Vehicle Size and Weight Regulations, Permit Operation, and Future Trends

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This paper reviews current limits on truck sizes and weights, present practices in permit issuance, and current trends in vehicle sizes and weights. Present legal limits on sizes and weights are summarized, and the permit operations of several states are reviewed. Future trends in the sizes and weights of trucks are indicated. Problems of and implications for the present highway system are identified and discussed.

The size and weight of commercial vehicles operating on the public highways of this nation are controlled by various federal, state, and local regulations (1, 2, 3), including the provisions of the Federal-Aid Highway Act (U.S. Code, Vol. 5, section 127, 1956 and 1974). While these limits are fixed, all of the states allow movements exceeding them through the use of oversized-overweight vehicle permits available by special application. Some permits are issued annually on a routine basis. Other "one time only" moves can be extremely complicated and require extensive engineering study before a decision on the permit can be made. The trends shown in vehicle sizes and weights through permit operation reflect potential future changes in truck transportation.

The objectives of this paper are

1. To present a summary of present legal limits on sizes and weights,
2. To summarize permit operations of several states,
3. To indicate future trends in the sizes and weights of vehicles, and
4. To discuss some problems in the present system and suggest improvements that might be made.

SUMMARY OF LEGAL LIMITS

Historical Perspective

The public good has been served through government regulation of the size and weight of commercial vehicles. The reasons justifying these regulations were probably best summarized by the Interstate Commerce Commission (ICC) in 1941; the reasons included protection of existing highways and bridges, conservation of state resources, promotion of safety, and control of competition between different forms of transportation.

Before 1956, individual states had exclusive jurisdiction in the regulation of vehicle size and weight. However, in that year, the federal government entered the arena with the passage of the Federal-Aid Highway Act of 1956. Section 127 of that act stated that no federal highway funds were to be allocated to states that allowed vehicles to operate on the Interstate systems with single-axle loads in excess of 80 kN (18 000 lb), tandem-axle loads in excess of 140 kN (32 000 lb), gross vehicle weights exceeding 325 kN (73 280 lb), and overall width greater than 245 cm (96 in). However, if the state limits established in July 1956 were greater than those described above, then the higher limits were to continue in effect. These regulations effectively restricted truck sizes, since federal aid constituted the major portion of the funds for new highway construction and rehabilitation.

Studies after passage of that act concluded that the limits could indeed be raised (4). After much heated debate, the Federal-Aid Highway Act of 1974 amended the 1956 act by raising single-axle and tandem-axle limits to 90 and 150 kN (20 000 and 34 000 lb), respectively. Gross vehicle weights were to be determined by the "bridge" formula but were not to exceed 355 kN (80 000 lb). Specifically, the bridge formula is

$$W = 0.227[3.28LN/(N-1) + 12N + 36] \tag{1}$$

where

W = overall gross weight on any group of two or more consecutive axles as the mass in megagrams,
L = distance in meters between the extreme of any group of two or more axles, and
N = number of axles in the group under consideration.

References for actual calculation of the gross vehicle weight are available (5). This bridge formula relationship demonstrates that, if gross vehicle weights are increased, an increase in vehicle length and the number of axles may be required on short bridge spans to maintain the bridge stresses at an acceptable level. For long bridge spans the large dead loads relative to the live loads make it possible to increase gross vehicle weights.

Weight Limits

The present legal weight limits for steering axles, single axles, tandem axles, and the entire vehicle are summarized by state in Table 1 (1, 6, 7). These loads range from 80 kN (18 000 lb) to 105 kN (24 000 lb) for a single axle and 140 to 200 kN (32 000 to 44 000 lb) for a tandem axle as shown in Figure 1. Tandem axles are normally defined as axles with a spacing between 100 and 245 cm (40 and 97 in) apart. Most single-axle maximums are between 80 kN and 100 kN (22 000 lb), whereas load limits for tandems are primarily in the range of 140-160 kN (32 000-36 000 lb).

The method for determination of gross vehicle weight (GVW) is indicated in the final column of Table 1. For GVW calculation, most states rely on the bridge formula itself or a table of weights using a combination of factors included in the bridge formula calculation. It should be noted that some states, such as Michigan, impose seasonal weight limitations lower than normally allowed (1).

Geographical distributions of single- and tandem-axle and GVW limits are included in Figures 2, 3, and 4. It is noteworthy that practically all the states that had single- and tandem-axle weights higher than the 1956 legislated maximums are located on the East Coast. On the other hand, states west of the Mississippi are regulated by the federal limit on axle loads. The distribution of gross vehicle weight limits is just the opposite. States east of the Mississippi have limits lower than the federally imposed 355 kN (80 000 lb), while states west of the Mississippi typically have limits greater than the federal maximum. Movements exceeding the federal limits in the western portion of the country require routine permits.

