warnings were not obtained; however, several States did report the figures given in the following tabulation:

State	Period Reported	Vehicles Weighed	Arrests Made	Warnings Issued
Kansas	4/1/49 to 4/30/49	2,389	169	
Maine	1/1/49 to 3/31/49	1,386	300	
Maryland	2/14/49 to 5/28/49	1,250	1,212	
Ohio	1/1/48 to 12/31/48	50,000	5,595	784

Additional statistics are given under Practices of Selected Enforcement Agencies.

PRACTICES OF SELECTED ENFORCEMENT AGENCIES

Among the States having well-organized and sustained enforcement programs are Illinois, Iowa, Indiana, Michigan, Missouri, Pennsylvania, Virginia and Washington. The enforcement practices of each of these States are outlined in the following briefs:

Illinois: Size-weight laws are enforced chiefly by the State police through operation of permanent weight stations and by use of portable scales operated by roving field details. The police may conduct a suspected violator up to a two-mile distance for weighing on public scales. The driver who violates the size-weight law may be arrested and taken before a magistrate. For the first conviction penalty is provided by a fine of from \$1.00 to \$100.00; for the second conviction within a year penalty is provided by a fine of from \$100 to \$300 and upon a third conviction with a 12-months' period, the court may also suspend the registration license of the violating vehicle up to one year. Officers may require the excess load to be removed before the overweight vehicle is allowed to proceed to its destination and the present policy is to cause such unloading. From January 31, 1949 to August 1, 1949, 346,378 trucks were weighed and 18,934 arrests made for overweight violations.

Iowa: The State Highway Commission of Iowa enforces the size-weight laws through its own 18 uniformed enforcement officers operating under the supervision of the Safety and Traffic Engineer. Fifteen permanent weight stations are supplemented by roving details making selected spot and selected hour checks. A suspected vehicle may be weighed either by portable or stationary scales and the enforcement officer may require that such vehicle be driven to the nearest public scales. A tolerance of 3 percent on axle loads and 10 percent on gross load is provided by law. Upon conviction of overweight violation the law provides a penalty of a fine not to exceed \$100 or imprisonment for not more than 30 days. The enforcement officer may require such portion of the load to be removed as may be necessary to reduce the gross weight to the permissible limit, and the present policy is to so reduce the weight.

The following statistics are taken from the 1948 Annual Report of the Highways Commission:

Period from July 1, 1947 to June 30, 1948

Trucks weighed	9784
Under registration	3055
Axle overload	3988
Gross overload	452
Registration and axle violation	137
Axle and gross violation	18
Improper registration	694
Overwidth	239
Overlength	248
Overheight	156
Fines and costs collected	\$128,650
Increased registration	212,264

Expenditure of \$83,000 per year for enforcement is authorized from the Primary Road Fund. Proceeds from fines are allocated to the county school fund.

Indiana: The size-weight laws are enforced chiefly by the State Police through the operation of 20 permanent weight stations, supplemented by roving loadometer parties. Officers may conduct suspect vehicles to the nearest scales in event such scales are within two miles. A 1000-lb. tolerance is allowed if the excess load does not exceed 1000 lb. If in excess of 2000 lb. a graduated penalty of fines applies to the

first thousand pounds of excess weight also. Officers may require the excess load to be removed before the vehicle is allowed to proceed to its destination and present policy requires load reduction. From January 1 to May 31, 1949, 11,849 vehicles were weighed, resulting in 2,805 arrests. The average fine was about \$70.00.

The following information has been obtained relative to the policy of the Indiana State Police Department in enforcement of graduated penalty provision: "If the violation is only 1000 lb., either gross or axle, no arrest should be made; if the overweight is over 1000 lb., either gross, or axle, then 2 cents per pound may be the fine assessed by the court for such overweight above the original 1000 pounds until the overweight is 2000 lb. over the axle or gross limit. After the violation exceeds 2000 lb., gross or axle, no tolerance is given (for violations above 2000 lb., the 1000-lb. tolerance is not to be allowed. The 1000-lb. tolerance is only to be considered when the violation is 2000 lb. or less). Only one 1000-lb. tolerance is to be given even though there is more than one violation, (overweight axles and gross overweight are considered as separate violations).

"Departmental policy in regards to unloading remains the same. Make all trucks unload after the arrest or shift the load if the overweight violation is 3000 lb. or over. If the cargo is by nature unloadable, then check the bills of lading and determine which is closer, the destination or the point of departure. Have them proceed to the closest point."

The penalty is graduated as follows:

2¢ per pound from 1000 lb. to 2000 lb. excess
3¢ per pound for each pound of excess when excess is from 2001 lb. and 3000 lb.
6¢ per pound for each pound of excess when excess is from 3001 to 4000 lb.
8¢ per pound for each pound of excess when excess is from 4001 lb. to 5000 lb.
10¢ per pound for each pound of excess when excess is from 5001 lb. or more.

See Table 12 for permissible weight per wheel based on rim size.

Michigan: The law is enforced by weighing trucks at eight weigh stations located at strategic points on the trunk line highways operated by weigh-masters of the State highway department 24 hours a day for 5 days a week. In addition to the eight permanent weigh stations 19 roving crews operate portable scales for spontaneous checking. Any police officer or duly authorized agent of the Michigan State Highway Department having reason to believe that a vehicle is in violation of weight laws may require the vehicle to be driven to the nearest weighing station of the State highway department for weighing. Weighing is limited to heavy trucks; pick-ups and unloaded open trucks are excluded.

The enforcement officers may require any excess load to be removed before the vehicle proceeds, and do enforce this provision, using discretion in their requirements.

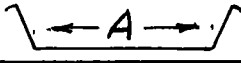
Any driver or owner convicted of violation of the weight law is guilty of a misdemeanor. Upon a second conviction the punishment of a driver is by fine of from \$25 to \$1000 or by imprisonment not exceeding 90 days, and any owner convicted of a

TABLE 12

Use this Table in determining the measurement of tire width between flanges of the rim as set out in the new Size and Weight Law. The measurement given times 800 lb. per inch will give you permissible weight per wheel as set out in Column 4.

For dual wheels double the finding in Column 4.

F O R T R U C K S

FOR	:	:	RIM WIDTH	:	PERMISSIBLE
TIRE SIZE	:	RIM SIZE	:		WEIGHT PER WHEEL
6.00	:	4.50	:	4-1/2"	3600 LBS.
6.50	:	5.0 or 5.0OR	:	5"	4000 LBS.
7.00	:	5.5 or 5.5OS	:	5-1/2"	4400 LBS.
7.50	:	6.0 or 6.0OS	:	6"	4800 LBS.
8.25	:	6.5 or 6.5OT	:	6-1/2"	5200 LBS.
9.00	:	7.0 or 7.0OT	:	7"	5600 LBS.
10.00	:	7.5 or 7.5OV	:	7-1/2"	6000 LBS.
11.00	:	8.0 or 8.0OV	:	8"	6400 LBS.
12.00	:	8.5	:	8-1/2"	6800 LBS.

INDIANA STATE POLICE

second offense is guilty of a misdemeanor and in addition to penalties therefor is required to pay a fine of not less than 1 cent per pound for weight in excess of permissible legal weight. Any driver convicted of a third offense shall be punished by fine of from \$50 to \$100 or by imprisonment not to exceed 90 days, or by both such fine and imprisonment, and any owner who is convicted of a third offense is guilty of a misdemeanor, and in addition to the penalties provided therefor, is required to pay a fine of 2 cents per pound for any weight carried in excess of the legal permissible weight. In addition to these penalties for a third conviction the court may suspend the operator's or chauffeur's license of the driver for not to exceed 90 days or may suspend the owner's vehicle registration license for not to exceed 90 days.

During 1948 the State highway department made 1,397,315 inspections on the trunk line system, of which 22,508 were violations. 6076 of the violators were given summons to appear in justice court; the rest, 15,534, being given warning tickets. By years the percentage of violators as determined by weighings at the trunk line weighing stations are as follows:

%
1945 - 1.4
1946 - 1.8
1947 - 1.9
1948 - 1.6

During the season of load restrictions the percentage of violations increases. During this restricted season in 1946 it was 2.2 percent as compared to the yearly average of 1.6 percent.

The State Highway Department has budgeted \$180,000.00 for weight stations during 1949 of which about \$20,000.00 will be for new equipment and modernization.

Missouri: The highway patrol is the chief enforcement agency in carrying out the provisions of the size-weight law. Fifteen 3-ft. platform scales located on principal routes are complemented with loadometer scales as required on escape routes. The platform scales were installed by the State Highway Department and are operated and maintained by the highway patrol which operates them from 8 to 24 hours per day, under an irregular schedule to proclude pre-knowledge of operating periods by truck drivers. Civilian employees operate the scales and police officers are called when overloads are discovered. Officers may also conduct suspect trucks to the weighing station. Removal of excess loads is required if the proper distribution per axle cannot be obtained by shifting. Violation of the weight law is deemed a misdemeanor, and upon conviction thereof any person, firm, corporation, partnership or association is fined not less than \$5.00 nor more than \$500, or by imprisonment in a county jail for a term of not exceeding twelve months, or by both such fine and imprisonment.

Table 13 presents a summary of weighing activities during the calendar year of 1948:

TABLE 13

Weight Station Summary for 1948

Missouri State Highway Patrol

	Trucks Weighed	Hours Open	Total Warnings	Total Arrests	PSC	Over Weight	Others
January	62425	5012	3041	495	49	346	100
February	53131	4465½	2755	547	71	314	162
March	66127	5189	3385	491	59	329	103
April	58430	4593	2611	388	47	235	106
May	60265	4750	2440	495	73	325	97
June	71857	4353-3/4	2121	451	69	306	76
July	75365	5094½	2837	588	92	371	125
August	56179	3925	2470	493	58	323	112
September	59081	4125½	2373	495	57	362	76
October	60897	4461	2188	549	49	416	84
November	57566	4557	2379	544	50	423	71
December	55379	4232½	2183	443	48	346	49
TOTAL	736702	54658-3/4	30783	5979	722	4096	1161

Pennsylvania: Enforcement of size-weight law is handled by the State Police Department in Pennsylvania. Using portable scales 15 roving details of three troopers each, operate on a statewide basis. Each detail works five 8-hour days each week making selected spot and hour checks. Enforcement officers may weigh vehicles by means of portable or stationary scales or may require a suspect vehicle to be driven to the nearest stationary scales in the event such scales are within a distance of two miles.