Length Limits

A summary of state regulations with regard to the length of straight trucks, truck trailers, and tractor-semitrailer, tractor-trailer, and truck trailer combinations is included in Table 2. The range of allowable maximums for combination lengths is about 17.0-24.5 m (55-80 ft). Double and triple trailers are allowed to operate by permit in many states, yielding an effective length maximum of 32.0-33.0 m (105-108 ft) as shown in Figure 5. Most state regulations allow either 17.0 or 20.0 m (55 or 65 ft) in length under routine, non-permit operation as illustrated in Figure 6.

The geographical distribution of maximum lengths for combinations exhibits a marked division approximately midway between the East and West Coasts as shown in Figure 7. Roughly one-half of the western states allow legal maximums exceeding 20.0 m (65 ft), while states to the east are restricted to combination lengths less than or equal to 20.0 m (65 ft) under non-permit operations.

In addition, nearly half of the states in the East do not allow the operation of multiple combinations on their highways. In the West, this is considered common practice; all of the states allow the operation of "double" truck-trailer configurations and five states allow "triple" operations as shown in Figure 8. Doubles are configurations with a truck-tractor attached to a semi-trailer, which is pulling a full trailer. A triple combination typically includes a truck-tractor followed by a semi-trailer and two full trailers. (The operation of these vehicles is sometimes restricted to time of day and by weather limitations.) The lack of uniformity in legal configurations from state to state presents problems for the hauler passing through a state that regards certain configurations as illegal that are completely legal in adjacent states. The economic implications resulting from this practice are discussed later.

The maximum length for single trucks varies from 10.5-17.0 m (35-56.6 ft) and exhibits no geographical pattern. The lack of uniformity in this area of regulation is readily apparent in Figure 9.

Table 1. Axle and GVW limits.

	Vehicle Weight (kN)				
State	Steering Axle	Single Axle	Tandem Axle	GVW	GVW Basis[a]
Alabama	63.5	90 (100)[f]	175 (200)[f]	355 (410)[f]	B
Alaska	2.0[b]	90	150	(485)[f]	T
Arizona	NS	90	150	355 470P[g]	T
Arkansas	55.5	80	140	325	A
California	55.5	90	150	355	T
Colorado	NS	90 (80)[f]	160	355 (380)[f]	B, V
Connecticut	2.5[b]	100	165	325	V
Delaware	3.0[b]	90	160 (180)[f]	355	T, V
Florida	2.5[b]	100	200	355	B
Georgia	NS	90	180	355	B
Hawaii	–[c]	105	15[illegible]	360	B
Idaho	3.5[b]	90	150	355 470P[g]	B
Illinois	NS	80	140	325	T, V
Indiana	3.5[b]	80 (100)[f]	140	325	
Iowa	NS	80	145	325	T
Kansas	NS	90	150	355 380	T, B
Kentucky	2.5[b]	90 (95)[f]	150 (160)[f]	355 365	A
Louisiana	3.0[b]	90	150	355	A
Maine	2.5[b]	100	150 (170)[f]	355	B, V
Maryland	NS	100	(185)[f]	330	T, V
Massachusetts	3.5[b]	100	160	355	T, V
Michigan	3.0[b]	90	150	355 605	A, B
Minnesota	53.5	90	150	355	B
Mississippi	63.5	80	140	325	T
Missouri	NS	80 (100)[f]	140	325	T
Montana	NS	90P[g]	150P[g]	340 470P[g]	T
Nebraska	80.0 90.0	85 90P[g]	150	425P[g]	T
Nevada	NS	90	150	355, (485)[f], 575P[g]	B
New Hampshire	2.5[b]	100	160	355	B
New Jersey	3.5[b]	105	160	355	B
New Mexico	2.5[b]	95	150	385	T
New York	3.5[b]	100	160	355	B
North Carolina	2.5[b]	90	170	355	V
North Dakota	2.5[b]	90	150	355 (470)[f]	B
Ohio	3.0[b]	90	150	355	T
Oklahoma	NS	90	150	355 (400)[f]	T
Oregon	2.5[b]	90	150	355 470P[g]	T
Pennsylvania	3.5[b]	105	165	325	V
Rhode Island	NS	100	160	355	V
South Carolina	NS	90 (100)[f]	155 (175)[f]	355 360	B
South Dakota	NS	90	150	355 (425)[f]	T
Tennessee	53.5	80	140	325	A
Texas	3.0[b]	90	150	355	B
Utah	NS	90	160P[g]	375P[g] 470P[g]	B
Vermont	2.5[b]	100 (105)[f]	160 (170)[f]	355	T
Virginia	3.0[b]	90 95	150 (160)[f]	355	T
Washington	2.5[b] 3.0[d]	90	150	355 470	B
West Virginia	NS	90	150	355	T
Wisconsin	58.0	90	150	355	B
Wyoming	NS	90	160	355 (450)[f]	B
Washington, D.C.	80.0[e]	100	170	325	T

Note: 1 kN = 225 lbf.

[a]GVW basis: T = gross weight controlled by a table of axle spacing up to a specified maximum; A = gross weight controlled by axle limits up to, in most states, a specified maximum; B = gross weight controlled by "bridge" formula; and V = gross weight controlled by maximum limits for specific vehicle types.

[b]Per 25 mm (1 in) of tire width.

[c]Maximum for each wheel is allowable tire pressure x tire area up to 53 kN (12 000 lb).

[d]For tires greater than 30 cm (12 in) wide.

[e]80-355 kN (22 000-80 000 lb) allowed with wide tires.

[f]Numbers in parentheses signify non-Interstate limits where different from Interstate limits.

[g]Permits required.

Height and Width Limits

The regulation of vehicle height and width is the most uniform of the many size and weight limits. This is most likely due to the physical restrictions placed by structure heights passing over the highway and by previous uniformity of lane widths. In approximately 87 percent of the states, maximum height is 410 cm (13.5 ft). Maximum width is 245 cm (96 in) in 80 percent of the states (1 cm = 0.39 in). Examination of the lists of exceptions below shows that even the excepted states have uniformity among themselves.

State	Width Limit (cm)
Connecticut	260
Idaho	260
Maryland	260
Massachusetts (over 45 kN)	260
Rhode Island	260
Washington	260
Hawaii	275
All other states	245

State	Height Limit (cm)
Arizona	425
California	425
Colorado	425
District of Columbia	380
Idaho	425
Maine	425
Montana	425

State	Height Limit (cm)
Nebraska	440
Nevada	425
Utah	425
Washington	425
Wyoming	425
All other states	410

In the final analysis, only Hawaii has established width limits in excess of 245 or 260 cm (96 or 102 in), and only the District of Columbia restricts vehicle heights less than 410 cm (13.5 ft).

The present maximum width of 245 cm is primarily limited by present roadway geometrics. The present manufacturing technology is capable of increasing axle widths up to 260 cm. However, increases beyond 260 cm would require significant retooling. Operation of vehicles on the Interstate system, where pavement lanes of 365 cm (144 in) or greater predominate, probably would not be as impaired by vehicle width increases up to or beyond 260 cm as much as city streets or local roads would. On these facilities, lane widths of 305-335 cm (120-132 in) are often found.

A significant number of structures would need to be raised on the highways, including the Interstate system, if vehicle heights were increased. Clearances of approximately 425 cm (14 ft) have been permitted by many jurisdictions in the past. Those clearances have been reduced by pavement overlays under overcrossings. Clearances would be further reduced if gross vehicle weights were increased and pavement sections were reconstructed to carry the additional loads.

PERMIT OPERATIONS

Use of Oversize-Overweight Permits

The need for regulation of the size and weight of vehicles has long been recognized to provide safety to the traveling public, to conserve the highway transportation facilities, and to regulate competition among transportation modes. However, all states have recognized the need to allow vehicles and loads exceeding these limits to move over our highways when such movements can be shown to be in the best interests of society and when no feasible alternative exists. Use of the public highways by oversize-overweight vehicles is controlled by state authorities through the issuance of special vehicle permits.

Permits are obtained through state agencies, usually, but not always, the state transportation agency. Most applications require similar information including name, address, vehicle dimensions, weight information, and route information. In addition, movers are required to post a bond to cover possible problems and to demonstrate to state authorities proof of liability and property damage insurance of a certain amount. Application is made, and at times issuance is routine. However, there are times when movements require an engineering analysis and review of the route requested to determine the possibility of pavement and/or bridge damage. The permit fees seldom reflect the costs incurred by such analyses.

Number of Permits Issued

In 1969, a national inventory of permit issuance was

Figure 1. Distribution of 1977 axle maximum weights.

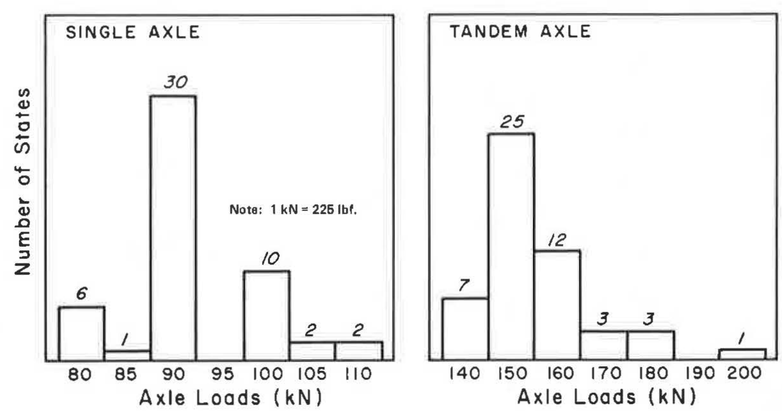


Figure 2. Single-axle maximum weights.