A tolerance of 10 percent is provided by law and officers require any excess beyond the permitted tolerance to be removed before the vehicle is allowed to proceed. The statutory penalty to be imposed upon conviction is a fine of \$50.00 or in default of payment thereof, imprisonment for not more than 10 days.

Statistics of weighings and arrests are abstracted as follows:

Weighing

<u>PERIOD</u>	<u>NO.</u>
1947 Calendar year	31,772
1948 Calendar year	65,216
1949, Jan. to April, incl.	43,315

ARRESTS

<u>PERIOD</u>	<u>NO.</u>
1947, Jan. to May, incl.	2096
1948, Jan. to May, incl.	3528
1949, Jan. to May, incl.	7096

Virginia: The State Police Department is the chief enforcement agency handling overweight violations. Three permanent weigh stations are operated continuously throughout the year. Augmenting the operations at the permanent stations the State Highway Department assists the police by operating three loadometer parties on a spot check basis with state police present for handling traffic and making arrests. In addition the State Police Department is equipped with 30 loadometers for use as required. Removal of excess weight is required by officers as occasion demands.

Penalty applies to any person, firm or corporation convicted of operating or causing to be operated over the highways a motor vehicle exceeding the maximum load limits. In addition to any other penalties imposed by the court the law provides the sum of two dollars per hundred pounds or fraction thereof for each and every hundred pounds of weight in excess of the maximum weight. Upon failure to comply with the penalty provision the right to operate a motor vehicle or vehicles upon the highways may be denied the offender until penalty provisions are fully complied with.

The following statistics on weighing activities are taken from the records of the highway department relating to their own weighing parties.

No. vehicles weighed, fiscal year ending 3/31/49		29,027
No. vehicles insufficiently licensed	365	
No. vehicles violating axle load limit	863	
No. vehicles violating gross load limit	389	
No. vehicles violating axle and gross load limit	2861	
No. vehicles violating license, ax, gross load	87	
	<u>4565</u>	
Total violations		
Fines assessed	\$175,506	
Court costs	<u>27,268</u>	
TOTAL	\$202,774	

In addition to the above activities by the highway department the State police issued summons for 1373 violations resulting in fines totalling \$44,859.60 and court costs totalling \$7,047.50. The grand total fines and costs resulting from weighings by highway department and state police for the fiscal year ending March 31, 1949, totalled \$254,681.10.

Washington: Size-weight law is enforced by the Highway Patrol with assistance from the Highway Department. Thirty scale houses are supplemented by loadometer operation. Officers may weigh vehicles either by means of a portable or stationary scale, and may require a suspect vehicle to be driven to the nearest public scale for weighing. The officers may require removal of excess weight and present policy requires load reduction as the occasion may demand.

Penalty for first conviction of overweight violation is a fine of from \$10 to \$25, for second conviction a fine of from \$25 to \$50 and in addition the court may suspend the certificate of license registration of such vehicle for not more than 30 days, and for a third and subsequent conviction a fine of from \$50 to \$100, and in addition the court shall suspend the certificate of license registration of such vehicle for not less than 30 days nor more than 90 days.

For the year ending April 30, 1949, the scale house-loadometer weighings totalled 152,009. Of these 6935 vehicles exceeded their licensed capacity, and 5,886 exceeded the legal limits. There were 10,157 warnings and 2,038 arrests. Scales were operated for a total of 20,490 hours.

APPENDIX

PORTABLE SCALES

Use and Acceptance in the Enforcement of
Legal Truck Load Limits on Highways

The Highway Research Board has received several inquiries relative to the extent of use of portable weighing scales in enforcement of load limits upon the highways and acceptance by courts of the portable scale as a proper weighing device. Accordingly, questionnaires were sent out in November, 1949 and returns have now been received from all of the States, the District of Columbia, and the Territory of Hawaii. The replies are summarized in Table 14.

All but 14 states reported regular use of the portable loadometer scale. Apparently the use of the portable scale is confined to the loadometer type.

Tolerances allowed in the use of this device vary. Six states advise that none is permitted. Where tolerances are allowed in percentages, the values range from 0.5 to 10 percent. Where allowed in pounds, the tolerances range from 300 lb. to 2000 lb. Oregon and Washington refer to the tolerance allowed by the National Bureau of Standards. The following is quoted from Handbook H 44,¹ issued September 1, 1949, by the National Bureau of Standards: "The basic maintenance tolerance for individual wheel-load weighers, on under-registration or on over-registration, shall be 5 percent of the known test load; the basic acceptance tolerance, on under-registration or on over-registration, shall be 3 percent of the known test load. When two wheel-load weighers are tested as a pair, the tolerance shall be applied to the sum of the indications of the two weighers, and the pair shall be approved or rejected upon the basis of the combined indications."

Three states (California, Kentucky, and New York) reported that the State Attorney General had ruled on the legal aspects of using the portable scale in the enforcement of legal load limits. In each case the ruling was favorable.

Four states (Arizona, North Dakota, West Virginia, and Wyoming) reported that the device was not acceptable to the State Department of Weights and Measures.

Ten states reported that the validity of the portable scale as a weighing device had been tested in the courts. None of these states reported an unfavorable decision.

All but eleven states reported that state-owned pit scales are in use or are to be installed. Commercial pit scales are used in 24 states to supplement their own scales or as the only device available to them. Sixteen states reported that commercial scales are not used and seven reported infrequent use.

¹/- National Bureau of Standards Handbook H 44, 1949, Specifications, Tolerances, and Regulations for Commercial Weighing and Measuring Devices. Superintendent of Documents, Washington, D. C. \$1.00

Several states sent in additional information and comments, excerpts of which are given below:

The Idaho Bureau of Highways stated: "Our State Police, who do the weighing with the portable scales, have made hundreds of arrests with no legal validity tests in the courts as yet. Many truckers have threatened to contest the portable scales but have not gone through with it." The letter from Idaho added: "Portable scales are hard to read accurately and unless the axles are kept level in weighing large discrepancies may occur. We usually have trenches deep enough so the portable scales will be level with the roadway as each axle is rolled across and weighed. We have found this method gives us much better results. We allow about 5 percent on each axle so we may be sure we are not over rating the weight of the trucks."

A letter from the Missouri State Highway Department stated that no difficulty had been experienced in obtaining convictions for overweight where the portable loadometer had been used and added the belief that the device should be used "because of the simple fact that trucks have found it quite easy to detour around the scale houses or to wait until the scale houses are closed and drive past during the closed periods." It was stated that "We have stopped trucks by roving Highway Planning Survey crews and found maps in the cab showing the locations and hours of operation of scale houses."

A questionnaire completed and returned by the Oklahoma Highway Patrol stated: "In our experience approximately 200 lb. is the greatest variation in weight between the loadometer and a platform scale. Most recent example was a load weighing in excess of 73,000 lb., for which there was 20 lb. difference in scale readings of platform and loadometer scales."

Superintendent Arthur M. Thurston of the Indiana State Police has kindly authorized the reproduction in its entirety of correspondence which he has received from Staff Captain Kermit E. Lewis on the subject, "Weighing Techniques for Specially Designed Trailer Equipment." It is believed that the following description of the tests of the loadometers will be of interest to all agencies having occasion to use this device in their operations.

APPENDIX

PORTABLE SCALES

Use and Acceptance in the Enforcement of
Legal Truck Load Limits on Highways

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TABLE 14 **HIGHWAY RESEARCH BOARD**
RESEARCH CORRELATION SERVICE
February 1950

State	Is Portable Loadometer Scale Used In Enforcement?	Name Any Other Portable Type Scale Used	What Tolerance is Allowed in Use of This Device?	Has Atty Gen'l Ruled on Legality of Using Port Scale in Enforcing Legal Load Limits?	If so, was Ruling Favorable?	If Not, Cite Reason	Is the Device Acceptable to Dep't of Wts & Measures for Use in Enforcing Load Limits?	If not Acceptable to Dep't of Wts. & Measures, Cite Reasons	Has its Validity as a Weighing Device Been Tested in Courts?	If so, what Decision was Rendered?	Are State-Owned Pit Scales Used in Enforcement of Load Limits?	Are Commercial Pit Scales Used in Enforcement of Load Limits?	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	
Alabama	No	None	- - -	No	- - -	- - -	Yes	- - -	No	- - -	No	Yes	A - No formal ruling Statement made that scale must be certified by Dep't of Weights and Measures B - State Law (Act 235-1949) allows 1,000 lbs tolerance in total load on any vehicle. C - Dep't. of Wts & Measures merely tests scale accuracy. Police Dep't is responsible for enforcing Load Limits.
Arizona	Only Twice	None	- - -	See Note A.	- - -	- - -	No	Said it was Inaccurate	No	- - -	To be Installed	No	
Arkansas	Yes		See Note B	No			Yes		No		Yes	Yes	
California	Yes	Black & Decker	3 to 5%	Verbally	Yes		Yes		No		Yes	Yes	
Colorado	No	None	- - -	No	- - -	- - -	No State Agency	- - -	- - -	- - -	Yes	Yes	D - Acceptable to the Dep't which controls as we do not have a Dep't of Wts and Measures E - About 10% on initial enforcement weighing by Dep't of Public Safety, a separate agency. F - When Weight Certificates are presented in court approved by Div of Weights and Measures, there were no further objections G - 1,000 lb on one axle or accumulative 1,000 lb. on all axles on gross weight H - Are using 3% on axles which includes all tolerances About 0.5% chargeable to scales
Connecticut	No	None	- - -	No	- - -	- - -	See Note C	- - -	No	- - -	Yes	Only occasionally	
Delaware	Yes - But not Regularly	None	10%	No	- - -	- - -	Do not know	- - -	No	- - -	Yes	No	
Florida	Yes	None	10%	No	- - -	- - -	See Note D	No Such Dept	- - -	- - -	Yes	No	
Georgia	Yes	None	See Note E	No			Has not been Submitted		No		Yes	No	I - Yes - 5 in operation 3 in construction 7 in plan department total 15 J - Depends on Road & Weather conditions, may be as much as 200 lb under ideal conditions K - Only as a check against State owned scales when accuracy of scale is questioned L - Enforcement officials check weigh bills from commercial pit scales M - So far as individual wheel and axle weight is concerned, yes N - Mass laws require Motor Vehicle Comptroller to enforce Wt Limits and Specify use of Port or Sta Scales
Idaho	Yes	None	About 5%	No			No Ruling		No		Yes	Yes	
Illinois	Yes	None	300 lb	No			Yes		Yes	See Note F	Yes	Yes	
Indiana	Yes	None	See Note G	No			Yes		Yes	Accepted	Yes	Yes	
Iowa	Yes	- - -	See Note H	No Ruling Requested			Yes		No		Yes	Yes	O - State law provides for weighing by means of either portable or stationary scales P - Safety Patrol enforces Load Limits and considers device unacceptable for enforcement Q - Difficulty of keeping accurate balance R - Laws authorizes officers to require that vehicles be driven to nearest stationary scales provided they're within 2 miles S - Discussed verbally If driver objects to loadometer wt, vehicle is taken to platform scales T - Courts have accepted our weights No test case has been tried U - 3% + by Nat'l Bur. Standards, but State Sealer will not seal unless within 1% ± V - Available scales are owned by cities and towns W - No set tolerance Reasonable allowances made for each vehicle X - If accuracy is questioned at time of weighing, certified public scale is used Z - Actual reading used for increase in registration up to 2000 lb over & above their registered wt Anything beyond 2,000 over reg gross, court action is taken
Kansas	Yes	None	3%	No			Yes		No		See Note I	Yes at \$15/day or 25¢/ ticket	
Kentucky	Yes	- - -	2,000 lb	Yes	Yes		Yes		Yes	Favorable	Yes	Yes	
Louisiana	Yes	None	See Note J	No	- - -	- - -	Yes	- - -	No	- - -	Yes	See Note K	
Maine	Yes		5%	No			Yes		No		Yes	Yes	M - So far as individual wheel and axle weight is concerned, yes N - Mass laws require Motor Vehicle Comptroller to enforce Wt Limits and Specify use of Port or Sta Scales
Maryland	Yes		500 lb	No			Yes		No		Yes	No	
Massachusetts	No	None	- - -	No	- - -	- - -	- - -	- - -	No	- - -	No	See Note L	
Michigan	Yes	None	1%	No			Yes		No		Yes	No	
Minnesota	Yes	None	5%	No	- - -	- - -	See Note M	- - -	No	- - -	Yes	Yes	O - State law provides for weighing by means of either portable or stationary scales P - Safety Patrol enforces Load Limits and considers device unacceptable for enforcement Q - Difficulty of keeping accurate balance R - Laws authorizes officers to require that vehicles be driven to nearest stationary scales provided they're within 2 miles S - Discussed verbally If driver objects to loadometer wt, vehicle is taken to platform scales T - Courts have accepted our weights No test case has been tried U - 3% + by Nat'l Bur. Standards, but State Sealer will not seal unless within 1% ± V - Available scales are owned by cities and towns W - No set tolerance Reasonable allowances made for each vehicle X - If accuracy is questioned at time of weighing, certified public scale is used Z - Actual reading used for increase in registration up to 2000 lb over & above their registered wt Anything beyond 2,000 over reg gross, court action is taken
Mississippi	No	None	Not Used	No	None	None	Has no such Dept	See Note N	No	None	Yes - 20	Occasionally	
Missouri	Yes - to some extent		No Definite Limit	No			Not Discussed with Them		No		Yes	Yes	
Montana	Yes	None	None	No		See Note O	No Formal Protest		Protested in Police Court Only	Weights by Loadometers Accepted	Yes	Seldom	
Nebraska	Occasionally	None	500 lb	No	- - -	No Request for Ruling	Ruling Not Requested	See Note P	No	- - -	Two will be Constructed	Yes	I - Yes - 5 in operation 3 in construction 7 in plan department total 15 J - Depends on Road & Weather conditions, may be as much as 200 lb under ideal conditions K - Only as a check against State owned scales when accuracy of scale is questioned L - Enforcement officials check weigh bills from commercial pit scales M - So far as individual wheel and axle weight is concerned, yes N - Mass laws require Motor Vehicle Comptroller to enforce Wt Limits and Specify use of Port or Sta Scales
Nevada	No	None	- - -	No	- - -	No Case Ever Presented	Not Used for Enforcement	- - -	No	- - -	No	No	
New Hampshire	Yes		None	No			Yes		Yes	Conviction Obtained	None	Yes	
New Jersey	No			No			Not Completely so Have no such Dept	See Note Q	No		Yes	Yes	
New Mexico	Yes	None	5%	No					No		No	Yes	R - Laws authorizes officers to require that vehicles be driven to nearest stationary scales provided they're within 2 miles S - Discussed verbally If driver objects to loadometer wt, vehicle is taken to platform scales T - Courts have accepted our weights No test case has been tried U - 3% + by Nat'l Bur. Standards, but State Sealer will not seal unless within 1% ± V - Available scales are owned by cities and towns W - No set tolerance Reasonable allowances made for each vehicle X - If accuracy is questioned at time of weighing, certified public scale is used Z - Actual reading used for increase in registration up to 2000 lb over & above their registered wt Anything beyond 2,000 over reg gross, court action is taken
New York	Yes	None	5%	Yes	Yes		Yes		Yes	Numerous	No	Occasionally	
North Carolina	Yes	None	None	No - See Note O			Yes		No		No	See Note R	
North Dakota	No	- - -	- - -	No			No	Not Accurate Enough	No		Not yet, but will be soon	Yes	
Ohio	Yes	None	None	No			Yes		No		Yes	No	U - 3% + by Nat'l Bur. Standards, but State Sealer will not seal unless within 1% ± V - Available scales are owned by cities and towns W - No set tolerance Reasonable allowances made for each vehicle X - If accuracy is questioned at time of weighing, certified public scale is used Z - Actual reading used for increase in registration up to 2000 lb over & above their registered wt Anything beyond 2,000 over reg gross, court action is taken
Oklahoma	Yes	None	None	No - See Note S			No information		No - See Note T		Yes	Yes	
Oregon	Yes	None	See Note U	No - See Note O	- - -	- - -	Yes	- - -	Yes	Favorable	Yes	No	
Pennsylvania	Yes	None	None	No Record of an Opinion	- - -	- - -	Yes	- - -	Yes	Upheld	Yes	Yes	
Rhode Island	Yes		200 lb	No					No		None	No - See Note V	V - Available scales are owned by cities and towns W - No set tolerance Reasonable allowances made for each vehicle X - If accuracy is questioned at time of weighing, certified public scale is used Z - Actual reading used for increase in registration up to 2000 lb over & above their registered wt Anything beyond 2,000 over reg gross, court action is taken
South Carolina	Yes		10%	No			Yes		No		Yes	No	
South Dakota	Yes		1,000 lb	No		Opinion has not been asked	Yes		No	Courts Accept Loadmeter Weights	Yes	Yes	
Tennessee	Yes		1,500 lb	No			Yes		No		Yes	Yes	
Texas	Yes	None	See Note W	No			Yes		No		No	No	W - No set tolerance Reasonable allowances made for each vehicle X - If accuracy is questioned at time of weighing, certified public scale is used Z - Actual reading used for increase in registration up to 2000 lb over & above their registered wt Anything beyond 2,000 over reg gross, court action is taken
Utah	Yes	None	See Note X	No - See Note O			Yes		No	- - -	Yes	Yes	
Vermont	Yes	None	See Note Z	No			Yes		No		No	Yes	
Virginia	Yes	None	5%	Loadometer Auth. by Law			Yes		Yes	Favorable in Circuit Courts	Yes	No	
Washington	Yes	None	Natl Bur of Standards No H-29	No			Yes		Yes	Affirmative	Yes	Yes-in special cases	AA - Only occasional spot checks made with 1 pair of loadometers
West Virginia	Have Been	None	300 lb / wheel	No	- - -	- - -	No	Inaccurate	No	- - -	No	No	
Wisconsin	Yes	None	500 to 1,000 lb	No			No Ruling Requested		No		Yes - 3	When necessary and available	
Wyoming	No			No			No		No		Yes	Yes	
Hawaii	Yes	None	0.5%	No	- - -	No Ruling Requested	Yes	- - -	No	- - -	Yes	No	AA - Only occasional spot checks made with 1 pair of loadometers
District of Columbia	See Note AA												
Puerto Rico													

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INDIANA STATE POLICE

November 1, 1949

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FROM: Kermit E. Lewis
Staff Captain

TO: Arthur M. Thurston
Superintendent

SUBJECT: Weighing Techniques for Specially Designed Trailer Equipment

Superintendent, on Oct. 4, 1949 Lieutenant Smith, Marion Lawless of the State Hi-way Commission and myself went to the Lafayette Post to witness and supervise the test weighing of an acid truck that was owned by the Ecoff Trucking Company. Present at the weighing were Mr. David Ecoff owner of the Ecoff Trucking Company, his attorney, Mr. Genther, representatives of the Standard and Sinclair Oil Companies, and Dr. Rolland G. Sturm, a physicist from Purdue University who did the overall job of supervising the weight check. This weighing demonstration was conducted to determine if our normal weighing techniques were accurate when using two loadometers weighing first one side of a tandem group then the other then adding the sum of these two weights to determine the weight of the tandem group.

We have had several recent discussions with Mr. Ecoff and arranged this test weight because it has developed that the weights obtained by the use of the two loadometers and the techniques heretofore described were not consistent with the weights registered upon platform scales.

At the test, the truck weighed was a tank semi-trailer designed especially for carrying acids. The tank is made of 3/8 inch armor plate and was loaded to capacity in such a manner that no surging of the acid fore and aft was possible. The results of the tests and techniques used are as follows:

USING TWO LOADOMETERS

Two loadometers were placed under each wheel of the steering axle and the following weights recorded.

Right Steering wheel	3,800
Left Steering wheel	<u>3,580</u>
Making total for steering axle	7,380

Next only two loadometers were used and our normal operational procedure followed in weighing the truck. First we placed two loadometers underneath the right wheels on the drive tandem group and the following weights were recorded:

Right front	8,960
Right back	<u>9,250</u>
Totaling	18,210

Next the two scales were removed from underneath the right wheels and placed under the left tandem drive wheels and the following weights recorded.