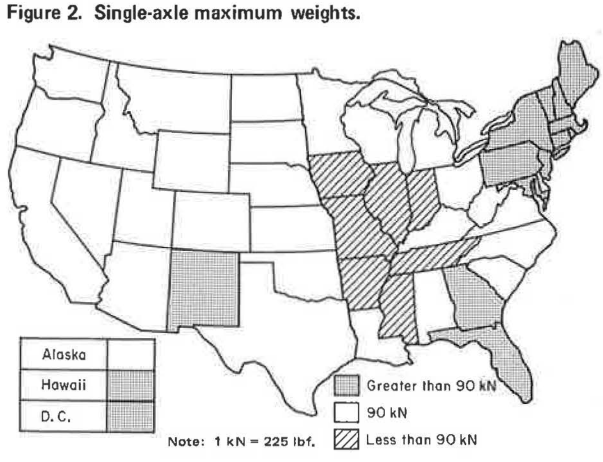
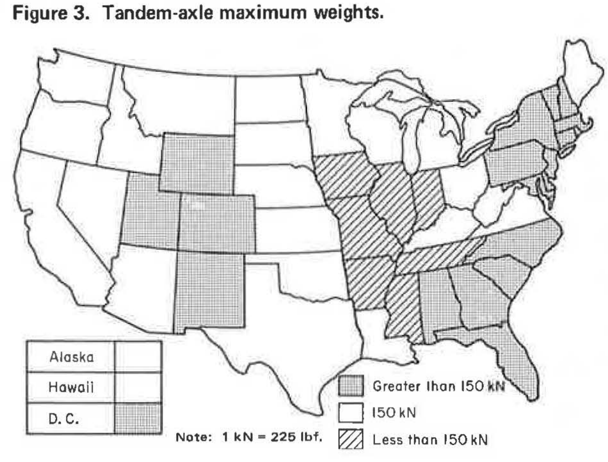


Figure 3. Tandem-axle maximum weights.



undertaken to determine basic data necessary for further study of the scope and economic impact of oversize-overweight permit operation (8). Samples of permits issued for the year 1966 were coded and the data processed into a variety of classifications. The summary of all oversize and overweight permits issued is included in Tables 3 and 4 (10). Total number of permits issued was 2 151 282. Forecasts for 1975 were on the order of 3.9-4.7 million permits.

Since this study, no other comparable compilation of data on the frequency of issuance of oversize-overweight permits has been undertaken. For this report, several states were contacted directly, and requests were made regarding the frequency of permit issuance. The table below was constructed with data supplied by several of the states contacted; data for 1966 are from Roy Jorgensen and Associates (8). While it is risky to draw substantial conclusions from these limited data, a conservative estimate would indicate that at least 3.0 million permits were issued in 1975.

State	No. Permits Issued 1966	1975	Percentage Change
Idaho	24 466	23 488	-4
Kansas	51 491	~60 000	16
Michigan	94 099	76 895	-18
Nevada	5 641	8 716	55
Pennsylvania	151 774	247 314	63
Texas	234 514	325 533	39
Utah	25 540	65 785	157

Figure 4. Combination GVW maximum weights.

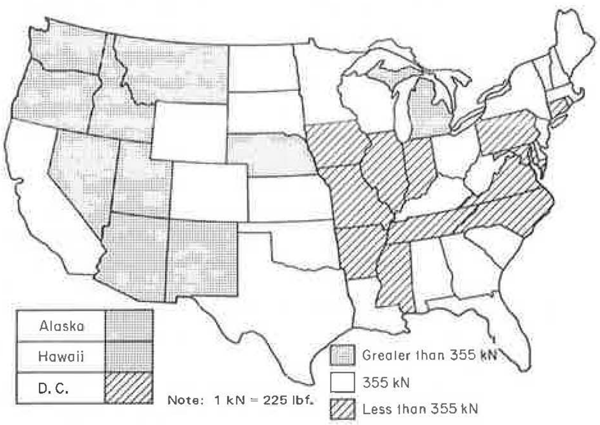


Table 2. Vehicle and combination length limits.