Left front	8,120
Left back	<u>8,275</u>
Totaling	16,395

Therefore:-----	Right side of drive tandem	18,210
	Left side of drive tandem	<u>16,395</u>
	Total weight of drive tandem	34,605

Using same technique the trailer tandem axle weights are recorded as follows:

Right front trailer tandem	8,670
Right back trailer tandem	<u>9,320</u>
Total weight of trailer tandem	17,990

Left front trailer tandem	8,780
Left back trailer tandem	<u>8,565</u>
Total weight of trailer tandem	17,345

Therefore:-----	Right side of trailer tandem	17,990
	Left side of trailer tandem	<u>17,345</u>
	Total	35,335

Therefore the total overall gross weight using the two loadometer technique is:

Steering axle	7,380
Drive tandem group	34,605
Trailer tandem group	<u>35,335</u>
Gross weight	77,320

USING FOUR LOADOMETERS

Using four loadometers placing one under each wheel of the tandem groups. The following weights recorded:

Steering axle remains constant at 7,380 lbs.

DRIVE TANDEMS

Left front drive tandem	7,440
Left back drive tandem	<u>7,070</u>
Total	14,510

Right front drive tandem	8,245
Right back drive tandem	<u>8,430</u>
Total	16,675

Therefore:-----	14,510
	<u>+ 16,675</u>

Total for drive tandem 31,185

TRAILER TANDEM

Left front trailer tandem	7,845
Left rear trailer tandem	<u>7,355</u>
Total	15,200

Right front trailer tandem	8,280
Right rear trailer tandem	<u>7,895</u>
Total	16,175

Therefore:----- 15,200
 + 16,175
Total tandem axle 31,375

Therefore:----- 7,380 Steering axle
 31,185 Drive tandem group
 31,375 Trailer tandem group
Gross 69,940

USING 50 FOOT PLATFORM SCALES

The truck was then driven to the city scales in Lafayette and the following weights recorded:

Gross weight	70,260
Steering axle	7,680
Steering and drive tandem	38,880

Therefore:----- Gross 70,260
 - 38,880
Trailer tandem 31,380

There was one observation; that was noted, there was a very slight variation in the weights noted when the vehicle was driven forward upon the scales and the weights recorded in comparison to the weight recorded when the vehicle was backed upon the scale. This variation was slight enough, however, to be negligible, also there was a very slight variation in the weights recorded when the vehicle was driven upon the scales and the brakes released. This weight difference at any time did not vary more than 15 pounds. These unusual variations in weight were explained by Dr. Sturm as being caused by friction in the unusual rocker arm type spring suspension and the shifting fore and aft of the center of gravity.

Many extremely interesting points were noted in these weighings, for instance, we took the gross weight of 70,260 pounds as determined by the city scales subtracted from it the weight of the steering axle plus the tandem drive group of 38,880 which left us the indicated weight of 31,380 pounds for the trailer tandem group.

The weight of the trailer tandem group as determined by the four loadometers was 31,375 pounds making only a difference of 5 pounds between the weights of our loadometers and the weights by platform scales.

The conclusions that can be drawn by this series of tests are these:

1. The loadometer itself is an extremely accurate scale. This is further borne out by the attached laboratory tests made on a loadometer by Purdue University.
2. When weighing trucks constructed as these acid trucks are, accurate weights cannot be determined by our normal weighing techniques whereby only two loadometers are used under one side of the vehicle at a time.
3. Loadometers can be used to accurately weigh these special type pieces of equipment or any type vehicle if four loadometers are used or if the loadometers are recessed within the pavement so there will be no deviation from the horizontal roadway surface.
4. The weights obtained by platform scales and the use of our loadometers are comparable for all practical purposes.

TABULATION OF WEIGHTS EMPLOYING VARIOUS WEIGHING TECHNIQUES

Using 2 loadometers first on one side then the other	:	Steering axle	:	Drive Tandem	:	Trailer Tandem	:	Gross
	:	7,380	:	34,605	:	35,335	:	77,320
Using 4 loadometers One under each tandem wheel	:	7,380	:	31,185	:	31,375	:	69,940
	:		:		:		:	
Axle at a time on platform scales	:	7,680	:	31,200	:	31,380	:	70,260
	:		:		:		:	
As a unit on plat- form scales	:	-----	:	-----	:	-----	:	
	:		:		:		:	

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INDIANA STATE POLICE

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October 13, 1949

FROM: Kermit E. Lewis
Staff Captain

TO: All Personnel

SUBJECT: Weighing Technique When Weighing With
Loadometers

Recently we have conducted several tests to determine the most accurate method to weigh tandem axle groups when using loadometers. These tests have shown that to secure accurate weights, on many of the new type tandem groups, it is necessary to weigh all of the wheels of the tandem group at one time with four loadometers or to weigh two wheels at a time providing the other two wheels of the tandem group are kept on the same horizontal plane or level by the use of ramps or suitable blocks.

To alleviate any confusion or controversy in the future, when weighing tandem axle groups, either drive tandem or trailer tandem groups, either use four loadometers or ramps to keep all tandem wheels on the same horizontal plane.

/s/ Kermit E. Lewis

Kermit E. Lewis
Staff Captain

KEL/mb

THE TRUCK WEIGHT PROBLEM IN HIGHWAY TRANSPORTATION
HIGHWAY RESEARCH BOARD

CHAPTER V

Design Practices

The structural features of highway pavements in the various States reveal wide variety in design practice. Even in adjoining States where the road requirements and conditions appear to be similar, pavements of different types and having marked differences in design are found. These differences in practice from State to State or from district to district within a State are due to differences in opinions or judgments of the designing authorities based principally on local experiences although, to some extent, these may have been supplemented by engineering investigation. However, considering the great number of factors, both physical and economic, which need to be evaluated in designing a type and strength of pavement for any given location, and the probable destructive forces to which the road will be subjected, the variety in kind and condition of pavements that now exists is not surprising.

Also, in view of the great increase in the magnitude, frequency and speed of loads that has occurred since most of the pavements were built, it is not surprising that many pavements are undergoing considerable structural deterioration.

In general the structural features of pavements have been determined on the basis of experience, in the light of prevailing and estimated traffic loads or of load limits established by law, and to some extent with the aid of several concepts of the mathematical relations between loads, pavement slabs and subgrades developed both theoretically and experimentally. These concepts have not yet been developed into acceptable rational methods of design. Nevertheless they have had important effects on current practice.

It has long been apparent to highway engineers and administrators that, if pavements are to be built that will last long enough for reasonable economy, some limitations must be put upon highway loads.

The problem was stated, basically, thirty years ago. In Public Roads Magazine, January 1919, Mr. H. E. Breed, Deputy Commissioner of Highways for New York, stated, "There must be an arbitrary limit of load for which we can design our roads. Otherwise as fast as they are built, roads will attract to themselves traffic heavier than they are designed to bear. The road and the load will be forever outstripping each other with great economic loss both of original investment in the road and in the appalling high maintenance."

Later Mr. Clifford Older in Transactions of the ASCE in 1924, discussing the Bates Road Test said, "A knowledge of the wheel-loads imposed by highway traffic is a fundamental requirement for rational design. It is believed that until more is known regarding the design of the economical highway transport freight unit, wheel-

loads must be arbitrarily limited by law, in order to safeguard the many millions of dollars already invested in pavements. In contemplating the design of a pavement, it is necessary either to assume the maximum expected wheel-load or be governed by the limits set by law."

In recognition of this principle the States began enacting laws to control highway loadings as far back as 1913.

It is interesting to review the following brief summary of facts taken from the 1941 report of the Interstate Commerce Commission to the 77th Congress:

The States of Maine, Massachusetts and Pennsylvania in 1913 were the first States to enact laws restricting the weights of highway loads. Pennsylvania set limits of 18,000 lb. axle-load and 750 lb. per inch width of tire. Maine adopted a gross load limit of 18,000, and Massachusetts a gross load limit of 28,000 lb. Both Maine and Massachusetts however permitted 800 lb. per inch width of tire.

In 1919 Iowa and Illinois each adopted a limit of 800 lb. per inch width of tire. Iowa stipulated a maximum wheel load of 8,000 lb., while Illinois set a limit of 16,000 lb. axle load.

The first States to enact laws permitting greater loads (up to 22,400-lb. axle loads) were Minnesota, Missouri and Washington. That was in 1921. Arizona accepted the same limit in 1922. Rhode Island adopted it in 1923, and New York in 1924. Then, Indiana and the District of Columbia set the same (22,400 lb. axle load limit) in 1925. By that date about half of the States had accepted a recommendation of the tire manufacturers to establish a limit of 800 lb. per inch width of tire. Hard rubber and high pressure pneumatic tires were thought to be capable of withstanding that much load, and since 14 in. had been decided upon as being the practical maximum width of hard rubber tires the axle load of 22,400 had been calculated by multiplying 800 by 14 by 2 (two wheels on an axle).

Nearly every State for several years has had, some legal restriction on loads. Approximately two-thirds of the States never have legally permitted axle-loads greater than 18,000 lb. Most of the States that once legalized 22,400-lb. axle loads later reduced the limits to 18,000 or 20,000 lb.

A few States retained an 8,000-lb. wheel load or a 16,000-lb. maximum axle load until the early 1930's. About that time the relative effects of different kinds of tires on the impact forces on pavements were studied by the U. S. Bureau of Public Roads and others. Among the investigators, it was agreed that 9,000-lb. wheel loads on balloon tires would be no worse for the pavement than 8,000-lb. on high-pressure pneumatic tires, or on the already outmoded, solid rubber tires. In December 1932 Public Roads Magazine called attention to the situation by the following statement. "Pneumatic and balloon tires have completely altered the effect of heavy vehicles on the road surface, and are now in practically universal use." Subsequently, the Interstate Commerce Commission report shows, most of the remaining, lower-load-limit States adopted an 18,000-lb. axle load, which limit became the AASHO recommended legal maximum axle load.

The pavement designs used by the States over the past 30 years and the service records of the pavements reflect the divergence in the legally adopted load limits, and at the same time the divergence in design methods. It is encouraging to note, at this time, that in both respects the States are drawing closer together.

FLEXIBLE PAVEMENT DESIGN

There are numerous possible varieties of flexible pavements depending on the availability of suitable materials and the preferences of the designing engineers. Approximately half of the States now use some specially devised empirical design procedure for flexible pavements to meet local conditions and requirements. Several States are currently engaged in studies to try to correlate flexible pavement performance with design in order to be able to make intelligent adjustments and further improve their methods. For flexible pavements on high type roads practice is fairly general of using base courses ranging in thickness from 6 to 8 in., and bituminous surface courses from 2 to 3 in. thick. On low-bearing value soils where experience or tests indicate that greater total pavement thickness is necessary, sub-base courses are used. The subbase material usually is of a lower quality and less expensive than the base course material. For heavy traffic on poor soil or where frost damage is likely to occur the sub-base layers sometimes range up to 18 in. thick.