State	Length (m) Straight Truck	Semi/Full Trailer	Combination	Remarks
Alabama	12.0	NS	17.0	-
Alaska	12.0	13.5	21.5	-
Arizona	12.0	NS/40	20.0	32.0 m with permit, I-15 only
Arkansas	12.0	NS	20.0	-
California	12.0	12.0/12.0	20.0	-
Colorado	10.5	NS	20.0	-
Connecticut	17.0	NS/12.0	17.0	-
Delaware	12.0	12.0/NS	20.0	-
Florida	12.0	NS/10.5, 12.0	17.0	10.5 m, 2-axle; 12.0 m, 3-axle; 33.5 m toll roads
Georgia	17.0	NS	17.0	-
Hawaii	12.0	NS	17.0, 20.0	17.0 m tractor-semitrailer, 20.0 m other
Idaho	12.0	NS	23.0, 29.0	23.0 m designated highways, permits required
Illinois	13.0	13.5	17.0, 18.5	17.0 m tractor-semitrailer, 18.5 m other
Indiana	11.0	NS	20.0, 30.0	30.0 m toll road only
Iowa	12.0	NS/10.5	18.5	-
Kansas	13.0	NS/13.0	20.0, 33.0	33.0 m toll road only
Kentucky	10.5	NS	17.0, 20.0	17.0 m tractor-semitrailer, 20.0 m tractor-semitrailer, both on designated highways only
Louisiana	10.5	NS	20.0	-
Maine	13.5	13.5/13.5	17.5	-
Maryland	12.0	NS	17.0, 20.0	20.0 m designated highways only
Massachusetts	10.5	NS	17.0	-
Michigan	12.0	NS	18.0, 20.0	20.0 m tractor-semitrailer and trailer
Minnesota	12.0	13.5/13.5	17.0	-
Mississippi	10.5	NS	17.0	-
Missouri	12.0	NS	17.0, 18.5, 20.0	17.0 m tractor-semitrailer, 18.5 m motor vehicle transporters, 20.0 m other
Montana	12.0	NS	18.5	21.5 m permit, 26.0 m permit on designated highways
Nebraska	12.0	NS/12.0	18.5, 20.0	18.5 m tractor-semitrailer, 20.0 m other
Nevada	12.0	NS	23.0, 32.0	32.0 m permit
New Hampshire	10.5	NS	17.0	-
New Jersey	10.5	NS/10.5	17.0	-
New Mexico	12.0	NS	20.0	-
New York	10.5	NS/10.5	17.0, 33.0	33.0 m toll road only
North Carolina	10.5, 12.0	NS	17.0	10.5 m, 2-axle; 12.0 m, 3-axle
North Dakota	12.0	NS	20.0	10.5 m, 2-axle; 12.0 m, 3-axle
Ohio	12.0	NS	17.0, 20.0, 30.0	17.0 m tractor-semitrailer, 20.0 m other, 30.0 m toll road
Oklahoma	12.0	NS	20.0	-
Oregon	12.0	12.0/NS	23.0, 32.0	23.0 m designated highways, 32.0 m permit only
Pennsylvania	10.5	NS	17.0, 30.5	30.5 m toll roads only
Rhode Island	12.0	12.0/NS	17.0	-
South Carolina	10.5, 12.0	NS	17.0, 18.5	Over 10.5 m need 3 axles, 18.5 m auto transports
South Dakota	10.5	NS	18.5, 24.5	24.5 m designated highways
Tennessee	12.0	NS	17.0	-
Texas	13.5	NS	20.0	-
Utah	13.5	13.5/13.5	20.0, 23.0, 33.0	23.0 m permit, 33.0 m designated highways, permit
Vermont	18.5	NS	18.5	-
Virginia	12.0	NS	17.0	-
Washington	10.5	12.0/NS	23.0	23.0 m permit
West Virginia	10.5, 12.0	NS	15.5, 17.0	10.5 m, 2-axle; 12.0 m, 3-axle; 17.0 m designated highways
Wisconsin	10.5	13.5/13.5	18.0	-
Wyoming	18.5	NS	26.0	26.0 m daylight operation only
Washington, D.C.	12.0	NS	17.0	-

Note: 1 m = 3.3 ft.

Figure 5. Maximum and minimum sizes and weights for 1977.

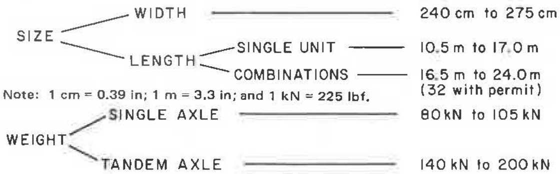


Figure 6. Distribution of 1977 combination maximum lengths.

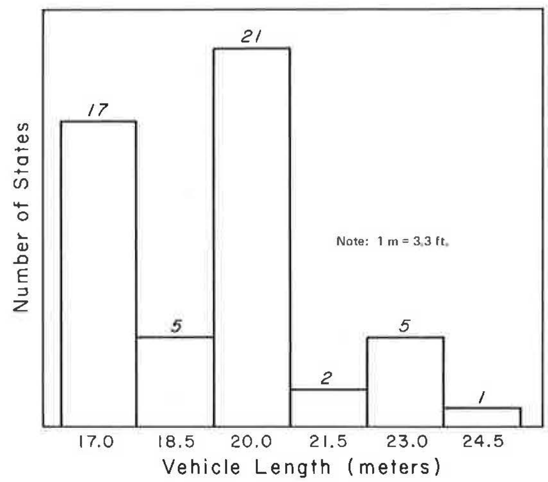


Figure 7. Combination maximum lengths.

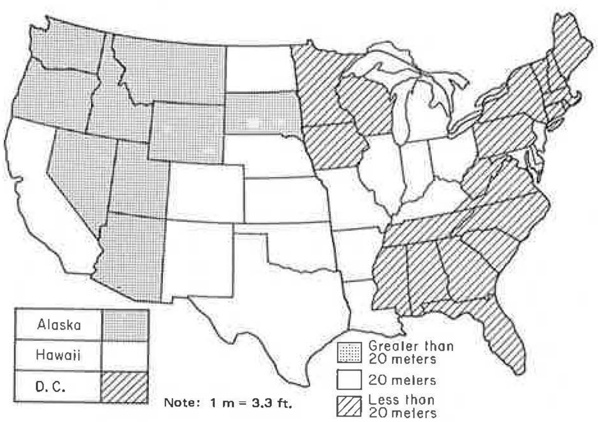


Figure 8. Multiple combinations.