In view of the many variables that enter into the problem of flexible pavement design it is not surprising that a great number of methods have been proposed and that many of them are in current use.

However, it is encouraging to note that considerable progress has been made toward the development of more scientific procedures of approach. Whereas, the earlier design methods used formulas intended to be applicable generally, later methods, although empirical in nature, make use of test data from the site in question. Research leading toward formulation of a rational method of design is under way.

Table 1 summarizes the formulas and methods proposed from 1901 to 1946 as reported by the Subcommittee on Methods of Measuring Strength of Subgrade Soil in Proceedings, Highway Research Board, Volume 25, page 8.

Current design practices of a number of States and other jurisdictions and a recommended practice by the Highway Research Board Committee on Flexible Pavement Design are given in Current Road Problems No. 8-R (Revised Edition) "Thickness of Flexible Pavements." These are summarized very briefly as follows:

Texas - The Soils Laboratory recommends a method of design based on triaxial compression tests of samples of known service behavior.

Wyoming - Design is based on California bearing ratio tests or modifications thereof, used in conjunction with eight CBR wheel-load curves. Selection of the wheel-load curve to be used is determined by evaluating job conditions and traffic.

Kansas - Design is based on results of triaxial compression tests on samples of each component of the road structure. Undisturbed samples are preferred.

TABLE 1
SUMMARY OF FORMULAS AND METHODS OF DESIGN OF FLEXIBLE PAVEMENTS

Name of Formula or Method	Basic Equation or Procedure	Type of Test to Determine Bearing Strength of Soil
Massachusetts Rule	$t = 0.5 \sqrt{\frac{P}{q}}$	Not specified.
Lehewre and Pons	For surface courses: $t = 0.45 \sqrt{\frac{P}{q}} - 0.4b$ For base courses: $t = 0.75 \sqrt{\frac{P}{q}} - 0.67b$	Not specified.
Harger and Bonney	$t = \sqrt{\frac{P}{2q} + \frac{w^2}{9}} - \frac{w}{3}$	Recommended values given for soils of various textures.
Downs	$t = 0.564 \sqrt{\frac{P}{q}}$	Not specified.
Gray	$t = 0.564 \sqrt{\frac{P}{q}} - a$	Not specified.
Hawthorn	$q = \frac{P}{(t \tan \theta + a)^2}$ $q = f(t, D_p, D_s, \phi, c)$	Shear test to determine ϕ and c .
Housel	$t = \frac{(p - 4m_2)b}{4m_1} + \frac{m_2b}{p}$	Shear test
Goldbeck	For single tires: $t = \sqrt{\frac{2P}{\pi q} - \frac{3L_2}{2}}$ For dual tires: $t = \sqrt{\left(\frac{B}{2\pi}\right)^2 + H - \frac{B}{2\pi}}$	Plate bearing test Load at $\frac{1}{2}$ in. indentation or at point at which ratio of pressure increase to indentation increase = 100.
Palmer and Barber	$t = \frac{a}{\sqrt{C_p/C_s}} \sqrt{\left(\frac{P}{q}\right)^2 - 1}$	Triaxial test.
Barber	Design curves Unit load, radius of loaded area, and cohesion and angle of internal friction of subgrade soil required.	Triaxial test
Hubbard and Field	Design curves Unit load and subgrade rating required.	Plate bearing test. Load at $\frac{1}{2}$ in. deflection.
Spangler	$d_p = \frac{0.9P \sqrt{\frac{P}{t}}}{C_s}$	Triaxial test or other tests.
Campen and Smith	Series of computations. Bearing strength of subgrade, of 6 in. sub-base in place, and/or of 6 in. of base in place required.	Plate bearing tests. Load at $\frac{1}{2}$ -in. deflection
North Dakota Cone	Design curve Cone bearing value required	Bearing test with cone penetration apparatus.
Committee on Flexible Pavement Design	Trial section method.	Plate bearing tests. Load for 0.2 in. net deflection at required number of load applications.
Vokao	$t_b = \frac{b(p - q)}{4 \sqrt{pq}}$ $t_s = \frac{P - p_s}{4m_2R}$ b	Plate bearing tests. Load at 0.1 to 0.2 in. deflection.
Navy	Trial section method.	Plate bearing tests Load at 0.2-in. deflection.
Klinger	$t = K_1 \sqrt{\frac{P}{q} - 1}$	Not specified.
C. B. R. Method	Design curves. Bearing ratio and wheel load required	Bearing ratio tests.
Glossop and Golder	Design curves. Shear strength and total load required.	Unconfined compression test on undisturbed sample.
Smith	Design curves. Radius of loaded area and principal stress difference of soil required	Triaxial test.
Civil Aeronautics Administration	Design curves Soil class and load required.	Classification tests, including grading, Atterberg constants, capillary rise, and California bearing ratio.

Minnesota - Design of thickness is based on correlation of service observations of roads with laboratory tests of bearing value made on soil conditioned to the moisture content and density found to approximate field conditions.

New Mexico - Thickness of granular base is estimated by use of graphs derived from tests of pressure on subgrades applied by truck wheels and transmitted through base courses of various thicknesses, as reported by Spangler and Ustrud in Vol. 20, Proceedings of the Highway Research Board.

North Carolina - Thickness design takes into consideration the type of base - untreated selected soil and crushed stone or gravel. The design considers three main factors: (1) the load and its mode of application, (2) the bearing capacity of the materials in the base structure and subgrade, (3) the distribution of the pressure exerted by the applied load.

California - The method makes use of the Hveem stabilometer - a triaxial testing device which measures the transmitted horizontal pressure resulting from an applied vertical pressure - to determine the "resistance value" (R) of the material and an expansion pressure apparatus to measure the pressure generated by swelling soils when held at practically constant volume in contact with water. The design is then based on the R values and expansion pressures of the underlying soil for several conditions of moisture and density, in relation to the estimated traffic and thickness of cover.

Group Index Method - A number of States use the group index in estimating the required thickness of subbase and total pavement. Values of the group index are derived from tests of grading, liquid limit and plasticity of subgrade soil.¹

Airport Pavements - The Corps of Engineers uses the California Bearing ratio test. The Civil Aeronautics Administration uses a numerical index of subgrade value based upon an empirical soil classification system. The Bureau of Yards and Docks of the Department of Navy uses loading tests on trial pavement sections.

Committee on Flexible Pavement Design, Highway Research Board - Reporting in Current Road Problems No. 8-R (Revised Edition) the Committee presents tables of recommended thicknesses for 18,000-lb. axle loads of granular type stabilized base courses, soil-cement base courses, subbase and pavement courses, in relation to the Highway Research Board subgrade soil classes.

CONCRETE PAVEMENT DESIGN

In the field of concrete pavement design there have been some recent definite trends, or changes in practice pertaining principally to subgrade preparation, subgrade elevation, pavement thickness, properties of the concrete, design and spacing of transverse joints and the use of reinforcing steel.

¹ - Standard Recommended Practice for the Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes. American Association of State Highway Officials, Designation M 145 - 49.

There is a decided trend towards abandoning the thickened edge concept of design and adopting uniform thickness in the slab cross-section. The general use of wider pavements which tend to permit loads to travel less close to the edges of the pavement may be one reason for this change, but, the major reason may be the fact that most of the load failures in old pavement are found developing in the middle, thinner portion of the thickened edge pavements. Several States particularly in the East, where heavy truck traffic has increased greatly in the last few years, are building thicker pavements than formerly.

In considering the present day problems in concrete pavement design some of the early thinking on the subject is of interest. The following is summarized from Professor T. R. Agg's text book (Third Edition - 1924) on, "Construction of Roads and Pavements."

Concrete slabs must support the traffic load and resist wear. They require strength and durability and their design entails consideration which do not always arise in other work.

Information now available permits more nearly a rational design than previously, but it is not yet possible to set forth a design that can be used with assurance for all conditions of traffic climate and soil.

Behavior of concrete slabs under various destructive agencies is fairly well known and thus indicates certain general principals that should be followed in design.

Temperature and moisture effect expansion, contraction, and curling actions which develop stresses depending on thermal coefficients and absorption of the constituent materials after they are cemented together and subjected to variations in moisture, temperature changes and complex dead and live load forces.

The effects of traffic on concrete pavements are to bend and distort the slabs. The slab deflects under the points of load and rises slightly at points away from the load, up to 12 feet distance. At cracks or joints exposed to traffic, unevenness of the surface will invite impact and serious concentration of forces at edges and corners which may cause progressive spalling and cracking and aggravate conditions inviting more rapid weathering. There is reason to believe that well-maintained pavements (smooth surfaces) are not subjected to serious impact, especially under pneumatic tires.

Concrete pavement design practice in the United States has stemmed largely from the results of the Bates Experimental Road in Illinois, the Pittsburg Test Road in California, the theoretical method of evaluating subgrade support of Dr. H. M. Westergaard, and the studies of the Bureau of Public Roads and other agencies. After the Bates Road tests the thickened edge cross section for slabs came into common use. Thicknesses have been based largely upon experience, although practice has been definitely influenced by the recommendations of the Bates Road investigators that the slab

thickness should be directly proportional to square root of the quantity $\frac{3P}{f}$ in which P is the imposed load and f is taken as not greater than 50 percent of the modulus of rupture of the concrete. This in effect allows 50 percent for the effects of fatigue, moisture and temperature stresses and other stresses produced by factors such as impact and subgrade movement.

The formula for slab thickness $t = \sqrt{\frac{3P}{f}}$ makes no allowance for subgrade support, on the assumption that temperature differentials cause the slabs to curl at the edges under some conditions thus removing it from contact with the subgrade, or that subgrade support may be lost by other causes.

In the Westergaard stress analysis the factor of subgrade support is considered and a factor K, the "subgrade modulus" was introduced into the stress formulas. Modifications of the formulas have since been proposed as the result of extensive researches. The status of knowledge concerning stressed in concrete pavements was summarized by E. F. Kelley in Public Roads magazine for July and August 1939.