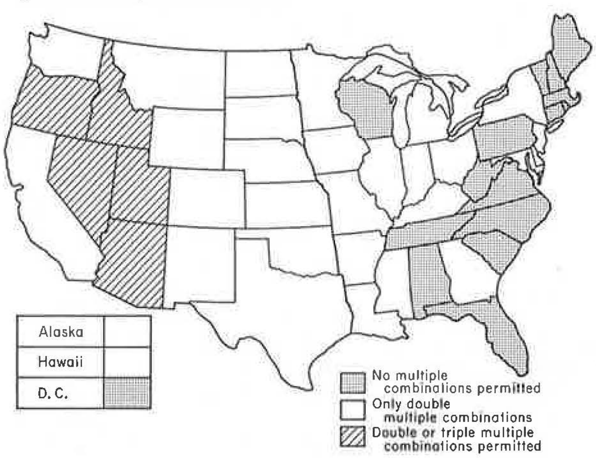
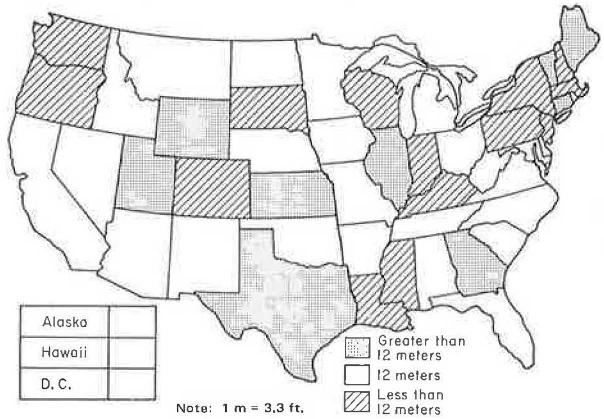


Figure 9. Straight truck maximum lengths.



The increase in permits issued is matched by a desire on the part of commercial vehicle operators for larger and heavier loads. It is likely that greater numbers of permits will be issued in the future with the increasing use and public acceptance of longer vehicles (i.e., triple trailers in several western states) and government recognition of the short-run fuel savings from larger, heavier loads. This of course comes at a time when transportation fuel is receiving attention as a significant portion of our national energy picture. However, the increased energy and economic efficiency provided to truck operators must be evaluated against increased construction and maintenance costs and energy.

Trends for the Future in Size and Weight Regulations

Studies (9, 10) have indicated possible new higher size and weight regulations as illustrated in Table 5. Winfrey reported benefit-cost ratios on the order of 2 to 15 for a single-axle limit increase to 115 kN (26 000 lb) and tandem-axle increase to 200 kN (44 000 lb) for several highway types (9). The Goals Report has indicated that single unit length rather than total vehicle length should be the concern of highway regulatory agencies (10). All indications are that the vehicle of the future will be larger and heavier, and perhaps wider.

Larger and heavier vehicles have been seen to improve the efficiency of operation by reducing operating costs, particularly labor costs, and increasing operating energy efficiency (11). However, increased gross vehicle weight may create damage to existing bridges and pavements unless vehicle lengths are increased sufficiently and more axles are added to retain lower axle loadings. Further, the influence of increased vehicle size and weight on safety must be considered. A major research project by the Federal Highway Administration is presently studying this impact in depth.

CONCLUSIONS AND RECOMMENDATIONS

At the moment, a major problem regarding the regulation of commercial vehicle size and weight is the lack of uniformity among states. This has caused considerable costs to carriers at locations where crossing state lines has meant the necessity of changing vehicle configuration. A classic example is the approximately 130-km (80-mile) section of I-90 in Pennsylvania. Both New York (on I-90) and Ohio allow the operation of doubles. Pennsylvania does not. Operators are forced to break down the doubles combinations and travel through Pennsylvania in single configurations. One source has

Table 3. Overdimension permits issued in 1966.

State	Overlength Only	Overwidth Only	Overheight Only	Overlength and Overwidth	Overlength and Overheight	Overwidth and Overheight	Overlength, Overwidth, Overheight	Oversize Dimensions Not Specified	Total Oversize
Alabama	333	5 966	300	900	67	700	1 966	0	10 232
Arizona	2 948	10 640	631	16 182	74	2 881	1 715	0	35 071
Arkansas	3 597	18 893	167	18 407	0	1 904	2 115	0	45 083
California	3 405	33 273	2 739	16 461	336	18 563	13 319	59	88 155
Colorado	3 248	17 151	664	16 138	210	6 322	4 820	0	48 553
Connecticut	2 106	10 549	527	10 753	32	1 222	2 110	0	27 299
Delaware	2 662	5 780	70	8 127	0	175	420	0	17 234
Florida	3 099	3 733	293	27 085	27	1 584	5 622	0	41 443
Georgia	1 436	12 665	248	22 365	0	957	5 210	0	42 881
Idaho	749	7 577	101	13 163	21	962	1 690	0	24 263
Illinois	2 272	29 906	603	24 687	115	3 348	2 444	231	63 606
Indiana	1 907	10 726	270	29 466	356	1 570	13 372	140	57 807
Iowa	1 334	5 963	333	600	100	1 364	4 878	33	14 605
Kansas	1 195	12 340	533	24 929	36	6 851	5 428	0	51 312
Kentucky	2 009	7 812	50	16 401	0	715	1 287	0	28 274
Louisiana	8 392	22 415	952	31 886	250	5 473	14 250	0	83 618
Maine	1 318	6 229	27	6 646	60	363	346	0	14 989
Maryland	1 745	607	36	39 664	213	71	759	0	43 095
Massachusetts	1 301	3 366	0	8 602	0	1	3	0	13 273
Michigan	6 572	14 687	173	36 078	180	1 016	4 406	0	63 112
Minnesota	5 211	11 157	169	14 117	104	1 697	1 874	34	34 363
Mississippi	474	18 691	344	13 701	104	1 442	1 778	0	36 534
Missouri	7 327	21 485	362	23 015	70	2 467	1 830	0	56 556
Montana	304	22 223	562	2	29	0	14	0	23 134
Nebraska	841	6 221	315	10 928	42	10 896	1 594	19	30 856
Nevada	0	5 359	0	0	0	0	0	0	5 359
New Hampshire	644	2 731	0	5 242	6	83	254	0	8 960
New Jersey	5 011	19 695	543	17 459	97	2 115	3 795	0	48 715
New Mexico	1 322	9 009	379	12 047	194	2 512	2 892	0	28 355
New York	1 874	11 143	68	29 280	0	238	1 798	753	45 154
North Carolina	202	4 755	126	23 288	25	683	1 846	0	30 925
North Dakota	532	3 903	342	5 477	157	1 888	2 295	0	14 594
Ohio	1 163	20 150	499	27 656	259	5 345	5 805	0	60 877
Oklahoma	8 134	22 922	1 991	28 687	198	10 651	15 080	0	87 663
Oregon	3 833	6 082	274	12 095	137	1 283	6 698	0	30 402
Pennsylvania	244	45 506	122	87 352	3 904	366	14 030	0	151 524
Rhode Island	137	555	15	579	4	77	65	0	1 432
South Carolina	1 095	3 090	81	19 361	60	1 130	226	0	25 043
South Dakota	757	7 596	62	7 488	24	1 056	527	19	17 529
Tennessee	1 850	7 736	82	16 054	112	135	873	692	27 534
Texas	34 926	48 614	3 638	55 799	882	26 096	61 132	0	231 087
Utah	3 999	2 128	81	2 280	365	285	5 227	0	14 365
Vermont	160	1 115	19	2 906	9	47	19	0	4 275
Virginia	4 858	10 646	531	25 584	143	570	3 329	0	45 661
Washington	8 636	26 487	355	19 326	0	4 069	3 905	0	62 778
West Virginia	2 626	9 986	311	9 946	289	1 714	2 036	14	26 922
Wisconsin	6 791	5 566	66	5 658	66	924	4 585	0	23 656
Wyoming	2 833	12 699	1 033	7 733	533	4 000	1 567	0	30 398
Washington, D.C.	243	196	39	316	136	179	874	0	1 983
Total	157 655	607 724	21 126	851 916	10 026	137 990	232 108	1994	2 020 539

claimed that nearly 5700 m^3 (1.5 million gal) of diesel fuel are lost annually in this operation (12).

Clearly, these nonuniform regulations do pose a problem for just keeping informed. A study currently under way has as its objective a quantification of the costs of this nonuniformity.

One report listed some problems regarding permit issuance in the year 1966 (8). The most important of these was the variance in laws, regulations, and philosophies. While this aspect of permit issuance was only briefly discussed in this paper, the investigation done does not indicate that any strides toward uniformity have taken place. Conversations with public utilities officials indicated that some steps toward uniformity have been made in rate regulation; however, the progress in oversize-overweight vehicle permits is questionable.

This investigation also indicated a paucity of data regarding permit issuance by each state. Only about 33 percent of the states contacted had raw data regarding the numbers of permits issued. The classification of these data was extremely difficult. One state kept a monthly record of permits issued divided into six classifications based on vehicle type. Over 50 percent of the entries for every month were in the miscellaneous category.

A good data base on the movements of oversized permit vehicles would help in the evaluation of the benefits and costs incurred by increasing vehicle sizes and weights. Larger, heavier loads can cause a significant increase in the damage to pavements if axle loads are increased. Bridges can also be damaged by increasing vehicle weights. Short-span bridges are most affected by increased axle loads. Medium-span bridges would be adversely affected by increased gross vehicle weights. However, long-span bridges would not be significantly influenced by increased loading, since the live load would be small relative to the dead load for the bridge. The effect of increasing vehicle load on bridge decks has not been adequately quantified at this time; however, increased axle loads are felt to be a major contributor to accelerated bridge deck deterioration. The knowledge of permit movements combined with information on illegal overloads can be used effectively to evaluate the efficacy of increasing vehicle size, to set permit fees, and to assess overload penalties.