From extensive researches and analytical study considerable knowledge of the stresses in concrete pavement caused by static wheel-loads and impact under moving loads due to irregularities in the pavement surface has been gained. Methods are available for pavement designs based upon this conception of load and upon a 50 percent stress allowance for fatigue.

However, the frequency and speed of moving loads, and in many cases the weights, have increased enormously, and recent experiences indicate that the earlier concepts may no longer explain what happens to the pavements. For instance, a great mileage of existing pavements is probably close to the fatigue limit for usage by 18,000-lb. axle loads.

Since the time of the Bates Road Test, how much dependence to place on dowels as a means of reducing load stress in the concrete, has been a moot question. However, it is now apparent that there is a growing tendency among designers to disregard dowels as a substitute for calculated required slab thickness, and to use them only for maintaining level alignment of the surface of adjoining slabs.

Within the last few years no less than half of the state highway departments have discontinued using thickened edge slabs and adopted uniform thickness for slab cross section. Some states still use both the thickened-edge design and uniform cross-sections. On the basis of last year's record, seven states were using the thickened-edge design exclusively.

Another major trend is that of omitting expansion joints, or rather of substitution of transverse contraction joints for expansion joints.

The use of granular material between the concrete pavement and the subgrade, has, in a very recent period become the common practice in a large number of States. It has been definitely demonstrated that granular materials placed over fine-grained or pumping soils will prevent pumping.² The observed distress of old pavement, and a

² - Final Report of Committee on Maintenance of Concrete Pavement as Related to the Pumping Action of Slabs. Harold Allen, Chairman. Proceedings of Highway Research Board, Volume 28, p. 281, (1948).

few of the newer ones, where heavy war-time truck traffic and the large military convoys were imposed upon them caused the highway engineers to question the adequacy of their designs. After study of the conditions the predominating conclusion was that the subgrades had not been properly treated or blanketed prior to the placing of the concrete slab. There has not been complete agreement on the details of the analysis of the trouble nor on how to cope with it most economically. Among forty or more states who presently require some kind of granular subbase, which may be anywhere from 4 inches to 15 inches in thickness, there is approximately a 2 to 1 preference shown in favor of using a porous readily drainable material rather than a dense graded relatively impervious layer. The problem of evaluating subgrades and subbases for rigid type pavements should have high priority in the national program of research.

Two of the structural features of concrete pavements mentioned previously, - properties of the concrete and the spacing of contraction joints to control cracking, have been found to be very closely related. Concrete made with aggregate having high thermal coefficient or high modulus elasticity has been found to require close spacing of joints to control cracking that tends to result from contraction and curling stresses. It is expected that these two factors, concrete composition and joints, will be studied much further; and that each of them will also be studied in relation to both the thickness of pavement and the manner and type of steel reinforcement which may be used in the concrete.

THE PROBLEM OF HIGHWAY LOADS AND STRUCTURAL DESIGN OF PAVEMENTS

It is apparent that further information on the relations of physical properties of pavements to magnitudes, frequencies and speeds of moving wheel-loads must be secured. The proportion of heavy vehicles on many miles of highways has increased to the point where principles of design must be re-examined and rational methods for design of new pavements and for re-appraisal of existing pavements developed. To this end the inter-relationships of these three sets of factors must become known:

1. Magnitude, frequency and speed of traffic loads,
2. Load supporting and durability characteristics of subgrade, subbase, base and pavement surfaces,
3. Effects of climatic conditions, such as heat, cold, ice, humidity, rainfall.

For many years the trend has been unmistakably toward heavier vehicles, traveling faster and closer together. The effects of many features of this kind of traffic on pavements have not been evaluated. For instance; what are the relations of stress and duration of stress to spacing of axles on heavy trucks and to various intervals between passage of separate vehicles? A static load of given size will produce a certain deformation of the pavement structure. If the same load is rolled along rapidly, it may not stay in one spot long enough for the full deformation to develop. But perhaps the next load gets there before the pavement has recovered from the deflection caused by the preceding load and so on. In such a case does the deflection accumulate, and what is the permanent deflection that is left when the passage of loads stops? There is also the large unexplored field of vibratory stresses. What is the effect of these stresses in the different components of a road and in structures?

To these and many other questions we do not have the answers.

It is known that concrete will fail under fatigue caused by repeated load applications under less stress than that caused by the maximum static load. The best known data on fatigue were derived from tests made in connection with the Bates Road, in which loads were applied to specimens at uniform intervals of $1\frac{1}{2}$ sec. But present day heavy trucks, with multiple axles, apply loads under an altogether different pattern of time interval, frequency and speed than was the case at the time of the Bates Road Tests in 1924. Do these fatigue data apply? Or, do they apply when the loads follow each other frequently but with irregular spacing? Do we need a greater margin of safety in design? We do not know the answers, but it may be there is something here that has had to do with the breakup of pavements.

Climatic conditions, which vary with geography, are known to have great effects on the supporting power and fluctuations in supporting power of the subgrades on which pavements are laid. This is a vital factor, because, pavements, like other structures are no better than their foundations. For instance, the effects of frost, which are under study now, are far from being completely understood.

In their analysis chart of the factors affecting the structural adequacy of pavements Hveem and Carmany¹ pose the following three basic problems in the design of pavements:

1. "How to anticipate the state of moisture density equilibrium which will develop in the soil during the service life of the project?"
2. "How to prevent failure due to plastic deformation of the basement soil?"
3. "How to prevent failure due to cracking of base and surface caused by flexing of foundation - fatigue failures?"

The answers to these questions depend upon knowledge of the inter-relationships of load, pavement characteristics and climate as previously mentioned. Much information is available on questions 1 and 2; not much on Number 3. There is ample need for research in all three.

Principle needed researches bearing upon the three questions are:

1. Information on seasonal moisture movements and changes in state of soil water and how they affect changes in bearing capacity.
2. Relations between magnitude, speed and frequency of rolling loads and stresses and strains in pavement and base courses; and deformations in subgrades under varying conditions. Magnitude of movement of slab ends necessary to start pumping of rigid pavements, in relation to soil type. Relations of characteristics of materials to strength and durability of pavements, and thermal properties of materials and mixtures.
3. Fatigue characteristics of rigid slabs, and effects of flexing of flexible pavement surfaces, bases and subgrades involving studies of fatigue failures, accumulative deformations, and resilience.

¹ - F. N. Hveem and R. M. Carmany, "The Factors Underlying the Rational Design of Pavements," Proceedings, Highway Research Board, Vol. 28, p. 101 (1948).

THE TRUCK WEIGHT PROBLEM IN HIGHWAY TRANSPORTATION
HIGHWAY RESEARCH BOARD

CHAPTER VI

Suggested Research Projects and Selected Bibliography
(Including a Test Road Program)

1. Problem Summary

The previous chapters point out several significant facts. Heavy truck transportation on rural roads has shown unprecedented growth, with the most phenomenal increases in the heaviest units. The ratio of axles of 18,000 pounds or over to total truck axles has increased sevenfold since 1940, and the ratio of units of gross weight of 50,000 pounds or more to total units has increased 12 fold, during the same period.

Fifteen states allow various axle loads in excess of the limits recommended by the A.A.S.H.O. policy of 1946, while thirty-four states hold close to the recommended policy. Legislation was introduced in several states during the 1949 sessions of legislatures to increase size and weight limits.

Control over granting overweight permits is increasing. Special routing, seasonal restrictions and other regulations are making for stricter policies. Among the states load limitations and manner of issuing permits vary widely.

In 1948, 5.5 percent of trucks and combinations exceeded the legal weight limits. Individual states have reported up to 25 percent of trucks and combinations in violation of the size-weight laws. Forty-seven states report the use of loadometers, or pit-scales in enforcement of legal load limits. Several states are installing pit scales at this time. Enforcement costs and fines are running into several millions of dollars annually, with increasing activity in the enforcement field.

At present structural design practices vary widely. Empirical formulas, and judgment based on past pavement performance are used in present design of pavements.

Interpretation of Summary

The foregoing summarization carries certain far-reaching implications:

1. The potential demand for use of the heaviest axle and gross vehicle loads is extremely high and increasing. The import of this demand is that more frequent applications of the heaviest permissible loads at faster speeds are to be expected. This implies the necessity for factors in design correlating frequencies, magnitudes and speeds of wheel loads.
2. The lack of uniformity in size-weight laws among the states causes a great deal of questioning as to what the appropriate limits should be, and creates an awkward situation for truck manufacturers and for interstate transporters.

3. The variety of policies and practices in the issuance of overweight permits becomes a source of vexation to the interstate transporter, and raises a question as to the propriety of allowing loads to be carried by permit in excess of limits allowed by license.
4. The increase in violations of maximum legal load limits is symptomatic of the intense desire for transporting by the most economical vehicle regardless of weight.
5. Finally, the wide variety in design practice indicates gaps in our present knowledge of structural design of pavements.

Need for Research

The import of this interpretive discussion is that there are important unanswered questions relating to the use of the heavy truck in highway transportation. Questions concerning design as related to the economics of demand, understanding of factors basic in size-weight legislation, uniform practice in issuance of overweight permits, and methods for effectuation of optimum enforcement, face the highway departments. The need for true answers to these questions is recognized and their importance accord them top priority in highway research.

A RESEARCH PROGRAM

A complete research program on the structural design of pavements alone would involve inquiry along many lines. Some 75 research projects bearing upon the problems of pavement design are mentioned in the October 1949 issue of the Highway Research Review. A comprehensive research program bearing on all the questions involved in the truck weight problem would include test roads, laboratory studies, pavement performance surveys, statistical studies, traffic performance studies and enforcement studies.

To study the relationships between loads, pavements and subgrades, full scale tests will be necessary. This will involve the controlled loading of test pavements together with measurements of the effects of loads on the elements of the pavement structure and the subgrade. Complementary laboratory investigations will naturally be required.

To get a test program within reasonable limits some selection must be made among the many variables of loading, structure, foundations and climate, that affect pavement service life. Success will depend upon the significance of the variables included in the program of study.

The variables that must be considered are as follows:

1. Wheel loads

- a. Magnitude
- b. Frequency
- c. Axle Spacing
- d. Lateral Placement
- e. Speed (various uniform rates, also acceleration and deceleration)
- f. Direction of movement
- g. Tire equipment

2. Subgrade

- a. Soil Type
- b. Moisture
- c. Density

3. Base and Subbase

- a. Type
- b. Cross Section
- c. Density

4. Pavement

- a. Type
- b. Section
- c. Thickness
- d. Reinforcing
- e. Joints (type and spacing)
- f. Age

Climate and Geography

Northern Humid Region (Glacial Soil Area, approximately Northern $1\frac{1}{2}$ tiers of States East of Missouri River)

Central Humid Region where subgrade freezing is less severe

South Humid Region where subgrades do not freeze

Western Semi-arid Region

Humid Pacific Coastal Areas

Controls

Careful consideration will need to be given to the range of variation, and the number of changes to be employed in each variable, since the number of test sections increase in geometrical progression with controlled variables. Complementary laboratory research to determine certain corollary relationships will reduce the number of field test sections required. For example the effects of fatigue may be investigated more readily and thoroughly in the laboratory than in the field.

Loads and structure can be controlled to develop data which may be interpolated or extrapolated within reasonable limits, and tests can be made at sites having regional characteristics in climate and soil.

Interest in a Research Program

Interest in the truck weight problem has been expressed in all of the States. In approximately half of them the problem is regarded as extremely serious. In only two States is it thought that there is no problem due to heavy loads. New England, and some other Northern States where thick granular subbases are generally employed against frost action, and in some Southern States where freezing temperatures seldom

penetrate to the subgrade the problem apparently is not felt as gravely as in the middle latitudes where with humid climate and wide variations in temperatures and sub-bases of less thickness the subgrades are subjected to many cycles of freezing and thawing each year. The semi-arid western states apparently felt the problem less severely than the states on the West Coast, and along the Mississippi River tributaries.

A predominant interest was indicated in some form of an accelerated road test either on existing roads or on specially built test roads incorporating the more important variables presently used in pavement design. Many engineers expressed the need for several regional test roads.

Willingness to cooperate in a fact-finding study was indicated by 31 of the 48 States. Others, while indicating their interest and desire to cooperate were not sure of the extent to which they might participate financially. Three administrators said that state laws might prevent financial assistance to a project operated outside of their own state.

Organizing for a Program of Research

It is generally agreed by highway officials that the research required in this field is too costly to be sponsored or undertaken by any single agency. The cost to the participating States of the road test now being made in Maryland, known as Road Test One - MD, discussed below, is expected to approximate \$65,000. But this is only about 1/3 of the total cost. The Bate's Road Test conducted by the Illinois State Highway Department in the early Twenties cost over \$500,000.

Besides, there is the regional aspect to the test road research. Varied soil and climatic conditions in the different sections of the United States make it desirable to conduct tests in perhaps five different regions. Therefore, a project too costly for one state might be borne by several states jointly.

Attention is directed to the procedure, approved by the Executive Committee of the American Association of State Highway Officials, for formulating and administering research projects recommended by committees of the Association to be jointly financed by two or more states. (This procedure is reprinted in the Appendix of this Chapter).

As an example of a cooperative undertaking in test road research the Test Road One - MD affords a good illustration. Representatives of a group of States in the central and eastern regions called together to discuss the truck load problem organized an Interregional Council on Highway Transportation to do something about it. Through the instrumentality of this group, arrangements have been made in accordance with the recommended A.A.S.H.O. procedure, for the Highway Research Board to conduct large-scale accelerated tests of a concrete pavement under controlled truck traffic using single axle loadings of 18,000 and 22,400 lb. and tandem axle loadings of 32,000 and 44,800 lb. This project is supported financially by 11 States, the District of Columbia and Bureau of Public Roads, with trucks and fuel furnished by the automotive and oil industries. A mile of existing concrete pavement has been turned over to the project by the State Roads Commission of Maryland.

In addition to these cooperative possibilities there is still opportunity and need for individual research. Reference is made to the following classified listing of Suggested Research Projects. Included in this listing are several projects adaptable to research by a single state highway department or by individual effort.

Suggestions for Research

During the 48-State canvass the highway departments were invited to submit suggestions for fact-finding studies. In response to this invitation 40 specific suggestions for research were received, a number of these being identical in character. It is evident from this return that there are many features of pavement design on which knowledge is lacking.

The suggested subjects, including field, laboratory and statistical research have been grouped under nine general headings in the listing which follows:

I. Field Tests

1. Effects of variation in structural design
 - a. Type of pavement
 - b. Kind, size and shape of aggregate
 - c. Continuous heavy re-inforcement
 - d. Type of subgrade, base and subbase
2. Effects of climatic conditions
3. Effects of traffic in normal composition
4. Effects of truck size-weight and maneuverability on geometric design

Some specific projects suggested to obtain information and data on the above subjects are:

- (a) Install various types and cross-sections of pavement and base courses in experimental roads.
- (b) Construct various types of subgrade treatments.
- (c) Construct concrete base on poor subgrade, overlay with macadam, and then place bituminous wearing course.
- (d) Construct similar test roads in 4 or 5 regions to observe effect of climate and soils.
- (e) Construct heavily reinforced concrete pavements.

II. Pavement Performance, or Condition Surveys

1. Effect of subgrade compaction on required pavement thickness.
2. Retention of relative densities obtained in subgrade by compaction.
3. Value of crushed material as an aid in mechanical stabilization of base course material in flexible pavements.

III. Laboratory Investigations

1. Effects of particle size and shape on stability and required thickness of bases and surface courses.
2. Effects of applying loads with various frequencies, durations of loading and rest periods with respect to fatigue accumulation and recovery.

As one phase of research item 2 the following project was suggested:

- (a) Provide pulsating application of the same static load through the medium of a single axle, then a tandem axle to determine relative fatigue resulting from comparable stress but with deflections differing in magnitude and area.
- (b) Provide the same dynamic load applied through a moving single and moving tandem axles at various speeds and frequencies to determine relative fatigue resulting from comparable stress but with deflections differing in magnitude and area.
- (c) Vary tandem wheel spacing and load to obtain comparable fatigue with single axle load used as control, using same frequency of application and speed.

IV. Statistical Studies

1. Age versus ton-miles carried in various axle-weight groups before reconstruction.
2. Cost per ton-mile of operations by axle-weight groups as shown in maintenance and construction costs during life of pavement, correlated with axle frequency distribution and speed distribution.
3. Correlation of condition survey, maintenance costs, pavement design, magnitude and frequency of axle loads.
4. Determine point of diminishing returns in weighing operations. (Cost of weighing versus fines received and conservation of highway system through reduction of overweight axles).

V. Accident Analysis

1. Determine accident rate per 100 million miles for or caused by trucks by weight group as compared to rate for or caused by passenger cars.
2. Correlate brake failures as cause of accident by trucks and by passenger vehicles.

VI. Traffic Studies

1. Effects of trucks on traffic delays.
2. Relative effects on percentage of violations of legal load limits of spontaneous checks versus regular pit scale operation.
3. Determine percentage of repeaters in load limit violations.
4. Determine reasons for violations and/or repetitions of violations of legal load limit by truck ownership.

VII. Study of Economic Interrelationships of Several Modes of Transport

A specific project suggested under this heading is the following:

Study origins and destinations of commodities hauled and compare transportation rates by rail and by motor freight.

VIII. Truck Load Law Study

1. To develop a simplified overweight law.

IX. Cooperative Investigation

1. A rational study in cooperation with the Bureau of Public Roads and Production Marketing Association to develop a marketing procedure which results in a minimum of hauling during the critical spring season.

TEST ROADS

It is apparent that many important questions relating to the effects of heavy moving loads on pavements can only be answered on full scale road tests by observing and measuring the effects of frequent passage of vehicles of known axle loadings at known speeds over pavements of definitely known composition and dimensions, on foundations of known character and load supporting ability.

In order to depict the factors involved in a test road program the following suggestive lay-out in broad outline is offered.

Number of Test Roads

To evaluate geographical and climatological conditions, test roads are suggested in five regions of the U. S.: Northern humid, Central humid, Southern humid, Western semi-arid and Pacific coastal humid.

Test roads should be on at least two soil types; cohesive and granular. A silty soil should be included if possible.

To include two soil types in each geographical region would require 10 test roads. It may be that the two or three soil types could be distributed among five regional test roads. Possibly some locations might be found with two satisfactory soil types in close enough juxtaposition for one test road to suffice.

Test Road Variables

Each test road would afford opportunity to evaluate a number of variables. However, the roads should include a minimum number of variables.

Subgrade Soil Condition

It would be desirable to include both moisture and density as variables, but that does not seem practical for an accelerated type of traffic test. Since the physical condition of most soil subgrades will fluctuate somewhat seasonally the important thing is to select a location where the composition of the soil is uniform and to so prepare the subgrade that any changes in condition will be uniform throughout the sections.

Tests should be made during both critical (if any) and non-critical seasons and extend over at least one year. An accelerated test will not permit complete adjustment of a subgrade soil to its environment. Therefore, any newly built test section should have the soil placed at a moisture content as near as possible to that which normally obtains in service. If practicable, at least one or more projects (in areas where freezing occurs) should include one where a frost susceptible soil prevails. That would make possible the determination of the effect of frost action.

Bases and Subbases

Sections of especially built experimental pavement should conform as far as possible to current design practice for typical highway traffic. Other sections should be built which are well below the required load bearing capacity and some should exceed the required load bearing capacity. Several thicknesses of base courses and subbases would be needed.

Pavement

Both flexible and rigid pavements of several thicknesses should be tested. Possibly more than one type of flexible pavement should be included. In concrete, plain and reinforced sections should be tested and joint type and spacing should be planned to yield useful data.

Loading

Test loads should be applied to observe the effects of magnitude, axle spacing, speed and frequency upon the pavements, bases and subgrades. A special fleet of vehicles and drivers should be used so that the loading schedule can be under exact control.

Observations

All effects of loads upon the pavement structure should be measured. The principal measurements will be deflection of subgrade, base and pavement surface under static and moving loads and stress deformations.

Detailed observations of moisture and density conditions of subgrades, sub-bases and bases should be made continually.

Observable effects, such as cracking, spalling and displacement should be measured and recorded.

A detailed record of meteorological data should be kept.

Corollary Investigations

Fatigue of concrete

Mechanics of load support of bituminous mixtures

Seasonal moisture movements in soil and changes in state of soil water and how the effect changes in bearing capacity.

Use of Existing Pavement for Study

Useful data can be obtained by controlled loading tests on existing pavements, although such tests will probably raise some questions that will have to be answered finally on specially built sections.