For intelligent study and proper decisions to be made, it is necessary for the raw data to be available. Considerable work needs to be done in this area so that an accurate and reliable data base, locally and nationally, will be available for assessing appropriate permit fees and to perform further research in this area.

The trend of increased vehicle size and weight may be expected to continue. Increased vehicle size and weight yield efficiency in the form of reduced operating costs and decreased fuel consumption per unit of payload. However, construction and maintenance costs and energy may be expected to increase. The magnitude of this trade-off must be evaluated not only with respect to

Table 4. Overweight permits issued in 1966.

State	GVW Only	Axle Only	GVW and Axle	Unknown	All
Alabama	0	0	0	0	0
Arizona	5 050	0	0	0	5 050
Arkansas	67	0	7 452	34	7 553
California	103	0	45 068	0	45 171
Colorado	1 362	35	35 140	12 889	49 426
Connecticut	272	111	11 555	32	11 970
Delaware	-	-	-	-	-
Florida	0	0	7 514	0	7 514
Georgia	0	0	7 073	0	7 073
Idaho	19	21	4 403	20	4 463
Illinois	29	57	20 097	1 000	21 183
Indiana	5 903	5 933	1 201	273	13 310
Iowa	4 435	33	0	4 393	8 861
Kansas	325	36	13 131	0	13 492
Kentucky	0	0	8 392	615	9 007
Louisiana	53	0	8 502	351	8 906
Maine	0	0	3 899	0	3 899
Maryland	108	0	12 810	36	12 954
Massachusetts	-	-	4 240	-	4 240
Michigan	-	-	0	27 632	27 632
Minnesota	414	419	3 314	-	4 147
Mississippi	5 615	184	54	456	6 309
Missouri	4 835	0	0	0	4 835
Montana	249	1 110	3 724	7 060	12 143
Nebraska	2 085	63	2 039	0	4 187
Nevada	0	107	1 117	176	1 400
New Hampshire	6	0	4 247	21	4 274
New Jersey	11 793	0	38	295	12 126
New Mexico	46	0	3 475	0	3 521
New York	77	0	22 081	753	22 911
North Carolina	5 690	607	2 124	0	8 421
North Dakota	3 954	124	0	2 607	6 685
Ohio	0	30	31 273	0	31 303
Oklahoma	88 696	0	0	0	88 696
Oregon	10 500	0	7 200	478	18 178
Pennsylvania	100	100	29 700	0	29 900
Rhode Island	118	0	184	0	302
South Carolina	0	21	179	0	200
South Dakota	251	12	2 380	0	2 643
Tennessee	42	66	4 307	692	5 107
Texas	789	4 703	86 071	0	91 563
Utah	0	0	12 253	81	12 334
Vermont	0	0	658	12	670
Virginia	0	0	12 225	0	12 225
Washington	22 209	909	15	0	23 133
West Virginia	2 474	86	6 682	0	9 242
Wisconsin	233	6 558	3 906	0	10 697
Wyoming	500	0	9 232	0	9 732
Washington, D.C.	56	0	1 539	20	1 615
All	178 458	21 325	440 494	59 926	700 203 +12 803[a]
Grand total					713 006

[a]Michigan issued 12 803 permits that exceeded axle limits and that, in other states, would have exceeded gross limits.

gross vehicle weight and axle loadings, but also for specific truck configurations.

A cursory evaluation indicates that a truck may be increased in gross vehicle weight if axle loads are not increased and the weight is spread out over an increased length. Maintaining present legal axle loads would eliminate pavement damage, damage to short-span bridges, and the potential accelerated wear of bridge decks. Triple trailers could meet these restrictions. However, the impact of increasing the length and weight on safety must also be considered. The effects that this configuration and increased weight would have on safety are not well defined at this time. More comprehensive research and evaluations must be performed to confirm the efficacy of increasing vehicle size and weight.

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Table 5. Past, present, and proposed sizes and weights.

Application	Actual 1956-1975	Actual 1975	FHWA Research Proposal[a]	1985 Proposed[b]
Weight, kN				
Single axle	80	90	115	115
Tandem axle	140	150	200	200
Maximum GVW[c]	325	355	535	535
Width, cm	245	245	260	260
Length, m				
Single trailer	-	-	-	13.5
Double or triple trailer	-	-	-	8.5
Single-unit vehicle	-	-	12.0	13.5
Overall combination vehicle	-	-	20.0	-
Tractor-semitrailer	-	-	17.0	-

Note: 1 kN = 225 lb; 1 cm = 0.39 in; 1 m = 3.3 ft.
[a]See NCHRP report (11). [b]See Fleet Owner (12). [c]Subject to bridge formula.

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