On an existing pavement the program of loading and observations would be about the same as on a specially built test road. Before testing, it would be necessary to make every conceivable measurement and observation on the subgrade, base and surface layer of the road. Also the construction and material records should be studied.

Some tests on existing roads should be made as pilot studies. Much usable information could thus be secured quickly at moderate expense and the lessons learned would result in economy of time and money on future test roads. It would be desirable to use road sections for this purpose upon which detailed records of materials, soil conditions and construction had been kept.

INITIAL PROJECT

(TEST ROAD ONE - MD)

At the initiation of the Interregional Council on Highway Transportation, an organization of officials of Central and Eastern States, arrangements have been completed for the conduct of an accelerated loading test of a 1.1-mile section of concrete pavement in Maryland. This project has been arranged cooperatively by the

States of Connecticut, Delaware, Illinois, Kentucky, Maryland, Michigan, Ohio, Pennsylvania, Virginia, Wisconsin and New Jersey, District of Columbia and Bureau of Public Roads, and is being directed and administered by the Highway Research Board.

The pavement is mesh-reinforced, and consists of two 12-foot lanes separated by a longitudinal joint, each lane having a 9-7-9-inch cross section. The pavement is laid on a base of granular material believed to be of above average stability.

The 1.1-mile section of this road has been closed to public traffic, and, dividing the total length into approximate halves, the two lanes of each half will be used as test tracks over which a controlled traffic of test vehicles will be operated, night and day, 7 days a week, for at least six months.

On one half of the road the vehicles to be operated on one lane will be single, two-axle trucks having an axle weight of 18,000 pounds. On the lane immediately adjacent the test vehicles will be single, two-axle trucks with an axle weight of 22,400 pounds.

On the other half of the road, the two lanes will be similarly subjected to a controlled test traffic, the traffic on one lane consisting of single tandem-axle trucks with a tandem weight of 32,000 pounds and on the other lane consisting of single tandem-axle trucks with a tandem weight of 44,800 pounds.

The loading schedule will result in a repetition of the controlled heavy load application at intervals averaging one per minute. The effects of the loads will be determined by observation of the cracks that form in the pavement and by measurements of the strain in the pavement and determination of changes that occur in the elevation of the surface of the pavement.

The road was paved in 1941 and has withstood normal traffic and seasonal weather changes for 9 years with very little damage.

TRUCK WEIGHT PROBLEM

Selected References

1. Whitton, Rex M., Chairman. "Report of Committee on Permits for Oversize and Overweight Vehicles". Proceedings, Highway Research Board, Vol. 21, pp. 305-310, 1941.
2. U. S. Interstate Commerce Commission. "Federal Regulation of the Sizes and Weight of Motor Vehicles". 77th Congress, 1st Sess., House Document No. 354, 1941.
3. MacDonald, Thomas H., Commissioner of Public Roads Administration. "Recommended Policy on Sizes and Weights to Permit Free Movement of Motor Vehicles Between the States". Address before the Federal-State Conference on War Restrictions, Washington, D. C., May 5, 1942.
4. Paxson, G. S., Bridge Engineer, Oregon State Highway Department. "Factors Influencing the Stress in Concrete Pavement from Applied Loads". Proceedings, Highway Research Board, Vol. 25, pp. 59-71, 1945.
5. Dimmick, Thomas B. "Heavy Axle Load Frequency". Proceedings, Highway Research Board, Vol. 25, pp. 354-363, 1945.
6. Highway Research Board. "Special Papers on the Pumping of Concrete Pavements". Research Report No. 1-D, 1945.
7. National Conference on Street and Highway Safety. "Uniform Vehicle Code. Act V: Uniform Act Regulating Traffic on Highways". Washington, D. C., U. S. Government Printing Office, 1948.
8. National Conference on Street and Highway Safety. "Model Traffic Ordinance". Washington, D. C., U. S. Government Printing Office, 1946.
9. Highway Research Board. "Special Papers on the Pumping Action of Concrete Pavements". Research Report No. 1-D, 1946 Supplement.
10. American Association of State Highway Officials. "Policy Concerning Maximum Dimensions, Weights and Speeds of Motor Vehicles to be Operated over the Highways of the United States". Adopted April 1, 1946.
11. Loutzenhiser, Fred B. "Effect of the AASHO Code on Truck Design". Commercial Car Journal, July, 1946.
12. Woods, K. B., Green, F. H. and Sweet, H. S. "Pavement Pumping Correlated with Traffic Loads". Proceedings, Highway Research Board, Vol. 27, pp. 209-231, 1947.
13. Highway Research Board. "Maintenance Methods for Preventing and Correcting the Pumping Action of Concrete Pavement Slabs." Current Road Problems No. 4-R, Revised, Sept., 1947.

14. Highway Research Board. "A Survey of Pumping in Illinois". Research Report No. 1-D, 1948 Supplement.
15. Allen, Harold, Chairman. "Final Report of Committee on Maintenance of Concrete Pavements as Related to the Pumping Action of Slabs". Proceedings, Highway Research Board, Vol. 28, pp. 281-309, 1948.
16. Civil Engineering. "Bituminous Subsealed Concrete Pavements Withstand Accelerated Traffic Tests". P. 40, June, 1948.
17. American Association of State Highway Officials, National Conference on Street and Highway Safety and Institute of Traffic Engineers. "Manual on Uniform Traffic Control Devices for Streets and Highways". Washington, D. C., U.S. Government Printing Office, 1948.
18. American Trucking Associations, Inc. "American Trucking Trends, 1949". An annual publication. Washington, D. C.
19. Truck-Trailer Manufacturing Association, Inc. "State Size and Weight Limits for Trucks and Truck-Trailers". Washington, D. C., 1949.
20. Automobile Manufacturers Association. "Motor Truck Facts, 1949". An annual publication. Detroit, Mich.
21. The Four Wheel Drive Auto Co. "Truck and Trailer, Size and Weight Restrictions". Clintonville, Wisc., 1949.
22. Portland Cement Association. "A Charted Summary of Concrete Road Specifications Used by State Highway Departments". Chicago, Ill., 1949.
23. Fairbank, H. S. "Sizes and Weights of Motor Vehicles Require Economic Study". Civil Engineering, p. 40, June, 1949.
24. Ohio State Highway Dept. "Effect of Increased Truck Weight Limitations on Highway Pavements Proposed in Ohio State Senate Bill No. 163". June, 1949.
25. MacDonald, Thomas H., Commissioner of Public Roads Administration. "Highways in the Public Service". Presented at ARBA Conference and 46th Annual Meeting, Washington, D. C., Feb. 7, 1949.
26. Woods, K. B., "Effect of Heavy Loads on Pavement Design". Paper presented before Highway Division of ASCE at Oklahoma City, Okla., April 21, 1949, and will be available in June from the Society.
27. Masheter, P. E. and Marshall, H. E. "Foundations for Pavements". Presented at ARBA Conference and 46th Annual Meeting, Washington, D. C., Feb. 7, 1949.
28. National Highway Users Conference. "Motor Vehicle Law Series: State Restrictions on Sizes and Weights". Current Loose-Leaf. Washington, D. C.
29. U. S. Bureau of Public Roads. "Traffic Trends on Rural Roads". Public Roads, A Journal of Highway Research, Oct-Nov-Dec., 1946, March, 1948, March, 1949, and Feb., 1950. Washington, D. C.

30. U. S. Bureau of Public Roads. "Highway Statistics". An annual publication.
31. Lynch, J. T. and Dimmick, T. B. "Axle Load and Gross Load Trends". Presented at 29th Annual Meeting, Highway Research Board, 1949.
32. Hadden, Samuel C. "The Problem of Highway Vehicle Size and Weight Distribution". Paper presented at Midwestern Regional Conference of the Council of State Governments at Davenport, Iowa, July 26, 1949.
33. Engineering News-Record. "Checking Highway Damage". P. 21, Nov. 17, 1949.
34. Lant, N. E. "Overloads Injure Roads and are Menace to Safety". Louisiana Highways, Vol. 3, No. 12, pp. 3-6, Dec. 1949.
35. Saal, Carl. "Time and Gasoline Consumption in Motor Truck Operation as Affected by the Weight and Power of Vehicles and the Rise and Fall in Highways". Highway Research Board, Research Report No. 9-A, Feb. 1950.
36. The Truck Weight Problem in Highway Transportation. Factual review of the problems issued in six installments (1950) Highway Research Board.

APPENDIX

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS
COMMITTEE ON RESEARCH ACTIVITIES
REPORT OF SPECIAL COMMITTEE

Procedure for Formulation and Administration of Research Project Recommended by Committees of the American Association of State Highway Officials to be Financed Jointly by Two or More States.

(Approved by Executive Committee, American Association of State Highway Officials, September 24, 1948)

1. A Committee of the American Association of State Highway Officials desiring to recommend a research project for joint financing by two or more States, with or without use of Federal-aid $1\frac{1}{2}$ percent funds, should submit a project statement and estimates of cost to the Committee on Research Activities. The project statement should show the need for the research, the scope of the proposed work, and list the States that might be expected to take part.

2. The project statement should be referred for comment to the chairman of other appropriate committees of the Association. On due consideration thereafter the Committee on Research Activities should transmit a report of its findings with recommendation for action to the Chairman of the Committee on Standards of the Association.

3. If recommended by the Committee on Research Activities, the Chairman of the Committee on Standards should submit the proposed project to the consideration of the States that may be concerned in its financing and of the Public Roads Administration and ascertain which of the States are willing and able to participate. The Chairman of the Committee on Standards should thereupon notify the Highway Research Board of the proposed project and of the interested agencies.

4. Upon receipt of this notification, the Highway Research Board should offer its Correlation Service to the States concerned and to the Public Roads Administration for the purpose of arranging, to the satisfaction of all contributing States, a scheme of joint financing.

5. If desired by the States concerned, and upon approval of its Executive Committee, the Highway Research Board should undertake supervision and administration of the jointly arranged project, proceeding as follows:

- (a) To enter into agreements with the individual States for payment to it of contributions to the support of the work.
- (b) To appoint a project committee to plan and direct the work, which committee shall include representatives of the Committee on Research Activities and of the Committee sponsoring the project.

- (c) To arrange the necessary staff and proceed with the work.
- (d) To prepare and publish reports of the project in accordance with the terms of its agreements and with the approval of the Committee on Research Activities and to distribute such reports to all States and the Public Roads Administration.